The Oracle logo, consisting of the word "ORACLE" in a red, sans-serif font, is positioned in the upper left corner of the slide. The background of the slide features a close-up of a building's facade with a repeating pattern of dark, oval-shaped tiles, set against a sky with soft, orange and blue clouds at sunset or sunrise. A semi-transparent dark grey horizontal band spans the middle of the slide, containing the main title and subtitle.

ORACLE

Upgrade to Oracle Database 23ai

Best Practices

Oracle

DBAs

run the world





DANIEL OVERBY HANSEN

Distinguished Product Manager
Database Upgrade, Migrations & Patching



dohdatabase



@dohdatabase.com

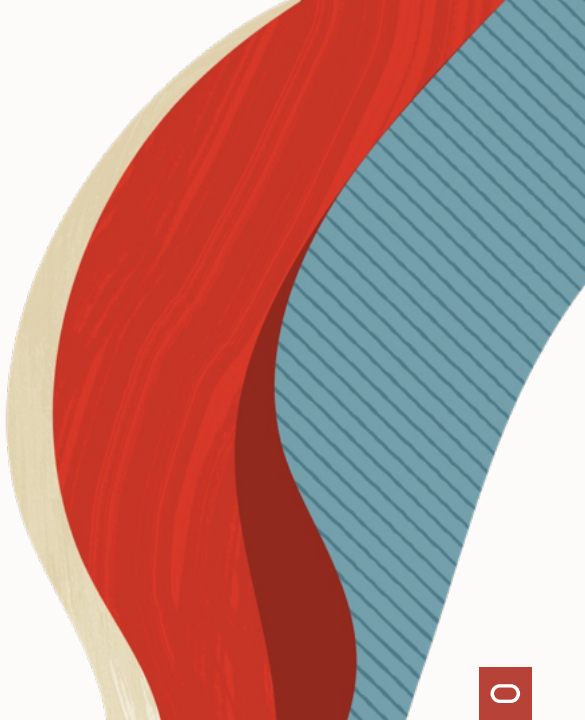


<https://dohdatabase.com>

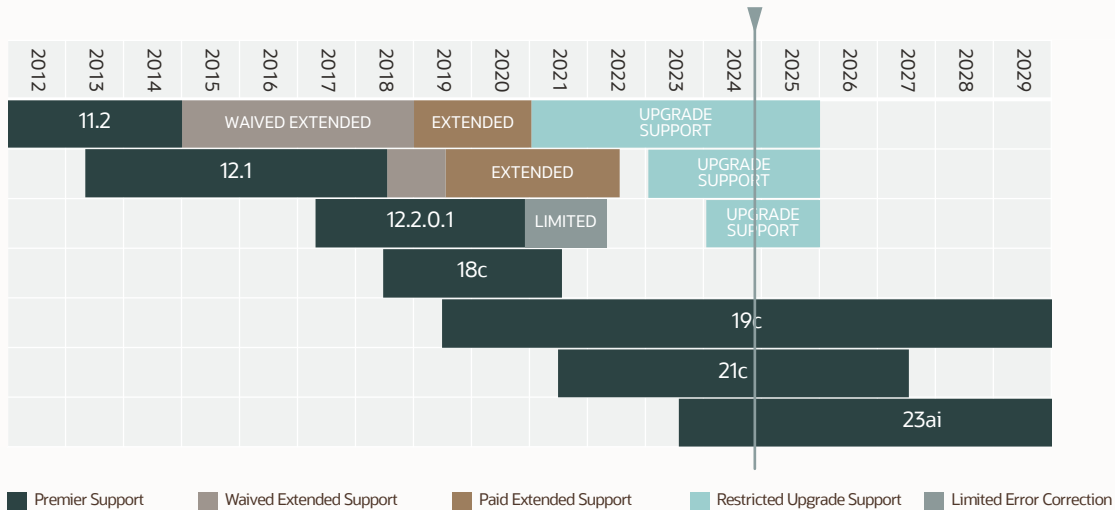
Before upgrade

How to upgrade and convert

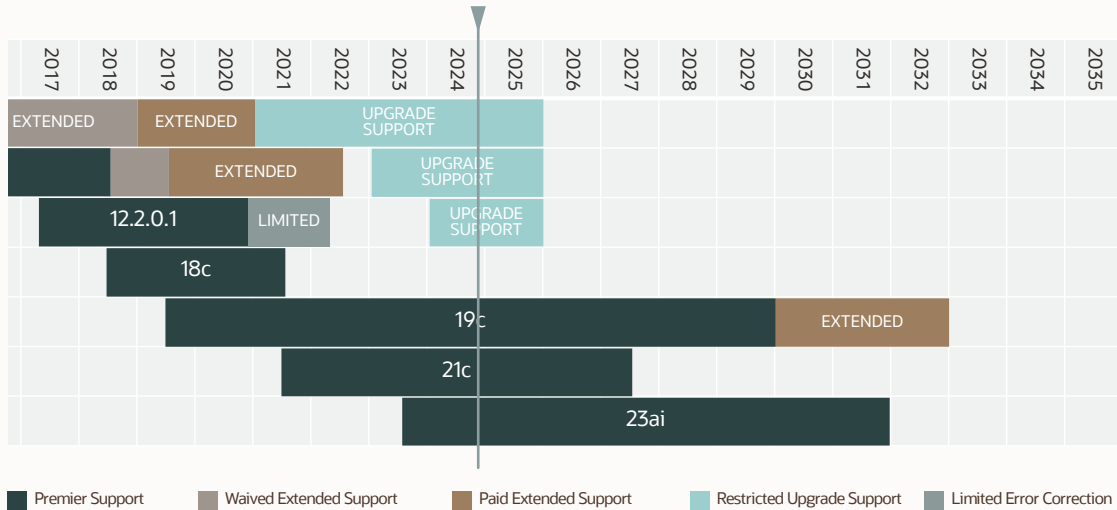
After upgrade



Lifetime Support Policy



Lifetime Support Policy



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

--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;
```



Update Exadata System Software to the latest version, minimum 24.1

- Exadata Database Machine and Exadata Storage Server Supported Versions (Doc ID [888828.1](#))



Upgrade to Oracle Grid Infrastructure 23ai

- Manages Oracle Database 19c and newer
- Upgrade older databases in advance



Raise ASM disk group compatibility

- Set `compatible.rdbms` to `19.0.0.0.0`



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;
```



On important databases,
execute a dictionary check before upgrade

- Formerly known as *Health Check*
- MOS Doc ID [136697.1](#)


```
upg1.sid=DB19
```

```
