

# Smart E-Learning System Architecture based on Cloud Computing

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With the advent of new technologies, companies and academic institutions are striving to keep pace with the advancement in Information and Communication Technologies and to streamline the way to manage or upgrade their IT resources. Cloud Computing provides an alternative solution to achieve these objectives within budget. A number of colleges and universities all over the world are implementing cloud infrastructure to reduce the IT operational cost and increasing the effectiveness and convenience of educational services. Cloud computing can play an important role in the education sector in providing ubiquitous access (anytime, anywhere, independent of device) to the learning material. This approach provides a new way to design and manage IT resources in an efficient manner not only by increasing the user's productivity and hardware utilization but also decreasing infrastructure cost through virtualization. This research paper presents a smart e-learning system based on cloud platform in delivering and sharing e-learning resources. The authors also discuss the features of the smart E-Learning system over the traditional system and propose architecture of smart e-learning system for the education institutions.

**Keywords:** Smart E-learning system, Smart Education, Virtualization, Cloud Computing.

## Introduction

Cloud computing is playing a major role in Information Technology, with its potential benefits to offers flexibility, accessibility, scalability, high performance, reliability, and cost reduction. As a result of, organizations all over the world are utilizing cloud computing to operate and expand their businesses while reducing IT-related operating costs. Cloud computing attracted a great deal of attention in the field of the education in order to provide better educational services within limited IT budget. As we are aware that number of schools and educational institutions are increasing, by adopting cloud computing will not only help institutions to save their IT costs, but also help the institutions to provide efficient and convenient educational services. There are many learning management systems such as: Moodle, Blackboard, etc. Moreover, it supporting cloud based educational services [1].

## Problems Statement

Education has been the integral part of the people life as sleeping and eating. It is created so many generations to thousands of years and remains doing so in our present. Now a day, technology has changed therefore many new thing as well as manner they digest information. As you can see the digital tools become replacing traditional teaching methods such as: computer, audio, visual, and computer.

In part of develop country the traditional teaching style are used in educational organization. In the traditional teaching method, the lectures explain all concept to the students with help of the blackboard and chalks. Therefore, all important topic is written on the blackboard so student can have written notes. By the way, the aim of students in tradition teaching is to pass the exams only.

In traditional teaching, classrooms environment is lecturecentered wherever the lecture often talks to the students instead of encouraging them to ask questions, interact, and make student understand the lesson thoroughly. In the most classes involve routine learning, where most of the students depend on the memorizing topics without having a full understanding of the topics to pass the exams. Long dictations and lectures in the classroom usually leave the student to less engaged and attentive. In a traditional class, time limitation restricts the students to complete collaborative activities. Also, it results in skipping classes and missing lessons. Furthermore, traditional class has no opportunity for interact with their teachers and their classmates after the class contact hours.

Lacks emphasis on the critical thinking, traditional teaching methods lacks in encouraging students to think critically and apply the skills gained by reasoning and experience. Traditional teaching methods lacks students-centered learning in which the role of lecturer as facilitator. This method of learning is not give student deeper levels of understanding needed for lifelong learning and complex concepts.

Poor process oriented learning, traditional methods emphasizes only passing exams, whether or not student under examine material. The learning process is like this devalued, and student does not encourage for understand the ways, skills and techniques needed to find solutions. constructivist learning holds the process equally important as result due to it stimulates skills important as long after schooling

Due to changes in technology, and internationalization are powerful education system for evolve to provide flexible education environment, which offers learners

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with the quality function encompassing formal, non formal education and formal. From this point, is fully approach to integrate IT in education, improve learning present and future, to ensure the student and teachers effective use of the new technologies such as Learning management system. Joining the quality of the information from traditional methods with the effective learning and the using of learning Management system tools in lectures time holds promise as the progressive stander that become wide range of the learning skills and will contract attention of all students from digital generation and fast-paces.

**Literature Review**

Now a day, cloud computing is main key of innovation in the computing industry. It is based on network so it basically on the internet. Is to ensure to provide to user a simple uses of computing resources on the demand. Cloud computing is high level of scalable with establish virtualized resources that able to available to the users. Therefore, cloud computing is a great technology that have signification impact on the learning environment and teaching [2].

