Replace **3** 32-bit servers with **1** Dell™ PowerEdge™ R710 64-bit server

Email

Database

Active Directory

VM   VM   VM
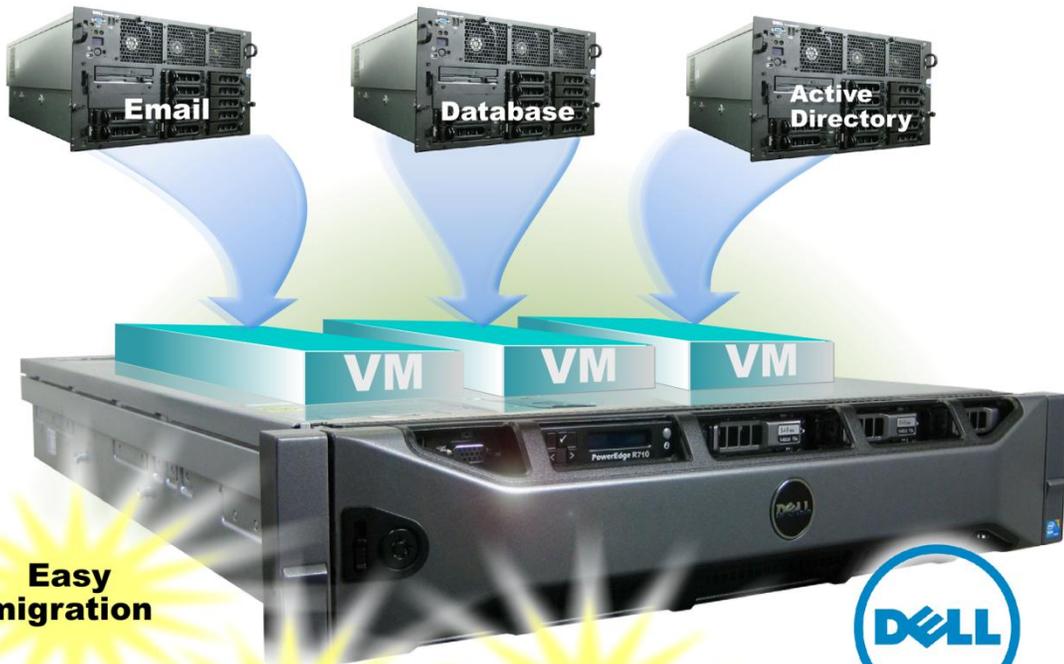
PowerEdge R710

Easy migration

Better performance

80% less power

DELL

With Microsoft® Windows Server® 2008 R2 and Hyper-V™

Principled Technologies®

A migration guide commissioned by Dell Inc.

Table of Contents

Dell and Microsoft simplify the move from 32-bit to 64-bit platforms

In today's business environment, organizations may stay with 32-bit computing to avoid what they perceive to be the risks of upgrading their applications to 64-bit platforms. As this Principled Technologies (PT) study and the related performance study[1] show, however, you can make the move to 64-bit computing today without changing your applications—and gain performance headroom and reduce energy costs! Dell 64-bit servers running Microsoft Windows Server 2008 R2 let you take advantage of the performance and power of 64-bit computing without having to upgrade your applications. Microsoft's virtualization technologies let you consolidate multiple existing 32-bit older servers into virtual machines on a new Dell server. They can move 32-bit applications to the new platform unaltered; the entire 32-bit server simply becomes a virtual machine in the new environment. Such a move lets you reduce power usage and save space while positioning you to move to 64-bit applications when the time is right.

This Guide demonstrates how easy Dell and Microsoft make the move to 64-bit computing. We not only introduce the Microsoft tools and Dell servers that help make the transition easy, we also perform an actual hands-on migration of three existing servers: an Active Directory domain controller, a server running Microsoft SQL Server® 2005, and a server running Microsoft Exchange Server 2003.[2]

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[1] Performance: 32-bit to 64-bit server transition
http://www.principledtechnologies.com/clients/reports/Dell/32to64performance0410.pdf

[2] We chose to virtualize Microsoft Exchange Server 2003 because it is a common legacy email solution. Microsoft does not officially support virtualizing Exchange Server 2003 with Hyper-V, but in our hands-on work the virtualization worked without a problem.

In our companion performance report, available at http://www.principledtechnologies.com/clients/reports/Dell/32to64perfor mance 0410.pdf, we measure the performance gains and power savings from this actual migration. This companion report proves that the transition to a 64-bit Dell PowerEdge R710 can yield tangible performance benefits, more efficient power usage, and greater CPU headroom.

NOTE

Those with more complex configurations, special requirements, or the desire to avoid doing the migration themselves may wish to investigate the consulting services Microsoft and Dell offer.

Dell and Microsoft simplify the move from 32-bit to 64-bit platforms

Dell and Microsoft combine server and software technologies to make consolidating from 32-bit to 64-bit platforms simple and successful. Microsoft has created the System Center Virtual Machine Manager 2008 R2 (SCVMM), which can automatically transition your 32-bit servers to a new Dell PowerEdge R710 running 64-bit Windows Server 2008 R2 with Hyper-V. SCVMM uses physical-to-virtual (P2V) automation to convert the older systems to virtual machines effortlessly and with minimal downtime. In this section, we detail the characteristics of the 64-bit Dell PowerEdge R710 as well as the virtualization features of Microsoft Windows Server 2008 R2.

The Dell PowerEdge R710; 64-bit power

The Dell PowerEdge R710 we tested for this Guide is a high-performance server that can readily support significant consolidation. The Dell PowerEdge R710 offers many new features for maximizing performance on virtualized applications and for minimizing operational expenses, including the following:

64-bit computing with large RAM capacities
The Dell PowerEdge R710 allows for up to 144 GB of RAM via its 18 DIMM slots, which accept any of the following sizes of DDR3 RAM: 1GB, 2GB, 4GB, or 8GB. These amounts of memory, along with the 64-bit Windows software platform, allow you to virtualize multiple servers in a single machine.

Power
The Dell PowerEdge R710 includes enhancements that let it use less energy than many older servers do. When you consolidate many legacy servers onto a Dell PowerEdge R710, the potential power savings are dramatic. In our companion performance report listed above, we saw power savings of up to 80 percent.

