Patch Me If You Can

SAOUG Webinar, June 2023

Photo by Laura Ockel on Unsplash

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Patch Me
if you can

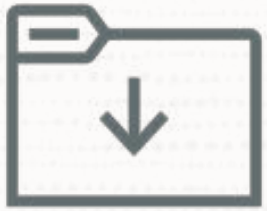
Installation and Patches

Patching Basics

Patching Methods

Grid Infrastructure Patching

Patching Insights

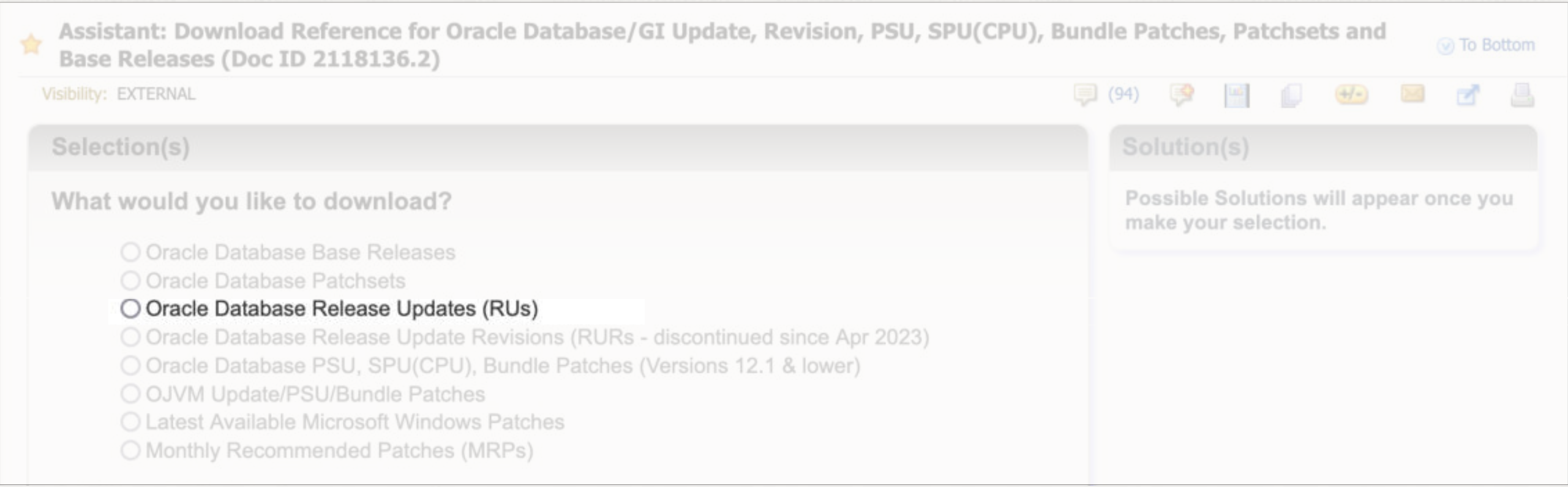


You always start with Oracle Database 19c base release

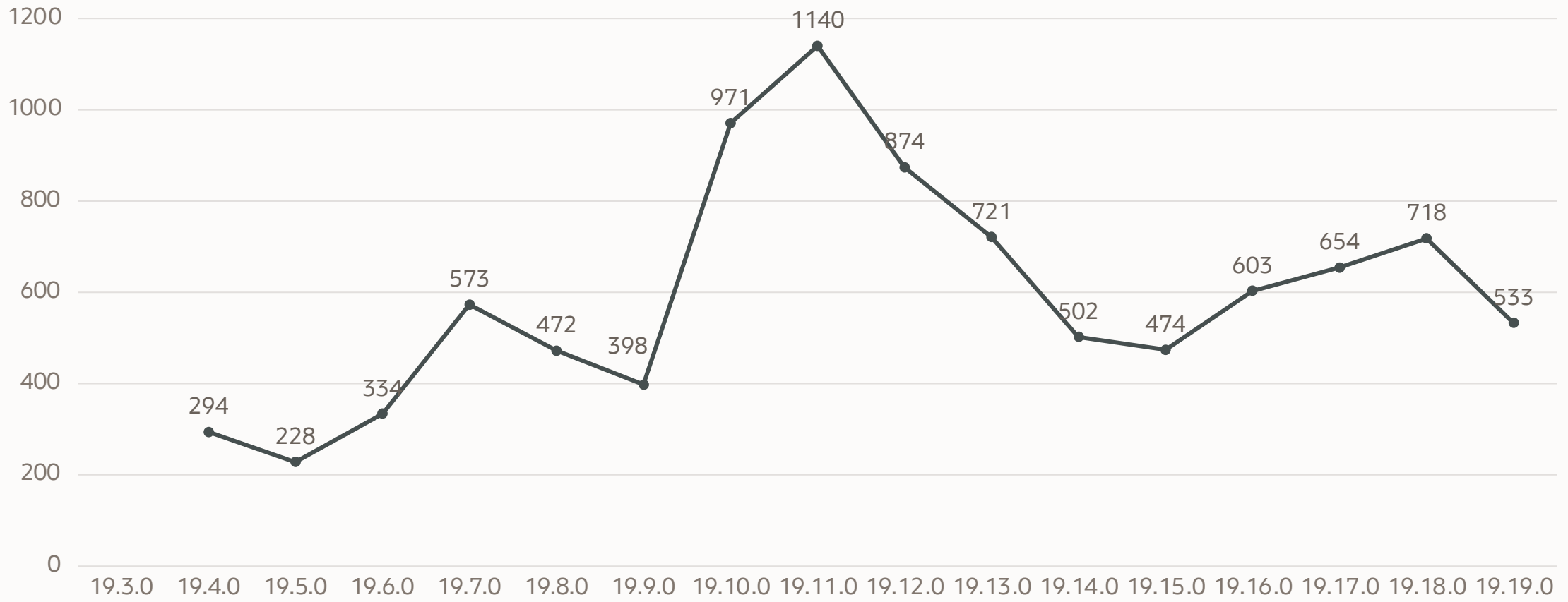
- Oracle Database 19.3.0

Apply the most recent Release Update

Use the Patch Download Assistant MOS Note: 2118136.2



Release Update Contents



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

You are missing out if you don't apply a recent Release Update

- Thousands of fixes
- 243 security fixes

Apply the most important patches

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

Recommended Patches for 19.18 DB Home

Below is the list of important patches to consider applying on top of 19.18. 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	NON ROLLING	Added
35037877 (replaces 20289608)			[SECURITY] EM patching may fail with ORA-4067	[list-patches]		20-APR-2023
32727143	19.19		[SQL EXECUTION] Transaction-level content isolation for transaction-duration global temporary tables	[list-patches]		20-APR-2023
34557500 (replaces 31544097)	19.19	DBMRP 19.17.0.0.230321, DBMRP 19.18.0.0.230321	[BLOCK TRACK] CTWR caused multiple instances to hung state on the RAC Standby DB	[list-patches]		20-APR-2023
34340632			[AQ] Smart Monitoring & Resiliency in AQ KGL Memory Usage To Help Message Cleanup And Prevent ORA-600 [KGL-HEAP-SIZE-EXCEEDED].	[list-patches]		14-APR-2023
35246710 (replaces 33803836)	19.19	DBMRP 19.18.0.0.230418	[BUFFER CACHE] High "Direct Path Read" Waits After 19.18 DBRU Patching	[list-patches]		08-APR-2023
34832725 (replaces			[SHRD CRSRS] ORA-4031 and / or High Shared Pool Latch Contention During Session Creation in	[list-		25-

