



*Automated patching* : Pivot from Manual  
to Scalable with Oracle Database Lifecycle  
Management Pack

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MTS-2 Database Engineering, Database Platform Security

## About me

- Oracle Technologist since 1995
- Specialist in RAC, VLDB, Golden Gate & 24x7 installations
- Managed Large Oracle ERP programs as program manager
- Varied responsibilities at Paypal including DB engineering/architecture/operations
- MongoDB/Cassandra/Couchbase

## About Paypal

- Oracle powers our transactional data
- One of the largest private clouds in the world
- 16PB stored on Oracle
- 10+ TB streamed daily via Goldengate
- **200+** million active accounts

Two decades ago, our founders invented payment technology to make buying and selling faster, secure, and easier—and put economic power where it belongs: *In the hands of people.*

# Global scale



Our customers can accept payments in > 100 currencies, withdraw funds to their bank accounts in 50 currencies, and hold balances in their PayPal accounts in 25 currencies.

Almost 8,000 PayPal team members provide 20 support to our customers in over languages.

We are a trusted part of people's financial lives and a partner to merchants in 200+ markets around the world.

# Business Challenge of Compliance & Configuration

Increasing burden of responding to internal and external audits and enforcing standards



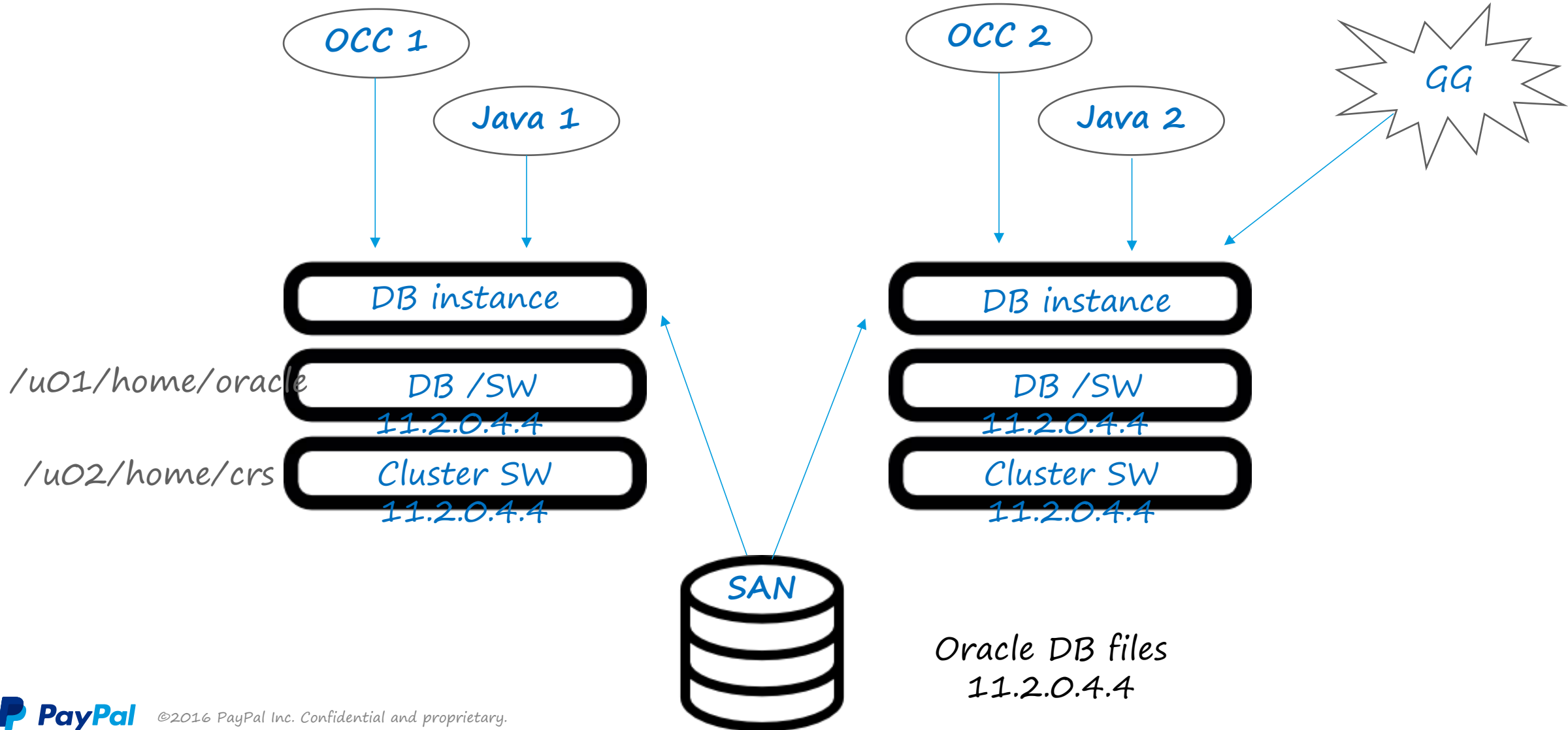
- *Initial deployment via gold images radically reduced build times*
- *Patching remained an enormous business challenge*
- *Aside from availability impacts, required 4-8 hours of dedicated DBA time per cluster*

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1. Typical Paypal Database Environment
2. Patching an Oracle DB at Paypal
3. Critical facets of a Patching Experience
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6. Discuss Fleet Management

