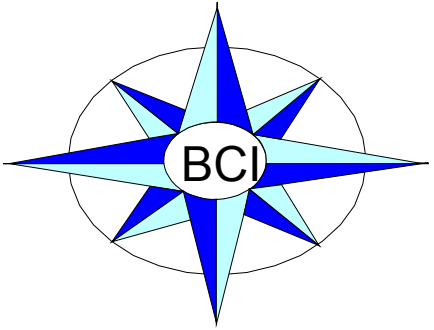
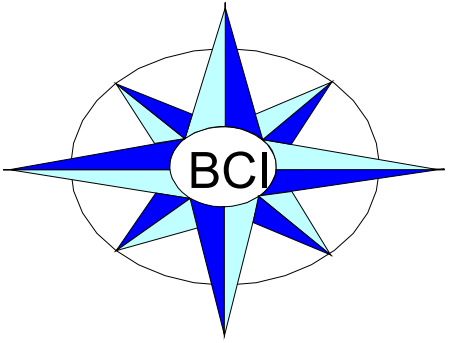


1

Module

Multitenant Container Database and Pluggable Databases



1

Basics of Multitenant Container Database 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

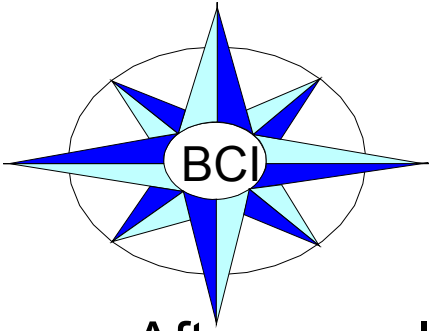
- **Security**
  - Unified Audit
  - Privilege Analysis
  - Data Redaction
- **HA**
  - RMAN
- **Manageability**
  - DB Operations
  - Schema Change Plans
  - Data Comparisons

Day 4

- **Performance**
  - SQL Tuning
  - Real-Time ADDM
  - Compare Period ADDM
  - Resource Mgr
  - Index, Table, ADR

Day 5

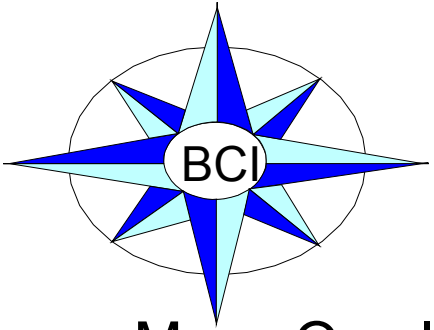
- **Miscellaneous**
  - Data Pump, SQL*Loader & External Tables
  - Partitioning
  - SQL
  - *Other topics in referenced courses*



Objectives

After completing this lesson, you should be able to:

- Describe the multitenant architecture
- Describe the root and pluggable database containers
- Differentiate the root from a pluggable database
- Explain pluggable database plugging
- List impacts in various areas

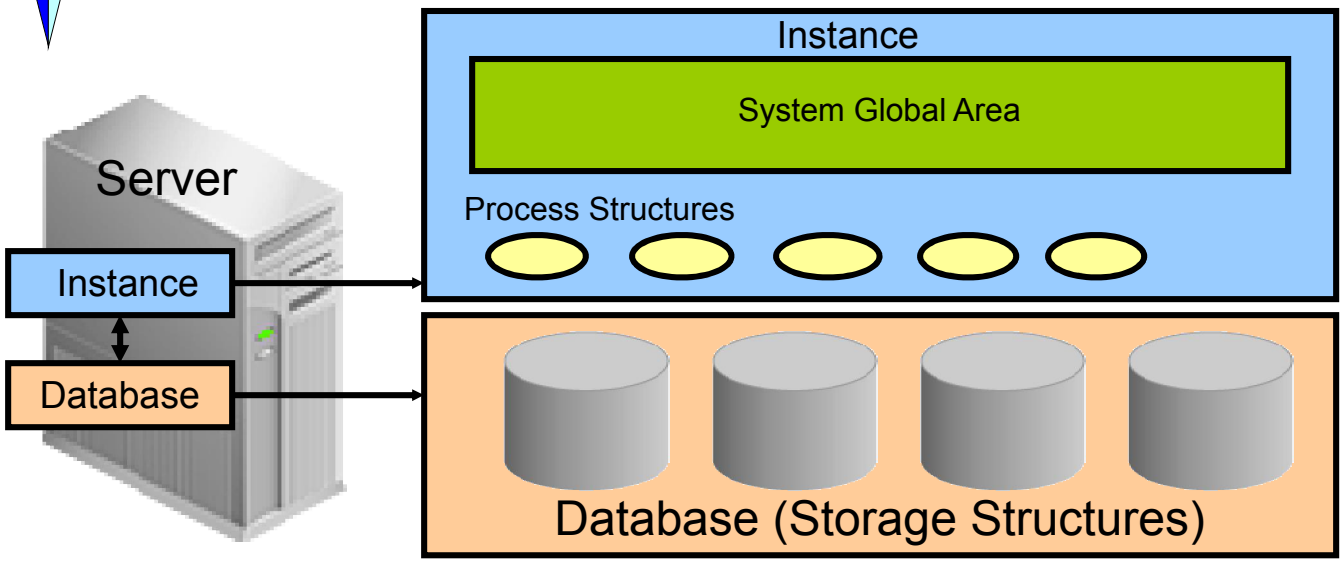


Challenges

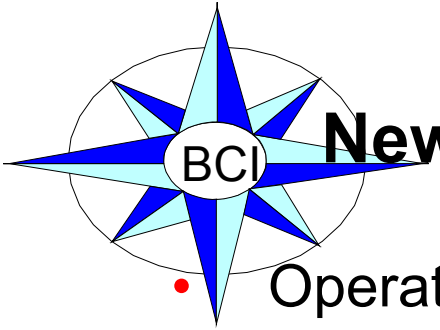
Many Oracle customers have large numbers of “departmental” applications built on Oracle RDBMS. They:

- Do NOT use a significant percentage of the hardware on which they are deployed
- Have instance and storage overhead preventing large numbers of “departmental” databases from being placed on the same physical and storage server
- Are NOT sufficiently complex to require 100% of the attention of a full time administrator
- Do require significant time to patch or upgrade all applications

Oracle Database in 11*g* Release 2

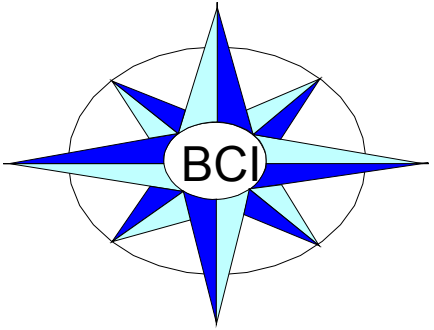


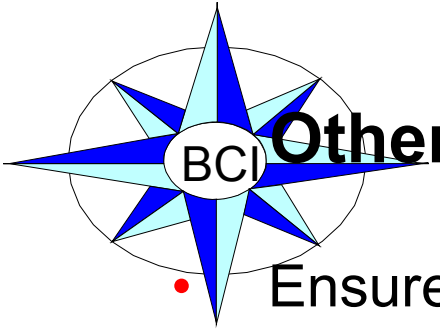
- Multiple monolithic or non-CDBs share nothing:
  - Too many background processes
  - High shared/process memory
  - Many copies of Oracle metadata



New Multitenant Architecture: Benefits

- Operates **multiple databases in a centrally managed platform** to lower costs:
  - Less instance overhead
  - Less storage cost
- Reduces DBA resources costs and maintains security
  - No application changes
  - **Fast and easy provisioning**
  - **Time saving for patching and upgrade**
  - **Separation of duties** between:
    - Different application administrators
    - Application administrators and DBA
    - Users within application
- **Provides isolation**

