IMPLEMENTATION OF CLOUD COMPUTING SYSTEM IN LEARNING SYSTEM DEVELOPMENT IN ELECTRONIC ENGINEERING EDUCATION STUDY PROGRAM

by Baharuddin, Dina Ampera, Hesti Febriasari, Muhammad Aulia Rahman Sembiring, Abdul Hamid

IMPLEMENTATION OF CLOUD COMPUTING SYSTEM IN LEARNING SYSTEM DEVELOPMENT IN ELECTRONIC ENGINEERING EDUCATION STUDY PROGRAM

Baharuddin, Dina Ampera, Hesti Febriasari, Muhammad Aulia Rahman Sembiring, Abdul Hamid

Article Info	Abstract
	The development of technology demands a variety of activities that can be easily accessed regardless of space and time. The development of information technology has become an innovative, dynamic, and economically profitable solution. Information technology is the answer to the problems and challenges faced by the world of education. Cloud computing is changing the way information technology services are provided and distributed so that institutions have the opportunity to access the educational and scientific information. Cloud Computing technology is a new paradigm in the delivery of computing services, which has many advantages compared to conventional systems. This study discusses cloud computing in general and some examples of the application of cloud computing services and their benefits in the Electrical Engineering Education Study Program environment. The case study taken is the application of cloud computing services in the Electrical Engineering Education Study Program, where Cloud computing is a computing model, as resources such as processors or computing power, storage, networks, and software are abstracted and provided as services on a network or internet with using the remote access pattern. The purpose of this study was to determine whether cloud computing might be applied to learning, as well as the benefits provided by cloud computing in the development of learning systems. This study uses a qualitative descriptive method with data collection techniques in the form of literature studies. Based on the research conducted, the results show that the services provided by cloud computing have various benefits, namely increasing efficiency and effectiveness in the use of cloud computing-based technology in the learning process.

Introduction

The development of technology is currently very rapid, this is evidenced by the existence of various kinds of applications that support daily needs both in the field of education. The use of technology that used to be more supportive of side jobs or even recreation, has turned into the main work facility. This also has an impact on the education system in Indonesia. In education, for example, teachers and students will be familiar with distance learning interactions. There are so many online learning applications that can be applied in the world of education

today. According to Arizona (2020), online learning is a form of distance learning/training by utilizing telecommunications and information technology, such as the internet, CD-ROOM (direct and indirect). Online learning connects students (students) with their learning resources (databases, experts/instructors, libraries) who are physically separated or even far apart but can communicate, interact or collaborate (directly/synchronously and indirectly/asynchronously).

Supported by existing technology, all activities become easier, faster, and cheaper, and the information available is very abundant and very easy to access anywhere and anytime. Technology users are countless from the young to the old, whether used for business, communication, and the like according to their individual needs.

The utilization of technological developments can facilitate work, one of the technologies currently developing is cloud computing. Cloud computing is computing that is supported by computer network services, the scale of computing can be changed dynamically and resources are provided through the internet in the form of services. All resources (software, platforms, infrastructure) in cloud computing have been provided by service providers so that users are no longer charged with providing resources (Ginting, 2018).

Cloud computing is a computing model whose resources, such as computing power, storage media (storage), network (network), and software (software) are run as a service through network media, and can even be accessed anywhere as long as they are located. connected to the internet. In this case, being able to build a simple cloud computing network can be done on a local network/intranet (Maimunah, Yati, & Puspitasari, 2012).

Cloud computing technology or commonly known as cloud computing is now widely used and is not a new thing. Cloud computing technology can save you more money than having to build your network infrastructure in the short term. The need for cloud computing technology is mostly only on connection costs and data processing as needed. For some companies or institutions that already have good network infrastructure and technology, the application of cloud computing technology can be maximized and efficient.

The development of information technology is a solution that is innovative, dynamic, and has economic benefits. Information technology can answer the problems and challenges faced by the world of education. Cloud computing is changing the way information technology services are provided and distributed so that institutions have the opportunity to access the educational and scientific information. Through this information technology, it is hoped that education in higher education will get optimal performance because institutions can focus more on the main processes that must be carried out rather than managing information technology broadly (Andriyani et al., 2013).