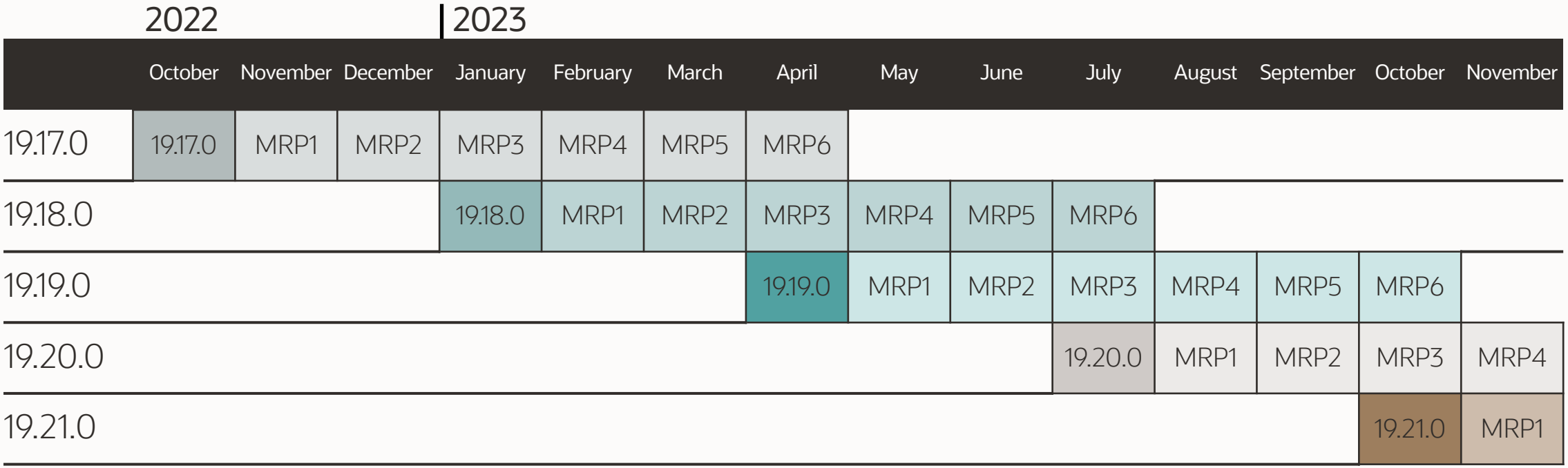
Monthly Recommended Patches

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

Release Updates | Timeline

	2021				2022				2023				2024		
	January	April	July	October	January	April	July	October	January	April	July	October	January	April	July
19c	19.10.0	19.11.0	19.12.0	19.13.0	19.14.0	19.15.0	19.16.0	19.17.0	19.18.0	19.19.0	19.20.0	19.21.0	19.22.0	19.23.0	19.24.0
21c		21.3.0	21.4.0	21.5.0	21.6.0	21.7.0	21.8.0	21.9.0	21.10.0	21.11.0	21.12.0	21.13.0	21.14.0	21.15.0	

Monthly Recommended Patches | Timeline



An MRP is a collection of several one-off patches

- Delivered via a merge patch
- Included patches must be RAC Rolling Installable

An MRP does not change the release number

- Like `v$instance.version_full`

MRP content is cumulative but only within one MRP line

- Example:
  19.17.0 MRP5 contains all previous MRPs done for Oracle 19.17.0
- MRPs are not bundle patches,
  so to install a newer MRP you must roll off previous MRPs

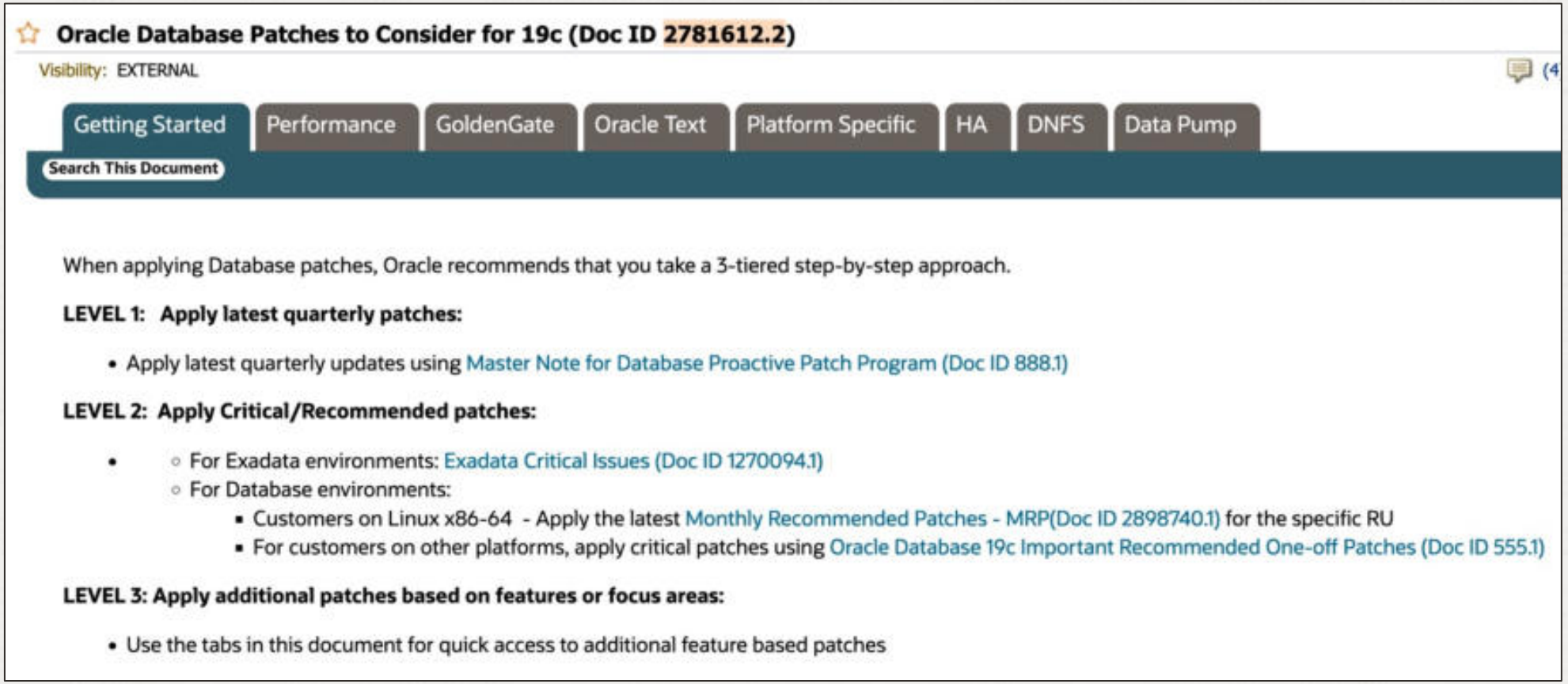
MRPs can contain security fixes

- Release Updates remain the primary security fix delivery mechanism

In OCI, include MRPs
by creating a *Database Software Image*

Apply the most important patches

In addition, use Patches to consider for 19c: MOS Note: 2781612.2



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

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

Release Updates contain patches for Perl in Oracle Home

Release Updates contain patches for JDK in Oracle Home

- JDK patches are from *last* quarter
- If required, find up-to-date patches in JDK and PERL Patches for Oracle Database Home and Grid Home (Doc ID 2584628.1)

Release Updates contain time zone patches

- Database time zone file is not upgraded
- New databases use latest time zone file

Release Updates contain optimizer fixes - but they are off by default

- Enable using `DBMS_OPTIM_BUNDLE`
- Check MOS Doc ID 21470071

Patch Me
if you can

Installation and Patches

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Patching Insights

Basic Facts | What Is 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 ...
```


Basic Facts | How To Apply A Patch

`$ORACLE_HOME/OPatch`

