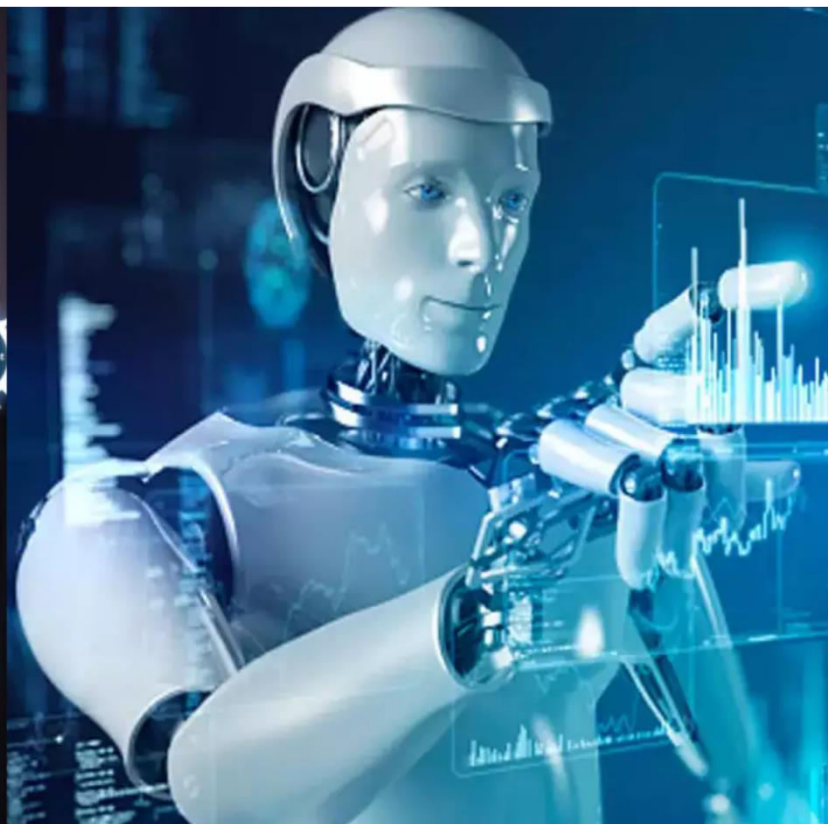




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E-Learning based on Cloud Computing: Requirements, Challenges and Solutions

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ABSTRACT: Cloud computing has emerged as a compelling paradigm in recent times, revolutionizing the management and delivery of services via the internet. This transformative shift is rapidly reshaping the landscape of information technology, bringing the long-envisioned promise of utility computing into reality. The impact of cloud computing extends beyond technological realms and has the potential to transform education on a global scale. Through cloud-based services, an extensive reservoir of knowledge becomes accessible to teachers and students alike, transcending geographical constraints and device limitations. By aiding nations in reducing costs and simplifying the delivery of educational services, cloud computing facilitates the acquisition of 21st century skills by students worldwide. This, in turn, positions them to compete and thrive in the interconnected global information society. Our research aims to establish an e-learning application model grounded in cloud computing, leveraging its capabilities in mass data storage, high-speed computing, and efficient resource allocation, and sharing. While certain challenges, such as platform security, technical standards, and regulatory concerns, remain unresolved and warrant further investigation, the trajectory of e-learning application models based on cloud computing is unstoppable. As cloud computing technologies advance and their applications become more widespread, e-learning is poised to enter a new era, driven by the evolving capabilities and broader adoption of cloud computing.

KEYWORDS: Cloud Computing, E-Learning, E-Learning, Based on Cloud Computing.

I. INTRODUCTION

In recent years, cloud computing has emerged as a transformative technology that has revolutionized the computing industry, fundamentally altering how applications are developed and accessed over the Internet. This paradigm shift involves delivering services via the Internet, allowing users to access hardware and software resources on-demand, paying only for the usage. Clouds can be a conglomeration of both physical and virtualized resources in centralized distributed data centers, supporting various workloads such as batch-style backend jobs and client-facing applications. The adoption of cloud computing has significantly reduced the burden of IT infrastructure maintenance and management, offering economic and scalable solutions that benefit enterprises. Cloud environments require minimal software and hardware infrastructure, providing a convenient and efficient platform for various applications.

