

**MIGRATING LEGACY PHYSICAL
SERVERS TO VMWARE VSPHERE
VIRTUAL MACHINES ON DELL
POWEREDGE M610 BLADE SERVERS
FEATURING THE INTEL® XEON®
PROCESSOR 5500 SERIES**



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Introduction

Virtualization and consolidation overview



Dell PowerEdge M610 blade server featuring Intel Xeon Processor 5500 series



Dell EqualLogic PS5000XV iSCSI SAN

This Guide shows the ease and cost benefit of consolidating multiple legacy physical servers onto a single server running VMware vSphere™ 4. In this Guide, we use the Dell™ PowerEdge™ M610 blade server featuring the Intel® Xeon® Processor 5500 series, paired with the Dell™ EqualLogic™ PS5000XV iSCSI SAN storage system. We provide concepts and procedures that will help you perform this consolidation and migration using VMware vSphere.

The VMware vSphere product encompasses many technologies and several software components. In this Guide, we use VMware ESX™, the core hypervisor VMware includes in all editions of VMware vSphere. For the physical to virtual conversion process, we use the VMware vCenter Converter™ tool.

Principled Technologies (PT) has performed hands-on research and drawn on real-world experiences to document best practices and help systems administrators and virtualization administrators simplify operations and take advantage of the features of VMware vSphere technologies to consolidate multiple physical systems onto a single virtualization platform.

This document covers the key overall concepts and procedures you need to consolidate your legacy physical servers to a virtualized VMware vSphere platform. It reviews in detail the approach that PT and Dell recommend for a tested and validated consolidation of legacy physical systems running the older Windows Server® 2003 platform to a virtualized platform, running VMware ESX. We use VMware vCenter Converter to perform our physical to virtual (P2V) migration and keep the legacy software, including the operating system, as is. Organizations sometimes wish to reap the benefits of virtualization without incurring the maintenance and redesign costs that sometimes accompany an operating system or application upgrade; the P2V process allows for this. The organization can then upgrade individual virtual machines as time and resources allow.

As we note above, we use the Dell PowerEdge M610 blade server and the Dell EqualLogic PS5000XV iSCSI SAN as our virtualization hardware platform in this Guide. We cover configuration of the storage, installation of the host operating system and virtualization tools, and the P2V migration itself.

What is virtualization? How can I use it to consolidate, and what are the benefits?

Generally speaking, *virtualization* is the ability to run multiple operating system environments or machine environments on one physical system. There are two basic types of virtualization. Type 2 virtualization is a hosted solution, where the virtual machines run inside another operating system, and thus are several layers above the hardware. Type 1 virtualization products, such as VMware ESX, included in VMware vSphere, run much closer to the “bare metal” of the server and interact with hardware directly through a control program known as the hypervisor. By working closer to the hardware, Type 1 products can typically provide better performance than Type 2 offerings.

Generally speaking, *consolidation* refers to the process of combining multiple items to make a single, more effective unit. In this Guide, we discuss combining the concepts of virtualization and consolidation to achieve your overall goals. In an IT context, you can consolidate several types of items, including the following:

Physical servers. In this Guide, consolidation typically means consolidating servers. After a successful consolidation, all applications should run on fewer servers than before, and those applications should run at least as well as they did previously.

Storage. As you follow the procedures in this Guide, you will consolidate storage by moving software and data from a number of servers to a larger, more modern storage area network (SAN), in our case a Dell EqualLogic PS5000XV.

Locations. As you consolidate servers through virtualization, you may reduce the number of locations you need for servers. Planning for consolidating geographic locations is beyond the scope of this Guide.

Why consolidate?

Done well, consolidation yields a more economical environment with more consistent management practices, better use of hardware, and all applications performing at least as well as they did previously. An effective consolidation effort improves reliability and security while bringing significant savings to the organization. Some of the ways consolidation can stretch your technology budget include the following:

Hardware savings. Buying, powering, and supporting fewer servers brings obvious savings to an organization. Less obvious are the other significant cost savings that fewer servers mean over time, such as fewer hardware replacement purchases as these consolidated servers age out. In other words, your future purchase growth rate may decrease. Other potential hardware cost savings areas may include racks and network switches; as the number of servers decreases, these costs decrease as well.

Software license savings. Like traditional consolidation, VMware virtualization technology can let organizations reap significant software licensing savings. While licensing structures and fees vary by product, the following example using Microsoft® SQL Server® illustrates the possibilities.

This pricing example uses the per-processor licensing model of SQL Server. (Details on licensing SQL Server are available [for download here.](#))

Our Dell PowerEdge M610 blade server has two physical sockets, each socket populated with an Intel® Xeon® Processor X5570. Licensing SQL Server Enterprise Edition per processor lets us run as many SQL Server instances as we wish on this physical machine. Figure 1 shows a possible configuration.

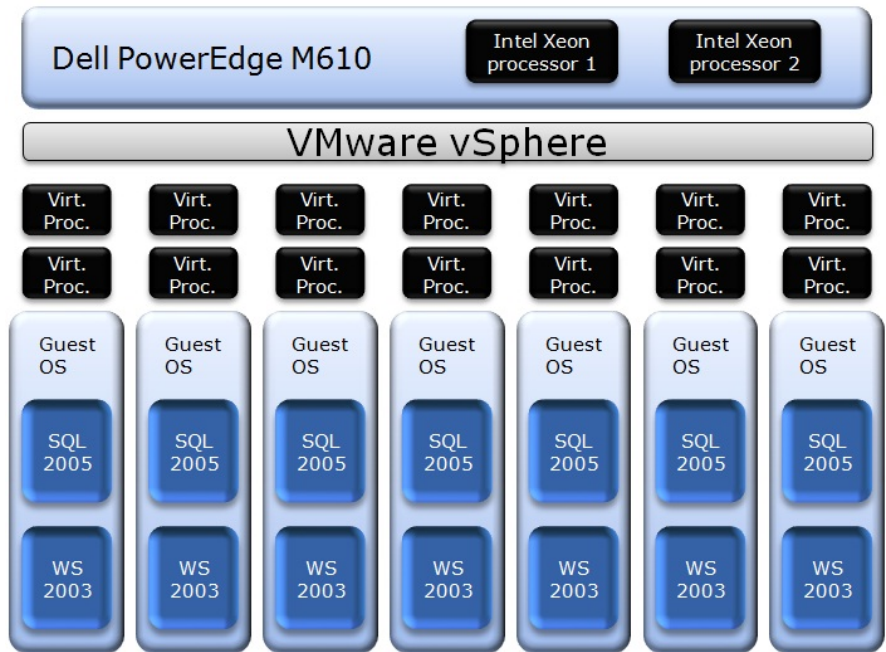


Figure 1. Sample configuration of seven virtual machines running on the Dell PowerEdge M610, each with two virtual processors.

