Cloud based E-Learning–Using cloud to provide Learning as a Service

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Abstract—*Cloud computing is one of the new technology in the IT world. It has proved to be the most advantageous in recent times so it has found use in many fields including education. The usage of electronic media to impart partial, or complete course, be it in school, college or any business organization has proved to most efficient and time saving. One requires various hardware and software resources for E-Learning. Many educational institutions find it difficult to afford such investments, thereby, diverting their focus towards the use of cloud computing. With the help of cloud computing, cost of implementing E-Learning is greatly reduced, along with easier maintenance and updating of the study material. This paper discusses how cloud computing can be used to provide Learning as a Service. Furthermore this paper discusses framework and features of the web-based learning environments (LMS). The paper also points out the various benefits of using cloud computing for E-Learning and the issues related to E-Learning systems.*

1. INTRODUCTION

Among all the available learning technologies, web-based learning has more benefits as compared to traditional learning methods. Presence of a physical environment is not a compulsion anymore, so this is one of the biggest advantages a web-based learning can offer to students and trainers.

E-Learning is most suited for distance education[10], where trainers and students can share notes and assignments respectively. The trainer updates the learning material and can easily assess the assignments and tests taken by the students.

There are a minimum of two entities that are involved in an E-Learning system, namely students and trainers. In an E-Learning system, the trainers and the students can perform the following tasks with the help of personal computers, laptops or mobile devices at the location of their choice.

With the help of an E-Learning System, the students are able to:

a) Enroll into an online course
b) Take examinations
c) Send the feedback regarding the course and the related material
d) Submit projects and assignments

With the help of an E-Learning System, the trainers are able to:

a) Communicate with students
b) Organize notes and study material
c) Set tests and assignments
d) Send feedback
e) Assess exams, tests, projects, assignments and homework assigned to the students.

2. BENEFITS OF CLOUD COMPUTING THAT CAN BE USED IN E-LEARNING

2.1 *Agility* – it improvises according to the ability of the user to adapt to the re-provision of the resources related to the technological infrastructure. It is the power to change swiftly, rapidly and effectively to suit the changing environment.

2.2 *Cost reduction* – one of the finest features of employing cloud computing is cut down on the cost of establishing the infrastructure and the various resources required to serve a purpose. All these are made available by the cloud providers at a very small rate as compared to buying everything on your own.

2.3 *Virtualization* – this allows users to share servers and resources thereby increasing utilization. Applications residing on multiple locations can be accessed at a single location with the help of virtualization technology.

2.4 *Multitenancy* – this requires multiple users to share servers and other resources thereby cutting down on the cost.

2.5 *Location independence* – this allows the user to access applications and resources from any where across the globe with the help of any device, such as laptops, PCs, mobile phones etc. as these resources are accessed via the Internet, they can be made available through any of the devices mentioned previously.

2.6 Maintenance – as the clouds are not installed individually on all the systems, its maintenance becomes easy. Making the computing centralized helps in easier software updates

3. BENEFITS OF E-LEARNING

3.1 *Time* – E-Learning removes one of the two main restrictions imposed on students as well as faculty when it comes to delivering lectures, i.e., time and place. With the help of E-Learning, students can take the lectures that are uploaded online whenever it is convenient to them. They are no longer bound by the timetable of the classes.

3.2 *Location* – the second freedom given to the students is the location at which they can take up the classes. They are no longer required to be physically present at a particular place (school/college/institute) to attend lectures. Students can download the study material, go through online tutorials and participate in discussion forums.

3.3 *Communication* – the students can easily communicate with their fellow students as well as the trainers with the help of online forums.

3.4 *Increased productivity* – traditional form of education bound the tutors and the students by geographical location and time. Once this restriction is removed with the help of online learning, people are able to do more with the less that they have. There is no restrain as to how much time one needs to give to any discussion. The focus now lies on the quality of the output generated.

3.5 *Costs* – inclusion of E-Learning in the education system has lead to reduction of various kinds of costs including cost of study material, updating and maintenance charges and the travel charges borne by the students and trainers. These costs, thus saved, can be used else where, thereby improving the performance.

