## Practice 5-1: Shutting Down and Starting Up the Oracle Database

**Objective:**

To stop all running databases and listeners, create a new CDB named `CDBLAB` with three PDBs using DBCA, and ensure that all databases are running at the end of the practice.

**Steps:**

1. **Identify and Stop All Running Databases and Listeners**

   First, identify all running databases and listeners:

   ```
   xhost +
   su - oracle
   pgrep -lf smon
   pgrep -lf tns
   ```

   Stop all running databases:

   ```
   sqlplus / as sysdba
   SHUTDOWN IMMEDIATE;
   ```

   Make sure listener is stopped:

   ```
   lsnrctl status
   lsnrctl stop
   ```

   **Important:** Open new terminal and run these commands as **root** user:

   Make sure the `listener.ora` is created. If not, create it:

   ```
   cd ~/Desktop
   git clone https://github.com/fenago/oracle19c-administration.git
   cd ~/Desktop/oracle19c-administration

   cp listener.ora /u01/app/oracle/product/19.3.0/dbhome_1/network/admin/

   sudo chown -R oracle
   /u01/app/oracle/product/19.3.0/dbhome_1/network/admin/listener.ora
   ```

Make sure listener is running:

```
su - oracle
lsnrctl start
```

2. **Set Oracle Environment Variables**

   Set the Oracle environment variables using the `oraenv` script:

   ```
   . oraenv
   ORACLE_SID = [oracle] ? CDBLAB
   ```

   Then

```
export ORACLE_BASE=/u01/app/oracle
export ORACLE_HOME=/u01/app/oracle/product/19.3.0/dbhome_1
export ORACLE_SID=CDBLAB
export PATH=$ORACLE_HOME/bin:$PATH
```

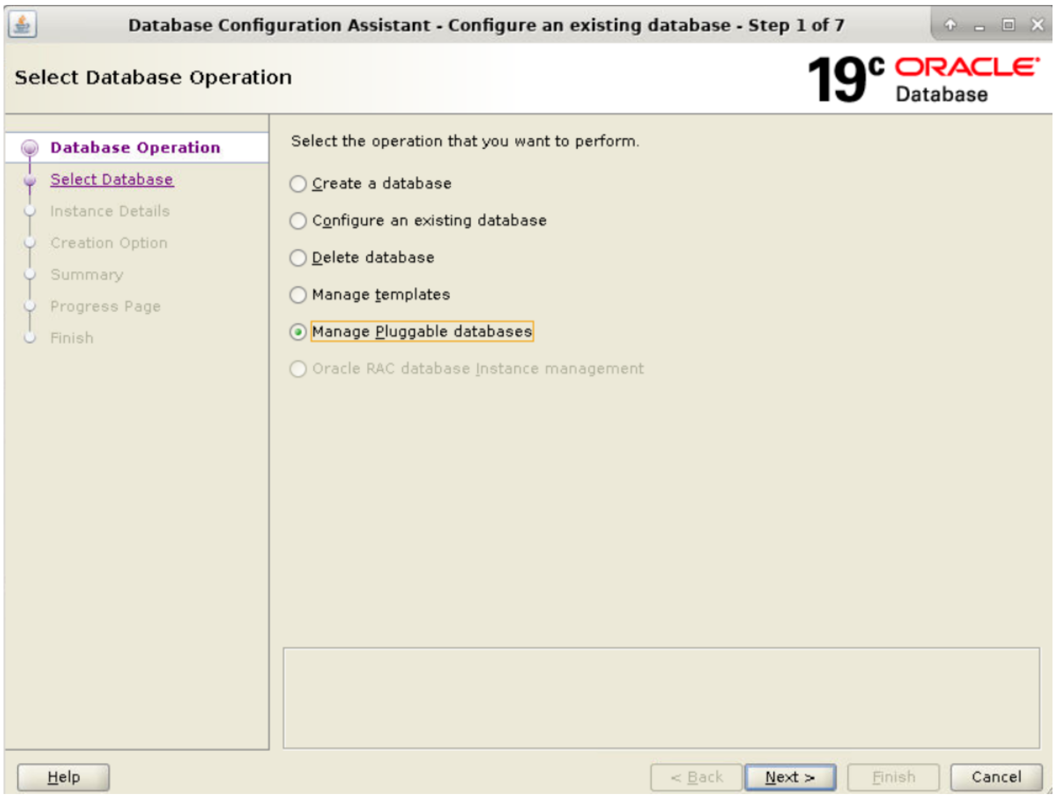
3. **Create a New CDB with Three PDBs Using DBCA**

   Use the following command to create a new CDB named `CDBLAB` with three PDBs ( `PDBLAB1` , `PDBLAB2` , and `PDBLAB3` ):

```
 dbca -silent -createDatabase \
-templateName General_Purpose.dbc \
-gdbname CDBLAB -sid CDBLAB -responseFile NO_VALUE \
-characterSet AL32UTF8 \
-sysPassword fenago \
-systemPassword fenago \
-createAsContainerDatabase true \
-numberOfPDBs 1 \
-pdbName PDBLAB1 \
-pdbAdminPassword fenago \
-databaseType MULTIPURPOSE \
-memoryMgmtType auto_sga \
-totalMemory 1536 \
-storageType FS \
-datafileDestination "/u01/app/oracle/oradata/" \
-redoLogFileSize 50 \
-listeners LISTENER \
-emConfiguration DBEXPRESS \
-emExpressPort 5501 \
-ignorePreReqs
```

   Run the command `dbca` to launch the Oracle Database Configuration Assistant.

In the DBCA welcome screen or main menu, select the "Manage Pluggable Databases" option.

