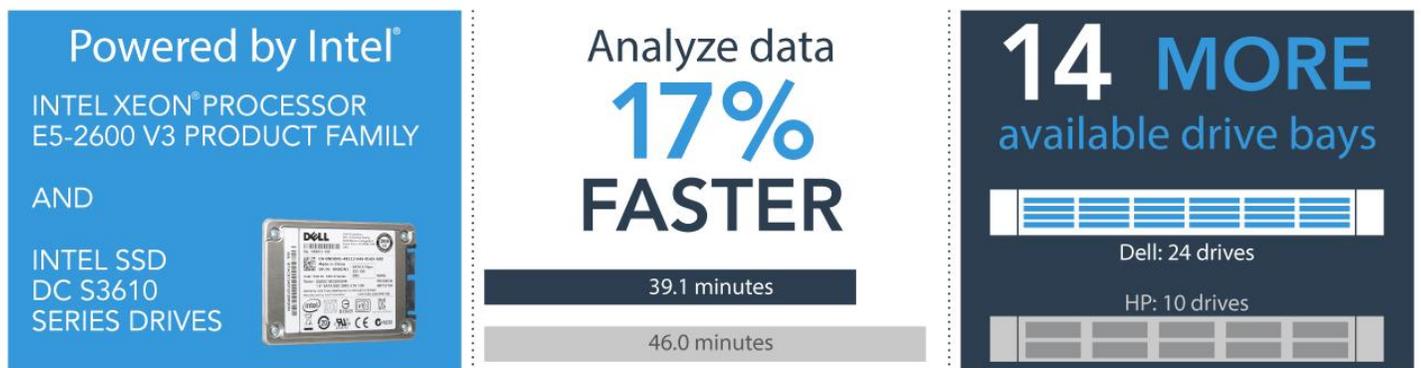


# DATABASE SERVER PERFORMANCE COMPARISON: DELL POWEREDGE R630 VS. HP PROLIANT DL360 GEN9

## BOOST DATABASE PERFORMANCE AND DRIVE COUNT WITH THE DELL™ POWEREDGE™ R630 SERVER



vs. HP DL360 Gen9

Companies are increasingly mining data to gain insights to drive their business decisions. Whether the data is in the area of customer relationships, social media, sales, or any other business area, it is critical that the server running the database applications that contain this data be up to the task. It should offer both strong performance to deliver actionable insights quickly and storage system capacity to grow as your company does.

The 1U Dell PowerEdge R630 features Intel Xeon processors E5-2695 v3, Intel DC S3610 Series solid-state drives (SSDs), and twenty-four 1.8-inch drive bays for generous storage capacity. In the Principled Technologies labs, we tested the TPC-H-like database performance of the R630 and the HP ProLiant DL360 Gen9. We configured the servers with roughly comparable storage capacity and saw how long each took to complete a heavy TPC-H-like workload. We found that the PowerEdge R630 finished this workload 17 percent faster than the DL360 did.

We also looked at the number of drives each server can accommodate. The PowerEdge R630 we tested holds twenty-four drives while the DL360 only holds 10. Spreading data across more disks can lead to faster data access and better performance.

The performance edge and greater number of drives of the Dell PowerEdge R630 mean you have the support you need for future growth and stronger performance for today.



# FASTER ANSWERS TO BUSINESS QUERIES AND ROOM TO GROW IN A COMPACT FORM FACTOR

Imagine a company with a growing body of data that it relies on to inform its business decisions. The company is seeking a server solution that can deliver strong database performance today and that can hold increasing amounts of data as it continues to expand. Limited datacenter space means that the company is very interested in a compact server.

The PowerEdge R630 is a space-saving, 1U server designed by Dell to be capable of supporting complex and demanding enterprise applications. Despite its slim design, the PowerEdge R630, powered by Intel Xeon E5-2695 v3 processors, accommodates twenty-four 1.8-inch solid-state drives (SSDs). We also tested the HP ProLiant DL360 Gen9 with ten 2.5-inch SSDs, the maximum number that this server could equip.

In our labs, we compared the two servers using a HammerDB TPC-H-like database benchmark scenario representing a heavy business analytics workload.<sup>1</sup> For specific information on the Dell server and benchmark configuration, see [Appendix A](#). For detailed system configuration information, see [Appendix B](#). For specifics of our testing, see [Appendix C](#).

