ORACLE

Patching Master Class

Danish Oracle User Group

Oracle
DBAs
run the world

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AGENDA

15:00
Intro to
Patching

15:30
Hands-On
Lab

16:30
Grid Infrastructure
Questions

17:00
End of
workshop

Quaterly Patching

My database is
not facing the internet

Photo by Ben Wicks on Unsplash

Critical Patch Alert July 2022 | Risk Matrix

CVE#	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)									Supported Versions Affected	Notes
					Base Score	Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confid-entiality	Inte-grity	Avail-ability		
CVE-2020-35169	Oracle Database - Enterprise Edition	None	TCPS	Yes	9.1	Network	Low	None	None	Un-changed	High	High	None	12.1.0.2, 19c, 21c	
CVE-2022-21510	Oracle Database - Enterprise Edition Sharding	Local Logon	None	No	8.8	Network	Low	None	None	Changed	High	High	High	None	See Note 1
CVE-2022-21511	Oracle Database - Enterprise Edition Recovery	EXECUTE ON DBMS_IR.EXECUTESQLSCRIPT	Oracle Net	No	7.2	Network	Low	High	None	Un-changed	High	High	High	None	See Note 1
CVE-2022-21565	Java VM	Create Procedure	Oracle Net	No	6.5	Network	Low	Low	None	Un-changed	None	High	None	12.1.0.2, 19c, 21c	
CVE-2022-24729	Oracle Application Express (CKEditor)	User Account	HTTP	No	5.7	Network	Low	Low	Required	Un-changed	None	None	High	Prior to 22.1.1	
CVE-2021-41184	Oracle Application Express (jQueryUI)	User Account	HTTP	No	5.4	Network	Low	Low	Required	Changed	Low	Low	None	Prior to 22.1.1	
CVE-2022-0839	Oracle SQLcl (Liquibase)	Local Logon	None	No	5.0	Local	Low	Low	Required	Un-changed	High	None	None	19c	
CVE-2021-45943	Oracle Spatial and Graph (GDAL)	Create Session	Oracle Net	No	4.3	Network	Low	Low	None	Un-changed	None	None	Low	19c, 21c	
CVE-2022-21432	Oracle Database - Enterprise Edition RDBMS Security	DBA role	Oracle Net	No	2.7	Network	Low	High	None	Un-changed	None	None	Low	12.1.0.2, 19c, 21c	

You always start with Oracle Database base release

- Oracle Database 19.3.0

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Always apply the most recent RU

Use the Patch Download Assistant <u>MOS Note: 2118136.2</u>

Assistant: Download Reference for Oracle Database/GI Update, Revision, PSU, SPU(CPU), Bundle Patches, Patchsets and Base Releases (Doc ID 2118136.2)

Visibility: EXTERNAL

Selection(s)

What would you like to download?

- ○ Oracle Database Base Releases
- ○ Oracle Database Patchsets
- ● **Oracle Database Release Updates (RUs)**
- ○ Oracle Database Release Update Revisions (RURs - discontinued since Apr 2023)
- ○ Oracle Database PSU, SPU(CPU), Bundle Patches (Versions 12.1 & lower)
- ○ OJVM Update/PSU/Bundle Patches
- ○ Latest Available Microsoft Windows Patches
- ○ Monthly Recommended Patches (MRPs)

Solution(s)

Possible Solutions will appear once you make your selection.

Release Update Contents
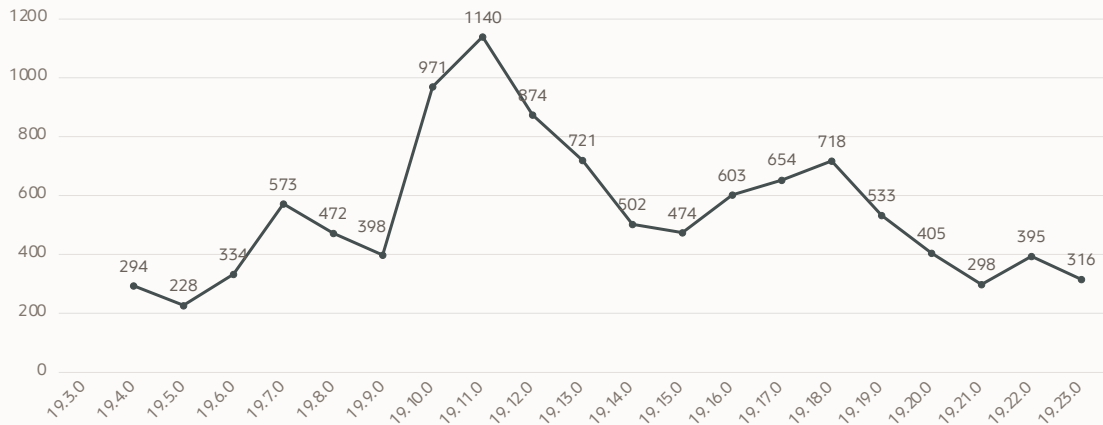
Database 19 Release Updates and Revisions Bugs Fixed Lists (Doc ID 2523220.1)

If you don't apply a recent Release Update, you will miss thousands of fixes

- Almost 11k fixes with 19.23.0
- Almost 300 security fixes

Apply the Most Important Patches

Always use Important Recommended One-Off Patches: MOS Note: 555.1

Recommended Patches for 19.22 DB Home

Below is the list of important patches to consider applying on top of 19.22. In addition to the relevant patches listed below, you should also review patches in Database PSU/BP/Update/Revision - Known Issues Primary Note(Doc ID 1227443.1) and Oracle Database Patches to Consider for 19c (Doc ID 2781612.2) which contains patches to consider for specific areas such as Data Pump, Golden gate etc.

