ORACLE

Speeding up Oracle Database Patching

UKOUG Breakthrough 2022

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Episode 1

Release and Patching Strategy

105 minutes – Feb 4, 2021

Episode 2

AutoUpgrade to Oracle Database 19c

115 minutes – Feb 20, 2021

Episode 3

Performance Stability, Tips and Tricks and Underscores

120 minutes – Mar 4, 2021

Episode 4

Migration to Oracle Multitenant

120 minutes – Mar 16, 2021

Episode 5

Migration Strategies – Insights, Tips and Secrets

120 minutes – Mar 25, 2021

Episode 6

Move to the Cloud – Not only for techies

115 minutes – Apr 8, 2021

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Introduction

Overview

Move production databases from one Long Term Support release to the next

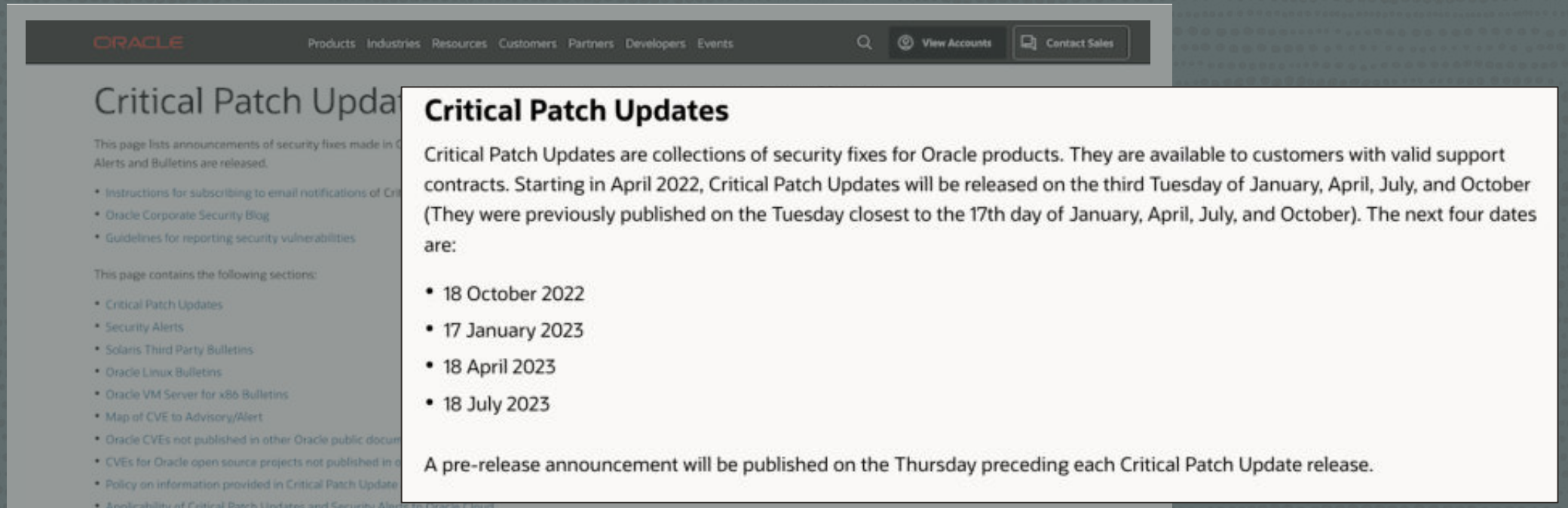
Upgrade to Oracle Database 19c


My database is
not facing the internet
Photo by Ben White on Unsplash

Photo by Clint Patterson on Unsplash

Finding the Right Patches | Quarterly

https://www.oracle.com/security-alerts/



Critical Patch Updates

Critical Patch Updates are collections of security fixes for Oracle products. They are available to customers with valid support contracts. Starting in April 2022, Critical Patch Updates will be released on the third Tuesday of January, April, July, and October (They were previously published on the Tuesday closest to the 17th day of January, April, July, and October). The next four dates are:

- 18 October 2022
- 17 January 2023
- 18 April 2023
- 18 July 2023

A pre-release announcement will be published on the Thursday preceding each Critical Patch Update release.

Do I need to apply this bundle?

How to evaluate the risk

Photo by Lubo Minar on Unsplash

Critical Patch Alert October 2022 | Risk Matrix

CVE#	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	Base Score	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)								Supported Versions Affected	Notes
						Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confid-entiality	Inte-grity	Avail-ability		
CVE-2022-21596	Oracle Database - Advanced Queuing	DBA user	Oracle Net	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19c	
CVE-2022-21603	Oracle Database - Sharding	Local Logon	Local Logon	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19c, 21c	
CVE-2020-36518	Oracle Database - Fleet Patching (jackson-databind)	REST User	HTTP	No	6.5	Network	Low	Low	None	Un-changed	None	None	High	19c, 21c	
CVE-2022-1587	Oracle Notification Server (PCRE2)	Subscriber	HTTP	No	6.5	Network	Low	Low	None	Un-changed	None	None	High	19c, 21c	See Note 1
CVE-2020-36518	Spatial and Graph (jackson-databind)	Authenticated User	HTTP	No	6.5	Network	Low	Low	None	Un-changed	None	None	High	19c, 21c	
CVE-2022-21606	Oracle Services for Microsoft Transaction Server	None	HTTP	Yes	6.1	Network	Low	None	Required	Changed	Low	Low	None	19c	See Note 1
CVE-2022-39419	Java VM	Create Procedure	Oracle Net	No	4.3	Network	Low	Low	None	Un-changed	Low	None	None	19c, 21c	
CVE-2021-41495	Oracle Database - Machine Learning (Numpy)	Create Session	Oracle Net	No	4.3	Network	Low	Low	None	Un-changed	None	None	Low	21c	

Patching Basics

Patching Strategies

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 | How To Apply A Patch

What is installed in my Oracle Home?

OPatch

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

DBMS_QOPATCH

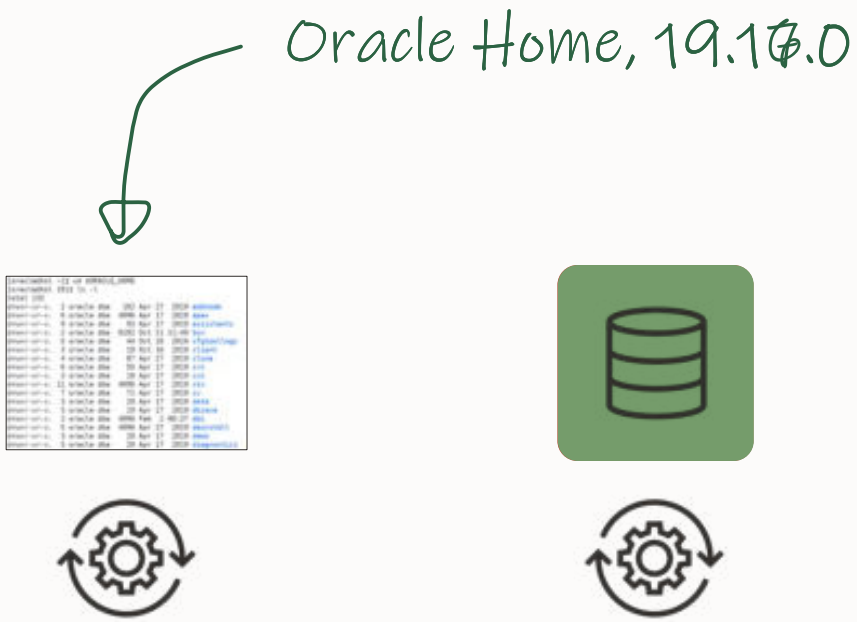
```
SQL> select xmltransform(dbms_qopatch.get_opatch_lsinventory, dbms_qopatch.get_opatch_xslt) from dual;
```

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

What is installed in my database?

