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Overhead Analysis as One Factor Scalibility of Private Cloud Computing for IAAS Service

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Abstract— The rapid development of technology leads to improvement in a variety of computing concepts, information and communication technology(ICT). The ICT environment is become more complex and costly. Cloud Computing is one of phenomenon int the new ICT services, Cloud Computing model has three categories of services : Infrastructure As A Service (IAAS), Platform As A Service (PAAS), Software As A Service (SAAS). It also has four deployment models which are private cloud computing, community cloud, public cloud and hybrid Cloud.

This research aims to determine the overhead of the virtualization environment. It is expected the private cloud with virtual technology, that utilizes the maximum resources does not degrade server scalability. The implementation of private cloud is using OpenStack with configuration multiple interfaces multiple servers.

The results of the thesis indicate that the overhead of a single virtual machine is 114 ms (database server) and 212 ms (web server), to ten virtual machines are active 615 ms (database server) and 786 ms (web server). Overhead that occurs on a single VM can still be neglected, despite the performance degradation with increasing number of active virtual machines the execution time of servers application tends to be linear close to shape belongs to the physical servers.

Index Terms— Overhead, private cloud computing, IAAS, OpenStack, multiple interfaces multiple servers.

1 Introduction

As the rapid development of technology leads to improvement in a variety of computing concepts, the information and communication technology (ICT) environment becomes more complex and costly. Provision of reliable infrastructure have consequences for the ICT users to be able to use it effectively and efficiently.

Cloud computing is one of development phenomenon in the new ICT services. Cloud Computing is a model which provides computing resources or information technology (e.g., software, processing power, storage.) that allows customers to "take and use" resources on-demand, via the internet (NIST, 2011).

With the cloud computing, it will change the paradigm of the company or organization in ICT investment. Cloud computing can be promoted to consolidate ICT infrastructure, simplify management, maximizing the utilization of computing resources and at the end it would be able to save the operational costs.

Infrastructure As a Service (IAAS) is a service that "rent" the basic technology information resources, which includes media storage, processing power, memory, operating system, network capacity, etc. which can be used by users to run applications virtually.

The implementation of virtual technology that utilizes the maximum resources of server, is expected to reduce its scalability to the virtualization environment such as overhead.

2 Literature Review

Cloud computing is one of development phenomenon in the new ICT services. Cloud Computing is a model which provides computing resources (e.g., software, processing power, storage.) that allows customers to "take and use" resources on-demand via the internet (NIST, 2011). There are four proposed ontology which is expected to be a framework and guidance in conducting research in cloud computing. This ontology consist of cloud application (software as a service), cloud software environment (platform as a service), cloud software infrastructure (infrastructure as a service, data as a service, communication as a service), software kernel, firmware / hardware (hardware as a service) (Youseff, 2008).

Infrastructure As a Service (IAAS) is a service that "rent" the basic information technology resources, which include media storage, processing power, memory, operating system, network capacity, etc. which can be used by users to run applications virtually. In a virtualized environment, (Nurhaida, 2009) performed overhead measurement, linearity, performance isolation and the use of hardware resources in a virtualized environment. The research used VMWare ESX 3.5.0 as virtualization application.

2.1 Virtual Server scalibility

Scalability is the ability to improve system performance gradually in accordance with the work load by increasing the number of resources. To evaluate overhead due to the virtualization mechanisms, we compare the execution time of an application running on a non-virtualized operating system (Ta) with another execution time of the same application run within a single virtual machine (Tav). The overhead may be negligible for a virtual machine and becomes significant when several virtual machines running at the same time (context switch overhead may exist even if no application is executed on the other virtual machines) and the formula is :

$$Ov = Tav - Ta \quad \text{..... (2.1)}$$

Meanwhile, Ta is also compared with Tanv when some virtual machines n running at the same time. In this scenario, only a virtual machine actually runs the application. The other n − 1 VMs are not running any application.

$$Ovn = Tanv - Ta \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.2)$$

where Ovn = Virtualization Overhead and Tanv = Executing time for n virtual machines.

3 Research Methodology

Two scenarios used in this study has been proposed. Previously, resource analysis study has been conducted to run the scenario.

- For the first scenario, private cloud computing was implemented with Infrastructure As A Service (IAAS) in MTI network as shown in Figure 3.1. The design of private cloud consisted of four computers, which consist of one master computer and three slave computers. The configuration is using multiple interfaces of multiple servers.