## WHAT WE TESTED AND FOUND

We measured the TPC-H-like database performance of the Dell PowerEdge R630 in the following SATA/SAS disk configuration:

- two 1.8-inch 80GB Intel SSD DC Series 3500 6Gb/s Boot SATA SSDs to store the operating system files
- twenty-two 1.8-inch 200GB Intel SSD DC Series S3610 6Gb/s Mixed-Use SATA SSDs configured in a RAID 10 for database storage

We also tested the HP ProLiant DL360 Gen9 in the following SATA/SAS disk configuration:

- two 2.5-inch 240GB SSDs to store the operating system files
- ten 2.5-inch 240GB SSDs configured in a RAID 10 for database storage

### Performance advantages

On both servers, we installed the operating system and a default instance of Microsoft® SQL Server® 2014. Next, we used our benchmark utility, HammerDB, to configure and run a TPC-H-like workload. We ran with a HammerDB user count of 10, and report the time it took for all 10 HammerDB users to finish the workload. The scale

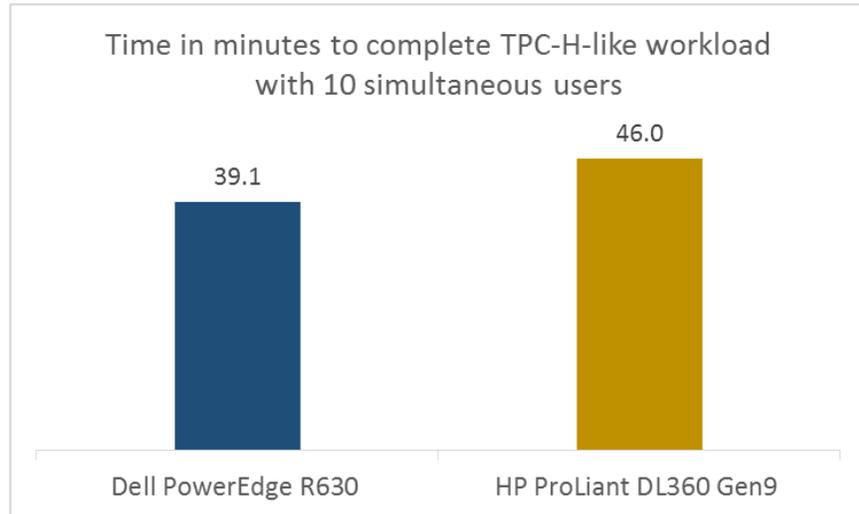
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<sup>1</sup> Note that our tests were not official TPC results and are not comparable in any manner to the official TPC audited results. See [Appendix A](#) for more information on the benchmark test we used, HammerDB.

parameter in the HammerDB TPC-H database creation process sets the database size. For this test, we chose a scale of 100, which roughly equates to a 100GB dataset.

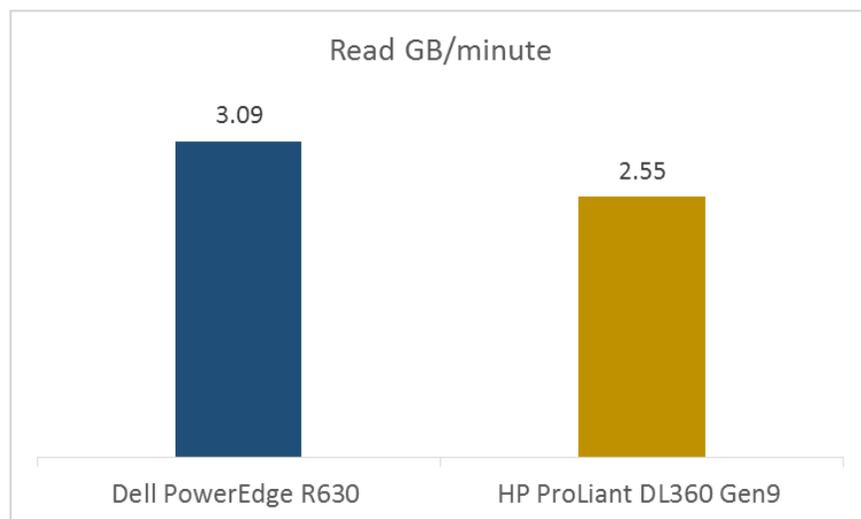
We performed three test runs on each server and report the median run from each. As Figure 1 shows, the Dell PowerEdge R630 performed the full set of 22 queries in our TPC-H-like workload in only 39.1 minutes, making it 17 percent faster than the HP ProLiant DL360 Gen9, which needed 46.0 minutes to complete the queries.

