ORACLE

Patch Me If You Can

UKOUG Webinar, May 2023

Photo by Laura Ockel on Unsplash

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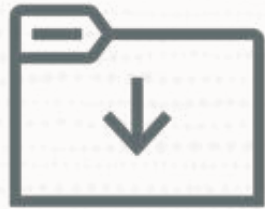
https://dbarj.com.br

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

Before upgrading, apply the most recent RU

Use the Patch Download Assistant MOS Note: 2118136.2

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

To Bottom

Selection(s)

Solution(s)

What would you like to download?

Possible Solutions will appear once you make your selection.

○ Oracle Database Base Releases
○ Oracle Database Patchsets
○ Oracle Database Updates (Versions 12.2 & higher)
○ Oracle Database Update Revisions (Versions 12.2 & higher)
○ Oracle Database PSU, SPU(CPU), Bundle Patches (Versions 12.1 & lower)
○ OJVM Update/PSU/Bundle Patches
○ Latest Available Microsoft Windows Patches

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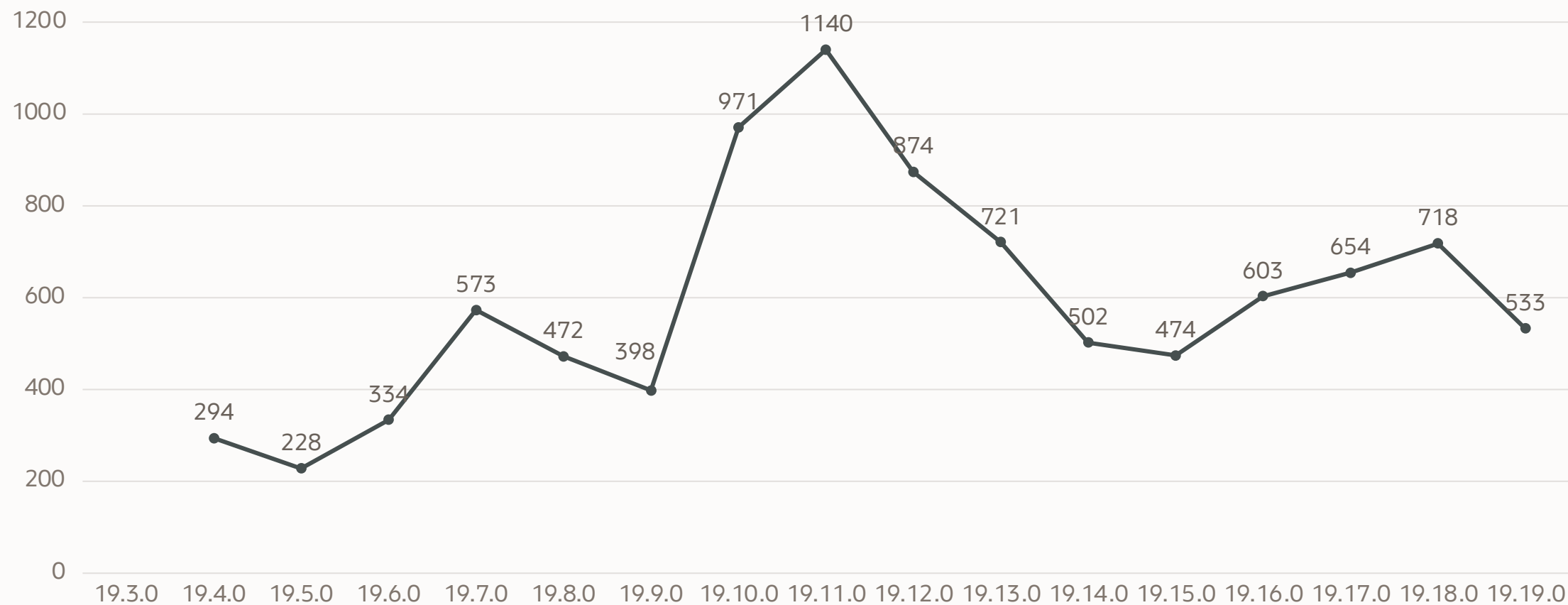
Database 19 Release Updates and Revisions Bugs Fixed Lists (Doc ID 2523220.1)

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-patches]		25-MAR-2023

Monthly Recommended Patches

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

Timeline | Release Updates

	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

	2022			2023										
	October	November	December	January	February	March	April	May	June	July	August	September	October	November
19.17.0	19.17.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6							
19.18.0				19.18.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6				
19.19.0							19.19.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6	
19.20.0										19.20.0	MRP1	MRP2	MRP3	MRP4
19.21.0													19.21.0	MRP1

An MRP is a collection of several one-off patches

- Delivered via 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: 19.17.0 MRP5 contains all previous MRPs done for Oracle 19.17.0

MRPs may contain security fixes

- Release Updates remain the primary security fix delivery mechanism

Soon, MRPs may be available in OCI

- Including ExaDB-C@C

MRP Facts | More Information

[Introducing Monthly Recommended Patches (MRPs) and FAQ (Doc ID 2898740.1)](#)

[Patching News: RURs are gone – long live MRPs (Blog Post)](#)

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

[Oracle Database Patch Maintenance](#)

Before upgrading, apply the most important patches

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

As of 19.18.0 Perl patches are included in Release Updates

- Consider patching JDK as well (Doc ID 2584628.1)

As of 19.18.0 time zone patches are included in Release Updates

Patch Me
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Installation and Patches

Patching Basics

Patching Methods

Grid Infrastructure Patching

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 $\longrightarrow$ Applies binaries to an Oracle Home

All instances are down

datapatch $\longrightarrow$ 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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Installation and Patches

Patching Basics

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Grid Infrastructure Patching

