

# Preface

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How often have you heard this kind of marketing hype around the use of ESX Server and its compatriots, GSX Server and VMware Workstation?

ESX Server from VMware is hot, Hot, HOT!

The latest version of ESX Server does everything for you!

A Virtualization Utopia!

VMware is the Bomb!

VMware ESX, specifically its latest incarnation, Virtual Infrastructure 3, does offer amazing functionality with virtualization, dynamic resource load balancing, and failover. However, you still need to hire a consultant to come in to share the mysteries of choosing hardware, good candidates for virtualization, choosing installation methods, installing, configuring, using, and even migrating machines. It is time for a reference that goes over all this information in simple language and detail so that readers with different backgrounds can begin to use this extremely powerful tool.

Therefore, this book explains and comments on VMware ESX Server versions 2.5.x and 3.0. I have endeavored to put together a “soup to nuts” description of the best practices for ESX Server that can also be applied in general to the other tools available in the Virtual Infrastructure family inside and outside of VMware. To this end, I use real-world examples wherever possible and do not limit the discussions to just those products developed by VMware, but instead expand the discussion to virtualization tools developed by Vizioncore, Hewlett-Packard (HP), and other third parties. Given that I worked for HP, I use HP hardware and tools to show the functionality we are discussing, yet everything herein translates to other hardware

just as easily. Although things are named differently between HP and their competitors, the functionality of the hardware and hardware tools is roughly the same. I have endeavored to present all the methods available to achieve best practices, including the use of graphical and command-line tools.

As you read, keep in mind the big picture that virtualization provides: better utilization of hardware and resource sharing. In many ways, virtualization takes us back to the days of yore when developers had to do more with a lot less than we have available now. Remember the Commodore 64 and its predecessors, where we thought 64KB of memory was huge? Now we are back in a realm where we have to make do with fewer resources than perhaps desired. By keeping the big picture in mind, we can make the necessary choices that create a strong and viable virtual environment. Because we are doing more with less, this thought must be in the back of our mind as we move forward and helps to explain many of the concerns raised within this tome.

As you will discover, I believe there is quite a bit of knowledge to acquire and numerous decisions to make before you even insert a CD-ROM to begin the installation. How these questions are answered will guide the installation, as you need to first understand the capabilities and limitations of the ESX environment, and the application mix to be placed in the environment. Keeping in mind the big picture and your application mix is a good idea as you read through each chapter of this book.

### **Who Should Read this Book?**

This book delves into many aspects of virtualization and is designed for the beginning administrator as well as the advanced administrator.

### **How Is this Book Organized?**

Here is, in brief, a listing of what each chapter brings to the table.

#### **Chapter 1: System Considerations**

By endeavoring to bring you “soup to nuts” coverage, we start at the beginning of all projects: the requirements. These requirements will quickly move into discussions of hardware and capabilities of hardware required by ESX Server, as is often the case when I talk to customers. This section is critical, because understanding your hardware limitations and capabilities will point you to a direction that you

can take to design your virtual datacenter and infrastructure. As a simple example, picture the idea of whether you will need to run 23 servers on a set of blades. Understanding hardware capabilities will let you pick and choose the appropriate blades for your use and how many blades should make up the set. In addition, understanding your storage and virtual machine (VM) requirements can lead you down different paths for management, configuration, and installation. Checklists that lead to each chapter come out of this discussion. In particular, look for discussions on cache capabilities, the best practice for networking, mutual exclusiveness when dealing with storage area networks (SANs), hardware requirements for backup and disaster recovery, and a checklist when comparing hardware. This chapter is a good place to start when you need to find out where else in the book to go look for coverage of an issue.

### **Chapter 2: Version Comparison**

Before we launch down the installation paths and further discussion, best practices, and explorations into ESX, it is time to take time out and discuss the differences between ESX version 3.x.x and ESX version 2.5.x. This chapter opens with a broad stroke of the brush and clearly states that they *are* different. Okay, everyone knows that, but the chapter then delves into the major and minor differences that are highlighted in further chapters of the book. This chapter creates another guide to the book similar to the hardware guide that will lead you down different paths as you review the differences. The chapter covers installation differences, VM differences, and management differences. Once these are clearly laid out and explained, the details are left to the individual chapters that follow. Why is this not before the hardware chapter? Because hardware may change, but the software running on it definitely has with ESX 3, so this chapter treats the hardware as relatively static when compared to the major differences between ESX version 3 and ESX version 2.