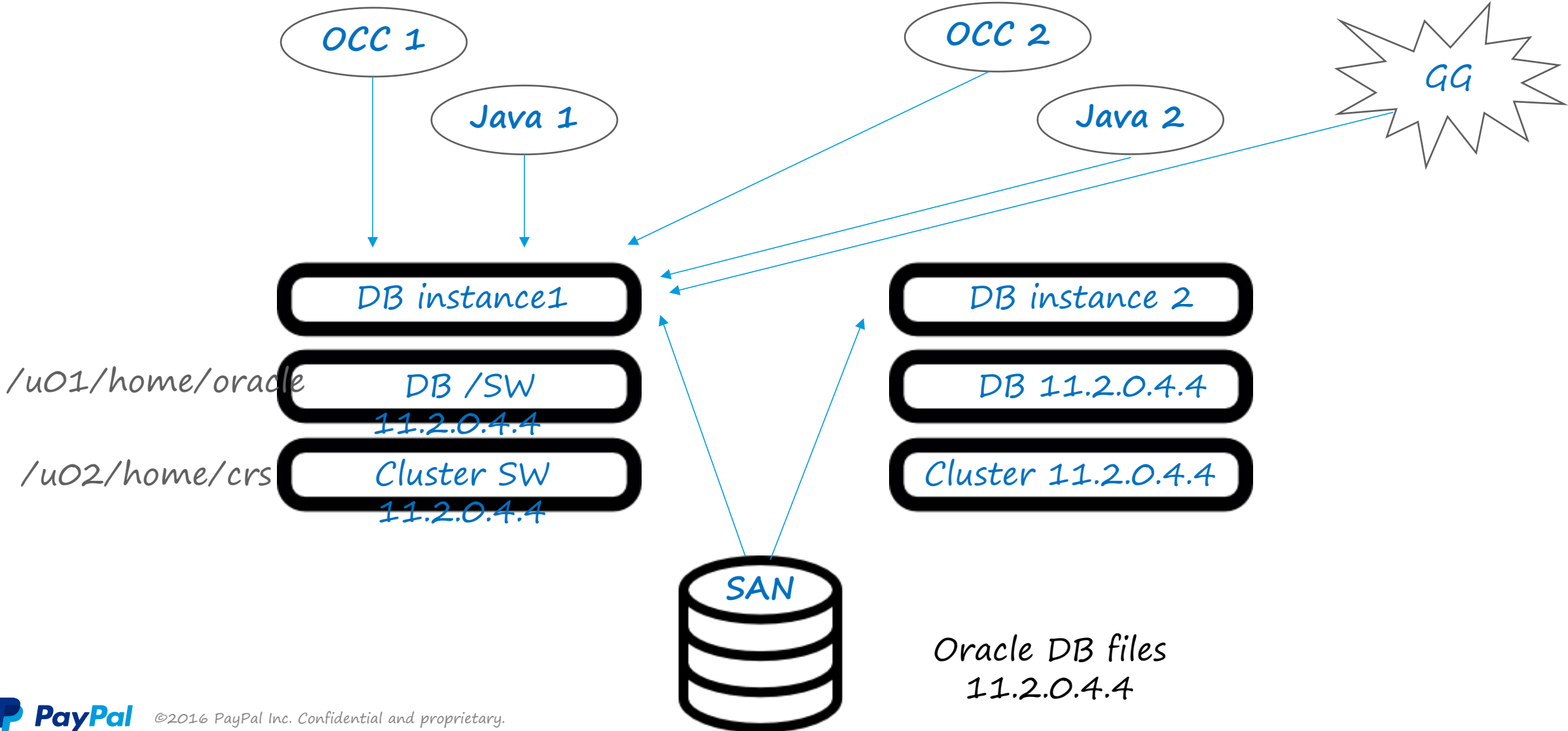
# RAC RAC Everywhere : A basic Oracle DB @ Paypal