Bug	Fixed in RU	Fixed in MRP	Description	Patches	RAC Rolling Installable	Database Online Installable	Added
36273767 (replaces 35733946)			ORA-1578: oracle data block corrupted on tempfile even after 35904282, 35733946	[list-patches]	YES	YES	30-APR-2024
35286895	19.23		[KPDB] Switchover/Failover Failing for Backup-Based Cadg : ORA-1113: File 3013 Needs Media Recovery	[list-patches]	YES	YES	29-APR-2024
36480774			[RECOVERY] Slow Opening of database in RAC database for other instance	[list-patches]	YES	YES	27-APR-2024
36366069	19.23	DBMRP 19.21.0.0.240319, DBMRP 19.22.0.0.240319	CPU spinning on CTWR and reports ORA-32701 / instance crash post 19.21 DBRU on standby	[list-patches]	YES	YES	28-MAR-2024
35998116 (replaces 35037877)	19.23	DBMRP 19.21.0.0.240319, DBMRP 19.22.0.0.240319	[DBSEC_PRIVS] PLS-00801: internal error pgm.c:pgmrcm 4] from internal trigger compilation	[list-patches]	YES	YES	27-MAR-2024

Monthly Recommended Patches

A collection of recommended one-off fixes
provided at monthly intervals
via a single downloadable patch

Quarterly Release Updates

	January	April	July	October	January	April	July	October	January	April	July	October	January	April	July
	2023				**2024**				**2025**				**2026**		
19c	19.18.0	19.19.0	19.20.0	19.21.0	19.22.0	19.23.0	19.24.0	19.25.0	19.26.0	19.27.0	19.28.0	19.29.0	19.30.0	19.31.0	19.232.0
21c	21.10.0	21.11.0	21.12.0	21.13.0	21.14.0	21.15.0	21.16.0	21.17.0	21.18.0	21.19.0					
23ai							23.5.0	23.6.0	23.7.0	23.8.0	23.9.0	23.10.0	23.11.0	23.12.0	23.13.0

Monthly Recommended Patches

	2023			2024										
	October	November	December	January	February	March	April	May	June	July	August	September	October	November
19.21.0	19.21.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6							
19.22.0				19.22.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6				
19.23.0							19.23.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6	
19.24.0										19.24.0	MRP1	MRP2	MRP3	MRP4
19.25.0													19.25.0	MRP1

An MRP is an optional collection of several important one-off patches

- Delivered as a merge patch

ⓘ

An MRP does not change the release number

- Like `v$instance.version_full`

MRPs are cumulative
but only within one MRP line

- Example: 19.21.0 MRP6 contains all previous MRPs done for Oracle 19.21.0

MRPs are Linux only

MRPs can contain security fixes

- Release Updates remain the primary security fix delivery mechanism

Sorry, but there is more to talk about …

Apply Additional Important Fixes and Bundles

Oracle Database Patches to Consider for 19c (Doc ID 2781612.2)

Visibility: EXTERNAL

Getting Started | Performance | GoldenGate | Oracle Text | Platform Specific | HA | DNFS | Data Pump | Partitioning | Multitenant | General | Oracle Spatial

Search This Document

When applying Database patches, Oracle recommends that you take a 3-tiered step-by-step approach.

LEVEL 1:   Apply latest quarterly patches:

- Apply latest quarterly updates using Master Note for Database Proactive Patch Program (Doc ID 888.1)

LEVEL 2: Apply Critical/Recommended patches:

- ○ For Exadata environments: Exadata Critical Issues (Doc ID 1270094.1)
  ○ For Database environments:
    ▪ Customers on Linux x86-64 - Apply the latest Monthly Recommended Patches - MRP(Doc ID 2898740.1) for the specific RU
    ▪ For customers on other platforms, apply critical patches using Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)

LEVEL 3: Apply additional patches based on features or focus areas:

- Use the tabs in this document for quick access to additional feature based patches

Always use the latest OPatch

- Patch 6880880

Patching Basic

What Can Be in a Patch?

FILES

New or changed executables, libs or files
```
bin/oracle
bin/srvctl
oracore/zoneinfo/timezone_34.dat
```

Apply and rollback scripts
```
sqlpatch/.../nnn_apply.sql
sqlpatch/.../nnn_rollback.sql
```

**SQL
PL/SQL**

New or changed objects
```
alter table sys.tab$ ...
create index sys.i_tab1 ...
create or replace package sys.dbms_scheduler ...
```

How to Apply a Patch?

