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TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- Oracle Architecture
- Memory Components
- Background Processes

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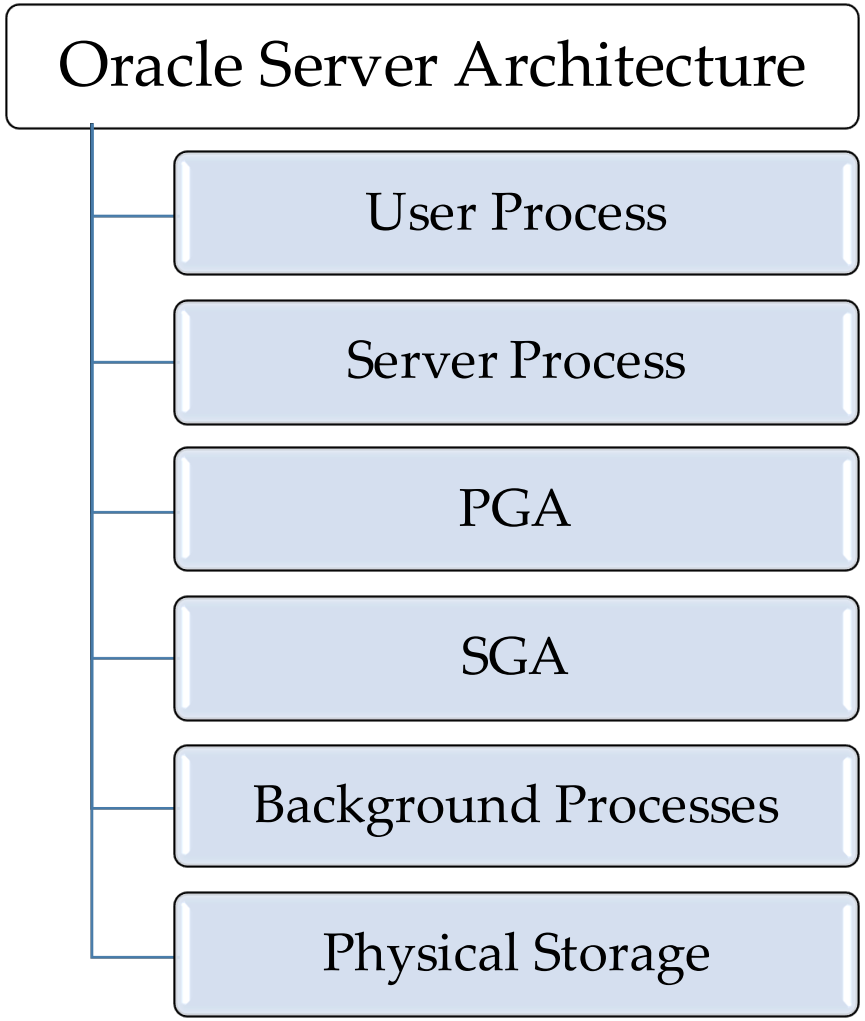
Oracle 19c Database Architecture



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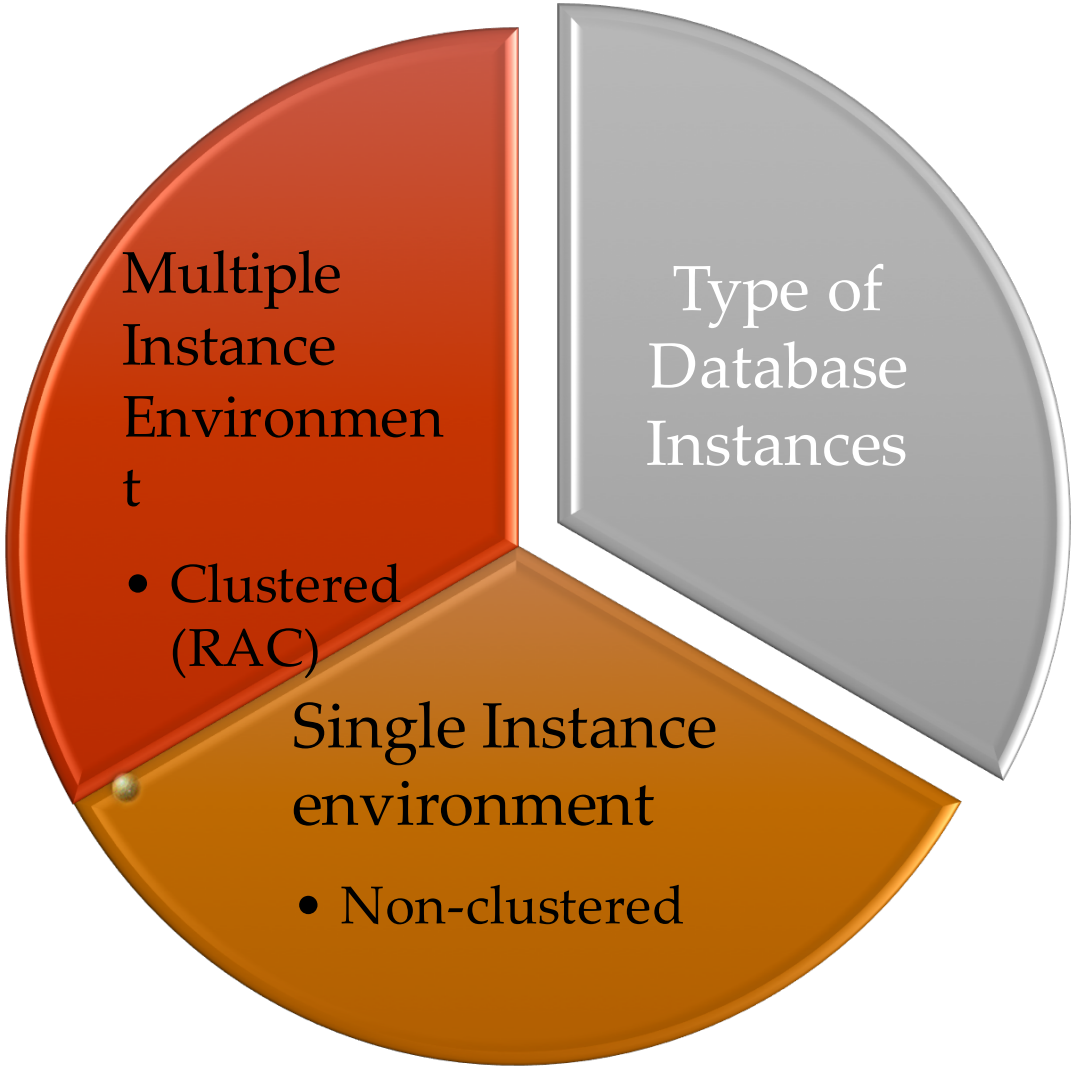
Oracle 19c Database Architecture



