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

Up to 5.7x performance per system watt per dollar

69% lower hardware cost*  |  Up to 42% less power consumption  |  Twice the headroom

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.
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.](image)

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.

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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.
Mission-critical database performance: Intel Xeon processor E7 v2 family vs. IBM POWER7+

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.

![CPU utilization graph]

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.
Figure 6 provides detailed configuration information for the test systems.

<table>
<thead>
<tr>
<th>System</th>
<th>Intel Xeon processor E7-4890 v2-based server</th>
<th>IBM POWER 7+processor-based server</th>
</tr>
</thead>
<tbody>
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<td>Intel DPS-1200TB A</td>
<td>Emerson 7001599-J000</td>
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<td>1,925</td>
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<td><strong>Cooling fans</strong></td>
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<td>Total number</td>
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<td>PSD1209PMBX-A</td>
<td>IBM PN 00E7691</td>
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<td>8</td>
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<td>Ondemand governor</td>
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<td>IBM</td>
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<td>POWER7+</td>
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<td>Power 750 Express</td>
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<td>AM770_052</td>
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<td>Intel Xeon processor E7-4890 v2-based server</td>
<td>IBM POWER 7+ processor-based server</td>
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<tr>
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<td>JFS2</td>
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<td>System</td>
<td>Intel Xeon processor E7-4890 v2-based server</td>
<td>IBM POWER 7+processor-based server</td>
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<td>--------</td>
<td>---------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
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**Ethernet adapters**

**First network adapter**

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<th>IBM Integrated Multifunction Card with Copper SFP+ 10GbE</th>
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<tbody>
<tr>
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**Second network adapter**

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<th>Vendor and model number</th>
<th>Intel Corporation 82576 Gigabit Network Connection</th>
<th>Broadcom® BCM95719A1904G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Quad-port</td>
<td>Quad-port</td>
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**Fibre adapter**

<table>
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<tr>
<th>Vendor and model number</th>
<th>HP PN AJ63A (Emulex LPE12002)</th>
<th>IBM PN 10N9824 (Emulex LPE12002)</th>
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<tr>
<td>Type</td>
<td>PCI Express</td>
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<td>Firmware</td>
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**Optical drive(s)**

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<th>Vendor and model number</th>
<th>TEAC DV-W28 - ATAPI</th>
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**USB ports**

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</table>

*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
   nsspr.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
   openslap.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 \

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(Revised 2/28/14 to include full methodology)
7. Edit the sysctl file.
   `vim /etc/sysctl.conf`
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   storagel.test.lan storagel storage.test.lan storage
    ```

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

Modifying this line:

```bash
* soft nproc 1024
```

To reflect this change:

```bash
* - nproc 16384
```

14. Create a logical volume.

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

Logical volume "lv_u01" created

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

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

```
/dev/mapper/vg_intel-lv_u01 /u01 ext4 defaults 1 2
storage10g2:/intell/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.

```bash
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.

```bash
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


   vim /etc/udev/rules.d/99-oracle-asmdevices.rules
KERNEL="sd*[a-z]", SUBSYSTEM="block", DEVTYPE="disk",
ENV(ID_SERIAL)="3600144f07c620b000000052f362ba021e", NAME="oracleasm/intel_redo_0_10",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL="sd*[a-z]", SUBSYSTEM="block", DEVTYPE="disk",
ENV(ID_SERIAL)="3600144f07c620b000000052f362bb0220", NAME="oracleasm/intel_redo_1_10",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL="sd*[a-z]", SUBSYSTEM="block", DEVTYPE="disk",
ENV(ID_SERIAL)="3600144f07c620b000000052f362bb0222", NAME="oracleasm/intel_redo_0_11",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL="sd*[a-z]", SUBSYSTEM="block", DEVTYPE="disk",
ENV(ID_SERIAL)="3600144f07c620b000000052f362bc0224", NAME="oracleasm/intel_redo_1_11",
OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL="sd*[a-z]", SUBSYSTEM="block", DEVTYPE="disk",
ENV(ID_SERIAL)="3600144f07c620b000000052f362bc0226", NAME="oracleasm/intel_redo_0_12",
OWNER="oracle", GROUP="dba", MODE="0660"
Mission-critical database performance: Intel Xeon processor E7 v2 family vs. IBM POWER7+

(Revised 2/28/14 to include full methodology)
22. Execute udevadm and start udev.
   ```
   udevadm control --reload-rules
   start_udev
   ```

23. List the ASM devices.
   ```sh
   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
   ```
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,
Mission-critical database performance: Intel Xeon processor E7 v2 family vs. IBM POWER7+

(Revised 2/28/14 to include full methodology)
'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.
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
   ```
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.
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.
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.
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.
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.
20. Set the file size to 98,304 MB. Click Apply.
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 -1 '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
   
