



The science behind the report:

Analyze more data, faster, by upgrading to latest-generation Dell EMC PowerEdge R750 servers

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report [Analyze more data, faster, by upgrading to latest-generation Dell EMC PowerEdge R750 servers](#).

We concluded our hands-on testing on March 8, 2021. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on March 3, 2021 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1: The time in seconds that each VM on each solution we tested needed to complete the data analytics workload. Lower numbers are better. Source: Principled Technologies.

| | Dell EMC™ PowerEdge™ R730xd | Dell EMC PowerEdge R740xd | Dell EMC PowerEdge R750 | Dell EMC PowerEdge R750 |
|---|-----------------------------|---------------------------|-------------------------|-------------------------|
| Number of VMs running data analytics workloads | 2 | 10 | 12 | 16 |
| VM1 | 278 | 202 | 143 | 166 |
| VM2 | 265 | 202 | 145 | 164 |
| VM3 | | 199 | 144 | 165 |
| VM4 | | 200 | 145 | 166 |
| VM5 | | 196 | 144 | 166 |
| VM6 | | 202 | 143 | 165 |
| VM7 | | 199 | 144 | 166 |
| VM8 | | 201 | 144 | 163 |
| VM9 | | 199 | 144 | 166 |
| VM10 | | 203 | 144 | 165 |
| VM11 | | | 143 | 165 |
| VM12 | | | 142 | 165 |
| VM13 | | | | 166 |
| VM14 | | | | 165 |
| VM15 | | | | 165 |
| VM16 | | | | 161 |
| Average time (sec) | 272 | 200 | 144 | 165 |

System configuration information

Table 2: Detailed information on the systems we tested.

| Server configuration information | Dell EMC PowerEdge R750 |
|--|---|
| BIOS name and version | Dell 1.1.1 |
| Non-default BIOS settings | N/A |
| Operating system name and version/build number | Microsoft Windows Server 2019 Datacenter |
| Date of last OS updates/patches applied | 3/23/2021 |
| System Profile Settings | Performance |
| Processor | |
| Number of processors | 2 |
| Vendor and model | Intel® Xeon® Gold 6330 |
| Core count (per processor) | 64 |
| Core frequency (GHz) | 2 |
| Stepping | Model 106 Stepping 6 |
| Memory module(s) | |
| Total memory in system (GB) | 1,024 |
| Number of memory modules | 16 |
| Vendor and model | Samsung® M393A8G40AB2-CWE, Hynix HMAA8GR7AJR4N-XN |
| Size (GB) | 64 |
| Type | PC4-3200 |
| Speed (MHz) | 3,200 |
| Speed running in the server (MHz) | 3,200 |
| Storage controller | |
| Vendor and model | Dell PERC H755N Front NVMe™ |
| Cache size (GB) | 8 |
| Firmware version | 52.13.0-3536 |
| Driver version | 7.712.50.00 |
| Local storage | |
| Number of drives | 8 |
| Drive vendor and model | Samsung MZ-WLJ1T60 |
| Drive size (GB) | 1,600 |
| Drive information (speed, interface, type) | NVMe, SSD, 2.5 |
| Local storage | |
| Number of drives | 1 |
| Drive vendor and model | Intel SSDPEDMD020T4 DC P3700 |
| Drive size (GB) | 2,000 |
| Drive information (speed, interface, type) | NVMe, PCIe® |

| Server configuration information | | Dell EMC PowerEdge R750 |
|----------------------------------|--------------------------------|-------------------------|
| Network adapter | | |
| Vendor and model | Intel Ethernet 25G 2P E810-XXV | |
| Number and type of ports | 2 x 25G | |
| Driver version | 1.5.74.0 | |
| Cooling fans | | |
| Vendor and model | Foxconn PIA060K12Q | |
| Number of cooling fans | 6 | |
| Power supplies | | |
| Vendor and model | PWR SPLY, 1400W, RDNT, LTON | |
| Number of power supplies | 2 | |
| Wattage of each (W) | 1,400 | |

How we tested

In our lab, we tested the Dell EMC PowerEdge R750 server with eight NVMe SSDs in a RAID 10 volume. We used the TPC-H-like workload from the HammerDB benchmark tool. First, we created a gold VM and cloned it nine times to have 10 VMs for testing. During testing, the server reached about 60 percent CPU utilization, and so we added two VMs. With 12 VMs running workloads, the server reached 68 percent CPU utilization. We then added four VMs for a total of 16 running workloads.

