ORACLE

2

CDB and Regular PDBs

Objectives

After completing this lesson, you should be able to:

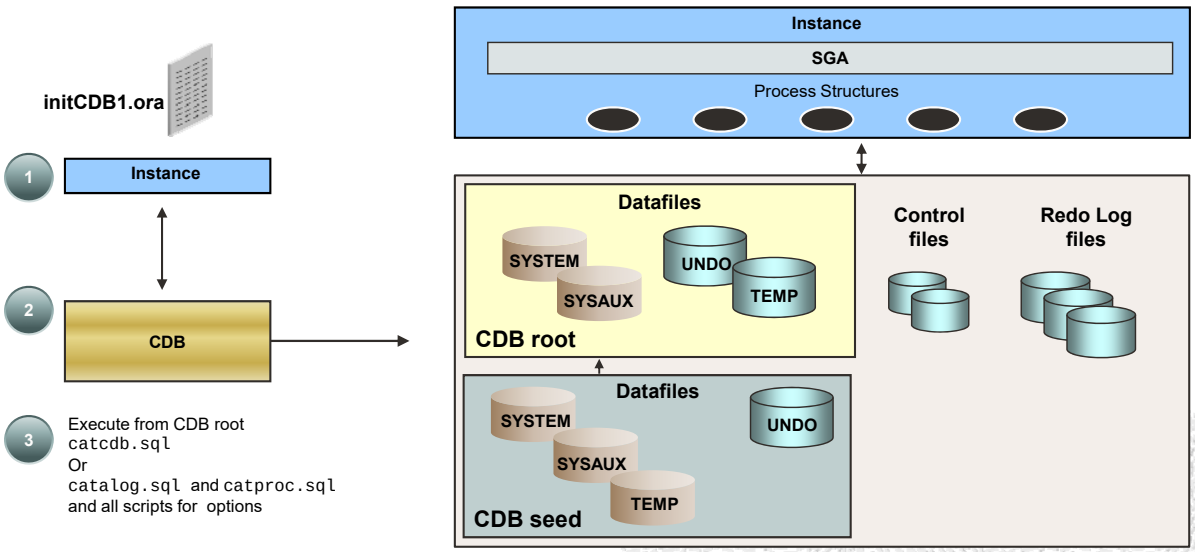
- Configure and create a CDB
- Create a new PDB from the CDB seed
- Explore the instance
- Explore the structure of PDBs
- Explore the ADR

Goals

Create a multitenant container database:

- To consolidate many pre-12.1, 12c, 18c, and 19c non-CDBs into a single, larger database
- To prepare a container:
  - For plugging any future new application
  - For testing applications
  - For diagnosing application performance
- To simplify and reduce time for patching and upgrade

Creating a CDB



Creating a CDB: Using SQL*Plus

1. Start up the instance :
   a. Set `ORACLE_SID=CDB1`.
   b. Create the `initCDB1.ora` file and set parameters:
      - `CONTROL_FILES` to CDB control file names
      - `DB_NAME` to a CDB name
      - `ENABLE_PLUGGABLE_DATABASE` to TRUE

```
SQL> CONNECT / AS SYSDBA
SQL> STARTUP NOMOUNT
```

2. Create the database:

```
SQL> CREATE DATABASE cdb1 ENABLE PLUGGABLE DATABASE …
          SEED FILE_NAME_CONVERT = ('/oracle/dbs','/oracle/seed');
```

➔ CDB$ROOT + PDB$SEED created

3. Execute the `$ORACLE_HOME/rdbms/admin/catcdb.sql` SQL script.

Clause: SEED FILE_NAME_CONVERT

```
SQL> CREATE DATABASE cdb1
     USER SYS IDENTIFIED BY p1 USER SYSTEM IDENTIFIED BY p2
     LOGFILE GROUP 1 ('/u01/app/oradata/CDB1/redo1a.log',
                      '/u02/app/oradata/CDB1/redo1b.log') SIZE 100M,
             GROUP 2 ('/u01/app/oradata/CDB1/redo2a.log',
                      '/u02/app/oradata/CDB1/redo2b.log') SIZE 100M
     CHARACTER SET AL32UTF8 NATIONAL CHARACTER SET AL16UTF16
     EXTENT MANAGEMENT LOCAL DATAFILE
                     '/u01/app/oradata/CDB1/system01.dbf' SIZE 325M
     SYSAUX DATAFILE  '/u01/app/oradata/CDB1/sysaux01.dbf' SIZE 325M
     DEFAULT TEMPORARY TABLESPACE tempts1
            TEMPFILE '/u01/app/oradata/CDB1/temp01.dbf' SIZE 20M
     UNDO TABLESPACE undotbs
             DATAFILE '/u01/app/oradata/CDB1/undotbs01.dbf' SIZE 200M
     ENABLE PLUGGABLE DATABASE
     SEED FILE_NAME_CONVERT =('/u01/app/oradata/CDB1','/u01/app/oradata/CDB1/seed');
```