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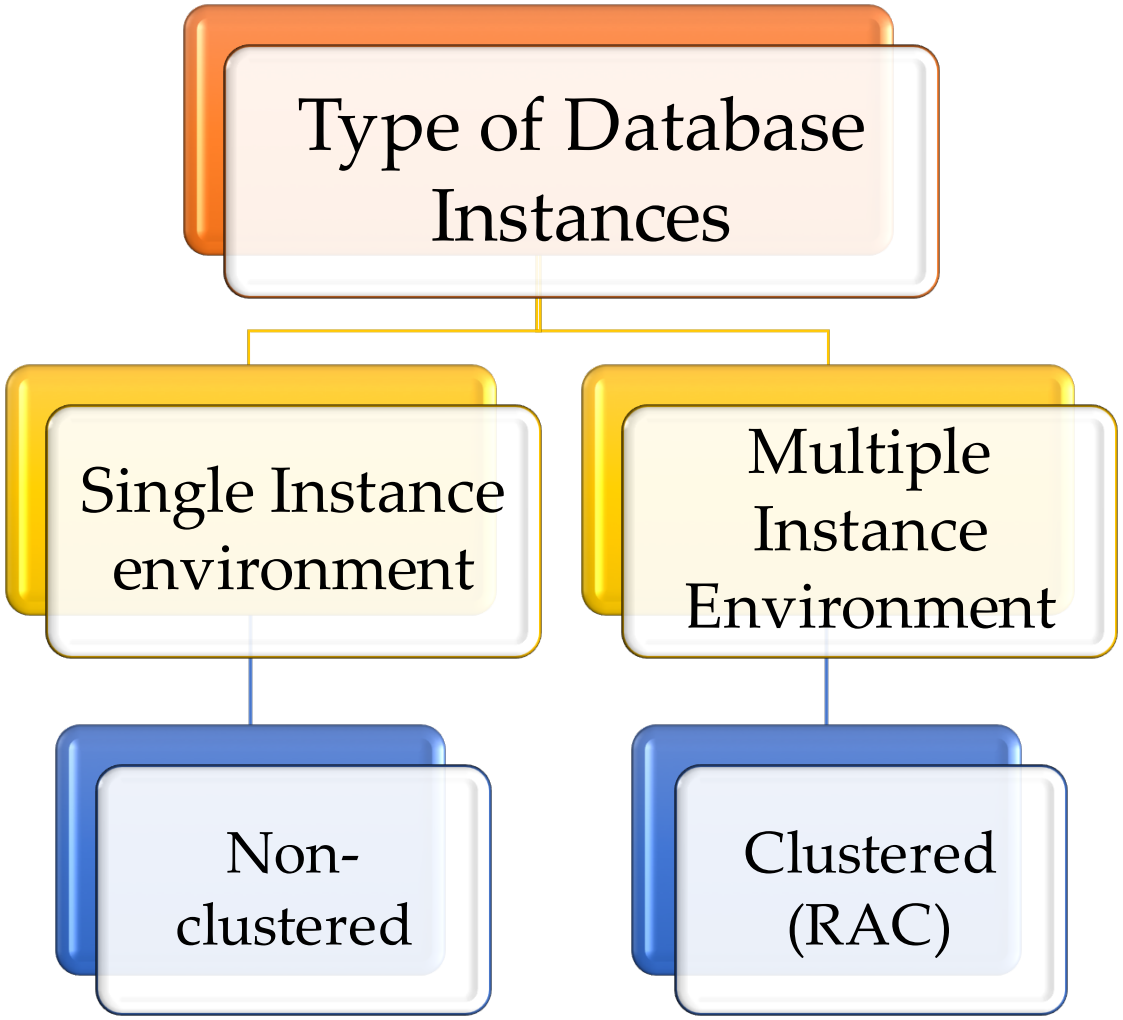
Oracle 19c Database Architecture



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Oracle 19c Database Architecture

Connection

The User process connects to the server process

The server process connects to the SGA

If data is not in memory the server process loads data from the physical structures into the SGA

user --- sql statement -- server --- sga = session

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Oracle 19c Database Architecture

The Database consists of an

- Instance
- Datafiles

The Instance consists of

- SGA
- PGA
- Background processes

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Oracle 19c Database Architecture

The Oracle Datafiles are:

- Control files
- DataFiles
- Online Redo Log Files

ASM (Grid Infrastructure)

Non-ASM

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Non Database files

- archivelog files
- alert.log files
- trace files

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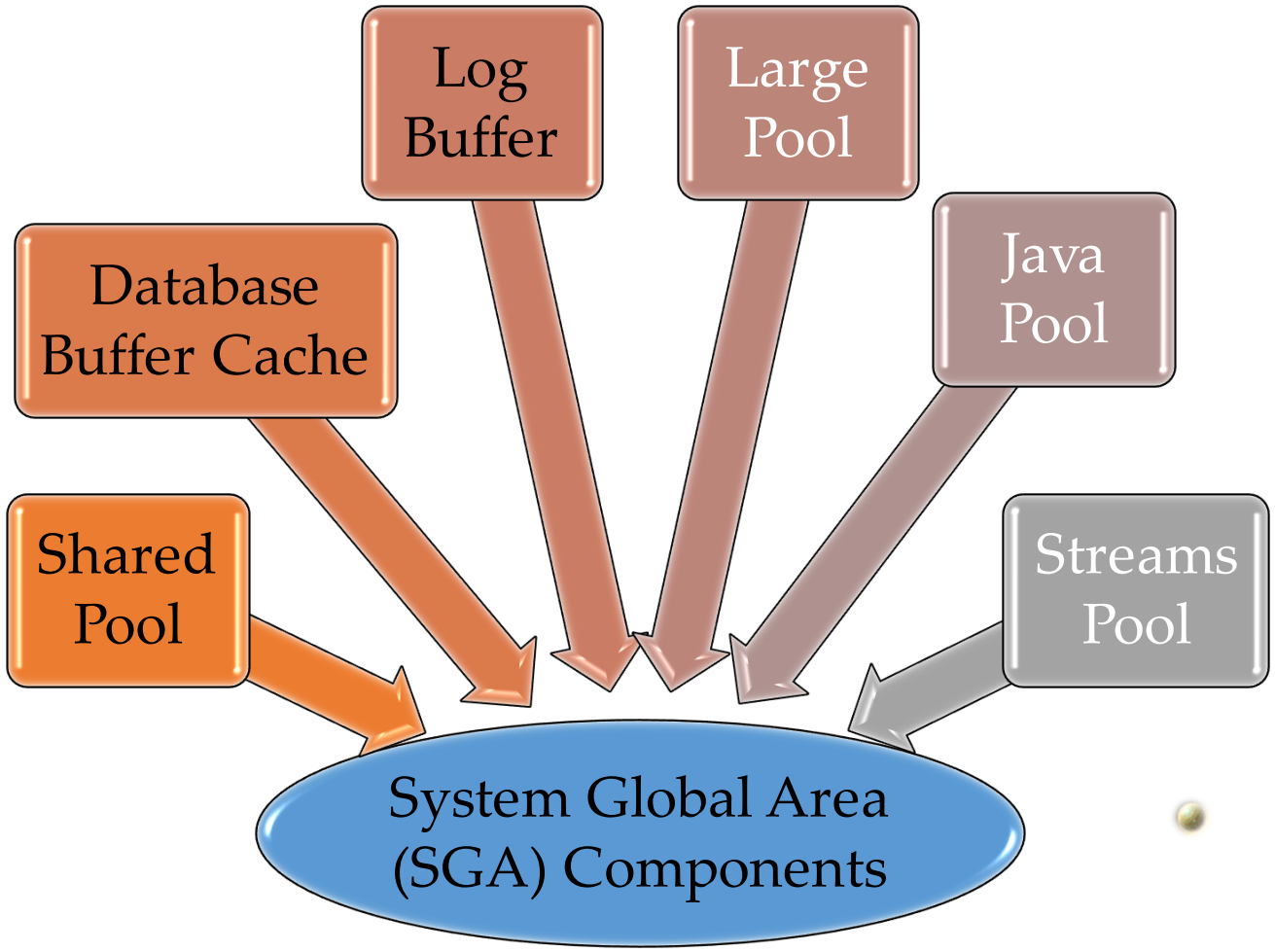
Oracle 19c Database Architecture



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Oracle 19c Database Architecture

Shared Pool

- Shared Sql Statements
- Library Cache
- Dictionary cache
- Sql Results Cache

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Oracle 19c Database Architecture

Database Buffer Cache

- Logical data read from the Datafiles
- Goal is to retrieve most information from memory
- Keep Pool
  - Data does not age out
- Default Pool
  - Over time data does age out
- Recycle Pool
  - Data ages out right after processing is complete

