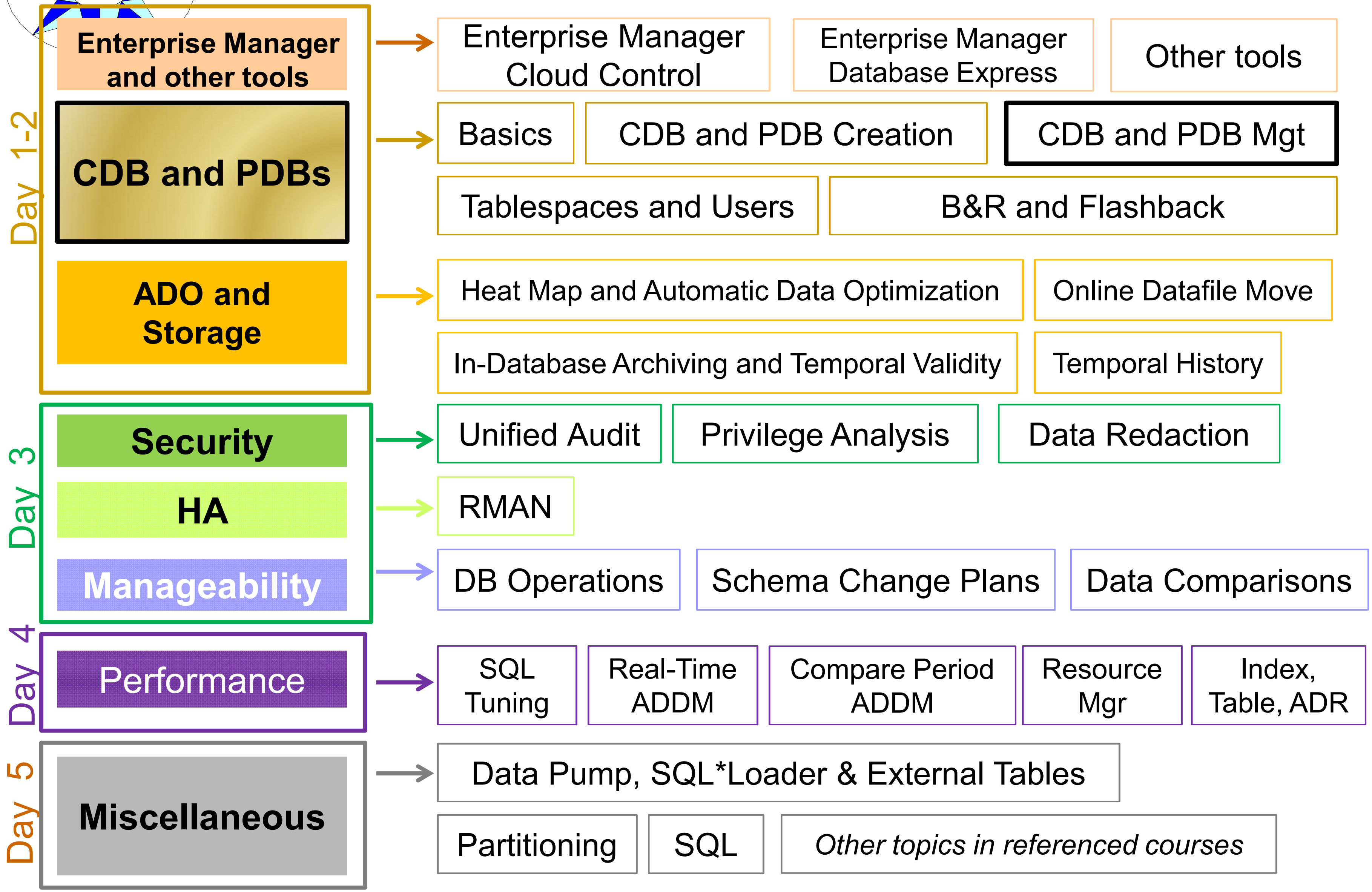
3

Managing Multitenant Container Databases and Pluggable Databases

Oracle Database 12*c* New and Enhanced Features



Day 1-2

Enterprise Manager and other tools

Enterprise Manager Cloud Control

Enterprise Manager Database Express

Other tools

CDB and PDBs

Basics

CDB and PDB Creation

CDB and PDB Mgt

Tablespaces and Users

B&R and Flashback

ADO and Storage

Heat Map and Automatic Data Optimization

Online Datafile Move

In-Database Archiving and Temporal Validity

Temporal History

Day 3

Security

Unified Audit

Privilege Analysis

Data Redaction

HA

RMAN

Manageability

DB Operations

Schema Change Plans

Data Comparisons

Day 4