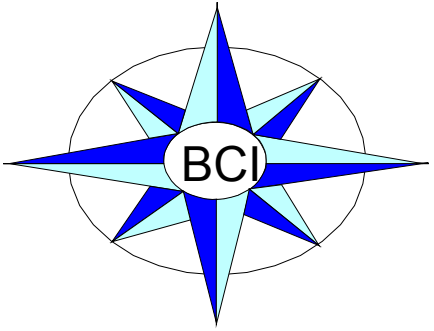




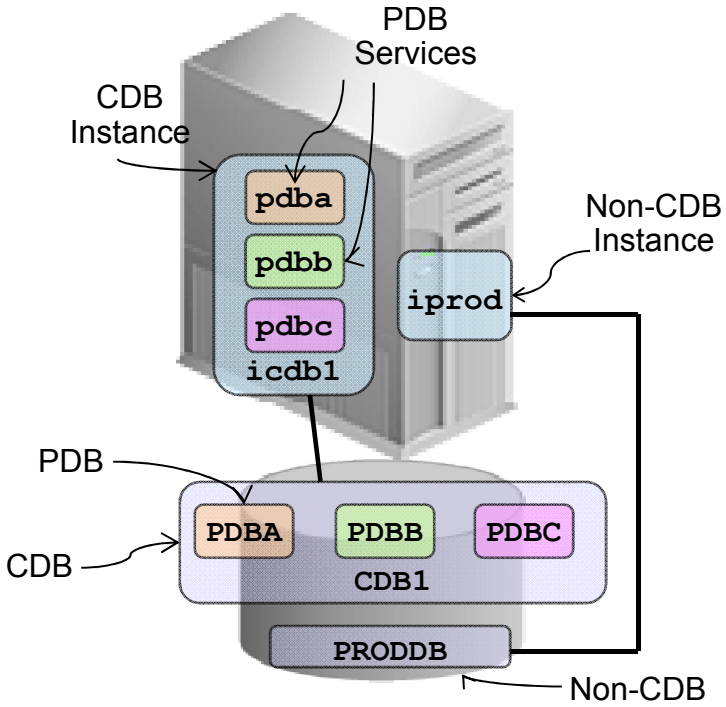
Other Benefits of Multitenant Architecture

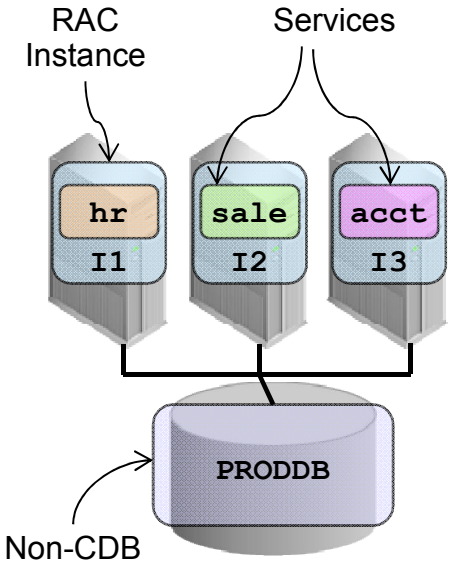
- Ensures **full backwards-compatibility** with non-CDBs
- Fully operates with RAC
- Is integrated with Enterprise Manager and Resource Manager
- Allows central management and administration of multiple databases
  - Backups / disaster recovery
  - Patching and upgrades

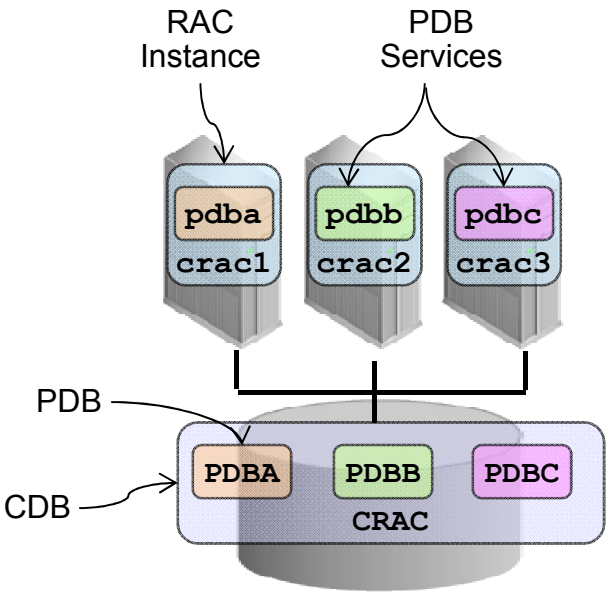
Other Benefits of Multitenant Architecture (Notes Only)



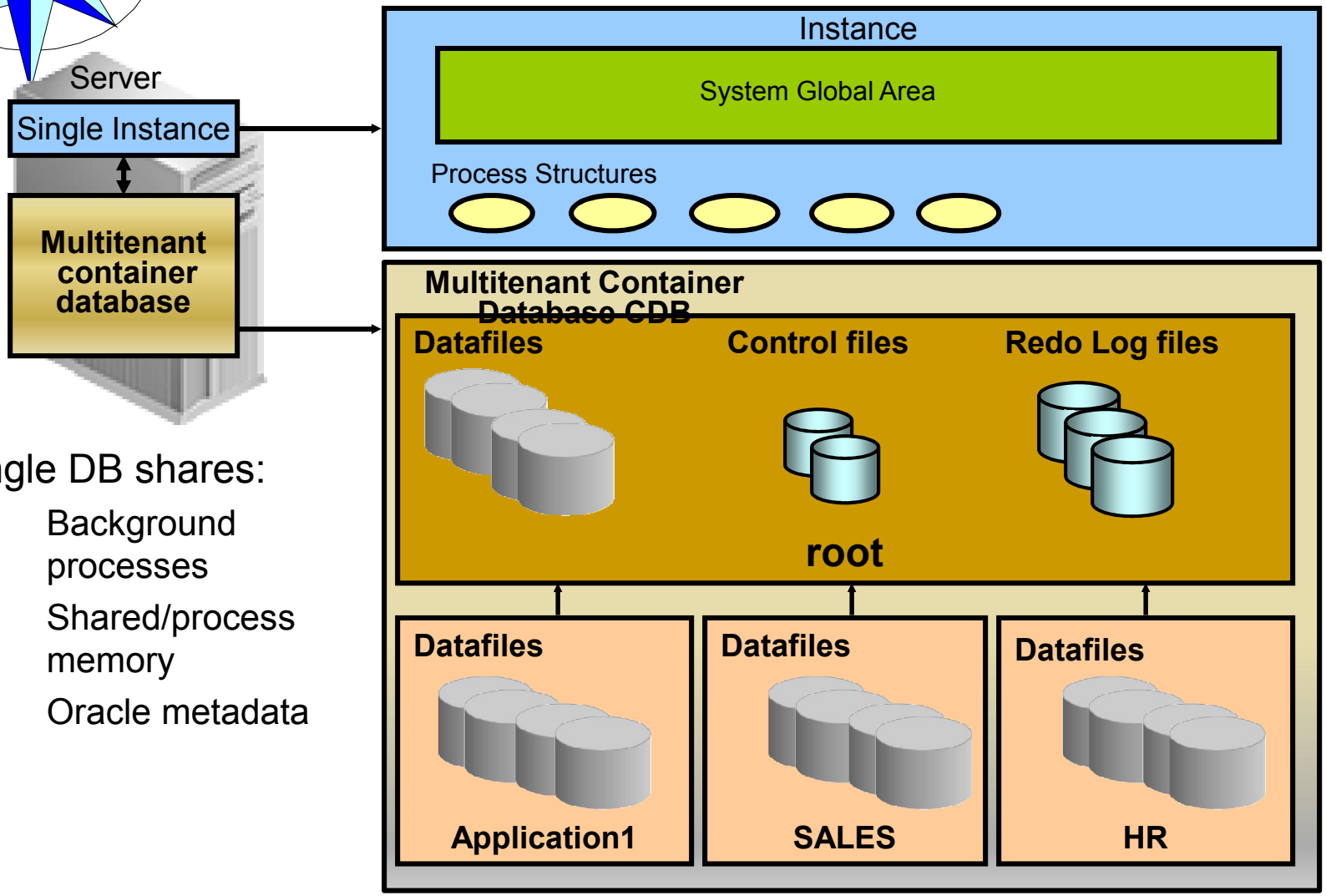
Configurations





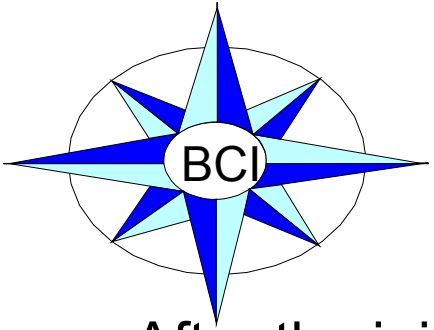


Multitenant Container Database



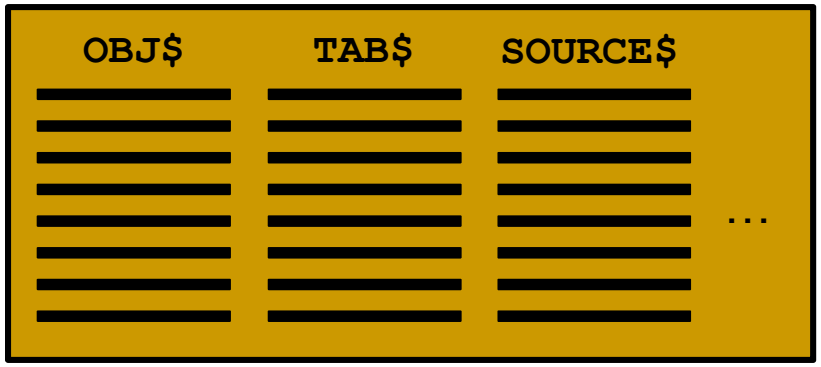
Single DB shares:

- Background processes
- Shared/process memory
- Oracle metadata

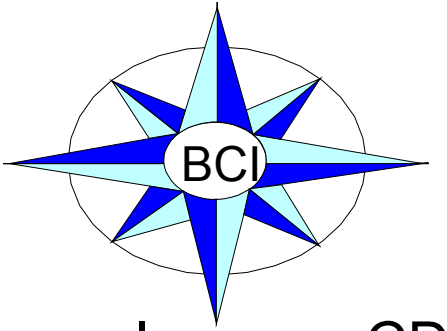


Pristine Installation

After the initial database creation, the only objects are Oracle-supplied objects.



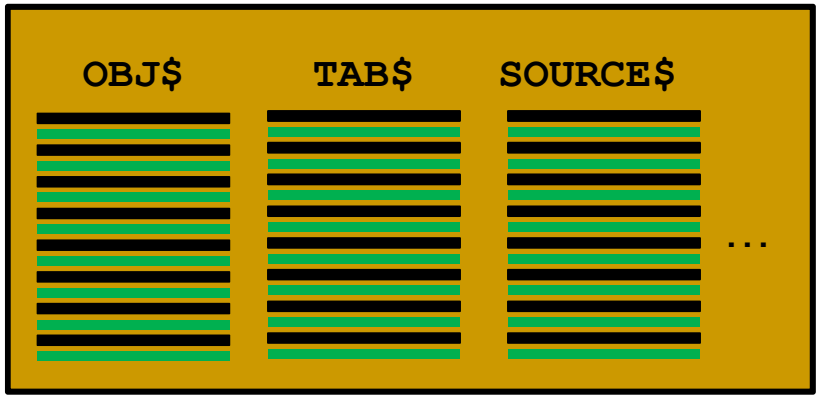
Oracle System data



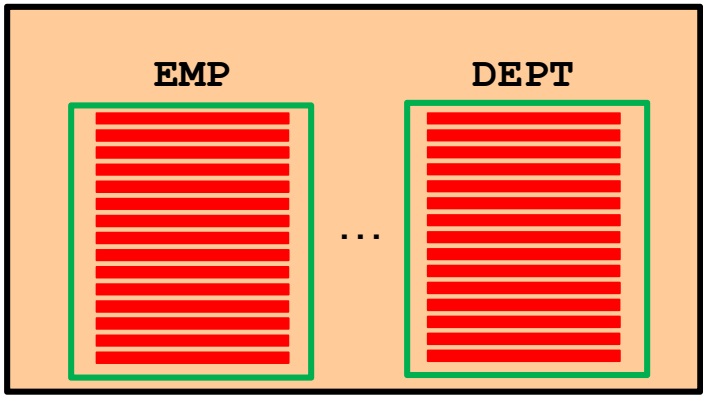
Adding User Data

In a non-CDB, user data is added:

- The metadata is mixed with the Oracle supplied data in the data dictionary.