Patching Insights

Patching Concepts | In-Place Patching

Oracle Home, 19.18.0
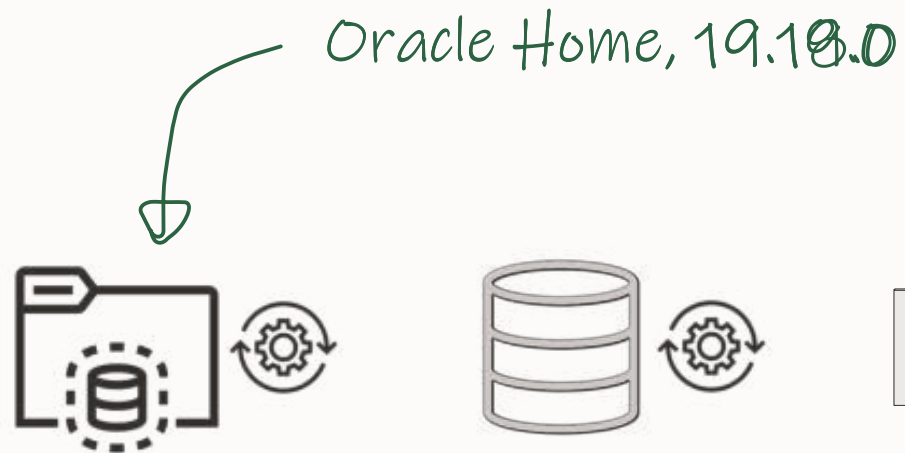
```
[oracle]$ $ORACLE_HOME/OPatch/datapatch -verbose
```

Patching Concepts | Out-of-Place Patching

Oracle Home, 19.18.0
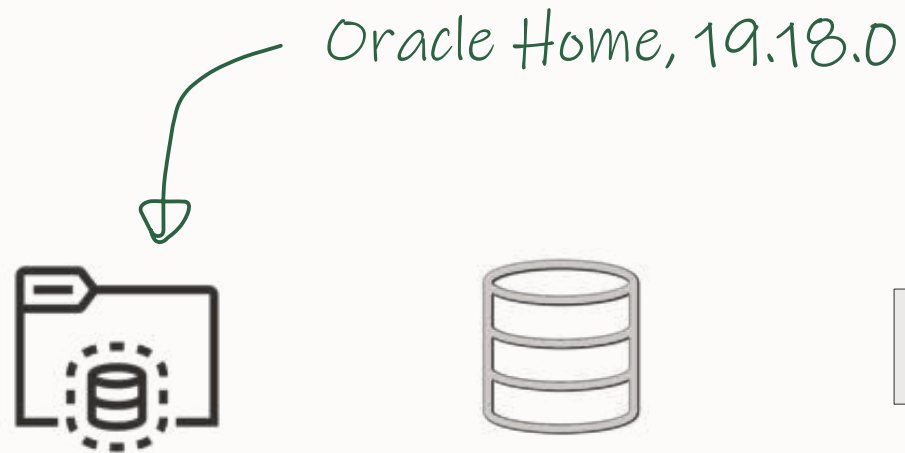

```
SQL> SHUTDOWN IMMEDIATE
```