`opatch` ⇒ Applies binaries to an Oracle Home ⇒ All instances using this Oracle Home are down

`datapatch` ⇒ Applies SQL and PL/SQL changes to a database ⇒ Database is up

What is installed?

In the Oracle Home?

```
$ opatch lsinventory
$ opatch lspatches
```

```
SQL> select
xmltransform(dbms_qopatch.get_opatch_lsinventory,
dbms_qopatch.get_opatch_xslt) from dual;
```

- [Oracle Database 12.1 : FAQ on Queryable Patch Inventory (Doc ID 1530108.1)](Doc ID 1530108.1)

In the database / PDB?

```
SQL> select * from cdb_registry_sqlpatch;
```

Patching Methods

In-Place Patching

Oracle Home, 19.23.0
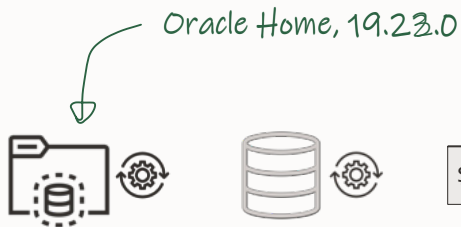
$ORACLE_HOME/OPatch/opatch rollback -id ...

Out-of-Place Patching

Oracle Home, 19.22.0
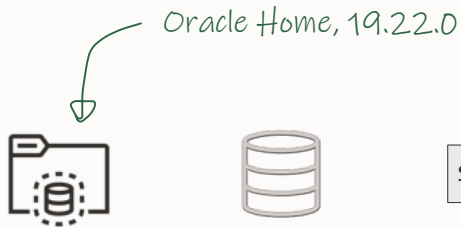
```
SQL> SHUTDOWN IMMEDIATE
```
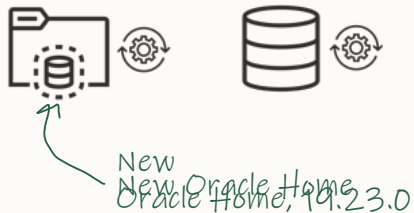
```
[oracle]$ $ORACLE_HOME/OPatch/datapatch -verbose
```

New
New Oracle Home
Oracle Home, 19.23.0

👍 Always patch Out-of-Place

- Don't argue with us ☺

Installation Tip

```
/home/oracle/stage
├── DPBP
│   ├── 35261302
│   └── PatchSearch.xml
├── MRP
│   ├── 35333937
│   │   ├── 34340632
│   │   ├── 35012562
│   │   ├── 35037877
│   │   ├── 35116995
│   │   └── 35225526
│   └── PatchSearch.xml
├── OJVM
│   ├── 35050341
│   └── PatchSearch.xml
└── RU
    ├── 35042068
    └── PatchSearch.xml
```

ONE SINGLE COMMAND

```
./runInstaller \
  -applyRU /home/oracle/stage/RU/35042068 \
  -applyOneOffs /home/oracle/stage/DPBP/35261302,
                /home/oracle/stage/OJVM/35050341,
                /home/oracle/stage/MRP/34340632,
                ...
                /home/oracle/stage/MRP/35225526
```

Be sure to copy all configuration files to the new Oracle Home

- AutoUpgrade does it for you
- Additional details in blog post

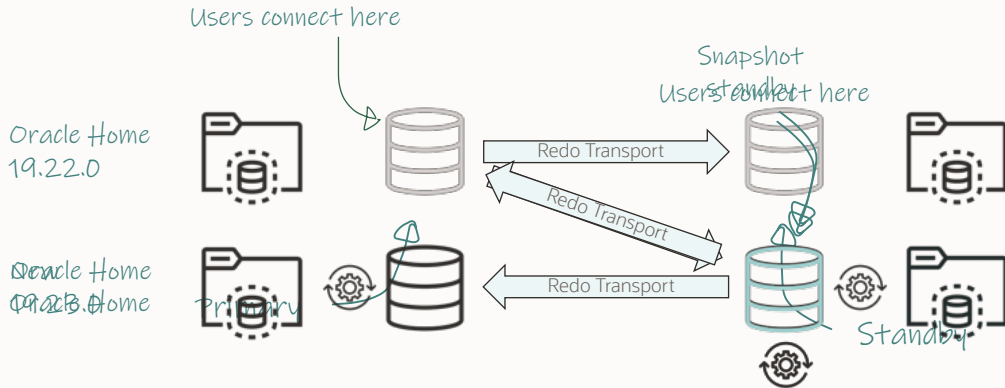Reduce downtime to the time it takes to perform a switchover

- [Data Guard Standby-First Patch Apply (Doc ID 1265700.1)](#)

Safely test and verify patches with Standby-First Patch Apply

- [Data Guard Standby-First Patch Apply (Doc ID 1265700.1)](#)