Performance

SQL Tuning

Real-Time ADDM

Compare Period ADDM

Resource Mgr

Index, Table, ADR

Day 5

Miscellaneous

Data Pump, SQL*Loader & External Tables

Partitioning

SQL

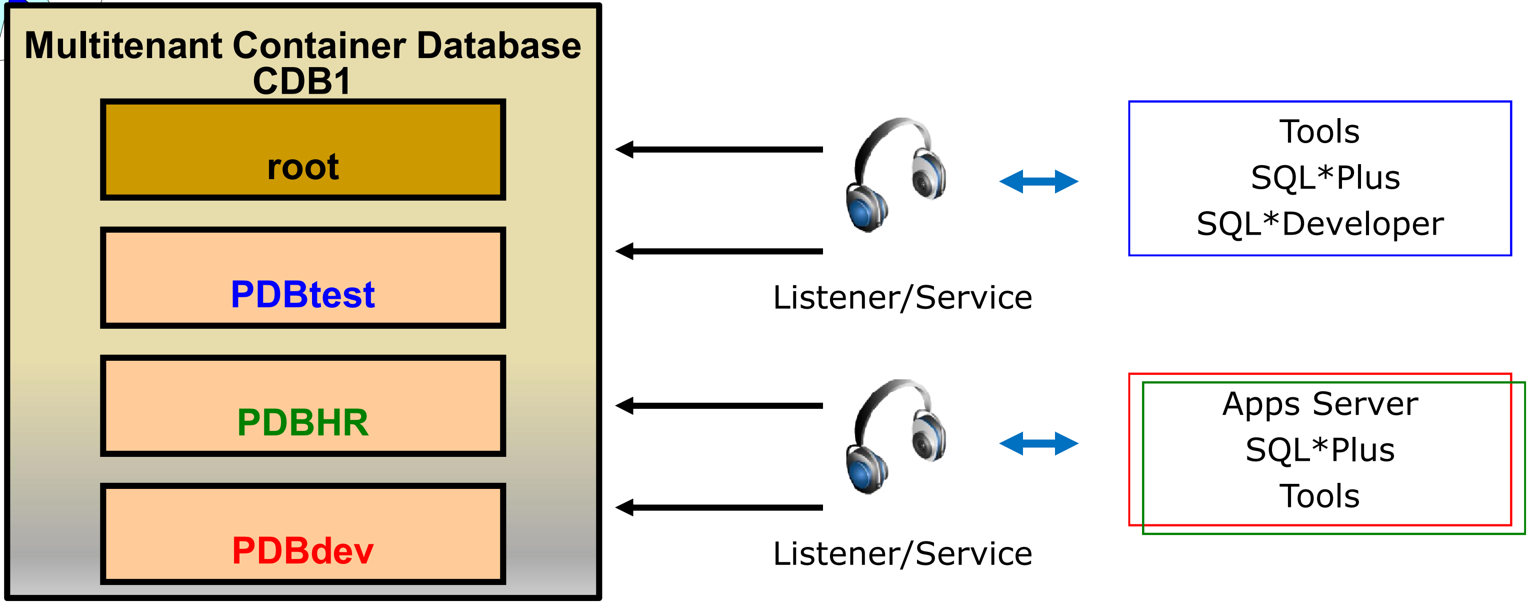
Other topics in referenced courses

Objectives

After completing this lesson, you should be able to:

- Establish connections to CDB / PDB
- Start up and shut down a CDB
- Open and close PDBs
- Create event triggers to open PDBs
- Change the different modes and settings of PDBs
- Evaluate the impact of parameter value changes

Connection



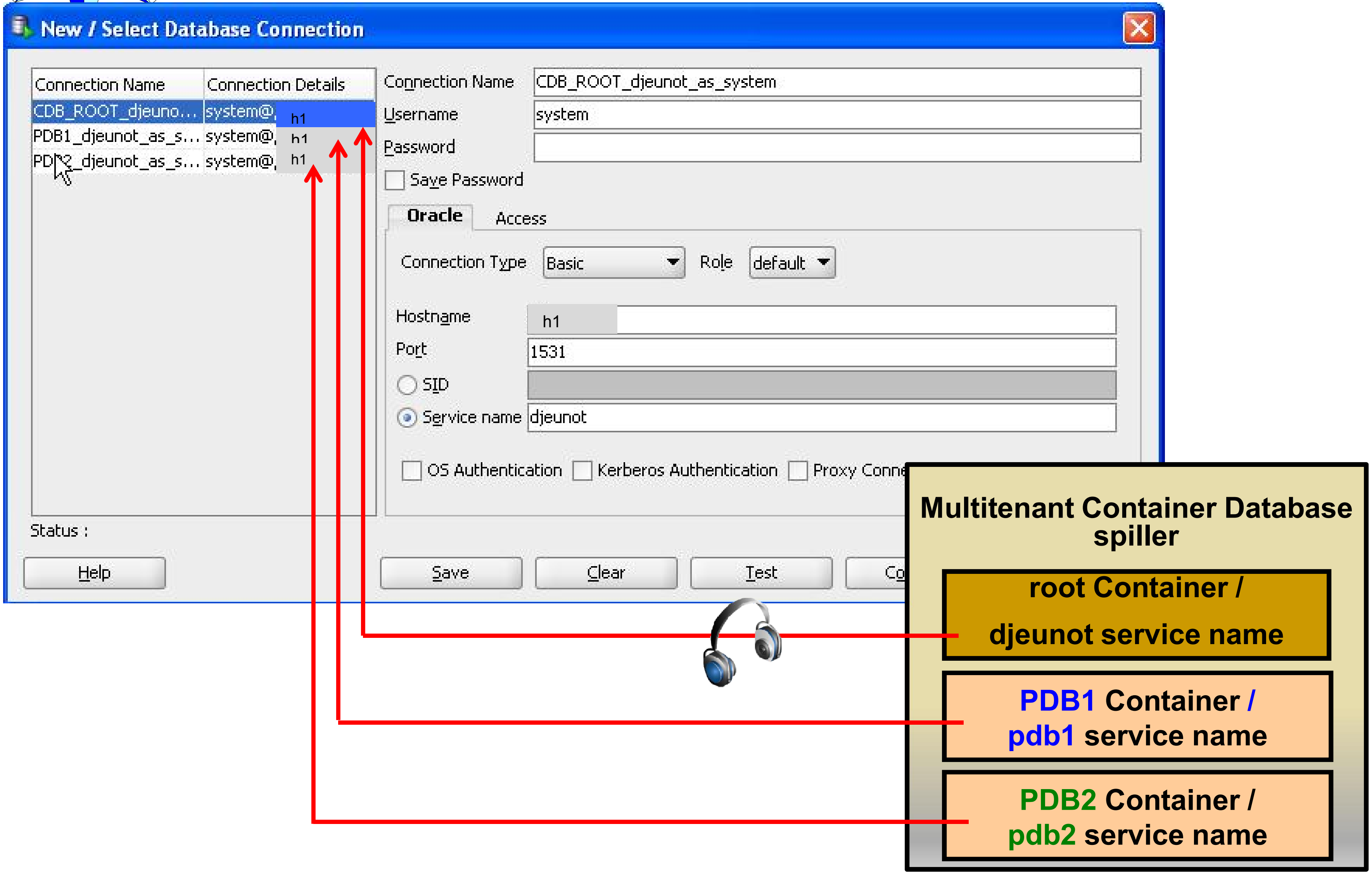
- Every PDB has a default service.

```
SQL> SELECT name, pdb FROM cdb_services;
```

