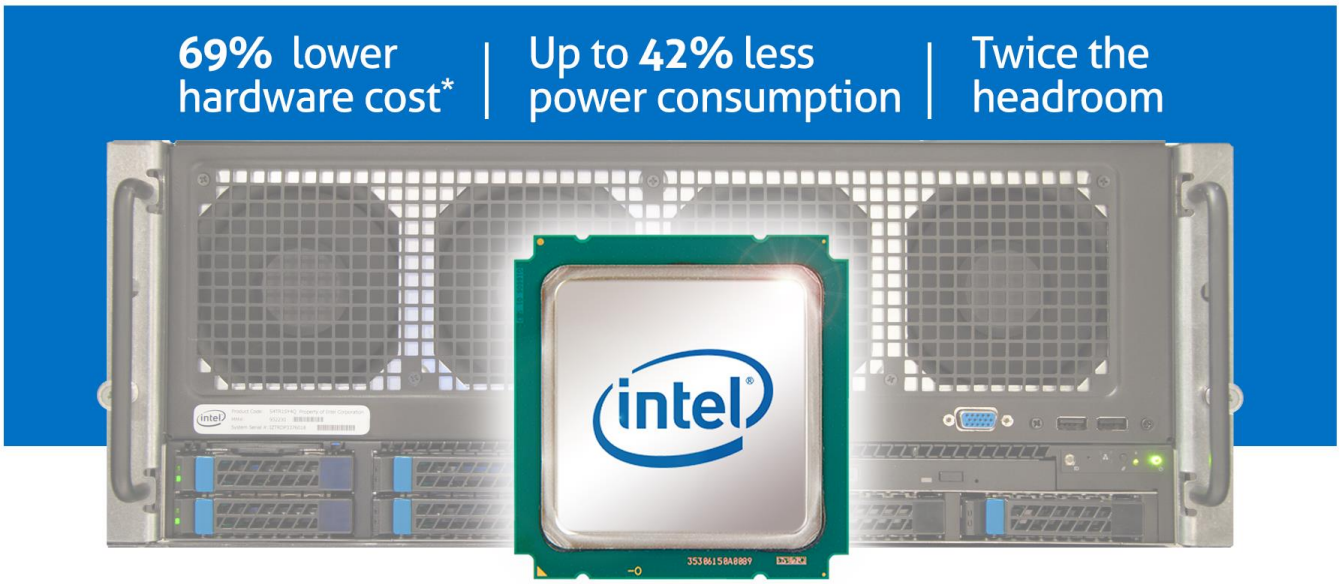
MISSION-CRITICAL DATABASE PERFORMANCE: INTEL XEON PROCESSOR E7 V2 FAMILY VS. IBM POWER7+

Up to 5.7x performance per system watt per dollar



on an Intel® Xeon® processor E7-4890 v2 -based server

versus an IBM® POWER7+™ processor-based server running large, mission-critical workloads

Your large databases are not just part of your business; they are vital to operation day in and day out. For these mission-critical workloads, not just any hardware will do. You need reliable, high-performing systems to power these database applications and ensure employees and customers can complete the tasks that they need to.

High-performance processors can ensure the performance you need, but which performs the best, saves on acquisition costs, reduces power consumption, and leaves headroom for future growth? In our labs at Principled Technologies, we compared two systems based on high-performance processors: a new four-socket Intel Xeon processor E7-4890 v2-based server versus an IBM POWER7+ processor-based system. Running bare-metal Oracle® Database 12c workloads, the Intel Xeon processor-based system outperformed the IBM POWER7+ system by 15.9 percent in our tests. What's more, the better-performing Intel Xeon processor-based system costs 69.4 percent less, used up to 42.0 percent less idle power, and used 33.5 percent less active power, while leaving twice the headroom for future growth. All these factors lead to a 5.7x performance per system watt per dollar advantage.

These results show that servers harnessing the new Intel Xeon processor E7 v2 family can deliver the high performance per system watt per dollar you demand for your large, mission-critical databases while helping your bottom line.

* Reflects price estimates Intel provided.

FEBRUARY 2014

A PRINCIPLED TECHNOLOGIES TEST REPORT

Commissioned by Intel Corp.

MORE PERFORMANCE MEANS BETTER BUSINESS

Customers and employees alike need to access your critical databases without waiting. By maximizing the performance of your infrastructure, you ensure that business keeps moving as quickly as possible. This has the potential to lead to such benefits as increased user satisfaction, larger profits, and even decreased infrastructure costs as you eliminate underperforming hardware.

These critical databases need specialized, reliable processing hardware that can deliver the highest performance possible. To help determine the performance, power consumption, and processor headroom that certain processor architecture might bring to your Oracle Database environment, we compared the Intel Xeon processor E7-4890 v2 against the IBM POWER7+ using a supply chain warehouse OLTP database workload on Oracle Database 12c. We used the open-source HammerDB utility as our test tool.

For system configuration information, see Appendix A. To learn how we tested, see our step-by-step details in Appendix B.

And the winner is…

In our lab tests, the Intel Xeon processor E7-4890 v2-powered server outperformed the IBM POWER7+ processor-based system. The Intel Xeon processor system was able to handle 1.16 times the number of Oracle transactions per minute that the IBM POWER7+ system could handle (see Figure 1). This means that the Intel Xeon processor E7 v2 family-based server delivered 15.9 percent more performance than the IBM POWER7+ system for the Oracle database in our tests.

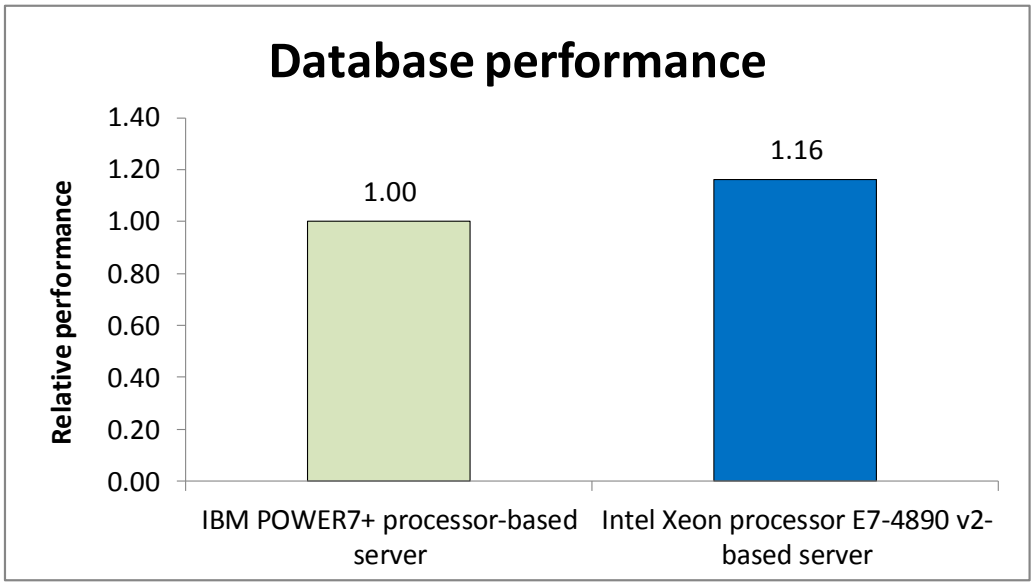


Figure 1: The Intel Xeon processor E7-4890 v2-powered server delivered 15.9 percent more database performance than the IBM POWER7+-based server delivered.

Factoring in system cost

Increased performance for critical database workloads is important, but at what cost does that large increase come? In this case, the high-performing Intel Xeon processor E7-4890 v2-based server would cost significantly less—69.4 percent less—than its lower-performing competitor. Figure 2 compares the estimated price for the configured four-socket Intel Xeon processor E7-4890 v2-powered server compared to the IBM Power 750 Express server with IBM POWER7+ 4.0 GHz processors.[1] These prices give Intel Xeon processor E7-4890 v2-powered server a 3.2x advantage in reducing acquisition cost, which frees up money for other efforts.

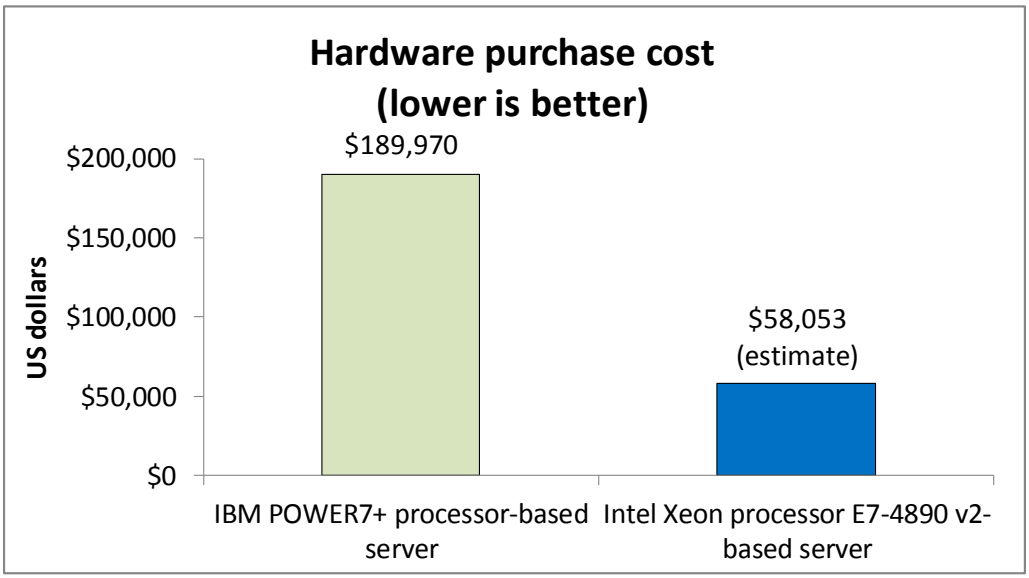


Figure 2: The Intel Xeon processor E7-4890 v2-powered server would cost an estimated 69.4 percent less to purchase than the IBM POWER7+-based server.

