

ORACLE

# Speeding up Oracle Database Patching

OUGN 2023

---

**Daniel Overby Hansen**

Senior Principal Product Manager





## DANIEL OVERBY HANSEN

---

Senior Principal Product Manager  
Cloud Migration

 <https://dohdatabase.com>

 dohdatabase

 @dohdatabase

### 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



## Recorded Web Seminars

<https://MikeDietrichDE.com/videos>

More than 30 hours of technical content,  
on-demand, anytime, anywhere





# Introduction



## Overview





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

## Upgrade to Oracle Database 19c

A young boy with a joyful expression is sitting on a wooden bench outdoors. He is wearing a blue and white plaid shirt and a dark cap. He is holding an open book on his lap and laughing heartily, with his mouth wide open. The background is a soft-focus outdoor setting with trees and sunlight filtering through the leaves, creating a warm and pleasant atmosphere.

***My database is  
not facing the internet***

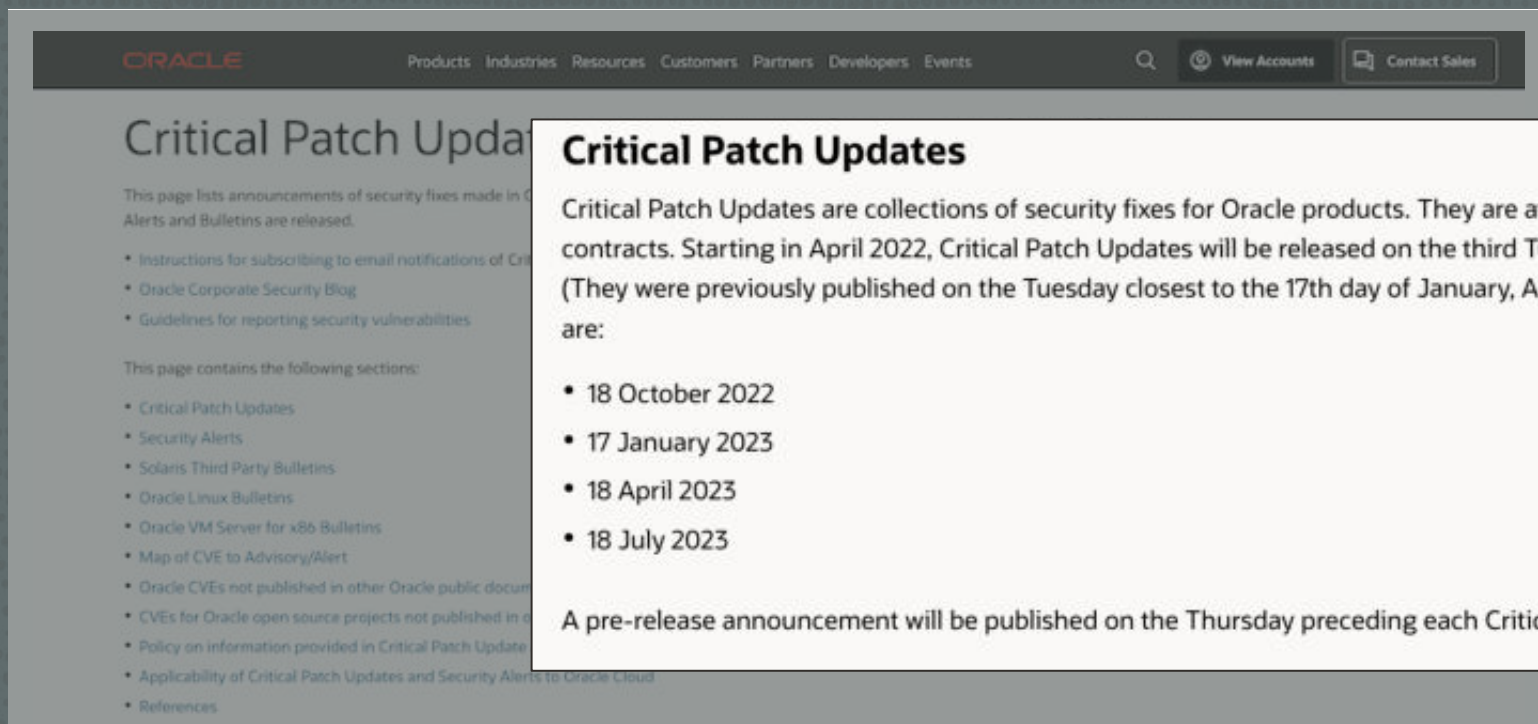
# 92%

of malware gets  
delivered via email



# Finding the Right Patches | Quarterly

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

A screenshot of the Oracle website's 'Critical Patch Updates' page. The page has a dark header with the Oracle logo and navigation links: Products, Industries, Resources, Customers, Partners, Developers, Events. There are also links for 'View Accounts' and 'Contact Sales'. The main content area is titled 'Critical Patch Updates' and includes a paragraph explaining that this page lists announcements of security fixes. Below this, there are links for 'Instructions for subscribing to email notifications of Critical Patch Updates and Bulletins are released.', 'Oracle Corporate Security Blog', and 'Guidelines for reporting security vulnerabilities'. A section titled 'This page contains the following sections:' lists various links including 'Critical Patch Updates', 'Security Alerts', 'Solaris Third Party Bulletins', 'Oracle Linux Bulletins', 'Oracle VM Server for x86 Bulletins', 'Map of CVE to Advisory/Alert', 'Oracle CVEs not published in other Oracle public documents', 'CVEs for Oracle open source projects not published in other Oracle public documents', 'Policy on information provided in Critical Patch Updates and Security Alerts', 'Applicability of Critical Patch Updates and Security Alerts to Oracle Cloud', and 'References'.

