

Contents

1 CDB Basics

- Oracle Database 19c Multitenant Architecture 1-2
- Objectives 1-3
- Challenges 1-5
- Non-CDB Architecture 1-6
- Multitenant Architecture: Benefits 1-7
- Other Benefits of Multitenant Architecture 1-8
- Oracle Multitenant Container Database 1-9
- Configurations 1-10
- Database Objects in a Non-CDB 1-11
- User-Added Objects to a Non-CDB 1-12
- SYSTEM Objects in the USER Container 1-13
- Provisioning a Pluggable Database 1-14
- Multitenant Container Database Architecture 1-15
- Containers 1-16
- Tools 1-17
- Data Dictionary and Dynamic Views 1-18
- Terminology 1-19
- Impacts 1-20
- Summary 1-22
- Practices Environment - 1 1-23
- Practices Environment - 2 1-24
- Practice 1: Overview 1-25
- Multitenant Architecture Poster 1-26

2 CDB and Regular PDBs

- Objectives 2-2
- Goals 2-3
- Creating a CDB 2-4
- Creating a CDB: Using SQL*Plus 2-5
- Clause: SEED FILE_NAME_CONVERT 2-6
- Clause: ENABLE PLUGGABLE DATABASE 2-7
- After CDB Creation: What's New in CDB 2-8
- Data Dictionary Views: DBA_xxx 2-9
- Data Dictionary Views: CDB_xxx 2-10

Data Dictionary Views: Examples 2-11
Data Dictionary Views: V\$xxx Views 2-12
After CDB Creation: To do List 2-13
Automatic Diagnostic Repository 2-14
Automatic Diagnostic Repository: alert.log File 2-15
Provisioning New Pluggable Databases 2-16
Tools 2-17
Create New PDB from PDB\$SEED 2-18
Steps: With FILE_NAME_CONVERT 2-19
Steps: Without FILE_NAME_CONVERT 2-20
Summary 2-21
Practice 2: Overview 2-22

3 Application PDBs and Application Installation

Objectives 3-2
Regular PDBs 3-3
PDBs and Applications 3-4
Application Containers 3-5
Application Containers: Other Features 3-6
Types of Containers 3-7
Creating Application PDBs 3-8
Application Name and Version 3-9
Installing Applications 3-10
Patching and Upgrading Applications 3-11
Application Common Objects 3-12
Use Cases for Application Containers 3-13
Use Case: Pure PDB-Based Versus Hybrid Model 3-14
Container Map 3-15
Container Map: Example 3-16
Query Routed Appropriately 3-17
Dynamic Container Map 3-18
Container Map and Containers Default 3-19
Query Across CDBs Using Application Root Replica 3-20
Durable Location Transparency 3-21
Data Dictionary Views 3-22
Terminology in Application Container Context 3-23
Commonality in Application Containers 3-24
Impacts 3-25
Summary 3-26
Practice 3: Overview 3-27

4 PDB Creation

- Objectives 4-2
- Cloning Regular PDBs 4-3
- Cloning Application Containers 4-4
- Plugging a Non-CDB into CDB 4-5
- Plugging a Non-CDB into CDB as PDB Using DBMS_PDB 4-6
- Replicating Non-CDB into CDB 4-7
- Cloning a Non-CDB or Remote PDB 4-8
- Plugging an Unplugged Regular PDB into CDB 4-9
- Flow 4-10
- Plugging Using Archive File 4-12
- Unplugging and Plugging Application PDBs 4-13
- Converting Regular PDBs to Application PDBs 4-14
- Unplugging and Plugging a PDB with Encrypted Data 4-15
- Local UNDO Mode Versus Shared UNDO Mode 4-16
- Cloning Remote PDBs in Hot Mode 4-17
- Near-Zero Down Time PDB Relocation 4-18
- Proxy PDB: Query Across CDBs Proxying Root Replica 4-20
- Creating a Proxy PDB 4-21
- Using DBCA to Clone a Remote PDB 4-22
- Using DBCA to Relocate a Remote PDB 4-23
- Using DBCA to Duplicate a CDB 4-24
- Dropping PDBs 4-25
- Summary 4-26
- Practice 4: Overview 4-27