Clause: ENABLE PLUGGABLE DATABASE

Without **SEED FILE_NAME_CONVERT**:

- OMF: **DB_CREATE_FILE_DEST=**'/u02/app/oradata'

```
SQL> CONNECT / AS SYSDBA
SQL> STARTUP NOMOUNT
SQL> CREATE DATABASE cdb2
      USER SYS IDENTIFIED BY p1 USER SYSTEM IDENTIFIED BY p2
      EXTENT MANAGEMENT LOCAL
      DEFAULT TEMPORARY TABLESPACE temp
      UNDO TABLESPACE undotbs
      DEFAULT TABLESPACE users
      ENABLE PLUGGABLE DATABASE;
```

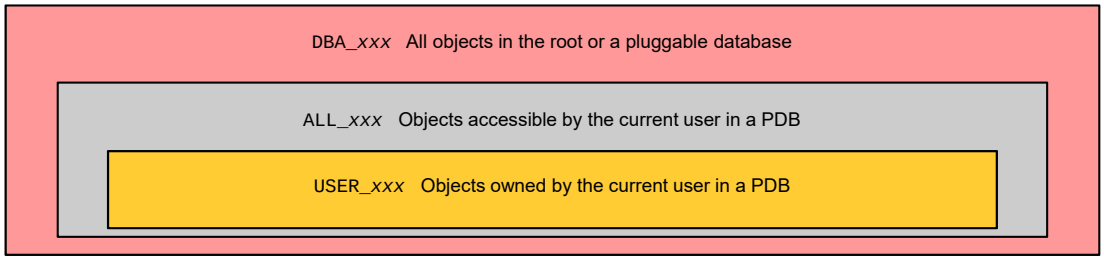
- Or instance parameter: **PDB_FILE_NAME_CONVERT =** '/u02/app/oradata/CDB2','/u02/app/oradata/seed'

After CDB Creation: What's New in CDB

A CDB has new characteristics compared to non-CDBs:

- **Two containers:**
  - The CDB **root** (CDB$ROOT)
  - The CDB **seed** (PDB$SEED)
- **Several services**: One per container
  - Name of CDB root service = name of the CDB (cdb2)
    - Maximum number of services: 10000
    - Max nb of services per PDB<= max nb of services in CDB
- **Common users** in CDB root and CDB seed: SYS, SYSTEM …
- **Common privileges** granted to common users
- **Predefined common roles**
- Tablespaces and data files associated with each container:
  - SYSTEM, SYSAUX, and UNDO

Data Dictionary Views: DBA_xxx

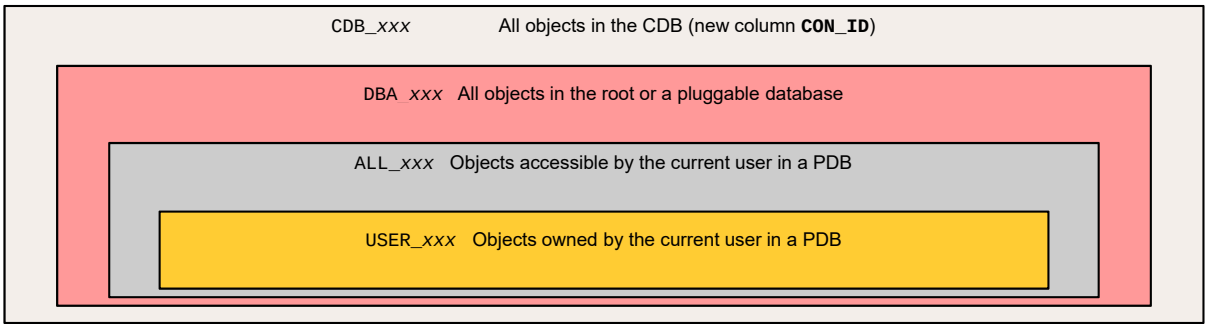


DBA dictionary views providing information within PDB:

```
SQL> SELECT table_name FROM dict WHERE table_name like 'DBA%';
```

- DBA_tablespaces: All tablespaces of the PDB
- DBA_data_files: All data files of the PDB
- DBA_tables: All tables in the PDB
- DBA_users: All common and local users of the PDB

Data Dictionary Views: CDB_xxx



CDB dictionary views provide information across PDBs:

```
SQL> SELECT view_name FROM dba_views WHERE view_name like 'CDB%';
```