Setting up the Dell EMC PowerEdge R750 server

Configuring the RAID

1. When booting the server, select F2 to boot into System Setup (BIOS).
2. Select Device Settings.
3. In SL 3: Dell PERC H755N Front Configuration Utility, select the RAID Controller.
4. Select Main Menu.
5. Select Configuration Management.
6. Select Create Virtual Disk.
7. Select RAID level. For our testing, we selected RAID 10.
8. Click Select Physical Disks, and select the disks to configure as RAID 10.
9. Name the Virtual Disk, select Fast Initialization, click Create Virtual Disk, and confirm the selection.

Installing Windows Server 2019 Datacenter Edition on the Dell EMC PowerEdge R750 server

1. Insert the installation media into the CD/DVD drive, and restart the server.
2. When the option appears, to enter the Boot Manager, press F11.
3. Select UEFI Boot Menu.
4. Select the boot media, and press Enter.
5. When prompted to boot from DVD, press any key.
6. When the installation screen appears, leave the 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 2019 Datacenter Edition (Server with a GUI), and click Next.
10. Check the box to accept the license terms, and click Next.
11. Click Custom: Install Windows only (advanced).
12. Select Drive 0 Unallocated Space, and click Next. Windows will begin and restart automatically.
13. When the Settings page appears, in the Password and Reenter Password fields, enter your password.
14. Log in with the password you used in step 13.
15. Using Windows Update, download and install all updates.
16. To ensure Windows does not apply new updates during testing, disable the Windows Update service.

Installing the Hyper-V role

1. Open the Server Manager.
2. Click Manage→Add Roles and Features.
3. At the Before You Begin screen, click Next.
4. Choose Role-based or feature-based installation, and click Next.
5. Choose the local server, and click Next.
6. Choose Hyper-V, and when prompted, click Add Features. Click Next.
7. At the Hyper-V Things to Note screen, click Next.
8. Choose a port for the virtual switch, and click Next.
9. Choose whether or not you want to add live migration capabilities, and click Next.
10. Set your default storage, and click Next.
11. Check the box for automatic restart, and click Install.

Creating and configuring the VMs on the Dell EMC PowerEdge R750 server

1. Open the Hyper-V manager.
2. Right-click the host server, and choose New→Virtual Machine.
3. At the Before You Begin screen, click Next.

4. Name the VM, and choose the storage option. Click Next.
5. Choose Generation 2, and click Next.
6. Enter the desired amount of memory for the startup memory, and click Next. For our testing, we used 32,768.
7. Choose the network connection, and click Next.
8. Choose 40 GB for the disk size, and click Next.
9. Choose Install an operating system later, and click Next.
10. Click Finish.
11. Right-click the VM you created, and choose Settings...
12. Change the number of processors, and click Apply. For our testing, we set the number of processors to eight.
13. Click the SCSI Controller, highlight Hard Drive, and click Add.
14. Choose Virtual hard disk, and click New.
15. At the Before You Begin screen, click Next.
16. Choose Fixed size, and click Next.
17. Name the HDD, and choose the data volume for the location. Click Next.
18. Set the size to 175 GB, and click Next.
19. Click Finish.
20. To create a 50GB log virtual hard disk (VHD), repeat steps 13 through 16.
21. Set the size to 50 GB, name the HDD, store the log VHD on the log volume, and click Finish.
22. To create a 100GB backup VHD, complete steps 13 through 16.
23. Set the size to 100 GB, name the HDD, store the backup VHD on the OS volume, and click Finish.
24. Using Windows Disk Manager, add three additional HDDs to the VM.

Installing Windows Server 2019 Datacenter Edition on a VM

1. Insert the installation media into the CD/DVD drive, and restart the server.
2. When prompted to boot from DVD, press any key.
3. When the installation screen appears, leave the language, time/currency format, and input method as default, and click Next.
4. Click Install now.
5. When the installation prompts you, enter the product key.
6. Select Windows Server 2019 Datacenter Edition (Desktop Experience), and click Next.
7. Check the box to accept the license terms, and click Next.
8. Click Custom: Install Windows only (advanced).
9. Select Drive 0 Unallocated Space, and click Next. Windows will begin and restart automatically.
10. When the Settings page appears, in the Password and Reenter Password fields, enter your password.
11. Log in with the password you used in step 10.
12. Using Windows Update, download and install all updates.
13. To ensure Windows does not apply new updates during testing, disable the Windows Update service.