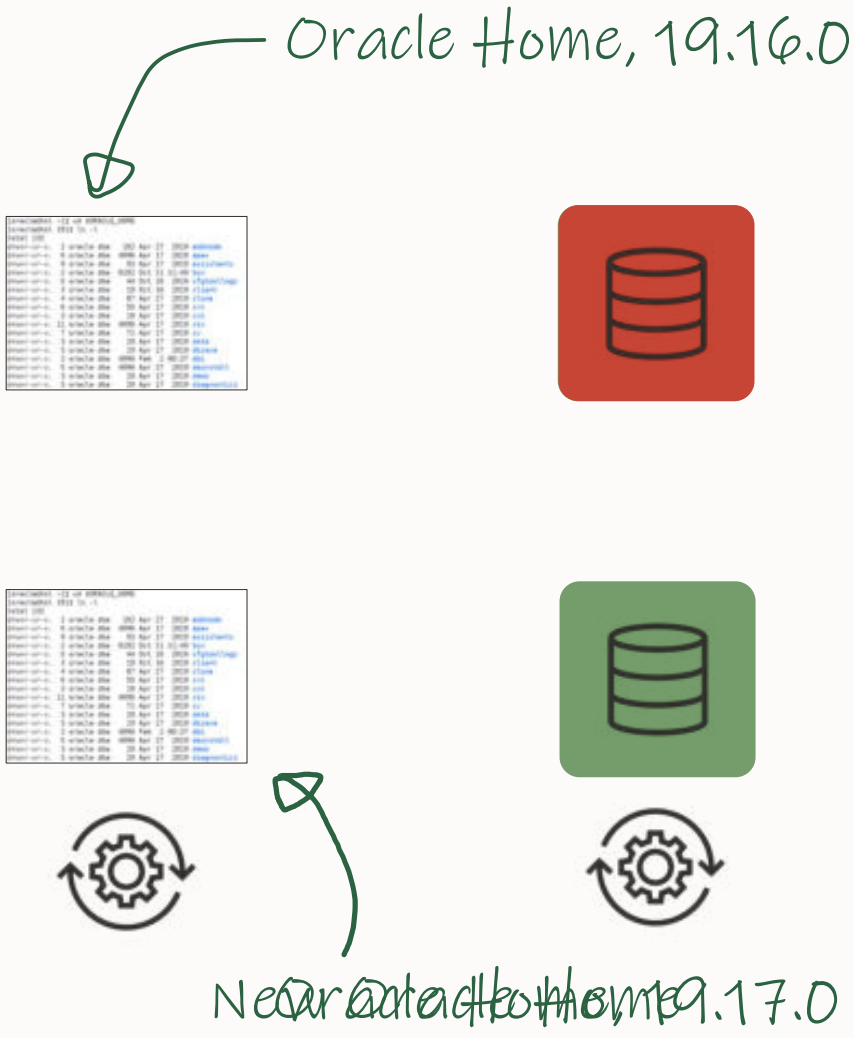
```
SQL> select * from dba_registry_sqlpatch;
SQL> select * from cdb_registry_sqlpatch;
```

Patching | In-Place




```
$ datapatch -verbose
```

Patching | Out-of-Place

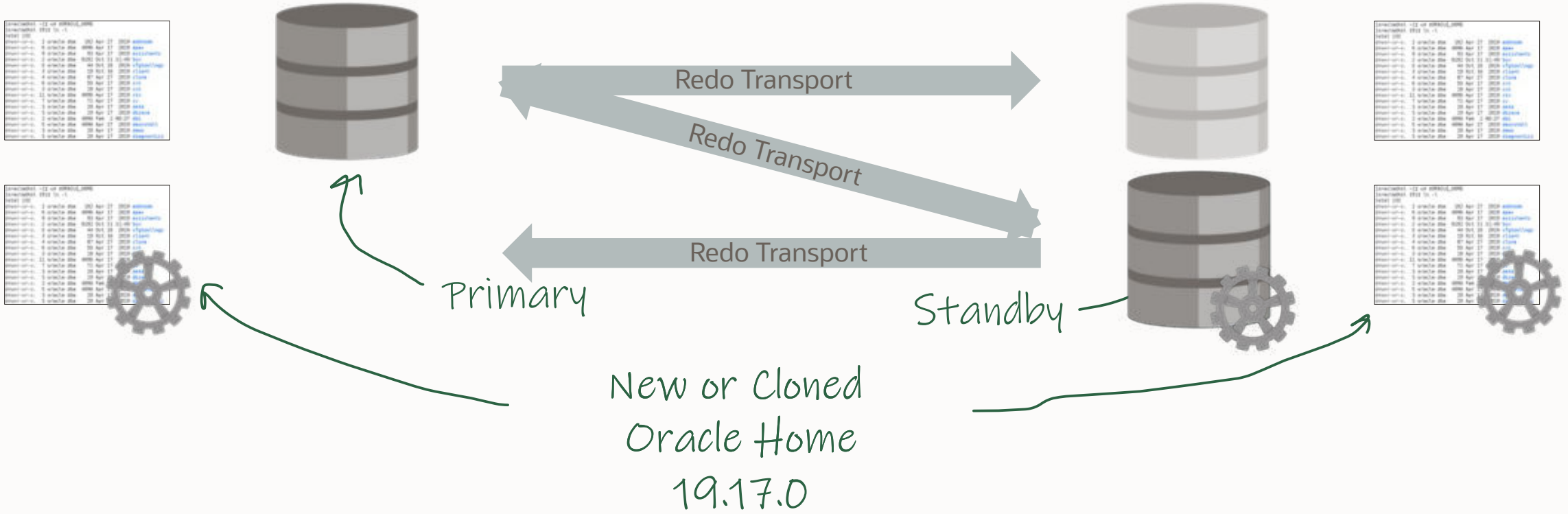



```
SQL> SHUTDOWN IMMEDIATE
```

```
$ datapatch -verbose
```

