PROWESS

Behind the Report: Lower Your TCO by Selecting the Right Platform for Your Oracle® Workloads

This document provides the system-configuration details and step-by-step procedures that Prowess used to collect performance data for Oracle® Database 19c on two Dell Technologies™ platforms:

- Dell EMC™ PowerEdge™ R740xd (two-socket server)
- Dell EMC PowerEdge R940 (four-socket server)

This document also includes details on the following storage infrastructure:

- Dell EMC™ PowerStore 7000T appliance

For the full analysis, read the report **"Lower Your TCO by Selecting the Right Platform for Your Oracle® Workloads."** Testing was concluded on February 7, 2021.

Server Configurations

	Dell EMC™ PowerEdge™ R740xd	Dell EMC PowerEdge R940
Processor		
Processor SKU	Intel® Xeon® Gold 6240M processor	Intel Xeon Gold 6240M processor
Number of processors	2	4
Core count (per processor)	18	18
Total cores	36	72
Server details		
BIOS name and version	2.10.9	2.10.0
Non-default BIOS settings	Default	Default
Operating system name and version/build number	Red Hat® Enterprise Linux® (RHEL) 8.3 Linux 4.18.0-193.el8.x86_64	RHEL 8.3 Linux 4.18.0-193.el8.x86_64
Date of last operating system updates/patches applied	2/1/2021	1/17/2021
Memory		
Total memory in system	576 GB	1,152 GB

Number of memory modules	12 x 32 GB DDR-4 dual-rank 2,933 MHz 12 x 16 GB DDR-4 dual-rank 2,933 MHz	24 x 32 GB DDR-4 dual-rank 2,933 MHz 24 x 16 GB DDR-4 dual-rank 2,933 MHz
Vendor and model	Micron Technology	Micron Technology
Storage controller		
Vendor and model	Dell™ PowerEdge RAID Controller (PERC) H740P Adapter	QLogic® QLE2742 32 gigabits per second (Gbps) dual-port Fibre Channel controller
Cache size (GB)	8,192 MB	8,192 MB
Firmware version	50.9.4-3025	15.15.06
Driver version	10.01.00.25.08.3-k	10.01.00.25.08.3-k
Serial ATA (SATA) solid-state drive (SSD) storage		
Number of drives	2	2
Drive vendor and model	Intel® SSDSC2KB019T8R	Intel SSDSC2KB019T8R
Drive size	1.92 TB	1.92 TB
Drive information (speed, interface, and type)	6 Gbps SATA SSD	6 Gbps SATA SSD
Networking		
Network adapters	Broadcom® advanced dual-port 10 Gb Ethernet (GbE) Dual-port, 25 GbE Intel® Ethernet Network Adapter XXV710 Broadcom® Gigabit Ethernet BCM5720	Dual-port 10 GbE Base-T and dual-port 1 GbE Base-T adapter Dual-port 10/25 GbE SFP28 adapter
Fibre	Dual-port 32 Gb QLogic QLE2742 Fibre Channel controller	Dual-port 32 Gb QLogic QLE2742 Fibre Channel controller
Cooling fans		
Number of cooling fans	6	8
Power supplies		
Vendor and model	Dell PWR SPLY, 750 W, RDNT, ARTESYN	Dell PWR SPLY, 1,600 W, RDNT, DELTA
Number of power supplies	2	2
Wattage of each (W)	750 W	1,600 W
Software		
Operating system	Red Hat Enterprise Linux (RHEL) 8	RHEL 8
Oracle® Database	Oracle Database 19c (RU 19.9)	Oracle Database 19c (RU 19.9)

Dell EMC™ PowerStore 7000T Details

- 91.6 TB of physical disk space
- 25 x 1.9 TB NVM Express® (NVMe®) SSD
- 4 x 8.5 GB NVMe NVRAM
- 21 x 3.8 NVMe SSD
- Software version 1.0.2.0.5.003

Testing Procedures

Configuring the Dell EMC PowerStore 7000T Storage Volumes

For the single-server Dell EMC PowerEdge R940 and Dell EMC PowerEdge R740xd servers' attached-storage configuration:

