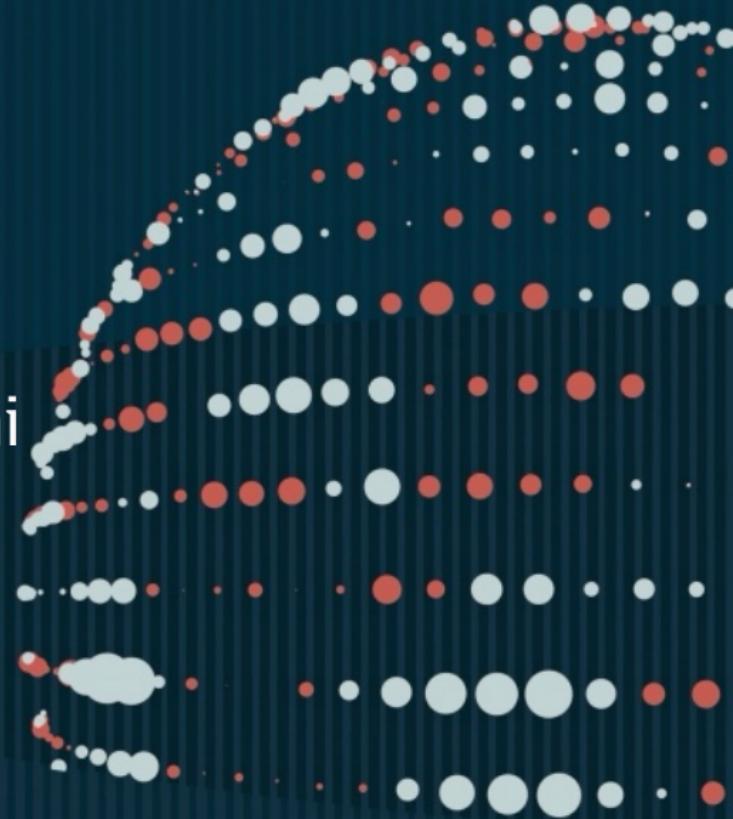




DatabaseWorld
at CloudWorld

Upgrade to Oracle Database 23ai

Best Practices and Customer Experience



Oracle
DBAs
run the world





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<https://mikedietrichde.com>

