



The science behind the report:

Get more VMware vSAN database performance with Intel Optane SSDs and HPE ProLiant DL380 Gen10 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 [Get more VMware vSAN database performance with Intel Optane SSDs and HPE ProLiant DL380 Gen10 servers](#).

We concluded our hands-on testing on April 8, 2019. 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 April 6, 2019 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

Throughput	Configuration with eight NAND NVMe™ SSDs	Configuration with six NAND NVMe SSDs + two Intel® Optane™ NVMe SSDs	Percent win
Read throughput (MB/s)	631	827	31.06%
Write throughput (MB/s)	1,392	1,899	36.42%
Total throughput (MB/s)	2,023	2,726	34.75%

Input/output operations per second (IOPS)	Configuration with eight NAND NVMe™ SSDs	Configuration with six NAND NVMe SSDs + two Intel® Optane™ NVMe SSDs	Percent win
Read IOPS	77,296	101,407	31.19%
Write IOPS	112,468	155,136	37.93%
Total IOPS	189,764	256,543	35.19%

System configuration information

The table below presents detailed information on the systems we tested. Both configurations we tested used HPE ProLiant DL380 Gen10 servers. The first configuration used eight NAND NVMe SSDs per server, with two of these SSDs assigned to the vSAN cache tier and six of the SSDs assigned to the vSAN capacity tier. The second configuration used two Intel Optane SSDs per server for the vSAN cache tier and six NAND NVMe SSDs for the vSAN capacity tier.

Server configuration information	HPE ProLiant DL380 servers
Tested by	Principled Technologies
Test date	04/06/2019
Workload & version	SLOB 2.4.2.1
Server platform	HPE ProLiant DL380 Gen10
BIOS name and version	U30 v1.46 (10/02/2018)
BIOS settings	Performance
Operating system name and version/build number	VMware® ESXi™ 6.7 with vSAN 6.7
Date of last OS updates/patches applied	04/01/2019
Power management policy	Static High Performance Mode
Processor	
Number of processors	2
Vendor and model	Intel Xeon® Gold 6154 CPU @ 3.00GHz
Core count (per processor)	18
Core frequency (GHz)	3.0
Stepping	H0
Hyper-Threading	Yes
Turbo	Yes
Memory module(s)	
Total memory in system (GB)	384
Number of memory modules	24
Vendor and model	Samsung® M393A4K40BB2-CTD6Q
Size (GB)	32
Type	PC4-2666V
Speed (MHz)	2,666
Speed running in the server (MHz)	2,666
NVMe memory present?	No
Total memory (DDR+NVMe RAM)	384
Local storage (OS)	
Number of drives	1
Drive vendor and model	HP Boot SD Card

Server configuration information	HPE ProLiant DL380 servers	
Drive size (GB)	32	
Drive information (speed, interface, type)	SD	
vSAN capacity tier storage	First configuration	Second configuration
Number of drives	6	6
Drive vendor and model	Intel DC P4500 (SSDPE2KX020T7P)	Intel DC P4500 (SSDPE2KX020T7P)
Drive size (GB)	2000	2000
Drive information (speed, interface, type)	NAND NVMe	NAND NVMe
vSAN cache tier storage	First configuration	Second configuration
Number of drives	2	2
Drive vendor and model	Intel DC P4500 (SSDPE2KX020T7P)	Intel P4800X (SSDPE21KE75GAP)
Drive size (GB)	2,000	375
Drive information (speed, interface, type)	NAND NVMe	Intel Optane NVMe
Network adapter		
Vendor and model	Intel XXV710	
Number and type of ports	2 x 25GbE	
Cooling fans		
Vendor and model	Delta PFM0612XHE	
Number of cooling fans	6	
Power supplies		
Vendor and model	HPE 865414-B21	
Number of power supplies	2	
Wattage of each (W)	800	

