Building a Private Cloud Computing and The Analysis against DoS (Denial of Service) attacks
Case Study at SMKN 6 Jakarta

Rizal Broer Bahaweres[1,2], Johan Sharif [1], Mudrik Alaydrus[1]

[1]Graduate Program of Electrical Engineering Department, Mercu Buana University

[2] Informatics Dept., Faculty of Science & Tech., UIN Jakarta, Indonesia

rizalbroer@ieee.org, johansmk6@gmail.com , mudrikalaydrus@yahoo.com

Abstract—*The development of Cloud Computing is growing and becoming a trend that is widely used in the world of telecommunications today. In education, cloud computing becomes something that is needed to support the teaching and learning process. We analyze and design the network infrastructure in schools to implement cloud computing in local area schools. Then we built a system to create a server for cloud computing that can be accessed through the wired network and wireless network. Once the server cloud computing is installed and then we test functions such as uploading and downloading files whether to run well. The next step is to perform the test by doing DOS (Denial Of Service). The results show when no server DoS attack goes well with a large throughput. However, after the DoS attacks decreased throughput value and the greater the number of attacks is increasingly reducing the throughput of the server cloud. This shows that Cloud Server that have been built are still vulnerable to DoS attacks.*

Keywords—*Cloud Computing; Private Cloud; Education; QOS;DoS (Denial of Service)*

I. INTRODUCTION

Cloud computing (cloud computing; cloud) by NIST (National Institute of Standards and Technology) is a form of service that opened the opportunity to be present everywhere, giving comfort, network access on demand to the location of the computing resources configured (eg , networks, servers, storage, applications, and services), which can be quickly implemented and launched, with minimal management effort or service provider to use. Cloud computing has become a significant technology trends, and many experts expect that cloud computing will reshape information technology (IT) processes and IT market. In education the application of cloud computing can be applied to support the learning process [1]. Improving Quality of Sevice is a necessity in maintaining the the performance of cloud services [2].

Using the web-based applications in education is a requirement at this time [8]. SMKN 6 Jakarta have departments of Multimedia and Animation, where the duties collected in the form of images, animations, movie and sound files that are large files. Currently the collection file with flashdrive students to computer / laptop teacher concerned. This method has many problems, such as the spread of the virus from a computer and transfer files that require a long time so the time wasted collecting duties especially during the final hours will take the next teacher. If sending by using the internet then constrained by bandwidth and the limitations of file delivery.

The problems that can be identified in this study are as follows:

- Is the Cloud Computting system can be used to support the learning process ?.

- Is Cloud Computing services that have been built have good quality?

Experimented with DoS (Denial of Service) attacks will provide an overview of how the quality of service Cloud Computing server that has been built [3]. Results and analysis of QOS (Quality Of Service) can be taken into consideration as well as a reference to improve the service Cloud Computing server specifically and generally improved picture quality of the existing service network [4].

The research object is in the environment SMKN 6 Jakarta with existing network facilities in schools with the operating system and the existing software. Existing conditions and circumstances may vary with the other schools or other environments. Characteristics of the network and software which may be used will also affect the design of the system was made and the quality of existing services.

II. LITERATURE REVIEW

A. Related research

A baseline study came from a researcher in conclusion Cloud computing is an excellent alternative for the education agency that mainly under the budget shortfall to operate the system information effectively without spending more capital for computers and network devices [1]. Other researchers also discuss the quality of service in the cloud computing by Ardagna et al [2]. Another study discusses DoS (Denial Of Service) attacks in cloud computing by Chauhan et al [3]. then the model to determine the quality of service obtained from studies by Dong et al[4].

Here are the main studied that we make as a basic approach in research and differences with the research we do as shown in the table 1.

Table 1 Related Research

	JOURNAL/ RESEARCH	SIMILARITY	DIFFERENCE
1	Ercan, T. (2010). Effective use of cloud computing in educational institutions. Procedia, Social and Behavioral Sciences	Implementation in education	Journal only effectiveness assessment, this research has been the application.
2	F. John Krautheim, ----- Private Virtual Infrastructur for Cloud Computing	Using Private Cloud Computing	Journal talk about security, the study discusses the QOS
3	Ardagna, D., Casale, G., Ciavotta, M., Pérez, J. F., & Wang, W. (2014). Quality-of-service in cloud computing : modeling techniques and their applications.	QOS in Cloud Computing	Journal analyze three models used in Cloud Computing, research using one of the models used
4	Chauhan, K., & Prasad, V. (2015). Distributed Denial of Service (DDoS) Attack Techniques and Prevention on Cloud Environment, 4(September), 210–215.	Using DoS as a test of the quality of service	Journal analyzed in terms of security, the study used as the server service quality analyzer

B. Cloud Computing

Types of Cloud Computing services according to NIST divided into three as follows:

• Software as a Service (SaaS)

SaaS is a service of Cloud Computing where customers can use the software (software) that has been provided by the cloud provider.

