CONSOLIDATE AND UPGRADE TO SAVE UP TO $172K: DELL POWEREDGE R620 AND MICROSOFT SQL SERVER 2014

Dell™ PowerEdge™ R620 server using Microsoft® Windows Server® 2012 R2 with Hyper-V® and SQL Server® 2014
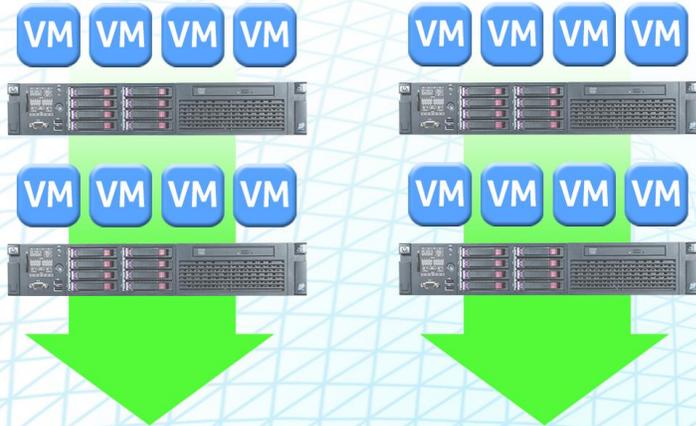
*Handled **4X** the workload of an older server*

*Up to **$172,573** in three-year TCO savings*

*Consolidate **up to 8U** of rack space into 1U*

Versus the costs and space requirements of four, four-year-old dual-socket servers

For every growing business, there will come a time when your infrastructure is too outdated to keep up. You can upgrade your four-year-old servers to the maximum memory and CPU capacity, but they will still be nearing end of life and may still not be fast enough to keep up with your growing user base. Upgrading your hardware infrastructure can be an expensive and challenging task, and it can be difficult to know if you are making the right choice. You need a solution that will be space-efficient, cost-effective, and high performing. The Dell PowerEdge R620 can provide these characteristics, providing cost savings and providing high performance. The Dell PowerEdge R620 is also a very space-efficient design, allowing your business to consolidate 8U worth of legacy servers into 1U, saving your business valuable rack space.

In the Principled Technologies labs, we tested the performance of a legacy server running older software and of the Dell PowerEdge R620 using Microsoft Windows Server 2012 R2 with Hyper-V and SQL Server 2014. We found that 16 VMs on the Dell PowerEdge R620, each running Microsoft Windows Server 2012 R2 with SQL Server 2014, achieved the same or greater performance than that of four VMs on a four-year-old dual-socket server, with each VM running Windows Server 2008 R2 and SQL Server 2008 R2.

We also compared the cost of both solutions. We found that replacing four of the four-year-old servers with the Dell PowerEdge R620 could save a business $172,573 over three years.

SAVING WITH THE POWEREDGE R620: TCO COMPARISON

In addition to delivering the same performance of four four-year-old servers using just one 1U rack server, the Dell PowerEdge R620 can save you money when you upgrade. We found that the Dell PowerEdge R620 could save up to $172,573 over three years compared to continuing to run four four-year-old dual-socket servers.

For our cost comparison, we calculated the total cost of ownership (TCO) of a Dell PowerEdge R620 running Microsoft Windows Server 2012 R2 and SQL Server 2014 against four four-year-old dual-socket servers running Windows Server 2008 R2 and SQL Server 2008 R2. The large difference in costs over three years is mainly due to the software licensing savings achieved by the lower core count of the Dell PowerEdge R620 solution, over the higher core count of the older four-server solution.

The Dell PowerEdge R620 can save space in your datacenter. In a scenario where the Dell PowerEdge R620 replaces four four-year-old dual-socket 2U servers, you could save 7U of rack space and the switch and cabling costs for three servers. The innovative design of the Dell PowerEdge R620 allows it to pack a lot of power into just 1U of space, potentially saving your business power and cooling costs.