upg1.source_home=/opt/oracle/product/19c
```

```
upg1.target_home=/opt/oracle/product/23ai
```

```
upg1.target_cdb=CDB1
```

```
upg1.run_dictionary_health=full
```

```
#To run only the critical checks
```

```
#upg1.run_dictionary_health=critical
```

```

upg1.sid=DB19
upg1.source_home=/opt/oracle/product/19c
upg1.target_home=/opt/oracle/product/23ai
upg1.target_cdb=CDB1
upg1.run_dictionary_health=full
#To run only the critical checks
#upg1.run_dictionary_health=critical

```

```

dbms_dictionary_check on 05-SEP-2023 09:41:30
-----
Catalog Version 19.0.0.0.0 (1900000000)
db_name: DB19
Is CDB?: NO
Trace File: /opt/oracle/diag/rdbms/db19/DB19/trace/DB19_ora_25104_DICTCHECK.trc

```

Procedure Name	Catalog Version	Fixed Vs Release	Timestamp	Result
.. OIDOnObjCol	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. ErrorInObj	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. SourceNotInObj	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. OversizedFiles	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. PoorDefaultStorage	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. PoorStorage	1900000000	<= *All Rel*	09/05 09:41:30	PASS
*** 2023-09-05T09:41:30.934258+00:00				
.. TabPartCountMismatch	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. TabComPartObj	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. Mview	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. ValidDir	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. DuplicateDataobj	1900000000	<= *All Rel*	09/05 09:41:30	PASS
.. ObjSyn	1900000000	<= *All Rel*	09/05 09:41:31	PASS
.. ObjSeq	1900000000	<= *All Rel*	09/05 09:41:31	PASS



