



# Prepare for Oracle Database 23c

Prepare to Upgrade to Oracle Database 23c  
Sprinkles of Oracle Database 23c New Features

New York Oracle User Group  
February 2024



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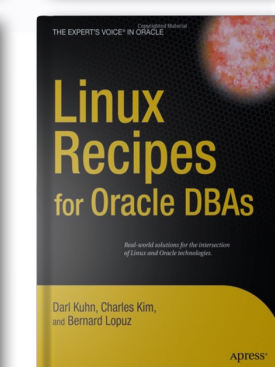
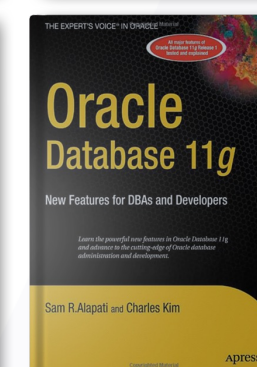
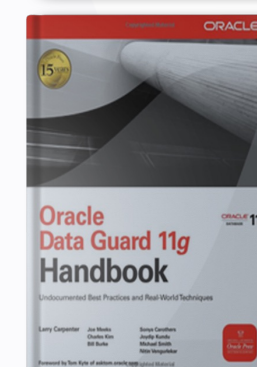
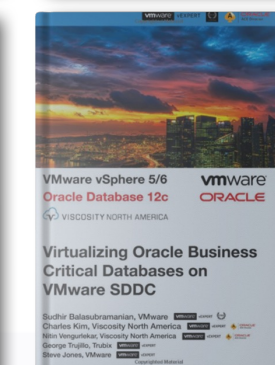
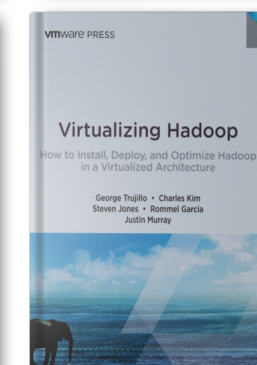
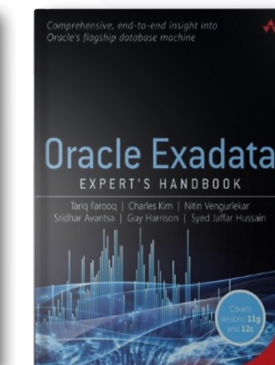
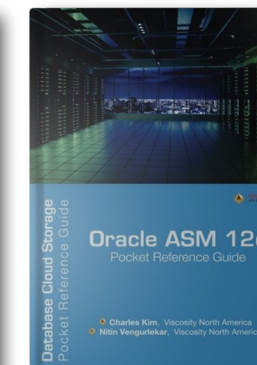
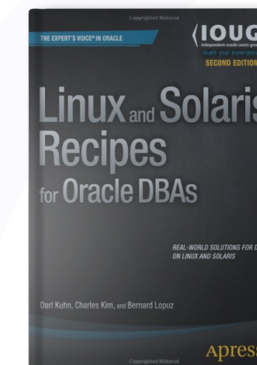
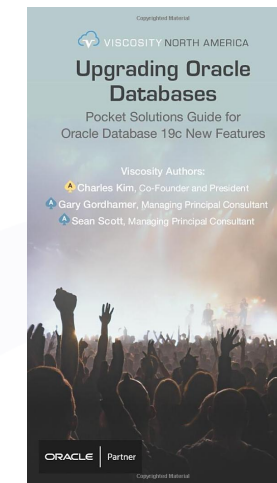
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# Charles Kim



## Oracle ACE Director

- Oracle ACE Director
- Founder and CEO of Viscosity
- Author of **11 Books** in the Oracle Ecosystem
- Oracle Expertise: Mission Critical Databases:  
Exadata, RAC, Data Guard, ASM, RMAN, Shareplex/GoldenGate
- Specialize in “**Complex Data Replication & Integration**” with **Shareplex & GG**
- Oracle Management Cloud Certified
- Oracle Exadata Certified Implementation Specialist
- Oracle Certified RAC Expert
- Oracle Linux Certified Expert
- Former President of the Oracle Cloud SIG for several years





# Viscosity's Oracle ACEs

## The Oracle ACE Program

The Oracle ACE Program recognizes and rewards individuals for their contributions to the Oracle community.



Charles Kim  
CEO | Co-Founder

 @racdba

 **ACE Director**



Rich Niemiec  
Chief Innovation Officer

 @richniemiec

 **ACE Director**



Craig Shallahamer  
Applied AI Scientist

 @orapub

 **ACE Director**



Sean Scott  
Principal Consultant

 @oraclesean

 **ACE Director**



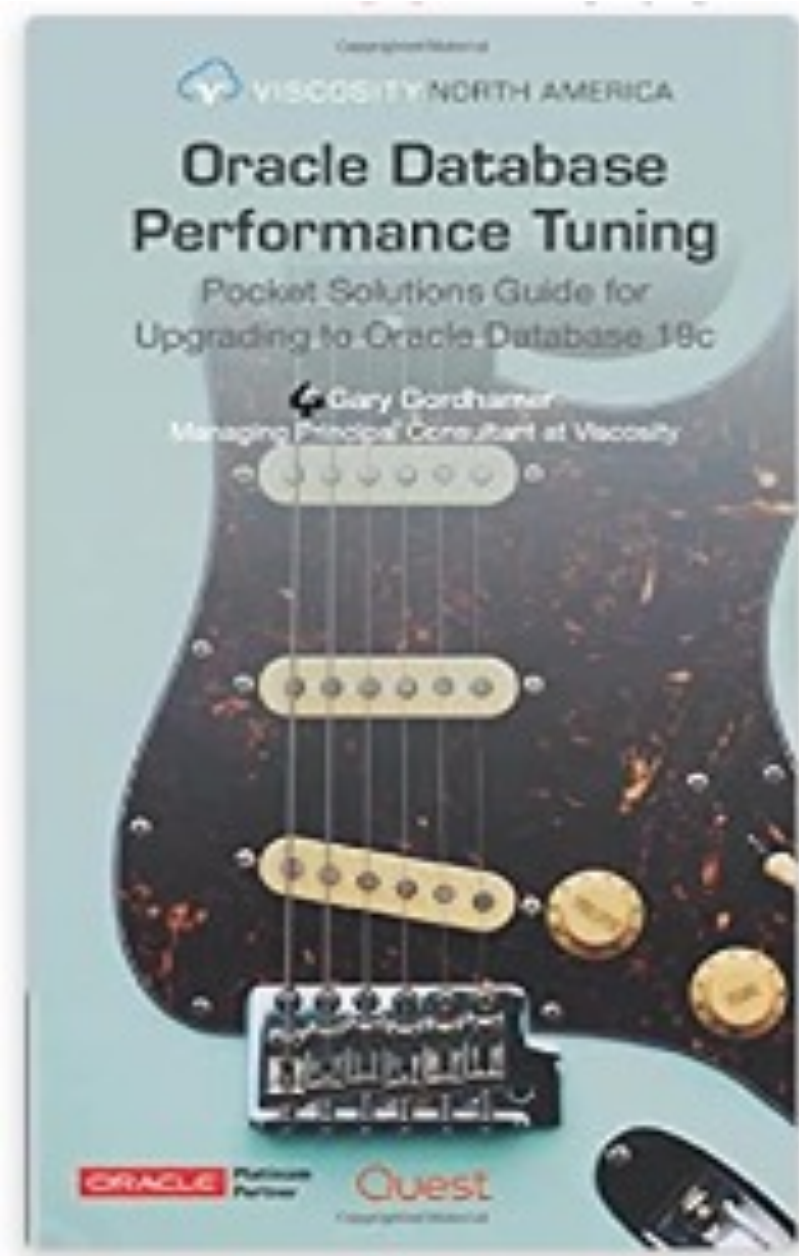
Gary Gordhamer  
Principal Consultant

 @ggordham

 **ACE Pro**

**Julio Ayapan**  
Principal Consultant  
Oracle ACE  
Alumni





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# Upgrading to Oracle Database 23c

**Updating both books for Oracle Database 23c**

Big Focus on AutoUpgrade

Performance Tuning

Additional 23c New Features

# Evolution of the Oracle DBA



Kind of DBA	Timeline
<u>CLI DBA</u>	<u>Early 90's DBAs</u>
<u>GUI DBA (Right Click DBAs)</u>	<u>Late 90's and Dot Com</u>
<u>Google DBA (Developers)</u>	<u>Dot Com and 2000's</u>
<u>iDBA</u>	<u>Dot Com, IOUG iDBA Master Curriculum</u>
<u>RAC DBAs (MAA DBAs)</u>	<u>2000+ after 9.2 (but major spike with 10.2) + <b>Data Guard</b></u>
<u>DMA</u>	<u>2010+ Database Machine Administrator</u>
<u>vDBA / vRAC DBA</u>	<u>2010+ Evolving role of a DBA in the virtual world</u>
<u>Cloud DBA</u>	<u>2011+ Database Consolidation with <a href="#">Private Database Cloud</a> Oracle Database 12c Launches June 2013</u>
<u>Public Cloud DBA</u>	<u>2015+ Oracle Public Cloud with Database Cloud Service, Database Backup Cloud Service, Storage Cloud Service, IaaS Cloud Service</u>
<u>PDBAs</u>	<u>2017+ Multi-Tenant with Oracle Database 12c Release 2 GA – March 2017</u>
<u>Oracle 18c</u>	<u>February 2018 in Oracle Cloud, July 2018 On-Premise</u>
<u>Oracle 19c</u>	<u><a href="#">January 2019 - LiveSQL</a> <a href="#">February 2019 for on-premises Exadata; April 2019 General Release (Terminal Release or Long Term Release)</a></u>
<u>Oracle 20c</u>	<u><a href="#">Dead! Made preview in the cloud but did not GA</a></u>
<u>Oracle 21c</u>	<u><a href="#">January 2021 - Preview released in Cloud</a> <a href="#">August 2021 – GA On-Premise</a></u>
<u>Oracle 22c</u>	<u><a href="#">Skipped</a></u>
<u>Oracle 23c</u>	<u><a href="#">Next Long Term Release</a></u>


Converged  
DBA

“It is not the strongest or the most intelligent who will survive but those who can best manage [adapt to] change.”

The DBA role is not dying.

The DBA role has always been changing.

# Oracle Release Dates

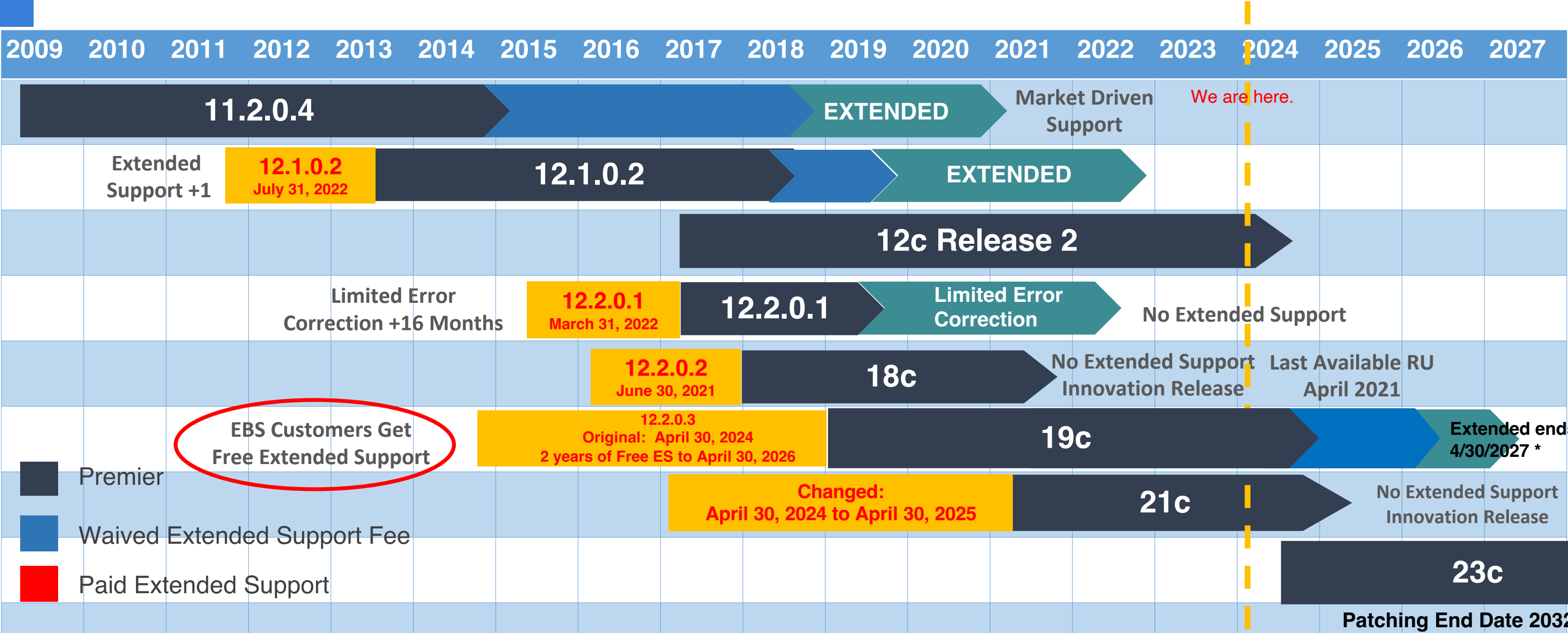
Oracle Database 11g Release 1	Aug 2007
Oracle Database 11g Release 2	Sept 2009
Oracle Database 12c Release 1	June 2013
Oracle Database 12c Release 1 (Patchset) - 12.1.0.2	June 2014
Oracle Database 12c Release 2 (Cloud)	September 2016
Oracle Database 12c Release 2 (On-premise)	March 2017
Oracle 18c - “Cloud First”	February 2018
Oracle 18c – Available on Exadata	February 2018
Oracle 18c – Available on ODA	March 2018
Oracle 18c – On-Premise	July 2018
Oracle 19c - Exadata On-Premise	Feb 13, 2019
Oracle 19c - General Availability - Terminal Release	April 2019
<del>Oracle Database 20c Preview Release on OCI Only (R.I.P)</del> 	Feb 14, 2020
Oracle Database 21c on OCI (Cloud First)	December 2020
Oracle Databse 21c – On-Premise	August 2021
Oracle Database 21c XE Edition	September 2021
Oracle Database 23c Developer Release	April 3, 2023
Oracle Database 23c OCI GA	September 2023