4. LMS- LEARNING MANAGEMENT SYSTEM

A learning management system (LMS) is a software application for the administration, documentation, tracking, reporting and delivery of electronic educational technology (also called e-learning) education courses or training programs [1][2].

LMS is the framework that handles all the aspects related to e-learning. LMS not only delivers the content online, but also handles the registration of the student to a particular course, reporting, auditing, tracking and other management functionalities. The main use of LMS in e-learning is to automate the learning process with maximum efficiency and hopefully showcase better performance.
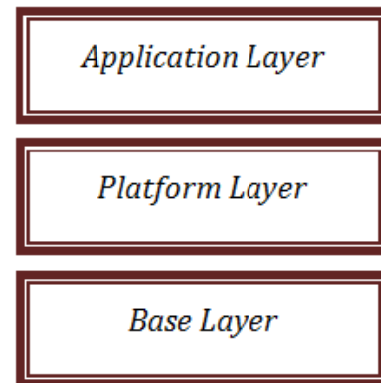

Fig. 1: Framework of E-Learning using Cloud Computing

a. The base layer of the cloud makes the use of infrastructure resources and provides these resources as a service to the users of the cloud. These resources are stored as a shared pool and allocated to the users as per their demand. Virtualization plays an important role in this layer. This is because the resources are shared in a flexible manner between the users and the resources can be scaled according to the usage by the users for large scale organizations. The base layer provides the hardware for the platform layer.

b. With the help of the hardware provided by the base layer, the platform layer of the cloud carries out the task of software development, computing and data storage. The users can also make use of the platform layer to complete the task of business intelligence processing which were, earlier, difficult to complete. Virtualization provides for high level of flexibility in this layer. Users have the choice of which device to use according to the complexity of dealing with the content.

c. The application layer of the cloud is the layer which provides the interface with the help of which students, trainers and other users of the e-learning system can access resources and avail other facilities. The application layer provides the computing environment to the users of the cloud. The users can demand the access to resources and other data by being on the network from any location. All the activities such as registration of the course, submission of assignments, etc are done by the users at this layer.
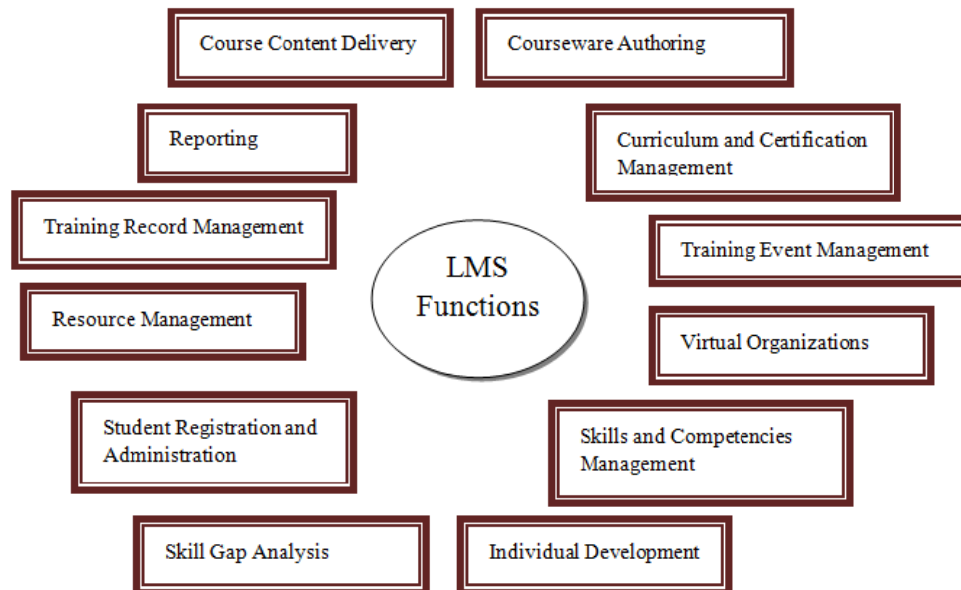
5. FUNCTIONS PERFORMED BY LMS

