A Conceptual System Architecture for Cloud-Based E-learning Systems for Higher Education in India

Mudit Khetan, Dr. Vinod Kr. Gupta

***Abstract*— E-learning is the new means which has the potential to support the traditional education system. E-learning is gaining popularity and is considered as a viable and efficient means of content delivery and student engagement for many courses in higher education institutions. Due to the affordability and availability of Internet enabled computing devices and developments in ICT, every learner has the opportunity to improve her understanding and enhance her educational qualifications. In this paper we propose a conceptual system architecture that can take the advantage of Cloud-based computing facilities and provide the online learning aids in the form of audio, video, animation, and simulation applications. We also discuss some of the factors that will have an impact of such an initiative with respect to the higher education in India.**

***Index Terms*— Cloud Computing, e-Learning, Higher Education, SaaS.**

I. INTRODUCTION

The potential for educating masses by bringing quality education to their doorsteps as the ultimate enabler first became realisable with the advent of E-Learning techniques and tools. Despite enhanced reach beyond the traditional campuses, still E-Learning was not able to prove to be a game-changer as it was restricted by the physical delivery of the course material and relied on one-way communication without and feedback from the user. The widespread and growing use of Internet by common masses and adoption of newer connectivity and communication devices like Internet enabled mobile devices, have brought us to a point where E-Learning can be actually taken to the earlier untapped markets/users. Cloud-based solutions offer us a new and reliable platform where differences of technology can be bridged without compromising on the quality and keeping the solution affordable. The role that cloud-based e-learning solutions can play in transforming the higher education landscape of India and becoming a growth driver makes them more interesting than ever.

This paper's structure is as follows: Section II discusses the limitations of traditional e-learning approach being largely followed by many instituions in India. Section III touches upon the topic of cloud computing and the benefits it has to offer to higher education. Section IV elaborates the importance of cloud in the e-learning processes, especially for higher education in India. Section V contains the conceptual system architecture of a cloud-based e-learning system. Section VI contains the conclusion and future work. Finally, section VII contains the reference and bibliographical notes.

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II. II. LIMITATIONS OF CONVENTIONAL E-LEARNING SYSTEMS

We also define e-learning as per our own perspective as "E-learning is the use of multimedia technology and the Internet, with the help of which we can provide the learning resources and on-demand software to access those resources to enable a conducive and 360° learning environment." E-learning is the way where each and every person can share his/her knowledge with any one at any time without the boundaries of language, distance and costs.

There have been various types of e-learning material for various levels of education – from kindergarten to university education – like audio and video tapes/disks and satellite TV based education (like IGNOU's Gyandarshan channel). The most striking common feature of these conventional systems has been their passive learning approach on the part of the end-user, the learner. Although, these systems have served a very great purpose of taking the education out of the confines of a school/college, but still they lack the real-time conversational capabilities that are the hallmark of any interaction between a teacher and her students. A few more important factors in their not-so-great outcome in terms of reaching out to masses are their costs (in case of tapes/disks), time limitation (in case of TV slots), non-interactivity and inability to allow the learner readily refer to any related learning material.

An alternate that has become vary popular since mid-1990s is the Internet-based (or more specifically web-based) e-learning systems. The Internet provided many opportunities to people to connect to and communicate with each other in ways, never earlier heard about. Using a properly designed website, an institution (school/college/ university) can provide various learners, associated with it, a plethora of options – audio clips; video lectures; subject notes; live chat; video conferencing; online assessment systems; discussion forums; and newsgroups. Again the problem, particularly in context of a country like India, remains that these tools, taken together, are non-compatible and have to be co-related by the learners themselves, most of the times. Also, these tools are developed and/or employed by most institutions on a stand-alone basis for their custom needs.

On a close inspection, we may realise that all such tools

implemented by an institution vary from other such tools by only a little degree and most of their features and functionality are similar in nature.

If there is a way to integrate all such tools of enabling e-learning as well as many other software and services of general use to the members (learners, teachers, and administration) of an institution, then all educational institutions catering to a particular category of students can make use of the best practices being followed by other institutions. This has positive ramifications, particularly in case of developing countries in most of Asia, Africa, Latin-America and particularly India. The present scenario in Indian context is very grime and not so promising when we take into account the growing population, growing aspirations, rising demand for skilled workforce, and dearth of skilled and qualified teachers/trainers in many disciplines. Even in case of premier institutions like IITs, IIMs, AIIMS, IT-BHU, any many more the current faculty strength is in the range of 50% to 65% of the sanctioned strength. The situation in case of primary, middle and high school is even more dreadful as there is multiplicity of school education boards, lack of qualified teachers and resources and even unrecognised schools.

