



The science behind the report:

# Get more from Dell EMC PowerEdge R750xs servers with 3<sup>rd</sup> Generation Intel Xeon Scalable processors

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 [Get more from Dell EMC PowerEdge R750xs servers with 3<sup>rd</sup> Generation Intel Xeon Scalable processors](#).

We concluded our hands-on testing on August 10, 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 August 9, 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: Results of our DVD Store 3 benchmark, VM density, and power efficiency testing

	Dell EMC™ PowerEdge™ R750xs	Dell EMC PowerEdge R740xd
Total OPM per server	114,407	64,818
Total VMs per server	8	5
Average OPM per VM	14,301	12,964
Average power usage during the run (watts)	584	429
Average OPM per watt	195.90	151.09

## System configuration information

Table 2: Detailed information on the systems we tested.

System configuration information	Dell EMC PowerEdge R750xs	Dell EMC PowerEdge R740xd
BIOS name and version	Dell 1.2.1	Dell 2.5.4
Non-default BIOS settings	N/A	N/A
Operating system name and version/build number	VMware ESXi™, 7.0.2, 17867351	VMware ESXi, 7.0.2, 17867351
Date of last OS updates/patches applied	7/09/2021	7/09/2021
Power management policy (OS)	Performance per watt	Performance per watt
Processor		
Number of processors	2	2
Vendor and model	Intel® Xeon® Gold 6330	Intel Xeon Gold 6230
Core count (per processor)	28	20
Core frequency (GHz)	2.00	2.10
Stepping	Model 106 Stepping 6	Model 85 Stepping 7
Memory module(s)		
Total memory in system (GB)	256	192
Number of memory modules	16	12
Vendor and model	Samsung® M393A2K43DB3-CWE	Micron® MTA18ASD2G72PDZ-3G2R1TI
Size (GB)	16	16
Type	PC4-25600	PC4-25600
Speed (MHz)	3,200	3,200
Speed running in the server (MHz)	3,200	3,200
Storage controller		
Vendor and model	Dell PERC H345 Front	Dell PERC H730P
Cache size (GB)	0	2
Firmware version	51.14.0-3900	25.5.6.0009
OS storage		
Number of drives	2	1
Drive vendor and model	Intel SSDSCKKB480G8R	Internal Dual SD Module
Drive size (GB)	500	1
Drive information (speed, interface, type)	NVMe M.2, SSD	SD card
Local storage		
Number of drives	8	8
Drive vendor and model	Samsung PM1635A	Samsung PM1635A
Drive size (GB)	800	800
Drive information (speed, interface, type)	12 Gbps SAS, SSD, 2.5	12 Gbps SAS, SSD, 2.5

System configuration information	Dell EMC PowerEdge R750xs	Dell EMC PowerEdge R740xd
Network adapter		
Vendor and model	Broadcom® NetXtreme BCM5720	QLogic® 577xx/578xx BCM57800
Number and type of ports	2 x 1Gb	4 x 10Gb
Driver version	21.80.8	15.05.12
Cooling fans		
Vendor and model	Dell 038HNJ	Dell 0NST36
Number of cooling fans	5	6
Power supplies		
Vendor and model	PWR SPLY,1100W,RDNT,LTON	PWR SPLY,1100W,RDNT,DELTA
Number of power supplies	2	2
Wattage of each (W)	1,100	1,100

# How we tested

## About the test environment

We installed VMware ESXi 7.0 U2 to internal storage on the Dell PowerEdge R750xs server, the Dell PowerEdge R740xd server, and a separate infrastructure server. We set up the servers under test to run on a memory balanced configuration and equipped the R740xd server with 12 DIMMs and the R750xs server with 16 DIMMs. The memory difference exists because the R740xs server has 6 memory channels and requires 12 DIMMs to achieve a balanced configuration while the R750xd has 8 memory channels and requires 16 DIMMs to achieve a balanced configuration. We applied all BIOS and firmware updates available as of August 9, 2021 and connected all servers using onboard 1 GbE Ethernet ports to a Dell X1052 switch. We installed support VMs, including vCenter and client VMs, on the separate infrastructure server. On the R740xd server, we installed the hypervisor on internal dual DS modules. On the R750xs server, we installed the hypervisor on a dual M.2 SSDs. To provide storage for the VMs under test, we configured both servers with eight 800 GB SAS SSDs, which we set up as a RAID10 virtual disk. Then, we presented this virtual disk to the hypervisor as a single datastore. We used an Extech power meter to record the power usage for both servers during testing.

