Installation Experiences with Oracle 11gR2 on Linux on System z

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<thead>
<tr>
<th>Trademark</th>
<th>Description</th>
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<tr>
<td>AIX*</td>
<td>Geographically Dispersed Parallel Sysplex</td>
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<tr>
<td>APPN*</td>
<td>HiperSockets</td>
</tr>
<tr>
<td>CICS*</td>
<td>HyperSwap</td>
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<tr>
<td>DB2*</td>
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<td>DirMaint</td>
<td>IBM e(logo)server*</td>
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<td>DRDA*</td>
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<td>IMS</td>
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<td>e-business logo*</td>
<td>InfoPrint*</td>
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<td>ECKD</td>
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<td>GDPS*</td>
<td>On demand business logo</td>
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<td>OS/390*</td>
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<td>Processor Resource/Systems Manager</td>
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<td>RACF*</td>
<td>System z9</td>
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<td>Resource Link</td>
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</tr>
<tr>
<td>z/Architecture</td>
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</tr>
<tr>
<td>z/OS*</td>
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<td></td>
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<td>zSeries*</td>
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Topics to Cover

• 11gR2 Install and Patching Notes
• Current Hot Topics with Oracle on System z Linux
• Oracle 11gR2 Features with Linux on System z
11gR2 Install and Patching Notes:
## Oracle Database Released Dates

<table>
<thead>
<tr>
<th>IBM Platform</th>
<th>10.2.0.4</th>
<th>10.2.0.5</th>
<th>11.1.0.7</th>
<th>11.2.0.1</th>
<th>11.2.0.2</th>
<th>11.2.0.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux x86:</td>
<td>22-Feb-08</td>
<td>30-Apr-10</td>
<td>18-Sep-08</td>
<td>1-Sep-09</td>
<td>13-Sep-10</td>
<td>23-Sep-11</td>
</tr>
<tr>
<td>Linux on System z:</td>
<td>16-Dec-08</td>
<td>3-Jan-11</td>
<td>Not planned</td>
<td>Not planned</td>
<td>30-Mar-11</td>
<td>1-Dec-11</td>
</tr>
<tr>
<td>AIX on POWER:</td>
<td>15-May-08</td>
<td>3-Jun-10</td>
<td>6-Oct-08</td>
<td>22-Dec-09</td>
<td>19-Oct-10</td>
<td>29-Oct-11</td>
</tr>
<tr>
<td>System x Windows</td>
<td>17-Mar-08</td>
<td>19-Jul-10</td>
<td>10-Oct-08</td>
<td>5-Apr-10</td>
<td>15-Dec-10</td>
<td>11-Nov-11</td>
</tr>
</tbody>
</table>

* Oracle on System z Releases are getting better and better with every release.
* Patch Set Updates are the same date as other Platforms.
Enterprise Manager Grid Control

- Oracle Enterprise Manager – 10.2.0.5 Agent supports running Oracle 11gR2 databases.

- Oracle Support has published a release Date of Q4 Financial Year 2012, for the new Enterprise manager 12c Grid Control Agent – which means between **Now and May 2012** for Linux on System Z.
The libstd c++ package replaces the compat-libstdc++ package
Compat-libstdc++-33 Error

- `libstdc++33` package replaces the `compat-libstdc++` package
- `rpm -q --provides libstdc++33.rpm`
  
  ```
  compat-libstdc++
  libstdc++.5 = 3.3.3-7.8.1
  libstdc++.so.5()(64bit)
  libstdc++.so.5(CXXABI_1.2)(64bit)
  libstdc++.so.5(CXXABI_1.2.1)(64bit)
  libstdc++.so.5(CXXABI_1.2.2)(64bit)
  libstdc++.so.5(GLIBCXX_3.2)(64bit)
  libstdc++.so.5(GLIBCXX_3.2.1)(64bit)
  libstdc++.so.5(GLIBCXX_3.2.2)(64bit)
  libstdc++.so.5(GLIBCXX_3.2.3)(64bit)
  libstdc++.so.5(GLIBCXX_3.2.4)(64bit)
  libstdc++.so.5(GLIBCXX_3.2.5)(64bit)
  libstdc++.so.5(libstdc++.so.5)(64bit)
  libstdc++.33 = 3.3.3-7.8.1
  ```

- To complete the installation, click the Ignore Requirements box, then, hit the install/next button to finish the Oracle 11g R2 installation.

