

# Exadata Patching Demystified

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# About Me

- Director & Founder of DB Alchemist Limited
- Member of an elite group of Oracle Professionals by successful completion of Oracle Certified Master (11g & 12c OCM)
- My Profile has been published on Oracle Website (<http://education.oracle.com/education/otn/KJoy.htm>)
- An Oracle Certified Expert (OCE) : Exadata Administration
- Having 15+ Years of Experience as Oracle Consultant
- Specialization in Oracle Exadata , ZFS , ZDLRA, RAC, ASM , Dataguard , Performance Tuning
- Key Clients :



# EXADATA Experience



- Managing & Administering Exadatas with multi-terabytes of data warehouses at Major Banks / Financial institutions.
- Worked on different flavors of Exadata (2-Socket/ 8 Socket) : X2,X3,X4,X5,X6
- Worked on setup of Storage Expansion racks for growing the storage capacity and bandwidth of in-house Exadata Machines.
- Configuring, Maintaining & troubleshooting Exadata Storage including Exadata Celldisks, Grid Disks
- Migration of Databases from Non-Exadata to Exadata platform.
- Setup of Oracle ZFS and configuration of dNFS for storage of Backups on ZFS filesystems.
- Patching complete Stack of Exadata including Compute nodes, Infinibands , Storage Servers on Full Rack Exadata Servers.
- Troubleshooting Exadata Smart scan / Query offloading issues.
- Monitoring Exadata Storage Servers using Metrics, Alerts and Enterprise Manager.
- Oracle Zero Data Loss Recovery Appliance (ZDLRA) Management & Patching.



## How It would have Started !!



**And that's the Outcome !!!**



## **Evolution of Exadata**

### **Year 2008**

- Oracle plans to build an Open Hardware Stack Solution
- No Need for Proprietary Hardware
- Compete with the likes of Netezza & Teradata
- Oracle Launches Exadata V1 (**HP** Oracle Database Machine)

### **Year 2009**

- Acquisition of Sun Microsystems
- There was a U-turn on the idea of open solution
- Entire HP kit replaced by the Sun Kit.
- Oracle launches Exadata V2

# Journey of Exadata (2008 – 2017)

<b>•Exadata generation (2-socket)</b>	<b>V1</b>	<b>V2</b>	<b>X2-2</b>	<b>X3-2</b>	<b>X4-2</b>	<b>X5-2</b>	<b>X6-2</b>	<b>X7-2</b>
•Date introduced	Sep-08	Sep-09	Sep-10	Sep-12	Nov-13	Jan-15	Apr-16	Oct-2017
•Disk storage (raw TB)	168	336	504	504	672	1344	1344	1680
•Flash cache (raw TB)	N/A	5.3	5.3	22.4	44.8	89.6	179.2	358.4
•Compute cores	64	64	96	128	192	288	352	384
•Max memory (GB)	256	576	1,152	2,048	4,096	6,144	12,288	12,288
<b>•Exadata generation (8-socket)</b>	<b>N/A</b>	<b>N/A</b>	<b>X2-8</b>	<b>X3-8</b>	<b>X4-8</b>	<b>X5-8</b>	<b>X6-8</b>	<b>X7-8</b>
•Date introduced	N/A	N/A	Sep-10	Sep-12	Jul-14	Nov-15	Apr-16	Oct-2017
•Disk storage (raw TB)	N/A	N/A	504	504	672	1344	1344	1680
•Flash cache (raw TB)	N/A	N/A	5.3	22.4	89.6	89.6	179.2	358.4
•Compute cores	N/A	N/A	96	160	240	288	288	384
•Max memory (TB)	N/A	N/A	4	4	12	12	12	12