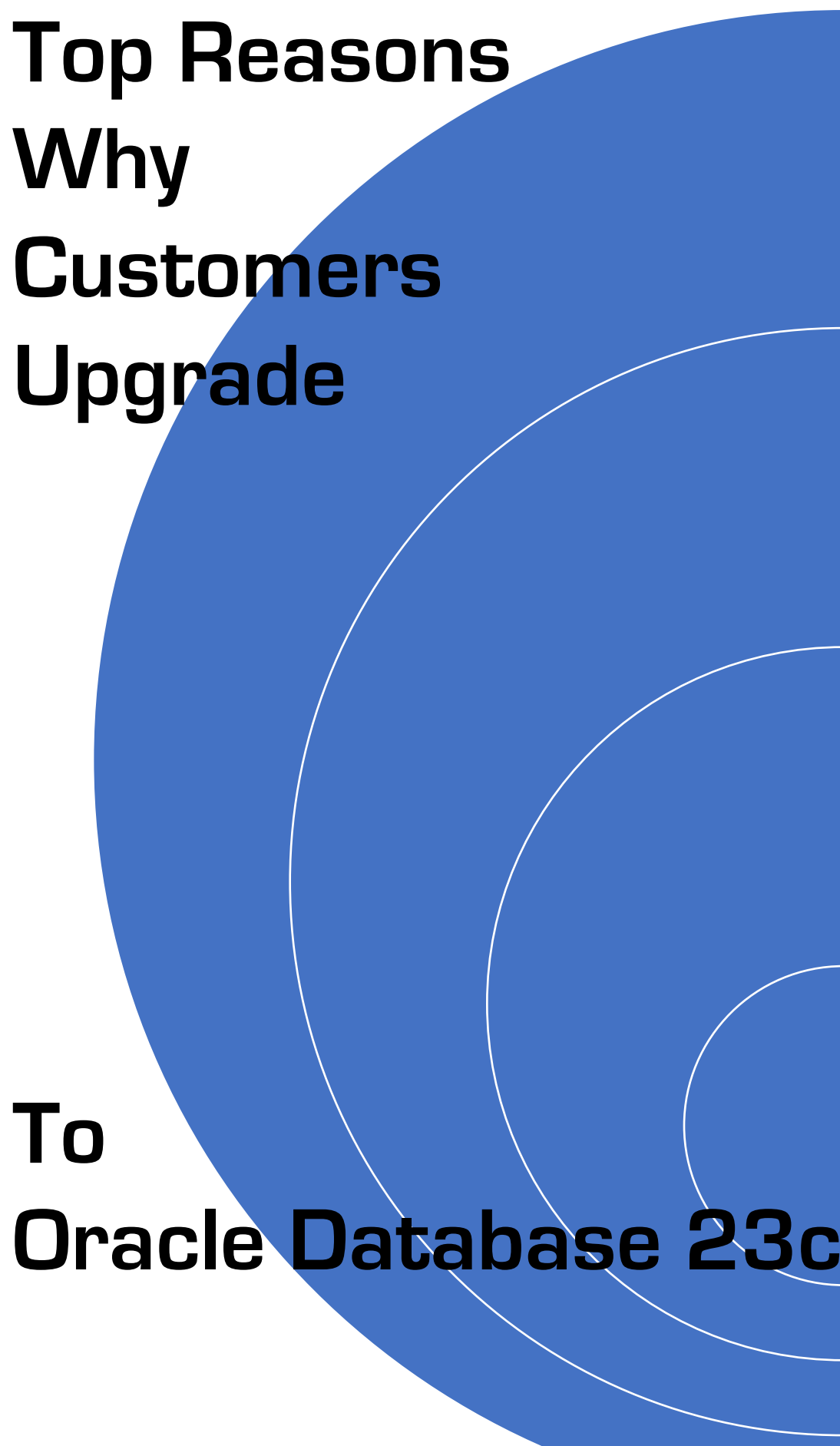
# Lifetime Support Commitments and Plans

Planned Release and Support Timelines - Subject To Change

Updated for NYOUG February 2024: <https://www.dbaexpert.com/upgrading-to-oracle-database-23c/>



- Oracle Database 19c and 23c releases provide long-term support and extended support
- Innovation Release - 2 years of Premier Support, and no Extended Support
  - Long Term Release - 5 years of Premier Support, and 3 years of Extended Support
  - Check MOS Note **742060.1** for the latest schedule



**New and Improved Database Features**

- **Security**
- Converged Database Enhancements
- **Performance**
- Higher Availability

**Compliance and Regulations**

Long-Term Support

- Extended Support

**Attract Talented People**

- No one wants to work for a shop that is a dinosaur

# What is Your Timeline to Upgrade to 23c

## Database Upgrade Considerations

### Top 10 Questions to ask yourselves:

1. **How long does it take** for your company to upgrade?  
DEV/QA/UAT/PROD How many databases do you have? How many environments do you have?
2. Have you already adopted **PDBs**? Do you have a **complicated** environment? RAC? Exadata?
3. What are the **key new** features that you will adopt as part of the upgrade?
4. Are you **migrating** to the cloud as part of the upgrade?  
Or are you upgrading **hardware** or OS as part of the upgrade? Are you **modernizing** your stack?
5. What were the **biggest pain points** from you last upgrade? How can we mitigate against them?



# What is Your Timeline to Upgrade to 23c

Top 10 Questions to ask yourselves:

6. Will **applications** need to be **updated**? Do we need to factor version compatibility with the new database version?

7. Will ODBC and JDBC **drivers** need to be updated on the clients, ETL servers, application servers? **General recommendation is to upgrade drivers first, but you may encounter the chicken and the egg situation.**


8. Do you have **database links** to other databases? Do those databases need to be upgraded? Is there compatibility issues? Are you using **heterogeneous** services to SQL Server?

9. Does your organization have the **skillset** to support the upgrade efforts? Does your team have the skillset to support the database (more so the application teams) after the upgrade?

10. Do you have a **test** plan? Do you have **backout** plans? With compliance and QA teams, how fast can you push the upgrade?





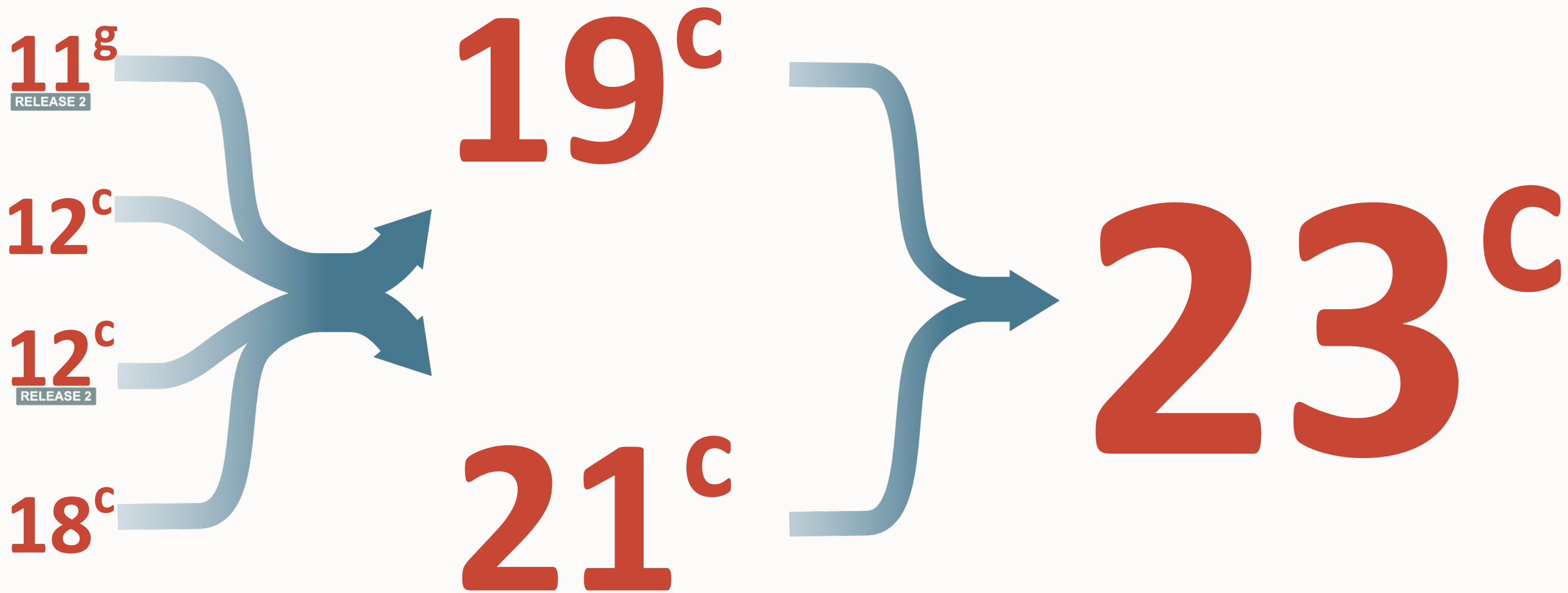
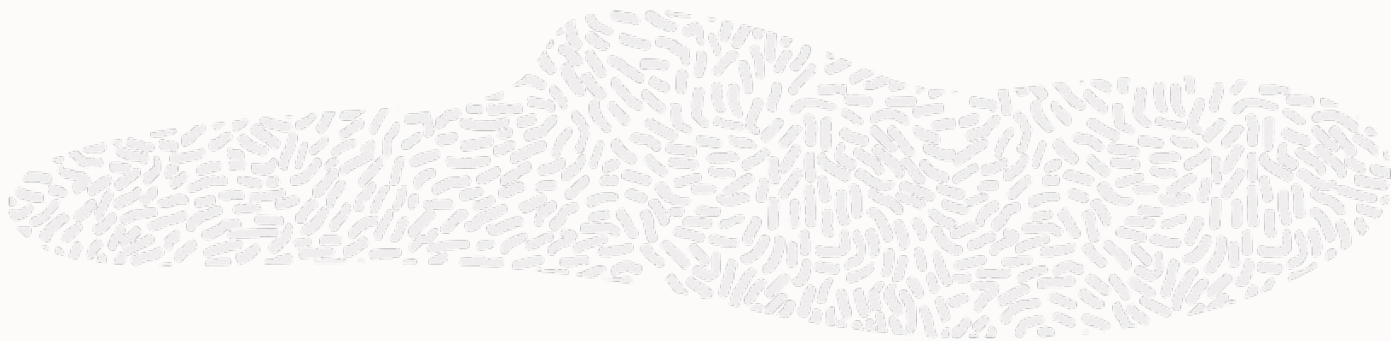


# How do we get to 23c?

Oracle database upgrade paths



# Upgrade Path to Oracle Database 23c





# Upgrade Path to Oracle Database 23c

What if you  
are on  
11.2.0.3?