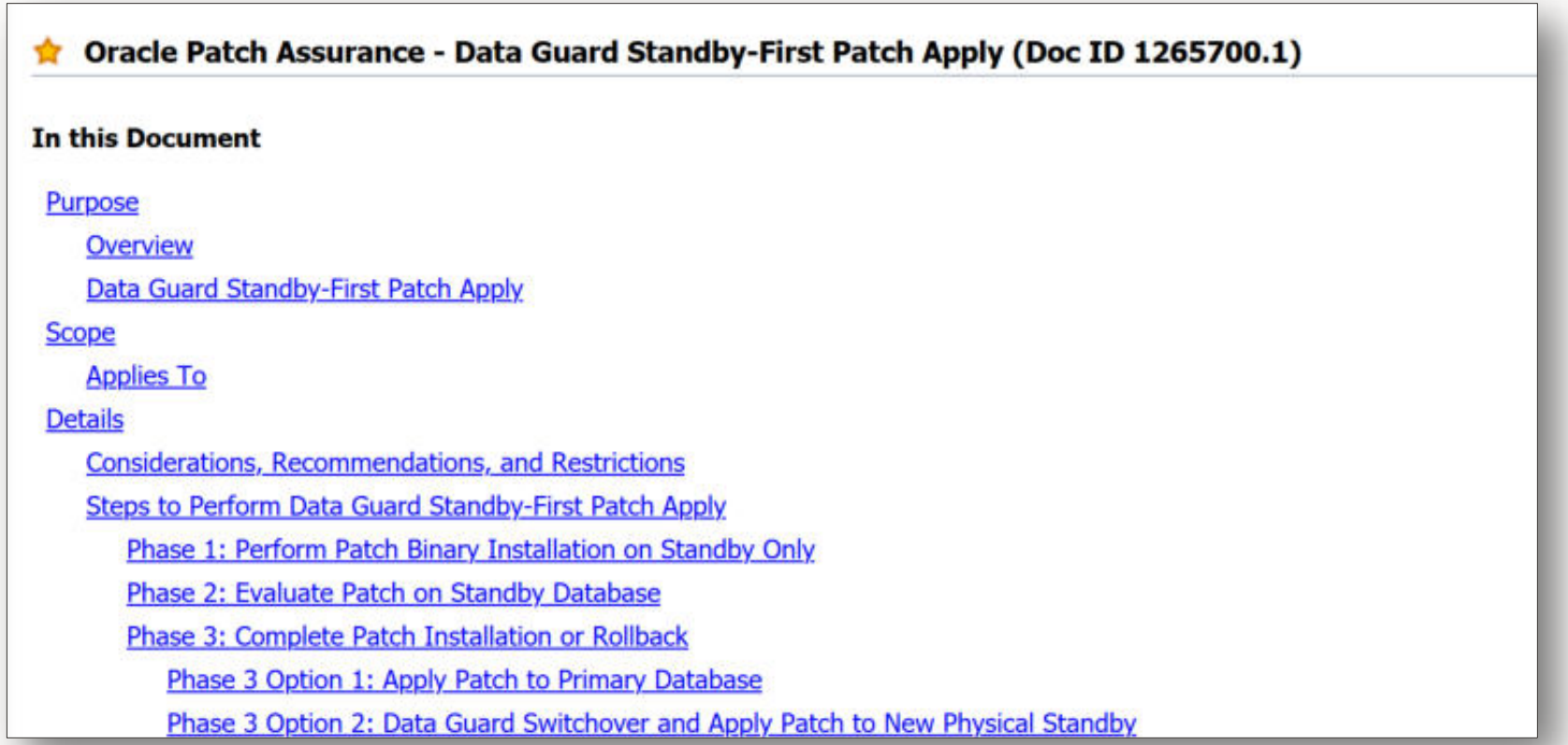
Always patch out-of-place

Recommendation | Standby-First Patch Apply




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

Recommendation | Standby-First Patch Apply



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

In this Document

Purpose
- Overview
- Data Guard Standby-First Patch Apply

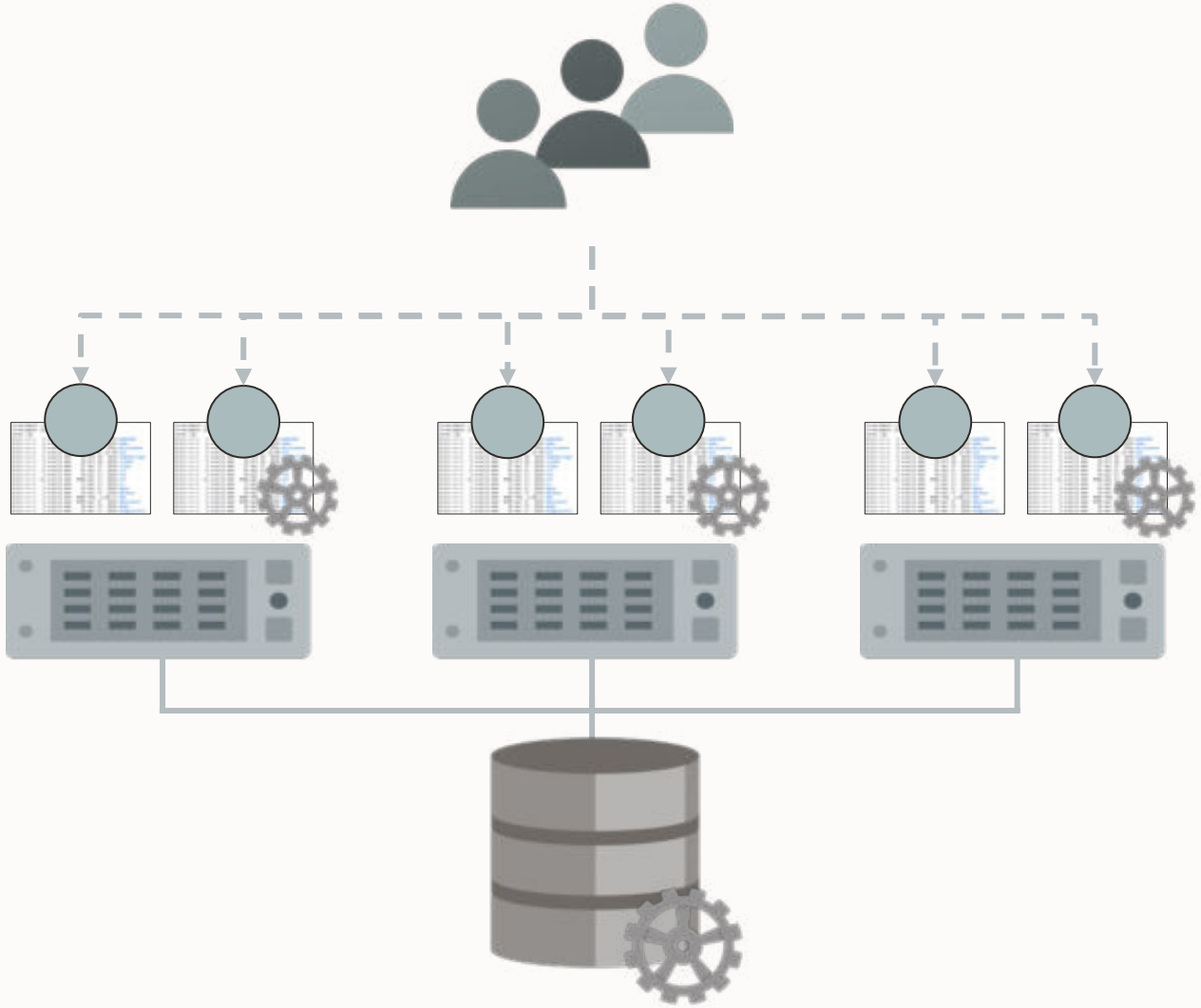
Scope
- Applies To

Details
- Considerations, Recommendations, and Restrictions
- Steps to Perform Data Guard Standby-First Patch Apply
  - Phase 1: Perform Patch Binary Installation on Standby Only
  - Phase 2: Evaluate Patch on Standby Database
  - Phase 3: Complete Patch Installation or Rollback
    - Phase 3 Option 1: Apply Patch to Primary Database
    - Phase 3 Option 2: Data Guard Switchover and Apply Patch to New Physical Standby