III. CLOUD COMPUTING – AN INTRODUCTION

Cloud computing refers to the computing resources like data, software and platform (host environment) accessible via a computer network (usually Internet), rather than from a local computer. Users or clients can perform a task, such as word processing, with a client such as browser and with service provided through such cloud based computational resources. Since the cloud is the underlying delivery mechanism, cloud-based remote applications and services may support any type of software application or service in use today. Some of the widely accepted benefits of the cloud-based systems are elaborated as under:

- *Cost* is greatly reduced and capital expenditure is converted to operational expenditure, as infrastructure is typically provided by a third-party and does not need to be purchased. Pricing on a pay-per-use basis is offered to the users and minimal or no IT skills are required for implementation.
- *Device and location independence* enable users to access systems using a web browser regardless of their location or what device they are using – be it a PC, smart phones or tablets. As infrastructure is off-site and accessed via the Internet the users can connect from anywhere.
- *Multi-tenancy* enables sharing of resources and costs among a large pool of users, allowing for:
    - Centralization of infrastructure in areas with lower costs of operations.
    - Peak-load capacity of the system increases.
    - Utilization and efficiency of the costly and complex systems increases from 15%-20% levels to more than 65%-75% levels.
- *Reliability* improves through the use of multiple redundant sites, which makes it suitable for business continuity and disaster recovery.
- *Scalability* via "on-demand" provisioning of resources on a self-service basis in near real-time. Performance is monitored and kept consistent by designing loosely-coupled architecture using web services as the system interface.
- *Security* typically improves due to centralization of data, increased security-focused resources, etc., but raises concerns about loss of control over certain sensitive data.
- *Environmental Sustainability* is championed through improved resource utilization, more efficient systems, and lower power consumption levels.

IV. SIGNIFICANCE OF CLOUD IN E-LEARNING DELIVERY MECHANISM

The proposed cloud-based e-learning is not aimed to replace the traditional education delivery system such as classroom learning. But via cloud-based e-learning we can create a learning environment where latest technologies can be used to deliver a range of the teaching aides and thereby maximizes the participation of pupil in the learning process.

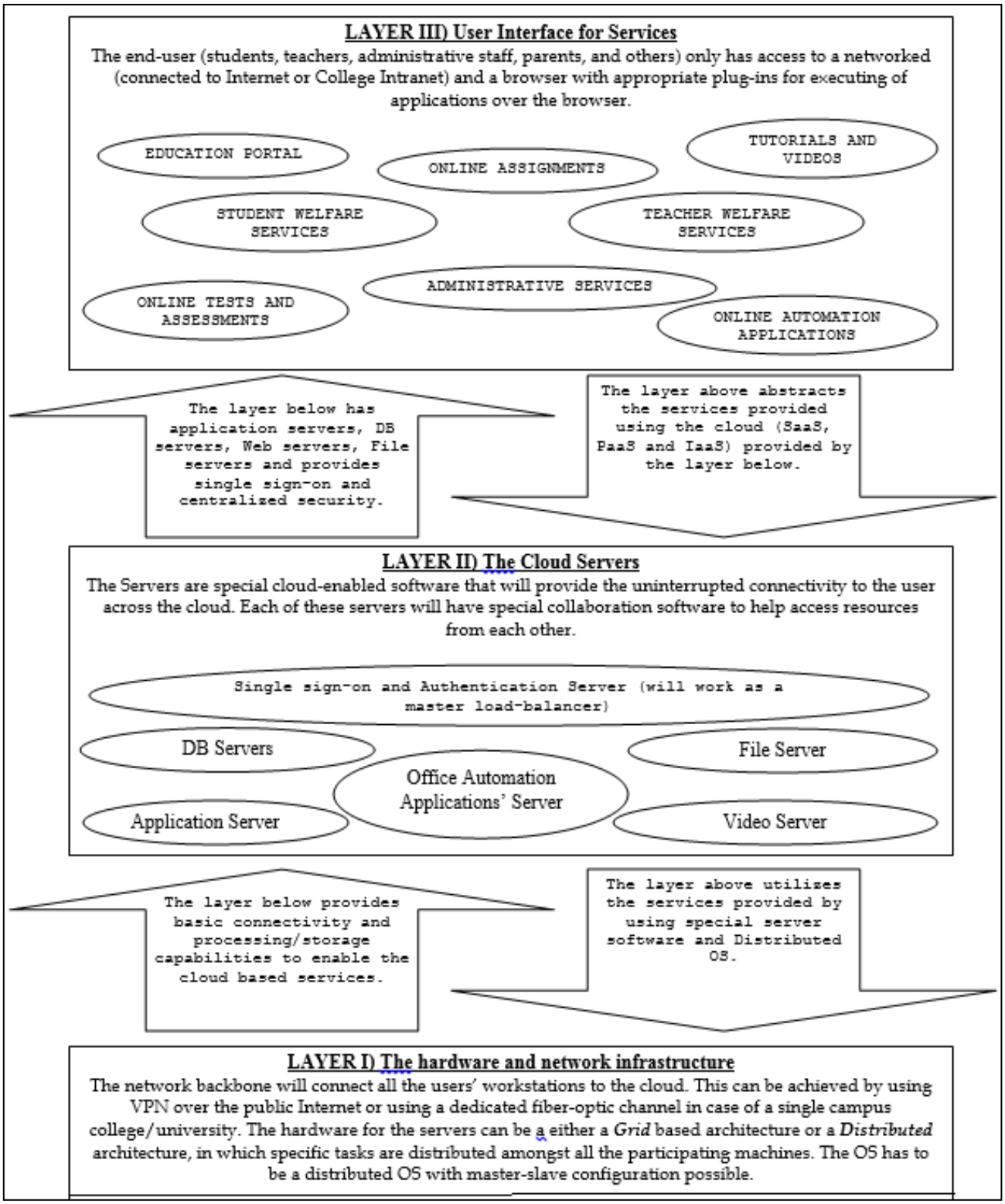
In education, especially in the realm of higher education, there has to be emphasis on collaboration among the students and teachers from different institutions and fields. All the present and popular ways of collaboration among today's learning community, including emails and attachments, do not provide for real-time collaboration and sharing. Also because of the unavailability of a common and integrated platform, many students who are not already part of the elite group of IIT/IIM league are always left out from this kind of collaboration or shared learning.