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

New or Cloned
Oracle Home, 19.19.0

Always patch out-of-place

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

Snapshot standby

Oracle Home 19.18.0

Redo Transport

Redo Transport

Redo Transport
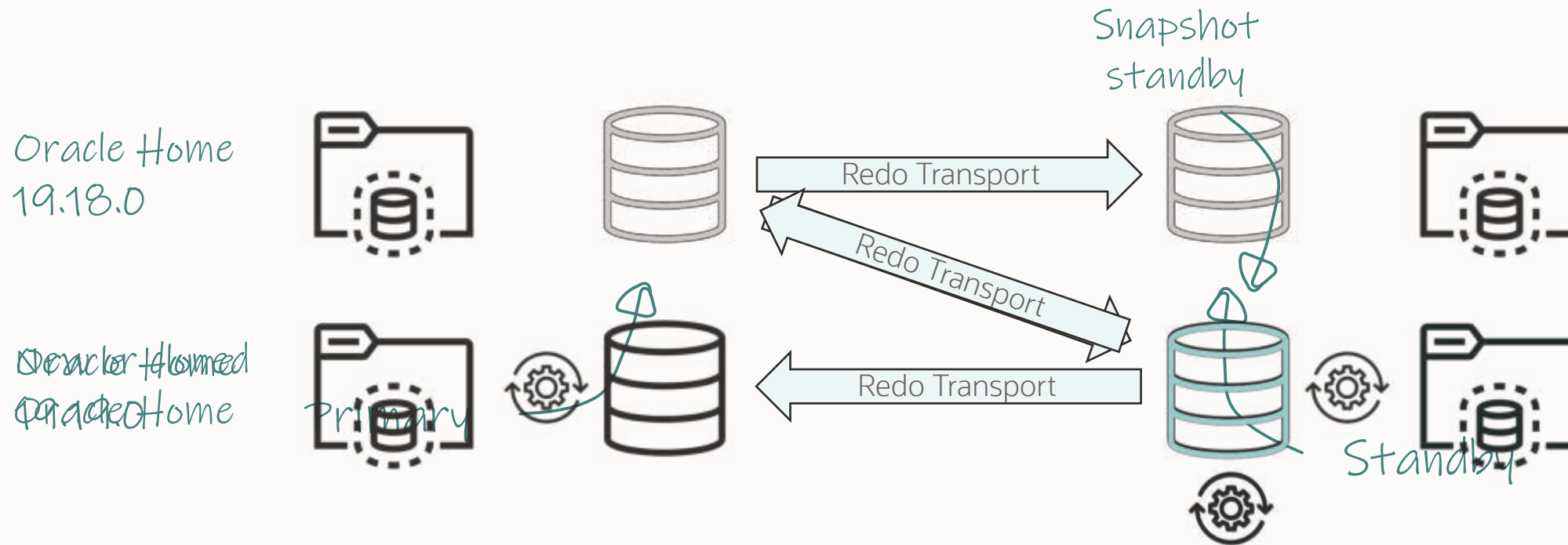
Primary

Standby

```
[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

User

Connections

~~Instances~~

~~Oracle Homes~~

Nodes

~~Database~~
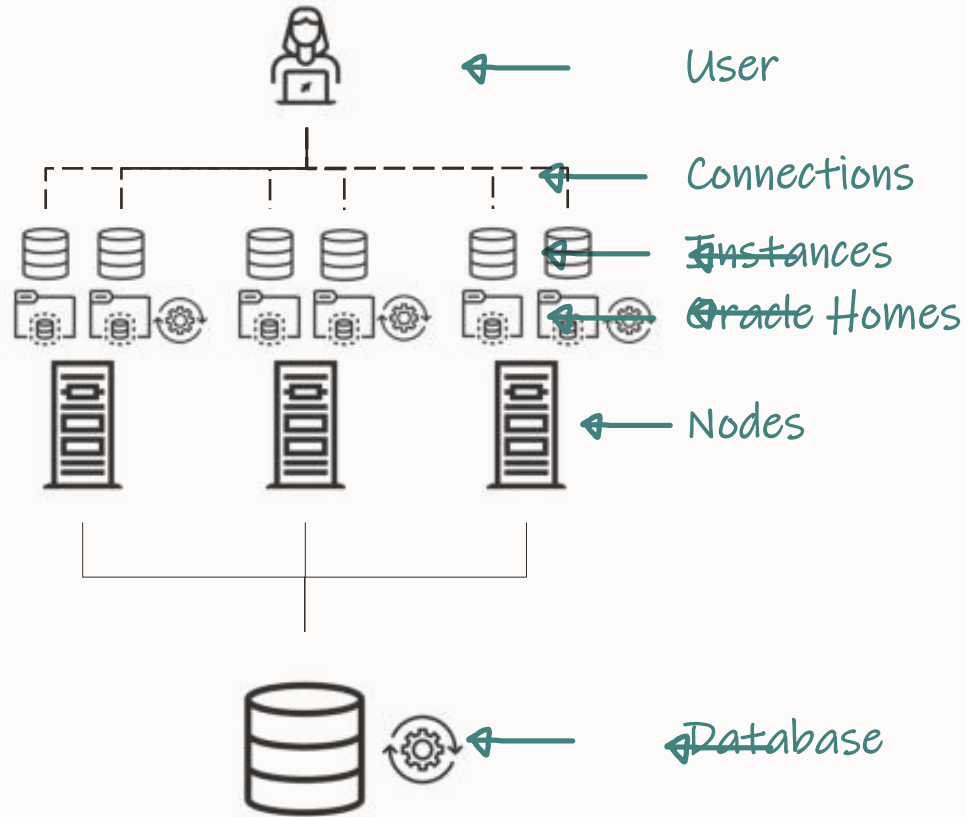
```
$ $ORACLE_HOME/OPatch/opatchauto
```

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

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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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Patching Methods

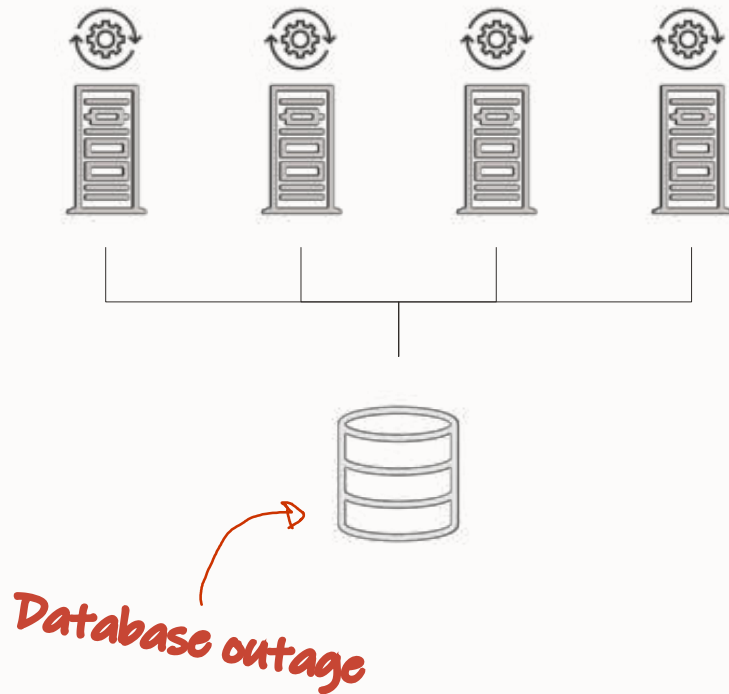**Grid Infrastructure Patching**

Patching Insights

The following patching concepts apply to Oracle Database patching as well

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
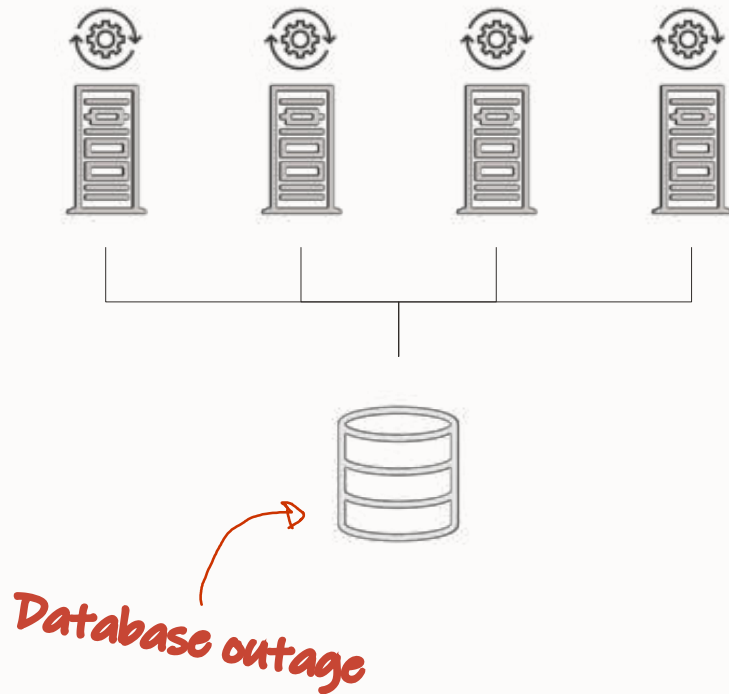
Database outage

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
