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Virtual Machine Converter

Research Article

Vishal Dembi[1], Vinay Kumar Vishwakarma[1]*, Vinit Murty[1] and Vivek Yadav[1]

1 BE, Department of Computer Engineering, Imperial College of Engineering and Research, Maharashtra, India.

Abstract: Act of creating a virtual (rather than actual) version of something, including but not limited to only virtual computer hardware platform, operating system (OS), storage device, or computer network resources is known as Virtualization. Virtualization is a much-discussed area of technology which is helped by the current success of x86 server virtualization products such as VMware ESX Server, Microsoft Hyper-V and Citrix XenServer. The major goal of this process (virtualization) is to manage workloads by transforming traditional computing to make it more scalable. For so many years, there has been a battle between VMware vSphere and Microsoft Hyper-V. In general, vSphere has won the feature battle, although Hyper-V is certainly not much behind; the product can hold its own and does hold its own for many organizations that have made the decision that its the right solution for their needs. But still, Hyper-V is not the first choice of many organizations. Organizations depends a lot on VMware virtualization products. As VMware is popular as compared to Hyper-V, its upgrades are also popular and even expensive than the Hyper-V. There comes the question of economy where many organizations have to invest in these costly upgrades and spend a lot of their assets. Therefore, we propose to build an application which will help in minimizing the costs of these upgrades and will help Hyper-V to evolve more into this tech-world. In this project, we propose to develop this application, Virtual Machine Converter which will convert the Virtual Machines files (.vmdk) to Hyper-V Machines Files (.vhdx) enabling Hyper-V to evolve more as VMware has evolved.

Keywords: Virtualization, VMware, vSphere, Hyper-V, Hypervisor.

1. Introduction

Virtualization began to step in the computer world in 1960s mainframe computers as a technique of logically separating the mainframes resources for various applications [1]. Since then, the meaning of the term has changed to the next level. Virtualization, in computing, refers to the act of creating a virtual version of something, including but not limited to a virtual computer hardware are platform, Operating system (OS), storage device, or computer network resources. VMware figured out how to virtualize the x86 platform in 1998, which was once thought to be impossible, and which had a big impact in creating the market for x86 virtualization. The solution to it was an integration of binary translation and direct execution on the processor that allowed multiple guest OSs to run independently on the same machine with a comparatively less virtualization overhead. A virtualization layer is added between the hardware and operating system which can be seen in Figure 1.This proposed virtualization layer makes sure that multiple operating system instances are running side by side within virtual machines on a single computer, dynamically dividing and sharing the available physical resources such as CPU, storage, memory and I/O devices.VMwares have customers with production servers that are successfully running without any problem for more than four years. For industry standard x86 systems, approaches to virtualization can be of either a hosted or a hypervisor architecture. A hosted architecture installs and helps the virtualization layer to run as an application on top of an OS and backs the widest range of harware configurations

* *E-mail: vinay.11vishu@gmail.com*

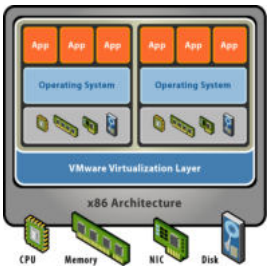

Figure 1. **x86 virtualization layer [2]**

On the other hand, virtualization layer is directly installed in the hypervisor architecture on an x86-based system. Hypervisor uses direct access to the hardware resources rather than going through an operating system, a hypervisor is comparatively efficient than a hosted architecture and bears improved extensibility, robustness and performance [2]. VMware Player, Workstation and Server employ a hosted architecture for flexibility, while ESX Server uses a hypervisor architecture on certified hardware for data center class performance. To understand the methodologies employed for x86 virtualization, a brief background on the component parts is useful. The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution

2. What is Hypervisor?

A hypervisor or virtualmachinemonitor (VMM) is a computer software, firmware or hardware that generates and enables virtual machines to run on a computer [3]. A computer on which a hypervisor runs one or more than one virtual machines is known as a host machine. Each virtual machine (client) is called a guest machine. The hypervisor presents the guest operating systems with a virtual operating platform and manages the execution of the guest operating systems. Many instances of a variety of operating systems may share the virtualized hardware resources.

