# Multitenant Architecture and RAC

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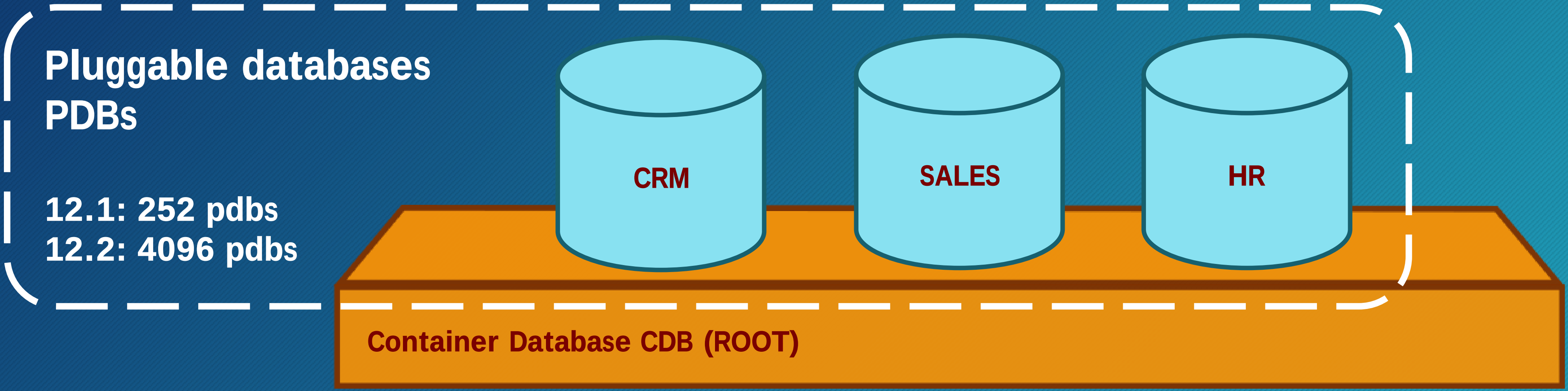
# Objectives

In this lecture, you will learn how to perform the following:

- Describe the architecture of Oracle Database Multitenant
- Create a Container Database (CDB)
- Describe the difference between common and local users
- Connect to a CDB and PDBs
- Startup and shutdown CDB and PDBs
- Understand the CDB-level performance views
- Clone a PDB online
- Drop a PDB

