

# Upgrade to Oracle Database 23ai

Best Practices and Customer Experience

Oracle  
**DBAs**  
run the world





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<https://mikedietchde.com>

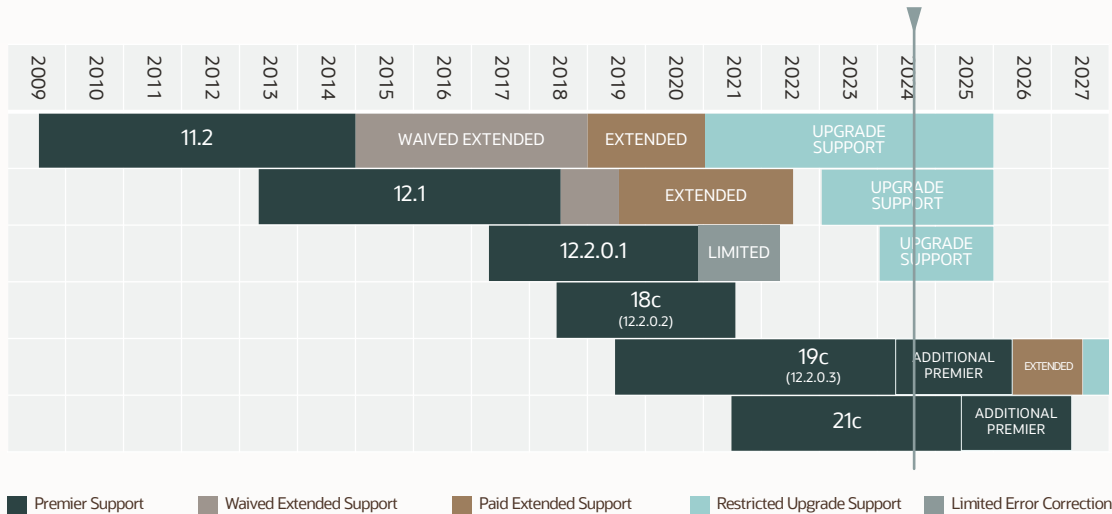
<https://dohdatabase.com>

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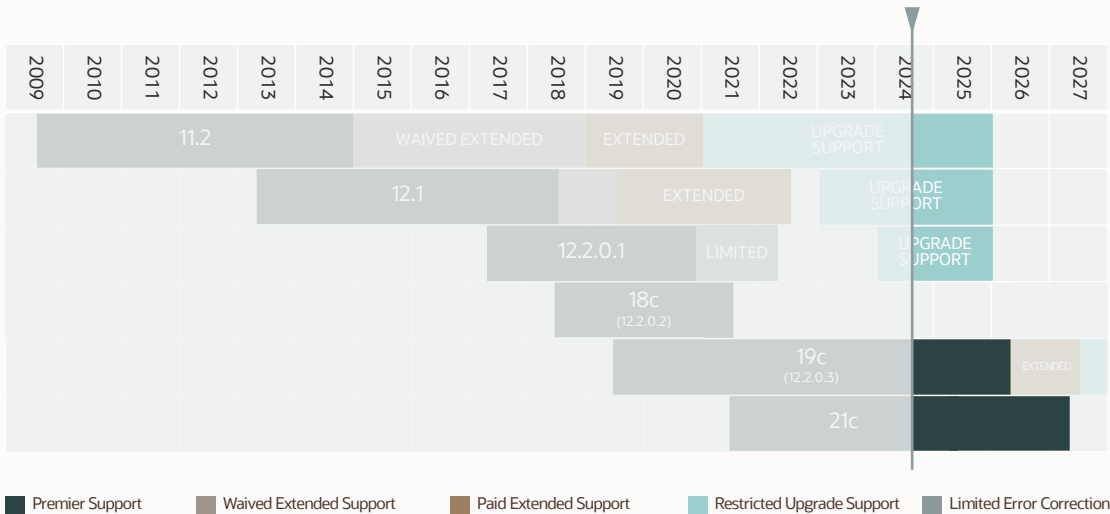
<https://alexzaballa.com>

# Before Upgrade and Migration

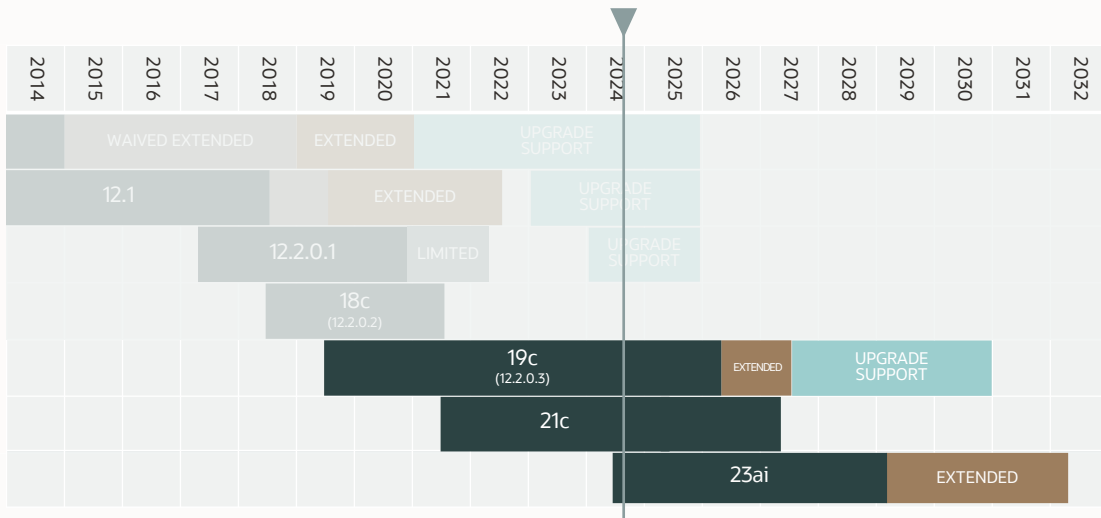
# Lifetime Support Policy



# Lifetime Support Policy



# Lifetime Support Policy





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

- Release Schedule of Current Database Releases  
(Doc ID [742060.1](#))