The conventional learning process allows for criticism from those who want to improve the quality of education. Learning systems that only rely on meetings between educators and students will need complements along with changes in technology and the development of devices that allow connecting to the internet. Learning is required to apply high effectiveness along with the times. Information technology support for learning systems makes the exchange of information fast and instant. The conventional system in the learning system should have been abandoned since the discovery of multimedia communication media. Due to the nature of the internet that can be connected at any time, which means students can take advantage of learning programs provided on the internet network at any time according to their free time so that the space and time constraints they face in finding learning resources can be overcome. With the rapid development in the fields of telecommunications, multimedia, and information technology; listening to lectures, taking notes on paper of course left behind.

UNDERSTANDING CLOUD COMPUTING

Cloud computing is a computing model, in which resources such as processors/computing power, storage, network, and software are abstracted and provided as services on the network/internet using remote access patterns (Alfatih and Marco, 2015). On-demand availability on-demand, easy to control, dynamic, and virtually unlimited scalability are some of the important attributes of cloud computing. Cloud computing can provide unlimited services for computer users to access applications without being limited by time, place, and distance. Cloud computing can be divided into three main categories, namely Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS) (Sulistyo and Agustina, 2013). Software as a Service (SaaS) is a further evolution of the ASP (Application Service Provider) concept. As the name implies, SaaS makes it easy for users to be able to take advantage of software resources by subscribing. So, there is no need to either invest in in-house development or purchase a license. Technically, this application model utilizes a web-based interface that is accessed via a web browser. An example of this SaaS is Goggle Docs from Google which is an office tool application similar to Microsoft Word. By using Goggle Docs, we can process documents without having to install Microsoft Office such as Microsoft Word. SaaS is a cloud computing application model that focuses on individual users.

Platform as a Service (PaaS) is a service that provides ready-made modules that can be used to develop an application, which of course can only be run on that platform. PaaS services offer more than just data storage, they provide a place to build and deploy applications without needing to know how much processor or memory is required for the application. It also offers specialized services such as data access, authentication, and payment for new applications (Appistry, 2009). One example of a PaaS service is Google AppEngine which offers services for developing and hosting web applications.

Infrastructure as a Service (IaaS) is a service that rents out basic information technology resources, which include storage media, processing power, memory, operating system, network capacity, etc., which tenants can use to run their applications. IaaS is located one level lower than PaaS. These services generally offer virtual servers that can be used by one or more computing devices that can run several choices of operating systems and software, and there are data storage and communication facilities. An example that offers IaaS services is Amazon where users are given the right to perform various activities to the server such as installing software, configuring access permissions, and firewalling.

Cloud computing applies computational methods, namely capabilities related to information technology that is presented as a service that is accessed via the internet, without knowing the infrastructure in it, the experts who design the system or have control over the existing infrastructure. Architecture is generally divided into 3 parts, namely infrastructure, platform, and application. Every service that is accessed does not need to be installed on every end-user device, to be able to access cloud computing services only a web browser or program interface is needed (Ernawati, 2013).

Cloud computing has five characteristics (Mell and Grance, 2011), namely (1) On-demand services, customers can determine computing capabilities automatically without requiring interaction with service providers (2) Broad network access, services can be accessed from various standard platforms (3) Centralized computing resources, computing resources are collected in one location to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically applied according to customer demand through the internet network (4) Elasticity of provision of computing resources quickly, provision or reduction of computing resources can be tailored to customer needs (5) Scalable services, cloud computing automatically controls and optimizes the

use of computing resources by increasing measurement capabilities at several levels of abstraction according to the type of service.

Method

Second Level Headings

This research was conducted using a descriptive method with a qualitative approach and literature study. Qualitative research is used concerning the opinion of Sugiyono, (2009) that qualitative research methods are naturalistic research methods because the research is carried out in natural conditions (natural settings), and the data collected is analyzed qualitatively.

Data collection techniques using library research, namely data collection techniques by examining related sources such as books, literature, notes, and reports related to the problem to be studied. The literature used is library sources in the form of journals, research reports, books, and online news. Selected journal articles published in several universities are relevant to the research theme, for example, the definition and concept of cloud computing database systems, how they are implemented, and the benefits of cloud computing for its users.

Qualitative is considered relevant to describe the current conditions and is the background for research, namely online learning during a pandemic. The type of data collected is secondary data in the form of research results from various articles, library sources, and documents as well as elaboration sentences from the answers of research subjects conducted by interview. The subjects and objects in this study were students and lecturers of the Department of Electrical Engineering Education, the State University of Medan with the snowball throw technique.

The research instrument was in the form of interview guidelines which were conducted online through the google form application which was distributed through WhatsApp student groups. Data analysis was carried out using interpretive descriptive methods, with the analysis cycle in the form of an interactive cycle. Referring to Faisal's opinion (2001), the interactive cycle consists of data display (data display), data reduction (data reduction), and conclusion visualization (conclusion visualization).