# Patching a DB : Rolling patching is a must to ensure 100% availability

112044

112049

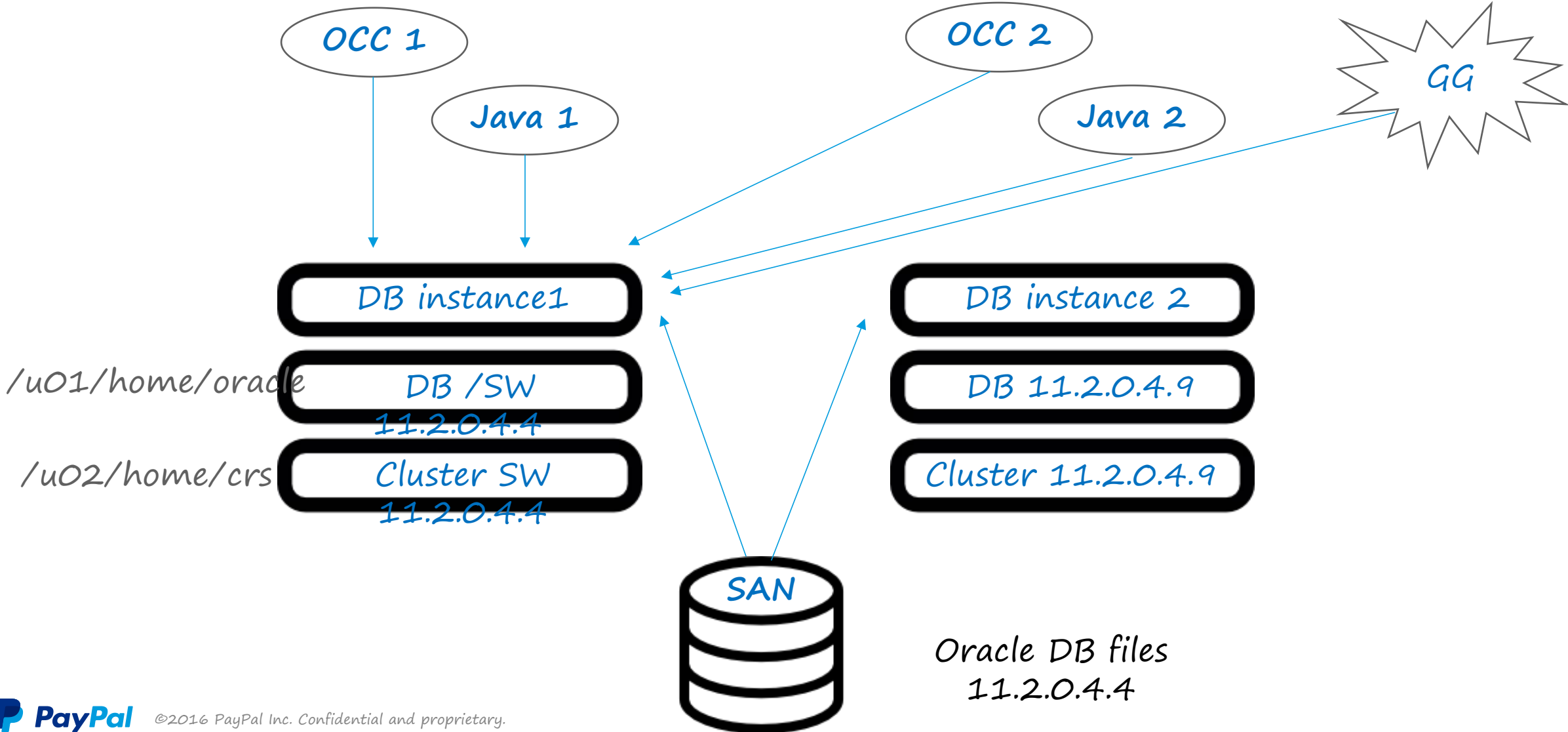




# Patching a DB : Rolling patching is a must to ensure 100% availability

112044

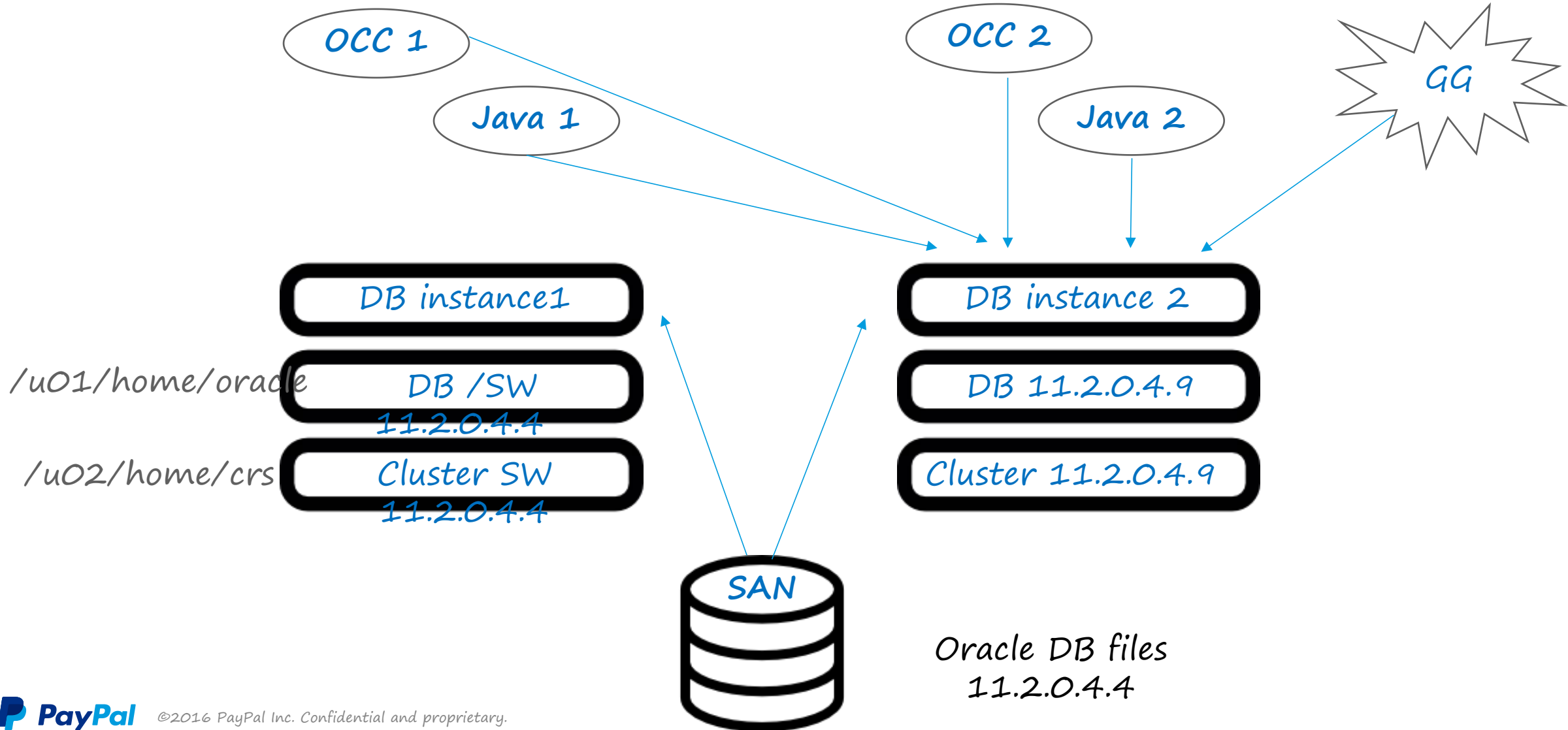
112049



# Patching a DB : Rolling patching is a must to ensure 100% availability

112044

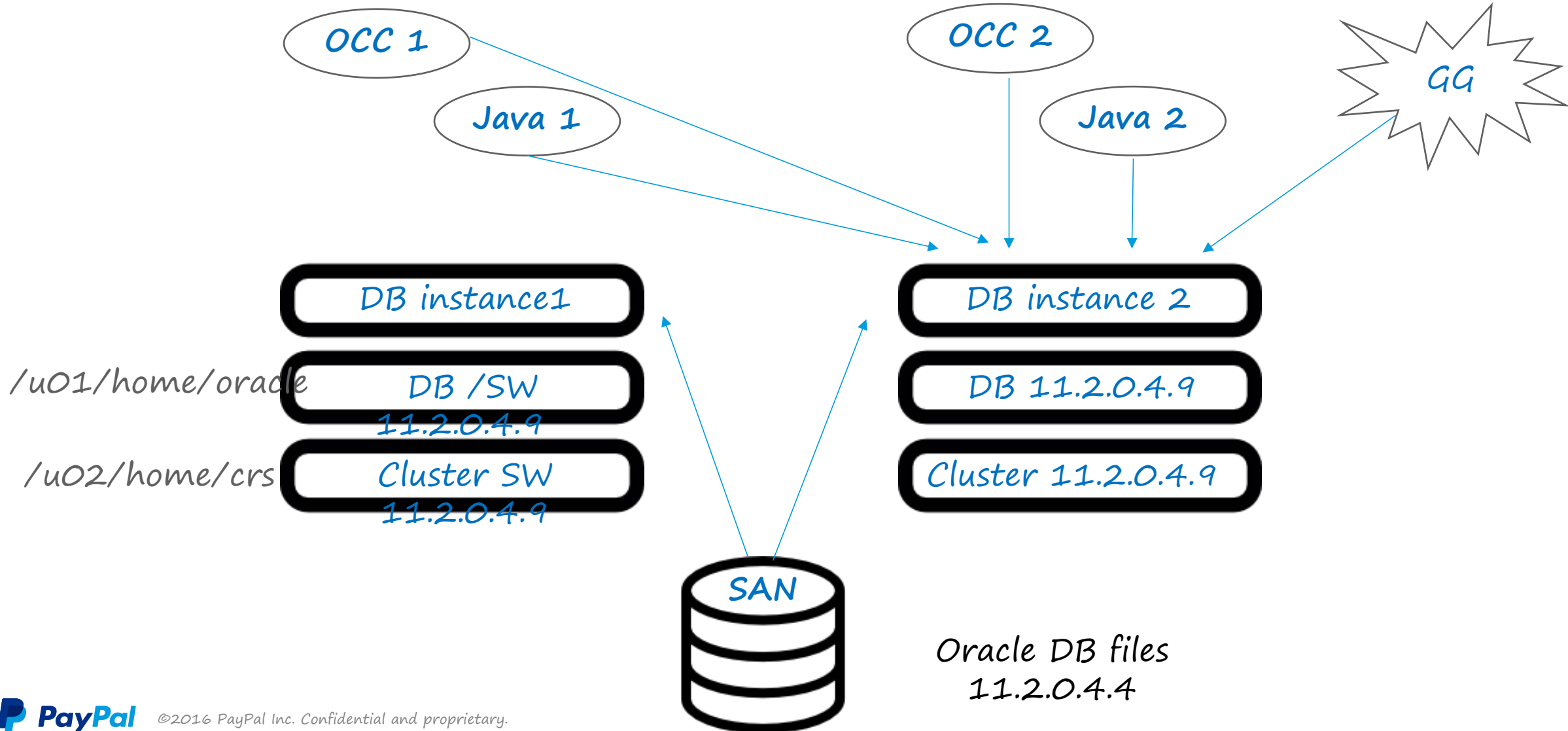
112049



# Patching a DB : Rolling patching is a must to ensure 100% availability

112044

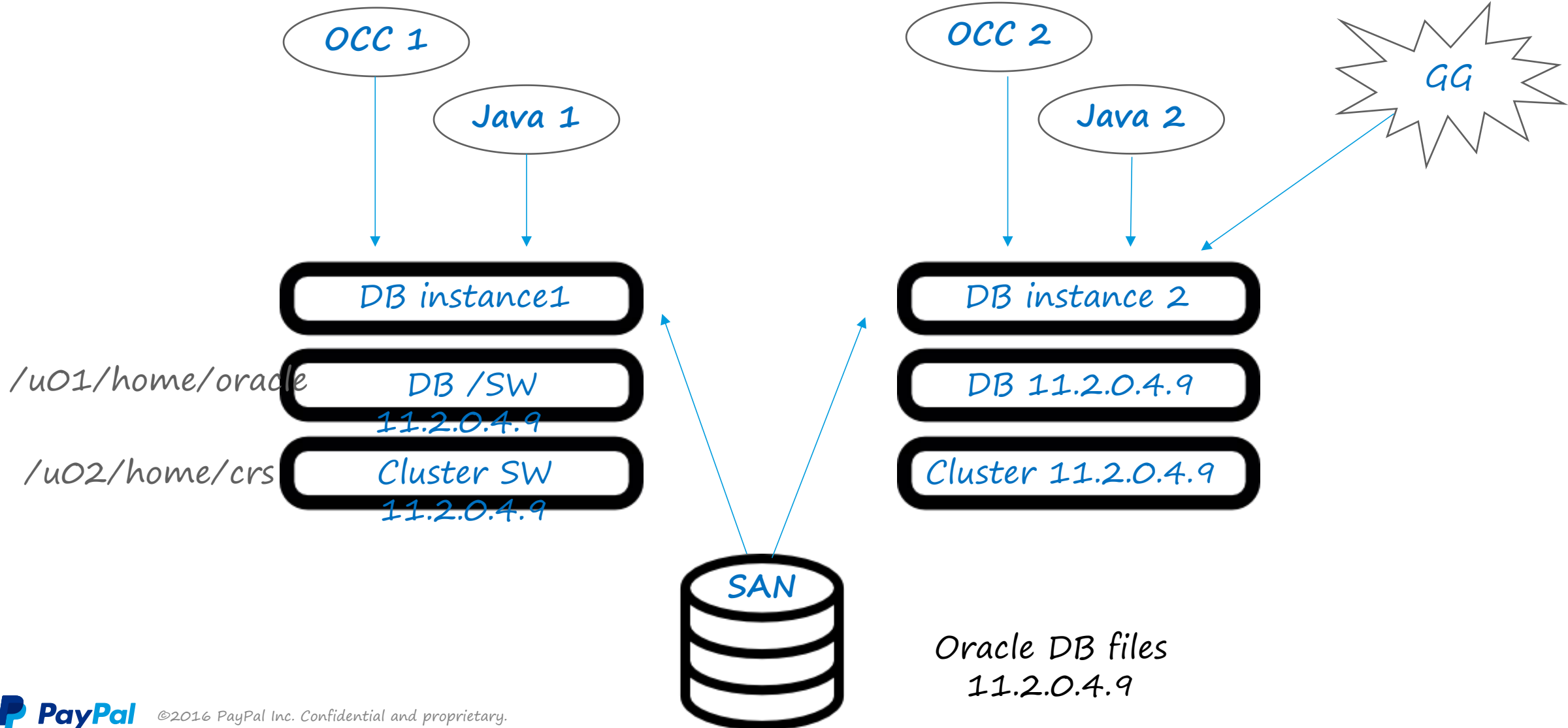
112049



# Patching a DB : Rolling patching is a must to ensure 100% availability

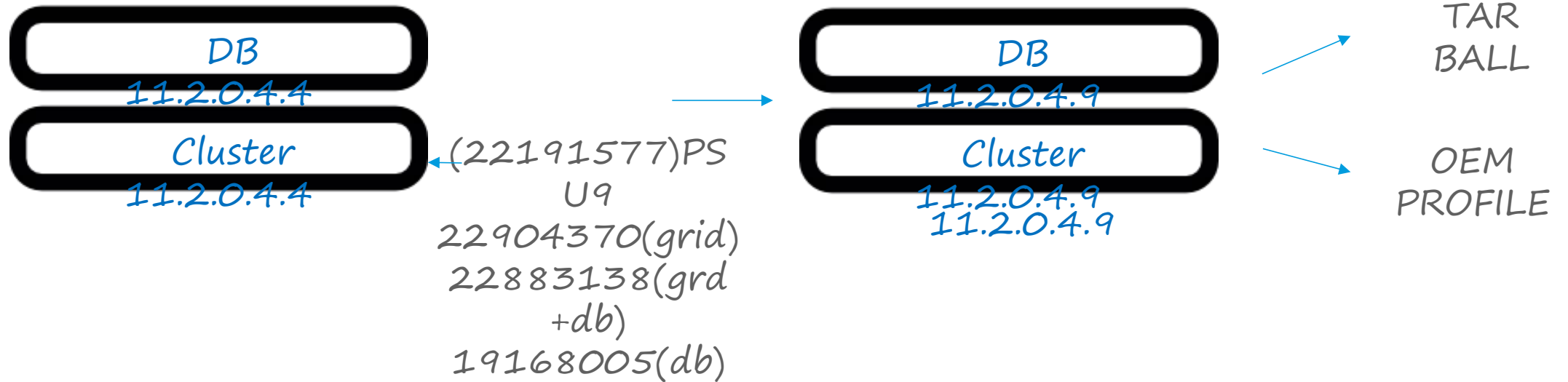
112044 →

112049



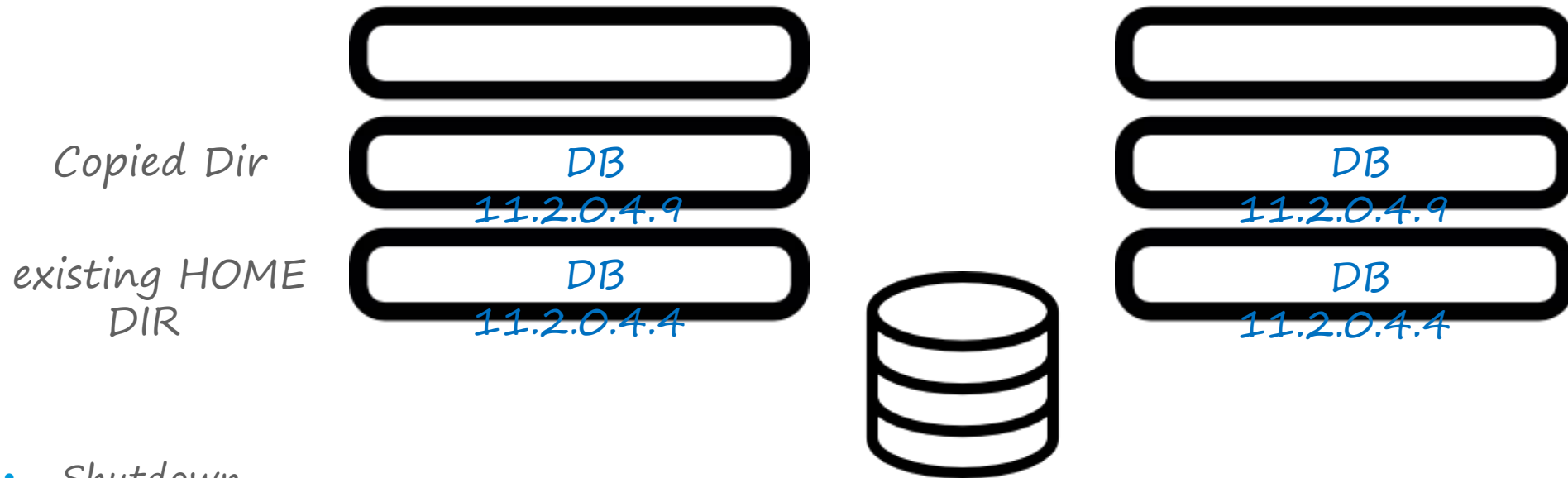
# Manual Patching – Creating a Gold Image

- SOLARIS      \* PRIMARY
- LINUX        \* ADGRO