• Platform as a Service (PaaS)

PaaS is a Cloud Computing service from us can rent a "home" following the environment, to run applications that have been created. Customers do not need to bother to set up a "home" and maintaining "home" is. What is important applications created to run well. Maintenance of this "house" (the operating system, network, database engines, application frameworks, etc.) is the responsibility of the service provider.

• Infrastructure as a Service (IaaS)

IaaS is a service of Cloud Computing where we can "hire" IT infrastructure (unit of computing, storage, memory, network, etc.) therein.

While based on the spread, NIST split three types of cloud computing, namely:

• Public Cloud

Cloud Computing is a service provided to the general public. Users can simply register or use existing services.

• Private Cloud

Cloud computing services are provided to meet the internal needs of the organization / company.

• Hybrid Cloud

Is a combination of service Public Cloud and Private Cloud implemented by an organization / company.
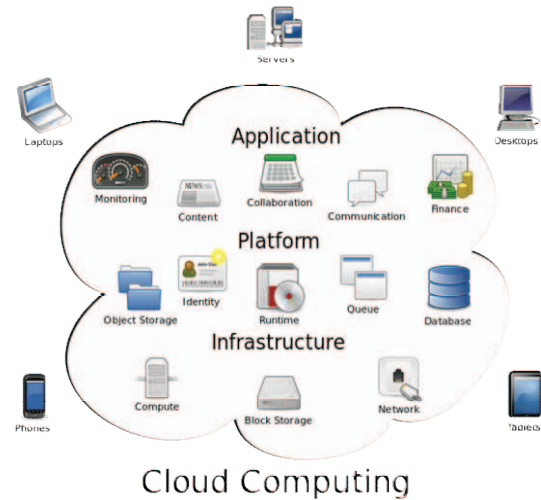

Figure 1. Cloud computing metaphor

C. Quality Of Service (QOS)

Quality of Service (QoS) is the ability of a network to provide a good service by providing bandwidth, overcome jitter and delay. Quality of service (Quality of Service) is a network mechanism that enables applications or services to operate as expected. One of the parameter in the QoS is Throughput That is the speed (rate) effective data transfer, measured in bps. Throughput is the total number of successful packet arrival observed at destination during a specified time interval divided by the duration of this time interval.

The parameters in QoS :

• Throughput

That is the speed (rate) effective data transfer, measured in bps.

• Packet Loss

Is a parameter that describes a condition that indicates the total number of lost packets.

• Delay (latency)

Is the time it takes the data to travel from origin to destination.

• Jitter or variation of packet arrival

• MOS (Mean Opinion Score)

The quality of the received signal is typically measured subjectively and objectively.

D. Denial Of Service

DoS (denial of service) attacks is a type of attack on a computer or server in the Internet network by spending resources owned by that computer until the computer is not able to function properly thus indirectly prevent other users to access the service from a computer who attacked them.

Types of DOS attacks, including:

• Ping Of Death

A ping of death is a type of attack on a computer system that involves sending a malformed or otherwise malicious ping to a computer.

• Syn flooding

Syn Flooding attack is done by exploiting the weaknesses the protocol at the time of the handshake process.

• Remote controled attack

Remote controlled attack is basically the control of some other network to attack the target.

• UDP flood

UDP attacks, this utilizes the connectionless UDP protocol to attack the target.

• Smurf Attack

The Smurf Attack is a distributed denial-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address.

III. RESEARCH METHODOLOGY

The research object of this paper is a new system that is a system built Cloud Computting to test the functions of existing applications and the quality of the existing network. In particular object in the test is the Cloud Computing server that will be in measuring the quality of its network services.

To build applications required to build a model of cloud computing servers. This study uses Linear Sequential Model considering Cloud Computing built a system that has a high complexity and requires a long time so it needs to be built systematically.

