Architecture of Modern E-learning Education System using Cloud Computing

Rinkey, Piyush Gupta, Archana Bhatnagar

Abstract*: Education system of India is influenced by the development of computing. In today's fast era education pattern, learning style is completely changed due to changes in the technology. Today we are focusing on paper less education system which is fast, effective and less time consuming. In this era the focus is goes more on concepts not only on concepts. Cloud computing technology has completely changed the world over the last decade. Not only have more In this paper we discuss the changes due to cloud infrastructure and consider the use of data decentralization to provide better, fast and effective content management system for e-learning. New architecture for education system easily connecting people and devices with learning management system. The purpose of paper is to give a cloud based e-learning environment for the new generation. This paper also discusses the architecture of the cloud based system, advantages of cloud based system and future aspects of new system. Provide cloud based e-learning system to reduce the cost, can be more effective, easier to update and modify and provide security to the end user by stopping unauthorized user access. Architecture of cloud based e-learning system needs fast and reliable internet services.With the help of cloud based learning users can easily access the information very fast and by the ease mode. By this proposed architecture various services are provided to user and on demand. As cloud is a very booming technology so by moving traditional web based learning on cloud environment, it becomes a great combination.

***Keywords* : ICT, QA, QC.**

I. INTRODUCTION

The field of ICT is completely changed due to Cloud Computing.Services provided by the cloud have a drastic and rapidly changes due to the growth in computing technology and cloud computing technology. These changes in cloud technology are adopted by industry and education system.Now a day's education system is drastically changes and the learning pattern, learning style is changed with the help of technology [1]. Vision of education is changed with the help of cloud computing technology.

Before the one decade the teaching was only inside the classroom but with the help of latest technology is increasingly spread it's wings both inside and outside the classroom. In make our education system as outcome based education system the latest new trends and technologies provide a direction. Now the education system is moving from contents to concepts. It is not limited to a classroom, now it is spread from all around the world. Now people can at a corner of the world and get educated from another corner or the world. To move our education system from old format to new format needs a powerful technology which can cover all futuristic demand of application based education system.

To adopt a new technology to gain benefits in education system, to understand the benefits and limitation of this technology it is very crucial, so we implement it in an ideal way. It also includes the potential aspects of cloud computing and overcome the limitation of this technology to make a better use in education system. E-learning is a revolutionary change in the education system paradigm to move the focus on virtualization classroom which is not having limitation of distance. E-learning platform is based on the various functionalities such as LMS, e-mail, CMS, web-pages, and discussion forums etc. [2][3][4].

Cloud Computing environment provide infrastructure, software and services as a bristlebear to e-Learning systems. Cloud computing also give help in the field of data mining techniques to search and provide valuable contents on CMS and LMS using Knowledge Management System. It provide scalable and dynamically support for changing necessities along time.

This article give a brief discussion about the existing learning methods, comparative analysis of previously existing techniques to enhance e-learning. After that we will included about cloud computing revolution as a spine for service and infrastructure, along with its essential features to support e-Learning. Finally we will propose architecture for e-Learning and discuss about the challenges of this technique.

- LEARNING

Learning is a process of changing thoughts of mind by using our senses which can be visualization, listening doing experiments etc. Learning will design the behavior of a human, so in sort we can say learning will design human mind[3]. Learning is continues ongoing process. Thinking about Learning only focuses on our formal education, which is started from out childhood to our adulthood.

Field of learning if based on many theories from last 70 years[1]. These theories will focus on the learning mechanism so we will empower our decision making power. In this time the learning was based on the saying "Seeing is believing"[3][5]. From last 20 years the learning techniques are completely changed and it focus on the application based learning. Pattern so the understanding of the subject will create application based learning scenarios. All the theories for learning can be categorized into five main types: humanist, behaviorist, cognitive, social learning, and critical reflection. Each type is having its bright side and dark side [6].