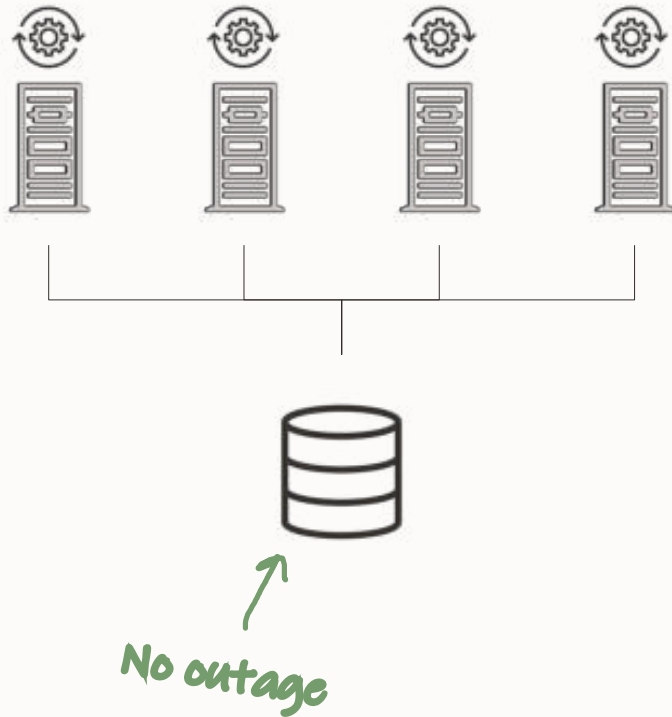
No outage

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 Concepts

No outage

ROLLING IN GROUPS

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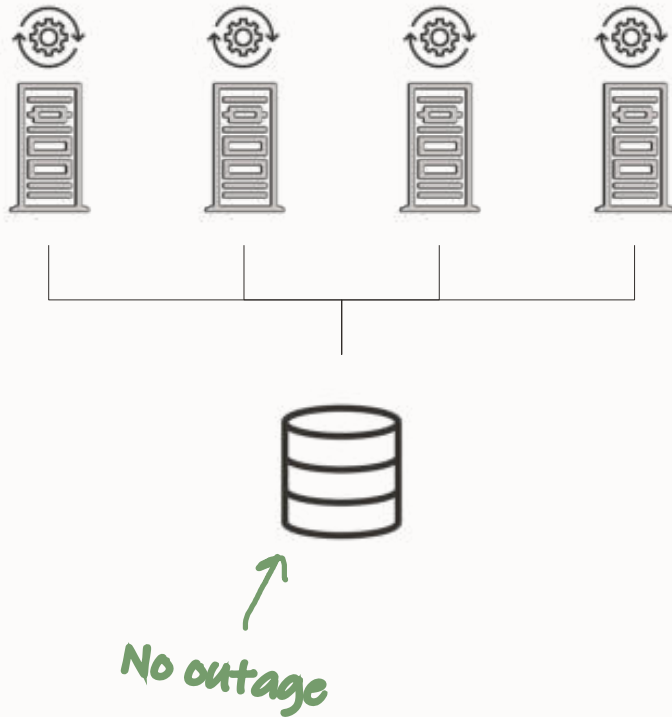- No database outage
- Patch must be RAC rolling installable
- Other nodes must handle workload while one node is patched

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

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

FAN event

Instance going down
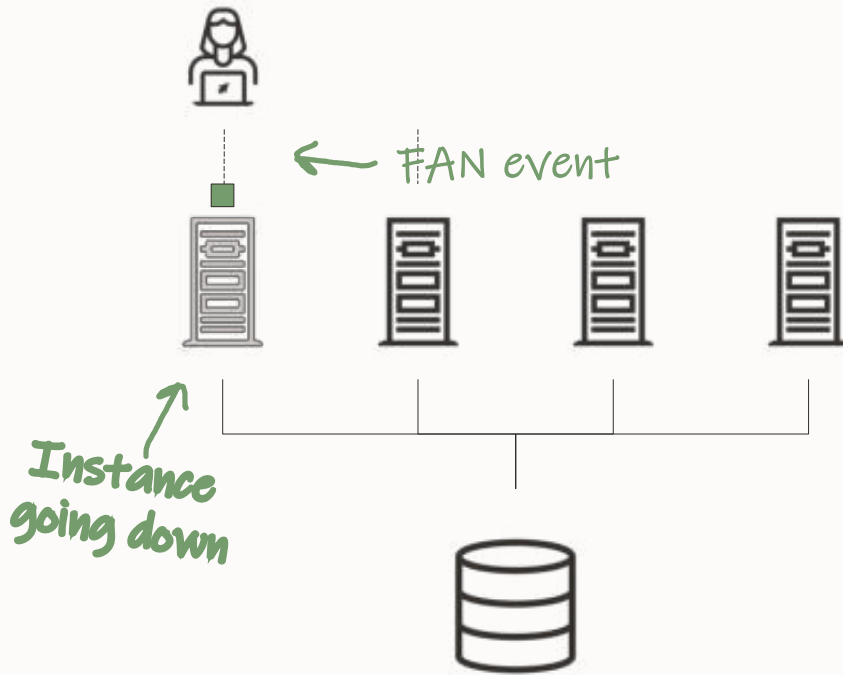
DRAINING

- 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`

Setting `drain_timeout` very low may cause a login storm

- Exercise caution on databases with many connections

Setting `drain_timeout` very high may be risky

- Load is spread on fewer instances
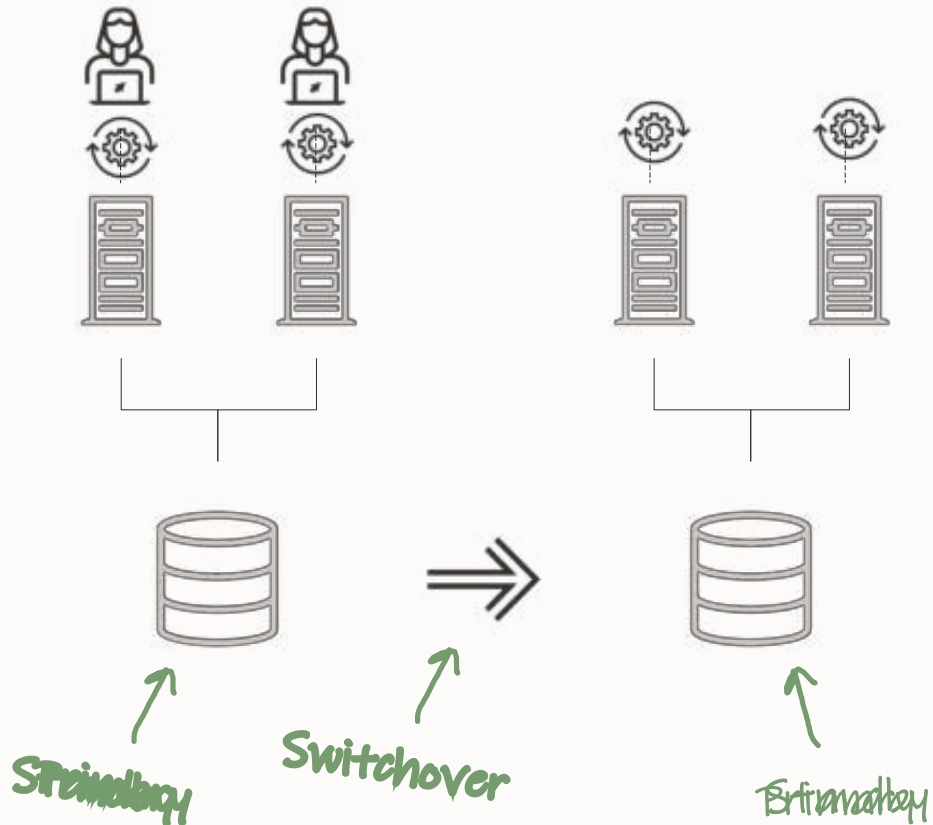- Cluster is in `ROLLING PATCH` state for an extended period

Comply with Maximum Availability Architecture

- [Continuous Availability - MAA Checklist for Applications for the Oracle Database](#)

Grid Infrastructure | Data Guard

Streaming   Switchover   Primary

