MICROSOFT SHAREPOINT CONSOLIDATION AND TCO: DELL POWEREDGE R720 VS. HP PROLIANT DL380 G7

Improve your SharePoint® performance and gain room to grow with IT payback in 36 months

Your existing SharePoint servers are doing their jobs, but your company plans to grow. Consolidating these servers onto a single more powerful virtualized server, such as the new Dell PowerEdge R720 powered by the Intel Xeon processor E5-2600 series, has the potential to benefit your business in a number of ways. You can decrease the amount of hardware you need to store, maintain, power, and cool and you can support more users.

We measured SharePoint Standard Edition performance running a combination of publishing and collaboration tasks with two solutions: a new Dell PowerEdge R720 server and an HP ProLiant DL380 G7 server. The Dell PowerEdge R720 delivered 63.4 percent greater total performance, measured in requests per second, than the HP ProLiant DL380 G7 running our SharePoint workload.

The savings in hardware, maintenance, power, and cooling costs make the Dell PowerEdge R720 a wise investment for any business. In a scenario where this server replaces two existing HP ProLiant DL380 G7 servers, purchasing the Dell PowerEdge R720 can pay back the investment in hardware and the migration effort in as little as three years.

A PRINCIPLED TECHNOLOGIES TEST REPORT
Commissioned by Dell Inc.; February 2012

MEET YOUR GROWING COLLABORATION NEEDS WITH FEWER SERVERS

For testing, we compared the performance of a HP ProLiant DL380 G7 with an external HP StorageWorks EVA 4400 storage array running SharePoint Server 2007 (Standard Edition) with the performance of a Dell PowerEdge R720 with an external Dell EqualLogic™ PS5000VX storage array running SharePoint Server 2010 (Standard Edition) inside four virtual machines.

We used test clients running Microsoft Visual Studio® 2010 to execute the test workload, and ran the workload with 25 users and no think time so it would perform each task as quickly as possible. To simulate the traffic of SharePoint users, we used a custom workload with a user profile that browsed various SharePoint Web pages and uploaded different size files. (Prior to testing, we ensured that it worked the same on both SharePoint 2010 and SharePoint 2007.) We built custom Web pages and used a corpus of existing files of various sizes to simulate SharePoint users completing everyday tasks.

We ran four clients simultaneously against the ProLiant DL380 G7, and eight clients against the PowerEdge R720, using two clients per VM. We added clients until the performance gains peaked and increased no further.

The HP ProLiant DL380 G7 ran Microsoft Windows Server® 2008 R2 non-virtualized with one instance of SharePoint Server 2007 and gave the best scores with four test clients. The Dell PowerEdge R720 ran Windows Server 2008 R2 with Hyper-V™ running four VMs. Each VM gave the best performance with two test clients per VM, for eight total test clients running against the Dell PowerEdge R720.

We chose to run four VMs on the Dell server based on the capabilities of the HP server. The HP ProLiant DL380 G7 is a dual-socket server with quad-core processors with two threads per core, for 16 total logical processors. On the Dell PowerEdge R720, we used the same number of logical processors for testing. The maximum number of logical processors each VM can support on Hyper-V is four, so we ran four VMs each with four logical processors for a total of 16 logical processors. (Note: The Dell PowerEdge R720 is a dual-socket eight-core processor with two threads per core, for a total of 32 logical processors, so we did not use all processors for testing. This could potentially leave the server with room for additional growth.) Because both servers used 16 logical processors, the systems were configured as closely as possible.

Note: In the real world, your individual VMs and individual servers will host one or several of the many different SharePoint roles. We configured the HP ProLiant DL380 G7 and each VM on Dell PowerEdge R720 as a standalone SharePoint server. This representative test is only an approximation of what you might expect to see in your

environment. Your actual configuration will differ greatly from this implementation and will include role separation, high-availability considerations, and other choices.

As Figure 1 illustrates, the four VMs, each running a single instance of SharePoint Server Standard on the Dell PowerEdge R720 solution delivered a total of 299 requests per second (RPS). This is 63.4 percent more than the 183 RPS the single SharePoint Server instance on the HP ProLiant DL380 G7 delivered.

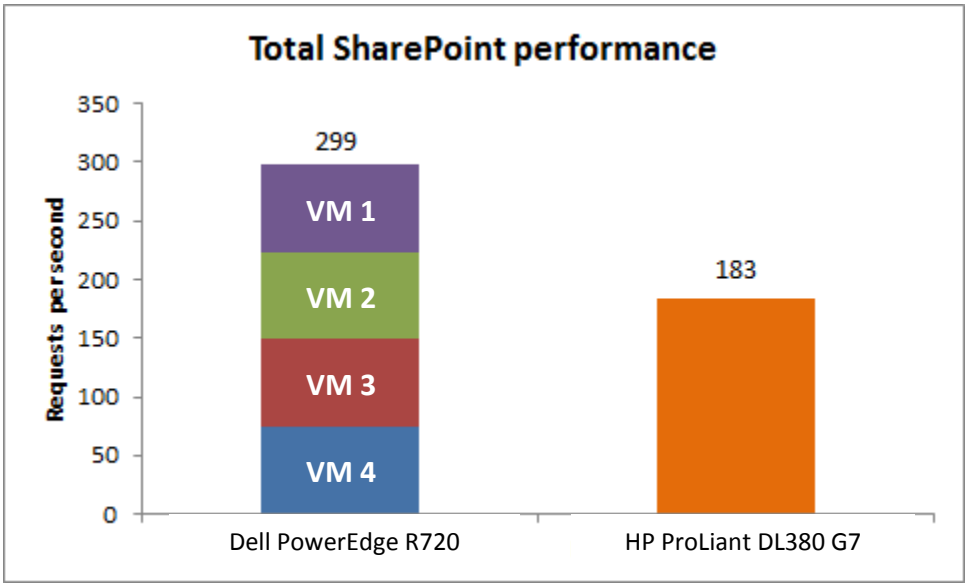

Figure 1: The Dell PowerEdge R720 delivered 63.4 percent greater SharePoint performance than the HP ProLiant DL380 G7. Higher numbers are better.