## 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.

## 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



# Do I need to apply this bundle?

How to evaluate the risk





# 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 <a href="#">Risk Matrix Definitions</a> )								Supported Versions Affected	Notes
						Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confidentiality	Integrity	Availability		
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 \(Doc ID 1530108.1\)](#)

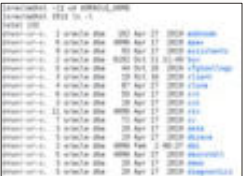
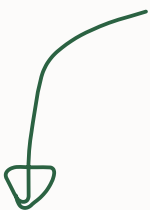
## What is installed in my database?

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

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

# Patching | In-Place

Oracle Home, 19.18.0



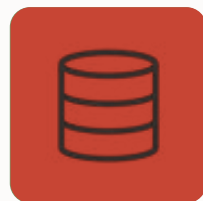
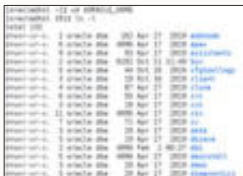
```
$ datapatch -verbose
```



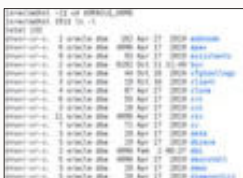


## Patching | Out-of-Place

Oracle Home, 19.18.0



```
SQL> SHUTDOWN IMMEDIATE
```



```
$ datapatch -verbose
```



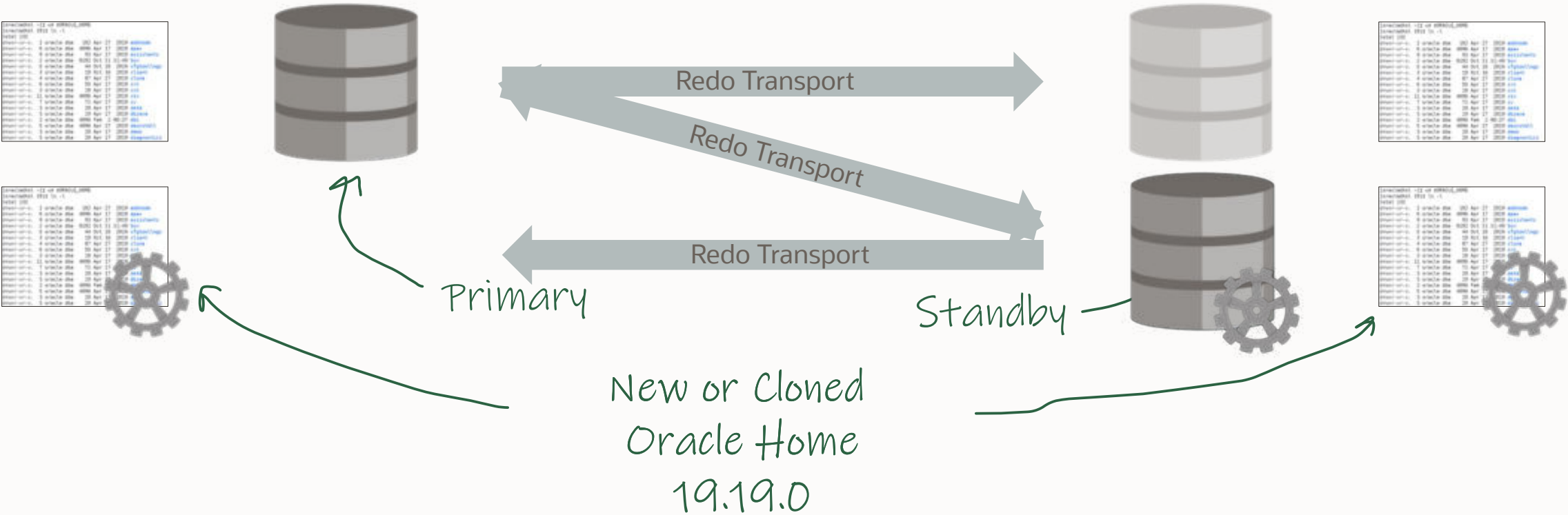
## Near-Orthogonal Home 9.19.0





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](#)