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

In-place

1

Replaces existing Oracle Home

Uses `opatchauto`

Out-of-place

2

Creates a new Oracle Home

Uses `opatchauto` or `gridSetup`

Use out-of-place patching

- Minimize downtime
- Minimize risk during outage
- Easier rollback

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

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

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 ——————— Completely <u>hide interruptions from users</u>

Hides planned and unplanned events

Comply with <u>MAA guidelines</u>

OPatch

See also <u>Transparent Application Continuity</u>

PATCHING SUCCESS

Cluster Verification Utility

Patch Level

Application Continuity

OPatch ———————————

Always use the <u>latest version of OPatch</u>

Use in GI and DB homes

Patch Me
if you can

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Patching Insights

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

Reusing Oracle Home leads to:
- Disk footprint increases
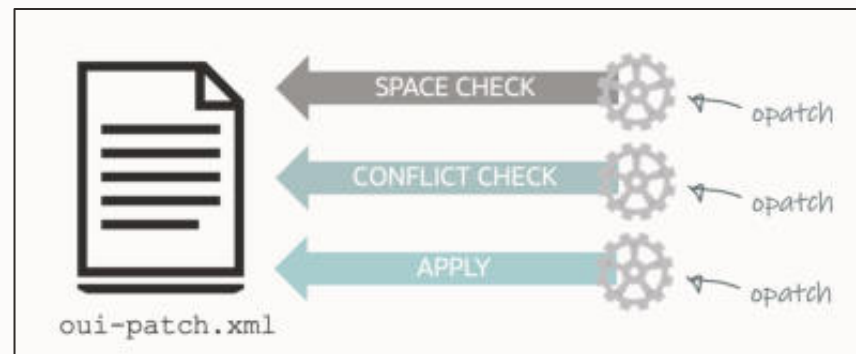- Patching runtime increases