Standby-First Patching

Users connect here

Snapshot standby
Users connect here

Oracle Home
19.22.0

Oracle Home
19.23.0
New Home

Primary

Redo Transport
Redo Transport
Redo Transport

Standby

```
[oracle]$ $ORACLE_HOME/OPatch/datapatch -verbose
```

Patch must Standby-First installable

- Check the patch readme

Avoid database downtime with
RAC Rolling Patch Apply

RAC Rolling Patching

User

Connections

Instances

Oracle Homes

Nodes
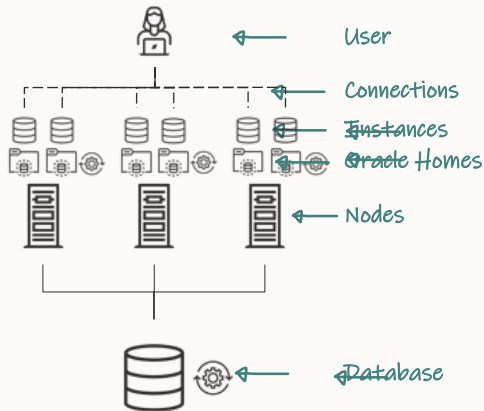
Database

- New Oracle Home
- Patch Oracle Home
- Move to new Oracle Home
- Execute datapatch

Release updates are **always**:

Standby-First installable

RAC Rolling installable

Datapatch

Patching a database

1

Start database in new Oracle Home

Start in normal open
Open all PDBs

2

Complete patching with `datapatch`

Found in `$ORACLE_HOME/OPatch`
One database per invocation
Multiple datapatch sessions in parallel
Datapatch User Guide (Doc ID 2680521.1)

👍 Analyze the database for patching readiness using Datapatch Sanity Checks

- Datapatch User Guide (Doc ID 2680521.1)
- Executed by AutoUpgrade in analyze mode

Recompile invalid objects
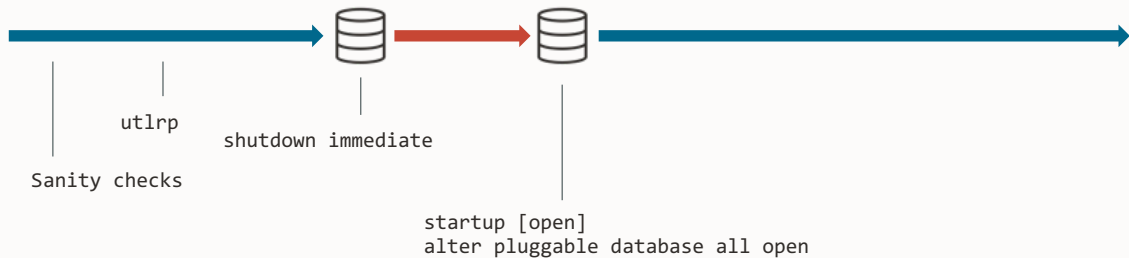before invoking `datapatch`

Patching Timeline

utlrp

shutdown immediate

Sanity checks
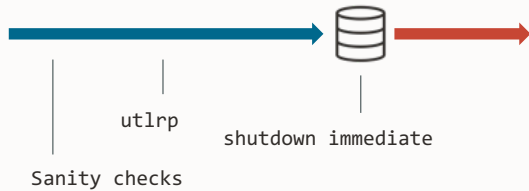
👍 The database must be open
Only open PDBs are patched

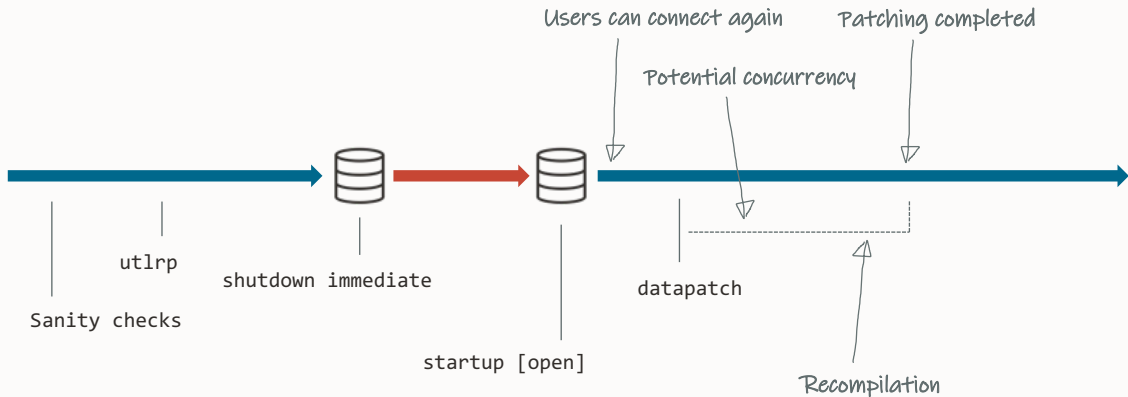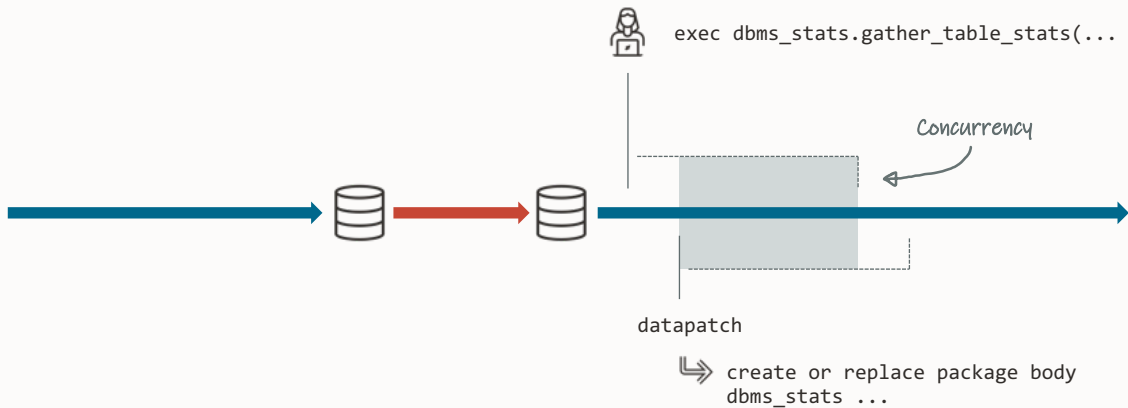- Upgrade mode or restricted session is not needed

