

DATABASE SERVER COMPARISON: DELL POWEREDGE R630 VS. LENOVO THINKSERVER RD550

BOOST DATABASE PERFORMANCE AND STORAGE CAPACITY WITH THE DELL™ POWEREDGE™ R630 SERVER

The Dell PowerEdge R630 with Intel® SSDs outperformed the competition.

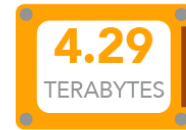


Intel SSD
DC S3610 Series drives

14% MORE
ORDERS PER MINUTE

Dell 443,560

Lenovo 385,990



1½ TIMES
THE STORAGE CAPACITY
in the tested configuration

POWERED BY
THE INTEL XEON®
PROCESSOR E5-2600
V3 PRODUCT FAMILY



vs. Lenovo® ThinkServer® RD550

When selecting a server for running your database applications, you want hardware that can deliver strong performance and offer plenty of storage capacity for your current data set, along with the option to scale for future growth. The 1U Dell PowerEdge R630 features Intel Xeon processors E5-2660 v3, Intel DC S3610 Series solid-state drives (SSDs), and twenty-four 1.8-inch drive bays for generous storage capacity to power your storage needs today and tomorrow.

In the Principled Technologies labs, we tested the Dell PowerEdge R630 server, and the Lenovo ThinkServer RD550, using a performance benchmark that measured the number of orders per minute that each server could process utilizing a database application. We found that the PowerEdge R630 handled 14.9 percent more orders than the ThinkServer RD550. Processing more orders per minute means users or applications can process more critical business transactions in the same amount of time.

We also noted the usable capacity of each server in the configurations we tested. While configurations and drive capacities can vary, having 22 drive bays available is an advantage over having just 12 when drive capacities are relatively even. The PowerEdge R630 we tested had 4.29 terabytes of storage, one and a half times the capacity of the ThinkServer RD550 we tested. The PowerEdge R630 is designed by Dell to maximize performance by bringing large capacities of flash storage closer to the compute power of the server, and when your system has not only the storage performance to keep your applications running smoothly, but also storage capacity, this translates to a flexible and agile solution.



MORE PERFORMANCE + ROOM TO GROW

Imagine a rapidly growing enterprise that needs to upgrade its existing infrastructure to a more scalable solution for running database applications. The company needs a server solution that can handle an extreme transactional rate with today's demand and that can expand in capacity as the company and its applications expand. With increasing database demands and limited space in the company datacenter, it is essential that the solution be compact, and be capable of delivering excellent performance. The PowerEdge R630 is powerful server that not only helps boost performance but also provides versatility in the form of extra storage capacity.

WHAT WE TESTED AND FOUND

To compare the Dell PowerEdge R630 to the Lenovo ThinkServer RD550, we created and ran an online transaction processing (OLTP) database workload with the benchmark DVD Store 2.1, which delivers results in terms of the number of orders per minute that the application could complete.¹

We measured the database performance of the Dell PowerEdge R630 in the following maximum SATA disk count configuration (24 bays):

- two 1.8-inch Intel SSD DC Series 3500 6Gb/s Boot SATA SSDs to run the operating system (capacity of each drive: 80 GB)
- twenty-two 1.8-inch Intel SSD DC Series S3610 6Gb/s Mixed-Use SATA SSDs for database storage (capacity of each drive: 200 GB)

We also tested the Lenovo ThinkServer RD550 in its maximum SATA disk count configuration (12 bays):

- twelve 2.5-inch SATA SSDs (capacity of each drive: 240 GB)