Ensure dictionary and fixed objects statistics are accurate

- Save downtime by gathering in advance

```
begin
```

```
--dbms_stats.gather_dictionary_stats;
```

```
dbms_stats.gather_schema_stats('SYS');
```

```
dbms_stats.gather_schema_stats('SYSTEM');
```

```
dbms_stats.gather_fixed_objects_stats;
```

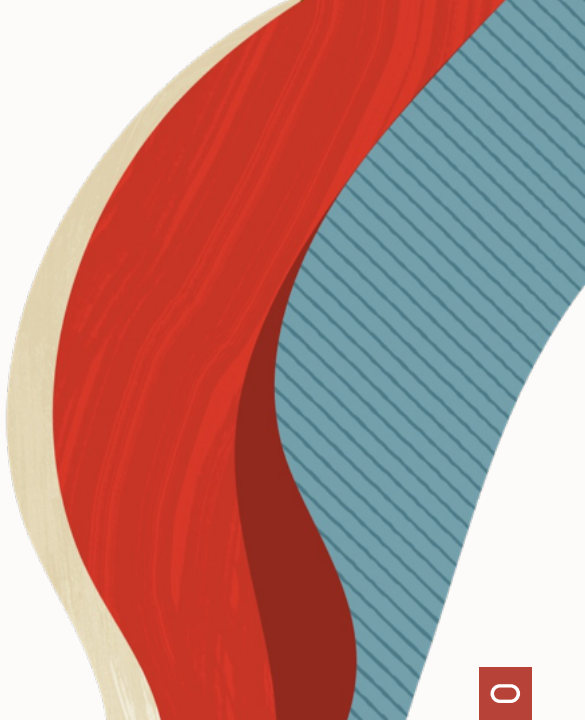
```
end;
```

```
/
```

Before upgrade

How to upgrade and convert

After upgrade



How 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



Simplified Installation

- 1 Download software
- 2 Download patches
- 3 Unzip
- 4 Update OPatch
- 5 Install
- 6 Apply patches



