Upgrade to Oracle Database 23ai Best Practices

Oracle

DBAs

run the world

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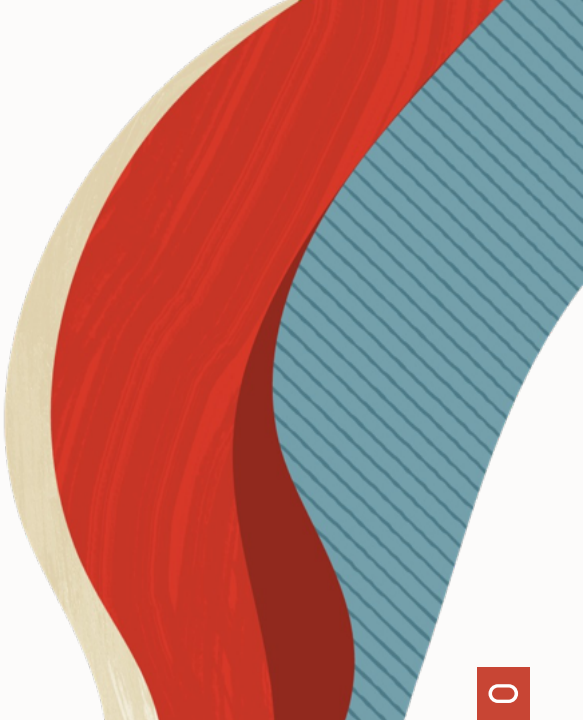
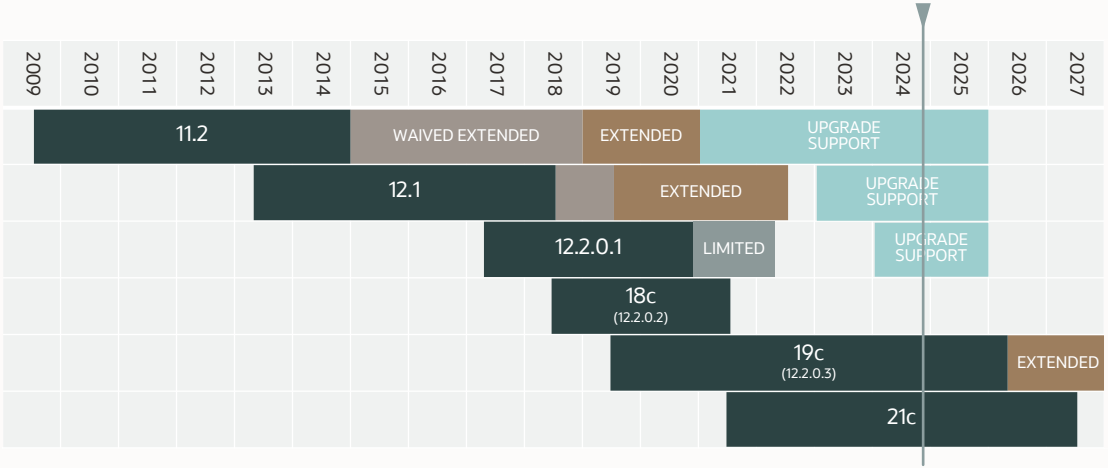
Before upgrade

