私立東海大學

資訊工程研究所

碩士論文

指導教授：楊朝棟 博士

實作一個 KVM 雲端基礎建設與監測系統

Implementation of a KVM IaaS with Monitoring System on Cloud Environment

研究生：陳柏翰

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東海大學資訊工程學系 研究所

研究生 陳 柏 翰 所提之論文

實作一個 KVM 雲端基礎建設與監測系統

經本委員會審查，符合碩士學位論文標準。

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賴冠州

朱正忠

指 導 教 授 楊朝棟 簽章

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摘要

雲端計算是近幾年來相當熱門的話題。如何將雲端系統使用在大型計算、建置大型分散式儲存叢集以及提供服務，是現在非常熱門且熱烈的討論議題，不論是對企業或是個人都是一個必然的趨勢。雲端實際上是指網路，這個名字來自工程師在示意圖，往往用雲代表了一個網路。而雲端的網路服務大致可分為三種：軟體即服務（SaaS）、平台即服務（PaaS）和基礎設施即服務（IaaS）。在這些類型中，軟體即服務(SaaS)允許用戶從雲遠程運行應用程序。平台即服務（PaaS）包括作業系統與自定義特定的應用軟體。基礎設施即服務（IaaS）是指計算資源作為服務，包括虛擬化機器的部分和硬體資源單位。本論文主要研究方向在於如何在雲端環境上建置 KVM 系統並運作，並使用 KVM 提供虛擬環境給使用者申請使用。在使用者介面部分，我們考量到降低使用者操作界面的複雜性，針對使用者部分我們採用淺顯易懂網頁介面，讓使用者在操作上無障礙。在實驗部分，本文比較了實體機器運算效能與 KVM 運算效能，並分析實驗結果。

關鍵字：雲端運算、雲端服務、資源監測、虛擬化、虛擬機器

Abstract

Cloud computing is a very hot topic in recent years. How will the system be used in large-scale cloud computing, to build large-scale distributed storage cluster and the provision of services is now very popular and lively discussion of the question, whether the enterprise or the individual is an inevitable trend. Actually refers to the network cloud, the name comes from the engineers in the diagram, often represented by a network cloud. The cloud of network services can be divided into three types: Software as a Service (SaaS), Platform as a Service (PaaS) and infrastructure as a service (IaaS). In these types, the Software as a Service (SaaS) allows users to run applications remotely from the cloud. Platform as a Service (PaaS), including the operating system and custom application-specific software. Infrastructure as a Service (IaaS) is the computing resources as a service, including some virtual machines, hardware resource units. This thesis research is how to build the KVM environment in the cloud system and operation, and use the KVM provides a virtual environment to the user to apply. In the user interface part, this work can reduce the complexity of cloud resources accessing for the user part. This thesis uses the web interface that is easy to understand, accessible for users in the operations. In the experimental results, this work compares the performance of physical machine and KVM virtual machine, and analyzes the results.

Keywords: Cloud computing, Cloud services, Resource monitoring, Virtualization, Virtual machines

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研究所的兩年過得非常快，回想當初推甄東海大學資訊工程學系到加入高效能計算實驗室，因為實驗室扎實的內容，期間總覺得有吸收不完的新技術可以研究，我想其中的酸甜苦辣只有經歷過高效能計算實驗室的碩士才能回味吧！

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Chapter 1

Introduction

1.1 Motivation

Cloud computing is currently a popular topic, but also all the main axis of development in recent years, the main points of infrastructure as a service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), cloud computing is not a new technology, it is a new concept. The early stages of the laboratory started in the creation and development of gird computing cluster and other distributed computing technologies and related issues, for the vigorous development in recent years is also very interested in cloud computing[30][31].

There are many companies currently offer a cloud of related services, like Google, Amazon [30], Yahoo! other companies, tens of thousands of servers used to construct a large-scale computing resources, and provides a variety of services previously not available Such as: large storage space, a huge amount of computing power, no need to download the online features such as edit view, for their own local computing and storage resources are limited, users can access via the Internet computing resources they need.

KVM virtualization technology currently implemented and not many companies providing services, so this paper to more than one machine set up and monitor the cloud system, and to implement virtualization, KVM, providing users to apply. In addition to the KVM implementation, the performance aspects of our attention[36].

1.2 Contributions

This thesis focused on the cloud computing infrastructure, particularly virtual machines and physical monitoring component. Goal is to achieve a system can provide users apply and use the virtual machine, and can monitor the physical system. The information can be monitored include CPU utilization, disk usage, virtual machine space, memory usage. This system also uses a mechanism for Migration, when a problem occurs, the administrator can shift the user's virtual machine to another physical machine operation, and the user will not feel any abnormalities. This thesis details our work. Meanwhile, the thesis also carried on the system performance test using the KVM.

1.3 Thesis Organization

In chapter 2, we describe the techniques used and some background knowledge. Chapter 3 describes the system architecture and key algorithms which this thesis ware used. Chapter 4 conducts some experiments for our proposed system. In final, chapter 5 states the conclusions and future work of this thesis.

Chapter 2

Background and Related Work

2.1 Cloud Computing

Cloud computing is a computing approach based on the Internet. In this way, resources can be shared by the required hardware and software available to computers and other devices. Users no longer need to understand the "cloud"in the details of the infrastructure, do not possess the necessary professional knowledge, without direct control. Cloud computing describes a new Internet-based services to increase IT use and delivery models, usually involving the Internet is easy to provide dynamic and often is a virtual extension of the resource. The cloud is network, Internet a metaphor.

Cloud computing can be considered include the following levels of service: infrastructure as a service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS)[31].

- Infrastructure as a Service (IaaS): Users can follow the required level of computer and network equipment and other resources, to the service provider subscription service, and may require changes to settings, and service provider by users of the CPU, memory, Disk space, network load to calculate the costs.
- Platform as a Service (PaaS): development of services vendors who rented to a computer, this computer has all the necessary hardware and software developers environment; or to provide application developers to market, in accordance with the amount of traffic with the use of resources Developer fees.

- Software as a Service (SaaS): the software stored in the data center to provide users network access services, according to period or pay-per-order the type of charge.

2.2 Virtulization

Virtualization technology is due to present a single host more and more powerful hardware performance, if only a single server implementation of the tasks seem too much idle time, so multiple hosts by the hardware virtualization technology, the original value Line by more than one virtual host, after the service, placed on a single powerful server is running, but also makes virtualization virtual machine after the machine easier to control than real checks and controls, more flexible configuration and can be anywhere in the world And can achieve real-time transfer of virtual machines to ensure uninterrupted service. The virtualization diagram shown on Figure 2.1.