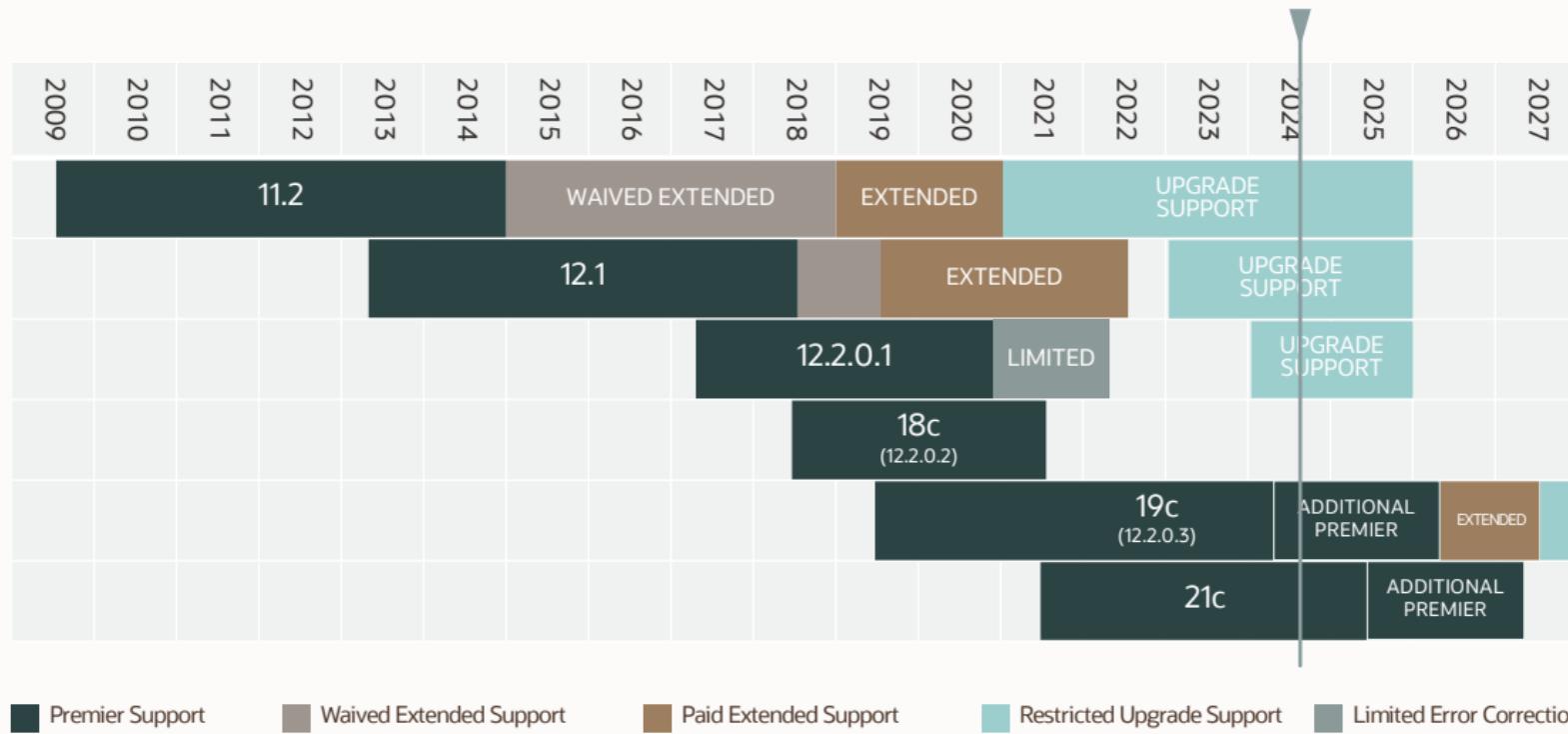
<https://dohdatabase.com>

<https://dbarj.com.br>

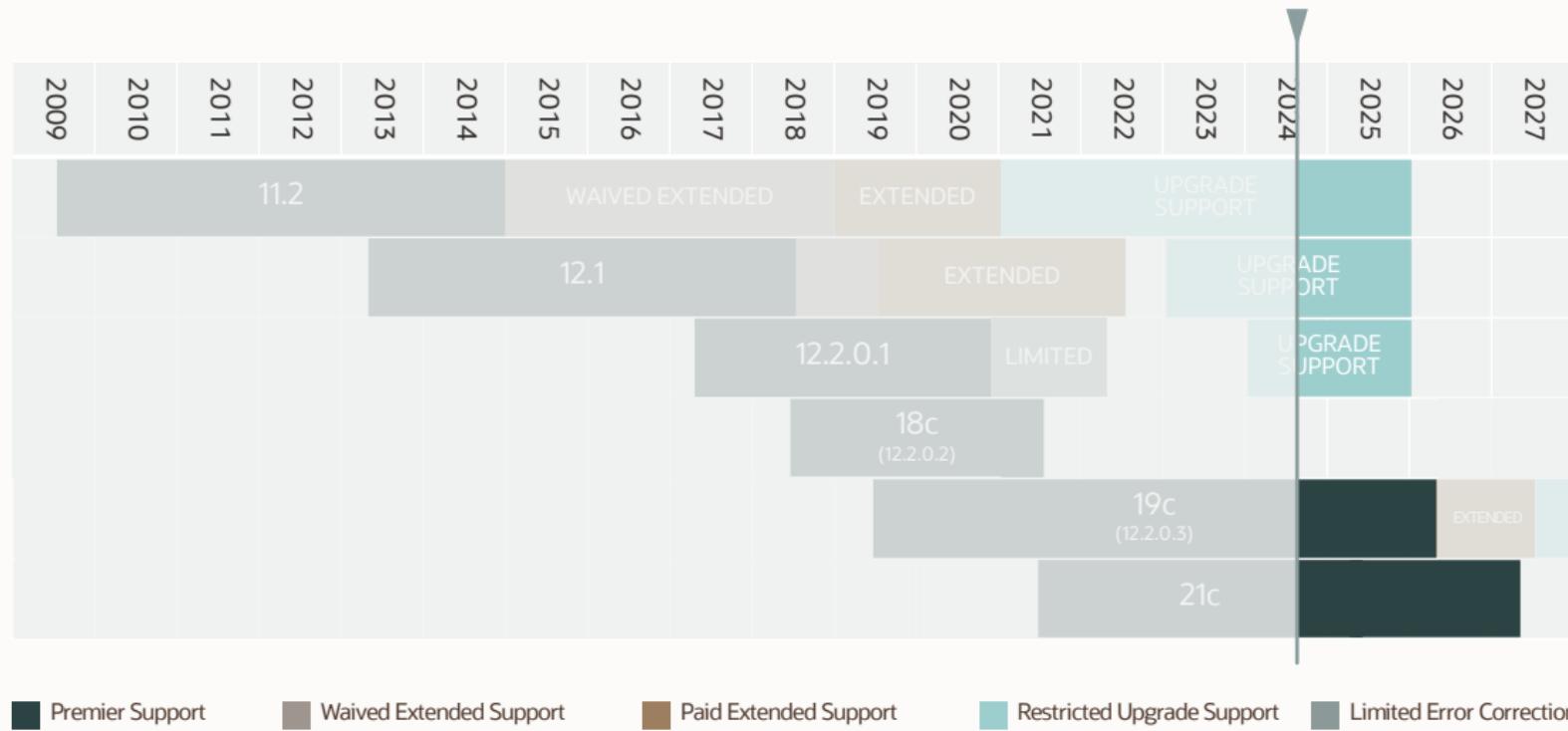
<https://alexzaballa.com>

Before Upgrade and Migration

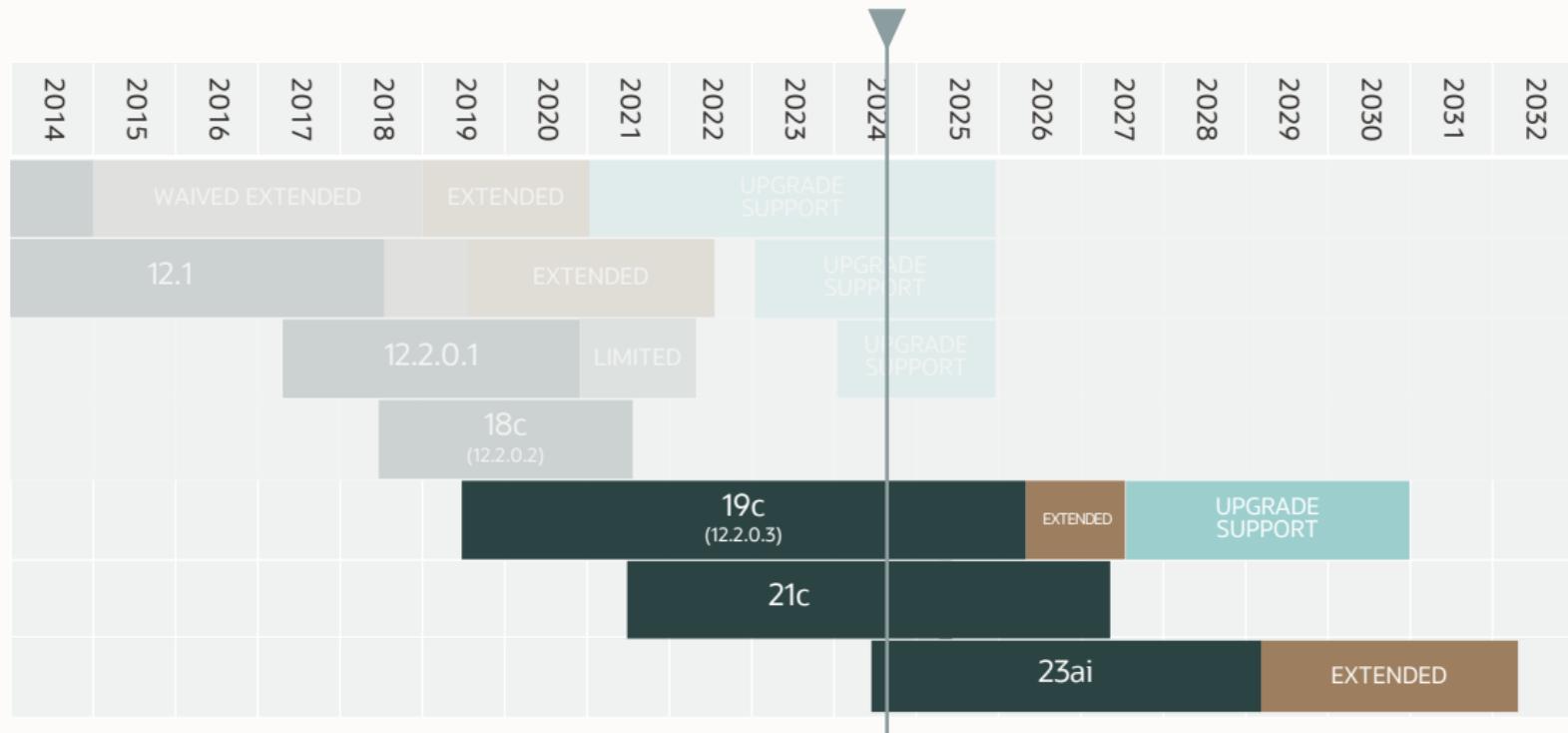
Lifetime Support Policy



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_pdbs=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
```

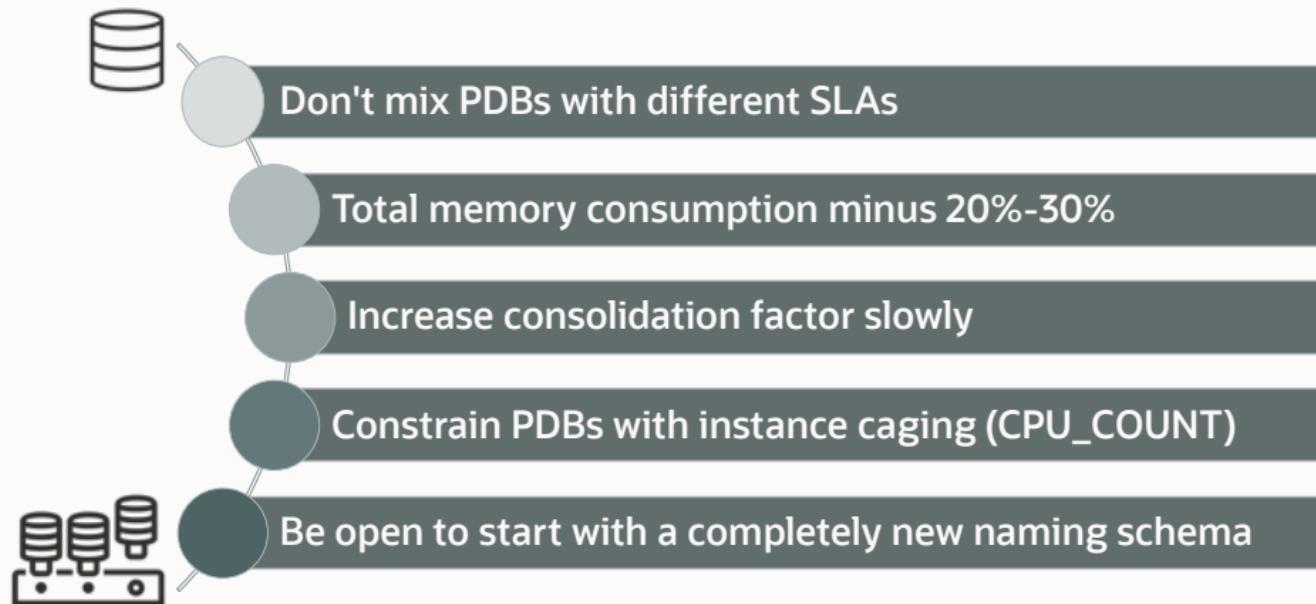
```
SQL> alter system set noncdb_compatible=true;  
SQL> shutdown immediate  
SQL> startup
```

```
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 ^{#12}	No
19c	Yes	Yes	Yes	Was	Was	Yes ^{#12}	Yes ^{#9}
18c	No	Was	Was	Was	Was	Was	Was ^{#9}
12.2.0	No	Was	Was	Was	Was	Was	Was ^{#9}
12.1.0	No	Yes ^{#12}	Yes ^{#12}	Was	Was	Yes ^{#12}	Yes ^{#12}
11.2.0	No	No	Yes ^{#9}	Was ^{#9}	Was ^{#9}	Yes ^{#12}	Yes ^{#9}