How we tested

Our testing environment consisted of four HP ProLiant DL380 Gen10 servers. We configured each server with 384 GB of RAM. For the first configuration, we configured each of the four servers with eight NAND NVMe SSDs, using two for the vSAN cache tier and six for the vSAN capacity tier. For the second configuration, we configured each of the four servers with two Intel Optane SSDs for the vSAN cache tier and six NAND NVMe SSDs for the vSAN capacity tier. In all of the configurations, we used two vSAN disk groups per server, with each disk group containing a single cache disk and three capacity disks. We created a template Red Hat Enterprise Linux 7.6 VM, installed Oracle 12c, and created ASM disk groups to divide the storage according to use type. We then installed the Silly Little Oracle Benchmark (SLOB), initialized the test database, and performed disk-intensive tests over three runs to come up with a median result. Based on preliminary tests, we found the optimal configuration to be two VMs per server, for a total of eight VMs in the cluster.

Installing VMware ESXi 6.7

1. Attach the installation media.
2. Boot the server.
3. At the VMware Installer screen, press Enter.
4. At the EULA screen, to Accept and Continue, press F11.
5. Under Storage Devices, select the appropriate virtual disk, and press Enter.
6. As the keyboard layout, select US, and press Enter.
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.
14. Repeat steps 1 through 13 on the rest of the servers.

Deploying the VMware vCenter® Server 6.7

1. On a Windows server or VM, locate the VMware-VCSA installer image.
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 “vCenter Server with an Embedded Platform Services Controller” selected and click Next.
8. Enter the FQDN or IP address of the host onto which the vCenter Server Appliance will be deployed.
9. Provide the server’s username and password, and click Next.
10. Accept the certificate of the host you chose to connect to by clicking 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 on Next.
17. At the Introduction page, click on Next
18. At the Appliance configuration page, select the time synchronization mode and SSH access settings, click on Next
19. Select Create a new SSO domain.
20. Provide a password, and confirm it.
21. Provide an SSO Domain name and SSO Site name, and click on Next.
22. At the CEIP page click Next
23. At the Ready to complete page, click Finish.
24. When installation completes, click Close.
25. Using the vSphere® web client, log into the vCenter server using the credentials previously provided.

Creating a cluster and adding the hosts to VMware vCenter

1. Once logged into 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. Click OK.
8. Once you have created the cluster, right-click the cluster, and click Add Host.
9. Enter the FQDN for the first server, and click Next.
10. Enter the root credentials for the server, and click Next.
11. To accept the server's certificate, click Yes.
12. Review the server details, and click Next.
13. Assign the desired license, and click Next.
14. Disable Lockdown mode, and click Next.
15. Click Finish.
16. Repeat steps 8 through 15 for the remaining servers in the cluster.

Configuring the VMware vSphere Distributed Switch for the cluster

1. Navigate to the Networking tab.
2. Expand the vCenter for the cluster.
3. Right-click the datacenter, and click Distributed Switch→Distributed Switch.
4. Enter a name for the vDS, and click Next.
5. Select Distributed switch: 6.7.0, and click Next.
6. Set the number of uplinks to two, and enter a vSAN as the new default port group.
7. Click Next.
8. Review the settings, and click Finish.
9. Select the new vDS, and click the configure tab.
10. Under Properties, click Edit..
11. Click Advanced, and for the MTU setting, type 9000.
12. Click OK.
13. On the left-hand side, right-click the new vSAN port group that was created along with the new vDS.
14. Click Edit Settings.
15. Click VLAN, and enter the VLAN for vSAN traffic.
16. Click OK.
17. Right-click the vDS, and click Distributed Port Group→New Distributed Port Group.
18. Enter vMotion as the name of the new port group and click Next.
19. Under VLAN, set a VLAN to for vMotion. Click Next.
20. Review the port group settings, and click Finish.
21. Right-click the vDS, and click Distributed Port Group→New Distributed Port Group.
22. Enter VM_NET as the name of the new port group and click Next.
23. Under VLAN, set a VLAN to for VM_NET. Click Next.
24. Review the port group settings, and click Finish.
25. Right-click the vDS, and click Add and Manage Hosts...
26. Select Add hosts, and click Next.
27. Click + New hosts...
28. Select all the compatible hosts in vCenter cluster, and click OK.
29. Click Next.
30. Select Manage physical adapters and Manage VMkernel adapters, and click Next.
31. For each host, select each of the two 25Gb ports, click Assign uplink, and assign them to the two uplink ports.
32. Click Next.
33. Select the first host, and click +New adapter.
34. Click an existing network, and click Browse.
35. Select the vMotion port group, and click OK.
36. Click Next.
37. Check the vMotion service to enable it, and click Next.