Figure 1 compares the total three-year costs for each solution.
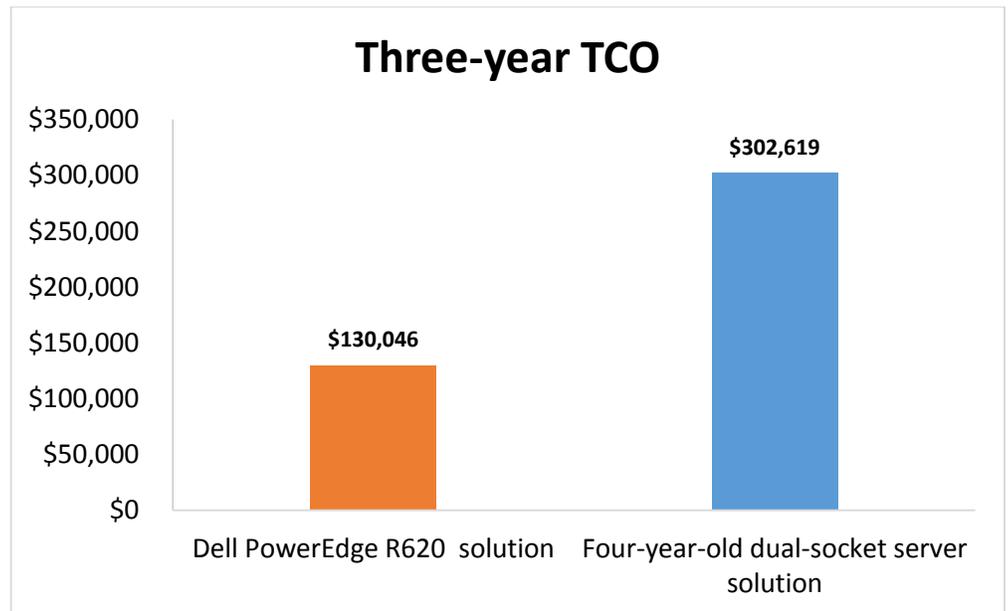
Figure 1: Three-year TCO comparison for four four-year-old dual-socket servers versus the Dell PowerEdge R620 solution. Lower numbers are better.

Three-year TCO

- Dell PowerEdge R620 solution: $130,046
- Four-year-old dual-socket server solution: $302,619

Figure 2 summarizes the projected costs for operating the two solutions over three years. For details on how we calculated at these numbers, see Appendix D.

	Dell PowerEdge R620 solution	Four-year-old dual-socket server solution	Dell PowerEdge R620 solution savings
Hardware expenses			
R620 hardware and support	$36,657	N/A	($36,657)
Support for existing HP servers	N/A	$10,344	$10,344
Software expenses			
SQL Server and Windows Server	$87,105	$265,932	$178,827
Data center expenses			
Power and cooling	$1,629	$6,703	$5,074
Data center space and ports	$1,155	$5,240	$4,085
Labor expenses			
Deployment	$800	$0	($800)
Management	$2,700	$14,400	$11,700
Total three-year TCO	**$130,046**	**$302,619**	**$172,573**

Figure 2: Summary of three-year TCO for the Dell PowerEdge R620 solution and the four-year-old dual-socket solution.

WHAT WE TESTED

We compared the performance of two solutions running different versions of SQL Server on these two solutions:

- **Dell PowerEdge R620** with Microsoft Windows Server 2012 R2 that hosted 16 Windows Server 2012 R2 VMs each running SQL Server 2014.
- **A single four-year-old dual-socket server** with Windows Server 2008 R2 that hosted four Windows Server 2008 R2 VMs running SQL Server 2008 R2.

As a growing business would have likely upgraded their aging server during its life span, we tested a four-year-old dual-socket server solution with upgrades over the stock configuration. Our configuration of the four-year-old dual-socket server included 48 GB of memory and six-core processors. We created four VMs with 8 GB of memory and two vCPUs each to mimic a business that would have increased its VM count and VM configuration over time.

On the Dell PowerEdge R620, we created 16 VMs with 8 GB of memory and two vCPUs to match the VMs created in the legacy environment. All VMs in both environments used a 50GB VHD for the guest OS and two separate 30GB VHDs for the SQL Server database files and log files.

To create our real-world ecommerce workload, we used the DVD Store Version 2.1 benchmarking tool. We used a 20-millisecond think time for both servers to generate a database workload that achieved at least 15,000 orders per minute (OPM) per VM. The DVD Store 2.1 benchmark measured database performance with a 10GB Microsoft SQL Server 2008 R2 database on the four-year-old dual-socket server and the same database upgraded to Microsoft SQL Server 2014 on the Dell PowerEdge R620.