### **Chapter 3: Installation**

After delving into hardware considerations and ESX version differences, we head down the installation path, but before this happens, there is another checklist that helps us to best plan the installation. Just doing an install will get ESX running for perhaps a test environment, but the best practices will fall out from planning your installation. You would not take off in a plane without running down the preflight checklist. ESX server is very similar, and it is easy to get into trouble. As an example, we had one customer that decided on an installation without first understand-

ing the functionality required for clustering VMs together. This need to cluster the machines led to a major change and resulted in the reinstallation of all ESX servers in many different locations. A little planning would have alleviated all the rework. The goal is to make the readers aware of these gotchas before they bite. After a review of planning, the chapter moves on to various installations and discusses where paths diverge and why they would. As an example, installing boot from SAN is quite a bit different from a simple installation, at least in the setup, and due to this there is a discussion of the setup of the hardware prior to installation for each installation path. When the installations are completed, there is post-configuration and special considerations when using different SANs or multiple SANs. Limitations on VMFS with respect to sizing a LUN, spanning a LUN, and even the choice of a standard disk size could be a pretty major concern. This chapter even delves into the vendor and Linux software that could be added after ESX Server is fully installed and why you would or would not want to do add it. Also this chapter suggests noting the divergent paths so that you can better install and configure ESX Server. When it comes to the additional software, this chapter leads you to other chapters that discuss the usage details in depth. And last, this chapter covers some of the aspects of automated deployment of ESX Servers and the tools needed to accomplish this task.

### **Chapter 4: Auditing, Monitoring, and Securing**

Because the preceding chapter discussed additional software, it is now time to discuss even more software to install that aids in the auditing, monitoring, and securing of ESX server. This chapter approaches ESX from the perspective of security, and out of that will come better tools for monitoring and auditing your server for failures and possible issues. There is nothing like having to read through several thousands of lines of errors just to determine a problem started. Using good monitoring tools will simplify this task and even enable better software support. That is indeed a bonus! Yet knowing when a problem occurred is only part of monitoring and auditing; you also need to know who did the deed and where they did it, and hopefully why. This leads to auditing. More and more government intervention (Sarbanes-Oxley) requires better auditing of what is happening and even when. This chapter launches into automating this as much as possible. Why would I need to sit and read log files when the simple application can e-mail me when there is a problem? How do I get these tools to page me or even self-repair? I suggest you take special note of how these concepts, tools, and implementations fit with your overall auditing, monitoring, and security requirements. Also, note

how security works inside ESX, because this is an extremely different view of the world, generally distinct from normal systems.

### **Chapter 5: Storage with ESX**

There are many issues dealing with SANs within ESX. There are simple ones from “is my SAN supported” and “why not” to more complex ones such as “will this SAN, switch, Fibre Channel host bus adapter provide the functionality I desire?” Because SANs are generally required to share VMs between ESX Servers, we discuss them in depth. This chapter lets you in on the not-so-good and the good things about each SAN and what the best practices are for use, support, and configuration. Also discussed in this chapter are network-attached storage (NAS) and iSCSI support within ESX. With SANs, there is good, bad, and the downright ugly. For example, if you do not have the proper firmware version on some SANs, things can get downright ugly very quickly! Although the chapter does not discuss the configuration of your SAN for use outside of ESX, it does discuss presentation in general terms and how to get the most out of hardware and, to a certain extent, software multipath capabilities. This chapter suggests you pay close attention to how SAN and NAS interoperate with ESX Server.

### **Chapter 6: Effects on Operation**

Before proceeding to the other aspects of ESX, including the creation of a VM, it is important to review some operational constraints associated with the management of ESX and the running of VMs. Operation issues directly affect VMs. These issues are as basic as maintaining lists of IPs and netmasks, when to schedule services to run through the complexities imposed when using remote storage devices, and its impact on how and when certain virtualization tasks can take place.

### **Chapter 7: Networking**

This chapter discusses the networking possibilities within ESX Server and the requirements placed upon the external environment if any. A good example is mentioned under the hardware discussion, where we discuss hardware redundancy with respect to networking. In ESX Server terms, this discussion is all about network interface card (NIC) teaming, or in more general terms, the bonding of multiple NICs into one bigger pipe for the purpose of increasing bandwidth and failover. However, the checklist is not limited to just the hardware but also

includes the application of best practices for the creation of various virtual switches (vSwitches) within ESX Server, what network interfaces are virtualized, and when to use one over the other, as well as any network lag considerations. It also includes the pitfalls related to debugging problems related to the network. The flexibility of networking inside ESX server implies that the system and network administrators also have to be flexible, as the best practices dictated by a network switch company may lead to major performance problems when applied to ESX Server. Out of this chapter comes a list of changes that may need to be applied to the networking infrastructure, with the necessary data to back up these practices so that discussions with network administrators do not lead toward one-sided conversations. Using real-world examples, this chapter runs through a series of procedures that can be applied to common problems in setting up networking within ESX Server.