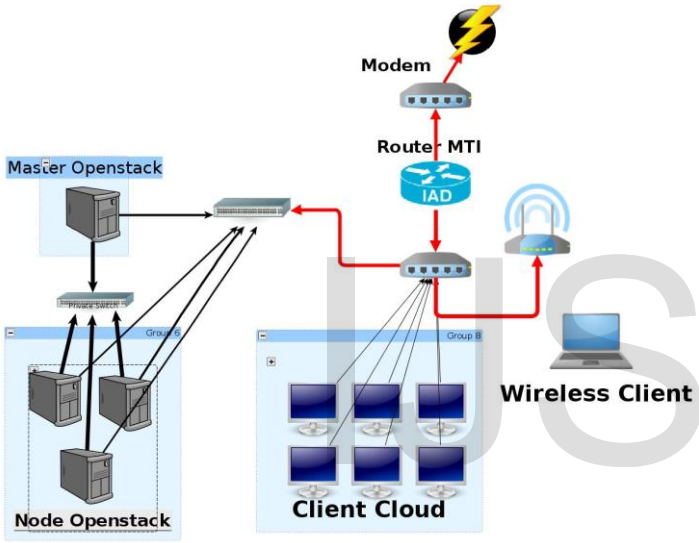

Figure 3.1 The design of Private Cloud Computing

  - The specification of master computer is 8 core processor, 8 GB memory, Hardisk 1 Terabyte and two Network Card. The master were installed and configured with OpenStack Compute and Glance.
  - The specification of slave computer is 4 core processor, 8 GB memory, 1 Terabyte Hardisk and two Network Card. The slave were installed and configured with Nova Compute and Nova Volume.

- In the second scenario, overhead will be measured. Network topology for testing overhead can be seen in Figure 3.2. In this scenario, the execution time between physical servers and virtual servers will be compared. The application will be installed in both servers (Database Server i.e. mysql server and webserver apache2). The server were installed with ubuntu server 10.04 (Lucid Lynx) 64 bit operating system, and the specifications of both servers are 8 processors, 8 GB memory and 1 Terabyte hardisk. Every server will be given different loads as follows:
  - Load for database server by backuping data of 146 MB taken from mediawiki database downloaded from http://opensourcetelkomspee dy.com / wiki / index.php / Main_Page.
  - Load for web server by http request as many as 5000 requests
  - Request process will be done by using apache benchmark tool which is available in apache2 applications.

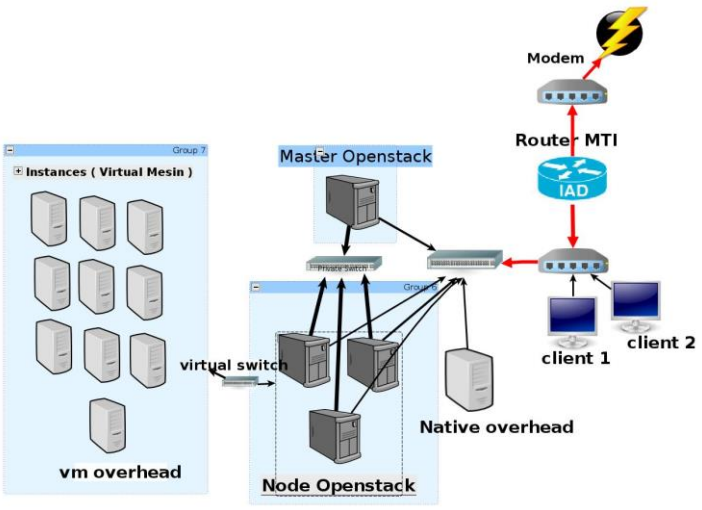

Figure 3.2 Network topology for testing overhead

4 Results and Discussion

Based from the testing process, the data was then collected for further analysis, as shown on Table 4.1.

Table 4.1 Evaluation of the overhead with loading scenarios on the Server

Skenario pembebanan database server	Jumlah proses	*Native (server fisik)*	Virtual Mesin	
Backup database 146 MB (Databaseserver)	1	0m3.903s	1	0m4.017s
			2	0m4.085s
			3	0m4.271s
			4	0m4.299s
			5	0m4.439s
			6	0m4.335s
			7	0m4.530s
			8	0m4.554s
			9	0m4.529s
			10	0m4.518s
5000 *http request* (webserver)	1	0m8.734s	1	0m8.946s
			2	0m9.467s
			3	0m9.375s
			4	0m9.478s
			5	0m9.400s
			6	0m9.528s
			7	0m9.544s
			8	0m9.446s
			9	0m9.473s
			10	0m9.520s

Based on data in Table 4.1, a graph of database and webserver measurement results is obtained as shown in Figure 4.1 and Figure 4.2

