**Cloud Computing for E-Learning**

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**Abstract**

Cloud-based learning systems are emerging as an attractive method for providing e-learning services. They can reduce costs due to lower requirements of hardware and software, and less need for onsite maintenance. They are also easier to deploy across multiple locations as they are centrally administered. They also offer benefits to end users in terms of accessibility, security, and compatibility. The study summarized the main advantages, features required for implement cloud computing and significant role of cloud computing in e-learning. As the cloud computing technologies become more sophisticated and the applications of cloud computing become increasingly widespread, e-learning will certainly usher in a new era of cloud computing.

**Keywords**:Cloud computing, E-learning, internet,distance education,virtualization

**Introduction**

In recent years, cloud computing as a new kind of advanced technology accelerates the innovation for the computer industry. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited. Education is a necessary human virtue and essential for society because it reflects the personality of the human being in our society. The effective way of teaching gives the quality of education and advance learning such as e-learning to the learners and also a high quality of teaching to the tutors. Information Technology (IT) plays a significant role in field of education. Now days, E-learning and M-learning have become very popular trends of the education technology riot. E-Learning is the new tool related to the virtualized distance learning by means of electronic communication mechanisms, specifically the Internet to enhance the traditional learning system. An E-learning system generally needs a lot of software and hardware resources. Today, many educational institutions cannot afford such investments and environments therefore cloud computing is the finest solution. The Cloud Computing environment rises swiftly as a natural platform to provide support to e-Learning systems.

**E-learning**

E-learning is a fast and efficient way to spread knowledge to learners in different parts of the world that provides the following definition of e-learning: “E-Learning uses the Internet or other digital content for learning and teaching activities, which takes full advantage of modern educational technology provided with a new mechanism of communication and resourcerich learning environment to achieve a new way of learning”. In addition, e-learning can significantly reduce the time learners spend on learning and it also allows them to access a broader spectrum of learning materials in accordance with their individual competences and situation without the limitations of time and space.

**Cloud Computing**

Cloud computing can be defined as “a new style of computing in which dynamically scalable and often virtualized resources are provided as a services over the Internet.” The National Institute of Standards and Technology (NIST) defined cloud computing as “ a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”[[1]](#endnote-2)

**Characteristics**

The main characteristics of Cloud Computing as a specialized distributed computing paradigm are the following :

* Scalability and elasticity.
* Economies of scale.
* Abstract entity.
* Accessibility
* Device and location independence
* High reliability
* Improved security
* Improved efficiency and utilization
* Constant performance monitoring.
* Maintenance of cloud computing applications is easier,

**Features**

Six main features for implement cloud computing in E-learning are described below:

**Cloud Platform**: Cloud platform provide an infrastructure for the implementation of a cloud-based educational media service environment by applying several IT and cloud computing technologies, such as data synchronization, virtualization, service provisioning, and multi-sharing services.

**Common File Format**: Common file format help to manipulate various types of media content on multiple device platforms based on an XML document format with HTML5, eXtensible 3-Dimensional (X3D), and JavaScript. XML has been used in many areas as a means of representing data and meta -data. It consists of two components: the Document Type Definition (DTD) that defines the schema for the XML document structure and the eXtensible Style sheet Language (XSL) that describes styles for representing XML data. That is, XML separately represents content and style, so that the same content can be viewed on multiple devices by defining only the styles appropriate to each device.

**Authoring Tool**: The system provides an authoring tool to allow teachers to create various types of smart media content including text, images, video, sounds, widgets, and 3D, VR, and AR objects and scenes. The content creation process is divided into three phases: control creation, file configuration and editing, and distribution. The document structure of the authoring tool system follows the structure of the Flow Document of WPF (Windows Presentation Foundation)

**Content Viewer**: Content viewer help to display media on multiple platforms. The contents created by the authoring tool are saved in the XML-based common file format. The viewer displays content on each device by converting the XML data to HTML, appropriate to each device.

**Inference Engine**: An inference engine provides students with personalized learning content by analyzing their preferences, learning styles, and content usage patterns. To achieve personalized learning services appropriate to each student’s characteristics, the system saves the learning content, learning patterns, and learning achievements of each student in databases and analyzes them to infer learning elements associated with each student’s characteristics. Then, the inference engine derives and builds individualized learning content for each student based on the inferred learning elements. Learning content is presented to students in order of interest and difficulty.

**Security System**: A security system not only to encrypt data and control privileged user access but also to protect and solve network problems in the cloud. For the security of content, we encrypted all media content managed in the cloud using the Advanced Encryption Standard (AES) which is the electronic data encryption standard established by the NIST. Security system helps to retain backup data of all media content, and establish a security policy that accommodates cloud security components, such as data preservation, service availability, reliability, and resiliency. The security policy will provide dependable smart-media content services by reducing damage from cloud attacks, accidents, or unexpected fault-loads.[[2]](#endnote-3)

**Significance of cloud computing in e-learning**

An advanced e-Learning System deployed on a Cloud Computing Architecture has a significant role and complexity in e-learning environment and must comply with the following requirements:

