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CLOUD COMPUTING FOR INTERNET-BASED E-LEARNING

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ABSTRACT

Technology research is having a favourable effect on education because of the rising number of studies. One of the contributions that information technology has made to education is the deployment of e--learning. Several educational institutions in Indonesia have begun implementing e--learning programmes. E--Learning has several advantages, including flexibility, diversity, and assessment. Whatever the commercial or open--source e--learning application, the present e--learning applications demand huge expenditures in infrastructure systems. It would be more expensive for the school to employ expert employees to maintain and improve an open source e-learning platform. Implementing e-learning in educational institutions can be a difficult task. It is more likely that an institution will have to construct its own e--learning system in light of the current trend toward online education. A joint effort to design and use an e--learning system is more likely to occur if there are two or more institutions that are willing to do so. E-learning is discussed in this study, as are the current condition and the issues it faces, as well as the basic notion and earlier suggested designs of cloud computing. Additionally, the authors have presented a model of cloud--based e--learning that includes five layers, namely: (1) infrastructure layer; (2) platform layer; (3) application layer; (4) user layer; and (5) access layer. On the other hand, in addition to this study, we also demonstrated the shift in paradigm from traditional e--learning to the cloud, as well as detailed the projected benefits of cloud--based learning.

Keywords: E---Learning, Cloud Computing, Cloud---Based E---Learning

I. Introduction

E-learning is increasingly being used by educational institutions to enhance the learning process and to offer learners with access to learning materials and information at any time, regardless of their location. In Indonesia, various educational institutions have incorporated e-learning. The flexibility, diversity, and quantification of e-learning are only some of its many advantages, despite the fact that implementing it is still a major challenge. To begin using e-learning, the most common obstacle to overcome is the prohibitive expense of getting started. E-learning institutions are increasingly placing emphasis on this. When institutions are classified as low budget, it is likely that they will have difficulty implementing e-learning, even if the institution has an acceptable budget. When it comes to implementing e-learning, a lack of suitable infrastructure becomes a serious issue (Siddiqui, *et al.* 2019). E-learning initiatives have difficulties in procuring server/PC, storage, and network components. In addition, the infrastructural support In addition, as e-learning becomes more widely used, many institutions do not have the manpower to design, create, and maintain e-learning systems, which necessitates a specialist in

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producing teaching materials typically known as an instructional designer. Each institution must take this into account when putting electronic learning into action. Because of the estimated expense of hiring them to supply exclusively for e-learning systems, colleges will do so as well.

II. E-Learning: Current State and Challenges

It is a web-based learning approach that strives to supplement and not replace existing education methods. Most e-learning systems use a client-server architecture and web-based technologies. When it comes to interoperability and accessibility, this design has significant limitations that prevent e-learning from being utilised to its fullest potential (El Mhouti, Erradi, & Nasseh, 2018). The usage of web services has been applied by numerous earlier researchers, such as (Sharma, et al. 2020), to address interoperability issues. The interoperability issue in e-learning has been solved by leveraging web services to choose and combine learning elements.

E-learning is becoming increasingly popular as mobile technology expands. Mobile learning refers to e-learning that takes advantage of mobile devices. (Sharma, et al. 2020) defines mobile learning as a learning strategy that allows learners to access training materials at any time and from any location using mobile technology and the internet. Depending on how it's used, mobile learning might encompass devices like cell phones, smartphones, PDAs, and other PDA-related accessories. In order to overcome the issue of e-learning system accessibility, mobile learning can be used.

In today's world, e-learning software can be derived from both commercial and open source sources. Commercial devices have the benefit of speedy adoption thanks to vendor technical assistance and continuing maintenance costs (El-Sofany, *et al.* 2018). Using commercial e-learning tools has the drawback of being more expensive up front, as well as ongoing infrastructure costs. In higher education, open source e-learning software are frequently employed. The initial cost of e-learning software is modest, but it still requires a large investment in infrastructure and a large investment in skilled employees to maintain and upgrade the e-learning software.

E-learning programmes at the time of this writing needed considerable expenditures in infrastructure technologies, regardless of whether they were commercial or open source. In order to maintain and improve an open source e-learning programme, the school would require a larger workforce of professionals (Sahaya Stalin Jose, & Seldev Christopher, 2019). The implementation of e-learning in educational institutions might be difficult. It's more common for institutions to construct their own e-learning systems than it is for them to leverage the e-learning trend. In the event if two or more institutions are willing to establish and utilise an e-learning system in order to lower the development costs and exchange learning resources, this is more likely to occur.