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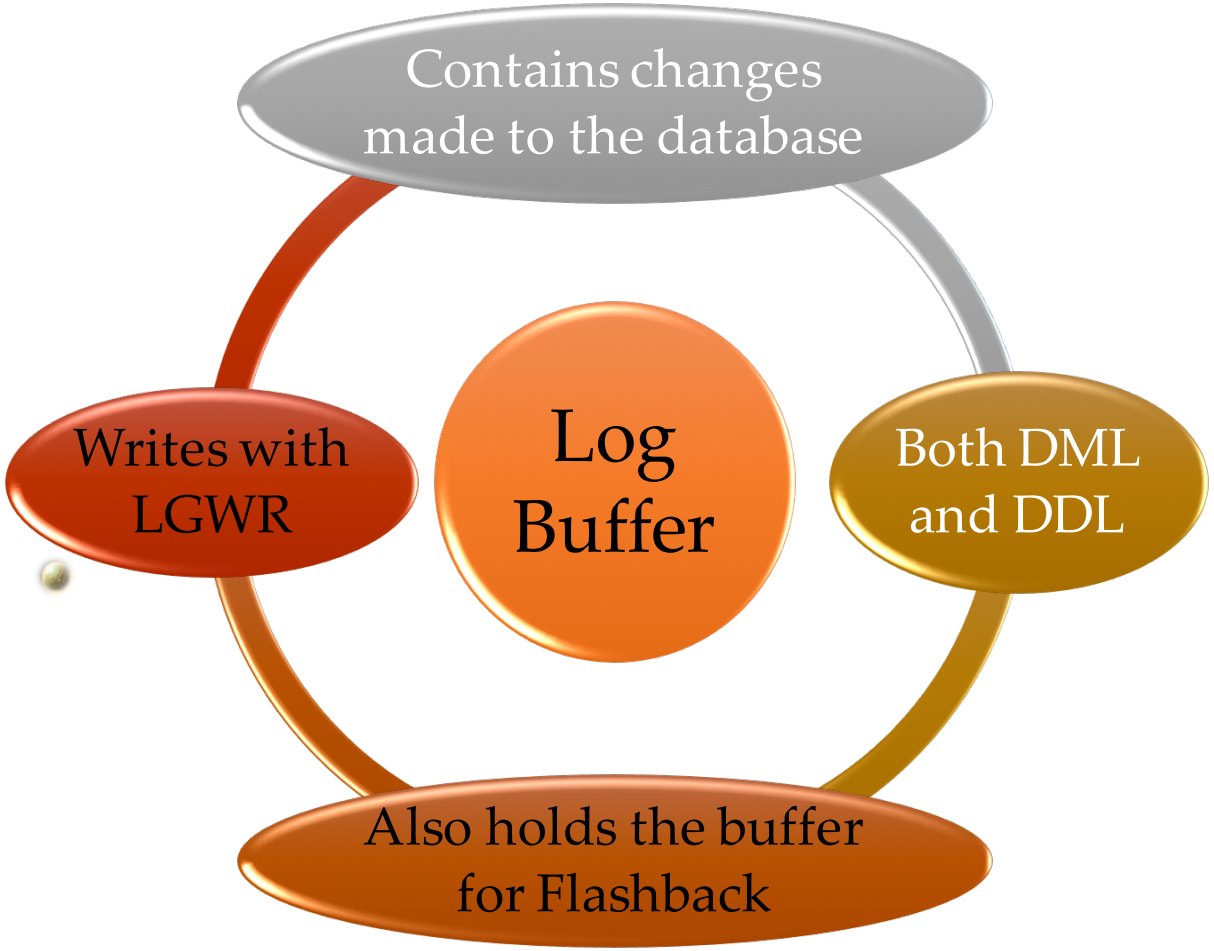
Oracle 19c Database Architecture



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Oracle 19c Database Architecture

Large Pool

Used for Shared Server

Used by RMAN

Used by ASM to perform disk activities

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Oracle 19c Database Architecture

- Used for Oracle Streams product
- Used for buffered queue messages

Streams Pool

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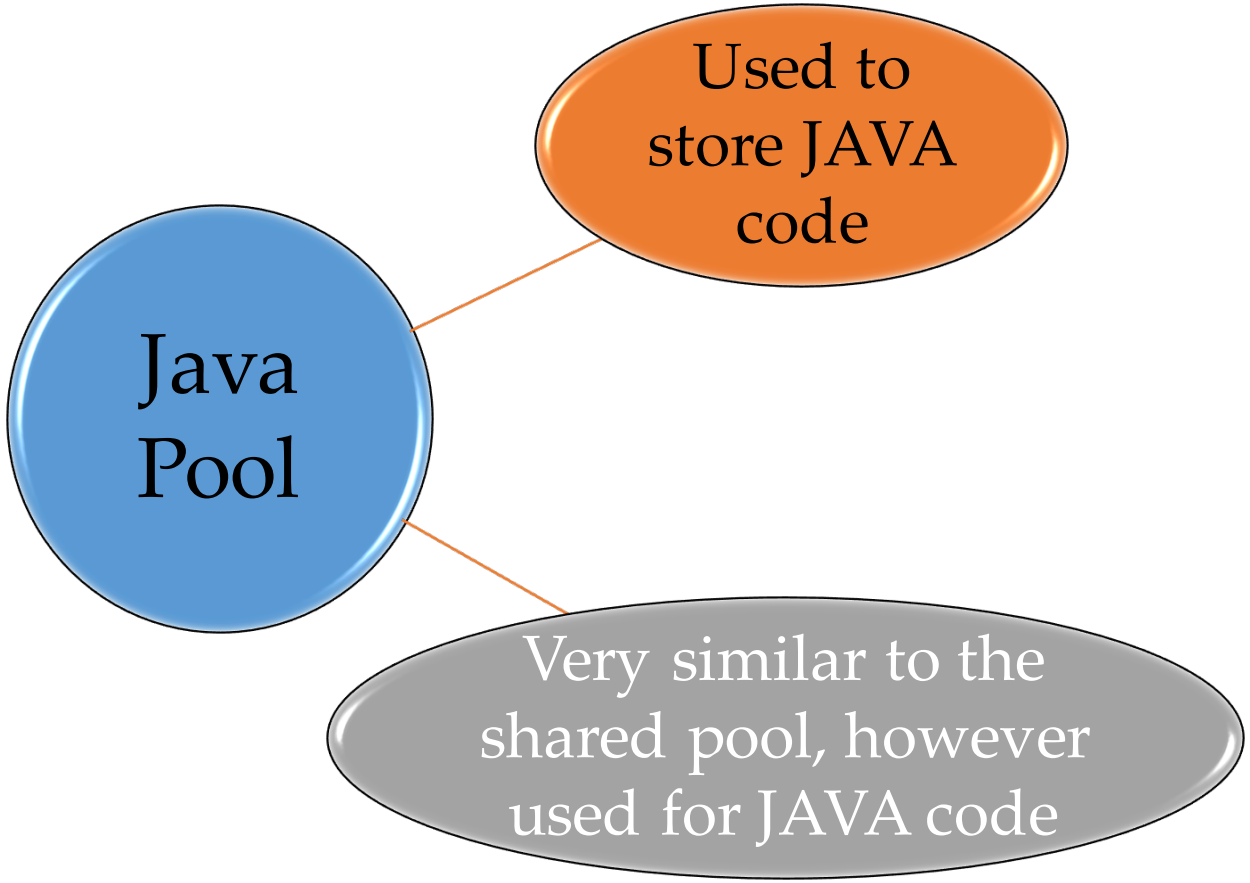
Oracle 19c Database Architecture



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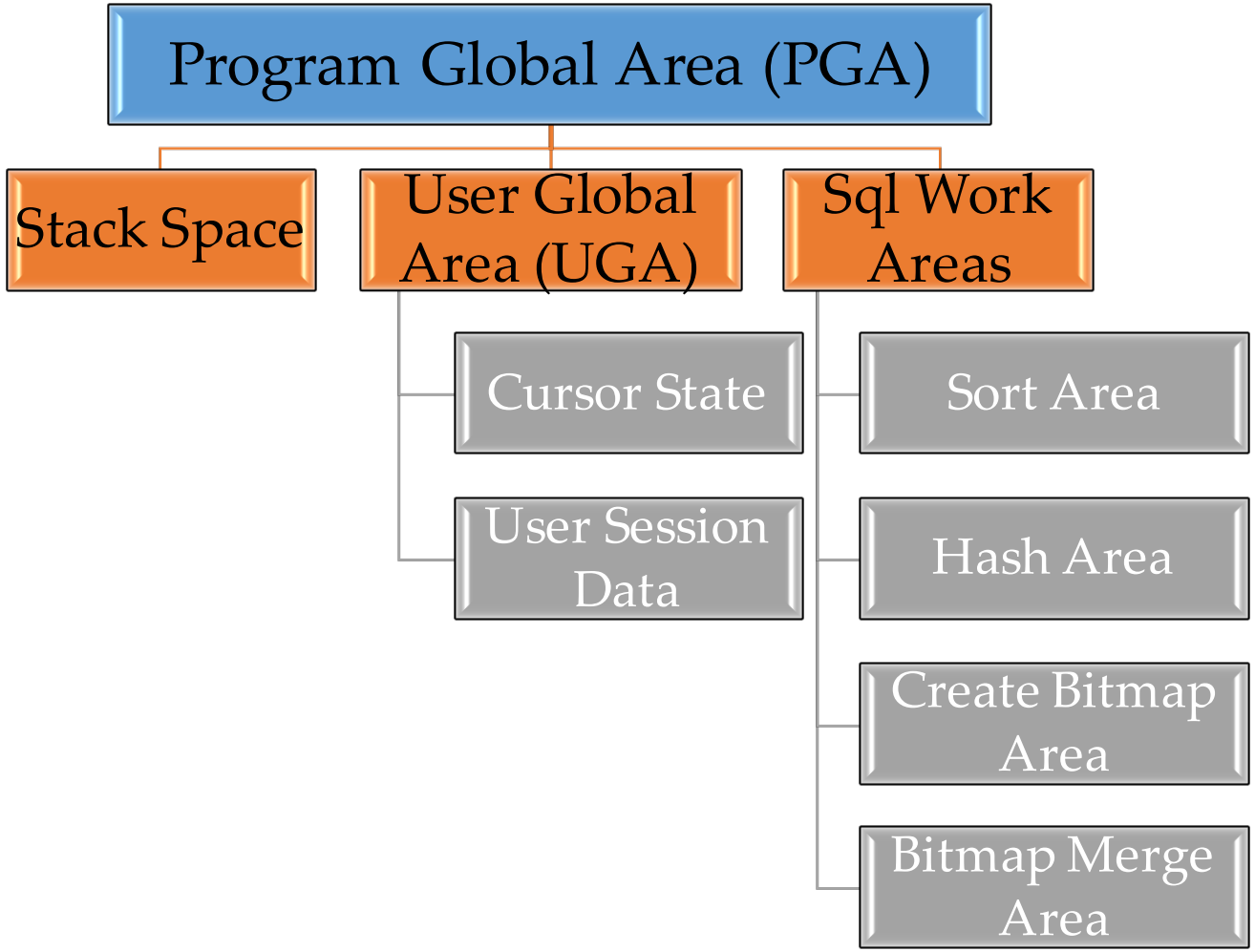
Oracle 19c Database Architecture