Simplified Installation

1 Download software

2 ~~Download patches~~

3 Unzip

4 ~~Update OPatch~~

5 Install

6 ~~Apply patches~~

Simplified Installation

1 Download software

2 Unzip

3 Install



Fully updated
Oracle Home

How 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

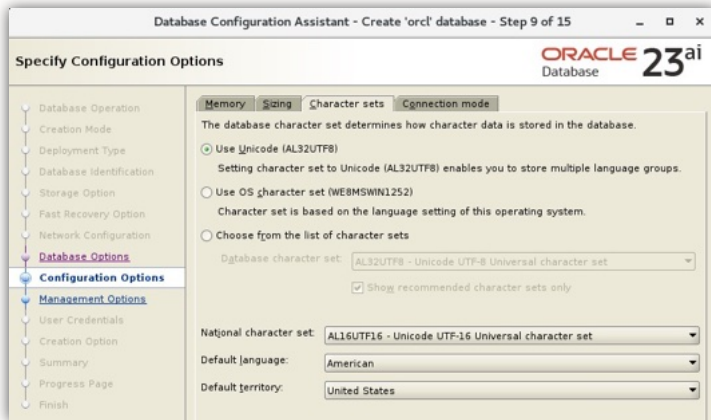
Create Container Database

1 Character set

- Always choose AL32UTF8
- Allows PDBs with any character set

2 Components

3 COMPATIBLE



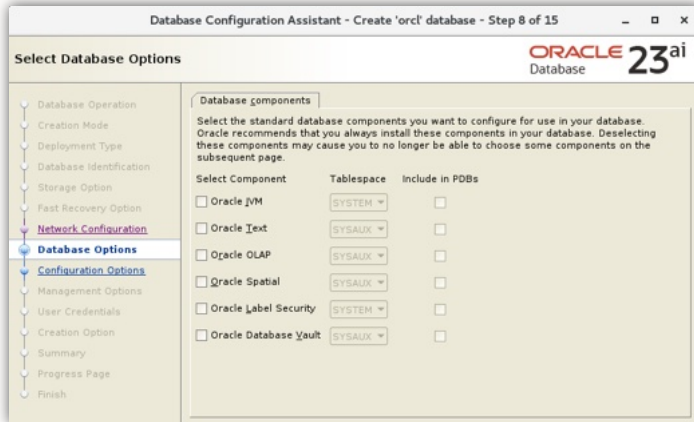
Create Container Database

1 Character set

2 Components

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

3 COMPATIBLE




Create Container Database

1 Character set

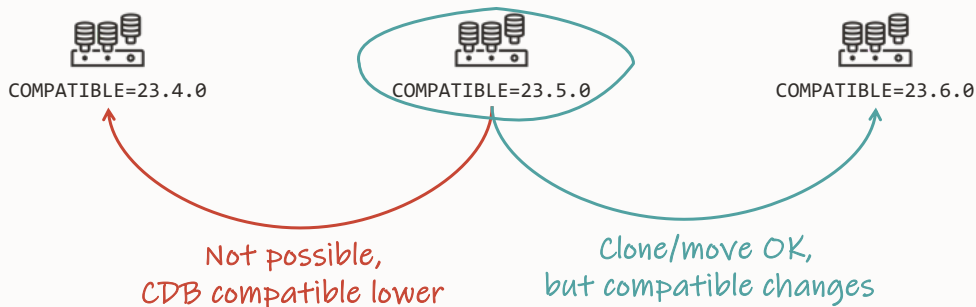
2 Components

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



--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;
```

How 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 24.7.241021
```

```
build.date 2024/10/21 11:16:20 -0400
```

```
build.hash babf5a631
```

```
build.hash_date 2024/10/18 18:36:27 -0400
```

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

```
build.type production
```

```
build.label (HEAD, tag: v24.7, origin/stable_devel, stable_devel)
```

```
build.MOS_NOTE 2485457.1
```

```
build.MOS_LINK https://support.oracle.com/.../?id=2485457.1
```

--Download the latest version of AutoUpgrade directly from oracle.com
--No authentication needed

```
wget https://download.oracle.com/otn-pub/otn_software/autoupgrade.jar
```



Flow

1

Plug in

2

Upgrade

3

Convert



23^{ai}

Demo

Upgrade to Oracle Database 23ai

- Using AutoUpgrade
- Including PDB conversion

[Watch on YouTube](#)

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

```
VERSION_FULL
```

```
-----
```

```
23.5.0.24.07
```




In OCI, upgrade individual PDBs using AutoUpgrade and refreshable clones

- See [blog post](#) for details



In OCI, upgrade entire CDBs
using cloud tooling

- Be sure to update cloud tooling beforehand



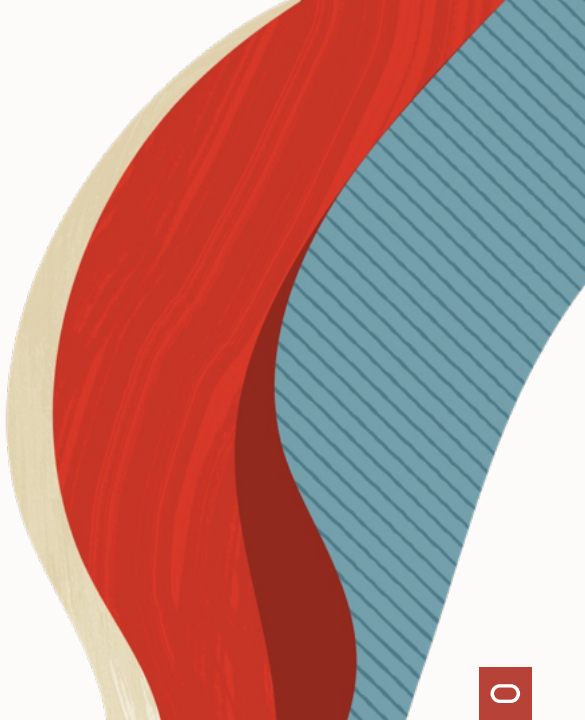
You can also migrate with Data Pump or Transportable Tablespaces

