An Overview of Cloud Computing To Improve Online Education

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Introduction

E-learning, often called "virtualized computing," is a kind of distance learning made possible via different forms of electronic communication. E-learning has the potential to be a useful supplement to the traditional classroom experience. The quantity of accessible online learning environments has grown dramatically during the last two years. Data mining for education information processing, which gathers pertinent data from a variety of internet sources, has the potential to enhance the current educational learning paradigm. This is done in an electronic setting, where the actual learning takes place. This is done because it is beneficial to the student's education. Cloud computing provides an infrastructure ideally suited to housing e-learning applications and platforms. Making automated adjustments to it is possible because it offers a scalable solution to the problem of transforming the use of computing resources over time. One way to do this is to provide a workable answer to the issue. For e-learning purposes, it is beneficial to use data mining methods in a distributed setting since this facilitates the management of big datasets with less effort. The article provides a summary of where cloud computing is now and provides some concrete examples of the kinds of infrastructure that have been built from the ground up to support such a system. You'll find both of these things in the paper, too. Aside from that, it investigates real-world applications of various strategies for e-learning and cloud computing. E-Learning, or electronic learning, is the practice of acquiring knowledge from an off-site source via the use of various forms of electronic communication, the Internet being the most common and well-known. They are based on the use of methods that provide several benefits to enhance the educational experience. Increasing the efficiency of both processes, is done (e-mail, web pages, discussion boards, learning platforms, and so on). The cloud computing setting becomes an obvious host for e-Learning systems and the use of data mining techniques. Because of the cloud's scalability and massive storage capacity, this is the case. These techniques make it possible to examine the enormous databases that resulted from the earlier process in order to extract the information that is inherent to the data. It's a good fit for the relevant applications since it allows for dynamic adjustments thanks to a scalable system that can keep up with evolving needs. In this article, we summarise the present state of cloud computing architecture as it pertains to e-learning applications. The phrase "cloud computing" is used to describe the process of putting data on the internet and then retrieving it using the same medium. Finally, we highlight several specific Cloud Computing e-learning methodologies from the existing scholarly literature. This may become public knowledge. Similar approaches may be found in the technical literature, so in this section we outline the characteristics of the most often used infrastructures for this setup.

*Keyboard:Learning Process, Cloud Computing,**Business value, Service deployment,** communication ,Education*

Introduction

The proliferation of online platforms for communication and education. It employs a number of structures and functions that might improve education in the classroom. This may be anything from a full-fledged online course to a simple email full of relevant links to a full-fledged online community. The internet has become a strong tool for improving the educational experience by increasing the amount of interaction and collaboration between students, content creators, and educators. Among the many positive aspects of using digital learning materials for instruction are the activities' reliability and repeatability, as well as the materials' flexibility, accessibility, and management. A combination of factors, including the proliferation of Covid-19 and the development of digital technology, has led to an increase in the use of e-learning or virtual teaching platforms in the field of information technology (IT). E-learning systems such as MOOCs, Blackboard, Desire to Learn (D2L), and the Virtual Learning Center are widely used by universities and colleges throughout the world (VLC). Virtual programmes are endorsed by the e-learning paradigm because they improve the learning environment and provide students more access to course resources. Regular users of online applications would be unable to keep up with the demands made on the underlying infrastructure by servicing that many students simultaneously. Further, the need for instructional materials might suddenly and dramatically increase. The school will need more modern infrastructure during peak hours to keep up with demand without disrupting other system operations. Customers in a pay-as-you-go system only have to pay for the resources they really use. These challenges may now be met as a result of cloud computing's development. Using a distant cloud service to store data and process requests was first presented as a way to save costs while increasing availability and dependability in computing. This pivot reflects the changing goals of cloud computing in this field. The workload is determined differently depending on the option chosen. The fundamental purpose of a computing grid is to increase the reliability and performance of a computer system. Meanwhile, cloud computing aims to simplify mobility and provide consumers with access to a wide range of services without requiring them to become experts in the underlying infrastructure. Among its many features, hosting and word processing are only the top of the iceberg.

The Fundamentals of Cloud Computing

Business value:
The adaptability of cloud computing and the ability to tie service prices to real use distinguish it from other forms of internet-based businesses. Since cloud computing is not like a typical resource expenditure that can be offset by a reduction in labour expenses, this is clearly crucial, but it also has the unforeseen effect of giving birth to hitherto untried business models.

Service deployment:
Customer service response times are drastically reduced because to cloud computing's emphasis on speed. It's not that payment hasn't been made at any point in the normal process; it just hasn't been done quickly.

