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# VMware vSphere Essentials

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## Introduction

Every VMware class I teach, whether it's the basic ICM (Install Configure, Manage) or it's the more involved FastTrack, a lot of students run into basic confusion on planning or the lingo. There are a few brave students who ask questions, and they should since they are in the classroom. But some don't ask questions, thinking it's the basics and by some miracle they should know it already. Consequently, I decided to cover these topics in this white paper. I hope this helps the target audience who are looking for vSphere Essentials to get started and will be in the class for more advanced, in-depth topics.

## Background on Physical Machines

The terminology seems to be the first cause for confusion. Remember, before we went to virtualization, we used to buy expensive servers from IBM, HP, Dell or other hardware vendors and then install our operating systems (Oss). The operating system was either something from Microsoft or some flavor of Linux. Then on top of that OS, we installed our application, for example, installing Windows 2008 on top of your Dell Server and then putting something like Microsoft Exchange or SQL on top of that.

We are so used to this scenario that it's sometimes hard to move away from that mindset, especially for folks who are only responsible for Server Administration and not vSphere Administration. After virtualization, we are installing VMware's ESXi on top of that Dell Server and then creating virtual machines (VMs) using vSphere Client (or the web version of the client) from some machine to manage the ESXi and creating VMs that will, in turn, be running the Microsoft or the Linux OS, which will then have products like MS Exchange or SQL installed.

 Administrators who are using Remote Desktop Protocol (RDP) or something similar to connect to the "Exchange Server" are still doing the same thing. They don't even need to know that it used to be installed on a physical Dell server and now has been virtualized and is on top of the ESXi as a VM. To the Exchange administrator, it is still the same process: using RDP to connect to the VM running Exchange Server. Even though I say that they don't need to know that the server has been virtualized, students sometime come to classes and talk about the support from a vendor if their product is on the physical system or has been virtualized on a VM. You need to check support issues with the product vendor that you are virtualizing, since it varies.

# Terminology

The terminology is now different. After virtualization, that Dell server hardware we installed our VMware ESXi product is called the Host. Windows 2008 is installed in a VM and is the Guest Operating System.

# Advantages to Implementing Virtual Machines

The advantage of doing this is that we previously used maybe 2 percent to 20 percent of our physical resources, since CPU and RAM were getting faster and comparatively cheaper. Now, after doing the virtualization, we can put multiple VMs on that same physical chassis from Dell (in our example) and each VM is isolated from the others. This isolation is important because if one of my VMs crashes, it will not have any effect on other VMs. Through consolidation, I have reduced the number of physical chasses I own. You will also see in the ICM and FastTrack classes that with many Fault Tolerant and Clustering methods available, we can protect this entire ESXi host along with all its VMs, if it were to fail.

Another advantage that we gain from consolidation is that, depending on the consolidation ratio you are implementing, you have reduced the number of machines you have purchased. This is not only a financial savings, it is space savings. Think about where you were putting these servers. They were all sitting in your Data Center, taking up a whole lot of space. Less rack space used means more savings. Also, more machines would have generated more heat; less heat means less air conditioning, providing even more savings.

Have you ever run into a dilemma: you want to purchase a physical server that doesn't have to be that powerful, but vendors don't usually sell hardware with lower configurations? Now, with virtualization, you can put those application servers in a VM, and you can have different CPU and RAM allocations for different VM set up the way you want them. The ESXi host does the resource sharing based on the allocation. You can do the carving of CPU and RAM per VM. This is called resource sharing, and is thoroughly covered in various VMware classes.

# Hypervisor

The VMware component that allocates CPU, Memory, and Input/Output is called Hypervisor. The installation of ESXi software right on top of the physical server (Dell Server in our case) is called bare-metal hypervisor architecture. So, an x86-based system running the virtualization layer directly is the bare metal hypervisor. This bare metal hypervisor option is common in real-life environments. There is another option, called the Hosted Virtualization (also referred to as Host-based virtualization), that is also available.

# Hosted Solution

After taking the VMware class where you performed various labs on high-end servers you might want to practice the same labs at home. You might not have those high-end servers at home, but you still have your home desktop or laptop with your Windows OS or Linux OS installed. You can purchase VMware Workstation, reasonably priced, from VMware and install that on a Windows-based machine; VMware Fusion is available for MAC users. Then, on top of that VMware workstation or VMware Fusion you can create VMs with the Windows 2008/ Exchange setup we discussed before. Unlike the previous example, this is done on top of an OS like Windows, or Linux, or Mac OSX/Lion. Since this is hosted on one of these OSs, this is called a hosted solution. This might be

perfect for your lab environment but not really recommended for a real production environment since you are then running these VMs (VM with Exchange or your databases) on VMware workstation that is itself running on top of your home version of Windows 7. I hope that screams NO to you as it does to me.