```
[oracle@hol ~]$ cd $ORACLE_HOME/OPatch
[oracle@hol OPatch]$ ls -l
total 164
drwxr-x---. 6 oracle dba    68 Apr 22  2020 auto
drwxr-x---. 2 oracle dba    31 Apr 22  2020 config
-rwxr-x---. 1 oracle dba   589 Apr 22  2020 datapatch
-rwxr-x---. 1 oracle dba   627 Apr 22  2020 datapatch.bat
drwxr-x---. 2 oracle dba    90 Apr 22  2020 docs
-rwxr-x---. 1 oracle dba 23550 Apr 22  2020 emdpatch.pl
drwxr-x---. 2 oracle dba  4096 Apr 22  2020 jlib
drwxr-x---. 5 oracle dba  4096 Mar 26  2020 jre
drwxr-x---. 9 oracle dba  4096 Apr 22  2020 modules
drwxr-x---. 5 oracle dba    58 Apr 22  2020 ocm
-rwxr-x---. 1 oracle dba 49462 Apr 22  2020 opatch
-rwxr-x---. 1 oracle dba  1442 Apr 22  2020 opatchauto
-rwxr-x---. 1 oracle dba   393 Apr 22  2020 opatchauto.cmd
-rwxr-x---. 1 oracle dba 16412 Apr 22  2020 opatch.bat
-rwxr-x---. 1 oracle dba  4290 Apr 22  2020 opatch_env.sh
-rw-r-----. 1 oracle dba  2551 Apr 22  2020 opatch.pl
drwxr-x---. 4 oracle dba    62 Apr 22  2020 opatchprereqs
-rwxr-x---. 1 oracle dba  3159 Apr 22  2020 operr
-rwxr-x---. 1 oracle dba  4218 Apr 22  2020 operr.bat
-rw-r-----. 1 oracle dba  3177 Apr 22  2020 operr_readme.txt
drwxr-x---. 2 oracle dba    19 Apr 22  2020 oplan
drwxr-x---. 3 oracle dba    21 Apr 22  2020 oracle_common
drwxr-x---. 3 oracle dba    24 Apr 22  2020 plugins
-rw-r-----. 1 oracle dba  2980 Apr 22  2020 README.txt
drwxr-x---. 2 oracle dba  4096 Apr 22  2020 scripts
-rw-r-----. 1 oracle dba    27 Apr 22  2020 version.txt
```

Basic Facts | How To Apply A Patch

`opatch`	Applies binaries to an Oracle Home	All instances are down
`datapatch`	Applies SQL and PL/SQL changes to a database	Database is up

Basic Facts | What's Installed

What is installed in my Oracle Home?

OPatch

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

DBMS_QOPATCH

```
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)

What is installed in my database?

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

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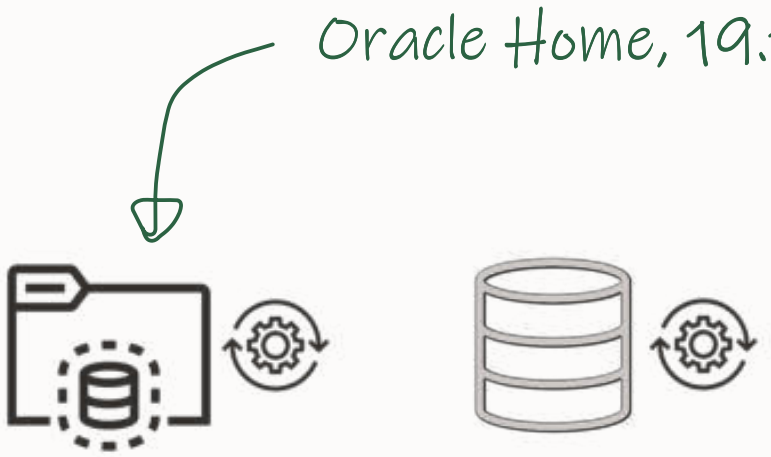
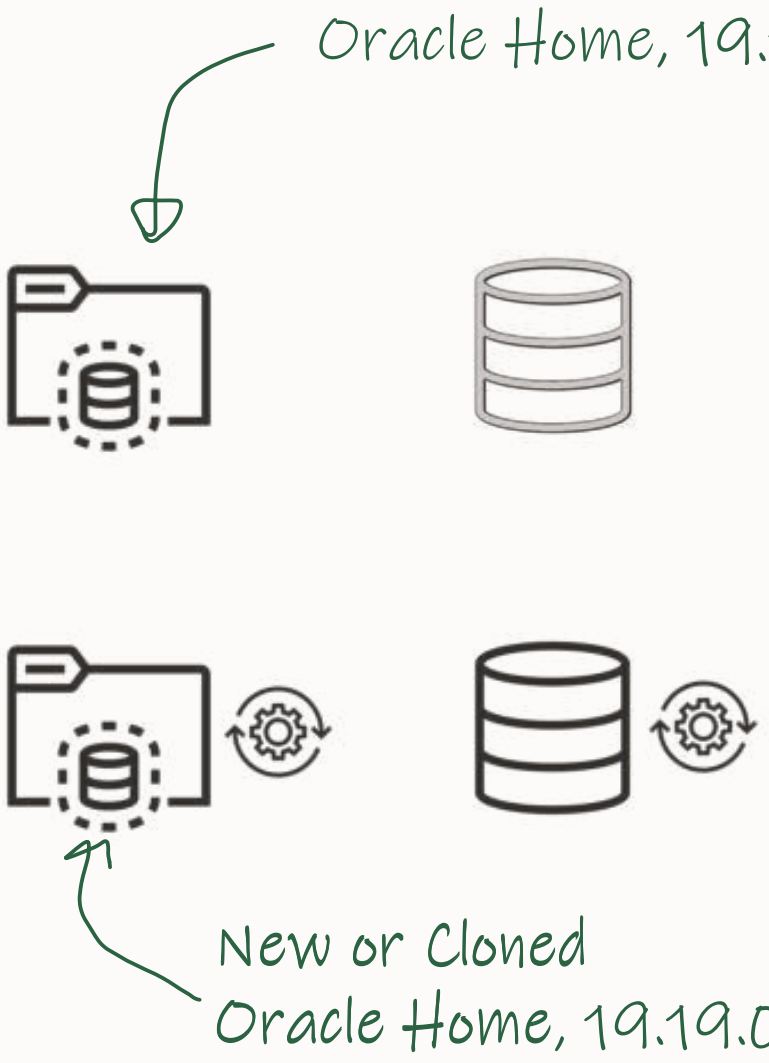
Patching Insights