Results and Discussion

1. CHARACTERISTICS OF CLOUD COMPUTATION

Cloud computing ideally has the following five characteristics in maximizing services, especially in supporting learning systems, namely (1) On-Demand Self-Services, A cloud computing service must be able to be utilized by users through independent mechanisms and immediately available when needed. Minimal service provider intervention. So, if you currently need application services such as CRM (Customer Relationship Management), you must be able to register independently and the service is immediately available (2) Broad Network Access, Cloud computing services must be accessible from anywhere, anytime, with any device even, as long as it can connect to the service network. As long as they are connected to the internet network, cloud computing users must be able to access these services, either through laptops, desktops, internet cafes, mobile phones, tablets, and other devices (3) Resource Pooling. Cloud computing services must be centrally available and be able to share resources efficiently. Because cloud computing is used by various customers, service providers must be able to share the

load efficiently, so that the learning system can be utilized optimally (4) Fast Elasticity, A cloud computing service must be able to increase or decrease capacity as needed. If the number of employees in the office increases, it can certainly add users easily. If the user puts a news site in a cloud computing network, if there is an increase in traffic because there is important news, then the capacity must be increased quickly. (5) Scalable Services, Cloud computing services must be provided in a scalable manner. Cloud computing services are paid according to usage if they take advantage of cloud computing services provided by other parties, so they must be measured properly (Maimunah et al., 2012).

Important factors that determine the success of cloud computing implementation are (1) Security, if the application is on a server owned by a cloud computing service provider and educational institutions access it via the internet, then everyone can also access the application. Hackers and intruders will be able to penetrate these global application security loopholes (2) Performance, cloud computing means that resources are placed away from users when compared to traditional centralized systems. This can impair the performance, except how much management is on the internal server itself (3) Governance compliance, cloud computing is not fully supported by regulations.

In contrast to educational institutions with minimal infrastructure, they can use cloud computing provider services. In large educational institutions like universities, they must have independently managed servers for the use of cloud computing technology. (4) Financial, Financing in the use of cloud computing takes into account the use of fixed costs and variable costs. In the long run, it is cheaper to own (pay once upfront) than to pay rent on an ongoing basis.

2. ONLINE LEARNING SYSTEM BASED ON CLOUD COMPUTING

Cloud learning system or cloud education system (CES) is divided into three, namely (1) centralized cloud learning system or centralized cloud education system, in this system connectivity between data centers in institutions is spread out but remains in one unit. units in the data center. provider. (2) a distributed cloud education system, many data centers in educational institutions are directly connected but not in a single provider data center; and (3) hybrid cloud education systems, educational institution data centers, and multiple provider data centers are interconnected with each other, an educational institution can share information resources using different provider data centers (Yuhua et al., 2010).
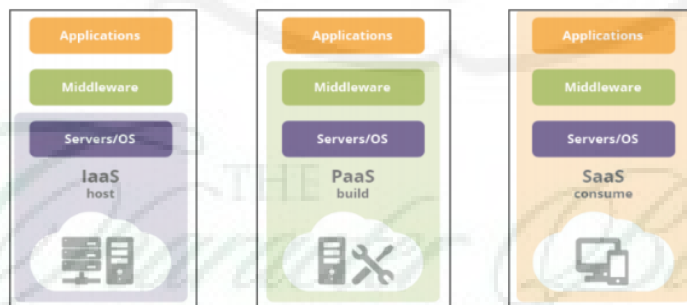

Figure 1. The basic service model of cloud computing

The learning process in cloud computing is very helpful for students and lecturers so that in this technology it is possible to access services and resources available wherever and whenever they need them, including various applications, services, and tools that are provided freely and openly and are easy to use (Ali et al., 2015). There

are several advantages in online learning using cloud computing, including (1) learning providers as centers of educational services, in this model perform the task of managing educational resources while ensuring the quality of education becomes more effective and efficient (2) online learning system based on cloud computing shows the task of lecturers to fill in online learning system content according to student requests, evaluate the learning process, prepare to learn performance reports, share information and knowledge with fellow lecturers to improve skills and interact with students, parents and the community (3) Students as a learning center is the basic principle of cloud education character.