Don't forget to look at power consumption

The cost of powering high-performance hardware day in and day out has a great effect on your ongoing operating expenses. The lower the power consumption, the better for your budget. While we ran our tests on the systems, we recorded the power they consumed both while idle and while running our Oracle Database 12c workload.

As Figure 3 shows, the Intel Xeon processor E7-4890 v2-based server consumed 42.0 percent less power while idle than the IBM POWER7+ processor-based system during a two-minute sampling period.

[1] Intel provided the estimated price for the Intel Xeon processor E7-4890 v2-based server. Price of the IBM POWER7+ processor-based server is list price from Avnet, February 2014. Prices do not include tax or shipping.

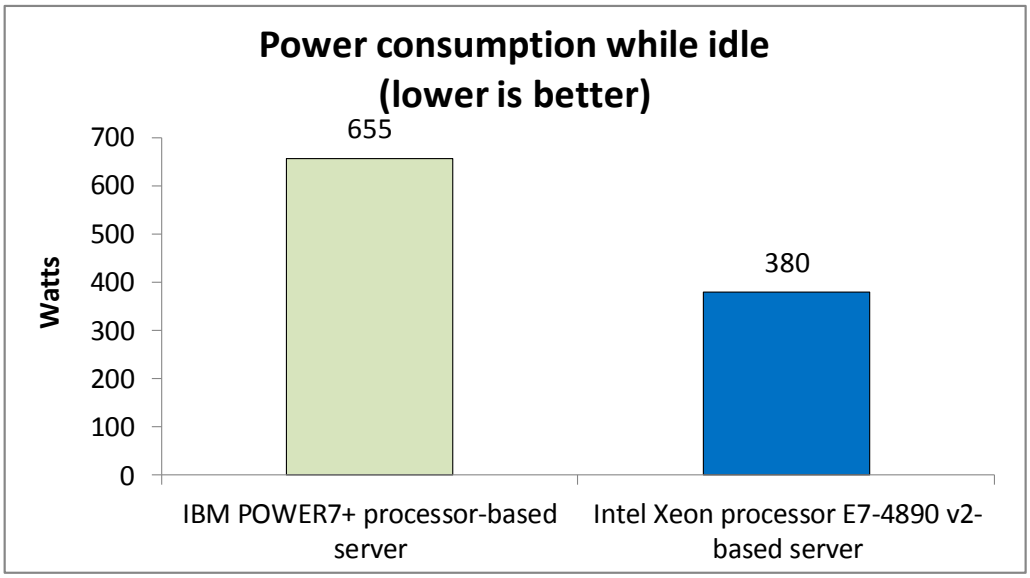


Figure 3: The Intel Xeon processor E7-4890 v2-powered server consumed 42.0 percent less power than the IBM POWER7+-based server while idle.

The Intel Xeon processor E7-4890 v2-based server also consumed 33.5 percent less power while running the test workload (see Figure 4).

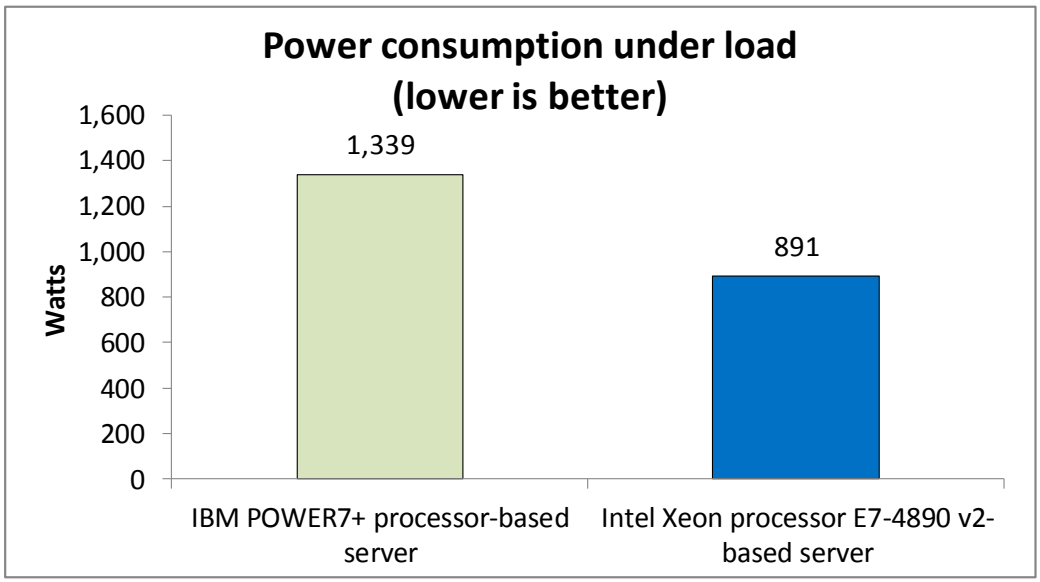


Figure 4: The Intel Xeon processor E7-4890 v2-powered server consumed 33.5 percent less power than the IBM POWER7+-based server while under load.

These results show that you don't have to sacrifice power efficiency to get the best performance out of your critical database workloads. The Intel Xeon processor E7-4890 v2-based server was able to provide both higher performance and lower power consumption in our tests, which can save you on operating costs.

Looking to the future

The Intel Xeon processor E7-4890 v2-based server delivered 15.9 percent more database performance, but how taxed was the system compared to its competitor?

As Figure 5 shows, The Intel Xeon processor E7-4890 v2-based system ran the workload with an average CPU utilization of 61.5 percent, compared to the IBM POWER7+-based system's 81.0 percent. This means that the Intel Xeon processor-based server had nearly twice the remaining headroom to handle more workloads than the IBM POWER7+-based server. The remaining headroom would allow you to add more workloads as your business grows in the future, without the cost of adding servers to your infrastructure.

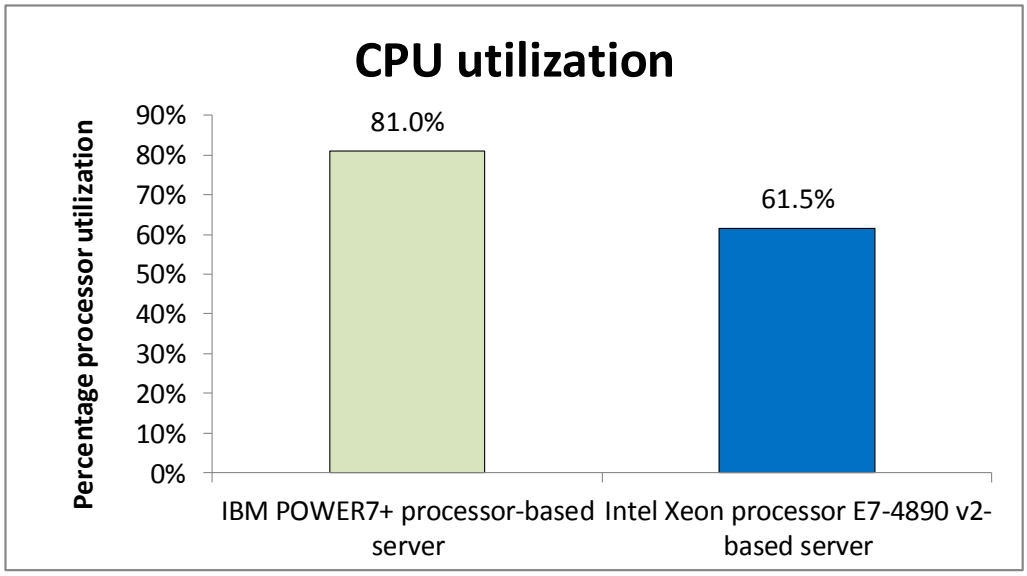


Figure 5: The Intel Xeon processor E7-4890 v2-powered server handled the workload with nearly twice the headroom of the IBM POWER7+-based server.

In addition to increased processor headroom for future growth, the Intel Xeon processor E7-4890 v2-based system supports six times more memory than the IBM Power 750 Express (6 TB vs. 1 TB), which can lead to performance advantages with memory-intensive applications. This increased memory footprint can be particularly beneficial to in-memory applications such as newer analytics and business intelligence programs.

WHAT WE TESTED

About the new Intel Xeon processor E7 v2 family

Intel designed the new Intel Xeon processor E7 v2 family to support mission-critical, high-performance workloads by adding up to 50 percent more cores/threads and 25 percent more cache to provide significant jumps in performance from previous releases. The Intel Xeon processor E7 v2 family provides up to 6TB DDR3 memory, supports up to 24 DDR3 DIMMs per socket, and supports up to 1,600MHz DDR3 speeds to improve performance and increase scalability.

The Intel Xeon processor E7 v2 family supports all the previous reliability, availability, and serviceability features of previous processor releases to support critical workloads. With Intel Run Sure technology, these processors add new RAS features,

including eMCA Gen 1, MCA Recovery – Execution Path, MCA IO, and PCIe Live Error Recovery.

For more information about the Intel Xeon processor E7 v2 product family, visit www.intel.com/content/www/us/en/processors/xeon/xeon-e7-v2-family-details.html.