In this study conducted in several stages as illustrated in the flowchart below.
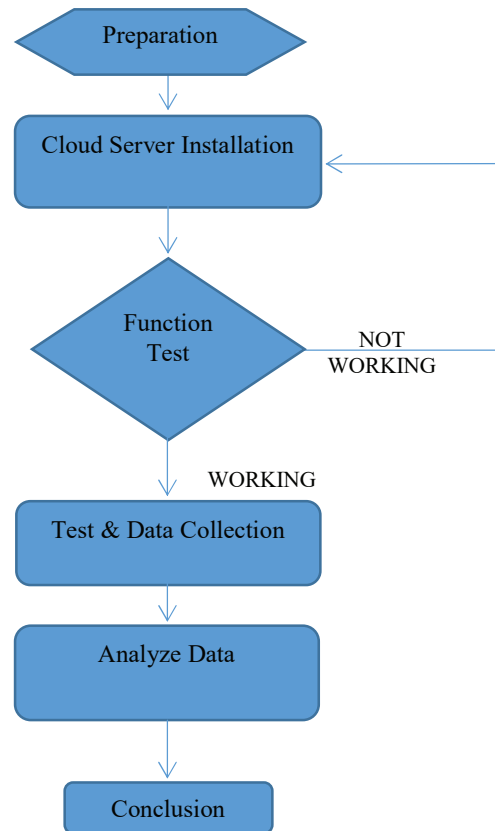

Figure 2. FlowChart The Research

A. Flow of process Research

• Preparation, at this stage of problem identification, analysis Problem Formulation software needs.

• Cloud Server Installation, at this stage of the installation process starts from the Cloud Computing server installation linux operating system, Apache web server, PHP 5, MySQL database and cloud applications software that is ownCloud

• Function Test, at this stage of the trial whether the functions that exist in the cloud computing server can run well. Test upload files, download files, running videos, adding user and access rights.

• Test & Data Collectionhe, the experimental test is do with DoS attacks to the cloud server with two attack scenarios. The previous step is retrieving data throughput value prior to the attack in order to become the material for analysis without and with DoS attacks. Scenario assault carried out by delivering server workloads cloud computing [2].

• Analyze data, from existing data are then analyzed

• Cunclution, from analysis of data can then be concluded

B. Research Environment

• Hardware Specifications

The hardware that will be used as servers should have better specs than by the computer client. For this study we used the computer server with hardware specifications are as follows: Intel Xeon, 3.0 GHz Dual Core1 Processor, 4 GB RAM, Ethernet GigaByte.

• Software Specifications

Specific software used is divided into two types, namely software for the operating system and application software for Cloud Computing. Operating system software that we use is Ubuntu Linux ver.14.04 LTE. Furthermore, to run a cloud computing need to install software applications and supporting software applications to run network-based IP / TCP. Software applications that use cloud computing is ownCloud which can be downloaded free of charge at https://owncloud.org/. Supporting software that cloud computing can run so we're using the Apache web server, PHP 5, MySQL Database

C. Testing Scenario

The first process in this research is to build a cloud computing system, with cloud server installation into existing network system. After Computting Cloud server can be installed and run, then the client can use with existing browsers, can use Internet Explorer, Mozilla Firefox or Google Chrome by writing in the site address http://IP-server/owncloud/.

Subsequently is take the throughput value of cloud computing server by uploading a file which is then captured by using wireshark. The first step is to take the data throughput value prior to the attack in order to become the material for analysis without and with DoS attacks.

Scenario 1

- using 3 PC to provide Cloud Computing server to attack.

- Number of ping each computer attacker is 32000 bytes,

- so the total attacks to the servers of Cloud Computing as much as 96000 bytes.

Scenario 2

- using 6 PCs to give attacks to the server Cloud Computing.

- Number of ping each computer attacker is 65000 bytes,

- the total attacks to the servers as much as 325000 bytes Cloud Computing.

IV. RESULT AND DISCUSSION

The first process in this research is to build a cloud computing system to the cloud server installation into existing network system. After that tested to ensure that the software has been installed and running well with the login function test, create a user, upload and download files. From the test results it can be concluded that the server cloud computing has

gone well. Further more the test by measuring Troughtput server being attacked by DoS (Denial Of Service) with the method of Ping Of Death.