Next Long Term Support release

# Oracle Database 23ai

---

Upgrade possible only from:

- Oracle Database 19c
- Oracle Database 21c



## Oracle Database 23ai supports the multitenant architecture only

- You must convert your database to a PDB

# Single vs. Multitenant



## Single Tenant

One PDB  
No extra license



## Multitenant

Multiple PDBs  
Extra license if **more** than 3 PDBs

--Use up to 3 user-created PDBs  
--without a license for Multitenant option.  
--Applies to Oracle Database 19c and newer, including SE2

```
alter system set max_pdb=3;
```



Generally, you don't need to change your application to use a pluggable database

```
alter session set container=PDB1;
```

```
alter database backup controlfile to trace;
```

ORA-65040: operation not allowed from within a pluggable database

# Non-CDB Compatible

- Some ALTER DATABASE and ALTER SYSTEM commands fail in a PDB
- Enable non-CDB compatibility by setting `NONCDB_COMPATIBLE=TRUE`
  - When you can't change the application
  - When you accept the reduced security

```
SQL> alter system set noncdb_compatible=true;  
SQL> shutdown immediate  
SQL> startup
```

```
SQL> alter system set noncdb_compatible=true;
```

```
SQL> shutdown immediate
```

```
SQL> startup
```

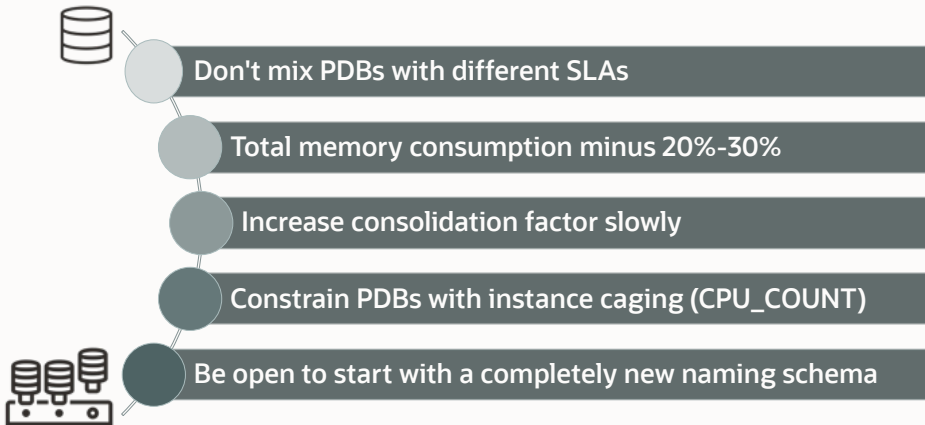
```
SQL> alter session set container=PDB1;
```

```
SQL> alter database backup controlfile to trace;
```

Database altered.

# Consolidation Strategies?

There is no "*best*" strategy





## Ensure your clients can connect to Oracle Database 23ai

- Upgrade your clients well in advance of the upgrade

# Client / Server Interoperability

Client Version	Server Version						
	23ai	21c	19c	18c	12.2.0	12.1.0	11.2.0
23ai#11	Yes	Yes	Yes	No	No	No	No
21c	Yes	Yes	Yes	Was	Was	Yes <sup>#12</sup>	No
19c	Yes	Yes	Yes	Was	Was	Yes <sup>#12</sup>	Yes <sup>#9</sup>
18c	No	Was	Was	Was	Was	Was	Was <sup>#9</sup>
12.2.0	No	Was	Was	Was	Was	Was	Was <sup>#9</sup>
12.1.0	No	Yes <sup>#12</sup>	Yes <sup>#12</sup>	Was	Was	Yes <sup>#12</sup>	Yes <sup>#12</sup>
11.2.0	No	No	Yes <sup>#9</sup>	Was <sup>#9</sup>	Was <sup>#9</sup>	Yes <sup>#12</sup>	Yes <sup>#9</sup>

MOS Note: 207303.1 - Client / Server Interoperability Support Matrix

--List current connections and their driver details

--Join to gv\$session for more details.

--<https://dohdatabase.com/2024/03/19/are-your-oracle-database-clients-ready-for-the-next-database-upgrade/>

```
select * from gv$session_connect_info;
```