For our hypothetical example, we estimate that, with virtualization, we can consolidate 35 identical heavy workloads onto five Dell PowerEdge M610 blade servers with Dell EqualLogic PS5000XV storage. Thus, we use seven as a reasonable consolidation estimate in the example below.

We then migrate 35 physical SQL Server environments to 7 virtualized SQL Server environments running on a single server and allocate two virtual processors to each of the 7 virtualized environments. That is a total of 14 virtual processors, but our new two-socket host machine has eight cores with Hyper-Threading technology, providing 16 logical processing threads. This usage is not a problem, however, because VMware vSphere handles the sharing of resources among the virtual machines. In this example, because we have purchased the Enterprise Edition of SQL Server and licensing on a processor based model, we can create an unlimited number of virtual environments containing SQL Server.



NOTE: The cost analysis below shows only licensing savings related to SQL Server. Windows Server licensing is independent of SQL Server, so check with your Microsoft sales representative about complete costs of both products.

Figures 2 and 3 present a brief cost analysis showing SQL Server cost savings based on the configuration in Figure 1. The non-consolidated environment assumes seven Enterprise Edition SQL Server instances, each running on a dedicated two-socket server, and they use list prices. The virtualized environment assumes a quad-core two-socket machine running SQL Server Enterprise Edition on each VM. Because Microsoft counts each socket as a processor for licensing purposes, the virtualized environment requires only 14 percent of the licensing cost as compared to the non-consolidated environment, yielding considerable savings.

	Non-consolidated environment	Consolidated VMware ESX Server environment
Description	7 two-socket dual-core servers, each running SQL Server enterprise	1 two-socket quad-core server, running VMware vSphere at the host and SQL Server Enterprise in each VM; licenses purchased for 2 physical processors
Cost	2 sockets x \$25,000 per-processor retail enterprise license x 7 servers = \$350,000 in SQL Server licensing; \$50,000 per SQL instance	2 sockets x \$25,000 per-processor retail enterprise license x 1 server = \$50,000 in SQL Server licensing; \$7,142 per SQL instance

Figure 2. Comparing SQL Server list licensing costs: seven non-virtualized two-socket servers versus a single two-socket server running seven dual-processor virtual machines. For licensing purposes, Microsoft counts one socket as a processor.

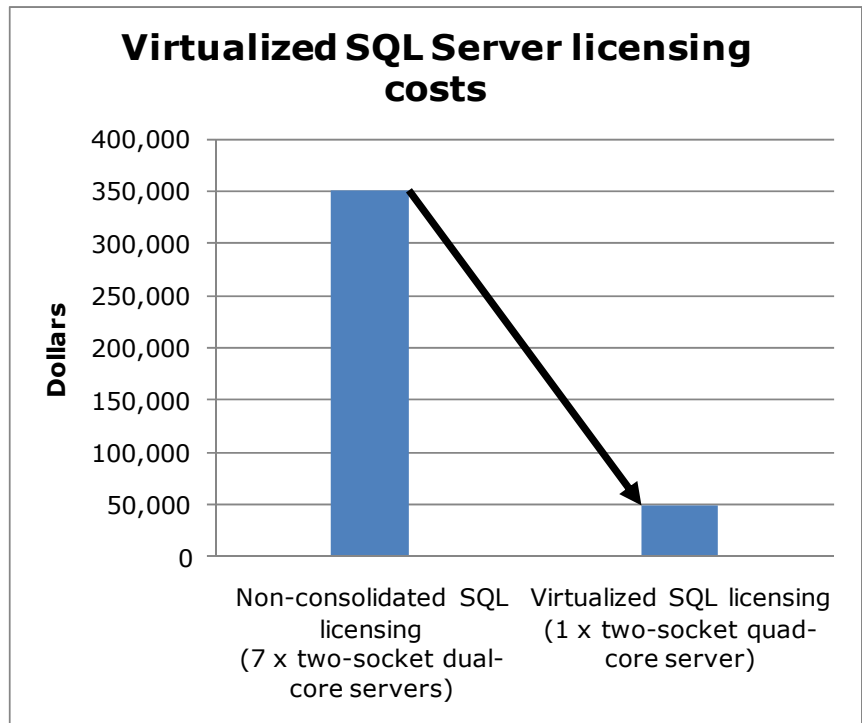


Figure 3. Example of SQL Server licensing savings when consolidating from seven two-socket servers to a single two-socket server running VMware vSphere. For licensing purposes, Microsoft counts one socket as a processor. SQL Server Enterprise Edition per processor licenses are required to run unlimited virtual SQL Server environments.

Maintenance and staff savings. A consolidated and virtualized infrastructure offers many opportunities for staffing, support, and maintenance cost savings. Less hardware and associated equipment means fewer servers that require security patches and monitoring.

Reduced staffing requirements. Regardless of your server-to-full-time-employee (FTE) administrator ratio, fewer servers mean fewer system administrators. Also, consolidation efforts often improve standardization across servers, simplifying administration for the system administrator, network engineer, and database administrator (DBA). Virtualization and consolidation can also provide greater opportunities for automation, further reducing the FTE requirements. Because the growth in the number of servers can slow when you consolidate, these savings can compound over time.

Reduced support costs. The cost of a given level of support is usually proportional to the size of the installation. By reducing the number of servers, the costs of your support agreements go down as well.

Power and cooling savings. Consolidating servers saves power in several ways:

- **Fewer servers.** Obviously, fewer servers consume less power.
- **More efficient servers.** Modern servers are typically more efficient than those of a few years ago, so you are likely to use less power per server.
- **Less cooling.** Fewer, more efficient servers produce less heat. Moreover, you can house them in a smaller space, thus reducing cooling costs even further.

Rent savings. Consolidation via virtualization reduces the floor space IT requires. By reducing the number of servers, you reduce the physical space required to hold the racks and the associated space necessary for servicing and airflow. You require less cooling, and so save on the space the air conditioners would require. Finally, consolidation may allow you to reclaim space, make more efficient use of the space you have, and thus delay expansion.

Regulatory compliance savings. With fewer physical devices storing data and more uniform management, a consolidated environment can make the process of complying with regulatory requirements such as Sarbanes-Oxley and the Health Insurance

Portability and Accountability Act (HIPAA) less expensive, easier, and more secure.

Sizing and baseline performance. Sizing is one key to a successful consolidation. The process of sizing involves gathering different performance baselines so you have at least an approximate set of requirements the new consolidated servers must meet. You do this by looking at the performance characteristics of existing hardware during normal business operations, and then applying growth and scalability estimates. The performance baselines you gather are useful when setting the configuration options on your vSphere virtual machines when it comes to the number of virtual processors and the amount of memory.