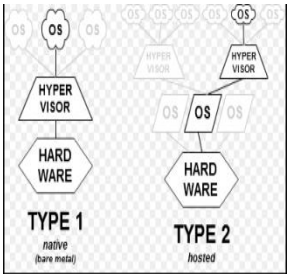

Figure 2. **Hypervisor Types [3]**

2.1. Type 1 Hypervisor

Type 1 (or native, bare metal) hypervisors are the type that run directly on the host's machine to control the hardware and to manage guest operating systems. A guest operating-system there by runs on another level above the hypervisor. This architecture represents the classic implementation of virtual-machine models; IBM developed the original hypervisors as bare-metal tools in the 1960s. Modern equivalents includeOracle VM server for SPARC,Oracle VM Server for x86,

theCitrixXenServer, VMware ESX/ESXi and Microsoft Hyper-V2008/2012

2.2. Type 2 Hypervisor

Type 2 (or hosted) hypervisors run within a conventional operating system environment. With the hypervisor layer as a distinct second software level, guest operating-systems run at the third level above thehardware.VMwareWorkstation and VirtualBoxexemplify Type 2 hypervisors.

3. VMware ESX/ESXi

VMware ESX is an enterprise-level computer virtulization product offered by VMware. ESX is a part of VMware's larger offering,VMware architecture, which adds reliability and management services to the core server product. VMware recommends that implementations running the earlier ESX architecture move to the newer ESXi hypervisor architecture [4].
VMware ESX and ESXi are VMware's enterprise softwareType 1 hypervisors for guest virtual servers; they run on host server hardware without an underlying operating system. The ESX host server requires some form of constant (fixed) storage, in most of the cases an array of hard disk drives that store the hypervisor and support files. ESXi allows the hypervisor to be installed on a dedicated compact storage device. Both support the services offered by VMware Infrastructure. VMware ESX and VMware ESXi provide the foundation for building a reliable and dynamic IT infrastructure [5]. VMware ESX and ESXi are one of the most widely and most implemented hypervisors which delivers the highest levels of performance and readability to companies of all sizes. VMware ESXi is the latest hypervisor architecture from VMware. It has an ultra-thin architecture with no dependence on a general-purpose Operating System, yet still offers all the same functionality, benefits and performance of VMware ESX.

4. Microsoft Hyper-V

Hyper-V, codenamed Viridian and formerly known as Windows Server Virtualization, is a native hypervisor; it can create virtual machines on x86-64 systems. Starting with Windows 8, Hyper-V supersedes Windows Virtual PC as the hardware virtuailization component of the client editions of Windows NT. Multiple guest computers can access a host server remotely running Hyper-V. Each guest computer could perform like they are using the host server directly. Applications could be run on the guest computers directly even if they are on the host server. Hyper-V has been released in a free stand-alone version, and has been upgraded to Release 2 (R2) status. It was updated in Windows server 2012.
Hyper-V exists in two variants:
1). As a stand-alone product called Hyper-V Server: Four major versions have so far been released: Hyper-V Server 2012 R2 (containing the current release of Hyper-V), Hyper-V Server 2012, Hyper-V Server 2008 R2 and Hyper-V Server 2008.
2). As an installable role in Windows Server 2012 R2, Windows server 2012, Windows server 2008 R2, Windows Server 2008 and the x64 edition of Windows 8 Pro.

5. Hyper-V VSVSPHERE: - Understanding the Differences

There has been a feature battle between Microsoft Hyper-V and VMware vSphere for years. In general, vSphere has been declared as the winner of this feature battle, although Hyper-V is certainly no slouch; the product holds its own motto for many organizations that have made the decision that its the right solution for their needs.

5.1. Product Level Overview

Both VMware and Microsoft products are available in multiple editions depending on the needs of the customer and both companies provide a free edition of their respective hypervisor tools for customers that do not have advanced needs.