**Figure 1: Time the two servers we tested needed to complete our TPC-H-like workload. Lower numbers are better.**



At the disk level, we saw a greater amount of data in GB read per second with the Dell PowerEdge R630. Figure 2 shows the total GB/sec each drive configuration processed during the test, as recorded by Windows® Performance Monitor. These results show that the Dell disk subsystem was able to process the application’s read requests faster, allowing the application to process requests faster than the HP disk subsystem.

**Figure 2: The Dell PowerEdge R630 had over 20 percent greater read performance of the HP ProLiant DL360 Gen9.**



## Storage advantages

The number of disk bays a server provides is important—the greater disk count gives your company more growth capacity potential and may avoid the necessity of purchasing additional external storage units. In addition to outperforming the HP ProLiant DL360 Gen9 in our performance testing, the PowerEdge R630, with its twenty-four 1.8-inch drive bays, offers more drive bays for server storage.

A greater number of drives can also translate to better performance even when the total amount of storage capacity in the server is the same. If a given amount of data is spread across 24 drives rather than 10 drives, any single drive is being hit less frequently. Because each drive is under less load, they can collectively deliver query responses more quickly.

## CONCLUSION

Performing analytical queries on business data has become an essential component of developing a company's strategic direction. When the servers running these database applications deliver better performance, this critical strategic data gets into the hands of decision makers more quickly.

We tested the TPC-H-like database performance of a 1U Dell PowerEdge R630, powered by Intel Xeon processors E5-2695 v3 and running SQL Server 2014, and compared it to that of the HP ProLiant DL360 Gen9. The R630 performed our workload 17 percent faster and offered 14 more drive bays for storage. These advantages can translate to a better experience for your database users and more room to accommodate the growth of your business.

When you're in the market for a database server, the Dell PowerEdge R630 is an excellent choice for meeting your present and future needs.

## APPENDIX A – ABOUT THE COMPONENTS OF OUR TESTS

### About the Dell PowerEdge R630

Fitting into just 1U of rack space, the Dell PowerEdge R630 features two Intel Xeon processors E5-2695 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.

In addition to the features above, the distinguishing flexibility feature of the Dell PowerEdge R630 is the choice of storage options. In addition to more traditional 2.5-inch hard disk drive (HDD) options, the Dell PowerEdge R630 includes 1.8-inch SATA SSD options. Figure 3 shows the 1.8-inch SATA SSD capacities and use types available on the Dell PowerEdge R630.

Capacity	Usage
60 GB	Boot
120 GB	Boot
480 GB	Read Intensive
960 GB	Read Intensive
100 GB	Mix Use
200 GB	Mix Use
400 GB	Mix Use

Figure 3: 1.8-inch SSD options on the Dell PowerEdge R630.

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 iDRAC7 with Lifecycle Controller and Dell OpenManage™, which all work to streamline management.

Learn more at [www.dell.com/us/business/p/poweredge-r630/pd](http://www.dell.com/us/business/p/poweredge-r630/pd).

### About the benchmark testing tool, HammerDB

HammerDB is an open-source benchmark tool that tests the database performance of many leading databases, including Oracle® Database, Microsoft SQL Server, PostgreSQL®, MySQL™, and more. The benchmark includes two built-in workloads derived from industry-standard benchmarks: a transactional (TPC-C-like) workload and a data warehouse (TPC-H-like) workload. For this study, we used the analytics or data warehouse workload. Our tests were not official TPC results and are not comparable in any manner to the official TPC audited results. For more information about HammerDB, visit [hammerora.sourceforge.net](http://hammerora.sourceforge.net).

## APPENDIX B – SYSTEM CONFIGURATION INFORMATION

Figure 4 provides detailed configuration information for the test systems.