About our test tool, HammerDB

HammerDB is an open-source benchmark tool that tests the database performance of many leading databases, including Oracle Database, Microsoft® SQL Server®, PostgreSQL, MySQL™, and more. The benchmark includes two built-in workloads derived from industry-standard benchmarks: a transactional (TPC-C-like) workload and a data warehouse (TPCH-like) workload. For this study, we used the transactional workload. Our tests were not official TPC results and are not comparable in any manner.

For more information about HammerDB, visit hammerora.sourceforge.net.

IN CONCLUSION

Choosing the right processor hardware to power your most important database applications can make or break how your business operates. For large, mission-critical databases, high-performance, reliable processors are key to keeping your databases up and running and performing well.

In our hands-on lab tests with large Oracle 12c databases, we found that a four-socket server powered by the Intel Xeon processor E7-4890 v2 delivered dramatically better database performance than an IBM POWER7+ processor-based system, increasing transactions per minute by 15.9 percent. Fewer servers or higher capacity at a 69.4 percent lower acquisition cost enables IT use the savings and innovate in other areas. Plus, in our tests the Intel Xeon processor E7-4890 v2-based server used up to 42.0 percent less power while idle and up to 33.5 percent less power while running our database workload, which in a real-world environment would reduce ongoing operational expense for energy. If you put these numbers all together, that equates to a 5.7x performance per steady-state system watt per acquisition dollar advantage – a key metric to ensure your datacenter space is efficient. The Intel Xeon processor E7 v2 family-based system also left twice the processor headroom to allow for future growth.

Selecting systems that can deliver such top-of-the-line performance can ready your business to meet customer needs better, increasing satisfaction to improve your bottom line. Higher performing systems can also reduce the number of servers you need to house, power, and run, which makes your infrastructure more efficient and reliable.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 6 provides detailed configuration information for the test systems.

System	Intel Xeon processor E7-4890 v2-based server	IBM POWER 7+processor-based server
Power supplies		
Total number	2	2
Vendor and model number	Intel DPS-1200TB A	Emerson 7001599-J000
Wattage of each (W)	1,200	1,925
Cooling fans		
Total number	8	5
Vendor and model number	PSD1209PMBX-A	IBM PN 00E7691
Dimensions (h × w) of each	3.8" × 3.8"	3.25" × 3.25"
Volts	12	12
Amps	2.2	4.1
General		
Number of processor sockets	4	4 (2 x 4-core) dual-chip modules
Number of cores per processor	15	8
Number of hardware threads per core	2	4
System power management policy	Ondemand governor	Dynamic Power Savings (Favor Performance)
CPU		
Vendor	Intel	IBM
Name	Xeon	POWER7+
Model number	E7-4890 v2	POWER7+ 4.0 GHz
Socket type	LGA2011	POWER7
Core frequency (GHz)	2.80	4.00
Bus frequency	8.00 GT/s	100 GB/s (sustained)
L1 cache	64 KB Instruction (8-way Set-associative)	32 KB + 32 KB
L2 cache	256 KB Unified (8-way Set-associative)	256 KB (per core)
L3 cache	37.5 MB Unified (Fully Associative)	10 MB (per core)
Platform		
Vendor and model number	Intel C606J Chipset-based server	Power 750 Express
System model number	Reference platform (BRICKLAND)	8408-E8D
BIOS name and version	BIVTSDP1.86B.0046.R04.1312041636 (12/04/2013)	AM770_052

System	Intel Xeon processor E7-4890 v2-based server	IBM POWER 7+processor-based server
BIOS settings	Turbo Enabled HT Enabled HW Prefetch Enabled ACL Prefetch Enabled NUMA Enabled EIST Enabled C State Enabled	Default
Memory module(s)		
Total RAM in system (GB)	1,024	1,024
Maximum memory configuration possible (TB)	6	1
Type #1		
Vendor and model number	Samsung® M393B2G70BH0-CK0	Micron® MT36KSF2G72PZ-1G4
Type	DDR3	DDR3
Speed (MHz)	1,600	1,066
Speed running in the system (MHz)	1,600	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	11-11-11	9-9-9
Size (GB)	16	16
Number of RAM module(s)	32	64
Chip organization	Double-sided	Double-sided
Rank	Dual-rank	Dual-rank
Type #2		
Vendor and model number	Micron 36JSF2G72PZ-1G6E1	N/A
Type	DDR3	N/A
Speed (MHz)	1,600	N/A
Speed running in the system (MHz)	1,600	N/A
Timing/Latency (tCL-tRCD-tRP-tRASmin)	11-11-11	N/A
Size (GB)	16	N/A
Number of RAM module(s)	32	N/A
Chip organization	Dual-sided	N/A
Rank	Dual-rank	N/A
Operating system		
Name	Red Hat Enterprise Linux 6.5	AIX 7.1 TL3 SP1
File system	ext4	JFS2
Kernel	2.6.32-431.3.1.el6.x86_64	64-bit
Language	English	English
RAID controller		
Vendor and model number	LSI SAS9217-8i	IBM PCIe 3Gb SAS Controller
Firmware version	07.22.01.00	0422003f
Hard drives		
Vendor and model number	Seagate ST9300653SS	IBM 9FU066-039

System	Intel Xeon processor E7-4890 v2-based server	IBM POWER 7+processor-based server
Number of drives	2	2
Size (GB)	300	146.8
RPM	15,000	15,000
Type	SAS	SAS
Ethernet adapters		
First network adapter		
Vendor and model number	Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection	IBM Integrated Multifunction Card with Copper SFP+ 10GbE
Type	Dual-port	Onboard dual-port
Second network adapter		
Vendor and model number	Intel Corporation 82576 Gigabit Network Connection	Broadcom® BCM95719A1904G
Type	Quad-port	Quad-port
Fibre adapter		
Vendor and model number	HP PN AJ63A (Emulex LPE12002)	IBM PN 10N9824 (Emulex LPE12002)
Type	PCI Express	PCI Express
Firmware	2.01A12	2.02x7
Optical drive(s)		
Vendor and model number	TEAC DV-W28 - ATAPI	IBM PN 74Y7341
Type	DVD-RW	DVD-RW
USB ports		
Number	4	3
Type	2.0	2.0

Figure 6: System configuration information for the test systems.

APPENDIX B – HOW WE TESTED

Configuring Red Hat Enterprise Linux and Oracle Database 12c

We installed Red Hat Enterprise Linux on the Intel server, then configured settings as we specify below. Screen outputs are in grey boxes.

1. Disable SELINUX.

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

2. Disable the firewall for IPv4 and IPv6.

```
chkconfig iptables off
chkconfig ip6tables off
```

3. To update the operating system packages, type the following:

```
yum update -y
```

```
Installed:
  kernel.x86_64 0:2.6.32-431.3.1.el6

Updated:
  ca-certificates.noarch 0:2013.1.95-65.1.el6_5
  dmidecode.x86_64 1:2.11-2.el6_1
  dracut.noarch 0:004-336.el6_5.2
  dracut-kernel.noarch 0:004-336.el6_5.2
  ethtool.x86_64 2:3.5-1.2.el6_5
  kernel-firmware.noarch 0:2.6.32-431.3.1.el6
  nspr.x86_64 0:4.10.2-1.el6_5
  nss.x86_64 0:3.15.3-3.el6_5
  nss-sysinit.x86_64 0:3.15.3-3.el6_5
  nss-tools.x86_64 0:3.15.3-3.el6_5
  nss-util.x86_64 0:3.15.3-1.el6_5
  openldap.x86_64 0:2.4.23-34.el6_5.1
  openssl.x86_64 0:1.0.1e-16.el6_5.4
  p11-kit.x86_64 0:0.18.5-2.el6_5.2
  p11-kit-trust.x86_64 0:0.18.5-2.el6_5.2
  python.x86_64 0:2.6.6-52.el6
  python-libs.x86_64 0:2.6.6-52.el6
  tzdata.noarch 0:2013i-2.el6
  yum.noarch 0:3.2.29-43.el6_5
  yum-rhn-plugin.noarch 0:0.9.1-49.el6
```

4. To install additional packages, type the following commands:

```
yum install -y acpid cpuspeed wget vim nfs-utils openssh-clients man
lsscsi unzip smartmontools numactl ipmitool OpenIPMI
```

5. Reboot the server.

```
reboot
```

6. Install additional packages with the following commands:

```
yum install -y \
```

```
binutils \
compat-libcap1  \
compat-libstdc++-33  \
compat-libstdc++-33.i686  \
gcc  \
gcc-c++  \
glibc  \
glibc.i686  \
glibc-devel  \
glibc-devel.i686  \
ksh  \
libgcc  \
libgcc.i686  \
libstdc++  \
libstdc++.i686  \
libstdc++-devel  \
libstdc++-devel.i686  \
libaio  \
libaio.i686  \
libaio-devel  \
libaio-devel.i686  \
libXext  \
libXext.i686  \
libXtst  \
libXtst.i686  \
libX11  \
libX11.i686  \
libXau  \
libXau.i686  \
libxcb  \
libxcb.i686  \
libXi  \
libXi.i686  \
make  \
sysstat  \
unixODBC  \
unixODBC-devel \
xorg-x11-xauth \
xorg-x11-utils
```

7. Edit the sysctl file.

```
vim /etc/sysctl.conf
```

```
fs.file-max = 6815744
kernel.sem = 250 32000 100 128
kernel.shmmni = 4096
kernel.shmall = 1073741824
kernel.shmmax = 4398046511104
net.core.rmem_default = 262144
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
fs.aio-max-nr = 1048576
net.ipv4.ip_local_port_range = 9000 65500

vm.nr_hugepages = 262144
vm.hugetlb_shm_group = 54321
```