Patching Timeline

utlrp

shutdown immediate

Sanity checks

startup [open]
alter pluggable database all open

You can run `datapatch` while users are connected to the database
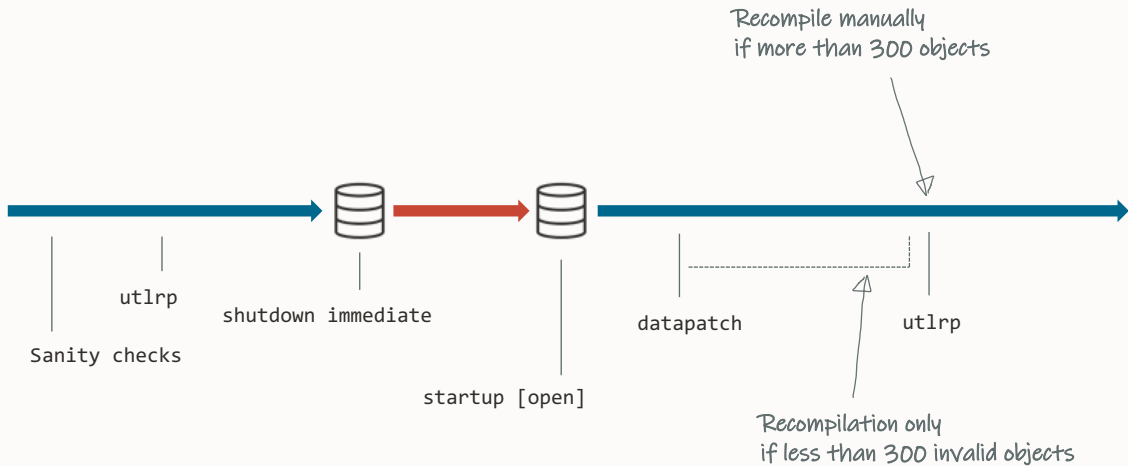
- Details in [blog post](#)

Patching Timeline

Users can connect again

Patching completed

Potential concurrency

shutdown immediate

utlrp

Sanity checks

datapatch

startup [open]

Recompilation

Patching Timeline

exec dbms_stats.gather_table_stats(...

Concurrency

datapatch

```
create or replace package body
dbms_stats ...
```

Concurrency

- Datapatch waits 15 min to acquire a lock
  - On timeout, `ORA-04021 timeout occurred while waiting to lock object`

- Optionally, <u>find blocking session</u> and kill it

- Increase timeout using `-ddl_lock_timeout` *`<time-in-seconds>`*

Patching Timeline

Recompile manually
if more than 300 objects

utlrp

shutdown immediate

Sanity checks

startup [open]

datapatch

utlrp

Recompilation only
if less than 300 invalid objects

```
$ ./datapatch -verbose
SQL Patching tool version 19.19.0.0.0 Production on Sun Jun 25 07:12:19 2023


.
.
.
.


Automatic recompilation incomplete; run utlrp.sql to revalidate.
   PDBs: PDB1 PDB$SEED

SQL Patching tool complete on Sun Jun 25 07:12:19 2023
```

Datapatch uses `REGISTRY$SQLPATCH_RU_INFO` to control the patching operations

If in doubt run `datapatch` again

- Datapatch only does what is needed
- You can run `datapatch` as many times as you like

Datapatch Rollback Scripts

Apply/rollback scripts:
```
$ORACLE_HOME/sqlpatch/.../nnn_apply.sql
$ORACLE_HOME/sqlpatch/.../nnn_rollback.sql
```

Rollback scripts (zipped as BLOB):
```
SELECT  PATCH_DIRECTORY
FROM    REGISTRY$SQLPATCH_RU_INFO
```

(*) Datapatch stores rollback scripts for one-offs in `REGISTRY$SQLPATCH`

Update database directories using
`rdbms/admin/utlfixdirs.sql`

AutoUpgrade

We made upgrading easy.
Now we make patching just as easy.