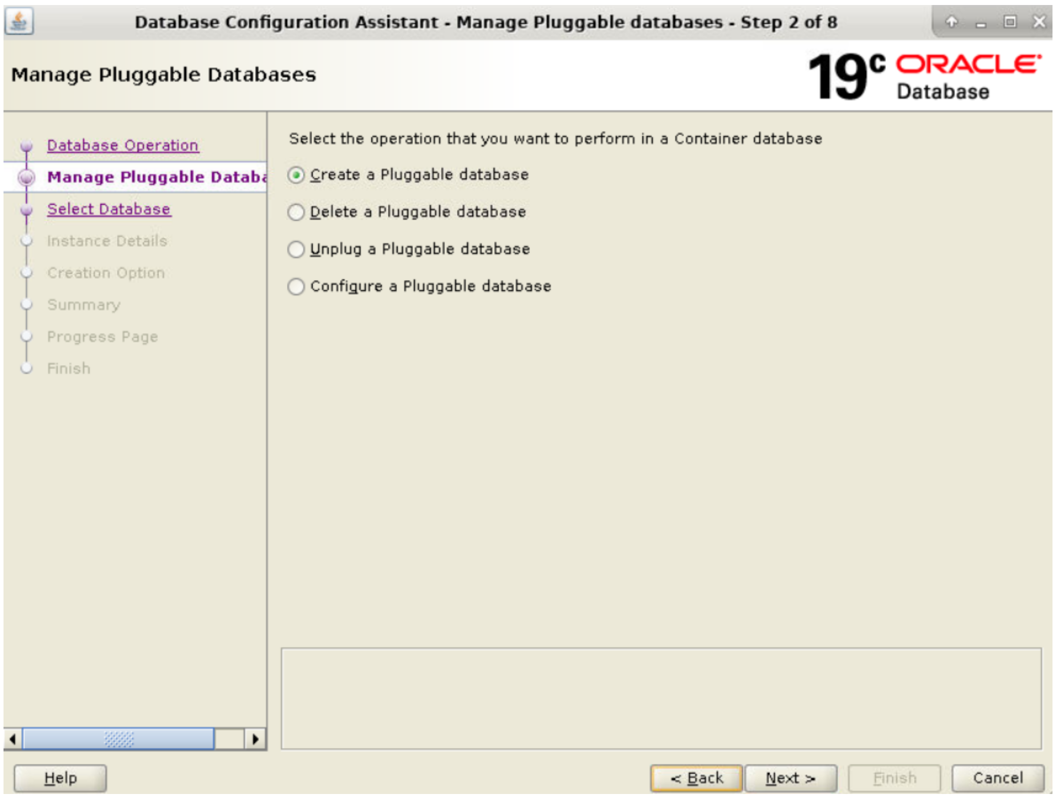

Database Configuration Assistant - Configure an existing database - Step 1 of 7

Select Database Operation

Select the operation that you want to perform.

- ○ Create a database
- ○ Configure an existing database
- ○ Delete database
- ○ Manage templates
- [✓ Manage Pluggable databases]
- ○ Oracle RAC database Instance management

select the "Create a Pluggable Database" option.


Database Configuration Assistant - Manage Pluggable databases - Step 2 of 8

Manage Pluggable Databases

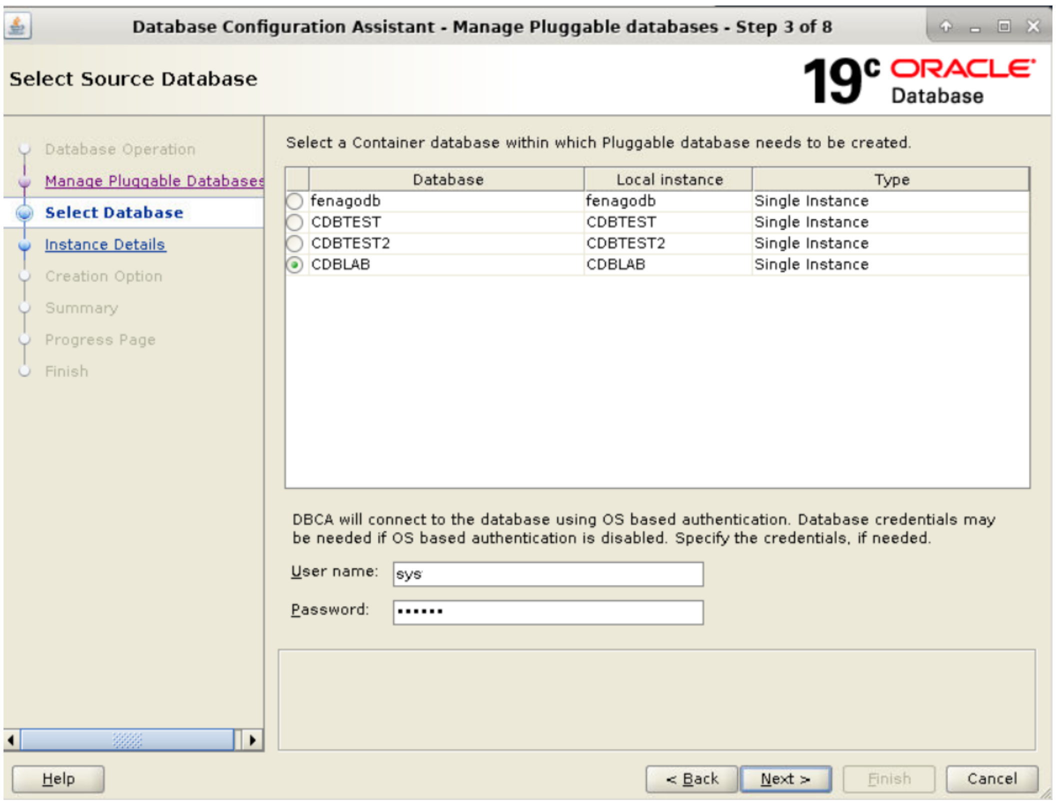
Select the operation that you want to perform in a Container database

- [✓ Create a Pluggable database]
- ○ Delete a Pluggable database
- ○ Unplug a Pluggable database
- ○ Configure a Pluggable database

DBCA will prompt you to connect to the CDB `CDBLAB`. Provide the necessary credentials.

**User name**: `sys`

**Password**: `fenago`



Database Configuration Assistant - Manage Pluggable databases - Step 3 of 8

Select Source Database

Select a Container database within which Pluggable database needs to be created.

