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HYPERVISOR FOR VIRTUALIZATION IN PRIVATE CLOUD

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Abstract

The article deals with testing and choosing right virtualization platform with management tools for building private cloud, in which methods for power control of virtual machines can be applied. Main brick in every virtualization platform is hypervisor which carries out virtualization and management tools which deliver the services such as web management, storage management and resources management from one place.

Key words

hypervisor, private cloud, virtualization

INTRODUCTION

Our goal is to design a cloud based on OpenSource solutions with other solutions to speed up installation and provisioning of physical servers as hardware resources for the cloud. Building a new data center is a time consuming and iterative process of identical steps. Final solution must have interfaces or API through which we can implement our next step power control algorithms.

PACS is a technology of medical imaging which provides economical storage with access to that storage from different modalities (source devices) (1). Technology like that can be virtualized, because it needs the basic resources such as storage, CPU, RAM and network connectivity. Hosting multiple PACS servers in virtual infrastructure on the same physical host saves resources based on virtualization usage. PACS servers store medical studies in field of medical treatment and research used randomly. Based on that, every PACS server can be virtualized as a virtual machine.

METHODS

In IT, virtualization means creation of a virtual version of device or resource such as server, disk storage or operating system, where virtualization tools divide those physical resources into one or more executable environments. Devices, applications and people may communicate with virtual resources as if they were real logical resources. The term virtualization came from "nowhere" and is associated with many computational technologies covering the following issues:

- Virtualization of disk storage: merging together several network disk storages that act as a single disk storage.
- Virtualization of servers: dividing physical server into many smaller virtual servers.
- Virtualization of operating system: type of server virtualization which works on the core layer of operating system.
- Virtualization of networks: network resources usage with help of logical segmentation of one big physical network.
- Application virtualization (2).

There are two types of hypervisors called:

- Hypervisor type 1
- Hypervisor type 2.

Hypervisor type 1

This type of hypervisor is shown in Fig. 1. Hypervisor 1 is installed on plain hardware, which means that the first thing installed on server as operating system is a hypervisor. Benefit from this type of software is, that hypervisor is directly communicating with the hardware underneath. These hardware resources are then paravirtualized and delivered to the running virtual machines. This is the most preferred type of hypervisor in the enterprise systems (3).

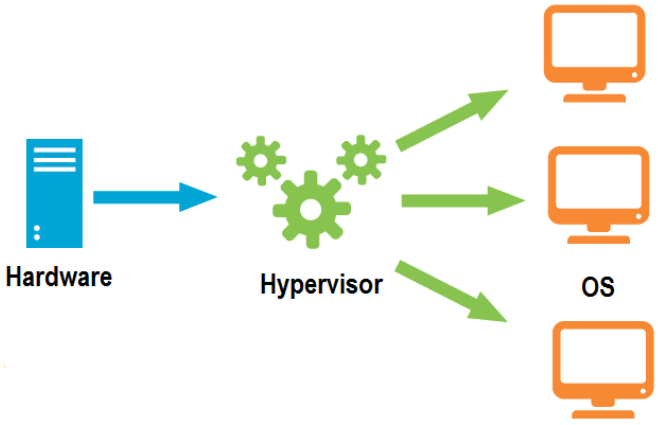

Fig. 1 *Hypervisor type 1*

Hypervisor type 2

The hypervisor is shown in Fig. 2 and is called as guest hypervisor. Software is not installed directly to the plain hardware, but on the top of the running operating system. Perhaps, server on which Windows Server 2008 runs may have an installed VMWare Workstation 8 on the top of the operating system. Even if there is another jump between hardware and physical resources, latency is minimal, and with nowadays modern functionality of operating systems, hypervisor type 2 has the optimal power (3).

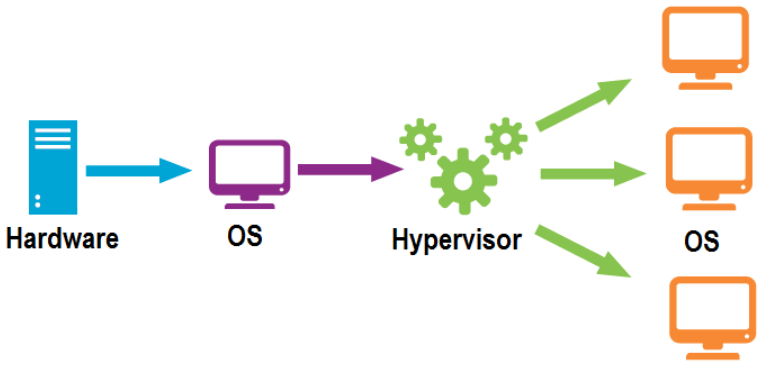

***Fig. 2** Hypervisor type 2*

Before choosing the right hypervisor, there are a few things which should be considered:

- Be 100% sure that the chosen hypervisor is compatible with hardware to be used.
- Choose the right compromise between performance, simple management and ability of future integration with new functionalities.
- Do not forget high availability.
- Reliability.
- Scalability.