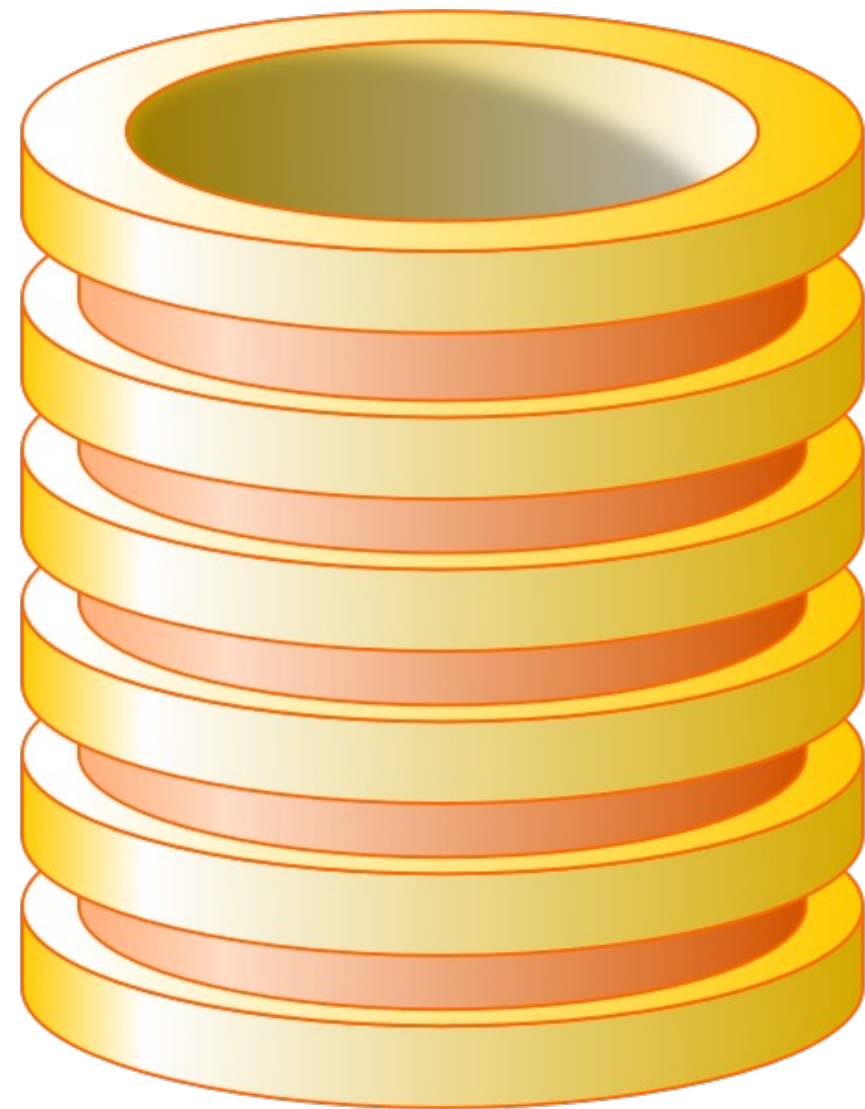
Oracle Database Release	Must Upgrade to Interim Jump	Target Version
11.2.0.4	Oracle Database 19c or Oracle Database 21c	23c
12.1.0.2 (12c Release 1)		
12.2.01 (12c Release 2)		
Oracle Database 18c		



# The Compatible Initialization Parameter

Oracle Database Release	Default Value	Minimum Value
Oracle Database 23c	23.0.0	19.0.0
Oracle Database 21c	21.0.0	12.2.0
Oracle Database 19c	19.0.0	11.2.0
Oracle Database 18c		11.2.0
Oracle Database 12c Release 2 (12.2)		11.2.0

If you create a new database, you should accept the default 23.0.0 compatible parameter



# Upgrade Methods

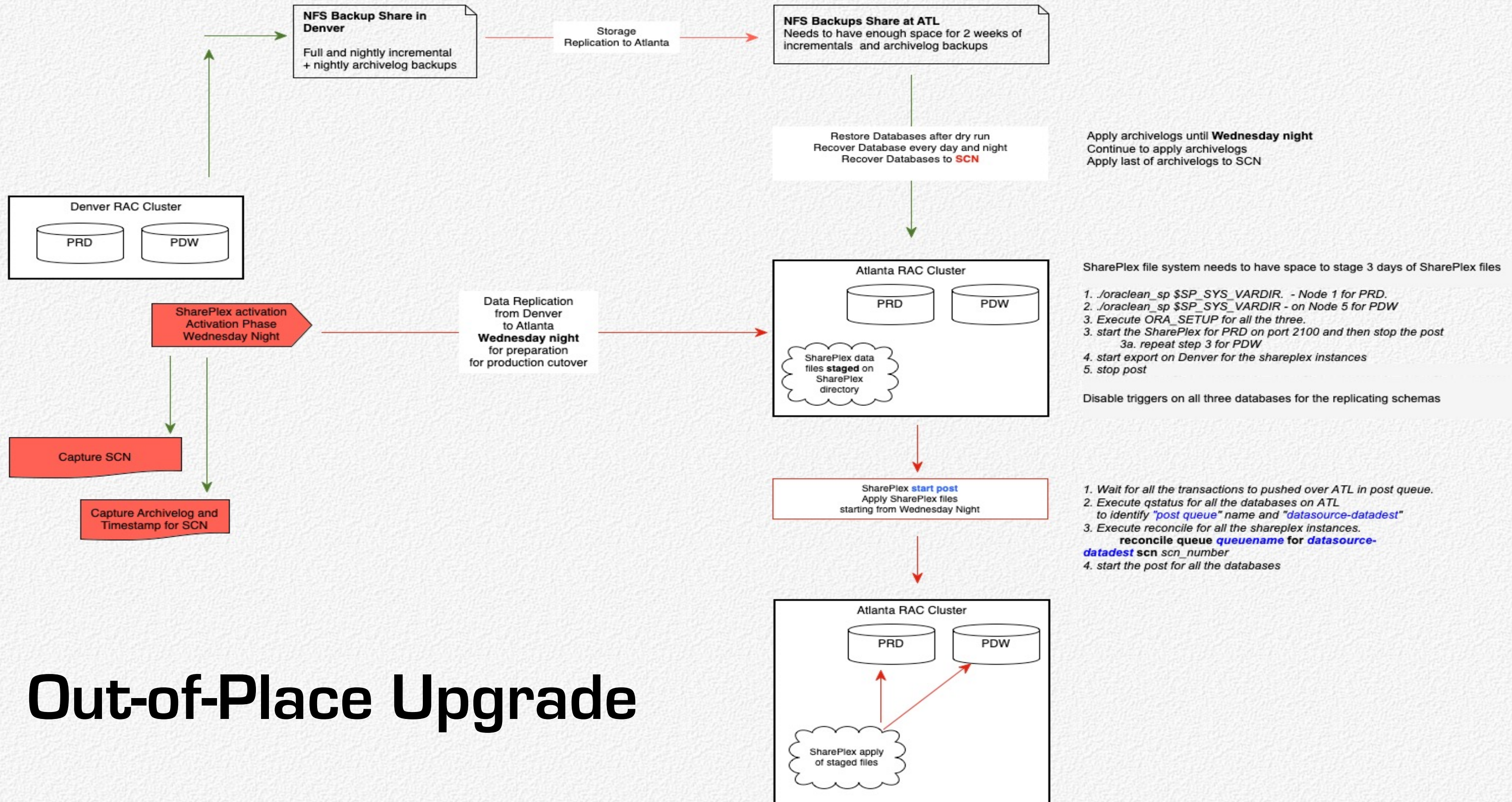
Method	Upgrade From	Upgrade To
Datapump Export/Import	11.2.0.4, 12.1.0.2, 12.2.0.1, 18c	23c
AutoUpgrade DBUA DBUpgrade	11.2.0.4, 12.1.0.2, 12.2.0.1, 18c	19c Then to 23c
	19c	23c
Transportable Tablespace	11.2.0.4, 12.1.0.2, 12.2.0.1, 18c	23c
GoldenGate / SharePlex	11.2.0.4, 12.1.0.2, 12.2.0.1, 18c	23c
Transient Logical Approach DBMS_ROLLING	11.2.0.4, 12.1.0.2, 12.2.0.1, 18c	19c Then to 23c
	19c	23c

## Near-Zero downtime upgrade

- Leveraging products like Oracle GoldenGate or Quest SharePlex, we can help customers perform zero-downtime upgrades to Oracle Database 23c
- By incorporating reverse replication back to the source database, create an insurance policy for the company so that you can perform a zero-risk database upgrade value proposition



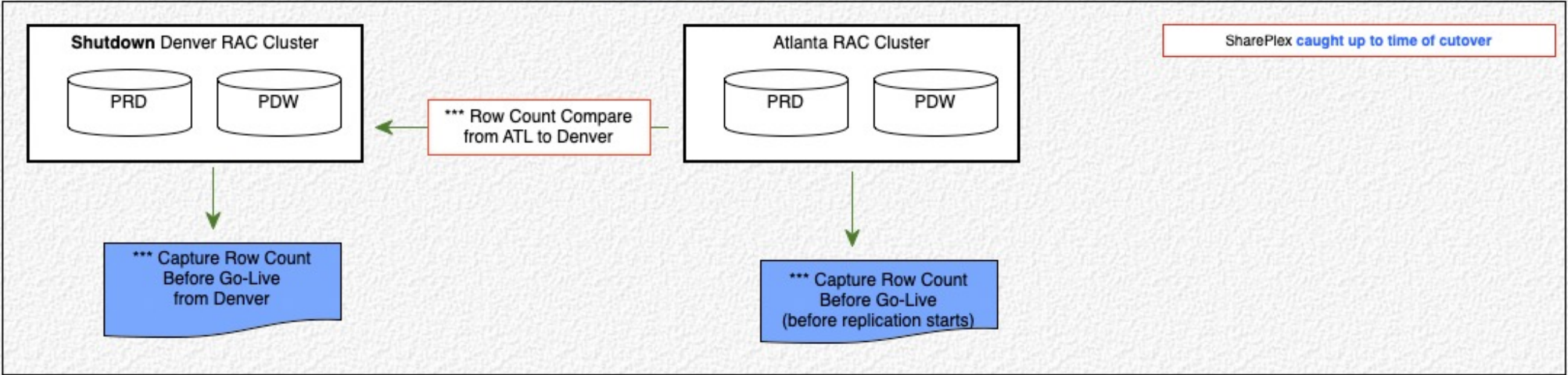
# Zero Downtime Database Upgrade and Data Center Migration Strategy





# Production Cutover Row Count Validation

## Production Cutover



**Friday night**  
1) Break connection from Phoenix - stop SharePlex  
2) Enable Triggers



# Oracle 19c - Oracle's Recommended Roadmap

- Oracle **strongly recommends** that customers upgrade their databases to Oracle Database 19c
  - 19c is the terminal release of Oracle Database 12c Release 2
  - 19c is the **long-term support** or extended support will only be offered on this version
- Oracle Database 19c will have premier support up to ~~March 31, 2023~~. April 30, 2024.
- Extended support will be provided until ~~March 31, 2026~~. April 30, 2027
- Oracle Database 23c will go **GA** this year but most customers will not venture there until next year



# MRPs for Linux Only



## Monthly Recommended Patches (MRP)

Start on November 2022

Linux Platforms Only

- To provide more frequent access to recommended and well-tested collections of patches
- Starting on October 2022, 19c RURs will no longer be provided for 19.17.0 and above

### Notes:

- Sunsetting of 19c RURs and FAQ (Doc ID 2898381.1)

**“ MRPs may include critical 3rd Party Security vulnerabilities. The Quarterly Database Release Update (RU) will continue to be primary mechanism for delivery of Database Security vulnerabilities announced as part of the Quarterly Security CPU program”**

# Oracle Database 19c

## Upgrade Checklists and Patch Information

Best  
Practice

N-1

555.1	Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1) Death of the RURs ☺ Welcome MRPs
2521164.1	Oracle Database 19c Proactive Patch Information Start Here For Patch Downloads
<a href="#">2539778.1</a>	Oracle 19c - Complete Checklist for Manual Upgrades to Non-CDB Oracle Database 19c
<a href="#">2543981.1</a>	Oracle 19c - Complete Checklist for upgrading Oracle 12c, 18c Container Database (CDB) to Oracle 19c Release using DBUA
2549866.1	Oracle 19c - Complete checklist for <b>Manual</b> Upgrade for upgrading Oracle 12.x, 18c <b>Container</b> database (CDB) to Oracle 19c (19.x)
<a href="#">2545064.1</a>	Oracle 19c - Complete Checklist for Upgrading to Oracle Database 19c (19.x) using DBUA
2539778.1	Oracle 19c - Complete Checklist for Manual Upgrades to Non-CDB Oracle Database 19c
2539751.1	Patches to apply before upgrading Oracle GI and DB to 19c
2542082.1	19c Grid Infrastructure and Database Upgrade steps for Exadata Database Machine running on Oracle Linux
1587357.1	Oracle Database (RDBMS) on Unix AIX,HP-UX,Linux,Solaris and MS Windows Operating Systems Installation and Configuration Requirements Quick Reference (12.1/12.2/18c/19c)



# **What You Will Lose De-supported Options**

**Prepare for  
De-supported Features  
and Functionality**

# Oracle Database 19c

Deprecated and De-supported in 19c

Support for DBMS_JOBS	<p>Oracle Scheduler replaces the DBMS_JOB package Only supported for backwards compatibility</p> <p>During the upgrade, a compatible entry will be created in DBMS_SCHEDULER PreUpgrade will check for inconsistencies or issues</p>
Oracle Media	<p>No longer supported Implementation is removed</p>
Oracle Streams	<p>No longer supported PreUpgrade check will detect and notify presence of Oracle Streams Recommendation is to upgrade to</p> <ul style="list-style-type: none"><li>• Oracle GG</li><li>• Quest SharePlex</li><li>• HVR</li></ul>
Standard Edition RAC	<p>No Longer Supported But we have options</p>

# Oracle 19c RAC and SE2 De-Support

- SE does not provide all the HA capabilities in Oracle Database
- SE2 Socket Requirements are hard to meet (as hardware evolves)
- SE RAC has been diminishing demand
- MOS: 2504078.1
- **Standard Edition High Availability**
  - Works with ASM or ACFS
  - Starting with Oracle Database 19c Release Update (19.7), you can install Oracle Database Standard Edition 2 in high availability mode
  - SPFILE for the database instance initialization parameters and a database password file stored for the database instance initialization parameters in Oracle ASM or Oracle ACFS
  - Register the Standard Edition 2 single-instance database with SCAN listeners as remote listener and node listeners as local listener.