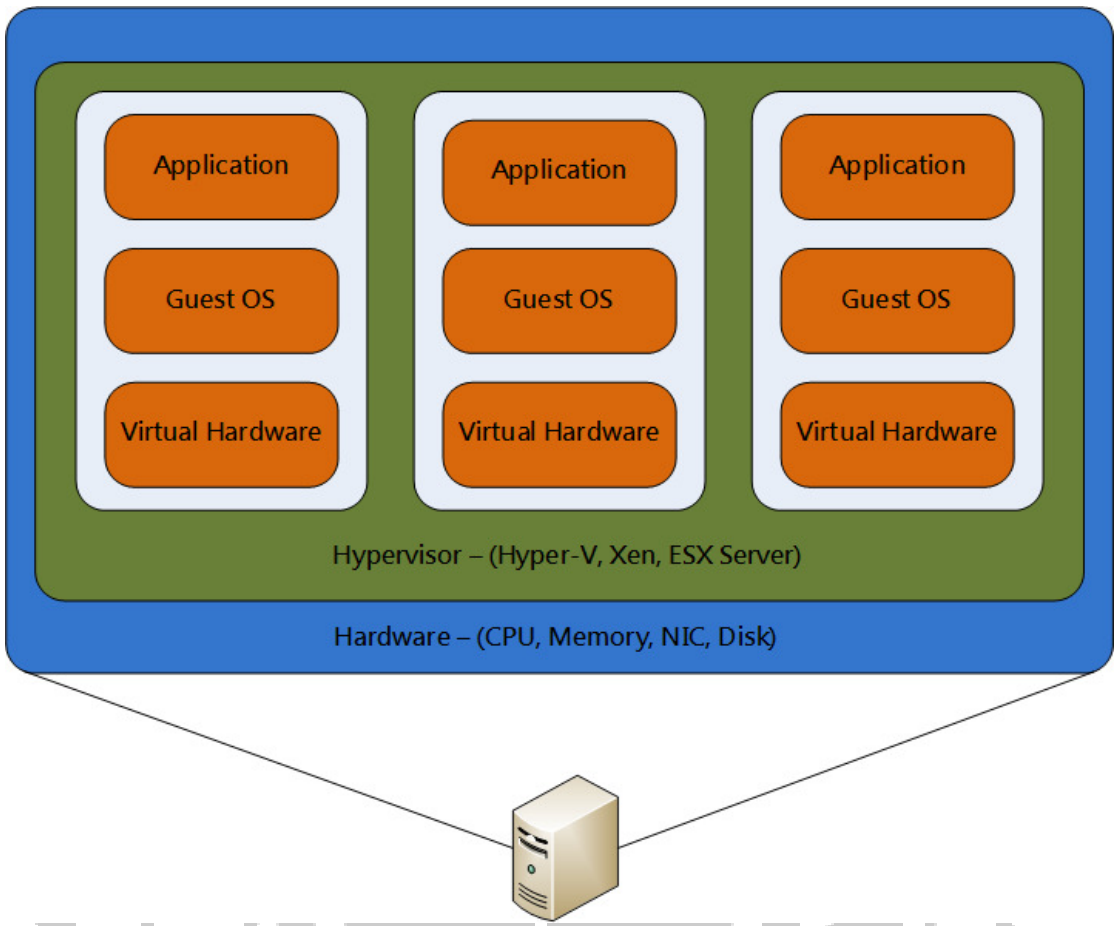


Figure 2-1. Virtualization diagram

The virtualization technology is an internal access control by CPU, in a real operating system, applications and users between the placements of a administrator to control the entire virtual machine CPU process, to enable Guest OS CPU think that they have full rights Implement their own programs.

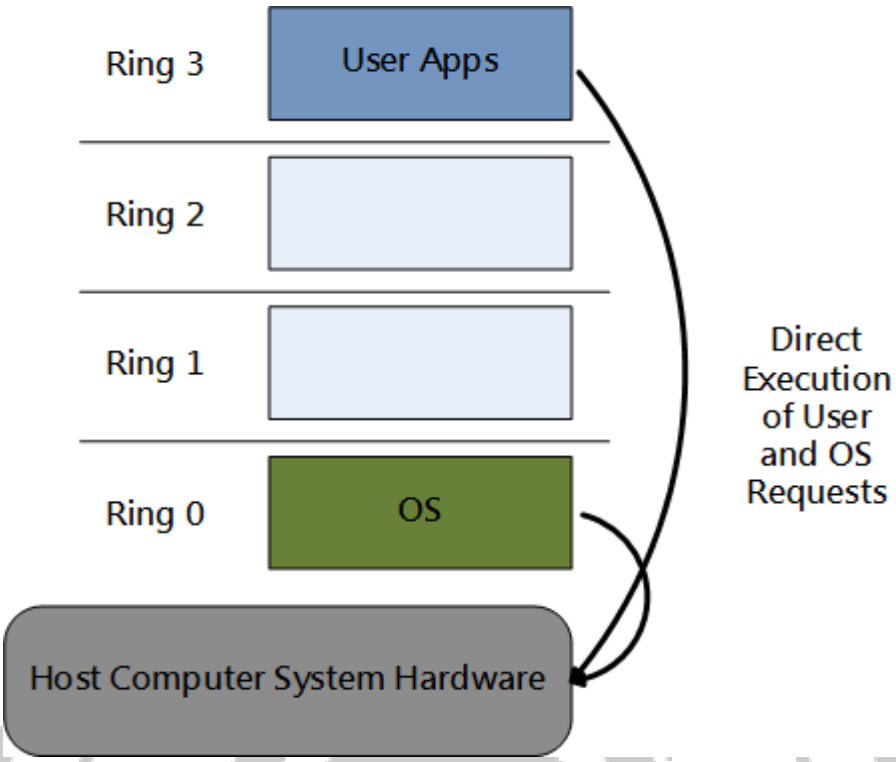


Figure 2-2. The general operation system

The case of the general operation of the operating system shown on Figure 2.2, the user's program is the implementation of the Ring 3 in the CPU part, and the implementation of the operating system and then operate in Ring 0 in the control of CPU and the hardware, the hardware is a direct implementation By the operating system and user application are to the instructions.

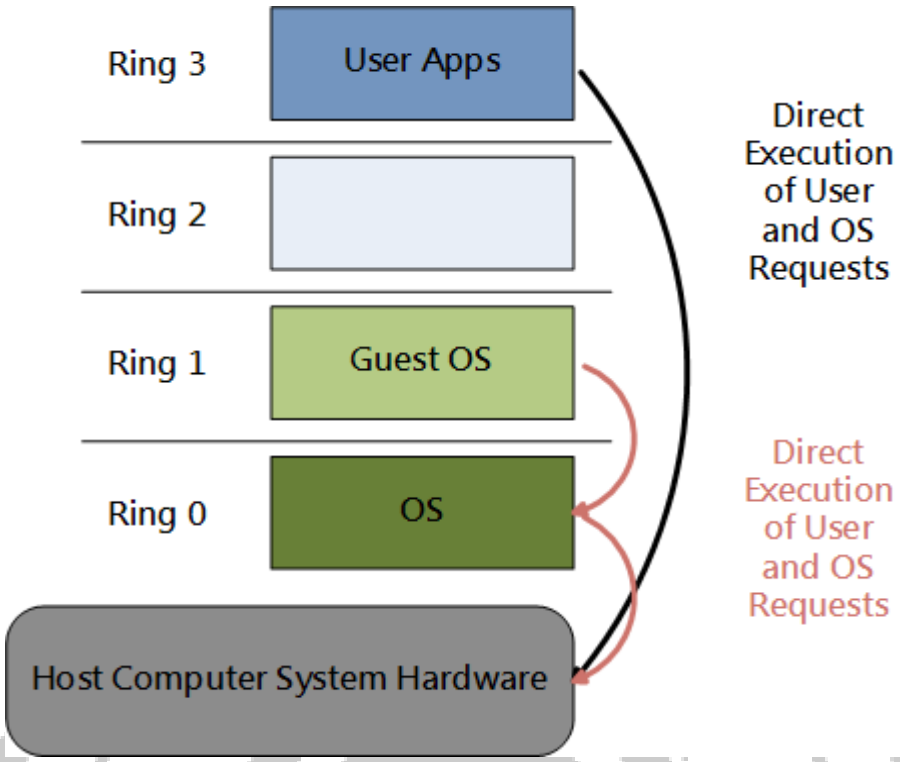


Figure 2-3. The virtualization operation system

Figure 2.3 shows the virtualization operation system. User application is still part of the implementation of the Ring 3, and the virtual operating system out (Guest OS) into the implementation of the Ring 1, was originally part of the operating system should become a Virtual Machine Manager (VMM) of the holding, Guest OS is not to be executed directly to the CPU instruction execution, but to use Virtual Machine Manager made after translation to CPU and hardware for the implementation of the action.

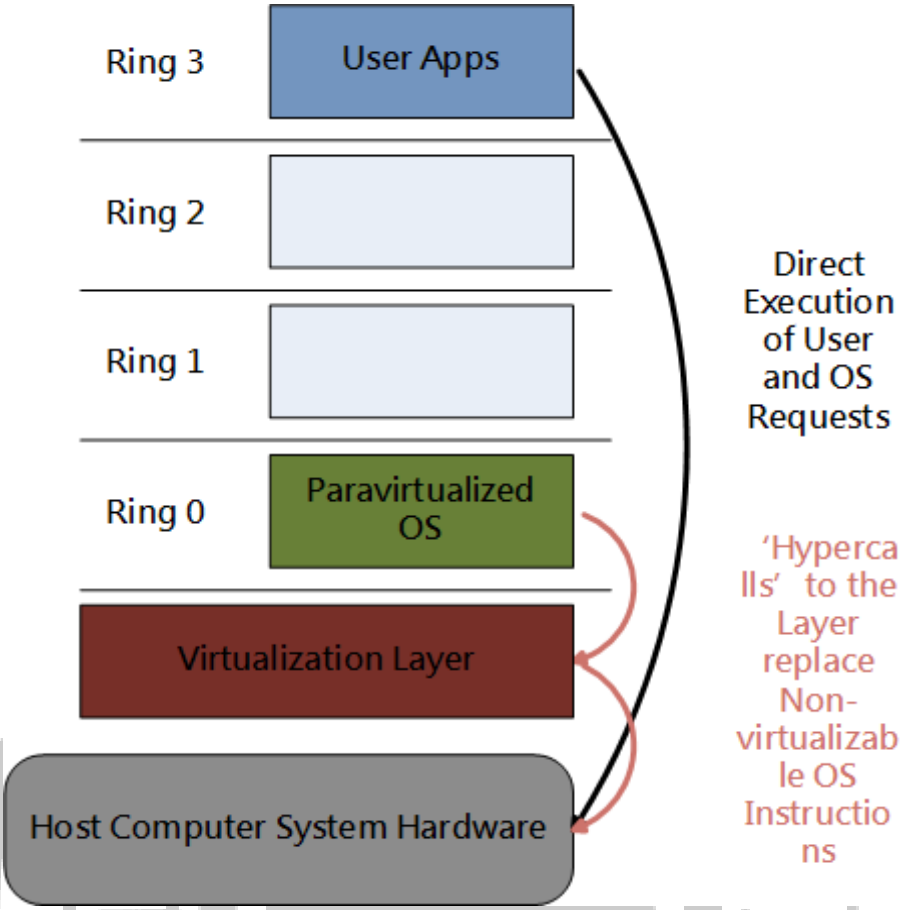


Figure 2-4. Para-virtualization

Para-virtualization with the full virtualization of the difference is that full virtualization of the Guest OS does not need to make any changes to the line-up will have all the hardware that they own rights, but so are the underlying needs of the operation command VMM to assist the conversion, resulting in the implementation of efficiency will be somewhat less, and some low performance virtualization to solve the problem, because the Guest OS does not need to go through the operation of translation at this time, but later issued directly through the bottom of the virtual layer Hardware, eliminating the need for a conversion step, is the performance has improved, but the disadvantage of this method is that the core of the operating system must be modified so that the underlying hardware, operating systems and virtual step

instructions, you need the operation of the operating system software with the virtual The results can be achieved this way, the difficulty of this method lies.