Revised Manuscript Received on August 25, 2019.
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II. LEARNING TO E-LEARNING

After the independence of our county, education was the prime area to make a change for government. “Education develops a nation” was the key factor behind the growth of education field. During 1950 to 1975 the education was limited with reading and writing. During 1975-1980 the experimental based education system attracts the attention of learning technologist [1][4]. After the development of electronics and internet the education line have a revolution in learning style. After the revolution in internet technology the learning was moved in the direction of electronic learning (e-Learning)[8]. At the time of 1980 the e-Learning technology became popular in the world. During that time distance learning became popular because it’s beneficiary needs flexibility in time and place. e-Learning evolution make its beneficiaries a flexibility to learn anywhere[8]. Prime focus of e-Learning was “Take your class anywhere you go”[5][4][7]. Computer based training system was coming in the picture. Due to the revolutionary changes in the internet availability and speed, the present era learning.

In the era of Digital India, our education system[4] becomes more approachable and effective. E-Learning makes education system more impactful and due to the revolution in communication industry now there are no geographical constraints for learner. Virtual classroom[8], distance education[5], discussion forums, content management system, learning management system change the meaning of class room teaching. Education data is transferred from one system to another system and Computer Based Training (CBT)[7] became more popular. Communication industry makes the availability of the contest all over the world. Now a day’s education is not limited with only text, it includes graphics, audio, video, forums, chat rooms in the learning module. Now e-Classroom is the future of education.

III. CLOUD TECHNOLOGY

For information technology, Cloud computing is a revolutionary change in last decade. Cloud computing is the most acceptable and appreciable sub filed of information technology for business enterprises, entertainment world, publication industry and education industry. Online shopping industry, mail services and approximately all the big industries are adopting or ready to adopt cloud technology for their business expansion. In the present era the number of users for internet as well as the speed for internet goes up exponentially [7][8]. Requirement of increasing demand of information technology need high processing speed, huge data storage to fulfill the requirement of service providers. Cloud computing full fills these requirements with a very low cost.

Cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. servers, storage, networks, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

The National Institute of Standards andTechnology (NIST) defines.

Striking features of Cloud such as pay-by-use, on-demand, self-service. makes it for valuable for the industry. Cloud computing establish a new trend by providing these facilities with a on-demand, fast and effective manner. For a new company infrastructure, computing power and storage power are the most important features now a days, cloud computing become a bridge between the services and service providers[9]. Organization are providing flexible environment due to thecloud computing services. Computing equipment requirement with a guarantee of computing speed is fulfilled on demand services.

Virtualization be a most striking feature of cloud computing. Virtualization provide IT firms to expand and shrink their computation capacity and storage requirement without any physical expansion at their site. The cost of overall requirement is very less as compared to fulfill the actual requirement by adding at their location.

Cloud Computing provides the following benefits such as Efficiency, cost saving, Remote Accessing, Flexibility, Future Proofing, Resilience without Redundancy [10].

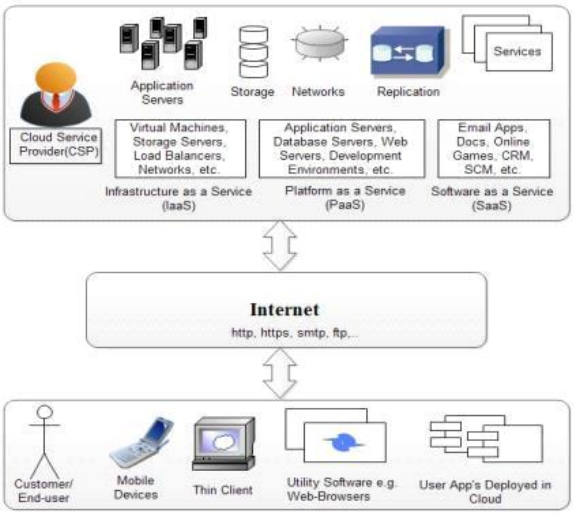

Figure 1: Architecture of Cloud Computing

In general there are three basic design of cloud computing fulfill the requirement of the industry[2]:

- Infrastructure as a Services (IaaS)
- Platform as a Services (PaaS)
- Software as a Services (SaaS)