- Service name has to be unique across CDBs.

```
SQL> CONNECT / AS SYSDBA
SQL> CONNECT sys@PDBtest AS SYSDBA
SQL> CONNECT local_user1@hostname1:1525/PDBHR
SQL> CONNECT common_user2@PDBdev
SQL> SHOW CON_NAME
```

Connection with SQL*Developer



New / Select Database Connection

Connection Name	Connection Details
CDB_ROOT_djeuno…	system@ h1
PDB1_djeunot_as_s…	system@ h1
PDB2_djeunot_as_s…	system@ h1

Connection Name: CDB_ROOT_djeunot_as_system

Username: system

Password:

□ Save Password

Oracle | Access

Connection Type: Basic ▼ Role: default ▼

Hostname: h1

Port: 1531

○ SID

● Service name: djeunot

□ OS Authentication □ Kerberos Authentication □ Proxy Conne

Status :

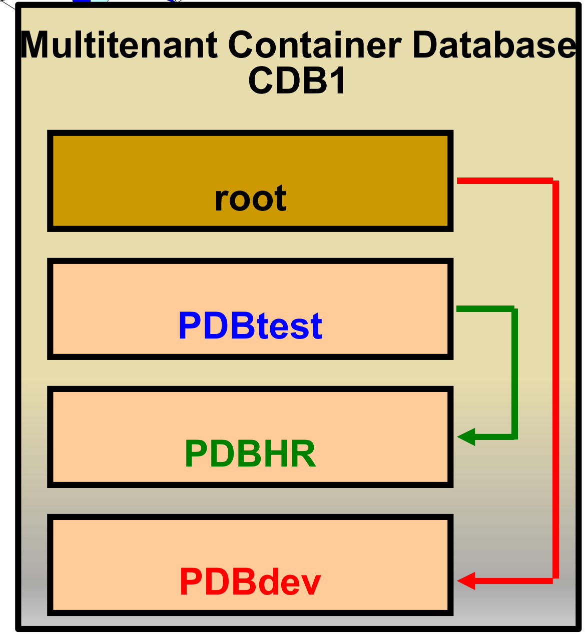
Multitenant Container Database spiller

root Container / djeunot service name

PDB1 Container / pdb1 service name

PDB2 Container / pdb2 service name

Switching Connections



Two possible ways to switch connection between containers within a CDB:

- Reconnect:

```
SQL> CONNECT / AS SYSDBA
SQL> CONNECT local_user1@PDBdev
```

- Use `ALTER SESSION` statement:

```
SQL> CONNECT sys@PDBtest AS SYSDBA
SQL> ALTER SESSION SET CONTAINER=PDBHR;
SQL> SHOW CON_NAME
SQL> ALTER SESSION SET CONTAINER=CDB$ROOT;
```