Processors
The Dell PowerEdge R710 uses the Intel Xeon Processor 5500 series. These processors automatically adjust their speed and energy usage to meet the requirements of your applications, improving performance and saving power. Combined with support for ever-increasing amounts of memory, the

Intel Xeon Processor 5500 series makes the Dell PowerEdge R710 an excellent virtualization platform.

Management
The Dell PowerEdge R710, like all late-model Dell servers, comes with the Dell Lifecycle Controller. This tool simplifies management by providing a single interface for management functions and by storing critical information in the system itself. There are no CDs or USB keys to keep track of for drivers or firmware. In addition, you can use the Lifecycle Controller in conjunction with Microsoft System Center Configuration Manager 2007 to streamline remote operating system deployments. More information on the Dell Lifecycle controller is located at: http://www.delltechcenter.com/page/Lifecycle+Controller.

Windows Server 2008 R2 and Hyper-V

Microsoft enables server consolidation through virtualization with its hypervisor, Hyper-V. Hyper-V is included in the Standard, Datacenter, and Enterprise editions of Windows Server 2008 R2. Hyper-V 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 Hyper-V
The Dell PowerEdge R710 supports the features Hyper-V requires, which include the following:
- A compatible 64-bit processor
- Hardware Data Execution Protection (DEP) enabled
- Hardware-assisted virtualization, specifically processors that include the Intel-VT or AMD-V features.

Features of Hyper-V
With the release of Windows Server 2008 R2, Hyper-V includes some improved and enhanced features. Below, we list some of Hyper-V's noteworthy new features.

Live migration. Hyper-V lets you migrate running virtual machines with no downtime. This gives organizations 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 gives system administrators the flexibility to implement system maintenance as needed on physical hosts, without interrupting client services.

Processor compatibility mode. When implementing live migration, migrating VMs across different CPU versions becomes seamless with Hyper-V's processor compatibility mode. This allows an administrator to migrate VMs from host to host as long as the hosts' processors are within the same family.

Cluster Shared Volumes. Hyper-V leverages Cluster Shared Volumes (CSV) to make storage more flexible, especially as it relates to clusters. Using CSV, multiple servers can access the same logical unit numbers (LUNs) on a storage area network (SAN), enhancing the speed of live migration.

Hot-add storage. Hyper-V's hot-add storage feature lets you add storage in the form of both virtual hard disks (VHDs) and pass-through disks while a VM is up and running. With this enhanced feature, virtualization managers can work with storage administrators to quickly provision new storage based on application and business needs, with no interruption of service.

More efficient use of power. With the Core Parking features of Windows Server 2008 R2 and the support of Second Level Address Translation (SLAT), Hyper-V allows organizations to save energy costs by automatically "parking" or shutting down processing cores to save power.

Resource allocation in Hyper-V

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

Memory allocation. Hyper-V manager allows you to adjust the memory allocated to virtual machines. On the Dell PowerEdge R710 with 24 GB of RAM, you can assign from 8 MB of RAM to nearly 24 GB of RAM to a virtual machine. You can use this feature to provision additional RAM easily to new VMs as needed after a migration or during a heavy workload period.

CPU allocation. You can assign one or more virtual processors to a virtual machine and then use more granular resource controls to allocate and balance CPU resources amongst multiple VMs. Figure 1 shows the Hyper-V manager settings for the virtual CPUs. You can set the number of virtual CPUs. Additionally, you can reserve a percentage of the physical CPU by setting the VM reserve percentage (minimum). You can also cap the amount of CPU available to the VM by setting the VM limit percentage (maximum). Lastly, you can use the relative weight value to prioritize certain VMs over others.

NOTE

You can assign a maximum of four virtual CPUs to a VM. However, not all guest OSs support four virtual CPUs.
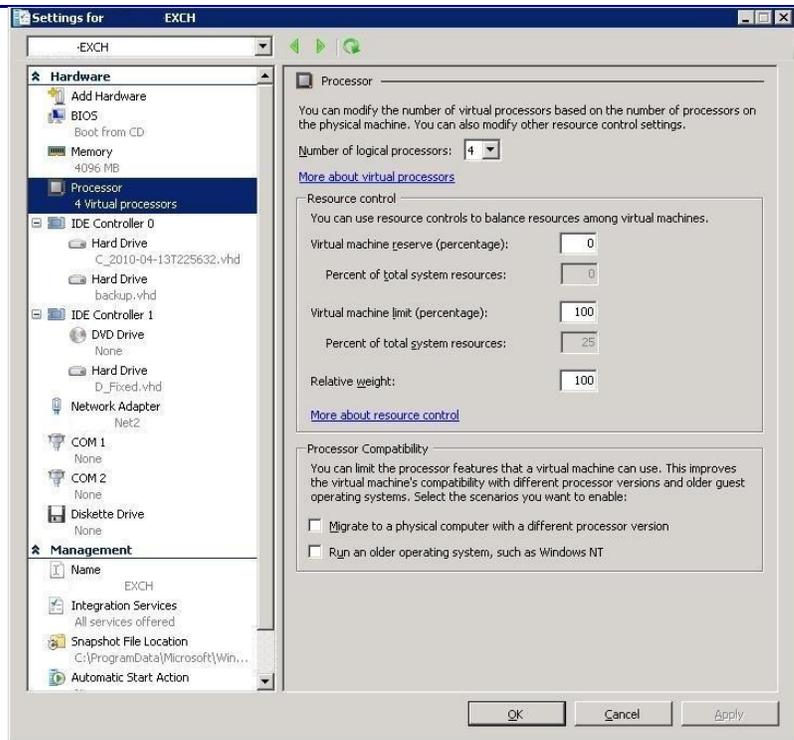
Figure 1. CPU settings for a sample virtual machine in Hyper-V Manager.

Monitoring and tuning Hyper-V

When you install the Hyper-V role in Windows Server 2008 R2, the installation automatically creates Hyper-V-specific performance monitor counters. You can use these to monitor your VM resource utilization, and then adjust your resource controls as necessary.

Two sample counter sets are as follows:

Hyper-V Hypervisor Logical Processor counters. This set of counters contains information regarding the logical processors in your system. For our systems, the number of logical processors is equal to the number of processor cores. Because we are using dual Quad-Core Intel Xeon Processor X5570s with Hyper-Threading, we have 16 logical processors.