- Suse Link ->
  [http://www.novell.com/support/dynamickc.do?cmd=show&forward=nonthreadedKC&docType=kc&externalId=7004995&sliceid=1](http://www.novell.com/support/dynamickc.do?cmd=show&forward=nonthreadedKC&docType=kc&externalId=7004995&sliceid=1)
Oracle 10gR2 -> 11gR2 Upgrade

TIP => Safe to Ignore the OCR Integrity Check for Upgrades
Oracle Patch Set Update Notes

• Are released on the same date as other platforms quarterly.

• With Linux on System z, the “opatch auto” currently has a bug, so use the manual steps in the appendix, but don’t forget to run “catbundle.sql psu apply” for any existing or newly created databases.

• **Bug 13722527** - OPATCH AUTO FUNCTIONALITY NOT AVAILABLE IN 11.2.0.1.9 VERSION ON IBM: ZLINUX logged.

• **Tip** Apply per 3.2 Case 5 of the Patch Notes before running root.sh
  • opatch napply -oh $ORACLE_HOME -local /u01/stage/13343438
Linux UDEV Rules for Oracle

Create a `/etc/udev/rules.d/99-udev-oracle.rules` file to assign permissions for DASD devices.

```
vi /etc/udev/rules.d/99-udev-oracle.rules
```

**Result:**
```
KERNEL="dasd*1", ID="0.0.0300", OWNER="grid", GROUP=":oinstall", MODE="0660", SYMLINK="ASM0300"
KERNEL="dasd*1", ID="0.0.0305", OWNER="grid", GROUP=":oinstall", MODE="0660", SYMLINK="ASM0305"
```

Make an entry for each device you plan to use with Oracle ASM.

From Oracle we can now work with the new ASM Disk Device:

```
ALTER DISKGROUP DG2 add disk '/dev/ASM0305';
ALTER DISKGROUP DG2 rebalance power 2;
```
11.2.0.3 RAC Install with UDEV Symbolic Links

**Issue** – Can hang at 75% for System Pre-check

**Workaround** - Download Patch – 13497268 and `cp exactask /tmp/CVU_11.2.0.3.0_grid` on all nodes while on screen panel 7 of Grid install

**Problem can occur on all distributions of Linux (x86, Power etc)**
Current Hot Topics with Oracle on System z Linux
Oracle’s VKTM Process

• New in 11gR2 Oracle VKTM process (Virtual Time Keeper)
  • VKTM is responsible for providing centralized time tracking
    • wall-clock time (updated every second)
    • reference-time counter (updated every 20 ms)

  • When System is CPU Idle – vktm still runs.
  
  • Non idle Linux Guest z/VM consistently stays in Q3 Status
    (which means it will never swap/release it’s memory).
  • If DB is stopped the database the Linux Guest goes to Q1 (or
    Q2) releasing memory. Restart DB, the machine stays in Q3.

• You can Disable tracing -> 11.2.0.3 + Oracle Note: 1381270.1
  To turn off VKRM tracing:
  alter system set events '10720 trace name context forever, level 0x10000000';

  To turn off VKTM tracing:
  alter system set events '10795 trace name context forever, level 2';
Linux strace of Oracle’s VKTM Process

$ ps -ef | grep vktm
oracle   6723   1  0 09:08 ?        00:00:00 ora_vktm_TEST11202

[root@orarac1 ~]# strace -p 6723
Process 6723 attached - interrupt to quit
gmtimeofday({1323711237, 10495}, NULL) = 0
gmtimeofday({1323711237, 10555}, NULL) = 0
nanosleep({0, 10000000}, {1323711237, 10495}) = 0
gmtimeofday({1323711237, 21947}, NULL) = 0
gmtimeofday({1323711237, 21999}, NULL) = 0
nanosleep({0, 10000000}, {1323711237, 21947}) = 0

• Oracle does a lot of Linux **gettimeofday** calls (up to 100 per second) particularly with statistics_level set to '**typical**' or '**all**'

• SuSe 11 SP1 and Red Hat 6.1(Perhaps Future 5.x) versions have **reduced cpu consumption** for **gettimeofday()**

Reference ->
One Customer’s 11.2.0.3 Experience:

- Oracle’s **VKTM** process still uses almost the same amount of CPU minutes (about **0.08** vs. 0.09 with 11.2.0.2)

- However, we can see a great improvement with **ora_dia0** process. (about **0.07** sec cpu/minute vs. **0.28** with 11.2.0.2)

- database 1: 
  installed with NO options
  The "gettimeofday" function is called 300 times every 15 seconds.