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Oracle 19c Database Architecture

Standard Background processes

Server Process	• Communicates between the user process and SGA
SMON	• Instance failure
PMON	• Process failure
DBWR	• Writes to data files

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Oracle 19c Database Architecture

Standard Background processes

LGWR

- Writes from the log buffer to online redo logs
  - 1 mb
  - 1/3 full
  - commit
  - 3 secs

MMON

- AWR

MMAN

- memory target
- sga target

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Oracle 19c Database Architecture

Standard Background processes

CHKPT	• Updates the headers of data files to keep everything in-sync
ARCH	• Used when the database is in Archive log mode
RVWR	• Used for Flashback database
CTWR	• Change tracking file

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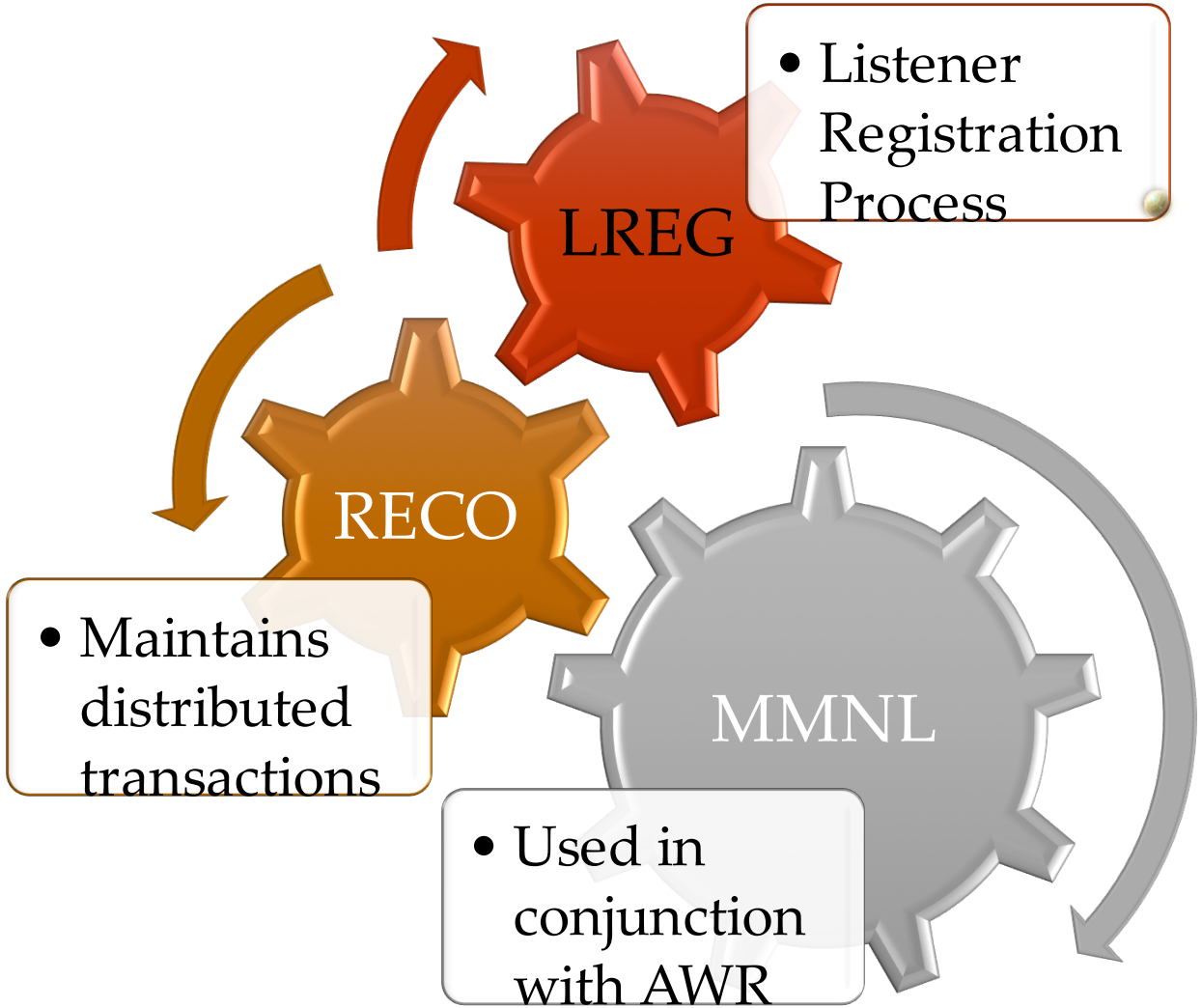
Oracle 19c Database Architecture

Standard Background processes



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Oracle 19c Database Architecture

Grid Infrastructure Processes		
OHAS • Oracle High Availability Services	OCCS • Oracle cluster synchronization services	DISKMON • ASM Disk monitor

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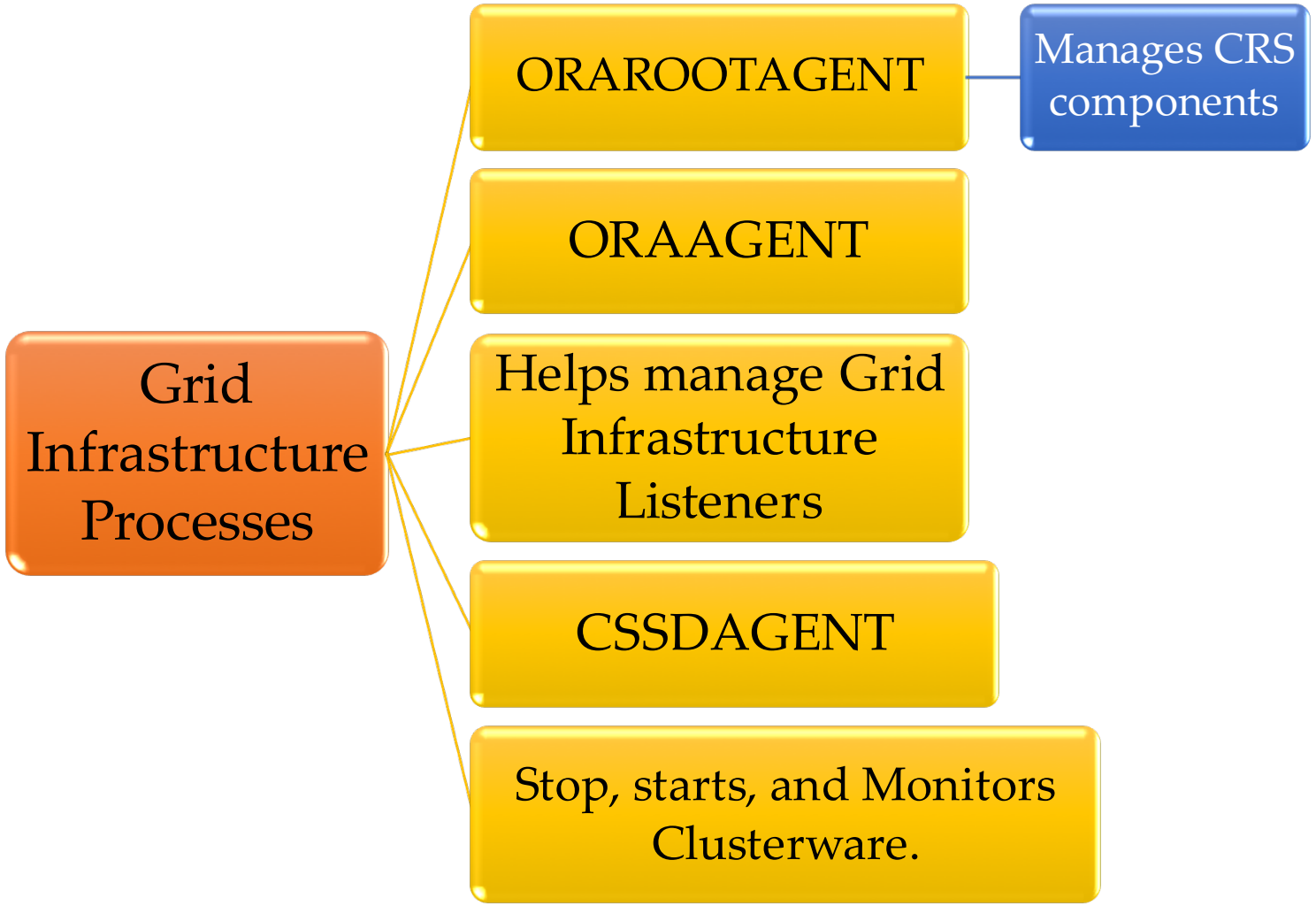
Oracle 19c Database Architecture