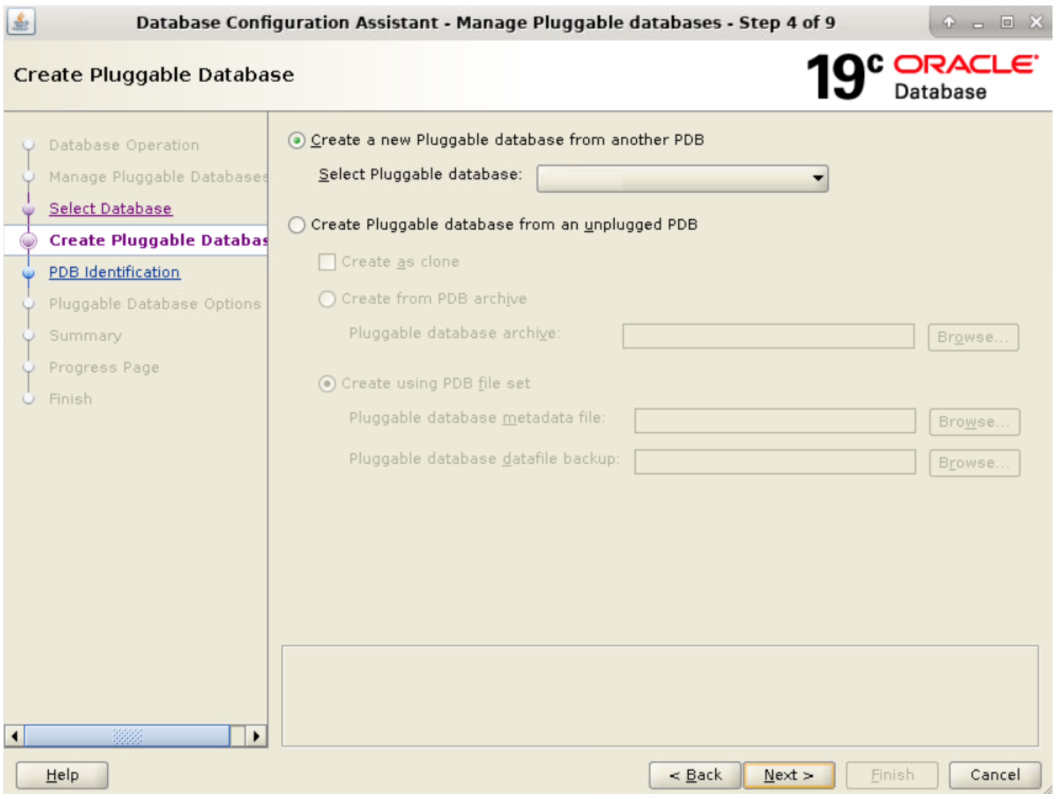
| | Database | Local instance | Type |
|---|---|---|---|
| ○ | fenagodb | fenagodb | Single Instance |
| ○ | CDBTEST | CDBTEST | Single Instance |
| ○ | CDBTEST2 | CDBTEST2 | Single Instance |
| ● | CDBLAB | CDBLAB | Single Instance |

DBCA will connect to the database using OS based authentication. Database credentials may be needed if OS based authentication is disabled. Specify the credentials, if needed.

User name: sys

Password: ••••••

Click **Create a new pluggable database from another PDB**, Choose `PDBLAB1` from dropdown and create `PDBLAB2` and `PDBLAB3` ony by one.


Database Configuration Assistant - Manage Pluggable databases - Step 4 of 9

Create Pluggable Database

19c ORACLE Database

- Database Operation
- Manage Pluggable Databases
- Select Database
- **Create Pluggable Database**
- PDB Identification
- Pluggable Database Options
- Summary
- Progress Page
- Finish

(●) Create a new Pluggable database from another PDB

Select Pluggable database:

( ) Create Pluggable database from an unplugged PDB

[ ] Create as clone

( ) Create from PDB archive

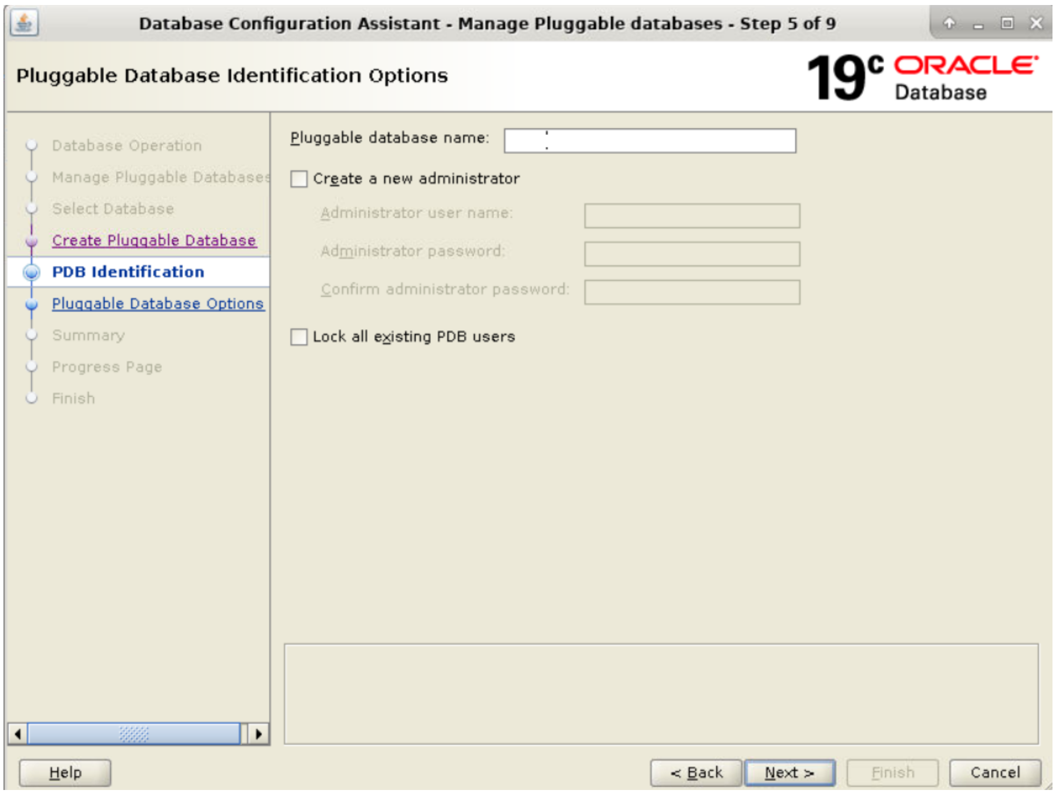
Pluggable database archive: Browse...

(●) Create using PDB file set

Pluggable database metadata file: Browse...

Pluggable database datafile backup: Browse...

