



The science behind the report:

Refresh to HPE ProLiant DL380 Gen10 servers with Toshiba PX05S Series Enterprise 12Gbps SAS SSDs and do more

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 [“Refresh to HPE ProLiant DL380 Gen10 with Toshiba PX05S Series Enterprise 12Gbps SAS SSDs and do more.”](#)

On April 25, 2018, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. For older systems, we chose configurations representative of typical purchases of those systems. We concluded hands-on testing on May 22, 2018.

System configuration information

The table below presents detailed information on the systems we tested.

Server configuration information	HPE ProLiant DL380 Gen10	HPE ProLiant DL380 Gen9
BIOS name and version	U30 v1.36	P89 v2.56
Non-default BIOS settings	None	None
Operating system name and version/build number	VMware® ESXi™, 6.5.0, 7388607	VMware ESXi, 6.5.0, 7388607
Date of last OS updates/patches applied	04/25/18	04/25/18
Power management policy	Max Performance	Max Performance
Processor		
Number of processors	2	2
Vendor and model	Intel® Xeon® Gold 6130	Intel Xeon E5-2660 v3
Core count (per processor)	16	10
Core frequency (GHz)	2.10	2.60
Stepping	H0	M1

Server configuration information	HPE ProLiant DL380 Gen10	HPE ProLiant DL380 Gen9
Memory module(s)		
Total memory in system (GB)	128	64
Number of memory modules	8	4
Vendor and model	Hynix HMA82GR7AFR8N-VK	SAMSUNG® M393A2G40DB0-CPB2Q
Size (GB)	16	16
Type	PC4-2666	PC4-2133
Speed (MHz)	2,666	2,133
Speed running in the server (MHz)	2,666	2,133
Storage controller		
Vendor and model	HPE Smart Array P408i-a SR Gen 10	HPE Smart Array P440ar
Cache size (GB)	2	2
Firmware version	1.34	6.30
Local storage (type A)		
Number of drives	8	8
Drive vendor and model	Toshiba PX05SVB160	HP 868822-B21
Drive size (GB)	1,600	960
Drive information (speed, interface, type)	12Gb SAS SSD	6Gb SATA SSD
Network adapter		
Vendor and model	Broadcom® NetXtreme® BCM5719 Gigabit Ethernet	Broadcom NetXtreme BCM5719 Gigabit Ethernet
Number and type of ports	4 x 1GbE	4 x 1GbE
Cooling fans		
Vendor and model	AVC DBTA063B2S	Nidec V60E12BS1M3-08T062
Number of cooling fans	6	6
Power supplies		
Vendor and model	HPE 865414-B21	HPE 720478-B21
Number of power supplies	2	2
Wattage of each (W)	800	500

How we tested

Installing VMware vSphere onto the servers

We installed VMware vSphere® 6.5 on the internal SD card of the servers.

1. Connect the appropriate VMware vSphere installation media to the server.
2. Boot the server to the VMware vSphere installer.
3. At the EULA screen, to accept and continue, press F11.
4. Under Storage Devices, select the appropriate virtual disk, and press Enter.
5. Select US English as the keyboard type and language.
6. For the host, enter the root password.
7. Enter the root password twice, and press Enter.
8. To start installation, press F11.
9. After the server reboots, press F2, and enter root credentials.
10. Select Configure Management Network, and press Enter.
11. Select the appropriate network adapter, and select OK.
12. Select IPv4 settings, and enter the desired IP address, subnet mask, and gateway for the server.
13. Select OK, and restart the management network.

Creating the workload virtual machines

We created an eight drive RAID 10 volume using the SSDs in each server, and then created a single datastore in ESXi to hold all the VM data (OS, data, and log VMDKs). We created workload VMs for our testing, with the number of VMs depending on how many each server was able to support. Each VM had 4 vCPUs and 8 GB of memory, and a connection to our testing network. We installed Microsoft® Windows Server® 2016 and SQL Server® 2017 onto each VM.

Creating the base VM

1. In VMware vCenter™, navigate to Virtual Machines.
2. Click Create a new VM.
3. Click Next.
4. Enter a name for the virtual machine, and click Next.
5. Place the VM on the appropriate host, and click Next.
6. Select the appropriate datastore to host the VM, and click Next.
7. Click Next.
8. Select the guest OS as Windows Server 2016, and click Next.
9. In the Customize Hardware section, make the following changes:
 - Increase the vCPUs to 4.
 - Increase the VM memory to 8,192 MB.
 - Add a 110GB VMDK for SQL data, and select VMware Paravirtual controller and Thick Provisioned Eager Zeroed. Place the VMDK in the SSD datastore
 - Add a 30GB VMDK for SQL logs, and select VMware Paravirtual controller and Thick Provisioned Eager Zeroed. Place the VMDK in the SSD datastore.
10. Connect the VM to the test network.
11. Click Next.
12. Click Finish.