- database 2: 
  installed with all options: (java, xml, Text, spatial, APEX, etc ....... )
  The "gettimeofday" function is called 1500 times every 15 seconds.
Additional VKTM - Suggestions

Collect SAR Data on an idle system:

**Red Hat:**

```
/usr/lib64/sa/sadc -d -F -l 2 150 vktmtest.sadc
```

**SuSe:**

```
/usr/lib64/sa/sadc -S ALL -F 2 150 vktmtest.sadc
```

Convert the raw sadc data into readable text with:

- `sar -A -f vktmtest.sadc > vktmtest.sar`

```
CPU  %usr  %nice  %sys  %iowait  %steal  %irq  %soft  %guest  %idle
Average: all  0.16  0.00  0.21  0.08  0.16  0.04  0.01  0.00  99.34
```
Oracle RAC Inter-Connect Considerations

- With System z you can use an Open System’s Adapter Interface (OSA) e.g. eth1 or a Real Hipersocket configured on Layer 2 for the Oracle RAC Interconnect.

- Must Have Linux interface configured with ARP enabled due to Oracle’s new Redundant Interconnect capabilities in 11.2+

- System z SAP processor’s assist with Network offload of cpu utilization.
### Various Network Interfaces on an Oracle RAC Node:

<table>
<thead>
<tr>
<th>Interface</th>
<th>Link Type</th>
<th>HW Address</th>
<th>IP Address</th>
<th>Broadcast</th>
<th>Mask</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>eth0</td>
<td>Ethernet</td>
<td>02:00:00:0F:00:01</td>
<td>UP BROADCAST RUNNING MULTICAST</td>
<td>MTU:1500</td>
<td>Metric:1</td>
<td>NOTE ARP is Enabled</td>
</tr>
<tr>
<td>eth0.1859</td>
<td>Ethernet</td>
<td>02:00:00:0F:00:01</td>
<td>inet addr:XXX.XXX.155.57</td>
<td>Bcast:158.151.155.255</td>
<td>Mask:255.255.254.0</td>
<td>NOTE ARP is Enabled, w/ VLAN Tagging</td>
</tr>
<tr>
<td>hsi0</td>
<td>Ethernet</td>
<td>06:00:F0:01:00:0E</td>
<td>inet addr:192.168.1.57</td>
<td>Bcast:192.168.1.255</td>
<td>Mask:255.255.255.0</td>
<td>Oracle Private Interconnect (RAC)</td>
</tr>
</tbody>
</table>

- **eth0.1859:1**: 1st Oracle SCAN IP Setup in DNS
- **eth0.1859:2**: 2nd Oracle SCAN IP Setup in DNS
- **eth0.1859:3**: 3rd Oracle SCAN IP Setup in DNS
- **hsi0.1**: Oracle HA IP Redundant Interconnect
Oracle Automatic Memory – MEMORY_TARGET

- New memory parameter **MEMORY_TARGET** (AMM – Automatic Memory management)

- Combines ASMM (Automatic Shared Memory Management) parameters SGA_TARGET and PGA_AGGREGATE_TARGET

- If setting **MEMORY_TARGET** too large you may see…
  
  **ORA-00845:** MEMORY_TARGET not supported on this system
  
  Oracle alert log shows:
  
  WARNING: You are trying to use the MEMORY_TARGET feature. This feature requires the /dev/shm file system to be mounted for at least 847249408 bytes.

- The error is really that the **MEMORY_TARGET** needs a larger /dev/shm

  Run the following to resize tmpfs:
  
  ```bash
  # umount tmpfs
  # mount -t tmpfs shmfs -o size=1300m /dev/shm
  # df -k /dev/shm
  Filesystem 1K-blocks Used Available Use% Mounted on
  shmfs 1331200 0 1331200 0% /dev/shm
  ```

  *** make permanent in the /etc/fstab file or startup file.***
Oracle 11gR2 – Changes in Mutex Locking

11gR2 Experience -> If using cursor_sharing = “FORCE” or “SIMILAR”

1) ORA-600 errors as workload increases [kkspsc0: basehd] or [kgILockOwnersListAppend-ovf] - applied patches to address