1. Sign in to the Dell EMC PowerStore administration console.
2. Select the Storage page.
3. Select **Create**.
4. Configure the volume with the following settings:

Name	**Oracle_4Proc_Data**
Quantity	**4**
Size	**4 TB**
Volume Performance Policy	**High**

5. Select **Next.**
6. From **Available hosts**, select **<serverName>**.
7. Select **Next**.
8. Select **Create** to create the new volume.
9. Complete the steps above with following settings for each group:

a. Archive:

Name	**Oracle_4Proc_Archive**
Quantity	**1**
Size	**100 GB**
Volume Performance Policy	**High**

b. Grid:

Name	**Oracle_4Proc_Grid**
Quantity	**1**
Size	**150 GB**
Volume Performance Policy	**High**

c. Redo:

Name	**Oracle_4Proc_Redo**
Quantity	**2**
Size	**100 GB**
Volume Performance Policy	**High**

d. Temp:

Name	Oracle_4Proc_Temp
Quantity	2
Size	1,002 GB
Volume Performance Policy	High

e. Undo:

Name	Oracle_4Proc_Undo
Quantity	2
Size	100 GB
Volume Performance Policy	High

Configuring the RAID Controller

- Set the two disks in the RAID controller to RAID 1.

Installing and Configuring Red Hat® Enterprise Linux®

1. Mount the Red Hat® Enterprise Linux® (RHEL) 8.2 media.
2. Start the RHEL installation.
3. Select **Time & Date**, and then set the time zone to **Central**.
4. Select **Additional packages**, and then select **Windows File Server** and **Remote Management for Linux**.
5. Select **Installation Destination**, select **Custom**, and update the partitions:

/home	550 GiB
/ (root)	1.16 TiB
/swap	50 GiB

6. Select **Install**.
7. Set the root password.
8. Restart the server when prompted.
9. Use Secure Shell (SSH) to connect to the server.
10. Disable subscription notifications:

```
vi /etc/yum/pluginconf.d/subscription-manager.conf

    enabled=0
```

11. Run `dnf update`.
12. Restart the server.
13. Check the operating system version:

```
hostnamectl
```

14. Configure a second private network.
15. Set `Transparent _hugepage` to never:

```
echo never > /sys/kernel/mm/transparent_hugepage/enabled
```

16. Stop and disable the firewalld service:

```
systemctl stop firewalld
systemctl disable firewalld
```

17. Disable the auditd service:

```
systemctl disable auditd
```

18. Set selinux to disabled:

```
vi /etc/selinux/config
SELINUX=disabled
```

19. Install other prerequisites:

```
dnf install -y sysstat wget gdisk
```

20. Download and install atop for system performance data collection:

```
wget https://www.atoptool.nl/download/atop-2.6.0-1.el8.x86_64.rpm
rpm -ivh atop-2.6.0-1.el8.x86_64.rpm
```

21. Install the Oracle® Database preinstall:

```
dnf localinstall -y oracle-database-preinstall-19c-1.0-1.el8.x86_64.rpm
```

22. Add the following groups for Oracle Database:

```
groupadd -g 54327 asmdba
groupadd -g 54328 asmoper
groupadd -g 54329 asmadmin
```

23. Add the Oracle user to the new groups:

```
usermod -G asmdba,asmoper,asmadmin -a oracle
```

24. Set the Oracle password:

```
passwd oracle
```

25. Set up multipath:

```
/sbin/mpathconf --enable
```

26. Scan for Small Computer System Interface (SCSI) drives:

```
rescan-scsi-bus.sh -a
```

27. Discover multipath devices:

```
multipath -r
```

28. List multipath devices:

```
multipath -ll
```

29. Configure multipath:

```
vi /etc/multipath.conf

devices{

        device {

                vendor "DellEMC"

                product "PowerStore"

                path_selector "queue-length 0"

                rr_min_io_rq 1

                path_grouping_policy "group_by_prio"

                detect_prio yes

                #prio "alua"

                path_checker "tur"

                failback immediate

                fast_io_fail_tmo 15

                no_path_retry 3

                max_sectors_kb 1024

        }
```