The purpose of presenting this paper is to present an architecture that may enable existing and new e-learning systems in institutions of higher education, like universities, using the latest advancements in cloud computing to foster a culture of research, collaboration and knowledge dissemination. The main characteristics of this proposal are based on three premises:

1. To avoid the capital investments in hardware and software and costs related to their maintenance, up-gradation and replacement (due to obsolescence).
2. To provide a level playing field to a large number of students who can make use of the resources, available on demand, to enhance their knowledge and employability.
3. To tap the combined power of shared knowledge and research so that the overall climate in the country becomes more conducive by the day towards upgrading the skills of man-power at all levels.

V. V. A MODEL ARCHITECTURE OF A CLOUD-BASED E-LEARNING SYSTEM

Cloud computing is typically divided into three levels of service offerings: Software as a Service (Saas), Platform as a Service (Paas), and Infrastructure as a service (Iaas).



The top layer, i.e. Saas, is a model of software deployment whereby a provider licenses an application to customers for use as a service on demand. Saas software vendors may host the application on their own web servers or download the application to the consumer device, disabling it after use or after the "on-demand" contract expires.

The middle layer, or PaaS, is the encapsulation of a development environment abstraction and the packaging of a payload of services. Paas offerings can provide for every phase of software development and testing, or they can be specialized around a particular area, such as content management.

IaaS is at the lowest layer and is a means of delivering basic storage and compute capabilities as standardized services over the network. Servers, storage systems, switches, routers, and other systems are pooled (through virtualization technology, for example) to handle specific types of workloads from batch processing to server/storage augmentation during peak loads.

The above architecture contains the three layers:

1. User interface layer.
2. Cloud layer.

3. Hardware Layer.

User interface layer - The user interface layer will provide all the functionalities that can be used by the different stakeholders (includes teacher, student, administrative staff and others). In this layer we have provided the different learning objects (Like online test and assessments, online assignments, video tutorials, lecture notes, education portals and many more) which can be used by different users via the internet.

Cloud layer - The Servers are special cloud-enabled software that will provide the uninterrupted connectivity to the user across the cloud. Each of these servers will have special collaboration software to help access resources from each other. This layer contains three servers (single sign-on authentication server, web server and application server).the main work of authentication server is to verify whether the user is valid or not or whether the user name and password provided by the user is correct or not. The user can only access those services or resources, if he/she is legitimate user. Before using the resources, user needs to fill the registration form. The purpose of the application server is to provide the environment where stakeholder/end user can execute their applications in an efficient manner. It doesn't matter that the particular software is available on the user machine or not. The main purpose of the web server is to deliver the learning elements on the user machine that can be accessed through the internet.

Hardware layer - The network backbone will connect all the work station to the cloud. Here we are using two types of cloud public cloud and private cloud. With the help of private cloud user can access or open the application only its own machine and with the help of public cloud he/she can share that application to everyone.

VI. CONCLUSION AND FUTURE WORK

The above architecture is describing the benefits of e-learning over the traditional education system. The e-learning is very popular now a day and many IT organizations are using the services of cloud computing to more efficiently utilize the services on internet. We are now developing this architecture for our institute. We are providing all the beneficial materials to the students which help them to understand the topics very well. This also improves the interaction between the student and teacher. Now a day the licensed software is very costlier to buy. So for that we are providing the internet based service to open or to share the file or any learning material remotely. In future we are also try to providing the concept of video conferencing, mailing and chatting through which user can interact with each other and with teachers and enhanced their knowledge in more efficient manner.

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