Hyper-V Hypervisor Virtual Processor counters. This set of counters contains information regarding the virtual processors specific to each virtual machine in your system.

Regarding storage, Microsoft Windows Server 2008 R2 now improves fixed-size virtual hard disk performance to equal that of pass-through disks. However, VHD storage provides the most flexibility when migrating from host to host and working with both live migration and SCVMM. Choose your storage layout carefully when designing your new virtualized environment, as this can directly affect performance and future flexibility.

NOTE Hyper-V requires that the operating system's VHD be on the virtual IDE controller.

We show you how: Planning the migration

This section reviews some of the topics you should consider prior to migrating your platform and any applications.

Evaluating 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. Doing this serves two purposes. First, it provides a prime opportunity to identify potential problems before you move to a Hyper-V 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 Hyper-V virtual machine memory and processor settings.

SCVMM P2V conversion options

SCVMM allows two options for performing your P2V conversion: online and offline. In an online conversion, SCVMM creates a point-in-time copy of local NTFS volumes and data if the applications are Volume Shadow Copy Service (VSS)-aware.[3] Using an online conversion will result in minimal downtime, but does offer the small potential for data loss. Offline conversions, on the other hand, boot the source machine into WinPE and produce a consistent image of the source machine, transfer that image to the virtual machine, and cleanly transition the machine.
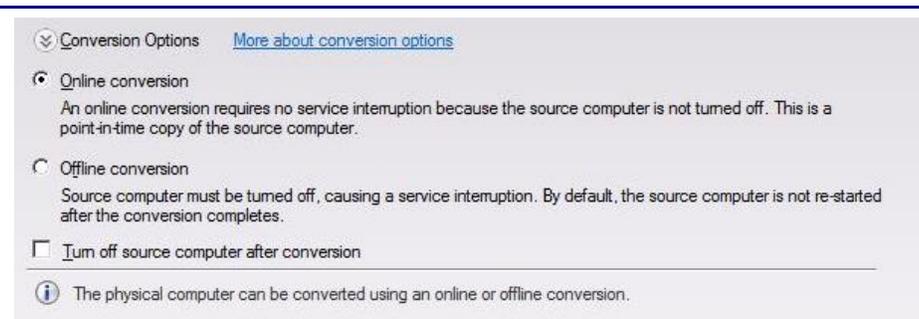
Figure 2. Machine conversion options during the P2V process.

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[3] For more information, see http://technet.microsoft.com/en-us/library/dd221390.aspx.

Application-specific considerations

You should study and analyze the requirements of each physical server and its role in your organization prior to converting to virtual machines. Below, we offer some brief recommendations and considerations for the three applications that we performed P2V operations on as part of this Guide and in our companion performance report. Each environment, application, and set of user requirements is different, so thoroughly evaluate your specific requirements prior to migration.

Active Directory considerations

Conversion window and backup. As with any migration, plan maintenance windows accordingly and perform sufficient backup procedures.

Use offline conversion only. Microsoft recommends using only the offline P2V conversion method for Active Directory domain controllers. This keeps all directory data consistent as the machine is converted from a physical to a virtual state.

Use multiple domain controllers. You should also follow Microsoft's recommendations in having multiple domain controllers. While your Active Directory domain controller is offline during the conversion, the secondary domain controller will be able to service requests for your environment. In our environment, we followed documented best practices and configured a second physical domain controller on our network.

Reallocate resources after the transition. In some environments, legacy Active Directory servers are often underutilized from a CPU and RAM resource perspective. If your current utilization is low on the physical legacy servers, you can adjust the number of logical processors and the amount of RAM in the virtual machine configuration downward, providing the same level of performance to your users, while conserving power and performance for other virtual machines.

Microsoft SQL Server considerations

Conversion window and backup. As with any migration, plan maintenance windows accordingly and perform sufficient backup procedures.

Offline or online conversion. The offline conversion method is not required for SQL Server, but, as Microsoft states, it provides for greater data integrity during your conversion. In our lab environment, we chose the default online conversion method, but stopped the SQL Server services prior to migrating. Your maintenance window and user workload will dictate the conversion method you choose.

Reallocate CPU and RAM resources. The virtualized environment offers great flexibility in adjusting hardware resources with minimal downtime and effort. If your SQL Server applications have long needed a memory boost, you can now easily add RAM to your virtual machine after conversion. In our test lab for our performance report, we adjusted the available RAM from 4

GB in our legacy server to 10 GB in our new virtual machine. Although the guest VM still runs 32-bit Windows Server 2003, we used Physical Address Extensions (PAE) and Address Windows Extensions (AWE) to provide more RAM to our SQL Server applications.

Evaluate Disk I/O needs. SQL Server is known for its heavy disk I/O requirements. Depending on your environment, you may choose to isolate the SQL Server VM's VHD files on its own physical disk subsystem. For this Guide and for the accompanying performance report,[4] we created a distinct physical volume for SQL Server data.

Microsoft Exchange Server considerations

Conversion window and backup. As with any migration, plan maintenance windows accordingly and perform sufficient backup procedures.

Offline or online conversion. The offline conversion method is not required for Microsoft Exchange 2003, but, as Microsoft states, it provides for greater data integrity during your conversion. In our lab environment, we chose the default online conversion method, but stopped the relevant Exchange services prior to migrating. Your maintenance window and user workload will dictate the conversion method you must choose.

Evaluate Disk I/O needs. Like SQL Server, Exchange is known for its heavy disk I/O requirements. Depending on your environment, you may choose to isolate the Exchange VM's VHD files on its own physical disk subsystem. For this Guide and for the accompanying performance report,[5] we created a distinct physical volume for Exchange data.

Storage considerations

Hyper-V storage options

The Hyper-V environment offers three options for storage: pass-through disks, fixed-size VHDs, and dynamically sized VHDs. Both pass-through disks and fixed-size VHDs perform at near bare metal speeds in Windows Server 2008 R2. If you have storage management software that needs to access the disks directly, pass-through disks may be the best option. However, pass-through disks require you to allocate a dedicated disk to a virtual machine, making pass-through disks less flexible. VHDs are more flexible when working with other features such as live migration and do not require dedicating a complete LUN to a VM. The default option when performing a P2V migration, such as the one we exhibit in this Guide, is to use a dynamically sized VHD file, as we did for this Guide. For heavy I/O

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[4] Performance: 32-bit to 64-bit server transition
http://www.principledtechnologies.com/clients/reports/Dell/32to64performance 0410.pdf
[5] *Ibid.*

workloads, you can later convert the dynamically sized disk VHD to a fixed-size disk VHD using SCVMM or Hyper-V Manager.

