HYPERVISOR PERFORMANCE BASE CLOUD COMPUTING AT MULTI PLATFORM VIRTUAL MACHINE

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Abstract

Hypervisor using binary translation to translate physical machines to virtual machines and take a long time for translate binary code. There are two hypervisor default in Proxmox VE 2.1 namely KVM with fullvirtualization and openVZ with operating system-level virtualization technique, both technique are used together, if this case running together in server hypervisor it means that execution will be running slow. This research will be overcome this problem by choose the best hypervisor so virtual machine still running well if there are many request from client in cloud service. This research using quantitative type of research with experimental and comparative methode because we compare two hypervisor and than make virtual machine experiment using some scenario with trial. This research result two methode that all researcher can be used to test hypervisor performance to get the best hypervisor that is KVM that have better performance than openVZ so this hypervisor suitable to implemented in cloud computing.

Keywords-virtualization, cloud computing, virtual machine, hypervisor, operating system.

A. INTRODUCTION

In this session we would explain about the general concept of cloud computing and the part of it namely virtualization to complete the big problem in this hypervisor research. But before we explain about cloud computing and virtualization, better if we know about cloud computing service.

1. Definition of Cloud Computing

Cloud computing is a fundamental new paradigm in which computing is migrating from personal computers sitting on a person's desk to large, centrally managed datacenters [1].

A cloud computing is a set of network enabled services, providing scalable, QoS guaranteed, normally personalized, inexpensive computing platforms on demand, which could be accesed in a simple and pervasive way [2].

There are three category of cloud computing services that we expressed in a figure 1:

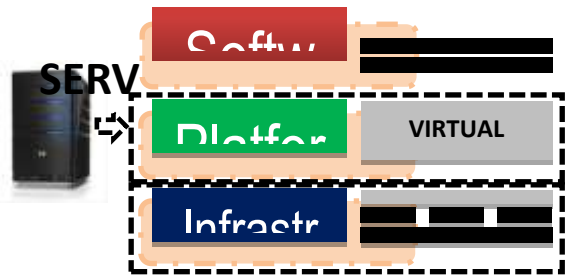


Figure 1. Cloud Computing Sevices

a. Infrastructure as a Service (IaaS)

Like Amazon web services, the larger provider in this word, provide many virtual server with

unique IP address and storage also according to developer need. In this research we will use personal computer Lenovo H330 as a server that support hardware virtualization cause we use Proxmox VE 2.1 cloud computing technology that using KVM and openVZ hypervisor using full virtualization and OS-level virtualization technic.

b. Platform as a Service (PaaS)

This service In cloud defined as a category of cloud computing services that provide a computing platform and known as virtual machines which represents an operating sistem.

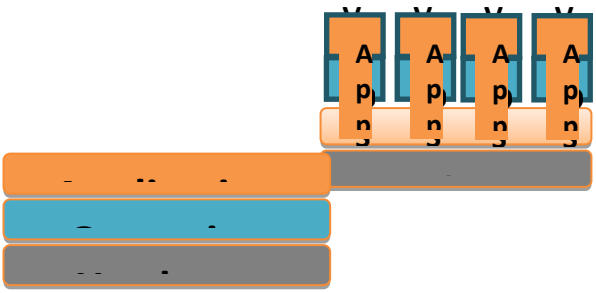
c. Software as a Service (SaaS)

Software or an application is hosted as a service and provided to costumers across the internet.

2. Definition of Virtualization

Virtualization is a translation technic of a hypervisor for hiding the physical characteristics of computing resources to simplify the way in which other infrastructure systems, platform and applications that end users interact with the resources

The difference between native server and virtualization server.



a. Native Server b. Virtualization Server

Figure 2.The difference between native and virtualization server.