30. Create **99-oracle-asm.rules** in **/etc/udev/rules.d.**

    a. Add the following information to enforce permissions on the disks:

```
KERNEL=="dm-*",ENV{DMNAME}=="Oracle*",OWNER="oracle",GROUP="oinstall",MODE="0660"
```

31. Get the list of Globally Unique Identifiers (GUIDs) to set up in multipath:

```
multipath -l | awk '/PowerStore/ {print $1 $2} '
```

32. Add the multipath configuration to the end of /etc/multipath.config:

```
multipaths{

      multipath{

            wwid   <wwid>

            alias    Oracle_Grid

      }

      multipath{

            wwid    <wwid>

            alias   Oracle_Data-002

      }

      multipath{

            wwid    <wwid>

            alias   Oracle_Data-001
```

```
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Data-004
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Data-003
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Temp-002
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Temp-001
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Redo-001
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Redo-002
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Undo-001
        }
        multipath{
                wwid    <wwid>
                alias   Oracle_Undo-002
        }
}
```

33. Reload the rules and configuration:

```
udevadm control --reload-rules
udevadm trigger
```

34. List the disk permissions and verify that oracle:oinstall owns the folder:

```
ll /dev/dm*
```

35. Create the following directories:

```
mkdir -p /u01/app/19c/oracle
mkdir -p /u01/app/19c/grid
mkdir -p /u01/app/oracle
mkdir -p /u01/app/grid
```

36. Change the ownership to **Oracle** and change the group to `oinstall`:

```
chown -R oracle:oinstall /u01
```

37. Change the permissions:

```
chmod -R 775 /u01/
```

38. Update the security limits.conf file:

```
vi /etc/security/limits.conf


oracle        soft    nproc   2047
oracle        hard    nproc   16384
oracle        soft    nofile  1024
oracle        hard    nofile  65536
oracle        soft    stack   10240
oracle        hard    stack   32768
oracle        soft    memlock 3145728
oracle        hard    memlock 3145728
oracle        soft    data    unlimited
oracle        hard    data    unlimited
```

39. Sign in as an Oracle user:

```
su - oracle
```

40. Update the Oracle user .bash_profile, entering environment-specific settings:

```
vi ~/.bash_profile
# User specific environment and startup programs
Export DISPLAY=:1
export TMP=/tmp
```

```
export TMPDIR=$TMP
export ORACLE_HOSTNAME=<hostname>
export ORACLE_UNQNAME=orcl
export ORACLE_BASE=/u01/app
export GRID_HOME=/u01/app/19c/grid
export DB_HOME=$ORACLE_BASE/oracle
export ORACLE_HOME=/u01/app/19c/oracle
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/JRE:$ORACLE_HOME/lib:/lib:/usr/lib
export CLASSPATH=$ORACLE+HOME/JRE:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib
alias grid_env='. /home/oracle/grid_env'
alias db_env='. /home/oracle/db_env'
```

41. In the Oracle home folder, create grid_env, entering environment-specific settings:

```
export ORACLE_SID=+ASM
export ORACLE_HOME=$ORACLE_HOME
export PATH=$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
```

42. In the Oracle home folder, create db_env:

```
export ORACLE_HOME=$ORACLE_HOME
export PATH=$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
```

Installing Oracle Database 19c

1. Copy the installation files over to the server tmp directory:
   - LINUX.X64_193000_db_home.zip
   - LINUX.X64_193000_grid_home.zip
   - p31750108_190000_Linux-x86-64.zip
   - p6880880_190000_Linux-x86-64.zip
2. Sign in as Oracle:

```
su oracle
```

3. As Oracle, in the tmp directory, create a directory for the Oracle Database 19c 19.9 patch:

```
mkdir p31750108
```

4. Change directory to the new patch directory:

```
cd p31750108
```

5. Unzip the 19.9 patch into the folder:

```
unzip /tmp/p31750108_190000_Linux-x86-64.zip
chmod -R 777 p31750108
```

6. Change the directory:

```
cd /u01/app/19c/grid
```

7. Unzip the grid installation files:

```
unzip /tmp/LINUX.X64_193000_grid_home.zip
```

8. Delete the OPatch folder:

```
rm -rf OPatch
```

9. Extract the OPatch patch into the grid folder:

```
unzip /tmp/p6880880_190000_Linux-x86-64.zip
```

10. Check the opatch version:

```
 ./opatch version
```

11. Patch the Oracle Database 19.3 installation with Oracle Database 19.9 installation media:

```
/gridSetup.sh -applyRU /tmp/p31750108/31750108
```