38. Enter the desired network information for the new VMKernel, and click Next.
39. Click OK.
40. Select the first host, and click +New adapter.
41. Click select an existing network, and click Browse.
42. Select the VSAN port group, and click OK. Click Next.
43. Check the Virtual SAN service to enable it, and click Next.
44. Enter the desired network information for the new VMKernel, and click Next. Click OK.
45. Select each of the remaining hosts individually, and repeat steps 33 through 44 for each server. Click Next.
46. Analyze the impact, and click Next.
47. Review the settings, and click Next.

Enabling Virtual SAN on the server cluster

1. Log into the vCenter web client, and navigate to Hosts and Clusters.
2. Expand the primary site management vCenter, and select the vSAN cluster.
3. Select the Configure tab, and under Virtual SAN, click General→Configure
4. On the vSAN capabilities screen, click Next.
5. On the Network validation screen, click Next.
6. Select which disks to claim for cache and which for capacity in the vSAN cluster, and click Next.
 - a. For the configuration using Intel Optane in the vSAN cache tier, create two groups of one Optane cache disk per three NAND capacity disks per server.
 - b. For the configuration using NAND NVMe SSDs in the vSAN cache tier, create two groups of one NAND cache disk per three NAND capacity disks per server.
7. On the Ready to complete screen, click Finish.

Installing Red Hat Enterprise Linux 7.6 for Oracle

1. Create a new VM with 36 vCPUs (18 cores per socket), 32 GB of RAM, and a 500GB hard disk.
2. Edit the VM settings, add three VMware Paravirtual SCSI controllers, and configure as shown in the table below.

Oracle virtual disk configuration		
VMDK	VMDK size (GB)	SCSI virtual device node
OS	500	0:0
DB1	500	0:1
DB2	500	0:2
Log1	200	0:3
DB3	500	1:0
DB4	500	1:1
Log2	200	1:2
DB5	500	2:0
DB6	500	2:1
Log3	200	2:2
DB7	500	3:0
DB8	500	3:1
Log4	200	3:2

3. Attach the Red Hat Enterprise Linux 7.6 ISO to the VM, start the VM, and open a console session to install the OS.
4. Select Install or upgrade an existing system.
5. Choose the language you wish to use, and click Continue.
6. Select Installation Destination.
7. Select the desired disk for the OS.

8. Under Other Storage Options, select I will configure partitioning.
9. Click Done.
10. Select Click here to create them automatically.
11. Remove the /home partition.
12. Expand the swap partition to 20GB.
13. Assign all remaining free space to the / partition.
14. Click Done.
15. Click Accept Changes.
16. Select Kdump.
17. Uncheck Enable kdump, and click Done.
18. Select Network & Hostname.
19. Enter the desired hostname for the VM.
20. Turn on the desired network port, and click Configure.
21. On the General tab, select Automatically connect to this network when it is available.
22. On the IPv4 Settings tab, under Method, select Manual.
23. Under Addresses, click Add, and enter the desired static IP information for the server.
24. Enter the desired DNS information.
25. Click Save, and click Done.
26. Select Date & Time, and ensure the correct date, time, and time zone are set.
27. Click the cog next to the Network Time On/Off switch to add your NTP server.
28. Add the IP address of your NTP server, and click +.
29. Uncheck all other NTP servers.
30. Click OK.
31. Click Done.
32. Click Begin Installation.
33. Select Root Password.
34. Enter the desired root password, and click Done.
35. When the installation completes, select Reboot to restart the server.