Among the characteristics to examine on each server are the following:

- Processor utilization
- Memory requirements of the OS and applications
- Disk layout
- Database or file size
- Maximum concurrent users
- Types and rates of storage utilization, such as large sequential writes, random reads, etc.

The server you choose for virtualization and consolidation must do more than match the combined capacity of all the other current servers today. It must have enough excess capacity to still perform well at the end of its expected life span. Fortunately, given the improvements we note below, finding such servers is entirely possible. Also, given the flexibility and portability that virtualization provides, future hardware upgrades are easier; you can move virtual machines from host to host and migrate them to other equipment if need be.

In recent years, server capabilities have greatly increased. Here are some of the improvements that make it possible to consolidate multiple servers into a single system:

- **More processors.** Modern quad-core processors double or even quadruple the number of processing cores available without increasing the physical size of the server. Some applications benefit even further by increased number of threads available in the processing core. For example, Intel

Hyper-Threading technology allows two threads per processor core.

- **More processing power per core.** While clock speeds have changed little, processors have undergone a generational shift. Industry-standard benchmarks, such as SPECint, show today's processors are much faster than their counterparts of 3 to 5 years ago. According to Intel, the Intel Xeon processor 5500 series shipping today, for example, performs up to nine times faster than the single core processor, the Intel Xeon processor 5100 series, which shipped in 2005.
- **64-bit address space.** The advantages of the vastly greater address space on a 64-bit environment are widely documented. Five years ago, many processors did not support 64-bit addressing.
- **Faster memory.** The memory in a modern system is two to three times as fast as that in a 3- to 5-year-old system. This is achieved not only with the improved memory module performance, but also with the significant increase in memory bandwidth now available between the processors and memory modules.
- **Faster storage.** Disk transfer rates have improved substantially. Some performance critical workloads now have the option to use Solid State Disk (SSD) technology in place of conventional Hard Disk Drive (HDD) technology.
- **Cheaper storage and greater capacity.** Disk capacity has greatly increased, while the cost per GB has decreased.

We further discuss sizing at a conceptual level in the Getting ready section.

VMware vSphere overview

VMware vSphere is a full suite of virtualization technologies that include various virtualization software components. VMware ESX is the core hypervisor component of VMware vSphere. Generally speaking, a hypervisor is a Type 1 virtualization product: a thin layer of software enabling virtual machines to run on one physical machine and allowing direct access to most hardware.

Requirements for running VMware vSphere

The Dell PowerEdge M610 supports the features VMware vSphere requires, which include the following:

- A compatible 64-bit processor
- 2GB minimum RAM

- One or more network adapters
- Hardware-assisted virtualization, specifically processors that include the Intel-VT or AMD-V features. Figure 4 shows the virtualization feature enabled on our Dell PowerEdge M610. Note that the BIOS uses the term Virtualization Technology.

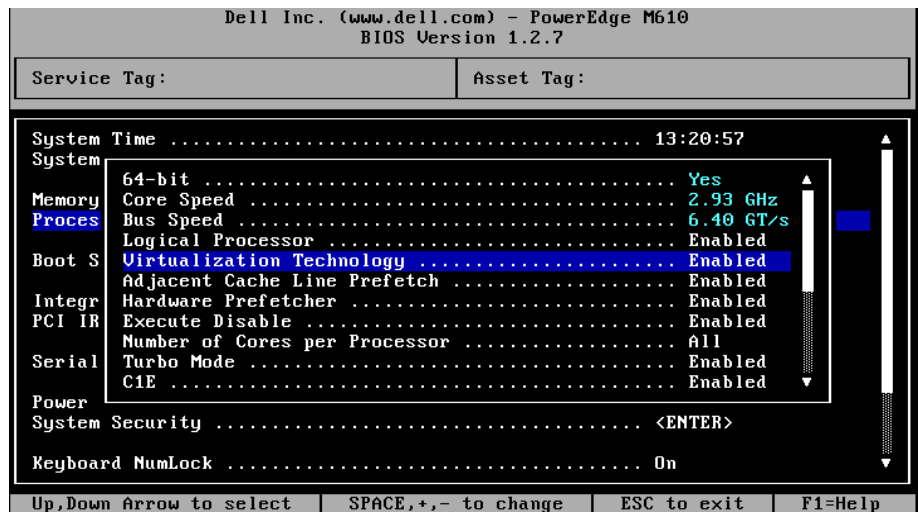


Figure 4. Example BIOS configuration for the Dell PowerEdge M610 showing virtualization technology enabled.

Features of VMware vSphere

With the release of VMware vSphere 4, VMware enhances and improves many features. Below, we list some of VMware vSphere's noteworthy features.

- **vMotion Technology.** With vMotion, you can migrate running virtual machines with no downtime. This provides organizations with a powerful tool to utilize physical resources more efficiently, transparently migrating VMs and workloads from host to host for power savings reasons, heavy workload periods, and so on. It also provides system administrators flexibility to implement system maintenance as needed on physical hosts, with no interruptions to client services. Also, on newer processor technologies, such as the Intel Xeon processor 5500 series we use in our PowerEdge M610 blade server, VMware supports Enhanced vMotion Compatibility (EVC). EVC takes advantage of Intel Flex Migration features to allow live migration of VMs across different generations of Intel processors.

- **Many guest operating systems supported.** VMware ESX Server offers support of many guest operating systems, including Windows, Linux, Solaris, Netware, and others.

Resource allocation in VMware vSphere

Consolidation using VMware vSphere allows an organization to save money on hardware. Consolidation brings competition for physical resources, such as CPU cycles, RAM, and NIC bandwidth. The vSphere client allows system administrators to allocate resources as they see fit, based on expected virtual machine workloads.

- **Memory allocation and overcommitment.** VMware vSphere allows you to adjust the memory allocated to virtual machines, and even allows oversubscription of memory. The maximum amount of memory you can allocate to a VM is 255 GB.
- **CPU allocation.** You can assign one or more virtual processors to a virtual machine. In VMware vSphere, you can assign up to 8 vCPUs per VM.
- **Varied SCSI controllers.** VMware vSphere offers various virtual SCSI controllers for VMs: LSI Logic Parallel and SAS for reliable boot disks. For enhanced I/O performance, VMware vSphere offers a Paravirtual SCSI controller.