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Oracle 19c Architecture

- Summary
  - Database processes
  - Container Processes
  - SGA

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Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- Define Oracle's Multitenant Architecture
- Root Containers
- Container Databases/Pluggable Databases

Multitenant Architecture

What is oracle's Multitenant Architecture?

- The ability to have several oracle self-contained databases sharing common system structures
- The ability to copy an entire database from one root container database to another
- The definition Multitenant is several databases sharing resources:
  - SGA
  - Control files
  - System files
  - online Redo log files

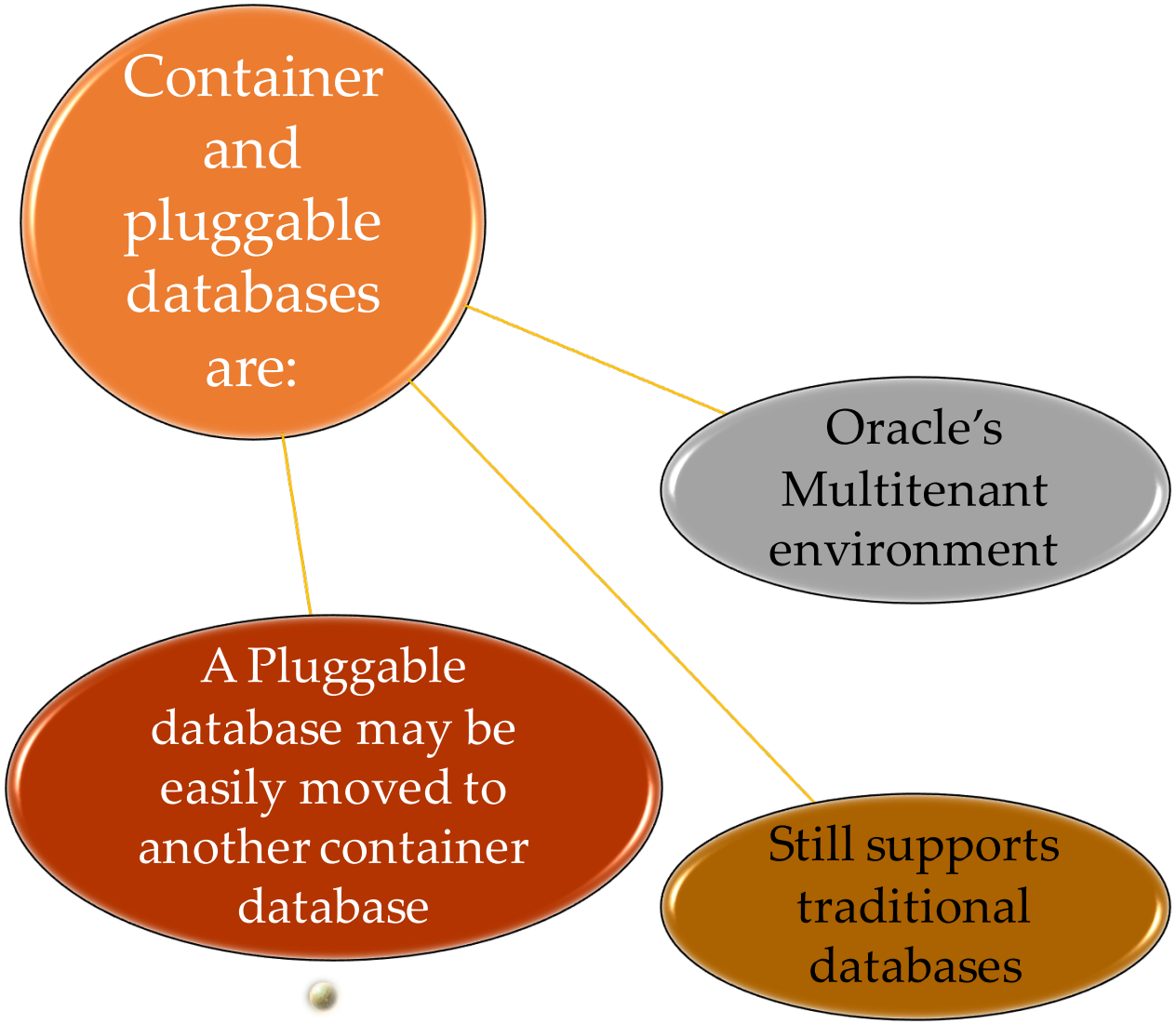
Multitenant Architecture

What is a pluggable database?

What is a container databases?

- A Container database is a set of or group of application databases
- Provides for a centralized management of common databases
- Can be patched and upgraded from one location
- May be grouped together single change may apply to many

Oracle 19c Database Multitenant Architecture



Oracle 19c Database Multitenant Architecture

Container Databases

Similar to original oracle technology

Databases shares the SGA, control files and Redo log files, Datafiles System, and undo

Container database will be application datafiles

HR datafiles	INV datafiles	AP Datafiles

Oracle 19c Database Multitenant Architecture

The container database will contain all system related information

The pluggable database will be the application databases that can 'plug in' to the system database

Initial creation will only create the base oracle database schemas

- OBJ$
- TAB$
- SOURCE$

Oracle 19c Database Multitenant Architecture

- The Oracle main container is referred to as the 'root container'