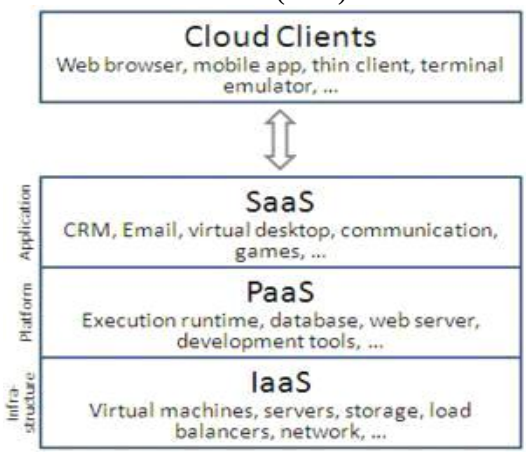

Figure 2: Basic Model of Cloud

Cloud Computing services available with the four models of deployment:

- Hybrid Cloud
- Private Cloud
- Community Cloud
- Public Cloud

For cloud setup of an organization we are creating virtualization. In computing cloud service provider create virtual availability to the customer for the hardware, platform, network resources and software [11][5].To provide all the resources available at client site virtually is called virtualization.

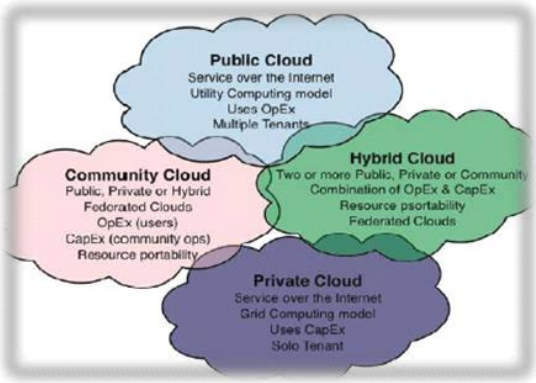

Figure 3: Cloud Model

IV. E-LEARNING WITH CLOUD TECHNOLOGY

Cloud Computing is an emerging technology to provide services for enhancing computing power, storage capacity, network and software services. It provides these services by virtualization technique, where physical resources are not provided to customer but the services for those resources are provided virtually in a non-interruptive manner. User does not aware about the resource location which are used by user with the help of cloud computing. A user or users will get the services for a server and communicate with the server at the time of accessing the computing requirement. Server location is not visible to user but guaranteed services provided to the user. If there is a problem in the hardware the services and data will be auto shifted to another server.

This technology makes E-Learning availability [2] to all kind of movable smart devices i.e mobiles, tablets, laptop, tablets and PDA [12]. In the present era many companies are working as a service provider for the cloud computing to technical work such as development, startups, and technical training providers with a low cost.

Due to the development in the Information Technology and to enhance the learning environment for the new technologies and enhancing the learning style more realistic and practical we need a change in learning strategies from learning to E-Learning [13].

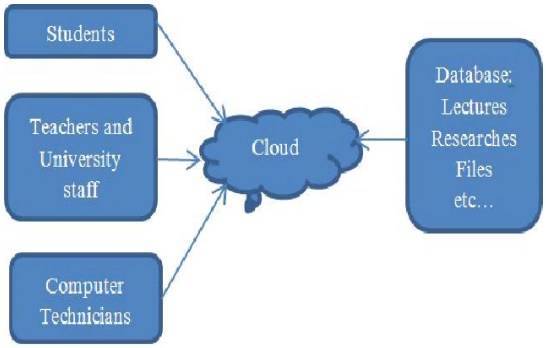

Figure 4: Basic Cloud Architecture for E-Learning

This technology makes the availability of E-Learning to the every corner of the world. Cloud computing having characteristics such as:reliability, scalability availability, agility and elasticity makes cloud demand as a backbone for E-Learning platform.

As we know "Every coin is having two sides", cloud computing is also having some dark side of this technology such as: requirement of internet connection, speed of internet connection, accessibility aspects and issue of data security [10].