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



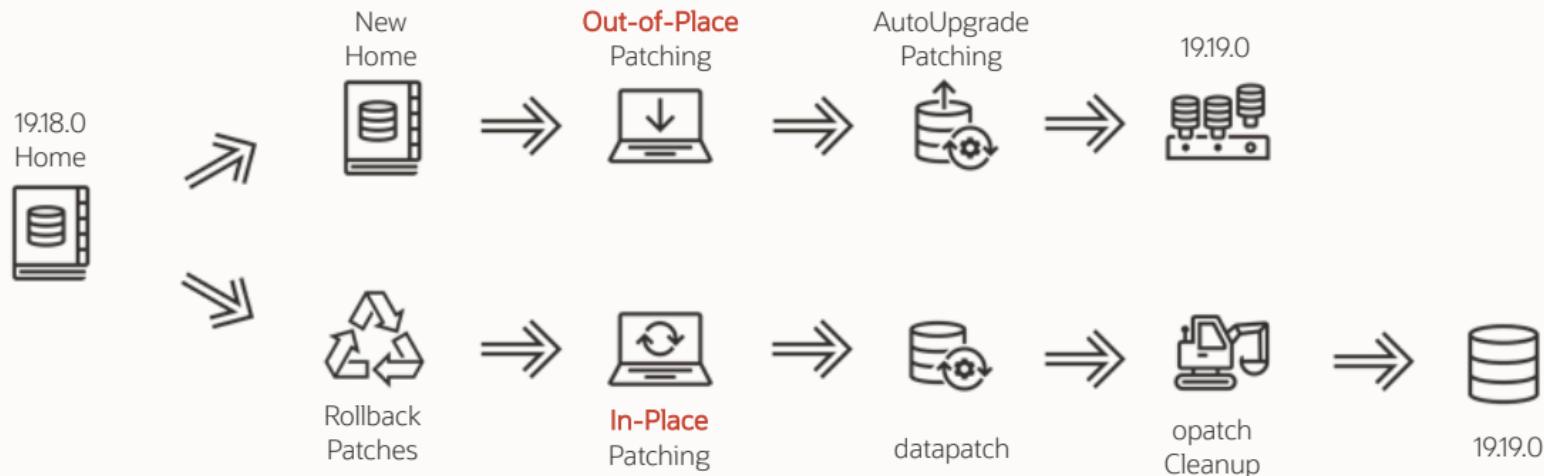
Use Out-Of-Place Patching

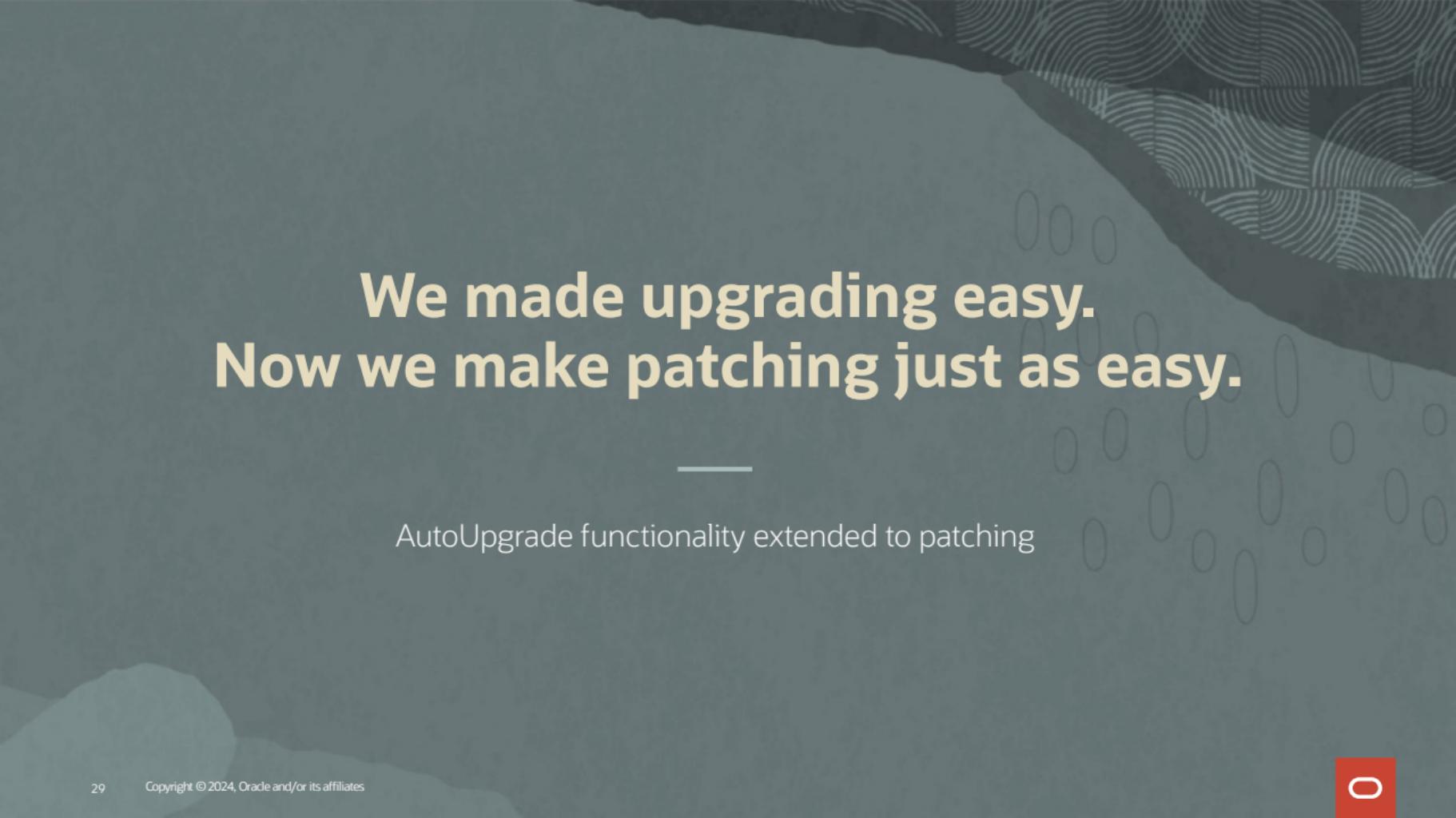
- Minimize downtime
- Minimize risk during outage
- Easier rollback

Exercise Patching?

Use our Patch Me If You Can LiveLabs

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





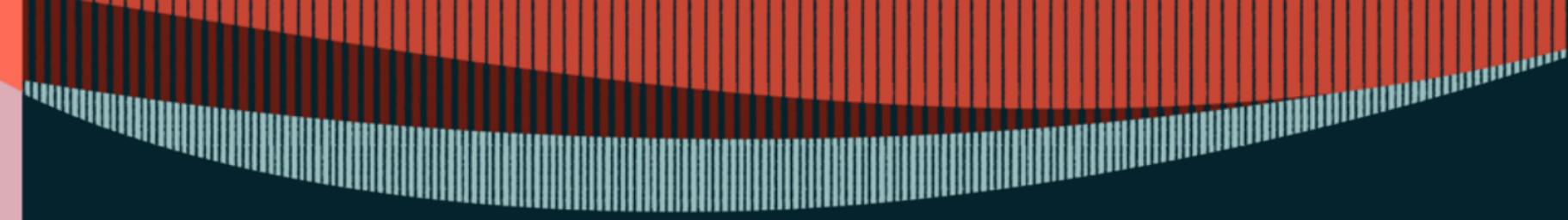
We made upgrading easy. Now we make patching just as easy.