How to upgrade and convert

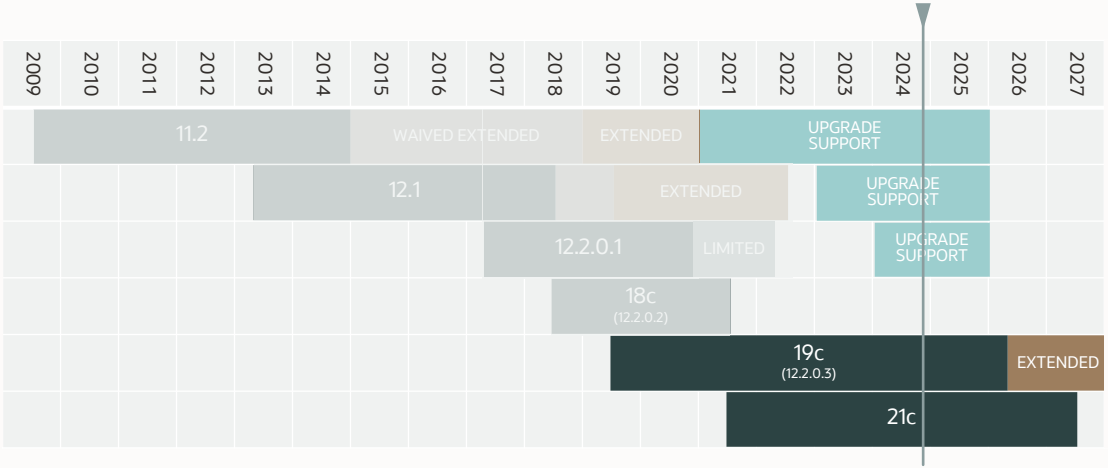
After upgrade



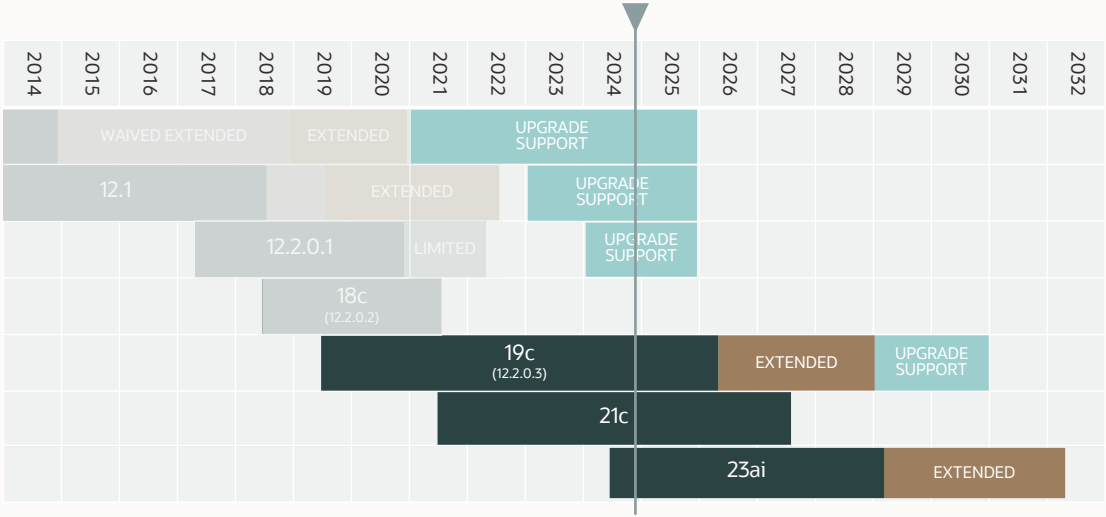
Lifetime Support Policy



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

Do you want to upgrade?

Oracle Database 11.2.0.4
Oracle Database 12.1.0.2
Oracle Database 12.2.0.1
Oracle Database 18c

Oracle Database 11.2.0.4
Oracle Database 12.1.0.2
Oracle Database 12.2.0.1
Oracle Database 18c

Oracle Database 19c

Oracle Database 23ai

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_pdbs=3;
```


Update Exadata System Software to the latest version, minimum 24.1.6

- 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
                                    Catalog       Fixed
Procedure Name                      Version    Vs Release    Timestamp       Result
----------------------------------- ... ---------- -- ---------- -------------- ------
.- OIDOnObjCol                      ... 1900000000 <=  *All Rel* 09/05 09:41:30
PASS
.- LobNotInObj                      ... 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

*** 2023-09-05T09:41:30.934258+00:00
PASS
.- 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

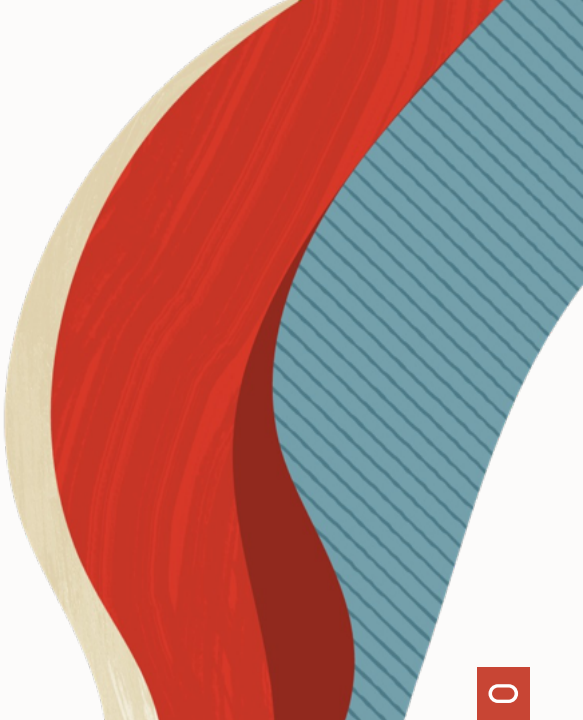
- Save downtime by gathering in advance