ABOUT THE DELL POWEREDGE R720

According to Dell, the Dell PowerEdge R720 rack server is a general-purpose platform designed to excel at running a wide range of applications and virtualization environments for both mid-size and large enterprises. It has highly expandable memory (up to 768GB) and improved I/O capabilities to match. With Intel® Xeon® E5-2600 processors and the ability to support dual RAID controllers, the R720 can handle more demanding workloads, like Microsoft SharePoint Server 2010.

ACHIEVE PAYBACK IN AS LITTLE AS THREE YEARS BY CONSOLIDATING THE WORKLOAD OF TWO HP PROLIANT DL380 G7S

To show the total cost of ownership (TCO) savings the Dell PowerEdge R720 can deliver, we looked at a hypothetical business replacing two existing HP ProLiant DL380 G7 servers running SharePoint Server 2007 SP2 with a single Dell PowerEdge R720 server running Microsoft SharePoint Server 2010 in four virtual machines.

For our hypothetical TCO analysis, we assume that the business is using the Foundation edition of SharePoint Server, which is available at no cost for servers

properly licensed for Microsoft Windows Server. Note: The SharePoint version and licensing model you use in your environment will determine your specific costs and savings. The energy, administration, Windows Server licensing and other savings, as well as the other cost factors, we examined should remain relatively constant regardless of version used.

To illustrate the cost savings this consolidation can provide, we calculated the costs for a hypothetical enterprise planning this migration and compared those costs to those of retaining the existing servers. We found that thanks to savings in software and hardware support, server administration, and data center costs for energy, ports, and space, the Dell PowerEdge R720 can pay back the investment in hardware and the migration effort in as little as three years.

Figure 2 summarizes the costs for the two solutions.

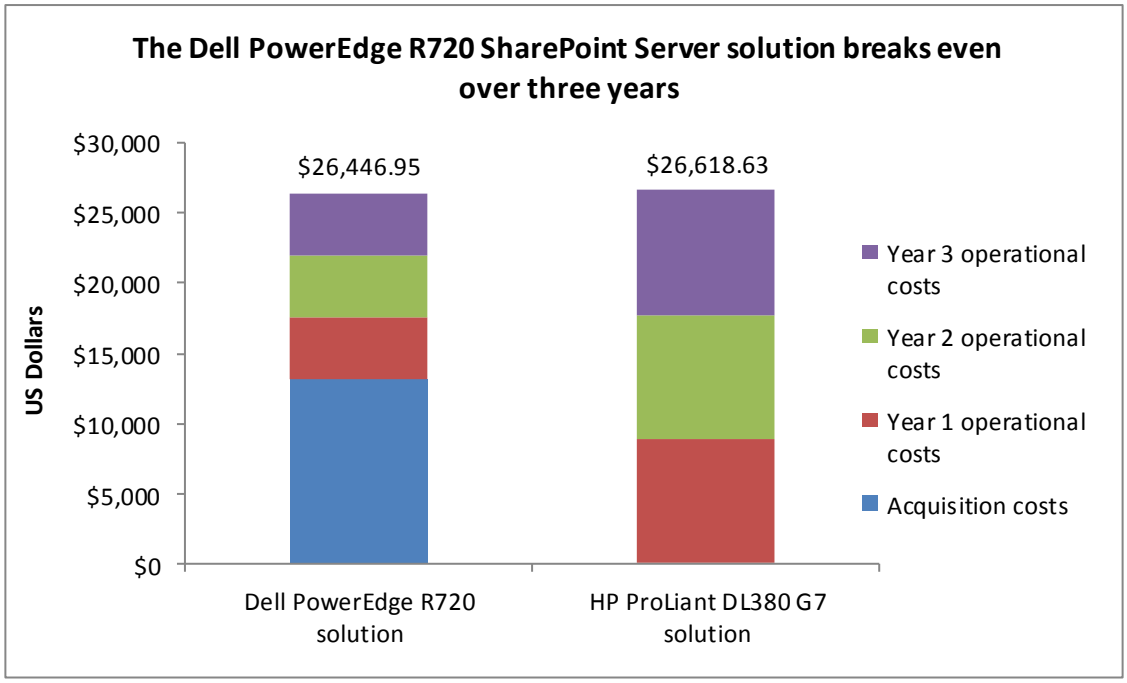

Figure 2: Breakdown of acquisition and operational costs for the two solutions over three years.

Figure 3 shows that the Dell PowerEdge R720 solution can deliver payback in as little as 36 months.