The user/application database is referred to as the Pluggable Database PDB

Root
- Oracle Metadata

PDB
- User Metadata
- User Data

Oracle 19c Database Multitenant Architecture

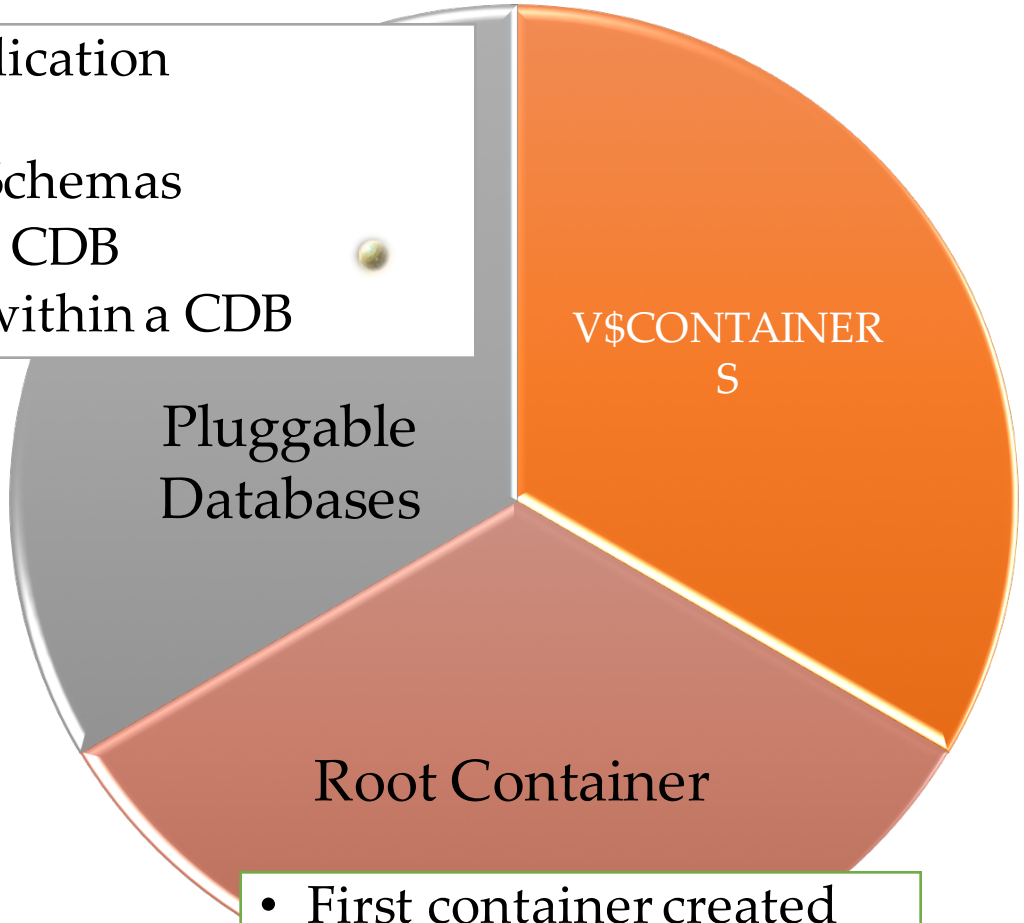
The pluggable databases are created by

- Plug in the non-CDB (Backwards databases)
- Database Cloning
- use PDB
- Re-Plug on PDB into the CDB
- PDB = Pluggable Database
- CDB = Container Database

Oracle 19c Database Multitenant Architecture

Container Database

- Contains application information
- Tablespaces/Schemas
- 253 PDBS per CDB
- 512 Services within a CDB