Help | < Back | Next > | Finish | Cancel


Database Configuration Assistant - Manage Pluggable databases - Step 5 of 9

Pluggable Database Identification Options

19c ORACLE Database

- Database Operation
- Manage Pluggable Databases
- Select Database
- Create Pluggable Database
- **PDB Identification**
- Pluggable Database Options
- Summary
- Progress Page
- Finish

Pluggable database name:

[ ] Create a new administrator

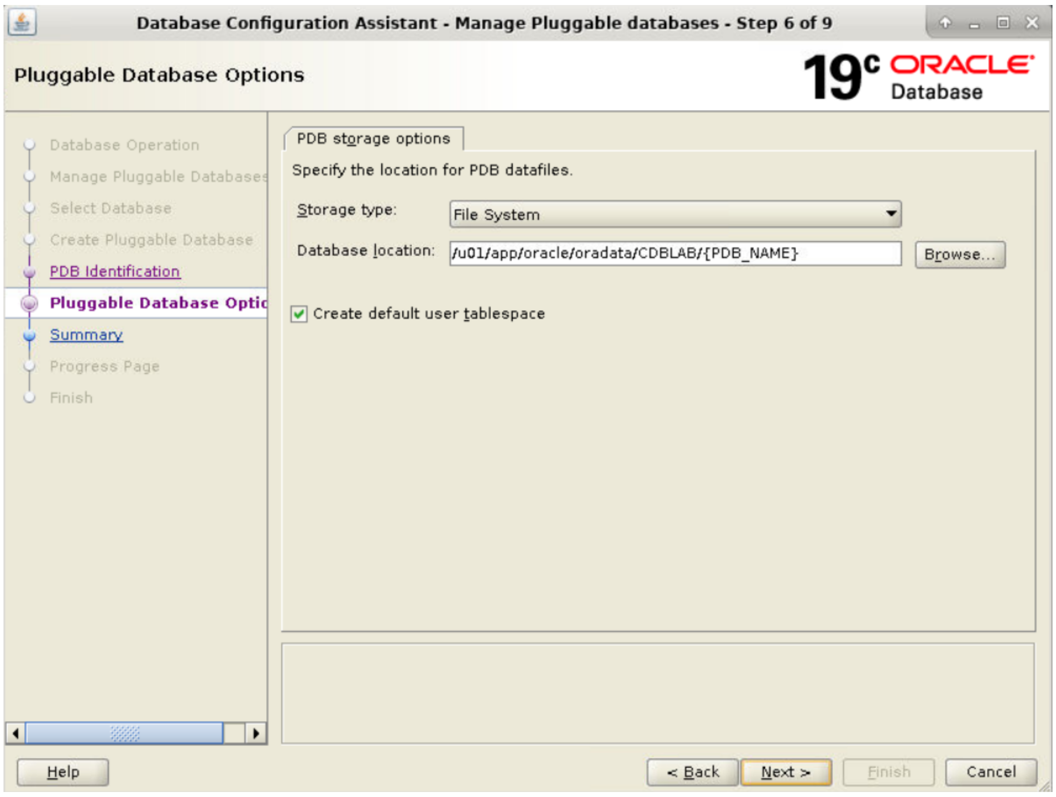
Administrator user name:

Administrator password:

Confirm administrator password:

[ ] Lock all existing PDB users

Help | < Back | Next > | Finish | Cancel



Pluggable Database Options

PDB storage options

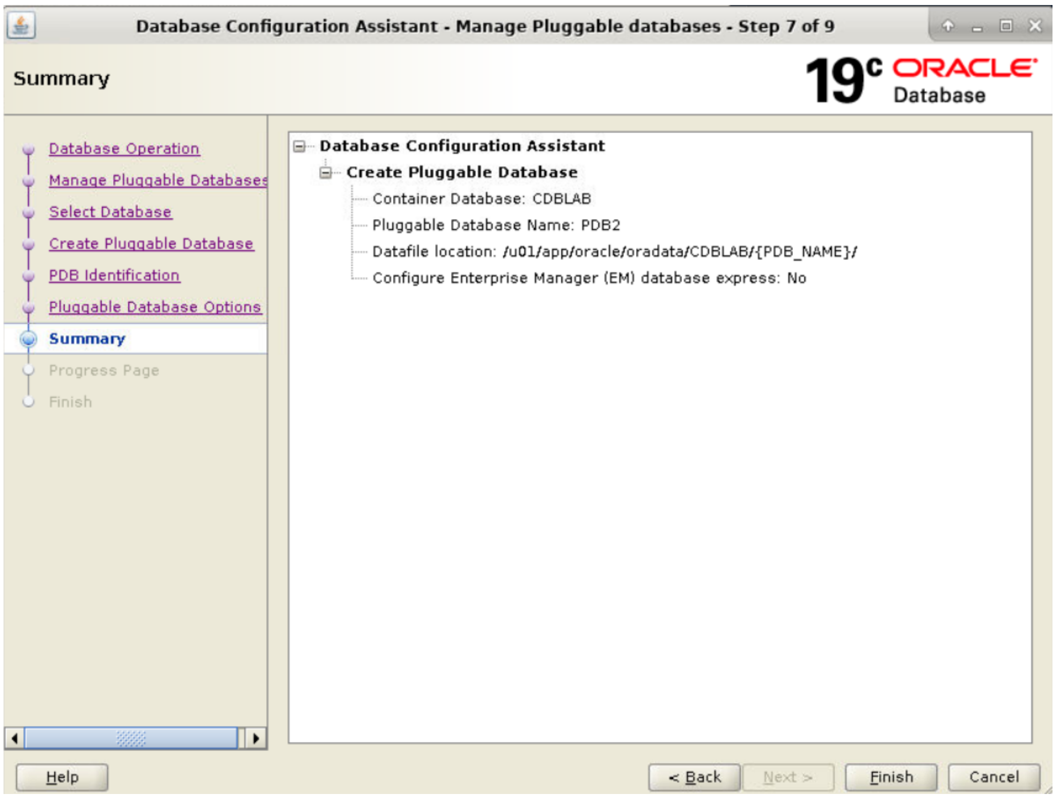
Specify the location for PDB datafiles.