# What is the Oracle Database Multitenant Architecture?

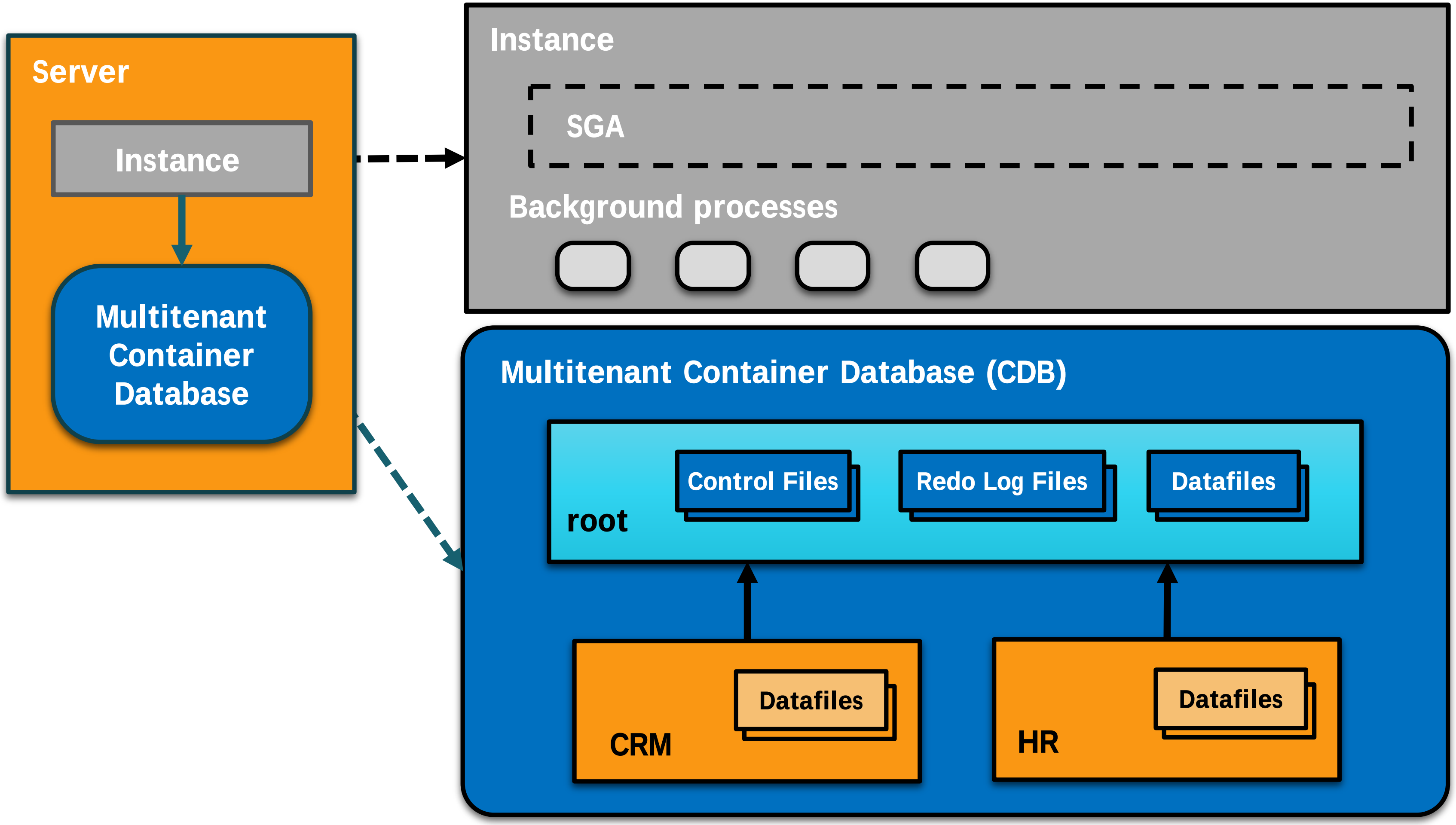
- Consolidate one or more databases into a single housing container database.
- CDB database vs non-CDB database



# Oracle Database Multitenant Advantages

- Addresses the consolidation challenges:
  - Resources utilization
  - DBA resource costs
- Existing applications and schema do not need to change
- Tenant isolation
- Easy and efficient database cloning and moving