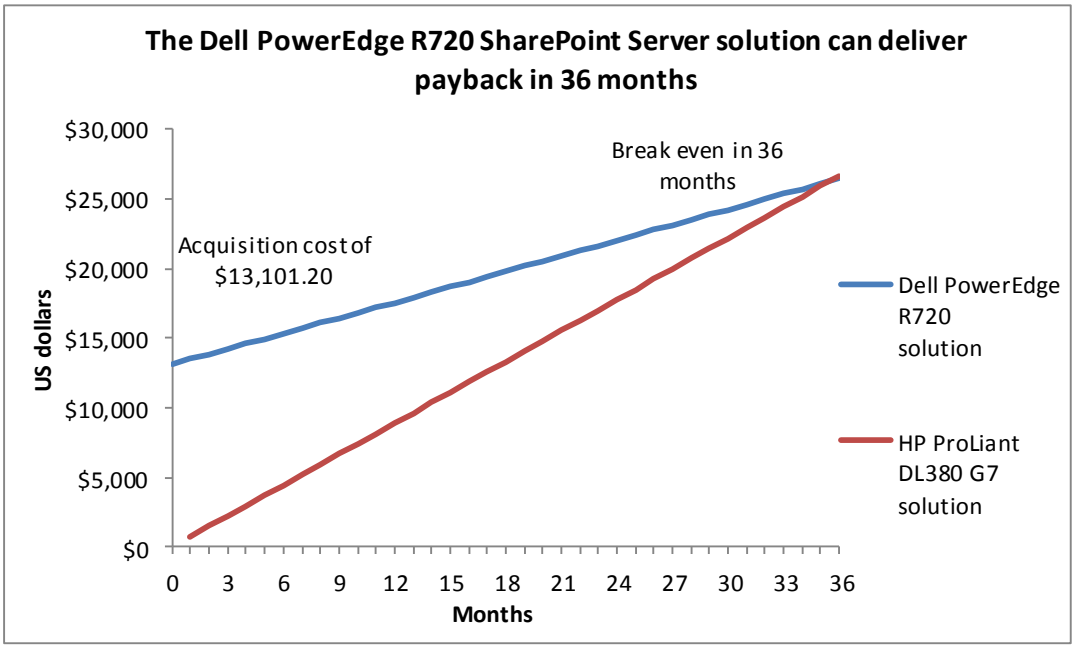

Figure 3: Payback period for replacing two HP ProLiant DL380 G7 servers with a single Dell PowerEdge R720 server.

The Dell PowerEdge R720 solution can save up to 50 percent of the annual operating costs of the HP ProLiant DL380 G7 solution

The Dell PowerEdge R720 solution can save up to 50 percent of the annual operating costs of the HP ProLiant DL380 G7 solution through savings in software and hardware support costs, server administration costs, and data center costs for energy, ports, and space.

Figure 4 summarizes the acquisition costs and annual operational costs of the two solutions and shows the operational cost savings for the Dell PowerEdge R720 solution. For additional assumptions, see Appendix D.

	Dell PowerEdge R720 solution	HP ProLiant DL380 G7 solution	Annual cost savings for Dell PowerEdge R720 solution	Percentage savings
Acquisition costs				
Hardware cost	$12,509.00			
Migration cost	$2,950.20			
Windows Server 2008 R2 Enterprise Edition savings	-$2,358.00			
Total acquisition cost	$13,101.20			

	Dell PowerEdge R720 solution	HP ProLiant DL380 G7 solution	Annual cost savings for Dell PowerEdge R720 solution	Percentage savings
Annual operational costs				
OS software support Windows Server 2008 R2 Enterprise Edition (per server)	$589.50	$1,179.00	$589.50	50%
Hardware support	$833.00	$1,179.33	$346.33	29%
Administration costs	$2,324.18	$5,113.20	$2,789.02	55%
Energy costs	$254.62	$506.78	$252.16	50%
Port costs (1 port per server)	$250.00	$500.00	$250.00	50%
Data center space costs	$197.28	$394.56	$197.28	50%
Total operational costs	$4,448.58	$8,872.88	$4,424.29	50%
Total 3-year operational costs	$13,345.75	$26,618.63	$13,272.88	50%
Total costs	**$26,446.95**	**$26,618.63**	**$171.68**	**1%**

Figure 4: Cost savings for the Dell PowerEdge R720 solution.

The Dell PowerEdge R720 solution requires one-half the number of Windows Server licenses

The Dell PowerEdge R720 solution consolidates the workloads of two HP ProLiant DL380 G7 servers onto four VMs running under Microsoft Windows Server 2008 R2 with Hyper-V. Using the per-server with CAL licensing model, the Dell PowerEdge R720 solution reduces the two Windows Server licenses needed to a single license. The Dell PowerEdge R720 solution saves on annual Software Assurance costs for the unused license. We also assign the license cost of the unused license as acquisition cost savings for the Dell PowerEdge R720 solution assuming that the license can be reassigned and will save the enterprise the acquisition cost of a license on another system.

The Dell PowerEdge R720 solution saves up to 29 percent annually in hardware support costs

Hardware support costs for the Dell PowerEdge R720 solution are lower than for the two HP ProLiant DL380 G7 servers it replaces. For the existing servers, we use the costs of the HP Care Pack, 3 Years, 6-hour 24x7 CTR, Defective Media Retention Hardware Support, for the HP ProLiant DL380 from the HP On-line store. For the Dell PowerEdge R720, we use the costs of 3 Year ProSupport and Mission Critical 4HR 7x24 Onsite Pack provided to us by Dell. For each solution, we convert the three-year costs into annual costs. The hardware support costs for the single Dell PowerEdge R720 server are 29 percent lower than for the two existing servers.

The Dell PowerEdge R720 solution can save up to 55 percent annually in server administration costs

Even in a one-to-one server comparison, the manageability improvements of the Dell PowerEdge R720, including agentless management, would yield savings in administration costs. We estimate that a single administrator could manage 44 servers such as the Dell PowerEdge R720 compared to 40 servers such as the HP ProLiant DL380 G7, saving 9 percent for a single server. Savings reach 55 percent when comparing management of one Dell PowerEdge R720 to that of two existing servers over three years.