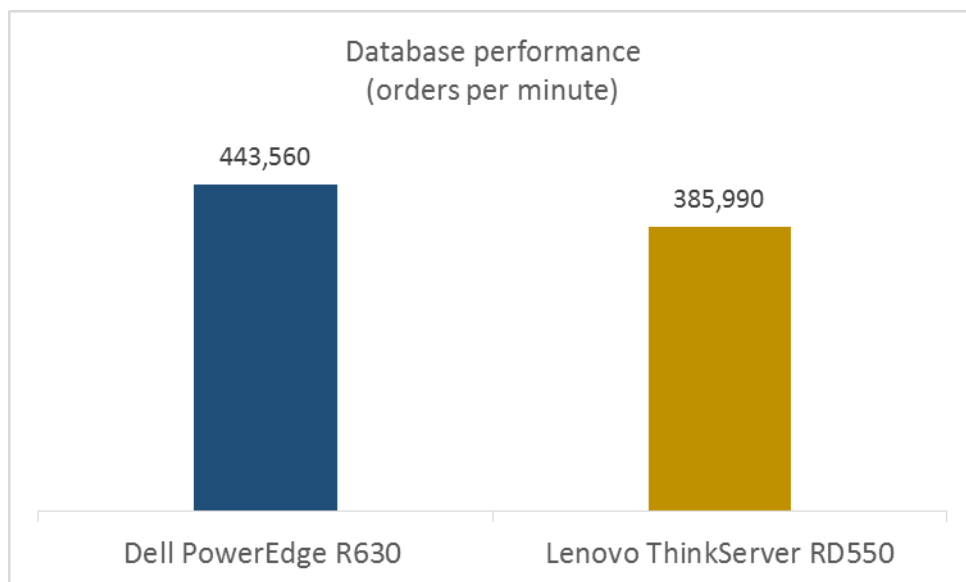
Performance

We used Microsoft Hyper-V on both servers, and created eight virtual machines (VMs), each running an instance of Microsoft SQL Server 2014 and containing the benchmark workload.

We performed three test runs and report the median from each server. As Figure 1 shows, at maximum SATA disk count configurations, the Dell PowerEdge R630 outperformed the Lenovo ThinkServer RD550 by 14.9 percent; delivering 57,570 more orders per minute, for a total of 443,560 OPM.

¹ For information on the server and benchmark, see [Appendix A](#). For detailed system configuration information, see [Appendix B](#). For specifics of our testing, see [Appendix C](#).

Figure 1: SQL Server 2014 performance for the two servers we tested. Higher numbers are better. Each server contained the maximum SATA SSD counts, 24 for the Dell, 12 for the Lenovo.



Storage capacity

The amount of storage capacity a server provides is important—greater disk space gives your company more time to grow before you need to replace the server. In addition to outperforming the Lenovo ThinkServer RD550 in our performance testing, the PowerEdge R630 offers more drive bays (twenty-four 1.8-inch bays) to store data, more than the Lenovo RD550, which offers just twelve 2.5-inch drive bays. Figure 2 presents the storage configuration for the two servers we used in our testing. As it shows, the Dell PowerEdge R630 we tested, with a configured total of 4.3 TB of storage space, could store 52.8 percent more data than the configured Lenovo ThinkServer RD550 we tested.

Server as tested	Drive size and type	Capacity per drive	Quantity	Total capacity
Dell PowerEdge R630	1.8-inch Intel DC Series S3610 6Gb/s Mixed-Use SATA SSD	200 GB	22	4.29 TB
Lenovo ThinkServer RD550	2.5-inch SSDs	240 GB	12	2.81 TB

Figure 2: Storage capacity of the servers we tested. To calculate total capacity in terabytes, we divided the capacity in GB by 1,024. Higher numbers are better. Each server contained the maximum SATA SSD counts, 24 for the Dell, 12 for the Lenovo.

CONCLUSION

We tested the OLTP performance of a 1U Dell PowerEdge R630, powered by Intel Xeon processors E5-2660 v3, running Microsoft Hyper-V and virtual machines running SQL Server 2014, and compared it to that of the Lenovo ThinkServer RD550 running the same software. For each server, we selected the maximum SATA SSD count that was configurable for each model. The Dell PowerEdge R630 outperformed the Lenovo ThinkServer RD550 by 14.9 percent and offered more than one and a half times the storage space for data in our configuration.

By selecting a server that handles more orders per minute and offers significantly more storage capacity potential than the competition, you get a not only faster, efficient experience for your database users, but also have the scaling potential for your storage needs ahead of your business growing.