Desupport of Oracle Real Application Clusters (RAC) with Oracle Database Standard Edition 19c (Doc ID 2504078.1)



# Deprecated and De-Supported in 21c

## • **Deprecated**

- Traditional Auditing
- Deprecation of Policy-Managed Databases
- Deprecation of TLS 1.0 and 1.1 Transport Layer Security
- Deprecation of Oracle Wallet Manager
- Deprecation of Oracle OLAP
- Grid Infrastructure Management Repository (GIMR) Deprecation
- Deprecation of Quality of Service Management

## • **Desupported**

- Oracle Failsafe
- Desupport of V\$OBJECT\_USAGE View
  - Use USER\_OBJECT\_USAGE instead
- REMOTE\_OS\_AUTHENT initialization parameter
- Desupport of Non-CDB Oracle Databases
- Desupport of ACFS on Windows
- Desupport of VERIFY\_FUNCTION and VERIFY\_FUNCTION\_11G
- Desupport of Adobe Flash-Based Oracle Enterprise Manager Express
- DBMS\_OBFUSCATION\_TOOLKIT is desupported
  - replaced with DBMS\_CRYPTO

# Deprecated and De-Supported in 23c

- **Deprecated**

- DBUA + command line catupgrade
- Oracle Persistent Memory Deprecation
- mkstore command line utility → to be absorbed by orapki
- DB\_RESULT\_CACHE

- **De-Supported**

- exp utility
  - imp will still be around for obvious reasons
- EM Express (Oracle Enterprise Manager Database Express)
- TLS 1.0 and 1.1
- 32-bit Oracle database client
- Traditional Auditing (next slide)

# Auditing



## End of Traditional Auditing

- Traditional Auditing was deprecated in Oracle Database 21c
- Traditional Auditing is desupported in Oracle Database 23c
- Need to move to Unified Auditing

## Audit Individual Columns for Tables and Views

- Create audit policies on individual columns of tables and views
- Allows us to eliminate the noise in the audit trail by reducing actions to only sensitive columns of interest.
- **Traditional to Unified Audit Syntax Converter** - Generate Unified Audit Policies from Current Traditional Audit Configuration (Doc ID 2909718.1)

If you have upgraded your Oracle database installation from release 11g, then **at a minimum**, you should enable the following predefined policies, which address the most common security and compliance needs:

### Secure configuration audit options

1. (ORA\_SECURECONFIG), such as audits of the ALTER ANY TABLE system privilege
2. Logon failures (ORA\_LOGON\_FAILURES)

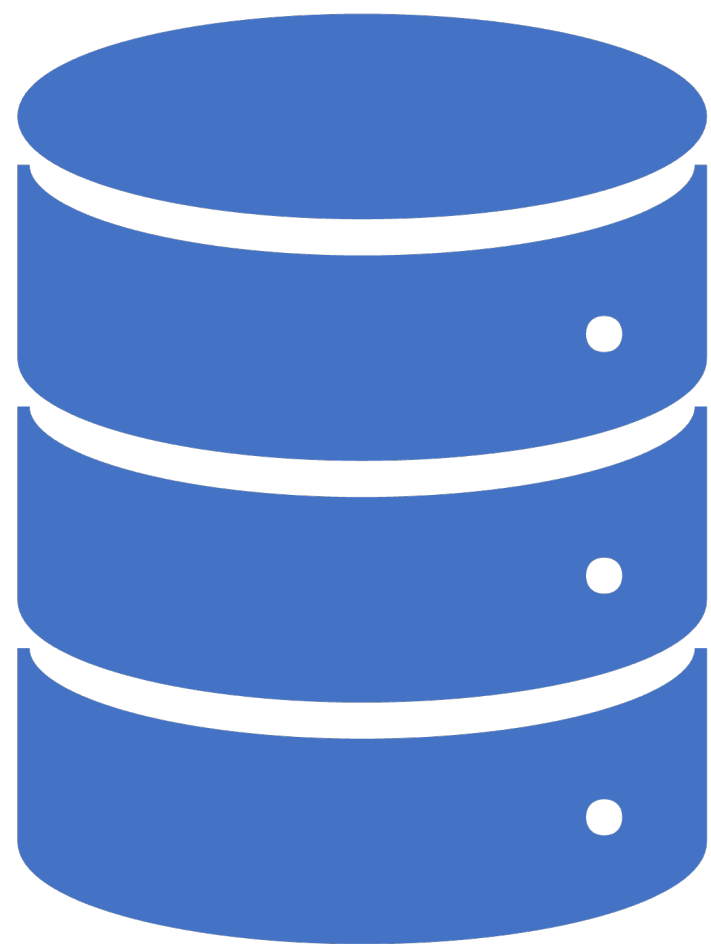
All new Oracle databases from 12.2 and later, have the ORA\_SECURECONFIG and ORA\_LOGON\_FAILURES pre-defined unified audit policies automatically enabled.

**During database upgrades, these predefined unified audit policies are not enabled.**

- **Reason why you should run the latest DBSAT on your databases after each upgrade.**



**PDB**



**Oracle Database 21c - The first CDB-Only Release**

**PDB is THE FUTURE: Changes How DBAs Work**

**Oracle Database 23c is right around the corner**

# Oracle Database 19c

## 3 PDBs - FREE TO USE



Starting in Oracle Database 19c, each container database can have up to **3** pluggable databases

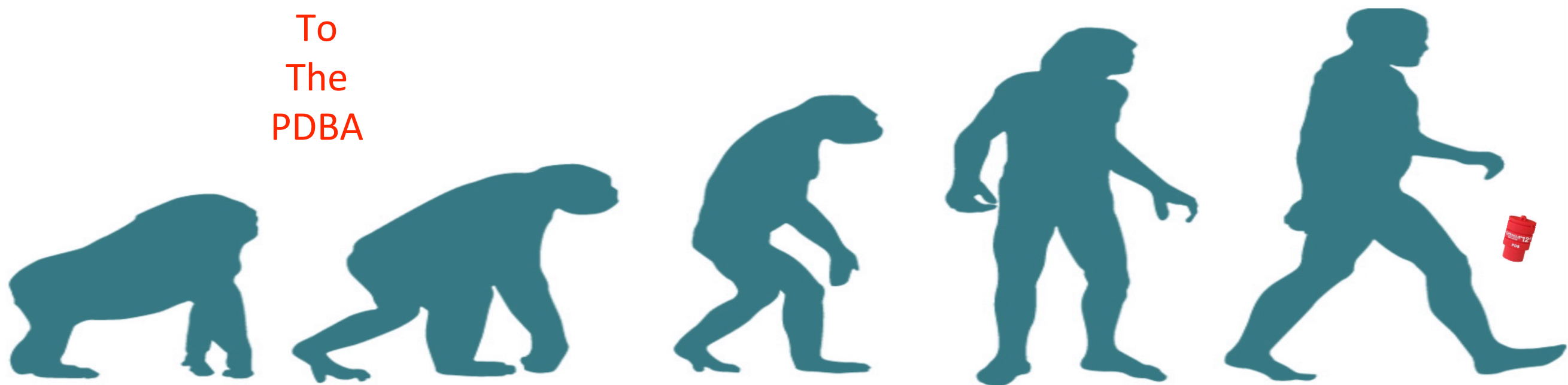
- Change how we perform database **upgrades**
- Change how we do data center **migrations**
- Change how we perform **patches**

**19<sup>c</sup>** **ORACLE<sup>®</sup>**  
Database



# Evolution of Multitenant (PDB) Features

Evolution of the  
Dinosaur DBA  
To  
The  
PDBA



Read Only  
Source –  
**Cold/Remote  
Clone**



Read Write  
Source –  
**Hot/Refresh  
Clone**



Online  
**Relocate**

Lockdown Profiles

PDB Archives

Proxy PDBs

Refreshable PDB  
Switchover (18c)

Refreshable PDBs  
(12.2)

Snapshot Carousels  
(18c Exa)



@ViscosityNA

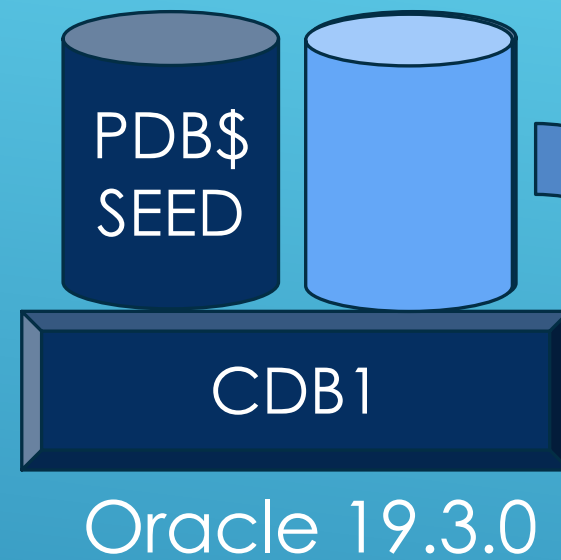
**NEW IN  
12.2**



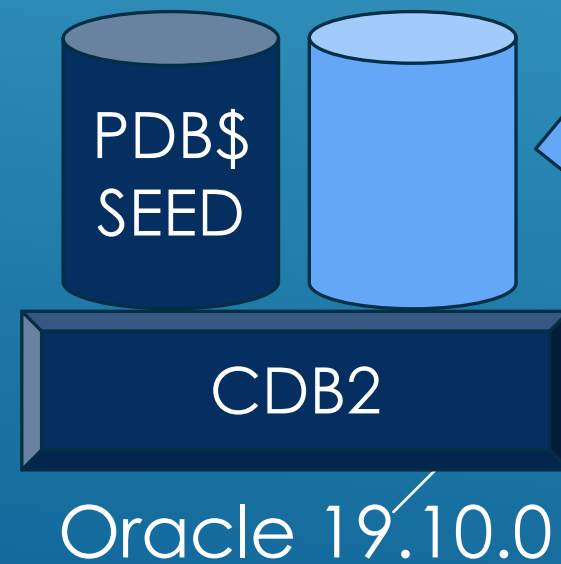
VISCOSITY NORTH AMERICA

# PATCHING

**1** Create new CDB2 with same components as CDB1 - make sure COMPATIBLE is identical



**2** Relocate PDB

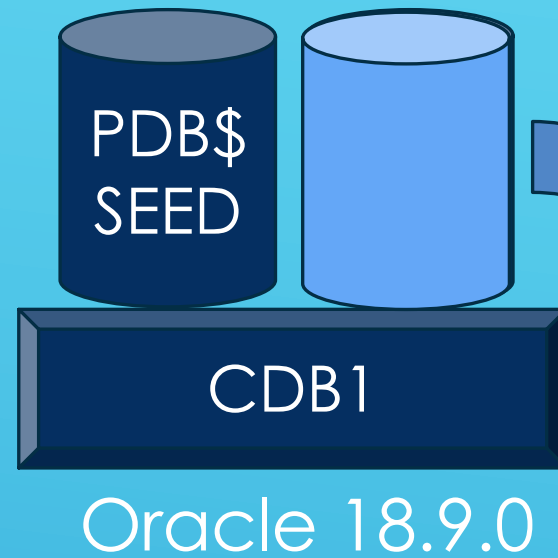


**3** Execute 'datapatch -verbose'

# UPGRADING

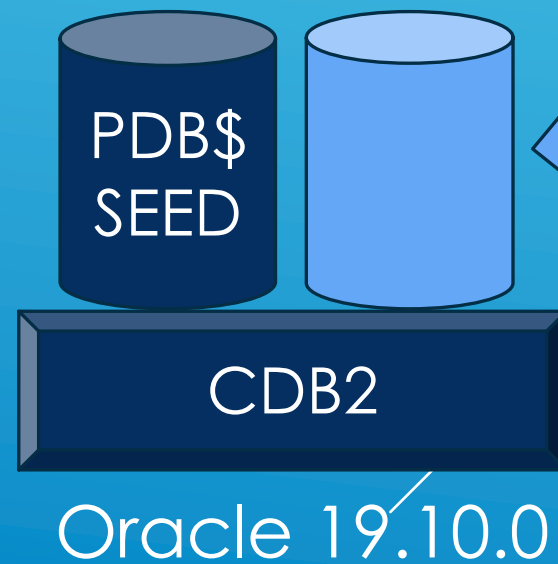
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Create new CDB2 with same components as CDB1 – This time as an Oracle Database 19c