The Dell PowerEdge R720 solution can save up to 50 percent annually in energy costs

We measured the power usage of the two server models and used those results to estimate energy costs for the two solutions. We estimate that the servers run full time at the tested load. We include costs for cooling as well as powering the servers. We assume the cost to cool the existing servers is the same as the cost to power them, so we double the power cost to get the cost for power and cooling. We assume the cooling efficiencies of the new Dell servers would save on power for cooling; we multiply the power cost for the Dell PowerEdge R720 by 1.8 to get the cost for power and cooling. We estimate a per-KWH-hour cost of 10.39 cents based on the US average commercial price for September 2011 as reported by the U.S. Energy Information Administration.[1] For this workload, the energy costs of single servers of the server models were similar. The Dell PowerEdge R720 solution saves by doing the work of two existing servers on a single server.

Additionally, although we did not perform extreme temperature testing, Dell is the only server manufacturer that warrantees its mainstream servers for excursion-based operation up to 45C/113F, which according to Dell white papers can yield operational savings of up to $250,000 annually per megawatt of IT equipment or a one-time capital expenditure savings of approximately $3M per megawatt of IT equipment.[2]

The Dell PowerEdge R720 solution saves 50 percent annually in data center costs for ports and space

We assume the enterprise charges for rack space on a per-rack unit basis and for data center ports on a per-port basis. The two existing servers take up twice the

[1] http://www.eia.gov/electricity/monthly/index.cfm (report epmxlfile5_6_b.xls)

[2] http://content.dell.com/us/en/enterprise/by-need-efficient-infrastructure-data-center-energy-efficiency-energy-management.aspx

space of the Dell PowerEdge R720, four rack units vs. two rack units, and require twice as many ports.

CONCLUSION

Replacing two existing HP ProLiant DL380 G7 servers with an Intel Xeon processor E5-2600 series-powered Dell PowerEdge R720 servers can improve performance and lower your total cost of ownership. The Dell PowerEdge R720 delivered 63.4 percent more performance than an HP ProLiant DL380 G7 using our custom workload.

Not only did the Intel Xeon processor E5-2600 series-based Dell PowerEdge R720 server outperform the HP ProLiant DL380 G7 servers, it also has the potential to reduce the cost of operating your data center. By lowering costs in a number of areas—Windows Server licensing, server administration, energy usage, and data center ports and space—the Dell PowerEdge R720 server pays back its initial investment in as little as three years.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 5 provides configuration information for the two servers we tested.

System	Dell PowerEdge R720	HP ProLiant DL380 G7
Power supplies		
Total number	2	2
Vendor and model number	Dell D750E-S1	HP DPS-750RB A
Wattage of each (W)	750	750
Cooling fans		
Total number	6	6
Vendor and model number	AVC DBTC0638B2V	Nidec® UltraFlo™
Dimensions (h x w) of each	2-1/2” x 2-1/2”	2-3/8” x 2-5/8”
Volts	12	12
Amps	1.20	2.45
General		
Number of processor packages	2	2
Number of cores per processor	8	4
Number of hardware threads per core	2	2
System power management policy	Balanced	Balanced
CPU		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E5-2680	X5570
Stepping	6	D0
Socket type	LGA2011	FCLGA1366
Core frequency (GHz)	2.70	2.93
Bus frequency	8.0 GT/s	6.4 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache (MB)	20	8
Platform		
Vendor and model number	Dell PowerEdge R720	HP ProLiant DL380 G7
Motherboard model number	00W9X3	ProLiant DL380 G7
BIOS name and version	Dell 0.3.37	HP P67 (5/5/2011)
BIOS settings	Default	Default
Memory module(s)		
Total RAM in system (GB)	64	12
Vendor and model number	Hynix HMT31GR7BFR4A-H9	Micron MT18JSF25672PDZ-1G4F1DD
Type	PC3-10600R	PC3-10600R
Speed (MHz)	1,333	1,333
Speed running in the system (MHz)	1,333	1,333

System	Dell PowerEdge R720	HP ProLiant DL380 G7
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-36	9-9-9-24
Size (GB)	8	2
Number of RAM module(s)	8	6
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
Operating system		
Name	Windows Server 2008 R2 SP1	Windows Server 2008 R2 SP1
Build number	7601	7601
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Graphics		
Vendor and model number	Matrox® G200eR	ATI ES1000
Graphics memory (MB)	16	64
Driver	Matrox Graphics, Inc 2.4.1.0 (9/8/2011)	Microsoft 6.1.7600.16385 (6/21/2006)
RAID controller		
Vendor and model number	PERC H710P Mini	HP Smart Array P410i
Firmware version	3.130.05-1311	5.14
Driver version	Dell 5.1.90.64 (3/2/2011)	6.20.2.64 (8/10/2010)
Cache size	1 GB	512 MB
Hard drive		
Vendor and model number	Dell Savvio ST9300605SS	HP EH0146FAWJB
Number of disks in system	2	2
Size (GB)	300	146
Buffer size (MB)	64	16
RPM	10,000	15,000
Type	SAS	SAS
Ethernet adapters		
Vendor and model number	Intel Gigabit 4P I350-t rNDC	HP NC382i Multifunction Gigabit Server Adapter
Type	PCI-E	PCI-E
Driver	Intel 11.14.42.0 (9/13/2011)	6.2.9.0 (2/4/2011)
Optical drive(s)		
Vendor and model number	TEAC DV-28SW	N/A
Type	DVD-ROM	N/A
USB ports		
Number	4 external, 1 internal	4 external, 1 internal
Type	2.0	2.0

Figure 5: Configuration information for the two servers.