APPENDIX A – ABOUT THE COMPONENTS

About the Dell PowerEdge R630

Fitting into just 1U of rack space, the Dell PowerEdge R630 features two Intel Xeon processors E5-2660 v3 to deliver high compute performance. Dell designed the PowerEdge R630 with cloud applications, virtualization environments, and high performance computing (HPC) infrastructures in mind. The PowerEdge R630 has 24 DIMM slots to support up to 1.5 TB of memory, supports an optional internal GPU processing accelerator, and can support up to two optional NVMe Express Flash PCIe SSDs to reduce storage bottlenecks.

With redundant power supply units, hot-swappable hardware, and Dual SD card for Failsafe Hypervisors, the Dell PowerEdge R630 supports hardware high availability. The PowerEdge R630 comes standard with iDRAC8 with Lifecycle Controller and Dell OpenManage, which all work to streamline management.

Learn more at www.dell.com/us/business/p/poweredge-r630/pd.

About DVD Store Version 2.1

To create our real-world OLTP 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, to show what kind of performance you could expect for your customers. 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.

Learn more at www.delltechcenter.com/page/DVD+Store.

APPENDIX B – SYSTEM CONFIGURATION INFORMATION

Figure 3 provides detailed configuration information for the test systems.

System	Dell PowerEdge R630	Lenovo ThinkServer RD550
Power supplies		
Total number	2	2
Vendor and model number	Dell 0G6W6KX02	LiteON® PS-2751-1V-LF
Wattage of each (W)	750	750
Cooling fans		
Total number	7	8
Vendor and model number	Nidec® R40W12BS1NB8-07A02	Delta® GFM0412SS-DE1P
Volts	12	12
General		
Number of processor packages	2	2
Number of cores per processor	10	10
Number of hardware threads per core	20	20
System power management policy	Performance	Performance
CPU		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E5-2660 v3	E5-2660 v3
Socket type	FCLGA2011-v3	FCLGA2011-v3
Core frequency (GHz)	2.6	2.6
Bus frequency	9.6 GT/s	9.6 GT/s
L1 cache	32KB + 32KB (per core)	32KB + 32KB (per core)
L2 cache	256KB (per core)	256KB (per core)
L3 cache	25MB	25MB
Platform		
Vendor and model number	Dell PowerEdge R630	Lenovo ThinkServer RD550
BIOS name and version	1.3.0	PB1TS126
BIOS settings	Performance	Performance
Memory module(s)		
Total RAM in system (GB)	128	128
Vendor and model number	Samsung® M393A1G43DB0-CPB	Lenovo 03T7861
Type	PC4-2133P	PC4-2133P
Speed (MHz)	2,133	2,133
Speed running in the system (MHz)	2,133	2,133
Timing/Latency (tCL-tRCD-tRP-tRASmin)	15-15-15-36	15-15-15-36
Size (GB)	8	8
Number of RAM module(s)	16	16
Chip organization	Double-Sided	Double-Sided
Rank	Dual	Single

System	Dell PowerEdge R630	Lenovo ThinkServer RD550
Operating system		
Name	Microsoft® Windows Server® 2012 R2	Windows Server 2012 R2
Build number	6.3.9600	6.3.9600
File system	NTFS	NTFS
Kernel	NT	NT
Language	English	English
RAID controller		
Vendor and model number	Dell PERC H730 Mini	Lenovo RAID 720ix AnyRAID
Firmware version	25.2.2-0004	24.3.0-0074
Driver version	6.602.12.0	6.703.3.0
Cache size (MB)	1024	1024
Solid-state drives		
First drive		
Vendor and model number	Intel SSDSC1NB080G4R	Intel SSDSC2BB240G4L
Number of drives	2	12
Size (GB)	80	240
Type	SATA SSD	SATA SSD
Second drive		
Vendor and model number	Intel SSDSC1BG200G4R	N/A
Number of drives	22	N/A
Size (GB)	200	N/A
Type	SATA SSD	N/A
Ethernet adapters		
Vendor and model number	Dell Broadcom® 5720 Quad-Port	Lenovo I350-T4 AnyFabric 1Gb 4Port
Type	NDC	Mezz
Driver	7.10.12	12.11.97.1

Figure 3: Detailed configuration information for the test systems.