Look at the picture a. above, native speaker consist of 3 layersnamely hardware, operating system and application difference with virtualization server, there are 4 layers hardware, hypervisor/Virtual Machine Manager (VMM) , virtual operating systems and virtual applications. Inside VMM we can install operating system for server depend on cloud computing technology that builded. If we wanna using UEC (Ubuntu Enterprise Cloud) we can use linuxubuntu 10.10 Maverick Meerkat for server, Windows server R2 with Hyper-V hypervisor (windows include hyper-V hypervisor inside) for windows and DebianforProxmox. In this research, we use ProxmoxVE 2.1 with two hypervisor inside KVM and OpenVZ where the hypervisor in virtualization server as a host and virtual machine as a guest.We have to

install operating system inside host and every guest.

Virtual machines operate under the control of software commonly referred to as a ‘hypervisor’, which provides a global mechanism for control and scheduling system resources.

Hypervisorscan run natively on the server hardware or can be hosted within a conventional operating system. For detail look at the fig.3 below.

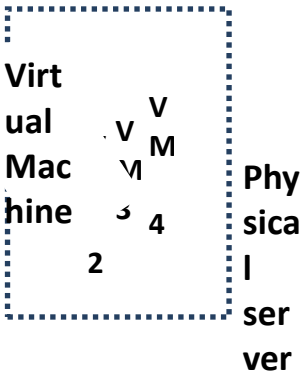


Figure 3. Server Virtualization

In this research we use minimum requirement for serverusing Lenovo H330 that support hardware virtualization.

B. HYPERVISOR

The are many kind of hypervisor technical virtualization like full virtualization, paravirtualization, hardware assisted virtualization and OS-level virtulization. And we use both from the fourth types of virtualizations namely full virtualization and Operating System-level Virtualization using KVM and OpenVZ hypervisor.

KVM hypervisor take directly from Linux’s kernel by adding some modules that convert it in a hypervisor.The code of this hypervisor about 10000 rows and consist of 100 until 500 virtual machine ID (VMID). By using virtiotechnique, it is possible for the driver’s virtualization offering a better management of API interface between guestOS and KVM kernel.

OpenVZusing OS Virtualization where’s the guestOS is called container or Virtual Private Server. Unlike Xen or KVM where each guest has got it’s own kernel, in OpenVZ all the containers have one kernel in common with the hostOS. Anyway every guestOS has got it’s own IP, I/O and memory. Since every guestOS is a process in OpenVZ hypervisor, this methode offers a better possibility than Xen and KVM in scalability but weaker in isolation. OpenVZ can modify the Linux’s kernel giving to every unmodified Linux-based OS the possibility to be executed as a process in Linux. All the above hypervisors support the SMP (Symetric Multi Processor) technique. This means that some guestOS can use some host processors at the same time.

From hypervisor to applications there are virtual Machine that worked like

physical machine and we also call as a guest in virtual server. And every virtual machine (VM) with full virtualization technic had to install operating system as we need, in this research we install linux in VM1 and windows in VM2 to compare the performance with difference OS. And then compare the difference applications in the same OS.

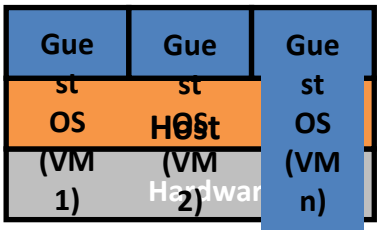


Figure 4.KVM Hypervisor Architecture in Full Virtualization

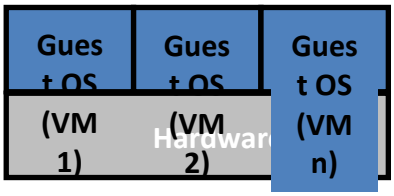


Figure 5.OpenVZ Hypervisor Architecture in OS-level virtualization

The difference and equality between both of hypervisor's are :

No.	Difference and equality	KVM	OpenVZ
1	Virtualization solutions which gives the ability OS – level virtualization in the linux kernel		✓
2	Virtualization solutions which gives the ability full virtualization in the linux kernel based virtual machine	✓	
3	Distributed as free software	✓	✓
4	Developed by the community that supported by a commercial company	✓	✓
5	Faster process		✓

C. METHODOLOGY

This qualitative research using comparative, experimental and associative methode.There is consensus in the scientific community in the academicabout what would be the best way to evaluate problem solutions in the research.