- First container created and it is mandatory
- Oracle objects and metadata

Oracle 19c Database Multitenant Architecture

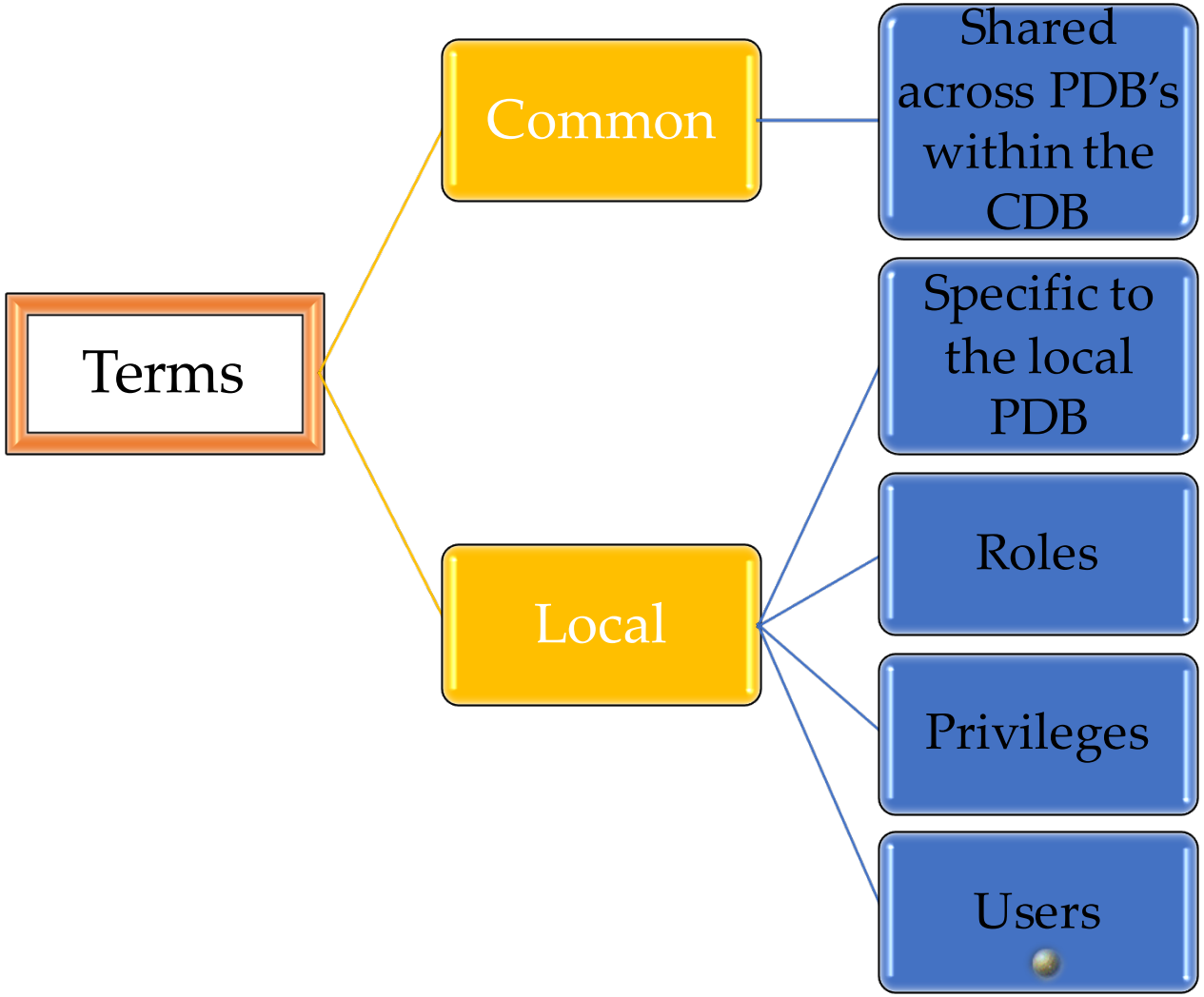
Root Container

UNDO

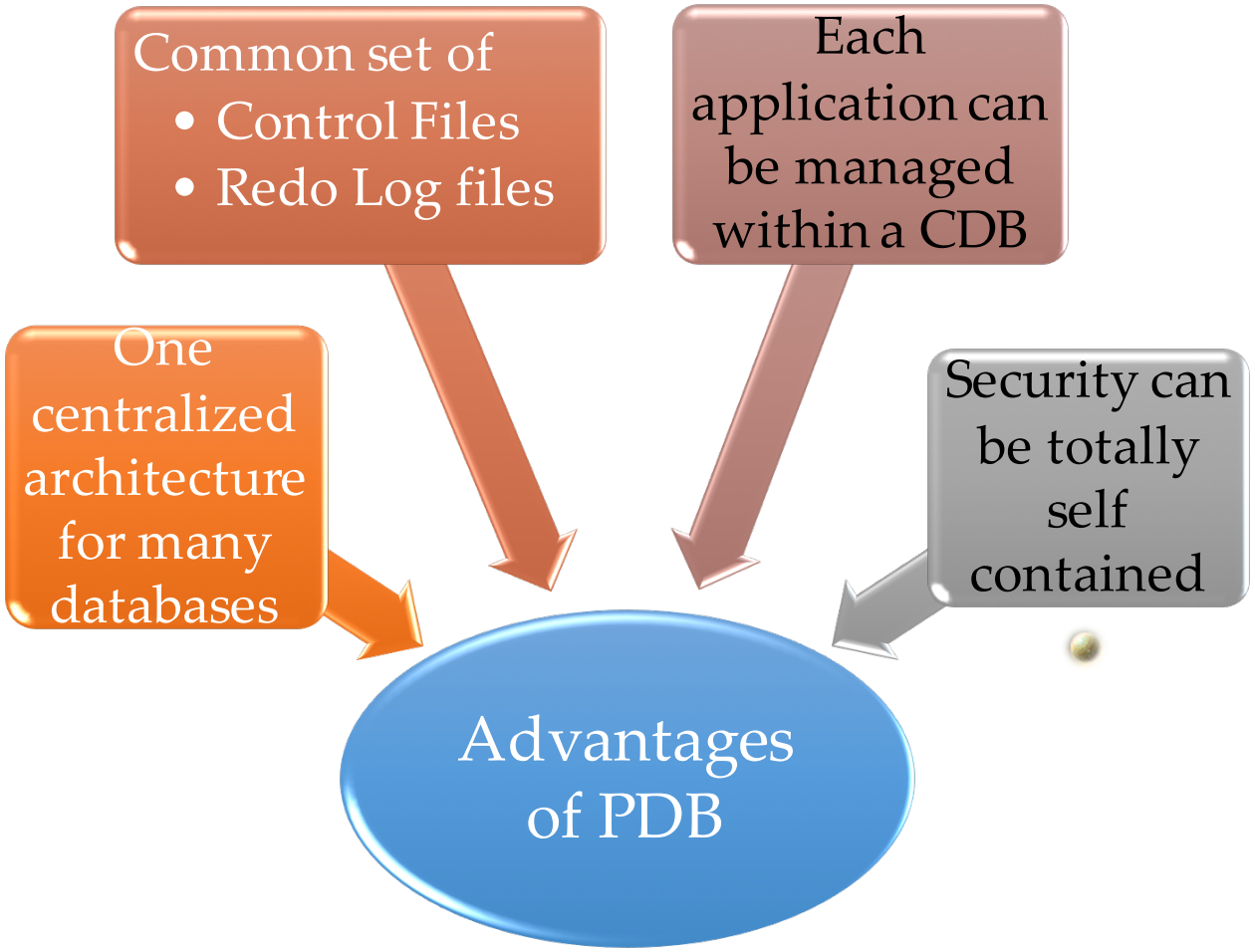
Temp Tablespaces

Control Files and Redo log files belong to the CDB

Oracle 19c Database Multitenant Architecture



Oracle 19c Database Multitenant Architecture



Oracle 19c Database Multitenant Architecture

New set of dictionary tables

CDB_
- All the objects across the PDB

DBA_
- All objects within the current PDB

ALL_
- All objects accessible to the current user

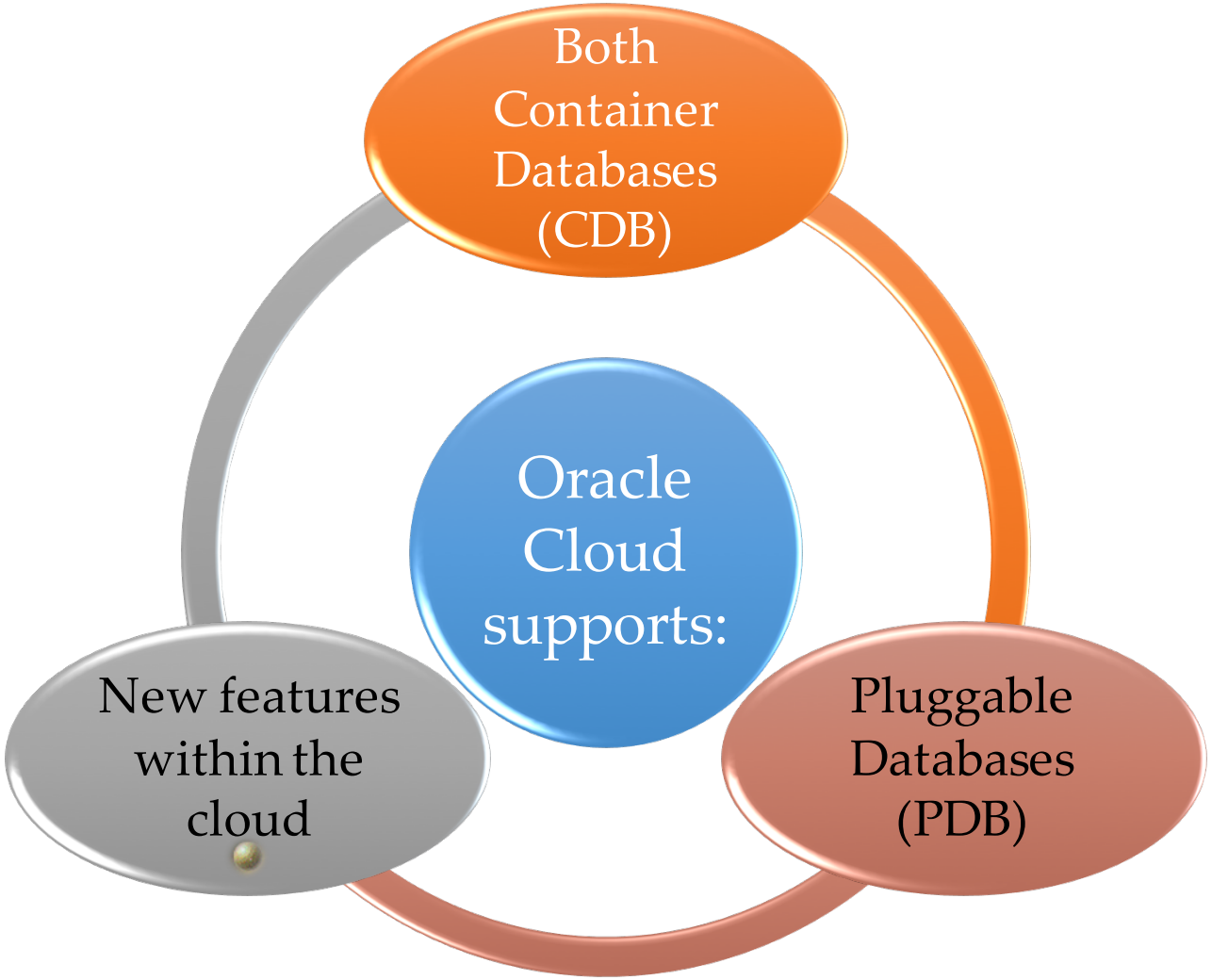
User_
- Objects owned by the current user

Oracle 19c Database Multitenant Architecture

Changes

- Specify a common characterset
  - (Unicode)
- Uses a single spfile
- Database names need to qualified in select statements
  - select * from app.tab@gl
- Data Guard is enforced at the CDB level
- Auditing at the CDB and PDB level
- Supports Golden Gate and Scheduler

Oracle 19c Database Multitenant Architecture



Oracle 19c Database Multitenant Architecture

- The overall repository of common metadata used across applications

Container Databases (root)

- The application specific database that contains data and metadata relating to a specific application

Pluggable Databases

- Summary
  - Container Databases
  - Pluggable Databases
  - Architecture

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Lesson Topics

Identify CDB_* Views

Identify PDB_* Views

Utiltize CDB Security

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Oracle 19c Container Database Architecture

- Container database and pluggable database are new to Oracle 19c
- There is one root container database with multiple pluggable database
- A pluggable database may be plugged and unplugged from one container database to another

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Oracle 19c Container Database Architecture

Once a container database is started pluggable databases may be independently started or set to automatically start

Pluggable database share the following with the container database and other pluggable databases:

- SGA
- SYSTEM Tablespaces
- SYSAUX tablespaces
- Online Redo Logs
- Undo Tablespaces

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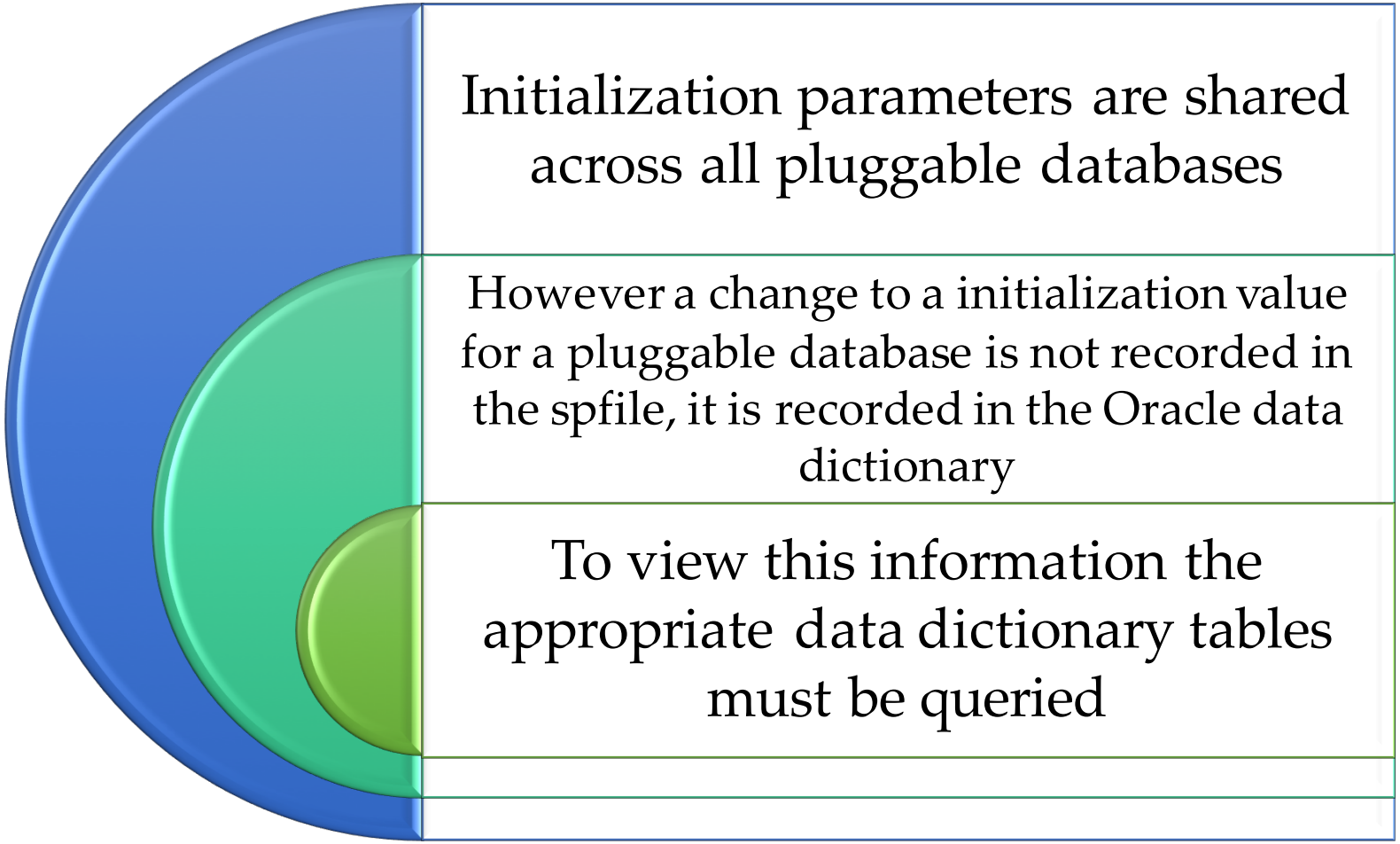
Oracle 19c Container Database Architecture