## Hollywood Debut of Exadata



# *The Exadata Stack*

# The Exadata Stack

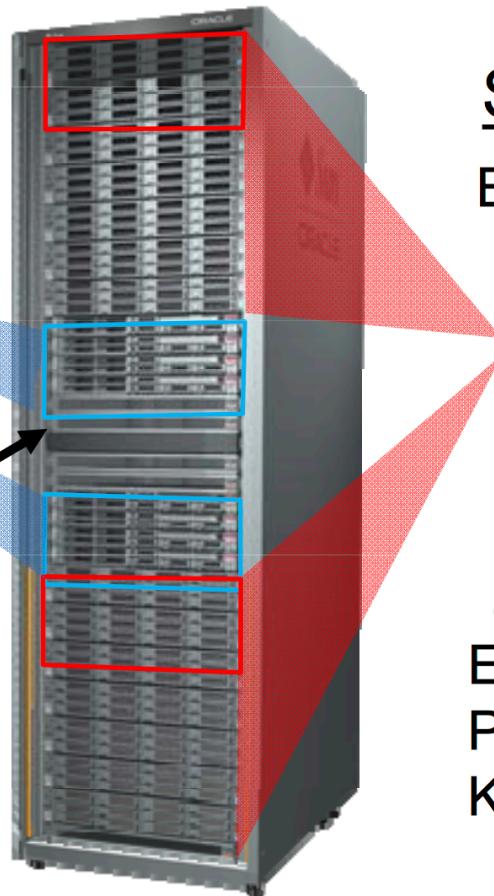
## Database Grid

Database Servers

- Firmware / OS
- Oracle GI / RDBMS

## InfiniBand Network

Switches



## Storage Grid

Exadata Storage Servers

## Other Components

Ethernet switch

Power distribution

KVM

# Exadata Master Note

- **Exadata Database Machine and Exadata Storage Server Supported Versions (Doc ID 888828.1)**

## Latest Releases and Patching News

Before upgrading, see the [Requirements for Exadata Feature Usage](#) section in this document for software requirements that may necessitate pre-upgrade patch application to other software in order to support specific Exadata features or patch application methods.

- New [QFSDP](#) release - Quarterly Full Stack Download Patch (QFSDP) Apr 2017
- New [Exadata 12.2.1.1.1 \(Note 2231247.1\)](#)
  - Before updating to this release review the following: 1) included software updates (e.g. UEK4 and InfiniBand switch software 2.2.5-3); 2) virtualized (OVM) database server update ordering requirement; 3) virtualized (OVM) database server Grid Infrastructure requirement, and; 4) ACFS UEK4 requirement
- New [Exadata 12.1.2.3.5 \(Note 2231245.1\)](#)
- New [12.1.0.2 Database release](#) - 12.1.0.2.170418 (Apr 2017) Database Proactive Bundle Patch
- New [11.2.0.4 Database release](#) - 11.2.0.4.170418 (Apr 2017) Database Patch for Exadata
- New [Oracle Exadata Deployment Assistant](#) (OEDA) release Apr 2017 - Supports 12.2.0.1, 12.1.0.2 (DBBP1-DBBP170418) and 11.2.0.4 (BP1-BP170418)
- New [Note 2217053.1](#) - RAC Rolling Install Process for the "Oracle JavaVM Component Database PSU" (OJVM PSU) Patches
- New [12.2.0.1 Database release](#)
- New [Exadata 12.1.2.4.0 \(Note 2207151.1\)](#) for Exadata SL6

## **QFSDP**

- The QFSDP contains the complete collection of current software patches, and will be released quarterly (JAN/APR/JUL/OCT)
- QFSDP releases contain the latest software for the following components:

### **Infrastructure**

- Exadata Storage Servers
- InfiniBand Switch
- Exadata Database Server
- Power Distribution Unit

### **Database**

- Oracle Database and Grid Infrastructure DBBP, PSU
- Oplan
- OPatch

## Exadata Versions: How the numbers Match Up

**12.2.1.1.5.171218.1**

- Product version (e.g. 12.2.1.1.5)
- Date Code in YYMMDD format (e.g. 171218)
- (optional) Oracle-internal build number (e.g. 1)



# *Cell Servers Patching*

# Components Updated

- ✓ Oracle Linux operating system
- ✓ Firmware (Flash, Disk, RAID controller, ILOM)
- ✓ Exadata software (“*The Secret Sauce*”)



# Cell Servers Patching

- ✓ Download and stage patch on compute node
- ✓ Create a file (cell\_group) to list all the cell server hostnames
- ✓ Unpack patch and check SSH connectivity
- ✓ `dcli -l root -g cell_group hostname -a`
- ✓ Run patch prerequisite check before applying
- ✓ `./patchmgr-cells cell_group -patch_check_prereq`
- ✓ Apply patch `./patchmgr-cells cell_group -patch`
- ✓ For rolling : `./patchmgr-cells cell_group -patch -rolling`
- ✓ Perform a cleanup
- ✓ `./patchmgr-cells cell_group -cleanup`
- ✓ `dcli -l root -g cell_group imageinfo | grep 'Active image version'`