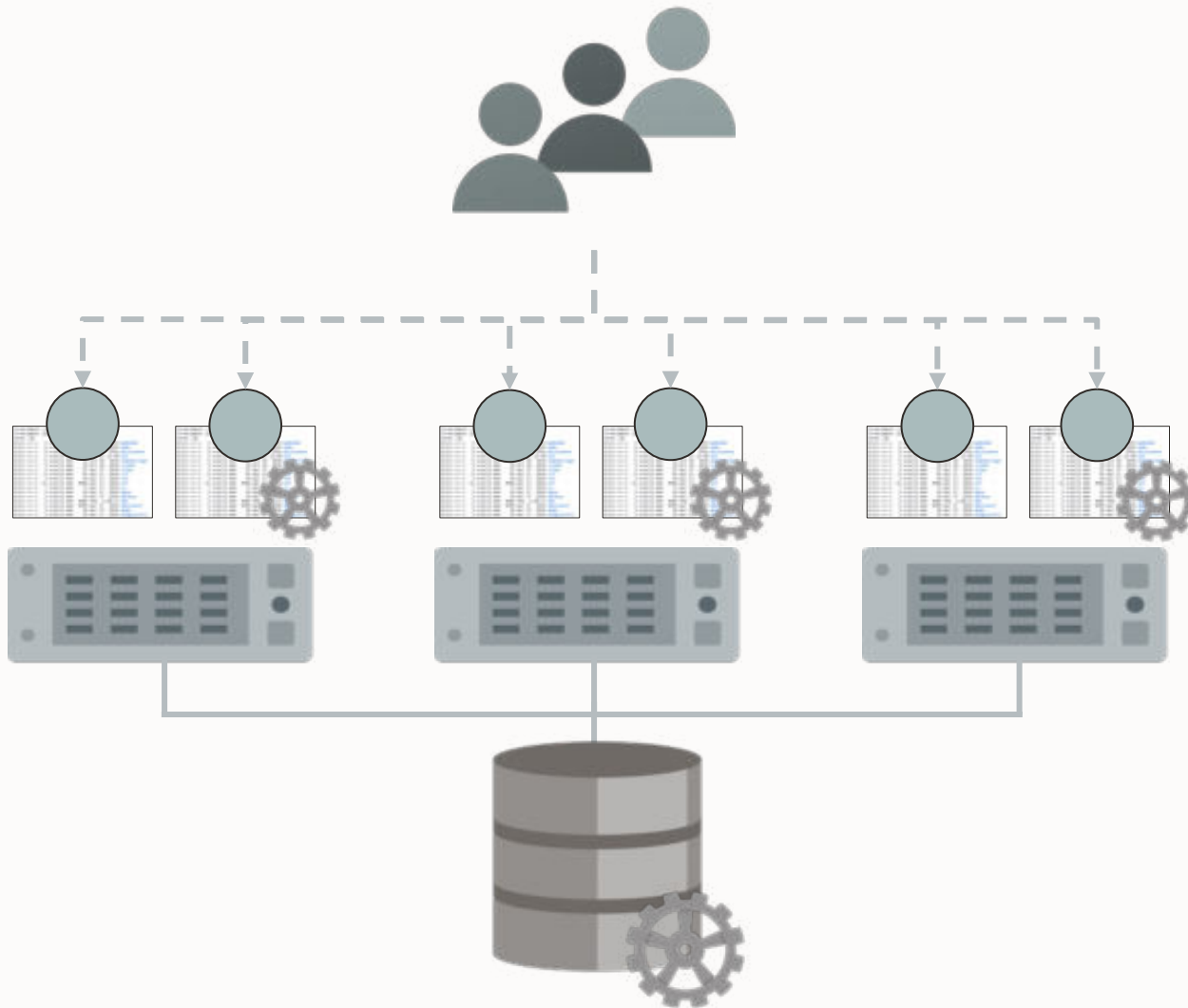
[Phase 3 Option 2: Data Guard Switchover and Apply Patch to New Physical Standby](#)