Xen is the University of Cambridge Computer Institute in the GNU (General Public License) of the GPL (General Public License) authorized the release of the free software, which aims to achieve high performance mainframe virtualization technologies to enable a single host can be modeled as multi-Taiwan (heterogeneous operating system) hosts. For the public in source code, a variety of programs and related technology, ongoing development, also is one of open source virtualization platform, the main program. The development of the Xen VMM (Virtual Machine Monitor) software for the effective and safe use of high-end mainframe computer of the resource. The VMM shown on Figure 2.5. With the rising performance of the host CPU, and memory prices and other factors, cause the host idle rate, combined with low PC into the mainstream, corporate owned dramatic increase in the number of hosts, resulting in increased operating costs. To save costs, will be split into a complex virtual host host the increasing demand.

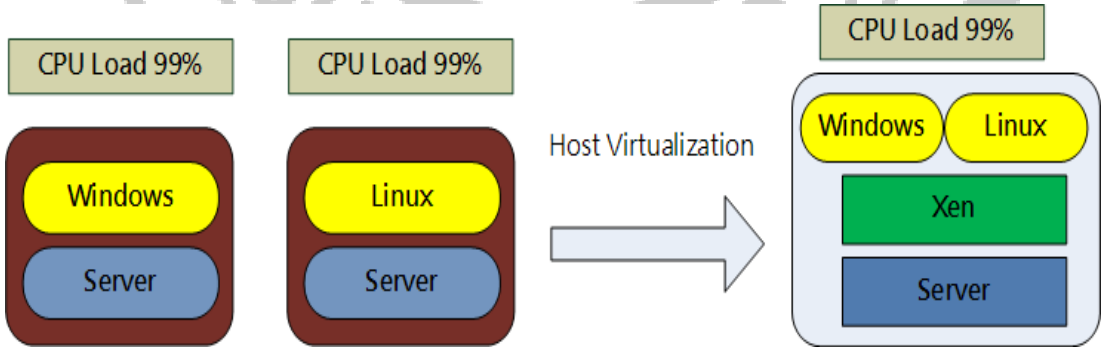


Figure 2-5. Host Virtualization

KVM (Kernel-based Virtual Machine) is a virtualization solution for Linux on x86 hardware containing virtualization extensions Technology (Intel VT or AMD-V).

It consists of a loadable kernel module “kvm.ko”, which provides the core virtualization infrastructure and a specific processor module, supports KVM intel.ko module or KVM amd.ko module. KVM on a machine can run multiple virtual machines. Each virtual machine has its own virtualized hardware, such as: network card, disk, video card ....

Host of desktop processors generally the average utilization rate of about 15 ~ 20% will be hosting the DC(Data Center) the use of space, power and related maintenance costs much higher than the virtual host, so the host virtualization Technology helps enterprises or research institutions to reduce costs. Although there are some 「virtualization into the host, if the calculation of its associated costs down, may not reduce the overall cost」 and other remarks, but did not reduce the host system vendors support the trend of virtualization, but gradually risen to the mainstream.

2.2.1 Xen’s Architecture

Host virtualization software generally divided into two kinds of Host OS and Xen’s hypervisor as shown in Figure 2.6, Host OS layer deployed in the virtual Windows, Linux and other operating systems, and then install the virtualization layer on top of other operating systems, virtualization Layer below the operating system, known as Host OS, the top of the OS called the Guest OS. The Xen’s hypervisor is installed directly on the host, the other want to deploy the operating system installed on it, and to cut the resources required for Host OS, better performance, CPU, Memory, Network, Storage and other resource management are more Easy. The use of Xen’s hypervisor and VMM(Virtual Machine Monitor) architecture. Main purpose of efficient and safe control of the host CPU, Memory and other resources[44].

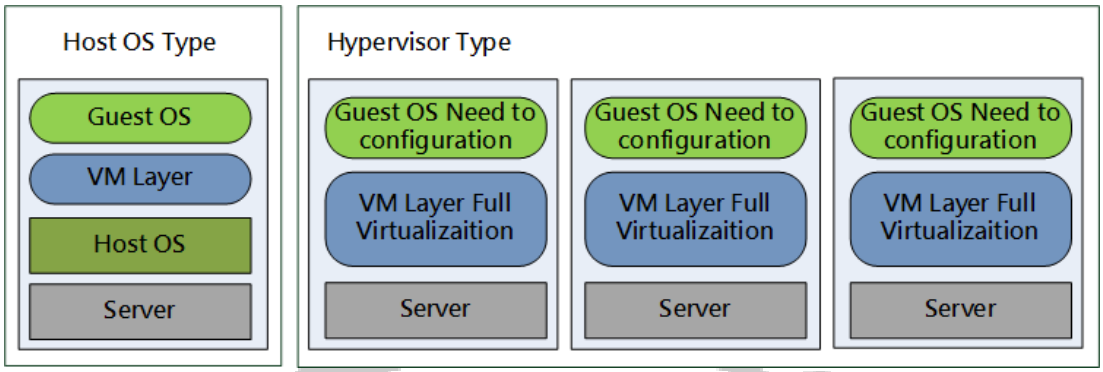


Figure 2-6. Host and Xen's hypervisor type

Xen's hypervisor used is divided into Para-Virtualization and Full-Virtualization. Para-Virtualization in the Guest OS kernel must do the appropriate amendments, such as the Linux and other open source OS, its core can be modified for Xen and adjustments made in particular to reduce the burden and improve performance. And Full-Virtualization in the Guest OS cannot be amended, more suitable for a similar Windows installation. Processor vendor Intel Virtualization Technology(Intel VT) and the "AMD Virtualization(AMD-V) also support virtualization, with which the host CPU can be virtual environment in the semi-direct install Windows. There are also Windows in Para-virtualization drivers running on the environment.

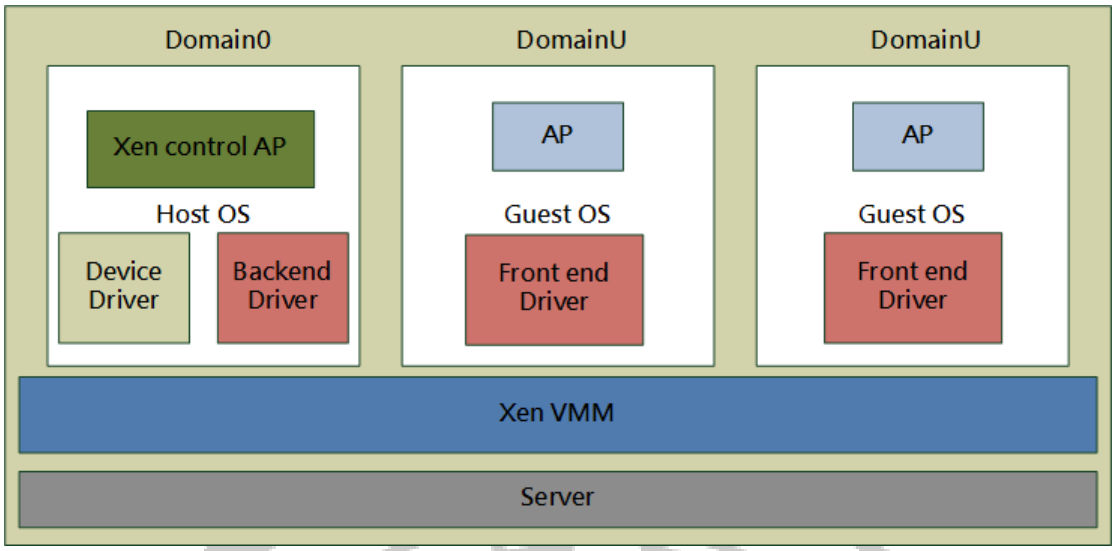


Figure 2-7. Domain0 and DomainU

Xen management in the virtual host, use the Domain to do management unit, Domain is divided into two types as shown in Figure 2.7, one of which is managed by the Domain0, play like the Host OS role, a Xen Control of AP, to manage another type of DomainU. DomainU installed on the field Guest OS and AP, in the use of physical resources, must be through Domain0 took the deal, cannot directly call the hardware drivers.