# Storage Server Patching



Method	Downtime	Patch Install Time
Rolling	None	Up to 2 hours per cell
Non-rolling	Up to 2 hours in total	Up to 2 hours in total



Rolling	Non-Rolling
Does not require downtime	All Cells are done in parallel
Only 1 cell is affected in case of issues	All Databases must remain shutdown
Takes much longer	Much faster as compared to Rolling

# The Final Outcome

```
Kernel version: 2.6.39-400.294.1.el6uek.x86_64 #1 SMP Wed Jan 11 08:46:38 PST 2017
Cell version: OSS_12.1.2.3.4_LINUX.X64_170111
Cell rpm version: cell-12.1.2.3.4_LINUX.X64_170111-1.x86_64

Active image version: 12.1.2.3.4.170111
Active image kernel version: 2.6.39-400.294.1.el6uek
Active image activated: 2017-09-24 04:46:57 -0400
Active image status: success
Active system partition on device: /dev/md6
Active software partition on device: /dev/md8

Cell boot usb partition: /dev/sdml
Cell boot usb version: 12.1.2.3.4.170111

Inactive image version: 12.1.2.3.3.161208
Inactive image activated: 2017-08-13 01:41:43 -0400
Inactive image status: success
Inactive system partition on device: /dev/md5
Inactive software partition on device: /dev/md7

Inactive marker for the rollback: /boot/I_am_hd_boot.inactive
Inactive grub config for the rollback: /boot/grub/grub.conf.inactive
Inactive kernel version for the rollback: 2.6.39-400.286.3.el6uek.x86_64
Rollback to the inactive partitions: Possible
```



# *Compute Node Patching*

## Compute Node Patching

- Old Method
  - ./dbnodeupdate.sh -u -l p20746761\_121211\_Linux-x86-64\_neu.zip
  - ./dbnodeupdate.sh -c
- New Method
  - ./patchmgr -dbnodes /home/oracle/dbs\_group -upgrade -iso\_repo p25463013\_122110\_Linux-x86-64.zip -target\_version 12.2.1.1.0.170126.2

## What Happens Behind the Scenes...

- ✓ Collecting files & executing commands
- ✓ Checking Filesystem Labels
- ✓ Unzip the Patch file into an iso file
- ✓ Mounting the Inactive LVM
- ✓ Performing a Backup of root filesystem & /boot
- ✓ Performing yum update
- ✓ Reboot of the compute node
- ✓ Dbnodeupdate.sh : completion step to start the clusterware services

## A Powerful Utility : dbnodeupdate.sh

- ✓ Creates log file to track script execution and changes
- ✓ Creates diag file with 'before patching' situation
- ✓ Creates and runs the backup utility
- ✓ Checks space requirements of /boot filesystem
- ✓ Includes 'check-only' option
- ✓ Relinks all Database and Grid Infrastructure (GI) Homes
- ✓ Enables / disables GI to stop/start
- ✓ Validates provided media (zip, http)
- ✓ Validates user input
- ✓ Provides rollback option
- ✓ Checks for free space in "/"

# Steps to be executed

```
Active Image version      : 12.1.2.3.3.161109
Active Kernel version     : 2.6.39-400.286.3.el6uek
Active LVM Name          : /dev/mapper/VGExaDb-LVDbSys1
Inactive Image version    : 12.1.2.1.2.150617.1
Inactive LVM Name         : /dev/mapper/VGExaDb-LVDbSys2
Current user id          : root
Action                   : upgrade
Upgrading to              : 12.1.2.3.4.170111 (to exadata-sun-computenode-exact)
Baseurl                  :
file:///var/www/html/yum/unknown/EXADATA/dbserver/180917141225/x86_64/ (iso)
Iso file                 :
/radump/ospatch_bk/iso.stage/exadata_ol6_base_repo_170111.iso
Create a backup            : Yes
Shutdown EM agents        : Yes
Shutdown stack             : No (Currently stack is up)
Missing package files     : Not tested.
RPM exclusion list        : Not in use (add rpms to
/etc/exadata/yum/exclusion.lst and restart dbnodeupdate.sh)
RPM obsolete lists         : /etc/exadata/yum/obsolete_nodeps.lst,
/etc/exadata/yum/obsolete.lst (lists rpms to be removed by the update)
                                         : RPM obsolete list is extracted from exadata-sun-
computenode-12.1.2.3.4.170111-1.noarch.rpm
Exact dependencies         : No conflicts
Minimum dependencies       : No conflicts
LogFile                   : /var/log/cellos/dbnodeupdate.log (runid:
180917141225)
Diagfile                  : /var/log/cellos/dbnodeupdate.180917141225.diag
Server model               : ZDLRA (ORACLE SERVER X5-2)
dbnodeupdate.sh_rel.       : 5.170804 (always check MOS 1553103.1 for the latest
release of dbnodeupdate.sh)
Note                      : After upgrading and rebooting run './dbnodeupdate.sh
-c' to finish post steps.
```