[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/opatchauto
```

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



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

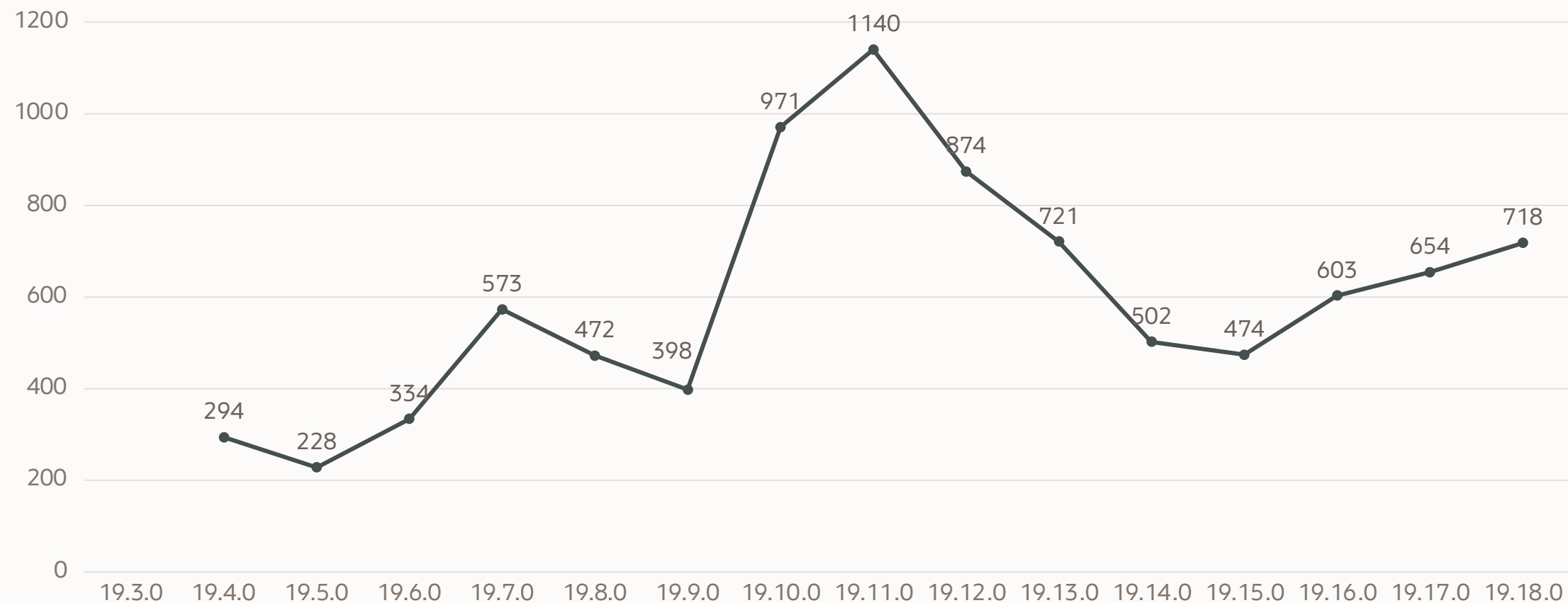


# Timeline | Release Updates

	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**

 **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)**

**What would you like to download?**

- ☐ 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

**Solution(s)**

Possible Solutions will appear once you make your selection.



# Monthly Recommended Patches

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

# 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

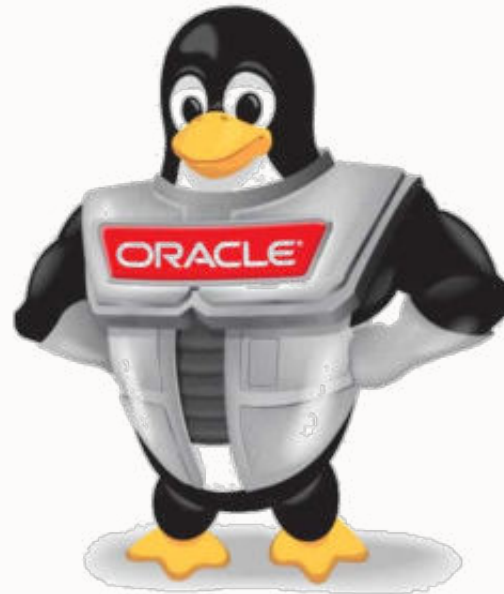


# Monthly Recommended Patches

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?	Collection of important one-off patches from 555.1