In this research we used Meier et al stages, the basic methodology for performing testing activities.

1. First stage, Identify test environment means that we must identify the physical test environment and the production environment as well as the

tools and resources available to the test team. The physical environment includes hardware, software and network configurations. This research take place in 3 places by publishing cloud network with the same access speed download 1 Mbps and upload 0,22 Mbps.

2. Second stage, identify the performance acceptance criteria.In this stage we identify the response time, availability, uptime and downtime using proxmox, OpManager 8 and cacti.
3. Third stage, Plan and design tests, identify key scenarios. Look at the figure 6 below, the key scenarios are “hypervisor” and this layer in server above hardware but in cloud computing inside infrastructure as a service.

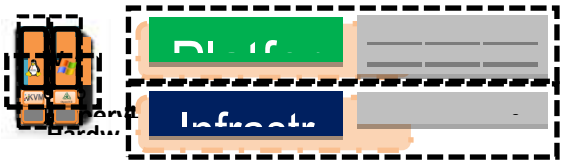


Figure 6. Part of research in cloud computing layer

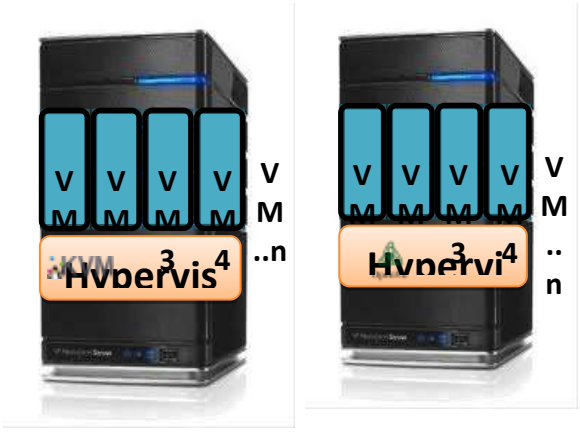
4. Fourth stage, configure test environment. We prepare to use proxmox cloud computing technology with debianas the operating system for the host system which is well supported among all the evaluated virtualization solutions.
5. Fifth stage, implement test design. After fourth stage finished means that
6. Sixthstage, execute tests.And first we start to control workload system obtain CPU utilization and response time virtual machine by running 1 VM and other idle and when all VM running together. In this stage we also measure availability, performance and quality of the machine, Second measuring availability, performance and quality when client use the application.
7. Seventh stage, analyze, report and retest. In this stage we make some testing from applications implementation to knows the quality of machine and software to handle web server applications. We identify the types of requirements and the requirement can be devided into four major types : functional, quality, platform and process requirement. In this case we used quality requirement to ensure that the system possesses quality attributes such as response time, throughput, reliability and availability of the server that is very impotant for measure the quality of server covering satisfaction all civitas

academic in using campus area network for all they need.

D. RESULT AND DISCUSSION

This section presents the result of our experiments. In methodology stage we had identify many question for this research about why we have to used proxmox cloud computing with KVM and OpenVZ Hypervisor, research clearly explain that many advantage using KVM than OpenVZ hypervisor includeeasy to developed many application using multiplatform operating system that many IT Developer can modify their application.

In this research there are three scenario that we used to compare both hypervisor and make some experiment with virtual machine and application. In the first scenario we compare two hypervisor in proxmox, KVM and OpenVZ hypervisor. Look at the figure 7 below



a. KVM hypervisor analyzed

b.OpenVZhypervisor analyzed

Figure 7. Hypervisor Analysis Scenario

Table 1. Virtual machine result at KVM hypervisor

Jumlah Mesin Virtual	Memori Usage	Uptime (s)	Down Time (s)	Availability (%)
1 Mesin Virtual	455 MB	7200	0	100
2 Mesin Virtual	885 MB	7200	0	100
3 Mesin Virtual	2.90 GB	7200	0	100
4 Mesin Virtual	2.86 GB	7020	180	97.50
5 Mesin Virtual	2.83 GB	6120	1080	85.00
6 Mesin Virtual	3.56 GB	3540	3660	49.17