AutoUpgrade functionality extended to patching

```
$ cat DB19.cfg

patch1.source_home=/u01/app/oracle/product/19/dbhome_19_22_0
patch1.target_home=/u01/app/oracle/product/19/dbhome_19_23_0
patch1.sid=DB19


$ java -jar autoupgrade.jar -config DB19.cfg -mode deploy
```

Patching

USE
Familiar interface
Console
Logging

ANALYZE
Prechecks
Summary report

PROTECT
Resumable
Restoration
Restore point
Fallback

AUTOMATE
srvctl
/etc/oratab
Files
Datapatch

Fleet Patching
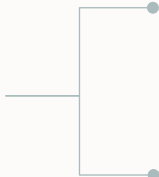
AutoUpgrade

Automate your patching process and benefit from the familiar AutoUpgrade

Fleet Patching and Provisioning

Go fleet scale with FPP and benefit from additional functionality like deployment of Oracle Home

Patching Success

Your way to patching success

1 Find the right patches

2 Use golden images

3 Patch out-of-place

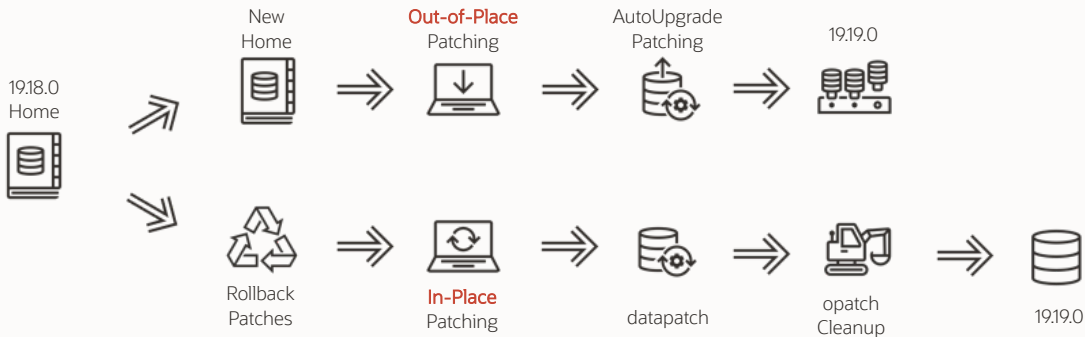# AGENDA

15:00
Intro to
Patching

15:30
Hands-On
Lab

16:30
Grid Infrastructure
Questions

17:00
End of
workshop

Hands-On Lab

New Home → **Out-of-Place** Patching → AutoUpgrade Patching → 19.19.0

19.18.0 Home →

Rollback Patches → **In-Place** Patching → datapatch → opatch Cleanup → 19.19.0

Get Started

https://bit.ly/dougpatch2024

AGENDA

15:00
Intro to
Patching

15:30
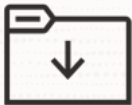Hands-On
Lab

16:30
Grid Infrastructure
Questions

17:00
End of
workshop

Grid Infrastructure Patching

You always start with the base release

- Oracle Grid Infrastructure 19.3.0

Most Recent Release Update

Use the Patch Download Assistant <u>MOS Note: 2118136.2</u>

Assistant: Download Reference for Oracle Database/GI Update, Revision, PSU, SPU(CPU), Bundle Patches, Patchsets and Base Releases (Doc ID 2118136.2)

Visibility: EXTERNAL

Selection(s)

What would you like to download?

- ○ Oracle Database Base Releases
- ○ Oracle Database Patchsets
- ● Oracle Database Release Updates (RUs)
- ○ Oracle Database Release Update Revisions (RURs - discontinued since Apr 2023)
- ○ Oracle Database PSU, SPU(CPU), Bundle Patches (Versions 12.1 & lower)
- ○ OJVM Update/PSU/Bundle Patches
- ○ Latest Available Microsoft Windows Patches
- ○ Monthly Recommended Patches (MRPs)

Solution(s)

Possible Solutions will appear once you make your selection.

Most Important Patches

Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)

Recommended Patches for 19.21 GI Home

Below is the list of important patches to consider applying on top of 19.21. In addition to the relevant patches listed below, you should also review patches in Database PSU/BP/Update/Revision - Known Issues Primary Note(Doc ID 1227443.1) and Oracle Database Patches to Consider for 19c (Doc ID 2781612.2) which contains patches to consider for specific areas such as Data Pump, Golden gate etc.
Only one OCW (Oracle Clusterware) patch should be applied to GI homes. Ensure you apply the patch starting with X8M if you are on an X8M system

Bug	Fixed in RU	Fixed in MRP	Description	Patches	NON ROLLING	Added
35739076		Not Applicable	[VOS] Linux: ORA-800 / Set Priority / DB Performance Merge Patch for 19.21 (Requires Root Access) - 34286265 34318125	[list-patches]		20-OCT-2023

Version GI 19.21_555.1: 35739076

If you don't apply a recent Release Update,
you will miss hundreds of fixes

Together or separately
... that's the question

Patching Oracle Grid Infrastructure and Oracle Database

Patching GI and DB together?

