



Meet more database processing demand with more computing power on IBM Cloud

VMware Cloud Foundation on IBM Cloud featuring Intel Xeon processors E5-2650 v4 handled more ecommerce orders per minute than IBM Cloud servers powered by Intel Xeon processors E5-2650 v3

Running transactional database workloads on an infrastructure-as-a-service (IaaS) platform can bring flexibility and scalability to your organization's critical database applications. When ordering a VMware® Cloud Foundation solution supported by IBM® Cloud, choosing newer compute resources is a simple way to allow these database applications to perform better and support more processing demand.

For the IBM-VMware solution we tested at Principled Technologies, Intel® Xeon® E5-2650 v4 processors boosted transactional database work compared to Intel Xeon E5-2650 v3 processors. Your databases can support more work, creating an opportunity for increased revenue or greater application output, by simply choosing the next generation processor when ordering a solution from the IBM Cloud console.

By simply choosing newer compute resources...



...your database applications can process 17% more ecommerce orders per minute.



Let your workloads dictate your IBM Cloud configuration

The IBM-VMware solution we tested is one of many offerings from IBM Cloud. The range of Intel Xeon processors that power the IBM Cloud configurations allows your IT admins to select the desired number of cores and processors, as well as RAM, processor speed, networking speed, and internal drives based on need. In addition, IT and financial departments can choose between monthly and hourly pricing options. IBM datacenters around the world feature Cloud Foundation, so your admins can choose to run applications and workloads in a specific location that ensures security and compliance.

Upgrade with a single click on the console

Upgrading to Intel Xeon processors E5 v4 for a Cloud Foundation on IBM Cloud requires minimal effort from your IT admins. Our admin needed only to select the desired configuration and spin up an instance using the web console. If your admin were to upgrade a processor on any on-premises solution, it could take several hours or even days to research, find, and install the appropriate hardware components to meet your workload requirements.

Considerations for choosing a processor

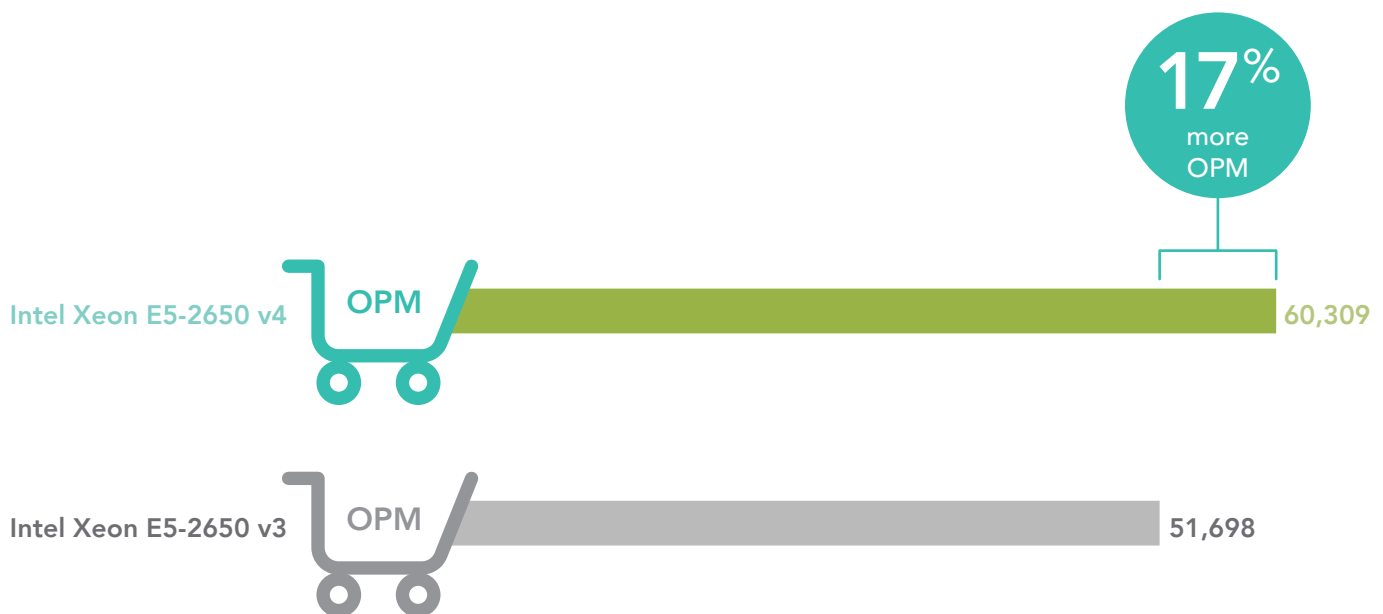
Powerful processors are a driving resource for database application efficiency. As you choose your IBM-VMware solution, you'll want the resources that support your database applications to allow for performance that meets the demand of your users. For our purposes, each solution featured two processors: E5-2650 v3 processors for the first and E5-2650 v4 processors for the second. As the Intel Xeon processor E5-2650 v4 has two more cores than the Intel Xeon processor E5 v3, our second solution featured four more cores. The E5 v4 processors have many advantages, such as higher memory bandwidth and a larger L2 +L3 cache, that can lead to better application performance and efficiency.