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

Avoid downtime with RAC Rolling Patching

Recommendation | RAC Rolling Patching



```
$ $ORACLE_HOME/OPatch/datapatch -verbose
```

Release updates are **always**:

Standby-First installable

RAC Rolling installable

Patching Process

Patching Strategies

The Database Patching Process

FIND

Find the right bundle and one-off patches

INSTALL

Download and install the patches

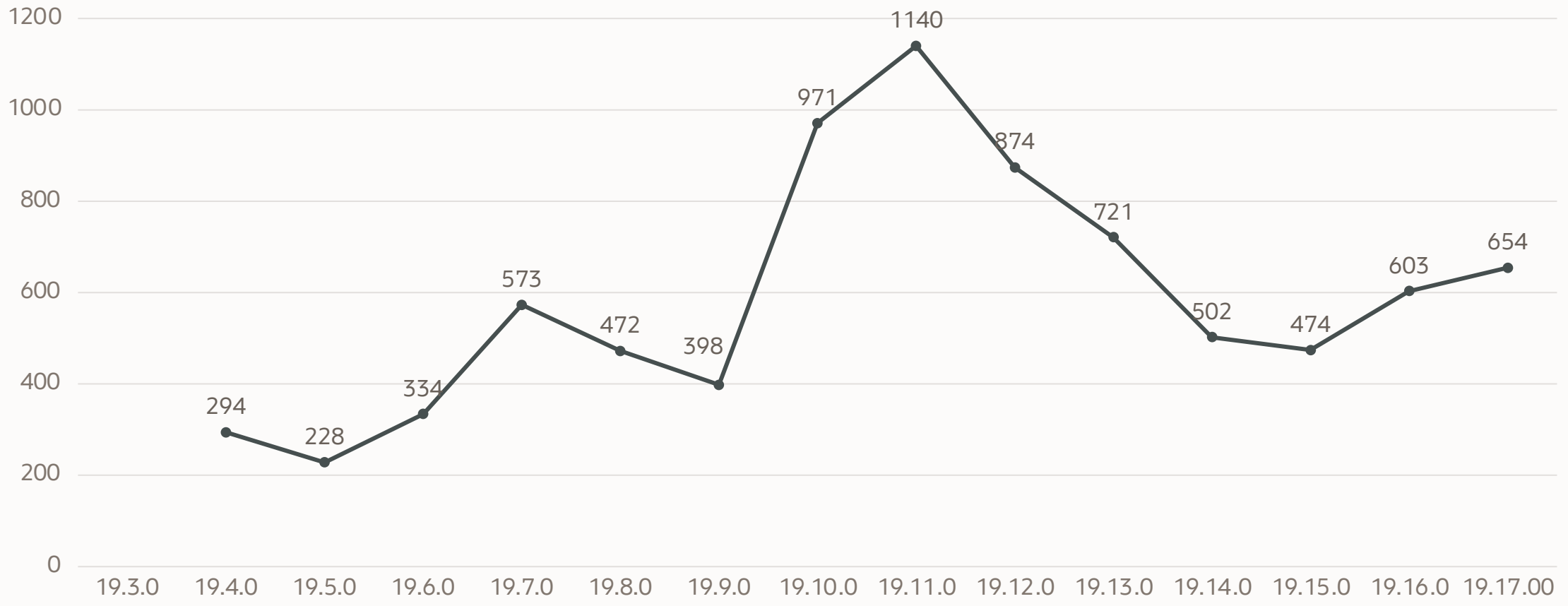
APPLY

Apply the patches to the database

Timeline | Release Updates

	2020				2021				2022				2023		
	January	April	July	October	January	April	July	October	January	April	July	October	January	April	July
19c	19.6.0	19.9.0	19.8.0	19.9.0	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
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