APPENDIX C—DETAILED TEST METHODOLOGY

We used default performance BIOS settings on each server. We configured the RAID on both servers with a read ahead read policy and a write through write policy to enable FastPath. Each server had two Intel Xeon E5-2660 v3 processors, 128 GB of RAM, and eight virtual machines. Each VM had Microsoft SQL Server 2014 installed, four vCPUs, 8 GB of RAM, one 41GB disk for the OS, one 44GB disk for the data, and one 23GB disk for the logs.

Configuring the RAID on the Dell PowerEdge R630

Creating the virtual drive for the OS

1. Power on the server.
2. When the option appears, press F2 to enter the System Setup.
3. Click Device Settings.
4. Select the RAID Controller Configuration Utility.
5. Click Configuration Management.
6. Click Create Virtual Disk.
7. From the Select RAID Level drop-down menu, click RAID1.
8. On the Select Physical disks From line, choose Unconfigured Capacity.
9. Click Select Physical Disks.
10. On the Select Media Type line, choose SSD.
11. Check the boxes next to the two 80GB SSDs.
12. At the top of the screen, click Apply Changes.
13. Click OK.
14. Name the virtual disk.
15. Leave Virtual disk Size and Virtual Disk Size Unit as they appear.
16. Verify that the Strip Element Size is 64KB.
17. Select No Read Ahead for the Read Policy and Write Through for the Write Policy to enable FastPath.
18. Click Create Virtual Disk.
19. Check the box next to Confirm, and click Yes.
20. Click OK.

Creating the virtual drive for the SQL VMs and their data and log files

1. From the Select RAID Level drop-down menu, click RAID10.
2. On the Select Physical disks From line, choose Unconfigured Capacity.
3. Click Select Physical Disks.
4. On the Select Media Type line, choose SSD.
5. At the bottom of the screen, click Check All.
6. At the top of the screen, click Apply Changes.
7. Click OK.
8. Name the virtual disk.
9. Leave Virtual Disk Size and Virtual Disk Size Unit as they appear.
10. Verify that the Strip Element Size is 64KB.

11. Select No Read Ahead for the Read Policy and Write Through for the Write Policy to enable FastPath.
12. Click Create Virtual Disk.
13. Check the box next to Confirm, and click Yes.
14. Click OK.

Initializing the virtual drives

1. Navigate to the Configuration Utility main menu.
2. Click Virtual Disk Management.
3. Select Virtual Disk 0.
4. From the Operation drop-down menu, select Fast Initialization.
5. Click Go.
6. Check the box next to Confirm, and click Yes.
7. Click OK.
8. Press the ESC key or click back to return to the previous menu.
9. Select Virtual Disk 1.
10. Repeat steps 4 through 7.
11. Click Finish, and reboot the server.

Configuring the RAID on the Lenovo ThinkServer RD550

Creating the virtual drive for the OS

1. Power on the server.
2. When the option appears, press F10 to enter the Lenovo ThinkServer Deployment Manager (TDM).
3. In the left pane, click Storage Management.
4. Click Configuration Management.
5. Click Create Virtual Drive.
6. From the Select RAID Level drop-down menu, click RAID10.
7. From the Select Drives From drop-down menu, click Unconfigured Capacity.
8. Under Span 1, click Select Drives.
9. From the Select Media Type drop-down menu, choose SSD.
10. Select the first six unconfigured drives by using the drop-down menu beside each drive to select Enabled.
11. At the bottom of the screen, click Apply Changes.
12. Click OK.
13. Click Add More Spans to select the drives for Span 2.
14. Repeat steps 8 through 12 for Span 2.
15. Name the virtual drive.
16. Change the Virtual Drive Size to 50.
17. Verify that the Virtual Drive Size Unit is GB.
18. Change the Strip Size to 64 KB.
19. Select No Read Ahead for the Read Policy and Write Through for the Write Policy to enable FastPath.
20. Verify that the I/O Policy is Direct and the Access Policy is Read/Write.