   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
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

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.  
   i oo -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 storagel.test.lan storagel 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
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
```

Mission-critical database performance: Intel Xeon processor E7 v2 family vs. IBM POWER7+

A Principled Technologies test report

(Revised 2/28/14 to include full methodology)
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
26. Rename the LUNs.

```bash
ren dev -l 'hdisk2' -n 'ibm_data_0_0'
ren dev -l 'hdisk3' -n 'ibm_data_0_1'
ren dev -l 'hdisk4' -n 'ibm_data_0_2'
ren dev -l 'hdisk5' -n 'ibm_data_0_3'
ren dev -l 'hdisk6' -n 'ibm_data_0_4'
ren dev -l 'hdisk7' -n 'ibm_data_0_5'
ren dev -l 'hdisk8' -n 'ibm_data_0_6'
ren dev -l 'hdisk9' -n 'ibm_data_0_7'
ren dev -l 'hdisk10' -n 'ibm_data_0_8'
ren dev -l 'hdisk11' -n 'ibm_data_0_9'
ren dev -l 'hdisk12' -n 'ibm_redo_0_10'
ren dev -l 'hdisk13' -n 'ibm_redo_0_11'
ren dev -l 'hdisk14' -n 'ibm_redo_0_12'
ren dev -l 'hdisk15' -n 'ibm_redo_0_13'
ren dev -l 'hdisk16' -n 'ibm_redo_0_14'
ren dev -l 'hdisk17' -n 'ibm_redo_0_15'
ren dev -l 'hdisk18' -n 'ibm_data_1_0'
ren dev -l 'hdisk19' -n 'ibm_data_1_1'
ren dev -l 'hdisk20' -n 'ibm_data_1_2'
ren dev -l 'hdisk21' -n 'ibm_data_1_3'
ren dev -l 'hdisk22' -n 'ibm_data_1_4'
ren dev -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'
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)}'
   ```

<table>
<thead>
<tr>
<th>Mode</th>
<th>Owner</th>
<th>Group</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_0</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_1</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_2</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_3</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_4</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_5</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_6</td>
</tr>
<tr>
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<td>dba</td>
<td>/dev/ribm_data_0_7</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_8</td>
</tr>
<tr>
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<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_0_9</td>
</tr>
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<td>dba</td>
<td>/dev/ribm_data_1_0</td>
</tr>
<tr>
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<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_1</td>
</tr>
<tr>
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<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_2</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_3</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_4</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_5</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_6</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_7</td>
</tr>
<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_8</td>
</tr>
<tr>
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<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_data_1_9</td>
</tr>
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<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_redo_0_10</td>
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<td>/dev/ribm_redo_0_11</td>
</tr>
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<td>dba</td>
<td>/dev/ribm_redo_0_12</td>
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<td>crw-rw----</td>
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<td>dba</td>
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<td>/dev/ribm_redo_0_14</td>
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<tr>
<td>crw-rw----</td>
<td>oracle</td>
<td>dba</td>
<td>/dev/ribm_redo_0_15</td>
</tr>
</tbody>
</table>

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
   ```
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.
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.

```bash
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,
```

Mission-critical database performance: Intel Xeon processor E7 v2 family vs. IBM POWER7+

A Principled Technologies test report 32

(Revised 2/28/14 to include full methodology)
'/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.
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.
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.
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.
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.
20. Set the file size to 98,304 MB. Click Apply.
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.

_disableLogging=FALSE
_disableSelftuneCheckpointing=TRUE
_enableNUMASupport=TRUE
_inMemoryUndo=TRUE
_kglHotObjectCopies=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_async_io=TRUE
dispatchers='(PROTOCOL=TCP) (SERVICE=tpcc1XDB)'
dml_locks=500
fast_start_mttr_target=0
filesystemio_options='setall'
large_pool_size=lg
local_listener='LISTENER_TPPC1'
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.
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