Hyper-V offers flexible enterprise-ready storage configurations and capacities. For instance, VHD capacities go up to 2TB, Fibre Channel and iSCSI are supported and high-availability options are built-in. In addition, hot-add VHD storage allows for flexible provisioning.

P2V storage considerations

When transitioning from your legacy servers using the P2V functionality in SCVMM, you must consider the originating partition size on the legacy servers, as it cannot be downsized as part of the P2V conversion. You must ensure your storage is adequate to accommodate the current size of your partitions.

Additionally, your choice of dynamically sized or fixed-sized VHD files during the P2V process will dictate the time necessary for your P2V transition. Choosing to move your volumes to fixed-sized VHD files will take significantly longer than moving to dynamically sized VHD files, depending on the volume size.

We show you how: Preparing for migration – OS installation

Installing Windows Server 2008 R2

This section provides an overview of the Windows Server 2008 R2 installation process on the Dell PowerEdge R710. (Appendix A provides complete, detailed installation instructions.)

NOTE

Plan on around 30 minutes for installing Windows Server 2008 R2 Enterprise Edition on the Dell PowerEdge R710 server. The time to install updates will increase over time as Microsoft releases OS updates for Windows Server 2008 R2.

1. Insert the Microsoft Windows Server 2008 R2 Enterprise Edition DVD into the DVD drive and reboot the system. If a message appears telling you to press any key to boot from CD or DVD, do so. During the boot, a message that Windows is loading files appears, followed by a Windows booting loading bar.
2. For Hyper-V, you must install Standard, Datacenter, or Enterprise Edition. We chose Enterprise Edition. Accept the license terms, proceed with the installation, and enter the information the installation software requires.
3. Set your password; enter configuration information, including the public IP address and domain information; and reboot the system.
4. Download and install updates. (Download times will vary based on number and size of updates.)

Installing the Hyper-V role

Enabling Hyper-V on your Windows Server 2008 R2 installation is very straightforward, requiring just a few short steps. We provide detailed instructions in Appendix B.

1. Click Start, and click Server Manager. Click Roles, and choose Add Roles.
2. Click Hyper-V. (See Figure 3.) Configure your networking as you desire, and proceed to install the Hyper-V role.
3. The installation requires one or more reboots upon completion, after which the Hyper-V role finishes installing.
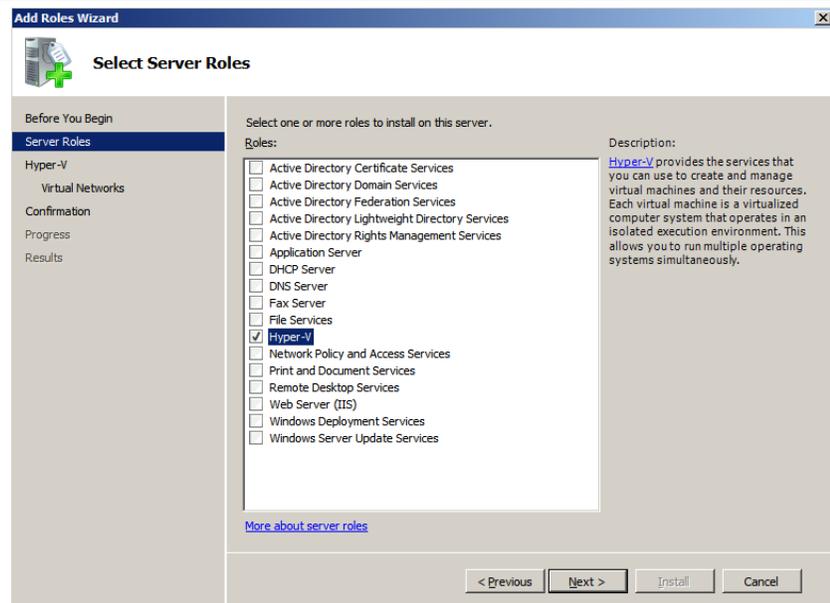
Figure 3. Installing the Hyper-V role in Windows Server 2008 R2.

Creating the Virtual Machine for SCVMM

SCVMM requires a machine on which to run its services. We chose to virtualize this machine on our new Hyper-V platform. Here, we provide an overview of the steps required to create your first virtual machine using Hyper-V Manager. For detailed steps on this process, see Appendix C.

1. Click Start, Administrative Tools, and click Hyper-V Manager.
2. Create a new VM, assigning just one virtual processor, 2GB of RAM, and create a 30GB VHD for the operating system to be installed on.
3. Insert the Windows Server 2008 R2 installation media, and attach the physical media to the VM.
4. Start the VM and install Windows Server 2008 R2, which will require several reboots of the VM.

We show you how: SCVMM 2008 R2 installation

SCVMM 2008 R2 overview

System Center Virtual Machine Manager (SCVMM) is Microsoft's enterprise-level offering in virtual machine management. SCVMM lets administrators manage virtual machines and hosts across the enterprise, including previous-generation Microsoft Virtual Server products and VMware vSphere™ products. Along with the P2V features we explore in this Guide, SCVMM has many other features that help organizations in their consolidation efforts, such as rich Windows PowerShell™ capabilities, host analysis prior to VM provisioning, P2V and virtual-to-virtual (V2V) conversions, and integration with Microsoft System Center Operations Manager for resource optimization and management.

All SCVMM implementations, no matter how simple or complex, require the following components: VMM server and default library server, VMM database running on SQL Server 2005 or 2008, VMM Administrator Console, and the virtual machine host. In this Guide, we installed all VMM components on our new virtual machine, and our physical host was the Dell PowerEdge R710 server. For simplicity, we chose a stand-alone configuration of SCVMM, although Microsoft allows for flexibility in scaling out for configuring more complex environments.

NOTE

Microsoft licenses SCVMM in both Enterprise and Workgroup Editions. In our case, with only one Hyper-V host machine, the Workgroup Edition was sufficient. Your licensing situation may vary.