```
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`

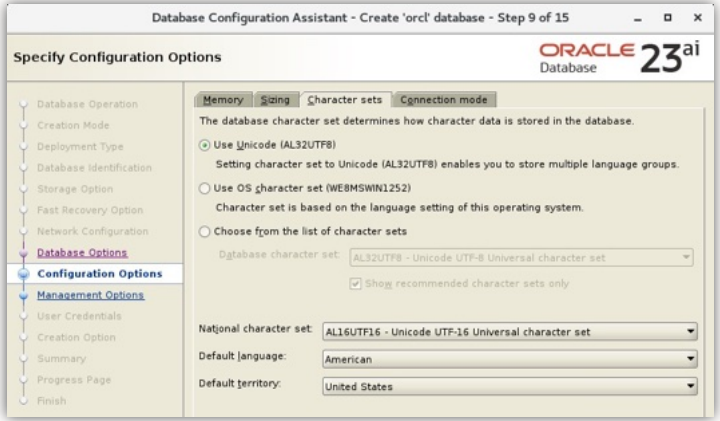
Create Container Database

1 Character set

- Always choose AL32UTF8
- Allows PDBs with any character set

2 Components

3 COMPATIBLE



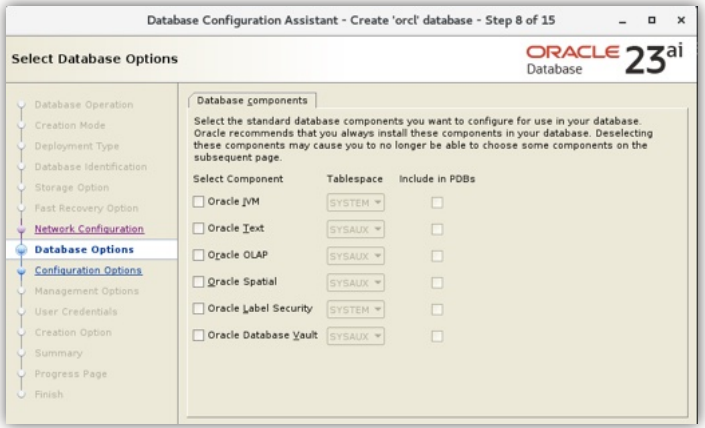
Create Container Database

1 Character set

2 Components

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

3 COMPATIBLE



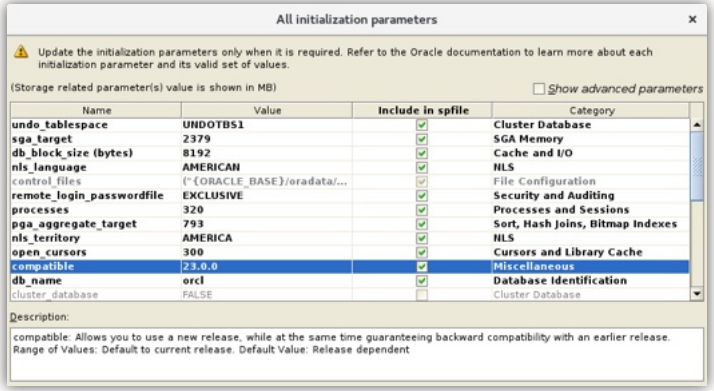
Create Container Database

1 Character set

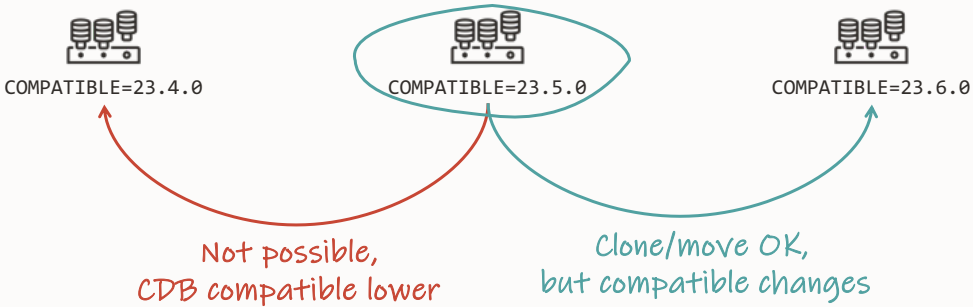
2 Components

3 COMPATIBLE

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



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 2485457.1

```
$ 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
```