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

Solution

Clean up available since opatch 37
`opatch util deleteinactivepatches`

Patching Performance | Clean up

Original `oui-patch.xml` with 12 RUs

- 1001 lines

  - Space check: 5:29 min
  - Conflict check: 5:26 min
  - Check during apply: 5:29 min
  - Raw patch apply: 3:58 min

  - Total time taken: 19:22 min

Cleaned `oui-patch.xml` with only 2 RUs

- 136 lines

  - Space check: 0:09 min
  - Conflict check: 0:08 min
  - Check during apply: 0:12 min
  - Raw patch apply: 3:51 min

  - Total time taken: **4:20** min

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

Patching a Database

1

Start database in new Oracle Home
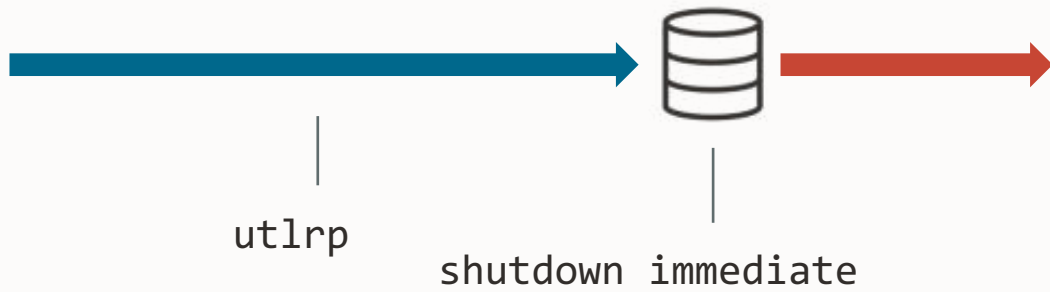
Start in normal open
Open all PDBs

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)](#)

Recompile invalid objects
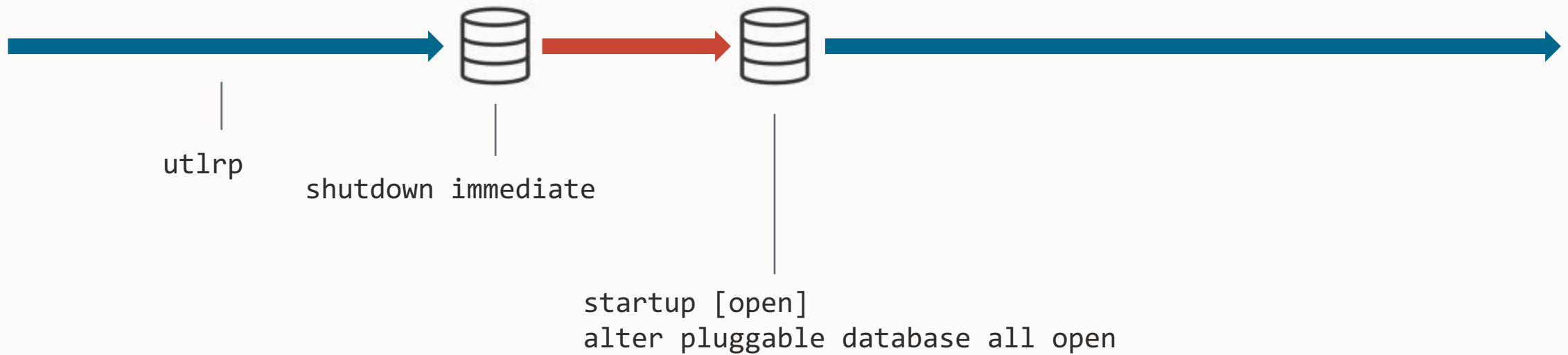before invoking datapatch

Patching Timeline

utlrp

shutdown immediate

The database must be open
Only open PDBs are patched

- Upgrade mode or restricted session is not needed

Patching Timeline