Option 1
TOGETHER

One maintenance window

Longer, single patching window

Several changes

When draining is a problem

Option 2
SEPARATELY

Two maintenance windows

Shorter window, but longer overall patching

One change at a time

For well-behaving applications

Keep GI and DB patch levels in synch

- This is what we test and run in our Cloud

Unusual combinations are supported, but we strongly advice against it

- GI 19.16.0 and DB 19.20.0
- Node 1 with GI 19.16.0, node 2 with GI 19.18.0
- Patching node 1 on Monday, node 2 on Tuesday …
- Mix of GI and DB versions on various nodes

Grid Infrastructure Patching Methods

1

In-place
Replaces existing Oracle Home
Uses `opatchauto`

2

Out-of-place
Creates a new Oracle Home
Uses `opatchauto` or `gridSetup`

Grid Infrastructure Patching Methods

1 In-place
Replaces existing Oracle Home
Uses `opatchauto`

2 Out-of-place
Creates a new Oracle Home
Uses `opatchauto` or `gridSetup`
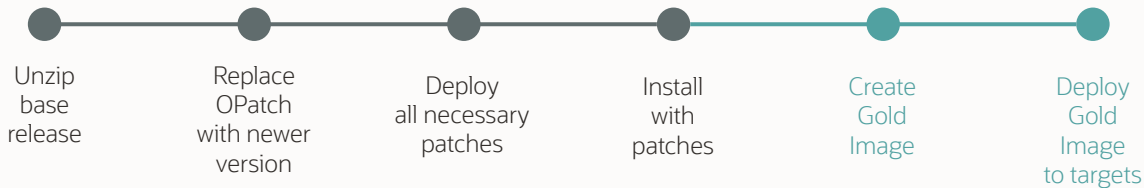
23ai GI home disk space greatly reduced to 3 GB

- 12 GB in 19c

Use golden images

- [Blog post](#)

Golden Images

Unzip base release — Replace OPatch with newer version — Deploy all necessary patches — Install with patches — Create Gold Image — Deploy Gold Image to targets

Demo

Install GI home
Apply Release Update
Create golden image

Watch on YouTube

```
--Unzip base release and update OPatch

unzip -oq LINUX.X64_193000_grid_home.zip
mv OPatch OPatch_old
unzip p6880880...zip
```

```
--Install the Oracle Home and apply Release Update and one-offs
--Specify multiple one-offs using comma-separated list

./gridSetup.sh -silent -applyRU <patch_dir> \
                       -applyOneOffs <patch_dir> \
                       ...
```

```
--Always create your golden image from a "fresh" home
--Never use a production home

./gridSetup.sh -createGoldImage \
               -destinationLocation $GOLDIMAGEDIR \
               -silent
```

```
--Deploy golden image throughout your environment
--Just unzip and attach on node 1, installer copies to other nodes

unzip -oq my_golden_image.zip
./gridSetup.sh -silent \
                oracle.install.db.CLUSTER_NODES=node1,node2 \
                ...
```
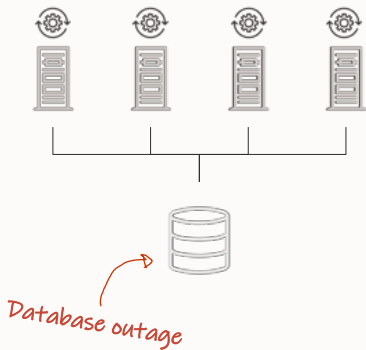
Works for database homes as well

- Use `runInstaller` instead
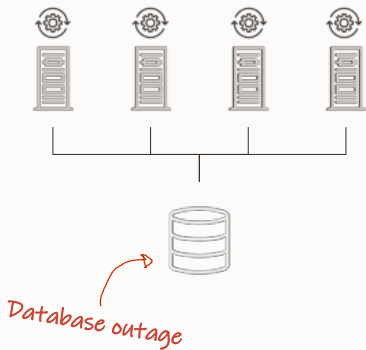
Grid Infrastructure Patching Concepts

Database outage

ALL NODE

- All nodes patched at one time
- One long database outage
- Works for all patches, including non-rolling
- Cluster at full capacity except for outage

Rolling Patch - OPatch Support for RAC (Doc ID 244241.1)

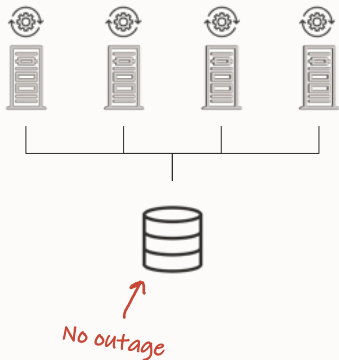# Grid Infrastructure Patching Concepts

Database outage

MINIMUM DOWNTIME

- Nodes patched in two batches
- One short database outage
- Works for all patches, including non-rolling
- Other nodes must handle workload while another batch is patched