Fig. 2: Functions performed by LMS for e-learning

6. FEATURES OF LMS THAT ARE BENEFICIAL TO THE USERS OF LEARNING MANAGEMENT SYSTEM

6.1 Ease of use – the user interface of the LMS is made in such a way that it is easy to be used by the students, trainers as well as the other members of the organization. Registration of a student into a course becomes an easy task as compared to the traditional means of registration into courses. The study material can be uploaded and updated in an easy manner.

6.2 Scalability – Scalability refers to the growth with respect to the size. The LMS can be scaled up or down according to the number of its users.

6.3 Security – Users of the LMS are authenticated with user ID's and passwords. One user cannot see the data related to another user. The user data is stored in the cloud where proper security measures have been taken to secure the data.

6.4 Robust – with the help of LMS, regular reports can be generated easily. Detailed report at the time of completion of the course, individual users and course content can be easily generated. Feedback reports can be sent with the help of LMS.

6.5 Saves cost and time – use of LMS helps in saving cost and time that maybe borne by the students and trainers in the name of distribution of notes, travelling to the location where lectures are delivered, and such similar activities.

7. PROBLEMS FACED BY E-LEARNING SYSTEMS

7.1 Scalability issues – as the domain of the business providing the services increase, the e-learning systems need to be flexible enough to adapt to such changes and scale accordingly. At times, scalability results in increasing the cost for resource management. This is because, coping with overloaded servers will require more resources to be employed to handle the data traffic.

7.2 Efficient utilization of resources – consider the following situations: the machines in the laboratories are held even when they are idle, i.e. no classes are taking place; the PC laboratories and servers are not used during vacation breaks and during night time; but resources are overused during examinations or at the end of the semesters. These situations are enough to portray those resources are not used at their full potential leading to inefficient utilization of resources.

7.3 Maintenance and Licensing costs – the educational organization needs to pay for the maintenance of the machinery (systems and servers), installation and technical support for the various software packages and the cost for the site licensing.

7.4 Security and privacy – the risks associated with cloud computing tag along when we implement e-learning based on cloud computing. The data that resides within the cloud demands high degree of security measures to be applied for its safety. The various measures to ensure protection of data kept

on the servers could be cryptographic measures of encryption of data, special security hardware and other data loss software.

7.5 Reliability and availability – the data or information that is being shared via cloud needs to be monitored timely to ensure that correct information is being shared. It is important to ensure that the correct service is being provided using internal tools or third-party tools. Supervision of the SLAs, the usage of the services and business dependencies of the services.

7.6 Performance and bandwidth cost- businesses tend to spend the amount, saved on the hardware, on the bandwidth. For data-intensive applications, this cost is very high. Delivery of complex data that is rich in media over the Internet requires more bandwidth. To ensure high performance delivered by the applications, the businesses need to adapt to various measures for ascertaining the robustness and reliability of the application

8. CONCLUSION AND FURTHER RESEARCH

Cloud computing based E-Learning is an efficient alternative to traditional learning. It creates opportunities for students and teachers to access resources and applications and communicate in a cost effective manner quickly. Web-based learning environments such as Learning Management Systems (LMS) have made use of the benefits of the cloud computing to provide highly efficient e-learning applications. The students and teachers are now able to complete their tasks in reduced time and costs. With the help of Cloud based E-Learning, the students at one part of the world can benefit from the lectures delivered by a teacher at some other location across the globe. This will largely benefit the students from the rural areas. The e-learning system is not meant to completely replace the teachers and the existence of schooling culture, it is just another means of delivering the knowledge that the teachers want to impart to their pupils. The combined efforts of e-learning with the help f cloud computing could take the teaching altogether to the next level. The cloud being economically helpful to all sectors of the society, many organizations and institutions are going to adopt this new technology with open hearts.

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