Self-service deployment:

Customers can use the cloud's ad hoc and well-defined services on their own. These fundamentals suggest a fully automated service provisioning, which the customer can take or leave. "Both Infrastructure as a Service (IAAS) and Platform as a Service (PAAS) in the cloud represent transitional phases that alter cloud computing's deployment approach and economic value. Since cloud computing is a totally new offering, it would be detrimental to merely add a cloud to the present services. Understanding what makes cloud computing unique is essential. The rapid pace of current development has led to the replacement of the traditional concept with on-demand service, meaning that the full potential of SaaS (Software as a Service) has yet to be realised. In actuality, corporations routinely resell the same items under new names. Similarly, in an attempt to cash in on the cloud computing boom, capabilities that previously existed have been rebranded without any substantial functional modifications. Cloud washing is a marketing strategy used by companies to convince decision-makers in the business and IT sectors that their product is essential to staying current with technological advances. Cloud cleaning as a process, however, has not been fully implemented just yet due to a few missing variables. When developing Cloud-based industrial apps, it's important to keep scalability in mind. In order for a cloud-based application to perform successfully, it must be created with the option of limitless abstract scalability, which is controlled on a service-by-service basis. Cloud-based apps must have a scalable architectural foundation since the service manipulates the architecture of the application itself.

E-Learning Tasks And Cloud Computing

Several causes, such as the demise of traditional classroom education and the exponential growth of students, instructional materials, services, and resources, have contributed to the meteoric rise of e-learning systems. In terms of data storage, processing speed, and bandwidth, you should choose a system that can grow with your organisation without breaking the budget. Cloud computing may be seen in action here, with data storage and retrieval serving as an example use case. In order to better understand the benefits of cloud computing, especially on the technical and pedagogical levels, it may be useful to characterise the promise of SaaS applications for robust and complete remote learning in comparison to more "conventional" learning settings. Helpful resources like lesson plans, video lectures, peer tutoring, etc., can only be accessed on the internet, and we need to remove barriers to their widespread use. The usefulness of cloud computing in the classroom is starting to be recognised by many educational institutions. As a result of initiatives such as JISC, a number of countries, including the UK, have already built an education cloud with data management and storage technologies (2012). Education It is common practise to take use of cloud computing by using a cloud-based, SaaS-based e-learning platform. The little amount of hardware the system needs increases the likelihood of it being adopted widely. The supplier no longer has to worry about keeping the system up and running, and the manufacturer has access to vital information and free, automated upgrades, all thanks to Web 2.0. Technical goals like uniformity, harmony, optimal resource utilisation, and the long-term stability of the e-learning ecosystem may be aided by cloud computing and other components of today's expanding e-learning infrastructure. A recent study looked at what happens when e-learning programmes are built to run on the cloud and the results were mixed. Due to the

potentially worldwide reach of the programme, web programming abilities will initially be in higher demand. As a consequence, the subscriber has saved money by not having to buy software licences, build infrastructure, or hire new staff. The organisation can save money, speed up the implementation, and eliminate certain IT jobs. In time-critical scenarios like Coivd19, this will be just as helpful. In order to make more sophisticated programmes and necessary apps accessible, the education sector should foot the bill for their own content consumption. Many schools might benefit from using a SaaS server. Considering the cloud can store an endless quantity of data, it is essentially scalable. The programme is designed to handle a large increase in users without slowing down. The SaaS provider must implement rigorous security measures if the client is to trust them with all of their software infrastructure. There is a growing need for educational platforms and data integrators due to the fact that client data is scattered across numerous services and must be combined to acquire a comprehensive image of the organisation. Few writers have investigated the potential benefits of a cloud-based curriculum in terms of technology. There are some people who are hesitant to move to cloud services because of the high cost involved. The use of hard discs for transferring and backing up data across devices is now outdated. The more knowledge students are able to acquire, the more options they will have in the future and the more their understanding will develop along with them. After a collision, there will be little debris to clean up. In the case of a computer failure, very little data is lost. Recent advances in virtualization have made it possible for schools to use electronic learning (E-Learning), giving students access to course materials and enabling them to make changes to their files regardless of their location. The educational establishment and the student body may save money by going this route.