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
```



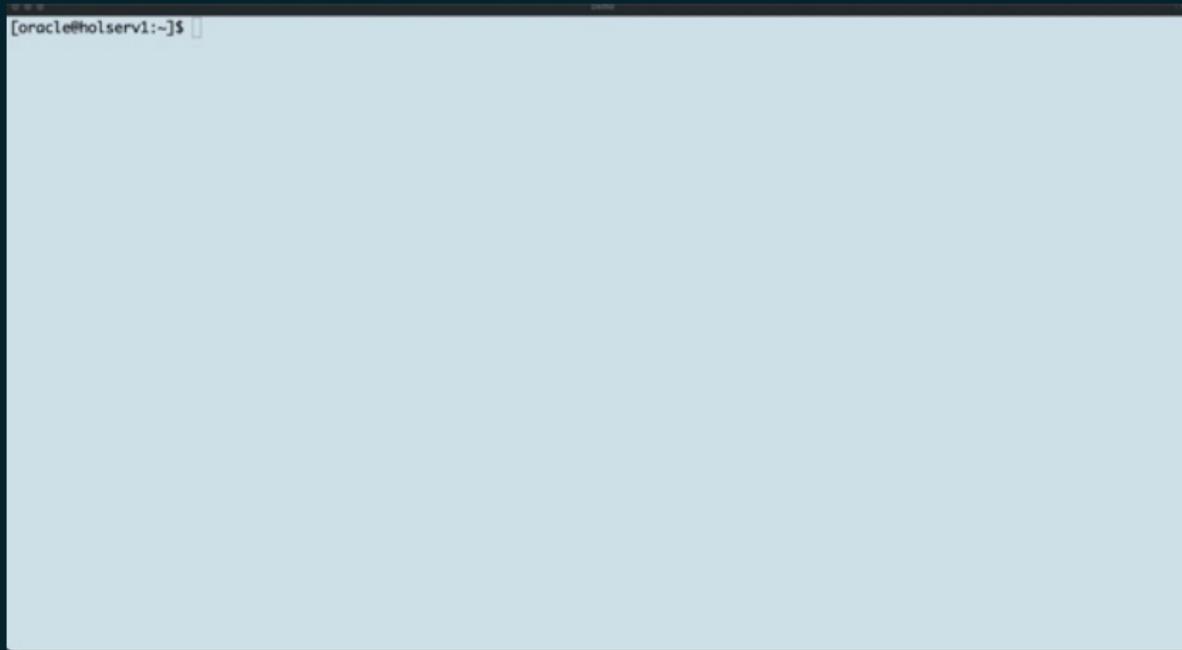
But we wanted more...

```
$ 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

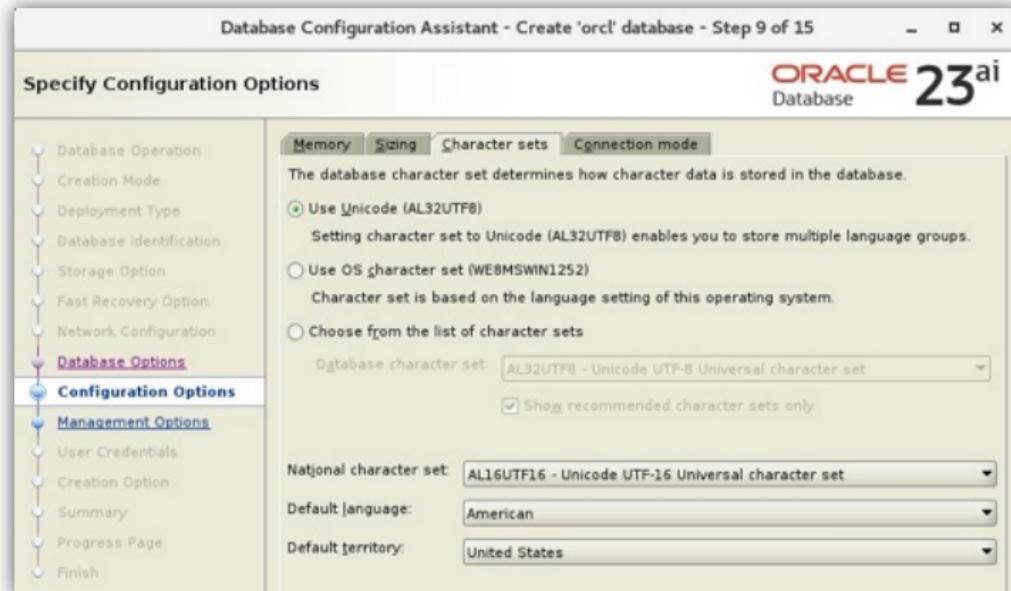
Create Container Database

1 Character set

- Always choose AL32UTF8
- Allows PDBs with any character set

2 Components

3 COMPATIBLE



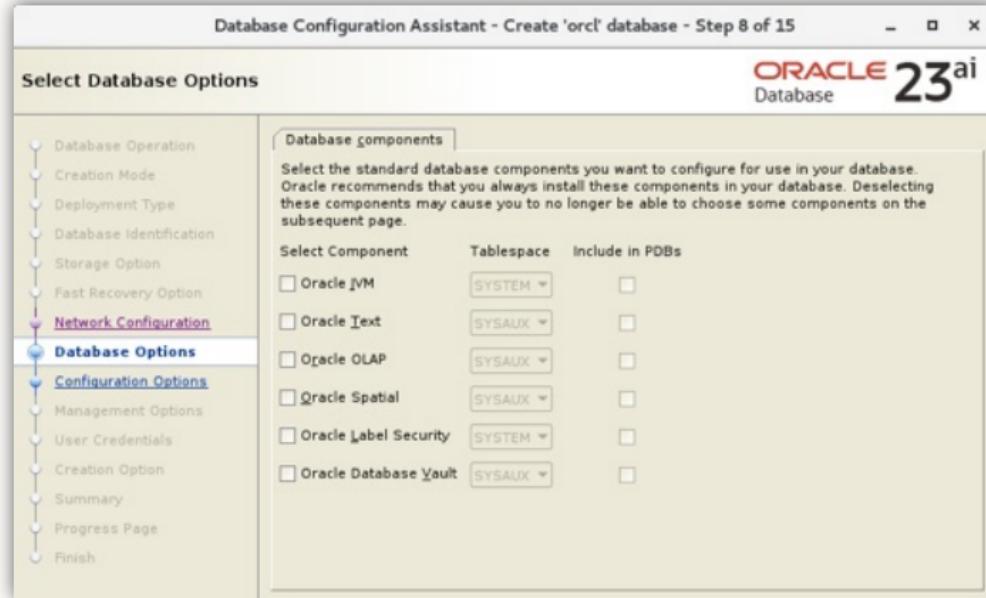
Create Container Database

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)