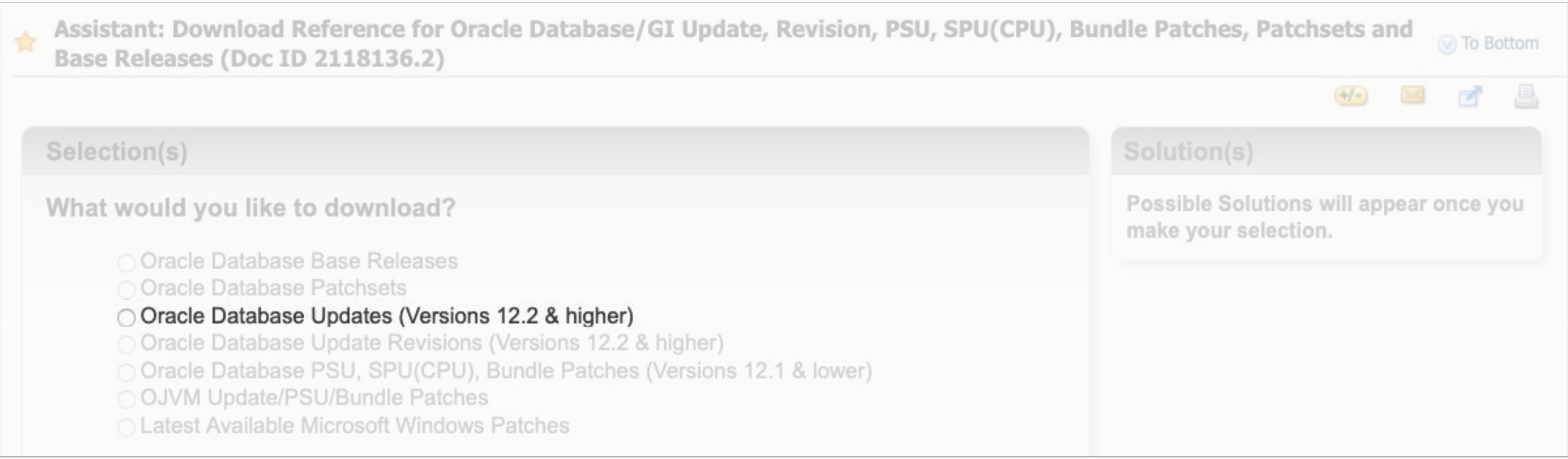
Release Update | Bugs Fixed



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

Release Update

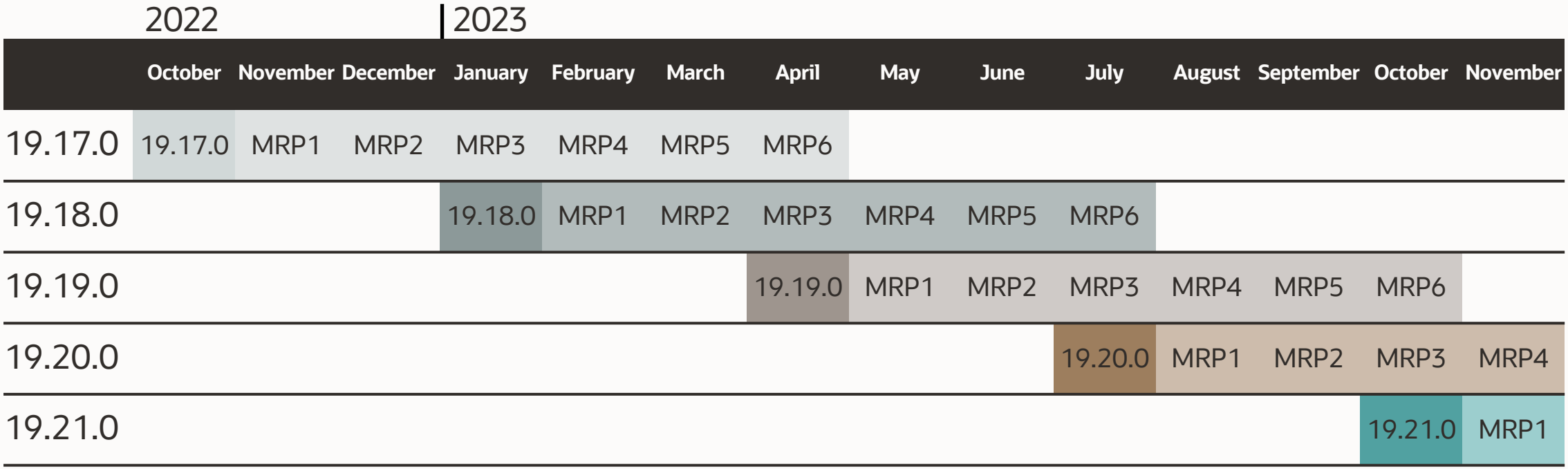
Use the **PATCH DOWNLOAD ASSISTANT**



Monthly Recommended Patches

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

Monthly Recommended Patches | Timeline



Monthly Recommended Patches

What kind of patch is it?	It is a merge patch tied to a specific Release Update
Does it change the release number?	No
What is in an MRP?	Important bug fixes from 555.1
Does it contain security fixes?	No, Release Updates are still our way of fixing those
Do I need to patch monthly?	We recommend that
Do I need to re-certify my app?	No, but test like you would do with one-offs
What about databases in OCI?	To be decided

Monthly Recommended Patches

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

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

Oracle Database Patch Maintenance

Data Pump Bundle Patch

Fewer Issues

Important patches are included.
Monitor for bugs that affects many customers.

Faster Patching

The bundle patch changes the way Data Pump is patched. Subsequent patches apply faster.

ALWAYS APPLY

- Latest Release Update
  Doc ID 2118136.2
- Latest Monthly Recommended Patches
  Doc ID 555.1
- Data Pump Bundle Patch
  Doc ID 2819284.1

The Database Patching Process

FIND

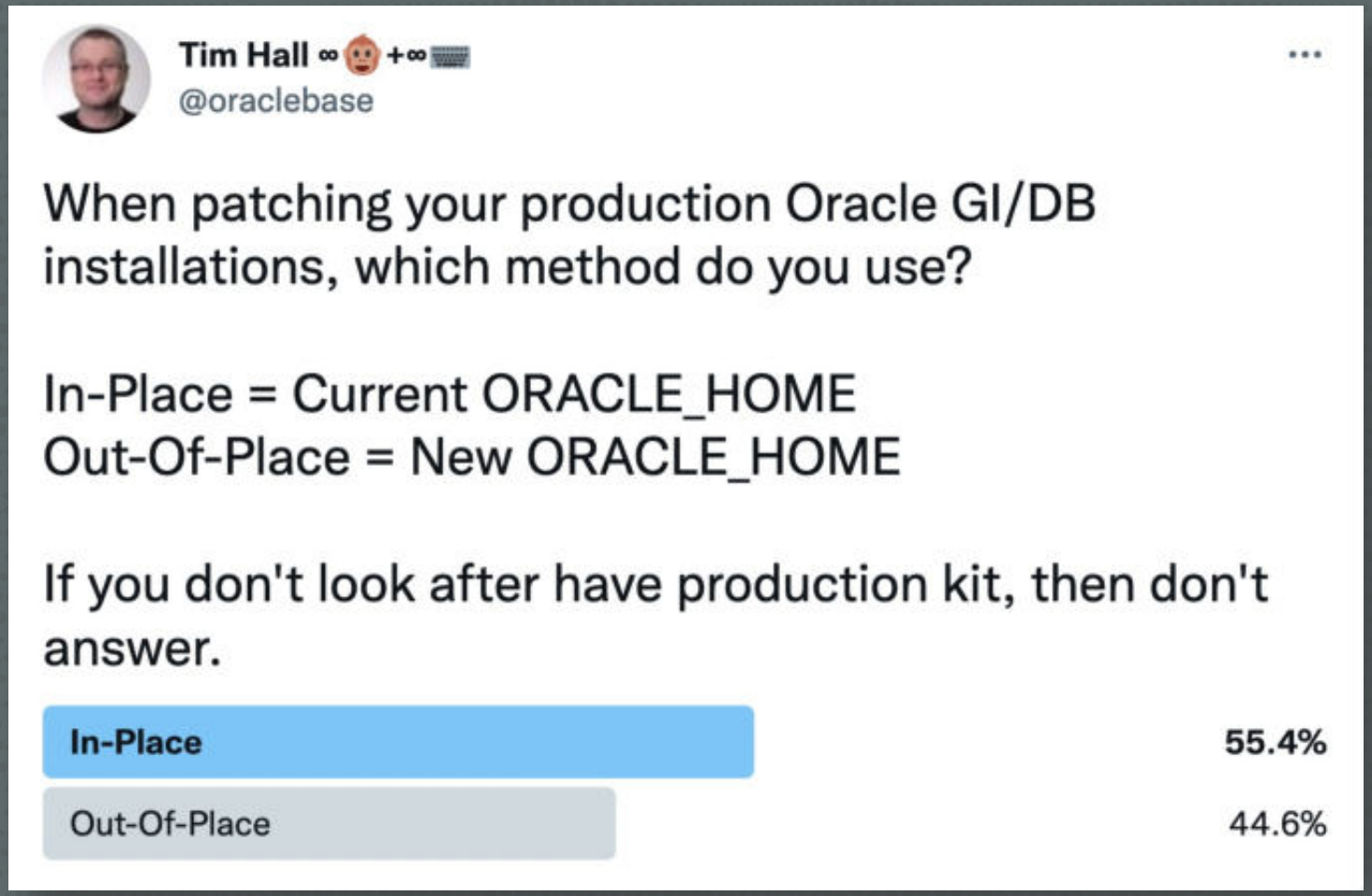
Find the right bundle and one-off patches

INSTALL

Download and install the patches

APPLY

Apply the patches to the database



Twitter

Always patch out-of-place with a brand-new Oracle Home

Avoid cloned Oracle Homes and in-place patching

Patching Performance

opatch and datapatch have excellent rollback capabilities

Patch history:	`$ORACLE_HOME/inventory/ContentsXML/oui-patch.xml` No archive functionality - unofficial hack

Old patches:	`$ORACLE_HOME/.patch_storage`
	`$ORACLE_HOME/.opatchauto_storage`
	Archive functionality