2) AWR showing -> cursor: mutex S and library cache lock
   1. Download and apply the 11.2.0.2.3PSU Patch 11724916
   2. Enable event 106001 to address Bug 10187168.
      To enable the fix "_cursor_features_enabled" needs to be set

3) Oracle 11.2.0.2.2 PSU (Patch Set Update) includes new parameters that you can tweak based on workload characteristics. Even more fixes have been added

   Note: 10411618 - Enhancement to add different "Mutex" wait schemes [ID 10411618.8]

4) 11.2.0.3 Has even more Mutex enhancement’s
PAV Support

Overview

- z/VM provides support for the Parallel Access Volumes (PAV) feature of IBM System Storage subsystems.
- With PAV, a real DASD volume is accessed through a Base subchannel (device) and one or more Alias subchannels.
  - Volume (represented by Base) shadowed by 1 or more Aliases
  - Looks like multiple separate, real DASD to host operating system

![Diagram of DASD E100-E102 accessing same data]
Oracle I/O Performance Tips:

1) I/O scheduler on Red Hat - `zipl.conf parameters"elevator=noop"` helps with reducing cpu usage.

2) Reduce Read ahead for LVM file systems containing Oracle datafiles only.
   `lvchange -r none <lv device name>`
   `lvdisplay /dev/oradb-vg/oradb-lv`

3) Oracle parameter – `_fastpin_enable=1` will result in utilizing "Consistent Gets from cache (fast path)"

4) Oracle Parameters that can reduce cpu 5-10% 
   `statistics_level = 'basic'`
   `timed_statistics=TRUE`

Dynamic, effects the total data used on AWR reports, **can reduce cpu utilization by 5-10%**
Oracle 11gR2 Features with Linux on System z
Oracle Real Application Testing:

Record Production Load on Test System and Replay on Another System:

![Graph showing capture and replay times with statistics]

Network Time (hh:mm:ss) 111:12:22
Think Time (hh:mm:ss) 01:20:39
Clients 5
Clients Finished 5

**Replay Statistics**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Replay</th>
<th>Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB Time</td>
<td>101113.652 seconds</td>
<td>345295.467 seconds</td>
</tr>
<tr>
<td>Average Active Sessions</td>
<td>14.98</td>
<td>13.79</td>
</tr>
<tr>
<td>User calls</td>
<td>37189662</td>
<td>96100235</td>
</tr>
<tr>
<td>Network Time</td>
<td>400342.054 seconds</td>
<td>N/A</td>
</tr>
<tr>
<td>Think Time</td>
<td>4838.536 seconds</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Capture Considerations

• Planning:
  • Adequate disk space for captured workload (binary files) with nfs read-write
  • Database restart is needed (care is needed)
    • Startup restrict
      • Capture will un-restrict
      • If RAC Start on one node – other nodes down then bring other nodes up.
  • A way to restore database for replay purposes:
    • Physical restore (scn/time provided)
    • Logical restore of application data
    • Flashback/snapshot-standby
  • Filters can be specified to capture subset of workload.

• Overhead:
  • Performance overhead ~ 4.5%
  • Memory overhead : 64 KB per session
  • Disk space
Oracle Real Application Testing - Replay Workload Wizard

Replay Workload: Customize Options

- Database: orcl
- Capture Name: capturejfv1
- Logged In As: SYS

Some replay parameters can be modified to change the behavior of the replay. Refer to system documentation for more information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>synchronization</td>
<td>This parameter determines if synchronization will be used during workload replay. If this parameter is set to TRUE, the COMMIT order in the captured workload will be preserved during replay and all replay actions will be executed only after all dependent COMMIT actions have completed. The default value is TRUE.</td>
<td>TRUE</td>
</tr>
<tr>
<td>connect_time_scale</td>
<td>This parameter scales the elapsed time from when the workload capture started to when the session connects with the specified value and is interpreted as a % value. The default value is 100.</td>
<td>100 %</td>
</tr>
<tr>
<td>think_time_scale</td>
<td>This parameter scales the elapsed time between two successive user calls from the same session and is interpreted as a % value. Setting this parameter to 0 will send user calls to the database as fast as possible during replay. The default value is 100.</td>
<td>100 %</td>
</tr>
<tr>
<td>think_time_auto_correct</td>
<td>This parameter reduces the think time if workload replay goes slower than workload capture. If this parameter is set to TRUE, the system will correct the think time (based on the think_time_scale parameter) between calls when user calls take longer to complete during replay than during capture. The default value is TRUE.</td>
<td>TRUE</td>
</tr>
</tbody>
</table>
Database Migration With Transportable Database / Tablespaces

• Transportable Databases Methodology is the easiest if DB is same “endian binary format”, AIX, Solaris, HP-UX, Linux on System z are all Big.