2

Clone PDB



3

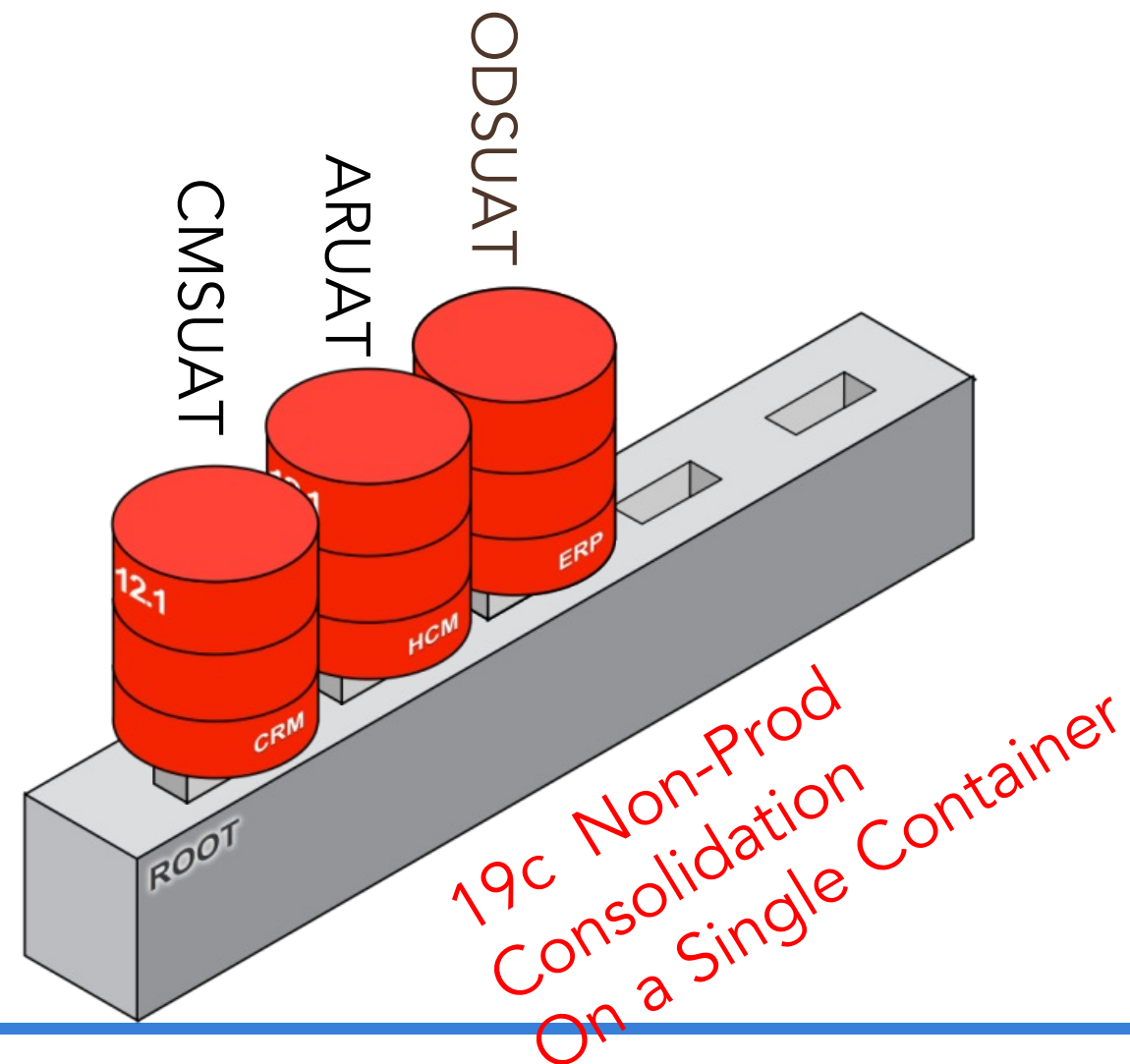
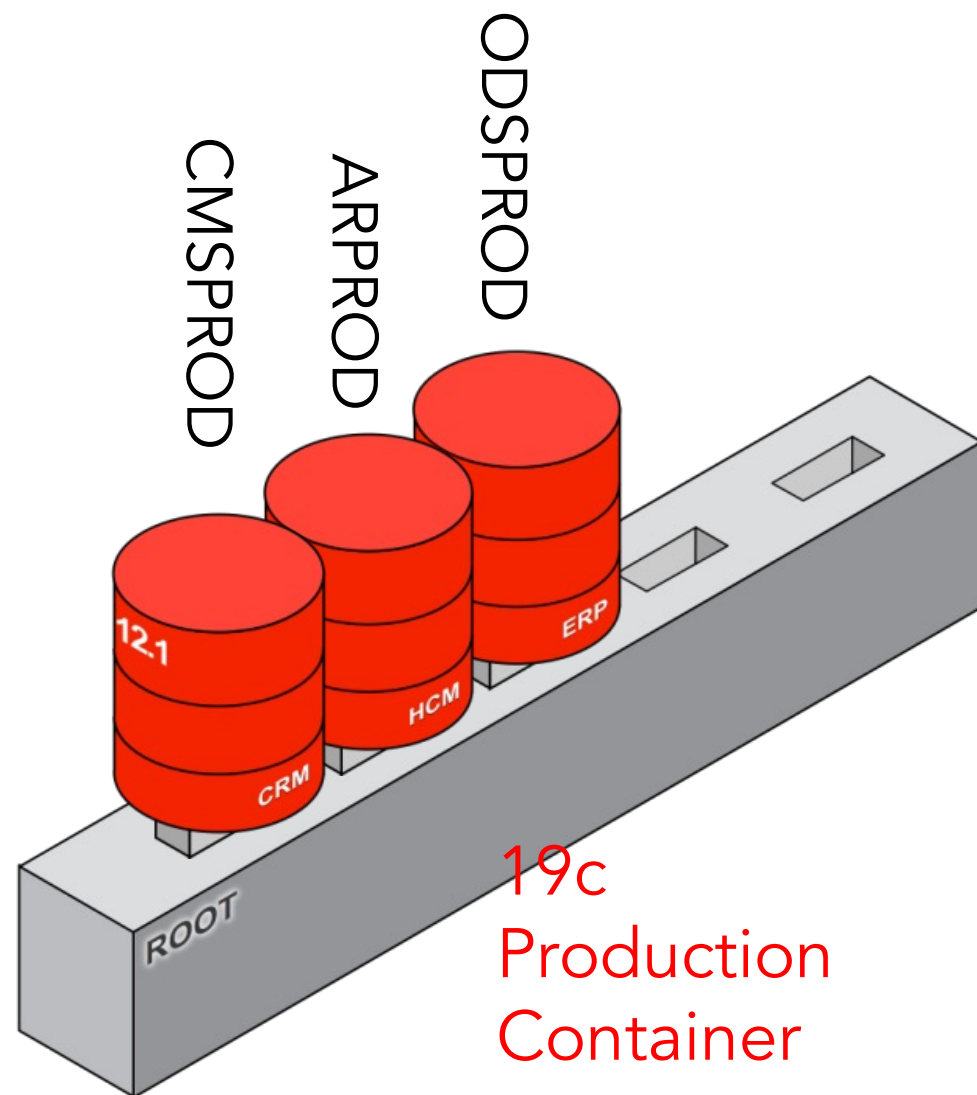
SQL> alter pluggable database open upgrade;

```
$ perl $ORACLE_HOME/rdbms/admin/catctl.pl -d \  
$ORACLE_HOME/rdbms/admin -c 'PDB' \  
-I $ORACLE_BASE catupgrd.sql
```



## 19c PDB Consolidation for Cost Containment

Standardize in consolidating multiple databases (customers) into a single container



PDB Complete Isolation  
Meets Compliance & Regulatory Requirements

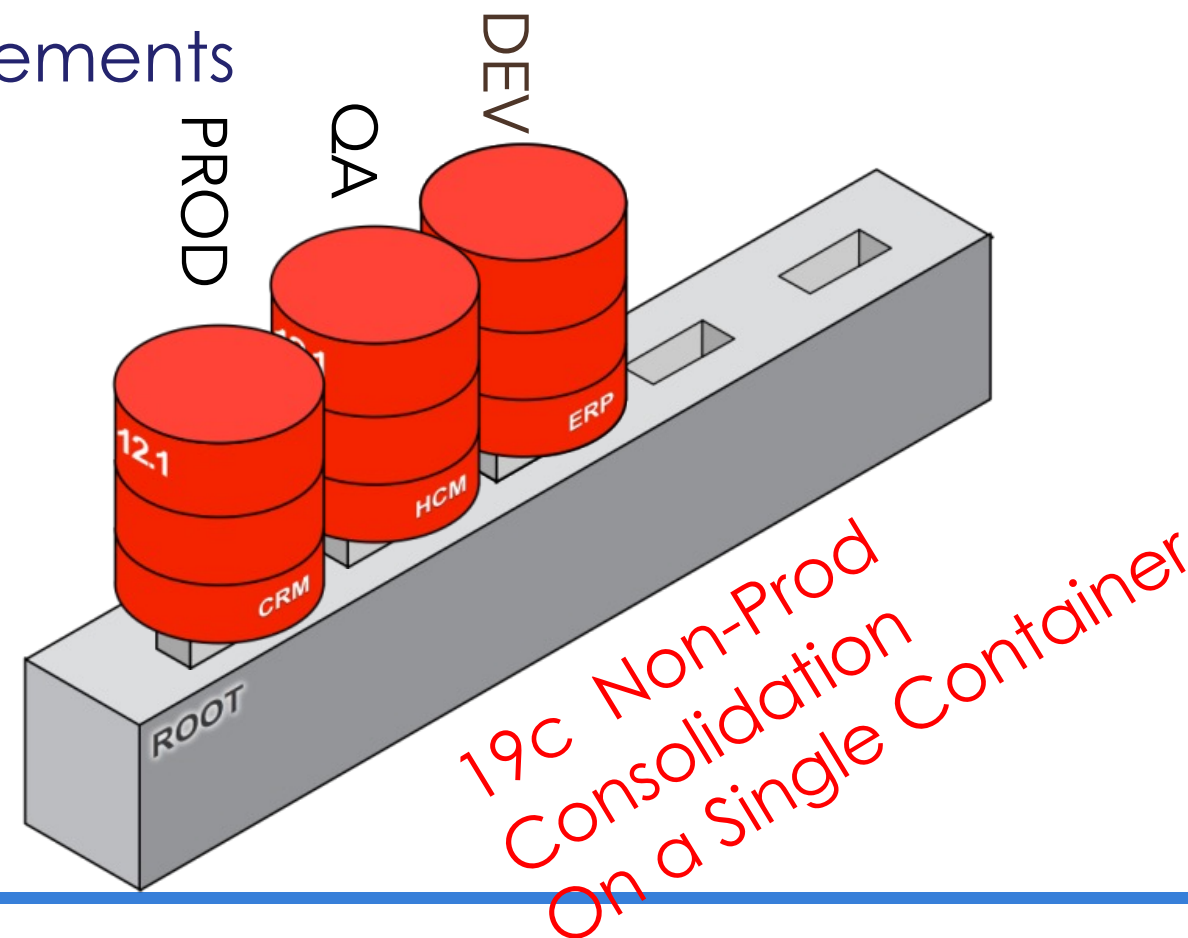
# 19c PDB Consolidation for Cost Containment