Getting ready

Evaluating your servers for virtualization and consolidation

Gather baseline performance data

During your research phase, you should use Performance Monitor or other tools to gather data on the typical workload and performance statistics on the server you are considering moving to a virtual environment. This practice serves two purposes. First, it provides a prime opportunity to identify potential problems before you move to a vSphere-based solution. Second, you can use the information you gather to map out your resource allocation needs, which you can then use to configure your vSphere virtual machine memory and processor settings.

Poor candidates for P2V conversion

Not every server is a good candidate for P2V conversion. Here, we present a few examples of servers that you should consider carefully before transitioning to virtual environments.

Active Directory domain controllers. VMware does not recommend using VMware vCenter Converter for converting Active Directory domain controllers. The recommended approach for converting domain controllers is to demote the domain controller using the dcpromo utility, provision a new virtual machine with a fresh install of Windows Server acting as a domain controller, then use the static IP addresses and hostname of the original source physical machine.

Servers with critical performance requirements. If your server has stringent performance requirements, it may be best to leave it on a dedicated non-virtualized server. On a dedicated server, it is much easier to find any bottlenecks that might occur. It is also much simpler to address any problems when you need not worry about disrupting other work on the same server.

Servers with specialized requirements. Some servers may have requirements you cannot fulfill in a virtualized environment, such as applications that depend on highly specialized file layouts or direct access to specific hardware. If you do choose to convert these servers, you may wish to uninstall the hardware-specific applications, such as RAID utilities, networking applications, or other management tools that were specific to the original physical source machine.

Preparing your server and storage

Defining our environment

We used three servers in our environment to demonstrate the P2V process: a Dell PowerEdge M610 with Intel Xeon processor X5570 running the VMware ESX hypervisor, a legacy HP ProLiant DL385 physical server, and a machine running VMware vCenter Converter software.

To be specific, our example VMware ESX host was a Dell PowerEdge M610 running VMware ESX, which VMware includes in VMware vSphere 4. We connected a Dell EqualLogic PS5000XV iSCSI SAN to the Dell PowerEdge M610 via a Dell™ PowerConnect™ 6248 switch. Our source physical server for conversion was an HP ProLiant DL385. We installed the VMware vCenter Converter software on a Dell™ PowerEdge™ 2950 running Windows Server® 2008 R2. We connected all components via a gigabit Ethernet switch. Per best practices from Dell EqualLogic, we isolated the iSCSI network traffic onto its own physical network,

separate from any other network communication. Also as a best practice, we configured jumbo frames at all layers of our iSCSI network stack. Figure 5 illustrates our setup.

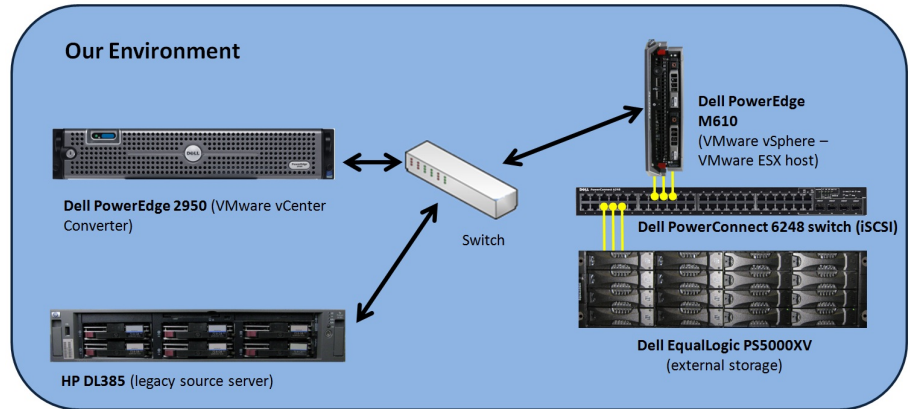


Figure 5. The setup we used in our hands-on research for this Guide.

Figures 6 and 7 present the hardware and software we used to simulate our source physical server, vCenter Converter machine, and vSphere virtualization server. Figure 8 shows storage system specifications.

Server	Processor	Memory	Disk drives
Dell PowerEdge M610 (VMware ESX host)	2 x Intel Xeon Processor X5570 (2.93 GHz)	72 GB	<u>2 x SAS, 15K RPM, 73 GB</u>
<u>HP ProLiant DL385 (source physical server)</u>	2 x AMD Opteron™ 254 (2.8 GHz)	4 GB	2 x SCSI, 10K RPM, 73GB
Dell PowerEdge 2950 (VMware vCenter Converter)	2 x Intel® Xeon® Processor E5440 (2.83 GHz)	32 GB	73 GB

Figure 6. Servers we used in our hands-on research for this Guide.

Server	Operating system
Dell PowerEdge M610 (VMware ESX host)	Host operating system: VMware ESX, included in VMware vSphere 4 Guest operating system: Windows Server 2003 R2 Enterprise Edition SP2 x64
HP ProLiant DL385 (source physical server)	Windows Server 2003 R2 Enterprise Edition SP2 x86
Dell PowerEdge 2950 (VMware vCenter Converter)	Windows Server 2008 R2 Enterprise Edition

Figure 7. Software we used in our hands-on research for this Guide.

Hardware	Specifications
Dell EqualLogic PS5000XV	16 x SAS, 15K RPM, 146GB disk drives; 3 active 1Gb network ports; 1GB cache
Dell PowerConnect 6248 Switch	48 port switch for dedicated iSCSI use

Figure 8. Storage system specifications.

Configuring the storage

Overview

In this section, we discuss the setup of our Dell EqualLogic PS5000XV storage, from initial configuration through LUN creation. Following best practices from Dell EqualLogic, we isolated our storage network onto its own Dell PowerConnect 6248 switch, enabled jumbo frames at all levels of the iSCSI network stack, and used multiple network connections from our server to take advantage of Multipathing I/O (MPIO) capabilities. We followed the procedures from Dell EqualLogic's white paper "Configuring VMware vSphere software iSCSI with Dell EqualLogic PS series storage" to configure the iSCSI software initiator in vSphere.




NOTE: Plan on at least 30 minutes for drive configuration on the server and storage.

A note on virtualized storage

In a vSphere environment, you have several options for both disk formats and virtual storage controllers. Regarding disk format, you can choose either Thin Provisioned Format, where the virtual disk grows as space needs require, or Thick Format, where the virtual

disk immediately fills up the datastore space specified. The default is Thick Format.

There are multiple virtual controller types, and you should consider your workload and guest operating system when configuring the controllers. The BusLogic Parallel, LSI Logic Parallel, and LSI Logic SAS controllers are the defaults for most guest operating boot disks. LSI Logic SAS is only available on VMs using hardware version 7. If you have applications that use high amounts of I/O, such as database or email servers, then consider using the VMware Paravirtual SCSI controller.