# Manual-Patching

Using the TAR BALL/PROFILE deployment



- Shutdown
- Move 11204 11204\_OLD
- Move 112049 11204
- Copy 11204\_OLD/Config files
- Start CRS
- Start DB

11204/Config

- Using OEM profile to deploy new dir (but keeping HOME dir same) necessitates running clone.pl



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## Technical Challenges to delivering successful automation

1. Application connections rolls are a significant challenge (OCC/Java pools/ GG)
2. Brown-outs due to reconfiguration at instance startup/stop, necessitate minimum no of stops/starts
3. Exact moment of startup/stop db instance need to be controlled
4. Patching GRID+ DB Home required db owner /super user privileges
5. PSU patching is actually PSU++ Patching

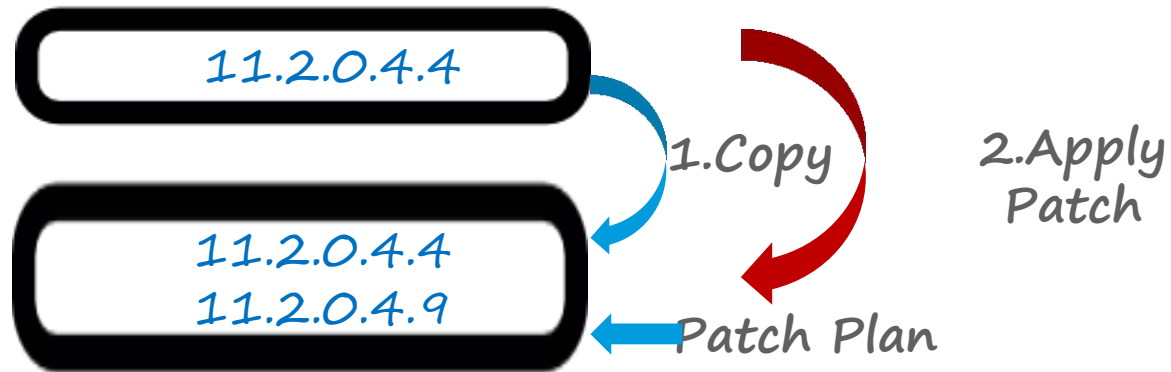
PayPal version will have for example:

PSU patch &

- 5 additional "cluster + DB" patches
- 2 cluster only patches
- 4 DB only patches

# OEM – Patching Plan

- *Advantages:*
  - OEM has inbuilt procedures for fine-grained control of each step including DB start/stop
  - OEM has all the metadata/admin framework readily available, including methods for allowing limited root access
- Patching Plan – Out of place patching



- Stop database instance
- Point to 112049 home
- Start database instance



# Issues with Patching Plan

1. Cannot combine multiple patches with one patching plan -a problem for PSUs with MLRs added
2. Does not use a standard gold image, so end state is neither guaranteed nor stable.
3. Out of place patching changes home name
4. One-off , piecemeal patching.