# How to Plugin, Upgrade and Convert

# Where Do You Start?



## Installation

Download and install  
Oracle Database 23ai



## Container Database



## AutoUpgrade



## Installation of Oracle Home is simpler

- Gold images with recent Release Update
- Available for Oracle Database 23ai



23ai GI home disk space  
**greatly** reduced to 3 GB

- 12 GB in 19c



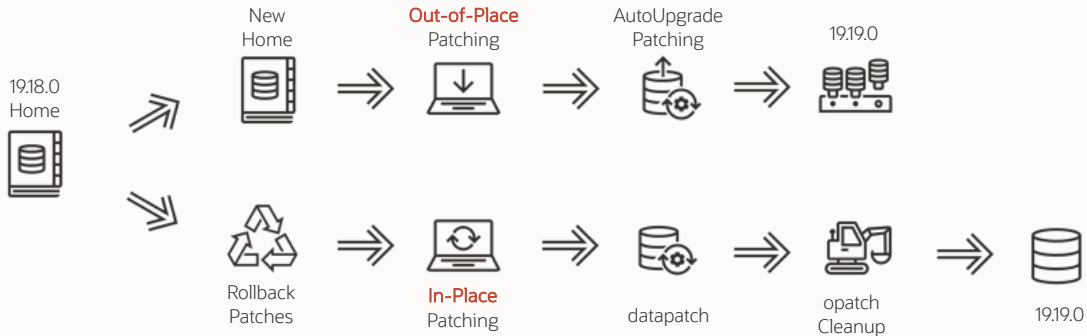
## Use Out-Of-Place Patching

- Minimize downtime
- Minimize risk during outage
- Easier rollback

# Exercise Patching?

## Use our **Patch Me If You Can** LiveLabs

- <https://apexapps.oracle.com/pls/apex/dbpm/r/livelabs/view-workshop?wid=3740>



**We made upgrading easy.  
Now we make patching just as easy.**

---

AutoUpgrade functionality extended to patching

```
$ cat DB23.cfg
```

```
patch1.source_home=/u01/app/oracle/product/23/dbhome_23_4_0  
patch1.target_home=/u01/app/oracle/product/23/dbhome_23_5_0  
patch1.sid=DB23
```

```
$ java -jar autoupgrade.jar -config DB23.cfg -mode deploy
```



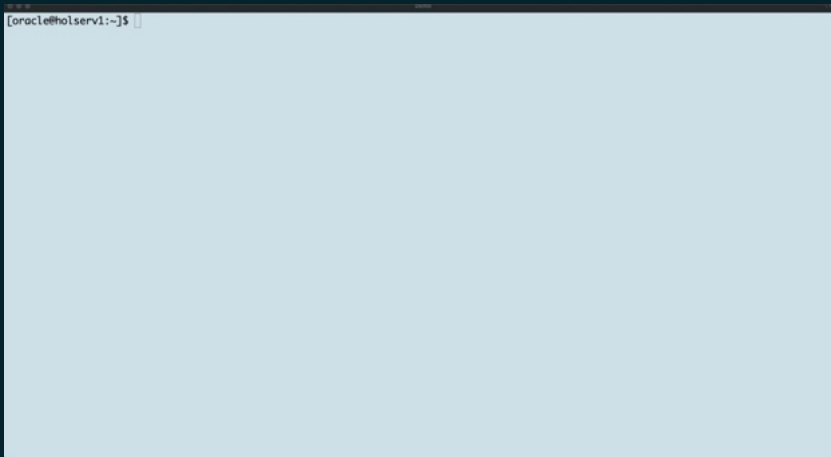
But we wanted more...

```
$ cat DB23.cfg
```

```
patch1.source_home=/u01/app/oracle/product/19/dbhome_19_14_0  
patch1.target_home=/u01/app/oracle/product/19/dbhome_19_24_0  
patch1.sid=FTEX  
patch1.folder=/home/oracle/autopatch/patch  
patch1.patch=RU,OPATCH,OJVM,DPBP  
patch1.download=YES  
patch1.db_availability=OFFLINE  
patch1.method=OUTOFPLACE
```

```
$ java -jar autoupgrade.jar -patch -config DB23.cfg -mode deploy
```