 **NOTE:** You cannot store the boot disk for a VM on the VMware Paravirtual SCSI adapter.

We installed a mezzanine Ethernet network card into our Dell PowerEdge M610 to double our number of NICs to four. Using four pass-through Ethernet modules in our blade chassis, we then cabled three of our four NICs to the Dell PowerEdge 6248 switch. If you have multiple trays of Dell EqualLogic storage broken into several groups, you may find it necessary to use virtual LAN (VLAN) functionality on your switch. Here, we assume only one tray and one server.

Below, we illustrate the exact storage layout we used. (See Figure 9.) For detailed instructions on how we configured the Dell EqualLogic storage, see [Appendix A](#).

Disk Configuration Dell PowerEdge M610 with Dell EqualLogic PS5000XV

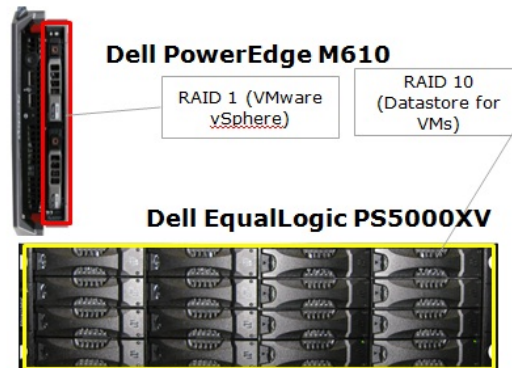


Figure 9. The physical storage configuration we used in the virtualization consolidated server in our hands-on research for this Guide.

Internal disk drives

Our Dell PowerEdge M610 server contained two drives. We configured the drives using RAID 1 for the host operating system.

Storage Switch

Our Dell PowerConnect switch had 48 ports, and we configured them to use maximum transmission unit (MTU) sizes of 9,216, the maximum, for jumbo frames. For this Guide, we used only six ports, three for the server, and three for the storage.

SAN drives

The Dell EqualLogic PS5000XV contained 16 drives, with 2 drives in spare mode, creating a total of 14 active drives. We reset the array, and created a storage group with one member and one storage pool. We set this member to have a RAID 10 policy, and for this Guide, we did not use any snapshot reserve allocations on our LUNs. Finally, we created a large external LUN that we then revealed at the host operating system for guest operating system virtual disks.

Below, we provide an overview of setting up storage on both the internal disks in the Dell PowerEdge M610 and the external Dell EqualLogic PS5000XV array. We include approximate wait times for each step. ([Appendix A](#) provides complete, detailed installation instructions.)

- 1.** Press Ctrl+R to enter the Dell PowerEdge Raid Controller utility on boot. Configure the internal drives as a RAID 1 volume and initialize the volume. (10 minutes)
- 2.** Configure the Dell EqualLogic storage group, connecting to the storage array via a serial cable. Specify the group IP address, subnet mask, and group credentials. (10 minutes)
- 3.** Cable the remaining NICs on the Dell EqualLogic PS5000XV to the storage switch. Using the Dell EqualLogic web interface, modify the IP settings for the remaining two NICs, and enable them. Configure the LUNs via the Dell EqualLogic web interface. (10 minutes)

Installing VMware ESX

We installed VMware ESX, included in VMware vSphere 4, on the Dell PowerEdge M610. This section provides an overview of the

installation. We include approximate wait times for each step. ([Appendix B](#) provides complete, detailed installation instructions.)



NOTE: Plan on at least 16 minutes for installing VMware ESX on the Dell PowerEdge M610 server. Each step below takes at least 1 minute. We provide the approximate amount of time each step takes in parentheses. These times exclude data entry time.

1. Insert the VMware vSphere DVD into the DVD drive and reboot the system. Press Enter to start the installation in graphical mode. You will see the installation initializing. (3 minutes)
2. Click Next to proceed through the Welcome screen, accept license terms, choose no loading of drivers, and enter any serial number information you have. (2 minutes)
3. Choose the configurations for your installation: networking parameters, standard or advanced setup, the location of the installation, and the date and time settings. (2 minutes)
4. Set the root password and proceed with the installation. Restart the server when the installation completes. (9 minutes, including the restart)

Configuring iSCSI inside the host

This section provides an overview of the iSCSI configuration at the host operating system level. To connect to the iSCSI storage and configure MPIO, you must configure your additional NICs. We then used the procedures Dell EqualLogic describes in “Configuring VMware vSphere software iSCSI with Dell EqualLogic PS series storage” to configure the iSCSI software initiator. Our procedures below reflect that white paper, but for full details see here: <http://www.equallogic.com/resourcecenter/assetview.aspx?id=8453>.

([Appendix C](#) provides complete, detailed installation instructions.)



NOTE: Plan on at least 18 minutes for configuring iSCSI in the host operating system on the Dell PowerEdge M610 blade server. Each step below takes at least 1 minute. We provide the approximate amount of time each step takes in parentheses. These times exclude data entry time.

1. Using our Appendix and the Dell EqualLogic whitepaper as a guide, create and execute a

shell script to create the necessary vSwitch, enable jumbo frames, create the VMkernel ports, and bind the vnic. Assign the appropriate IP addresses and subnet mask information. (8 minutes)



NOTE: You should only do this on iSCSI dedicated NICs.

2. Using the vSphere client, reconfigure the VMkernel ports to have only one active vnic per VMkernel port. (2 minutes)
3. While in the vSphere client, enable the iSCSI software initiator on the host.
4. Run additional commands at the console to bind the VMkernel ports to the iSCSI software initiator. (2 minutes)
5. Using the vSphere client, connect to the Dell EqualLogic group, and configure each path to use Round Robin access. (3 minutes)
6. Configure the external LUNs in Configuration → Storage. Create datastores, and format. (3 minutes)

Installing VMware vCenter Converter

VMware vCenter Converter overview

VMware vCenter Converter is a free software utility available via download at vmware.com that you can use to convert both Windows and Linux physical machines to virtual machines capable of running on the VMware vSphere platform. With a P2V wizard and within a few minutes, this software tool allows administrators to quickly and reliably virtualize their servers.

There are two versions of vCenter Converter available: the standalone converter and the converter integrated into vCenter Server. We used the standalone converter product for this Guide, as vCenter Server is outside the scope of this guide. Requirements for VMware vCenter Converter are relatively basic: you need a Windows XP, Vista, Server 2003, or Server 2008 machine, and approximately 1GB of disk space.

Installing VMware vCenter Converter

This section provides an overview of the installation of vCenter Converter on Windows Server 2008 R2. VMware vCenter Converter supports various levels and versions of Windows for installation. See the release notes at http://www.vmware.com/pdf/converter_standalone_guide401.pdf for more information and details.