## Consolidate databases into a single container

**Not a recommended deployment model**

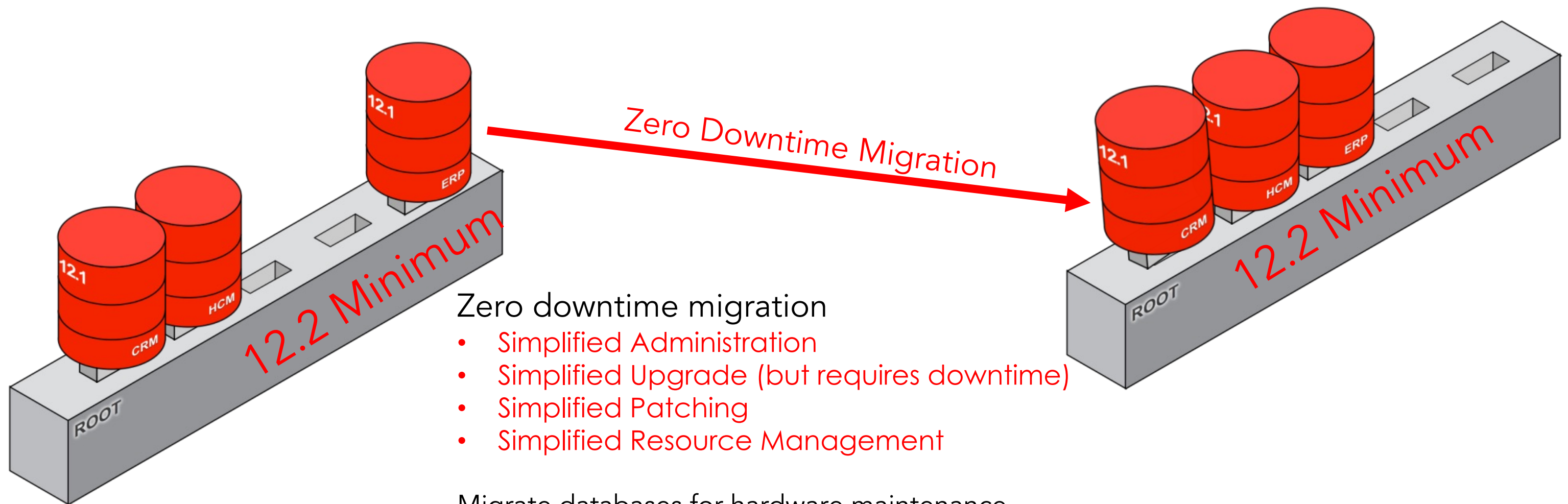
**Can put PROD, QA and DEV on a single container**

PDB Complete Isolation  
Meets Compliance & Regulatory Requirements



# 19c PDB Database

## High Availability



### Zero downtime migration

- Simplified Administration
- Simplified Upgrade (but requires downtime)
- Simplified Patching
- Simplified Resource Management

Migrate databases for hardware maintenance

Migrate databases for OS upgrades



**More PDB**

# Dynamic CPU Scaling

## CPU Min Count at PDB Level

- Works with Oracle Database Resource Manager (DBRM)
- Starting in Oracle 19.4, CPU\_MIN\_COUNT is available to set **minimum** CPUs when the system is under load conditions
  - Reserve CPU
  - Protect from noisy neighbors
- Set in conjunction with CPU\_COUNT to set the **upper** limit

# Fined Grained PDB Patching

PDB is the Future

- Patch individual PDBs in a Multi-tenant environment
- Allows bug fixes to be patched only on specific PDBs rather than across the entire CDB



# High Availability Considerations

## Active Data Guard: DML Redirection

**DBMS\_ROLLING with ADG: Introduced in 12.1.0.1**

**Transient Standby: Started with 11.1.0.6**

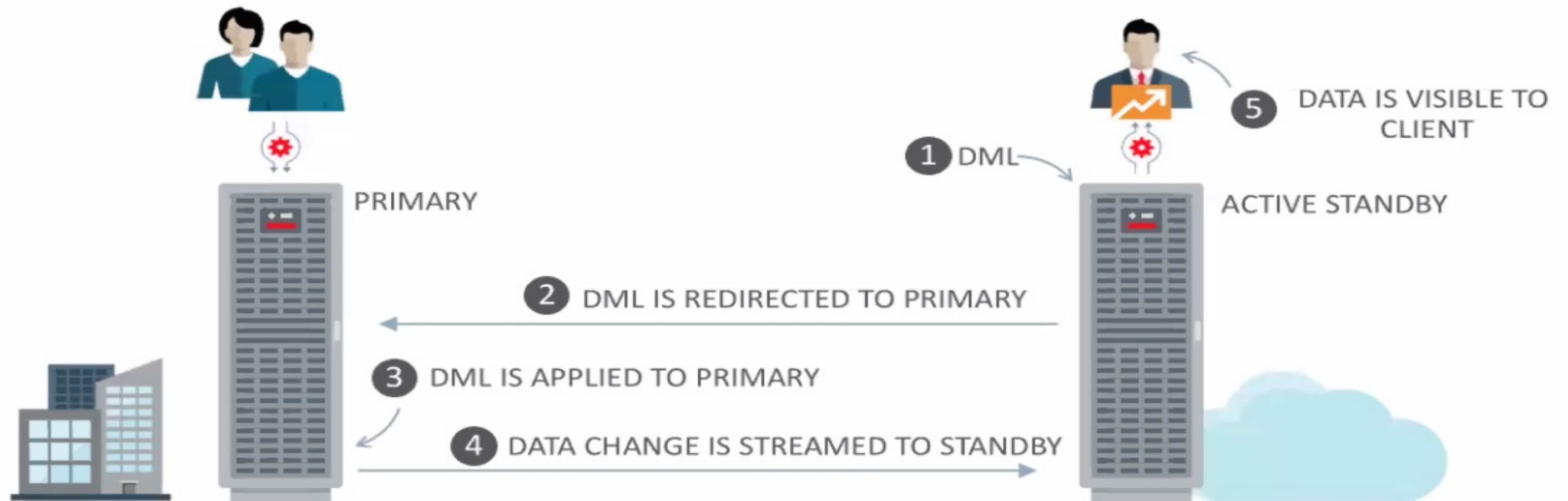
## 23c: Flashback Time Travel

# Read Mostly Physical Standby

19<sup>c</sup> ORACLE<sup>®</sup>  
Database

## Active Data Guard : DML Redirection

- Read Mostly Standby



# 19c: Data Guard DML Redirection

## RUN DML on Active Data Guard

- Re-Direct DML statement back to the primary database
  - Data changes will happen on the primary database
  - Changed blocks will ship to ADG
  - ADG will be in sync to maintain redundancy
- 
- Set **ADG\_REDIRECT\_DML initialization parameter = TRUE**
  - SQL> ALTER **SESSION** ENABLE ADG\_REDIRECT\_DML;



# Observer and FSFO



## Observer in Observe Only Mode

Configure it to Observe only creating a '**test mode**' to see when a failover or other interaction would have occurred during the normal production processing

- Can tune FSFO for finer granularity
- Can see IF FSFO would have actually occurred without production impact
- Improve failover validation

## Dynamically Change FSFO target

With 12.2, we can have multiple FSFO targets

With 19c, we can change the targets without FSFO being disabled

# Additional 19c New Features

## Clear Flashback logs periodically to increase FRA size predictability

Starting in 19c, the management of space in the fast recovery area is simplified

Oracle Database monitors flashback logs in the fast recovery area and automatically deletes flashback logs that are beyond the retention period. When the retention target is reduced, flashback logs that are beyond the retention period are deleted immediately.

## New Parameters for Tuning Automatic Outage Resolution

DATA\_GUARD\_MAX\_IO\_TIME sets the maximum number of seconds that can elapse before a process is considered hung while performing a regular I/O operation in an Oracle Data Guard environment. Regular I/O operations include read, write, and status operations.

DATA\_GUARD\_MAX\_LONGIO\_TIME sets the maximum number of seconds that can elapse before a process is considered hung while performing a long I/O operation in an Oracle Data Guard environment. Long I/O operations include open and close operations.

# **23c Data Guard & HA Enhancements**

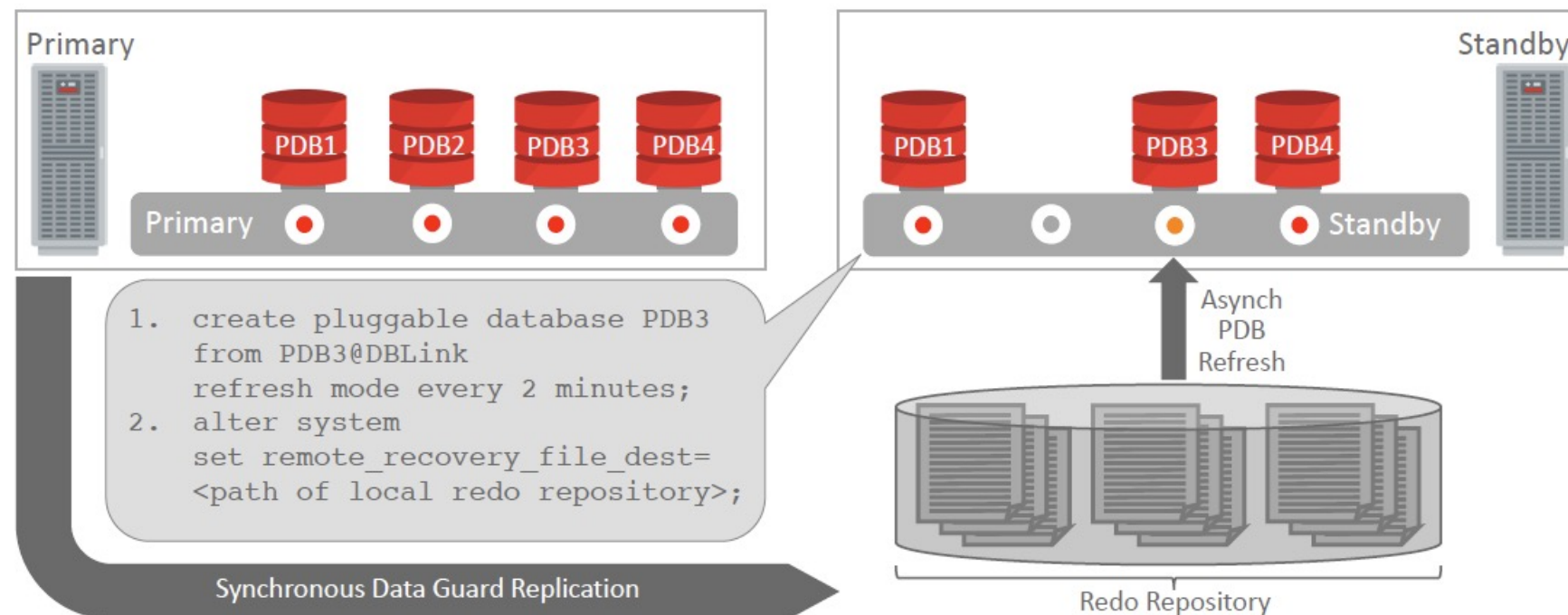


# Remote Data Guard Redo Repository (18c)

- A Component of the Data Guard Far Sync
- Requires ADG license

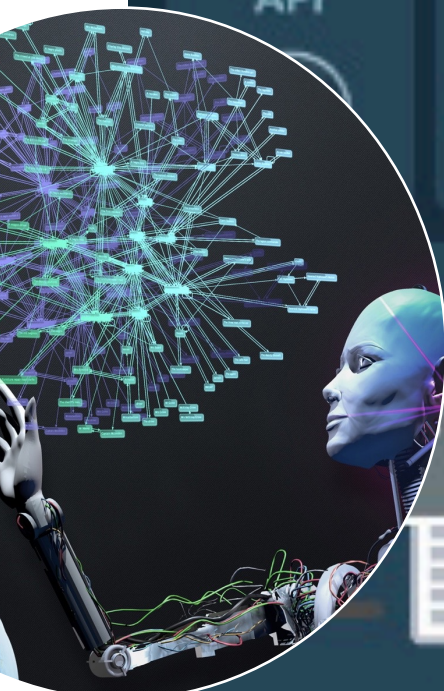
## Near-Zero Data Loss Per-PDB Switchover

Enabled by integration with Data Guard Redo Repository



## Advantages

- Minimizes impact of scanning redo logs
- Minimizes amount of redo transport between CDBs
- Enables **near-zero data loss architecture**



**RAC**  
Oracle RAC on Kubernetes & Podman  
Dual Instance Rolling Patching

**Per-PDB Data Guard Integration Enhancements**

Reconnect Refreshable PDBs to source (23c)  
Disconnect, Open PDBs as Read-Write and then reconnect the PDB as a refreshable PDB  
Essentially like a snapshot standby database

Per-PDB Time Zone (23c on-premise) for Sysdate queries

PDB-level Data Guard (21c)  
CDB1:PDB1: Primary --> CDB2: PDB1 DR: Standby  
CDB2:PDB2: Primary --> CDB1:PDB2 DR: Standby  
Where CDB1 is the primary for PDB1 and CDB2 is the primary for PDB2

Read-Only Per PDB Standbys (23c)

**Core Database**

Increased number of columns to 4096  
Managing Flashback Database Logs Outside the Fast Recovery Area  
...  
...  
...  
RUR's are transitioning to MRPs (available on Linux x86-64)  
Monthly Recommended Patches (MRPs)

# Flashback Time Travel Enhancements

## Create Flashback Archives in Your Database

- Flashback Time Travel helps to meet compliance requirements
- Track and archive transactional changes to tables including schemas
- Enable tracking of DML (such as INSERT and DELETE)
- Enable tracking of DDL operations on tables (such as creating and truncating tables)
  - Archive the changes made to the rows of the table in history tables
- Flashback Time Travel maintains a history of the evolution of a table and schema.
  - Enables you to issue flashback queries (AS OF and VERSIONS) on the table and its schema.
- You can view the history of DDL and DML changes made to the table.