# Demo



# Where Do You Start?



## Installation



## Container Database

Create a new CDB in  
Oracle Database 23ai



## AutoUpgrade

# Create Container Database



**1** Character set

**2** Components

**3** COMPATIBLE

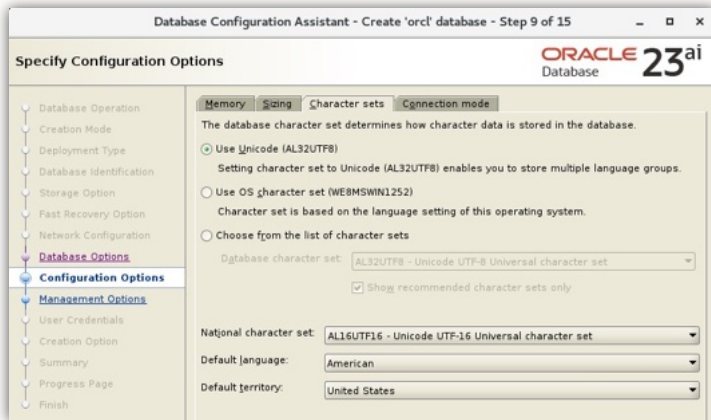
# Create Container Database

## 1 Character set

- Always choose AL32UTF8
- Allows PDBs with any character set

## 2 Components

## 3 COMPATIBLE



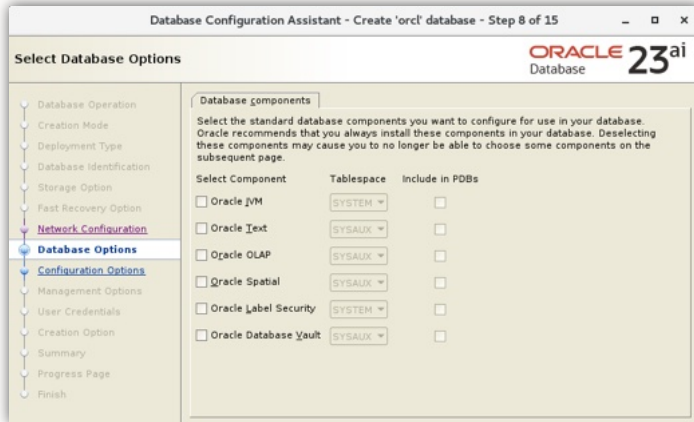
# Create Container Database

## 1 Character set

## 2 Components

- Install as many as you need
- No more than that

## 3 COMPATIBLE




# Create Container Database

## 1 Character set

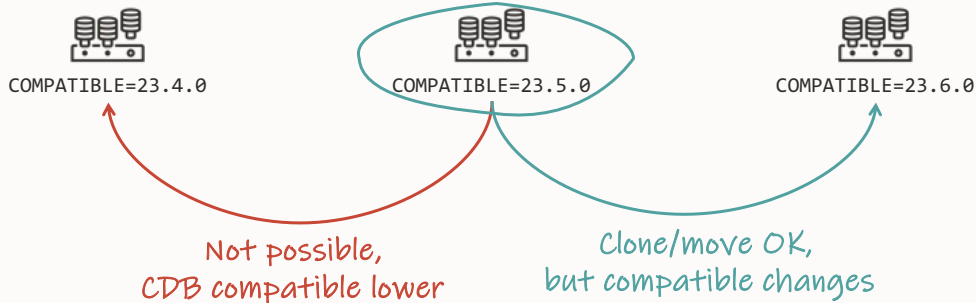
## 2 Components

## 3 COMPATIBLE

- Keep at the default setting, 23.0.0
- Unless you want the option of downgrade

All initialization parameters			
 Update the initialization parameters only when it is required. Refer to the Oracle documentation to learn more about each initialization parameter and its valid set of values.			
(Storage related parameter(s) value is shown in MB) <input type="checkbox"/> Show advanced parameters			
Name	Value	Include in spfile	Category
undo_tablespace	UNDOTBS1	<input checked="" type="checkbox"/>	Cluster Database
sga_target	2379	<input checked="" type="checkbox"/>	SGA Memory
db_block_size (bytes)	8192	<input checked="" type="checkbox"/>	Cache and I/O
nls_language	AMERICAN	<input checked="" type="checkbox"/>	NLS
control_files	{~{ORACLE_BASE}/oradata/...	<input checked="" type="checkbox"/>	File Configuration
remote_login_passwordfile	EXCLUSIVE	<input checked="" type="checkbox"/>	Security and Auditing
processes	320	<input checked="" type="checkbox"/>	Processes and Sessions
pga_aggregate_target	793	<input checked="" type="checkbox"/>	Sort, Hash Joins, Bitmap Indexes
nls_territory	AMERICA	<input checked="" type="checkbox"/>	NLS
open_cursors	300	<input checked="" type="checkbox"/>	Cursors and Library Cache
compatible	23.0.0	<input checked="" type="checkbox"/>	Miscellaneous
db_name	orcl	<input checked="" type="checkbox"/>	Database Identification
cluster_database	FALSE	<input type="checkbox"/>	Cluster Database
Description:			
compatible: Allows you to use a new release, while at the same time guaranteeing backward compatibility with an earlier release. Range of Values: Default to current release. Default Value: Release dependent			

# Compatible



```
SQL> select version_full from v$instance;
```

```
VERSION_FULL
```

```
-----
```

```
23.5.0.24.07
```

# Where Do You Start?



## Installation



## Container Database



## AutoUpgrade

Download latest version,  
create your config file  
and start the process



Always download  
the latest version of AutoUpgrade

- My Oracle Support Doc ID 24854571

```
$ java -jar autoupgrade.jar -version
```

```
build.version 24.5.240701
```

```
build.date 2024/07/01 12:36:10 -0400
```

```
build.hash d15e41338
```

```
build.hash_date 2024/06/27 13:56:59 -0400
```

```
build.supported_target_versions 12.2,18,19,21,23
```

```
build.type production
```

```
build.label (HEAD, origin/devel)
```



# Flow

1

Plug in

2

Upgrade

3

Convert



23<sup>ai</sup>



## You can also migrate with Data Pump or Transportable Tablespaces

- Suitable when direct upgrade is not possible
- Smaller databases
- Reorganizing data

# Plugin - Standby Databases?

# Data Guard



*Plug-in on primary propagates  
to standby database via redo*

**1** Enabled recovery

**2** Deferred recovery

# Enabled Recovery

1

## Enabled recovery

```
create pluggable database ... standbys=all
```

Standby records PDB creation

Standby locates data files

MRP applies redo to PDB

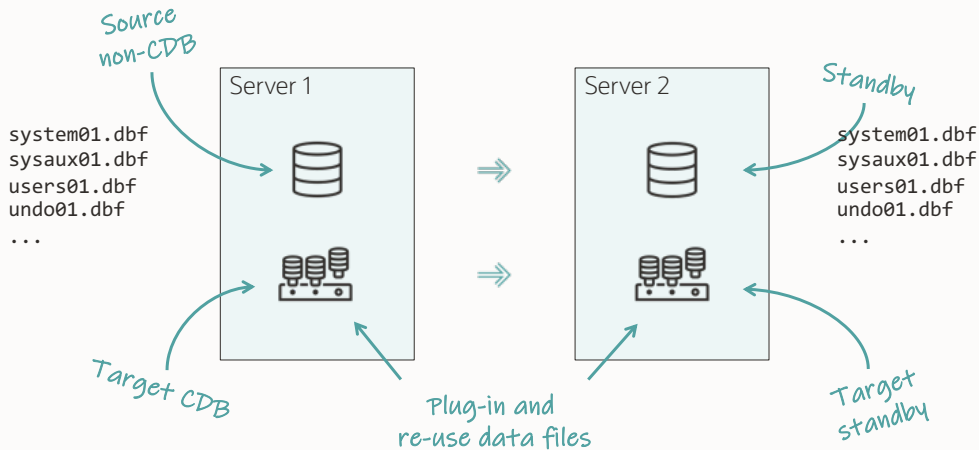
PDB is immediately protected

*Default*

2

## Deferred recovery

# Enabled Recovery





All data files on primary and standby  
must be at the same SCN

# Enabled Recovery

- The plug-in happens on the primary database
- The plug-in uses the manifest file
- The manifest file contains information on data files from the primary database only

## How does the standby database know which files to plug in?

# Enabled Recovery

How does the standby database know which files to plug in?