8. Apply the changes with the following command:

```
sysctl -p
```

9. Edit the security limits configuration.

```
vim /etc/security/limits.conf
```

```
oracle  soft    nofile  1024
oracle  hard    nofile  65536
oracle  soft    nproc   2047
oracle  hard    nproc   16384
oracle  soft    stack   10240
oracle  hard    stack   32768
oracle  soft    memlock 536870912
oracle  hard    memlock 536870912
```

10. Add the necessary groups and users.

```
groupadd -g 54321 oinstall
groupadd -g 54322 dba
groupadd -g 54323 oper
useradd -u 54321 -g oinstall -G dba,oper oracle
```

11. Modify the password for the Oracle user.

```
passwd oracle
```

```
Changing password for user oracle.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
```

12. Edit the hosts file.

```
vim /etc/hosts
```

```
127.0.0.1       localhost localhost.localdomain localhost4 localhost4.localdomain4
::1             localhost localhost.localdomain localhost6 localhost6.localdomain6

192.168.137.1   controller1.test.lan controller1 controller.test.lan controller
192.168.10.1    controller1g1
192.168.20.1    controller1g2

192.168.137.5   storage1.test.lan storage1 storage.test.lan storage
```

```
192.168.10.5    storage10g1.test.lan storage10g1
192.168.20.5    storage10g2.test.lan storage10g2

192.168.137.11  intel1.test.lan intel1
192.168.10.11   intel10g1.test.lan intel10g1 intel.test.lan intel tpcc1.test.lan tpcc1
192.168.20.11   intel10g2.test.lan intel10g2

192.168.137.21  ibm1.test.lan ibm1
192.168.10.21   ibm10g1.test.lan ibm10g1 ibm.test.lan ibm
192.168.20.21   ibm10g2.test.lan ibm10g1

192.168.137.100 hammerdb1.test.lan hammerdb1
192.168.10.100  hammerdb10g1.test.lan hammerdb10g1 hammerdb.test.lan hammerdb
192.168.20.100  hammerdb10g2.test.lan hammerdb10g2
```

13. Edit the 90-nproc.conf file.

```
vim /etc/security/limits.d/90-nproc.conf
```

Modifying this line:

```
*          soft    nproc    1024
```

To reflect this change:

```
* - nproc 16384
```

14. Create a logical volume.

```
lvcreate -L 30G -n lv_u01 vg_intel
```

```
Logical volume "lv_u01" created
```

15. Make the file system and modify /etc/fstab.

```
mkfs.ext4 -L /u01 /dev/vg_intel/lv_u01
vim /etc/fstab
```

```
/dev/mapper/vg_intel-lv_u01  /u01                    ext4    defaults        1 2
storage10g2:/intel/fra  /u01/app/oracle/fast_recovery_area      nfs
rw,bg,hard,nointr,rsize=65536,wsize=65536,tcp,actimeo=0,vers=3,timeo=600 0 0
storage10g2:/share      /mnt/share              nfs
rw,bg,hard,nointr,rsize=65536,wsize=65536,tcp,actimeo=0,vers=3,timeo=600 0 0
```

16. Create folders and set permissions for Oracle installation.

```
mkdir /u01
mount /u01
mkdir -p /u01/app/oracle/flash_recovery_area
mount /u01/app/oracle/flash_recovery_area
chown -R oracle:oinstall /u01
chmod -R 775 /u01/
```

17. Edit the profile file to set environment variables.

```
vim /home/oracle/.bash_profile
```

```
# Oracle Settings
export TMP=/tmp
export TMPDIR=$TMP
```

```
export ORACLE_HOSTNAME=intel.test.lan
export ORACLE_BASE=/u01/app/oracle
export GRID_HOME=$ORACLE_BASE/product/12.1.0/grid
export DB_HOME=$ORACLE_BASE/product/12.1.0/dbhome_1
export ORACLE_HOME=$DB_HOME
export ORACLE_SID=tpcc1
export ORACLE_TERM=xterm
export BASE_PATH=/usr/sbin:$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'
```

18. Edit the grid_env file, and adjust additional variables:

```
vim /home/oracle/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
```

19. Edit the db_env file, and adjust additional variables:

```
vim /home/oracle/db_env
export ORACLE_SID=tpcc1
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
```

20. Edit the scsi_id file.

```
echo "options=-g" > /etc/scsi_id.config
```

21. Edit the 99-oracle-asmdevices rules file.

```
vim /etc/udev/rules.d/99-oracle-asmdevices.rules
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362ba021e", NAME+="oracleasm/intel_redo_0_10",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bb0220", NAME+="oracleasm/intel_redo_1_10",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bb0222", NAME+="oracleasm/intel_redo_0_11",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bc0224", NAME+="oracleasm/intel_redo_1_11",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
```

```
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bc0226", NAME+="oracleasm/intel_redo_0_12",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bc0228", NAME+="oracleasm/intel_redo_1_12",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bd022a", NAME+="oracleasm/intel_redo_0_13",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bd022c", NAME+="oracleasm/intel_redo_1_13",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362be022e", NAME+="oracleasm/intel_redo_0_14",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362be0230", NAME+="oracleasm/intel_redo_1_14",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bf0232", NAME+="oracleasm/intel_redo_0_15",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f362bf0234", NAME+="oracleasm/intel_redo_1_15",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773c0236", NAME+="oracleasm/intel_data_0_0",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773c0238", NAME+="oracleasm/intel_data_1_0",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773d023a", NAME+="oracleasm/intel_data_0_1",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773d023c", NAME+="oracleasm/intel_data_1_1",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773e023e", NAME+="oracleasm/intel_data_0_2",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773f0240", NAME+="oracleasm/intel_data_1_2",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f4773f0242", NAME+="oracleasm/intel_data_0_3",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477400244", NAME+="oracleasm/intel_data_1_3",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477410246", NAME+="oracleasm/intel_data_0_4",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477410248", NAME+="oracleasm/intel_data_1_4",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f47742024a", NAME+="oracleasm/intel_data_0_5",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
```

```
ENV{ID_SERIAL}=="3600144f07c620b00000052f47742024c", NAME+="oracleasm/intel_data_1_5",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f47743024e", NAME+="oracleasm/intel_data_0_6",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477440250", NAME+="oracleasm/intel_data_1_6",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477440252", NAME+="oracleasm/intel_data_0_7",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477450254", NAME+="oracleasm/intel_data_1_7",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477450256", NAME+="oracleasm/intel_data_0_8",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f477460258", NAME+="oracleasm/intel_data_1_8",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f47747025a", NAME+="oracleasm/intel_data_0_9",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd*[a-z]", SUBSYSTEM=="block", ENV{DEVTYPE}=="disk",
ENV{ID_SERIAL}=="3600144f07c620b00000052f47747025c", NAME+="oracleasm/intel_data_1_9",
OWNER="oracle", GROUP="dba", MODE="0660"
```

22. Execute udevadm and start udev.

```
udevadm control --reload-rules
start_udev
```

23. List the ASM devices.

```
ls -l /dev/oracleasm/intel_* | awk '{print $10}'
```

```
/dev/oracleasm/intel_data_0_0
/dev/oracleasm/intel_data_0_1
/dev/oracleasm/intel_data_0_2
/dev/oracleasm/intel_data_0_3
/dev/oracleasm/intel_data_0_4
/dev/oracleasm/intel_data_0_5
/dev/oracleasm/intel_data_0_6
/dev/oracleasm/intel_data_0_7
/dev/oracleasm/intel_data_0_8
/dev/oracleasm/intel_data_0_9
/dev/oracleasm/intel_data_1_0
/dev/oracleasm/intel_data_1_1
/dev/oracleasm/intel_data_1_2
/dev/oracleasm/intel_data_1_3
/dev/oracleasm/intel_data_1_4
/dev/oracleasm/intel_data_1_5
/dev/oracleasm/intel_data_1_6
/dev/oracleasm/intel_data_1_7
/dev/oracleasm/intel_data_1_8
/dev/oracleasm/intel_data_1_9
/dev/oracleasm/intel_redo_0_10
```

```
/dev/oracleasm/intel_redo_0_11
/dev/oracleasm/intel_redo_0_12
/dev/oracleasm/intel_redo_0_13
/dev/oracleasm/intel_redo_0_14
/dev/oracleasm/intel_redo_0_15
/dev/oracleasm/intel_redo_1_10
/dev/oracleasm/intel_redo_1_11
/dev/oracleasm/intel_redo_1_12
/dev/oracleasm/intel_redo_1_13
/dev/oracleasm/intel_redo_1_14
/dev/oracleasm/intel_redo_1_15
```

Installing Oracle Grid Infrastructure for a Standalone Server (Intel)

1. Run the GUI installer for Oracle Grid using the following commands:

```
ssh –Y oracle@intel
grid_env
cd /mnt/share/linux/grid
./runInstaller
```