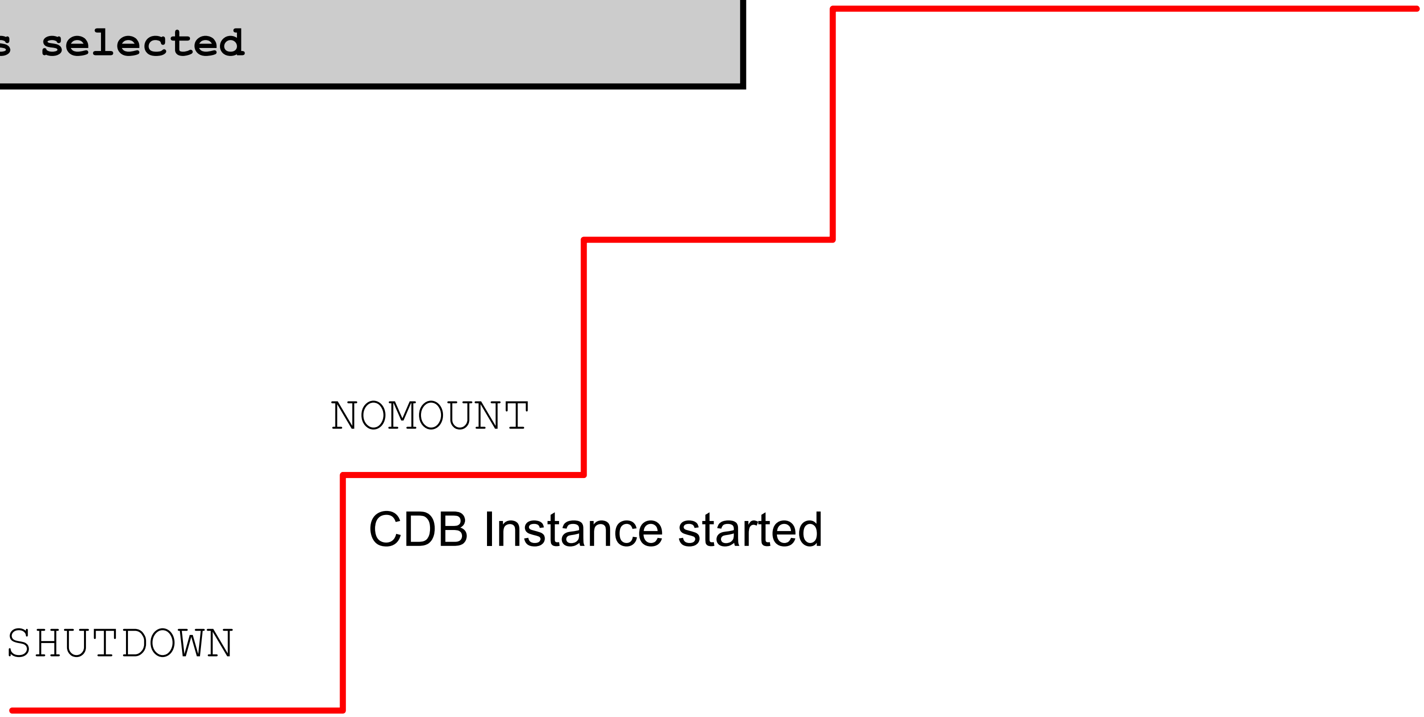
- Using `CONNECT` allows connection under common or local user.
- Using `ALTER SESSION SET CONTAINER` allows connection under common user only granted new system privilege `SET CONTAINER`.
  - `AFTER LOGON` triggers do not fire.
  - Transactions are still pending after switching containers.

Starting Up a CDB Instance

```
SQL> CONNECT sys@CDB1 AS SYSDBA
SQL> STARTUP NOMOUNT
```

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

no rows selected
```



CDB Instance started

Mounting a CDB

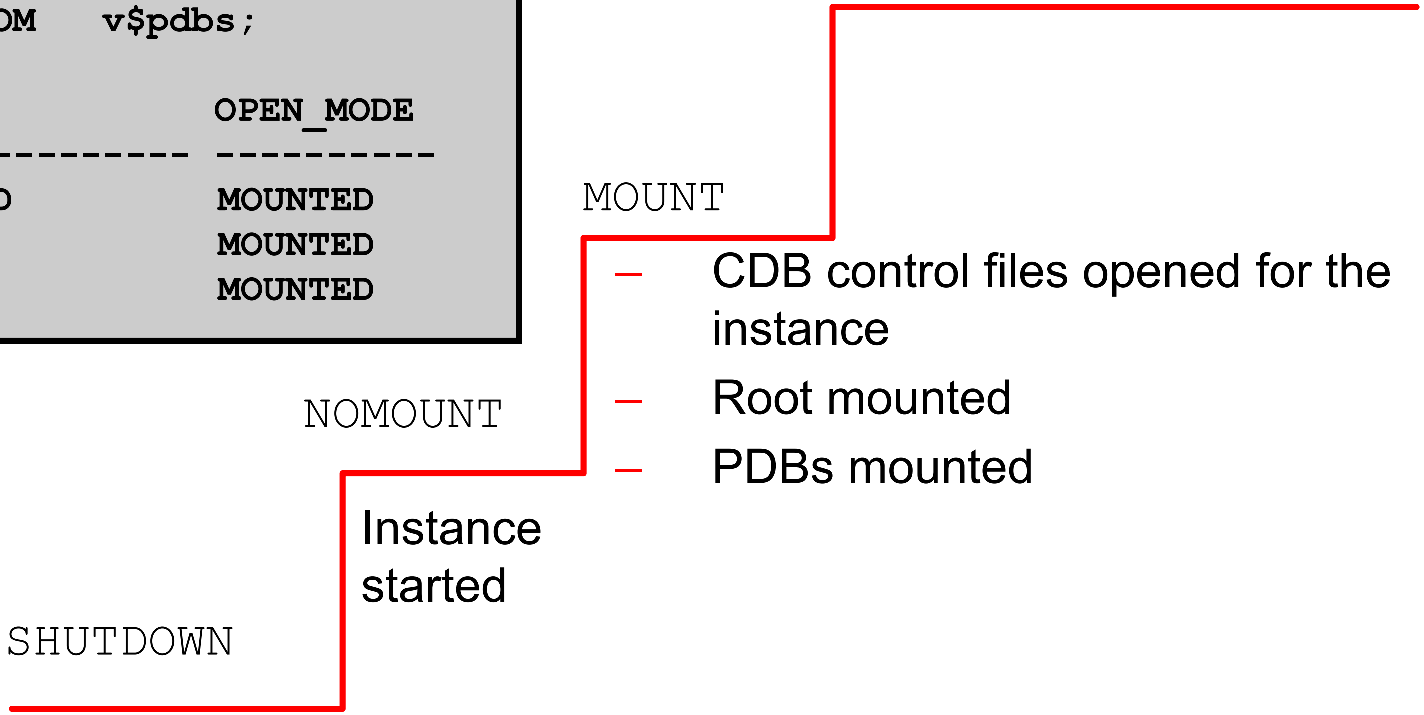
```
SQL> CONNECT sys@CDB1 AS SYSDBA
SQL> STARTUP MOUNT
```

Or