Apply/rollback scripts:	`$ORACLE_HOME/sqlpatch` No archive functionality

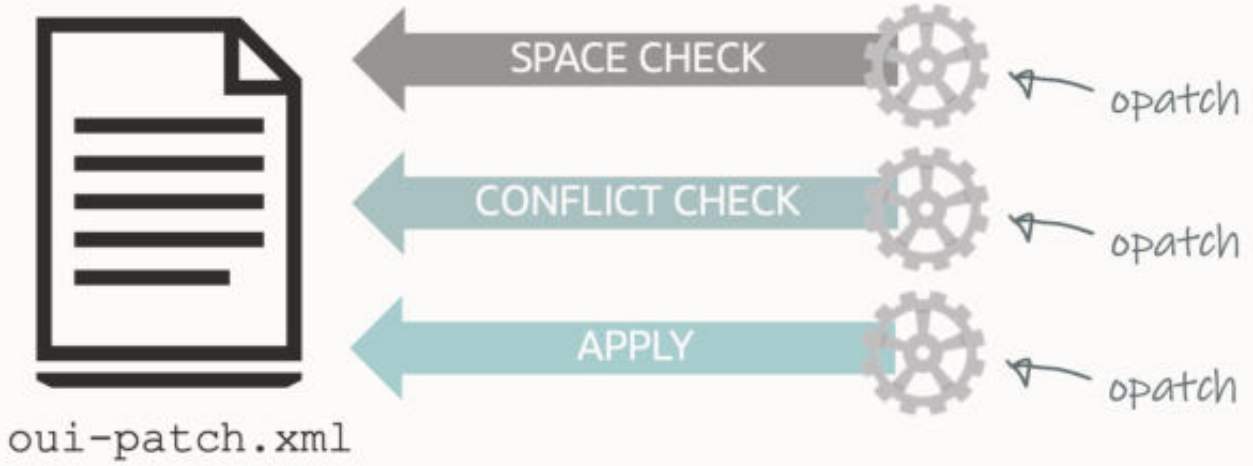
Reusing Oracle Home leads to:

- Disk footprint increases
- Patching runtime increases

Patching Performance

Many customers encountered increasing patching duration

- 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



Patching Performance | Experiment

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**

Edited `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**

Always use the latest OPatch

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

1

Unzip new Oracle Home

Download 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 ...
```


The Database Patching Process

FIND

Find the right bundle and one-off patches

INSTALL

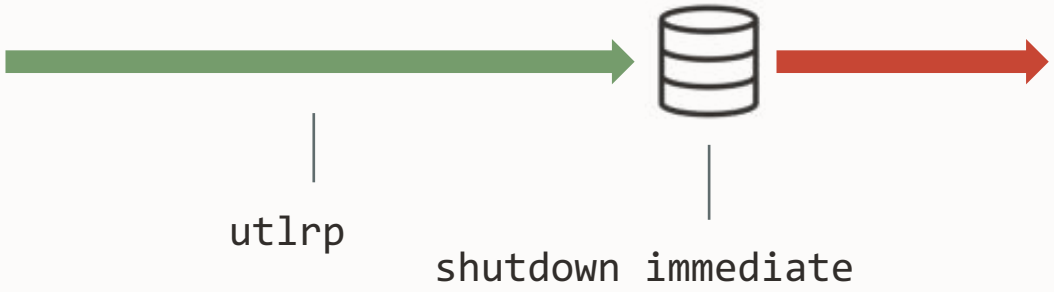
Download and install the patches

APPLY

Apply the patches to the database

Recompile invalid objects before patching your Oracle Database

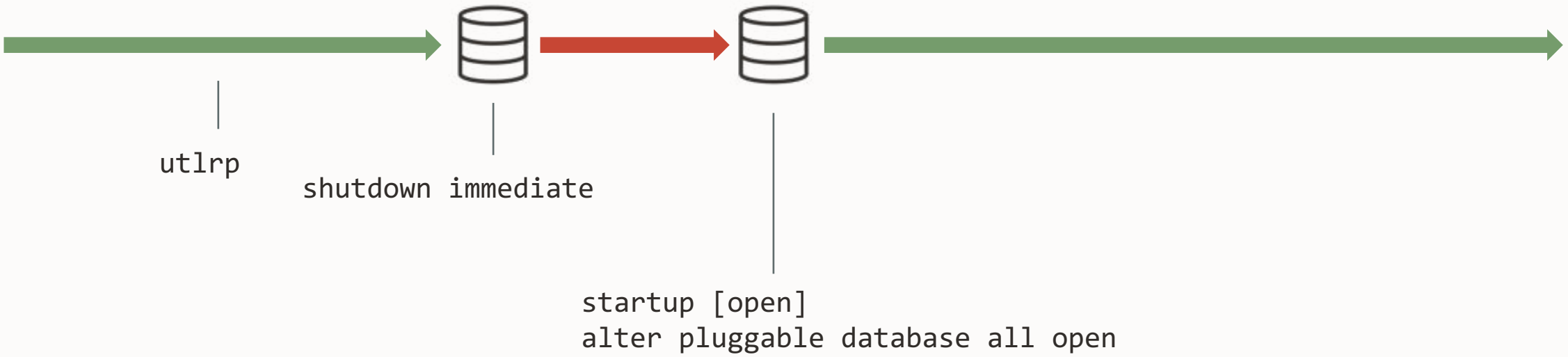
Patching Timeline



The database must be open
Only open PDBs are patched

Upgrade mode or restricted session is not needed

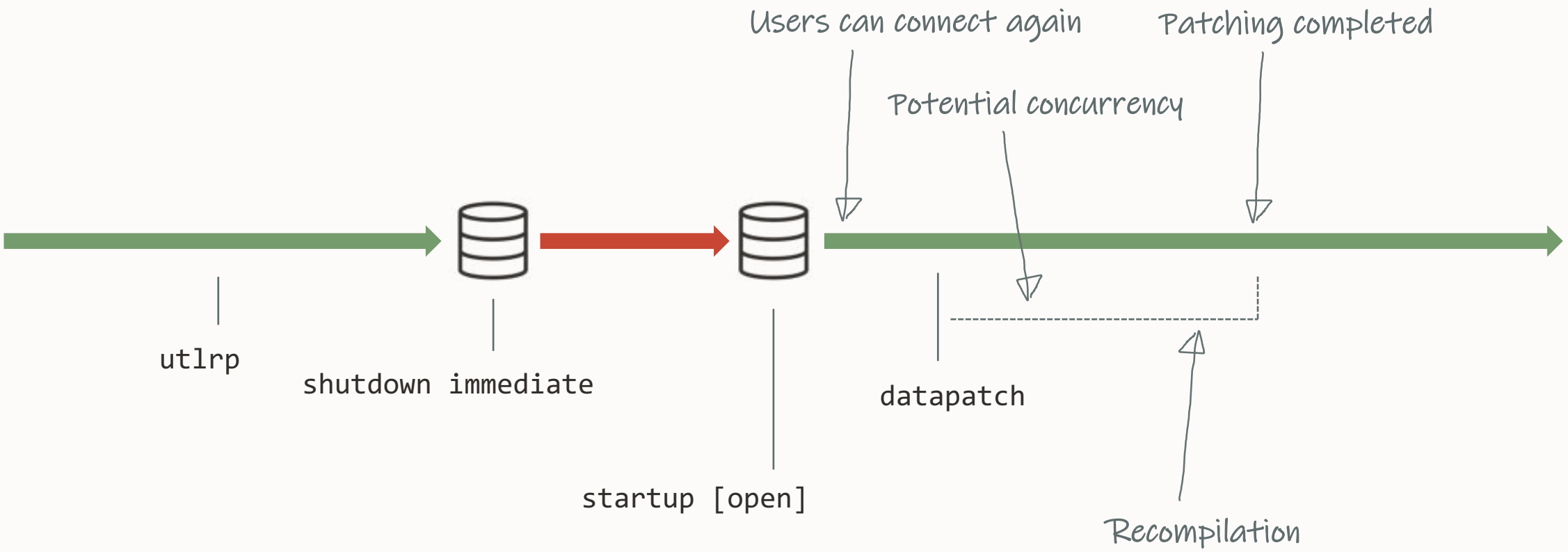
Patching Timeline



You can run datapatch while users are connected to the database

Details in blog post

Patching Timeline



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

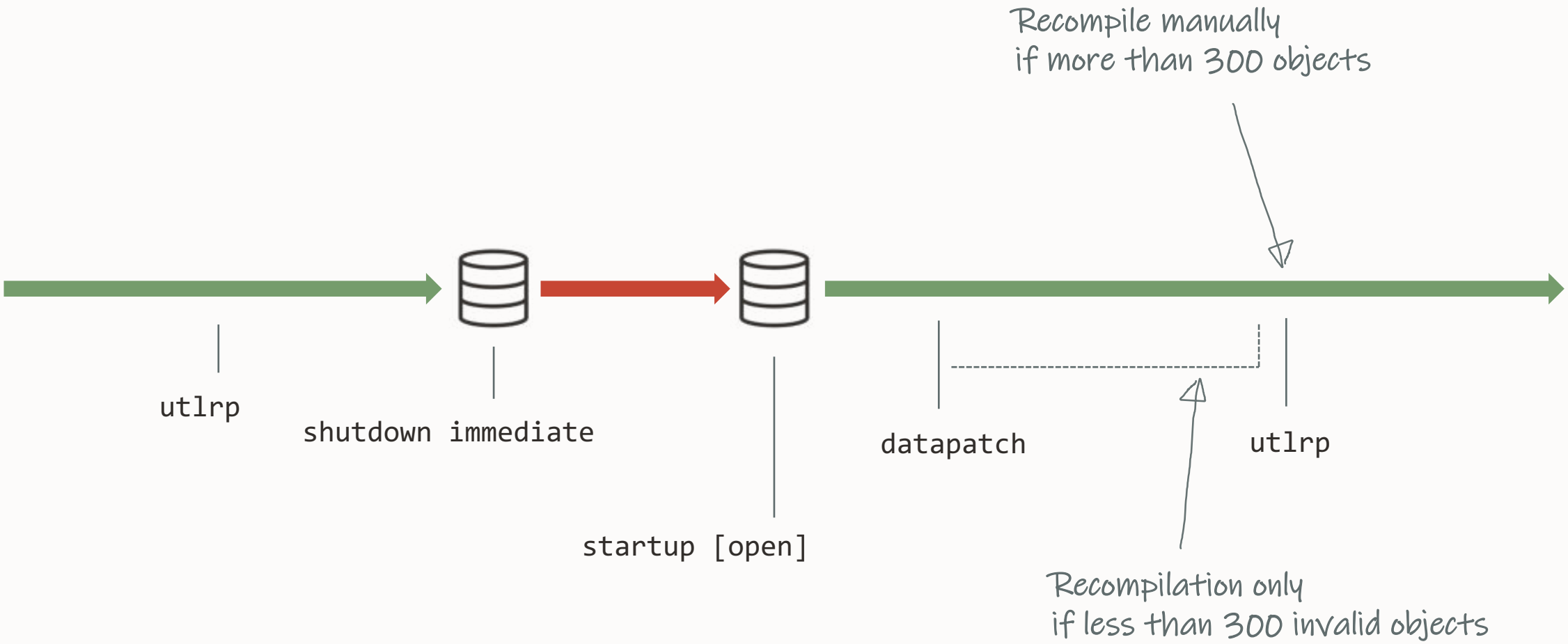
Recompilation

- 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