- 1 Regular files
- 2 OMF in regular file system
- 3 ASM

# Enabled Recovery

How does the standby database know which files to plug in?

- 1 Regular files  
*Simple and straight forward ...*
- 2 OMF in regular file system  
*Simple and straight forward ...*
- 3 ASM  
*Well ...*

# Enabled Recovery | ASM

Primary



Standby



```
SQL> select name from v$datafile;  
  
NAME  
-----  
+DATA/DB_BOSTON/DATAFILE/system.269.1103046537  
+DATA/DB_BOSTON/DATAFILE/sysaux.270.1103046537  
+DATA/DB_BOSTON/DATAFILE/users.273.1103046827
```

```
SQL> select name from v$datafile;  
  
NAME  
-----  
+DATA/DB_CHICAGO/DATAFILE/system.265.1103050007  
+DATA/DB_CHICAGO/DATAFILE/sysaux.266.1103050007  
+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009
```

Same file,  
but different name

```
SQL> alter diskgroup data add alias  
      '+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009'  
for  
      '+DATA/CDB1_CHICAGO/<PDB_GUID>/DATAFILE/users.269.1103050009':
```

# Data Guard | Re-use Data Files

Primary



Standby



Looking for file like on primary



```
Recovery scanning directory +DATA/DB_BOSTON/... for any matching files
Deleted Oracle managed file +DATA/DB_BOSTON/...
Successfully added datafile 37 to media recovery
Datafile #37: +DATA/DB_CHICAGO/DATAFILE/users.269.1103050009
```



Follows alias and finds the real file

# Data Guard | Enabled Recovery

[Reusing the Source Standby Database Files When Plugging a PDB into the Primary Database of a Data Guard Configuration \(Doc ID 2273829.1\)](#)

★ Reusing the Source Standby Database Files When Plugging a PDB into the Primary Database of a Data Guard Configuration (Doc ID 2273829.1)

**In this Document**

- [Goal](#)
- [Solution](#)
- [Prerequisites](#)
- [Steps](#)
- [Resolving Errors](#)
- [References](#)

**APPLIES TO:**

Oracle Database Cloud Service - Version N/A and later  
Oracle Database Exadata Express Cloud Service - Version N/A and later  
Oracle Database - Enterprise Edition - Version 12.1.0.2 and later  
Oracle Database Cloud Schema Service - Version N/A and later  
Gen 1 Exadata Cloud at Customer (Oracle Exadata Database Cloud Machine) - Version N/A and later  
Information in this document applies to any platform.

**GOAL**

To plug in an existing 12.1.0.2 or later PDB residing in a CDB as part of a Data Guard configuration into another CDB that is part of a different Data Guard configuration where the current Primary CDB and the target CDB both have standby databases and allow you to use the original Standby database's data files to update the destination CDB's Standby.

This note describes a multitenant migration option for maintaining standby databases when the source database is a PDB. If your source database is a non-CDB, please see [Document 2273304.1](#).

For Oracle RDBMS 19.15 and later, the Data Guard broker MIGRATE command has been enhanced to execute the steps contained in this document. It will manage configurations of the destination CDB containing a single physical standby database and will handle TDE enabled databases. Please see High Availability Overview and Best Practices - PDB Switchover and Failover in a Multitenant Configuration for more information on this feature.

Always test the steps in a dev/test environment prior to using in production. Since the original files are being modified directly by the plugin on the primary and by the consumption