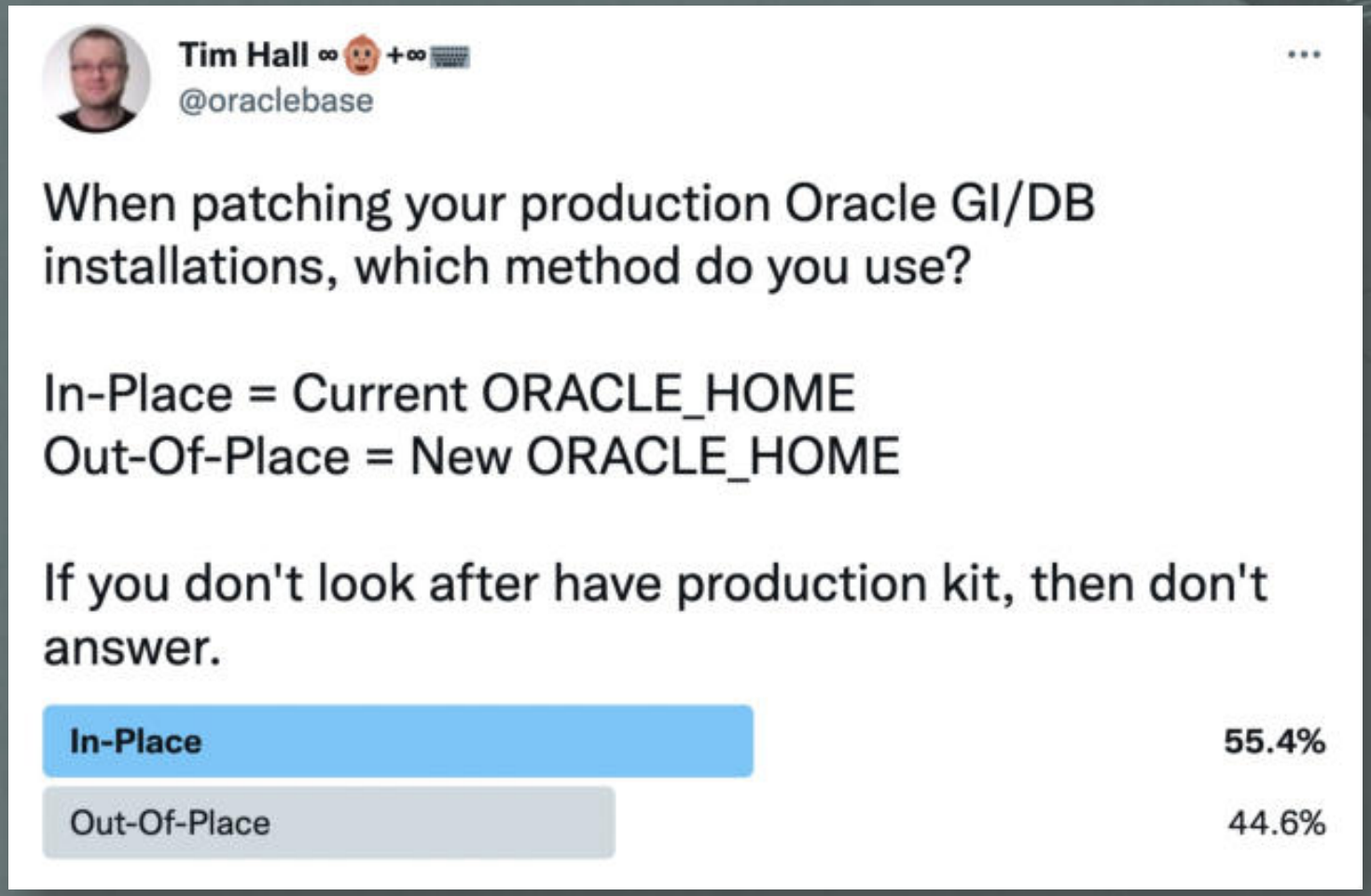
Patching Concepts | In-Place Patching




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

Patching Concepts | Out-of-Place Patching





Twitter

Always patch out-of-place

- Minimize downtime
- Avoid conflicts *surprise*
- Easier rollback
- Use brand-new Oracle Home to avoid the need for rolling off patches before applying new ones

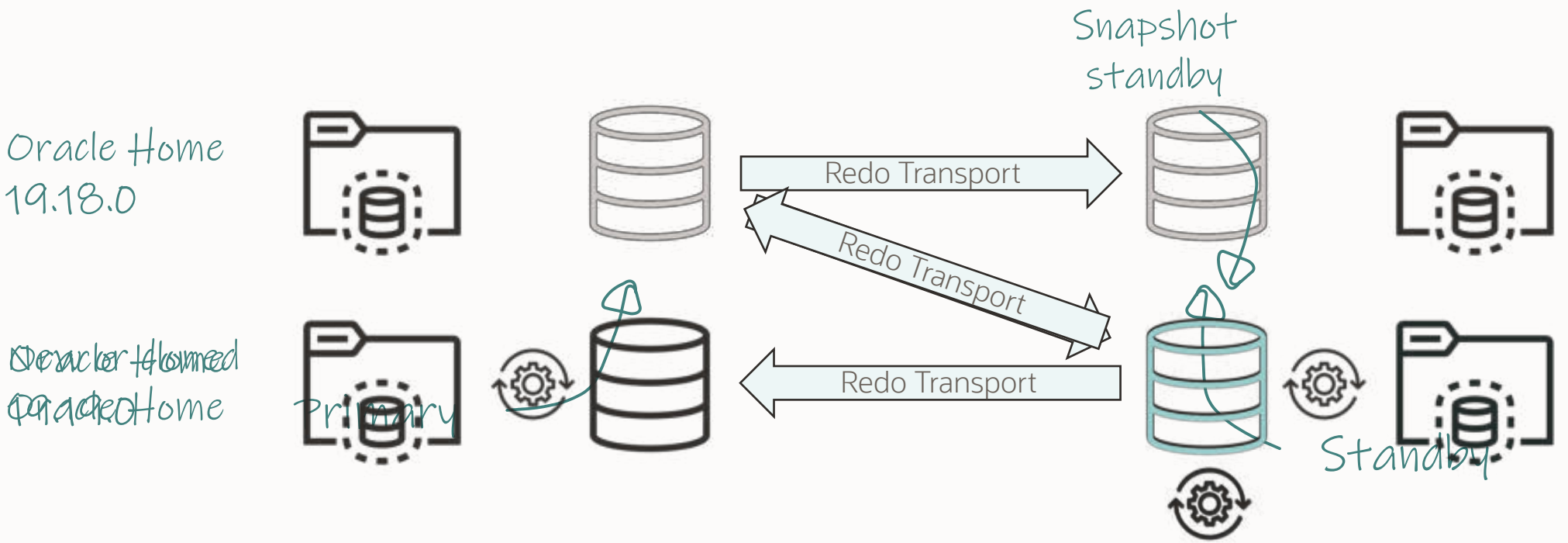
Be sure to copy all configuration files to the new Oracle Home

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

Safely test and verify patches with Standby-First Patch Apply

- Oracle Patch Assurance - Data Guard Standby-First Patch Apply (Doc ID 1265700.1)

Patching Concepts | Standby-First Patch Apply




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

The patch must be marked as Standby-First Installable

- Check the patch readme

Execute Datapatch on primary database

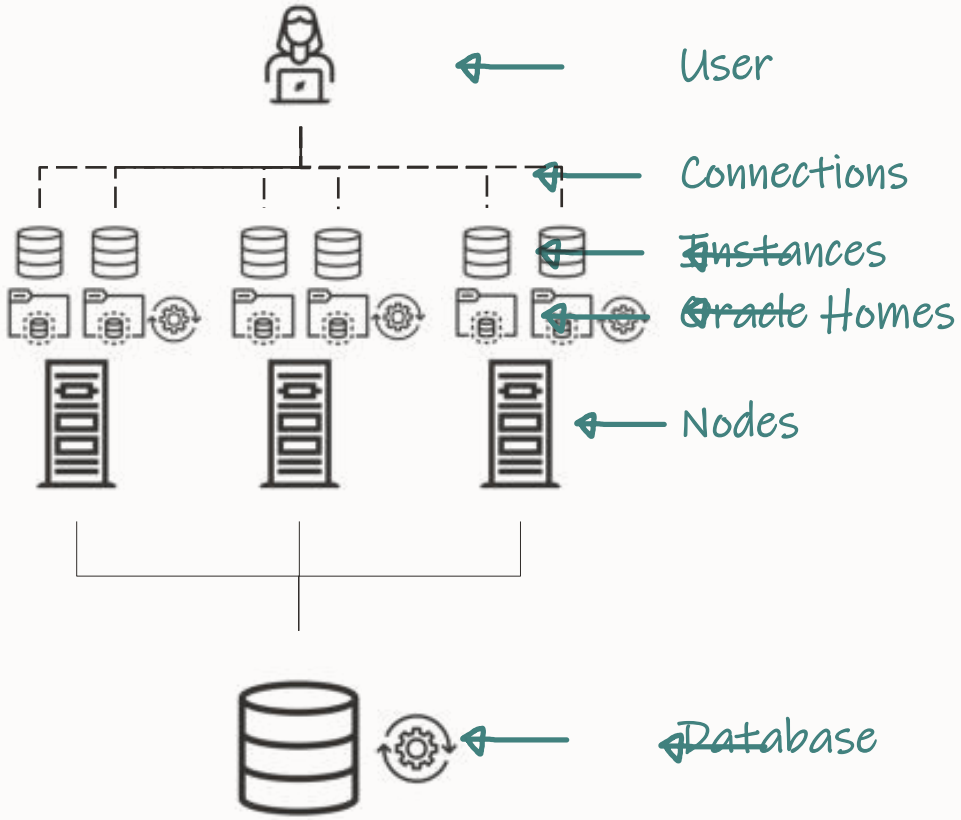
- Execute as quickly as possible when all databases are running on the new Oracle Home

Additional restrictions apply

- For details, check Oracle Patch Assurance - Data Guard Standby-First Patch Apply (Doc ID 1265700.1)

Avoid downtime with RAC Rolling Patching

Patching Concepts | RAC Rolling




```
$ $ORACLE_HOME/OPatch/opatchauto
```

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

RAC Rolling Patching | Best Practices

Keep GI and DB patch level in sync

- This is what we test
- This is how we run our cloud

Supported, but not recommended, combinations

- Grid Infrastructure home = 19.14.0
- Database home = 19.16.0

- Grid Infrastructure home = 19.18.0
- Database home = 19.14.0

- Node 1 – Grid Infrastructure home = 19.14.0
- Node 2 – Grid Infrastructure home = 19.17.0

- Patching node 1 on Monday, then patching node 2 on another day

- Operating a cluster with different Oracle versions of either Grid Infrastructure and/or Database homes on each of the nodes

Can I delay or omit applying patches to a subset of instances/nodes in an Oracle RAC cluster?