```
SQL> ALTER DATABASE cdb1 MOUNT;
```

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

NAME                OPEN_MODE
----------------   ----------
PDB$SEED            MOUNTED
PDB1                MOUNTED
PDB2                MOUNTED
```



Instance started

- CDB control files opened for the instance
- Root mounted
- PDBs mounted

Opening a CDB

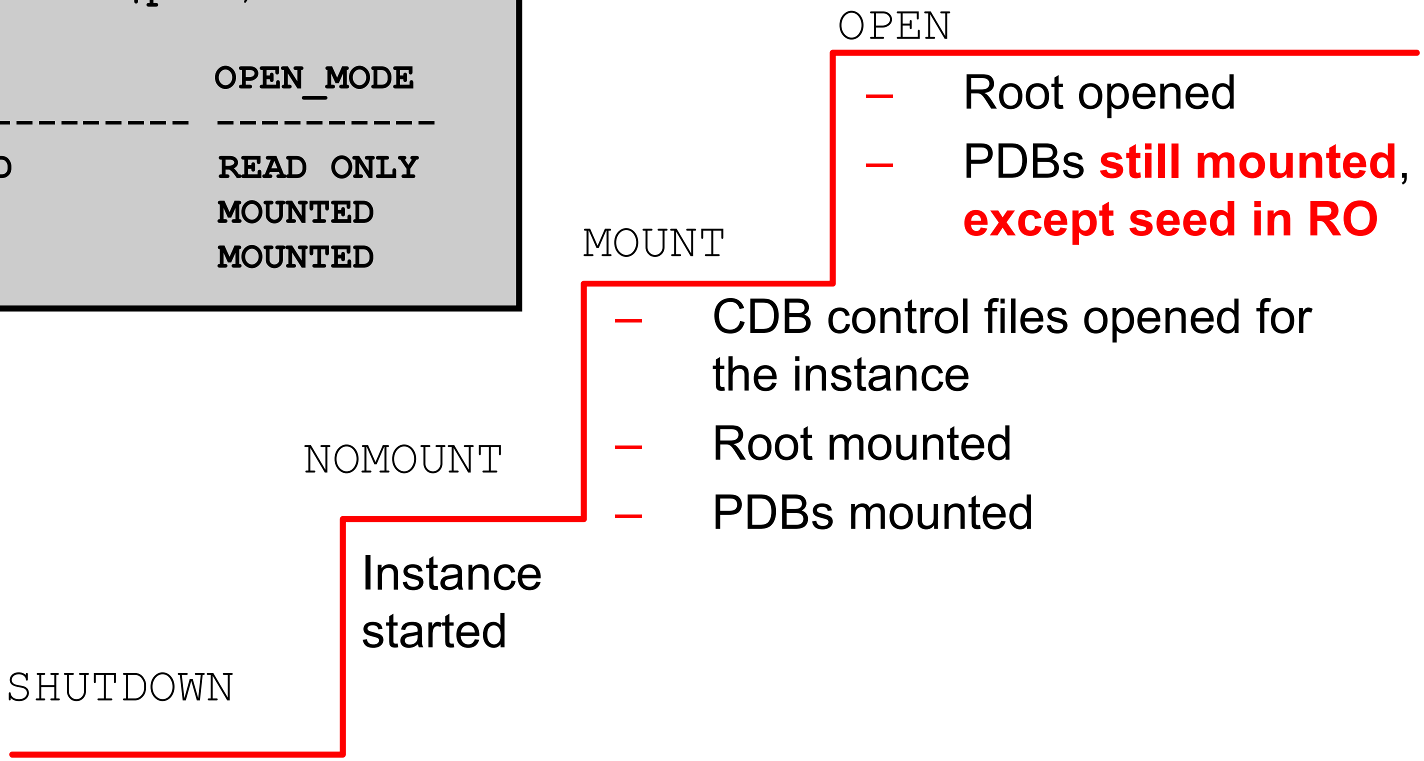
```
SQL> STARTUP
```

Or

```
SQL> ALTER DATABASE cdb1 OPEN;
```

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

NAME                OPEN_MODE
----------------    ----------
PDB$SEED            READ ONLY
PDB1                MOUNTED