Xen in the industry, the American have been led by Novell SUSE Linux Server(SLES) and Red Hat Enterprise Linux(RHEL) and other commercial Linux version used. In addition, Oracle also introduced a virtualization product Oracle VM, which Sun Microsystems released xVM Server and other products. It can be seen, Xen virtualization software on the host, has been widely supported by the system vendors.

2.2.2 KVM's Architecture

Kernel-based Virtual Machine(KVM) is a Linux core, a part of the framework, the current structure of native virtualization support KVM hardware-assisted virtualization is supported by the CPU, Intel virtualization technology called VT(Virtualization Technology, as shown on Figure 2.8) or AMD's AMD-V Technology in Linux through the two CPU module to support two different KVM (Intel: kvm-intel.ko; AMD: kvm-amd.ko). In RHEL5 update4 automatically according to /proc/cpuinfo of flag to select the appropriate CPU module, this script file stored in /etc/sysconfig/modules/kvm.modules [36].

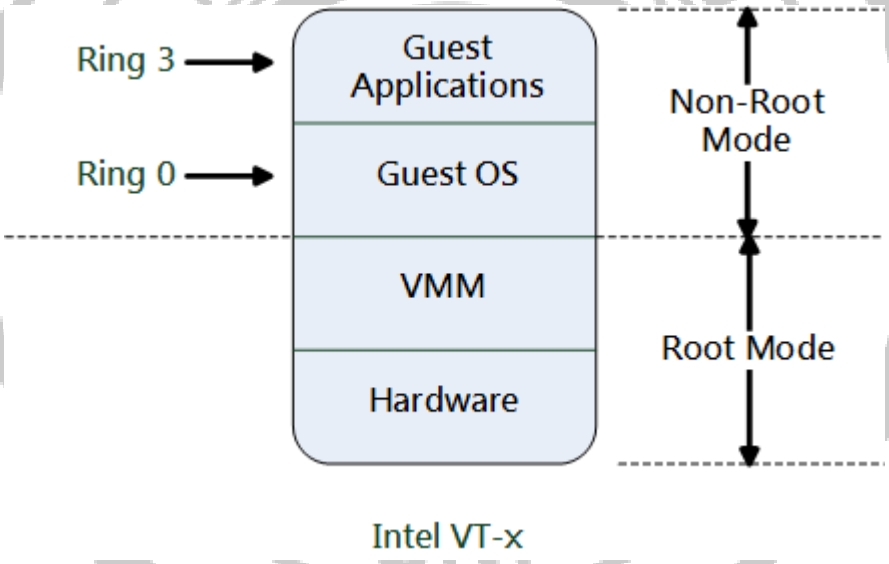


Figure 2-8. Intel virtualization technology

Support for the Para-virtualization, such as he now supports Linux and Windows, Para-virtual network device drivers, and the balloon (on the memory technology VMM-virtual memory manager) has done for Linux Guest's CPU optimization.

KVM is currently only operating in the i386/x86_64 the CPU on the system, such as PowerPC and IA64 are still in development stage. Linux's core team in Linux

2.6.20 (February 2007) version of KVM will be included. FreeBSD Kernel module approach also supports KVM.

However, KVM alone cannot be completed virtualization must also do something with the QEMU device simulation and the following GNU software:

- KVM kernel module: GPLv2
- KVM user module: LGPLv2
- QEMU virtual CPU core library and QEMU PC system emulator: LGPL
- Linux user mode QEMU emulator: GPL
- BIOS files (bios.bin、vgabios.bin and vgabios-cirrus.bin): LGPLv2 or later

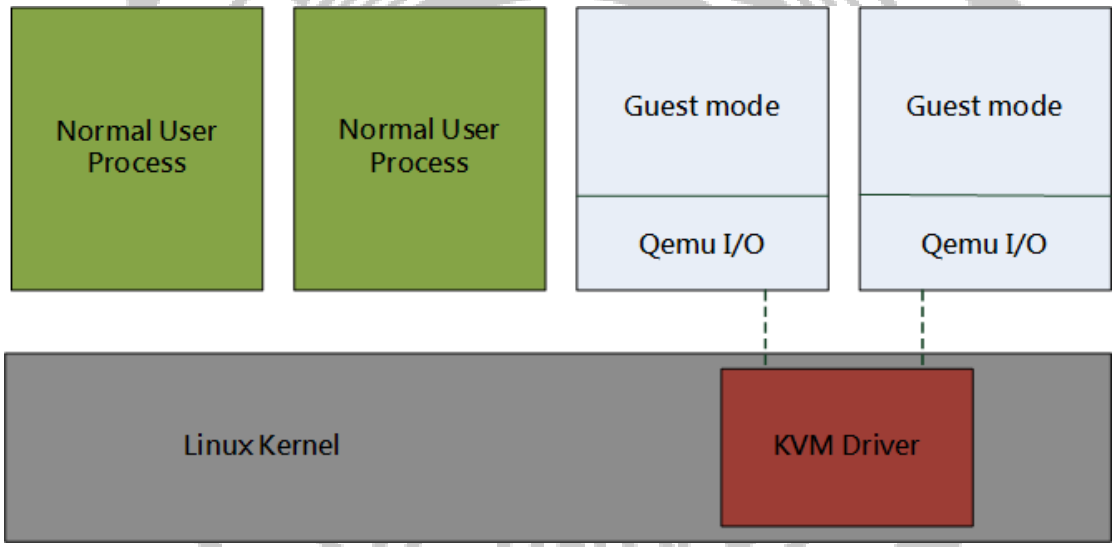


Figure 2-9. KVM's architecture

Show in Figure 2.9, KVM's architecture consists of two parts:

- Kernel Device Driver (managing the virtualization hardware) - Used to manage and simulation Virtual Machine hardware.
- User space process - qemu is a PC hardware emulator, after the modified KVM become kqemu.

Table 2-1. Comparison of Xen and KVM

	Virtualization	Advantages	Kernel integrity	Hardware dependencies
Xen	Para-Virtualization Full-Virtualization(need CPU suppose)	CPU performance better	Kernel 2.6.23 was added	Does not have Intel VT-x or AMD-V
KVM	Full-Virtualization(need CPU suppose)	I/O performance better	Kernel 2.6.20 was added	Must have the Intel VT-x or AMD-V

Table 2.1 shown, this thesis will compare the advantages:

- Scalability and elasticity
- Availability and reliability
- Manageability and interoperability
- Accessibility and portability

Finally, select the KVM-based virtualization platform for the article.

2.3 MySQL Cluster

MySQL cluster is MySQL company's distributed database system,and published in 2004. It is designed to provide high availability and high performance, while allowing for nearly linear scalability. MySQL Cluster is implemented through an additional storage engine available within MySQL called NDB.

Because it is a distributed database system, also has the following advantages, including:

- Can be distributed among multiple nodes in a different location, and therefore a realization of a distributed database solution.
- Expansion is very good; you can add nodes to achieve the expansion of the database cluster.

- Good redundancy, multiple nodes have a complete database data, so any downtime will not result in a node outage.
- High availability of low cost, unlike traditional high-availability storage solutions need to share the same equipment and special software to achieve, NDB as long as there is enough memory will be realized.

2.4 Related Work

In recent years, performance improvement management process technology advances make it possible to try to use the virtual machine (VM) computing platform. Many studies have been implemented through the virtual network environment, reduce system costs. Data transmission between server nodes often appear in parallel and distributed computing systems, high cost of the network may cause significant loss of performance throughout the system.

Amazon EC2 (Elastic Compute Cloud) is a virtual machine allows users to perform the required lease operating system. EC2 way through the web service so that users can implement their own virtual machine at any time, users will be able to run any virtual machine that you want the software or application.

Binbin Zhang put forward for the KVM in the study of I / O optimization, how to simplify the client operating system by eliminating redundant operations in a virtual environment. Simplification of the client operating system will be an important direction for future research to optimize the performance of the VMM. They are studying how to make the guest operating system more effectively in a virtual environment, and how to make the guest operating system, VMM and the host operating system to better complement each other. Hope I / O optimizations to improve the performance of KVM [2].

The user can always create, execute, terminate its own virtual machine, how

much count how many times, and therefore the system is "flexible" use. This thesis focuses VMs running on physical machines and use KVM technology to Implementation a virtualization environment for user to application and use.