Configuring Red Hat Enterprise Linux 7.6 for Oracle

1. Log onto the server as root.
2. Disable the firewall:


```
systemctl stop firewalld
systemctl disable firewalld
```
3. Disable SELinux:


```
vi /etc/selinux/config
SELINUX=disabled
```
4. Update RHEL 7.6:


```
yum update -y
```
5. Using yum, install the following prerequisite packages for Oracle Database:


```
yum install -y binutils.x86_64 compat-libstdc++-33 compat-libstdc++-33.i686 compat-libcap1.x86_64
gcc.x86_64 gcc-c++.x86_64 glibc.i686 glibc.x86_64 glibc-devel.i686 glibc-devel.x86_64 ksh libaio.i686
libaio.x86_64 libaio-devel.i686 libaio-devel.x86_64 libdmx libgcc.i686 libgcc.x86_64 libstdc++.i686
libstdc++.x86_64 libstdc++-devel.i686 libstdc++-devel.x86_64 libXi.i686 libXi.x86_64 libX11 libXau
libxcb libXext.i686 libXi libXmu libXt libXtst.i686 libXtst.x86_64 libXv libXxf86dga libXxf86misc
libXxf86vm make.x86_64 net-tools nfs-utils smartmontools sysstat.x86_64 unixODBC unixODBC-devel unzip
xhost xorg-x11-apps xorg-x11-utils xorg-x11-xauth zip zlib-devel zlib-devel.i686
```
6. Disable auditd:

```
systemctl disable auditd
```

7. Create Oracle users and groups by running these shell commands:

```
groupadd -g 54321 oinstall
groupadd -g 54322 dba
groupadd -g 54323 oper
groupadd -g 54324 backupdba
groupadd -g 54326 kmdba
groupadd -g 54325 dgdba
groupadd -g 54327 asmdba
groupadd -g 54328 asmoper
groupadd -g 54329 asmadmin
useradd --uid 54321 --gid oinstall --groups dba,oper,backupdba,dgdba,kmdba,asmdba,asmoper,asmadmin
oracle
```

8. Create a password for the oracle account with `passwd`
9. Create the following directories, and assign the following permissions.

```
mkdir -p /u01/app/12.1.0.2/grid
mkdir -p /u01/app/oracle/product/12.1.0.2/db_1
chown -R oracle:oinstall /u01
chmod -R 775 /u01/
```

10. On a separate computer, navigate to the RHEL Labs page for the RHEL Tuner for Oracle (<https://access.redhat.com/labs/rhelfto/>) and fill out the proper details for your system (we put the SGA as 300GB). Click the button to generate the script for your server.
11. Copy the RHEL Tuner script to your server.
12. On your server, execute the RHEL Tuner, accepting all changes.
13. Append the following to the `/etc/security/limits.conf`:

```
oracle - nofile 65536
oracle - nproc 16384
oracle - stack 32768
oracle - memlock 29360128
* soft memlock unlimited
* hard memlock unlimited
```

14. Modify the system's kernel parameters by appending the following to `/etc/sysctl.conf`:

```
vm.nr_hugepages = 175000
vm.hugetlb_shm_group = 54321
```

15. Add the following lines to the `.bash_profile` for the oracle user:

```
export TMP=/tmp
export TMPDIR=$TMP

export ORACLE_HOSTNAME=<HOSTNAME>
export ORACLE_UNQNAME=orcl
export ORACLE_BASE=/u01/app/oracle
export GRID_HOME=/u01/app/12.1.0.2/grid
export DB_HOME=$ORACLE_BASE/product/12.1.0.2/db_1
export ORACLE_HOME=$DB_HOME
export ORACLE_SID=orcl
export ORACLE_TERM=xterm
export BASE_PATH=/usr/sbin:$PATH
export PATH=$ORACLE_HOME/bin:$BASE_PATH

export LD_LIBRARY_PATH=$ORACLE_HOME/lib:/lib:/usr/lib
export CLASSPATH=$ORACLE_HOME/JRE:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib

alias grid_env='. /home/oracle/grid_env'
alias db_env='. /home/oracle/db_env'
```