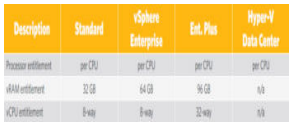

Figure 3. **Edition Comparision[8]**

5.2. Supported Guest Operating Systems

In breadth of operating system support, VMwares vSphere is the clear winner, although Microsoft has made steady strides in Hyper-V. Hyper-V supports all Microsoft operating systems both client and server since Windows 2000. For full support, the latest operating system service pack is required. In addition to supporting Windows operating systems, Hyper-V supports:

- CentOS 5.2-5.7 and CentOS 6.0 and 6.1
- Red Hat Enterprise Linux 5.2 5.7, 6.0 and 6.1
- SUSE Linux Enterprise Server 11 with Service Pack 1
- SUSE Linux Enterprise Server 10 with Service Pack 4

VMware, on the other hand, provides a much more comprehensive level of support for guest operating systems. In addition to supporting most Linux variants, vSphere also provides support for Max OS X 10.7 and other versions of OS X Server, FreeBSD, OS/2 Warp, Netware and Solaris.

5.3. Virtual Machine Storage Capabilities Compared

Storage is another essential shared resource in a virtual environment. Only with the right kind of storage can the hypervisor products achieve their true potential. However, even before the issue of advanced features as they relate to storage can be discussed, administrators must understand the storage capabilities and limitations that exist in both vSphere and Hyper-V.

Table 1. **Storage Types[8]**

Technology	Description	vSphere	Hyper-V
DAS	Directly attached storage	✓	✓
NAS	Network attached storage	✓	
FC	Fiber Channel	✓	✓
iSCSI	Internet SCSi	✓	✓
FCoE	Fiber Channel over ethernet	✓	

5.4. vSphere VMFS vs. Microsoft VHD

One of VMwares claims to fame has been VMFS (Virtual Machine File System), the incredibly powerful and scalable file system that enables much of VMwares feature set. VMFS provides a number of capabilities and features that are not found in Microsofts competing VHD (Virtual Hard Disk) format. In a cluster environment, VMFS truly shines. VMFS allows the hot add and removal of hosts to and from the cluster without the need to interrupt other running workloads. Currently, shipping Hyper-V solutions do not have this dynamic flexibility. Both VMware and Microsoft allow administrators to make direct use of disks through respective pass-through techniques. For vSphere, this feature is known as Raw Device Mapping (RDM). In the Hyper-V world, these are known as Pass-Through Disks. In this area, there isnt much difference. Pass-through techniques can be used to improve overall performance. On the storage management front, vSphere is still light years ahead of Microsoft in providing native features to the environment. Here are some features that are available in vSphere, but missing from Hyper-V [8]:

- Centralized management of datastores. A single location in which all data stores can be managed in order to provide more visibility into the environment.
- Storage Management Initiative Specification (SMI-S) support. Standardized monitoring of storage.

6. Proposed Work

In this project, we propose to develop this application, Virtual Machine Converter which will convert the Virtual Machines files (.vmdk) to Hyper-V Machines Files (.vhdx) using Virtual Library Functions. This will help in clearing out the differences between VMware and Hyper-V. It will also help Hyper-V to evolve more into this tech world so that more and more leading organization will get their hands on Hyper-V instead of using VMware for their Virtualization related work

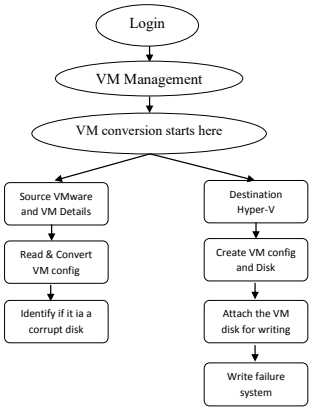

Figure 4. **Brief Overview of Proposed Work**

We are going to include the next generation hypervisor technique i.e., Cross Hypervisor that eliminates the need for different operating systems by providing the OS services required by the applications. This design makes sure that applications are not locked into a particular OS platform and also clarify development, bring down the material costs, and utilizes the system resources more productively. Cross-OS Hypervisor is redefining virtualization, thereby bypassing multiple layers of OS and hypervisor schedulers for the benefit of performance increases.

7. Conclusion

Our proposed paper based on Virtual Machine Converter shows how to take virtualization to the next level in this modern era of computing. We have proposed to show that how can a virtual machine file (.vmdk) can be converted into a Hyper-v file (.vhdx) with making room for more development in the near future. Our application tries to help Hyper-V evolve such that more organizations can have hands on experience and we tend to include Cross Hypervisor which eliminates the need for many operating systems by providing the OS functionalities required by the applications.

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