Does it contain security fixes?	Maybe, but Release Updates are our way of fixing those
Are MRPs cumulative?	Yes, within a Release Update
Do I need to re-certify my app?	No, but test as you would do with one-offs
What about databases in OCI?	To be decided



# Monthly Recommended Patches



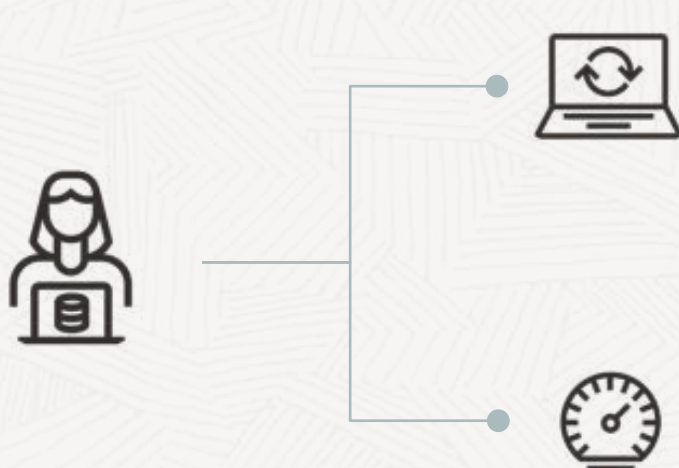
# Monthly Recommended Patches

[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



Tim Hall ∞ 🤖 +∞ 🇺🇸  
@oraclebase



When patching your production Oracle GI/DB installations, which method do you use?

In-Place = Current ORACLE\_HOME  
Out-Of-Place = New ORACLE\_HOME

If you don't look after have production kit, then don't answer.

In-Place

55.4%

Out-Of-Place

44.6%