Storage type: File System

Database location: /u01/app/oracle/oradata/CDBLAB/{PDB_NAME}

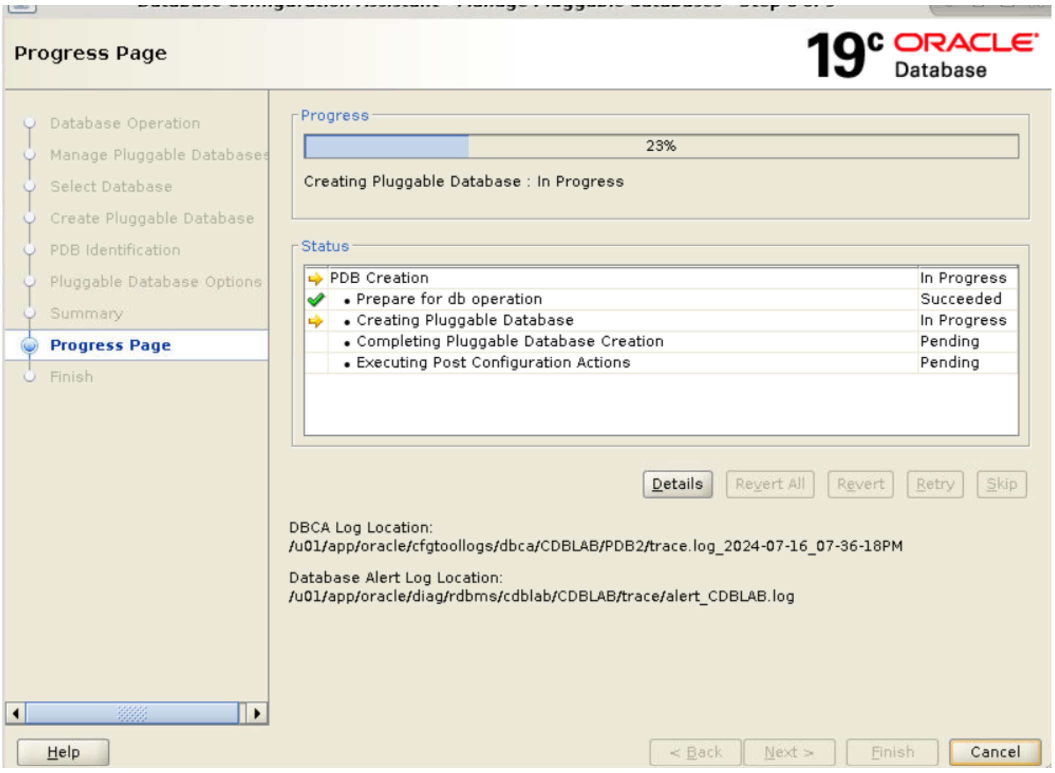
Browse...

✓ Create default user tablespace


Database Configuration Assistant - Manage Pluggable databases - Step 7 of 9
19c ORACLE Database
Database Operation
Manage Pluggable Databases
Select Database
Create Pluggable Database
PDB Identification
Pluggable Database Options
Summary
Progress Page
Finish
Help
< Back
Next >
Finish
Cancel

Summary

```
Database Configuration Assistant
  Create Pluggable Database
    Container Database: CDBLAB
    Pluggable Database Name: PDB2
    Datafile location: /u01/app/oracle/oradata/CDBLAB/{PDB_NAME}/
    Configure Enterprise Manager (EM) database express: No
```



23%

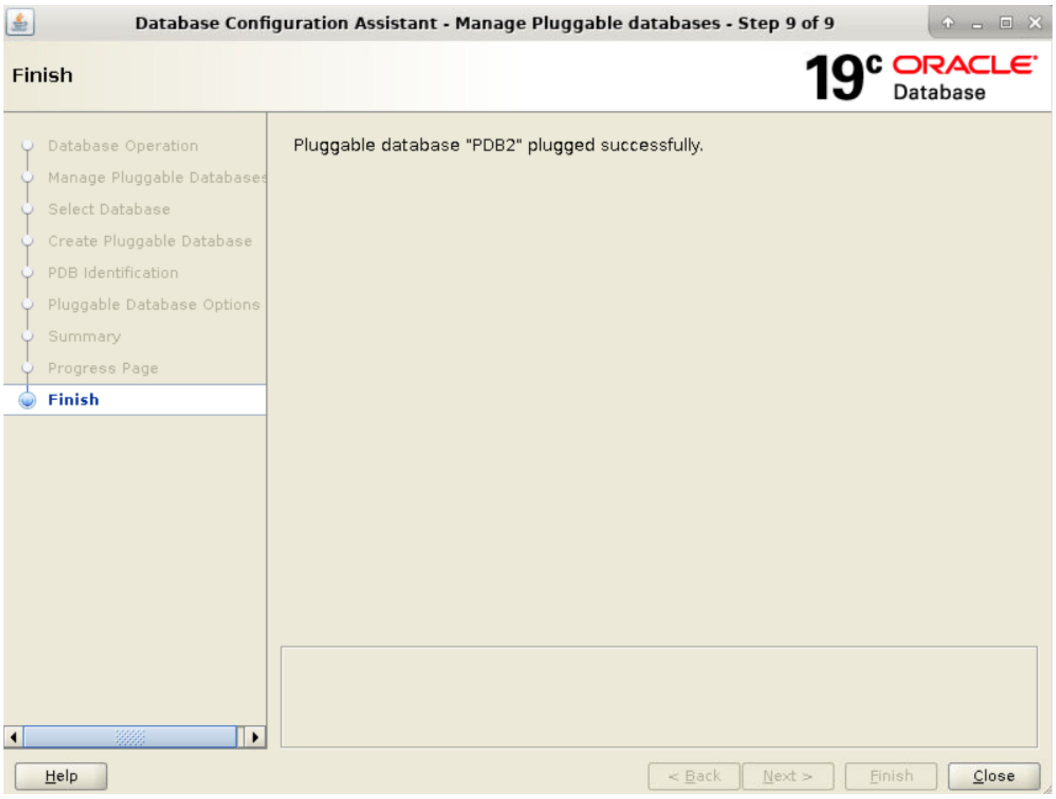
Creating Pluggable Database : In Progress

Status

| | | |
|---|---|---|
| ➡ | PDB Creation | In Progress |
| ✓ | • Prepare for db operation | Succeeded |
| ➡ | • Creating Pluggable Database | In Progress |
| | • Completing Pluggable Database Creation | Pending |
| | • Executing Post Configuration Actions | Pending |

DBCA Log Location:
/u01/app/oracle/cfgtoollogs/dbca/CDBLAB/PDB2/trace.log_2024-07-16_07-36-18PM

Database Alert Log Location:
/u01/app/oracle/diag/rdbms/cdblab/CDBLAB/trace/alert_CDBLAB.log