Additionally, cloud computing is considered as on-demand provision of the computing power, applications, IT resources and database storage via cloud services platform through internet with the pay-as-you go pricing (Amazon,2017). Cloud computing has three main types: Private, Public and Hybrid cloud.

Private cloud mean that all application and cloud resources are managing by company itself, alike to intranet functionality. The private cloud vender provides scalable resources and virtual application, these two are available together to cloud users in order to use and share. In addition, it is more secure due to specified internal exposure. And only the designee and company can be access to the operate in the private cloud.

Public Cloud is where resources are dynamical provided in fine-grained, self services via the internet, by web services or web application by the third party offers that shares resources and charge the user as per their usage of these resources. On the other hand, public cloud is less secure than private cloud due to places on additional burden of make sure that each application and data accessed in the public cloud are protected from malicious attacks.

Hybrid Cloud is the combination of private and public cloud. The hybrid Cloud offers the scalability and cost effectiveness of the public Cloud along with performance and security of private Cloud. The companies do not need to change their underlying IT infrastructure [3].

The given below comparison highlight the benefits of cloud computing over traditional computing.

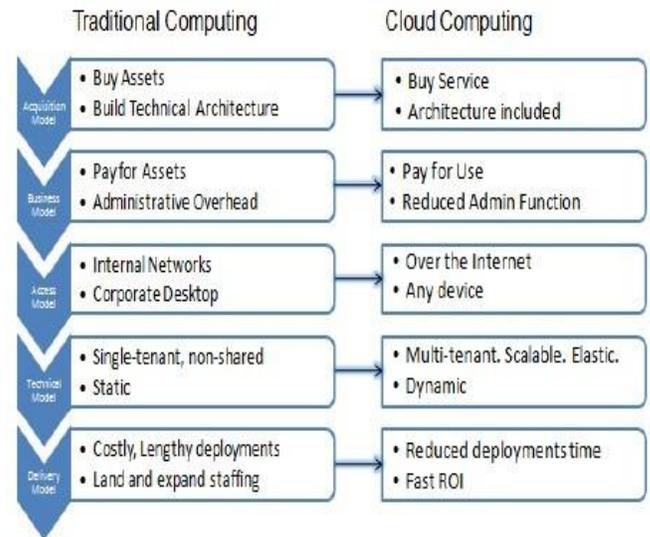


Figure 1: Traditional computing vs. Cloud computing [2]

**Traditional E-Learning to Smart E-Learning**

Traditional e-learning employs internet based learning. Using E-Learning over Internet improve the efficiency of the educational services as it offer a lot of benefits like: diversity, flexibility, openness, control and a lot more. Figure 2 represents the architecture of a simplified E-Learning system.

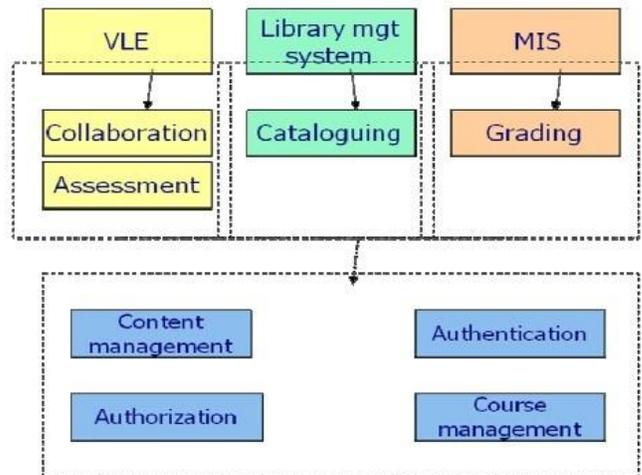


Figure 2: Architecture of a simplified E-Learning system [2]

**Proposed System**

The proposed system provides a method to deliver and share educational resources through smart e-learning system using private cloud. The proposed system utilize Private cloud environment to take the full control of cloud services at the institution premises. As discussed earlier, it can reduce the IT costs, and increases scalability, flexibility, availability and security of the smart e-learning system. It helps institutions to create and share different forms of the learning contents available on their Learning Management System through the cloud platform. (Mihye Kim,2013). Figure 3 demonstrate the Smart E-Learning system Architecture.