Chapter 3

System Design and Implementation

In our entire framework, cloud computing system with KVM is a major architecture to achieve the goal of economizing on power and user friendly.

3.1 System Architecture

Amazon Elastic Compute Cloud (Amazon EC2) is a network service that provides resizable compute capacity in the cloud. It is designed to calculate the size of the network easier to develop.

Amazon EC2's simple Web service interface to obtain and configure capacity with minimal friction. It gives user full control of your computing resources, allowing user to Amazon established computing environment. Amazon EC2 to reduce the time required to obtain and boot new server instances to minutes, allowing user to quickly scale capacity, both up and down, as user's computing needs change. Amazon EC2 changes the economics of computing capacity allows user to only pay for actual use. Amazon EC2 provides tools to build flexible applications and fault isolation itself is a common fault conditions. [30]

Amazon Elastic Compute Cloud (Amazon EC2) to provide users with the cloud computer to perform the required rental application system. EC2 web services by providing a way so that users can choose to perform the Amazon machine image file, the user can in this virtual machine you want to run any software or application.

The user can always create, execute, terminate its own virtual machine, how much count how many times, and therefore the system is "flexible" use.

As a Infrastructure as a Service(IaaS) provider, this thesis join an ideas of virtualizes in the cloud system to economize power、web interface and user friendly to manage the virtual machines. Therefore, there are some distinct on framework of cloud; our architecture as figure 3.1.

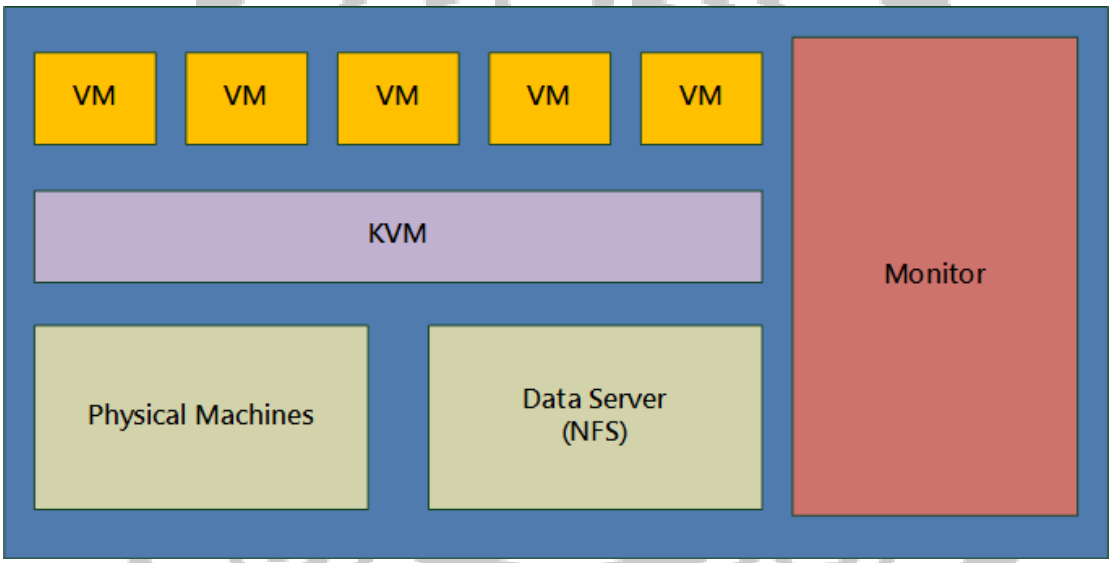


Figure 3-1. Virtual Machine System Architecture

About user friendly, users simply connect to the site through the Internet, and then set their own needs, you can create a virtual machine, the user does not need to know what happened back may need to set any object, they can be consistent with their own Needs of virtual machines. The user diagram is shown on Figure 3.2.

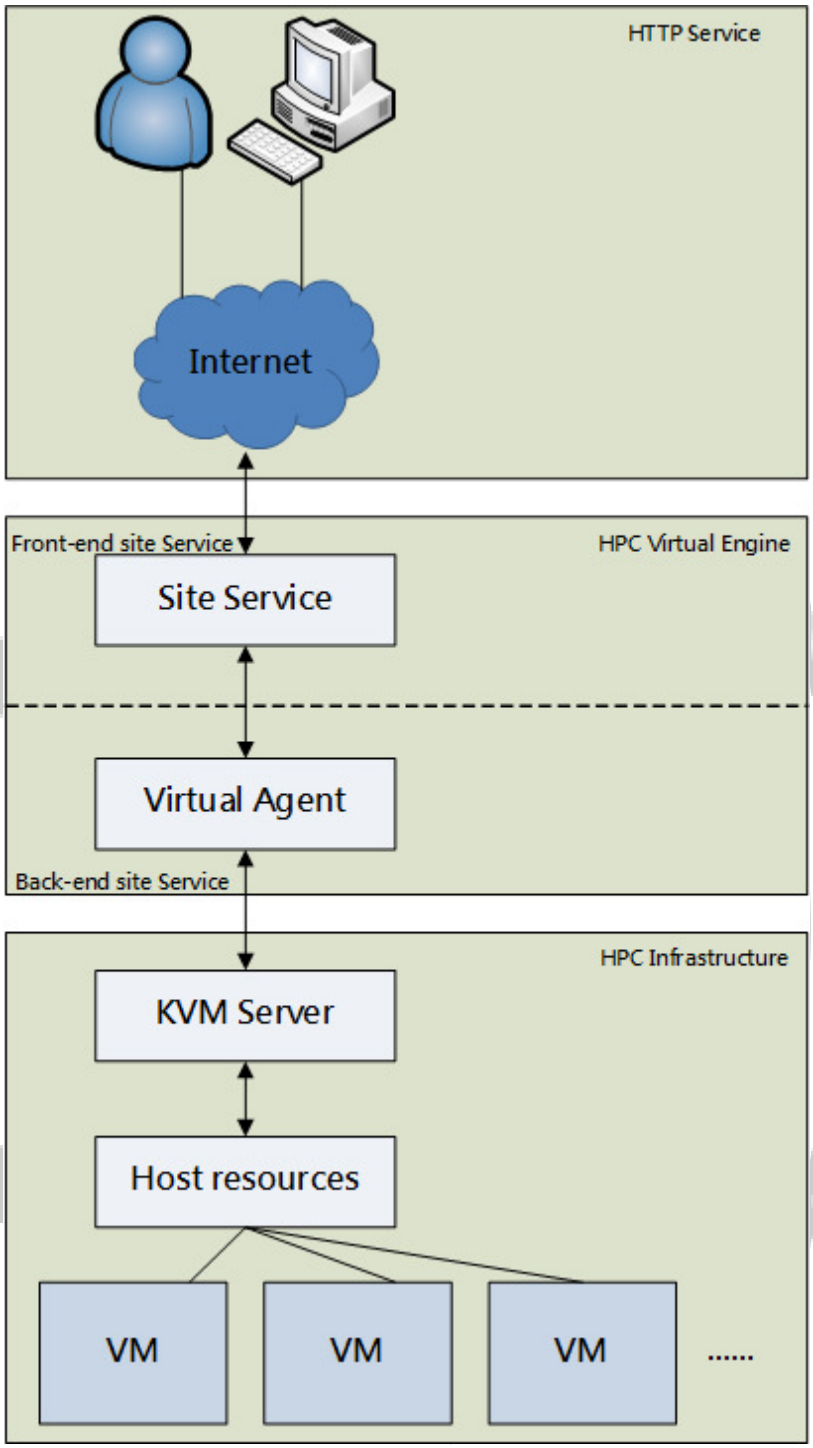


Figure 3-2. User diagram

According to the previous plan, this thesis have established physical machine using KVM virtual machine system and provides a Web interface to manage the virtual machine. Our virtual system was built up with four homogeneous computers; the hardware of these computers is equipped with Intel Xeon CPU E5410 2.33 GHz,

eight gigabytes memory, 500 gigabytes disk, Ubuntu 10.04 operating system, and the network connected to a gigabit switch.

3.2 User Interface

3.2.1 End User's Web Page

This thesis designs a useful web interface for end users to register/login or select other service, and for administrators to manage and monitor all of VMs.

It is very important for the operators who use this system that is easy and simple to operate, select service and get information. For this reason, this thesis designs a single page for all of the steps when they want to see VM's status.

In this page, they can give the VM a name, choose space of VM storage, number of VM processors, and the size of memory they want to use. At the same page, they can also choose other services, such as user info, VM monitor, and if have any problem can send mail to us. More details for the end users' web pages, they are shown on Figures 3-3, 3-4, 3-5, 3-6, and 3-7.