III. Cloud Computing

Cloud computing provides a new paradigm for managing and organising information technology resources. According to one description, it is a "concept for providing on-demand network access to a shared pool of customizable computing resources" (such as computer networks, servers and storage) that may be swiftly supplied and released with little administration effort or service provider engagement. The cloud computing service paradigm is made up of several tiers, including SaaS, PaaS, and IaaS. (IaaS).

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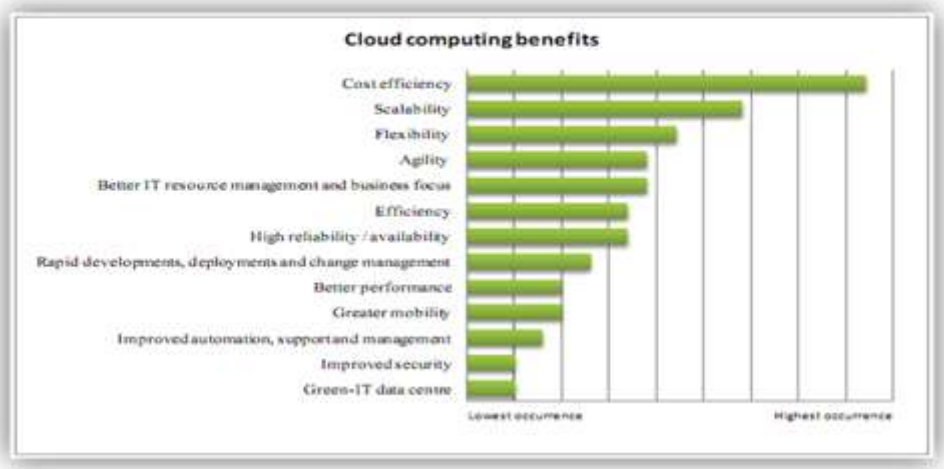
It is possible to choose from four different forms of cloud computing, each with its own set of advantages. There are private and public cloud computing models (Matthew, Kazaure, & Okafor, 2021). The private model is intended at an organisation where the cloud operations are handled by another party or the organisation itself, while public cloud computing models are aimed at a general public or an industry. There are many organisations that make up the "community of practise" under this paradigm, and the allocation of work is a major consideration. A hybrid cloud distribution model combines many existing hybrid approaches. In most cases, this is done with a specific goal, such as a relationship between technical standards and data ownership..

Fig. 1. The Advantages of implementing *Cloud Computing*



It is clear from Figure 1 that Cloud Computing provides several advantages over traditional IT infrastructure, including the efficiency cost (Basha, 2020). Investment in infrastructure and application development can be financed at a lower cost by reducing the cost of operating expenditures (such as management fees and maintenance). Pay as you go (PaaS) and free (PaaS) are two options for cloud computing. Customers just pay for what they use from service providers in both circumstances.

IV. Cloud-Based E-Learning Architecture

Previous cloud-based architectures developed by researchers in this field will be addressed in this chapter, as well as the suggested architecture in this study. In addition, the suggested architecture will be detailed in this chapter.

V. Proposed Cloud-Based E-Learning Architecture

Using previous architectures as a starting point, we've come up with our own design. As illustrated in Figure 5, our suggested architecture consists of five levels: the infrastructure, platform, application, access, and user layers.

The infrastructure layer is the first layer. Cloud platform, virtual machine, virtual repository, and physical infrastructure, including servers, network devices, storage facilities, and other physical facilities, are all included in this tier (Matthew, Kazaure, & Okafor, 2021). Sharing IT infrastructure resources and connecting the system's massive system pool together are two functions of the infrastructure layer (Gupta, Sharma, & Sood, 2022). To put it another way, cloud computing allows the hardware layer to function more like an internet service, allowing the