No. All patching operations should be completed on all Oracle Real Application Clusters (RAC) instances as quickly as possible. When applying patches to an Oracle Grid Infrastructure or Oracle Database home, these patches must be made effective as soon as possible, ideally within 24 hours. Rolling patching of RAC clusters with the draining of connections is a recommended and well-tested process. However, running mixed patch levels inherently brings more risk, and testing any given patches in a mixed manner will be less robust than trying a uniform set of patches across the cluster. Running with a mix of patches across a cluster for an extended time increases the risk of exposure to untested corner cases impacting system stability, scalability, and potential availability. Additionally, some functionality is restricted during rolling patching.

RAC: Frequently Asked Questions (RAC FAQ) (Doc ID 220970.1)

Release updates are **always**:

Standby-First installable

RAC Rolling installable

Patch Me
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Installation and Patches

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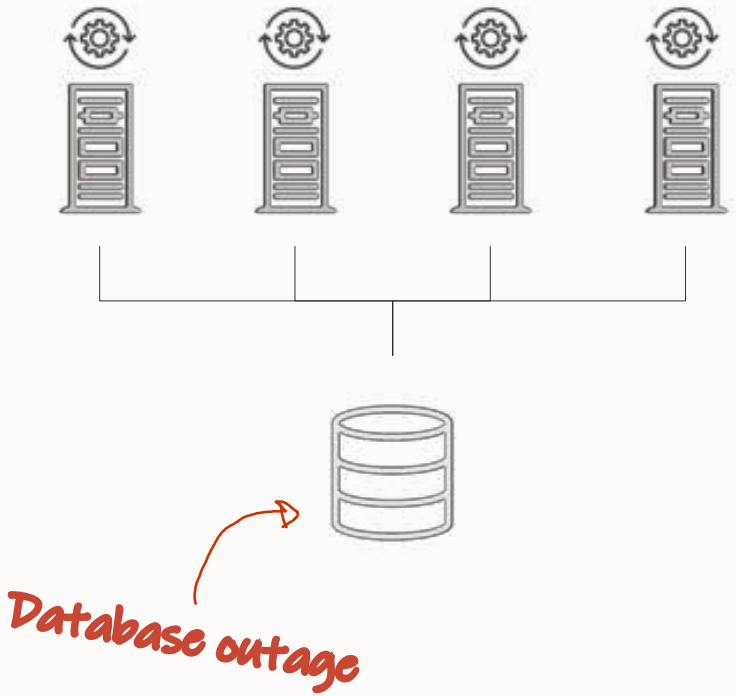
Patching Insights

The following patching strategies apply to Oracle Database patching as well

Grid Infrastructure | Patching Strategies

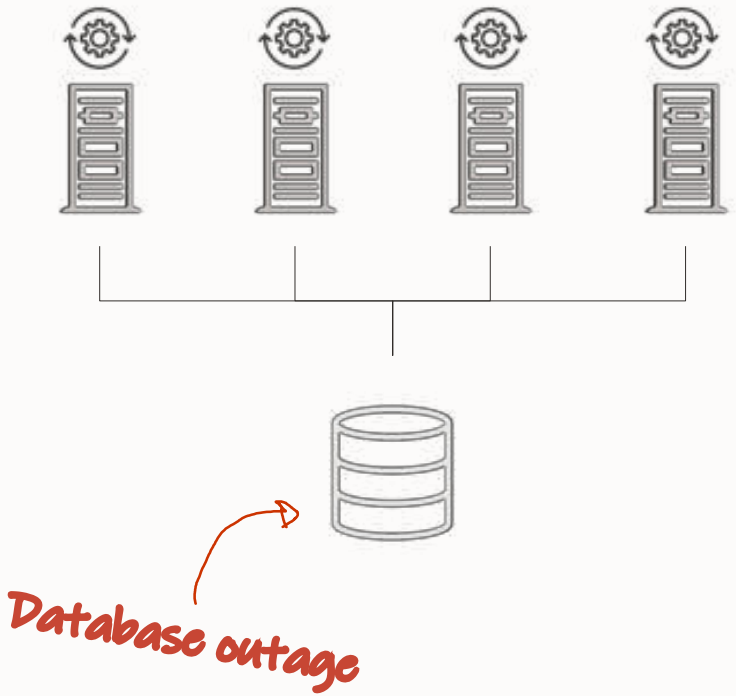


ALL NODE

- 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 Strategies

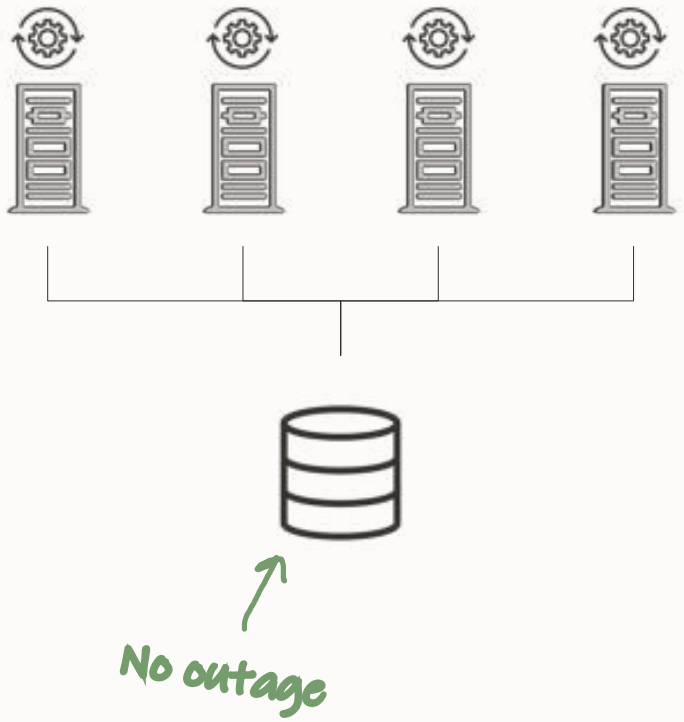


MINIMUM DOWNTIME

- 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 Strategies

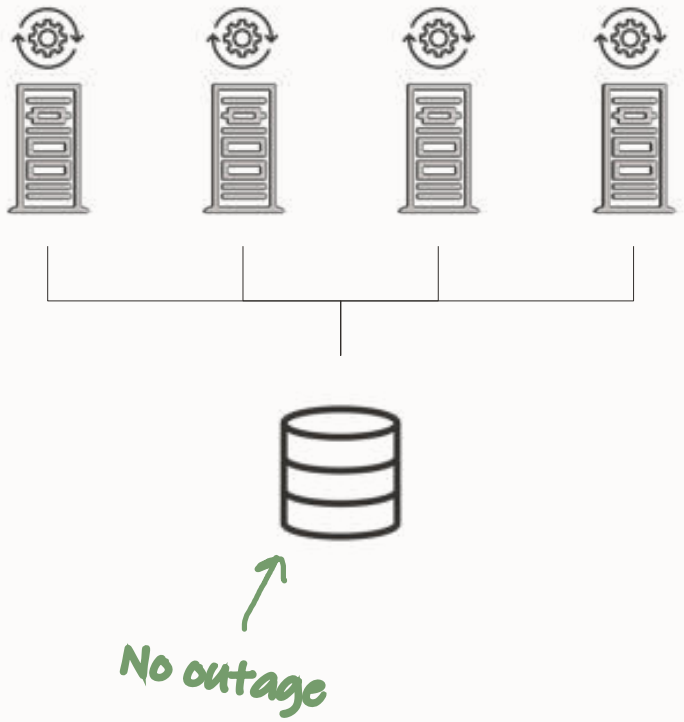


ROLLING

- Each node patched separately
- 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)

Grid Infrastructure | Patching Strategies



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)