APPENDIX B - HOW WE TESTED

Our test bed consisted of an isolated network with three servers—the Dell PowerEdge R720 with four SharePoint server VMs, the HP ProLiant DL380 G7 SharePoint server, and an Active Directory® server—and eight clients running Visual Studio 2010. For comparison purposes, we configured each VM as a standalone SharePoint server environment. This approach allowed us a modular method to determine an exact increase in performance in identical environments. Results in your specific situation will vary. On the Dell PowerEdge R720, we used SharePoint 2010 Standard Edition with SQL Server 2008 Express, both installed in each VM. On the HP ProLiant DL380 G7, we used SharePoint Server 2007 Standard Edition with SQL Server 2005 Express, both installed on the same server. The Active Directory server is a basic Active Directory domain controller set up with defaults. We gave all servers and VMs appropriate IP addresses and logged them in on the domain. We installed Windows Server 2003 on the eight client machines, and applied all updates. Each VM had Visual Studio Ultimate 2010 installed, and ran the test scripts against the SharePoint servers. Figures 6 and 7 show our test bed set ups for the two solutions.

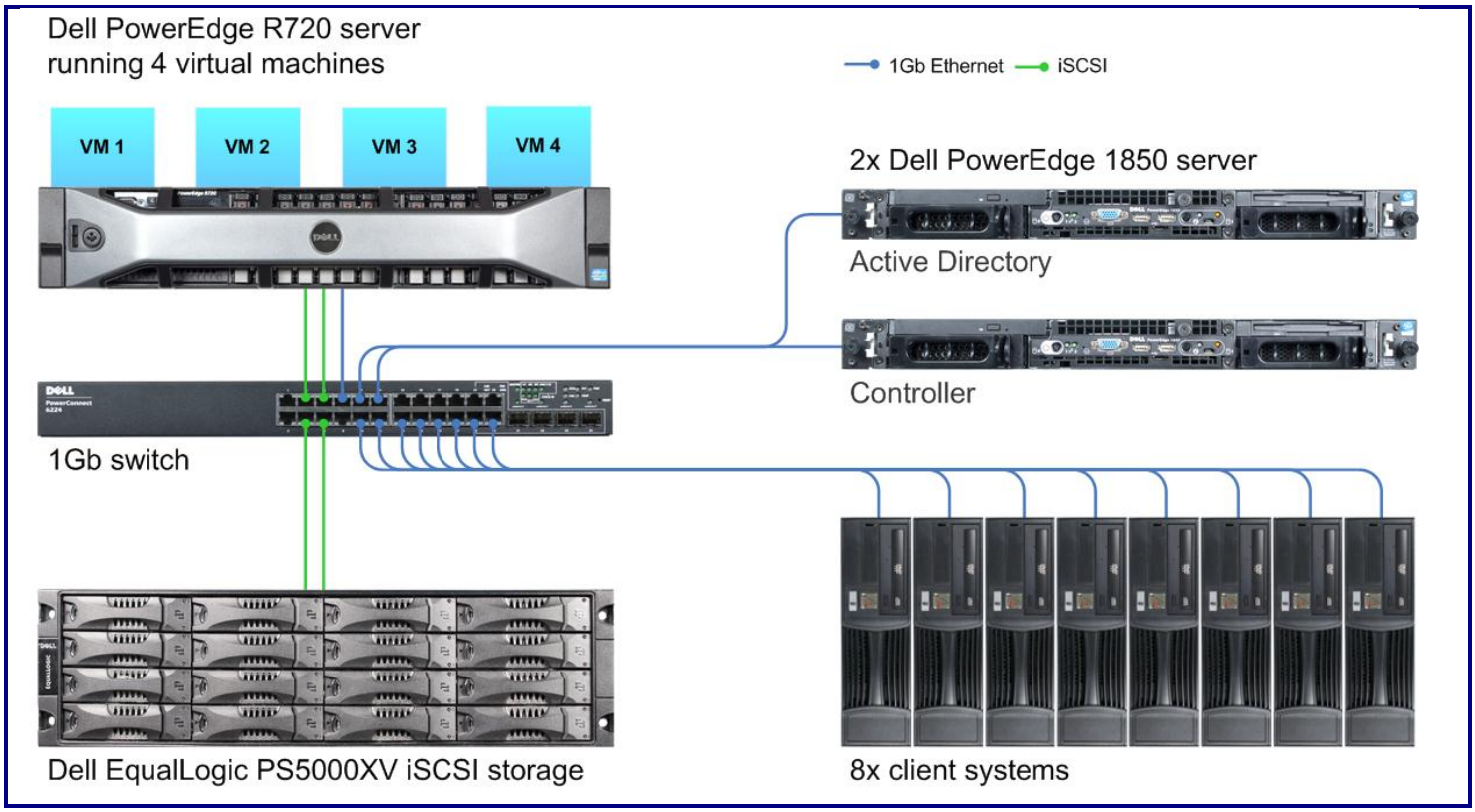

Figure 6: Our test bed setup for the Dell PowerEdge R720 solution.