- CDB_pdbs: All PDBs within the CDB
- CDB_tablespaces: All tablespaces within the CDB
- CDB_users: All users within the CDB (common and local)

Data Dictionary Views: Examples

- Comparisons:

1
2
```
SQL> CONNECT / AS SYSDBA
SQL> SELECT role, common, con_id FROM cdb_roles;
SQL> SELECT role, common FROM dba_roles;
```

3
4
```
SQL> CONNECT sys@PDB1 AS SYSDBA
SQL> SELECT role, common, con_id FROM cdb_roles;
SQL> SELECT role, common FROM dba_roles;
```

- Access to V$ views showing data from PDBs can be secured using privilege.

```
SQL> SELECT name,open_mode FROM v$pdbs;

NAME             OPEN_MODE
---------------- ----------
PDB$SEED         READ ONLY
PDB1             READ WRITE
```


Data Dictionary Views: V$xxx Views

SGA accessed by all containers: V$ views and `CON_ID` column

```
SQL> SELECT distinct status, con_id FROM v$bh order by 2;

STATUS     CON_ID
---------- ------
cr              1 ----------> CDB root
free            1
xcur            1
xcur            2 ----------> CDB seed
cr              3 ----------> PDB1 PDB
```

```
SQL> select OBJECT_ID, ORACLE_USERNAME, LOCKED_MODE, CON_ID from V$LOCKED_OBJECT;

OBJECT_ID  ORACLE_USERNAME  LOCKED_MODE  CON_ID
---------- ---------------- ----------- -------
     83711 SYS                       3       3 <---------- PDB1 PDB
     83710 DOM                       3       4 <---------- PDB2 PDB
```

After CDB Creation: To do List

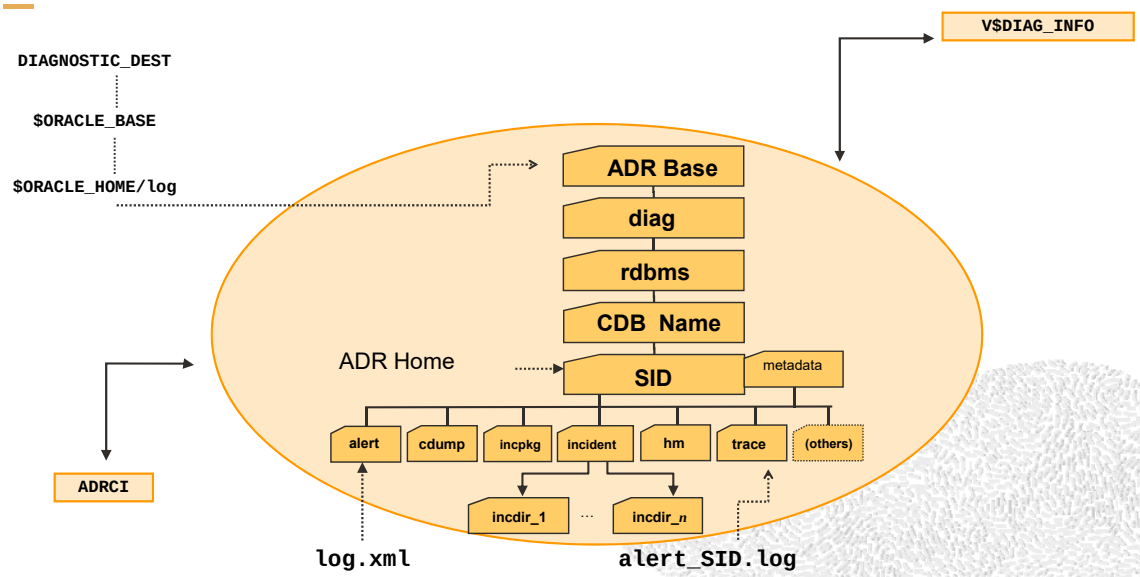
After CDB creation, the CDBA has to:

- Create the SPFILE from the PFILE
- Execute the `$ORACLE_HOME/rdbms/admin/utlrp.sql` script
- Optionally plug non-CDBs and create new PDBs
- Test startup/shutdown procedures
- Automate PDBs opening
- Create backup and recovery procedures

After PDB creation, each PDBA in its own PDB has to:

- Set a default tablespace
- Optionally create additional temporary tablespaces

Automatic Diagnostic Repository



Automatic Diagnostic Repository: alert.log File

The alert_CBD1.log shows new DDL statements.

```
CREATE DATABASE cdb1
  …
ENABLE PLUGGABLE DATABASE
SEED   FILE_NAME_CONVERT=('/u01/app/oradata/CDB1','/u01/app/oradata/seed');

CREATE PLUGGABLE DATABASE PDB$SEED AS CLONE USING …
CREATE PLUGGABLE DATABASE pdb1 … ;
ALTER PLUGGABLE DATABASE pdb1 UNPLUG INTO … ;
ALTER PLUGGABLE DATABASE ALL OPEN ;
ALTER PLUGGABLE DATABASE pdb2 CLOSE IMMEDIATE ;
```


Provisioning New Pluggable Databases

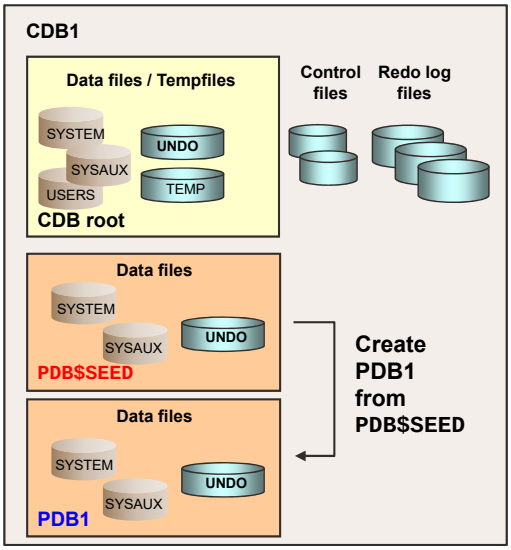
- Create a new PDB from the CDB seed.
- Plug an unplugged PDB into the same CDB or into another CDB.
- Plug a non-CDB in a CDB as a PDB.
- Clone a PDB from another PDB (local or remote CDB, hot or cold).
- Relocate a PDB from a CDB into another CDB.
- Proxy a PDB from another PDB.

Tools

To provision new PDBs, you can use:

- SQL*Plus
- SQL Developer
- Enterprise Manager Cloud Control
- Enterprise Manager Database Express
- Database Configuration Assistant (DBCA)
  - Clone from CDB seed
  - Clone from an existing PDB
  - Plug an unplugged PDB
  - Clone a remote PDB
  - Relocate a PDB from a remote CDB to a local CDB

Create New PDB from PDB$SEED



- Copies the data files from PDB$SEED data files
- Creates tablespaces SYSTEM, SYSAUX, UNDO
- Creates a full catalog including metadata pointing to Oracle- supplied objects
- Creates common users:
  - SYS
  - SYSTEM
- Creates a local user (PDBA), granted local PDB_DBA role
- Creates a new default service

Steps: With FILE_NAME_CONVERT

Create a new PDB from the seed using **FILE_NAME_CONVERT**:

1. Connect to the CDB root as a common user with the CREATE PLUGGABLE TABASE system privilege:

```
SQL> CREATE PLUGGABLE DATABASE pdb1
     ADMIN USER admin1 IDENTIFIED BY p1 ROLES=(CONNECT)
     FILE_NAME_CONVERT = ('PDB$SEEDdir', 'PDB1dir');
```

2. Use views to verify:

```
SQL> CONNECT / AS SYSDBA
SQL> SELECT * FROM cdb_pdbs;
SQL> SELECT * FROM cdb_tablespaces;
SQL> SELECT * FROM cdb_data_files;
SQL> ALTER PLUGGABLE DATABASE pdb1 OPEN RESTRICTED;
SQL> CONNECT sys@pdb1 AS SYSDBA
SQL> CONNECT admin1@pdb1
```

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Steps: Without FILE_NAME_CONVERT

Create a new PDB from seed without **FILE_NAME_CONVERT**:

- Use OMF: **DB_CREATE_FILE_DEST =** '/u01/app/oradata/CDB1/**pdb1**'

Or

- Use the instance parameter: **PDB_FILE_NAME_CONVERT =** '/u01/app/oradata/CDB1/seed','/u01/app/oradata/CDB1/**pdb1**'

```
SQL> CREATE PLUGGABLE DATABASE pdb1
     ADMIN USER pdb1_admin IDENTIFIED BY p1 ROLES=(CONNECT);
```

Or

- Use the clause in the CREATE PLUGGABLE DATABASE command:
  CREATE_FILE_DEST = '/u01/app/oradata/CDB1/**pdb1**'

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Summary

In this lesson, you should have learned how to:

- Configure and create a CDB
- Create a new PDB from the CDB seed
- Explore the instance
- Explore the structure of PDBs
- Explore the ADR

Practice 2: Overview

- 2-1: Exploring CDB architecture and structures
- 2-2: Creating a new CDB
- 2-3: Creating a new PDB