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](https://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

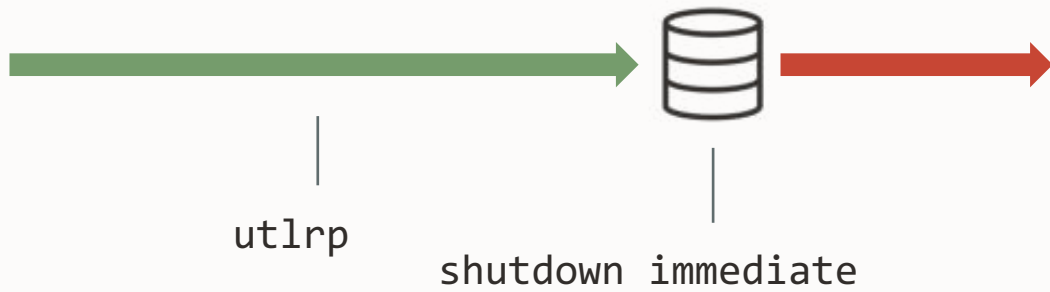




Recompile invalid objects  
before patching your Oracle Database



# Patching Timeline

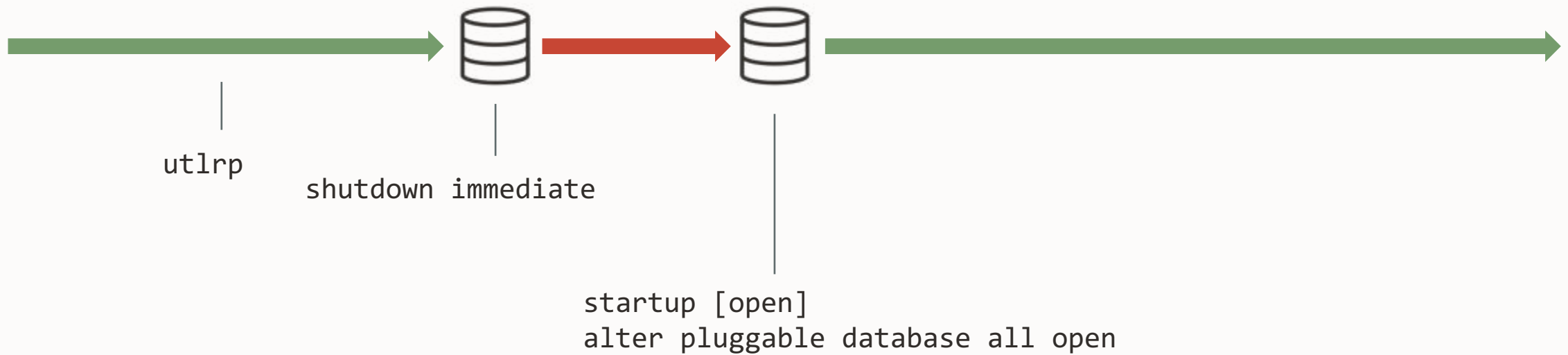




The database must be open  
Only open PDBs are patched

Upgrade mode or restricted session is **not** needed

# Patching Timeline



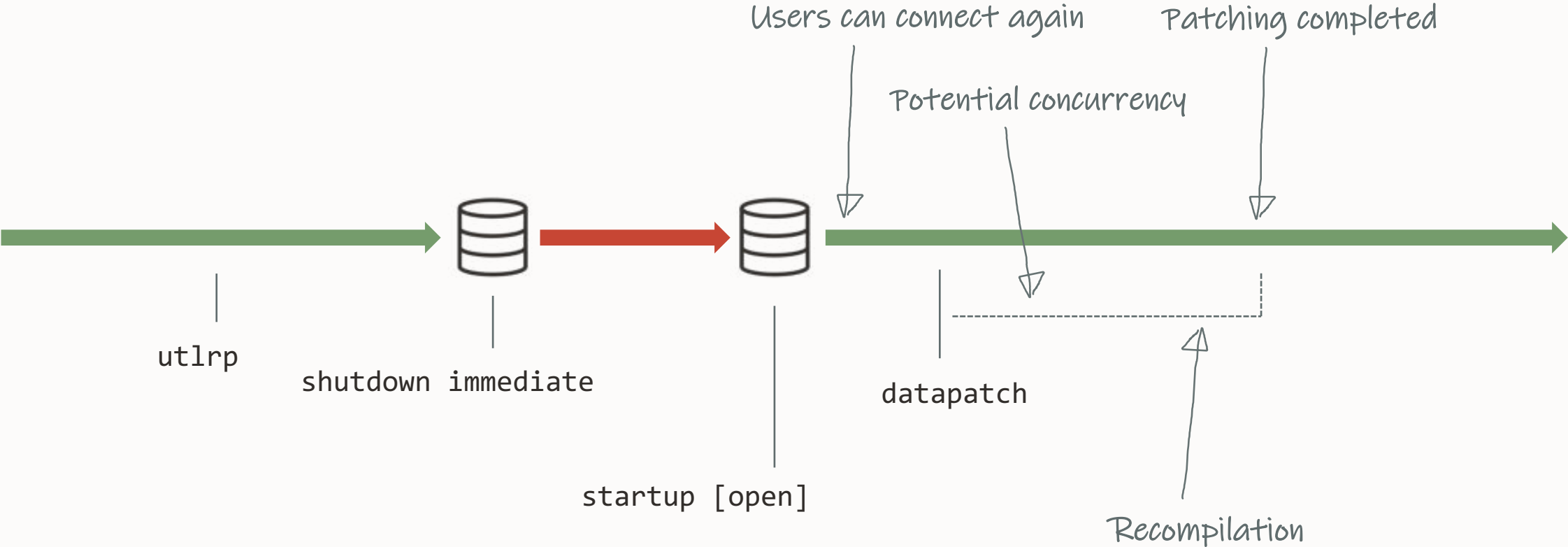


You can run datapatch while users are connected to the database

Details in [blog post](#)



# Patching Timeline



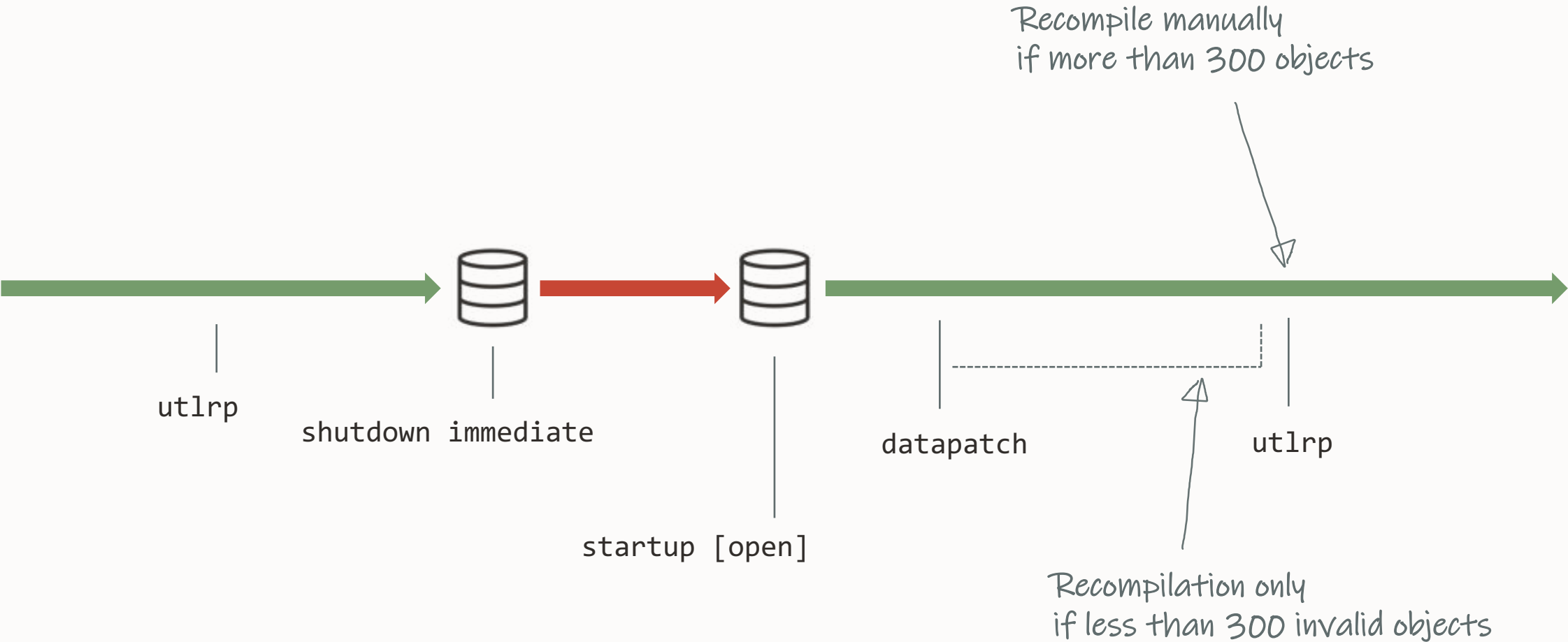


Datapatch uses **REGISTRY\$SQLPATCH** to control the patching operations

# 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`

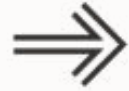


`$ORACLE_HOME/sqlpatch/sqlpatch.pl`