V. RELATED WORK

In this field the researchers provide different architecture to provide fast and effective services of E-Learning using cloud computing architecture. Brief discussion about the existing model is present here with their advantages and limitations. Cloud computing does not provide any physical machine rather than it provide computing speed with the concept of virtualization. Blue Sky framework focused on delivering Infrastructure as Services (IaaS)[2][6] and come with a physical architecture layer having physical resources, monitoring, user interface and provisioning in its architecture. This architecture was powerful that time but the security aspect was not covered with that architecture. User of that architecture was providing security with that architecture.

Web 2.0 is needed by North Atlantic Treaty Organization (NATO) for military work. Snow Leopard Cloud was designed for this purpose which provides Platform as a, Services (PaaS)[2]. On web 2.0 remote accessing, remote management, video teleconferencing, Voice over IP (VOIP) services was provided by this architecture [14][3]. As this architecture was designed for the military services so the security was the prime feature for that architecture. User data as well as the network interface was secure in this architecture by using effective encryption techniques.

VI. PROPOSED WORK

In this we including 5 sub layers i.e. our proposed E-Learning cloud architecture can be divided into 5 sub layers names as: Infrastructure layer, software resource layer, Resource management layer, service layer and application layer. Working of the layers is defined as:

- Infrastructure layer: This layer contains information about all the infrastructure, physical resources, computing devices, storage devices, management information system, teaching resources, hardware, and required software. This model contains all the required

things which we need in traditional classroom teaching using multimedia resources. In our model this layer is the lowest layer or like a physical layer of TCP/IP model. All the basic physical work like power consumption, physical memory, permanent memory, CPU, virtualization technology, are divided into multiple domain at this layer. This layer is dynamic as well as scalable, so to add a new resource at this layer is easier when the requirement for the processing speed, physical memory and permanent storage will be increased.

- Software resource layer: This layer contains required operating system and middleware component needed for the E-Learning platform. Middleware technology helps to integrate various software resources to get a better interface for the software development. Required software resources are available through cloud by embed these software resources at this layer.

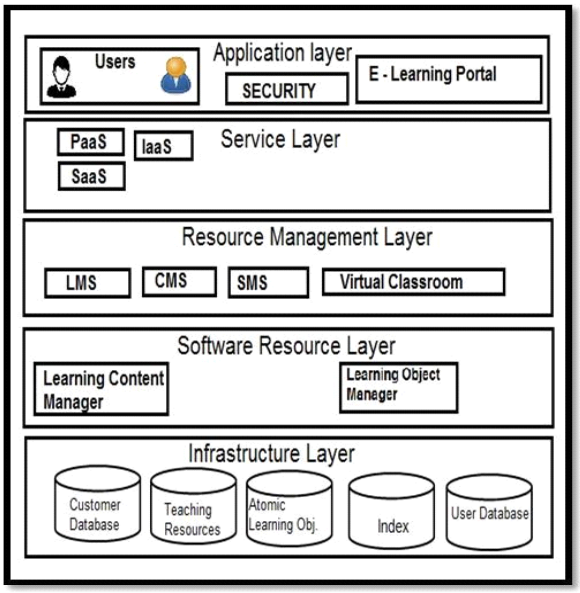

Figure 5: Proposed Architecture of E-Learning

- Resource management layer: This layer willprovide the services for resource management. This layer will provide a loosely coupled binding between software and hardware so during the demand of different resources it will be easier to change the hardware or software depends on the user's requirement. With the help of virtualization of cloud technology this task became easier. This layer contains Study Management System (SMS), Content Management System (CMS), Learning Management System (LMS), Virtual Classroom Management, Course Management System services.
- Service layer: This layerprovides all the three basicservices of cloud technology, namely, Software as a service (SaaS), Platform as a service (PaaS), and Infrastructure as a service (IaaS)[15]. In SaaS, cloud computing service is provided to customers. Users of the E-Learning will access our services by having a fast speed internet connection. There is no need to have fast speed infrastructure, no need for specified software. Subscriber will access these services by internet connection. No need to install software at end use side. They will pay a rental on monthly, quarterly, half yearly or yearly basis.

