Implementation of Cloud Computing Database System in Education Sector for Student Learning in Higher Education

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Abstract: Information and communication technology is growing increasingly rapidly. One of the technologies that is currently developing is cloud computing. Cloud computing is a computing service that utilizes the internet network as its support. Cloud computing technology can be applied in various fields, including education. This research contains how the application of cloud computing in the education sector and the benefits that will be obtained when cloud computing is applied. The purpose of this research is to find out whether cloud computing is possible to be applied to the education sector, as well as the benefits provided by cloud computing. This research 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 presented by cloud computing have a variety of benefits, mainly to increase efficiency and effectiveness in the education sector.The learning process by utilizing *cloud computing* began to be felt in learning activities. Seeing the potential and benefits of cloud computing that can be used to assist student learning so that students get information on learning materials, and make it easier for teachers to share information on learning materials. In relation to learning, *cloud computing* is expected to equip students with positive new skills, because *cloud computing* has supporting features that can be used as a means for students to share knowledge and learning materials.

INTRODUCTION

Technology is currently developing very rapidly in a short time. It is proven by the existence of various kinds of applications to support daily needs in the fields of government, business, and education. With the support of existing technology, all activities become easier, faster, and cheaper, and the information available is very

abundant and very easily accessible anywhere and anytime. There are countless technology users ranging from young to old, whether used for business, communication, and the like according to their respective needs.

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

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

Universities or colleges need programs or applications to process existing data, for example, the online KRS system, mail server and web portal for each unit in the University. Over time, the data processed and stored on the system will increase, so a large capacity storage area is needed. In addition to the problem of the need for a larger storage area, a service is also needed that can ensure data security, data recovery including easy access to the data anywhere and anytime (Wardhana & Assegaff, 2017).

The development of cloud computing systems can facilitate educational institutions in providing information, student data, processing grades and various academic reporting. All activities in the academic environment can be controlled remotely through mobile devices, tablets, laptops, or PCs with the help of cloud computing connected to the control system (automation system) (Alfatih & Marco, 2015).

The demand for cloud computing services in Indonesia is very rapid. One of them can be seen from the growth of the Amazon Web Services (AWS) business, a subsidiary of Amazon.com, which helps the education sector to create a skilled workforce in the field of cloud computing. Students are given training and certification by AWS through AWS Educate to engage in cloud education.

This is intended to fulfill the limited supply of cloud computing human resources

in Indonesia.

From the description above, we can know that this article was prepared to find out what cloud computing means, how cloud computing is implemented in the education sector, and the benefits that will be obtained if cloud computing is applied to the education sector.

RESEARCH METHODS

This research uses a qualitative descriptive research method, which describes the cloud computing database system and its implementation, and the benefits of cloud computing. Descriptive qualitative research method is a method that aims to describe a research object through samples or data that has been collected and make generally applicable conclusions (Sugiyono, 2008).

Data collection techniques using literature studies. The term literature study is very familiar as a literature study, which is a data collection technique by examining related sources such as books, literature, notes, and reports related to the problem to be studied. The literature study data collection method was chosen in order to obtain basics and opinions in writing which were carried out by studying various literature related to the problem to be studied, besides that literature studies also affect the credibility of the results of the research conducted (Nazir, 1988).

The literature used is literature sources in the form of journals, research reports, books, and online news. The selected journal articles are journal articles published in several universities that are relevant to the research theme, such as the definition and concept of cloud computing database systems, how they are implemented, and the benefits of cloud computing for its users.

RESULTS AND DISCUSSION

Cloud Computing in Indonesian is "Cloud Computing," if interpreted simply is one way to access the data and applications we have from anywhere using the internet network. Cloud computing in another sense is an information technology service that can be utilized or accessed by users through any device supported by the internet network.

Cloud computing scientifically means a mechanism that allows users to "rent" information technology resources such as software, processing power, storage and other resources. Cloud computing users rent resources as needed and utilize them, then pay according to what is used.