# Automation with Scripts

1. Total Control
2. Uses OEM framework. Gold Image deployment is the core strategy
3. Can be submitted with a wrapper OEM job
4. Lets us keep the same HOME name

## Cons

- Need to push the scripts to every node being patched and manage those deployments

# OEM Job & scripts

The screenshot displays the Oracle Enterprise Manager Cloud Control 12c interface. The main content area shows a job execution report for a target named 'paypal.com'. The report is a table with columns for 'Select', 'Name', 'Targets', 'Status', 'Started', 'Ended', and 'Elapsed Time'. The job is titled 'Execution: paypal.com' and has a status of 'Succeeded'. Below this, a list of tasks is shown, all of which are 'Succeeded'. The tasks include 'ORA\_PATCH\_READINESS\_VFY\_00', 'ORA\_INIT\_CHECKPOINT\_01', 'ORA\_STOP\_SERVICES\_02', 'ORA\_CHECK\_SERVICES\_CHECKPOINT\_03', 'ORA\_MOVE\_OCC\_04', 'ORA\_STOP\_GG\_05', 'ORA\_PRE\_DBSTOP\_CHECKPOINT\_06', 'ORA\_STOP\_DB\_07', 'ROOT\_SWITCH\_CRS\_08', and 'ORA\_RELINK\_CRS\_09'. The elapsed times for these tasks range from 2 seconds to 7.8 minutes. At the bottom of the report, there is a 'Log Report' button and a set of action buttons: 'Delete Run', 'Create Like', 'Edit', and 'View Definition'.

Select	Name	Targets	Status	Started	Ended	Elapsed Time
<input type="radio"/>	▼ All Executions					
<input checked="" type="radio"/>	▼ Execution: paypal.com	paypal.com	Succeeded	Nov 9, 2016 12:00:10 PM GMT-08:00	Nov 9, 2016 12:12:35 PM GMT-08:00	12.4 minutes
	Previous					
<input type="radio"/>	▶ Task: ORA_PATCH_READINESS_VFY_00	paypal.com	Succeeded	Nov 9, 2016 10:56:53 AM GMT-08:00	Nov 9, 2016 10:58:06 AM GMT-08:00	1.2 minutes
<input type="radio"/>	▶ Task: ORA_INIT_CHECKPOINT_01	paypal.com	Succeeded	Nov 9, 2016 10:58:06 AM GMT-08:00	Nov 9, 2016 10:58:08 AM GMT-08:00	2 seconds
<input type="radio"/>	▶ Task: ORA_STOP_SERVICES_02	paypal.com	Succeeded	Nov 9, 2016 10:58:08 AM GMT-08:00	Nov 9, 2016 10:59:05 AM GMT-08:00	56 seconds
<input type="radio"/>	▶ Task: ORA_CHECK_SERVICES_CHECKPOINT_03	paypal.com	Succeeded	Nov 9, 2016 10:59:05 AM GMT-08:00	Nov 9, 2016 10:59:25 AM GMT-08:00	19 seconds
<input type="radio"/>	▶ Task: ORA_MOVE_OCC_04	.paypal.com	Succeeded	Nov 9, 2016 10:59:25 AM GMT-08:00	Nov 9, 2016 10:59:30 AM GMT-08:00	5 seconds
<input type="radio"/>	▶ Task: ORA_STOP_GG_05	.paypal.com	Succeeded	Nov 9, 2016 10:59:30 AM GMT-08:00	Nov 9, 2016 10:59:33 AM GMT-08:00	3 seconds
<input type="radio"/>	▶ Task: ORA_PRE_DBSTOP_CHECKPOINT_06	paypal.com	Succeeded	Nov 9, 2016 11:04:01 AM GMT-08:00	Nov 9, 2016 11:08:39 AM GMT-08:00	4.6 minutes
<input type="radio"/>	▶ Task: ORA_STOP_DB_07	.paypal.com	Succeeded	Nov 9, 2016 11:08:39 AM GMT-08:00	Nov 9, 2016 11:10:49 AM GMT-08:00	2.2 minutes
<input type="radio"/>	▶ Task: ROOT_SWITCH_CRS_08	.paypal.com	Succeeded	Nov 9, 2016 11:10:49 AM GMT-08:00	Nov 9, 2016 11:20:13 AM GMT-08:00	9.4 minutes
<input type="radio"/>	▶ Task: ORA_RELINK_CRS_09	.paypal.com	Succeeded	Nov 9, 2016 11:20:13 AM GMT-08:00	Nov 9, 2016 11:28:02 AM GMT-08:00	7.8 minutes
	Next 11 - 18 of 18					

# OEM Job & scripts

The screenshot displays the Oracle Enterprise Manager Cloud Control 12c interface. The browser address bar shows the URL `/em/faces/sdk/nonFac` and the page title is "Job Run: 11204 PSU PATCHL...". The main navigation bar includes "Enterprise", "Targets", "Favorites", and "History". A search bar for "Search Target Name" is visible.

The "Job" section is active, showing a table of job execution details. The table has columns for "Select", "Name", "Targets", "Status", "Started", "Ended", and "Elapsed Time". The main execution is "Execution: paypal.com" with a status of "Succeeded" and an elapsed time of 12.4 minutes. Below it, a list of tasks is shown, all with a status of "Succeeded".

Select	Name	Targets	Status	Started	Ended	Elapsed Time
<input type="radio"/>	▽ All Executions					
<input checked="" type="radio"/>	▽ Execution: paypal.com	... .paypal.com	Succeeded ⓘ	Nov 9, 2016 12:00:10 PM GMT-08:00	Nov 9, 2016 12:12:35 PM GMT-08:00	12.4 minutes
	<a href="#">Previous 1 - 10 of 18</a>					
<input type="radio"/>	▷ Task: ROOT_START_CRS_10	.paypal.com	Succeeded	Nov 9, 2016 11:28:02 AM GMT-08:00	Nov 9, 2016 11:31:52 AM GMT-08:00	3.8 minutes
<input type="radio"/>	▷ Task: ORA_SWITCH_DB_HOME_11	.paypal.com	Succeeded	Nov 9, 2016 12:00:10 PM GMT-08:00	Nov 9, 2016 12:10:19 PM GMT-08:00	10.2 minutes
<input type="radio"/>	▷ Task: ROOT_RUN_DBROOT_12	.paypal.com	Succeeded	Nov 9, 2016 12:10:19 PM GMT-08:00	Nov 9, 2016 12:10:23 PM GMT-08:00	4 seconds
<input type="radio"/>	▷ Task: ORA_CHECKPOINT_AND_START_DB_13	.paypal.com	Succeeded	Nov 9, 2016 12:10:23 PM GMT-08:00	Nov 9, 2016 12:12:24 PM GMT-08:00	2 minutes
<input type="radio"/>	▷ Task: ORA_RUN_POST_PATCH_SQL_14	.paypal.com	Succeeded	Nov 9, 2016 12:12:24 PM GMT-08:00	Nov 9, 2016 12:12:27 PM GMT-08:00	3 seconds
<input type="radio"/>	▷ Task: ORA_START_GG_15	paypal.com	Succeeded	Nov 9, 2016 12:12:27 PM GMT-08:00	Nov 9, 2016 12:12:30 PM GMT-08:00	3 seconds
<input type="radio"/>	▷ Task: ORA_START_SERVICES_16	paypal.com	Succeeded	Nov 9, 2016 12:12:30 PM GMT-08:00	Nov 9, 2016 12:12:33 PM GMT-08:00	3 seconds
<input type="radio"/>	▷ Task: ORA_FINAL_CHECKPOINT_17	paypal.com	Succeeded	Nov 9, 2016 12:12:33 PM GMT-08:00	Nov 9, 2016 12:12:35 PM GMT-08:00	2 seconds
	Next					