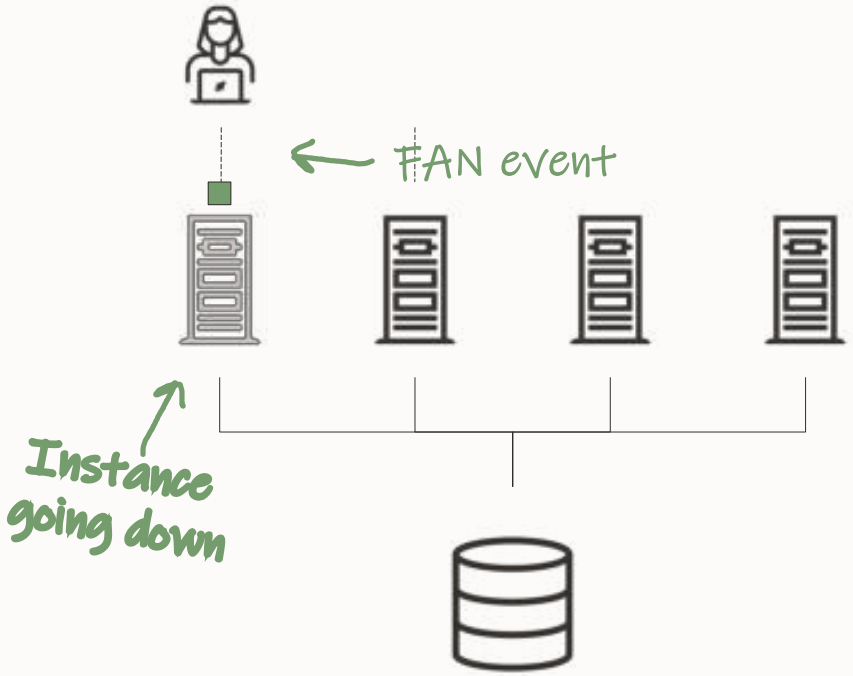
Rolling installation of patches is preferred, but requires effective draining

- Optionally, consider a *batched* approach

Complete a rolling patch installation as quickly as possible

- Ideally within 24 hours
- Certain functionality during the rolling patch installation

Grid Infrastructure | Draining



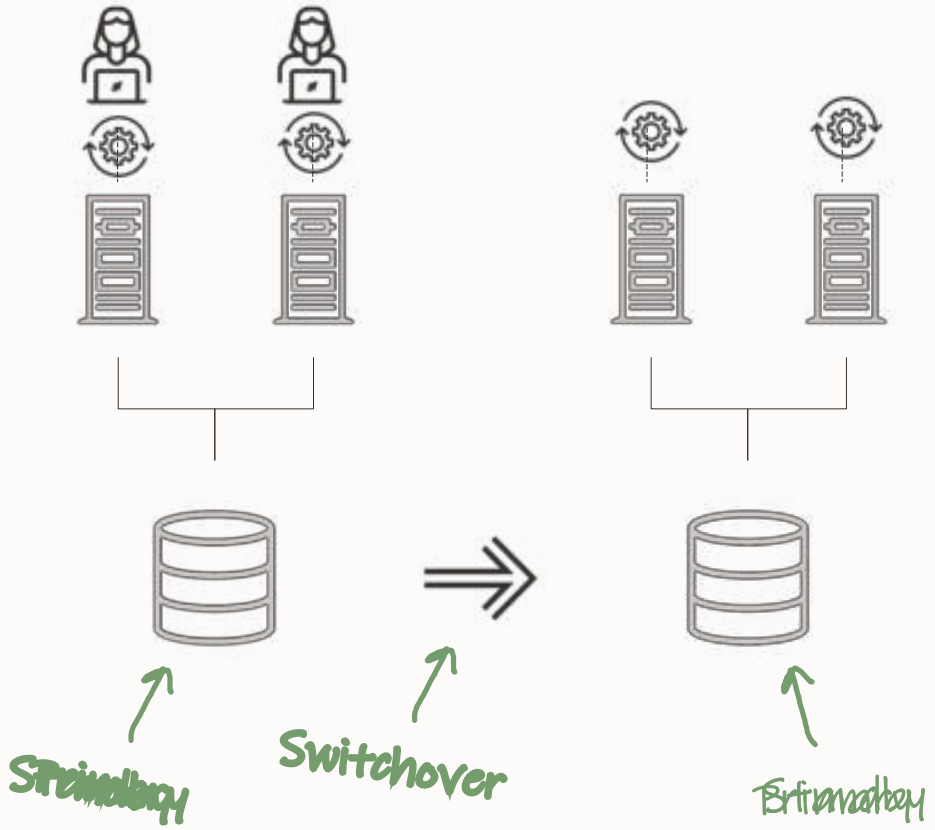
DRAINING

- 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`

Comply with Maximum Availability Architecture

- Continuous Availability - MAA Checklist for Applications for the Oracle Database

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

Patching Methods

1 In-place

Replaces existing Oracle Home

Uses `opatchauto`

2 Out-of-place

Creates a new Oracle Home

Uses `opatchauto` or `gridSetup`

Use out-of-place patching

- Minimize downtime
- Minimize risk during outage
- Easier rollback
- Also for Oracle Restart

Patching Grid Infrastructure and Database

Option 1

TOGETHER

One maintenance window

Longer window

Several changes

Option 2

SEPARATELY

Two maintenance windows

Shorter, but more windows

One change at a time

Keep maintenance windows close to each other

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

top tips

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

top tips

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

top tips

PATCHING SUCCESS

Cluster Verification Utility

Patch Level

Application Continuity

OPatch

Always use the latest version of OPatch

Use in GI and DB homes

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Always use the latest OPatch

- Download Patch 6880880
- MOS Note: 274526.1
- Why should you use the most recent version of OPATCH?

If OPatch takes too long, use out-of-place patching with a brand-new Oracle Home

- Avoid cloned Oracle Homes and in-place patching
- Also avoids rolling off patches before applying new ones

Reusing Oracle Home leads to:

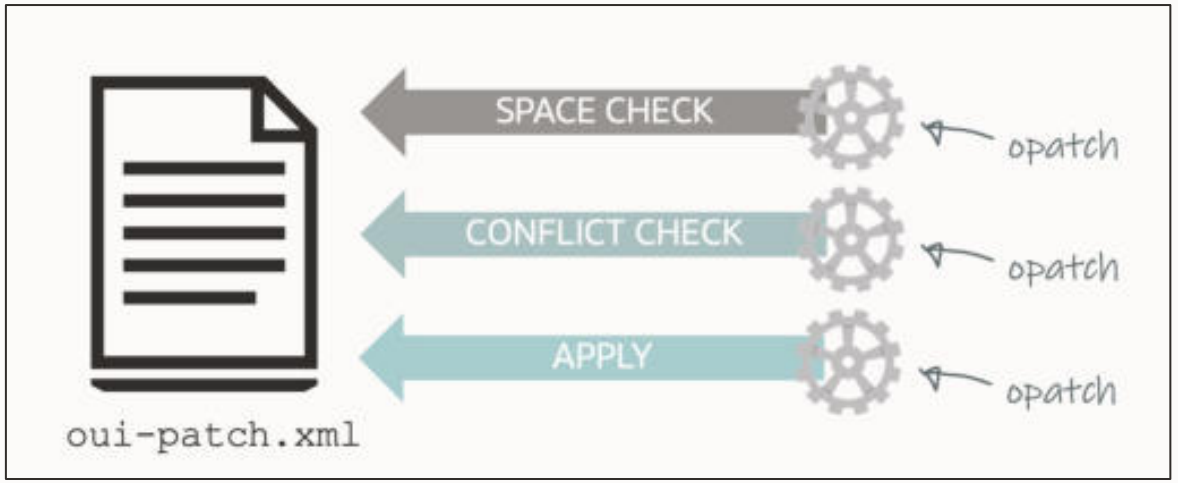
- Disk footprint increases
- Patching runtime increases

Patching Performance

Root cause for long `opatch` runtime

`opatch` maintains an ever-growing patch history in `$ORACLE_HOME/inventory/ContentsXML/oui-patch.xml`

This file gets queried multiple times and can delay patching massively



Remove old patches from Oracle Home using `opatch util deleteinactivepatches`

- Available in OPatch version 37
- Execute after patching and Oracle Home cloning
- For scripting use `-silent`

Patching Performance | Clean Up Example

Oracle Home, 19.3.0

Apply Release Update 19.6.0

Apply Release Update 19.7.0

Apply Release Update 19.8.0

...