Let's get back to our bare metal solution. If I still have a legacy OS like Microsoft's Windows NT, for example, that I need to maintain in my production environment. Now, imagine that your existing Windows NT system is dead and you need to get that up and running fast. You don't have those legacy servers anymore and the high-end new servers and their components might not be recognized by an older OS like Windows NT. This is a perfect candidate for virtualization because these I/O calls are going through the Hypervisor. So, another advantage of doing virtualization with VMware's vSphere is that you have support for legacy OSs on your new hardware (ESXi Host). Now, I hope administrators of most environments will look at migrating to newer OSs and not continue using Windows NT, since its legacy.

## What Is a Virtual Machine?

To the Server Administrator, the virtual machine is just another machine/server. They just RDP to this system as they have done before. But what is a VM to a vSphere Administrator or to the Hypervisor. To us, the VM is nothing but a "bunch of files." There are many files with various extensions that make up the VM. We could directly manipulate some of the files to affect the V M even though it might be reserved for advanced vSphere administrators. Many time, GUI gives you the control you seek so you don't have to manipulate the files directly, but you can.

## Some Files that Make up a Virtual Machine

So, what's in these files? Well, everything. For example, we have a .vmx file that contains the configuration of the VM. The name of the file is going to be whatever you called the VM with the .vmx extension. What is in the .vmx file? .vmx is the main file for the VM. In the GUI, when you use the wizard to create the VM, all the answers to the wizard questions are in this file. This includes information on the Guest Operating System, Networking, and other things such as disk sizes. So, .vmx – a simple text file – is an important file that is stored in the same place where your VMs are stored.

Another important file is the .vmdk file extension. Again, the name of the file is the name of the VM followed by the .vmdk extension. You can see this using your vSphere Client, selecting your VM, and looking at the properties/settings of the VM. Once you see the Datastore, you can right-click and select Browse Datastore from the menu. However, if you use the Storage Views tab (select the VM and click on the Storage Views tab) you will see all the files related to the VM. You will see the .vmx file and many more files. You will see the .vmdk file, but you will also see a file with <name of the vm>-flat.vmdk, which was not visible when we did the right-click on Datastore and did Browse Datastore. This Storage Views tab is showing you the correct information.

- The .vmdk file is not the real disk content; it is just the virtual disk characteristics. The flat.vmdk file is the one that contains the virtual disk's data (the real meat).
- The .log files are very helpful when working with VMware support folks for troubleshooting
- The .nvram is the actual VM BIOS. Just as in the physical machine, the VMs have BIOS settings, too.
- The .vmsd is for VM's snapshots.

- The .vmsn is the state of the RAM of the VM if you chose to take the snapshot of the memory.
- The .vmtx is the one you will see if you are using **Templates**. This is good if you are deploying multiple VMs and you don't wish to sit and answer individual questions while going through installation wizards and various other prompts. Deploying from templates is very efficient use of your time and is covered in VMware classes in its own lesson.

There are many more files out there that make up these VMs. We discuss these in the VMware ICM class and the VMware Fast Track classes. So, if the virtual machine is nothing but a bunch of files, it's easy to move these files from one datastore to another datastore.

## Virtual Hardware

VM uses virtual hardware. The guest OS you are using in the VM has no idea that the hardware is virtual (remember, this will be defined in the .vmx file or through some GUI wizard you are going through). There have been many iterations of what hardware can be configured for the VM. This is called the hardware version. Different hardware versions are available in different versions of products from VMware. Hardware version is going to be one of those questions you get to answer when you are going through wizard to create the VM. So, what hardware version should you pick?

## ESXi 5

Well, it is true that the newer hardware versions are available on newest versions of ESX product line. For example, for EXSi 5.1, hardware version 9 is the newest version (as of the writing of this whitepaper). So, if you have a mixed environment of ESXi 5.1 and some older versions, then you should not pick Hardware version 9 when you are creating a VM. Here is a list of hardware versions that we have been through.