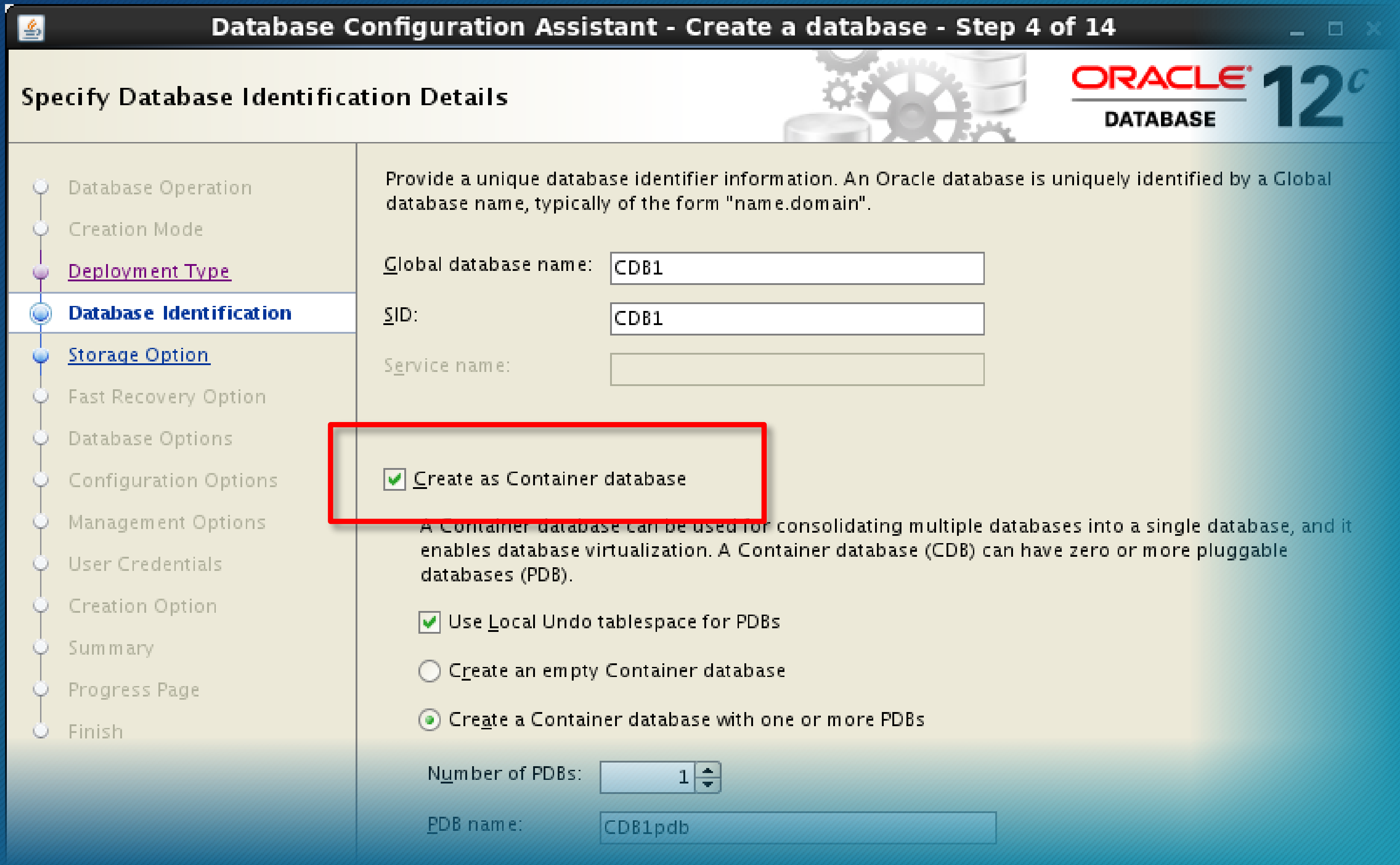
# Multitenant Architecture



# Multitenant Architecture Terms

| Term | Definition |
|---|---|
| Container Database (CDB) | A multitenant container database that houses zero or more pluggable databases. |
| non-CDB | A database that was created without using the multitenant architecture. All the pre-12c  databases are non-CDBs. |
| Pluggable Database (PDB) | Portable collection of schemas, schema objects, and nonschema objects that appears to an Oracle Net client as a non-CDB. |
| Root container (CDB$ROOT) | A master set of data files and metadata (data dictionary tables, Oracle-supplied packages, system users) and containing information regarding all containers within a CDB. |

# Creating a CDB using DBCA



Database Configuration Assistant - Create a database - Step 4 of 14

Specify Database Identification Details

Provide a unique database identifier information. An Oracle database is uniquely identified by a Global database name, typically of the form "name.domain".

Global database name: CDB1

SID: CDB1

Service name:

☑ Create as Container database

A Container database can be used for consolidating multiple databases into a single database, and it enables database virtualization. A Container database (CDB) can have zero or more pluggable databases (PDB).