Students have the opportunity to organize their learning process, meaning in terms of time and learning materials by the curriculum and the conditions and requirements set by the education provider agency (4) Cloud computing will make it easy for parents to keep up with the progress of their child's learning process in an easy way. With this convenience, parents will be more active in helping the learning process become even better. (5) With an internet-based system such as in cloud computing, the public will easily control the development of education at the educational institution. (6) Centralization of infrastructure and services. Cloud computing technology can share the use of infrastructure virtually so that it is enough to build a cloud computing architecture at the center, while other users such as educators, students, parents, and the public only use the application with all its conveniences at the web level only (7) Effectiveness of resources study. Most of the learning process is done in cloud computing.

Learning resource materials are all included in cloud computing, the learning evaluation process, reports on student learning progress, sharing knowledge with other educators. So that education providers can manage learning materials that require classrooms or practice rooms, manage to learn resources, manage learning time according to needs and conditions, and optimize benefits inflexibility of time and place. Educators as the main source of learning will have more time to improve their abilities (8) Cooperation and sharing of e-learning. This technology offers ease of collaboration between institutions, interaction and sharing between educational stakeholders as well as ease of evaluation because every work is well documented (9) Rationality of navigation arrangements. The use of cloud computing in a learning system requires an interface using a clear and easy-to-understand module structure so that the application is easy to use by users, and easy to learn, not complicated because this is the essence of using cloud computing technology (Ali et al., 2015).

Sulistyo and Agustina (2013) explain that cloud computing is divided into three basic service models, namely Software as a service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). The three models are described as follows.

    a. Software as a Service (SaaS) is the first popular cloud computing service. Software as a Service is a continuation of the evolution of the concept of ASP (Application Service Provider). SaaS makes it easy for users to be able to utilize software resources by subscribing so that SaaS users do not need to invest in either in-house development or purchasing licenses. SaaS is a cloud computing application model that focuses on individual users by utilizing a web-based interface that is accessed via a web browser. For example, Goggle Docs from Google is an office tool application similar to Microsoft Word, so users can process documents without having to install Microsoft Office.

    b. Platform as a Service (PaaS) is a service that provides ready-made modules that can be used to develop applications that can only run on that platform. on PaaS, Services provide a place to build and deploy applications without needing to know how much processor or memory is required for the application. In

another sense, PaaS offers more services than data storage. An example of PaaS is Google Apennine which offers services for users to develop and host web applications.

c. Infrastructure as a Service (IaaS) is one level below PaaS. IaaS is what "rents" basic information technology resources including operating systems, processing power, storage media, memory, network capacity, and other services, which are used by the tenant to run the intended applications. An example of offering IaaS services is Amazon. Here users are given the freedom to perform various activities to the server such as installing software, configuring access permissions, and firewalls

Cloud Deployment Models

PRIVATE — Manufacturing organization has its own private cloud

PUBLIC — Manufacturing organization shares cloud with general public

HYBRID — Combination of cloud deployment models

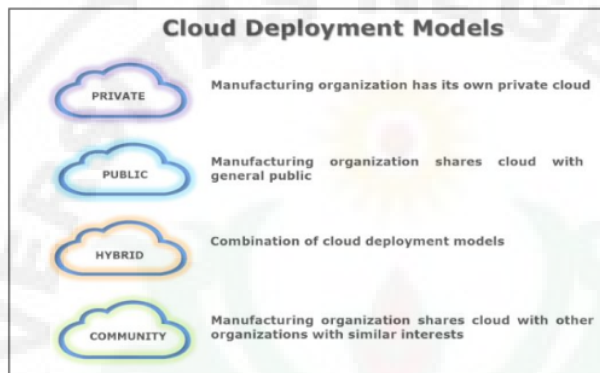COMMUNITY — Manufacturing organization shares cloud with other organizations with similar interests

Figure 2. Cloud computing development model.

Based on the infrastructure manager, cloud computing is divided into four areas, namely private cloud, community cloud, public cloud, and hybrid cloud. Management in the private cloud is carried out by a certain institution, in the community cloud the management is carried out by several institutions that support a community, while in the public cloud a large industry group manages by providing cloud services for the wider community, while in the hybrid cloud the management is carried out by combining two or more cloud computing infrastructure management in a private cloud, community cloud, or public cloud (Christiani, 2018).

3. IMPLEMENTATION OF CLOUD COMPUTING IN THE LEARNING SYSTEM

The concept and implementation of cloud computing show that cloud computing technology can be an evaluation in improving the quality of learning, the quality of information, and can support all activities at universities and organizations more stable, and better controlled (Santiko, Rosidi, & Wibawa, 2017). In the implementation of cloud computing, there are still obstacles, especially technical constraints regarding the infrastructure of the computing technology, namely the limited internet access, both broadband, and dial-up. The limitations of internet access in some areas have caused this technology to not be widely used. If not used, its use is still limited to applications available on the internet (SaaS) and has not touched the PaaS and IaaS models. In addition, the limited application of cloud computing in the education sector is caused by technical constraints, especially virtualization problems and doubts about the security guarantees provided by cloud computing.