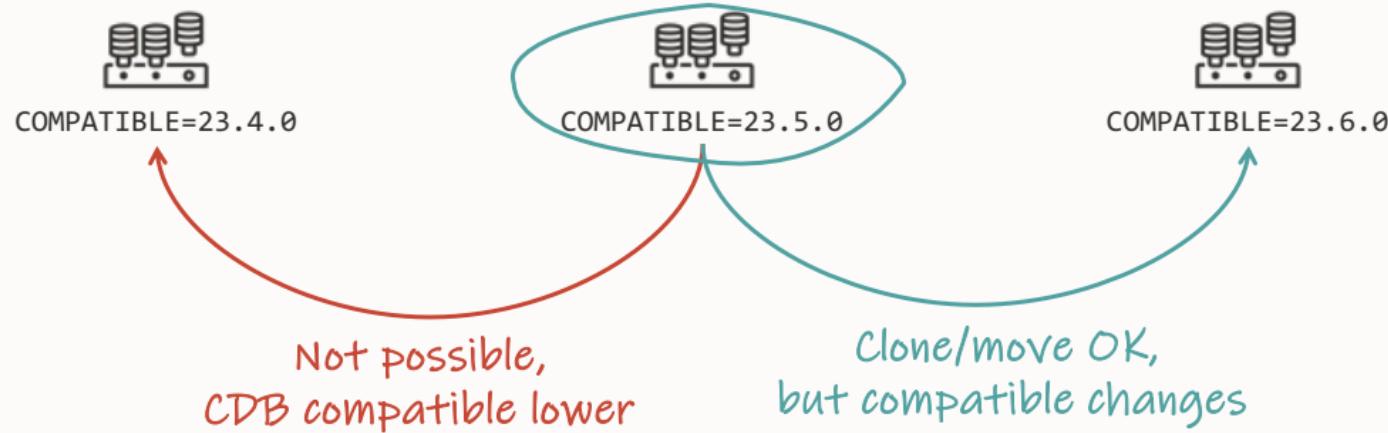
Show advanced parameters

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 2485457.1

```
$ 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^{ai}



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



1 Enabled recovery

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

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

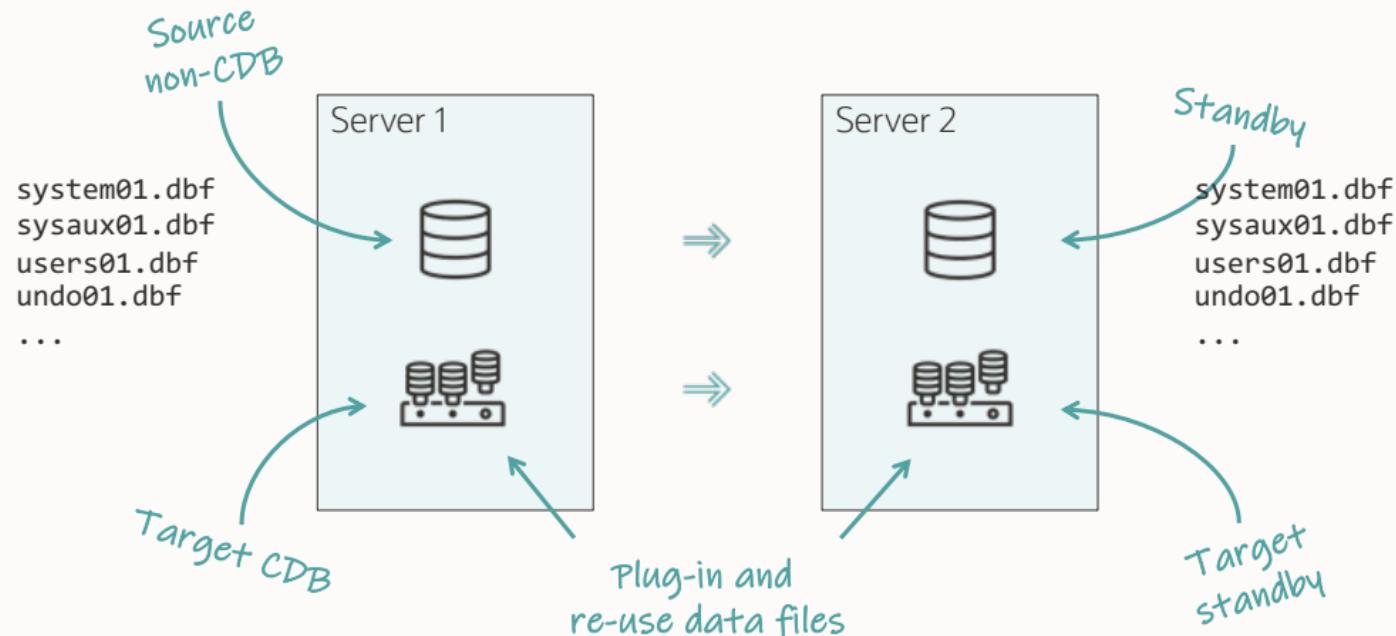
PDB is immediately protected

2

Deferred recovery

Default

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