Apply Release Update 19.18.0

Patching Performance | Clean Up Example

Before

`oui-patch.xml`

1001 lines

Cleanup

```
opatch util deleteinactivepatches
```

After

`oui-patch.xml`

136 lines

Patching runtime:

19m 22s

Patching runtime:

4m 20s

1

Unzip new Oracle Home

Download base release from oracle.com

2

Update OPatch

Download from Oracle Support

3

Install Oracle Home and patches

Attach Oracle Home and apply patches in one operation

```
./runInstaller -applyRU ... -applyOneOffs ...
```

Check blog post for details

Run unattended using `-silent`

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

- Datapatch Sanity Checks
- Datapatch User Guide (Doc ID 2680521.1)
- Executed by AutoUpgrade in analyze mode
- Work in progress

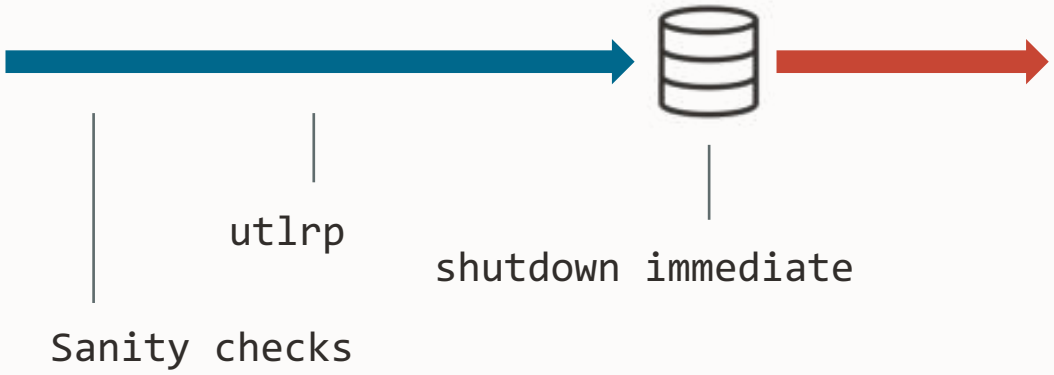
```
$ ./datapatch -sanity_checks

...

Check: DB Components status - OK
Check: PDB Violations - OK
Check: System invalid objects - OK
Check: Tablespace Status - OK
Check: Backup jobs - OK
Check: Temp Datafile exists - OK
Check: Datapump running - OK
Check: Container status - OK
Check: Encryption wallet - OK
Check: Dictionary statistics gathering - OK
Check: Scheduled Jobs - NOT OK (WARNING)
  Message: There are current running or scheduled jobs set to run on the next hour.
  Scheduled jobs may have an impact when run during patching.
  :
    JOB_NAME,NEXT_RUN_DATE,SCHEMA_NAME,STATE
    CLEANUP_TRANSIENT_PKG,23-MAY-23 11.08.53.000000 AM +01:00,APPUSER,SCHEDULED
```

Recompile invalid objects before invoking datapatch

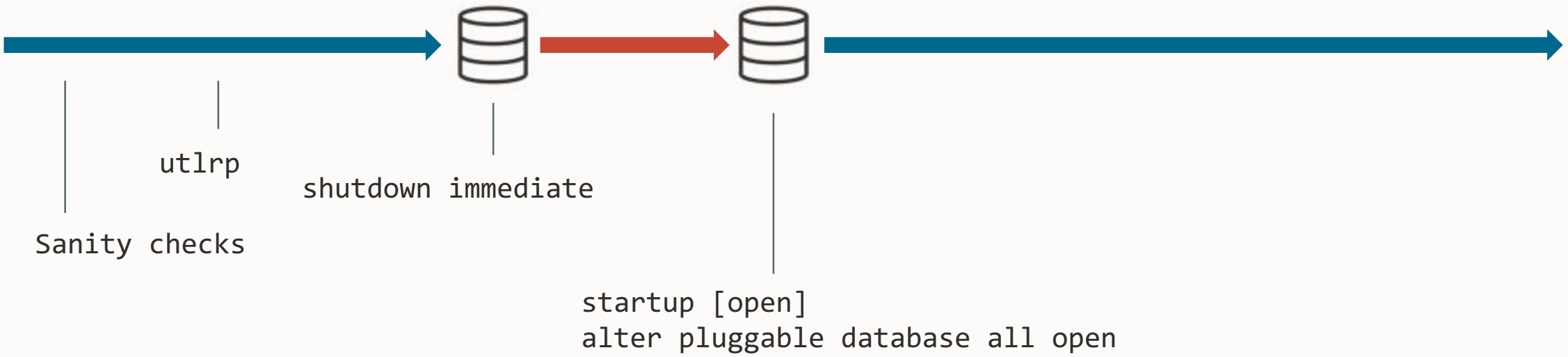
Patching Timeline



The database must be open
Only open PDBs are patched

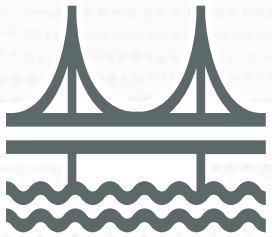
- Upgrade mode or restricted session is not needed