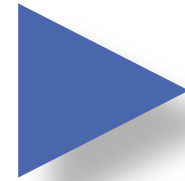
# Prepare Upgrade Checklist



# Clean Up: Recycle Bin



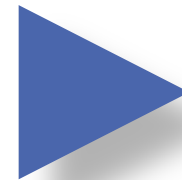
- Especially before patch set or release upgrade purge the recycle bin:
  - Since Oracle 12c this will be done by the `preupgrade_fixups.sql`
- General recommendation:
  - Empty the recycle bin at least once per week with an automatic job during off-peak times



```
purge DBA_RECYCLEBIN;
```

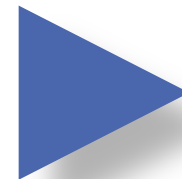
# Components: Validation Check

- Make sure all components are VALID before upgrade



```
Select COMP_ID, COMP_NAME,  
STATUS, VERSION from  
DBA_REGISTRY where  
STATUS<>'VALID';
```

- Components are INVALID?



```
@?/rdbms/admin/utlrbp.sql
```

- If that does not correct component status, further diagnosis might be required



[MOS Note:472937.1:](#)

Information On Installed Database Components

[MOS Note:753041.1:](#)

How to diagnose Components with NON VALID status



If you are not using it, think about removing it

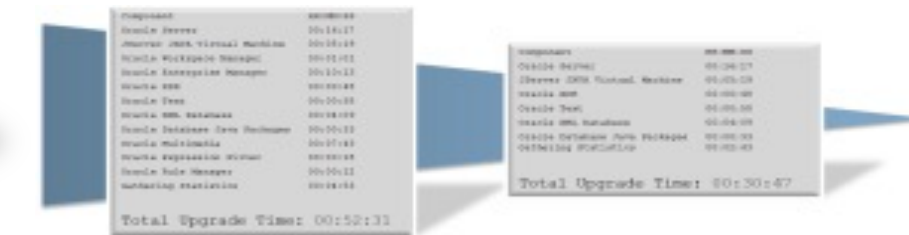
# Components: Removal

Potential reasons to remove components:

- A component **does not exist anymore** in Oracle Database 12c



- **Speed up** the upgrade process



- A component is **obsolete**



[Component Removal Tech Details](http://tinyurl.com/ComponentCleanup)  
<http://tinyurl.com/ComponentCleanup>

# Performance: Preserve Statistics

Gather accurate performance statistics from production

- Accurate means: Starting at least 1 month before the upgrade
- Use Automatic Workload Repository (AWR) Snapshots interval 30-60 minutes and retention >31 days
  - Extract AWR:  
– SQL> @?/rdbms/admin/awrextr.sql
  - Performance snapshot comparison using AWR DIFF reports:  
SQL>select \* from table(  
DBMS\_WORKLOAD\_REPOSITORY.AWR\_DIFF\_REPORT\_HTML(<DBID>, 1, 101, 121, <DBID>, 1, 201, 221));

[MOS Note:1477599.1](#) Best Practices Around Data Collection For Performance Issues

## Pre-Upgrade/Migrate Considerations

### Always Consider Minimal or Zero Downtime Approach

- Set **Guaranteed Restore Points** accordingly
- Ensure **AWR retention** is long enough to capture historical data for comparison
  - ASH too
- Backup your database statistics, in case an older SQL plan needs restoring
- Definitely consider **RAT** for real workload testing, instead of synthetic workloads tests
- *If upgrading older version of RAC to new version in place, special consideration need to be understood*
  - Upgrade the Grid Infrastructure stack first
    - Treat the GI upgrade like you do an OS upgrade
  - Legacy clients may not support new Net connections



# AWR - TopNSQL

[https://docs.oracle.com/en/database/oracle/oracle-database/19/arpls/DBMS\\_WORKLOAD\\_REPOSITORY.html#GUID-E2B46878-1BDB-4789-8A21-016A625530F1](https://docs.oracle.com/en/database/oracle/oracle-database/19/arpls/DBMS_WORKLOAD_REPOSITORY.html#GUID-E2B46878-1BDB-4789-8A21-016A625530F1)

## Examples:

8 days retention, 60 minute interval, topnsql 30

- execute dbms\_workload\_repository.modify\_snapshot\_settings(retention => 11520, interval => 60, topnsql => 'DEFAULT');

8 days retention, 60 minute interval, topnsql 100

- execute dbms\_workload\_repository.modify\_snapshot\_settings(retention => 11520, interval => 60, topnsql => 100);

30 days retention, 60 minute interval, topnsql 100

- execute dbms\_workload\_repository.modify\_snapshot\_settings(retention => 43200, interval => 60, topnsql => 100);

90 days retention, 60 minute interval, topnsql 100

- execute dbms\_workload\_repository.modify\_snapshot\_settings(retention => 129600, interval => 60, topnsql => 100);

## Verify AWR settings

- select a.snap\_interval, a.retention, a.topnsql
- from dba\_hist\_wr\_control a, v\$database d
- where a.dbid = d.dbid;

# Pre-Upgrade JAR Tips

- Set environment variables:

```
export NEW_HOME=$ORACLE_19C_HOME
export OLD_HOME=$ORACLE_HOME
```

- Run the pre-upgrade JAR:

```
$NEW_HOME/jdk/bin/java -jar $NEW_HOME/rdbms/admin/preupgrade.jar TERMINAL TEXT
```

- Perform fixups:

```
$NEW_HOME/perl/bin/perl -I$NEW_HOME/perl/lib \
-I$NEW_HOME/rdbms/admin $NEW_HOME/rdbms/admin/catcon.pl \
-l $ORACLE_BASE/cfgtoollogs/$ORACLE_SID/preupgrade/ \
-b preup_$ORACLE_SID \
$ORACLE_BASE/cfgtoollogs/$ORACLE_SID/preupgrade/preupgrade_fixups.sql
```

# Pre-upgrade checks and review

- Force Logging
- Block Change Tracking
- NLS values:
  - Time zone
  - Language
  - Territory
  - Character set/ NLS character set
- Contents, size and space in FRA
- Restore Points
- Database links
- Directories
- External tables
- Jobs and Scheduler Jobs
- NOLOGGING objects and tablespaces
- Datafiles, Tempfiles, Redo Log files
- Environment variables
  - SQLPATH
  - TWO\_TASK
- Check .profile, .bash\_profile, .bashrc, etc.
- Check crontab
- Review deprecated, de-supported features
- OS links
- Upgrading to New Version of the OS (validate shell scripts and programs)
- Check Apex Compatibility
  - <https://mikedietrichde.com/2017/05/02/is-your-apex-version-certified-with-your-database-release/>



# DBMS\_HCHECK



Allows DBAs to check for known data dictionary problems in the database

- DBMS\_HCHECK.FULL
  - FULL performs all checks and displays the output on the screen
  - Also writes the output to a trace file
  - Can be executed against the root container or a pluggable database
- DBMS\_HCHECK.CRITICAL
  - CRITICAL performs only critical checks and displays the output on the screen
  - Also writes the output to a trace file
  - Can be executed against the root container or a pluggable database

## Pre 23c

- hcheck.sql - Script to Check Data Dictionary for Known Problems (Doc ID **136697.1**)
- Download and execute the hcheck.sql script to check on potential data dictionary problems (or corruptions) in the system tablespace.
  - We run it for ALL customers before we do database upgrades and major patches
  - **Especially for E-Business Suite customers** prior the database upgrade
- With DBMS\_HCHECK as a built-in package, we no longer have to download the hcheck.sql script

# Collect dictionary and fixed objects statistics in advance

Reduce downtime by gathering system statistics in advance

```
begin
  dbms_stats.gather_schema_stats('SYS');
  dbms_stats.gather_schema_stats('SYSTEM');
  dbms_stats.gather_fixed_objects_stats;
end;

/
```

- Can reduce Datapump export time

Pre Upgrade Tasks
Schedule the full database backups prior to upgrading / patching the environment (the night before the upgrade or patching)
Determine who will be available from the support side if we need IT support
Validate root, grid, oracle access, grid access
Export Database statistics for backup
Change AWR retention window to minimum <b>31 days</b> - need to do this way ahead of time
Review data guard configuration since all of the environments have data guard - Make sure that force logging is enabled - Check for corrupt datafiles from unrecoverable activities
Create a preemptive SR with Oracle
Stage the 19c software on PROD RAC
Stage the 19c software on DR RAC
Apply RU Patch PROD RAC to 19.10
Apply Patch DR RAC to 19.10
Setup SQL.NET ora with 11g logon
Copy initialization parameter file to 19c on PROD and DR
Copy password file to 19c on PROD and DR
Copy tnsnames.ora file
Execute dbupgdiag.sql
Execute Viscosity Pre Upgrade Check Script
Execute java with the preupgrade.jar file
Record invalid objects
Validate application server scripts for 19c database
Backup /etc/oratab
Review cron jobs
Make sure that glogin.sql is blank
Capture DBMS_JOBS
Capture directories
Capture extproc
Capture database links (as they need to be reset)
Day Before
Perform full level 0 backup of the Database (if possible)
Clean up file system space
Review output from preungrade scripts and provide remediation plan

# Sample PreUpgrade Check List



# Pre-upgrade backup and capture

- Database configurations:
  - \$ORACLE\_HOME/dbs
  - \$ORACLE\_HOME/network/admin
  - Wallets
  - Diagnostic directories
- SGA and PGA TARGET ADVICE
- Opatch inventory, patch registry
- RMAN:
  - show all
  - report unrecoverable
  - report need backup
  - report schema
  - list backup
- Capture listener information
  - show log\_directory
  - show log\_file
  - show log\_status
  - show trc\_directory
  - show trc\_file
  - show trc\_level
  - show rawmode
  - show displaymode
  - show rules
  - show inbound\_connect\_timeout
  - show dynamic\_registration
  - status services

# Pre-upgrade tasks

- Upgrade or Remove APEX
  - If you are not using Apex, remove it
- Review and remove hidden parameters
- Remove OJVM if you are not using it
- Extend ADR retention policy (30-60 days ahead of the production upgrade cutover)
- Extend AWR retention policy (30-60 days ahead of the production upgrade cutover)
- Review contents of crontab
- Backup spfile and memory to pfile
- Backup /etc/oratab
- Generate IPCS reports
- Backup SAR directory

# DBUA Tips

- Run DBUA in silent mode:

```
$NEW_HOME/bin/dbua -silent -dbName $ORACLE_SID \  
                  -upgrade_parallelism 2 \  
                  -recompile_invalid_objects true \  
                  -upgradeTimezone true \  
                  -performFixUp true
```

- Check upgrade status:

```
@$NEW_HOME/rdbms/admin/utlustrs.sql TEXT
```



# Auto Upgrade

# Autoupgrade Tips

- Check Java version:

```
$ORACLE_HOME/jdk/bin/java -version
```

```
java version "1.6.0_75"
```

```
Java(TM) SE Runtime Environment (build 1.6.0_75-b13)
```

```
Java HotSpot(TM) 64-Bit Server VM (build 20.75-b01, mixed mode)
```

- Java must be 1.8 or greater (19c home Java can be used):

```
$NEW_HOME/jdk/bin/java -version
```

```
java version "1.8.0_241"
```

```
Java(TM) SE Runtime Environment (build 1.8.0_241-b07)
```

```
Java HotSpot(TM) 64-Bit Server VM (build 25.241-b07, mixed mode)
```

# Oracle Database 19c

**19<sup>c</sup>** ORACLE<sup>®</sup>  
Database

**My Oracle Support Document 2485457.1**

- **Auto Upgrade** for Oracle Databases
  - Must download the AutoUpgrade Kit (Starting with 12.2 and 18.5)
    - For 12.2: Requires the January 2019 Release Updates (DBJAN2019RU)
  - Upgrade database instance from command line with **single configuration** file
  - Runs pre-upgrade tasks
  - Performs automated fix-ups
  - Performs the actual upgrade
  - Performs post-upgrade tasks
    - Automatic retry and tailback
    - Schedule the upgrade
    - Change init.ora parameters along the way

# AutoUpgrade Stages

- **SETUP:** The initial stage that the AutoUpgrade utility job manager creates as part of the preparation for starting a job.
- **PREUPGRADE:** The stage in which AutoUpgrade performs checks of your system, based on your current system configuration to determine its readiness for upgrade, such as checking to determine if you have sufficient available disk space.
- **PRECHECKS:** The stage in which AutoUpgrade analyzes your source Oracle home to determine if the database meets the requirements for upgrade.
- **GRP:** The guaranteed restore point (GRP), which AutoUpgrade creates before starting the upgrade process. This option is only available for Oracle Database Enterprise Edition releases. It is not available for Oracle Database Standard Edition. Even though AutoUpgrade creates a GRP by default, Oracle highly recommends that you perform a backup before starting your upgrade.
- **PREFIXUPS:** The stage in which AutoUpgrade performs preupgrade fixups before starting the upgrade. For example, this is the stage in which AutoUpgrade gathers dictionary statistics on the source Oracle home.
- **DRAIN:** The stage during which AutoUpgrade shuts down the database.
- **DBUPGRADE:** The stage in which AutoUpgrade performs the upgrade, and compiles any invalid objects that are found after the upgrade completes.
- **POSTCHECKS:** The stage in which AutoUpgrade performs checks on the target Oracle home (the upgraded Oracle Database) before starting postupgrade fixups.
- **POSTFIXUPS:** The stage in which AutoUpgrade performs processing of postupgrade fixups, such as upgrading the time zone.
- **POSTUPGRADE:** The stage in which AutoUpgrade copies or merges the source Oracle home configuration files (tnsnames.ora, sqlnet.ora, and other files) to the target Oracle home.