```
$ 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
```

1  Java patches

2  Bundle patches

3  One-off patches

Datapatch | Patch Rollback and Apply Queue

Oracle Home after `opatch`:

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

Database 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

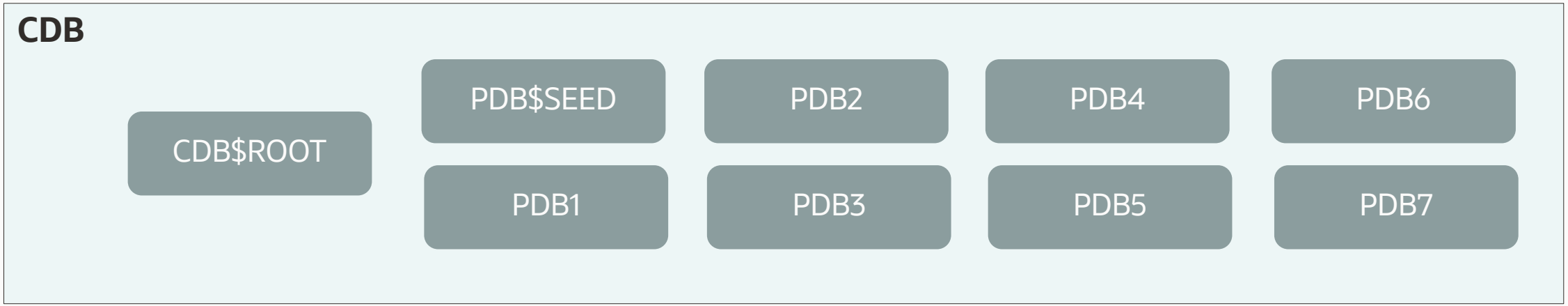
Apply/rollback scripts:

```
$ORACLE_HOME/sqlpatch/.../nnn_apply.sql
$ORACLE_HOME/sqlpatch/.../nnn_rollback.sql
```

Rollback scripts (zipped as BLOB):