Figure 3. Platform as a service

The problem of losing or corrupting higher education institution data can be solved if the data is not directly stored on a server that may be prone to damage, but is stored in a relatively safe location. The option that may be chosen is that universities have computer infrastructure and inter-computer networks, or universities can take advantage of cloud computing technology, of course, which is supported by the internet network, so that university management does not need to provide expensive infrastructure, it is only enough to rent several facilities needed to develop applications. from vendors that provide various cloud computing services such as Amazon, Salesforce, Google, Microsoft, Akamai sun, microsystems, Symantec, Microsoft, and other services.

Maimunah's writing (2012), that cloud computing services have the following 5 (five) characteristics. a) On-Demand Self-Services Users can determine computing capabilities automatically without requiring interaction with service providers. b) Broad Network Access Services can be accessed from various devices without being limited by distance and time as long as they are connected to the internet network. c) Resource Polling, i.e. cloud computing services must be available centrally and service providers must be able to share the load efficiently so that the system can be utilized optimally to serve multiple consumers using a multi-tenant model d) Rapid Elasticity A computing service must be able to increase or decrease capacity according to with customer needs. e) Measured Service Cloud computing automatically controls and optimizes the use of computing resources by increasing the measurement capability at several levels according to the type of service used.

4. BENEFITS OF CLOUD COMPUTING IN LEARNING SYSTEMS

The use of cloud computing technology in learning has an important role, especially in academic activities. The benefits that will be obtained if cloud computing is applied to learning include accessibility, namely data can be accessed anytime and anywhere as long as it is connected to the internet network. Scalability, namely cloud computing can increase data storage capacity without having to buy additional equipment such as hard drives or the like.

Security, cloud computing service providers guarantee the security of existing data, for example when a natural disaster occurs, the data stored in cloud computing is of course safe even if the hard drive or hardware is damaged (Sahi, 2019). The application of cloud computing in learning provides many benefits. All parties involved in it directly experience the benefits of cloud computing, including students, lecturers, IT staff, administrative staff, to the university board of directors. The perceived benefits of cloud computing are certainly not the same, the benefits in terms of improving the quality of teaching and learning media, economic benefits such as saving resources, as well as benefits from the ease of application and infrastructure maintenance (Kurniawan, 2015).
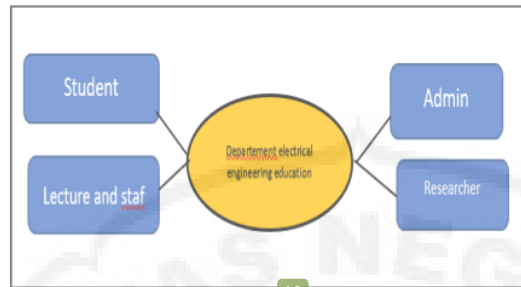
Figure 4. The structure of cloud computing service users in the Electrical Engineering Education Study Program
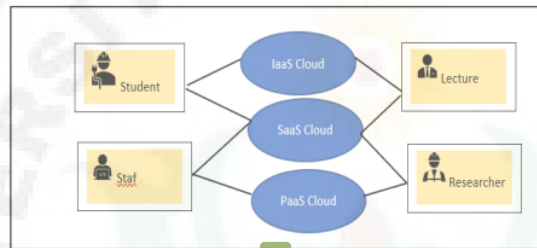

Figure 5. Cloud services that are accessed by users in the Electrical Engineering Education Study Program environment

Cloud computing services commonly used in the Electrical Engineering Education Study Program are Google Docs, Dropbox, and because these applications are easy to use, inexpensive, and reliable. These services are commonly used by students in general, so they are easier to adapt if the teaching and learning process in the Electrical Engineering Education Study Program environment uses these applications. Cloud computing offers several advantages that make it very attractive to implement, including high availability, low response time, and scalability.

Common applications such as Google Apps for Education or Microsoft Office 365 offer online applications to support user productivity, such as the use of word processing, spreadsheets, and presentations that can be used in class. Therefore, the use of cloud computing is very important, especially in terms of storing various data that is very important and requires very good security. Data storage using ordinary storage media certainly has drawbacks, especially if the tool used for data storage is damaged or lost, while internet-based storage media or what is known as cloud computing can be accessed anywhere and anytime without fear of losing the storage device. Dhika Akhirina, & Destiawati, 2019).