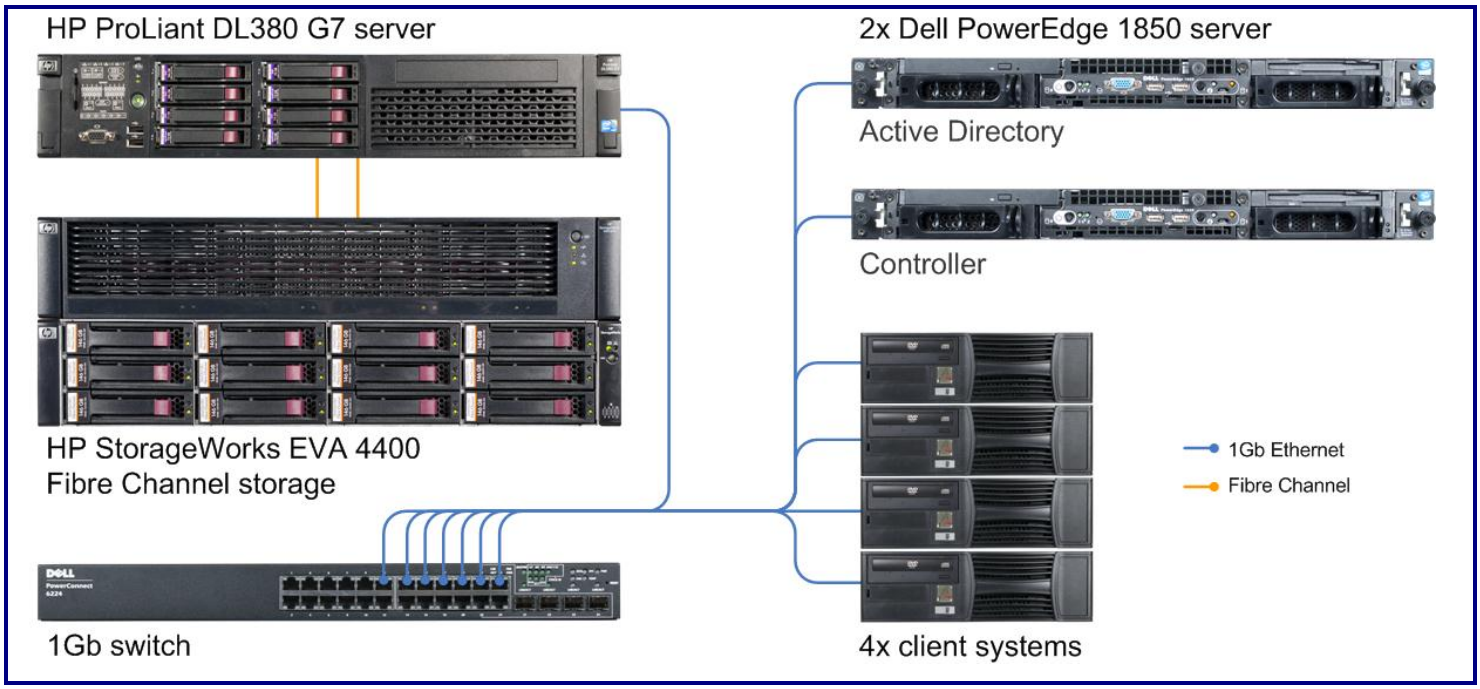

Figure 7: Our test bed setup for the HP ProLiant DL380 G7 solution.

We used Visual Studio 2010 to run a load test that simulated 25 users per client browsing Web sites and uploading documents. The load test was 10 minutes long, consisting of a 2-minute warm-up time, and an 8-minute run time. We set the load test so that all users simulated utilizing LAN connections, Internet Explorer® 7, and no think times. The load test ran two Web tests, which simulated a user browsing the SharePoint default Web site, and uploading a single file to one of 10 shared documents libraries on a team Web site. Each iteration of the Web test uploaded a different document from our corpus. We ran four clients simultaneously against the ProLiant DL380 G7, and eight clients against the PowerEdge R720, using two clients per VM.

While the test was running, Visual Studio recorded CPU utilization and total requests per second on our SharePoint server. After each run, we restored the WSS_Content database to its original state and rebooted the SharePoint servers. We conducted three runs on each server. We determined the median run based on the total requests-per-second score from each run.

Configuring the external storage arrays

We used one tray of Dell EqualLogic PS5000XV storage connected to the PowerEdge R720 with two dedicated 1Gb NICs for iSCSI traffic. We set all 14 disks into a RAID 10, and created two LUNs to hold the VM OS VHDs and separate data VHDs. The OS LUN was 280 GB, and the data LUN was 632 GB.

We used one tray of HP StorageWorks EVA4400 storage connected to our ProLiant DL380 G7 server with two fibre connections for iSCSI traffic. We set all 12 disks into a RAID 10, and created two LUNs to hold the VM OS VHDs and separate data VHDs.

Installing Windows Server 2008 R2 with SP1

We installed Windows Server 2008 R2 with SP1 on all of our test servers using the following steps:

1. Insert the installation DVD for Windows Server 2008 R2 with SP1 into the DVD drive.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation). Click Next.
5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Click Start, type `change power-saving settings` and press Enter.
12. Click Change plan settings.
13. Change the Turn off the display drop-down menu to Never.
14. Click Save changes, and close the Power Options, Screen Saver Settings, and Personalization windows.
15. Run Windows Update to install the latest updates.
16. Join the computer to the domain.