Rolling Patch - OPatch Support for RAC (Doc ID 244241.1)
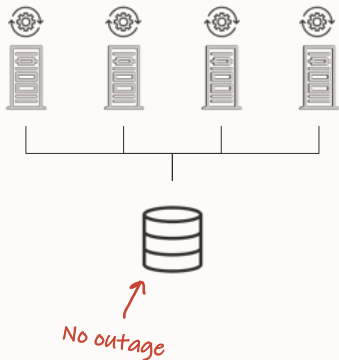
Grid Infrastructure Patching Concepts

ROLLING

- Each node patched separately
- No database outage
- Patch must be RAC rolling installable
- Other nodes must handle workload while one node is patched

No outage

Rolling Patch - OPatch Support for RAC (Doc ID 244241.1)

Grid Infrastructure Patching Concepts

No outage

ROLLING IN GROUPS

- Patch a subset together
- Useful when draining is a problem
- No database outage
- Patch must be RAC rolling installable
- Other nodes must handle workload while one node is patched

Rolling Patch - OPatch Support for RAC (Doc ID 244241.1)

Demo

Patch a 2-node RAC system
GI and database

Watch on YouTube

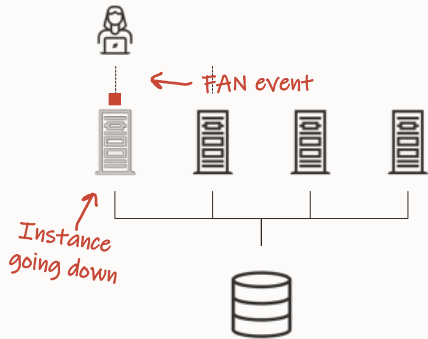⚠️ Complete a rolling patching operation always as quickly as possible

- RAC: Frequently Asked Questions (Doc ID 220970.1)

Rolling patching requires efficient draining

- Optionally, consider a *batched* approach

Draining Connections

FAN event

Instance
going down

DRAINING

- Allows users to finish their work
  and reconnect to another instance
- New sessions connect to other instances
- Sessions that don't drain in time
  are forcefully terminated
- Controlled by `drain_timeout` parameter
  in `srvctl` and `DBMS_SERVICE`

Drain Timeout

Setting `drain_timeout`
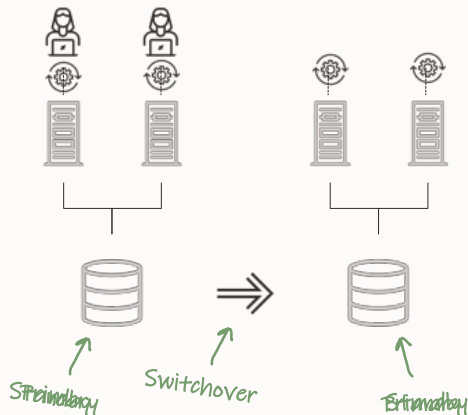very low?

- This may cause login storms
  - Be cautions on databases with many connections

Setting `drain_timeout`
very high?

- Load is spread on fewer instances
  - Cluster is in rolling patch mode for an extended period of time

Grid Infrastructure | Data Guard

ALTERNATIVE

- If draining is a problem
- Downtime limited to a switchover
- Test your Data Guard configuration

Data Guard | Additional Information

INTERVIEW WITH LUDOVICO CALDERA
Ludovico is Data Guard Product Manager and
he shares his top tips for patching Oracle Grid Infrastructure and Data Guard

PATCHING ORACLE GRID INFRASTRUCTURE AND ORACLE DATA GUARD
Blog post with additional details plus instructions on
how to patch GI and database at the same time when you have Data Guard

top tips
PATCHING SUCCESS

Cluster Verification Utility ——————

Patch Level

Application Continuity

OPatch

Use CVU before and after patching

Preferably through EXAchk or ORAchk

Identifies potential issues

Light-weight, non-intrusive

Always use the latest version

```
$ cluvfy stage -pre patch

Performing following verification checks ...

  cluster upgrade state ...PASSED
  OLR Integrity ...PASSED
  Hosts File ...PASSED

  ...

  Check for parameter kernel.shmmni ...PASSED
  /tmp directory free space ...PASSED
  Check for parameter kernel.shmall ...PASSED
  ORAchk checks ...PASSED

Pre-check for Patch Application was successful.
```

PATCHING SUCCESS

Cluster Verification Utility

Patch Level —————————

Application Continuity

OPatch

Apply patches regularly
Apply recent Release Updates
Apply MRPs
Keep GI and DB patch levels in sync

PATCHING SUCCESS

Cluster Verification Utility

Patch Level

Application Continuity

OPatch

Completely hide interruptions from users

Hides planned and unplanned events

Comply with MAA guidelines

See also Transparent Application Continuity

PATCHING SUCCESS

Cluster Verification Utility

Patch Level

Application Continuity

OPatch ————————————

Always use the latest version of OPatch

Use in GI and DB homes

Patching Success

Your way to patching success

1   Patch out-of-place

2   Use SwitchGridHome

3   Effective draining

Thank You