A. Test The Functionality Of Cloud Server

• Testing User Login

Tests will be performed to check whether the distribution of user and password can run well. Here the user will be tested for a group of teachers with a user name: *johan* and password: *johan*, this is the result.

Normal Data		
Action	Result	Conclusion
User name : johan Password : johan	Can be entered into the application	[x] Accepted [ ] Rejected
Wrong Data		
Action	Result	Conclusion
User name : johan Password : 123456	Unable to login and display message "forget your password ? Reset it!"	[x] Accepted [ ] Rejected

• Testing Uploading Files

The next testing a file upload function to test whether the server cloud computing can run well. Users used is Johan and user-uploaded file is "TESIS PPT NEW 1.ppt". The results can be seen in the figure below.
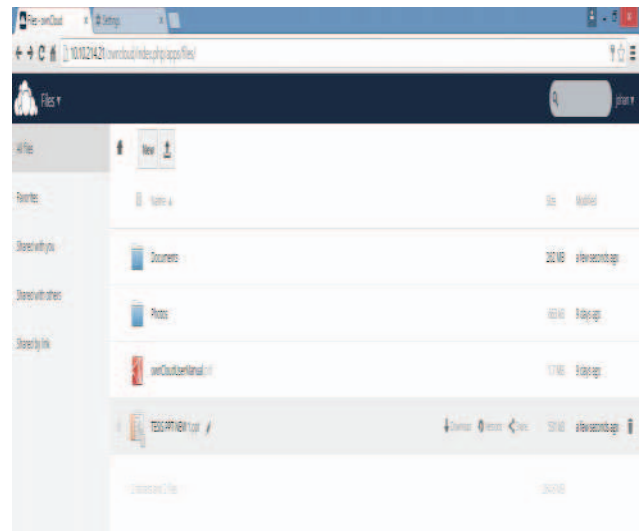

Figure 3. The Result Uploading File

B. Result For Troughtput Values

In this study, data collection taken as many as 30 times in which the initial data capture as much as 10 times the data throughput without DoS attacks as the reference data initial quality of service cloud computing system. Furthermore, the data throughput is taken as many as 10 times with scenario 1 attack with 3 computers with each attack with 32000 bytes. Last is the scenario 3 using 6 computers and each computer attack as much as 65000 bytes.

- Preliminary data, is the throughput without DoS (Denial Of Service) attacks

- Scenario 1, is giving DoS attack 32000 bytes with 3 Personal Computer.

- Scenario 2, is giving DoS attack 65000 bytes with 6 Personal Computer.

This is the result from our experiment measurement of throughput values :

Table 2 Experiment Measurement

Number	Preliminary data (Mbit/s)	Scenario 1 (Mbit/s)	Scenario 2 (Mbit/s)
1	47.929	43.048	32.085
2	44.739	45.038	38.628
3	45.298	37.810	30.192
4	55.634	44.506	42.507
5	44.891	44.272	36.995
6	53.504	42.734	30.852
7	43.159	43.402	42.421
8	45.204	44.830	30.833
9	50.068	36.257	30.989
10	42.848	38.421	34.022
Average	**47.327**	**42.032**	**34.952**

Figure 4. Table of Troughput Values

From the experimental results without a DoS attack as shown in the table above obtained value of the average throughput of 47.327 Mbit / sec. Scenario-1 is abouth 42.032 Mbit/sec and the Scenario-2 is 34.952 Mbit/sec.
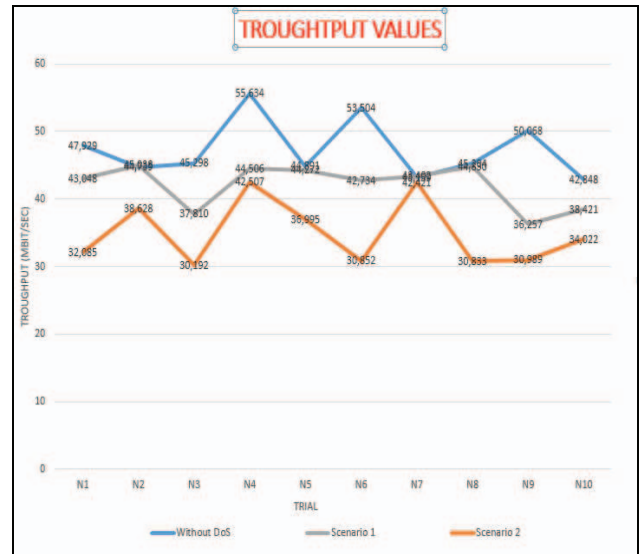

Figure 5. Toughtput Values

C. Analysis of The Data

From the results of experiments which are then summarized in a table and graphs that can be analyzed phenomenon. From the above experimental results can be seen:

- Average Throughput without DoS attacks amounted to 47.327 MBit / sec

- The average throughput with DoS attacks 32000 bytes x 3 PC amounted to 42.032 MBit / sec decreased by 11.19% from the normal state.