SCVMM 2008 R2 prerequisites

SCVMM requires multiple prerequisites for proper operation. In this section, we discuss the steps necessary to install and configure these prerequisites so that P2V conversions are possible. We discuss the detailed steps for setting up SCVMM prerequisites in Appendix D.

NOTE

Plan on at least 45 minutes for configuring prerequisites for the SCVMM server.

1. Join the SCVMM virtual machine to your domain. Consult your domain administrator for appropriate credentials. Restart the virtual machine when Windows prompts you to do so.
2. Configure the roles and services on your virtual machine to match the requirements published in the SCVMM documentation. These include some IIS requirements and some .NET components.
3. Run the Virtual Machine Manager Configuration Analyzer (VMMCA) to ensure your virtual machine meets all prerequisite requirements.

After you have installed all prerequisites for SCVMM on the virtual machine, you may proceed with the installation of SCVMM. For this Guide, we used SCVMM 2008 R2 in a stand-alone configuration. For complete details of the installation of SCVMM, see Appendix D.

We installed SCVMM 2008 R2 from the download available at http://www.microsoft.com/systemcenter/en/us/virtual-machine-manager/vmm-try-it.aspx#download.

NOTE

You must download the file and then unpack it. Plan on at least 25 minutes for installing the SCVMM server software.

1. Accept the license terms, and enter installation information. Next, complete the prerequisites check.
2. Configure the SQL Server connection information as requested by the installation wizard. As we noted above, you may use a local or remote instance of SQL Server, or you may choose to simply install SQL Server Express Edition. We used SQL Server Express Edition.
3. Configure your default library share, where SCVMM will store ISO images, VHD files, and other files for use by SCVMM. Be aware that you cannot change or remove this location once you have specified it in the installation.
4. Proceed with the SCVMM installation.
5. Install the SCVMM Administrator console on the SCVMM server for managing SCVMM.
6. Open the SCVMM Administrator Console, and connect to your SCVMM server.
7. Click Add Host, and configure the connection credentials. (See Figure 4.)
8. Finalize the host addition, and wait for the job to complete.
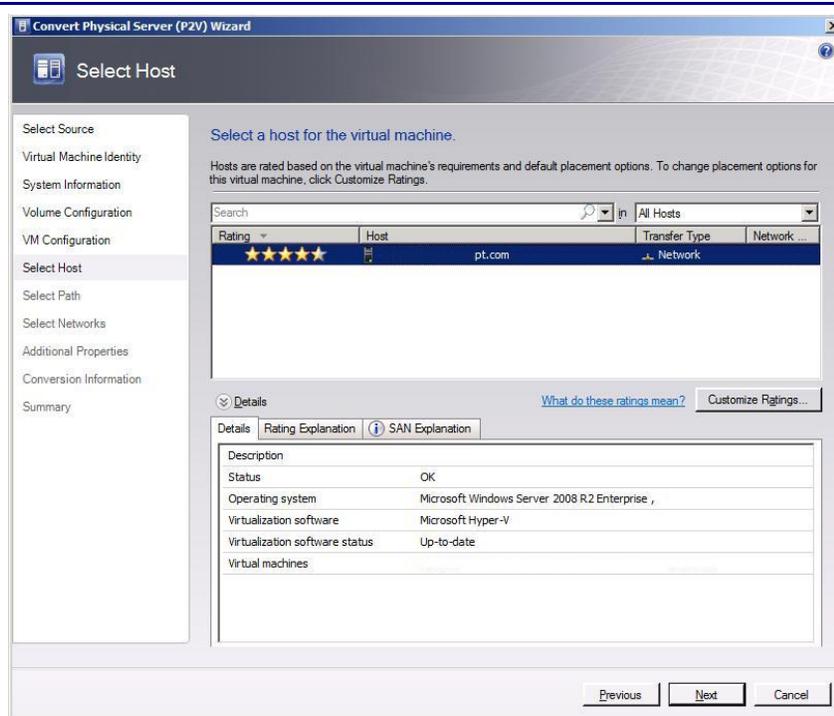
Figure 4. Adding the host in SCVMM.

NOTE

In order for SCVMM to manage your Hyper-V host, you must explicitly add the Hyper-V host to SCVMM. In our case, this was the Dell PowerEdge R710 server running Hyper-V, which also happened to be the host containing the SCVMM virtual machine.

We show you how: P2V with SCVMM

In this section, we review the process of performing a P2V conversion. In our example, we convert three legacy Dell PowerEdge 6800 servers running Windows Server 2003 R2 Enterprise Edition 32-bit to virtual machines on our 64-bit Hyper-V host, the Dell PowerEdge R710. In our case, the three legacy servers ran unique application workloads: Active Directory, Microsoft Exchange Server 2003, and Microsoft SQL Server 2005. The underlying operating system platform on all three servers was 32-bit Microsoft Windows Server 2003 R2, while the operating system on the destination server was 64-bit Windows Server 2008 R2 with Hyper-V.

Evaluate your storage needs carefully as you begin your P2V operation. For specifics on how we configured our storage on both the PowerEdge 6800 servers and the PowerEdge R710, see our accompanying performance report.[6]

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[6] Performance: 32-bit to 64-bit server transition
http://www.principledtechnologies.com/clients/reports/Dell/32to64performance 0410.pdf

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Below, we give overview steps on performing your P2V conversion. Our P2V conversion of each Dell PowerEdge 6800 server took approximately 25 minutes, with the system spending the majority of this time creating the VHD and copying the drive's data. Your conversion time will vary based on size and type of data transmitted. For complete details of the P2V process, see Appendix E.