For this Guide, we used vCenter Converter version 4.0.1 in our configuration. For complete details of the installation of vCenter Converter, see [Appendix D](#).



NOTE: We installed vCenter Converter from the download available at <http://www.vmware.com/products/converter/overview.html>

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Plan on just 5 minutes for installing the vCenter Converter standalone software. Each step below takes at least 1 minute. We provide the approximate amount of time each step takes in parentheses. These times exclude data entry time.

1. Accept the license terms, choose a folder location, and choose local or client-server installation. We kept the default of local installation. (1 minute)
2. Click Install. When the installation is complete, click Finish to close the installer. (4 minutes)

Performing the P2V operation

In this section, we review the process of performing a P2V conversion. In our example, we convert a legacy HP ProLiant DL385 running Windows Server 2003 x64 R2 Enterprise Edition to a guest on our VMware ESX host, the Dell PowerEdge M610 with Dell EqualLogic storage. VMware vCenter Converter supports hot cloning, where the source physical machine stays connected and online during the cloning process. We show the hot cloning process in this guide.

Below, we give overview steps on performing your P2V conversion. In our example, we perform a hot-clone conversion, where the physical server remained powered on throughout the process. Our P2V conversion of our legacy HP ProLiant DL385 with a 30GB

operating system volume took approximately 11 minutes. The system spent the majority of this time creating the virtual disk and copying the drive's data. Your time will vary based on size and type of data transmitted. For complete details of the P2V process, see [Appendix E](#).

- 1.** To prevent data corruption, shut down necessary services on the source physical machine, such as Microsoft Exchange or Microsoft SQL Server. Optionally, modify any static IP address to use DHCP just before conversion.
- 2.** Open the VMware vCenter Converter standalone client, and choose to Convert a machine.
- 3.** Specify the source machine and the proper credentials. vCenter Converter will install an agent on the source machine in order to perform the conversion.
- 4.** Specify the destination host and connection details.
- 5.** Configure basic VM details, such as the VM name, datastore to place the files, and the virtual machine hardware version.
- 6.** Customize the conversion process as necessary. You can choose how many NICs to connect, which volumes to copy, whether VMware tools are automatically installed, and so on. (See Figure 10.)

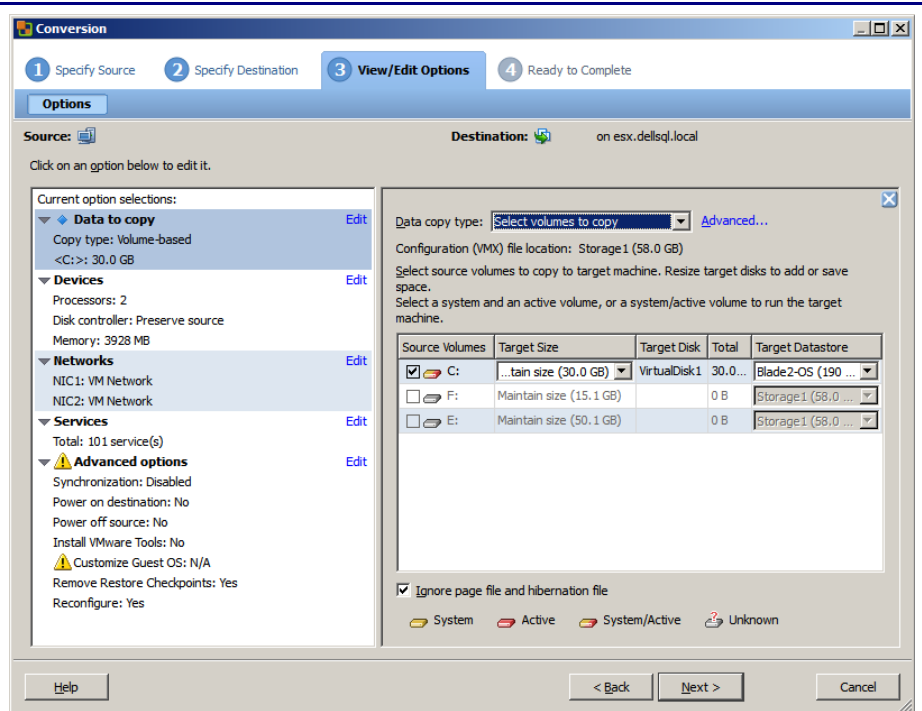


Figure 10. Configuring the new VM in the conversion wizard.

7. Finalize your configuration of the new VM, and click Create to perform the P2V operation. (11 minutes with our 30GB OS volume; times will vary based on drive sizes)

Performing post-P2V tasks

After your P2V conversion is complete, take precautionary steps to ensure all applications, service, network configuration, and any other configurations are complete and operable. Things you may want to verify include the following:

- **Security identifiers (SIDs).** Because the new VM is completely identical to the source machine, you will have conflicts on your network and domain if both the source physical machine and the new virtual machine are both powered on, since both machines will have identical SIDs, unique identifiers assigned to every machine in a Windows domain. The P2V process we outline here assumes immediate reprovisioning of the legacy server, or at a minimum, removal from the network.

- **MAC addresses, DNS, and other networking issues.** If your application uses machine specific MAC address information, you may experience issues. Also, you should verify your IP addresses on your new VM, and if you changed the IP address to use DHCP prior to the conversion, you should now change it back to static IP addressing.
- **VMware Tools.** Ensure the vCenter Converter conversion wizard installed the VMware tools. If VMware tools are not installed on the VM, you may experience sluggish performance. If you are unsure, simply reinstall VMware tools on the virtual machine.
- **Storage addition.** Configure and provision extra storage as needed for the new VM, as your virtual infrastructure is likely utilizing a more modern storage subsystem, such as a storage area network (SAN). Your legacy application and database servers may have long since needed upgrades to their storage subsystems. Now virtualized, you can quickly and easily add storage at will, with little to no downtime.

Summing up

As this Guide has explained, the process of consolidating your servers to a virtual environment on a Dell PowerEdge M610 Server with Intel Xeon processor 5500 series running VMware vSphere is relatively straightforward; you can perform a basic installation and convert physical machines to virtual in a couple of hours. We still recommend, however, that you first invest ample time in the pre-conversion planning phase. Doing so can help you avoid potential problems and help ensure a smooth conversion.

Appendix A. Configuring the storage

Configure your internal storage on the Dell PowerEdge M610 and the external storage iSCSI group on the Dell EqualLogic storage array by following these steps.

To complete the configuration of the internal storage, iSCSI storage, and switch, allow 35 minutes.