12. The patch will install, and then the Oracle Grid Infrastructure UI installation will start.
13. Select **Configure Oracle Grid Infrastructure for a Standalone Server**, and then select **Next**.
14. In the **Disk group name** field, enter **DATA**.
15. Create the ASM Disk Group page, select **Change Discovery Path**, and then update to **/dev/mapper**.
16. From **Redundancy**, select **External**.

17. From **Select Disks**, select the four data disks.
18. Select **Yes** when prompted with a warning.
19. Select **Next**.
20. Specify the **ASM Password** page, select **Use same passwords for these accounts**, and then select **Next**.
21. Specify the **Management Options** page, and then select **Next**.
22. On the **Privileged Operating System Groups** page, update **Oracle ASM Administrator (OSASM) Group** to **oinstall**, and then select **Next**.
23. Specify the **Installation Location** page, update **Oracle base** to **/u01/app/grid**, and then select **Next**.
24. On the **Create Inventory** page, select **Next**.
25. On the **Root script execution** page, select **Next**.
26. Check the warnings and follow the instructions as needed.
27. Run the **Fixup** script as directed on the server/servers as root.
28. Check the prerequisites again.
29. Select **Ignore All** to accept unfixable warnings, and then select **Next**.
30. Select **Yes** when prompted with a warning.
31. Select **Save response file**.
32. Select **Install**.
33. Run any necessary scripts as root.
34. Select **OK** to continue.
35. Wait for the installation to complete.
36. From the terminal, change directory to bin:

```
cd /u01/app/19c/grid/bin
```

37. To create disk groups, start the Automated Storage Manager Configuration Assistant (ASM Configuration Assistant).

```
./asmca
```

38. Create **Redo**, **Temp**, **Grid**, **Archive**, and **Undo** disk groups.
39. Exit after you have created those disk groups.
40. Change directory to /u01/app/19c/oracle.
41. Extract LINUX.X64_193000_db_home.zip:

```
unzip /tmp/LINUX.X64_193000_db_home.zip
```

42. Remove the OPatch director:

```
rm -rf OPatch
```

43. Extract the opatch update:

```
unzip /tmp/p6880880_190000_Linux-x86-64.zip
```

44. Patch Oracle Database 19c 19.3 with Oracle Database 19c 19.9:

```
./runInstaller -applyRU /home/oracle/patch/3750108/
```

45. The database GUI-based installer will begin.

46. Select the **Configuration Option** page, select **Set Up Software Only**, and then select **Next**.

47. Select the **Database Installation Option** page, select **Single instance database installation**, and then select **Next**.

48. Select the **Database Edition** page, select **Enterprise Edition**, and then select **Next**.

49. Specify the **Installation Location** page, update the **Specify Installation Location** field to **/u01/app/oracle**, and then select **Next**.

50. On the Privileged Operating Systems groups page, update the **Database operator (OSOPER) Group** to **oinstall**, and then select **Next**.

51. On the Root script execution configuration page, select **Next**.

52. On the Perform Prerequisite Checks page, repair any issues, if necessary.

53. When you've completed the preceding steps, select **Ignore all**, and then select **Next**.

54. Select **Save Response File**.

55. Select **Install**.

56. When prompted, run the configuration script as root. Database services will be installed.

57. Select **Close**.

58. Change directory to **/u01/app/19c/oracle/bin**.

59. Start the Database Configuration Assistant:

```
./dbca
```

60. Select the **Database Operation** page, select **Create a database**, and then select **Next**.

61. Select the **Database Creation Mode** page, select **Advanced Configuration**, and then select **Next**.

62. Select the **Database Deployment Type** page, select **Oracle Single Instance database** from the drop-down menu, and then select **Next**.

63. Specify the **Database Identification Details** page, select the **Create as Container Database** check box, and then select **Next**.

64. Select the **Database Storage Option** page, select **Use following for the database storage attributes**, and then select **Next**.