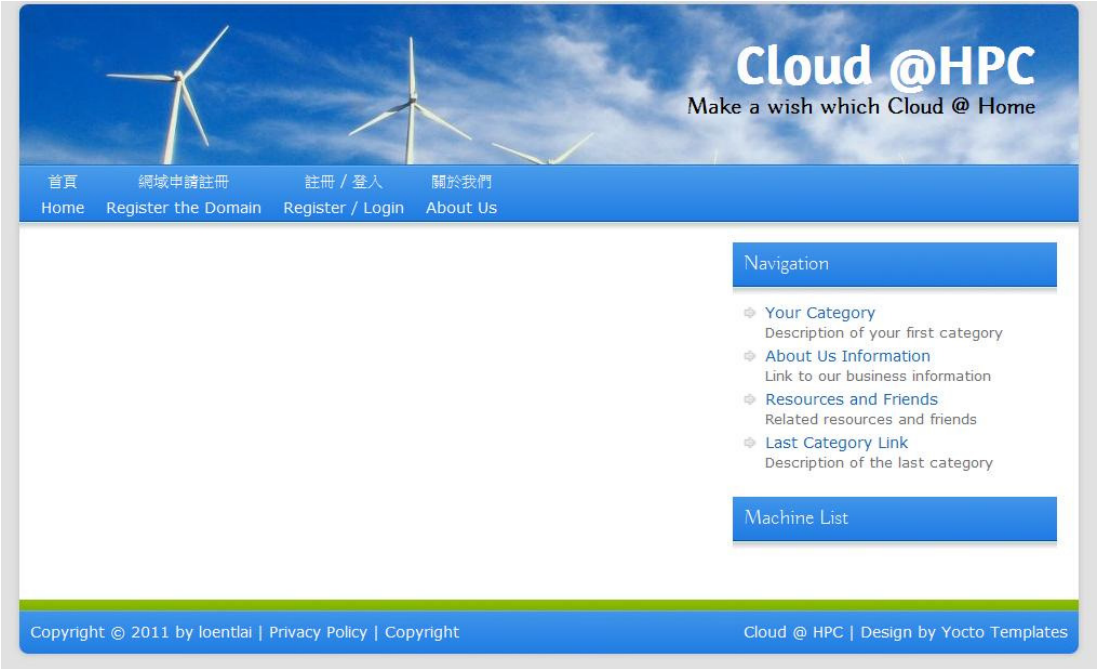


Figure 3-3. The top page of web portal

Figure 3-4. The login window

Figure 3-5. Create VM step 1

Figure 3-6. Create VM step 2

Figure 3-7. Create VM finish

In addition, also provides resources to the user control, let the user know the operation of an overview of the current system. It's shown on Figures 3.8 and 3.9.

Figure 3-8. VM monitor

Figure 3-9. Resource monitor

3.2.2 End User's Operate Set

When user login and create a virtual machine, through the start page, user can start the virtual machine. But to really get started, users must be prepared to VNC Connection, and then marked with IP and port as long as you can connect to the virtual machine. The setup is shown on Figures 3.10 and 3.11.

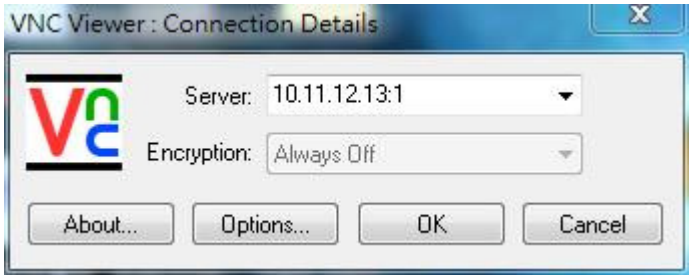


Figure 3-10. VNC connect

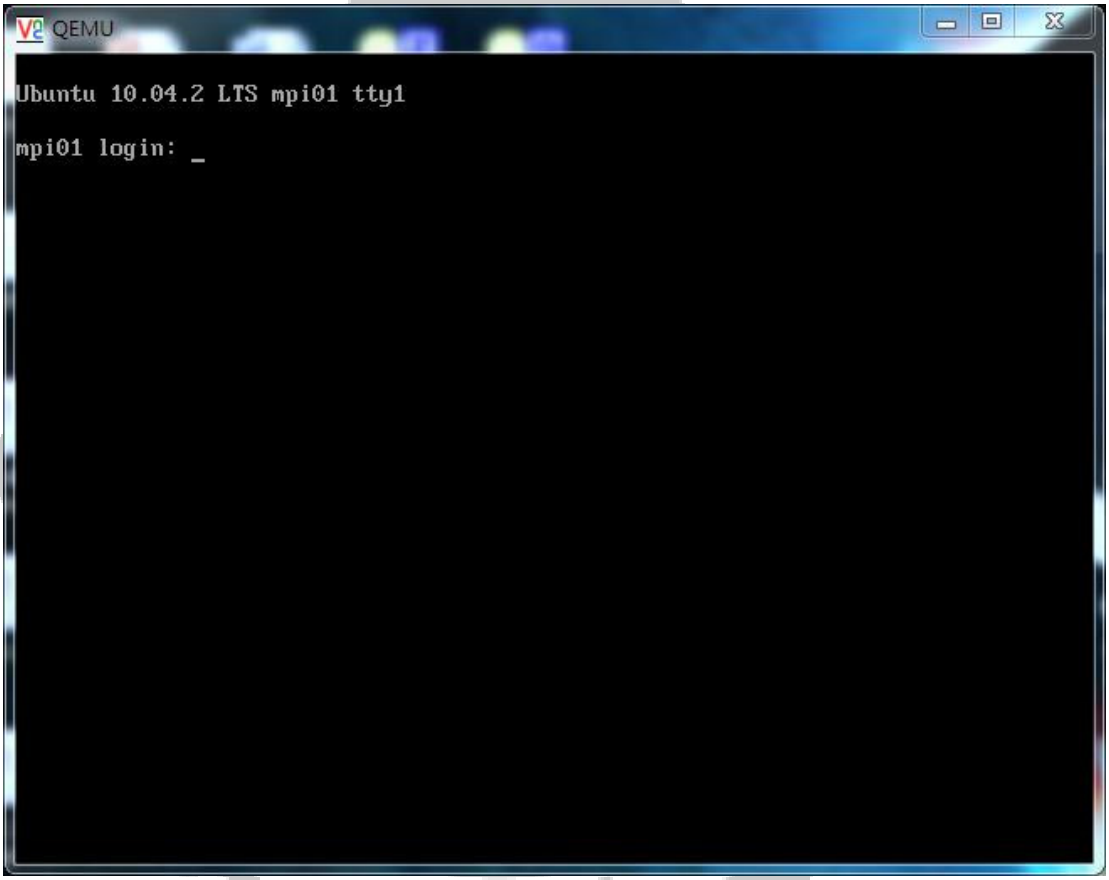


Figure 3-11. VM start

3.2.3 Administrator's Web Page

The management interface for admin is using the same login page (Figure 3.4). But the page only admin can see. The page can provide value to allow managers to adjust the system load, when it reaches the allowable value, whether the user can apply for VM. And adjust the system variables to control user apply the number of CPU,

memory size, hard disk size. The management interface is shown on Figure 3.12.

Figure 3-12. Administrator's web page

Chapter 4

Experimental Environment and Results

This thesis focus on the efficiency of KVM virtual machines, include test the virtual machine build time, start time, migration time and computing performance while migration.

The experiment programs are listed as below:

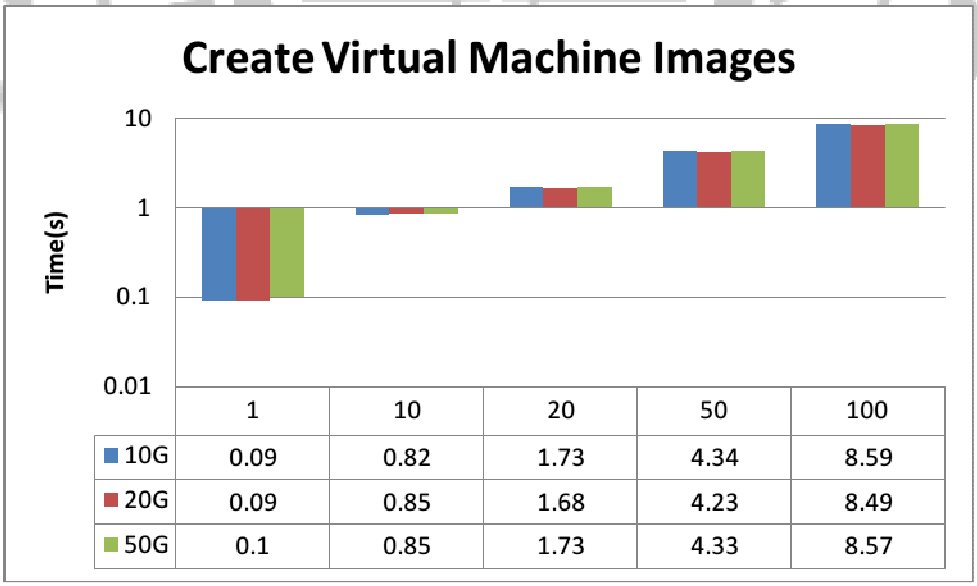
- **VM Build Time** - In order to enable users to obtain the application as quickly as the virtual machine, so this thesis tested the speed of the virtual machine created in order to understand how their efficiency.
- **Matrix Multiplication** - Matrix multiplication is an efficient algorithm, commonly used in performance calculations, and seeking the path, is an application of strong algorithms. , It is through the operation of multiplying a matrix with either a scalar or another matrix. by changing the size of the matrix of data can be different.
- **Jacobi** - An iterative method. In numerical linear algebra, Jacobi method is an algorithm to determine the solution of a system of linear equations of the absolute maximum in each row and column main diagonal elements. Each diagonal element is solved, and a plug in the process of approximation, and then iterate until convergence [35].
- **HPCC** - HPCC (HPC Challenge Benchmark) is a performance evaluation program, a number of different indices for the test can be used as high-performance computing capacity and determination of indicators. Content

of the test include HPL, STREAM, Random-access, PTRANS, FFTE, DGEMM and b_eff Latency / Bandwidth, seven test items [34].