System	Dell PowerEdge R630	HP DL360 Gen9
<b>Power supplies</b>		
Total number	2	2
Vendor and model number	Dell 0G6W6KX02	HP DPS-500AB-13
Wattage of each (W)	750	500
<b>Cooling fans</b>		
Total number	7	7
Vendor and model number	Nidec® R40W12BS1NB8-07A02	Nidec V40W12BS1M5-08A033
Volts	12	12
<b>General</b>		
Number of processor packages	2	2
Number of cores per processor	14	14
Number of hardware threads per core	28	28
System power management policy	Performance	Performance
<b>CPU</b>		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E5-2695 v3	E5-2695 v3
Socket type	FCLGA2011-v3	FCLGA2011-v3
Core frequency (GHz)	2.3	2.3
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	35MB	35MB
<b>Platform</b>		
Vendor and model number	Dell PowerEdge R630	HP DL360 Gen9
BIOS name and version	1.5.4	P89 v1.52 11/10/2015
BIOS settings	Performance	Performance
<b>Memory module(s)</b>		
Total RAM in system (GB)	128	128
Vendor and model number	Samsung M393A1G43DB0-CPB	Hynix HMA42GR7MFR4N-TF
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	16
Number of RAM module(s)	16	8
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual

System	Dell PowerEdge R630	HP DL360 Gen9
<b>Operating system</b>		
Name	Windows Server® 2012 R2 Datacenter	Windows Server 2012 R2 Datacenter
Build number	6.3.9600	6.3.9600
File system	NTFS	NTFS
Kernel	NT	NT
Language	English	English
<b>RAID controller</b>		
Vendor and model number	Dell PERC H730 Mini	HP Smart Array P840
Firmware version	25.3.0.0016	3.56
Driver version	6.602.35.0	63.12.0.64
Cache size (MB)	1024	4096
<b>Local storage</b>		
<b>First drive</b>		
Vendor and model number	Intel SSDSC1NB080G4R	HP EG0300FAWHV
Number of drives	2	2
Size (GB)	80	300
Type	SATA SSD	SAS
Speed (RPM)	N/A	10,000
<b>Second drive</b>		
Vendor and model number	Intel SSDSC1BG200G4R	Intel SSDSC2BA200G3P
Number of drives	22	8
Size (GB)	200	200
Type	SATA SSD	SATA SSD
<b>Ethernet adapters</b>		
Vendor and model number	Dell Broadcom® 5720 Quad-Port	HP Ethernet 1Gb 4-port 331i
Type	NDC	Embedded
Driver	7.10.61	17.2.0.0

Figure 4: Detailed configuration information for the test systems.

## APPENDIX C – DETAILED TEST METHODOLOGY

We created a two-disk RAID 1 on each system for the OS installation. We then created a RAID 10 out of the remaining disks—22 for the Dell and 8 for the HP. To ensure the best SSD performance, we configured each server's RAID controller for Write Through and No Read Ahead for the RAID 10 volumes under test. We followed the installation steps below to set up both servers.

### Installing Microsoft Windows Server 2012 R2 Datacenter Edition

1. Insert the installation USB drive into the rear USB 3.0 port, and restart the server.
2. 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, enter the product key.
9. Select Windows Server 2012 Datacenter 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, fill in the Password and Reenter Password fields with the same password.
14. Log in with the password you set up previously.

### Installing .NET Framework 3.5

1. Click Start→Server Manager→Manage→Add Roles and Features.
2. Select Role-based or feature-based installation, and click Next.
3. Select the local server under Server Pool, 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

1. Mount the installation DVD for SQL Server 2014.
2. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2014 DVD, and double-click it.
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 Enter the product key radio button, and enter the product key. 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\SQLSERVERAGENT for SQL Server Agent, and choose NT Service\MSSQLSERVER for 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 the Data Directories tab to relocate the system, user, and temp db files.
19. Change the location of the root directory to the D:\ volume.
20. Click Next.
21. At the Error and usage reporting screen, click Next.
22. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
23. At the Ready to Install screen, click Install.
24. After installation completes, click Close.
25. Close the installation window.
26. Open SQL Server 2014 Configuration Manager, and expand Protocols for MSSQLSERVER.
27. Right-click Named Pipes, and choose Enabled.
28. Click OK, and restart the SQL service.