* Compatibility and ability to collaborate with other e-learning systems;
* Performance and extendibility of the whole environment;
* Reusability and compatibility of e-learning content with existing standards like SCORM (Sharable Content Object Reference Model), IEEE Learning Object Metadata (LOM), IMS GLC (IMS Global Learning Consortium) Learning Resource Metadata Specification etc.
* Creation of Hypermedia Reusable Learning Object (HRLO) from different input learning content format (PDF, MPEG, MS Office, JavaScript, PHP, SCORM, IMS Content Package, etc.);
* Support for the common content creation tools (Dreamweaver, Adobe Flash, PowerPoint, Word);
* Content management ability such as electronic filling and file management;
* Fast content creation, distribution, integration and authorizing tools; Cloud Middleware Management System Security & Identity Management Component Monitoring & Management Component
* Modular structure including tools for e-learning content installation, development and management; XML support to work with different systems and easily integrate metadata for e-learning ontology creation;
* Database support with advanced search and header hiding ability
* Video Conferencing support and chat tool Survey campaign support
* Management of studding groups and debate forums
* Online assessment module
* Calendar, backup support and whiteboard
* Multi-Language support

**Advantages**

There are numerous advantages when the e-learning is implemented with the cloud computing technology, they are:

* **Low cost:** E-Learning users need not have high end configured computers to run the e-learning applications. They can run the applications from cloud through their PC, mobile phones, tablet PC having minimum configuration with internet connectivity. Since the data is created and accessed in the cloud, the user need not spend more money for large memory for data storage in local machines. Organizations also need to pay per use, so it’s cheaper and need to pay only for the space they need.
* **Improved performance**: Since the cloud based elearning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.
* **Instant software updates**: Since the cloud based application for e-learning runs with the cloud power, the software’s are automatically updated in cloud source. So, always e-learners get updates instantly.
* **Improved document format compatibility**: Since some file formats and fonts do not open properly in some PCs/mobile phones, the cloud powered e-learning applications do not have to worry about those kinds of problems. As the cloud based e-learning applications open the file from cloud.[[3]](#endnote-4)
* **Benefits for students**: Students get more advantages through cloud based e-learning. They can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers.
* **Benefits for teachers**: Teachers also get numerous benefits over cloud based e-learning. Teachers are able to prepare online tests for students, deal and create better content resources for students through content management, assess the tests, homework, projects taken by students, send the feedback and communicate with students through online forums.
* **Data security**: A very big concern is related to the data security because both the software and the data are located on remote servers that can crash or disappear without any additional warnings. Even if it seems not very reasonable, the cloud computing provides some major security benefits for individuals and companies that are using/developing elearning solutions.[[4]](#endnote-5)
* **Accessed via Web**: It implies an ease of access since anywhere, any time and any one can access the application, greater demand for Web Development skills.
* **No client-side software needed**: Therefore, it has reduced costs for subscriber, as no installation, software maintenance, deployment and server administration costs, and a lower total cost of ownership, reduced time-to-value, fewer IT staff is needed by the institution.
* **Pay by subscription based on usage**: Which is suitable for Software Model Education market, and can gain access to more sophisticated applications.
* **SaaS server may support many educational institutions**: Since the application is running on a server farm, the scalability in inherent to the system. As student usage grows, the software performance will not degrade.
* **All subscriber data held on SaaS server**: Very high level of security is needed by SaaS provider in order to gain trust of subscribers and sophisticated multitenanted software architecture. The subscriber data is distributed between many providers and it must be integrated in order to gain overview of business, higher demand for system and data integrators.
* **Flexibility:** Scale infrastructure to maximize investments. Cloud computing allows user to dynamically scale as demands fluctuate
* **Improved improbability** : it is almost impossible for any interested person (thief) to determine where is located the machine that stores some wanted data (tests, exam questions, results) or to find out which is the physical component he needs to steal in order to get a digital asset
* **Virtualization:** makes possible the rapid replacement of a compromised cloud located server without major costs or damages. It is very easy to create a clone of a virtual machine so the cloud downtime is expected to be reduced substantially.
* **Centralized data storage**: losing a cloud client is no longer a major incident while the main part of the applications and data is stored into the cloud so a new client can be connected very fast. Imagine what is happening today if a laptop that stores the examination questions is stolen.
* Monitoring of data access becomes easier in view of the fact that only one place should be supervised, not thousands of computers scattered over an extensive geographical area, for example. Also, the security changes can be easily tested and implemented since the cloud represents a unique entry point for all the clients
* No need for backing up everything to a thumb drive and transferring it from one device to another. It also means students can create a repository of information that stays with them and keeps growing as long as he wants them.
* Crash recovery is nearly unneeded. If the client computer crashes, there are almost no data lost because everything is stored in the cloud
* Allow students to work from multiple Places (home, work, library ... etc), find their files and edit them through the cloud and browser-based applications can also be accessed through various devices (mobile, laptop and desk top computers, provided internet access is available) [[5]](#endnote-6)

**Disadvantages**

* Overall performances may be affected by the Internet connection transfer rate;
* Data center subscription fee may be more expensive than the private hardware costs, on a long term basis;
* Data security require a high level QoS (Quality of Service) management and the need for backups is critical.[[6]](#endnote-7)
* Lack of face-to-face interaction with the tutor and the learners,
* Reduced social and cultural interaction

**Conclusion**

Currently the research society has suspected that an e-learning is the next generation of Education Learning Mechanisms. In this paper we tried to prove that cloud computing changed E-Learning future systems. A wide world of knowledge and tools now is available to tutors and learners through cloud based services all the time and accessed from anywhere, from any device. However, the limitations of cloud-based learning systems are that an Internet connection is mandatory, low speed connections reduce the efficiency of the provision of e-learning services, and issues surrounding the security of a cloud remain unclear. As the speed and stability of the Internet are continuing to improve, it seems likely that the popularity of cloud computing for e-learning will increase.

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