PDB2                MOUNTED
```



OPEN

- Root opened
- PDBs **still mounted**, **except seed in RO**

MOUNT

- CDB control files opened for the instance
- Root mounted
- PDBs mounted

NOMOUNT

Instance started

SHUTDOWN

Opening a PDB

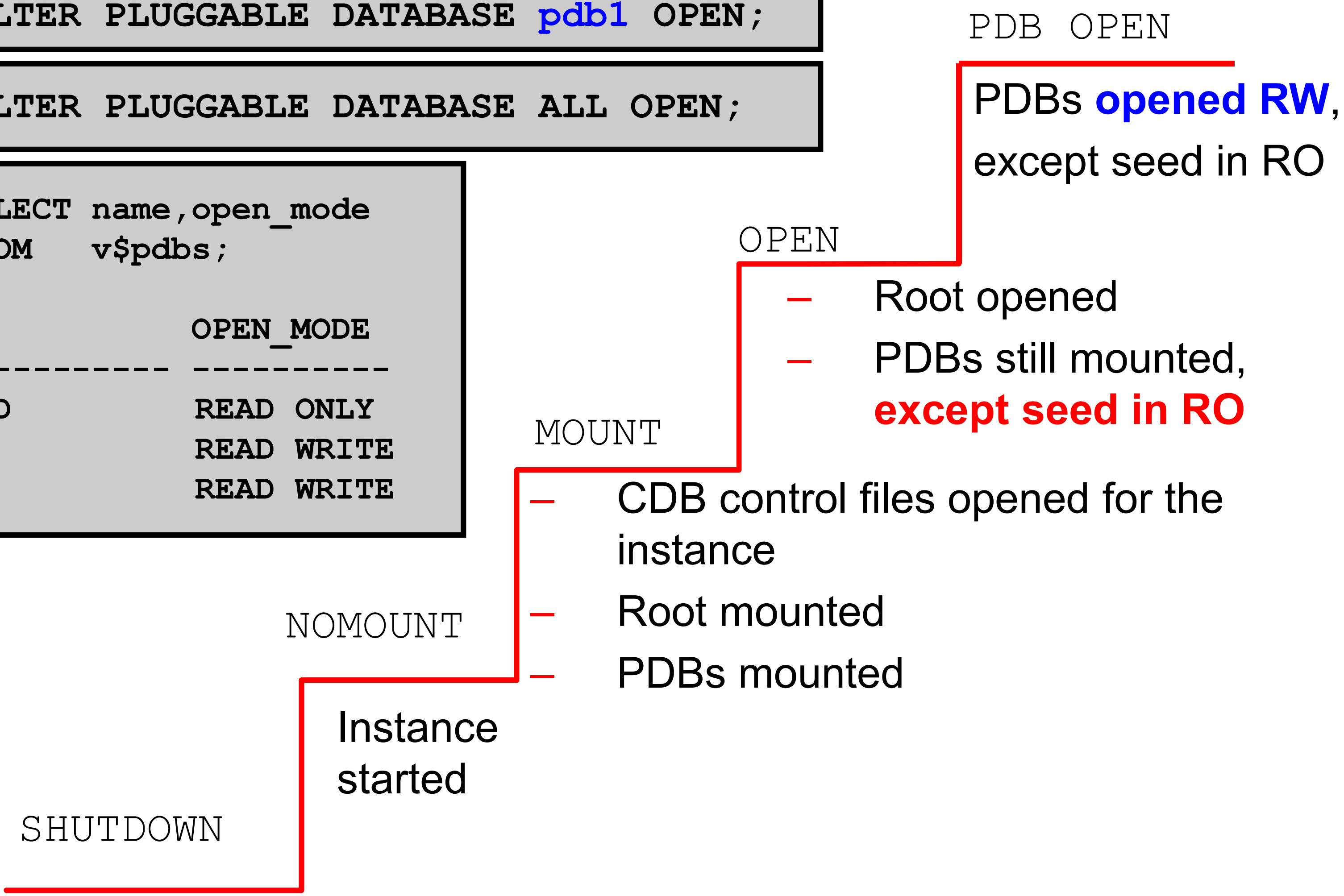
```
SQL> CONNECT sys@CDB1 AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE pdb1 OPEN;
```

Or

```
SQL> ALTER PLUGGABLE DATABASE ALL OPEN;
```

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

NAME                 OPEN_MODE
----------------     ----------
PDB$SEED             READ ONLY
PDB1                 READ WRITE
PDB2                 READ WRITE
```