1. Open the SCVMM Administrator Console and connect to your SCVMM server. Choose to convert a physical server.
2. Enter the appropriate connection information, scan the target system, and configure your VHD for your new destination VM. As Figure 5 shows, it is at this point you must choose whether to use fixed-size or dynamically sized VHDs.
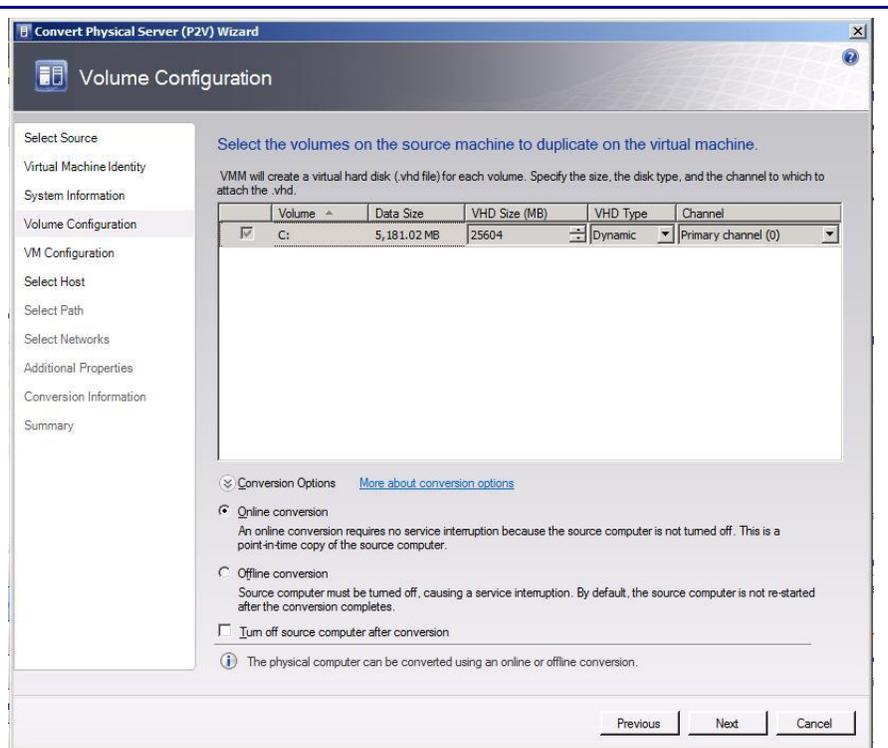
Figure 5. Configuring disk and conversion options during the P2V process.

NOTE

The VHD for the destination VM cannot be smaller than the original volume on the source machine.

3. Configure VM specific information, such as memory, number of processors, and virtual network.
4. Finalize your configuration of the new VM, and click Create to perform the P2V operation. (See Figure 6.) (Times will vary based on drive sizes.)
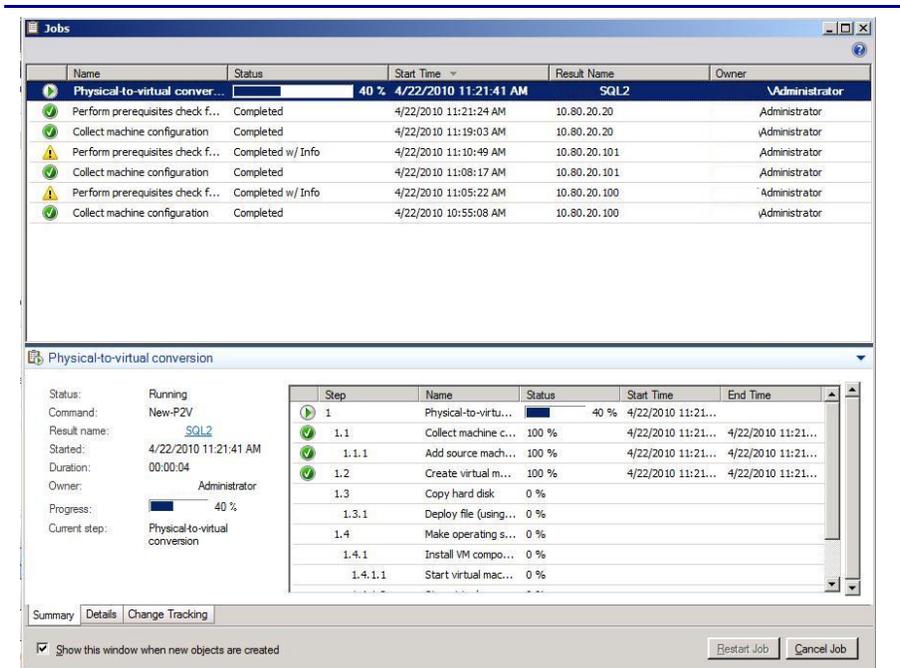
Figure 6. Performing the P2V operation in SCVMM.

Performing post-P2V tasks

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

Security identifiers (SIDs). Because the new VM is 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. This is because both machines with 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, as Hyper-V assigns MAC addresses to guests as they come online. Also, you should verify your IP addresses on your new VM.

Hyper-V Integration Services. Ensure the SCVMM P2V conversion wizard installed the Hyper-V Integration Services. If your devices are running in Emulated mode, you may experience sluggish performance. In our lab testing, although SCVMM did install Integration Services, the Hyper-V host

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had a more recent installation available. If you are unsure, simply reinstall Integration Services on the Hyper-V virtual machine.

Storage addition. Take advantage of the Windows Server 2008 R2 Hyper-V feature of hot-add storage. Your legacy application and database servers may have long since needed upgrades to their storage subsystems. Now that they are virtualized, you can quickly and easily add storage at will, with no downtime.

Summing up

As this Guide has explained, the process of consolidating your servers to a virtual environment on a Dell PowerEdge R710 Server with the Intel Xeon Processor 5500 series running Hyper-V is relatively straightforward; you can perform a basic installation and convert physical servers to virtual machines in a few hours. We still recommend 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.

Utilizing the Dell PowerEdge R710 for server virtualization and consolidation will greatly benefit any organization. It greatly expands your options for increasing memory, storage, and overall performance while reducing cost and effort at the same time.

For additional information, please see our companion report, Performance: 32-bit to 64-bit server transition, at http://www.principledtechnologies.com/clients/reports/Dell/32to64perfor mance 0410.pdf.

to refer to either the entities claiming the marks and names or their products.
Information in this document is subject to change without notice.

Appendix A. Installing the Windows Server 2008 R2 host

Allow 25 minutes on the Dell PowerEdge R710 to complete the installation of Windows Server 2008 R2.