Installing and configuring the Dell PowerEdge R720

After installing Windows Server 2008 R2 SP1, we used the following steps to install and configure the SharePoint Server 2010 VMs on the R720:

Adding the Hyper-V role

1. Open Server Manager, and click Roles.
2. Click Add Roles.
3. On the Before You Begin page, check the Skip this page by default box, and click Next.
4. Select Hyper-V, and click Next.
5. On the Hyper-V Introduction page, click Next.
6. On the Create Virtual Networks page, click Next.
7. Confirm installation selections, and click Install.
8. Once the installation is complete, click Close.
9. When the system prompts a restart, click Yes.
10. Allow the system to fully reboot, and log in using the administrator credentials.
11. Once the desktop loads, the Hyper-V Installation Results window will finish the installation.
12. Click Close. The Hyper-V role will now be available in Server Manager under Roles.

Configuring the virtual network

1. Right-click the server name in the list on the left side of Hyper-V, and choose Virtual Network Manager…
2. Choose External, and click Add.
3. Name the Virtual Network, and choose the appropriate NIC for your test bed network from the drop-down menu.
4. Click OK.

Creating the VMs

1. Click Action→New→Virtual Machine.
2. On the Before You Begin window, click Next.

3. Enter the name of the VM, and click Next.
4. Assign 6GB of memory, and click Next.
5. Choose the virtual network you created from the drop-down menu, and click Next.
6. Create a 30GB virtual hard disk with a name and location, and click Next.
7. Choose Install an operation System later, and click Next.
8. Click Finish.
9. Right-click the VM and choose Settings.
10. Change the number of Virtual processors to 4.
11. Click on Memory and choose Dynamic.
12. Set the Startup Ram to 6144 MB, and the Maximum RAM to 8192 MB.
13. Click OK.
14. Install Windows Server 2008 R2 on your VM.
15. Join the VM to the domain.

Creating a second VM

1. With your original VM turned off, navigate to the VHD storage drive.
2. Create a copy of the VHD, and rename it.
3. Using the steps above, create a new VM with one exception.
4. Instead of creating a new VHD, choose Use an existing virtual hard disk and navigate to the VHD you copied and renamed. Continue the VM creation as normal.
5. Follow steps 1 through 4 until you have four VMs.

Creating a second volume

1. Right-click your VM, and click Settings.
2. Click on the SCSI Controller in the hardware list, and choose Add Hard Drive.
3. Click New.
4. Click Next on the New Virtual Hard Disk Wizard page.
5. Choose Fixed size (we used 75 GB), and click Next.
6. Type in a name and location for the new VHD, and click Next.
7. Set the size of the VHD, and click Next.
8. Click Finish.

Installing Microsoft SharePoint Server 2010

1. Insert the installation DVD.
2. Launch setup.exe, and click Install software prerequisites.
3. Review the list of software, and click Next.
4. Accept the EULA, and click Next.
5. When the prerequisites finish installing, click Finish.
6. On the main SharePoint installation menu, click Install SharePoint Server.
7. Enter your product license key, and click Continue.
8. Accept the EULA, and click Continue.
9. Choose the Stand-alone server type, and click Install.
10. When the installation finishes, check the box for Run the SharePoint Products Configuration Wizard now, and click Close.
11. On the Welcome to SharePoint Products screen, click Next.
12. On the pop-up warning about services that will need to be restarted during the configuration, click Yes.
13. When the wizard has completed the configuration, click Finish.

14. Enter the specifications for the new site, and click OK.
15. Click Finish.
16. Using the SQL Management Tool, move the SharePoint databases to your data VHD.

Installing and configuring the HP ProLiant DL380 G7 server

We installed Windows Server 2008 R2 with SP1 on all of our test servers using the following steps:

1. Insert the installation DVD for Windows Server 2008 R2 with SP1 into the DVD drive.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation). Click Next.
5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Click Start, type `change power-saving settings` and press Enter.
12. Click Change plan settings.
13. Change the Turn off the display drop-down menu to Never.
14. Click Save changes, and close the Power Options, Screen Saver Settings, and Personalization windows.
15. Run Windows Update to install the latest updates.
16. Join the computer to the domain.

Installing SharePoint Server 2007 SP2

1. Insert the installation DVD for Micrsoft SharePoint 2007.
2. Click Run Setup.exe on the Autoplay menu.
3. Enter the product key, and click Continue.
4. Accept the Software License Terms, and click Continue.
5. Choose Basic install.
6. Each time you are prompted about SQL having known issues, click Run Program.
7. When the installation is complete, check the Run the SharePoint Prducts and Technologies Configuration Wizard now box, and click Close.
8. Click Next on the Welcome screen.
9. Click Yes on the services must restart prompt.
10. Download and install Service Pack 4 for SQL Server 2005 using default options.
11. Using SQL Server Manager, move the SharePoint databases to the data drive created from you EVA4400 storage.

Installing and configuring the Visual Studio 2010 clients

We installed Windows Server 2003 with all updates and service packs, and joined the domain.

Installing Microsoft Visual Studio 2010

1. Add the .NET Framework feature via the server manager.
2. Double-click setup.exe.
3. Uncheck the option to send installation information to Microsoft.
4. Click Install Visual Studio 2010.
5. Click Next.