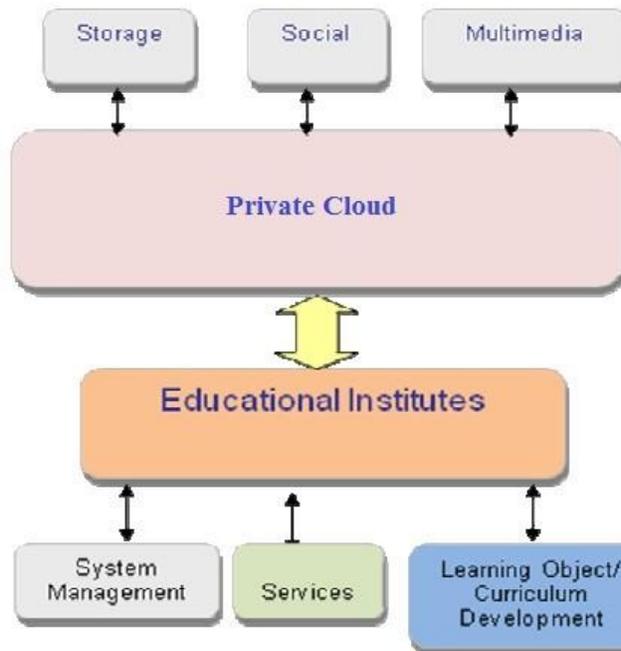


Figure 3: Smart E-Learning System Architecture

#### A. Features of proposed system

The proposed system utilized the benefits of private cloud in order to provide better educational services by integrating with existing IT technologies, for instances: virtualization, data synchronization, multi-sharing and services provisioning. Moreover, specific software and application needed to provide enhanced educational service in the educational institution using private cloud and can employ different services models of cloud computing (SaaS, PaaS, IaaS).

Implementing private cloud helps the educational institutions to take the advantage of cloud security at the maximum extent to protect their IT resources by only allowing the access to the legitimate users. Automation in the cloud provides the advantage to recover a failure node without affecting the operation of the cloud

system. The proposed smart e-learning system offers security, availability, resiliency, data preservation and reliability.

#### Cloud Computing Architecture

The Smart E-learning System is not replacing lectures, it allows lecturers to utilize the advancement in technology, tools and concepts, upload a new content, models for methods for teaching, therefore the lectures roles impossible to replace. The lecture will be still the leader of roles and at the same time is marking and improving of the smart e-learning system cloud. The learning strategy must develop an educational act. Furthermore, the virtual collaboration and interactive content guarantee a high retention factor. On the other side, smart elearning cloud is immigration of cloud computing technology in the scope of the e-learning, it is future of smart e-learning infrastructure, consist all important software and hardware resources engaging in the e-learning. After computer resources are virtualization, they provide it as form of services for the education organization, businesses and student to rent computing resources.

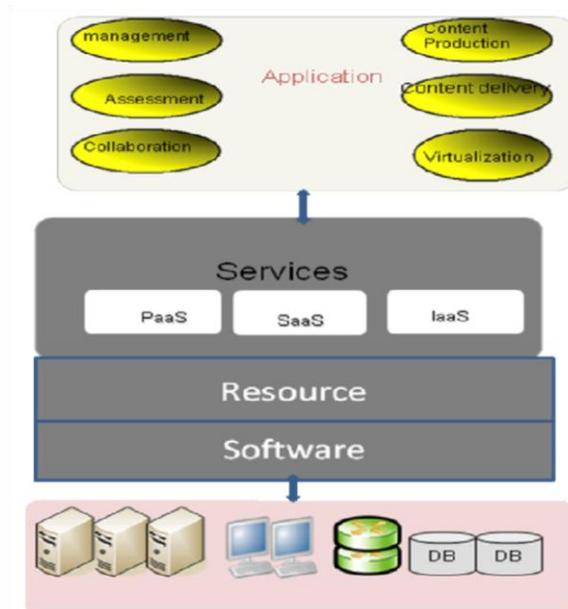


Figure 4: Smart E-learning Cloud Architecture [2]

The architecture of smart e-learning using cloud consists of five layers:

- An infrastructure layer that provides dynamic and scalable pool of physical resources
- Software layer that provide user-friendly interface to the learner.
- Resources management layer that is responsible for managing hardware and software resources.