For detailed configuration information of the servers, see Appendix A. See Appendix B for detailed information on how we tested the servers and see Appendix C for more hardware, software, and benchmark information.

WHAT WE FOUND

The Dell PowerEdge R620 supported 16 VMs running the SQL Server 2014 database workload, which was four times more than the four VMs on the four-year-old dual-socket server. In this configuration, the R620 can consolidate four times the VMs of the older server. Figure 3 shows the number of VMs each server supported. For OPM results per VM, see Appendix E.
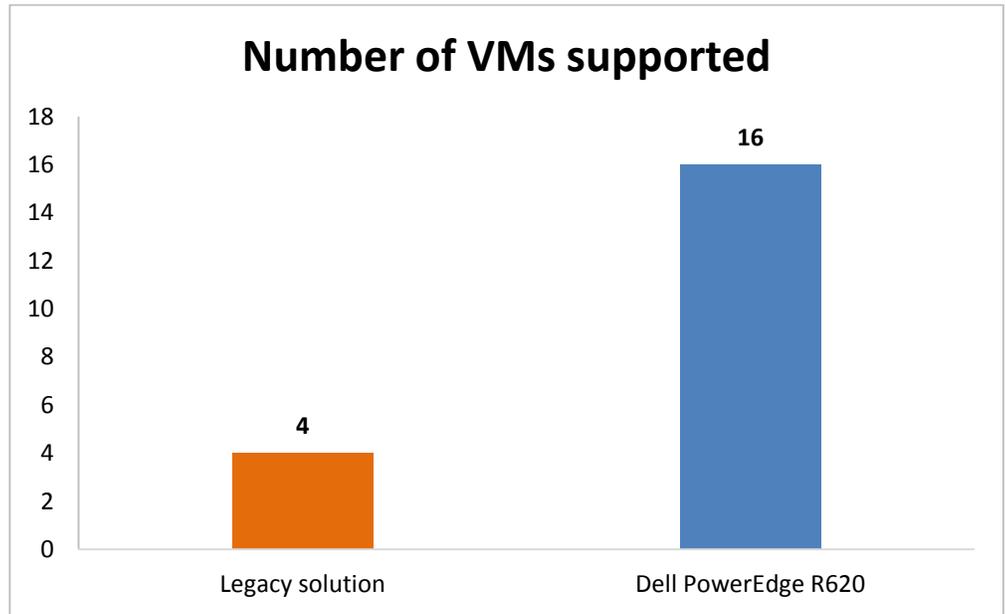
Figure 3: One Dell PowerEdge R620 did four times the work (16 VMs) of a single legacy solution (4 VMs), while maintaining the same level of performance in each VM.

Number of VMs supported

Legacy solution	4
Dell PowerEdge R620	16

IN CONCLUSION

Your growing business needs upgraded infrastructure to keep up with increased users and demand on your hardware. Adding memory and upgrading processors does not provide the same benefits to your infrastructure as a consolidation and upgrade can. Upgrading and consolidating your IT infrastructure to the Dell PowerEdge R620 running Microsoft Windows Server 2012 R2 and SQL Server 2014 can improve performance while saving money and rack space.

Based on our findings, a single Dell PowerEdge R620 can replace four four-year-old dual-socket servers with VMs running heavy SQL Server database workloads. We found that consolidating four older servers onto a Dell PowerEdge R620 and upgrading to Microsoft Windows Server 2012 R2 with Hyper-V and SQL Server 2014 could save up to $172,573 over three years, compared to keeping the four-year-old dual-socket servers. The Dell PowerEdge R620 can also consolidate 8U worth of legacy servers into 1U of space. If your business runs older versions of Microsoft SQL Server on end-of-life dual-socket servers, the Dell PowerEdge R620 with Microsoft Windows Server 2012 R2 with Hyper-V and SQL Server 2014 could save your company these costs while delivering better performance than the aging hardware and software.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 4 provides detailed configuration information for the test systems.