In this context, e-learning, an internet-based learning system, has gained considerable attention from software developers and vendors due to the advantages offered by cloud computing. E-learning has a profound impact on the teaching and learning environment, employing diverse media activities like text, images, audio, and animation to facilitate student engagement. Establishing an effective e-learning system typically demands substantial hardware and software resources, necessitating significant investments. As education is an indispensable aspect of modern life, e-learning stands out as a crucial method, utilizing networked information and communication technology (ICT) for teaching, training, and learning. The components of e-learning encompass various formats, online learner communities, and content experts and developers.

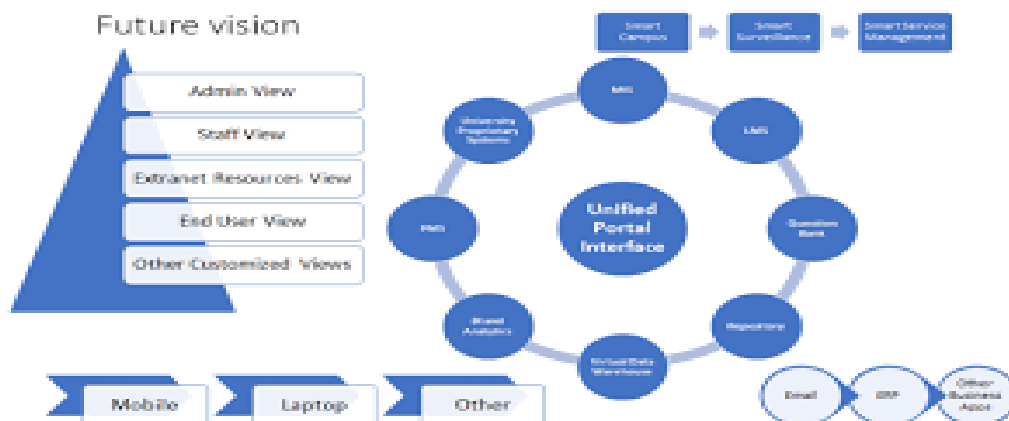


Fig 1: Cloud Computing For E-learning: A Proposed Model for Higher Education Institutions

To keep pace with the evolving landscape of e-learning, incorporating the latest multimedia and communication technology is essential. Cloud computing emerges as an optimal solution in this context, addressing challenges and providing a robust framework for enhancing e-learning systems. For academic organizations and institutions with limited budgets for hosting and operating online learning systems, cloud computing proves to be an excellent alternative. This paper delves into the intersection of cloud computing and e-learning, exploring the synergies between these technologies and addressing key questions surrounding their integration into the educational domain.

Cloud computing has emerged as a revolutionary computing model, granting users the ability to access applications from any location using connected devices. Originating from concepts like grid computing, utility computing, and software as a service (SaaS), this model facilitates seamless access to applications with a user-centric interface that renders the underlying cloud infrastructure transparent.

The operational core of cloud computing lies in massively scalable data centers, where computational resources are dynamically provisioned and shared, resulting in significant economies of scale. The associated service management platform aids in cost reduction when adding IT resources, distinguishing itself from traditional infrastructures. Various players in the IT industry have introduced cloud computing initiatives, attracting heightened interest from corporate clients seeking services such as infrastructure outsourcing, software as a service, key processes as a service, and next-generation distributed computing. Cloud computing functions as both a business delivery model and an infrastructure management methodology. The business delivery model optimizes the use of hardware, software, and network resources to deliver innovative services over the web. Simultaneously, the infrastructure management methodology enables IT organizations to efficiently oversee highly virtualized resources, allowing a substantial increase in data center capabilities without a corresponding surge in human resources.

II. RELATED WORK

The term “e-learning” have been introduced in October 1999 for the first time in “CBT systems seminar in Los Angeles”. Commission on Technology and Adult learning in 2001 defined e-learning as a learning content along with learning experiences and by active and passive etechnology. In fact, this technology, has established an opportunity for learning, work and increasing productivity integration. Therefore, the objective in e-learning is to utilize technology for increasing knowledge and the expertise of the learners that they can be more productive, find their own jobs and to maintain them with high quality, to advance in their professions and to effective their workplace, family and their society in a positive way [2]. In a general definition of e-learning is to utilize network technology in order to plan, course delivery and run leaning place to progress the learning achievement. Learning achievement in such system is subject to provide an appropriate environment, learner-centered and independent towards time and place which is known as elearning [3].