utlrp

shutdown immediate

startup [open]
alter pluggable database all open
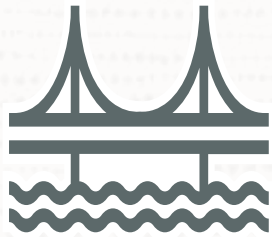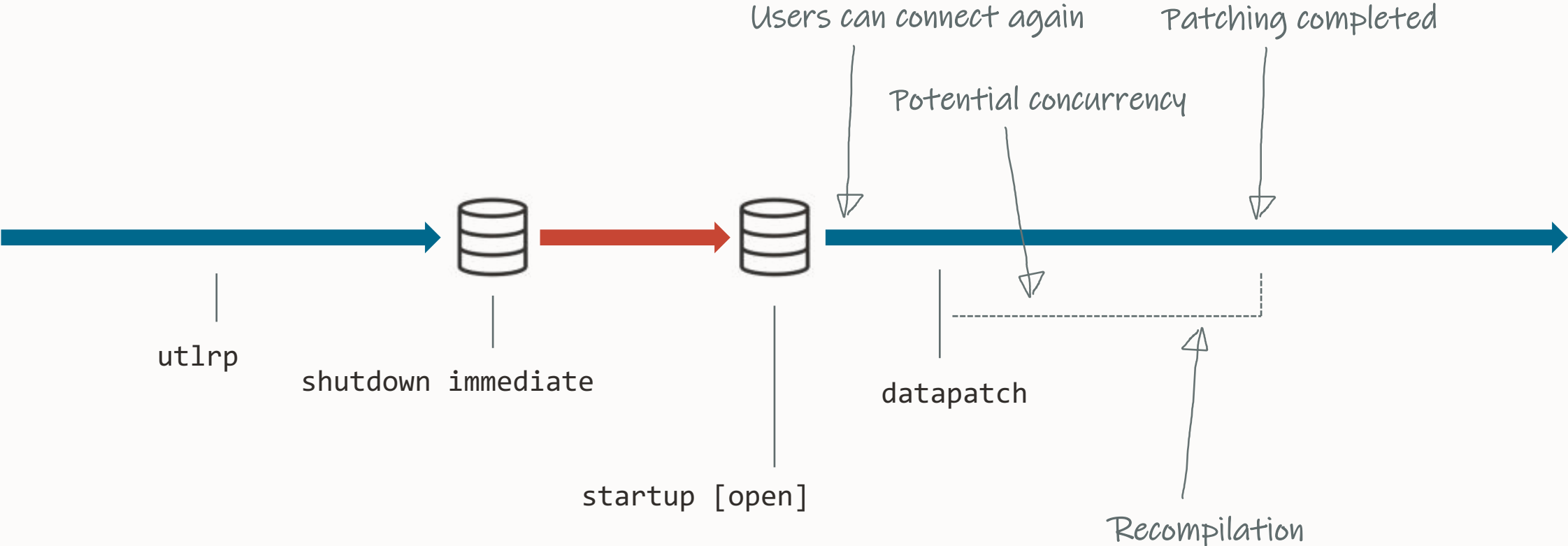
You can run datapatch while users are connected to the database

- Details in blog post

Stop Oracle GoldenGate while you are running datapatch

- Recommendation

Patching Timeline

Users can connect again

Patching completed

Potential concurrency

utlrp

shutdown immediate

startup [open]

datapatch

Recompilation

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
  - [How to Analyze Library Cache Timeout with Associated: ORA-04021 'timeout occurred while waiting to lock object %s%s%s%s%s.' Errors (Doc ID 1486712.1)](#)

- Timeout period controlled by `_kgl_time_to_wait_for_locks`
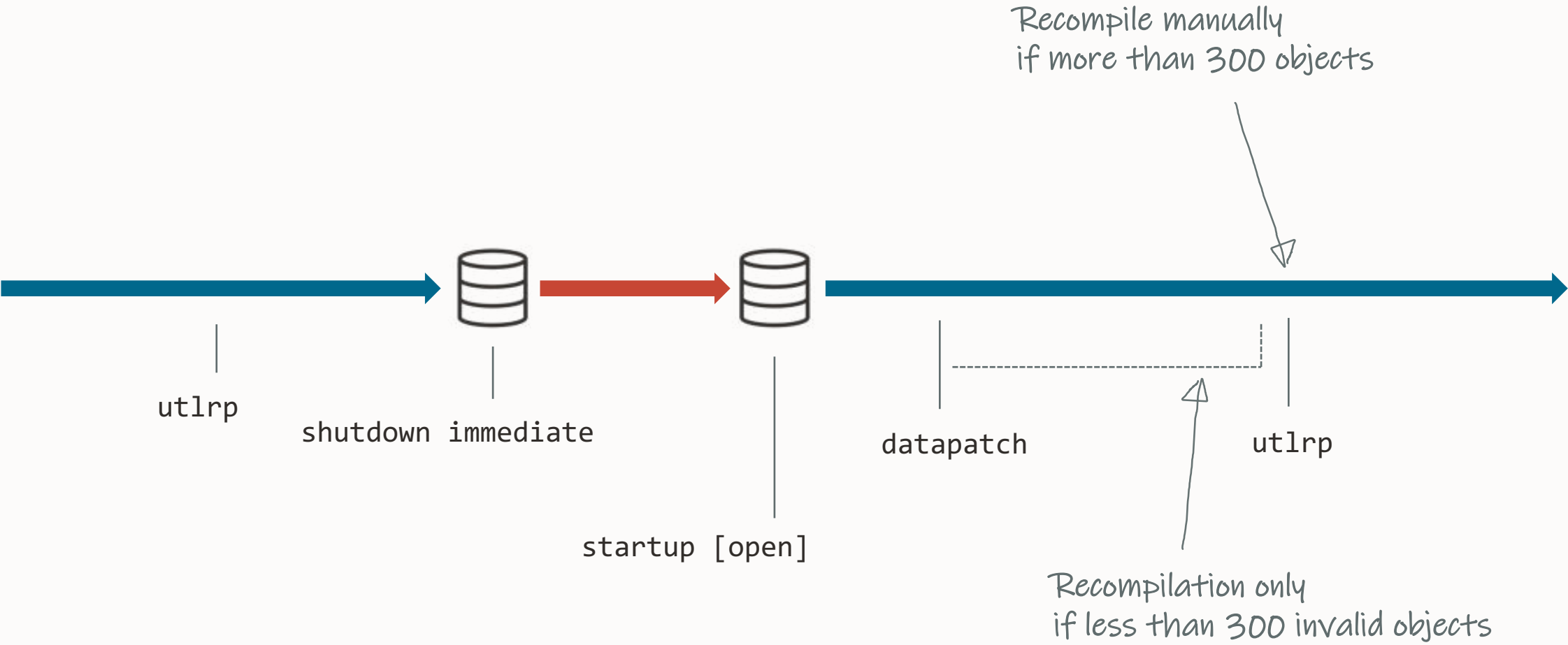 - Use under guidance of Oracle Support

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

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

Recompile manually
if more than 300 objects

utlrp

shutdown immediate

startup [open]

datapatch

utlrp

Recompilation only
if less than 300 invalid objects