## Behaviour of Non-Rolling upgrades

- ✓ If a node fails at the pre-check stage, the whole process fails.
- ✓ If a node fails at the patch stage or reboot stage, patchmgr skips further steps for the node. The upgrade process continues for the other nodes.
- ✓ The pre-check stage is done serially.
- ✓ The patch/reboot and complete stages are done in parallel.

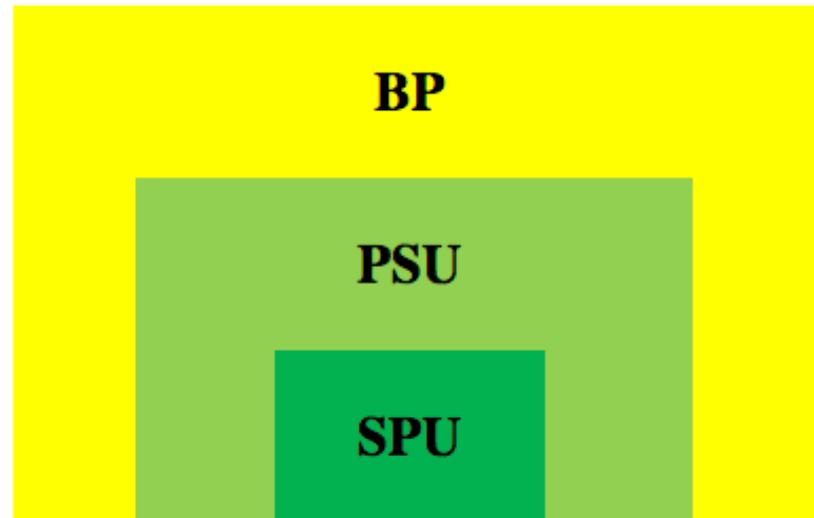
## Exadata Database Server Patching (GI & DB)

### Bundle Patches

- Installs on the top of Base release + Patchset
- Installed using the opatch utility
- It's a cumulative patch
- Includes the recent CPU/PSU
- It comprises of the GI PSU & DB PSU



# Why so many Patches ??



\* From Oracle 12.2 onwards now we have a new terminology RU & RUR's

# *Infiniband Patching*



## Infiniband Patching

- InfiniBand network connects the database servers and Exadata Storage Servers
- Switch firmware is upgraded in a rolling manner.
- If a spine switch is present in the rack, then the spine switch is upgraded first.
- `./patchmgr -ibswitches ibswitches.lst -upgrade -ibswitch_precheck`
- `./patchmgr -ibswitches ibswitches.lst -upgrade`

## Exadata Upgrade from 12.1 to 12.2

Run Exachk and fix any issues

Configure a Blackout on Grid Control

Perform a Backup of All compute nodes

### Grid Infrastructure : Latest DBBP

Apply the latest DBBP (like JAN 2017) to the existing GI -> 12.1.0.2.160419

### Patching Cell Servers

Shutdown Databases

Stop Clusterware Services

Check the Pre-reqs

Apply the Patch

Check the new imageversion

### Patching Compute Nodes

Run Pre-Check

Fix all errors reported

Run the Upgrade using patchmgr utility

Check the imageversion

Install rpms required for 3rd Party Products

### Patching the Infiniband Switches

Run Pre-Req checks

Run Upgrade

Verify

### Grid Infra Upgrade

Unzip the Grid Infra software to a new ORACLE\_HOME

Run Pre-checks like cluvfy

Run /gridSetup.sh

Run rootupgrade.sh

Check the version of Clusterware

New Weapon !!



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