1. Insert the Microsoft Windows Server 2008 R2 DVD into an external DVD drive, connect the DVD drive to the system, 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.
6. During the boot, a Windows is loading files message appears, followed by a Windows booting loading bar.
7. At the Install Windows Server 2008 screen, accept the defaults of English language, English time and currency format, and US keyboard or input method by clicking Next.
8. Click Install now.
9. At the Select the edition of Windows that you purchased screen, click the appropriate edition, and click Next.
10. At the Please read the license terms screen, check the I accept the license terms checkbox, and click Next.
11. At the Which type of installation do you want? screen, for Type of install, click Custom (Advanced).
12. At the Where do you want to install Windows? screen, click Drive options (Advanced).
13. Delete any existing partitions, recreate a partition, and format it. Highlight the partition, and click Next to start the installation.
14. When the system indicates that you must change the user's password before you log on the first time, click OK.
15. Enter a strong password in both the New password and Confirm password fields, and click the arrow.
16. At the Your password has been changed prompt, click OK. Windows then prepares the desktop.
17. Set the time zone.
18. Set the IP address, subnet mask, and domain information as per the steps in the next section.
19. Install Windows updates if applicable. (Download times will vary based on number and size of updates.)
20. Reboot the server after any updates install.

After rebooting, set the static IP addresses and subnet mask using the following process:

1. Click Start.
2. Right-click Network, and select Properties.
3. In the Network Sharing Center, click Manage network adapters.
4. Right-click the Local Area Connection, and select Properties.
5. In the Local Area Connection Properties dialog, highlight Internet Protocol Version 4 (TCP/IPv4), and click Properties.
6. Click the radio button next to Use the following IP address.
7. Enter the IP address you want the server to have, enter the Subnet mask, and enter the Preferred DNS server. Click OK.
8. Close the Network Connections window.
9. From the Start menu, right-click Computer, select Properties, and select Change settings.
10. Select the Computer Name tab.
11. Click Change.
12. Enter the server name.
13. Click the Member of Domain radio button.
14. Enter the domain name.
15. When the system prompts you to do so, enter the user name and password
16. When the Computer Name/Domain Changes window appears, click OK to close it.
17. Click OK to go past the warning to restart.
18. Click Restart Now to reboot the server.

Appendix B. Installing the Hyper-V role

Follow the steps below to install Hyper-V on Windows Server 2008 R2. Allow around 10 minutes for adding the Hyper-V role.

1. Click Start.
2. Expand Administrative Tools, and click Server Manager.
3. Right-click Roles, and select Add Roles.
4. On the Before You Begin page, click Next.
5. On the Select Server Roles page, select Hyper-V, and click Next.
6. On the Hyper-V page, click Next.
7. On the Create Virtual Networks page, select the appropriate Local Area Connection, and click Next. (In our Dell PowerEdge R710, we had four NICs in the system. We used the first as a NIC specifically assigned to the SCVMM virtual machine, and then one NIC per VM after the P2V process.)
8. On the Confirm Installation Selections page, click Install.
9. On the Installation results screen, click Close.
10. When Windows prompts you to reboot the server, click Yes. The server will reboot twice.
11. When you see the Installation Results page, click Close.

Appendix C. Installing the SCVMM virtual machine

Follow the steps below to create the first virtual machine on the Hyper-V server, which will run SCVMM.

1. Click Start.
2. Expand Administrative Tools, and click Hyper-V Manager.
3. From the Action menu, select New → Virtual Hard Disk.
4. Choose Fixed Size, assign 25GB for size, and place the VHD in the appropriate folder on the server.
5. From the Action menu, select New → Virtual Machine.
6. On the Before You Begin page, click Next.
7. On the Specify Name and Location page, enter the name for your new virtual machine, and click Next.
8. On the Assign Memory page, enter 2,048 MB of RAM.
9. On the Configure Networking, choose the network assigned to SCVMM traffic, and click Next.
10. Choose to add a virtual hard disk later.
11. On the installation Options page, accept the default of Install an operating system later, and click Next.
12. On the Completing the New Virtual Machine Wizard page, click Finish.
13. Right-click the virtual machine, and choose Settings.
14. Click Processors, and choose 1 virtual processor.
15. Click the virtual IDE controller 0.
16. Click Add, and click Hard Drive.
17. Browse to the VHD you created in Step 4, and choose that VHD for the guest OS VHD.
18. Click Apply.

Follow the steps below to install the guest operating system.

1. Insert the installation DVD for Windows Server 2008 R2 into the physical DVD drive.
2. In Hyper-V Manager, right-click the virtual machine, and choose Connect.
3. On the media menu, choose DVD Drive → Capture D:
4. On the Action menu, choose Start.
5. Double-click the VM to connect to the console.
6. During the boot of the VM, a Windows is loading files message appears, followed by a Windows booting loading bar.
7. At the Install Windows Server 2008 R2 screen, accept the defaults of English language, English time and currency format, and US keyboard or input method by clicking Next.
8. Click Install now.
9. At the Select the edition of Windows that you purchased screen, click the appropriate edition, and click Next.

10. At the Please read the license terms screen, check the I accept the license terms checkbox, and click Next.
11. At the Which type of installation do you want? screen, for Type of install, click Custom (Advanced).
12. In the Where do you want to install Windows? screen, click Drive options (Advanced).
13. Delete any existing partitions, recreate a partition, and format it. Highlight the partition, and click Next to start the installation.
14. When the system indicates that you must change the user's password before you log on the first time, click OK.
15. Enter a strong password in both the New password and Confirm password fields, and click the arrow.
16. At the Your password has been changed prompt, click OK. Windows then prepares the desktop.
17. Set the time zone.
18. Set the IP address, subnet mask, and domain information as per the steps in the above section.
19. Install Windows updates if applicable. (Download times will vary based on number and size of updates.)
20. Reboot the virtual machine after any updates install.

Appendix D. Installing SCVMM

Follow the steps below to install System Center Virtual Machine Manager 2008 R2 on the virtual machine. For this appendix, we assume that you have installed Windows Server 2008 R2 on the virtual machine and have joined this virtual machine to your Windows domain.

Allow at least 60 minutes for installing SCVMM. (Installation times will vary based on the hardware of the SCVMM server.)

The prerequisites for SCVMM 2008 R2 include various IIS components, .NET 3.5 framework, and a SQL Server instance, either remote or local. For this prerequisites procedure, we assume that you will use SQL Server Express, which is included in the main SCVMM 2008 R2 installation.