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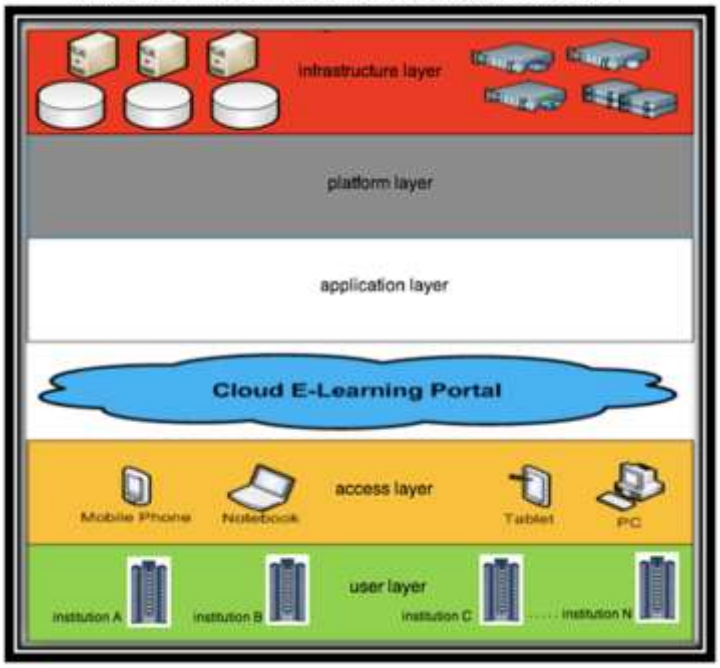
hardware resources to be shared and accessed securely and scalable. The plat-form layer is the second one. ELearning software runs on top of the operating system at this layer. In addition to the operating system, the application layer is supported by a wide range of applications (Gupta, Sharma, & Sood, 2022). The application layer is found at the bottom of the stack. Sharing learning resources and engaging in real-time or asynchronous conversation among users are both possible through this layer's usage of e-learning applications. Our design has been enhanced by the inclusion of an access layer. In our suggested design, this layer serves as the fourth tier of access (Rajabion, *et al.* 2019). This layer is in responsible of controlling how users may access cloud e-learning services, such as the sorts of devices they can use and the presentation models they can see (Basha, 2020). There are a range of services available through a number of devices (such as mobile phones, smartphones, computers, etc.) and a variety of presentation models that may be accessed through multi-channel access (such as mobile applications, desktop applications, and others). Increasing the number of devices that can access cloud-based e-learning resources is one of the primary goals of implementing this approach (Rajabion, *et al.* 2019). Additionally, in our proposed user layer design, we include multiple educational institutions.

Fig. 2. Proposed Cloud E-Learning Architecture



VI. Conventional E-Learning towards Cloud-Based E-Learning

As shown in Figure 1, cloud computing has several advantages, particularly in terms of cost efficiency, which might be utilised to building e-learning using cloud computing. It is difficult to choose between commercial and open source platforms, and it is expensive to hire skilled people to maintain and enhance an in-house produced university e-learning system (Sharma, *et al.* 2020). In-house developed systems have several disadvantages. Perhaps more likely than not, this process will take longer than anticipated.

A single e-learning platform in the cloud, offered by an e-learning cloud provider, may be used by institutions, as depicted in Figure 6. Using cloud computing services, an institution's expenditures for implementing e-learning

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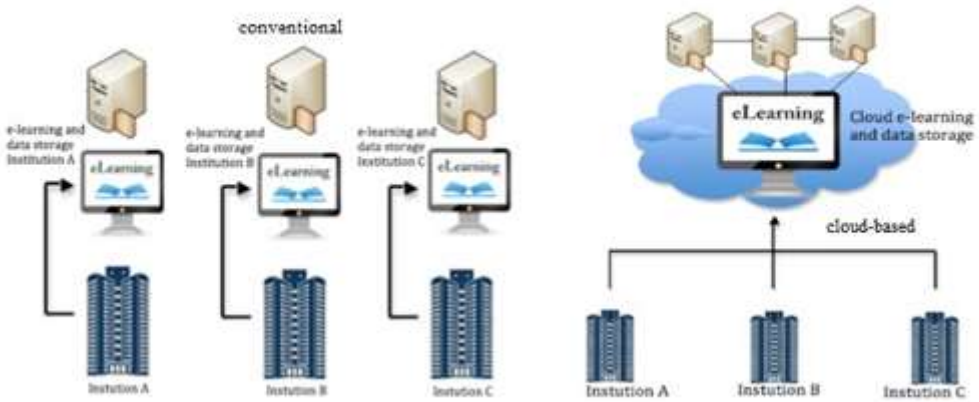
can be reduced since the institution does not have to pay for the acquisition of infrastructure, such as servers or storage (El Mhouti, Erradi, & Nasseh, 2018). As a client institution, you can lease cloud computing infrastructure from service providers. The cloud service provider has also offered the cloud environment for e-learning, as well as the e-ongoing learning's maintenance.

E-learning integration is one of the most revolutionary advances in the field. As well as e-learning that is designed, developed and maintained by an organization's internal governance. In spite of its many advantages, it was beset with problems from the start (Sahaya Stalin Jose, & Seldev Christopher, 2019). As a result, scalability is one of the most important characteristics that may be demonstrated in the use of e-learning in the cloud, according to. Virtualization technologies, such as virtual machine virtualization, can alleviate the physical restrictions that are inherent in a lack of resources and infrastructure by automating the administration of these resources as if they were a single entity (VM).