5 CDB and PDB Management

- Objectives 5-2
- Connection 5-3
- Switching Connection 5-4
- Creating Services 5-5
- Renaming Services 5-6
- Starting Up a CDB Instance 5-7
- Mounting a CDB 5-8
- Opening a CDB 5-9
- Opening a PDB 5-10
- Automatic PDB Opening 5-11
- Closing a PDB 5-12
- Shutting Down a CDB Instance 5-13
- Changing PDB Mode 5-14
- Modifying PDB Settings 5-15

Instance Parameter Change Impact 5-16
Instance Parameter Change Impact: Example 5-17
Using ALTER SYSTEM Statement on PDB 5-18
Configuring Host Name and Port Number per PDB 5-19
Summary 5-20
Practice 5: Overview 5-21

6 Storage

Objectives 6-2
Objects in Tablespaces 6-3
Tablespaces Created During PDB Creation 6-4
Defining Default Permanent Tablespaces 6-5
Temporary Tablespaces 6-6
UNDO Tablespaces 6-7
Summary 6-8
Practice 6: Overview 6-9

7 Security

Objectives 7-2
Creating Common Users in the CDB and PDBs 7-3
Creating Common Roles in the CDB and PDBs 7-4
Granting Privileges Commonly in the CDB and PDBs 7-5
Creating Common Profiles in the CDB and PDBs 7-6
Common Objects in Application Containers 7-7
Operations on Data-Linked Objects 7-8
Enabling Common Users to Access Data in PDBs 7-9
Finding Information About CONTAINER_DATA Attributes 7-10
Restricting Operations with PDB Lockdown Profiles 7-11
Restricting Operations in a PDB Lockdown Profile 7-12
PDB Lockdown Profiles Inheritance 7-13
Static and Dynamic PDB Lockdown Profiles 7-14
Auditing Actions in the CDB and PDBs 7-15
Managing Other Types of Security Policies in Application Containers 7-17
Securing Data with Oracle Database Vault 7-18
Oracle Database Vault-Enabled Strict Mode 7-19
Managing Keystore in the CDB and PDBs 7-20
Creating and Opening a Keystore 7-21
Setting TDE Master Encryption Keys 7-22
Managing Keystore in the CDB and PDBs 7-23
Keystore Management Changes for PDBs 7-24
Defining the Keystore Type 7-25

Isolating a PDB Keystore 7-26
Converting a PDB to Run in Isolated Mode 7-27
Converting a PDB to Run in United Mode 7-28
Migrating a PDB Between Keystore Types 7-29
Unplugging and Plugging a PDB with Encrypted Data 7-30
Per-PDB Wallet for PDB Certificates 7-31
Summary 7-32
Practice 7: Overview 7-33

8 Backup and Duplicate

Objectives 8-2
Goals 8-3
Syntax and Clauses in RMAN 8-4
CDB Backup: Whole CDB Backup 8-6
CDB Backup: Partial CDB Backup 8-7
PDB Backup: Partial PDB Backup 8-8
Using RMAN Backup to Plug an Unplugged PDB 8-9
Duplicating Pluggable Databases 8-10
Cloning Active PDB into an Existing CDB 8-11
Example: 1 8-12
Example: 2 8-13
Duplicating On-Premises CDB as Cloud Encrypted CDB 8-14
Duplicating On-Premises Encrypted CDB as Cloud Encrypted CDB 8-15
Migrating Cloud Encrypted CDB as On-Premises CDB 8-16
Checking for Block Corruption 8-17
Summary 8-18
Practice 8: Overview 8-19

9 Recovery and Flashback

Objectives 9-2
Goals 9-3
Instance Failure and Instance Recovery 9-4
NOARCHIVELOG Mode 9-5
PDB Tempfile Recovery 9-6
PDB SYSTEM or UNDO Tablespace Recovery 9-7
PDB Non-SYSTEM Tablespace Recovery 9-8
PITR 9-9
Migrating a Non-CDB to a CDB 9-10
Migrating a Non-CDB and Transporting Non-CDB Backups to a CDB 9-11
Relocating/Plugging a PDB into Another CDB 9-12
Plugging a PDB and Transporting PDB Backups to a CDB - 1 9-13

Plugging a PDB and Transporting PDB Backups to a CDB - 2	9-14
Using PrePlug-in Backups	9-15
To Be Aware Of	9-16
Example	9-17
CDB and PDB Flashback	9-18
PDB Flashback and Clean Restore Point	9-19
Creating a PDB Snapshot from a PDB	9-20
PDB Snapshot Carousel	9-21
Creating PDB Snapshot	9-22
Creating PDBs Using PDB Snapshots	9-23
Dropping PDB Snapshots	9-24
Flashbacking PDBs Using PDB Snapshots	9-25
Switching Over a Refreshable Cloned PDB	9-26
Unplanned Switchover	9-27
Summary	9-28
Practice 9: Overview	9-29