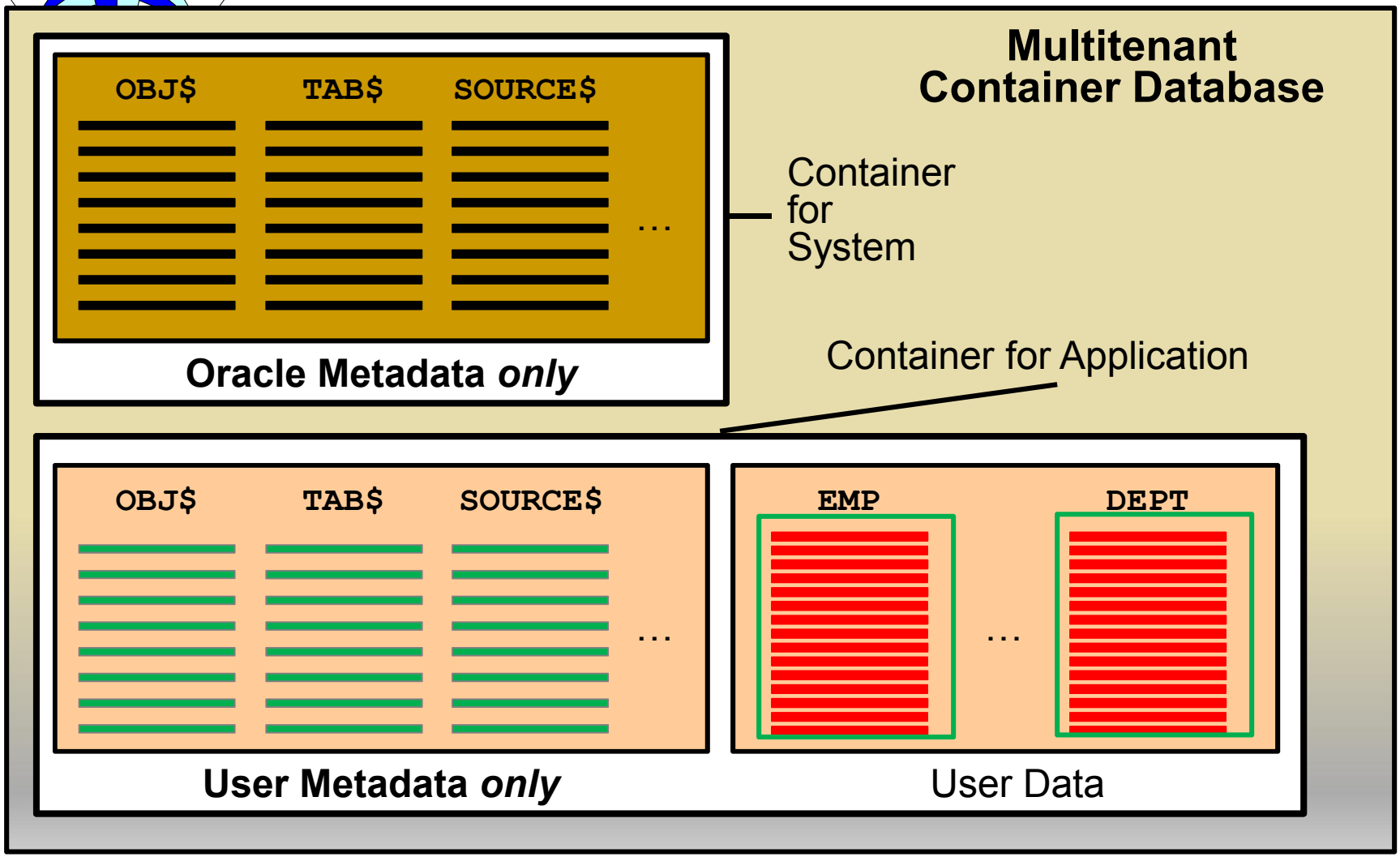


Oracle System data mixed with User metadata

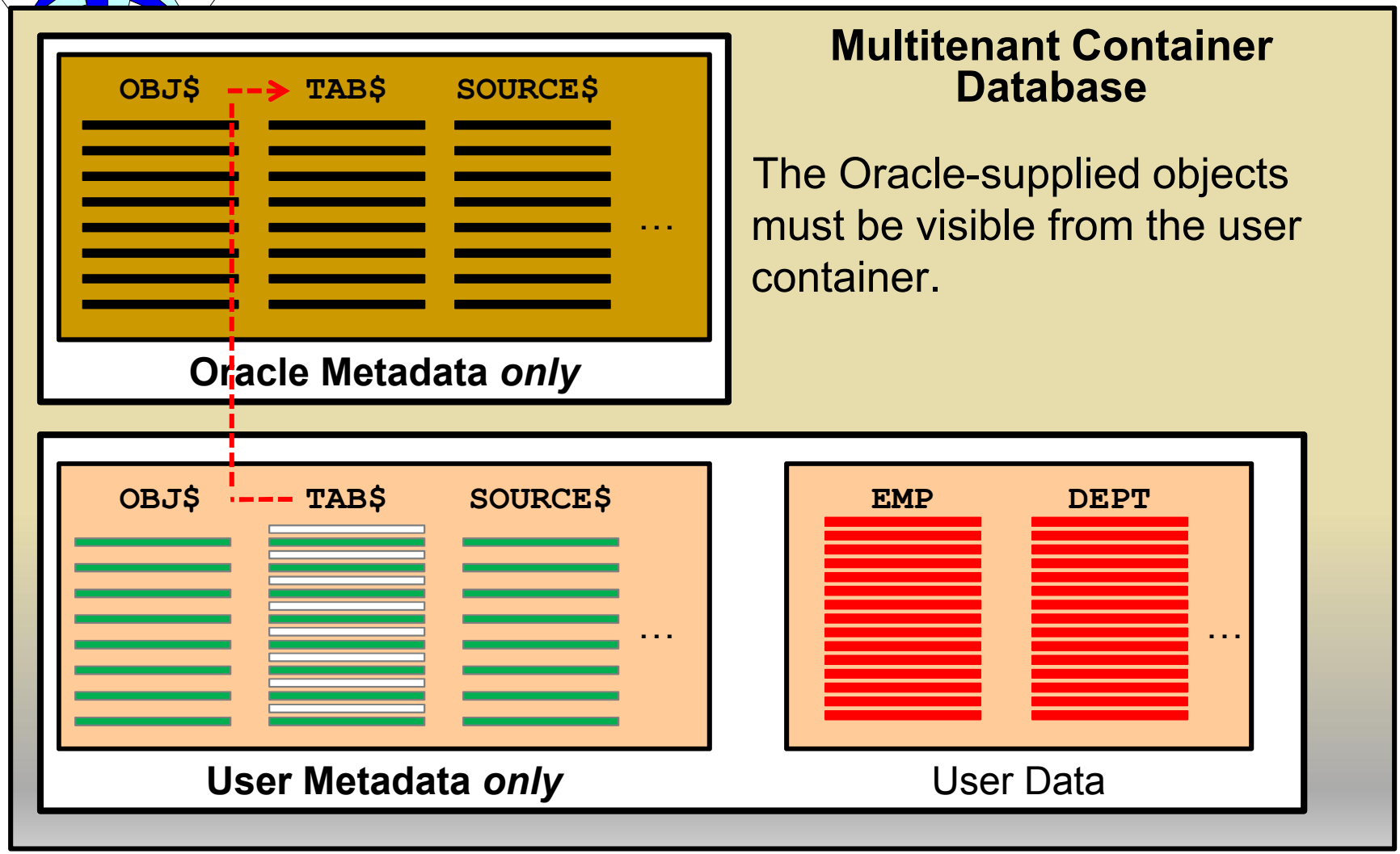


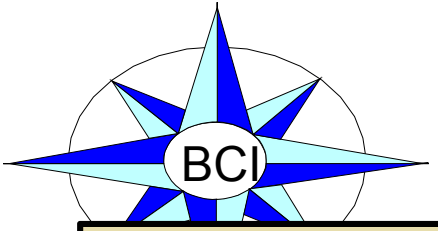
User Data

Separating SYSTEM and User Data

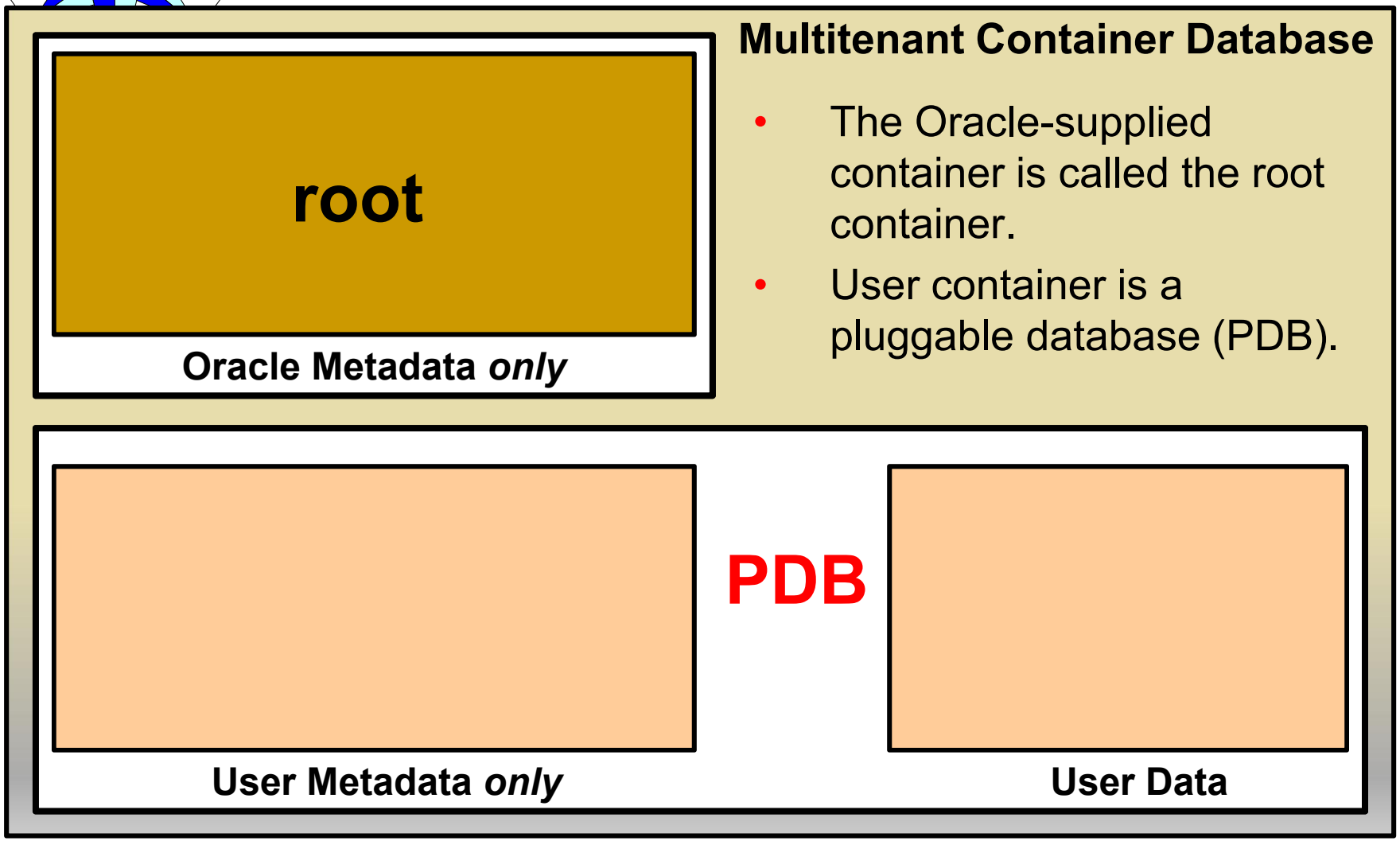