Patching Timeline



You can run datapatch while users are connected to the database

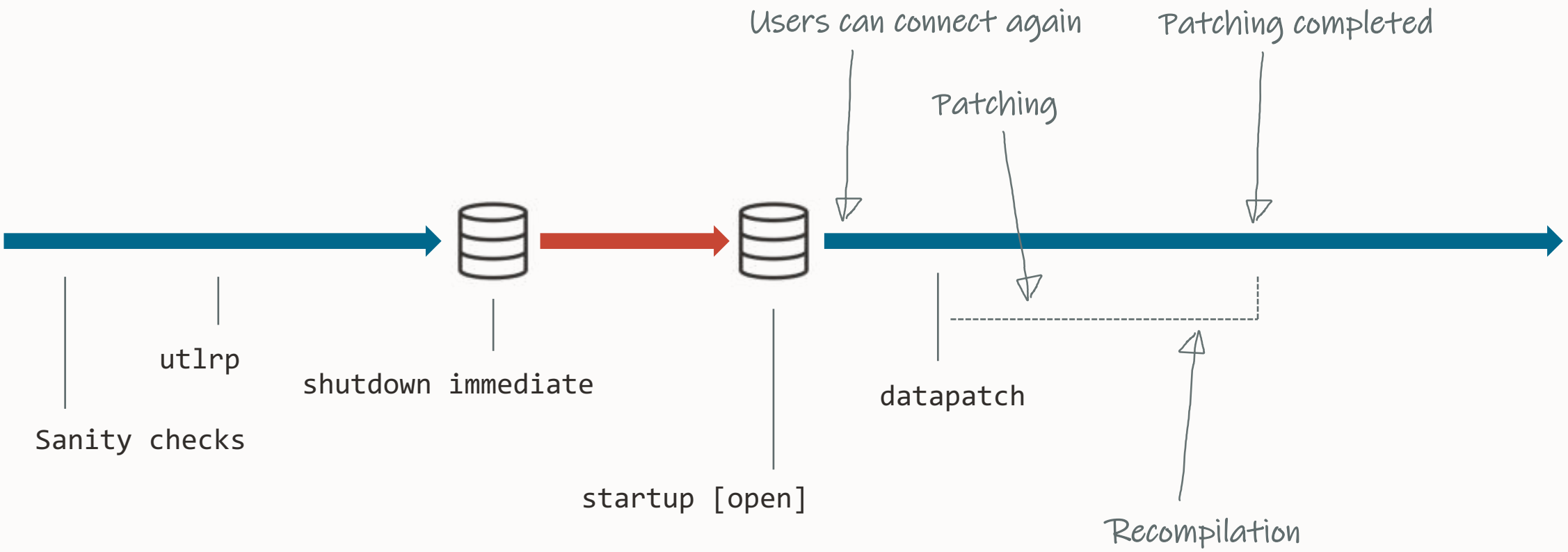
- Details in blog post



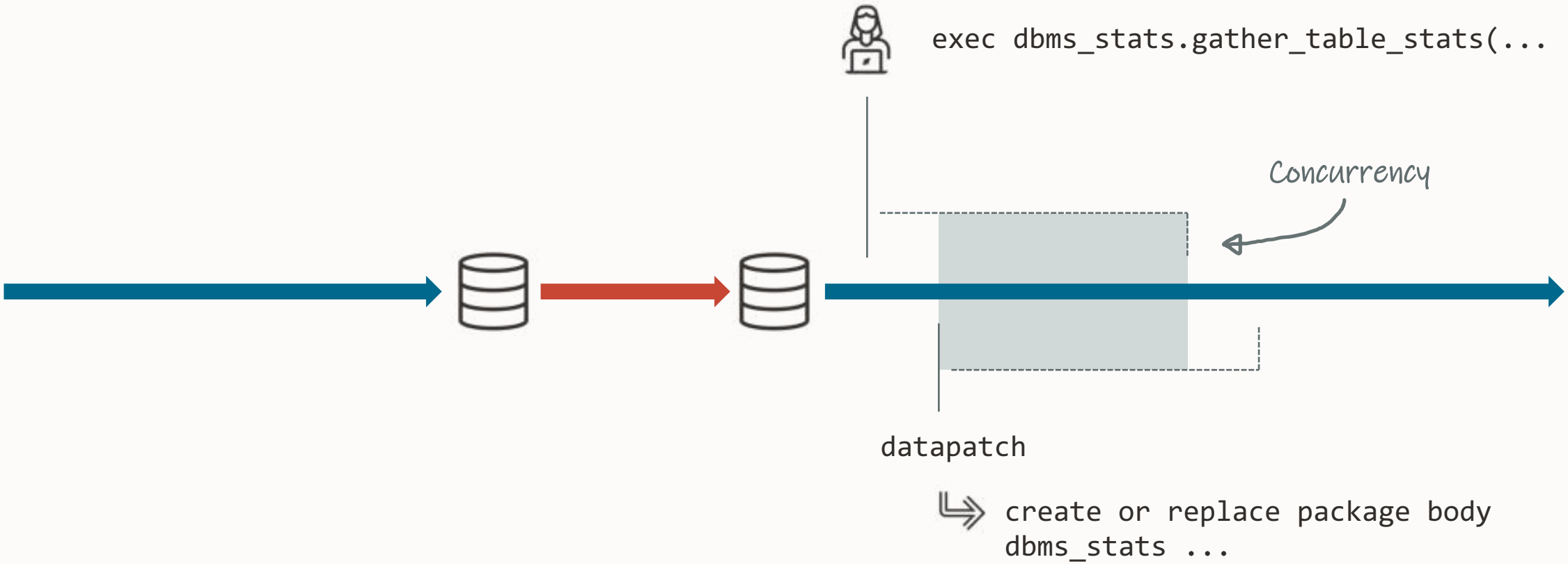
Stop Oracle GoldenGate while you are running datapatch

- Recommendation

Patching Timeline



Patching Timeline



Concurrency

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

- Optionally, find blocking session and kill it

- Increase timeout using `-ddl_lock_timeout` *n*

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

- You can query `DBA_REGISTRY_SQLPATCH`

If in doubt run Datapatch again

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

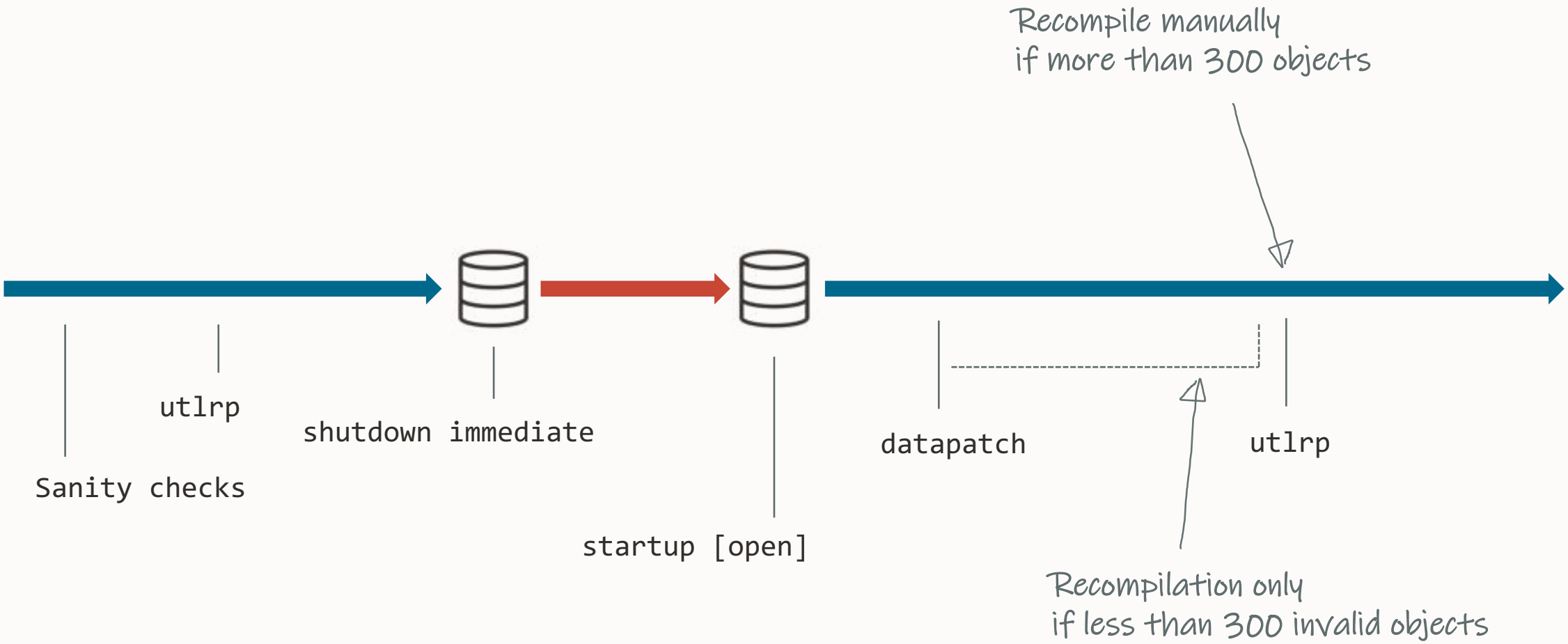
Recompilation

- Datapatch recompiles objects invalidated during patching
- If more than 300 objects are invalidated no recompilation takes places
  - Recompile manually
  - Or, objects will be recompiled on usage
- Adjust the threshold

```
datapatch ... -recomp_threshold 300
```

- Consider recompiling invalid objects after patching

Patching Timeline



```
$ pwd
/u01/app/oracle/cfgtoollogs/sqlpatch/sqlpatch_485_2022_01_19_22_13_40

$ grep "recomp_threshold" *catcon* -A1

[CDB$ROOT] Invalid ORACLE_MAINTAINED objects: before patching=0, after patching=0, recomp_threshold=300
[CDB$ROOT] All ORACLE_MAINTAINED objects are VALID, recompilation not needed.
[PDB$SEED] Invalid ORACLE_MAINTAINED objects: before patching=0, after patching=0, recomp_threshold=300
[PDB$SEED] All ORACLE_MAINTAINED objects are VALID, recompilation not needed.
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[PDB$SEED] All ORACLE_MAINTAINED objects are VALID, recompilation not needed.
```

$ORACLE_HOME/OPatch/datapatch

$ORACLE_HOME/sqlpatch/sqlpatch

$ORACLE_HOME/sqlpatch/sqlpatch.pl

```
use strict;
use Getopt::Long;

use sqlpatch.pm
```

Datapatch | Patch Apply Sequence

`datapatch` 

1  Java patches

2  Bundle patches

3  One-off patches

Datapatch | Patch Rollback and Apply Queue

Binary Registry after `opatch`:

- Patch 444 – Java Patch
- Patch 555 – Bundle Patch
- Patch 666 – One-off Patch

Oracle Home

SQL Registry before `datapatch`:

- Patch 111 – Java Patch
- Patch 222 – Bundle Patch
- Patch 333 – One-off Patch

Database

```
$ ./datapatch
```

datapatch queue

Rollback:

Apply:

Rollback:

Cumulative: Patch 222 to 555 – Bundle Patch

Apply:

Datapatch | Rollback Script

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
```

Less components, Faster patching

Components that often take the most time:

- JAVAVM
- ORDIM
- SDO

THANK YOU