21. Click Save Configuration.
22. From the drop-down menu, select Enabled, and click Yes to confirm changes.
23. Click OK.

Creating the virtual drive for the SQL VMs and their data and log files

1. From the Select RAID Level drop-down menu, click RAID10.
2. From the Select Drives From drop-down menu, click Free Capacity.
3. Click Select Drive Groups.
4. Change the Drive Group 0: RAID10 drop-down menu to Enabled.
5. Click Apply Changes.
6. Click OK.
7. Select the first six unconfigured drives by using the drop-down menu beside each drive to select Enabled.
8. Name the virtual drive.
9. Leave the Virtual Drive Size as it appears.
10. Verify that the Virtual Drive Size Unit is GB.
11. Change the Strip Size to 64 KB.
12. Select No Read Ahead for the Read Policy and Write Through for the Write Policy to enable FastPath.
13. Verify that the I/O Policy is Direct and the Access Policy is Read/Write.
14. Click Save Configuration.
15. From the drop-down menu, select Enabled, and click Yes to confirm changes.
16. Click OK.

Initializing the virtual drives

1. Navigate to the first menu page in TDM.
2. Click Virtual Drive Management.
3. Select Virtual Drive 0.
4. From the Operation drop-down menu, select Fast Initialization.
5. Click Go.
6. From the drop-down menu, select Enabled, and click Yes to confirm changes.
7. Click OK.
8. Press the ESC key or click back to return to the previous menu.
9. Select Virtual Drive 1.
10. Repeat steps 4 through 7.
11. Click Save & Exit.
12. Click Yes.
13. Click No.
14. Click the power button icon at in the upper-right corner of the screen.
15. Select Reboot.

Installing Microsoft Windows Server 2012 R2 Standard Edition on the Dell PowerEdge R630

1. Insert the installation USB drive into the rear USB 3.0 port, and restart the server.
2. When the option appears, press F11 to enter the Boot Manager.
3. Select BIOS Boot Menu.
4. Select the USB drive, and press Enter.
5. Press any key when prompted to boot from DVD.
6. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
7. Click Install now.
8. When the installation prompts you to, enter the product key.
9. Select Windows Server 2012 Standard Edition (Server with a GUI), and click Next.
10. Check I accept the license terms, and click Next.
11. Click Custom: Install Windows only (advanced).
12. Select Drive 0 Unallocated Space, and click Next, at which point Windows begins automatically, and restarts automatically after completing.
13. When the Settings page appears, complete the Password and Reenter Password fields with the same password.
14. Log in with the password you set up previously.

Installing Microsoft Windows Server 2012 R2 Standard Edition on the Lenovo ThinkServer RD550

1. Insert the installation USB drive into the rear USB 3.0 port, and restart the server.
2. When the option appears, press F12 to select the boot device.
3. Select the USB drive, and press Enter.
4. Press any key when prompted to boot from DVD.
5. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
6. Click Install now.
7. When the installation prompts you to, enter the product key.
8. Select Windows Server 2012 Standard Edition (Server with a GUI), and click Next.
9. Check I accept the license terms, and click Next.
10. Click Custom: Install Windows only (advanced).
11. Select Drive 0 Unallocated Space, and click Next, at which point Windows begins automatically, and restarts automatically after completing.
12. When the Settings page appears, complete the Password and Reenter Password fields with the same password.
13. Log in with the password you set up previously.

Installing Microsoft Hyper-V on each server

1. In the upper-right corner of the Server Manager window, click Manage → Add Roles and Features.
2. In the Add Roles and Features Wizard, click Next.
3. Select Role-based or feature-based installation, and click Next.