5. REASONS FOR USE CLOUD COMPUTING

There are nine reasons to use cloud computing (Anik, 2013) (Singh, & Hemalatha, 2012) (Achmad, & Paulus, 2015) (Warjiyono, 2014), namely: 1) Reducing Costs Users of cloud technology, no need to build cloud infrastructure, both software, hardware, servers, networks, and bandwidth, because all are provided by cloud service providers. Users only need to pay rent according to their operational needs. Thus, the user will save costs. 2) Increase Storage Capacity Cloud users can determine the amount of storage capacity according to their needs, eliminating the need for upgrading computer memory. 3) Automation With cloud computing technology, users or organizations do not need to form a special team to handle system updates and back-ups.

This is because the server will always be updated by the vendor or cloud service provider according to user or

company requests. 4) Flexibility The flexibility offered by cloud computing is more than conventional computing methods. This is because cloud computing has more flexibility than other network computing systems, and saves time as well as costs for users who are busy and who do not have available resources. 5) More Mobility Users can access information wherever they are/ubiquitous for a full 24 hours, meaning that work can be done anywhere using smartphones, tablets, laptops as long as they have a connection and access to the internet network. 6) Allows ICT to Stay Focused. Regular server updates and other computing problems are not to worry about, companies/users can be free to concentrate on the innovation of company products without thinking about how the infrastructure runs. 7) Sharing Resources Cloud computing technology can share resources (memory, storage, bandwidth, etc.), thus enabling all employees to access resources through cloud computing. Save more time and costs by placing resources in one location that is easily accessible to employees. 8) Business Agility Enables companies to be more active, where the speed of ordering capacity and services provided by the provider is an important element of cloud computing. Many cloud computing providers use software infrastructure to make it easier to add, move and change applications according to user needs. The big advantage that users get is that cloud computing is very dynamic and elastic. 9) One Back-up and Disaster Recovery Package Cloud computing provides convenience for users in terms of backup and post-disaster recovery. Where the backup and recovery process is borne by the provider so that it saves in terms of maintenance costs.

Conclusion

Cloud Computing is important to be applied to educational institutions. The use of cloud computing-based technology in the education sector can increase efficiency and effectiveness, so more insight into cloud computing is needed for lecturers and students. The benefits of cloud computing, especially for educational institutions, include high availability, large storage capacity, good accessibility, guaranteed data security, stability, and reliable systems, and cost-effective operations.

Cloud computing technology can be developed to support learning systems and help overcome various problems in the implementation of education. The need for efficiency and effectiveness in the implementation of the learning process is very necessary especially in terms of improving and maintaining the quality of learning outcomes. Implementation in the implementation of education needs to be supported by technological capabilities. The use of cloud computing-based technology in the learning process can increase efficiency and effectiveness in improving the quality of learning outcomes.

Educational institutions can take advantage of systems on cloud computing technology to make it easier for users to access data quickly while in an educational environment, secure user data, collect data centrally, facilitate data exchange, and facilitate communication between users in the educational environment. Cloud computing technology systems can be managed independently by educational institutions so that they can reduce costs for access to the internet, and users can access it simply by the availability of local networks in the educational environment or can use services provided by other parties for education providers with infrastructure procurement capabilities. inadequate, thereby saving the cost of technology infrastructure development.

Acknowledgements

References

Afdhal., 2013. Studi Perbandingan Layanan Cloud Computing. *Jurnal Rekayasa Elektrika*, vol.10, no.4, pp.193-201.

Alfatih, H. dan R. Marco. 2015. Analisis pengembangan dan perancangan sisteminformasi akademik smart berbasis cloud computing pada sekolah menengah umum negeri (smun) di daerah istimewa yogyakarta. *Jurnal Telematika*. 8(2):63–91.

Ali, K., A. Bakar, K. Kemdikbud, E. Gedung, dan J. J. Sudirman. 2015. Pengembangan model dan arsitektur pengajaran online menggunakan teknologi komputasi awan. 6–8.

Andriyani, R., M. Ulfa, dan W. Cholil. 2013. Pengukuran risiko pada penerapan cloud computing untuk sistem informasi (studi kasus universitas bina darma). *Prosiding Seminar Nasional Teknologi Informasi Komunikasi Dan Manajemen*. 53(9):1689–1699.