System	Dell PowerEdge R620	HP ProLiant DL380 G6
Power supplies		
Total number	2	2
Vendor and model number	Dell E750E-S0	HP 499249-001
Wattage of each (W)	750	460
Cooling fans		
Total number	7	6
Vendor and model number	Delta® GFC0412DS	Nidec® V60E12BS1A7-09A032
Dimensions (h × w) of each	1-1/2" × 1-3/4"	76mm × 64mm
Volts	12	12
General		
Number of processor packages	2	2
Number of cores per processor	8	6
Number of hardware threads per core	2	2
System power management policy	Default	Performance
CPU		
Vendor	Intel®	Intel
Name	Xeon®	Xeon
Model number	E5-2660	X5670
Socket type	FCLGA2011	FCLGA1366
Core frequency (GHz)	2.20	2.93
Bus frequency	8	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	20 MB	12 MB
Platform		
Vendor and model number	Dell PowerEdge R620	HP ProLiant DL380 G6
BIOS name and version	Dell 2.2.3	ProLiant P62
BIOS settings	Default	Performance
Memory module(s)		
Total RAM in system (GB)	160	48
Vendor and model number	Micron® MT36KSF1G72PZ	Micron MT36JSZF51272PY
Type	PC3-12800R	PC3-10600R
Speed (MHz)	1,600	1,333
Speed running in the system (MHz)	1,600	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	9-9-9-24
Size (GB)	8	4
Number of RAM module(s)	20	12
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual

System	Dell PowerEdge R620	HP ProLiant DL380 G6
Operating system		
Name	Microsoft Windows Server 2012 R2	Microsoft Windows Server 2008 R2
Build number	9600	7601
File system	NTFS	NTFS
Kernel	6.2.9600.16452	6.1.7601.18409
Language	English	English
RAID controller		
Vendor and model number	Dell PERC H710P	HP Smart Array P410i
Firmware version	21.2.1-0000	2.74
Driver version	6.802.19.0 12/5/2013	6.28.0.64 2/18/2014
Cache size (MB)	1024	1024
Local storage		
Vendor and model number	Dell LB400M / Dell ST9900805SS	HP EH0146FARWD / Seagate ST900205SS
Number of drives	6 (Data) / 2 (OS)	6 (Data) / 2 (OS)
Size (GB)	400 / 900	146 / 600
RPM	SSD / 10k	15k / 10k
Type	SAS / SAS	SAS / SAS
Ethernet adapters		
Vendor and model number	Intel Gigabit I350 4-port	HP NC382i 1GbE 2-port
Type	Integrated	Integrated
Driver	12.11.97.0 5/20/2014	7.10.6.0 3/11/2014

Figure 4: System configuration information for the test systems.

APPENDIX B – HOW WE TESTED

Configuring the Dell PowerEdge R620

Configuring the local storage

These steps outline how we configured the local storage in the R620. In our testing, we had two high-capacity hard disks and six medium-capacity solid-state drives. We configured the two HDDs in a RAID1 group and installed the host OS there. We also used the HDDs for guest OS and SQL Server Log VHDs. We configured the six SSDs in a RAID10 group and used that volume for the SQL Server Data VHDs.

1. Power on the Dell PowerEdge R620, and press Ctrl-R at the Dell PERC Configuration Utility prompt.
2. Select the storage controller, and press F2.
3. Select Create New VD, and press Enter.
4. Select the RAID type, physical disks needed, and any advanced settings. For the HDDs, we used RAID1 and left the default cache settings. For the SSDs, we disabled the cache by selecting No Read Ahead and Write Through. Select OK, and press Enter.
5. Press OK at the initialization warning.
6. Select the newly created VD, and press F2. Select Initialization→Start, and press Enter.
7. When the VD has finished initializing, exit the utility, and reboot the server.

Installing Microsoft Windows Server 2012 R2

These steps outline how we installed Microsoft Windows Server 2012 R2 onto the Dell PowerEdge R620 as well as on the VMs used in testing.

1. Attach the installation media to the host or VM.
2. Power on the host or VM, and boot into the Windows installer.
3. Once the installation files have been copied into memory, select the appropriate language, time and currency format, and keyboard layout, and click Next.
4. Click Install Now.
5. Enter the product key, and click Next.
6. Choose Windows Server 2012 R2 Datacenter (Server with a GUI), and click Next.
7. Check the I accept the license terms box, and click Next.
8. Choose Custom: Install Windows only (advanced).
9. Select the OS hard drive from the list, and click Next. This begins the installation.
10. Run Windows Update on the server until the operating system is completely up to date.