According to the National Institute of Standards and Technology, the definition of cloud computing is a model for improving convenience, providing on-demand access to a terminal network of shared, configurable cloud computing resources (i.e. networks, servers, storage, applications and delivered services) that can be rapidly deployed and released with minimal management effort or service provider interaction (Christina, 2016).

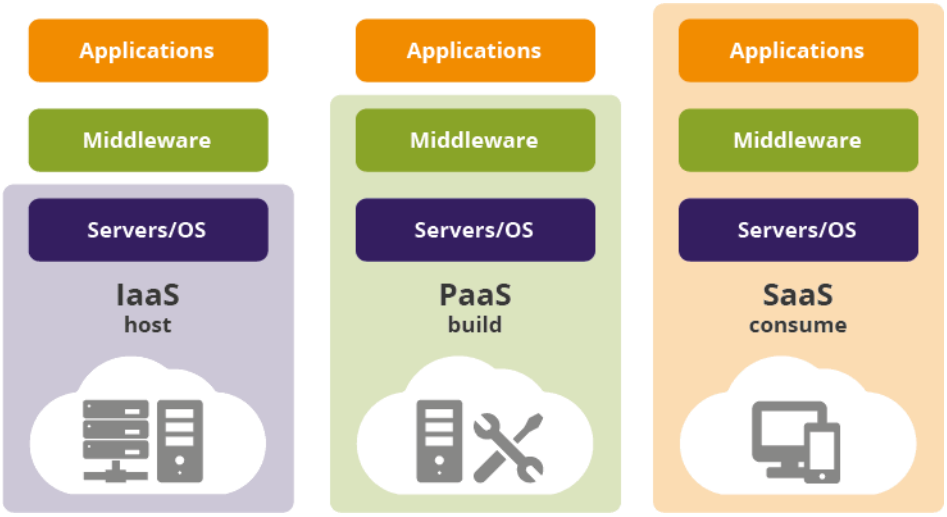


Figure 1. Basic service model of *cloud computing*

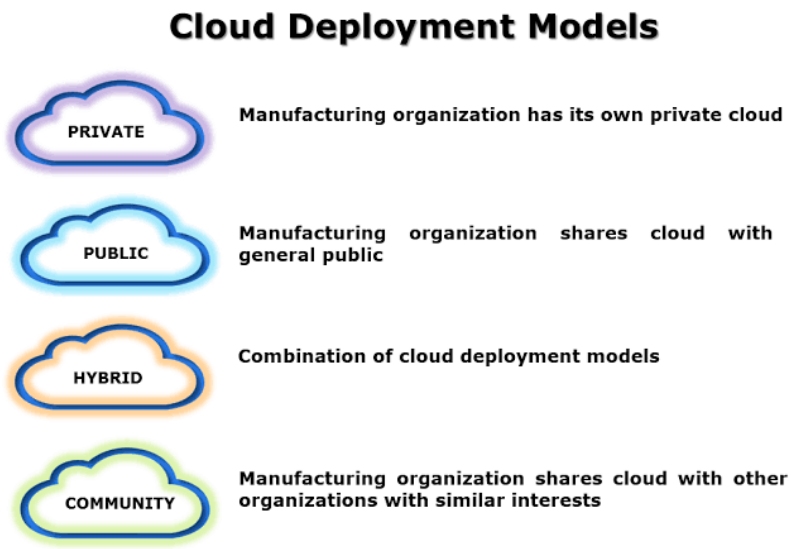
According to Sulistyo and Agustina (2013), cloud computing is divided into three basic service models, namely Software as a service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). The three models are explained as follows.

a) *Software as a Service (SaaS)* was the first popular *cloud computing* service. *Software as a Service* is a continuation of the evolution of the ASP *(Application Service Provider)* concept. *SaaS* makes it easy for users to take advantage of software resources by subscription, so SaaS users do not need to invest *in* either *in-house development* or license purchases. *SaaS* is a *cloud computing* application

model whose target is focused on individual *users*, namely by utilizing a *web-based interface* that is accessed through 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 an application that can only run on the *platform*. *PaaS* services provide a place to create and deploy applications without knowing how many *processors* or memory are needed for the application. In other words, *PaaS* offers services that are more than just data storage. An example of a *PaaS* service is *Google AppEngine* which offers services for users to develop and *host web* applications.

c) *Infrastructure as a Service (IaaS)* is one level below *PaaS*. *IaaS* is a service that "rents" basic information technology resources including operating systems, *processing power*, storage media, *memory*, network capacity and other services, which can be used by tenants to run their applications.An example that offers *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 computing deployment model.