• Transportable tablespaces is another methodology which can be used when going from Little Endian to Big Endian.
Transportable Tablespace Suggestions

- Perform an Assessment of the source database.
  
  ```sql
  select * from nls_database_parameters where parameter like '%SET%';
  NLS_NCHAR_CHARACTERSET    AL16UTF16
  NLS_CHARACTERSET          AL32UTF8
  ```

  **When you create your target database you will need to create with these values.

- Are the tables in the transportable set that use TIMESTAMP WITH TIMEZONE (TSTZ) columns?
  
  ```sql
  col name for a24
  col value$ for a10
  select name, value$ from props$ where name = 'DST_PRIMARY_TT_VERSION';
  ```

  - Source DB:

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DST_PRIMARY_TT_VERSION</td>
<td>14</td>
</tr>
</tbody>
</table>
Transportable Tablespace Check

BEGIN
   SYS.dbms_tts.transport_set_check
   ('USERS, DAVE', incl_constraints=>TRUE,
    full_check=>TRUE);
END;
/

SELECT * FROM TRANSPORT_SET_SET_VIOLATIONS;
   no rows selected
Additional Migration Tip

• If Possible perform SAN Disk Replication between Source and Target for the migration file system.

  • Went from 60 hours with NFS mount to 12 hours by unmounting the transporatable filesystem, performing a SAN replication, and then remounting opposed to using Network.
Single Client Access Name (SCAN) - Easier Configuration

Without a SCAN (pre-11g Rel. 2) - TNSNAMES entry *1 entry per node*

With a system change, all client TNSNAMES would need to be changed

```
ORACLASS =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = orausr07)(PORT = 1521))
      (ADDRESS = (PROTOCOL = TCP)(HOST = orausr08)(PORT = 1521))
      ...
      (ADDRESS = (PROTOCOL = TCP)(HOST = orausr17)(PORT = 1521))
      (CONNECT_DATA =
        ... )))
```

With SCAN only *1 entry per cluster* is used, regardless of # of nodes:

```
ORACLASS =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ORACLASS-SCAN)(PORT = 1521))
      (CONNECT_DATA =
        ... )))
```
<table>
<thead>
<tr>
<th>LPAR 1</th>
<th>LPAR 2</th>
<th>LPAR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux Guest</td>
<td>Linux Guest</td>
<td>Linux Guest</td>
</tr>
<tr>
<td>Singl Inst 1</td>
<td>Singl Inst 2</td>
<td>Singl Inst 2</td>
</tr>
<tr>
<td>Singl Inst 3</td>
<td>Singl Inst 3</td>
<td>Singl Inst 3</td>
</tr>
<tr>
<td>Singl Inst 4</td>
<td>Singl Inst 4</td>
<td>Singl Inst 4</td>
</tr>
<tr>
<td>Singl Inst 5</td>
<td>Singl Inst 5</td>
<td>Singl Inst 5</td>
</tr>
</tbody>
</table>

Oracle Clusterware

ASM

z/VM

z/OS

- Patch Oracle binaries, modify Linux parameters, etc..

Groups

shared storage

OCR and Voting
Oracle RAC One Node – deployment Omotion

LPAR 1

LPAR 2

Oracle Clusterware

LPAR 3

Singl Inst 1

Singl Inst 2

Singl Inst 3

Singl Inst 4

Singl Inst 5

ASM Disk Groups

• Restart Instance Service

shared storage

OCR and Voting

Linux Guest

ASM

z/VM

z/VM

z/VM

z/OS
RAC ONE – Transparent Application Failover - TAF

• Oracle Support Note – **453293.1**

• Step that needs to be configured Post Install of Clusterware, or else failover will not work properly.

```
srvctl modify service -d test -s testone -P BASIC -e SELECT -z 180 -w 5 -m BASIC -j SHORT
```

*** Demo of Oracle RAC ONE with IBM Linux on System z ***
Thank You