- Application layer: There are different types of userfor our services such as end user student, facilitator faculty members, and our prime users. This layer will access the different accessibility at the end user site depends on the subscription type or user type. Our E-Learning module will also be available on trial basis so this layer will take care about the access right of the end user and provide services according to their credentials.

- AUTOMATED AURTHORING TOOL FOR CONTANT MANAGEMENT

Automated authoring tool is used to design the content in similar format, so in every lesson, course and module, LMS contents look and feel will be similar. By using this tool we can design our fresh contents and update existing contents. In our LMS we are having documents, presentations, sheets and videos. For documents, presentation and sheet, we use prefix templates in our proposed LMS architecture. In our proposed system we use articulate 360 for contents design and updating.

VII. ARTICULATE 360

Articulate 360 is providing all the features we need for course content development. Several useful award winning authoring tools such as new responsive-authoring app, screen casting apps, an ever-growing library of course assets, an online tool for review and collaboration, and exclusive training webinars by industry experts are the key features of Articulate 360. There are several features to choose Articulate 360:

- **Simple Account Management:** User information,seat information, billing details is at common place.
- **Excellent Support:** User support is provided withfast and effective manner. Problem will be resolved within the same day.

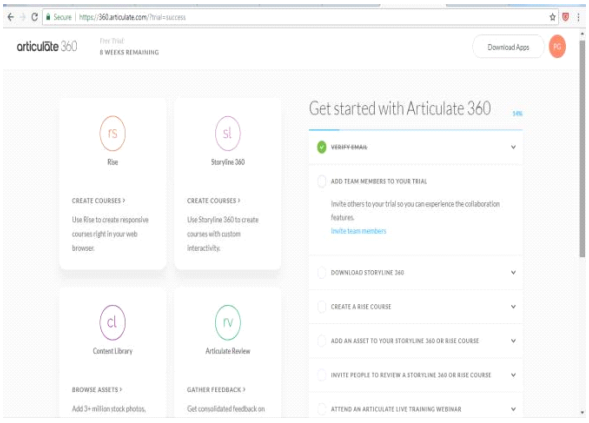

Figure 6: Articulate 360 authoring tool

VIII. E-LEARNING CONTENT DATASTORE (ELCD):

E-Learning Content Data Store (ELCDS) is a common location to store all the contents, which are designed for a learner. Contents are uploaded by the Trainer itself who designed the contents or admin also can do it. There are several modules (subjects) in a course. Educational Institute and student will purchase module according to their own requirements and the access of that module will be provided to them. In ELCDS contents will be in the form of documents,

sheets, power point presentation and video. Discussion forum is also provided to get more clarity about the doubts.

IX. MODULES IN E-LEARNING SYSTEM:

Proposed E-Learning system is having the following modules:

- User Login Module: All type of user for thesystem will be login threw this module.
- User Registration Module: In this module superadmin creates id for admin, teacher, student and organization. A super admin is already exist in the system and only super admin is having right to create admin.
- User Group Management Module: In this moduleunder an organization login we create no of users for various courses.

  For a special course we can creates multiple users.
- Course Management Module: Various courseslike technical, computer, and science are created in this module.
- Lecture Management Module: Lecture for aparticular course is prepared in this module.
- Message Management Module: User of oursystem will get notification on their mobile as well as password management will also generate notification.
- Mail Management Module: User registrationinformation, password recovery information and new courses available information is communicated to user by mail module.
- Video Lecture Management Module: A videolecture is also prepared to support some complex topics. This module will manage video lecture creation, uploading and downloading.
- Webinar Management Module: User at thedifferent courses will get special classes by webinar. In this module all different location user can connect and take participation in training and discussion.
- BENEFITS TO PROPOSED E-LEARNING ARCHITECTURE:
- Improved performance: In cloud technology all thepowerful and valuable resources are at cloud and not at client side so the performance at client side services will improve[16]. At client side not need to install the software only internet connectivity is required so the performance will be better.
- Cost Effective:

In E-Learning environment the students and teachers are at client end so there is no need to take high processing speed computers and high storage capacity. All the computation speed and storage is provided by cloud to the end user. They will only pay subscription charge and internet connection[16][17][20]. So the cost of user is saved. He is getting high speed services[21] at his or her fingertips.by accessing through their PC, mobile phones.