E-learning platforms
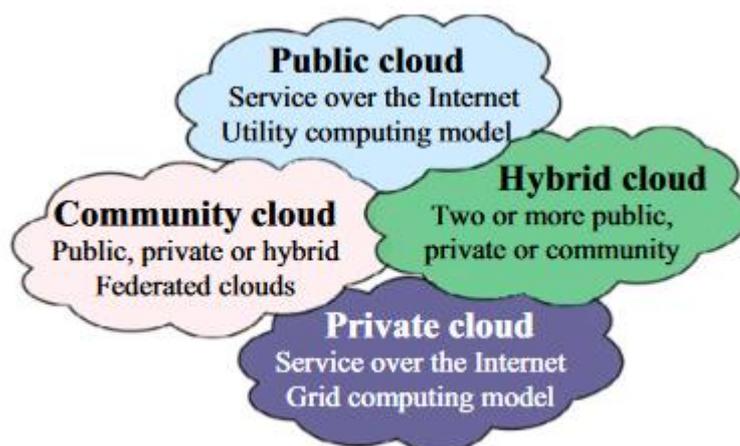
The cloud deployment models (Bora and Ahmed 2013)

The installation of e-learning systems is confronted with a significant amount of difficulty, and this difficulty manifests itself as issues. The use of cloud computing, on the other hand, is growing at a rapid pace and finding applications in practically every industry, including education. we will talk about the implications of shifting toward e-learning that is powered by

cloud computing services as well as the rationale for making this change. After that, the beneficial benefits of using cloud computing in online education will be emphasised with a focus on where the attention will be directed. Next, we'll explain the general architecture of cloud-based e-learning environments as well as discuss some examples of e-learning applications that have been developed with the aid of cloud computing.

Cloud Computing Benefits E-Learning

Cloud computing has developed into a promising new model for delivering ICT services in recent years. For the vast majority of technological applications, using cloud computing makes the most sense. Numerous studies have been conducted in this setting, with a concentration on the possible uses and advantages of cloud computing. There are several reasons why people are curious in e-learning on the cloud. Firstly, organisations and institutions that depend significantly on computers (such as those with online labs, computing centres, data centres, etc.) and those that use e-learning systems are always looking for methods to provide low-cost or even free alternatives to costly and exclusive resources. The pay-as-you-go model made possible by the cloud computing paradigm may be directly responsible for the expansion of e-learning platforms. Users are able to use computational resources on-demand, from any location, and pay only for the time those resources are really used, thanks to this approach. Any specific requirements or financial constraints may be adjusted to make this method work. In this era of pervasive internet and computer network usage, cloud computing is one of the most effective and cost-efficient ways to address the needs of educational institutions. Online education stored in the cloud might be utilised instead of adopting costly resources based on complicated hardware and software, resulting in a lower overall cost of provisioning and maintaining the service. On the other hand, cloud computing is extensively utilised in the education business and has the potential to greatly improve e-learning systems now in use by educational institutions. More and more educational establishments are using cloud computing for e-learning as a means to improve online education's accessibility and efficiency.Cloud services, thanks of its scalability and cost reduction, make it possible to install e-learning solutions in a way that is easier, more rapidly, and at a lower cost. In addition, cloud computing ushers in a new economic paradigm for usage in academic institutions, whereby the services provided are converted into digital assets. Using cloud computing, schools can better serve their students and make more efficient use of their resources. Additional materials for an e-learning system are sent to the user without the need for the user to download any new software or buy any new gear. This produces a system that is considerate of users' budgets while yet meeting their instructional needs. In addition, cloud-hosted e-learning enables the creation of a new breed of e-learning platforms that are accessible from several hardware platforms and can save information in the cloud. On these systems, classes may be taken online. A further advantage of cloud computing is that it provides a suitable environment for e-learning systems. For this purpose, it facilitates the use of data mining techniques, which become essential when dealing with large datasets in order to extract insights from them .The use of cloud computing in e-learning also facilitates better management of both the pedagogical and technical duties involved. Using cloud computing, schools take on the work of producing and distributing content as well as maintaining and updating what already exists. However, cloud service providers are responsible for developing and maintaining the e-learning platform . So, to sum

up, cloud computing addresses the key issue that prompted schools to create e-learning platforms in the first place: how to improve communication and collaboration between students and teachers. The new paradigm of cloud-based e-learning improves efficiency in a digital classroom by facilitating the sharing and collaboration of instructional materials and the participation of all students. The development of online education has taken a giant leap ahead with the introduction of this new approach.