Formatting a Windows NTFS volume for Microsoft SQL Server 2019 on a VM

1. Right-click the start icon, and click Disk Management.
2. Right-click the disk, and click Online.
3. Right-click the disk again, and click Initialize.
4. Right-click an unallocated area, and select New Simple Volume.
5. Click Next twice.
6. Assign a letter path, and click Next.
7. Set the Allocation Unit Size to 64K, and name the Volume Label.
8. Click Next.
9. Click Finish.
10. On all data and log volumes, complete steps 1 through 9.

Installing SQL Server 2019 on a VM

1. Attach the installation media ISO for SQL Server 2019 to the VM.
2. Double-click the Setup application.
3. In the left pane, click Installation.
4. Click New SQL Server stand-alone installation or add features to an existing installation.
5. Click the checkbox to accept the license terms, and click Next.
6. Click Use Microsoft Update to check for updates, and click Next.

7. On the Install Rules page, click Next.
8. Check the boxes for the following features, and click Next:
 - Database Engine Services
 - Full-Test and Semantic Extractions for Search
 - Client Tools Connectivity
 - Client Tools Backwards Compatibility
9. Leave the default instance, and click Next.
10. Leave the default Service Accounts, and click Next.
11. On the Server Configuration tab, choose Mixed Mode, and enter and confirm a password for the SQL Server system administrator (sa) account.
12. Click Add Current User to Specify the SQL Server administrators.
13. On the Data Directories tab, change the data root directory to the database volume.
14. Choose the log volume for the User database log directory.
15. If you plan to have a locally stored backup, then change the Backup directory to point to the necessary drive.
16. Click TempDB.
17. Change the number of TempDB files to eight, and change their location to the data volume.
18. Change the location of the TempLog file to the log volume.
19. Click Next.
20. At the Error and usage reporting screen, click Next.
21. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
22. At the Ready to Install screen, click Install.
23. Close the installation window.
24. Download and install SQL Server Management Studio.

Expanding TempDB and TempLog files on a VM

1. Open SQL Server Management Studio.
2. Expand Databases→System Databases.
3. Right-click tempdb, and choose Properties.
4. Click Files, and enter a new Initial Size (MB) for both files. The scale of your TPC-H-like database determines the required size. We set the eight tempdev files to 50GB and templog to 10GB to ensure there was enough space.
5. When the files finish expanding, click OK.

Enabling Lock pages in memory on the VMs

1. Click Start, 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 in the right pane, scroll down to Lock pages in memory.
4. Right-click Lock pages in memory, and click Properties.
5. Click Add User or Group, and add your SQL Server user account (NT SERVICE\MSSQLSERVER).
6. Click OK.

Configuring the VMs on all servers

Creating a database

1. Open SQL Server Management Studio.
2. Right-click Databases→New Database.
3. Name the database. We named ours `tpch`.
4. To add seven database files, click Add.
5. Name the database files, and click OK.

Installing HammerDB

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

Populating the database

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 the number of virtual users corresponding to the number of CPU cores.
6. Check the box for clustered column store, and click OK.
7. Double-click Build. This could take several hours.

Backing up the database

1. Open SQL Server Management Studio.
2. Right-click the TPC-H-like database, and click Tasks→Back up....
3. Choose a location to store the backup, and click OK.

Cloning the VMs

1. Once the initial VM is completely set up, shut down the VM.
2. Create a copy of each VHD on the various volumes.
3. Create a new VM with the desired RAM and vCPUs, and with no VHDs.
4. Add the copied VHDs to the VM: OS, data, log, and backup.
5. Complete steps 1 through 4 for as many VMs as you require.

Performing the test

1. Select Options→Benchmark.
2. Choose MSSQL Server and TPC-H.
3. Expand SQL Server→TPC-H→Schema Build.
4. Double-click Options, and set the scale to 100. Click OK.
5. Expand Driver Script, and double-click Options.
6. Set MAXDOP to 0.
7. Click OK.
8. Double-click Load.
9. Expand Virtual User, and double-click Options.
10. Choose 1 Virtual User, and check the boxes for Show Output and Log Output to Temp.
11. Click OK.
12. Double-click Create users.
13. Start Perfmon to capture CPU, RAM, and disk counters.
14. To begin the Power Test run click Start.
15. When the run finishes, stop Perfmon.
16. Save the HammerDB results text file and Perfmon output.
17. Open SQL Manager, delete the TPC-H-like database, and create a new one by restoring from the backup file.
18. Reboot the server.
19. To get three runs, complete steps 1 through 18 twice more.

Read the report at <http://facts.pt/poJUNRK> ►

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