2. Perform ASM and diskgroup post-installation configuration.

```
grid_env
sqlplus / as sysasm
```

```
SQL*Plus: Release 12.1.0.1.0 Production on Fri Feb 7 16:20:48 2014
Copyright (c) 1982, 2013, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Automatic Storage Management option
```

```
SQL> shutdown
```

```
ASM diskgroups dismounted
ASM instance shutdown
```

```
SQL> startup nomount
```

```
ASM instance started

Total System Global Area 1135747072 bytes
Fixed Size           2297344 bytes
Variable Size         1108283904 bytes
ASM Cache           25165824 bytes
```

```
SQL> ALTER DISKGROUP data MOUNT RESTRICTED;

Diskgroup altered.

SQL> ALTER DISKGROUP data RENAME DISK 'DATA_0000' TO
'data_0_0','DATA_0001' TO 'data_1_0';
Diskgroup altered.

SQL> shutdown

ASM diskgroups volume disabled
ASM diskgroups dismounted
ASM instance shutdown

SQL> startup

ASM instance started

Total System Global Area 1135747072 bytes
Fixed Size          2297344 bytes
Variable Size          1108283904 bytes
ASM Cache          25165824 bytes
ASM diskgroups mounted
ASM diskgroups volume enabled

SQL> ALTER DISKGROUP data SET ATTRIBUTE 'compatible.asm' = '12.1';

Diskgroup altered.

SQL> ALTER DISKGROUP data SET ATTRIBUTE 'compatible.rdbms = '12.1';

Diskgroup altered.

SQL> ALTER DISKGROUP data ADD
FAILGROUP DATA_0000 DISK
'/dev/oracleasm/intel_data_0_1' NAME data_0_1,
'/dev/oracleasm/intel_data_0_2' NAME data_0_2,
'/dev/oracleasm/intel_data_0_3' NAME data_0_3,
'/dev/oracleasm/intel_data_0_4' NAME data_0_4,
'/dev/oracleasm/intel_data_0_5' NAME data_0_5,
```

```
'/dev/oracleasm/intel_data_0_6' NAME data_0_6,
'/dev/oracleasm/intel_data_0_7' NAME data_0_7,
'/dev/oracleasm/intel_data_0_8' NAME data_0_8,
'/dev/oracleasm/intel_data_0_9' NAME data_0_9
FAILGROUP DATA_0001 DISK
'/dev/oracleasm/intel_data_1_1' NAME data_1_1,
'/dev/oracleasm/intel_data_1_2' NAME data_1_2,
'/dev/oracleasm/intel_data_1_3' NAME data_1_3,
'/dev/oracleasm/intel_data_1_4' NAME data_1_4,
'/dev/oracleasm/intel_data_1_5' NAME data_1_5,
'/dev/oracleasm/intel_data_1_6' NAME data_1_6,
'/dev/oracleasm/intel_data_1_7' NAME data_1_7,
'/dev/oracleasm/intel_data_1_8' NAME data_1_8,
'/dev/oracleasm/intel_data_1_9' NAME data_1_9;
```

```
Diskgroup altered.
```

```
SQL> CREATE DISKGROUP REDO0 EXTERNAL REDUNDANCY DISK
'/dev/oracleasm/intel_redo_0_10' NAME redo_0_10,
'/dev/oracleasm/intel_redo_0_11' NAME redo_0_11,
'/dev/oracleasm/intel_redo_0_12' NAME redo_0_12,
'/dev/oracleasm/intel_redo_0_13' NAME redo_0_13,
'/dev/oracleasm/intel_redo_0_14' NAME redo_0_14,
'/dev/oracleasm/intel_redo_0_15' NAME redo_0_15
ATTRIBUTE
   'compatible.asm' = '12.1',
   'compatible.rdbms' = '12.1',
   'sector_size' = '512';
```

```
Diskgroup created.
```

```
SQL> CREATE DISKGROUP REDO1 EXTERNAL REDUNDANCY DISK
'/dev/oracleasm/intel_redo_1_10' NAME redo_1_10,
'/dev/oracleasm/intel_redo_1_11' NAME redo_1_11,
'/dev/oracleasm/intel_redo_1_12' NAME redo_1_12,
'/dev/oracleasm/intel_redo_1_13' NAME redo_1_13,
'/dev/oracleasm/intel_redo_1_14' NAME redo_1_14,
'/dev/oracleasm/intel_redo_1_15' NAME redo_1_15
ATTRIBUTE
   'compatible.asm' = '12.1',
```

```
            'compatible.rdbms' = '12.1',
            'sector_size' = '512';

Diskgroup created.

          SQL> quit

Disconnected from Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 -
64bit Production
With the Automatic Storage Management option
```

Installing Oracle Grid Infrastructure for Standalone Server 12c on the Intel server

1. Run the GUI installer for Oracle Database using the following commands:

```
ssh –Y oracle@intel
db_env
cd /mnt/share/linux/grid
./runInstaller
```

2. Launch the Oracle Grid Infrastructure installation wizard.
3. In Software Updates, select Skip software updates, and click Next.
4. In Installation Options, select Install and Configure Oracle Grid Infrastructure for a Standalone Server, and click Next.
5. In Product Languages, select English and click the right-pointing arrow between the two selection panels to add English to the Selected languages panel. Click Next.
6. In Create ASM Disk Group, click Change Discovery Path.
7. Enter `/dev/ribm_*` for the Disk Discovery Path, and click OK.
8. Check the boxes for /dev/ribm_data_0_0 and /dev/ribm_data_1_0. Click Next.
9. In ASM Password, select Use same passwords for these accounts. Enter and confirm the password, and click Next.
10. In Operating System Groups, set the Oracle ASM Operator (OSOPER for ASM) Group to dba. Click Next.
11. Click Yes to confirm the notifications and continue.
12. In Installation Location, accept the default locations provided, and click Next.
13. In Create Inventory, accept the defaults, and click Next.
14. In Root Script Execution, check the box for Automatically run configuration scripts.
15. Select Use “root” user credential, and provide the root password. Click Next.
16. In Summary, review the information, and click Install to begin installation.
17. Click Yes to confirm using the privileged user for the installer.
18. In Finish, click Close to exit the installer.

Installing Oracle Database 12c on the Intel server

1. Run the GUI installer for Oracle Database using the following commands:

```
ssh –Y oracle@intel
db_env
cd /mnt/share/linux/database
```

```
./runInstaller
```

2. Launch the Oracle Database 12c Release 1 Installer.
3. In Configure Security Updates, check the I wish to receive security updates via My Oracle Support checkbox. Click Next.
4. Click Yes to confirm no email provided, and continue.
5. In Software Updates, select Skip software updates, and click Next.
6. In Installation Options, select Install database software only, and click Next.
7. In Grid Installation Options, select Single instance database installation, and click Next.
8. In Product Languages, select English and click the right-pointing arrow located between the two selection panels to add English to the Selected languages panel. Click Next.
9. In Database Edition, select Enterprise Edition, and click Next.
10. In Installation Location, accept the default locations provided, and click Next.
11. In Operating System Groups, accept the defaults, and click Next.
12. In Summary, review the information, and click Install to begin installation.
13. When prompted, follow the instructions to execute the scripts. Click OK when the scripts have completed.
14. In Finish, click Close to exit the installer.
15. When prompted in the GUI installer, run the root shell script to finish the Oracle Database installation.
    `/u01/app/oracle/product/12.1.0/dbhome_1/root.sh`

Creating the Oracle Database (using DBCA)

1. Launch the Database Configuration Assistant (DBCA).
2. In Database Operations, select Create Database, and click Next.
3. In Creation Mode, select Advanced Mode, and click Next.
4. In Database Template, select the Template for General Purpose or Transaction Processing, and click Next.
5. In Database Identification, type `tpcc1.test.lan` for the Global Database Name.
6. Type `tpcc1` for the SID. Click Next.
7. In Management Options, select Configure Enterprise Manager (EM) Database Express. Click Next.
8. In Database Credentials, select Use the Same Administrative Password for All Accounts.
9. Enter and confirm the administrative password, and click Next.
10. In Network Configuration, check the boxes for all listeners, and click Next.
11. In Storage Locations, select User Common Location for All Database Files. Type `+DATA` into the Database Files Location field.
12. Select Specify Fast Recovery Area. Type `(ORACLE_BASE)/fast_recovery_area` in the Fast Recovery Area field.
13. Set the Fast Recovery Area size to 2,048 GB, and click Next.
14. In Database Options, accept the defaults, and click Next.
15. In Initialization Parameters and under typical settings, set the Memory Size to 413,520 MB, and click next.
16. In Creation Options, select Create Database. Click Customize Storage Locations.
17. In the Customize Storage panel and under Redo Log Groups, select 1.
18. Set the file size to 98,304 MB. Click Apply.
19. Under Redo Log Groups, Select 2.
20. Set the file size to 98,304 MB. Click Apply.
21. Under Redo Log Groups, Select 3.
22. Click Remove and when prompted, click Yes.

23. To exit the Customize Storage panel, click Ok.
24. Click Next.
25. Review the Summary. To complete the database creation, click Finish.
26. Review the information on the screen, and click Exit.
27. To exit the DBCA, click Close.

Configuring AIX 7.1 and Oracle Database 12c for the POWER7+ server

In this section, we detail configurations on the POWER7+ server. Screen outputs are in grey boxes.