Arizona, Kurniawan. et.all. (2020). Pembelajaran Online Berbasis Proyek Salah Satu Solusi Kegiatan Belajar Mengajar di Tengah Pandemi Covid-19 . *Jurnal Ilmiah Profesi Pendidikan*. Volume 5 No 1 Mei 2020. (Online) Tersedia :https://jipp.unram.ac.id /index.php/jipp/article/download/111/99. DOI: 10.29303/jipp. v5i1.111 (Diakses: 25 Juni 2021).

Arzayeva, M., Rakhimzhanov, K., Abdrahmanova, A., & Umitkaliev, U. (2015). *Special aspects of distance learning in educational system. Anthropologist*, 22(3), 449-454. https://doi.org/10.1080/09720073.2015.11891900.

Ashari, A., & Setiawan, H., 2011. Cloud Computing: Solusi ICT ?. *Jurnal Sitem Informasi, JSI*., vol.3, no.2, pp.336-345.

SINGH, A., & HEMALATHA, M., 2012. Cloud Computing for Academic Environment. *International Journal of Information and Communication Technology Research*, vol.2, no.2, pp.98-101.

Bell, D., Nicoll, A., Fukuda, K., Horby, P., Monto, A., Hayden, F.,. Van Tam, J. (2006). Nonpharmaceutical interventions for pandemic influenza, national and community measures. *Emerging Infectious Diseases*. https://doi.org/10.3201/eid1201.051371.

Bell, S., Douce, C., Caeiro, S., Teixeira, A., Martin-Aranda, R., & Otto, D. (2017). Sustainability and distance learning: a diverse European experience? *Open Learning*, 32(2), 95-102. https://doi.org/10.1080/02680513.2017.1319638.

Caley, P., Philp, D. J., & McCracken, K. (2008). Quantifying social distancing arising from pandemic influenza. *Journal of the Royal Society Interface*. https://doi.org/10.1098/rsif.2007.1197.

Chan, N. N., Walker, C., & Gleaves, A. (2015). An exploration of students' lived experiences of using smartphones in diverse learning contexts using a hermeneutic phenomenological approach. *Computers and Education*. https://doi.org/10.1016Zj.compedu.2014.11.001.

Fardani, A., & Surendro, K., 2011. Strategi Adopsi Teknologi Informasi Berbasis Cloud Computing Untuk Usaha Kecil dan Menengah Di Indonesia. *Seminar Nasional Aplikasi Teknologi Informasi*. SNATI., pp.A1-A6.

FOSTER, I., ZHAO, Y., RAICU, I., & LU, S., 2008. Cloud computing and grid computing 360- degree compared. *Proceedings of IEEE Grid Computing Environment Workshop, GCE'08*., pp.1-10.

Ginting, Henndy. (2020). *Perubahan Perilaku sebagai Respon terhadap Wabah COVID-19*. Tulisan Edukasi HIMPSI di Masa Pandemi COVID-19 Seri 14. (Online) Tersedia : https://Covid19.go.id/edukasi/masyarakatumum/perubahan-perilaku-sebagai-respon-terhadap- wabah-Covid19 (Diakses : 22 Juni 2021).

Kurniawan, E 2015, 'Penerapan teknologi cloud computing di universitas', *Jurnal EKSIS*, Vol. 08, No. 01, hlm. 29-36.

Lukihardianti, A, & Yulianto, A 2018, '*Permintaan layanan cloud computing di Indonesia tumbuh pesat*', REPUBLIKA, Oktober 19, https://m.republika.co.id/amp/pgu0zq396.

Maimunah, A. K. Y. Yohanes, dan P. Neni. 2012. Konsep dan penerapan cloud computing untuk meningkatkan mutu pembelajaran. *CSRID Journal*. 4(3):220–230.

Makruf, I., Choiriyah, S., & Nugroho, A. (2021). Flipped Learning and Communicative Competence: An Experimental Study of English Learners. *International Journal of Education in Mathematics, Science and Technology*, 571-584.

Maimunah, Yakti, YAK, & Puspitasari, N 2012, 'Konsep dan penerapan cloud computing untuk meningkatkan mutu pembelajaran', *Jurnal CSRID*, Vol. 4, No. 3.

Mell, P. dan P. Grance. 2011. *The NIST Definition of Cloud Computing*. http://csrc.nist.gov/publications/nistpubs/800-145/

Muslim, M.A., & Retno, N.A., 2014. Implementasi Cloud Computing Menggunakan Metode Pengembangan Sistem Agile. *Scientific Journal of Informatics*, vol.1, no.1, pp.29-38.