Advantages Of Doing Online Instruction Over The Cloud

Cloud computing enables a wide variety of innovative approaches to distance learning. There are three ways in which online learning might benefit from cloud computing. Every e-learning solution comprises these three components: One option is to have the provider host the solution, while another is to create the platform by using the API, and still another is to use the platform to access the provider's services. The high cost and lack of necessary infrastructure for e-learning solutions necessitates a decrease in funding for information and communication technology (ICT) in schools. Cloud computing makes it easier for schools to increase or decrease the quantity of their offerings in response to student demand. It's convenient to have all of your files and programmes in one place, therefore a growing number of people are turning to cloud storage. Managing data and educational resources is simplified as a result. As an added bonus, cloud computing provides almost infinite data storage. If schools no longer need to install client-side software, they might save money on IT costs like server upkeep and programme revisions. It is anticipated that cloud downtime would be much minimised due to the ability to install a fresh clone of a virtual machine. Instead of having to monitor hundreds of computers all around the globe, you just need to keep an eye on one central hub. The ability of the cloud computing system to identify a failing node and remove it without disrupting the regular operation of the system guarantees the high availability of the e-learning system.

Technological Challenges in Cloud Computing

Since its many advantages have been well-known, cloud computing has seen widespread adoption. A few of the characteristics include on-demand self-service wide-area networking from a number of client platforms, resource pooling to serve numerous customers, quick elasticity (because the capabilities seem to be boundless to a customer), and a metered service that supports a pay-per-use business model. One must, however, bear in mind the limitations..In the sections that follow, we'll go into further depth about several of these problems. Using secure and efficient hardware management solutions for computation and data encoding is vital to protecting the privacy and trust of customers whose information is stored "out of their control" across several servers. As an added bonus, a set of security certifications and audits may boost user trust. In order to provide around-the-clock (24/7) service through redundant systems and keep network traffic to a minimum, we need to keep availability, fault tolerance, and recovery at very high levels. The capacity to scale resources in response to fluctuating user demands via strategic monitoring and intelligent resource management. Scheduling may be optimised if the usage patterns are known in advance, together with an estimate of the demand. Energy expenses might be lowered with the use of low-power, usage-adaptive microprocessors.

The Problems That Are Currently Facing E-Learning Systems

One of the many modern educational technologies, web-based learning has several benefits over the standard model of classroom teaching. One of its main advantages is that the learner may use it at his or her own convenience. In addition to the savings from not needing to rent a physical classroom, this helps keep prices low. Aside from the convenience of updating course materials, the teacher may employ multimedia resources to structure the course in a manner that is user-friendly, helping students learn the course's foundational concepts.. Finally, it may be seen as a student-centered approach that may accommodate for teacher diversity. All educators may now gauge their students' trust in their individual lessons' information while simultaneously evaluating and reusing shared body of knowledge. However, e-Learning still has several problems that require fixing before it can be widely used in schools. The scalability of e-Learning systems has a long way to go before it is fully realised at the infrastructure level. Multiple resources may be deployed and assigned to a single activity. This means that when the system is hit with a high workload, it will need to add and configure additional resources of the same type. This will make it much more expensive and harder to manage resources. The efficient administration of these resources is intrinsically linked to this basic issue. For instance, institutions' computer labs and server rooms saw relatively low use rates throughout the night and between semesters. Furthermore, because to the fluctuating pattern of utilisation, the demand for these resources is often greatest towards the end of a semester. The actual machines are kept even when they are not being used, which is a complete waste of resources. Finally, we should be aware that there are costs connected with maintaining the computers (and the building), but that the educational institution is liable for site licencing fees, software installation, and technical support for all software.

Conclusion

In conclusion, schools are increasingly relying on e-learning platforms and other types of information and communication technologyAmong the many reasons these businesses don't implement these systems is the high cost involved, insufficient space for storing data, insufficient software and hardware resources, and a lack of technical knowledge. Cloud computing is rapidly becoming the norm for underpinning online educational systems, and it will form the basis of the future generation of e-learning. The potential of cloud computing for application in distant learning was the primary focus of this research. The results of a survey were given, including topics like the fundamentals of cloud computing and online education, as well as the benefits and drawbacks of using cloud computing in online education, and the repercussions of doing so.The results indicate that cloud-based e-learning systems are rapidly replacing other methods of providing e-learning services to students. Since cloud-based e-learning systems need less hardware and software, they may be more cost-effective, while also providing users with more functional power. Given their centralised nature, cloud-based e-learning systems provide rapid rollout to many locations. This research shows some of the disadvantages of using cloud computing, despite the fact that its potential advantages are many. The inefficiency of offering e-learning services is exacerbated by slow Internet connections and worries about cloud security. In order to go on with this line of work, we have started building a cloud-based e-learning environment that will be used only

for the collaborative development of e-learning materials that will be sent to users as learning objects. The goal of the framework is to improve group study. When it comes to cloud-based e-learning, however, concerns of security, privacy, and confidence will get greater attention in future research.

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