1. Configure networking.

```
mktcpip -i'en4' -a'192.168.137.21' -m'255.255.255.0' -h'ibm.test.lan' -
n'192.168.137.1' -d'test.lan' -g'192.168.137.1'
chdev -l 'en0' -a netaddr='192.168.10.21' -a netmask='255.255.255.0' -a
state='up'
chdev -l 'en1' -a netaddr='192.168.20.21' -a netmask='255.255.255.0' -a
state='up'
```

2. Log in remotely using rsh.

```
rsh root@192.168.137.21
```

```
*******************************************************************************
*                                                                             *
*                                                                             *
*  Welcome to AIX Version 7.1!                                                *
*                                                                             *
*                                                                             *
*  Please see the README file in /usr/lpp/bos for information pertinent to    *
*  this release of the AIX Operating System.                                  *
*                                                                             *
*                                                                             *
*******************************************************************************
#
```

3. Change the root user password.

```
passwd
```

```
Changing password for "root"
root's New password: Password1
Enter the new password again: Password1
```

4. Install OpenSSL and OpenSSH packages:

```
cd /usr/sys/inst.images
installp -ac -Y -d . openssh.base openssl.base openssl.man.en_US
openssh.man.en_US
```

5. Log in using SSH.

```
ssh root@192.168.137.11
```

6. Install the AIX Toolbox for Linux base environment packages.

```
cd ~
mkdir -p ezinstall/ppc || :
cd ezinstall/ppc
```

```
ftp ftp.software.ibm.com
   Name> ftp
   Password> your e-mail address
   ftp> cd aix/freeSoftware/aixtoolbox/RPMS/ppc/wget
   ftp> binary
   ftp> get wget-1.9.1-1.aix5.1.ppc.rpm
   ftp> quit
rpm -hUv wget-1.9.1-1.aix5.1.ppc.rpm
wget -r -nd -g on
ftp://ftp.software.ibm.com/aix/freeSoftware/aixtoolbox/ezinstall/ppc/*.sh
chmod +x get*.sh
./getbase.sh
cd ~
rpm -Uhv ezinstall/ppc/base/*
```

7. You can now use the bash shell whenever you log in.

```
bash
bash-4.2#
```

8. Expand the swap logical volume.

```
lsps -a
lslv hd6
chps -s 126 hd6
```

9. Expand the root, /tmp, /usr, /var, and /opt volumes.

```
chfs -a size=1G /
Filesystem size changed to 2097152
chfs -a size=5G /tmp
Filesystem size changed to 10485760
chfs -a size=20G /usr
Filesystem size changed to 41943040
chfs -a size=1G /var
Filesystem size changed to 2097152
chfs -a size=1G /opt
Filesystem size changed to 2097152
```

10. Install AIX update TL3 (Technology Update 3) and SP1 (Service Pack 1).

```
cd /usr/sys/inst.images
wget -c --retr-symlinks ftp://<updates url>/* .
```

11. Add the necessary groups and users.

```
mkgroup -A oinstall
mkgroup -A dba
```

```
mkgroup -A oper
useradd -m -g oinstall -G dba,oper oracle
```

12. Modify the password for the Oracle user.

```
passwd oracle
```

```
Changing password for user oracle.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
```

13. Edit the security limits configuration.

```
chuser fsize=-1 cpu=-1 data=-1 stack=-1 rss=-1 nofiles=-1 oracle
chuser fsize=-1 cpu=-1 data=-1 stack=-1 rss=-1 nofiles=-1 root
```

14. Configure the Oracle user to use the bash shell.

```
chsh oracle /usr/bin/bash
```

15. Set the maximum number of processes to 16384.

```
chdev -l sys0 -a maxuproc='16384'
```

16. Increase Asynchronous IO (AIO) maximum requests to 65536.

```
ioo -o aio_maxreqs=65536
```

17. Configure system network settings.

```
no -p -o tcp_ephemeral_low=9000 -o tcp_ephemeral_high=65500
no -p -o udp_ephemeral_low=9000 -o udp_ephemeral_high=65500
no -p -o tcp_sendspace=262144
no -p -o tcp_recvspace=262144
no -p -o rfc1323=1
```

18. Edit the hosts file.

```
vi /etc/hosts
```

```
127.0.0.1               loopback localhost      # loopback (lo0) name/address
::1                     loopback localhost      # IPv6 loopback (lo0) name/address

192.168.137.1   controller controller1
192.168.10.1    controller1g1
192.168.20.1    controller1g2

192.168.137.5   storage1.test.lan storage1 storage.test.lan storage
192.168.10.5    storage10g1.test.lan storage10g1
192.168.20.5    storage10g2.test.lan storage10g2

192.168.137.11  intel1.test.lan intel1
192.168.10.11   intel10g1.test.lan intel10g1 intel.test.lan intel
192.168.20.11   intel10g2.test.lan intel10g2
```

```
192.168.137.21  ibm1.test.lan ibm1
192.168.10.21   ibm10g1.test.lan ibm10g1 ibm.test.lan ibm tpcc1.test.lan tpcc1
192.168.20.21   ibm10g2.test.lan ibm10g1

192.168.137.100 hammerdb1.test.lan hammerdb1
192.168.10.100  hammerdb10g1.test.lan hammerdb10g1 hammerdb.test.lan hammerdb
192.168.20.100  hammerdb10g2.test.lan hammerdb10g2
```

19. Create a new 30GB mirrored logical volume for Oracle program files formatted and mounted at "/u01".

```
mkdir /u01
mklv -c 2 -s y -t jfs2 -y hd12u01 rootvg 30g
crfs -v jfs2 -d'hd12u01' -m'/u01' -A'yes' -p'rw' -a agblksize='4096' -a
isnapshot='no'
mount /u01
```

20. Modify /etc/ filesystems.

```
vi /etc/filesystems
```

```
/u01/app/oracle/fast_recovery_area:
        dev             = /ibm/fra
        vfs             = nfs
        nodename        = storage10g2
        mount           = true
        options         =
rw,bg,hard,proto=tcp,vers=3,rsize=65536,wsize=65536,cio,timeo=600,intr
        account         = false

/mnt/share:
        dev             = /share
        vfs             = nfs
        nodename        = storage10g2
        mount           = true
        options         =
rw,bg,hard,proto=tcp,vers=3,rsize=65536,wsize=65536,cio,timeo=600,intr
        account         = false
```

21. Create folders and set permissions for Oracle installation.

```
mkdir -p /u01/app/oracle/flash_recovery_area
mount /u01/app/oracle/flash_recovery_area
chown -R oracle:oinstall /u01
chmod -R 775 /u01/
```

22. Edit the profile file to set environment variables.

```
vi /home/oracle/.bash_profile
```

```
# Oracle Settings
export TMP=/tmp
export TMPDIR=$TMP

export ORACLE_HOSTNAME=ibm.test.lan
```

```
export ORACLE_BASE=/u01/app/oracle
export GRID_HOME=$ORACLE_BASE/product/12.1.0/grid
export DB_HOME=$ORACLE_BASE/product/12.1.0/dbhome_1
export ORACLE_HOME=$DB_HOME
export ORACLE_SID=tpcc1
export ORACLE_TERM=xterm
export BASE_PATH=/usr/sbin:$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'
```

23. Edit the grid_env file, and adjust additional variables:

```
vi /home/oracle/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
```

24. Edit the db_env file, and adjust additional variables:

```
vi /home/oracle/db_env
```

```
export ORACLE_SID=tpcc1
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
```

25. Run cfgmgr to detect any new LUNs, and list disk drives using lsdev.

```
cfgmgr
lsdev -Cc disk
```

```
hdisk0  Available 06-00-00 SAS Disk Drive
hdisk1  Available 06-00-00 SAS Disk Drive
hdisk2  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk3  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk4  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk5  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk6  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk7  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk8  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk9  Available 0B-00-01 Other FC SCSI Disk Drive
hdisk10 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk11 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk12 Available 0B-00-01 Other FC SCSI Disk Drive
```

```
hdisk13 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk14 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk15 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk16 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk17 Available 0B-00-01 Other FC SCSI Disk Drive
hdisk18 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk19 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk20 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk21 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk22 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk23 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk24 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk25 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk26 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk27 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk28 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk29 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk30 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk31 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk32 Available 0B-01-01 Other FC SCSI Disk Drive
hdisk33 Available 0B-01-01 Other FC SCSI Disk Drive
```

26. Rename the LUNs.

```
rendev -l 'hdisk2'  -n 'ibm_data_0_0'
rendev -l 'hdisk3'  -n 'ibm_data_0_1'
rendev -l 'hdisk4'  -n 'ibm_data_0_2'
rendev -l 'hdisk5'  -n 'ibm_data_0_3'
rendev -l 'hdisk6'  -n 'ibm_data_0_4'
rendev -l 'hdisk7'  -n 'ibm_data_0_5'
rendev -l 'hdisk8'  -n 'ibm_data_0_6'
rendev -l 'hdisk9'  -n 'ibm_data_0_7'
rendev -l 'hdisk10' -n 'ibm_data_0_8'
rendev -l 'hdisk11' -n 'ibm_data_0_9'
rendev -l 'hdisk12' -n 'ibm_redo_0_10'
rendev -l 'hdisk13' -n 'ibm_redo_0_11'
rendev -l 'hdisk14' -n 'ibm_redo_0_12'
rendev -l 'hdisk15' -n 'ibm_redo_0_13'
rendev -l 'hdisk16' -n 'ibm_redo_0_14'
rendev -l 'hdisk17' -n 'ibm_redo_0_15'

rendev -l 'hdisk18' -n 'ibm_data_1_0'
rendev -l 'hdisk19' -n 'ibm_data_1_1'
rendev -l 'hdisk20' -n 'ibm_data_1_2'
rendev -l 'hdisk21' -n 'ibm_data_1_3'
rendev -l 'hdisk22' -n 'ibm_data_1_4'
rendev -l 'hdisk23' -n 'ibm_data_1_5'
```

```
rendev -l 'hdisk24' -n 'ibm_data_1_6'
rendev -l 'hdisk25' -n 'ibm_data_1_7'
rendev -l 'hdisk26' -n 'ibm_data_1_8'
rendev -l 'hdisk27' -n 'ibm_data_1_9'
rendev -l 'hdisk28' -n 'ibm_redo_1_10'
rendev -l 'hdisk29' -n 'ibm_redo_1_11'
rendev -l 'hdisk30' -n 'ibm_redo_1_12'
rendev -l 'hdisk31' -n 'ibm_redo_1_13'
rendev -l 'hdisk32' -n 'ibm_redo_1_14'
rendev -l 'hdisk33' -n 'ibm_redo_1_15'
```