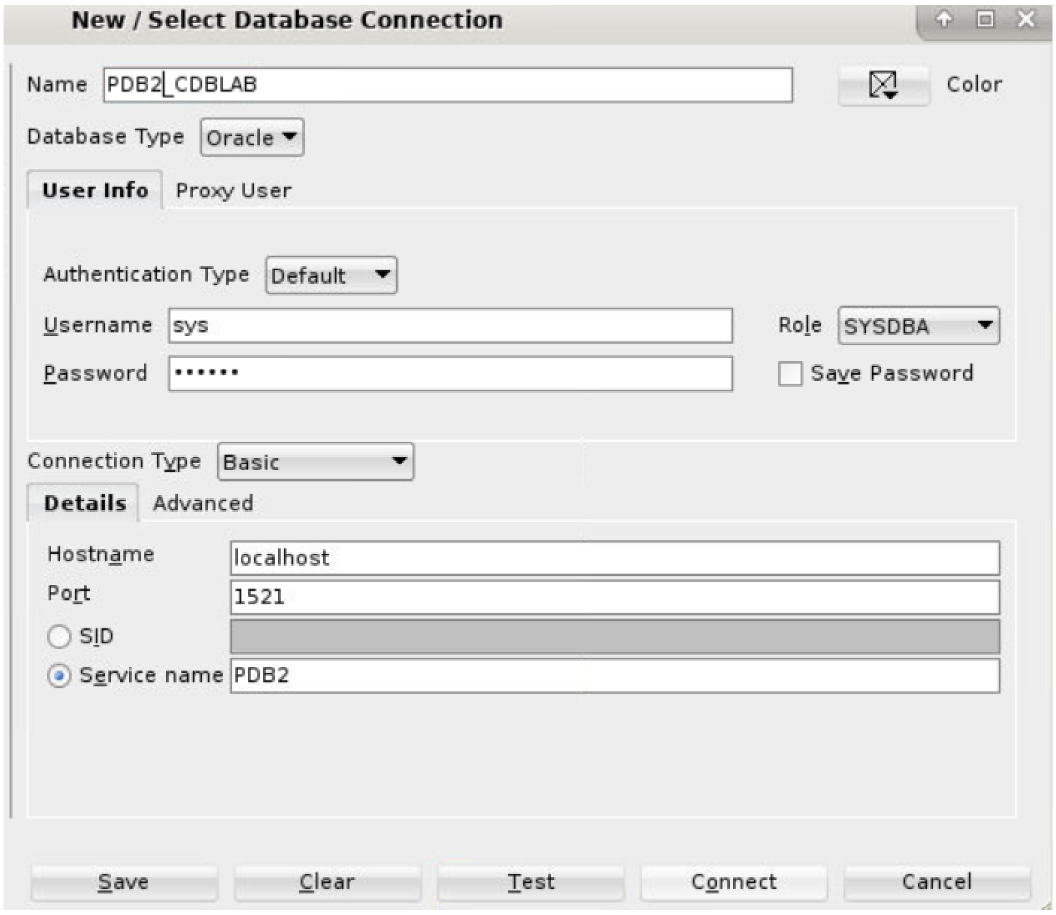


Database Configuration Assistant - Manage Pluggable databases - Step 9 of 9
Finish
19c ORACLE Database
Database Operation
Manage Pluggable Databases
Select Database
Create Pluggable Database
PDB Identification
Pluggable Database Options
Summary
Progress Page
Finish

Pluggable database "PDB2" plugged successfully.

**Connecting to PDBs Using SQL Developer**

1. **Launch SQL Developer**:
   - Locate and double-click the SQL Developer launcher icon on your desktop.
2. **Create new connections for PDB2_CDBLAB and PDB3_CDBLAB**:
   - **File -> New -> Database Connection...**
   - **Connection Name**: PDB2_CDBLAB
   - **Username**: sys
   - **Password**: fenago
   - **Connection Type**: Basic
   - **Role**: SYSDBA
   - **Hostname**: localhost
   - **Port**: 1521
   - **Service Name**: pdblab2



New / Select Database Connection

Name: PDB2_CDBLAB
Database Type: Oracle
Authentication Type: Default
Username: sys
Role: SYSDBA
Password: ••••••
[ ] Save Password
Connection Type: Basic
Hostname: localhost
Port: 1521
( ) SID
(●) Service name: PDB2

Repeat the same steps for PDB3_CDBLAB:

- **Connection Name**: PDB3_CDBLAB
- **Username**: sys
- **Password**: fenago
- **Connection Type**: Basic
- **Role**: SYSDBA
- **Hostname**: localhost
- **Port**: 1521
- **Service Name**: pdblab3

3. **Test and Save the Connections**:
    - Click the **Test** button to verify the connection details.
    - Click the **Save** button to save the connection.
    - Click the **Connect** button to establish the connection to PDB1 and PDB2.

**Manage PDBs in SQL Developer**

- **Explore the PDBs**:
    - In the **Connections** pane, expand `PDB1_CDBLAB` and `PDB2_CDBLAB` to explore tables, views, and other database objects.

4. **Verify the CDB and PDBs Creation**

   Connect to the CDB and verify the creation of the PDBs:

   ```
   sqlplus / as sysdba
   SELECT con_id, name, open_mode FROM v$pdbs;
   ```

5. **Start and Stop the CDB and PDBs**

   **Shutdown the CDB:**

   ```
   SHUTDOWN IMMEDIATE;
   ```

   **Startup the CDB in NOMOUNT Mode:**

   ```
   STARTUP NOMOUNT;
   ```

   **Mount the CDB:**

   ```
   ALTER DATABASE MOUNT;
   ```

   **Open the CDB:**

   ```
   ALTER DATABASE OPEN;
   ```

   **Open All PDBs:**

   ```
   ALTER PLUGGABLE DATABASE ALL OPEN;
   ```

   Verify the status of the PDBs:

   ```
   SELECT con_id, name, open_mode FROM v$pdbs;
   ```

6. **Set the PDB Save States**

   Save the state of the PDBs so they open automatically on CDB startup:

   ```
   ALTER PLUGGABLE DATABASE ALL SAVE STATE;
   ```

7. **Check the PDB Save States**

   Verify the saved states:

   ```
   SELECT con_id, con_name, state FROM DBA_PDB_SAVED_STATES;
   ```

8. **Stop the CDB**

   Shut down the CDB:

   ```
   SHUTDOWN IMMEDIATE;
   ```

9. **Start the CDB and Verify PDB States**

   Start the CDB and verify the PDB states:

   ```
   STARTUP;
   SELECT con_id, name, open_mode FROM v$pdbs;
   ```

10. **Ensure All PDBs Are Running**

    Ensure all PDBs are open:

    ```
    ALTER PLUGGABLE DATABASE ALL OPEN;
    SELECT con_id, name, open_mode FROM v$pdbs;
    ```

11. **Exit SQL*Plus**

    Exit SQL*Plus:

    ```
    EXIT;
    ```

12. **Start the Listener**

    Start the Oracle listener:

    ```
    lsnrctl start
    ```

## Summary

By following these steps, you will successfully identify and stop all running databases and listeners, create a new CDB named `CDBLAB` with three PDBs, and ensure that all databases are running at the end of the practice. This practice helps in understanding the complete lifecycle management of Oracle databases using DBCA and SQL*Plus commands.