Building the virtual machines

1. Use Server Manager to add the Hyper-V role to the host.
2. Use Hyper-V Manager to create a new virtual machine with two vCPUs and 8 GB of memory. Give the OS VHD 50 GB, and place it on the HDDs.
3. Create two more VHDs with 30 GB each for data and logs. Place the Log VHD on the HDDs and the Data VHD on the SSDs.

4. Create a virtual switch connected to the client network, and attach it to the VM.
5. Attach the OS installation media to the VM, and install the guest OS.

Installing Microsoft SQL Server 2014

These steps describe how we installed Microsoft SQL Server 2014 onto the test VMs.

1. Attach the installation media to the virtual optical drive for the VM.
2. Connect to the VM, and launch setup.exe from the installation media.
3. Choose the Installation section on the left, and click New SQL Server stand-alone installation or add features to an existing installation.
4. At the Product Key screen, enter the product key, and click Next.
5. At the License Terms screen, check the I accept the license terms box, and click Next.
6. At the Global Rules screen, allow the Global Rules check to finish, and click Next.
7. At the Microsoft Update screen, check the use Microsoft Update to check for updates (recommended) box, and click Next.
8. Once the updates have been downloaded and installed, click Next.
9. At the Install Setup Files screen, allow the setup files to install, and click Next.
10. At the Install Rules screen, allow the Install Rules check to run, and click Next.
11. At the Setup Role screen, select the SQL Server Feature Installation radio button, and click Next.
12. At the Feature Selection screen, select the features required for your installation. We selected Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tool Backwards Compatibility, Management Tools - Basic, and Management Tools - Complete.
13. At the Feature Rules screen, allow the Feature Rules check to run, and click Next.
14. At the Instance Configuration screen, click Next to use the default instance named MSSQLSERVER.
15. At the Server Configuration screen, click Next.
16. At the Database Engine Configuration screen, select the radio button for Mixed Mode (SQL Server authentication and Windows authentication) and enter a password for the SQL Server system administrator (sa) account.
17. Click Add Current User.
18. In the Data Directories tab, enter the directories to be used for SQL data and logs. We used E:\ and F:\, respectively, to place the data and logs on their appropriate VHDs. Click Next.
19. At the Feature Configuration Rules screen, allow the Feature Configuration Rules check to finish, and click Next.
20. At the Ready to Install screen, click Install.
21. After the installation has completed, close the wizard.

Configuring the legacy server

Installing Windows Server 2008 R2

Prior to installing Windows Server 2008 R2 on the HP ProLiant DL380 G6, we used the Smart Array configuration utility to create a RAID1 drive pair for the operating system and used the remaining six drives in RAID10 for the VM VHDs.

1. Insert the installation DVD for Windows Server 2008 R2 SP1 Enterprise into the DVD drive or attach the disk image to the VM, and boot into the installation media.

2. At the Language Selection Screen, click Next.

3. Click Install Now.

4. Select Windows Server 2008 R2 Datacenter (Full Installation), and click Next.

5. Click the I accept the license terms checkbox, and click Next.

6. Click Custom.

7. Click Next.

8. At the User's password must be changed before logging on warning screen, click OK.

9. Enter the desired password for the administrator in both fields, and click the arrow to continue.

10. At the Your password has been changed screen, click OK.

11. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.

Installing SQL Server 2008 R2

1. Attach the installation media to the VM.

2. In the VM guest operating system, run setup.exe.

3. If the installer prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.

4. In the left pane, click Installation.

5. Click New SQL Server stand-alone installation or add features to an existing installation.

6. At the Setup Support Rules screen, wait for the rule check to complete. If there are no failures or relevant warnings, click OK.

7. Enter your license key, and click Next.

8. Choose to accept the license terms, and click Next.

9. If no failures are displayed after the setup support files are installed, click Next.

10. At the Setup Role screen, choose SQL Server Feature Installation.

11. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Click Next.

12. At the Installation Rules screen, click Next after the check completes.

13. At the Instance configuration screen, leave the default selection of default instance, and click Next.

14. At the Disk Space Requirements screen, click Next.

15. At the Server Configuration screen, check that NT AUTHORITY\SYSTEM is selected for SQL Server Agent and SQL Server Database Engine. Click Next.

16. Assuming there are no failures, click Next.

17. At the Database Engine Configuration screen, select Mixed Mode.

18. Enter and confirm a password for the system administrator account.

19. Click Add Current user. This may take several seconds.

20. Click the Data Directories tab, and enter the appropriate drive and folders for database and logs.

21. Click Next.

22. At the Error and usage reporting screen, click Next.
23. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
24. At the Ready to Install screen, click Install.
25. After installation completes, click Close.