```
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
```



Standby



```
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



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`

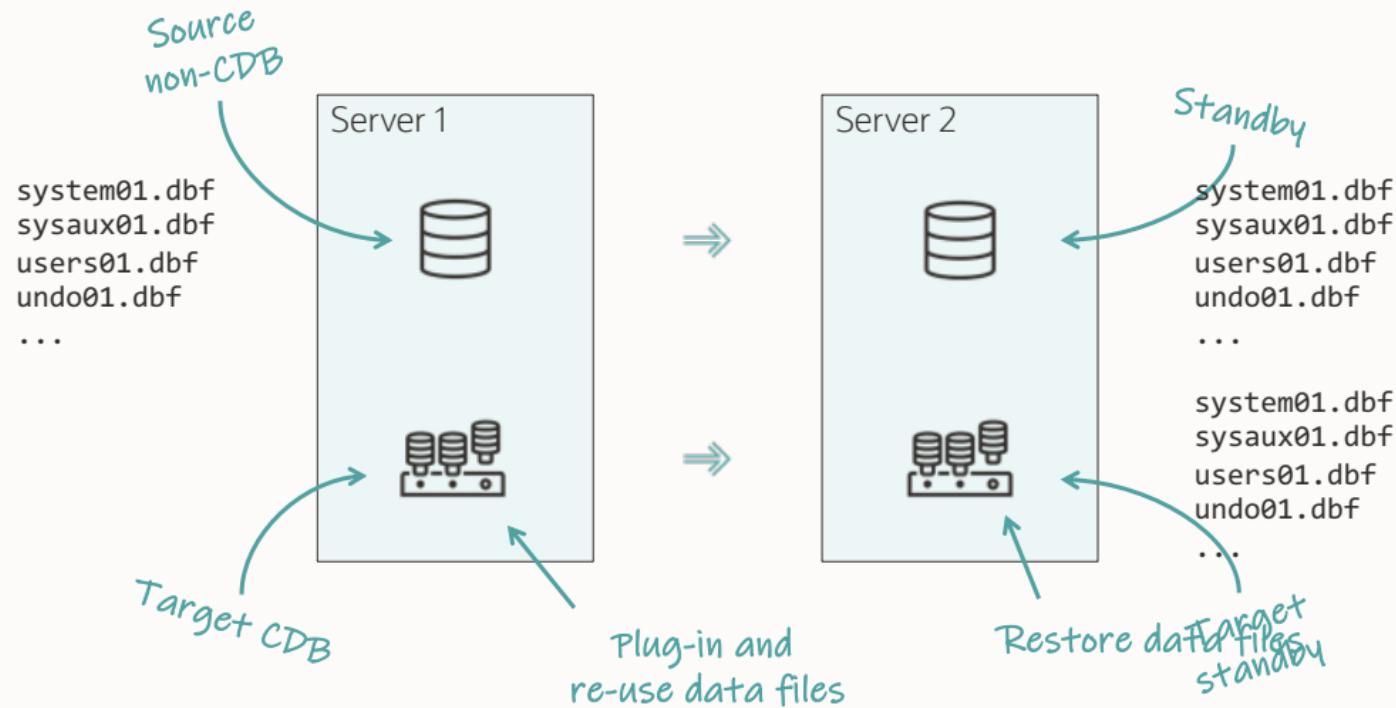
Standby records PDB creation

Standby ignores data files

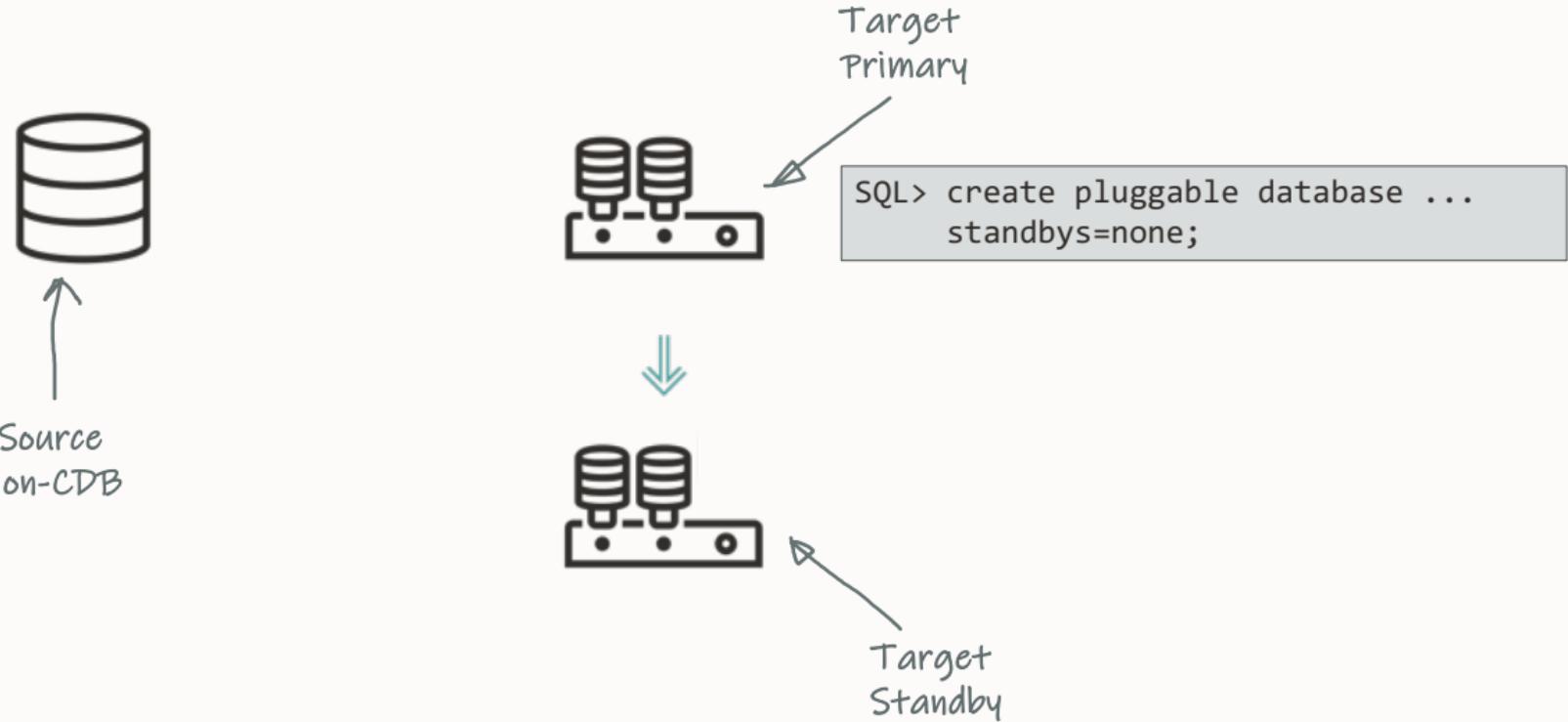
MRP skips redo

PDB protected after restore

Deferred Recovery



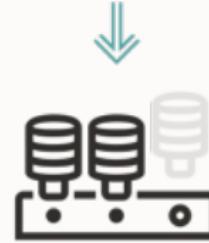
Deferred Recovery



Deferred Recovery



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



PDB created
Data files missing

Deferred Recovery



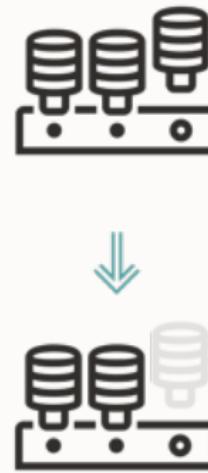
```
SQL> show pdbs
```

CON_NAME	OPEN MODE
PDB1	READ WRITE

```
SQL> show pdbs
```

CON_NAME	OPEN MODE
PDB1	MOUNTED

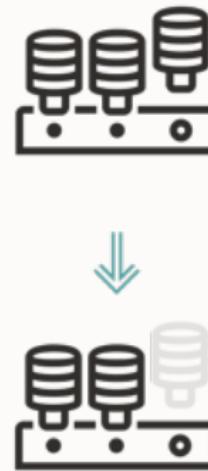
Deferred Recovery



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

NAME	RECOVERY_STATUS
PDB1	DISABLED

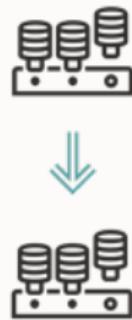
Deferred Recovery



```
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/