# Deferred Recovery

## 1

### Enabled recovery

`create pluggable database ... standbys=all`

Standby records PDB creation

Standby locates data files

MRP applies redo to PDB

PDB is immediately protected

## 2

### Deferred recovery

`create pluggable database ... standbys=none`

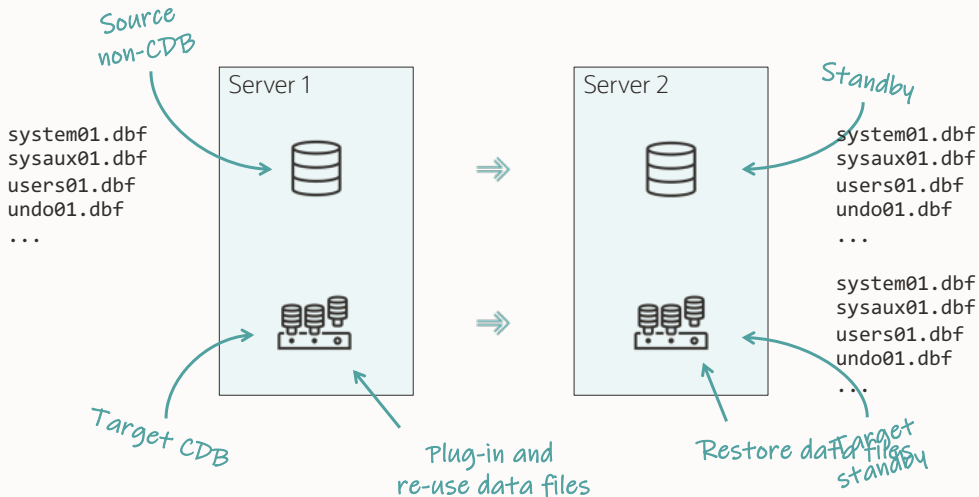
Standby records PDB creation

Standby ignores data files

MRP skips redo

**PDB protected after restore**

# Deferred Recovery



# Deferred Recovery



Source  
Non-CDB



Target  
Primary

```
SQL> create pluggable database ...  
standbys=none;
```



Target  
Standby

# Deferred Recovery



```
SQL> create pluggable database ...  
standbys=none;
```



PDB created  
Data files missing

# Deferred Recovery



```
SQL> show pdbs
```

CON_NAME	OPEN	MODE
PDB1	READ	WRITE

```
SQL> show pdbs
```

CON_NAME	OPEN	MODE
PDB1	MOUNTED	

# Deferred Recovery



```
SQL> select name, recovery_status  
       from v$pdb;
```

NAME	RECOVERY_STATUS
PDB1	DISABLED

# Deferred Recovery



```
RMAN> restore pluggable database  
... from service ... ;
```

```
SQL> alter pluggable database  
enable recovery;
```

```
SQL> alter database datafile  
... online;
```

# Deferred Recovery



```
RMAN> restore pluggable database  
... from service ... ;
```

```
SQL> alter pluggable database  
enable recovery;
```

```
SQL> alter database datafile  
... online;
```

- Automated process in Oracle Database 21c
- PDB Recovery Isolation
- Requires Active Data Guard



## Don't jeopardize your Data Guard

- Test the procedure and verify your environment

# Gotchas

--Allows CDB views to include information on PDB\$SEED objects.  
--By default, such information is hidden.  
--[https://mikedietrichde.com/2017/07/21/why-exclude\\_seed\\_cdb\\_view-is-now-an-underscore-in-oracle-12-2/](https://mikedietrichde.com/2017/07/21/why-exclude_seed_cdb_view-is-now-an-underscore-in-oracle-12-2/)

```
alter system set "_exclude_seed_cdb_view"=false;
```

--Default value is for CDBs with many PDBs  
--Other places, it leads to concurrency issues  
--Reset back to 12.1 default as described in MOS 2431353.1

```
alter system set "_cursor_obsolete_threshold"=1024  
comment="Added 2024-09-11 - see OCW24 and MOS Note: 2431353.1";
```

```
--Database collects SQL Plan Directives even when adaptive
--statistics are off.
--If you do not use Adaptive Statistics (optimizer_adaptive_statistics)
--then turn it completely off as described in MOS 2209560.1

alter system set "_sql_plan_directive_mgmt_control"=0
comment="Added 2024-09-11 - see OCW24 and MOS Note: 2209560.1";
```



# Should You Enable Optimizer Fixes?

Many optimizer fixes are **OFF** by default

Enable optimizer fixes using **DBMS\_OPTIM\_BUNDLE**

```
begin
  dbms_optim_bundle.enable_optim_fixes(
    action          => 'ON',
    scope           => 'BOTH',
    current_setting_precedence => 'YES');
end;
/
```

Find available bug fixes in ORAdiff or `dbms_optim_bundle.GetBugsForBundle`

# Should You Enable Optimizer Fixes?

oradiff.oracle.com

The screenshot shows the Oracle Release Analyzer Diff Utility interface. The left sidebar contains a navigation menu with options: Home, Parameters, Users, Roles, etc., Privileges, Included Fixes (selected), List of Fixes, Total Fixes, Search Fixes, List of CVEs, CPU Explore, and Fix Control. The main content area is titled "Version Selector" and includes fields for Source Release (19c), Source Patch Level (19.3.0 (Base Release)), Target Release (19c), and Target Patch Level (19.24.0). A "List Mode" toggle is visible. Below this, the "V\_\$SYSTEM\_FIX\_CONTROL" section displays a table with columns: BUGNO, VALUE, SQL\_FEATURE, DESCRIPTION, OPTIMIZER\_FEATURE\_ENABLE, EVENT, IS, and DEFAULT. The table contains three rows of data. A red arrow points to the "IS" column, which has a value of "1" for all three rows. At the bottom right, a pagination control shows "1 - 50 of 235" and a right arrow.

BUGNO	VALUE	SQL_FEATURE	DESCRIPTION	OPTIMIZER_FEATURE_ENABLE	EVENT	IS	DEFAULT
33636280	0	QKSFM_EXTTAB_33636280	fix for serializable transaction		0	1	
33649782	0	QKSFM_OR_EXPAND_33649782	Try LORE after ORE rejected due to LOB structure		0	1	
33667505	0	QKSFM_OR_EXPAND_33667505	enhance index check in presence of NLSORT function based index		0	1	