- **Computing Performance While Migration** - When the system is migrated and the user is using the resource calculation, the calculated result is not any migration and the result is the same, this thesis will test it.

4.1 VM Build Time

This experiment, this thesis tested the KVM image file in the creation of the efficiency, mainly on the number and size of construction compared as shown in Figure 4.1, when the construction is to quickly create, display image files in the establishment of KVM efficiency is good.

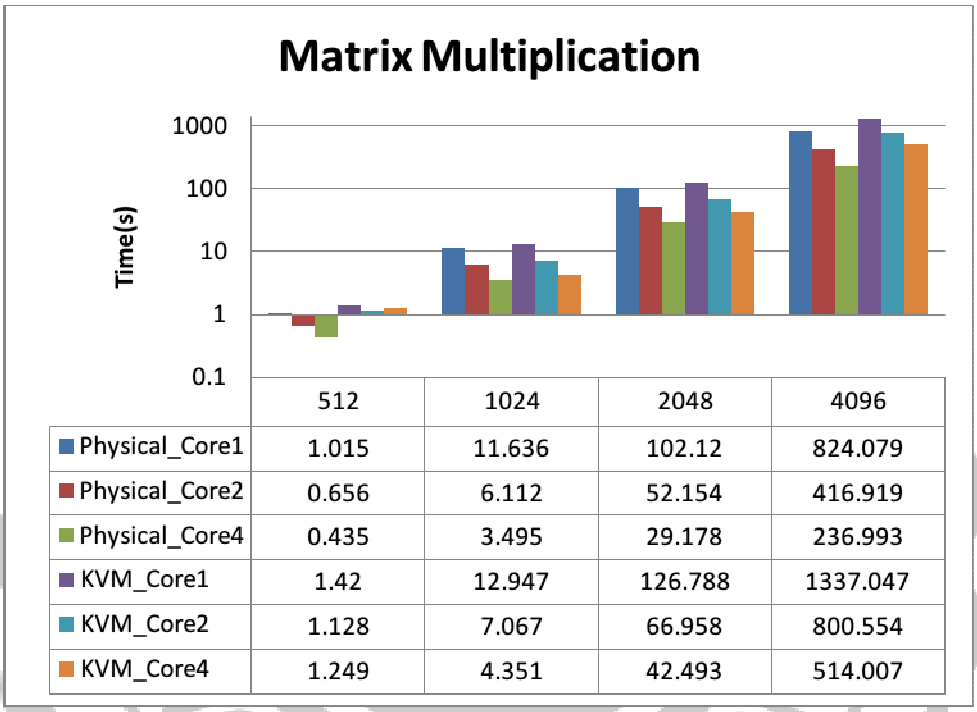


	1	10	20	50	100
10G	0.09	0.82	1.73	4.34	8.59
20G	0.09	0.85	1.68	4.23	8.49
50G	0.1	0.85	1.73	4.33	8.57

Figure 4-1. Create virtual machine images test

4.2 Matrix Multiplication

In this case, this thesis uses Matrix Multiplication to show the KVM and Physical computing performance.



	512	1024	2048	4096
Physical_Core1	1.015	11.636	102.12	824.079
Physical_Core2	0.656	6.112	52.154	416.919
Physical_Core4	0.435	3.495	29.178	236.993
KVM_Core1	1.42	12.947	126.788	1337.047
KVM_Core2	1.128	7.067	66.958	800.554
KVM_Core4	1.249	4.351	42.493	514.007

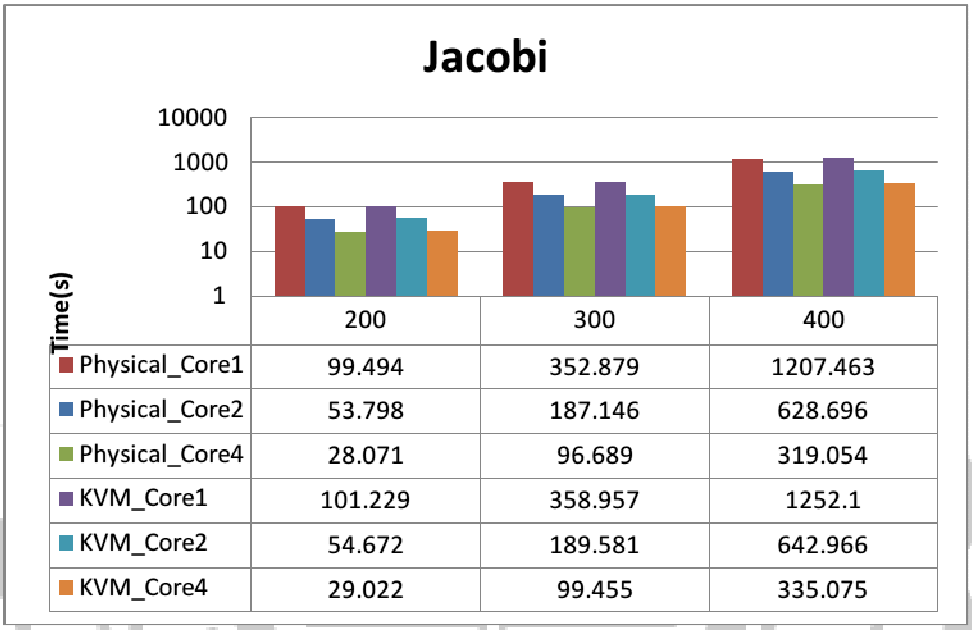
Figure 4-2. Matrix Multiplication sets

About the efficiency, this thesis tested the size of matrix 512,1024,2048,4096 in the figure 4.2. This thesis see the KVM, whether in single, dual and quad core in performance is not outstanding, the gap is about 1 to 1.5 times the computing speed. This thesis knows that KVM is not prominent in the CPU support, so this thesis tests another experimental.

4.3 Jacobi

In Figure 4.5, this thesis uses a Jacobi linear equation to record the KVM and physical

machines performance. By changing the size of the equation, compare the effectiveness of change, can be seen from the execution time using Jacobi operator, the physical machine and KVM only a little difference. Instructions in the use of KVM CPU computing performance, the performance will be as affected by the type of calculation.



	200	300	400
Physical_Core1	99.494	352.879	1207.463
Physical_Core2	53.798	187.146	628.696
Physical_Core4	28.071	96.689	319.054
KVM_Core1	101.229	358.957	1252.1
KVM_Core2	54.672	189.581	642.966
KVM_Core4	29.022	99.455	335.075

Figure 4-3. Jacobi sets

4.4 HPCC

In the case, this thesis use HPCC to measure the KVM and physical machine the overall performance, HPCC tests include HPL, STREAM, Random-access, PTRANS, FFTE, DGEMM and b_eff Latency / Bandwidth.

In Figure 4.3, this thesis can see that when the computation is not high, the physical machine's overall performance is better than KVM, but when computing the amount of increase, the KVM's performance with almost the same physical machine. Although the computing performance shown in KVM needs to be strengthened, but the overall performance, the place still has its expectations.