6. Accept the license terms, and click Next.
7. Choose the Full installation, and click Install.
8. Click Finish.

APPENDIX D - TCO DETAILS

Hardware costs

Dell provided us with hardware costs for the Dell PowerEdge R720, which had not been released at the time of this report. Our testing was on a pre-release model. Costs do not include discounts, shipping, or taxes. Dell quoted a price of $12,509 for the following configuration of the Dell PowerEdge R720:

- 2x Intel Xeon processor E5-2680s (2.70 GHz)
- 128 GB (16 x 8 GB) dual-rank PC3L-10600R memory (M/N HMT31GR7BFR4A-H9)
- PERC H710P Mini Controller
- Dual eight-port disk backplane (16 hard drive slots available)
- No internal hard drives
- Four-port NIC card (dual-port 1GB/dual-port 10GB)
- Redundant 1GB SD card with ESXi 5.0 installed
- 8GB iDRAC SD card, including iDRAC Enterprise

Migration costs

We assume that the migration from the two existing servers to the Dell PowerEdge R720 will take a week and a half. Migration includes the staff costs of planning the migration, ordering the hardware, setting up the server, and migrating software and databases. We estimate 30 hours for the migration and 30 hours for the other tasks, with all tasks carried out by a server administrator or equivalent. We estimate this cost at $5,950.20 based on 60 hours of a server administrator's time, with an hourly cost of $49.17. To calculate the hourly rate, we used the mean annual wage of $72,200 for a network and computer systems administrator as reported in the Bureau of Labor Statistics Occupational Employment and Wages for May 2010.[3] We added an additional 41.64 percent to cover benefits for total annual salary cost of $102,264.08, which would have an equivalent hourly full time wage equivalent of $49.17. We estimated the benefits rate using data in another Bureau of Labor Statistics report, Employer Costs for Employee Compensation – September 2011.[4]

Software licenses

For each solution, we assume the enterprise maintains current Microsoft Software Assurance on the Microsoft Windows Server software and that their licensing allows them to migrate the software between servers. We also assume they can renew the Software Assurance agreements for the 3 years in this analysis.

We assume the existing solution runs Windows Server 2008 R2 Enterprise using per-server licensing. This license model requires CAL licenses. We do not include CAL costs in this analysis because the number of users or devices and therefore Windows CALS would be the same for both solutions.

[3] http://www.bls.gov/oes/current/oes151142.htm

[4] http://www.bls.gov/news.release/ecec.t05.htm, Bureau of Labor Statistics report: Employer Costs –September 2011, Table 5. Private industry, by major occupational group and bargaining status, Management, Professional and Related column. That report estimates that salary is 70.6 percent and benefits are 29.4 percent of total compensation for Management, Professional, and Related employees in private industry. Using those numbers, we calculate benefits as 41.64% of salary.

We used software pricing from the Microsoft License Advisor tool[5] and used the Quick Quote option there to find the single license price for a Microsoft Open License for corporate organizations with the No Level pricing level. The prices quoted there are $2,358 per Windows Server 2008 R2 Enterprise Edition. Annual Software Assurance is one-fourth the license cost.

We assign the savings of the Software Assurance payments to the Dell PowerEdge R720 solution for any existing licenses that that solution does not need. We assume our hypothetical enterprise paid for the original license up front and makes annual Microsoft Software Assurance payments. We also assume they can either cancel the Software Assurance agreements for licenses that the Dell PowerEdge R720 solution does not need or can use the licenses elsewhere. We assume that the PowerEdge R720 solution can regain the original cost of the unneeded license by reusing the licenses elsewhere in the data center. We subtract their original purchase cost from PowerEdge R720 acquisition costs.

We assume the enterprise uses the Microsoft SharePoint Foundation 2010 for the Dell PowerEdge R720 solution, and Windows SharePoint Services (WSS) v3 for the HP solution, both of which are available at no extra cost with Windows Server licenses. Note: The SharePoint version and licensing model you use in your environment will determine your specific costs and savings. The energy, administration, Windows Server licensing and other savings, as well as the other cost factors, we examined should remain relatively constant regardless of version used.

Hardware support

Dell provided a quote of $2,899 for 3-year support for the Dell PowerEdge R720 server. We base the HP support estimate on the support for the HP ProLiant DL380 G7 on the 3-year support cost listed on the HP Store for the HP ProLiant DL380 models. Figure 8 shows the hardware support costs for each solution.

	3-year	1-year	Annual cost per solution	Percentage Dell savings
HP Support: HP Care Pack, 3 Years, 6-hour 24x7 CTR, Defective Media Retention Hardware Support, ProLiant DL380 G6	$1,769.00	$590.00	$1,179.33	29%
Dell Support: 3 Year ProSupport and Mission Critical 4HR 7x24 Onsite Pack	$2,499.00	$833.00	$833.00	

Figure 8: Hardware support for the two solutions.

Energy costs

Figure 9 shows the calculations for the annual energy cost estimates. We estimate typical watts using active and idle power measurements taken during our benchmark testing. The typical estimate assumes the servers run year round, running at the active power 20 percent of the time and at the idle power the rest of the time.

[5] http://www.microsoft.com/licensing/mla/default.aspx

Annual costs - Energy costs	Dell PowerEdge R720	HP ProLiant DL380 G7
Cost per kWh	0.1039	0.1039
Typical watts	155.42	139.2
Annual kWh per server	1,361.48	1,219.39
Multiplier for cooling	1.8	2.0
Total kWh for power and cooling one server	2,450.7	2,438.8
Annual energy cost per server	**$254.62**	**$253.39**
Annual energy cost for solution	**$254.62**	**$506.78**

Figure 9: Energy cost calculations for the two solutions.

Rack and space costs

We assume each server has a single port out and that the data center charges an annual per-port cost of $250. We assume an annual data center per-rack space cost of $2,170, or $98.64 per rack unit, based on each rack holding 22u of servers. We assign $197.28 per year in space costs to each of these 2u servers.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies, Inc.
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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 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.