1 - 50 of 235



# Should You Enable Optimizer Fixes?

## Upgrade?

Enable optimizer fixes using `DBMS_OPTIM_BUNDLE`

## New database?

Enable optimizer fixes using `DBMS_OPTIM_BUNDLE`

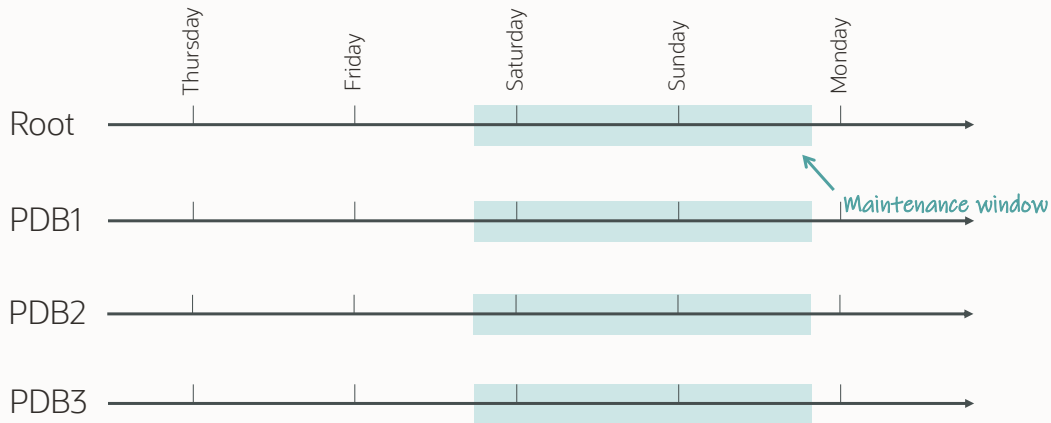
## Patching?

Do proper testing before enabling optimizer fixes using `DBMS_OPTIM_BUNDLE`

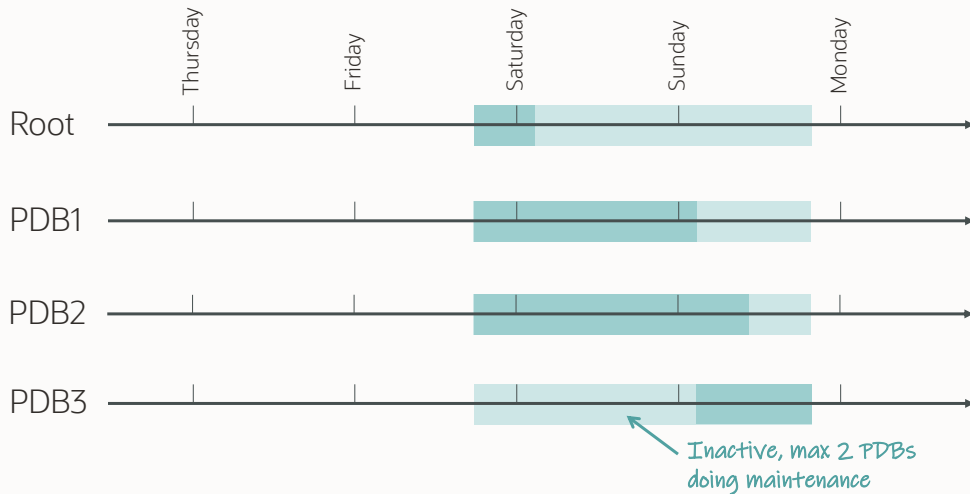


# Automated Maintenance Tasks

# Automated Maintenance Tasks



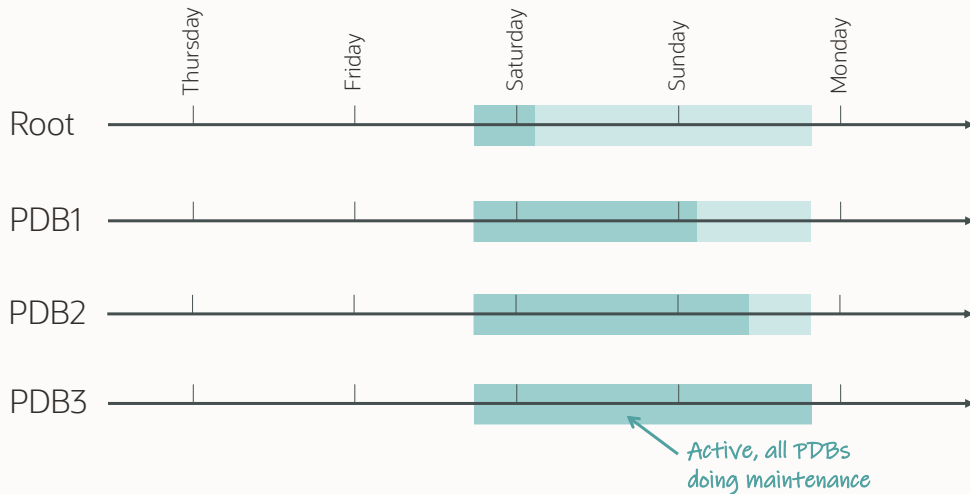
# Automated Maintenance Tasks



--Change the amount of PDBs that can run maintenance tasks at the same time  
--Default value 2