65. Select the **Fast Recovery Option page**, and then select **Next**.

66. Specify the **Network Configuration Details** page, and then select **Next**.

67. Select the **Oracle Data Vault Config Option** page, and then select **Next**.

68. On the Specify Configuration Options page:
    a. Set **SGA** to **40% of available memory**
    b. Set **PGA** to **20% of SGA configured memory**

69. Specify the **Management Options** page, and then select **Next**.

70. Specify the **Database User Credentials** page, select **Use the same administrative password for all accounts**, enter a password, and then select **Next**.

71. Select the **Database Creation Option** page, and then select **All Initialization Parameters**.

72. Check and update the following parameters:

```
*.audit_trail='NONE'
*.commit_logging='BATCH'
*.commit_wait='NOWAIT'
*.db_block_checksum='FALSE'
*.db_writer_processes=4
*.fast_start_parallel_rollback='HIGH'
*.replication_dependency_tracking=FALSE
*.temp_undo_enabled=TRUE
*.trace_enabled=FALSE
*.transactions_per_rollback_segment=1
*.undo_retention=2
```

73. After updating the parameters, select **Next**.

74. On the Summary page, select **Save Response File**.

75. Select **Finish**. Oracle Database is installed.

76. Set up the Oracle environment:

```
. oraenv
```

77. Enter `orcl`.

78. Start sqlplus:

```
sqlplus / as sysdba
```

79. Take a backup of the running spfile:

```
create pfile = '/tmp/orcl.ora' from spfile;
```

Configuring Oracle Tablespaces and the Redo Log

1. Configure the redo log files.

2. Run the following query to check the status of the log files:

```
select l.thread#, l.group#, l.archived, l.status, bytes/1024/1024 MB
from v$log l,
v$instance i
where l.thread# = i.thread#
order by 1, 2
```

3. Run the following query to add Redo log files:

```
alter database add logfile thread 1 group 5 ('+REDO') size 10G reuse;
alter database add logfile thread 1 group 6 ('+REDO') size 10G reuse;
alter database add logfile thread 1 group 7 ('+REDO') size 10G reuse;
alter database add logfile thread 1 group 8 ('+REDO') size 10G reuse;
```

4. Run the following query to switch the log file location:

```
alter system switch logfile;
alter system checkpoint global;
```

When the original log file is marked as Inactive, it can be dropped:

```
alter database drop logfile group <group number>;
```

5. Configure the TEMP log files:

```
select * from database_properties where property_name = 'DEFAULT_TEMP_
TABLESPACE';
create temporary tablespace TEMP2 TEMPFILE '+TEMP' size 15G;
alter database default temporary tablespace TEMP2;
drop tablespace TEMP including contents and datafiles;
alter tablespace TEMP2 rename to TEMP;
alter tablespace TEMP add tempfile '+TEMP' size 15G;
alter tablespace TEMP add tempfile '+TEMP' size 15G;
alter tablespace TEMP add tempfile '+TEMP' size 15G;
alter tablespace TEMP add tempfile '+TEMP' size 15G;
```

6. Configure the undo log files:

```
  CREATE UNDO TABLESPACE UNDOTBS2 DATAFILE '+UNDO/ORCL/DATAFILE/undotbs2_01.dbf'
SIZE 1024M AUTOEXTEND ON NEXT 100M MAXSIZE 2048M RETENTION NOGUARANTEE;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_02.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_03.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_04.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_05.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_06.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_07.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_08.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_09.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;0.3333

  alter tablespace UNDOTBS2 add datafile '+UNDO/ORCL/DATAFILE/undotbs2_10.dbf' size
100M AUTOEXTEND ON NEXT 100M MAXSIZE 10240M;

  ALTER SYSTEM SET UNDO_TABLESPACE = UNDOTBS2;

  DROP TABLESPACE UNDOTBS1 including contents and datafiles;
```