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

Before upgrade

How to upgrade and convert

After upgrade



Fallback Options | After Go-Live



1 Back to 19c non-CDB

- Data Pump
- GoldenGate

2 Back to 19c, stay multitenant

- Downgrade
- **COMPATIBLE** must be 19.0.0 in 23ai CDB



Backup your database after migration

- Level 0
- Practice restore with pre-plugin backups



Check your standby databases

- Special attention is needed for 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

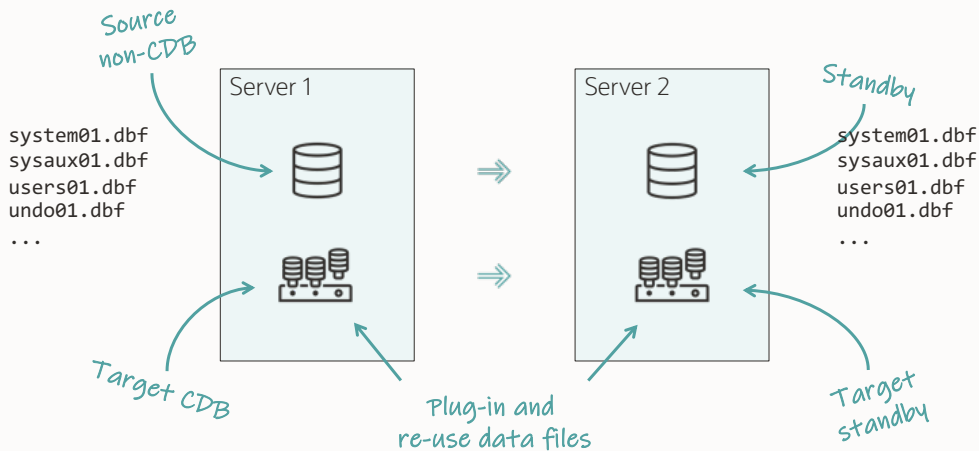
PDB is immediately protected

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

1 Regular files

- Standby search for data files at the same location as the primary
- Override with `DB_FILE_NAME_CONVERT`
- Or, override with `STANDBY_PDB_SOURCE_FILE_DIRECTORY`

Enabled Recovery

2 OMF in regular file system

- Standby search for data files at the OMF location (**DB_CREATE_FILE_DEST**)
- Move data files from non-CDB location into OMF location
- Or, create soft links in OMF location pointing to data file location

Enabled Recovery

3 ASM

- Standby search for data files at the OMF location (**DB_CREATE_FILE_DEST**)
- Use ASM aliases to find data files at non-CDB OMF location

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

Enabled Recovery | ASM

19c
Non-CDB
Primary



19c
Non-CDB
Standby



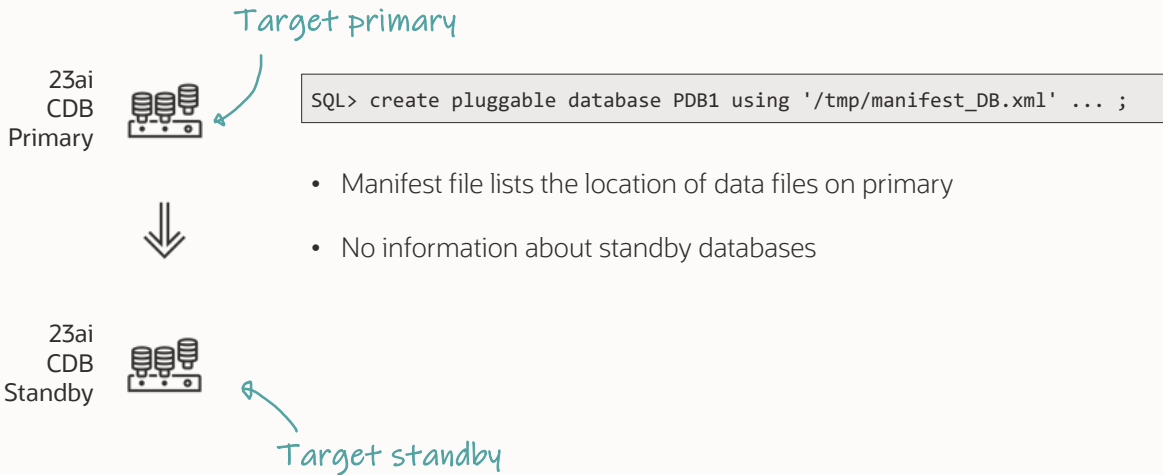
The manifest file contains

```
SQL> select dbms_pdb.describe('/tmp/manifest_DB.xml');
```