## Installing VMware ESXi 7.0 Update 2

1. Boot to the VMware ESXi installation media using a USB stick or virtual media.
2. Click Enter.
3. To accept and continue, click F11.
4. Under Storage device, select the installation drive, and click Enter.
5. Select US Default for keyboard layout, and click Enter.
6. Enter root password twice, and click Enter.
7. At the Confirm Install window, click F11.
8. At the Installation complete window, click Enter. The system will reboot.
9. To configure system after reboot, click F2.
10. Login with root user/password, and click Enter.
11. Scroll to Configure Management Network, and click Enter.
12. Scroll to IPv4 Configuration, and click Enter.
13. To select the configuration, scroll to Static IPv4, and click spacebar.
14. Set the IPv4 address, Subnet Mask, and Default gateway.
15. Click Enter.
16. Scroll to IPv6 Configuration, and click Enter.
17. To change the configuration, scroll to Disable IPv6, and click spacebar.
18. Click Enter.
19. Scroll to DNS Configuration, and click Enter.
20. To change the DNS configuration, scroll to Manually configure DNS, and click spacebar.
21. Add Primary DNS Server, Alternate DNS Server, and provide the hostname for the system.
22. Scroll to Custom DNS Suffixes, and click Enter.
23. Add the suffix that is required for testing, and click Enter.
24. To accept the changes, click ESC.
25. To confirm changes, click Y. The system will reboot.
26. To configure system after reboot, click F2.
27. Login with root user/password, and click Enter.
28. Scroll to Troubleshooting Options, and click Enter.
29. To enable ESXi, select Enable ESXi Shell, and click Enter.
30. To enable the shell, select Enable SSH, and click Enter.
31. Scroll to Restart Management Agents, and click Enter.
32. To confirm, click F11.
33. To exit, click ESC.
34. To log out, click ESC.

## Deploying the VMware vCenter Server® 7.0

1. On a Windows server or VM, locate the VMware-VCSA installer image using a USB stick or CD/DVD.
2. Mount the image, navigate to the vcsa-ui-installer folder, and double-click win32.
3. Double-click installer.exe.

4. Click Install.
5. Click Next.
6. Accept the terms of the license agreement, and click Next.
7. Leave the default Center Server with an Embedded Platform Services Controller selected, and click Next.
8. Enter the FQDN or IP address of the host onto which you are deploying the vCenter Server Appliance.
9. Provide the server's username and password, and click Next.
10. To accept the certificate of the host you chose to connect to, click Yes.
11. Provide a name and password for the vCenter Appliance, and click Next.
12. Set an appropriate Appliance Size, and click Next.
13. Select the appropriate datastore, and click Next.
14. At the Configure Network Settings page, configure the network settings as appropriate for your environment, and click Next.
15. Review your settings, and click Finish.
16. When the deployment completes, click Continue.
17. At the Introduction page, click Next.
18. At the Appliance configuration page, select the time synchronization mode and SSH access settings, and click Next.
19. Select Create a new SSO domain.
20. Provide an SSO Domain name and SSO Site name.
21. Provide a password, confirm it, and click Next.
22. At the CEIP page, click Next.
23. At the Ready to complete page, click Finish.
24. At the Warning pop-up, click OK.
25. Once Stage 2 has completed successfully, click Close.

## Creating a cluster and adding the hosts to VMware vCenter

1. Once logged into the vCenter, navigate to Hosts and Clusters.
2. Select the primary site management vCenter.
3. Right-click the vCenter object, and select New Datacenter.
4. Enter a name for the new datacenter, and click OK.
5. Right-click the new datacenter, and click New Cluster.
6. Enter vSAN as the name for the new cluster.
7. Leave all of the options untoggled, and click Next.
8. Review the details, and click Finish.
9. Once the cluster has been created, right-click the cluster, and click Add Host.
10. Enter the FQDN or the IP address and root credentials in the spaces provided for the first server.
11. To add all three servers, click Add host, repeat step 10 two more times, and click Next.
12. To accept the server's certificate, check the box beside all three servers, and click OK.
13. On the Host Summary page, click Next.
14. Click Finish.

## Creating the SQL Server primary VM

1. In VMware vCenter, navigate to Virtual Machines.
2. To create a new VM, click the icon.
3. Leave Create a new virtual machine selected, and click Next.
4. Enter a name for the virtual machine, and click Next.
5. Place the VM on the desired host with available CPUs, and click Next.
6. To host the VM, select the vSAN datastore, and click Next.
7. Select the appropriate guest OS, and click Next.
8. In the Customize Hardware section, use the following settings:
  - a. Set the vCPU count to 16.
  - b. Set the Memory to 8GB.
  - c. Add 1x 80GB VMDK for OS, 1x 100GB VMDKs for database files and 1x 60GB VMDK for database logs.
9. Create two additional VMware Paravirtual SCSI controllers, and assign the data and log VMDKs to the new controllers.
10. Attach the Windows Server 2019 ISO to the CD/DVD drive.
11. Click Next.