Configuring the database

We generated the data using the Install.pl script included with DVD Store version 2.1 (DS2), providing the parameters for our 10GB database size and the database platform on which we ran (Microsoft SQL Server). We ran the Install.pl script on a utility system running Linux. The Install.pl script generated the database schema.

After processing the data generation, we transferred the data files and schema creation files to a Windows-based system running SQL Server. We built the 10GB database in SQL Server, and then performed a full backup, storing the backup file on the C: drive for quick access. We used that backup file to restore the server between test runs.

The only modification we made to the schema creation scripts were the specified file sizes for our database. We explicitly set the file sizes higher than necessary to ensure that no file-growth activity would affect the outputs of the test. Other than this file size modification, we created and loaded the database in accordance to the DVD Store documentation. Specifically, we followed these steps:

1. We generated the data, and created the database and file structure using database creation scripts in the DS2 download. We made size modifications specific to our 10GB database, and made the appropriate changes to drive letters.
2. We transferred the files from our Linux data generation system to a Windows system running SQL Server.
3. We created database tables and stored procedures and objects using the provided DVD Store scripts.
4. We set the database recovery model to bulk-logged to prevent excess logging.
5. We loaded the data we generated into the database. For data loading, we used the import wizard in SQL Server Management Studio. Where necessary, we retained options from the original scripts, such as Enable Identity Insert.
6. We created indices, full-text catalogs, primary keys, and foreign keys using the database-creation scripts.
7. We updated statistics on each table according to database-creation scripts, which sample 18 percent of the table data.
8. On the SQL Server instance, we created a ds2user SQL Server login using the following Transact SQL (TSQL) script:

```
USE [master]
GO
CREATE LOGIN [ds2user] WITH PASSWORD=N'',
          DEFAULT_DATABASE=[master],
          DEFAULT_LANGUAGE=[us_english],
          CHECK_EXPIRATION=OFF,
          CHECK_POLICY=OFF
GO
```

9. We set the database recovery model back to full.
10. We created the necessary full text index using SQL Server Management Studio.
11. We created a database user, and mapped this user to the SQL Server login.
12. We then performed a full backup of the database. This backup allowed us to restore the databases to a pristine state relatively quickly between tests.

Running the DVD Store tests

We created a series of batch files, SQL scripts, and shell scripts to automate the complete test cycle. DVD Store outputs an orders-per-minute metric, which is a running average calculated through the test. In this report, we report the last OPM reported by each client/target pair.

Each complete test cycle consisted of the following general steps:

1. Clean up prior outputs from the target system and the client driver system.
2. Drop the database from the target.
3. Restore the database on the target.
4. Shut down the target.
5. Reboot the host and client system.
6. Wait for a ping response from the server under test (the hypervisor system), the client system, and the target.
7. Let the test server idle for 20 minutes.
8. Start the DVD Store driver on the client.

We used the following DVD Store parameters for testing:
```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --
n_threads=28 --db_size=10GB --think_time=0.02 --detailed_view=Y --
warmup_time=5 --csv_output=<drive path>
```

APPENDIX C – WHAT WE TESTED

About the Dell PowerEdge R620

The Dell PowerEdge R620 is a 1U, dual-socket server that packs great power into a small space. The Dell PowerEdge R620 incorporates all of the Dell 12G technologies including the iDRAC remote management, versatile storage capacity, operation efficiency, and outstanding I/O. With space for up to 384 GB of memory and 12.8 TB of local storage, the Dell PowerEdge R620 can handle the workloads of much larger servers.

For more information about the Dell PowerEdge R620, visit www.dell.com/us/business/p/poweredge-r620/pd.

About the Intel Xeon processor E5 family

The new Intel Xeon processor E5 family, which comes standard in new Dell PowerEdge servers, incorporates new technology and features to meet the computing demands of the present and future. The Intel Xeon processor E5 family delivers intelligent and adaptive performance using such features as Intel Turbo Boost Technology 2.0, Intel Advanced Vector Extension, Intel Integrated I/O, and Intel Data Direct I/O Technology. These new processors also feature Intel Trusted Execution Technology (Intel TXT) and utilize Intel Advance Encryption Standard New Instructions (Intel AES-NI) to help keep your data safe.