## Addendum: Verifying Created Files and Running Processes

**Objective:**

To verify all the files created for the new CDB ( `CDBLAB` ) and its three PDBs ( `PDBLAB1` , `PDBLAB2` , `PDBLAB3` ), and to find the processes that are running for all of them.

**Steps:**

1. **Open a New Terminal**

   Open a new terminal window.

2. **Verify Files Created for CDB and PDBs**

   Navigate to the Oracle datafile destination directory:

```
cd /u01/app/oracle/oradata/CDBLAB
ls -l
```

**Expected Files in `CDBLAB` Directory:**

- **Control Files:** `control01.ctl`, `control02.ctl`
- **Redo Log Files:** `redo01.log`, `redo02.log`, `redo03.log`
- **System Data Files:** `system01.dbf`, `sysaux01.dbf`
- **Temporary Tablespace:** `temp01.dbf`
- **Undo Tablespace:** `undotbs01.dbf`
- **PDB Seed Files:** `pdbseed/system01.dbf`, `pdbseed/sysaux01.dbf`

**Explanation:**

- **Control Files:** Essential for database startup, containing metadata about the database structure.
- **Redo Log Files:** Used for recovery purposes, storing all changes made to the database.
- **System Data Files:** Contain the core data dictionary and system information.
- **Temporary Tablespace:** Used for temporary storage of data during SQL operations.
- **Undo Tablespace:** Stores undo information for transactions.
- **PDB Seed Files:** Template files for creating new PDBs.

3. **Verify Files for Each PDB**

   Navigate to each PDB's directory and list the files:

   For `PDBLAB1`:

   ```
   cd /u01/app/oracle/oradata/CDBLAB/PDBLAB1
   ls -l
   ```

   For `PDBLAB2`:

   ```
   cd /u01/app/oracle/oradata/CDBLAB/PDBLAB2
   ls -l
   ```

   For `PDBLAB3`:

   ```
   cd /u01/app/oracle/oradata/CDBLAB/PDBLAB3
   ls -l
   ```

   **Expected Files in Each PDB Directory:**

   - **System Data File:** `system01.dbf`
   - **Sysaux Data File:** `sysaux01.dbf`
   - **Temporary Tablespace:** `temp01.dbf`
   - **Users Tablespace:** `users01.dbf`

   **Explanation:**

   - **System Data File:** Contains the core data dictionary and system information for the PDB.
   - **Sysaux Data File:** Auxiliary data for the PDB.
   - **Temporary Tablespace:** Temporary storage for SQL operations within the PDB.
   - **Users Tablespace:** Default tablespace for user data within the PDB.

4. **Find Running Processes for the CDB and PDBs**

Identify all running processes for the CDB and PDBs using the `pgrep` command:

```
pgrep -lf smon
```

**Expected Output:**

- You should see entries like `ora_smon_CDBLAB`, `ora_smon_PDB1`, `ora_smon_PDB2`, and `ora_smon_PDB3`.

**Explanation:**

- **SMON Process:** System Monitor process for each database, responsible for instance recovery, cleaning up temporary segments, and other tasks.

Check the listener process:

```
pgrep -lf tns
```

**Expected Output:**

- You should see an entry like `tnslsnr LISTENER`.

**Explanation:**

- **Listener Process:** Manages incoming client connections to the Oracle database.

5. **Detailed Process Information**

For more detailed information about each process, use the `ps` command:

```
ps -ef | grep smon
```

**Explanation:**

- This command provides detailed information about the `smon` processes, including the user running them, start time, and more.

6. **Checking Database Status in SQL*Plus**

Connect to SQL*Plus to check the status of the CDB and PDBs:

```
sqlplus / as sysdba
```

**Check the Status of the PDBs:**

```sql
SELECT con_id, name, open_mode FROM v$pdbs;
```

**Expected Output:**

- You should see the following:

```
CON_ID    NAME      OPEN_MODE
-------   -------   ----------
2         PDB$SEED  READ ONLY
3         PDBLAB1      READ WRITE
4         PDBLAB2      READ WRITE
5         PDBLAB3      READ WRITE
```

**Explanation:**

- **PDB$SEED:** Template for creating new PDBs, should be in READ ONLY mode.
- **PDBLAB1, PDBLAB2, PDBLAB3:** User-defined PDBs, should be in READ WRITE mode.

## Summary

By following these detailed steps, you will verify the files created for the new CDB and its PDBs and identify the running processes associated with them. This addendum ensures a thorough understanding of the Oracle database's file structure and process management.

## Summary: Important Files and Scripts for Managing `CDBLAB` and PDBs

### Oracle Home Directory Structure

The Oracle Home directory structure is as follows:

```
/u01/app/oracle/product/19.3.0/
└── dbhome_1/
    ├── bin/
    ├── config/
    ├── dbs/
    ├── include/
    ├── inventory/
    ├── javavm/
    ├── jdbc/
    ├── jlib/
    ├── lib/
    ├── network/
    ├── OPatch/
    ├── oracore/
    ├── perl/
    ├── plsql/
    ├── precomp/
    ├── racg/
    ├── rdbms/
    ├── relnotes/
    ├── slax/
    ├── sqlplus/
    ├── srvm/
    ├── suptools/
    ├── uc4/
    ├── ucp/
    └── xdk/
```

### Important Directories and Files

1. **bin/**:
   - **Location**: `/u01/app/oracle/product/19.3.0/dbhome_1/bin/`
   - **Description**: Contains executable files for Oracle utilities and commands.
   - **Important Files**:
     - `sqlplus` : Command-line tool to connect to the Oracle database.
     - `lsnrctl` : Listener control utility.

        - `dbca` : Database Configuration Assistant.

2. **dbs/**:
    - **Location**: `/u01/app/oracle/product/19.3.0/dbhome_1/dbs/`
    - **Description**: Contains database initialization parameter files and password files.
    - **Important Files**:
        - `initCDBLAB.ora` : Initialization parameter file for `CDBLAB` .
        - `spfileCDBLAB.ora` : Server parameter file for `CDBLAB` .

3. **network/admin/**:
    - **Location**: `/u01/app/oracle/product/19.3.0/dbhome_1/network/admin/`
    - **Description**: Contains network configuration files.
    - **Important Files**:
        - `listener.ora` : Configuration file for Oracle Net Listener.
        - `tnsnames.ora` : Network service names configuration file.
        - `sqlnet.ora` : Oracle Net Services configuration file.