At the bottom right of the job details, there are buttons for "Delete Run", "Create Like", "Edit", and "View Definition".

# Script parameters

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. The main content area is titled "Job" and shows the configuration for an "OS Command Task: ORA\_PATCH\_READINESS\_VFY\_00". The "Parameters" tab is active, displaying the following configuration:

- Command Type: Script
- \* OS Script: ora\_patch\_readiness\_vfy\_oo.sh
- Interpreter: PRIMARY\_as@pal.com CKPT\_23456

Below the OS Script field, there is a list of file paths: /oracle/grid/11.2.0.4, /oracle/grid/11.2.0.4\_new, /oracle/db/11.2.0.4, and /oracle/db/11.2.0.4\_new. A note below the interpreter field states: "If you change the interpreter to be used on the host instead of the default, it is recommended you provide the full path (Example: %perlbin%/perl)".

To the right, the "Target Properties" section provides a table of variables that can be used in parameters:

Name	Description
%emd_root%	location of Agent
%perlbin%	location of Perl binary used by Agent
%TargetName%	target name
%TargetType%	target type
%orcl_gtp_os%	Operating System
%orcl_gtp_csi%	Customer Support Identifier
%orcl_gtp_comment%	Comment
%orcl_gtp_contact%	Contact
%orcl_gtp_location%	Location
%orcl_gtp_platform%	Platform
%orcl_gtp_department%	Department
%orcl_gtp_cost_center%	Cost Center
%orcl_gtp_line_of_bus%	Line of Business
%orcl_gtp_target_version%	Target Version

# CONFIG FILE

```
IMAGE_TYPE=PRIMARY
GRIDHOMECURRENT=/oracle/grid/11.2.0.4
GRIDHOMESTAGE=/oracle/grid/11.2.0.4_new
DBHOMECURRENT=/oracle/db/11.2.0.4
DBHOMESTAGE=/oracle/db/11.2.0.4_new
PRIMARY_DB_NAME=
PATCH_NUM=23054359
PATCH_DESC=JULY2016PSU
CLUSTER_DB=dblabstb_clusterdb
INSTANCE_NAME=DBLABSTB_1
DB_ROLE=PHYSICAL STANDBY
WALLET_DIR=/oracle/admin/dblabstb/wallet
STOP_SESSION_COUNT=10
INSTANCE_NUMBER=      1
NODE_INSTANCE_COUNT=1
NODE_COUNT=2
DB_INSTANCE_COUNT=2
CRS_STORAGE_OPTION=1
CRS_NODEVIPS='nodex-vip/55.55.55.0/ixgbe2,nodey-
vip/55.55.55.0/ixgbe0'
VOTING_DISKS=NO_VAL
OCR_LOCATIONS=NO_VAL
RAC_OFF=30
EMAILID=xxxxxx@paypal.com
CKPT_YES=NOCKPT
LOCAL_NODE=nodex.paypal.com
CLUSTER_NODES=nodex.paypal.com,nodey.paypal.com
LOCAL_NODE_SHORT=nodex
CLUSTER_NODES_SHORT=nodex,nodey
CENTRAL_INV_LOC=/oracle/db/orainventory
DB_HOME_NAME="Db_11204"
GRID_HOME_NAME="Grid_11204"
CLUSTER_NAME=DBLAB_cluster
NETWORKS="ixgbe2"/16.100.8.0:public,"igb1"/199.999.
0.0:cluster_interconnect
SCAN_NAME=DBLAB-scan.paypal.com
SCAN_PORT=2115
GNS_CONF=false
ASM_DISK_GROUP=DBLAB_DATA
ASM_DISCOVERY_STRING=/dev/rdisk/cot*dos4
ASM_DISKS=/dev/rdisk/coxxxx00005084dos4
ASM_REDUNDANCY=EXTERNAL
MRP_ORIGINAL_COUNT=
GG_PROCESS_FOUND=NO
GG_HOME_EXISTS=NO
CRS_OFFLINE_COUNT=      1
```

The future is here!



Fleet Management with  
OEM!

# Database Fleet Maintenance

## Database **Fleet** Maintenance

**New!** Simplified Software Configuration Standardization at Scale



### Scan the Fleet

#### Discover Configuration Pollution

- Run Advisor to analyze the database estate
- Identify required standard configurations
- Prepare Reference environments for each standard configuration



### Create New Image and Subscribe

#### Create Gold Image

- List available images
- List versions of an image
- Make a version "Current"

#### Subscribe Databases to a Gold Image

- List subscriptions of an image
- Validate subscriptions



### Push Image and Switch

#### Deploy Image

- Shadow Home is created

#### Switch Database

- Migrate Listener
- Update Database: SI, GI, RAC, Standby



# OEM Fleet Management Features

1. End State driven management
2. Can be run from a central location (Uses EMCLI, the OEM command line interface)
3. Uses gold image
4. Granular control
5. Drift management (spotting outliers) and compliance tracking is easy.

# OEM Fleet Management - Start

Targets/Databases/Maintenance (Software Standardization Advisor)

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. The top navigation bar includes 'Enterprise', 'Targets', 'Favorites', and 'History'. The main content area is titled 'Database Maintenance' and features a 'Welcome to Software Standardization Advisor!' message. Below this, there is a section for 'Analysis of your Enterprise' with two checkboxes: 'Software Installations: Software Installations:0' and 'Collections Completed: Collections Completed:'. Two pie charts are displayed: 'Current Unique Software Configurations (67)' and 'Recommended Software Configurations (13)'. A tooltip for the recommended configurations shows: 'Product: Oracle Database', 'Release: 11.2.0.4.0', 'Platform: 23', and 'Installations: 216'. The criteria used for the recommendations are 'Product, Release, Platform'.