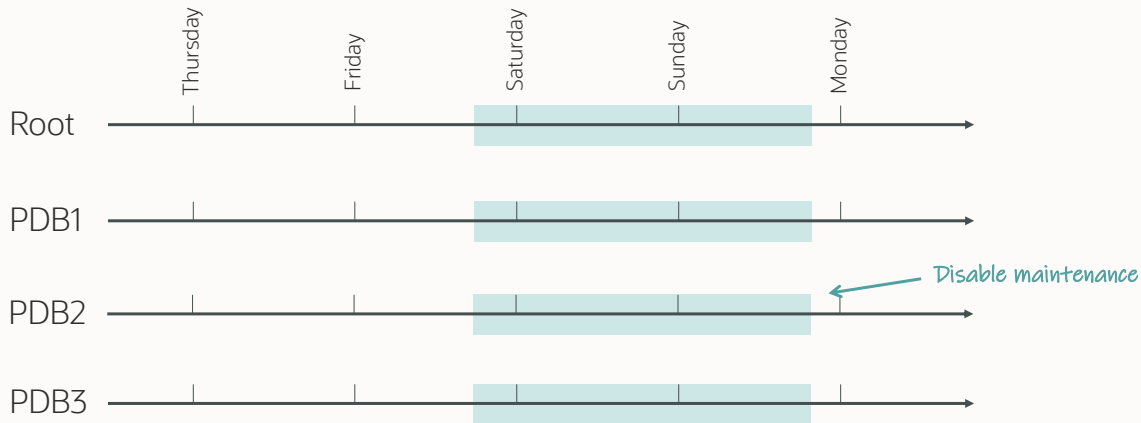
```
alter system set autotask_max_active_pdb=3;
```

# Automated Maintenance Tasks



```
--Selectively disable maintenance tasks in a PDB  
--For instance, test databases or databases that are rebuilt frequently  
  
alter session set container=PDB2;  
alter system set enable_automatic_maintenance_pdb=false;
```

# Automated Maintenance Tasks

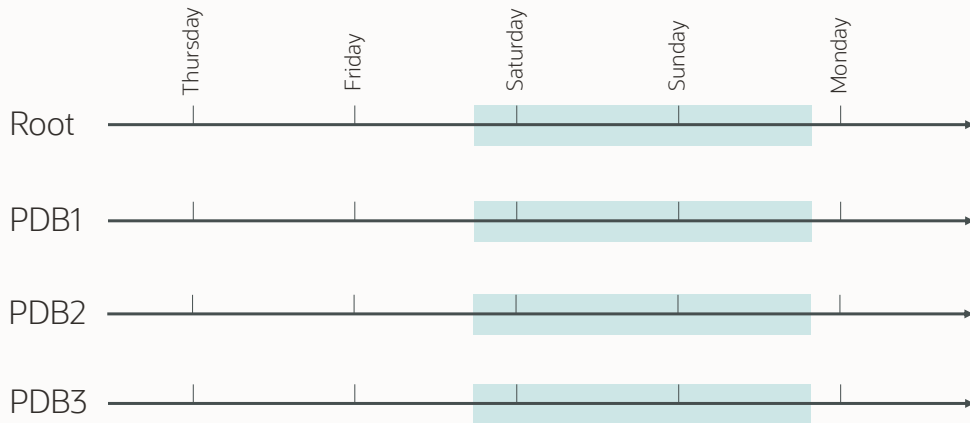




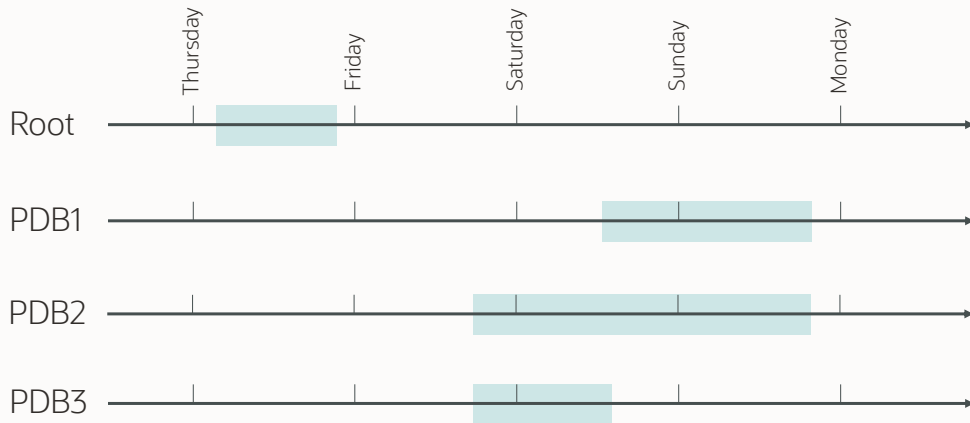
## Shift maintenance windows

- Optionally, shorten maintenance windows

# Automated Maintenance Tasks



# Automated Maintenance Tasks





## Selectively disable individual maintenance tasks using **DBMS\_AUTO\_TASK\_ADMIN**

- Does a test database need Automatic Segment Advisor?
- Or Evolve Advisor?



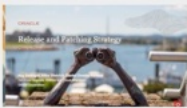
Resource Manager prevents maintenance tasks from *stealing* resources from users

- Consumer group `ORA$AUTOTASK`

### Episode 1

#### Release and Patching Strategy

105 minutes – Feb 4, 2021



### Episode 2

#### AutoUpgrade to Oracle Database 19c

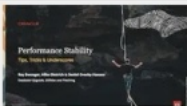
115 minutes – Feb 20, 2021



### 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 35 hours of technical content:

- All tech, no marketing
- On-demand
- Anytime
- Anywhere





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[oracle.com/database/upgrade/](https://www.oracle.com/database/upgrade/) and 7 more links

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Extracting metadata from an Oracle Data Pump dumpfile

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The limitations on parallel in Data Pump

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How does Data Pump employ parallelism during metadata export

150 views · 1 month ago



How does Data Pump employ parallelism during export and import?

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Best Practices for Oracle Data Pump - part 5

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Best Practices for Oracle Data Pump - part 4

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# YouTube Channel

[@UpgradeNow](https://www.youtube.com/@UpgradeNow)

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



SCAN ME





ORACLE  
DatabaseWorld  
at CloudWorld

# Thank You

Subtitle goes here

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