4. **rdbms/admin/**:
    - **Location**: `/u01/app/oracle/product/19.3.0/dbhome_1/rdbms/admin/`
    - **Description**: Contains SQL scripts for database creation, management, and maintenance.
    - **Important Files**:
        - `catalog.sql` : Script to create the Data Dictionary.
        - `catproc.sql` : Script to compile and install the PL/SQL packages.

5. **OPatch/**:
    - **Location**: `/u01/app/oracle/product/19.3.0/dbhome_1/OPatch/`
    - **Description**: Contains the OPatch utility for applying patches to the Oracle software.
    - **Important Files**:
        - `opatch` : OPatch executable file.

#### Datafile Locations

1. **CDBLAB Datafiles**:
    - **Location**: `/u01/app/oracle/oradata/CDBLAB/`
    - **Description**: Contains datafiles, control files, and redo log files for the `CDBLAB` .
    - **Important Files**:
        - `control01.ctl` , `control02.ctl` : Control files.
        - `redo01.log` , `redo02.log` , `redo03.log` : Redo log files.
        - `system01.dbf` : System datafile.
        - `sysaux01.dbf` : SYSAUX tablespace datafile.
        - `temp01.dbf` : Temporary tablespace datafile.
        - `undotbs01.dbf` : Undo tablespace datafile.

2. **PDB Datafiles**:
    - **Locations**:
        - `/u01/app/oracle/oradata/CDBLAB/PDBLAB1/`
        - `/u01/app/oracle/oradata/CDBLAB/PDBLAB2/`

        - `/u01/app/oracle/oradata/CDBLAB/PDBLAB3/`
    - **Description**: Contains datafiles for each PDB.
    - **Important Files**:
        - `system01.dbf` : System datafile for each PDB.
        - `sysaux01.dbf` : SYSAUX tablespace datafile for each PDB.
        - `temp01.dbf` : Temporary tablespace datafile for each PDB.
        - `users01.dbf` : Users tablespace datafile for each PDB.

**Verification and Management Scripts**

1. **Verify Database Status**:
    - **Command**: `SELECT con_id, name, open_mode FROM v$pdbs;`
    - **Description**: Checks the status of all PDBs within the CDB.
2. **Shutdown and Startup Commands**:
    - **Shutdown**:

      ```
      SHUTDOWN IMMEDIATE;
      ```

    - **Startup**:

      ```
      STARTUP;
      ```

3. **Managing PDBs**:
    - **Open a PDB**:

      ```
      ALTER PLUGGABLE DATABASE PDBLAB1 OPEN;
      ```

    - **Close a PDB**:

      ```
      ALTER PLUGGABLE DATABASE PDBLAB1 CLOSE IMMEDIATE;
      ```

## Summary

This summary highlights the key directories and files necessary for managing the `CDBLAB` and its PDBs. Understanding the location and purpose of these files and directories is crucial for effective database administration and maintenance.

## Addendum: Shutting Down and Restarting a Single PDB

**Objective:**

To provide detailed steps for shutting down and restarting a single Pluggable Database (PDB) within a Container Database (CDB).

**Steps:**

1. **Set Oracle Environment Variables**

   Set the Oracle environment variables using the `oraenv` script:

```
. oraenv
ORACLE_SID = [oracle] ? CDBLAB
```

2. **Connect to SQL*Plus as SYSDBA**

   Start SQL*Plus and log in to the database as the SYS user with the SYSDBA privilege:

   ```
   sqlplus / as sysdba
   ```

3. **Check the Status of the PDBs**

   Before shutting down a PDB, check the current status of all PDBs:

   ```
   SELECT con_id, name, open_mode FROM v$pdbs;
   ```

   **Expected Output:**

   ```
   CON_ID    NAME       OPEN_MODE
   -------   -------    ----------
   2         PDB$SEED   READ ONLY
   3         PDBLAB1       READ WRITE
   4         PDBLAB2       READ WRITE
   5         PDBLAB3       READ WRITE
   ```

4. **Switch to the PDB**

   Switch to the PDB you want to shut down. For example, to switch to `PDBLAB1` :

   ```
   ALTER SESSION SET CONTAINER = PDBLAB1;
   ```

5. **Shutdown the PDB**

   Shut down the PDB using the `CLOSE` command:

   ```
   ALTER PLUGGABLE DATABASE CLOSE IMMEDIATE;
   ```

   **Verify the PDB Status:**

   ```
   SELECT name, open_mode FROM v$pdbs WHERE name = 'PDBLAB1';
   ```

   **Expected Output:**

   ```
   NAME    OPEN_MODE
   ------  ----------
   PDBLAB1    MOUNTED
   ```

   **Explanation:**

   - The PDB `PDBLAB1` should now be in the MOUNTED state, indicating it is closed but not completely shut down.

6. **Restart the PDB**

   To restart the PDB, open it:

   ```
   ALTER PLUGGABLE DATABASE OPEN;
   ```

**Verify the PDB Status:**

```
SELECT name, open_mode FROM v$pdbs WHERE name = 'PDBLAB1';
```

**Expected Output:**

```
NAME     OPEN_MODE
------   ----------
PDBLAB1     READ WRITE
```

**Explanation:**

- The PDB `PDBLAB1` should now be in the READ WRITE state, indicating it is fully operational.

7. **Return to the Root Container**

   After managing the PDB, return to the root container ( `CDB$ROOT` ):

   ```
   ALTER SESSION SET CONTAINER = CDB$ROOT;
   ```

8. **Exit SQL*Plus**

   Exit SQL*Plus:

   ```
   EXIT;
   ```

**Summary**

## By following these steps, you can effectively shut down and restart a single PDB within a CDB. This procedure is essential for performing maintenance tasks or managing specific PDBs without affecting the entire CDB.

```
SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = pdblab2)
      (SID_NAME = PDBLAB2)
      (ORACLE_HOME = /u01/app/oracle/product/19.3.0/dbhome_1)
    )
    (SID_DESC =
      (GLOBAL_DBNAME = pdblab3)
      (SID_NAME = PDBLAB3)
      (ORACLE_HOME = /u01/app/oracle/product/19.3.0/dbhome_1)
    )
  )
```

this

```
PDBLAB2 =
  (DESCRIPTION =
```

```
    (ADDRESS = (PROTOCOL = TCP)(HOST = localhost)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = pdblab2)
    )
  )

PDBLAB3 =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = localhost)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = pdblab3)
    )
  )
```