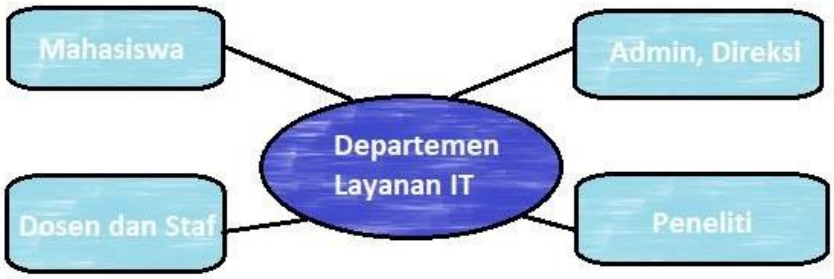
The concept and implementation of *cloud computing* shows that *cloud computing*

technology can be an evaluation in improving the quality of learning, the quality of information, and can support all activities in higher education institutions and organizations more stably, and better controlled (Santiko, Rosidi, & Wibawa, 2017).

In the application of *cloud computing*, there are still a number of obstacles, especially technical obstacles regarding the computing technology infrastructure, namely the limited internet access in several regions in Indonesia, both *broadband* and *dial-up.* Limited internet access in a number of regions has caused this technology not to be widely used. If 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 in Indonesia is caused by technical constraints, especially in virtualization issues and doubts about the security guarantees provided by *cloud computing.*

The utilization of *cloud computing* technology in education has an important role, especially in academic activities. The benefits that will be obtained if *cloud computing* is implemented in the world of education 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 though the *hard drive* or hardware is damaged (Sahi, 2019).

The application of cloud computing in the education sector provides many benefits. All parties involved in it feel the benefits of cloud computing directly. For example, in a university environment such as students, lecturers, IT staff, administrative staff, to the university board of directors. The benefits of cloud computing that are felt are certainly not the same, benefits in terms of improving the quality of teaching and learning media, benefits from the economic side such as resource savings, and benefits in terms of ease of maintenance of applications and infrastructure (Kurniawan, 2015).



User structure of *cloud computing* services at the University.

Some examples of cloud computing services commonly used in universities are Google Docs, Dropbox, and the like because these applications are easy to use, cheap, and reliable. These services are commonly used by students in general, so they are more adaptable if the teaching and learning process in the University environment uses these applications.

Cloud computing offers several advantages that make it very attractive to be implemented in the world of education, especially universities. Among them are high availability, low response time, and scalability. Some 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, spread sheets, and presentations that can be used in the classroom.

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 disadvantages, especially if the device used as 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 having fear of losing the storage device (Dhika Akhirina, & Destiawati, 2019).

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 operational cost savings.

From the overall results of the study it can be said that:

1. The results of the analysis referring to the level of student use of this cloud computing application will get a greater level of understanding of the material provided when compared to the provision of material that i s done verbally or orally from the instructor. This is in accordance with the role and function of *cloud computing* technology, especially in helping students understand learning and is also supported by the ease of operating the application, so users will not get difficulties.
2. The results of the observations made show that all the conveniences offered by this cloud computing application have become an attraction for users because they offer various conveniences such as:
   a. Students can obtain materials easily and can retrieve the lecture materials from wherever they are, as long as they are connected to the Internet.
   b. The teacher can still provide material when the teacher is unable to attend class, so students can still learn the material to be given.

The results of all research conducted in interviews can finally conclude that the existence of cloud computing applications is undeniable as one of the media that can be an alternative in obtaining information about lectures. Students can carry out their assignments according to the instructions given by their lecturers without having to meet in person. Some of these things can support the learning process to continue to run effectively. This is also a new experience for students and teachers who use this application as a medium that supports the learning process.

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