- The average throughput with DoS attacks 65000 bytes x 6 PCs amounted to 34.952 MBit / sec decreased by 26.15% from the normal state.

- So with DoS attacks that do occur reduction in throughput rate, though still able to walk either by direct observation, but this should be a concern so it does not become an obstacle later.

A significant decline of the throughput values or quality of service after obtaining a DoS attack is according to researchers from India Keyur Vivek Prasad Chauhan and in its International Journal said, "DDoS attacks create a system or network services unavailable to legitimate users. This attack is minimal disruption, or can be seriously damaging if critical systems are the main victims. Loss of network resources causing economic losses, delays in the work, and loss of communication between users of the network. "

V. CONCLUSION AND RECOMMENDATIONS

Based on the results of research on the various constraints Cloud Computing, it can be concluded that Cloud Computing is an option that can be used to provide IT resources and effective and efficient in conjunction with the utilization of IT resources. Cloud computing as an exciting development is a significant alternative today's educational perspective.

Students and administrative personnel have the opportunity to quickly and economically access various application platforms and resources through the web pages on-demand. Teachers and students can be helped in the learning process both in the collection of duties and the collection of teaching materials.

After testing and analyzing network quality cloud computing in SMKN 6 Jakarta, it can be some conclusions as follows:

- The cloud computing system that has been built to facilitate the teachers and students in learning and data collection can be easily accessed at any time.

- Through the measurement test throughput, decrease due to an interruption Denial of Service conducted several computers, the greater the amount of interference and the number of attackers increasingly reducing the throughput from server Cloud built.

- This proves that Cloud Computing server that is built still has shortcomings and should find a solution to cover it.

From the research that has been done can be developed for further research such as:

- Due to a decrease in throughput, this indicates that the system is still a weakness, for it needs to be investigated further how close these weaknesses as adding patches that can counteract DoS attacks.

- Patch or pieces of programs typically provided by software developers, then we can look on the internet and upgrading software Linux became sytem operations.

- Cloud computting built are still localized and can not be accessed from outside the school district SMKN 6 Jakarta. For further research developments and Cloud Computing can be accessed from outside the Public IP media alone or can ride to Computting Cloud service providers, so that teachers and students can access anywhere and anytime.

REFERENCES

[1] Ercan, T. (2010). Effective use of cloud computing in educational institutions. *Procedia, Social and Behavioral Sciences*, *2*, 938–942.

[2] Ardagna, D., Casale, G., Ciavotta, M., Pérez, J. F., & Wang, W. (2014). Quality-of-service in cloud computing : modeling techniques and their applications.

[3] Chauhan, K., & Prasad, V. (2015). Distributed Denial of Service (DDoS) Attack Techniques and Prevention on Cloud Environment, International Journal of Innovations & Advancement in Computer Science, 210–215.

[4] Dong, W. E., Nan, W., & Xu, L. (2013). QoS-Oriented Monitoring Model of Cloud Computing Resources Availability. 2013 International Conference on Computational and Information Sciences, 1537–1540.

[5] Faizal, M., & Rahman, A. (2013). International Journal of Instruction. The Effectiveness of Web-Based Multimedia Applications Simulation in Teaching and Learning, 6(2).

[6] Gonzalez, N., Miers, C., Red, F., & Simpl, M. (2012). Open Access A quantitative analysis of current security concerns and solutions for cloud computing. Springer Open Journal, 1–18.

[7] Katarina, Tiwari, A., Capretz, M. A. M., Article, I., & Url, A. (2013). Data management in cloud environments : NoSQL and NewSQL data stores. Journal of Cloud Computing: Advances, Systems and Applications 2013, Springer Open.

[8] Lei, S. (2014). Computer-Based Multimedia Application in Education. In *ICASSR 2014* (pp. 79–80).