```
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
```

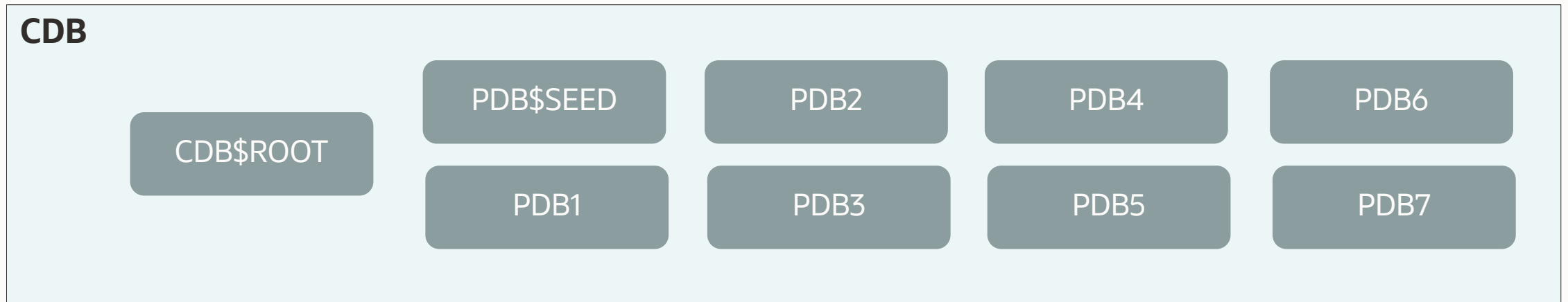
```
$ORACLE_HOME/sqlpatch/.../nnn_rollback.sql
```



Rollback scripts (zipped as BLOB):

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

# Multitenant



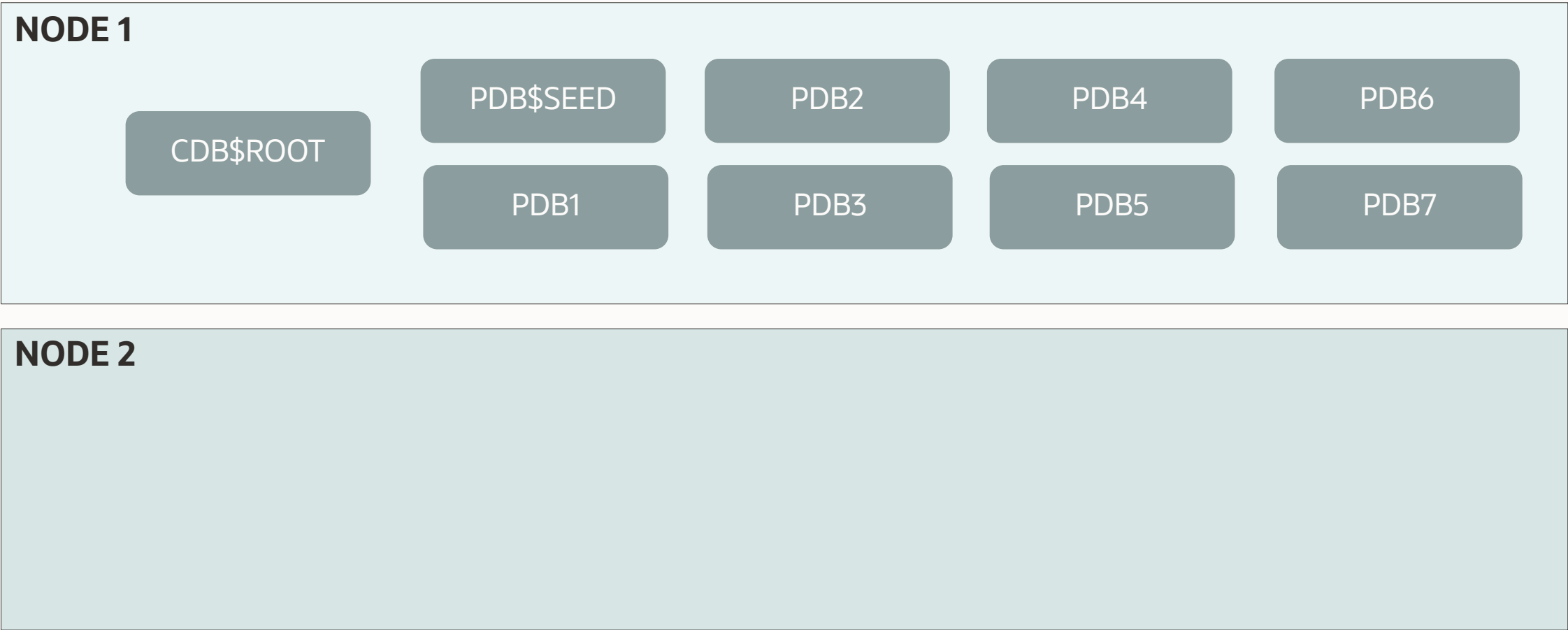
- Only open PDBs are patched
- Parallel degree determined by CPU count



## Significantly speed up patching using AutoUpgrade Distributed Patching

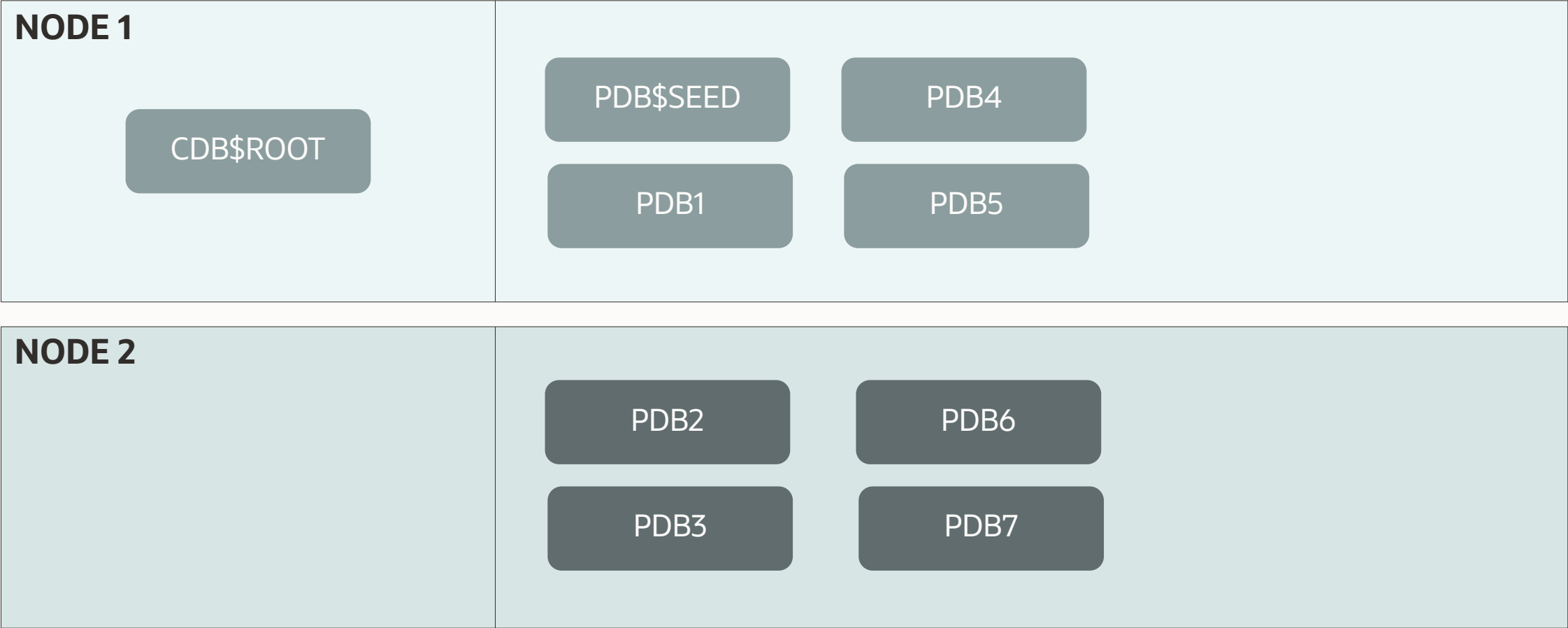
Applies to multitenant databases on RAC only

# Distributed Patching





# Distributed Patching



# Distributed Patching

To enable distributed patching