☑ Use Local Undo tablespace for PDBs

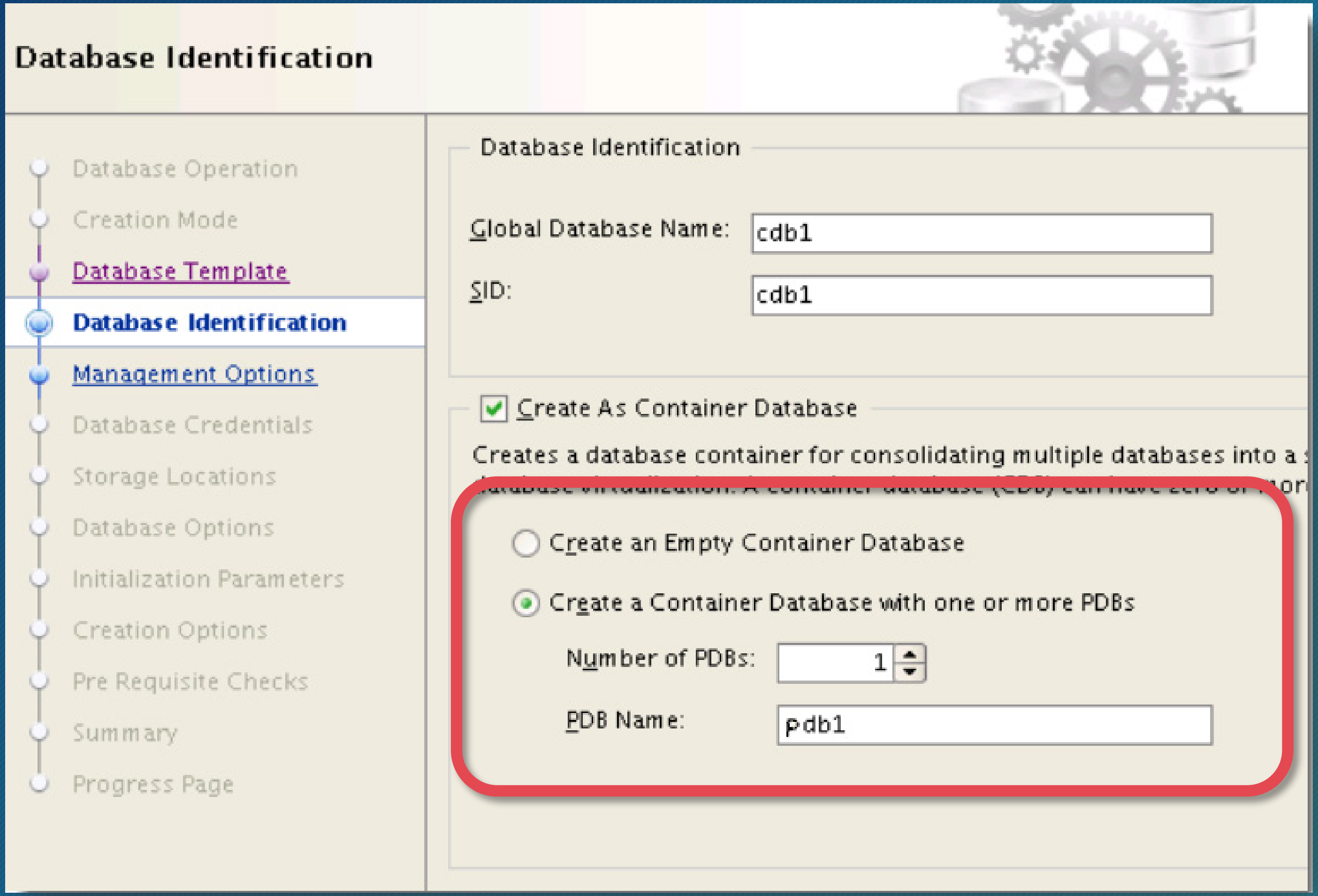
○ Create an empty Container database

● Create a Container database with one or more PDBs

Number of PDBs: 1

PDB name: CDB1pdb

# Creating a CDB using DBCA including PDBs



Database Identification

Database Identification

Global Database Name: cdb1

SID: cdb1

☑ Create As Container Database

Creates a database container for consolidating multiple databases into a s

○ Create an Empty Container Database

● Create a Container Database with one or more PDBs

Number of PDBs: 1

PDB Name: pdb1

# Common and Local Users

- **Common user:**
  - Created in the root
  - Can login to other PDBs in the CDB
  - Usually used for CDB-level administrators
  - SYS and SYSTEM are default common users
- **Local user:**
  - Defined in the container level
  - Can login only to its container
  - Usually used for data-owners and PDB-level administrators