1. Click Start, Administrative Tools, and click Server Manager.
2. Click Roles, and choose to Add a Role.
3. Choose Web Server (IIS), and click Next twice.
4. Uncheck all default selections, and select the following Role services:
   - IIS 6 Metabase Compatibility
   - IIS 6 WMI Compatibility
   - Static Content
   - Default Document
   - Directory Browsing
   - HTTP Errors
   - ASP.NET, which automatically adds the following:
   - .NET Extensibility
   - ISAPI Extensions
   - ISAPI Filters
   - Request Filtering

NOTE

The application will prompt you to Add Required Role Services for ASP.NET. Proceed with the addition of the required role services through the installation.

5. Click Next, and click Install.
6. When the installation completes successfully, click Close.
7. In the Sever Manager window, click Features, and choose to Add a Feature.
8. Select .NET Framework 3.5.1, and click Next.
9. Click Install.
10. When you finish the installation successfully, click Close.

We downloaded Microsoft System Center Virtual Machine Manager 2008 R2 from http://www.microsoft.com/systemcenter/en/us/virtual-machine-manager/vmm-try-it.aspx#download. We installed SCVMM on a virtual

machine. You should allow approximately 15 minutes for the installation of SCVMM 2008 R2.

1. On the physical Hyper-V host, in Hyper-V manager, start the virtual machine.
2. Insert the SCVMM 2008 R2 installation media in the physical server, and attach it in the VM.
3. Inside the virtual machine, launch the setup program when prompted.
4. Under the Setup heading, click VMM Server.
5. Accept the license terms, and click Next.
6. Choose whether or not to use Microsoft Update, and click Next.
7. At the Customer Experience Improvement Program screen, make your selection, and click Next.
8. At the Product Registration screen, enter your User name and Company, and click Next.
9. After setup completes the prerequisites check with no errors, click Next.
10. Accept the default location for the installation, and click Next.
11. At the SQL Server Settings screen, select Use a supported version of SQL Server if you have a pre-existing MSSQL instance. If not, choose to Install SQL Server 2005 Express Edition SP3 to install a local database server instance.
12. Enter the Server name, and check the box next to Use the following credentials.
13. Enter the appropriate User name, Domain, and Password.
14. Select an existing instance of SQL Server, check the box next to Create a new database, and click Next.
15. Accept the default Library Share Setting, and click Next.
16. Accept the port and VMM service account settings, and click Next.
17. Click Install.
18. Once the installation is complete, uncheck the box beside Check for the latest Virtual Machine Manager updates, and click Close.
19. Return to the Microsoft System Center Virtual Machine Manager setup screen.
20. Under the Setup heading, click VMM Administrator Console.
21. Accept the License Terms, and click Next.
22. At the Customer Experience Improvement Program screen, click Next.
23. After setup completes the prerequisites check with no errors, click Next.
24. Accept the default location for the installation, and click Next.
25. Accept the default Port Assignment, and click Next.
26. Click Install.
27. Once the installation is complete, uncheck the box beside Check for the latest Virtual Machine Manager updates, and click Close.
28. Click Exit to close SCVMM setup program.

Follow the steps below to create configure SCVMM for P2V.

1. To add a Hyper-V host for P2V conversion, in SCVMM, open the System Center Virtual Machine Manager Admin Console via the shortcut on the desktop.
2. At the Connect to Server prompt, enter the appropriate server name, and click Connect.
3. Once the Virtual Machine Manager finishes loading, click Add Host on the right-hand side of the screen.
4. Select the host location, and enter the appropriate credentials.
5. Click Next.
6. Enter the computer name of the host.
7. Check the box beside Skip Active Directory name verification, and click Add.
8. Select the host in the Selected servers list, and click Next.
9. At the Configuration Settings screen, click Next.
10. At the Host Properties screen, enter the desired path for new VMs, click Add, and click Next.
11. On the Summary screen, click Add Hosts. The Jobs window appears, showing the current progress of the Add virtual machine host task.
12. Once the job receives a status of Completed, close the Jobs window.

Appendix E. Performing the P2V conversion

Follow the steps below to perform the P2V conversion for your legacy systems to your new Hyper-V host using SCVMM 2008 R2.

Allow around 25 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, or if you choose to create fixed-size VHDs instead of the default dynamically sized VHDs.

1. In the Virtual Machine Manager Admin Console, click Convert physical server.
2. Enter the appropriate server name or IP address of the server you wish to convert as well as the appropriate credentials.
3. Click Next.
4. Enter the desired Virtual machine name, owner and description.
5. Click Next.
6. At the System Information screen, click Scan System.
7. Once the System Scan is complete, click Next.
8. At the Volume Configuration screen, enter the desired VHD setting, and click Next. (For Offline Conversion see section below.)
9. On Volume Configuration Screen, expand Conversion Options and select Offline conversion. Check Turn off source computer after conversion and press Next.
10. On the Offline Conversion Options screen, enter or select IP information for server and click next.

NOTE

You cannot set the VHD size to a smaller amount than the physical volume size; you can only increase it.

11. Enter the desired number of processors and memory size, and click Next.
12. Select the desired host for the virtual machine, and click Next.
13. Enter the desired virtual machine path, and click Next.
14. If there is an existing virtual network you want to connect the new virtual machine to, select it from the drop down list, and click Next.
15. Select the desired actions for when the physical server starts and stops, and click Next. The Convert Physical Server (P2V) Wizard will check for any issues that need to be resolved before continuing with the conversion.
16. Once all issues are resolved and the message No issues detected appears, click Next.
17. At the Summary screen, ensure that all properties have the desired value, and click Create.
18. The Jobs window will appear, showing the current progress of the Physical-to-virtual conversion task.
19. Once the job receives a status of Completed, close the Jobs window.

About Principled Technologies

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We provide industry-leading fact-based marketing and technology assessment services that help technology vendors and buyers understand the real differences among products. We bring to every assignment extensive experience with and expertise in all aspects of technology marketing, testing, and analysis; from researching new technologies, to developing new methodologies, to testing with existing and new tools, to delivering the results in whatever form best communicates them.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, white papers, PowerPoint presentations, and videos. Every piece of collateral reflects the results of our trusted independent analysis.

We customize our services to focus on each client's requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to assess how it will fare against its competition and to highlight its strengths.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for 25 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.