## 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.

## Enabling Lock Pages in Memory

1. Click Start, and type `gpedit.msc`, and press Enter.
2. In the Local Group Policy Editor, expand Computer Configuration→Windows Settings→Security Settings→Local Policies.
3. Select User Rights Assignment, and scroll down to Lock pages in memory in the right pane.
4. Right-click Lock pages in memory, and click Properties.
5. Click Add User or Group, and add your SQL user account (NT SERVICE\MSSQLSERVER).
6. Click OK.

## Installing HammerDB

1. Download the latest version of HammerDB from [www.hammerdb.com/download.html](http://www.hammerdb.com/download.html)
2. Double-click the exe file, chose English, and click OK.
3. Click Yes.
4. Click Next.
5. Choose a destination location, and click Next.
6. Click Next.
7. Click Finish.

## Expanding tempdb

1. Expand Databases→System Databases.
2. Right-click tempdb, and choose Properties.
3. Click Files, and enter a new Initial Size (MB) for both files. The size required will depend on the scale of your TPC-H database. We set tempdev to 100 GB and templog to 50 GB to ensure more than enough space.
4. When the files are finished expanding, click OK.

## Creating the database and database backup file

Note: We used HammerDB to create a TPC-H database and then we broke out the single database file into 20 database files.

1. Open HammerDB, and click Options→Benchmark.
2. Choose MSSQL Server and TPC-H.
3. Expand SQL Server→TPC-H→Schema Build.
4. Double-click Options.
5. Choose 100 scale, and 28 virtual users, and click OK.
6. Double-click Build. This build could take several hours.
7. Once the database has been created, open SQL Server Manager.
8. Right-click the TPCH database, and click Tasks→Back up...
9. Choose a location to store the backup, and click OK.

## Running the test

We ran the test with 10 simultaneous users with the MAXDOP set to eight. We created a backup file of the TPC-H database to allow us to restore to a clean database between each run. We ran the test until all 10 users finished the query set, and then reported the time it took to complete. We ran three iterations of each test, and report the median times in the body of this report.

1. Open SQL Server Manager, and restore the HammerDB database from the backup previously taken.
2. Open a new query and run the following:
 

```
alter database tpch
set allow_snapshot_isolation on

alter database tpch
set read_committed_snapshot on
```
3. Close SQL Server Manager, and restart the computer.
4. Open HammerDB, and select Options→Benchmark.
5. Choose MSSQL Server and TPC-H.
6. Expand SQL Server→TPC-H→Schema Build.
7. Double-click Options, and set the scale to 100. Click OK.
8. Expand Driver Script, and double-click Options.
9. Set MAXDOP to 8, and check the boxes for Refresh Function and Refresh Verbose.
10. Click OK.
11. Double-click Load.
12. In the Script Editor window, scroll down to line 436. Highlight and copy (cast(l\_quantity as bigint)) after “sum.” Paste the phrase after “avg” later in the line, as highlighted below.
 

```
set sql(1) "select l_returnflag, l_linestatus, sum(cast(l_quantity as
bigint)) as sum_qty, sum(l_extendedprice) as sum_base_price,
sum(l_extendedprice * (1 - l_discount)) as sum_disc_price,
sum(l_extendedprice * (1 - l_discount) * (1 + l_tax)) as sum_charge,
avg(cast(l_quantity as bigint)) as avg_qty, avg(l_extendedprice) as
avg_price, avg(l_discount) as avg_disc, count(*) as count_order from
lineitem where l_shipdate <= dateadd(dd,-:1,cast('1998-12-01'as
datetime)) group by l_returnflag, l_linestatus order by l_returnflag,
l_linestatus option (maxdop $maxdop)"
```
13. Expand Virtual User, and double-click Options.
14. Choose 11 Virtual Users (one user runs a refresh function in the background), and check the boxes for Show Output, Log Output to Temp, and Use Unique Log Name.
15. Click OK.
16. Double-click Create users.
17. Start Perfmon to capture CPU, RAM, and disk counters.
18. Click Start to start the run.
19. When the run finishes, stop Perfmon.
20. Save the HammerDB results text file and Perfmon output.
21. Repeat steps 1 through 20.

## ABOUT PRINCIPLED TECHNOLOGIES



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