Table 2. Virtual machine result at OpenVZ hypervisor

Jumlah Mesin Virtual	Memori Usage	Uptime (s)	Down Time (s)	Availability (%)
1 Mesin Virtual	94 MB	7200	0	100
2 Mesin Virtual	282MB	7200	0	100
3 Mesin Virtual	705 MB	7200	0	100
4 Mesin Virtual	1.08 GB	7200	0	100
5 Mesin Virtual	1.59 GB	7200	0	100
6 Mesin Virtual	1.62 GB	7200	0	100
7 Mesin Virtual	1.93 GB	7200	0	100
8 Mesin Virtual	2.38 GB	7110	90	98.75
9 Mesin Virtual	2.45 GB	7050	150	97.92
10 Mesin Virtual	2.78 GB	7020	180	97.50
11 Mesin Virtual	3.1 GB	6980	220	96.94
12 Mesin Virtual	3.36 GB	6850	350	95.14
13 Mesin Virtual	3.56 GB	6540	660	90.83

Figure 8. Access 3 Clients with 2 OS

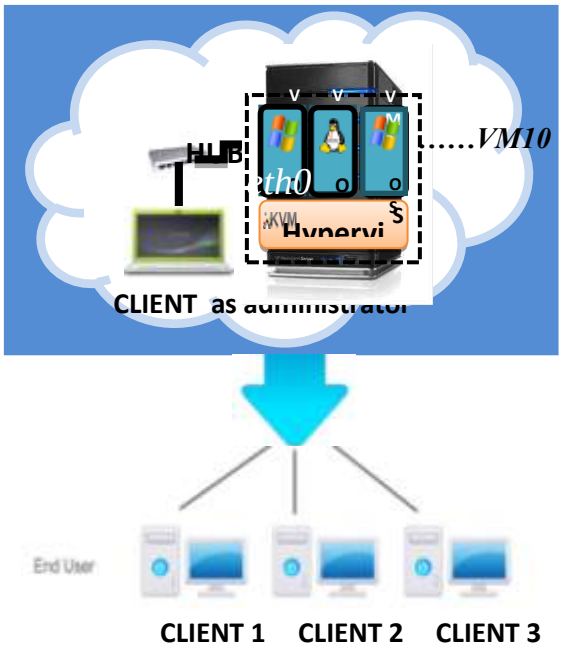


Figure 9.Analyzed Virtual Machine OS till

Table 3. Availability monitoring result

OPMANAGER WEEKLY REPORT

Mesin Virtual	Up			Down			Maintenance	Availability (%)
	jam	menit	detik	jam	menit	detik		
VM1	23	59	59			1	0	100.00
VM2	23	59	53			7	0	99.99
VM3	23	55	50		4	10	0	99.71
VM4	19	11	20	4	30	40	0	80.97
VM5	10	15	42	13	43	30	0	42.78
VM6	3	20		21	40		0	13.33
VM7							0	0.00
VM8							0	0.00
VM9							0	0.00

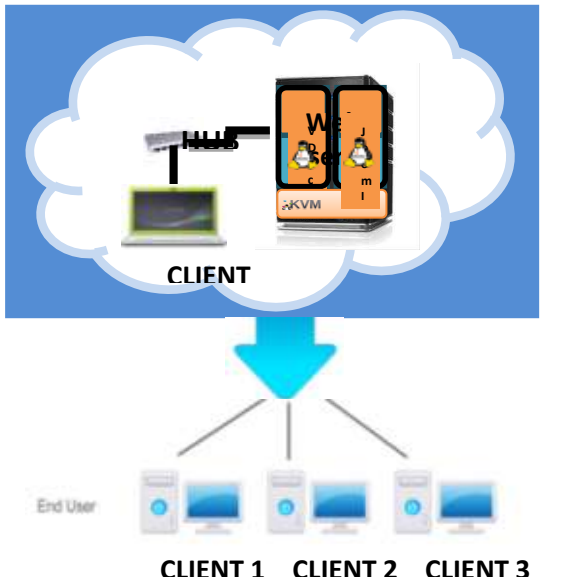


Table 5. Monitoring result for virtual machine availabilitywhen different application in the same OS