Fig. 3. Conventional E-Learning Towards Cloud-Based E-Learning



VII. Conclusion and Future Work

This paper outlines a cloud-based e-learning strategy. E-learning systems are expensive to maintain and improve using conventional techniques since they need the use of expensive equipment and systems, as well as the hire of IT personnel (El-Sofany, *et al.* 2018). Cloud computing may be utilised to create e-learning because it is now widely employed in the IT business. E-learning providers have provided the infrastructure, so educational institutions no longer have to pay for it, and agencies that want to utilise it pay just for the amount of time they spend using the service. E-learning systems may be developed and maintained using cloud services, and educational institutions just pay for the services they now need.

Among the five layers presented in this study are the infrastructure layer (the platform layer), the application layer (the application layer), and the user access layer. We've added the access layer and the user layer on top of the original three layers (Siddiqui, *et al.* 2019). The cloud e-learning access layer includes a wide range of devices, including laptops, PCs, cell phones, tablets, and so on. Numerous educational institutions will make use of cloud e-learning at the user level. There are three higher education institutions where a cloud-based e-learning prototype is being piloted and an assessment of the use of cloud-based e-learning will be undertaken afterward.

References

Basha, A. D. (2020). Cloud Computing Pillar-E-Learning. *International Research Journal of Computer Science (IRJCS)*, *7*, 16-20. https://www.academia.edu/download/62076498/02.FBCS1008120200212-42286-1lnld8p.pdf

El Mhouti, A., Erradi, M., & Nasseh, A. (2018). Using cloud computing services in e-learning process: Benefits and challenges. *Education and Information Technologies*, *23*(2), 893-909. https://idp.springer.com/authorize/casa?redirect_uri=https://link.springer.com/article/10.1007/s10639-017-9642-x&casa_token=C8fG2Mps1GIAAAAA:tN6qdKqnRKoApKm4TBOO45p4UkhlgcJotlMLKA1MGaD_85TzH0hSvfDfYDb4zHwNqtUPu7WdB5rcZ7Aeq2I

El-Sofany, H. F., El-Seoud, S. A., & Farouk, R. T. H. (2018, September). Studying the effect of using E-learning through secure cloud computing systems. In *International Conference on Interactive Collaborative Learning* (pp. 54-63). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-11935-5_6

Gupta, N., Sharma, N., & Sood, S. (2022). Empirical Analysis on Parameters for Adoption of Cloud-Based e-learning in Indian Higher Education System: A User's Perspective. In *Information and Communication Technology for Competitive Strategies (ICTCS 2020)* (pp. 977-991). Springer, Singapore. https://link.springer.com/chapter/10.1007/978-981-16-0739-4_91

Matthew, U. O., Kazaure, J. S., & Okafor, N. U. (2021). Contemporary Development in E-Learning Education, Cloud Computing Technology & Internet of Things. *EAI Endorsed Transactions on Cloud Systems*, e3. http://eprints.eudl.eu/id/eprint/4673/

Rajabion, L., Wakil, K., Badfar, A., Nazif, M., & Ehsani, A. (2019). A new model for evaluating the effect of cloud computing on the e-learning development. *Journal of Workplace Learning*. https://www.emerald.com/insight/content/doi/10.1108/JWL-12-2018-0156/full/html

Sahaya Stalin Jose, G., & Seldev Christopher, C. (2019). Secure cloud data storage approach in e-learning systems. *Cluster Computing*, *22*(5), 12857-12862. https://idp.springer.com/authorize/casa?redirect_uri=https://link.springer.com/article/10.1007/s10586-018-1785-z&casa_token=WUoCh1JKSUwAAAAA:bBFtBW3b8DjHmqtQumv1JWkilz8jTgF-LMT5CvSlTAtSTvgq5Rh8wjwif_2GKfqEYD88kBbfCwMQDl-5t1w

Sharma, N., Gautam, K., & Kumar, P. Cloud-based E-learning platforms. *and Predictive Analysis for Medical Science*, 271. https://www.degruyter.com/document/doi/10.1515/9783110715279/pdf#page=287

Siddiqui, S. T., Alam, S., Khan, Z. A., & Gupta, A. (2019). Cloud-based e-learning: using cloud computing platform for an effective e-learning. In *Smart Innovations in Communication and Computational Sciences* (pp. 335-346). Springer, Singapore. https://link.springer.com/chapter/10.1007/978-981-13-2414-7_31