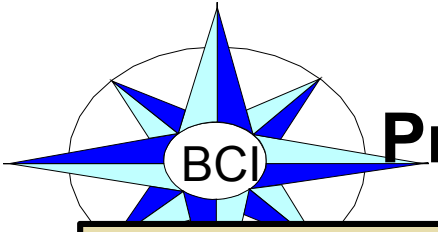
SYSTEM Objects in the USER Container



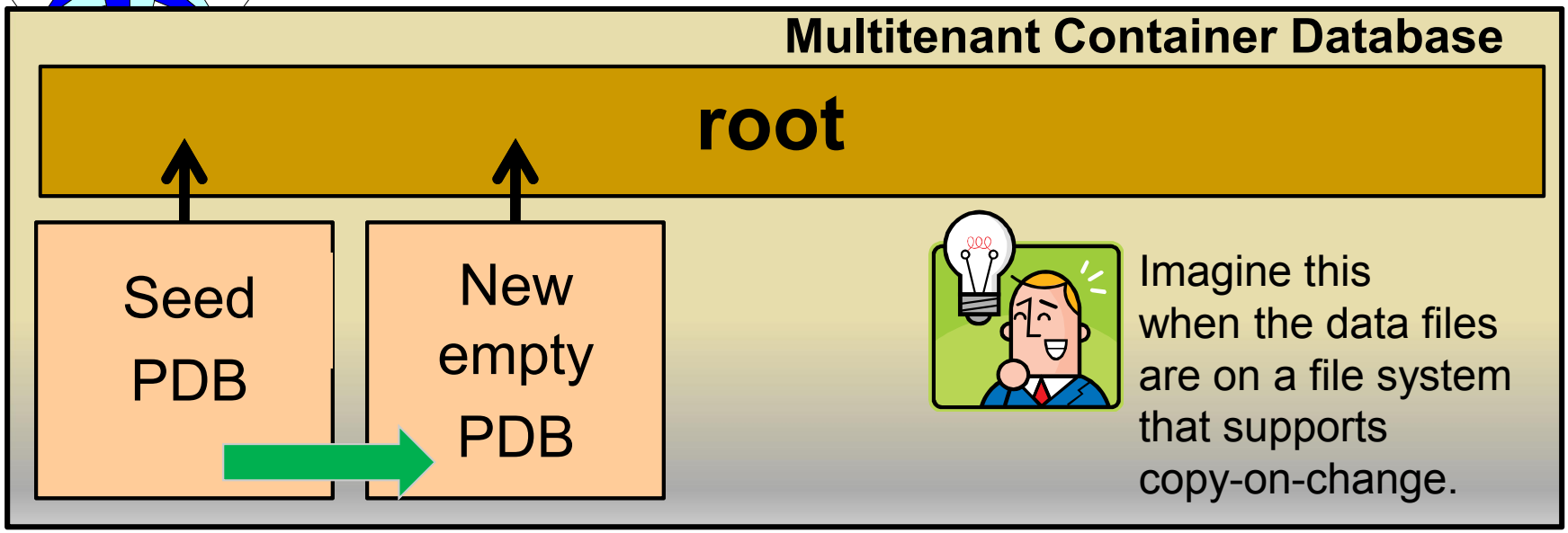


Naming the Containers





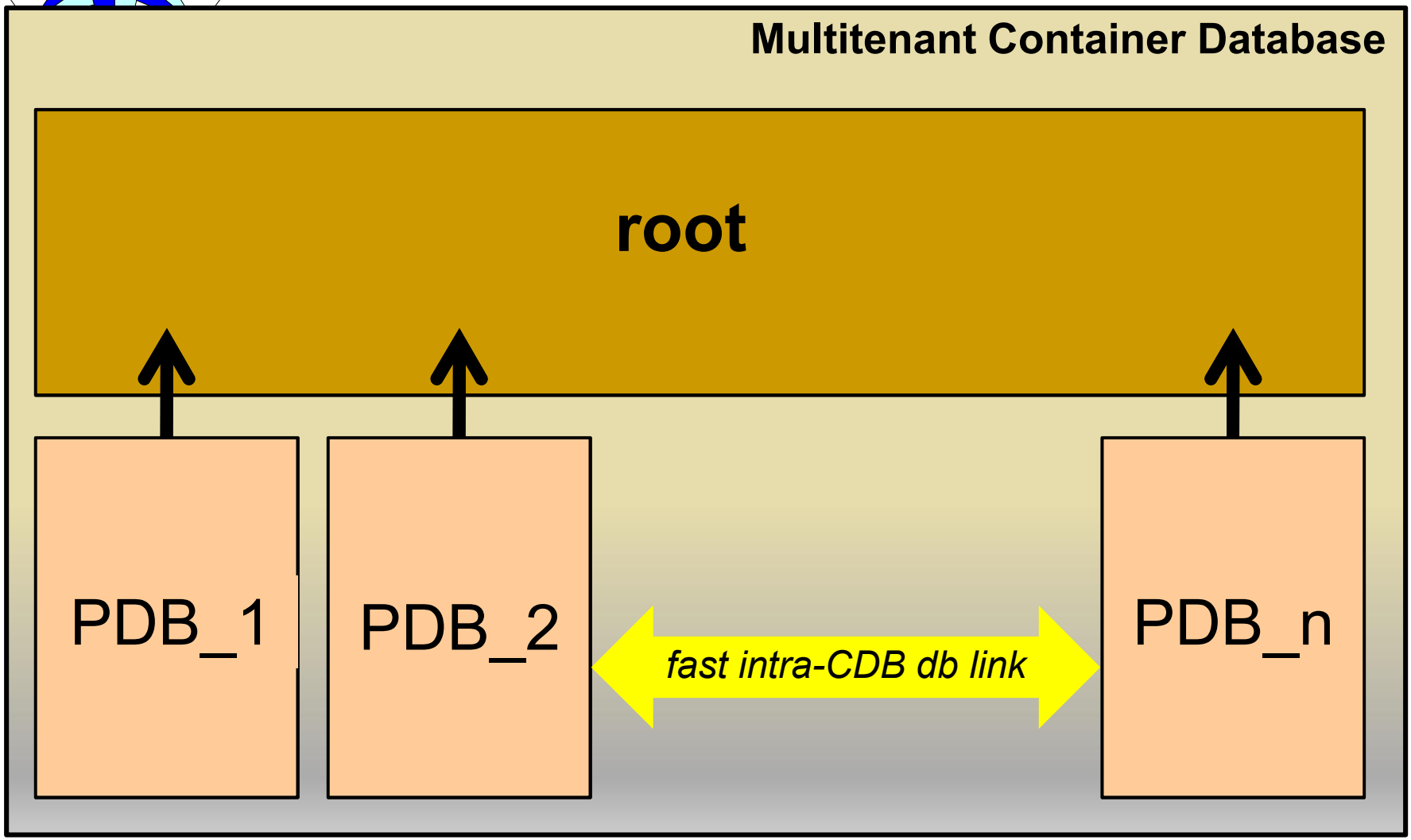
Provisioning a Pluggable Database



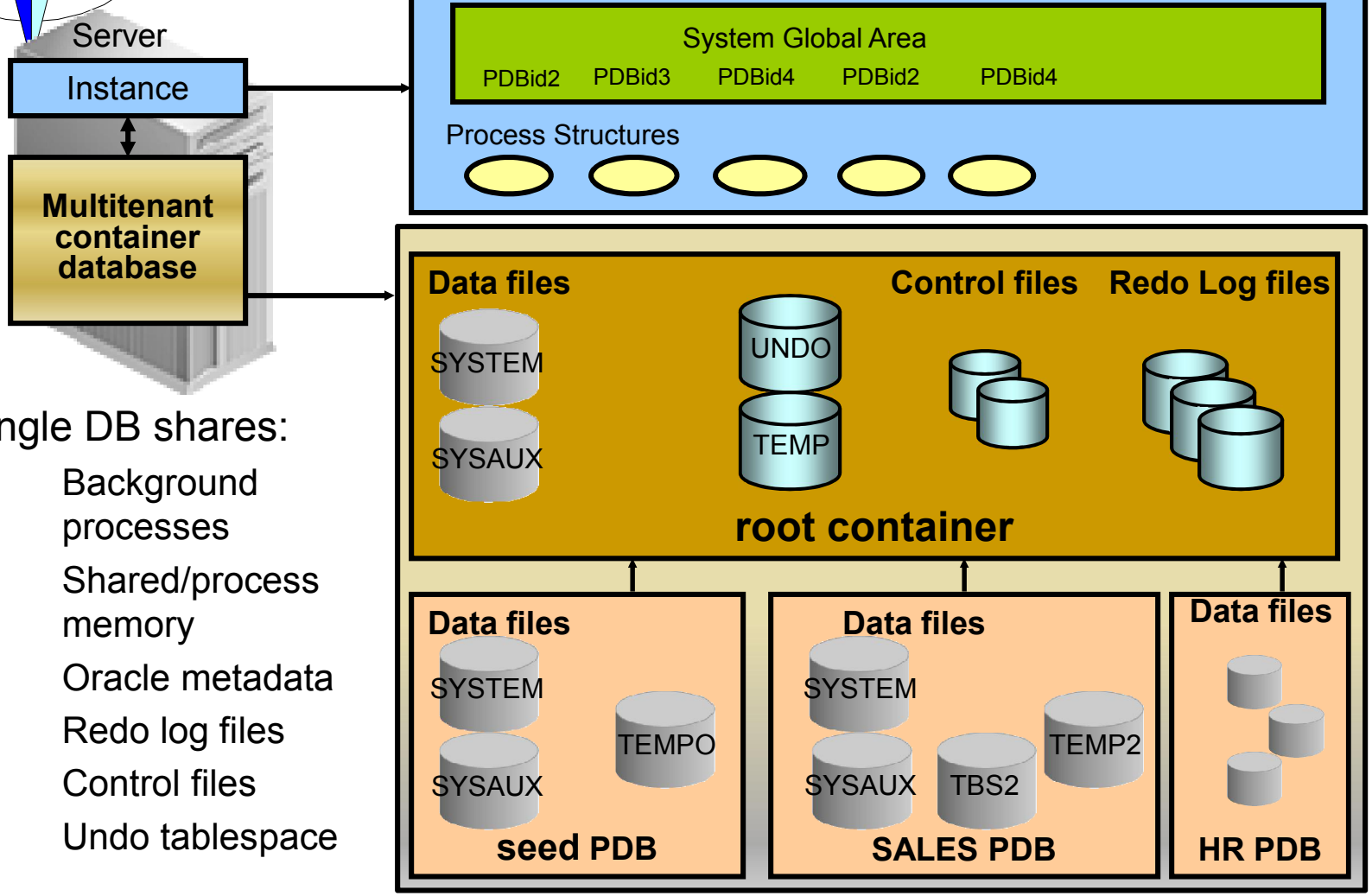
Four methods:

- Create new PDB from `PDB$SEED` pluggable database.
- Plug in a non-CDB.
- Clone a PDB from another PDB into the same or another CDB.
- Plug an unplugged PDB into another CDB.

Interacting Within Multitenant Container Database

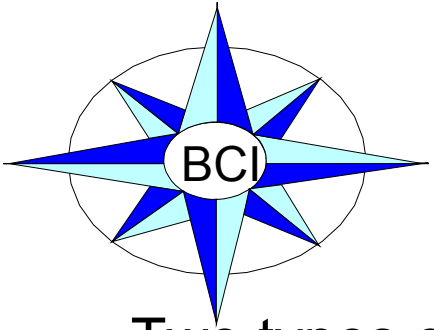


Multitenant Container Database Architecture



Single DB shares:

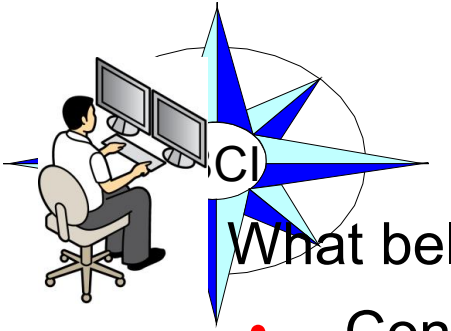
- Background processes
- Shared/process memory
- Oracle metadata
- Redo log files
- Control files
- Undo tablespace



Containers

Two types of containers in `V$CONTAINERS`:

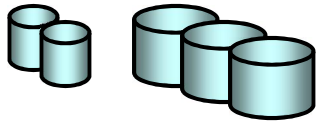
- The root container
  - The first container created at CDB creation
  - Mandatory
  - Oracle system-supplied common objects and metadata
  - Oracle system-supplied common users and roles
- Pluggable database containers (PDBs)
  - A container for an application:
    - Tablespaces (permanent and temporary)
    - Schemas / Objects / Privileges
    - Created / cloned / unplugged / plugged
  - Particular seed PDB
    - `PDB$SEED` provides fast provisioning of a new PDB
  - Limit of 253 PDBs in a CDB including the seed
  - Limit of 512 services in a CDB



Questions: Root Versus PDBs

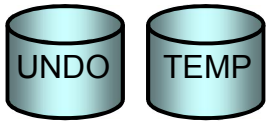
What belongs to the CDB and not to a specific container?

- Control files and redo log files



What is in the root that is not in PDBs?

- UNDO and default TEMP tablespace



- System supplied metadata
- Shared Oracle-supplied data
  - PL/SQL Oracle-supplied packages (`DBMS_SQL ...`)
  - PDBs service names
- CDB dictionary views providing information across PDBs
- CDB RM plan

Table SYS.OBJ$

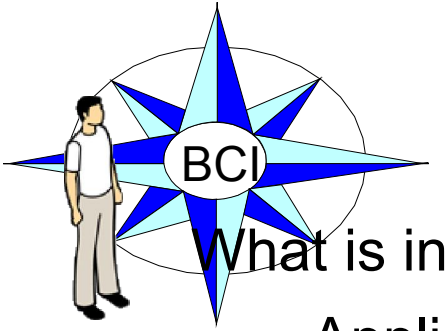
NAME	TYPE
TAB$	2
USER$	2

Table SYS.SERVICE$

NAME
PDB_SALES
PDB_HR

Views CDB_*xxx*

TABLE_NAME	CON_ID
EMPLOYEES	1
TEST	2



PDBA

Questions: PDBs Versus Root

What is in a PDB that is not in the root nor in another PDB?

- Application tablespaces 

- Local temporary tablespaces 

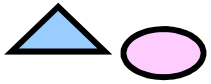
- Local users  and local roles 
  - Local users connect to the PDB where they exist
- Non-shared local metadata