High performance is what everyone wants, but advanced control of resources is also very important. Advantage of hypervisor type 1 is that it leaves a low footprint in the system, because it occupies the minimum of hardware resources. Hypervisor type 2 does not have all computation power of hardware for virtualization, because computation power is also used by operating system and running services. Hypervisor type 2 is less expensive than hypervisor type 1. It is zero cost or few hundred EUR for hypervisor type 2, by usage of OpenSource. Hypervisor type 1 is more expensive, because almost every advanced features are licensed separately. Hardware compatibility of hypervisor type 2 is much bigger, because it runs on Windows or Linux operating system. For hypervisors type 1 like VMware ESXi, there are drivers for physical devices, but their number is limited, which is limiting the choice of hardware. For example Microsoft Hyper-V will be functional on every hardware where Windows can be installed as operating system. Installation of hypervisors type 1 is straightforward and does not need experts for maintenance, but installation of hypervisor type 2 is similar to installation of other applications in operating system.

When choosing the right hypervisor for building a private cloud for our needs, we decided to test both hypervisors of type 1 and type 2. For the private cloud, we also need management tools, and therefore we made a decision to test the hypervisors implemented in all management stack, with all advanced features we need for building a private cloud. We tested proprietary and OpenSource solutions:

- VMware vSphere 5.5 – with hypervisor ESX – type 1.
- Microsoft Hyper-V server – with hypervisor Hyper-V – type 2.
- Citrix XenServer – with hypervisor Xen – type 1.
- RedHat RHEV – with hypervisor KVM – type 2.
-

All tested products are compared in Table 1. Table 1 shows only the basic tested parameters. Nearly 100 parameters were tested or compared.

COMPARISON OF TESTED CLOUD SOLUTIONS Table 1

Product	VMware vSphere	Microsoft Hyper-V Server	Citrix XenServer	RedHat RHEV
Version	5.5	2012	6.2	3.2
Host - Server				
Installation as hypervisor type 1	✓	✓	✓	✓
Needed Intel-VT or AMD-V	✓	✓	✓	✓
Hardware compatibility	Complex	Windows eco system	limited	Identical as Red Hat Enterprise Linux
Max. number of logical CPU	320	320	160	160
Max. number of cores per socket	unlimited	unlimited	unlimited	unlimited
Max. number of virtual CPU	4.096	2.048	4.000 Windows / 12.000 Linux	Unknown
Max. size of RAM	4 TB	4 TB	1 TB	2 TB
VM				
Max. number of virtual CPU	64 vCPU	64 vCPU	16 vCPU	160 vCPU
Max. size of virtual RAM	1 TB	1TB	128 GB	2 TB
Max. size of virtual HDD	62TB	64 TB	2 TB - 4GB	Unlimited
Cloud				
Integration to cloud	Cloud API	SC 2012 SP1 Service Provider Foundation	OpenStack API	REST API
Cloud extension	vCloud Director	SC 2012 SP1 Service Provider Foundation	Cloud Connect	CloudForms
Portability of disk images	OVF	OVF	OVF	OVF

RESULTS

The goal was to use OpenSource solutions which can save money for buying more hardware, to deploy larger and more powerful cloud. From the tested solutions, VMware is the best, but its price is high and hardware on which it can run is also limited. Microsoft Hyper-V is relatively new and support for Linux distributions is weaker and there is also a need for server licensing. Xen is OpenSource but the tested version Citrix XenServer is proprietary and paid.

For building a private cloud, we had chosen KVM hypervisor. It is OpenSource and it can be installed on cheaper hardware. It is natively supported and built into Linux kernel. But management solution RedHat RHEV is not suitable to our needs.

DISCUSSION

Choosing the right hypervisor is a highly individual process, because there is a lot of virtualization types such as Infrastructure as a Service, Application as a Service, and many more. To build a cloud, it is needed to know future usage of cloud and hardware availability. Financial aspect of building a cloud is much more significant when compare it to the price of hypervisors; it includes the price for hardware, datacenter, networking, cooling and all supporting services in a datacenter.

CONCLUSION

We need to find a new management solution, because RedHat RHEV is not suiting our needs. However, we have tested four the most-widely used hypervisors in the world and we have chosen the one we want to use. It is the main step of building the whole datacenter with virtualized PACS servers with control algorithms for studies prediction and power control algorithms of virtual machines.

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