Flow

1 Plug in

2 Upgrade

3 Convert

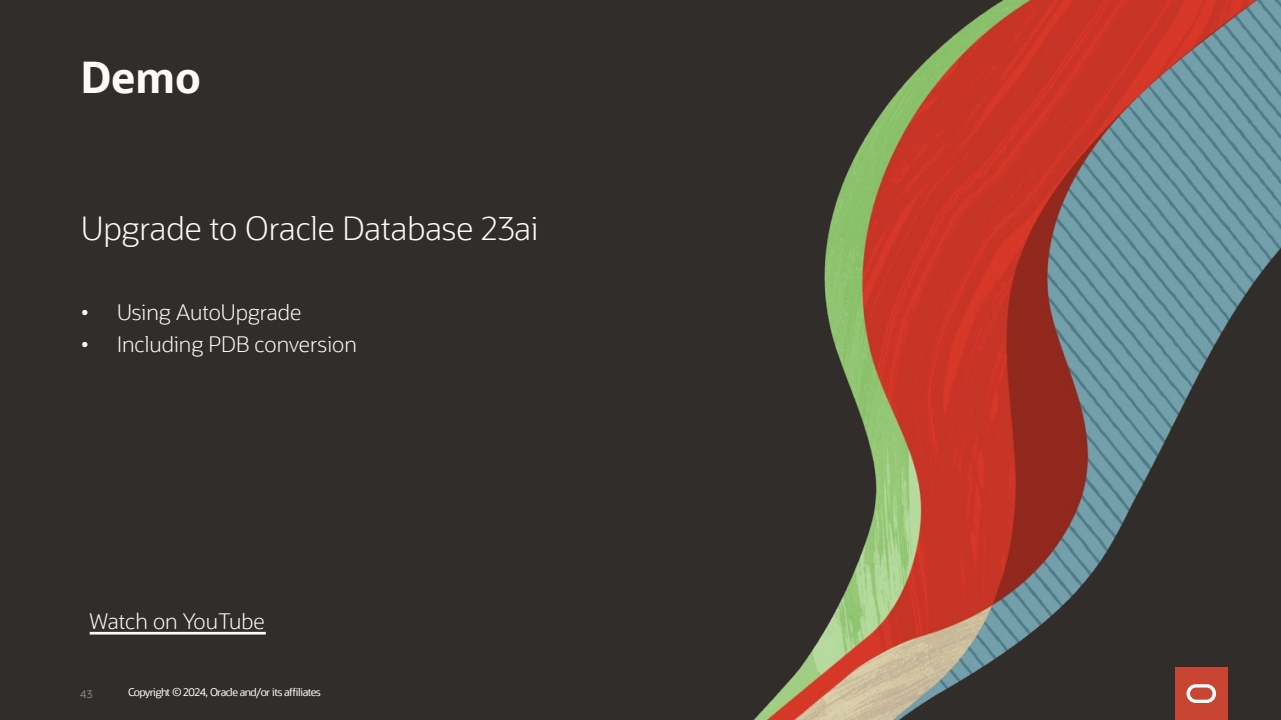
23ai

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

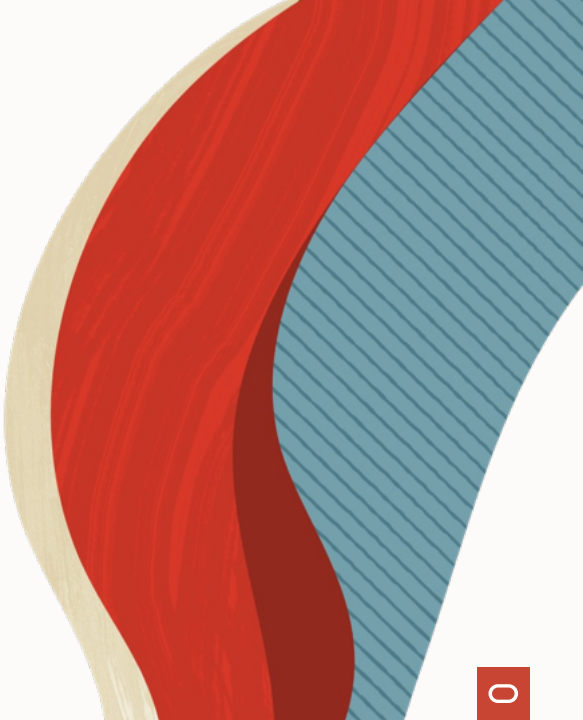
You can also migrate with Data Pump or Transportable Tablespaces

- 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

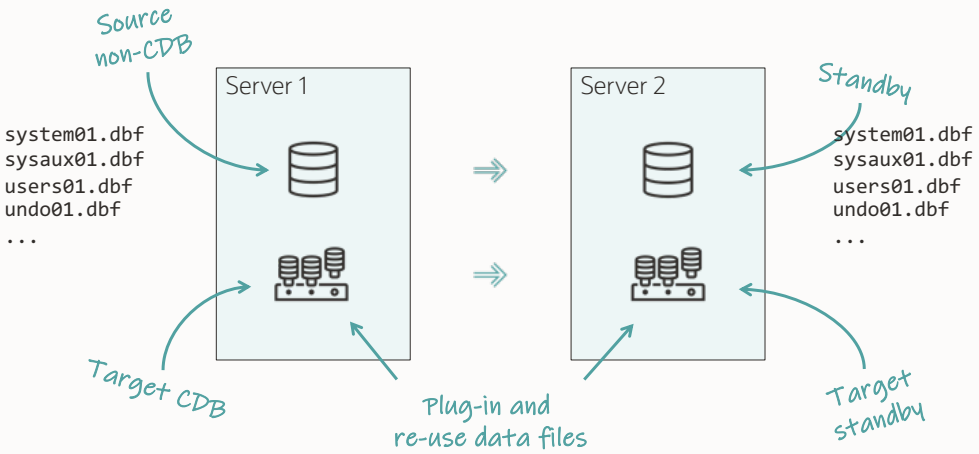
PDB is immediately protected

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

- File path on primary database only
- Not standby database

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

```
<?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

Target primary

23ai
CDB
Primary

```
SQL> create pluggable database PDB1 using '/tmp/manifest_DB.xml' ... ;
```

- Manifest file lists the location of data files on primary
- No information about standby databases

23ai
CDB
Standby

Target standby

Enabled Recovery | ASM

23ai
CDB
Primary

+DATA/DB_BOSTON/DATAFILE/users.273.1103046827

Redo record says:
Plug in this data file

No good, data file
has a different name

23ai
CDB
Standby

+DATA/DB_CHICAGO/DATAFILE/users.269.1103050009

Enabled Recovery | ASM

23ai
CDB
Primary

+DATA/DB_BOSTON/DATAFILE/users.273.1103046827

OK, let's check the OMF directory

23ai
CDB
Standby

+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

OK, let's check the OMF directory

23ai
CDB
Standby

+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
```