- Not standby database

```
<?xml version="1.0" encoding="UTF-8"?>
<PDB>
  <xmlversion>1</xmlversion>
  <pdbname>PDB1</pdbname>
  ...
  <guid>DDB49CFEFD8ED4FCE053E801000A078C</guid>
  ...
  <tablespace>
    <name>USERS</name>
    ...
  <file>
    <path>+DATA/DB_BOSTON/DATAFILE/users.273.1103046827</path>
```

Enabled Recovery | ASM



Enabled Recovery | ASM

23ai
CDB
Primary



23ai
CDB
Standby



+DATA/DB_BOSTON/DATAFILE/users.273.1103046827

Redo record says:
Plug in this data file

No good, data file
has a different name

+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009

Enabled Recovery | ASM

23ai
CDB
Primary



+DATA/DB_BOSTON/DATAFILE/users.273.1103046827



23ai
CDB
Standby



OK, let's check the OMF directory

+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009

+DATA/CDB1_CHICAGO/<PDB_GUID>/DATAFILE

It's empty

Enabled Recovery | ASM

23ai
CDB
Primary



+DATA/DB_BOSTON/DATAFILE/users.273.1103046827



23ai
CDB
Standby



OK, let's check the OMF directory

+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009

+DATA/CDB1_CHICAGO/<PDB_GUID>/DATAFILE

It's empty

```
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



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`

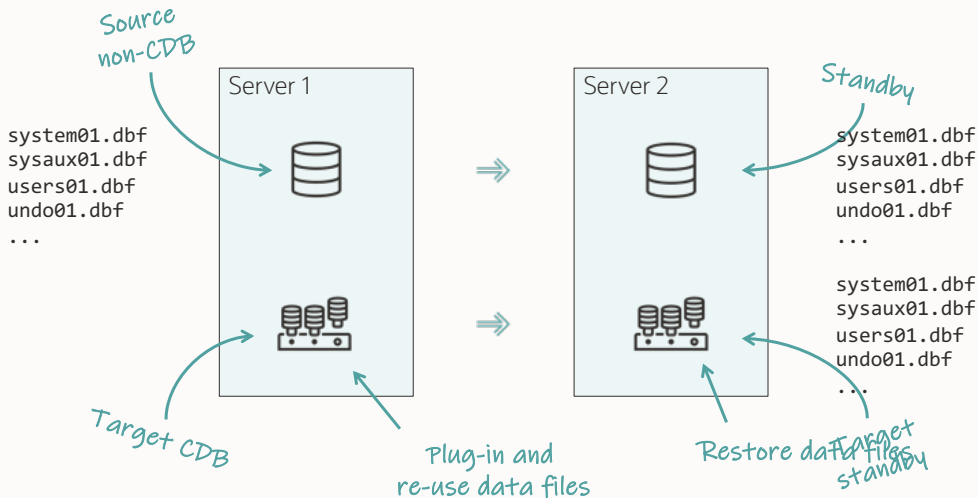
Standby records PDB creation

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

Further Details

Webinar:

[Move to Oracle Database 23ai –
Everything you need to know about Oracle Multitenant – Part 1](#)



Don't jeopardize your Data Guard

- Test the procedure and verify your environment

Performance Tips & Tricks



Patches For Optimal Performance

- 1 Install the latest Release Update
- 2 Install the latest Monthly Recommended Patches
- 3 Check for important recommended one-off patches (Doc ID [555.1](#))
- 4 Check for other [SQL performance bug fixes](#) (Doc ID [2773715.1](#))

Enable Optimizer Fixes

5 Selectively 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?

Upgrade
New database

Enable optimizer fixes using `DBMS_OPTIM_BUNDLE`

Patching

Do proper testing before enabling
optimizer fixes using `DBMS_OPTIM_BUNDLE`

- 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;
```

```
--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 2024-11-19 - Advice from 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;
```