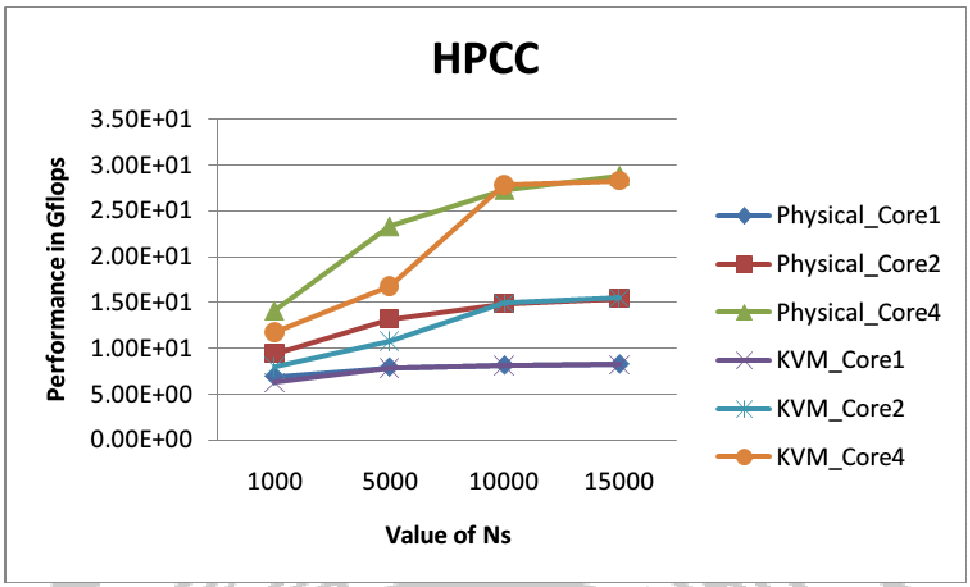
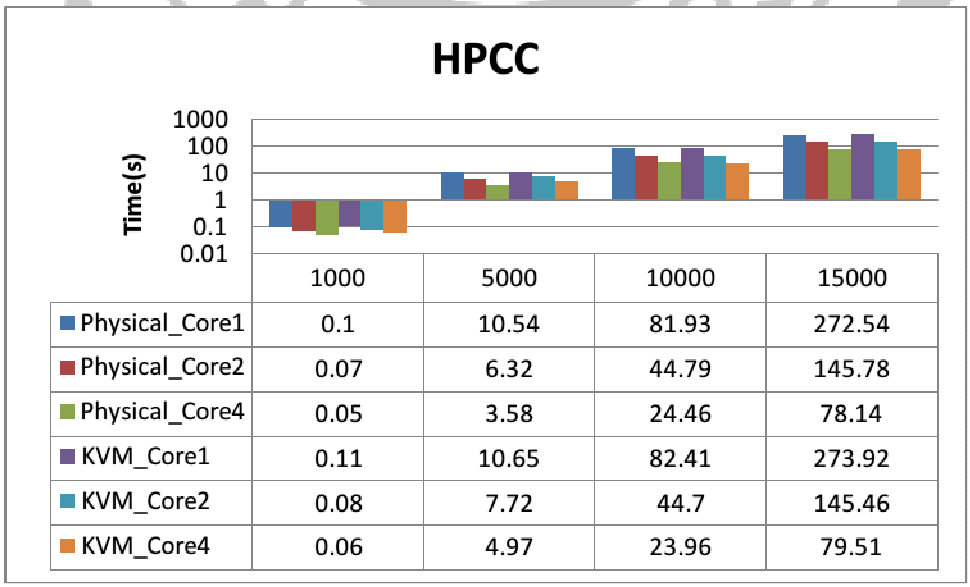


Figure 4-4. HPCC of performance sets

In the figure 4.4, KVM from the execution time can be found in the large amount of computing time, the efficiency has been with almost the same physical machine, or even slightly beyond. This is very surprising.



	1000	5000	10000	15000
Physical_Core1	0.1	10.54	81.93	272.54
Physical_Core2	0.07	6.32	44.79	145.78
Physical_Core4	0.05	3.58	24.46	78.14
KVM_Core1	0.11	10.65	82.41	273.92
KVM_Core2	0.08	7.72	44.7	145.46
KVM_Core4	0.06	4.97	23.96	79.51

Figure 4-5. HPCC of times sets

4.5 Computing Performance While Migration

In the last experiment, if user using computing resources, and then the machine starts migration. Experiments using performance measurement program HPCC. Start migration when the HPCC program running.

In Figure 4.6, the case will measure the results and the previous data of HPCC for comparison, this thesis can see that when the Migration is in progress, significantly reducing the efficiency, but is maintaining a certain performance. About the computing time, it is more than the normal operation time of 1.5 times, the result is shown on Figure 4.7.

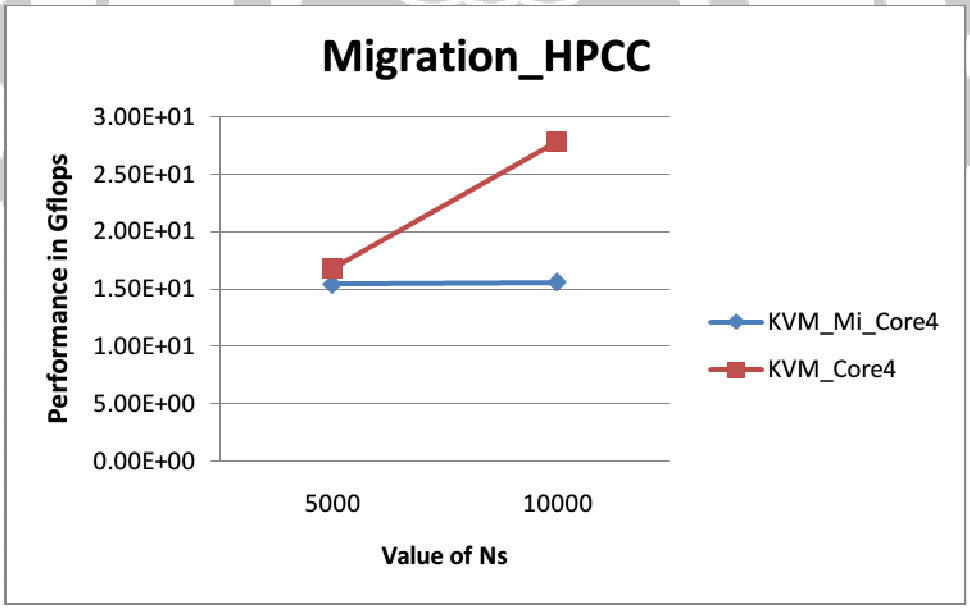


Figure 4-6. Migration performance with HPCC sets

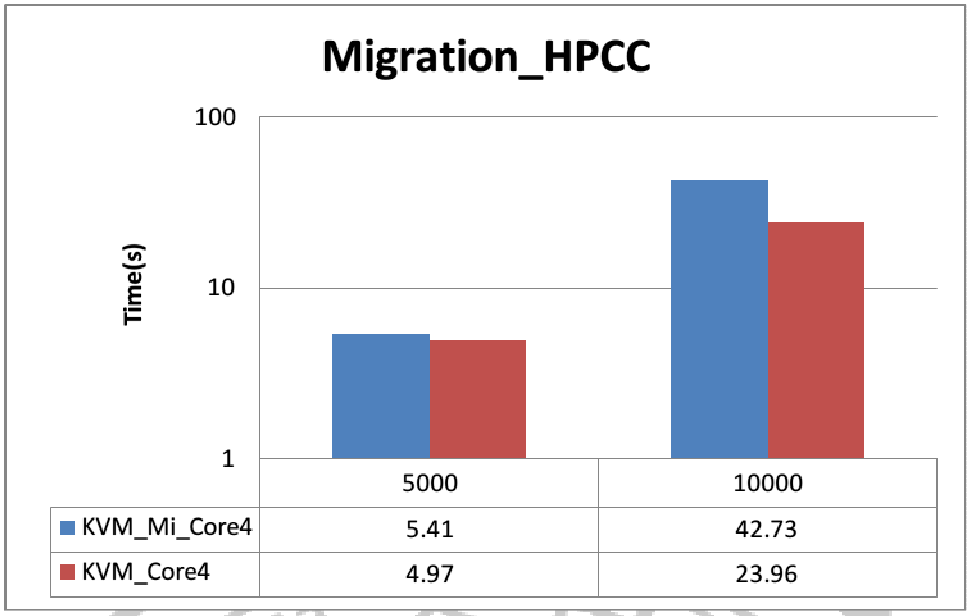


Figure 4-7. Migration time with HPCC sets

Chapter 5

Conclusion

In this paper, this thesis implemented a cloud of KVM infrastructure and monitoring website, which offers users to apply for the use and monitoring of VM state, and the main page with easy to understand the type, the user in the application and monitoring, can Obtained through the needs of the most simple steps in order to user friendly.

Unlike the past, the usage of Xen as the virtualization technology, this thesis tries to use KVM virtualization technology as a major. In addition, this thesis also tested a number of VM creations and implementation of the efficiency of the test, although there is still a gap from the best performance, but the final results were very satisfactory.

Although there is no other management software and optimized settings, and KVM is not like Xen, VMware and other virtualization software Convenient, but through open source, and more publicity, I believe the future will become mainstream virtualization software.

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