Table SYS.OBJ$

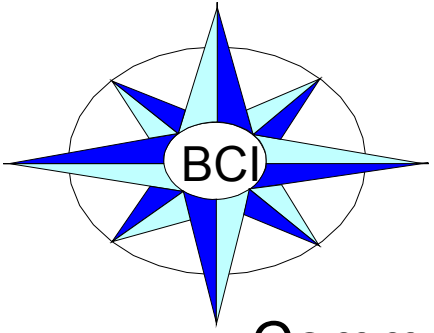
NAME	TYPE
EMPLOYEES	2
JOBS	2

- Non-shared application data with other PDBs

Table HR.EMPLOYEES

EMP_NAME
SMITH
JOHN

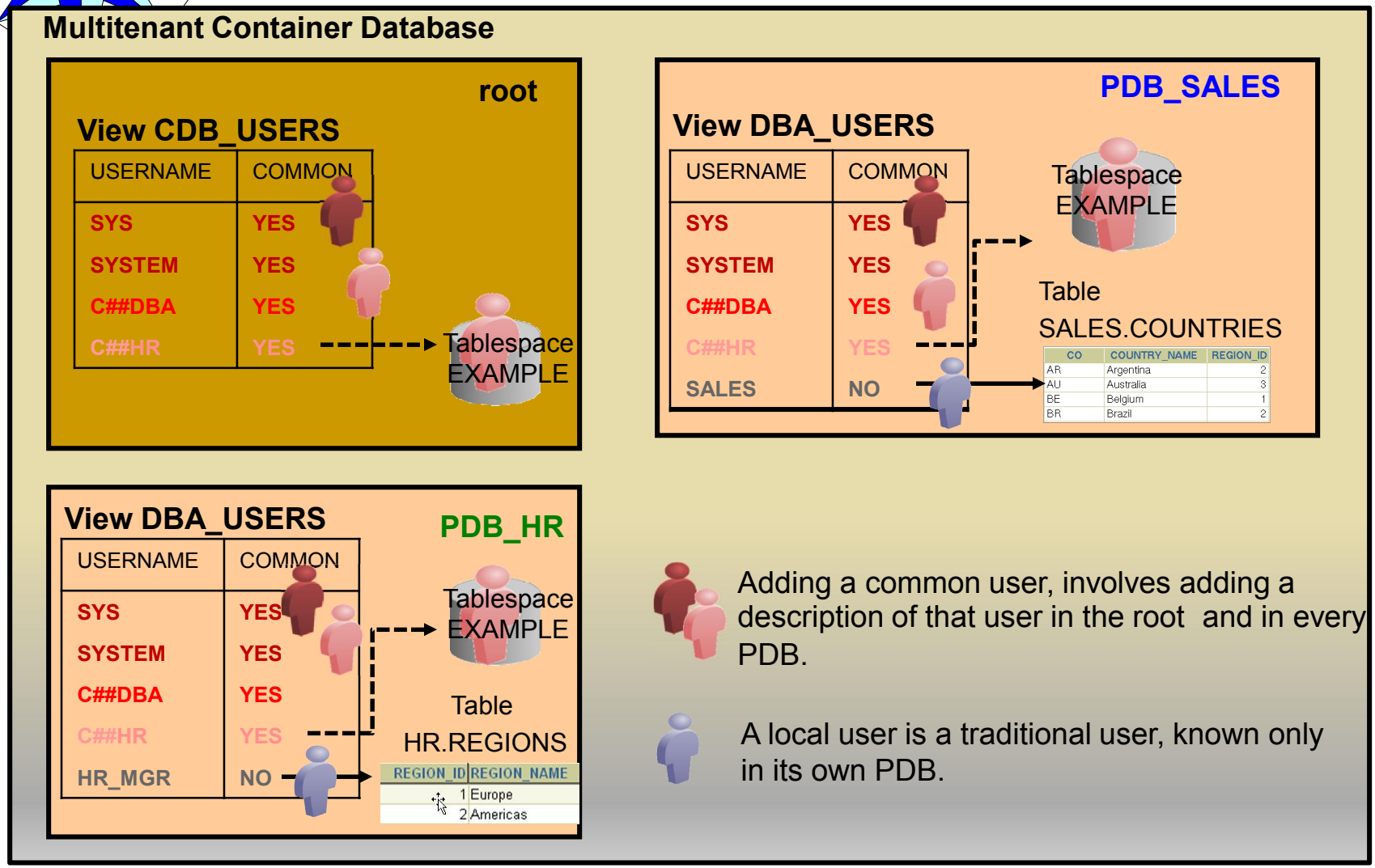
- PDB RM plan



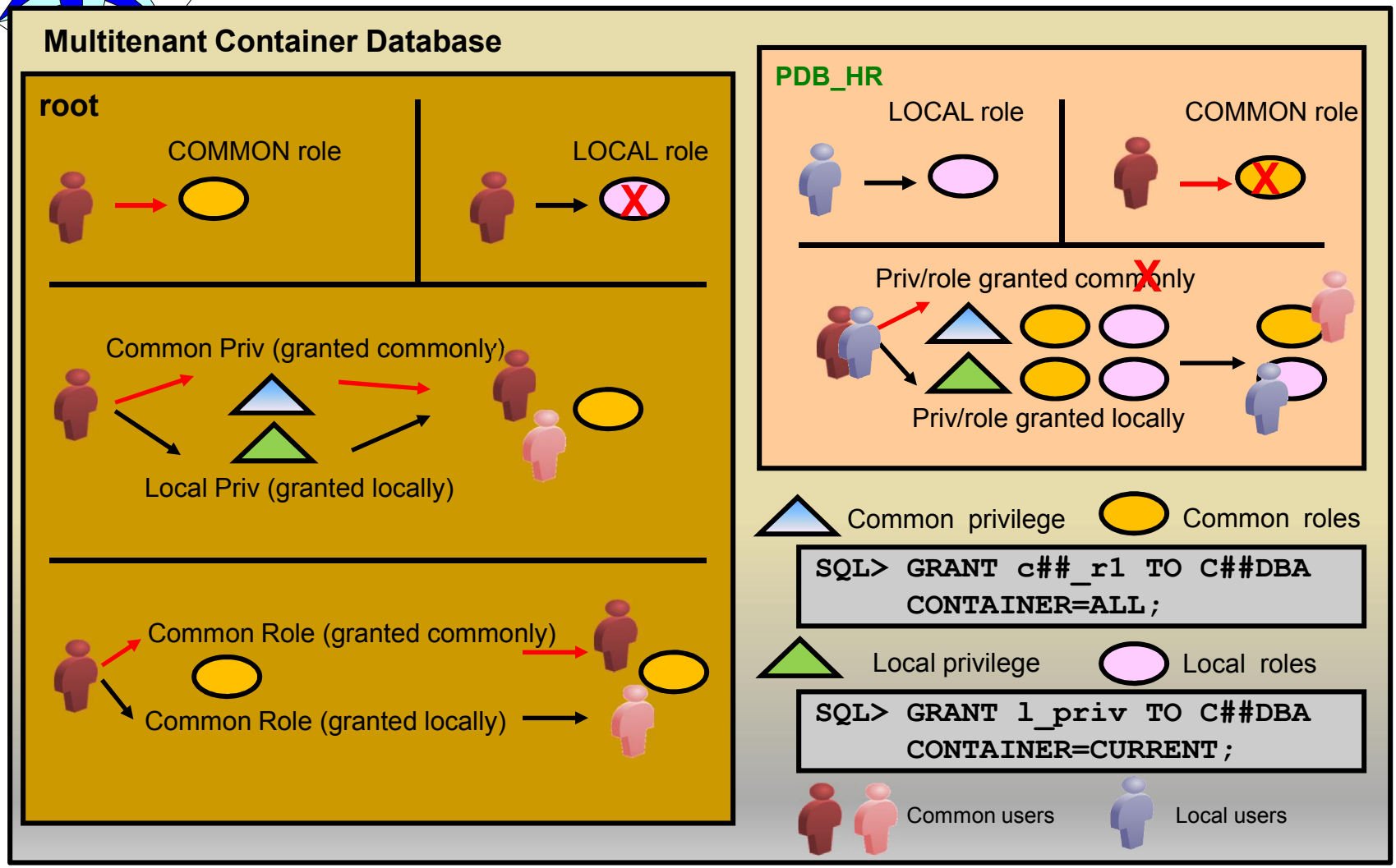
Terminology

- Common versus Local:
  - Users
  - Roles
  - Privileges
- CDB versus PDB level:
  - CDB Resource Manager plan versus PDB RM plan
  - Unified audit at CDB or PDB level
  - XStream at CDB or PDB level