16. Create the following files in the oracle user's home folder:

```
grid_env
export ORACLE_SID=+ASM
export ORACLE_HOME=$GRID_HOME
```

```

export PATH=$ORACLE_HOME/bin:$BASE_PATH

export LD_LIBRARY_PATH=$ORACLE_HOME/lib:/lib:/usr/lib
export CLASSPATH=$ORACLE_HOME/JRE:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib
db_env
export ORACLE_SID=orcl
export ORACLE_HOME=$DB_HOME
export PATH=$ORACLE_HOME/bin:$BASE_PATH

export LD_LIBRARY_PATH=$ORACLE_HOME/lib:/lib:/usr/lib
export CLASSPATH=$ORACLE_HOME/JRE:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib

```

17. Download and install OracleASM support and lib packages from here: <https://access.redhat.com/solutions/315643>
18. Navigate to the directory you downloaded the OracleASM packages and install them:

```
yum localinstall -y oracleasm*
```

19. Create a partition on all disks using fdisk
20. Edit /etc/sysconfig/oracleasm to contain the following:

```

# ORACLEASM_ENABLED: 'true' means to load the driver on boot.
ORACLEASM_ENABLED=true

# ORACLEASM_UID: Default UID owning the /dev/oracleasm mount point.
ORACLEASM_UID=oracle

# ORACLEASM_GID: Default GID owning the /dev/oracleasm mount point.
ORACLEASM_GID=oinstall

# ORACLEASM_SCANBOOT: 'true' means fix disk perms on boot
ORACLEASM_SCANBOOT=true

# ORACLEASM_USE_LOGICAL_BLOCK_SIZE: 'true' means use the logical block
# size reported by the underlying disk instead of the physical. The
# default is 'false' ORACLEASM_USE_LOGICAL_BLOCK_SIZE=false

```

21. Run the following command to initialize Oracle ASM:

```
oracleasm init
```

22. Run the following commands to configure all of the disks for Oracle ASM:

```

oracleasm createdisk DATA1 /dev/sdb1
oracleasm createdisk DATA2 /dev/sdc1
oracleasm createdisk DATA3 /dev/sde1
oracleasm createdisk DATA4 /dev/sdf1
oracleasm createdisk DATA5 /dev/sdh1
oracleasm createdisk DATA6 /dev/sdi1
oracleasm createdisk DATA7 /dev/sdk1
oracleasm createdisk DATA8 /dev/sdl1
oracleasm createdisk LOG1 /dev/sdd1
oracleasm createdisk LOG2 /dev/sdg1
oracleasm createdisk LOG3 /dev/sdj1
oracleasm createdisk LOG4 /dev/sdm1

```

Installing Oracle Grid Infrastructure 12c

1. Log in as the oracle user.
2. Unzip linuxx64_12102_grid_home.zip
3. Open an X terminal session, and browse to the unzipped database directory.
4. To set the Oracle grid environment, type `grid_env`
5. To start the installer, type `./runInstaller`
6. In the Select Installation Option screen, select Install and Configure Grid Infrastructure for a Standalone Server, and click Next.
7. Choose the language, and click Next.
8. In the Create ASM Disk Group screen, choose the Disk Group Name (DATA), and change redundancy to Normal.
9. Select the DATA disks.

10. In the Specify ASM Password screen, choose Use same password for these accounts, type the passwords for the ASM users, and click Next.
11. At the Management Options screen, click Next.
12. Leave the default Operating System Groups, and click Next.
13. Leave the default installation, and click Next.
14. Leave the default inventory location, and click Next.
15. Under Root script execution, leave the defaults, and click Next.
16. In the Prerequisite Checks screen, make sure that there are no errors.
17. In the Summary screen, verify that everything is correct, and click Finish to install Oracle Grid Infrastructure.
18. During the installation, the installation prompts you to execute two configuration scripts as root. Follow the instructions to run the scripts.
19. At the Finish screen, click Close.
20. To run the ASM Configuration Assistant, type `asmca`.
21. In the ASM Configuration Assistant, click Create.
22. In the Create Disk Group window, name the new disk group LOG, choose redundancy Normal Redundancy, and select the four LOG disks.
23. Click Advanced Options.
24. Set the database compatibility level to 12.1.0.0.0, and click OK.
25. Exit the ASM Configuration Assistant.