For more information about the Intel Xeon processor E5 family, visit www.intel.com.

About Microsoft Windows Server 2012

Windows Server 2012, the latest release of this server OS from Microsoft, includes many new features and enhancements. According to Microsoft, Windows Server 2012 focuses on four core areas:

1. **Beyond virtualization.** Windows Server 2012 provides a robust and dynamic virtualization platform through Hyper-V, and includes new features that provide flexible options for delivering cloud services.
2. **The power of many servers, the simplicity of one.** Windows Server 2012 offers features that allow for high availability and ease of management for multiple-server infrastructures.
3. **Every app, any cloud.** Windows Server 2012 delivers a scalable and flexible Web and application platform by providing a consistent and open set of tools and frameworks that apply to applications on premises, in the cloud, or in a hybrid environment.
4. **Modern work style, enabled.** Microsoft Windows Server 2012 empowers users and IT staff with remote access to data, applications, and simpler management tools while strengthening security and compliance.

About Microsoft SQL Server 2014

This latest iteration of the Microsoft SQL Server family is a next-generation data platform that includes many new features oriented to enterprise users focused on transactional performance and speed, time-to-insight, business analytics, high availability, and integration of their data streams into public and private cloud environments. Microsoft highlights the following key features:

Support for in-memory OLTP, via a memory and OLTP-optimized database engine integrated into the platform's data engine, and enhancements to the in-memory column store already present in Microsoft SQL 2012.

Ease of integration with Microsoft Azure, making SQL Server 2014 a platform for hybrid cloud, supporting scenarios such as cloud backup and cloud disaster recovery.

Better redundancy with AlwaysOn Availability Groups, allowing up to eight secondary replicas to be placed in different locations for high availability, read-access efficiency, and backup and data recovery.

For more information about Microsoft SQL Server 2014, visit www.microsoft.com/en-us/sqlserver/default.aspx.

About DVD Store Version 2.1

To create our real-world ecommerce workload, we used the DVD Store Version 2.1 benchmarking tool. DS2 models an online DVD store, where customers log in, search for movies, and make purchases. DS2 reports these actions in orders per minute that the system could handle. The DS2 workload also performs other actions, such as adding new customers, to exercise the wide range of database functions you would need to run your ecommerce environment.

APPENDIX D – PRICING DETAILS

To calculate the cost of consolidating with the Dell PowerEdge R620 compared to adding existing four-year-old dual-socket servers, we used the following costs:

Hardware

We used the MSRP for a Dell PowerEdge R620 with the following upgrades:

1. Chassis with up to eight drive bays and three PCIe slots
2. Dell PERC H710P RAID controller with 1GB cache
3. Two 900GB 10K RPM SAS 6Gbps 2.5in hot-plug hard drives
4. Six 400GB SLC SSD SAS 6Gbps 2.5in hot-plug solid-state drives
5. VFlash, 8GB SD Card for iDRAC Enterprise
6. Two Intel Xeon processors E5-2660
7. 20 8GB RDIMM 1600MT/s
8. ProSupport Plus: Mission Critical 4-Hour 7x24 On-Site Service with Emergency Dispatch for 3 years

We also included post-warranty support costs over three years for the four four-year-old dual-socket servers. Figure 5 shows the hardware costs for the configurations.

	Dell PowerEdge R620 solution	Four-year-old dual-socket server	Dell PowerEdge R620 solution savings
R620 hardware and support	$36,657	N/A	($36,657)
Support for existing HP servers	N/A	$10,344	$10,344
Total hardware expenses	**$36,657**	**$10,344**	**($26,313)**

Figure 5: Summary of hardware and hardware support costs for the Dell PowerEdge R620 solution and the four-year-old dual-socket solution.

Software

The Dell PowerEdge R620 contained 16 cores total. The legacy solution we tested had 12 cores; therefore, four of those servers would have 48 cores. The Dell PowerEdge R620 solution and the legacy server we tested contained two processors, so four of the legacy servers would contain eight processors. Figure 6 shows a summary of these costs.