- Benefits for students and teachers:In cloud basedE-Learning system students get benefits such as online courses, video tutorial, discussion forums, online assignment, online exam, online feedback system. In our proposed E-Learning system all the students of the courses will discuss at the same platform without disclosing their identity.

This platform also helps teachers by conducting online tests for students; create better content for student, getting students from different corner of the world. They can conduct exercise question[22] related with the topic and the data will be permanently saved in cloud so no need to create it again for another batch.

- Data security: In this architecture the primeconcern about the security of our data because out data is not at our end it is available at the cloud service providers end[18]. This mode provide security measures by which our data which is stored at cloud is encrypted and during data transfer at the user end it will be decrypted.

X. RESULTS EVALUATION

To evaluate the effectiveness and response of proposed system, a heuristic evaluation checklist is prepared which is based on Pierotti was used [18]. In this response sheet we are taking three response levels for the checklist criteria: (1) yes, (2) no, and (3) Not Applicable (NA). To check system usability [19] we are converting the answers into numbers on the basis of participants. Checklist [19][22] questions are categorized into 12 parts.

HEURISTIC	**RESPONSE (%)**		
	YES	**NO**	**NA**
User Management	93.0	4.0	3.0
Course Management	94.8	2.2	3.0
Uniqueness in contents	92.0	5.0	3.0
Flexibility and Ease of use	94.0	3.0	3.0
Error Control	90.8	5.2	4.0
Contents Quality	95.0	4.0	1.0
Cost	93.6	3.4	3.0
Documentation	91.0	6.0	4.0
Customer Support	97.0	1.5	1.5
Availability	93.7	3.0	3.3
Recovery	91.0	4.7	4.3
Speed	95.0	2.0	3.0
Average	**93.4**	**3.7**	**3.0**

Graphical representation of the heuristic is represent in the figure 7

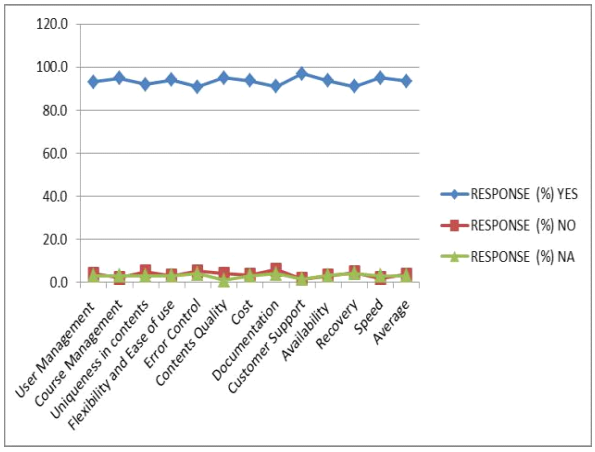

Figure 7: Performance Evaluation

XI. CONCLUSION

Cloud computing is a recently powerful technology which provide services for infrastructure, software and platform. These services are very cost effective and available through fast internet connection by using any device. With the help of cloud technology our E-Learning facility is available at any corner of the world for students as well as for the teachers. Now we can also deliver the services at student end as well as we can also have a facilitator (Teacher) at another corner of the world. These services are completely without geographical constraints [8][17][21].

E-Learning is the demand of 21st century education system. Obviously we are not replacing the role of a teacher now a days but a teacher includes the E-Learning approximately 50% - 70% in his teaching style will make a powerful impact of a teacher. From student point of view he or she can learn internationally by using his device and subscription of the services. For a teachers point of view he will have many students in his or her class globally without geographical constraints [7]. Current economic situation will also force education institute to adopt E-Learning module with their classroom teaching and cloud technology [21] available it at cost effective rates.

The aim of our work is to propose an architecture which provides faster accessibility to our contents. Mainly we focus on cloud computing benefits as well as user authentication, and user data security aspects. Future research will include process migration, fault management, and biometric authentication of users.

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