```
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

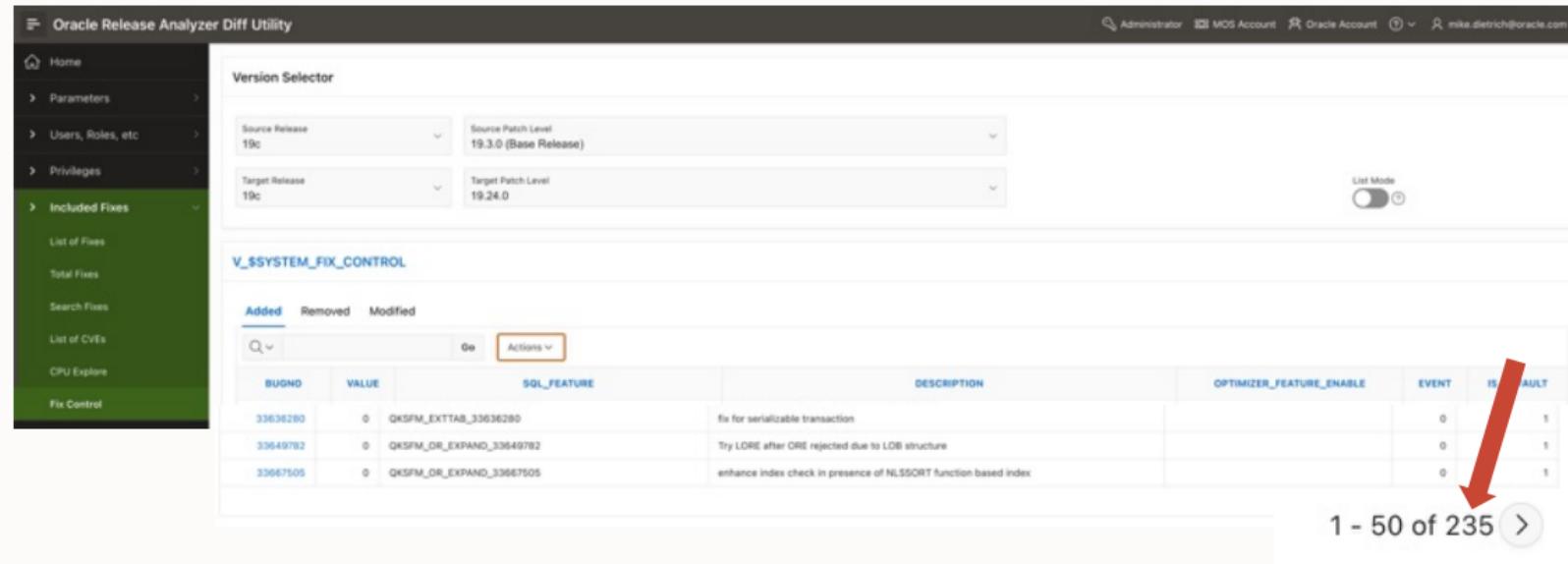
Enable optimizer fixes using **DBMS_OPTIM_BUNDLE**

```
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



Oracle Release Analyzer Diff Utility

Administrator MOS Account Oracle Account mike.dietrich@oracle.com

Home Parameters Users, Roles, etc. Privileges Included Fixes

Source Release: 19c, Source Patch Level: 19.3.0 (Base Release)

Target Release: 19c, Target Patch Level: 19.24.0

List Mode

V_\$SYSTEM_FIX_CONTROL

Added Removed Modified

BUGNO	VALUE	SQL_FEATURE	DESCRIPTION	OPTIMIZER_FEATURE_ENABLE	EVENT	IS_DEFAULT
33636280	0	QKSFN_EXTTAB_33636280	fix for serializable transaction		0	1
33649782	0	QKSFN_DR_EXPAND_33649782	Try LDRE after CRE rejected due to LOB structure		0	1
33667505	0	QKSFN_DR_EXPAND_33667505	enhance index check in presence of NLSSORT 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`

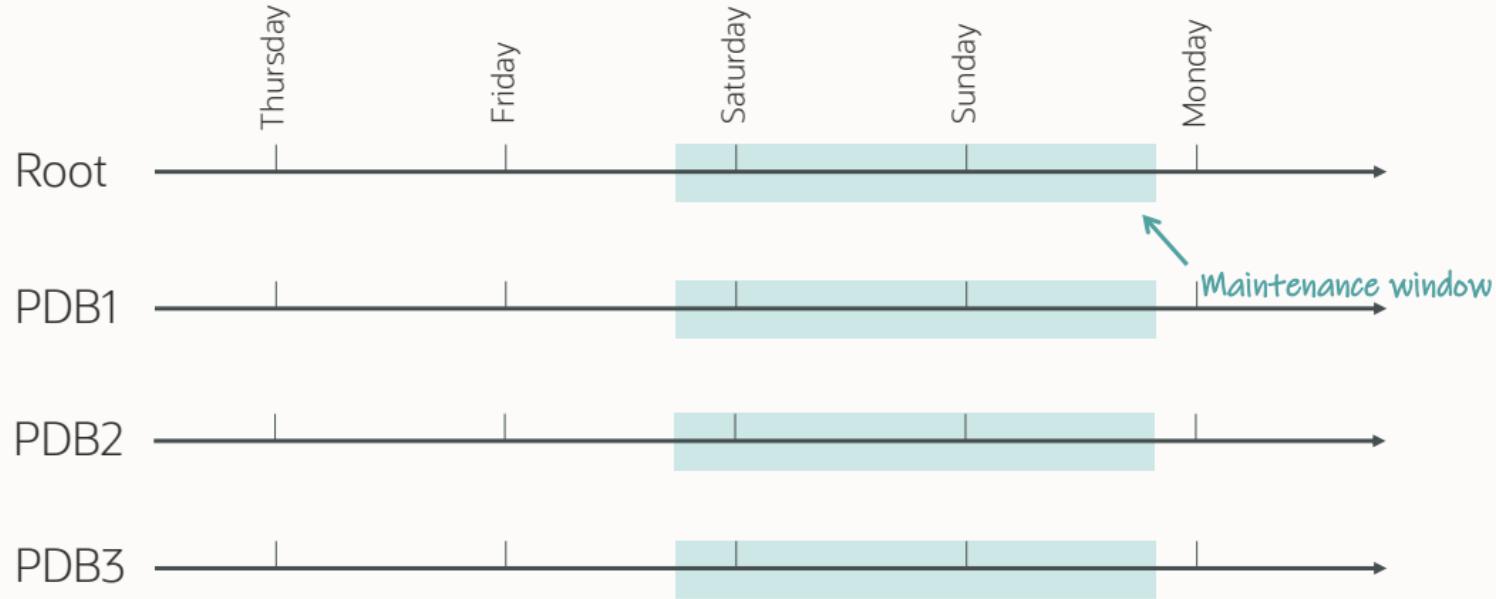
Patching?

Do proper testing before enabling optimizer fixes using `DBMS_OPTIM_BUNDLE`

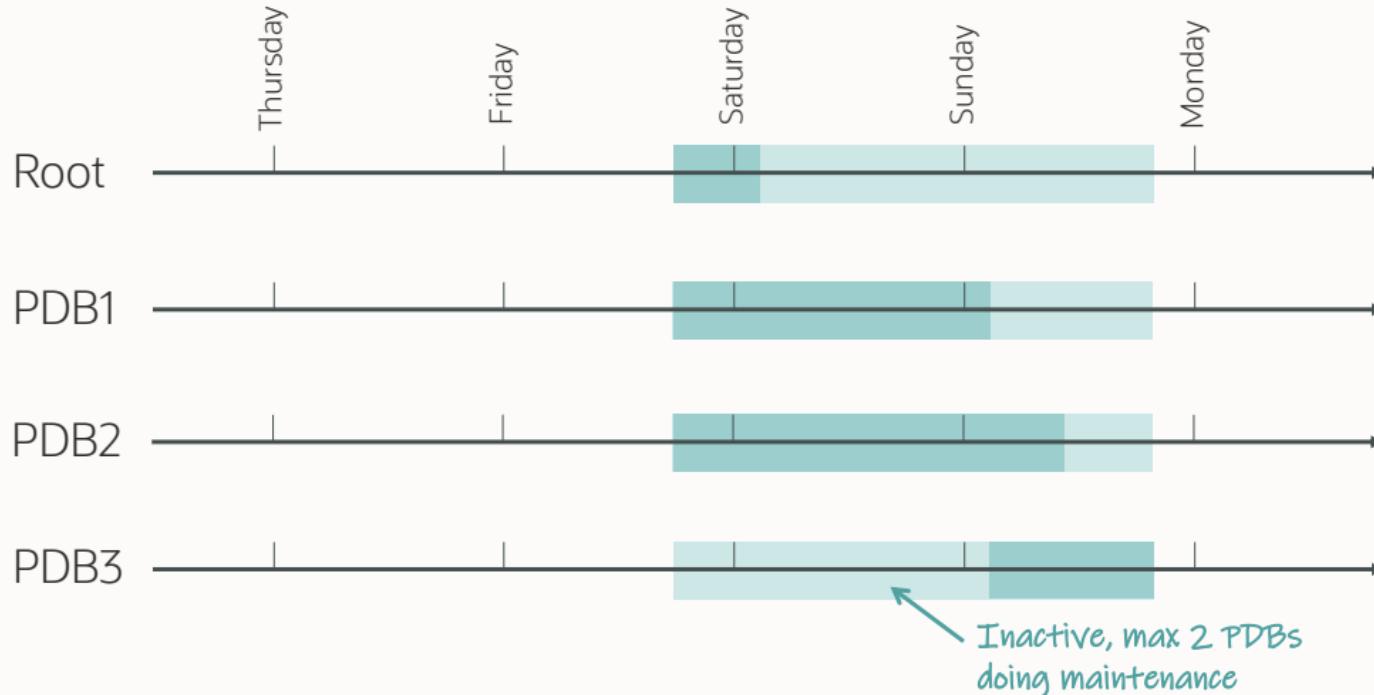


Automated Maintenance Tasks

Automated Maintenance Tasks



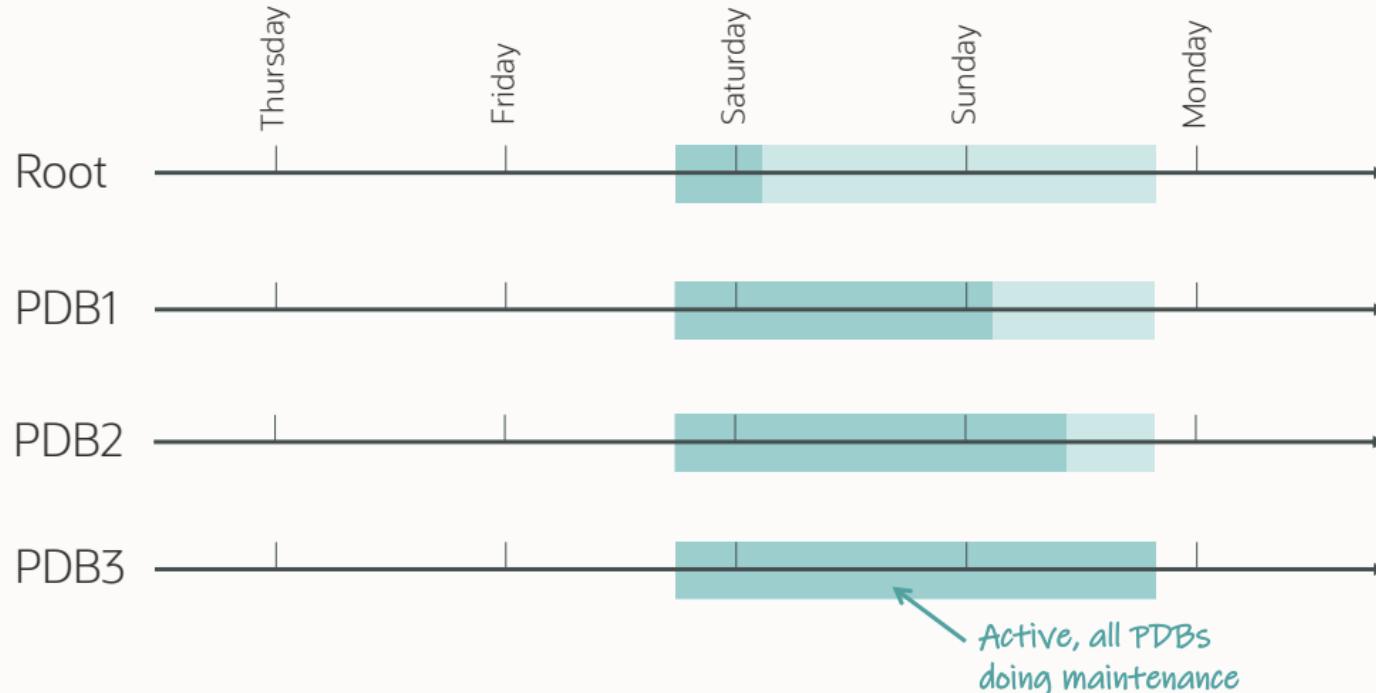
Automated Maintenance Tasks



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

```
alter system set autotask_max_active_pdbs=3;
```

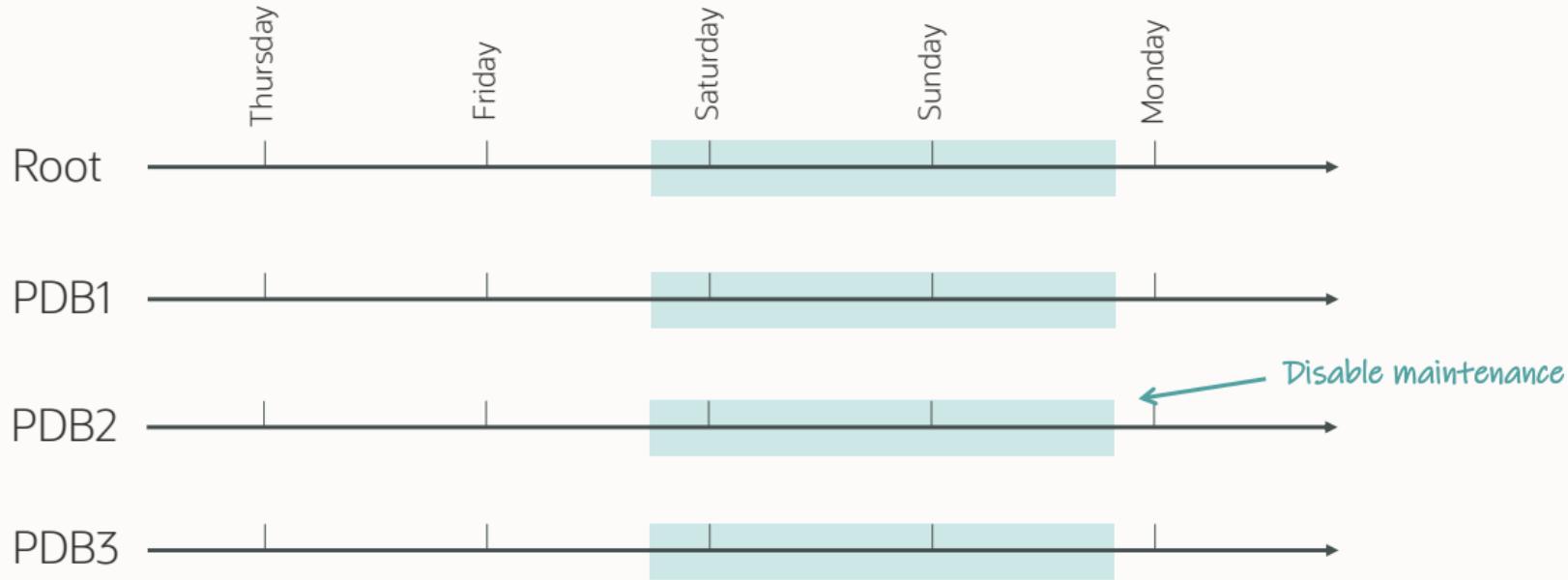
Automated Maintenance Tasks