We tested small deployments of each solution. The performance boost may seem modest on a small scale, but getting more powerful processors in a larger deployment could improve application performance significantly. What's more, choosing a more powerful computing capacity helps ensure high-volume database workloads don't raise CPU utilization to a level that can slow your critical applications.

Handle more ecommerce activity

We ran an online transaction processing (OLTP) workload against Microsoft® SQL Server® 2016 database VMs on each solution. The IBM-VMware solution featuring Intel Xeon processors E5 v3 handled 51,698 orders per minute (OPM). The solution featuring Intel Xeon processors E5 v4 handled 17 percent more OPM (60,309). The chart below illustrates the difference in OPM processing between the two solutions.

An increase in orders per minute can be helpful for ecommerce customers and businesses. Ecommerce applications that can handle more activity (searches, logins, and purchases) can lead to more satisfied customers and more revenue. In addition, the performance boost could translate to a nice bump in ecommerce sales for a business that scales out its IBM-VMware solution during heavy shopping periods.



Run applications and workloads on popular VMware virtual platforms in Cloud Foundation

IBM Cloud has partnered with VMware to offer organizations a subscription-based software-defined datacenter (SDDC) solution for public clouds. Cloud Foundation on IBM Cloud combines VMware vSphere®, VMware vSAN™, and VMware NSX® to deliver virtual cloud infrastructure. Organizations can benefit from extending their private cloud to Cloud Foundation on IBM Cloud while configuring the solution to meet their specific needs.

Conclusion

Simple choices sometimes have a significant impact. When you're ordering a Cloud Foundation solution on IBM Cloud architecture, selecting a newer processor can boost your database workload. We found that choosing newer Intel Xeon processors E5-2650 v4 over Intel Xeon processors E5-2650 v3 provided a 17 percent advantage in ecommerce OPM processing. Those additional ecommerce orders from just a single resource option when ordering an IBM-VMware solution can help boost sales and satisfy customers.



On July 28, 2017, 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 August 10, 2017.

Appendix A: System configuration information

We ran DVD Store version 3 on an IaaS VMware Cloud Foundation solution on IBM Cloud architecture with four Supermicro® PIO-628U-TR4T+-ST031 servers hosted in the IBM Cloud. We consolidated the infrastructure VMs to the first host in the cluster, and spread out the SQL VMs between the remaining three hosts. We also disabled vSphere DRS and HA to ensure all VMs remained in place during testing.

We used vSAN storage configured with two disk groups per host, and each disk group was comprised of one 1.2 TB SSDs used for caching and four 2 TB HDDs used for capacity.

We used VMWare vCenter® to create the virtual machines. We used the same VMs in both instances to show the performance gain of upgrading the processors.

- vCPU count set to 10 (12 for the upgrade)
- Virtual Memory set to 64 GB
- Primary Drive size set to 100 GB
- Database Drive size set to 300 GB
- Log Drive size set to 100 GB

We obtained the server configuration information below through the IBM Cloud console.