### **Chapters 8 and 9: Configuring ESX from a Host Connection, and Configuring ESX from a Virtual Center or Host**

These chapters tie it all together; we have installed, configured, and attached storage to our ESX Server. Now what? Well, we need to manage our ESX Server. There are three primary ways to manage an ESX Server: the use of the management user interface (MUI), which is a web-based client; the use of Virtual Center (VC), which is a .NET client; and the use of the command-line interface (CLI); as well as variations on these provided by HP and third parties. These chapters delve into configuration and use of these interfaces. Out of these chapters will come tools that can be used as part of a scripted installation of an ESX server, as mentioned in Chapter 3.

### **Chapter 10: Virtual Machines**

This chapter goes into the usage of the management interfaces as I address real-world examples of planning installations. This chapter discusses making and storing images of your installation media, where to place VM configuration files, choosing your installation size, and how dynamic disks, logical volume manager, and minimized installs affect that size. Also, this chapter launches into a discussion of the various swap files available to ESX and when each is used and why. In essence, the chapter discusses everything you need to know before you start installing VMs. Once that is discussed, it is possible to launch into installation of VMs using all the standard interfaces. We install Windows, Linux, and NetWare VMs, pointing out where things diverge on the creation of a VM and what has to

be done post install. This chapter looks at specific solutions to VM problems posed to us by customers: the use of eDirectory, private labs, firewalls, clusters, growing Virtual Machine File Systems (VMFSs), and other customer issues. This chapter is an opportunity to see how VMs are created and how VMs differ from one another and why. Also, the solutions shown are those from real-world customers, and they should guide you down your installation paths.

### **Chapter 11: Dynamic Resource Load Balancing**

Because monitoring is so important, it is covered once more with an eye toward dynamic resource load balancing (DRLB) and utilization goals. The chapter discusses the use of various performance-monitoring tools that will add to your understanding of how to balance resources across multiple ESX Servers. Whereas some tools perform DRLB, still others report the important aspects for the administrator to apply changes by hand. With the advent of DRLB, there needs to be a clear understanding of what is looked at by such tools. This chapter gives you that understanding by reviewing hardware-utilization data, usage data, and performance data presented by various tools. Then, after this data is understood, the chapter shows you the best practices for the application of the data using VMotion, ESX Server clustering techniques, and how to apply alarms to various monitoring tools to give you a heads up when something needs to happen either by hand or has happened dynamically. I suggest paying close attention to the makeup of DLRB to understand the limitations of all the tools.

### **Chapter 12: Disaster Recovery and Backup**

A subset of DLRB can apply to disaster recovery (DR). DR is a huge subject, so it is limited to just the ESX Server and its environment that lends itself well to redundancy and in so doing aids in DR planning. But, before you plan, you need to understand the limitations of the technology and tools. DR planning on ESX is not more difficult than a plan for a single physical machine. The use of a VM actually makes things easier if the VM is set up properly. A key component of DR is the making of safe, secure, and proper backups of the VMs and system. What to backup and when is a critical concern that fits into your current backup directives, which may not apply directly to ESX Server and which could be made faster. The chapter presents several real-world examples around backup and DR, including the use of redundant systems, how this is affected by ESX and VM clusters, the use of locally attached tape, the use of network storage, and some helpful scripts to make it all work. In addition, this chapter discusses some third-party tools avail-

able to make your backup and restoration tasks simpler. The key to DR is a good plan, and the checklist in this chapter will aid in developing a plan that encompasses ESX Server and can be applied to all the Virtual Infrastructure products. Some solutions require more hardware (spare disks, perhaps other SANS), more software (Vizioncore's ESXRanger, Power Management, and so on), and almost all of them require time to complete.

### **Epilogue: The Future of Virtualization**

After all this, the book concludes with a discussion of the future of ESX Server.

### **Appendixes**

Appendix A, "Security Scripts," presents a shell script that can be used to increase the security of an ESX Server. Appendix B, "ESX Version 3 Text Installation," presents the ESX text installation and Appendix C, "ESX Version 3 Graphical Installation," presents the ESX installation through the graphical interface.

### **References**

This element suggests possible further reading.

### **Reading . . .**

Please sit down in your favorite comfy chair, with a cup of your favorite hot drink, and prepare to enjoy the chapters in this book. Read it from cover to cover, or use as it a reference. The best practices of ESX Server sprinkled throughout the book will entice and enlighten, and spark further conversation and possibly well-considered changes to your current environments.