In the transition from traditional infrastructures, cloud computing facilitates the consumption of IT resources within data centers in ways not previously feasible. The conventional process of making IT resources available to end-users, involving activities like hardware procurement, space allocation, software installation, and network provisioning, often takes months. Cloud computing streamlines this process through automation, business workflows, and resource abstraction, significantly reducing the time required to make resources available from months to mere minutes. Moreover, cloud computing holds the potential to enhance resource utilization, decrease IT hardware requirements, and reduce global CO₂ emissions through virtualization at both the hardware and software levels. Network virtualization and path virtualization contribute further to resource abstraction and energy efficiency within routing processes. Cloud computing offers its services through three distinct models: software as a service (SAAS), platform as a service (PAAS), and infrastructure as a service (IAAS). SAAS caters to organizations accessed through the internet, PAAS provides development tools without necessitating software installation, and IAAS is managed by cloud service providers, supporting diverse operations encompassing storage, hardware, servers, and networking.

In a more accurate interpretation, e-learning has been defined as a new approach in providing a free leaning environment, flexible and distributed for everyone, in any place and any time by utilizing various digital technologies. “Free learning” means to learn independent towards time, place and progress speed of the learner. “Flexible learning” lets the learner to form the way, place and time of leaning. “Distributed learning” is not necessarily the same as distance education, but it points the close relation with distributed references. Distributed learning is a learning model which permits the teacher, learner and the content to be in different places and decentered which as a result the teaching and learning become independent towards time and place. The distributed learning model can be used in combination with attending courses and classroom-based with distance learning or it can be used to create totally virtual and network classes [3].

III. METHODS

Cloud computing is a model for universal access, simple and based upon the network order to a pool of configurable resources and shared on demand which are provided to users with the least managerial requirements or interactions [4]. Five significant features of cloud computing are as follows:

Service on Demand: the cloud customers shall have access to the resources and services of their own cloud without any interaction with the personnel of the provider company. Therefore, such service shall be accessible always and in case of service interruption, the service provider company shall be responsible for that.

Extensive access to the network: this is a certain fact that the cloud computing is formed based on network. The access to the resources of the cloud shall be possible from whole network, in order to do so, standardized methods have been utilized to maintain the connections among different operating systems, different platforms, such as workstations, laptops, tablets and even cellular phones

Calculation and measurement service: cloud computing systems shall be able to calculate and measure the used resources by the customers automatically. Determination of the size of consuming resources such as memory, saving capacity, network bandwidth, process, number of active users and etc. provide transparency for the provider and the cloud service customer.

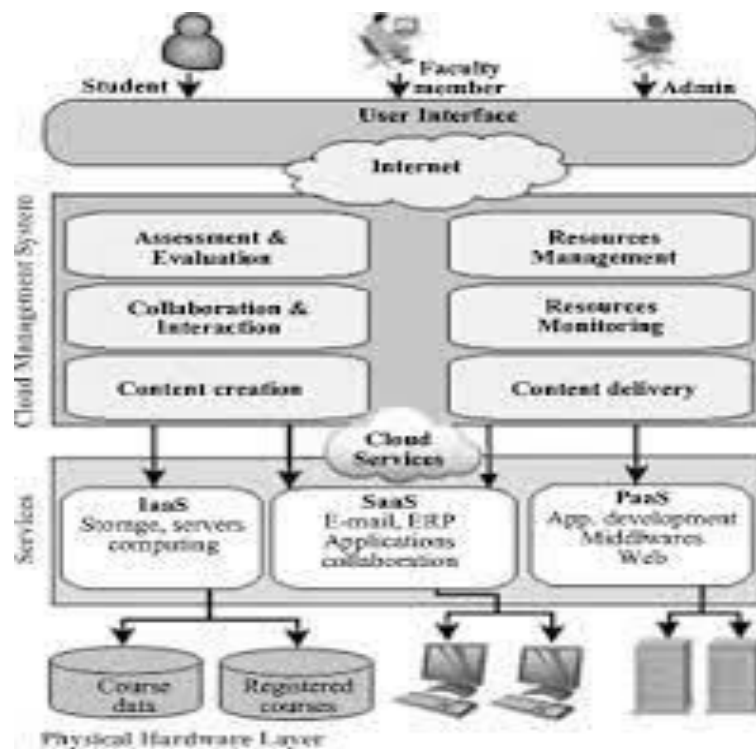


Fig 2: An E-Learning Architectural Framework for Nepal Using Cloud Computing and Satellite