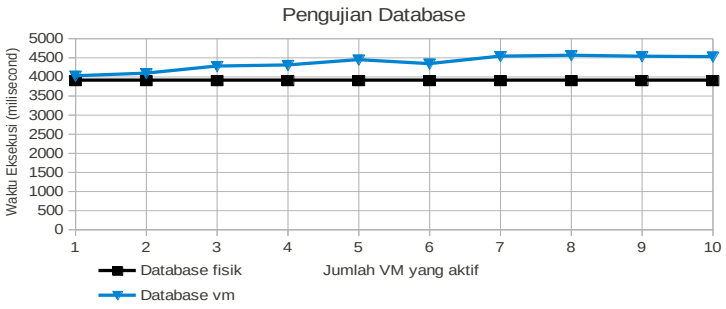

Figure 4.1 Graph of overhead measurement on mysql server

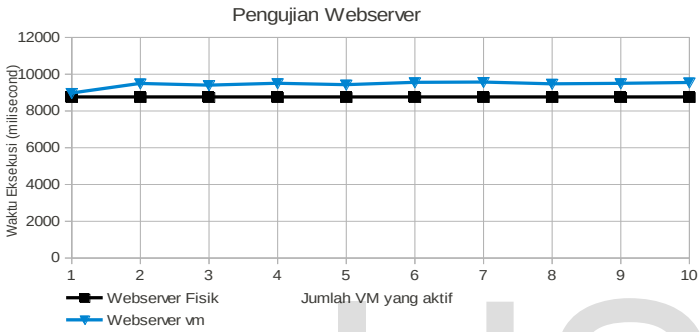

Figure 4.2 Graph of overhead measurement on the webserver

The execution time of the computing process in one physical server is correlated with that of in one overhead server. It can be seen from Figure 4.1 and Figure 4.2 that if one virtual server is running then the overhead is almost zero and can thus be neglected. However, when the number of virtual machines increases, the execution time of database and web server applications in more than one virtual servers tend to be linier and the shape of the curve close to shape belongs to the physical servers. From the measurements which have been done, the overhead values are obtained as follows:

- The overhead of the database server process are as follows. Ov = 114 ms and Ovn value = 615 ms. Database performance degradation after ten virtual machines run = 18.54%
- The overhead of the web server process are as follow. Ov = 212 ms and Ovn value = 786 ms. Webserver performance degradation after ten virtual machine run= In addition, the use of virtualization server with OpenStack has increased the optimalization of processor usage, from the level of 0.1% in the presence of an active virtual machine to 99.8% with 4 actives virtual machines. The memory usage also has been increased from 714 MB to 6731 MB as can be seen in Table 4.2. These values are obtained from the resource monitoring tool namely Top software in one of the slave. Hence, the use of virtual technology is a promising infrastructure that is reliable and optimizes all resources belong to servers.

Table 4.2 The optimization of the processor and memory usage

Number of active VM	Prosesor usage (%)	Memori usage (MB)
No VM is active	0,1	714
1 VM is active	25,1	6678
2 VM are active	49,9	6694
3 VM are active	74,9	6711
4 VM are active	99,8	6731

Another OpenStack ability is its fast system recovery during the system error by using the snapshot feature (i.e. backup and recovery process). Application of the snapshot can reduce almost half of the stages of recovery steps and saves time significantly. The snapshot result can be seen in Figure 4.3.

```
root@awan1:~# euca-describe-images
IMAGE   ami-0000000a     snapshot (masteradit)   mycloud available       private
IMAGE   ami-00000009     snapshot (nativebaru)   mycloud available       private
IMAGE   ami-00000008     snapshot (erickpovray)  mycloud available       private
IMAGE   ami-00000007     snapshot (faisalnative) mycloud available       private
IMAGE   ami-00000005     snapshot (masterpovray) mycloud available       private
IMAGE   ami-00000004     bucket/lucid-server-cloudimg-amd64.img.manifest.xml
nstance-store
```

Figure 4.3 Snapshot results in OpenStack

5 Conclusion and Future Works

5.1 Conclusion

- Private cloud computing with infrastructure as a service (IAAS) with multiple interfaces multiple servers has been successfully designed and built by using 4 servers and OpenStack in Master of Information Technology (MTI) Lab, Faculty of Engineering, Gadjah Mada University, Yogyakarta.
- The overhead values for one virtual machine are 114 ms (database server) and 212 ms (webserver). Mean while for ten active virtual machines are 615 ms (database server) and 786 ms (the webserver). Overhead that occurs in one virtual machine can be ignored and system perfomance degrades as the number of active virtual machines increase.
- Overheads of the webserver and database server applications in more than one virtual machine tend to be liniear and the shape of the curve close to the shape belongs to the physical servers.
- OpenStack server virtualization has increased the optimization of the processors from 0.1% in the absence of virtual machine to 99.8% with four active virtual machines. The memory usage has also been increased from 714 MB to 6731 MB.
- The use of snapshot provides a significant improvement of the recovery system. If there is error in the system or server error then snapshot technology can restores quickly.

5.2 Future works

- One of the drawback of virtualization is that all services are centralized in a machine. If one machine is damage or there is

error then it will fail to run all systems. This can be overcome by creating a Fail Over Server mechanism as a backup, using a tool called Heartbeat.

- The use of the GPU (Graphics Processor Unit) in the cloud system for parallel processing such as rendering.
- Development of the portal to software services (i.e. rendering -http://www. blendercloud.net/)
- Performance analysis of network communications in the cloud computing environment.

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