27. Adjust LUN queue depth and maximum transfer size.

```
chdev  -l 'ibm_data_0_0'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_1'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_2'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_3'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_4'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_5'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_6'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_7'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_8'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_0_9'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_10' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_11' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_12' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_13' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_14' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_0_15' -a queue_depth='30' -a max_transfer='0x100000'

chdev  -l 'ibm_data_1_0'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_1'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_2'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_3'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_4'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_5'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_6'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_7'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_8'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_data_1_9'  -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_1_10' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_1_11' -a queue_depth='30' -a max_transfer='0x100000'
```

```
chdev  -l 'ibm_redo_1_12' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_1_13' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_1_14' -a queue_depth='30' -a max_transfer='0x100000'
chdev  -l 'ibm_redo_1_15' -a queue_depth='30' -a max_transfer='0x100000'
```

28. Set permissions on new LUN devices for Oracle ASM use.

```
chown oracle:dba /dev/ribm_*
chmod 660 /dev/ribm_*
```

29. List the ASM devices.

```
ls -l /dev/ribm_* | awk '{print($1"\t"$3"\t"$4"\t"$10)}'
```

```
crw-rw----      oracle  dba     /dev/ribm_data_0_0
crw-rw----      oracle  dba     /dev/ribm_data_0_1
crw-rw----      oracle  dba     /dev/ribm_data_0_2
crw-rw----      oracle  dba     /dev/ribm_data_0_3
crw-rw----      oracle  dba     /dev/ribm_data_0_4
crw-rw----      oracle  dba     /dev/ribm_data_0_5
crw-rw----      oracle  dba     /dev/ribm_data_0_6
crw-rw----      oracle  dba     /dev/ribm_data_0_7
crw-rw----      oracle  dba     /dev/ribm_data_0_8
crw-rw----      oracle  dba     /dev/ribm_data_0_9
crw-rw----      oracle  dba     /dev/ribm_data_1_0
crw-rw----      oracle  dba     /dev/ribm_data_1_1
crw-rw----      oracle  dba     /dev/ribm_data_1_2
crw-rw----      oracle  dba     /dev/ribm_data_1_3
crw-rw----      oracle  dba     /dev/ribm_data_1_4
crw-rw----      oracle  dba     /dev/ribm_data_1_5
crw-rw----      oracle  dba     /dev/ribm_data_1_6
crw-rw----      oracle  dba     /dev/ribm_data_1_7
crw-rw----      oracle  dba     /dev/ribm_data_1_8
crw-rw----      oracle  dba     /dev/ribm_data_1_9
crw-rw----      oracle  dba     /dev/ribm_redo_0_10
crw-rw----      oracle  dba     /dev/ribm_redo_0_11
crw-rw----      oracle  dba     /dev/ribm_redo_0_12
crw-rw----      oracle  dba     /dev/ribm_redo_0_13
crw-rw----      oracle  dba     /dev/ribm_redo_0_14
crw-rw----      oracle  dba     /dev/ribm_redo_0_15
crw-rw----      oracle  dba     /dev/ribm_redo_1_10
crw-rw----      oracle  dba     /dev/ribm_redo_1_11
crw-rw----      oracle  dba     /dev/ribm_redo_1_12
crw-rw----      oracle  dba     /dev/ribm_redo_1_13
crw-rw----      oracle  dba     /dev/ribm_redo_1_14
crw-rw----      oracle  dba     /dev/ribm_redo_1_15
```

Installing Oracle Grid Infrastructure for a Standalone Server on AIX

1. Run the GUI installer for Oracle Grid using the following commands:

```
ssh -Y root@ibm
```

```
cd /mnt/share/aix/grid
./rootpre.sh
```

```
Copying new kernel extension to /etc....
Loading the kernel extension from /etc

 Oracle Kernel Extension Loader for AIX
       Copyright (c) 1998,1999 Oracle Corporation


 Successfully loaded /etc/pw-syscall.64bit_kernel with kmid: 0x50c9e000
 Successfully configured /etc/pw-syscall.64bit_kernel with kmid: 0x50c9e000
The kernel extension was successfuly loaded.

Checking if group services should be configured....
Nothing to configure
```

2. Run the GUI installer for Oracle Grid using the following commands.

```
ssh –Y oracle@ibm
grid_env
cd /mnt/share/aix/grid
./runInstaller
```

```
********************************************************************************

Your platform requires the root user to perform certain pre-installation
OS preparation.  The root user should run the shell script 'rootpre.sh' before
you proceed with Oracle installation.  rootpre.sh can be found at the top level
of the CD or the stage area.

Answer 'y' if root has run 'rootpre.sh' so you can proceed with Oracle
installation.
Answer 'n' to abort installation and then ask root to run 'rootpre.sh'.

********************************************************************************

Has 'rootpre.sh' been run by root on all nodes? [y/n] (n)
y

Starting Oracle Universal Installer...
```

3. Launch the Oracle Grid Infrastructure installation wizard.
4. In Software Updates, select Skip software updates, and click Next.
5. In Installation Type, select install and Configure Oracle Grid Infrastructure for a Standalone Server, and click Next.
6. In Product Languages, select English, and click the right-pointing arrow located between the two selection panels to add English to the Selected languages panel. Click Next.

7. In Create ASM Disk Group, click Change Discovery Path.
8. Enter `/dev/ribm_*` for the Disk Discovery Path, and click OK.
9. Check the boxes for /dev/ribm_data_0_0 and /dev/ribm_data_1_0. Click Next.
10. In ASM Password, select Use same passwords for these accounts.
11. Enter and confirm the password, and click Next.
12. In Operating System Groups, set the Oracle ASM Operator (OSOPER for ASM) Group to dba. Click Next.
13. Click Yes to confirm the notifications and continue.
14. In Installation Location, accept the default locations provided, and click Next.
15. Click Yes to confirm the notification and continue.
16. In Create Inventory, accept the defaults, and click Next.
17. In Root Script Execution, check the Automatically run configuration scripts checkbox.
18. Select Use "root" user credential, and provide the root password. Click Next.
19. In Prerequisite Checks, check the Ignore All checkbox to bypass the findings of the prerequisite checks. Click Next.
20. Click Yes to confirm information notification and continue.
21. In Summary, review the information, and click Install to begin installation.
22. Click Yes to confirm using the privileged user for the installer.
23. In Finish, click Close to exit the installer.
24. Perform ASM and diskgroup post-installation configuration.

```
grid_env
sqlplus / as sysasm
```

```
SQL*Plus: Release 12.1.0.1.0 Production on Tue Feb 11 00:07:10 2014
Copyright (c) 1982, 2013, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Automatic Storage Management option
```

```
SQL> shutdown
ASM diskgroups volume disabled
ASM diskgroups dismounted
ASM instance shutdown
```

```
SQL> startup nomount
ASM instance started

Total System Global Area 1135747072 bytes
Fixed Size           2297344 bytes
Variable Size         1108283904 bytes
ASM Cache           25165824 bytes
```

```
SQL> ALTER DISKGROUP data MOUNT RESTRICTED;
```

```
Diskgroup altered.
```

```
        SQL> ALTER DISKGROUP data RENAME DISK 'DATA_0000' TO
        'data_0_0','DATA_0001' TO 'data_1_0';
Diskgroup altered.
```

```
        SQL> shutdown
```

```
ASM diskgroups volume disabled
ASM diskgroups dismounted
ASM instance shutdown
```

```
        SQL> startup
```

```
ASM instance started

Total System Global Area 1135747072 bytes
Fixed Size           2297344 bytes
Variable Size          1108283904 bytes
ASM Cache           25165824 bytes
ASM diskgroups mounted
ASM diskgroups volume enabled
```

```
        SQL> ALTER DISKGROUP data SET ATTRIBUTE 'compatible.asm' = '12.1';
```

```
Diskgroup altered.
```

```
        SQL> ALTER DISKGROUP data SET ATTRIBUTE 'compatible.rdbms = '12.1';
```

```
Diskgroup altered.
```

```
        SQL> ALTER DISKGROUP data ADD
        FAILGROUP DATA_0000 DISK
        '/dev/ribm_data_0_1' NAME data_0_1,
        '/dev/ribm_data_0_2' NAME data_0_2,
        '/dev/ ribm_data_0_3' NAME data_0_3,
        '/dev/ ribm_data_0_4' NAME data_0_4,
        '/dev/ ribm_data_0_5' NAME data_0_5,
        '/dev/ ribm_data_0_6' NAME data_0_6,
```

```
'/dev/ribm_data_0_7' NAME data_0_7,
'/dev/ribm_data_0_8' NAME data_0_8,
'/dev/ribm_data_0_9' NAME data_0_9
FAILGROUP DATA_0001 DISK
'/dev/ribm_data_1_1' NAME data_1_1,
'/dev/ribm_data_1_2' NAME data_1_2,
'/dev/ribm_data_1_3' NAME data_1_3,
'/dev/ribm_data_1_4' NAME data_1_4,
'/dev/ribm_data_1_5' NAME data_1_5,
'/dev/ribm_data_1_6' NAME data_1_6,
'/dev/ribm_data_1_7' NAME data_1_7,
'/dev/ribm_data_1_8' NAME data_1_8,
'/dev/ribm_data_1_9' NAME data_1_9;
```

```
Diskgroup altered.
```

```
SQL> CREATE DISKGROUP REDO0 EXTERNAL REDUNDANCY DISK
'/dev/ribm_redo_0_10' NAME redo_0_10,
'/dev/ribm_redo_0_11' NAME redo_0_11,
'/dev/ribm_redo_0_12' NAME redo_0_12,
'/dev/ribm_redo_0_13' NAME redo_0_13,
'/dev/ribm_redo_0_14' NAME redo_0_14,
'/dev/ribm_redo_0_15' NAME redo_0_15
ATTRIBUTE
   'compatible.asm' = '12.1',
   'compatible.rdbms' = '12.1',
   'sector_size' = '512';
```

```
Diskgroup created.
```

```
SQL> CREATE DISKGROUP REDO1 EXTERNAL REDUNDANCY DISK
'/dev/ribm_redo_1_10' NAME redo_1_10,
'/dev/ribm_redo_1_11' NAME redo_1_11,
'/dev/ribm_redo_1_12' NAME redo_1_12,
'/dev/ribm_redo_1_13' NAME redo_1_13,
'/dev/ribm_redo_1_14' NAME redo_1_14,
'/dev/ribm_redo_1_15' NAME redo_1_15
ATTRIBUTE
   'compatible.asm' = '12.1',
   'compatible.rdbms' = '12.1',
```

```
        'sector_size' = '512';
```

```
Diskgroup created.
```

```
        SQL> quit
```

```
Disconnected from Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 -
64bit Production
With the Automatic Storage Management option
```