Sharing resources: computing resources are shared in cloud environment. It means several customers may use the resources simultaneously. In such situations this note is significant that the customer has no information about the accurate location of provided resources such as memory, saving capacity, network bandwidth, connection and etc. but he is able to determine the status in higher level of abstraction such as country, state, or the data center.

Capability of rapid expansion: the resources of the cloud shall be expandable, because from the customer view the fulfillment capability of cloud computing resources supplement shall seem unlimited and in every moment shall be purchasable with the desired scale of the customer.

IV. RESULT ANALYSIS

Although e-learning based on cloud computing has many advantages but also still this technology has some disadvantages. Some of these limitations are because of the complete dependence of e-learning based on the cloud to the internet, for instance, the bandwidth plays a vital role for data deployment in internet servers [15]. One of the solutions is expansion of optical fibers networks to provide better cloud resources for the educational environment of e-learning. Also due to the dependency to the internet, also the security is highly significant. The data are stored in the cloud servers with unknown locations. The security issue is the stored data. Therefore, it is needed that the information before storage to be encoded in the clouds.

Also, the cloud computing structure effects on the service of IT and consumption patterns used by e-learning and changes the old methods of using computer technology. Therefore, it effects on the ideology of the elearning users and their perceptions for more development of e-learning based on the cloud [15]. To prevent such problems, it is required to build an appropriate model for e-learning based on the cloud and also promotion of elearning applications based on the cloud widely for the users.

The major challenge of e-learning technology is the replacement of methods and traditional approaches of learning. Traditional environment of learning is differ from e-learning's [15]. In this case, by using the cloud computing for e-

learning system may face new difficulties in the learning environment. Therefore, to overcome such difficulties, proper managerial regulations shall be considered for e-learning based on the cloud. The learning content management, course management, exam management, performance management, student management and teacher's workload management shall be structuralized.

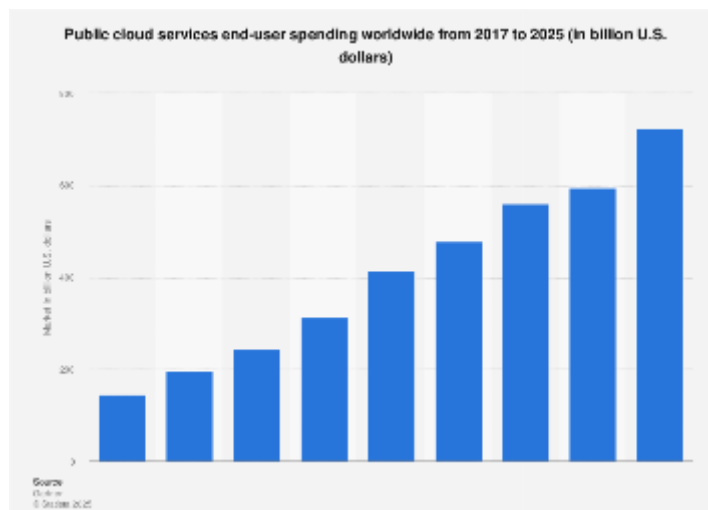


Fig 3: Public cloud computing market

At the end, the necessity of advancement of any technology is the role of beneficiaries in developing of them, to gain the best results in utilizing of them. When this approach in e-learning technology based on the cloud has been used, the teachers, and all of the learning specialists shall play a role in development of their own resources to produce the best learning collection of science and art.

V. CONCLUSION

The cloud computing is an advanced computing model based on internet which has been developed recently. By combination of the cloud computing and e-learning, the elearning system based on the cloud computing has been established that is a new idea for development of elearning and in future by development of e-learning the whole of educational system will be changed. There is no doubt that the use of the cloud computing in e-learning provides capabilities such as unlimited resources, proper scalability and expense reduction for e-learning. Although the limitations such as bandwidths, security, the educational management regulations and etc. exist which in this study it is suggested solutions for them.

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