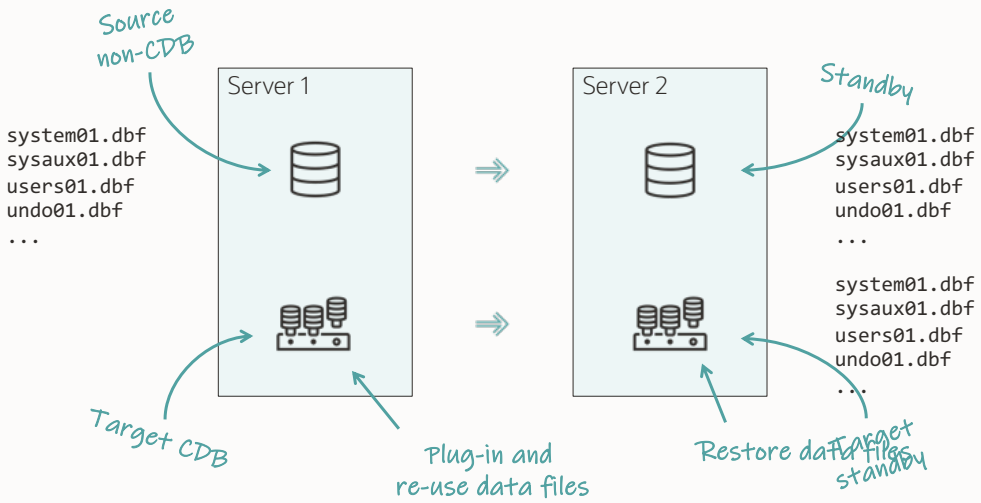
Standby records PDB creation

Standby ignores data files

MRP skips redo

PDB protected after restore

Deferred Recovery



Deferred Recovery

Source
Non-CDB

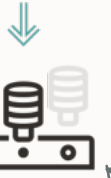
Target
Primary

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

Target
Standby

Deferred Recovery

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



Deferred Recovery

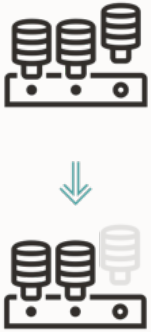
```
SQL> show pdbs

CON_NAME     OPEN MODE
PDB1         READ WRITE
```

```
SQL> show pdbs

CON_NAME     OPEN MODE
PDB1         MOUNTED
```

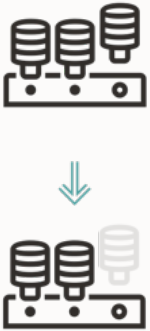
Deferred Recovery



```
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

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

Use as few initialization parameters as possible

- Stick to the defaults
- Stick to vendor recommendations

Only use underscores and events to solve specific situations

- Only under guidance of Oracle Support

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";
```

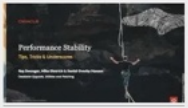

```
--Database collects SQL Plan Directives even when adaptive
--statistics are off.
--If you do not use Adaptive Statistics (optimizer_adaptive_statistics)
--then turn it completely off as described in MOS 2209560.1

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	Slides
Episode 16 (replaces Episode 1 from Feb 2021) Oracle Database Release and Patching Strategy for 19c and 23c *115 minutes – May 10, 2023*	
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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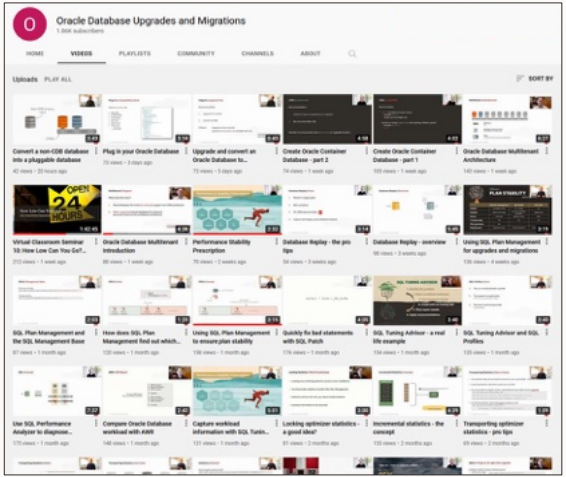

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- No buzzword
- All tech

SCAN ME

Just as easy as patching your smartphone

Thursday 21.11.2024 | 14:00 - 14:45 | Tokio

Thank You