```
$ 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.
```

```
$ 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.
```

$ORACLE_HOME/OPatch/datapatch

⮑ $ORACLE_HOME/sqlpatch/sqlpatch
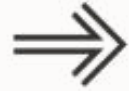
⮑ $ORACLE_HOME/sqlpatch/sqlpatch.pl

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

use sqlpatch.pm
```

Datapatch | Patch Apply Sequence

`datapatch` $\Rightarrow$

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

SQL Registry before `datapatch`:

> Patch 111 – Java Patch

> Patch 222 – Bundle Patch

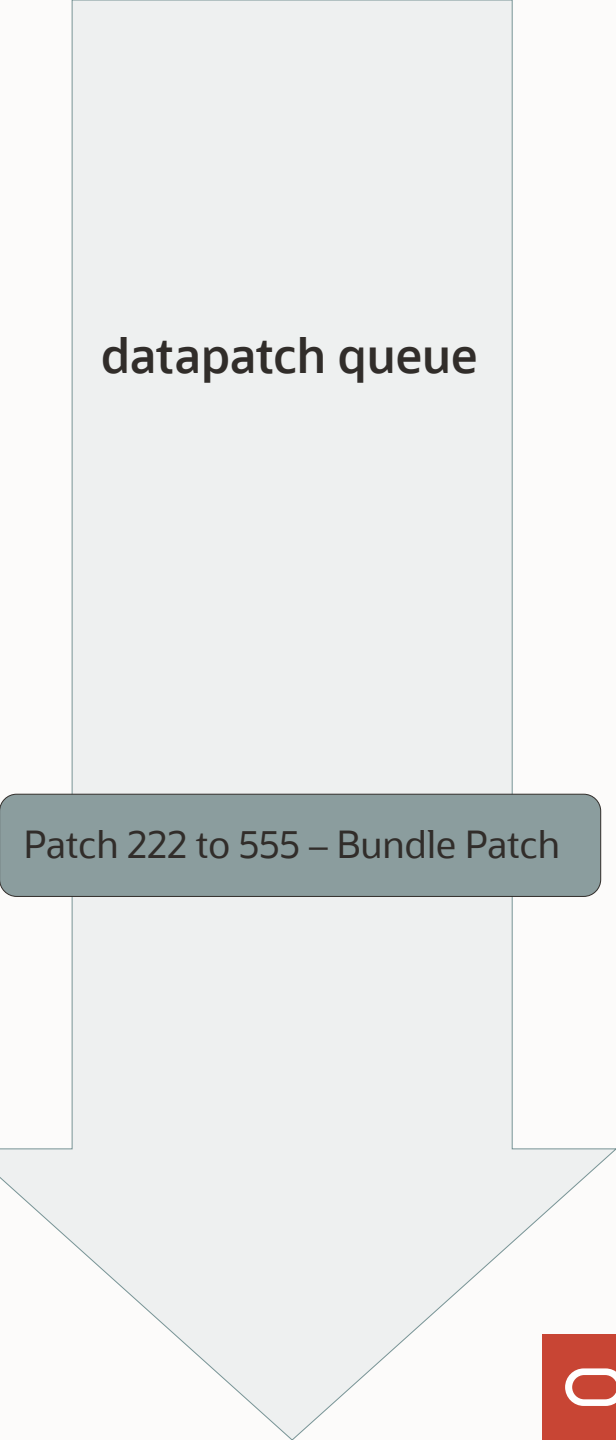> Patch 333 – One-off Patch

```
$ ./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,
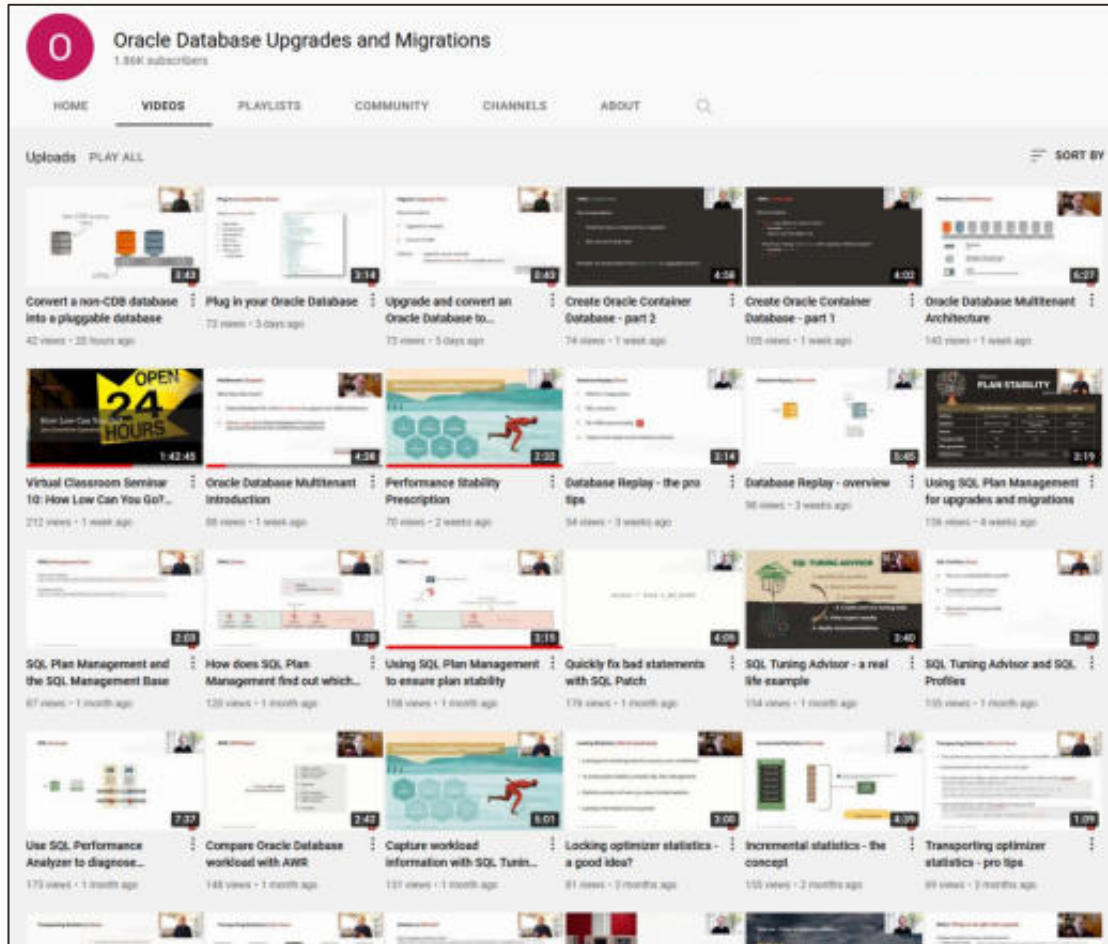# Faster patching

Typical candidates:
- JAVAVM
- ORDIM
- SDO

Patch Me
if you can

YouTube | Oracle Database Upgrades and Migrations

Link

- 300+ videos

- New videos every week

- No marketing

- No buzzword

- All tech

SCAN ME

THANK
YOU