Configuring the internal storage

Perform the initial configuration of the internal storage on the PowerEdge M610 server by following these steps. Allow approximately 10 minutes for configuring the internal storage.

1. Turn on the server.
2. During the boot sequence, you will see the message "Press <Ctrl><R> to Run Configuration Utility." Press <Ctrl><R>.



NOTE: You have only a few seconds to complete Step 2.

3. Configure the RAID 1 for the host OS. Select the controller for the internal drives, which is the PERC 6/i, and press Enter.
4. While Controller 0 is highlighted, press F2, and select Create New VD.
5. With the RAID level field highlighted, press Enter to open the drop-down list, and select RAID 1.
6. Using the Tab key to navigate, move to the Physical Disks section, and use the space bar to select the two internal drives (Drives 0 and 1). Then tab to highlight OK, and press Enter.
7. A message box appears telling you that initializing the RAID is highly recommended, but destructive. Press Enter to clear the message.
8. Highlight Virtual Disk 0, and press F2.
9. Select Initialization, press Enter, and select Start Init. When the system prompts you with any warnings, highlight OK, and press Enter.
10. Wait for the initialization to complete, exit the RAID utility, and reboot the server. (10 minutes)

Configuring the Dell EqualLogic PS5000XV and Dell PowerConnect 6248 switch

Perform the initial configuration on the Dell EqualLogic PS5000XV by following these steps. Allow approximately 15 minutes for configuring the Dell EqualLogic PS5000XV and 10 minutes for configuring the Dell PowerConnect 6248 switch.

- 1.** Connect a serial cable from a workstation to the Dell EqualLogic storage. Configure your serial client (e.g., PuTTY <http://www.putty.org>) to use the COM port designated by your machine.
- 2.** Cable eth0 on the Dell EqualLogic PS5000XV to the switch.
- 3.** Power on the storage array.
- 4.** When the application prompts you if you would like to configure the array, choose Yes.
- 5.** When the application prompts you for an IP address for eth0, enter a valid IP address.
- 6.** When the application prompts you for a subnet mask for eth0, enter a valid subnet mask.
- 7.** When the application prompts you if you want to configure a new group, select Yes.
- 8.** Enter the group IP address and the group name.
- 9.** Enter password information as requested by the configuration wizard.
- 10.** When the configuration is complete, disconnect the serial cable.
- 11.** Connect an Ethernet cable from the workstation to the switch, and configure the workstation IP address to be on the same subnet as the storage array.
- 12.** Open Internet Explorer, and browse to the group IP address you designated in Step 8.
- 13.** Enter the user and password.
- 14.** Click the member, accept the warnings about the member not being configured, and choose to configure it.
- 15.** Choose RAID 10 as the raid policy, and leave the default storage pool.
- 16.** Click the member once more, and click the Network tab.
- 17.** Set the IP address for the remaining two NICs.
- 18.** Right-click each offline NIC and bring each online.

- 19.** Right-click volumes, and choose new volume.
- 20.** Enter details about the volume, such as size, snapshot reserve, and so on. Click No access, and enable multiple initiators connection on the final configuration screen.
- 21.** Click the volume, and choose the Access tab.
- 22.** Click Add and click OK to add access for the host operating system.
- 23.** Follow the steps specified by Dell support to enable maximum frame size above 9000 for jumbo frames on the PowerConnect switch:
<http://support.dell.com/support/edocs/network/pc62xx/en/UG/HTML/configud.htm#wp1309021>.
- 24.** Open the Port Configuration page.
- 25.** Click Show All. The Port Configuration Table appears.
- 26.** Specify the Unit and Port you are copying from in Copy Parameters From.
- 27.** Click Copy To for each Port to receive these parameters.
- 28.** Click Apply Changes. The application copies the Port Configuration settings and updates the device.
- 29.** Copy the running configuration to the startup configuration by choosing the Copy Files page.
- 30.** Select Copy Configuration.
- 31.** Choose Running Configuration as the Source and Startup Configuration as the Destination.
- 32.** Click Apply Changes. Now your switch settings will persist on reboots.

Appendix B. Installing the VMware ESX hypervisor on the VMware vSphere host

Install VMware ESX Server by following these steps. To complete the installation of VMware ESX, allow 15 minutes on the Dell PowerEdge M610.

- 1.** Connect an external DVD drive to the server, insert the VMware vSphere DVD into the DVD drive, and reboot the system.
- 2.** During the boot, press F2 to enter setup.
- 3.** In setup, scroll down to CPU Information, and press Enter.
- 4.** Enable Virtualization Technology, if necessary.
- 5.** After you have checked the BIOS settings, press Escape to continue the boot. (2 minutes)
- 6.** To start the installation in graphical mode, press Enter when the boot prompts you.
- 7.** Click Next on the Welcome screen, and accept the terms of the license agreement.
- 8.** Accept the default keyboard layout, then if the application prompts you regarding custom drivers, press No, and press Yes to proceed.
- 9.** Enter your serial number information.
- 10.** Configure your NIC parameters. Remember to use only non-iSCSI NICs for system tasks. Set the IP address, and set the subnet mask.
- 11.** Choose the standard setup, and select the appropriate location for the installation. Accept any warnings regarding data loss.
- 12.** Set the date and time.
- 13.** Assign the root password, and optionally create additional users.
- 14.** Click Next on the summary screen to complete the installation. (8 minutes)
- 15.** Restart the server when the installation is complete. (3 minutes)

Installing the vSphere client on a management workstation

To perform various maintenance on your VMware vSphere host machine, it is necessary to connect via the vSphere client software. Follow the steps below to install vSphere on a management

workstation. Allow approximately 5 minutes to install the vSphere client.

- 1.** Configure your management workstation to be on the same subnet as your vSphere host. In Internet Explorer, navigate to the IP address of your vSphere host.
- 2.** Accept certificate warnings, and continue.
- 3.** Click vSphere to download the vSphere client.
- 4.** Choose Run to install.
- 5.** Choose your language, and click OK.
- 6.** On the Welcome screen, click Next.
- 7.** Accept the license terms, and click Next.
- 8.** Enter user and organization details, and click Next.
- 9.** Optionally, click the checkbox to install the update utility. Click Next.
- 10.** On the Destination Folder screen, click Next.
- 11.** Click Install.
- 12.** Click OK.

Appendix C. Configuring iSCSI and creating datastores in the host operating system

Configuring the iSCSI initiator

Configure iSCSI in the host operating system by following these steps. We provide approximate times for each step where the times are greater than 1 minute.



NOTE: We followed procedures from the whitepaper titled "Configuring VMware vSphere software iSCSI initiator with Dell EqualLogic PS Series Storage," located here: <http://www.equallogic.com/resourcecenter/assetview.aspx?id=8453>.