```
SELECT  PATCH_DIRECTORY
FROM    REGISTRY$SQLPATCH
```

Multitenant

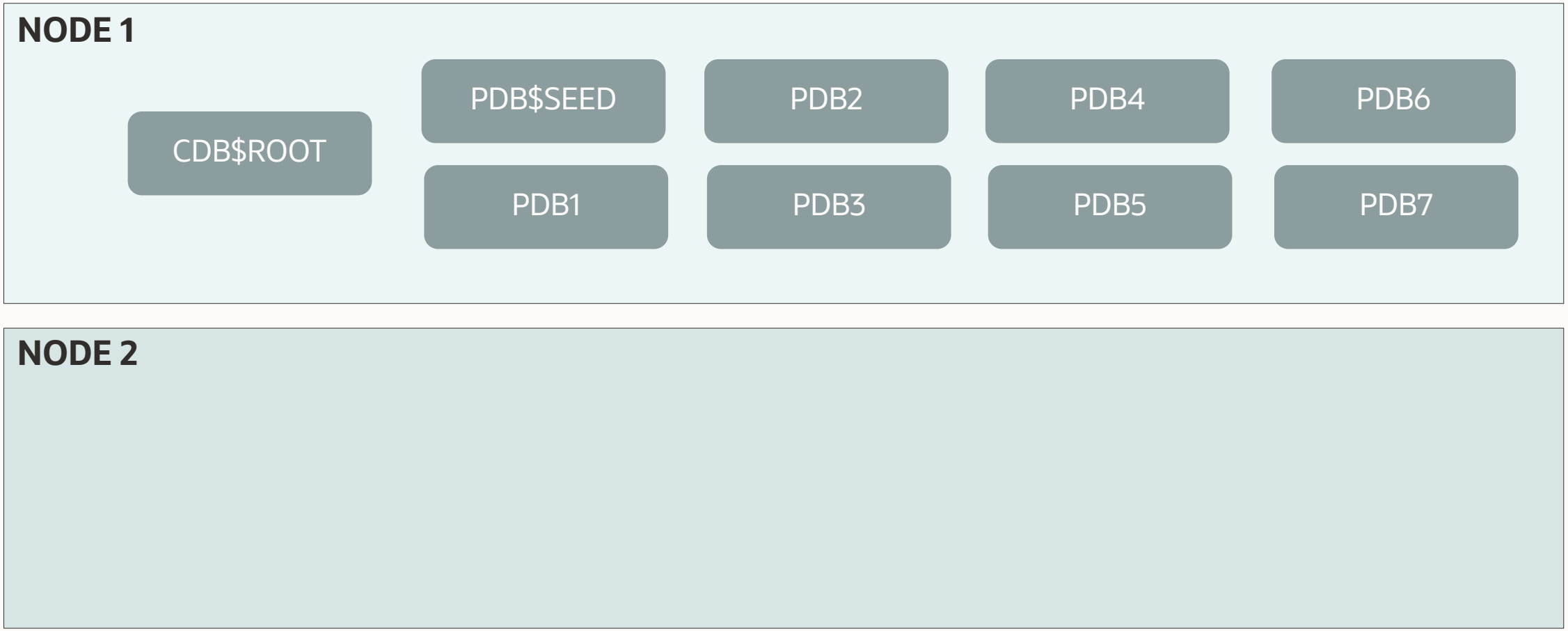


- Only open PDBs are patched
- Parallel degree determined by CPU count

Significantly speed up patching using AutoUpgrade Distributed Patching

Applies to multitenant databases on RAC only

Distributed Patching



Distributed Patching

Distributed Patching

To enable distributed patching

```
$ cat RACCDB.cfg

upg1.source_home=/u01/app/oracle/product/19/dbhome_19_15
upg1.target_home=/u01/app/oracle/product/19/dbhome_19_16
upg1.sid=RACCDB
upg1.tune_setting=distributed_upgrade=true


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


Less components, Faster patching

Typical candidates:

- JAVAVM
- ORDIM
- SDO

Performance Improvement

Old behavior

- `opatchauto` invokes `opatch` on every node
- `opatchauto` then invokes `datapatch` on every node

Result:

Many useless `datapatch` calls since it needs to be executed only once the last node has been patched

New behavior

- `opatchauto` invokes `opatch` on every node
- `opatchauto` invokes `datapatch` on last node

Result:

Useless `datapatch` calls avoided, faster patch runs. Fix is included in the current `opatch`

Datapatch

Datapatch User Guide (Doc ID 2680521.1)

Tips for patching success

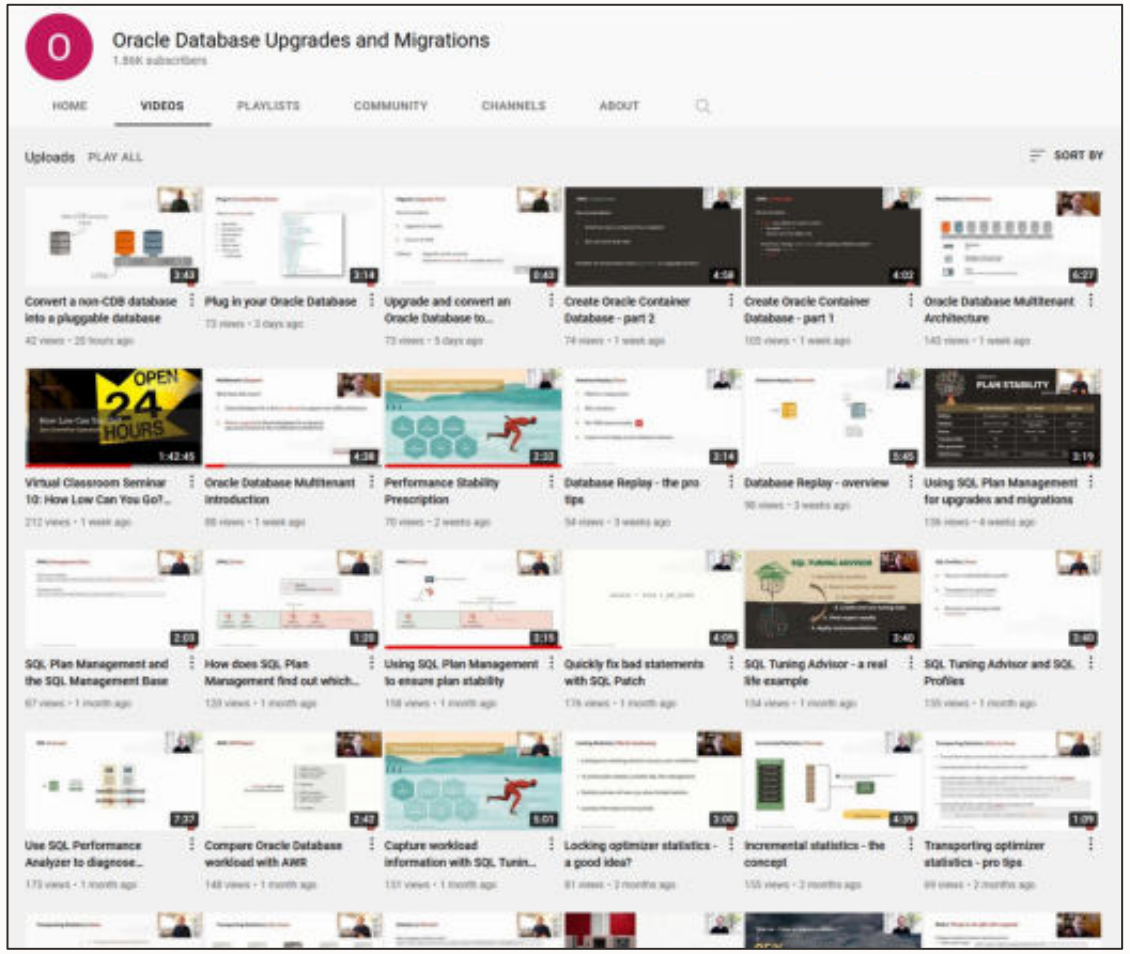
Patching Strategies

- Upgrade to Oracle Database 19c
- Always patch out-of-place with a brand-new Oracle Home
- Test the patch on snapshot standby
- Avoid downtime with RAC Rolling Patching
- Always apply latest RU, MRP, and Data Pump bundle patch
- Always use the latest OPatch
- Recompile invalid objects before invoking datapatch
- Run datapatch while users are connected
- Significantly speed up patching using Distributed Patching
- Less components, faster patching

Wrapping up

Overview

YouTube | Oracle Database Upgrades and Migrations



Link

- 200+ videos
- New videos every week
- No marketing
- No buzzwords
- All tech

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