4. Click Select a server from the server pool.
5. Select the host server from the server pool, and click Next.
6. Check the box next to Hyper-V.
7. When prompted to add features, click Add Features.
8. Click Next.
9. Click Next.
10. Click Next.
11. Select a network adapter to use for the virtual switch, and click Next.
12. Click Next.
13. Select the default location in which you wish to store virtual hard disks and configuration files.
14. Click Next.
15. Click Install.
16. After the installation successfully completes, close the wizard, and reboot the server.

Creating and configuring the SQL server virtual machines

Creating a virtual hard disk

1. In Hyper-V Manager, select the host server from the left pane.
2. In the Actions pane on the right-hand side, select New→Hard Disk.
3. Click Next.
4. Select VHDX, and click Next.
5. Select Fixed Size, and click Next.
6. Provide a name and select a file location for the VHDX, and click Next.
7. Select a size for the disk in GB. For our tests, we used 41GB for the OS disk, 44GB for the data disk, and 23GB for the log disk.
8. Click Next.
9. Click Finish.

Creating a virtual machine

1. In Hyper-V Manager, select the host server from the left pane.
2. In the Actions pane on the right-hand side, select New→Virtual Machine.
3. Click Next.
4. Provide a name for the virtual machine, and click Next.
5. Select Generation 2, and click Next.
6. Enter in an amount for the startup memory. We used 8192.
7. Click Next.
8. Choose a network to connect the VM to from the drop-down list, and click Next.
9. Select Use an existing virtual hard disk, and navigate to the location of your OS disk.
10. Select the correct disk, and click Open.
11. Click Next.
12. Click Finish.

Configuring the virtual machine

1. Right-click the virtual machine in Hyper-V Manager, and select Settings.
2. Change the virtual processor count to 4.
3. Click Add Hardware to add a SCSI Controller for each VHDX.
4. Under each SCSI Controller, select Hard Drive, and click Add.
5. Browse to the location of the virtual hard disks, select the correct VHDX, and click Open.
6. Change the Automatic Stop Action to Shut Down.
7. Click OK.

Installing Microsoft Windows Server 2012 R2 DataCenter Edition on the SQL Server VMs

1. In the virtual machine settings, add a DVD drive under one of the SCSI controllers.
2. Browse to the location of your Server 2012 R2 ISO, and click Open.
3. Change the boot order in the Firmware section to DVD Drive, and click Apply.
4. Click OK to close the settings menu.
5. Right-click on the virtual machine, and select Connect.
6. Click the power button icon to power on the VM.
7. Press any key when prompted to boot from DVD.
8. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
9. Click Install now.
10. When the installation prompts you to, enter the product key.
11. Select Windows Server 2012 DataCenter Edition (Server with a GUI), and click Next.
12. Check I accept the license terms, and click Next.
13. Click Custom: Install Windows only (advanced).
14. Select Drive 0 Unallocated Space, and click Next, at which point Windows begins automatically, and restarts automatically after completing.
15. When the Settings page appears, complete the Password and Reenter Password fields with the same password.
16. Log in with the password you set up previously.

Installing .Net Framework 3.5 on the SQL Server VMs

1. Click Start→Server Manager→Manage→Add Roles and Features.
2. Select Role-based or feature-based installation, and click Next.
3. Under Server Pool, select the local server, and click Next twice.
4. Under Features, select .NET Framework 3.5 Features, and click Next.
5. Click Install.
6. Click Close upon completion.

Installing SQL Server 2014 on the SQL Server VMs

1. Browse to the installation media for SQL Server 2014.
2. Run SETUP.EXE.
3. In the left pane, click Installation.
4. Click New SQL Server stand-alone installation or add features to an existing installation.