Installing Oracle Database 12c

1. Unzip `linux_12102_database.zip`.
2. Open a terminal to the unzipped database directory.
3. Type `db_env` to set the first Oracle database environment.
4. Run `./runInstaller.sh`.
5. Wait for the GUI installer to load.
6. On the Configure Security Updates screen, enter the credentials for My Oracle Support. If you do not have an account, uncheck the box I wish to receive security updates via My Oracle Support, and click Next.
7. At the warning, click Yes.
8. On the Download Software Updates screen, enter the desired update option, and click Next.
9. On the Select Installation Option screen, select Install database software only, and click Next.
10. On the Grid Installation Options screen, select Single instance database installation, and click Next.
11. On the Select Product Languages screen, leave the default setting of English, and click Next.
12. On the Select Database Edition screen, select Enterprise Edition, and click Next.
13. On the Specify Installation Location, leave the defaults, and click Next.
14. On the Privileged Operating System groups screen, keep the defaults, and click Next.
15. Allow the prerequisite checker to complete.
16. On the Summary screen, click Install.
17. Once the Execute Configuration scripts prompt appears, SSH into the server as `root`, and run the following command:


```
/u01/app/oracle/product/12.1.0.2/db_1/root.sh
```
18. Return to the prompt, and click OK.
19. Once the installer completes, click Close.

Creating and configuring the database

1. Using Putty with X11 forwarding enabled, SSH to the VM.
2. To switch to the first database environment, type `sas_db_env`.
3. To open the Database configuration assistant, type `dbca`, and press enter.
4. At the Database Operation screen, select Create Database, and click Next.
5. Under Creation Mode select Advanced Mode, and click Next.
6. At the Deployment Type screen, select General Purpose or Transaction Processing. Click Next.
7. Enter a Global database name and the appropriate SID, and uncheck Create as Container database. Click Next.
8. At the storage option screen, select Use following for the database storage attributes.
9. In the drop down, select Automatic Storage Management (ASM), and select +SAS for the file location.
10. At the Network Configuration screen, select the listener, and click Next.
11. At the Data Vault Option screen, leaves default, and click Next.
12. At the Configuration Options screen, set the SGA size to 98304 and the PGA size to 32768, and click Next.
13. At the Management Options screen select Configure Enterprise Manager (EM) Database Express, and click Next.
14. At the User Credentials screen, select Use the same administrative password for all accounts, enter and confirm the desired password,

and click Next.

15. At the Creation Options, select Create Database, and click Next.
16. At the summary screen, click Finish.
17. Close the Database Configuration Assistant.
18. To open the database manager in a Web browser, browse to <https://host.ip.address:5500/em>.
19. Log in as system with the password you specified.
20. Go to Storage→Tablespaces.
21. Click Create.
22. Type SLOB as the Name.
23. Select Big File, and click Next.
24. Set the file size to 200G, and click OK.
25. Go to Storage→Redo Log Groups.
26. Click Actions→Switch file... until you get one of the groups to go inactive.
27. Highlight the inactive group, and click Actions→Drop group.
28. Create two redo log groups, each with a single 10GB file on the +SAS ASM volume.
29. Repeat steps 26 and 27, removing the remaining default redo logs.

Installing SLOB and populating the databases

1. Download the SLOB kit from <http://kevinclonson.net/slob/>.
2. Copy and untar the files to /home/oracle/SLOB.
3. Edit the slob.conf file to match Appendix D.
4. To switch to the database environment, type db_env
5. To enter SQLPlus, run the following command:

```
sqlplus / as sysdba
```
6. To start the database, type startup
7. Once the database is up, type exit
8. To start the data population to the SLOB tablespace you created earlier, type ./setup.sh SLOB 256. When the setup is complete, the database is populated.
9. Shut down the VM, and clone seven instances.

Running SLOB on SAS

1. Log in as the Oracle user.
2. To switch database environment, type db_env
3. Start the database.
4. Navigate to /home/oracle/SLOB.
5. To start the test, type ./runit.sh 256.
6. Repeat step 5 two more times.
7. Shut down the database.