Server configuration information	
Server model	Supermicro PIO-628U-TR4T+-ST031
Number of servers	4
BIOS name and version	American Megatrends 2.0c (10/19/2016)
Non-default BIOS settings	None
Operating system name and version	VMware ESXi™ 6.0.0 u2
Date of last OS updates/patches applied	07-25-2017
Power management policy	Default
Processor #1	
Number of processors	2
Vendor and model	Intel Xeon E5-2650 v3
Core count (per processor)	10
Core frequency (GHz)	2.30
Stepping	M0
Processor #2	
Number of processors	2
Vendor and model	Intel Xeon E5-2650 v4
Core count (per processor)	12
Core frequency (GHz)	2.20
Stepping	M0

Server configuration information

Memory module(s)	
Total memory in system (GB)	128
Number of memory modules	8
Vendor and model	Samsung® M393A2K43BB1-CRC
Size (GB)	16
Type	DDR4
Speed (MHz)	2,400
Speed running in the server (MHz)	2,400
Storage controller	
Vendor and model	LSI MegaRAID® SAS 9361-8i
Firmware version	4.650.00-6383
Driver version	6.610.15.00
vSAN SSD storage	
Number of drives	2
Drive vendor and model	Intel S3710 Series
Drive size (GB)	1,200
vSAN HDD storage	
Number of drives	8
Drive vendor and model	Seagate® Enterprise Capacity 3.5 V5
Drive size (TB)	2
Network adapter	
Vendor and model	Intel Ethernet Controller X540-AT2
Number and type of ports	4x 10GbE
Driver version	4.1.1.4
Cooling fans	
Vendor and model	N/A
Number of cooling fans	4
Power supplies	
Vendor and model	Supermicro PWS-1K02A-1R
Number of power supplies	2
Wattage of each (W)	1,000

Appendix B: How we tested

Setting up the virtual infrastructure

Creating the first VM in ESXi

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. Select the appropriate datastore to host the VM, and click Next.
7. In the Customize Hardware section, use the above settings.
8. Click Next.
9. Click Finish.

Installing Microsoft Windows Server® 2016 Datacenter Edition on the VM

1. Boot the VM to the installation media.
2. Press any key when prompted to boot from DVD.
3. When the installation screen appears, leave 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. Check I accept the license terms, and click Next.
7. Click Custom: Install Windows only (advanced).
8. Select Windows Server 2016 Datacenter Edition (Desktop Experience), and click Next.
9. Select Drive 0 Unallocated Space, and click Next, at which point Windows begins automatically, and restarts automatically after completing.
10. When the Settings page appears, fill in the Password and Reenter Password fields with the same password.
11. Log in with the password you set up previously.

Installing VMware Tools™ on the 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 the Typical installation option.
5. When the VMware Tools installation has completed, restart the VM.

Installing SQL Server 2016 on the VM

1. Mount the installation DVD for SQL Server 2016.
2. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2016 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. 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 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 the database (DVD Store)

Data generation overview

We generated the data using the Install.pl script included with DVD Store version 3 (DS3), providing the parameters for our 100GB 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 2016. We built the 100GB 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. Generate the data, and create the database and file structure using database creation scripts in the DS3 download. Make size modifications specific to our 100GB database, and make the appropriate changes to drive letters.
2. Transfer the files from our 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 we 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 (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. 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.

The table below shows our initial file size modifications.

Logical name	Filegroup	Initial size (MB)
Database files		
primary	PRIMARY	10
ds_misc	DS_MISC	392
cust1	DS_CUST	40,511
cust2	DS_CUST	40,511
orders1	DS_ORDERS	40,016
orders2	DS_ORDERS	40,016
ind1	DS_INDEX	31,274
ind2	DS_INDEX	31,274
member1	DS_MEMBER	243
member2	DS_MEMBER	243
review1	DS_REVIEW	15,313
review2	DS_REVIEW	15,313
Log files		
ds_log	Not applicable	77,773

Running the DVD Store tests

Test start and run times

We ran all workloads concurrently to start and record all performance counters for this report. The specific testing parameters we used are included in the setup section, and the following section describes specifics for launching the test.

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 general steps:

1. Clean up prior outputs from the target system and the client driver system.
2. Drop the database from the target.
3. Restore the database 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:

```
ds3sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=60 --n_threads=(10 or 12) --db_size=100GB --think_time=0 --detailed_view=Y --warmup_time=5 --report_rate=1 -out_filename=<drive path>
```

This project was commissioned by IBM.



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