# AutoUpgrade Tool

## Doc ID 2485457.1

**19<sup>c</sup>** ORACLE<sup>®</sup>  
Database

### Source

- 11.2.0.4 or Higher
- The most recent version of AutoUpgrade Utility can be downloaded via this link: [AutoUpgrade Tool 2485457.1](#).

### Target

- Oracle Database 19c (19.3 and newer)
- Oracle Database 18c (18.5 and newer)
- Oracle Database 12c Release 2 (12.2 + DBJAN2019RU and newer)

# Autoupgrade Tips

- Check Autoupgrade version:

```
$NEW_HOME/jdk/bin/java -jar $NEW_HOME/rdbms/admin/autoupgrade.jar -version
```

```
build.hash 04dd9f2
```

```
build.version 19.7.5
```

```
build.date 2020/02/11 15:28:49
```

```
build.max_target_version 19
```

```
build.type production
```

# Autoupgrade Tips

- Sample autoupgrade configuration file:

```
# Global parameters
global.autoupg_log_dir=/opt/oracle/autoupgrade
# Database parameters
upg1.source_home=/opt/oracle/product/12.1.0.2/dbhome_1
upg1.target_home=/opt/oracle/product/19c/dbhome_1
upg1.sid=$ORACLE_SID
upg1.start_time=now
upg1.pdbs=*
upg1.log_dir=/opt/oracle/autoupgrade/$ORACLE_SID
upg1.upgrade_node=$(hostname -s)
upg1.run_utlrp=yes
upg1.timezone_upg=yes
upg1.target_version=19.7
```

# Autoupgrade Tips

- Run in analysis mode:

```
$NEW_HOME/jdk/bin/java -jar $NEW_HOME/rdbms/admin/autoupgrade.jar \  
                        -config /opt/oracle/autoupgrade/config.txt \  
                        -mode analyze
```

- Run autoupgrade (deploy):

```
$NEW_HOME/jdk/bin/java -jar $NEW_HOME/rdbms/admin/autoupgrade.jar \  
                        -config /opt/oracle/autoupgrade/config.txt \  
                        -mode deploy
```



# Autoupgrade Tips

- Sample autoupgrade configuration file:

```
# Global parameters
global.autoupg_log_dir=/opt/oracle/autoupgrade
# Database parameters
upg1.source_home=/opt/oracle/product/12.1.0.2/dbhome_1
upg1.target_home=/opt/oracle/product/19c/dbhome_1
upg1.sid=$ORACLE_SID
upg1.start_time=now
upg1.pdbs=*
upg1.log_dir=/opt/oracle/autoupgrade/$ORACLE_SID
upg1.upgrade_node=$(hostname -s)
upg1.run_utlrp=yes
upg1.timezone_upg=yes
upg1.target_version=19.7
```

# Autoupgrade Tips

## Another autoupgrade configuration file including PDB Migration

```
cat << EOF > $ORADATA/autoupgrade/config.txt
# Global parameters
global.autoupg_log_dir=$ORADATA/autoupgrade
global.raise_compatible=yes
global.drop_grp_after_upgrade=yes
global.remove_underscore_parameters=yes
```

```
# Common database parameters
upg.upgrade_node=localhost
upg.source_home=$ORACLE_HOME
upg.sid=$ORACLE_SID
upg.start_time=now
upg.run_utlrp=yes
upg.timezone_upg=yes
```

EOF

```
if [ -d "$ORACLE_19C_HOME" ]
then cat << EOF >> $ORADATA/autoupgrade/config.txt
# Database parameters - 19c upgrade
upg.target_home=$ORACLE_19C_HOME
upg.target_version=19
EOF
```

```
elif [ -d "$ORACLE_21C_HOME" ]
then cat << EOF >> $ORADATA/autoupgrade/config.txt
# Database parameters - 21c upgrade
upg.target_home=$ORACLE_21C_HOME
upg.target_cdb=${ORACLE_SID}CDB
upg.target_pdb_name=${ORACLE_SID}PDB
upg.target_version=21.5
upg.target_pdb_copy_option=file_name_convert=NONE
EOF
```

# APEX Upgrade

# Apex Manual Upgrade

Oracle APEX **Release 22.2**: released on November 2022

18c  
Oracle  
Database

- ORIGINAL PREUPGRADE ISSUE:
- 1. Upgrade Oracle Application Express (APEX) manually before the database upgrade.
- 
- The database contains APEX version 4.2.5.00.08. Upgrade APEX to at least version 18.2.0.00.12.
- 

## -- **Starting with Oracle Database Release 18, APEX is not upgraded**

- automatically as part of the database upgrade. Refer to My Oracle Support
- Note 1088970.1 for information about APEX installation and upgrades.

```
SQL> select count(*) from APEX_040200.WWV_FLOWS where id = 4000;  
COUNT (*)
```

-----

  → development install → apexins.sql

<https://www.oracle.com/tools/downloads/apex-v191-downloads.html>

- apex\_20.1.zip : Released April 2020
- apex\_19.2\_en.zip : November 2019

- **October 22, 2020: apex\_20.2.zip is out**

- [https://asktom.oracle.com/pls/apex/f?p=100:551::::RP\\_551:P551\\_CLASS\\_ID,P551\\_INVITED:9824,N&cs=110D22E6A6B683BC69BAFC2FE19677C37](https://asktom.oracle.com/pls/apex/f?p=100:551::::RP_551:P551_CLASS_ID,P551_INVITED:9824,N&cs=110D22E6A6B683BC69BAFC2FE19677C37)

- [Patch Set Bundle for Oracle APEX 20.2](#) (32006852)



# Upgrade Apex

@apexins.sql apex apex temp /i/

.... Thank you for installing Oracle Application Express 19.2.0.00.18

Oracle Application Express is installed in the APEX\_190200 schema.

The structure of the link to the Application Express administration services is as follows:

http://host:port/pls/apex/apex\_admin (Oracle HTTP Server with mod\_plsql)

http://host:port/apex/apex\_admin (Oracle XML DB HTTP listener with the embedded PL/SQL gateway)

http://host:port/apex/apex\_admin (Oracle REST Data Services)

The structure of the link to the Application Express development interface is as follows:

http://host:port/pls/apex (Oracle HTTP Server with mod\_plsql)

http://host:port/apex (Oracle XML DB HTTP listener with the embedded PL/SQL gateway)

http://host:port/apex (Oracle REST Data Services)

timing for: Phase 3 (Switch)

Elapsed: 00:00:52.44

timing for: Complete Installation

**Elapsed: 00:10:57.93**

PL/SQL procedure successfully completed.

1 row selected.

...null1.sql

timing for: Phase 1 (Installation)

Elapsed: 00:03:05.77

## Phase 2 (Upgrade)

**timing for: Enabling Phase 2**

**Elapsed: 00:00:00.00**

#

### # Upgrade Metadata (1)

#

...reset\_state\_and\_show\_invalid.sql

timing for: Upgrade Metadata (1)

Elapsed: 00:01:42.03

#

# Upgrade Metadata (2)

#

-- Upgrading new schema. -----

timing for: Upgrade Metadata (2)

Elapsed: 00:00:39.04

#

# Recompiling APEX\_190200 schema

#

...reset\_state\_and\_show\_invalid.sql

timing for: Recompiling APEX\_190200 schema

Elapsed: 00:00:21.55

#

# Configuring Restricted Schemas

#



# Oracle Release Analyzer Diff Utility

Find the differences between two Oracle Database releases

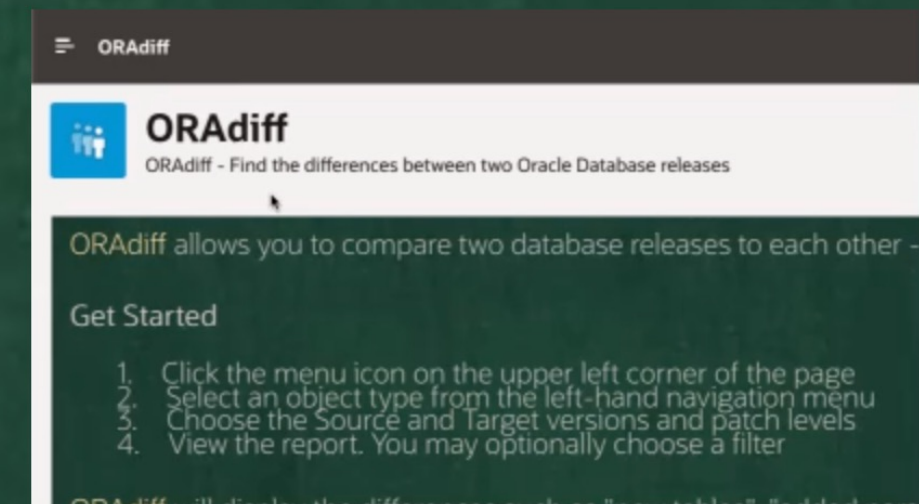
## Examine Oracle Database changes using ORAdiff

- <https://oradiff.oracle.com>

**Oracle Release Analyzer Diff Utility (ORAdiff)** allows you to compare two database releases to each other - with or without patch bundles on top.

### Get Started

1. Click the menu icon on the upper left corner of the page
2. Select an object type from the left-hand navigation menu
3. Choose the Source and Target versions and patch levels
4. View the report. You may optionally choose a filter



**ORAdiff** will display the differences such as "new tables", "added parameters", "changed columns", "removed privileges" and much more. ORAdiff search can tell you when a parameter was added and which files changed in your Oracle Home.

ORAdiff data is refreshed when new patch bundles are released to the public.

Questions? Ideas? Enhancement requests? Contact us via [My Oracle Support](#)

Home

Parameters

Users, Roles, etc

Privileges

Included Fixes

Oracle Database Home

Text Files

Search File

Objects

Fixed Objects

Audit

System

Scheduler

Release Notes

Version Selector

Source Version

19c

Source Patch level

19.21.0

Target Version

19c

Target Patch level

19.16.0

List Mode

Oracle Database Home

Added

Removed

Changed

		Go	Actions
	Path	MD5SUM	
	./inventory/Templates/perl/bin/podselect	0ED2816BCFD2AB8F52D29AE0A2F02A18	
	./inventory/Templates/perl/lib/5.28.1/x86_64-linux-thread-multi/CORE/config.h	52063430AB1285906489FBC65A5CC8A8	
	./inventory/Templates/perl/lib/5.28.1/x86_64-linux-thread-multi/Config.pm	07EA4189F52429F5F2584A865AC133E4	
	./inventory/Templates/perl/lib/5.28.1/x86_64-linux-thread-multi/Config_heavy.pl	DEEFADAEB8072A48E32AB302870684E6	
	./inventory/Templates/perl/lib/5.28.1/x86_64-linux-thread-multi/perllocal.pod	FA141847A90E792CFF2C0136A85BF50D	
	./inventory/Templates/perl/lib/site_perl/5.28.1/x86_64-linux-thread-multi/auto/DBD/Oracle/mk.pm	363C72E13CAFFB577FC1ADFB1950AA14	
	./inventory/oneoffs/34133642/etc/config/actions.xml	3DADFF0BA16B2336361398B07C898B89	
	./inventory/oneoffs/34133642/etc/config/inventory.xml	846EE0EAE544FE07B79EA918AE49625D	
	./jdk/bin/jvisualvm	3E094FDA1CF9FC0ACE60595F3DE23F7C	
	./jdk/lib/visualvm/etc/visualvm.clusters	4C15F1E4689B969281D25F9B50B52A60	
	./jdk/lib/visualvm/etc/visualvm.conf	E66AADFBC402DB2210B8E996FC30BC1D	

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