Installing Oracle Database 12c on the POWER7+ server

1. Run the GUI installer for Oracle Database using the following commands:

```
ssh –Y oracle@ibm
db_env
cd /mnt/share/aix/database
./runInstaller
```

```
***********************************************************************

Your platform requires the root user to perform certain pre-installation
OS preparation.  The root user should run the shell script 'rootpre.sh' before
you proceed with Oracle installation.  rootpre.sh can be found at the top level
of the CD or the stage area.

Answer 'y' if root has run 'rootpre.sh' so you can proceed with Oracle
installation.
Answer 'n' to abort installation and then ask root to run 'rootpre.sh'.

***********************************************************************

Has 'rootpre.sh' been run by root? [y/n] (n)
y

Starting Oracle Universal Installer...
```

2. Launch the Oracle Database 12c Release 1 Installer.
3. In Configure Security Updates, check the I wish to receive security updates via My Oracle Support checkbox. Click Next.
4. Click Yes to confirm no email provided, and continue.
5. In Software Updates, select Skip software updates, and click Next.
6. In Installation Option, select Install database software only, and click Next.
7. In Grid Installation Options, select Single instance database installation, and click Next.
8. In Product Languages, select English and click the right-pointing arrow located between the two selection panels to add English to the Selected languages panel. Click Next.
9. In Database Edition, select Enterprise Edition, and click Next.

10. In Installation Location, accept the default locations provided, and click Next.
11. In Operating System Group, accept the defaults, and click Next.
12. In Prerequisite checks, check the Ignore All checkbox to bypass the findings of the prerequisite checks, and click Next.
13. Click Yes to confirm the notification and continue.
14. In Summary, review the information, and click Install to begin installation.
15. In Install Product, follow the instructions to execute the scripts. Click OK when the scripts have completed.
16. In Finish, click Close to exit the installer.
17. When prompted in the GUI installer, run the root shell script to finish the Oracle Database installation.

```
/u01/app/oracle/product/12.1.0/dbhome_1/root.sh
```

Creating the Oracle Database (using DBCA)

1. Launch the Database Configuration Assistant (DBCA).
2. In Database Operations, select Create Database, and click Next.
3. In Creation Mode, select Advanced Mode, and click Next.
4. In Database Template, select the Template for General Purpose or Transaction Processing, and click Next.
5. In Database Identification, type `tpcc1.test.lan` for the Global Database Name.
6. Type `tpcc1` for the SID. Click Next.
7. In Management Options, select Configure Enterprise Manager (EM) Database Express. Click Next.
8. In Database Credentials, select Use the Same Administrative Password for All Accounts.
9. Enter and confirm the administrative password, and click Next.
10. In Network Configuration, check the boxes for all listeners, and click Next.
11. In Storage Locations, select User Common Location for All Database Files. Type `+DATA` into the Database Files Location field.
12. Select Specify Fast Recovery Area. Type `(ORACLE_BASE)/fast_recovery_area` in the Fast Recovery Area field.
13. Set the Fast Recovery Area Size to 2,048 GB, and click Next.
14. In Database Options, accept the defaults, and click Next.
15. In Initialization Parameters and under typical settings, set the Memory Size to 411,320 MB, and click next.
16. In Creation Options, select Create Database. Click Customize Storage Locations.
17. In the Customize Storage panel and under Redo Log Groups, select 1.
18. Set the file size to 98,304 MB. Click Apply.
19. Under Redo Log Groups, select 2.
20. Set the file size to 98,304 MB. Click Apply.
21. Under Redo Log Groups, select 3.
22. Click Remove and when prompted, click Yes.
23. To exit the Customize Storage panel, click Ok.
24. Click Next.
25. Review the Summary. To complete the database creation, click Finish.
26. Review the information on the screen, and click Exit.
27. To exit the DBCA, click Close.

Configuring Oracle Tablespaces and redo log

Alter the tablespaces on both systems as shown below.

```
ALTER DATABASE ADD LOGFILE GROUP 1
  (
'+REDO0/tpcc1/redo01_0.log',
'+REDO1/tpcc1/redo01_1.log'
  ) SIZE 96G;

ALTER DATABASE ADD LOGFILE GROUP 2
  (
'+REDO0/tpcc1/redo02_0.log',
'+REDO1/tpcc1/redo02_1.log'
  ) SIZE 96G;
```

```
CREATE BIGFILE TABLESPACE "TPCC"
  DATAFILE '+DATA/tpcc1/tpcc.dbf'
  SIZE 100G AUTOEXTEND ON NEXT 1G
  BLOCKSIZE 8K
  EXTENT MANAGEMENT LOCAL AUTOALLOCATE
  SEGMENT SPACE MANAGEMENT AUTO;


CREATE BIGFILE TABLESPACE "TPCC_OL"
  DATAFILE '+DATA/tpcc1/tpcc_ol.dbf'
  SIZE 50G AUTOEXTEND ON NEXT 1G
  BLOCKSIZE 16K
  EXTENT MANAGEMENT LOCAL AUTOALLOCATE
  SEGMENT SPACE MANAGEMENT AUTO;


CREATE UNDO TABLESPACE undotbs2
  DATAFILE '+DATA/tpcc1/undotbs02.dbf'
  SIZE 100M AUTOEXTEND ON NEXT 100M;

ALTER SYSTEM SET UNDO_TABLESPACE=undotbs2;

DROP TABLESPACE undotbs1 INCLUDING CONTENTS AND DATAFILES;

CREATE UNDO TABLESPACE undotbs1
  DATAFILE '+DATA/tpcc1/undotbs01.dbf'
  SIZE 8G BLOCKSIZE 8K;

ALTER SYSTEM SET UNDO_TABLESPACE=undotbs1;

DROP TABLESPACE undotbs2 INCLUDING CONTENTS AND DATAFILES;
```

Configuring the Oracle pfile

Alter the Oracle pfile on both systems as shown below.

```
_disable_logging=FALSE
_disable_selftune_checkpointing=TRUE
_enable_NUMA_support=TRUE
_in_memory_undo=TRUE
_kgl_hot_object_copies=4
```

```
aq_tm_processes=0
audit_file_dest='/u01/app/oracle/admin/tpcc1/adump'
audit_trail='NONE'
commit_logging='BATCH'
commit_wait='NOWAIT'
compatible='12.1.0.0.0'
control_files='+DATA/tpcc1/control01.ctl','+DATA/tpcc1/control02.ctl'
db_16k_cache_size=32749125632
db_block_checking='FALSE'
db_block_checksum='FALSE'
db_block_size=8192
db_cache_size=128849018880
db_create_file_dest='+DATA'
db_domain='test.lan'
db_file_multiblock_read_count=32
db_name='tpcc1'
db_recovery_file_dest_size=2048g
db_recovery_file_dest='/u01/app/oracle/fast_recovery_area'
db_writer_processes=4
diagnostic_dest='/u01/app/oracle'
disk_asynch_io=TRUE
dispatchers='(PROTOCOL=TCP) (SERVICE=tpcc1XDB)'
dml_locks=500
fast_start_mttr_target=0
filesystemio_options='setall'
large_pool_size=1g
local_listener='LISTENER_TPCC1'
lock_sga=TRUE
log_checkpoint_interval=0
log_checkpoint_timeout=0
log_checkpoints_to_alert=TRUE
open_cursors=2000
parallel_max_servers=0
parallel_min_servers=0
pga_aggregate_target=5g
plsql_code_type='NATIVE'
plsql_optimize_level=3
processes=1000
query_rewrite_enabled='TRUE'
remote_login_passwordfile='EXCLUSIVE'
replication_dependency_tracking=FALSE
result_cache_max_size=0
shared_pool_size=5905580032
statistics_level='BASIC'
timed_statistics=FALSE
trace_enabled=FALSE
transactions_per_rollback_segment=1
undo_management='AUTO'
undo_retention=0
undo_tablespace='UNDOTBS1'
```

Installing HammerDB Client

Complete the following steps on both systems.

1. Launch the Oracle Client Installer.
2. In Select Installation Type, select Administrator (1.8 GB) as the installation type, and click Next.

3. In Software Updates, select Skip software updates, and click Next.
4. In Select Product Languages, select English and click the right-pointing arrow located between the two selection panels to add English to the Selected languages panel. Click Next.
5. In Specify Installation Location, accept the default locations provided, and click Next.
6. In Create Inventory, accept the defaults, and click Next.
7. In Summary, review the information, and click Install to begin installation.
8. In Install Product, follow the instructions to execute the scripts. Click OK when the scripts have completed.
9. In Finish, click Close to exit the installer.

ABOUT PRINCIPLED TECHNOLOGIES

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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.