	Cost per unit	Four older servers with two six-core processors each		Dell PowerEdge R620 with two eight-core processors	
		Number	Total	Number	Total
Microsoft SQL Server Enterprise Software Assurance, two-core pack	$6,874	24	$164,976	8	$54,992
Microsoft Windows Server Datacenter Software Assurance, two-processor pack	$3,078	4	$12,312	1	$3,078
Two-year total			$177, 288		$58,070
Three-year total (1.5 * two-year total)			$265,932		$87,105
Three-year savings for the Dell R620 solution					**$178,827**

Figure 6: Summary of software and software support costs for the Dell PowerEdge R620 solution and the four-year-old dual-socket solution.

Data center expenses

Data center expenses can vary depending on many factors. Actual costs may be higher or lower for your environment. We entered the server configuration information into tools provided by each vendor to estimate the power usage of a workload with 80 percent CPU utilization. The Dell Energy Smart Solution Advisor calculated the Dell PowerEdge R620 power usage at 348 watts. The HP Power Advisor calculated the power usage for the HP ProLiant DL380 G6 at 358 watts. We calculated costs based on an energy cost of $.1047 per KwH.[1] We estimated the cost of cooling at .7 times the cost of power.[2]

Power and cooling	Dell PowerEdge R620	Four-year-old dual-socket server solution
Power usage (W)	348	1432
Power cost	$319.39	$1,314.29
Power and cooling cost	$542.96	$2,234.29
Three-year cost for power and cooling	**$1,629.00**	**$6,703.00**

Figure7: Summary of power and cooling costs for the Dell PowerEdge R620 solution and the four-year-old dual-socket solution.

---

[1] Average commercial rate for year ending April, 2014 in dollars per KwH
www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_3.
[2] www.datacenterknowledge.com/archives/2014/06/02/survey-industry-average-data-center-pue-stays-nearly-flat-four-years/

We estimated the cost for the data center space used by each solution at $155 per U over three years. That estimate assumed a 42U rack fills 7 square feet of data center space at a cost of $310 per year per square foot for a total of $2,170 for the rack.[3] We used this assumption to calculate the costs for the 8U used by the four-year-old dual-socket server solution and the 1U used by the Dell PowerEdge R620 server.

We included a cost per server for data center ports based on an estimate of $24,000 to purchase a 10Gbe networking switch and cables that support 48 connections at an average cost per connection of $500. We assumed two data center ports per server for a one-time cost per server of $1,000.

Labor

For management costs, we estimated the time required for each and multiplied it by a flat hourly cost. Figure 8 shows a summary of these costs.

Management	Hours per month per server	Number servers	Total	Annual total	Cost per hour	Annual cost	Three-year cost
HP legacy servers	2	4	8	96	$50	$4,800	$14,400
Dell PowerEdge R620	1.5	1	1.5	18	$50	$1,800	$2,700
Savings							$11,700

Figure 8: Summary of management costs for the Dell PowerEdge R620 solution and the four-year-old dual-socket solution.

Based on our experience, we estimated a deployment time of 16 hours for the Dell PowerEdge R620 at a rate of $50 an hour and a total cost of $800.

3
www.vmware.com/go/tcocalculator/newIndex.html?numvirtualMacin=40&productEdition=vSphere+Essentials+Plus&nummacinDeploy=40&virtualizationHost=Server+B+%28HP+DL380e+Gen8%2C+2+CPU%2C+128GB+RAM%29&networkedStorage=iSCSI+SAN&networkedStorageComparison=iSCSI+SAN&virtualizationManagement=Virtual+Machines&costofElectricity=Average&costofRealestate=Average&BaselinevmPerCpu=6&additionalvmPercpu=1&index_submit=See+Results

APPENDIX E – PERFORMANCE RESULTS

During our performance testing, we set a goal of achieving at least 15,000 OPM per VM in order to reflect an even level of workload distribution and service. Figure 9 lists the OPM results for each VM on each solution.

	Dell PowerEdge R620	Legacy solution
VM1	18,447	16,608
VM2	16,496	17,001
VM3	18,455	17,109
VM4	16,931	15,757
VM5	18,450	N/A
VM6	16,704	N/A
VM7	18,484	N/A
VM8	16,928	N/A
VM9	18,426	N/A
VM10	16,629	N/A
VM11	18,519	N/A
VM12	17,084	N/A
VM13	18,559	N/A
VM14	16,637	N/A
VM15	18,612	N/A
VM16	17,056	N/A

Figure 9: DVD Store 2 results for each VM in each solution. Higher numbers are better.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies®

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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.