- Service layer that provides software, platform, or infrastructure as a service.
  - Application layer.
1. Infrastructure layer is collected between teaching resources and information infrastructure, it consists of Intranet/Internet, information management system, system software and some common hardware and software. Teaching resources is traditional teaching model and distributed in various departments and domain. This layer is placed in the lowest level of the cloud service middleware, the main computing power such physical memory, CPU. By using virtualization technology, storage, physical server and network form virtualization group to bring named by upper software platform. The physical host pool is a dynamic and scalable, a new physical host enable to added in order to enhance physical computing power to cloud middleware services.
  2. Software resource layer is combined by middleware and operating system. Via middleware technology, selection of the software resources is integrated for provide a unified interface to software designer, therefore it easy to develop many of application based on software resource and embed them to cloud, and it available to the cloud computing users.
  3. Resources management layer is major to achieve loose coupling of hardware and software resources. By integration of the cloud computing and virtualization scheduling strategy.
  4. Server layer has three level of services which are: (Software as a services, Platform as a services, Infrastructure as a services). In SaaS cloud computing services is provide only to customers. As is various form traditional software, users software by internet, no need to one-time purchase to hardware or software. Moreover, no need for upgrade and maintain, only paying a monthly fee.
  5. Application layer is definite application of the integration the teaching resources in cloud computing model, consist of sharing the teaching resources and interactive courses. Sharing teaching resources contain material resources of teaching, information resources for instance: information center, digital

libraries and full sharing of human resources. This layer basically contains of education objectives, content production, assessment and management component and content delivery technology.

### Expected Benefits Of The Proposed Architecture

The intended benefits expected from the proposed smart elearning architecture are:

1. High Security: Private cloud can manage the resources more efficiently, balance the load and allows network administrator to control the security of the user's data and perform real-time monitoring of the resource.
2. Virtualization: It helps the institutions to:
  - Reduce power consumption and datacenter space
  - Increase hardware utilization
  - Lower upfront costs, including licensing fees
  - Simplify application and desktop lifecycle management
  - Lower operational costs for both maintenance and training
3. High Availability: One of the main benefit of cloud computing is automation to provide high quality of service. In case of any failure node, cloud system can automatically detect it and remove/replace it, thereby bot effecting the operation of the cloud.
4. Ubiquitous Access: Users can the system from anywhere, anytime and from any device.
5. Students can collaborate with each other through the proposed smart e-learning system. The proposed system can play a major role in utilizing the existing IT resources of the institutions at the fullest and enhancing the quality of the learning and teaching process in a better way.

Figure 5 depicts the interactive mode of the proposed architecture.

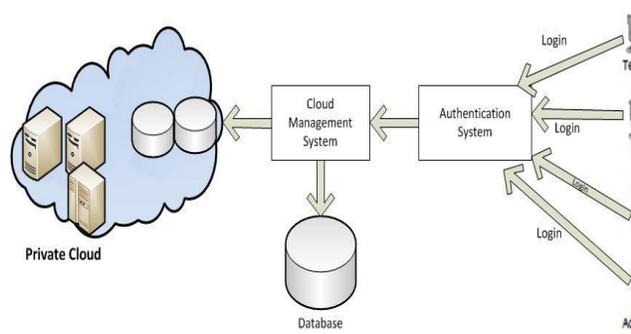


Figure 5: Interactive mode of the proposed architecture.

## Conclusion

Smart E-Learning enhances the efficiency and quality of teaching and learning process. Smart e-learning system provides an alternative solution to the institutions that are striving to keep pace with the advancement in Information and Communication Technologies and to streamline the way to manage or upgrade their IT resources. It not only reduces the IT operational costs but also provides away of delivering more economical, securable, and reliable education services. The research paper discussed the traditional e-learning system and proposed a smart e-learning system based on cloud platform in delivering and sharing e-learning resources. The authors discussed the features of the smart E-Learning system over the traditional system and proposed architecture of smart elearning system for the education institutions.

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