10 Performance

Objectives	10-2
Tuning a CDB	10-3
Sizing the CDB	10-4
Testing the Estimates	10-5
Managing SGA for PDBs	10-6
Managing PGA for PDBs	10-7
Monitoring PDB Memory Usage	10-8
AWR and ADDM Behavior	10-9
PDB-Level Snapshot Views	10-10
Configuring Automatic ADDM Analysis at the PDB Level	10-11
AWR Report	10-12
ADDM Tasks: At the CDB or PDB Levels	10-13
Enabling ADDM in a Pluggable Database	10-14
ADDM Data Visibility	10-15
Basic Rules: Statistics for Common Objects	10-17
Controlling the Degree of Parallelism of Queries	10-18
Heat Map and ADO Support	10-19
Managing Heat Map and ADO Policies in PDB	10-20
CDB Fleet	10-21
CDB Lead and CDB Members	10-22
Use Cases	10-23
DB Replay: The Big Picture	10-24
Capturing and Replaying in a CDB and PDBs	10-25

Reporting 10-26
Consolidated Database Replay Use Cases 10-27
Use Cases: Source Workloads 10-28
The Big Picture 10-29
Step 1 10-30
Step 2 10-31
Step 3 10-32
Step 4 10-33
Summary 10-34
Practice 10: Overview 10-35

11 Resources Allocation

Objectives 11-2
Allocating Resources in the CDB 11-3
Resource Manager and Pluggable Databases 11-4
Managing Resources Between PDBs 11-5
CDB Resource Plan Basics: Limits 11-6
PDB IO Rate Limit 11-8
CDB Resource Plan: Full Example 11-9
Maintaining a CDB Resource Plan 11-10
Managing Resources Within a PDB 11-11
Putting It Together 11-12
Considerations 11-13
PDB-Level Parallel Statement Queuing 11-14
PDB-Level Parallel Statement Queuing: CPU_COUNT 11-16
Session PGA Limit 11-17
Performance Profiles 11-18
Summary 11-19
Practice 11: Overview 11-20

12 Data Movement

Objectives 12-2
Using Oracle Data Pump with PDBs 12-3
Exporting from Non-CDB and Importing into PDB 12-4
Exporting and Importing Between PDBs 12-5
Exporting from PDB and Importing into Non-CDB 12-6
Full Transportable Export/Import: Overview 12-7
Full Transportable Export/Import: Usage 12-8
Full Transportable Export/Import: Example 12-10
Transporting a Database Over the Network: Example 12-11
Additional features of Oracle Data Pump 12-12

Using SQL*Loader with PDBs 12-13

Summary 12-14

Practice 12: Overview 12-15

13 Upgrade Methods

Objectives 13-2

Upgrading CDB and PDBs to 19c: Methods 13-3

Upgrading a CDB Including PDBs from 18c to 19c 13-4

Upgrading CDB Including PDBs from 18c to 19c 13-5

Upgrading a Single Regular PDB from 18c to 19c 13-6

Converting and Upgrading Regular PDBs to Application PDBs 13-7

Oracle Database AutoUpgrade 13-8

Practice 13: Overview 13-10

Cross-Platform Transportable PDB 13-11

Cross-Platform PDB Transport: Phase 1 13-12

Cross-Platform PDB Transport: Phase 2 13-13

Summary 13-14

Practice 13: Overview 13-15

A Consolidated Database Replay Procedures

Consolidated Replay Steps A-2

Procedures for Steps 4 and 5 A-3

Procedures for Steps 6 and 7 A-4

Procedure to Remap Connections with PDBs A-5

Procedure to Prepare the Replay A-6

Modes of Synchronization A-7

Procedure to Start Replay A-8

Views A-9

B Miscellaneous

Objectives B-2

Using Xstreams with a CDB and PDB B-3

Creating a Standby of a CDB B-4

Instantiating a PDB on a Standby B-6

Scheduling Operations in a PDB B-7

Jobs Coordinator and Resources B-8

Mining Statements of a PDB Using LogMiner B-9

Summary B-10

Practice B: Overview B-11