```
--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

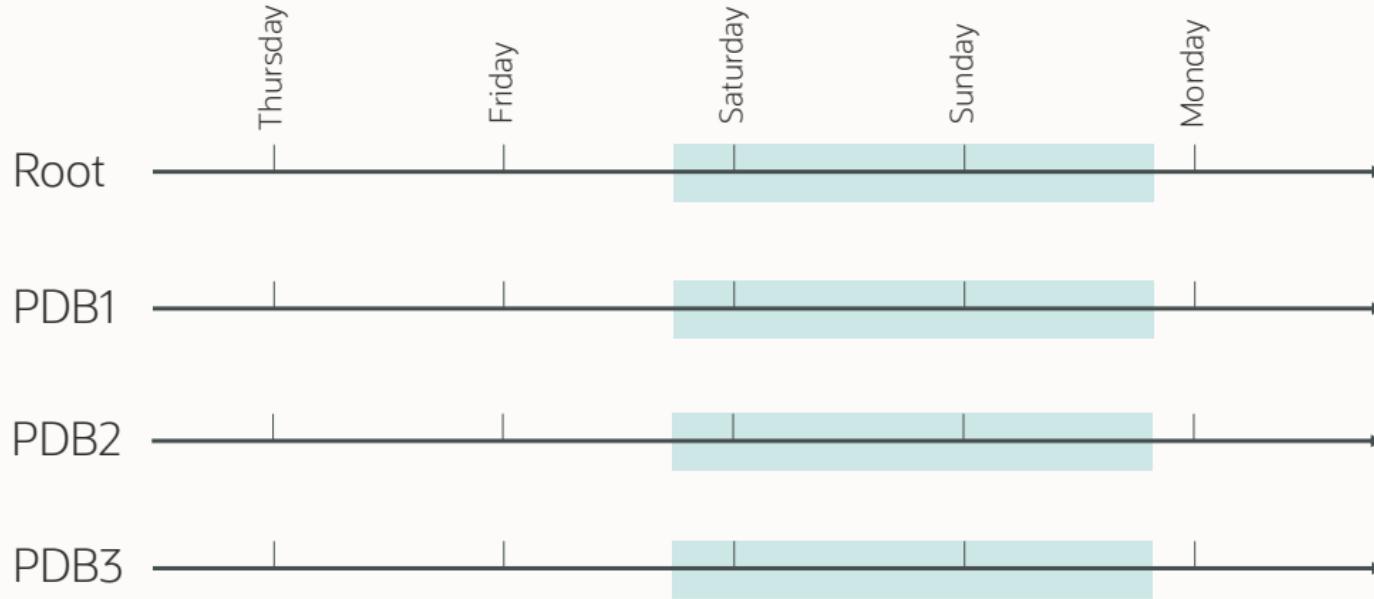




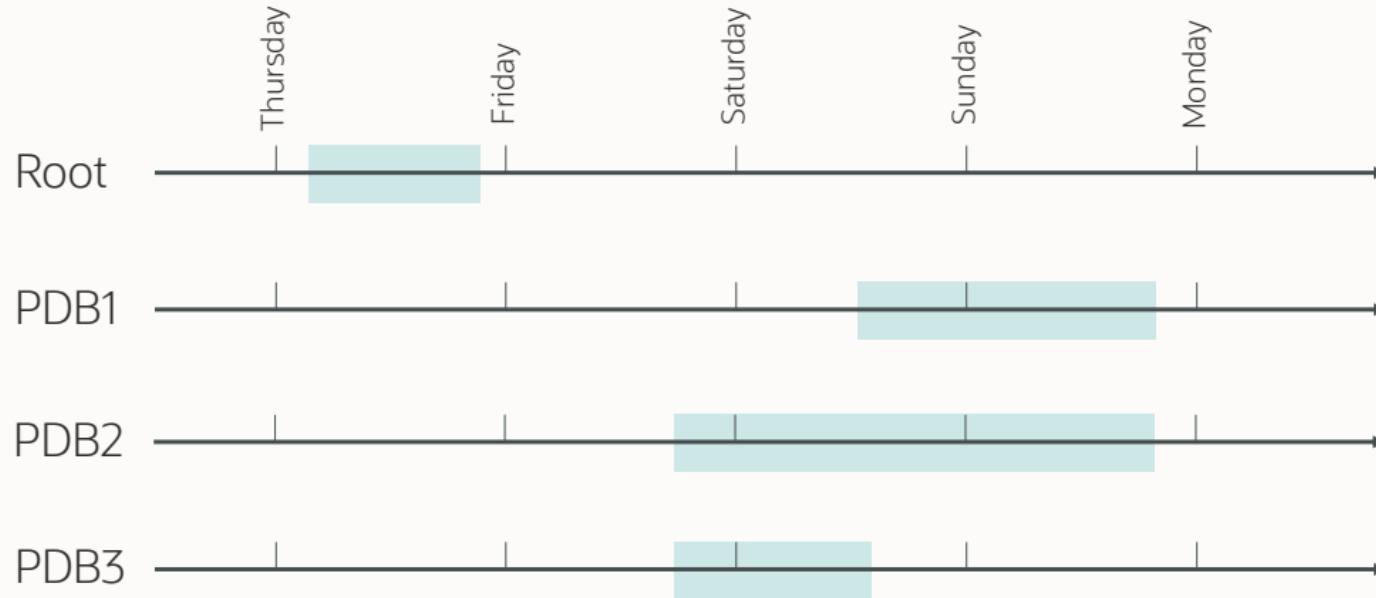
Shift maintenance windows

- Optionally, shorten maintenance windows

Automated Maintenance Tasks



Automated Maintenance Tasks





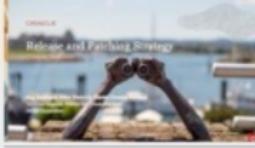
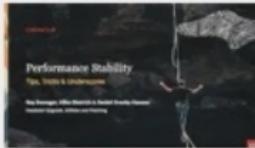
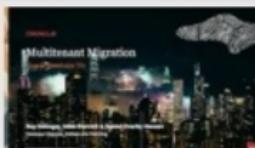
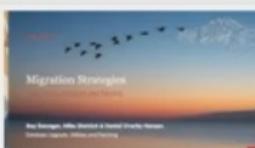
Selectively disable individual maintenance tasks using **DBMS_AUTO_TASK_ADMIN**

- 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	
<u>Release and Patching Strategy</u>	
105 minutes – Feb 4, 2021	
Episode 2	
<u>AutoUpgrade to Oracle Database 19c</u>	
115 minutes – Feb 20, 2021	
Episode 3	
<u>Performance Stability, Tips and Tricks and Underscores</u>	
120 minutes – Mar 4, 2021	
Episode 4	
<u>Migration to Oracle Multitenant</u>	
120 minutes – Mar 16, 2021	
Episode 5	
<u>Migration Strategies – Insights, Tips and Secrets</u>	
120 minutes – Mar 25, 2021	
Episode 6	
<u>Move to the Cloud – Not only for techies</u>	
115 minutes – Apr 8, 2021	

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<https://MikeDietrichDE.com/videos>

More than 35 hours of technical content:

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

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UpgradesNow - 5.4K subscribers - 318 videos

This is the official channel by Oracle Database Upgrade and Migrations team at Oracle. [more](#)

[mikedonoghue.com](#) and 7 more links

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