To complete the configuration of iSCSI in VMware vSphere, allow 18 minutes.

1. Log into the console.
2. Create the following shell script, and execute it to do the following: create a new vSwitch, enable jumbo frames, create the necessary VMkernel ports, apply them to the iSCSI vSwitch, attach physical NICs to the vSwitch, and bind the vmnics to the VMkernel ports.



NOTE: We used only one vSwitch for iSCSI traffic, and we had three physical NICs available for iSCSI. Your configuration may differ.

```
echo "Creating new vSwitch and enabling jumbo frames"
#create a new vSwitch for iSCSI
esxcfg-vswitch -a vSwitch1
#enable jumbo frames on the iSCSI vSwitch
esxcfg-vswitch -m 9000 vSwitch1

echo "Creating VMkernel Ports"
#create a vmk port and put them on the iSCSI vSwitch
esxcfg-vswitch -A iSCSI1 vSwitch1
#assign the IP for your iSCSI network to each vmk port
esxcfg-vmknic -a -i 192.168.1.5 -n 255.255.255.0 -m 9000
iSCSI1

#create a vmk port and put them on the iSCSI vSwitch
esxcfg-vswitch -A iSCSI2 vSwitch1
#assign the IP for your iSCSI network to each vmk port
```

```
esxcfg-vmknic -a -i 192.168.1.6 -n 255.255.255.0 -m 9000
iSCSI2

#create a vmk port and put them on the iSCSI vSwitch
esxcfg-vswitch -A iSCSI3 vSwitch1
#assign the IP for your iSCSI network to each vmk port
esxcfg-vmknic -a -i 192.168.1.7 -n 255.255.255.0 -m 9000
iSCSI3

echo "Attaching NICs to vSwitch"
#assign the physical nics to the iSCSI vSwitch
esxcfg-vswitch -L vmnic1 vSwitch1
esxcfg-vswitch -L vmnic2 vSwitch1
esxcfg-vswitch -L vmnic3 vSwitch1

echo "Binding vmnics to VMkernel Ports"
esxcfg-vswitch -p iSCSI1 -N vmnic1 vSwitch1
esxcfg-vswitch -p iSCSI2 -N vmnic2 vSwitch1
esxcfg-vswitch -p iSCSI3 -N vmnic3 vSwitch1
```

- 3.** Log into the vSphere client.
- 4.** Click the Configuration tab, and click Networking.
- 5.** On the iSCSI vSwitch, click Properties.
- 6.** Click the first VMkernel port, and click Edit.
- 7.** Click the NIC teaming tab.
- 8.** Select the checkbox to Override vSwitch Failover Order.
- 9.** Move the vmnic you wish to pair with this VMkernel port to the Active area, and move other vmnics to the unused category. Apply the changes.
- 10.** Repeat steps 6 through 9 for the remaining VMkernel ports.
- 11.** To enable the iSCSI software initiator, click Configuration, Storage Adapters.
- 12.** Select the iSCSI initiator, and click Properties.
- 13.** Click the General tab, and click Configure.
- 14.** Select the checkbox to enable iSCSI on the host.
- 15.** At the console, run the following commands to bind the VMkernel ports to the iSCSI software initiator.



NOTE: These VMkernel numbers and HBA numbers were specific to our environment. Yours may need to change.

```
esxcli swiscsi nic add -n vmk0 -d vmhba32
esxcli swiscsi nic add -n vmk1 -d vmhba32
esxcli swiscsi nic add -n vmk2 -d vmhba32
```

- 16.**In vSphere, to connect to the Dell EqualLogic storage, click Configuration, and click Storage Adapters.
- 17.**Click the iSCSI software adapter, and click Properties.
- 18.**Click the Dynamic Discovery tab.
- 19.**Click Add.
- 20.**Enter the Dell EqualLogic group IP address, and click OK.
- 21.**Right-click the LUN, and choose Manage Paths.
- 22.**Select Round Robin from the drop down, and click OK.

Configuring the datastores on the iSCSI external storage

- 1.** In vSphere, click the Configuration tab.
- 2.** In the Hardware pane, click Storage.
- 3.** Click Add Storage...
- 4.** Choose Disk/LUN. Click Next.
- 5.** Select the appropriate LUN. Click Next.
- 6.** Click Next.
- 7.** Enter a name for the datastore. Click Next.
- 8.** Click Next to accept the defaults for block size.
- 9.** Click Finish to complete the addition of the LUN.

Appendix D. Installing VMware vCenter Converter

Follow the steps below to install VMware vCenter Converter on a separate system. We assume that you have installed Windows Server 2008 R2. We provide approximate times for each step where the times are greater than one minute.

Allow at least 5 minutes for installing VMware vCenter Converter standalone.

- 1.** Download the latest version of VMware vCenter Converter Standalone Client from <http://www.vmware.com/download/converter/>.
- 2.** Double-click the setup file to execute.
- 3.** At the Welcome screen, click Next.
- 4.** Accept the license agreement, and click Next.
- 5.** Accept the default destination folder, and click Next.
- 6.** Select Local installation, and click Next.
- 7.** Click Install to begin the installation.
- 8.** Check the box next to Run Converter Standalone Client, and click Finish.

Appendix E. Performing the physical to virtual (P2V) conversion

Follow the steps below to perform the P2V conversion for your legacy system to your new VMware ESX host using VMware vCenter Converter. We provide approximate times for each step where the times are greater than one minute.

Allow at least 15 minutes for performing the P2V conversion. Note that your conversion time may be much longer if your source machine has large partitions that you are transferring.

- 1.** Open VMware vCenter Converter Standalone Client.
- 2.** In the upper left-hand corner, click Convert Machine.
- 3.** At the Machine Type screen, enter the appropriate information for the machine you wish to convert, and click Next.
- 4.** VMware needs to install vCenter Converter Standalone Agent on the source machine to complete the conversion. Set it to Automatically or Manually uninstall the Agent, and click Yes. VMware will then begin to deploy the agent.
- 5.** At the Destination Type screen, enter the appropriate information for the destination machine, and click Next.
- 6.** At the Host/Resource screen, enter the appropriate Virtual machine name, choose a Datastore, and choose a Virtual Machine Version; and click Next.
- 7.** At the View/Edit Options screen, resolve any errors, and ensure that you have configured all settings correctly. Click Next.
- 8.** Click Finish to begin the conversion.
- 9.** The task will then appear listed in the main window of the Converter. A progress bar will appear in the status column and an update log of current tasks will appear in the lower right-hand corner of the window. (11 minutes)
- 10.** Once the conversion is completed, the application will give the task a status of Completed with a checkmark.

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