```
$ cat RACCCDB.cfg

upg1.source_home=/u01/app/oracle/product/19/dbhome_19_18
upg1.target_home=/u01/app/oracle/product/19/dbhome_19_19
upg1.sid=RACCCDB
upg1.tune_setting=distributed_upgrade=true

$ java -jar autoupgrade.jar -config RACCCDB.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



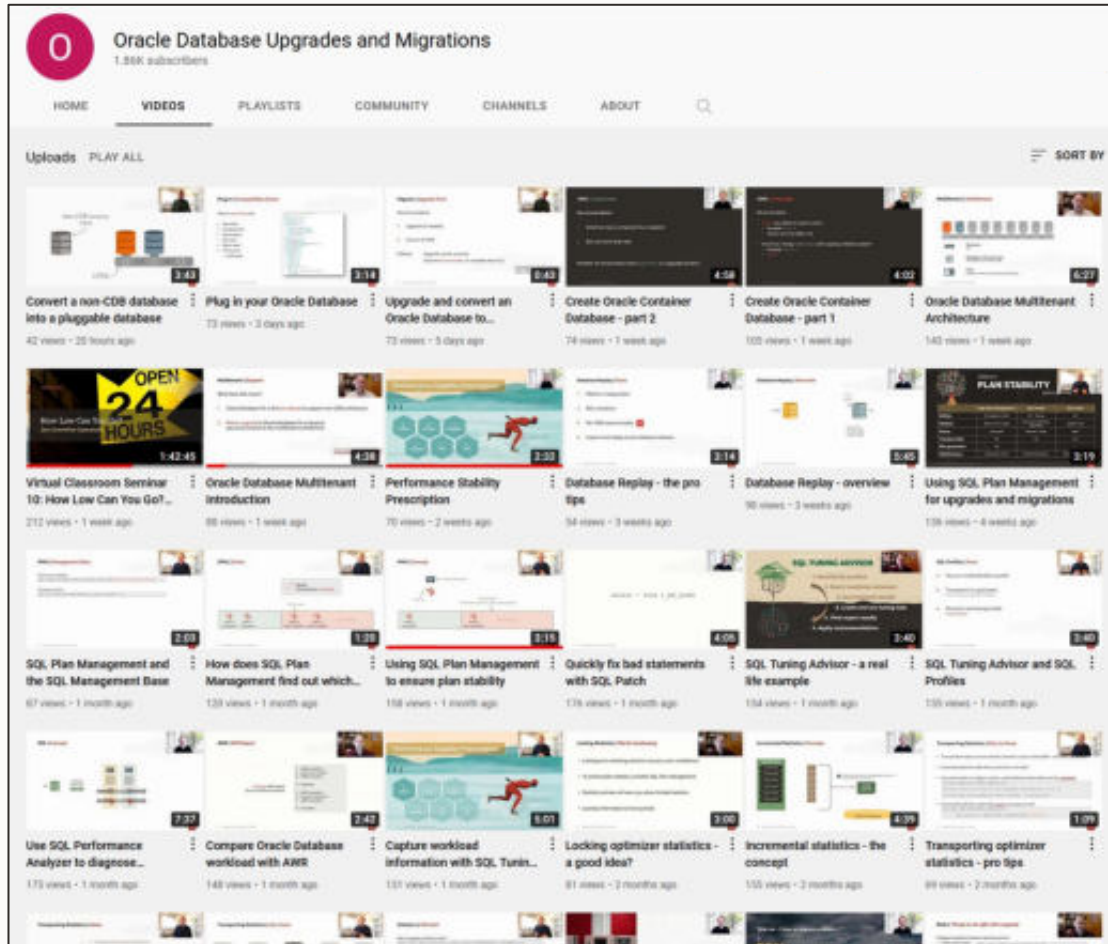
# Wrapping up



## Overview



# YouTube | Oracle Database Upgrades and Migrations



[Link](#)

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



# THANK YOU



**Visit our blogs:**

<https://MikeDietrichDE.com>

<https://DOHdatabase.com>

<https://www.dbarj.com.br/en>

# THANK YOU



**Webinars:**

<https://MikeDietrichDE.com/videos>

**YouTube channel:**

[@UpgradeNow](#)

**THANK**  
**YOU**