Nurhayati, N., Ampera, D., Chalid, S., Farihah, F., & Baharuddin, B. (2021). Development of Blended Learning Type and Flipped Classroom-Based Cultural Arts Subjects. *International Journal of Education in Mathematics, Science and Technology*, 655-667.

Rumetna, M.S., & Sembiring, I., 2017. Pemanfaatan Cloud Computing Bagi Usaha Kecil Menengah (UKM). *Prosiding Seminar Nasional Geotik*. Pp.1-9.

Sharif, J., 2015. Membangun Private Cloud Computing dan Analisa Terhadap Serangan DoS, Study Kasus SMKN 6 Jakarta. *IncomTech, Jurnal Telekomunikasi dan Komputer*, vol.6, no.3, pp.270-291.

Sugiyono, 2009, Metode penelitian kuantitatif, kualitatif dan R&D, Alfabeta,

Bandung. Sulistyo, GB & Agustina, C 2013, 'Penerapan cloud computing sebagai sarana pembelajaran siswa', Makalah disampaikan pada *Seminar Nasional Teknologi Informasi dan Multimedia,* 2013, STMIK AMIKOM, Yogyakarta.

Restuati, M., Nasution, M. Y., Pulungan, A. S. S., Pratiwi, N., & Safirah, B. (2021). Improvement efforts for student learning outcomes and motivation using Edmodo during the COVID-19 pandemic. *International Journal of Education in Mathematics, Science and Technology*, 614-624.

Sulistyo, G. B. dan C. Agustina. 2013. Penerapan cloud computing sebagai sarana. 19–23.

Wardhana, I & Assegaff, S 2017, 'Perancangan dan penerapan arsitektur cloud storage pada IAIN STS Jambi', *Jurnal Manajemen Sistem Informasi*, Vol. 2, No. 1, 244-259.

WU, J., PING, L., GE, X., WANG, Y., & FU, J., 2010. Cloud storage as the infrastructure of cloud computing. *Proceedings of International Conference on Intelligent Computing and Cognitive Informatics*, pp.380-383.

Youseff, L., Butrico, M., & Silva, D.D., 2008. Toward a unified ontology of cloud computing. *Proceedings of IEEE Grid Computing Environment Workshop, GCE'08.*, pp.1-10.

Yuhua, L., C. Lilong, X. Kaihua, dan Z. Xi. 2010. Application Modes, Architecture and Challenges for Cloud Educational System. *The 2nd International Conference on Computer Research and Development*. 2010. 331–334

Author Information

Baharuddin

https://orcid.org/0000-0002-2767-756X

Universitas Negeri Medan

Indonesia

Contact e-mail: baharuddin.bah@gmail.com

Hesti Febriasari

https://orcid.org/0000-0002-8009-4603

Universitas Negeri Medan

Indonesia

Contact e-mail: hesti@unimed.ac.id

Abdul Hamid

https://orcid.org/0000-0003-1630-7042

Universitas Negeri Medan

Indonesia

Contact e-mail: abdulhamid.k.mpd@gmail.com

Dina Ampera

https://orcid.org/0000-0003-3252-2551

Universitas Negeri Medan

Indonesia

Contact e-mail: dinaampera@unimed.ac.id

Muhammad Aulia Rahman Sembiring

https://orcid.org/0000-0003-3250-1742

Universitas Negeri Medan

Indonesia

Contact e-mail: marsembiring@unimed.ac.id

IMPLEMENTATION OF CLOUD COMPUTING SYSTEM IN LEARNING SYSTEM DEVELOPMENT IN ELECTRONIC ENGINEERING EDUCATION STUDY PROGRAM

8   publikasiilmiah.ums.ac.id:8080
    Internet Source   1%

9   sipeg.univpancasila.ac.id
    Internet Source   1%

10 H Pratama, I Prastyaningrum. "Effectiveness
    of the use of Integrated Project Based
    Learning model, Telegram messenger, and
    plagiarism checker on learning outcomes",
    Journal of Physics: Conference Series, 2019   1%
    Publication

11 proceeding.unnes.ac.id
    Internet Source   1%

12 rizkynugraha46.blogspot.com
    Internet Source   1%

13 humanities.utm.my
    Internet Source   1%

14 journal.binus.ac.id
    Internet Source   1%

15 Submitted to Universitas Jember
    Student Paper   1%

Exclude quotes	Off	Exclude matches	< 1%
Exclude bibliography	Off		