Configuring the HammerDB Client for Oracle Database

1. Install Red Hat Enterprise Linux 8.2.

2. Update Red Hat Enterprise Linux:

```
  dnf update
```

3. Install the network services library:

```
  yum install libnsl
```

4. In the /opt directory, create a sqldeveloper directory:

```
  mkdir sqldeveloper
```

5. Copy the sqldeveloper JDK, and then unzip it:

```
  copy jdk-11.0.9_linux-x64_bin.tar.gz
```

6. Unzip the JDK to /usr/lib/jvm.

7. Set JAVA_HOME to /usr/lib/jvm:

```
echo JAVA_HOME=/usr/lib/jvm
```

8. Copy sqldeveloper-20.2.0.175.1842-no-jre.zip to /opt/sqldeveloper.

9. Unzip sqldeveloper-20.2.0.175.1842-no-jre.zip.

```
cd /opt/sqldeveloper

unzip sqldeveloper-20.2.0.175.1842-no-jre.zip
```

10. Create an Oracle directory in /opt.

```
mkdir /opt/oracle
```

11. Unzip instantclient-basic-linux.x64-19.9.0.0.0dbru.zip to /opt/oracle.

12. Change directory to /opt/oracle/instantclient_19_9/network/admin.

13. Create a tnsnames.ora file:

```
vi tnsnames.ora
```

14. Enter the connection information for the Oracle Database installation:

```
ORCL =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = <hostname> ) (PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = orcl)
    )
  )
```

15. Create a hammerdb.sh file in /etc/profile.d.

```
vi /etc/profile.d/hammerdb.sh
```

16. Enter the following information:

```
export LD_LIBRARY_PATH=/opt/oracle/instantclient_19_9:$LD_LIBRARY_PATH

export ORACLE_LIBRARY=/opt/oracle/instantclient_19_9/libclntsh.so

export TNS_ADMIN=/opt/oracle/instantclient_19_9/network/admin
```

17. Download HammerDB and extract it to **/opt/hammerdb**.

18. Create the TPC-C® tablespace from the Microsoft® SQL Server® Developer client:

```
CREATE BIGFILE TABLESPACE "TPCC"

DATAFILE '+DATA' SIZE 100G AUTOEXTEND ON NEXT 1G

BLOCKSIZE 8K
```

```
EXTENT MANAGEMENT LOCAL AUTOALLOCATE
SEGMENT SPACE MANAGEMENT AUTO;


CREATE BIGFILE TABLESPACE "TPCC_OL"
DATAFILE '+DATA' SIZE 50G AUTOEXTEND ON NEXT 1G
BLOCKSIZE 8K
EXTENT MANAGEMENT LOCAL AUTOALLOCATE
SEGMENT SPACE MANAGEMENT AUTO;
```

19. Create the HammerDB TPC-C database with the following settings:

a. Launch HammerDB:

```
./hammerdb
```

b. Expand **Oracle** > **TPROC-C** > **Schema Build**.

c. Double-click **Options**.

d. Update the following fields:

Oracle Service Name	**orcl**
System User	**SYSTEM**
System User Password	**Password2020!**
TPROC-C User	**tpccuser**
TPROC-C Password	**tpcc**
TPROC-C Default Tablespace	**Tpcc**
TPROC-C Order Line Tablespace	**tpcc_ol**
Partition Tables	**checked**
Use Hash Clusters	**checked**
Number of Warehouses	**750**
Virtual Users to Build Schema	**45**

e. Double-click **Build** to start building the schema.

Running the Test

1. Expand **Driver Script**, and then open **Options.**

    a. Update the following fields:

Oracle Service Name	**orcl**
System User	**SYSTEM**
System User Password	**<System PW>**
TPROC-C User	**tpccuser**
TPROC-C Password	**tpcc**
TPROC-C Driver Script	**Test Driver Script**
Total Transactions per User	**1000000000**
Minutes of Ramp-up Time	**10**
Minutes for Test Duration	**20**
Use All Warehouses	**Checked**
Time Profile	**Checked**

2. Select **Load** to load the Driver Script options.

3. Expand **Virtual User**, and then open **Options**.

    a. Set virtual users to the specified test size.

    b. Select **Log Output to Temp**.

    c. Select **Use Unique Log Name**.

    d. Select **Log Timestamps**.

4. Select **Create** to load the Virtual User Options.

5. Run the following tests with the following user settings:

```
145 289 433 505
```