# Connecting to a CDB and PDBs

```
SQL> CONNECT / as sysdba
SQL> CONNECT sys@//hostname:1525/CDB1 as sysdba
SQL> CONNECT sys@//hostname:1525/PDBHR as sysdba
SQL> CONNECT scott@//hostname/PDBHR
SQL> SHOW CON_NAME
```

# Startup and Shutdown a PDB

- Affecting the current container:

```
ALTER PLUGGABLE DATABASE OPEN [READ ONLY];
ALTER PLUGGABLE DATABASE CLOSE [IMMEDIATE];
```

- Affecting a named container (from root):

```
ALTER PLUGGABLE DATABASE pdb1 OPEN;
ALTER PLUGGABLE DATABASE ALL OPEN;
ALTER PLUGGABLE DATABASE ALL EXCEPT pdb1 OPEN;
```

# Startup and Shutdown a PDB (cont)

- Using the **STARTUP** command (from root):

```
STARTUP PLUGGABLE DATABASE pdb1 [OPEN] [READ ONLY]
                                [RESTRICT] [FORCE]
```

- After connecting as PDB admin:

```
STARTUP
SHUTDOWN
```

- To view the state of the PDBs (from root):

```
SELECT NAME, OPEN_MODE, RESTRICTED FROM V$PDBS
```

# Startup and Shutdown a PDB in RAC

- To start a PDB in specific instances:

```
ALTER PLUGGABLE DATABASE pdb1 OPEN INSTANCES=('rac1','rac2');
ALTER PLUGGABLE DATABASE pdb1 OPEN INSTANCES=ALL;
ALTER PLUGGABLE DATABASE pdb1 OPEN INSTANCES=ALL EXCEPT ('rac1');
```

- To view the state of the PDBs (from root):

```
SELECT INST_ID, NAME, OPEN_MODE, RESTRICTED FROM GV$PDBS
```

- The same applies in shutting down the PDBs

```
ALTER PLUGGABLE DATABASE pdb1 CLOSE INSTANCES=('rac1','rac2');
```

# Startup and Shutdown a CDB

- Traditional command supported:

```
sqlplus / as sysdba
STARTUP
SHUTDOWN
```

- If registered in clusterware or Oracle Restart:

```
srvctl start database -d cdb
srvctl stop database -d cdb
```

# Data Dictionary Views in CDB level

| View Category within a PDB | Description |
|---|---|
| **USER_***** | Objects owned by the current user |
| **ALL_***** | Objects accessible by the current user |
| **DBA_***** | All the objects in within the current container (root or pdb) |
| **CDB_***** | All objects in the CDB (container identified by CON_ID)<br>Examples: CDB_PDBS, CDB_TABLESPACES, CDB_USERS |
| **V$***** | SGA accessed by all the containers (container identified by CON_ID) |

# Cloning a PDB Online

- You can clone a PDB within a CDB online:

```
CREATE PLUGGABLE DATABASE pdb2 FROM pdb1;
ALTER PLUGGABLE DATABASE pdb2 OPEN INSTANCES=ALL;
```

- In RAC, to register the cloned PDB in the clusterware:

```
srvctl add service -db cdbrac -pdb pdb2 -s pdb2srv
 -preferred cdbrac1 -available cdbrac2

srvctl start service -db cdbrac -s pdb2srv
```

# Dropping a PDB

- Remove its service:

```
srvctl stop service -db cdbrac -s pdb2srv
srvctl remove service -db cdbrac -s pdb2srv
```

- Drop the PDB including its datafiles:

```
ALTER PLUGGABLE DATABASE  pdb2 CLOSE INSTANCES=ALL;
DROP PLUGGABLE DATABASE  pdb2 INCLUDING DATAFILES;
```

# Oracle Multitenant Architecture: Further Learning

- Non-CDB is obsolete
- Information sources:
  - Courses
  - Books
  - Blogs

# Summary

In this lecture, you should have learnt how to perform the following:

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