5. Select the Specify a free edition radio button, and select Evaluation. Click Next.
6. Click the checkbox to accept the license terms, and click Next.
7. Click Use Microsoft Update to check for updates, and click Next.
8. Click Install to install the setup support files.
9. If there are no failures displayed, click Next.
10. At the Setup Role screen, choose SQL Server Feature Installation, and click Next.
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, after the check completes, click Next.
13. At the Instance configuration screen, leave the default selection of default instance, and click Next.
14. At the Server Configuration screen, choose NT Service\SYSTEM for SQL Server Agent and SQL Server Database Engine. Change the Startup Type to Automatic. Click Next.
15. At the Database Engine Configuration screen, select the authentication method you prefer. For our testing purposes, we selected Mixed Mode.
16. Enter and confirm a password for the system administrator account.
17. Click Add Current user. This may take several seconds.
18. Click Next.
19. At the Error and usage reporting screen, click Next.
20. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
21. At the Ready to Install screen, click Install.
22. After installation completes, click Close.
23. Close the installation window.

Configuring Windows Update

1. In the left pane of the Server Manager window, click Local Server.
2. In the main frame, next to Windows Update, click Not configured.
3. In the Windows Update window, in the main pane, click Let me choose my settings.
4. Under Important updates, select Never check for updates (not recommended), and click OK.
5. In the left pane, click Check for updates, and install all available updates.
6. Close the Windows Update window.

Configuring the database workload clients

For our testing, we used virtual clients for the Microsoft SQL Server workload. To create this client, we installed Windows Server 2008 R2, assigned a static IP address, and installed .NET 3.5.

Configuring the database

Data generation overview

We generated the data using the Install.pl script included with DVD Store version 2.1 (DS2), providing the parameters for our 20GB 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 database schema was also generated by the Install.pl script.

After processing the data generation, we transferred the data files and schema creation files to a Windows-based system running SQL Server 2014. We built the database in SQL Server 2014, 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. Besides this file size modification, the database schema was created and loaded according to the DVD Store documentation. Specifically, we performed the following 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 database and 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, 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.

Figure 4 shows our initial file size modifications.

Logical name	Filegroup	Initial size (MB)
Database files		
primary	PRIMARY	4
cust1	DS_CUST_FG	2,168
cust2	DS_CUST_FG	2,168
cust3	DS_CUST_FG	2,168
cust4	DS_CUST_FG	2,168
cust5	DS_CUST_FG	2,168
cust6	DS_CUST_FG	2,168
cust7	DS_CUST_FG	2,168
cust8	DS_CUST_FG	2,168
ind1	DS_IND_FG	1,280
ind2	DS_IND_FG	1,280
ind3	DS_IND_FG	1,280
ind4	DS_IND_FG	1,280
ind5	DS_IND_FG	1,280
ind6	DS_IND_FG	1,280
ind7	DS_IND_FG	1,280
ind8	DS_IND_FG	1,280
ds_misc1	DS_MISC_FG	256
ds_misc2	DS_MISC_FG	256
ds_misc3	DS_MISC_FG	256
ds_misc4	DS_MISC_FG	256
ds_misc5	DS_MISC_FG	256
ds_misc6	DS_MISC_FG	256
ds_misc7	DS_MISC_FG	256
ds_misc8	DS_MISC_FG	256
orders1	DS_ORDERS	1,536
orders2	DS_ORDERS	1,536
orders3	DS_ORDERS	1,536
orders4	DS_ORDERS	1,536
orders5	DS_ORDERS	1,536
orders6	DS_ORDERS	1,536
orders7	DS_ORDERS	1,536
orders8	DS_ORDERS	1,536
Log files		
ds_log	Not Applicable	20,480

Figure 4: Our initial file size modifications.

Running the test

Test start and run times

We ran the workloads separately and recorded all performance counters for this report. The specific testing parameters we used for the benchmark are included below.

About 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 general steps listed below.

1. Clean up prior outputs from the target VM and the client driver system.
2. Drop the database from the target VMs.
3. Restore the database on the target VMs.
4. Shut down the VMs and target host system.
5. Reboot the host and client systems.
6. Wait for a ping response from the server under test (the hypervisor system), the client systems, and the VM targets.
7. Let the test server idle for 10 minutes.
8. Start the DVD Store driver on the clients.

We used the following DVD Store parameters for testing:

```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --  
n_threads=32 --db_size=20GB --think_time=0 --detailed_view=Y --  
warmup_time=15 --report_rate=1 --csv_output=<drive path>
```

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.

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