SHUTDOWN

NOMOUNT

Instance started

MOUNT

- CDB control files opened for the instance
- Root mounted
- PDBs mounted

OPEN

- Root opened
- PDBs still mounted, **except seed in RO**

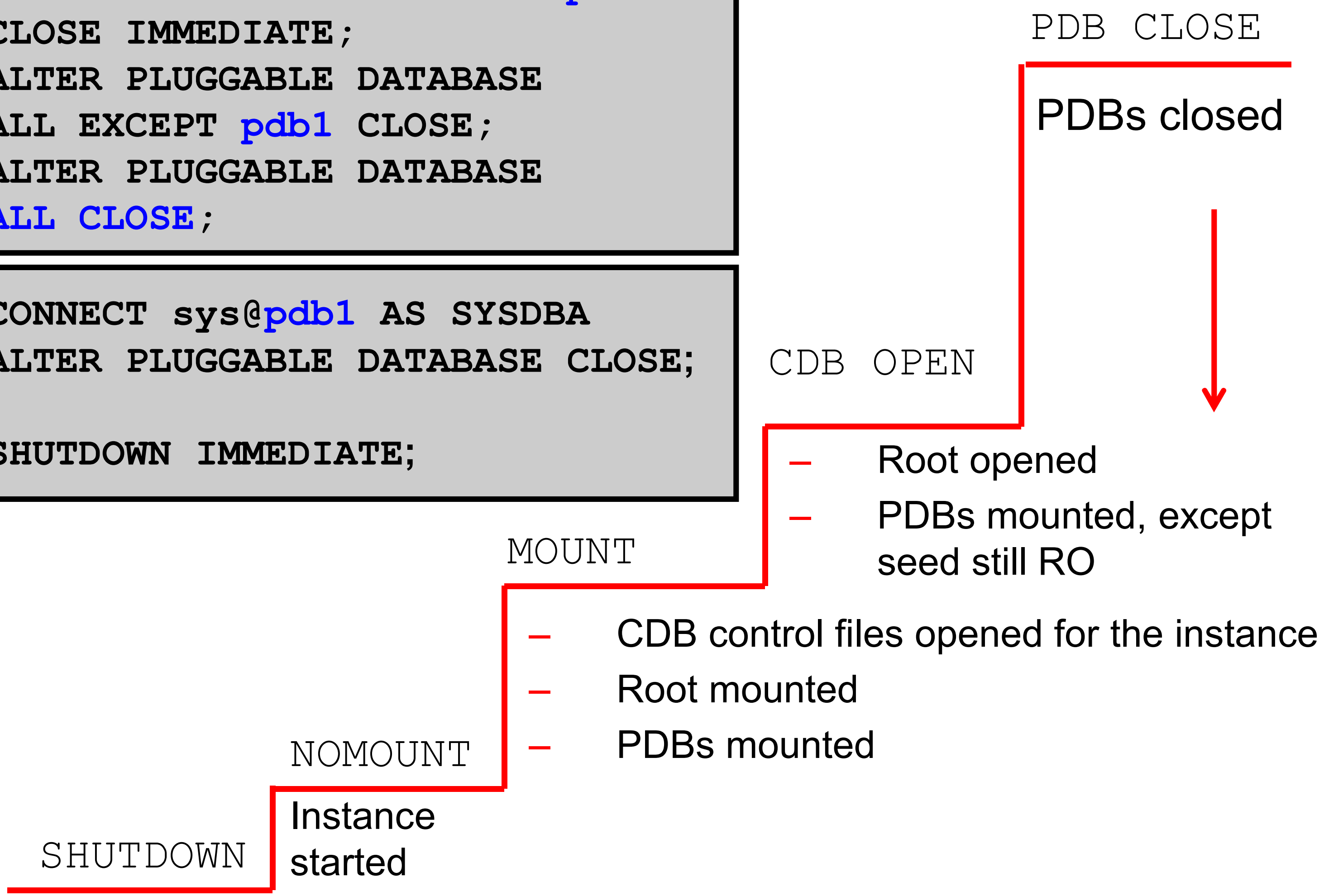
PDB OPEN

PDBs **opened RW**, except seed in RO

Closing a PDB

```
SQL> CONNECT / AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE pdb1
  2  CLOSE IMMEDIATE;
SQL> ALTER PLUGGABLE DATABASE
  2  ALL EXCEPT pdb1 CLOSE;
SQL> ALTER PLUGGABLE DATABASE
  2  ALL CLOSE;
```

```
SQL> CONNECT sys@pdb1 AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE CLOSE;
Or
SQL> SHUTDOWN IMMEDIATE;
```



PDB CLOSE

PDBs closed

CDB OPEN

- Root opened
- PDBs mounted, except seed still RO

MOUNT

- CDB control files opened for the instance
- Root mounted
- PDBs mounted

NOMOUNT

Instance started

SHUTDOWN

Shutting Down a CDB Instance

```
SQL> CONNECT sys@CDB1 AS SYSDBA
SQL> SHUTDOWN IMMEDIATE
```

- All PDBs closed (no new specific message)
- CDB closed
- CDB dismounted
- Instance shut down

```
SQL> CONNECT sys@PDB1 AS SYSDBA
SQL> SHUTDOWN IMMEDIATE
```

- PDB closed

Database Event Triggers: Automatic PDB Opening

Trigger to automatically open PDBs after `STARTUP`:

- `AFTER STARTUP` → `ON DATABASE`

New database event triggers:

- `AFTER CLONE` → `ON PLUGGABLE DATABASE`
- `BEFORE UNPLUG` → `ON PLUGGABLE DATABASE`
  - Triggers are deleted after firing.
  - Any failure in `AFTER CLONE` or `BEFORE UNPLUG` trigger cause operation to fail.

Changing PDB Mode

After closing a PDB, open in:

- Restricted mode:

```
SQL> CONNECT sys@pdb1 AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE CLOSE;
```

```
SQL> ALTER PLUGGABLE DATABASE OPEN RESTRICTED;
```

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

NAME                           OPEN_MODE
------------------------------ ----------
PDB1                           RESTRICTED
```

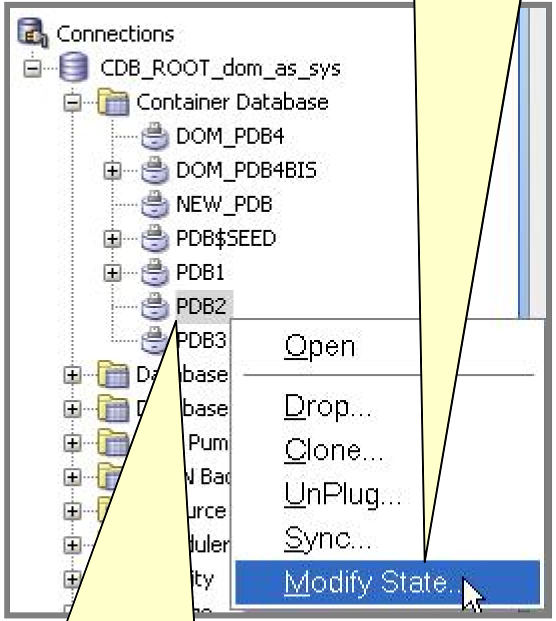
- Read-only mode:

```
SQL> CONNECT / AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE ALL OPEN READ ONLY;
```

- Read-write mode

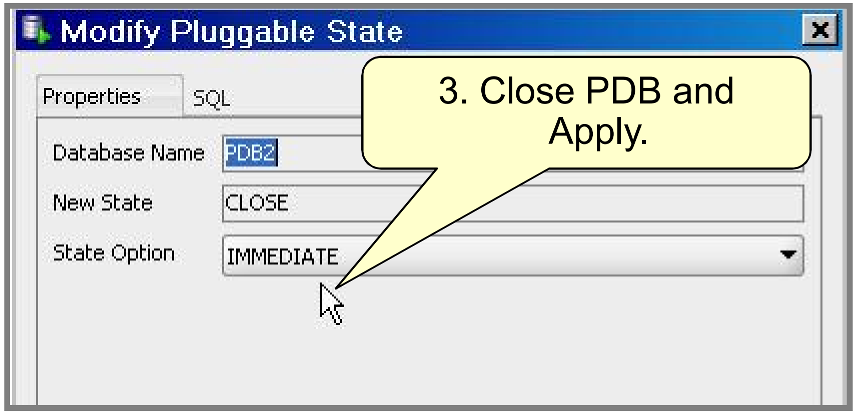
Changing PDB Mode: With SQL Developer

Perform the same operations with SQL Developer.



1. Select PDB to change its stat.e

2. Click Modify State.

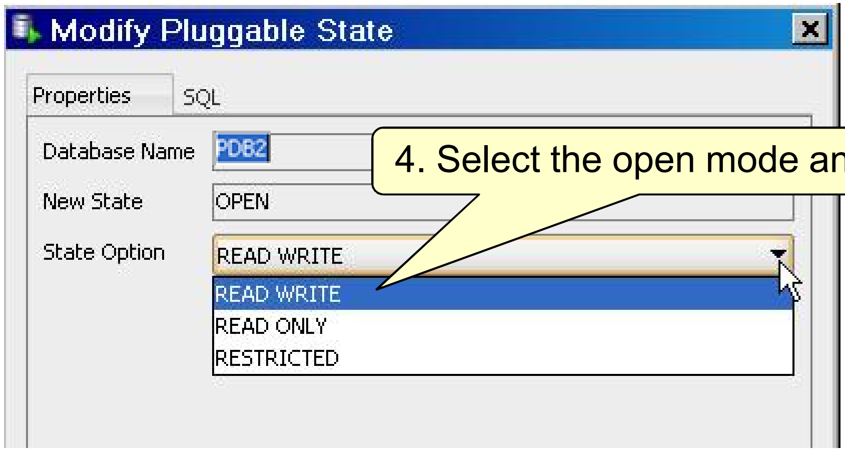


Database Name PDB2

New State CLOSE

State Option IMMEDIATE

3. Close PDB and Apply.



Database Name PDB2

New State OPEN

State Option READ WRITE

4. Select the open mode and Apply.

Modifying PDB Settings

- Bring a PDB data file online.
- Change the PDB default tablespace.
- Change the PDB default temporary tablespace.
- Set the PDB storage limit.
- Change the global name.

```
SQL> CONNECT sys@pdb1 AS SYSDBA
SQL> ALTER PLUGGABLE DATABASE
  2  DATAFILE '/u03/pdb1_01.dbf' ONLINE;
```

```
SQL> ALTER PLUGGABLE DATABASE DEFAULT TABLESPACE pdb1_tbs;
```

```
SQL> ALTER PLUGGABLE DATABASE DEFAULT TEMPORARY TABLESPACE
  2  temp_tbs;
```

```
SQL> ALTER PLUGGABLE DATABASE STORAGE (MAXSIZE 2G);
```

```
SQL> ALTER PLUGGABLE DATABASE RENAME GLOBAL_NAME TO pdbAPP1;
```

Instance Parameter Change Impact

- A single SPFILE per CDB
- PDB value changes are:
  - Loaded in memory after PDB close
  - Stored in dictionary after CDB shutdown
  - Only for parameters `ISPDB_MODIFIABLE=TRUE`

```
SQL> CONNECT sys@pdb1 AS SYSDBA
Connected.
SQL> ALTER SYSTEM SET ddl_lock_timeout=10;
System altered.
SQL> show parameter ddl_lock_timeout

NAME                                 TYPE        VALUE
------------------------------------ ----------- ---------
ddl_lock_timeout                      boolean     10
```

Instance Parameter Change Impact: Example

```
SQL> CONNECT sys@pdb2 AS SYSDBA

SQL> ALTER SYSTEM SET ddl_lock_timeout=20 scope=BOTH;

SQL> ALTER PLUGGABLE DATABASE CLOSE;
SQL> ALTER PLUGGABLE DATABASE OPEN;
```

```
SQL> CONNECT / AS SYSDBA
SQL> select VALUE, ISPDB_MODIFIABLE, CON_ID
  2  from   V$SYSTEM_PARAMETER
  3  where name ='ddl_lock_timeout';

VALUE                ISPDB     CON_ID
-------------------- ----- ----------
0                    TRUE           0
10                   TRUE           3
20                   TRUE           4
```

Quiz

When you `STARTUP` a CDB, is the sequence of operations performed automatically? True or False ?

a. The instance is started.

b. Control files are opened.

c. The root container is opened (redo logs and root data files).

d. Seed pluggable database is in `READ ONLY` mode.

e. Other PDBs are in still in `MOUNTED` mode.

f. Triggers may fire if they exist to open other PDBs.

Quiz

When you `STARTUP` a CDB, all PDBs can be opened in read-write mode.

a. False

b. True

Summary

In this lesson, you should have learned how to:

- Establish connections to CDB / PDB
- Start up and shut down a CDB
- Open and close PDBs
- Create event triggers to open PDBs
- Change the different modes and settings of PDBs
- Evaluate the impact of parameter value changes

Practice 4 Overview:
Managing a CDB and PDBs

These practices cover the following topics:

- Starting up and shutting down a CDB
- Connecting to PDBs and displaying context
- Opening and closing PDBs