**ORACLE Enterprise Manager** Cloud Control 12c

Enterprise Targets Favorites History Search

### Database Maintenance

**Welcome to Software Standardization Advisor!**  
Software Standardization Advisor can be used as a suggestion to:

- Standardize software configurations.
- Reduce the number of configurations based on the patch levels across your databases.
- Streamline and automate software upgrades and patching.

### Analysis of your Enterprise

Software Installations: Software Installations:0  Collections Completed: Collections Completed:

**Current Unique Software Configurations (67)**

**Recommended Software Configurations (13)**

Product: Oracle Database :  
Release: 11.2.0.4.0  
Platform: 23  
Installations: 216

Criteria Used: Product, Release, Platform

# OEM Fleet Management Flow -- Prepare

## FOR GRID HOME\*

1. Create Gold Image for GRID\_HOME (off a patched & baked CRS env). (image is created with image\_id)
2. If need be, update the Gold Image (each update gets a version id)
3. Set the latest/desired version as CURRENT

## FOR DB HOME\*

1. Create Gold Image for DB\_HOME (off a patched & baked DB env). (image is created with image\_id)
2. If need be, update the Gold Image (each update gets a version id)
3. Set the latest/desired version as CURRENT

\* Needs to be done only once for a given OS platform / IC protocol (UDP/RDS)

# OEM Fleet Management Flow -- Deploy

FOR GRID HOME\*

1. For the given target, subscribe to an Image(\_id).
2. Deploy the image on the target cluster in a NEW\_ORACLE\_HOME dir.
  - CURRENT version of the subscribed image will be selected

FOR DB HOME\*

1. For the given target, subscribe to an Image(\_id).
2. Deploy the image on the target cluster in a NEW\_ORACLE\_HOME dir
  - CURRENT version of the subscribed image will be selected

\* Repeat for every target cluster

# OEM Fleet Management Flow -- switch / update

FOR GRID HOME\*

1. Switch GRID\_HOME from current to new gold (patched) previously deployed.

FOR DB HOME\*

1. Switch DB\_HOME from current to new gold (patched) previously deployed.
2. Start-up DB

# OEM Fleet Management Flow -- Prepare

## FOR GRID HOME\*

1. Create Gold Image for GRID\_HOME (off a patched & baked CRS env). (image is created with image\_id)

```
emcli db_software_maintenance -createSoftwareImage -input_file="data:/xyz/input_cluster"
```

Input\_cluster:

```
IMAGE_NAME="Grid Home 11.2.0.4.9 PSU9 Gold Image"
```

```
REF_TARGET_NAME=Grid_home_11204_2_somenode.paypal.com
```

```
IMAGE_SWLIB_LOC=Database Provisioning Profiles/11.2.0.4.0/solaris_sparc64
```

```
REF_GI_CREDENTIALS=ORACLE:SYSMAN
```

```
STORAGE_NAME_FOR_SWLIB=default_loc
```

```
emcli db_software_maintenance -getImages
```

2. If need be, update the Gold Image (each update gets a version id)
3. Set the latest/desired version as CURRENT

```
emcli db_software_maintenance -updateVersionStatus -version_id=39E663C148FXXXXXX -status=CURRENT
```

## FOR DB HOME\*

1. Create Gold Image for DB\_HOME (off a patched & baked DB env). (image is created with image\_id)

```
REF_TARGET_NAME=Db_home_11204_1_somenode.paypal.com
```

1. If need be, update the Gold Image (each update gets a version id)
2. Set the latest/desired version as CURRENT

# OEM Fleet Management Flow -- Deploy

FOR GRID HOME\*

1. For the given target, subscribe to an Image(\_id).

```
emcli db_software_maintenance -subscribeTarget -target_name="cluster123" -target_type=cluster -  
image_id=39E788794B9XXXXXX
```

1. Deploy the image on the target cluster in a NEW\_ORACLE\_HOME dir.

- CURRENT version of the subscribed image will be selected

```
emcli db_software_maintenance -performOperation -name="Deploy 112049 GI Home" \  
-purpose=DEPLOY_GI_SOFTWARE \  
-target_type=cluster -target_list=cluster123 \  
-
```

```
-normal_credential=ORACLE:SYSMAN -privilege_credential=ROOT:SYSMAN \  
-new_oracle_home="/xyz/crs/112049"
```

FOR DB HOME\*

1. For the given target, subscribe to an Image(\_id).

```
emcli db_software_maintenance -subscribeTarget -target_name="somedb" -target_type=rac_database -  
image_id=39E788794B91XXXX
```

1. Deploy the image on the target cluster in a NEW\_ORACLE\_HOME dir

```
emcli db_software_maintenance -performOperation -name="Deploy 112049 DB Home" \  
-purpose=DEPLOY_DB_SOFTWARE -target_type=rac_database -target_list=somedb \  
-
```

```
-normal_credential=ORACLE:SYSMAN -privilege_credential=ROOT:SYSMAN \  
-new_oracle_home="/xyz/db/112049"
```

# OEM Fleet Management Flow -- switch / update

FOR GRID HOME\*

1. Switch GRID\_HOME from current to new gold (patched) previously deployed.

```
emcli db_software_maintenance -performOperation -name="Cluster123: Update GI Cluster"  
-purpose=UPDATE_GI -target_type=cluster -target_list=cluster123  
-normal_credential=ORACLE:SYSMAN -privilege_credential=ROOT:SYSMAN  
-node_list=nodex.paypal.com -startupDBAfterSwitch=false
```

FOR DB HOME\*

1. Switch DB\_HOME from current to new gold (patched) previously deployed.
2. Start-up DB
3. Run the required post patch SQL scripts **!!! Winner**

```
emcli db_software_maintenance -performOperation -name="nodex:Update DB Cluster"  
-purpose=UPDATE_RACDB -target_type=rac_database -target_list=somedb  
-normal_credential=oracle:SYSMAN -privilege_credential=ROOT:SYSMAN  
-node_list=nodex.paypal.com -dataguard_role=primary -ignoreStandbyPrereq=true
```



---

## State of the Nation: benefits of Fleet Management

1. Patching time 20 min/ node
2. Different DB Clusters patched in Parallel
3. Target of <15 distinct configuration looks achievable
4. Much standardized and therefore stable site
5. Compliance Reporting/ Drift Management is easier

QUESTIONS?