*It's better to fail in our lab,
than in production*

Try multitenant migration in our [Hands-On Lab](#)

For free using Oracle LiveLabs

Web Seminar

Episode 16

(replaces Episode 1 from Feb 2021)

Oracle Database Release and Patching Strategy for 19c and 23c

115 minutes – May 10, 2023

Slides



Episode 17

From SR to Patch – Insights into the Oracle Database Development process

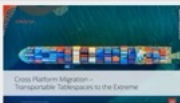
55 minutes – June 22, 2023



NEW Episode 18

Cross Platform Migration – Transportable Tablespaces to the Extreme

145 min – February 22, 2024



Episode 2

AutoUpgrade to Oracle Database 19c

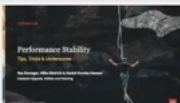
115 minutes – Feb 20, 2021



Episode 3

Performance Stability, Tips and Tricks and Underscores

120 minutes – Mar 4, 2021



Episode 4

Migration to Oracle Multitenant



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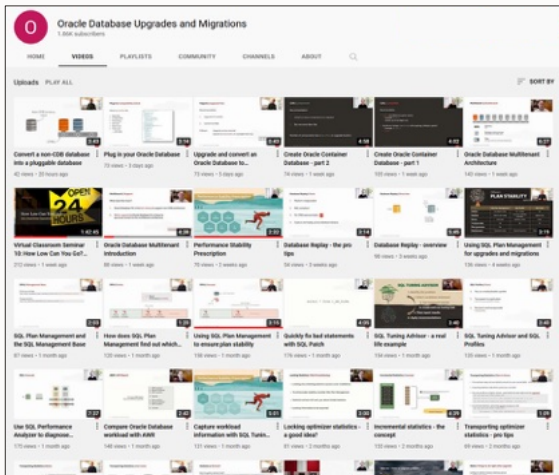
Rodrigo.R.Jorge@oracle.com



AlexZaballa.com

Alex.Zaballa@oracle.com

YouTube | Oracle Database Upgrades and Migrations



<https://www.youtube.com/@upgradenow>

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



Just as easy as patching your smartphone

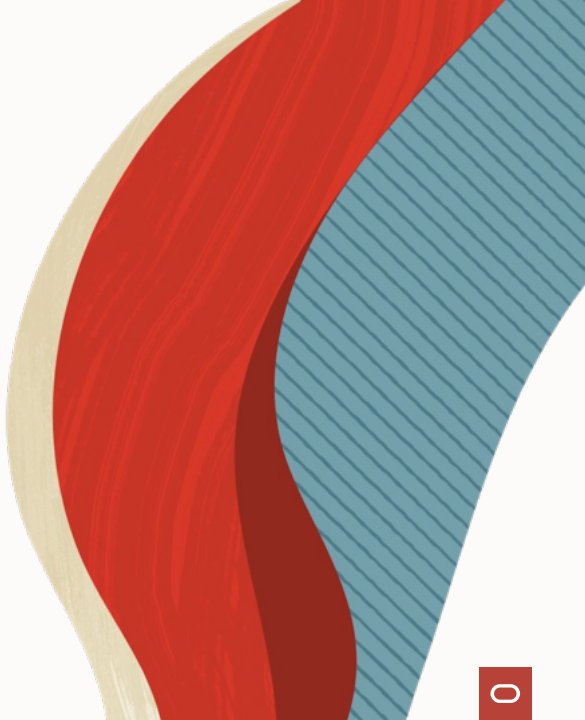
Our missing for patching with Oracle AutoUpgrade

Demo

One-Button Patching

- Download patches
- Install Oracle home
- Patch database

Watch on [YouTube](#)



Thank You