Common and Local Users

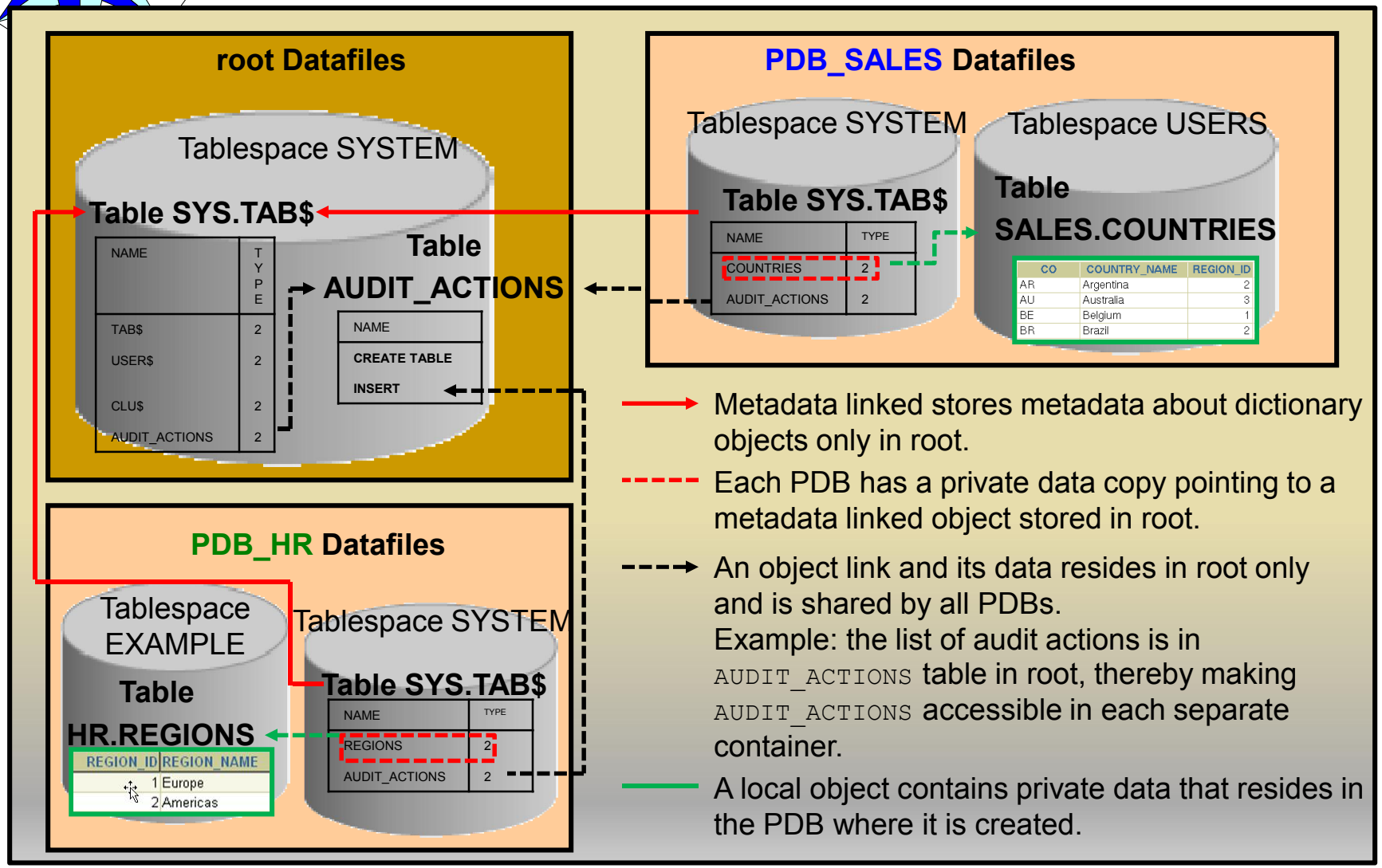


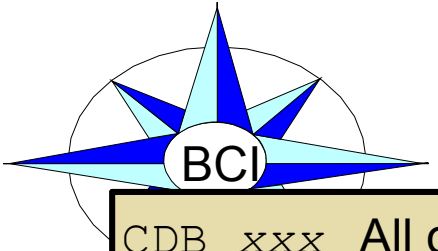
Common and Local Privileges and Roles



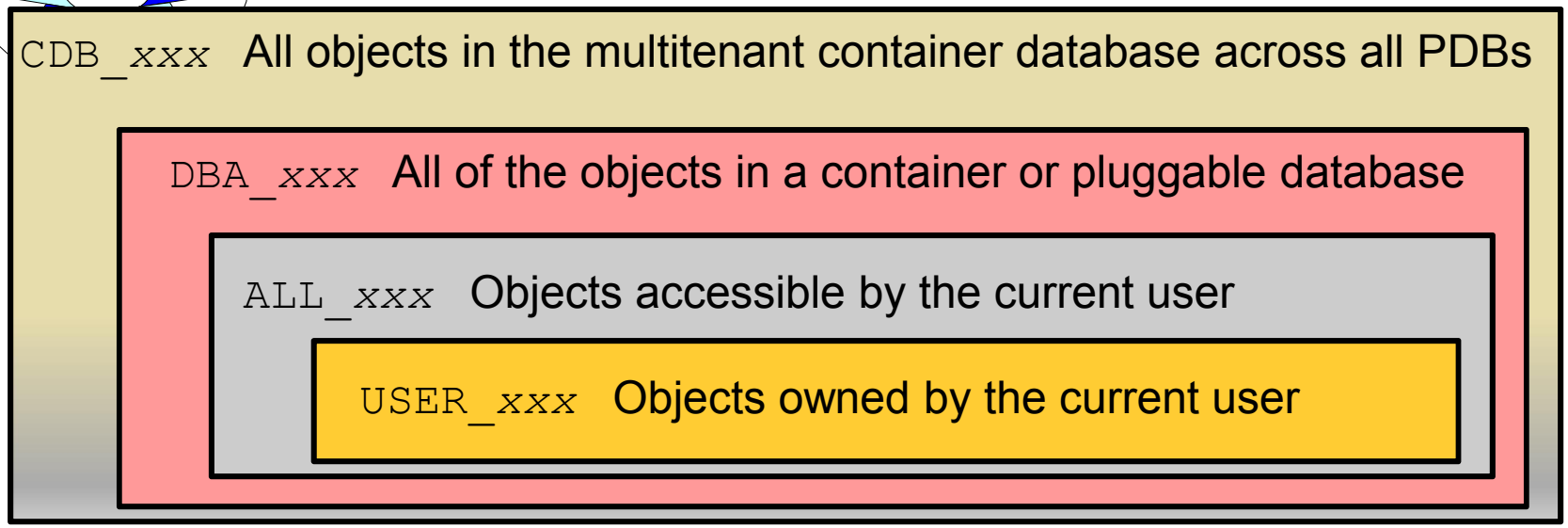
Shared and Non-Shared Objects

Multitenant Container Database





Data Dictionary Views

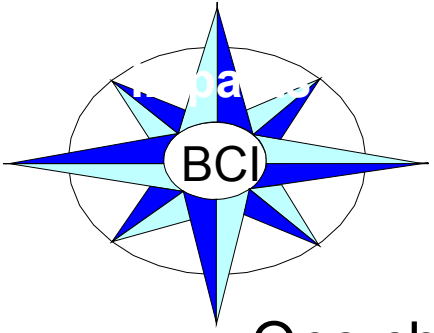



```
SQL> SELECT view_name FROM dba_views WHERE view_name like 'CDB%';
```

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

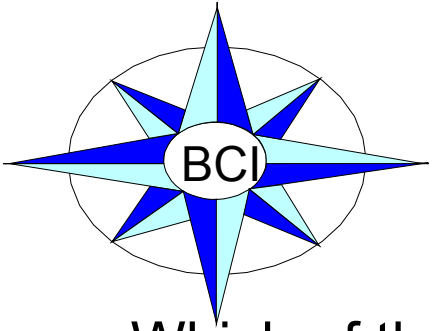
DBA dictionary views providing information within PDB:

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



Impacts

- One character set for all PDBs (Unicode recommended)
- PDB initialization parameters but a single SPFILE
- No PDB qualified database object names
  - SELECT * FROM HR:apps.tab1
  - Use DB Links: SELECT * FROM apps.tab1@HR
- Oracle Data Guard at CDB level
- Oracle Database Vault per PDB only
- One master key per PDB to encrypt PDB data
- Unified audit both at CDB and PDB level
- Oracle Scheduler
- Oracle GoldenGate
- Oracle Streams
- Oracle XStream both at CDB and PDB level



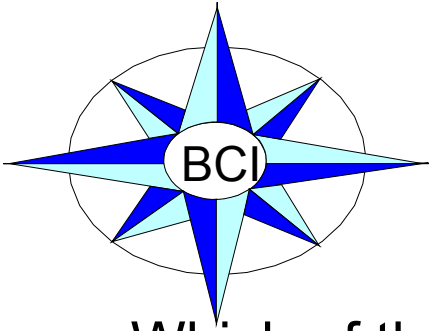
Quiz

Which of the following are true?

a. Oracle-supplied metadata resides only in the root container.

b. The seed PDB can sometimes be opened for very particular operations.

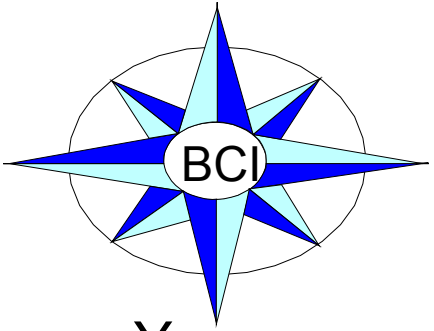
c. A PDB can have the same name in different CDBs.



Quiz

Which of the following are true? There is:

a. Only one `SYSTEM` tablespace per CDB
b. Only one instance per PDB
c. A set of redo log files per PDB
d. Only one `UNDO` tablespace per CDB
e. One `SYSAUX` tablespace per PDB

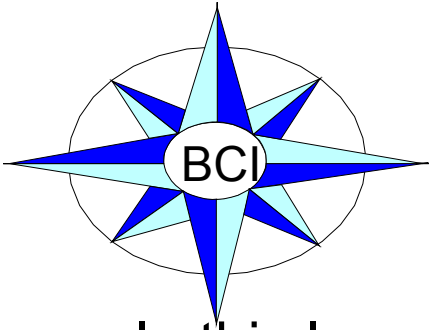


Quiz

You can create common users in a PDB.

a. True

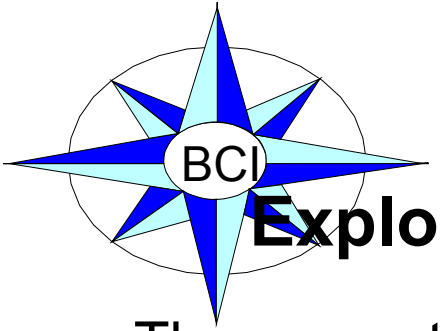
b. False



Summary

In this lesson, you should have learned how to:

- Describe the multitenant architecture
- Describe the root and pluggable database containers
- Differentiate the root from a pluggable database
- Explain pluggable database plugging
- List impacts in various areas



Practice 2 Overview: Exploring a Multitenant Container Database

These practices cover the following topics:

- Exploring the CDB processes and files
- Displaying CDB_*xxx* views