12. Click Finish.

## Installing Windows Server 2019

1. Attach the Windows Server 2019 ISO to the virtual machine.
2. Open the VM console, and start the VM.
3. When prompted to boot from DVD, press any key.
4. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
5. Click Install now.
6. When the installation prompts you, enter the product key.
7. Select Windows Server 2019 Datacenter Edition (Server with a GUI), and click Next.
8. Check I accept the license terms, and click Next.
9. Click Custom: Install Windows only (advanced).
10. Select Drive 0 Unallocated Space, and click Next. This starts Windows automatically, and Windows will restart automatically after completing.
11. When the Settings page appears, fill in the Password and Reenter Password fields with the same password. Log in with the password you set up previously.
12. In the VMs hosted on the ESXi servers, install VMware Tools.
13. From Server Manager, disable Windows Firewall.
14. Run Windows Updates.

## Installing SQL Server 2019 on the primary VM

1. To the VM, attach the installation media ISO for SQL Server 2019.
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 check box 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-Text 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. To Specify the SQL Server administrators, click Add Current User.
13. Click Next.
14. At the Error and usage reporting screen, click Next.
15. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
16. At the Ready to Install screen, click Install.
17. Close the installation window.
18. Download and Install SQL Server Management Studio.

# Configuring and running the DVD Store 3 benchmark

## Data generation overview

We generated the data using the Install.pl script included with DVD Store version 3 (DS3), providing the parameters for our 40GB database size and the database platform we used. We ran the Install.pl script on a utility system running Linux® to generate 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 2014. We built the 40GB database in SQL Server, then performed a full backup, storing the backup file remotely for quick access.

We used that backup file to restore the database when necessary.

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. Use database creation scripts in the DS3 download, generate the data, and create the database and file structure. Make size modifications specific to our 40GB database, and make the appropriate changes to drive letters.
2. Transfer the files from a Linux data generation system to a Windows system running SQL Server.
3. Using the provided DVD Store 3 scripts, create database tables, stored procedures, and objects.
4. To prevent excess logging, set the database recovery model to bulk-logged.
5. Load the generated data into the database. For data loading, use the import wizard in SQL Server Management Studio. Where necessary, retain options from the original scripts, such as Enable Identity Insert.
6. Using database creation scripts, create indices, full-text catalogs, primary keys, and foreign keys..
7. Update statistics on each table according to database-creation scripts, which sample 18 percent of the table data.
8. On the SQL Server instance, create 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
EXEC master..sp_addsrvrolemember @loginame = N'ds2user',
@rolename = N'sysadmin'
USE [DS3]
CREATE USER [ds3DS3user] FOR LOGIN [ds2user]
EXEC sp_addrolemember N'db_owner', N'ds3DS3user'
USE [master]
CREATE USER [ds3masteruser] FOR LOGIN [ds2user]
EXEC sp_addrolemember N'db_owner', N'ds3masteruser'
```

9. Set the database recovery model back to full.
10. Using SQL Server Management Studio, create the necessary full text index.
11. Create a database user, and map this user to the SQL Server login.

12. Perform a full backup of the database. This backup allows you to restore the databases to a pristine state.

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



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## Cloning additional SQL Server VMs

We generated the database, created the ds2user login, and stored the backup on the primary SQL VM. Then, we cloned the remaining VMs from the primary SQL VM. For our testing, we created 12 SQL VMs.

1. From a web browser, log into vCenter.
2. Right-click the primary SQL VM and select Clone → Clone to Virtual Machine
3. Select a name for the VM, select a datastore location to store it, and click Next.
4. Select the compute resource the VM will reside on, and click Next.
5. Set Select virtual disk format to Same format as source.
6. Set VM Storage Policy to Keep existing VM storage policies.
7. Select the appropriate datastore, and click Next.
8. Deselect all clone options, and click Next.
9. Review your settings, and click Next.

## Running the DVD Store 3 tests

We created a series of batch les, SQL scripts, and shell scripts to automate the complete test cycle. DVD Store 3 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 target.

During DVD Store 3 testing, we measured power consumption by attaching each server under test to an Extech power meter and recorded power usage. In this report, we report the average watts consumed by each target.

Each complete test cycle consisted of these general steps:

1. Clean up prior outputs from the target system.
2. Drop the database from the target.
3. Restore the database on the target.
4. Reboot the target system.
5. Wait for a ping response from the server under test and the client system.
6. Begin recording power with the Extech Power Analyzer.
7. Start the DVD Store driver on the clients.
8. At the conclusion of the test, stop recording power

We used the following DVD Store 3 parameters for testing:

```
ds3sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --n_threads=32
--db_size=40GB --think_time=0.00 --detailed_view=Y --warmup_time=5 --report_rate=1
--pct_newcustomers=20 --csv_output=<drivepath>
```

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This project was commissioned by Dell EMC.



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