- ESX 2.x gave us Hardware version 3
- ESX 3.x gave us Hardware version 4
- ESX/ESXi 4.x gave us Hardware version 7
- ESXi 5.0 gave us Hardware version 8
- ESXi 5.1 gave us Hardware version 9

The newest Hardware versions give us more capabilities and hardware support. For example, Hardware version 7 gave us the ability to create VMs with 255 GB of RAM, and in Hardware version 8 and Hardware version 9 we can create VMs with 1 TB of RAM. In Hardware version 7, you could have a maximum number of 8-way Virtual SMP. Hardware version 8 gave us maximum of 32 vCPU support, and Hardware version 9 has now doubled that to 64 vCPUs (all with proper licensing; contact your VMware rep for licensing information).

If I were building a brand new VMware vSphere environment with ESXi 5.1 version, then picking Hardware version 9 makes sense for me since all I have is ESXi 5.1. But if I have an existing environment with previous version of ESX/ESXi then I'll look at what Hardware versions are supported if I intend to move these VMs between hosts with different versions. (ESX has been discontinued starting with version 5 of the product line where we only have ESXi).

# VMware Workstation and Fusion Product Lines

I have only been talking about the Hardware versions in ESX/ESXi product line. There are other products from VMware that have their own support issues such as the VMware Workstation and the Fusion product lines for hosted solutions. You have to really know what version of hosted product you have. For example, VMware workstation 6.0x supports Hardware version 6, but VMware workstation 6.5x and VMware workstation 7.x support Hardware version 7. I like that the hardware version numbers line up with Workstation product line versions: Workstation 7 gave us Hardware version 7, Workstation 8 gave us Hardware version 8 support, and Workstation 9 gave us Hardware version 9 support. I hope this stays this way in future.

# Possible Mistakes

When moving a VM you must remember that the product you are moving it to cannot power on a VM with a hardware version that is higher than it supports. But if you are a moving a VM with a lower hardware version to something that supports higher hardware version then, it will power on but some functionality will be lost. Therefore, my recommendation is to keep the versions in sync or not choose the latest and greatest hardware version until every host has been upgraded and every VM has been upgraded to that version of hardware.

Now, I have mentioned a few times that you can use the vSphere client from one of your administration machines and point that to your ESXi host to manage it. However, if you are not a small company, you probably have too many ESXi Hosts in your organization to make this practical. Well, the good news for you is that there is a centralized administration option called vCenter. Historically, vCenter has only been a Windows solution, meaning you install the vCenter Server product on your Windows-based servers. This was good if you were already a Microsoft shop and had another Windows licenses; otherwise, you had to acquire the licenses. Starting with ESXi 5, we got another option, the vCenter Server as an appliance. Instead of using the Windows version and having to use a Windows license, you can use this Linux-based appliance. There are some limitations in this Linux version, but I hope future versions of this product will give us all or even more functionality that we have with the Windows version of vCenter.

# Windows and Appliance Versions of vCenter

Both the Windows version and the appliance version (Linux-based) of vCenter can be installed as a VM, but the Windows version can still be a separate physical machine if you chose to do so. Today, the recommendation is to use the vCenter on a WM, altho9ugh some students claim they prefer the physical machine for the vCenter.

# vSphere Client

Using the windows based vSphere client to point to the vCenter where all the hosts are being managed gives you a nice centralized view. You can also use your existing Active Directory infrastructure to login and start assigning permissions for whomever in your organization can access what resources. Starting with vSphere 5.1, you also have a vSphere web client, which is more feature-rich compared to the previous version in 5.0. Certain actions, like creating a VM with Hardware version 9 can only be done using the vSphere web client currently, not with the Windows version of vSphere client. For now, we might be running both versions of vSphere client but looks like we will be moving to the web client so there is no dependency of Windows.

# Conclusion

I hope this vSphere Essentials white paper has given you a basic understanding of some of the concerns or planning points to consider when you are getting ready to deploy vSphere in your organization. This is just a glimpse into the things to consider for vSphere which is why we have multiple VMware classes at Global Knowledge.

# Learn More

To learn more about how you can improve productivity, enhance efficiency, and sharpen your competitive edge, Global Knowledge suggests the following courses:

VMware vSphere: Install, Configure, Manage [V5.1]

VMware vSphere: Fast Track [V5.1]

VMware vSphere: What's New [V5.1]

VMware vSphere: Optimize and Scale [V5.1]

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# About the Author

Dheeraj (Raj) Tolani has been working with Global Knowledge as a contract instructor teaching various VMware and networking courses. He has been in the industry for over 18 years working with various technologies, including Cisco, Banyan Vines, Microsoft, Novell, and VMware. Dheeraj has worked as a consultant for various medical, financial, legal, government, and publishing companies. He runs a consulting company based in NYC providing IP integration solutions.