OPMANAGER WEEKLY REPORT

Mesin Virtual	Up			Down			Maintenance	Availability (%)
	jam	menit	detik	jam	menit	detik		
VM1	23	59	59			1	0	100.00
VM2	23	59	53			7	0	99.99
VM3	23	55	50		4	10	0	99.71
VM4	19	11	20	4	30	40	0	80.97
VM5	10	15	42	13	43	30	0	42.78
VM6	3	20		21	40		0	13.33
VM7							0	0.00
VM8							0	0.00
VM9							0	0.00

the performance of the two guest virtual machine using difference operating system linux and windows with the same xen hypervisor linuxubuntu10.10 MavrickMeerkat version as a host. Measuring quality requirement means that we have to test :

First, Test for virtual machine from one thread to another. The specification of memory in Lenovo H330 up to4GB of hardware will be devided1,5GB to each VM and 1GB left for the host. Using equation for availability, performance and quality of the machine :

- $Availability = \frac{run\ time}{total\ time}$

  Means that we consider about down Time Losses

  Include:

  1. Equipment failures
  2. Tooling Damage
  3. Unplanned Maintenance
  4. Process Warm up
  5. Machine changeovers
  6. Material shortage

- $Performance = \frac{total\ count}{target\ counter}$

  Means that we consider about Speed Losses include :

  1. Product misfeeds

2. Componen jams
3. Product flow stoppage
4. Level of machine operator training
5. Equipment age
6. Tooling wear

- $Quality = \frac{good\ count}{total\ count}$

  And talking about Quality means that we consider about Quality Losses include :

  1. Tolerance Adjustments
  2. Warm up process
  3. Damage
  4. Assemled incorrectly
  5. Rejects
  6. Rework

And to measure this we used OEE (Overall Equipment Effectiveness) to monitor and improve the efficiency to measuring all the metrics above. For this measurement, we take sample time period 8 hours/day to look at rush hour activity.

Second, test to measure the performance of web applications, we will try to measuring response time for web applicationsby using Campbell and alstad equation below in their paper entitled "Scaling Strategies and Tactics for Dynamic Web application":

$$R = \left(\frac{\text{Payload}}{\text{Bandwidth}}\right) + \text{RTT} + \left(\frac{\text{AppTurns(RTT)}}{\text{Concurrency}}\right) + \text{Cs} + \text{Cc}$$

Payload : the total size in bytes sent to the browser including the page and all of its resource files.

Bandwidth : from client to server, the minimal bandwidth in bps across all network links.

AppTurns: the number of components (image, scripts, CSS, flash, etc.) needed for the page to render.

RTT : Round Trip Time is the amount of time in ms it takes to communicate from client to server and back again.

Concurrency: the number of simultaneous request a browser will make for resources

Cs : Server Computer time, the time it takes for the server to parse the request, run application code, fetch data, and compose a response.

Cc : Client Compute time, the time it takes for the browser to render HTML, Execute scripts, Implementstylesheets, etc.

Payload can be reduced using compression and caching, AppTurns can be lowered by combining script and stylesheets, using image maps and CSS sprites for often used buttons and background images.

All this measurement completely done step by step until web application done.

E. CONCLUSION

This paper evaluated the efficiency of two operating system open source and under licence. In the first part of our study, we used several server to evaluated server OS (host OS) to configure the hardware include hardisk, memory and network for each guest OS which will suitable used for cloud computing support in our campus. The best performance of the specific requirement for OS server virtualization and for cloud computing is using linuxubuntu10.10 MavrickMeerkat version with interesting visual and various font with free application. This is important for client whose had been comfortable with windows application.

From the first case about server that prepared from UNHAS, we conclude that IT management (PTIK) need to prepare a new server to make this implementation if they want to develop CAN until cloud computing but didn't mean that IBM X series 226 server unused but we can use it as SAN (Storage Area Network) for failover clustering for the next research. For complete research until implementation will be published later.

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