Configuring the Oracle pfile

Alter the Oracle pfile as shown below. Then to make Oracle use it, enter the following, and restart Oracle:

```
CREATE SPFILE = '+DATA/ORCL/spfileorcl.ora' FROM PFILE=' $ORACLE_HOME/pfile.ora'

orcl.__data_transfer_cache_size=0
orcl.__db_cache_size=5771362304
orcl.__java_pool_size=234881024
orcl.__large_pool_size=1241513984
orcl.__oracle_base='/u01/app/oracle'#ORACLE_BASE set from environment
orcl.__pga_aggregate_target=34359738368
orcl.__sga_target=10099884032
orcl.__shared_io_pool_size=234881024
orcl.__shared_pool_size=2583691264
orcl.__streams_pool_size=0
*.audit_file_dest='/u01/app/oracle/admin/orcl/adump'
*.audit_trail='db'
```

```

*.compatible='12.1.0.2.0'
*.control_files='+DATA/ORCL/CONTROLFILE/current.260.999701793'
*.db_block_size=8192
*.db_create_file_dest='+DATA'
*.db_domain=''
*.db_name='orcl'
*.diagnostic_dest='/u01/app/oracle'
*.dispatchers='(PROTOCOL=TCP) (SERVICE=orclXDB)'
*.local_listener='LISTENER_ORCL'
*.lock_sga=TRUE
*.open_cursors=300
*.pga_aggregate_target=32768m
*.processes=8320
*.remote_login_passwordfile='EXCLUSIVE'
*.sga_target=9630m
*.undo_tablespace='UNDOTBS1'
*.use_large_pages='only'

```

Benchmark parameters

```

#### SLOB 2.4.0 slob.conf

UPDATE_PCT=50
SCAN_PCT=0
RUN_TIME=7200
WORK_LOOP=0
SCALE=8G
SCAN_TABLE_SZ=10M
WORK_UNIT=1024
REDO_STRESS=HEAVY
LOAD_PARALLEL_DEGREE=8

THREADS_PER_SCHEMA=1

DATABASE_STATISTICS_TYPE=awr # Permitted values: [statspack|awr]

#### Settings for SQL*Net connectivity:
#### Uncomment the following if needed:
#ADMIN_SQLNET_SERVICE="if needed, replace with a valid tnsnames.ora service"
#SQLNET_SERVICE_BASE="if needed, replace with a valid tnsnames.ora service"
#SQLNET_SERVICE_MAX="if needed, replace with a non-zero integer"
#
#### Note: Admin connections to the instance are, by default, made as SYSTEM
#         with the default password of "manager". If you wish to use another
#         privileged account (as would be the cause with most DBaaS), then
#         change DBA_PRIV_USER and SYSDBA_PASSWD accordingly.
#### Uncomment the following if needed:
DBA_PRIV_USER="system"
SYSDBA_PASSWD="password"

#### The EXTERNAL_SCRIPT parameter is used by the external script calling feature of runit.sh.
#### Please see SLOB Documentation at https://kevinclosson.net/slob for more information

EXTERNAL_SCRIPT=''

#####
#### Advanced settings:
#### The following are Hot Spot related parameters.
#### By default Hot Spot functionality is disabled (DO_HOTSPOT=FALSE).

DO_HOTSPOT=FALSE
HOTSPOT_MB=8
HOTSPOT_OFFSET_MB=16

```

```
HOTSPOT_FREQUENCY=3
```

```
#### The following controls operations on Hot Schema  
#### Default Value: 0. Default setting disables Hot Schema
```

```
HOT_SCHEMA_FREQUENCY=0
```

```
#### The following parameters control think time between SLOB  
#### operations (SQL Executions).  
#### Setting the frequency to 0 disables think time.
```

```
THINK_TM_FREQUENCY=0
```

```
THINK_TM_MIN=.01
```

```
THINK_TM_MAX=.01
```

Read the report at <http://facts.pt/qtaj3ob> ▶

This project was commissioned by HPE.



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