Installing Windows Server 2016 guest OS onto the VMs

1. Attach the Windows Server 2016 ISO to the VM.
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 2016 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. Windows will restart automatically after completing.
11. When the Settings page appears, enter the same password in the Password and Reenter Password fields.
12. Log in with the password you set up in the previous step.

Installing VMware Tools on the first VM

1. Right-click the VM in vCenter, and click Install VMware Tools to mount the appropriate image to the VM's virtual CD-ROM drive.
2. Ensure the VM is powered on, and log in as an administrator.
3. Navigate to the virtual CD-ROM drive in the VM, and double-click setup.exe to begin the wizard.
4. Follow the wizard, and select Typical installation.
5. When the VMware Tools installation has completed, restart the VM.

Installing SQL Server 2017 on the first VM

1. Prior to installing, add the .NET Framework 3.5 feature to the server.
2. Attach the installation media ISO for SQL Server 2017 to the VM.
3. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2017 DVD, and double-click it.
4. In the left pane, click Installation.
5. Click New SQL Server stand-alone installation or add features to an existing installation.
6. Specify Evaluation as the edition you are installing, and click Next.
7. To accept the license terms, click the checkbox, and click Next.
8. Click Use Microsoft Update to check for updates, and click Next.
9. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, and Client Tools Backwards Compatibility.
10. Click Next.
11. At the Instance configuration screen, leave the default selection of default instance, and click Next.
12. At the Server Configuration screen, accept defaults, and click Next.
13. At the Database Engine Configuration screen, select the authentication method you prefer. For our testing purposes, we selected Mixed Mode.
14. Enter and confirm a password for the system administrator account.
15. Click Add Current user. This may take several seconds.
16. Click Next.
17. At the Ready to Install screen, click Install.
18. Close the installation window.
19. In the SQL Server Installation Center, click on Install SQL Server Management Tools.
20. Click Download SQL Server Management Studio.
21. Click Run.
22. When the Microsoft SQL Server Management Studio screen appears, click Install.
23. When the installation completes, click Close.
24. Close the installation window.
25. Shut down the VM, and create clones for the remaining number of VMs.

DVD Store 2 Benchmark Configuration

Data generation overview

We generated the data using the Install.pl script included with DVD Store 2.1 (DS2), providing the parameters for our 40GB database size and the Microsoft SQL Server 2017 platform. We ran the Install.pl script on a utility system running Linux®. The Install.pl script also 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 2014. We built the 40GB 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 database to the SQL Server 2017-based VMs 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, we created and loaded the database schema according to the DVD Store documentation. Specifically, we followed the steps below:

1. Generate the data and create the database and file structure using database creation scripts in the DS2 download. We made size modifications specific to our 40GB database and the appropriate changes to drive letters.
2. Transfer the files from a Linux data generation system to a Windows system running SQL Server.
3. Create database tables, stored procedures, and objects using the provided DVD Store scripts.
4. Set the database recovery model to bulk-logged to prevent excess logging.
5. Load the data you generated 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. Create indices, full-text catalogs, primary keys, and foreign keys using the database-creation scripts.
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 (T-SQL) 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. Set the database recovery model back to full.
10. Create the necessary full text index using SQL Server Management Studio.
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 relatively quickly between tests.

Logical name	Filegroup	Initial size (MB)
Database files		
primary	PRIMARY	4
cust1	DS_CUST_FG	6,000
cust2	DS_CUST_FG	6,000
cust3	DS_CUST_FG	6,000
cust4	DS_CUST_FG	6,000
ind1	DS_IND_FG	3,205
ind2	DS_IND_FG	3,205
ind3	DS_IND_FG	3,205
ind4	DS_IND_FG	3,205
ds_misc	DS_MISC_FG	200
orders1	DS_ORDERS	3,000
orders2	DS_ORDERS	3,000
orders3	DS_ORDERS	3,000
orders4	DS_ORDERS	3,000
Log files		
ds_log	Not applicable	24,781

Running the DVD Store 2.1 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 these general steps:

1. Clean up prior outputs from the target system and the client driver system.
2. Drop the databases from the target.
3. Restore the databases 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 and the client system.
7. Let the test server idle for 10 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=60 --n_threads=32 --db_size=40GB --think_time=0.02 --detailed_view=Y --warmup_time=15 --report_rate=1 --csv_output=<drive path>
```

Read the report at <http://facts.pt/m1m109> ►

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