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Oracle 19c Container Database Architecture

Worksheet | Query Builder

```
select a.name,value$,con_id,b.name from pdb_spfile$ a join v$pdbs b on (a.pdb_uid=b.con_uid);
```

Query Result

SQL | All Rows Fetched: 1 in 0.004 seconds

	NAME	VALUE$	CON_ID	NAME_1
1	sessions	300	3	ORCL_PDB

To view database parameters by pluggable database (PDB)

select a.name,value$,con_id,b.name from pdb_spfile$ a join v$pdbs b on (a.pdb_uid=b.con_uid);

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Oracle 19c Container Database Architecture

Available data dictionary views to obtain pluggable database information are:

DBA_HIST_PDB_INSTANCE

- Pluggable database instance information

DBA_PDBS

- All pluggable databases and their current status

DBA_PDB_HISTORY

- The history of the pluggable database and which container it belonged to

V$PDBS

- Dynamic performance view for pluggable databases

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Oracle 19c Container Database Architecture

Available data dictionary views to obtain pluggable database information are:

V$PDB_INCARNATION
- Pluggable database versions

DBA_CDB_RSRC_PLANS
- Resource plans by container database

DBA_CDB_RSRC_PLAN_DIRECTIVES
- Container database resource plan directives

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Oracle 19c Container Database Architecture

Worksheet | Query Builder

```
select * from v$pdbs;
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.007 seconds

	DBID	CON_UID	GUID	NAME	OPEN_MODE	REST...	OPEN_TIME	CREATE_SCN	TOTAL_SIZE
1	2	4084953685	4084953685	F4BD06A7D07F...	PDB$SEED	READ ONLY	NO	17-JUL-14 08.28.25....	1720784	283115520
2	3	3572335755	3572335755	F4BD285D15A6...	ORCL_PDB	MOUNTED	(null)	(null)	2250867	0
3	4	1835756340	1835756340	F54B5AA77219...	PLUG_SEED	MOUNTED	(null)	(null)	2258978	0
4	5	4049108937	4049108937	FE56E9003D0B...	GOGOPDB	READ WRITE	NO	17-JUL-14 10.34.00....	2647487	283115520

To determine the status of PDBS query the V$PDBS view

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Container Database Architecture

orcldb_sys

Worksheet | Query Builder

```
select * from dba_hist_pdb_instance;
```

Script Output | Query Result

SQL | All Rows Fetched: 3 in 0.017 seconds

	DBID	I...	STARTUP_TIME	CON_DBID	OPEN_TIME	O...	PDB_NAME	CON_ID
1	1907214501	1	17-JUL-14 08.27.54.000000000 AM	4049108937	17-JUL-14 10.34.00.449000000 AM	OPEN	GOGOPDB	5
2	1907214501	1	16-JUL-14 01.33.52.000000000 PM	3572335755	16-JUL-14 01.44.56.341000000 PM	OPEN	ORCL_PDB	3
3	1907214501	1	16-JUL-14 04.10.57.000000000 PM	3572335755	16-JUL-14 04.12.29.382000000 PM	OPEN	ORCL_PDB	3

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```
desc dba_pdbs
Name          Null     Type
------------- -------- -------------
PDB_ID        NOT NULL NUMBER
PDB_NAME      NOT NULL VARCHAR2(128)
DBID          NOT NULL NUMBER
CON_UID       NOT NULL NUMBER
GUID                   RAW(16 BYTE)
STATUS                 VARCHAR2(13)
CREATION_SCN           NUMBER
```

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```
select * from dba_pdbs;
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.023 seconds

	PDB_ID	PDB_NAME	DBID	CON_UID	GUID	STATUS	CREATION_SCN
1	3	ORCL_PDB	3572335755	3572335755	F4BD285D15A68B6FE043650AA8C02DCF	NORMAL	2250867
2	2	PDB$SEED	4084953685	4084953685	F4BD06A7D07F7EC2E043650AA8C017C4	NORMAL	1720784
3	4	PLUG_SEED	1835756340	1835756340	F54B5AA7721970D8E043650AA8C08856	NORMAL	2258978
4	5	GOGOPDB	4049108937	4049108937	FE56E9003D0BADC3E043650AA8C073B8	NORMAL	2647487

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```
desc dba_pdb_history
Name                    Null     Type
----------------------- -------- -------------
PDB_NAME                NOT NULL VARCHAR2(128)
PDB_ID                  NOT NULL NUMBER
PDB_DBID                NOT NULL NUMBER
PDB_GUID                NOT NULL RAW(16 BYTE)
OP_SCNBAS               NOT NULL NUMBER
OP_SCNWRP               NOT NULL NUMBER
OP_TIMESTAMP            NOT NULL DATE
OPERATION               NOT NULL VARCHAR2(16)
DB_VERSION              NOT NULL NUMBER
CLONED_FROM_PDB_NAME             VARCHAR2(128)
CLONED_FROM_PDB_DBID             NUMBER
CLONED_FROM_PDB_GUID             RAW(16 BYTE)
DB_NAME                          VARCHAR2(128)
DB_UNIQUE_NAME                   VARCHAR2(128)
DB_DBID                          NUMBER
CLONETAG                         VARCHAR2(128)
```

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```
select * from dba_pdb_history;
```

Script Output | Query Result

SQL | All Rows Fetched: 0 in 0.044 seconds

PDB_NA...	PDB_ID	PDB_DBID	PDB_GUID	OP_SCN...	OP_SCN...	OP_TIM...	OPERAT...	DB_VER...	CLONE...	CLONE...	CLON

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```
desc v$pdbs
Name        Null Type
---------- ---- ------------
CON_ID          NUMBER
DBID            NUMBER
CON_UID         NUMBER
GUID            RAW(16 BYTE)
NAME            VARCHAR2(30)
OPEN_MODE       VARCHAR2(10)
RESTRICTED      VARCHAR2(3)
OPEN_TIME       TIMESTAMP(3)
CREATE_SCN      NUMBER
TOTAL_SIZE      NUMBER
```

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```
select * from v$pdbs;
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.006 seconds

		DBID	CON_UID	GUID	NAME	OPEN_MODE	REST...	OPEN_TIME	CREATE_SCN	TOTAL_SIZE
1	2	4084953685	4084953685	F4BD06A7D07F...	PDB$SEED	READ ONLY	NO	17-JUL-14 08.28.25....	1720784	283115520
2	3	3572335755	3572335755	F4BD285D15A6...	ORCL_PDB	MOUNTED	(null)	(null)	2250867	0
3	4	1835756340	1835756340	F54B5AA77219...	PLUG_SEED	MOUNTED	(null)	(null)	2258978	0
4	5	4049108937	4049108937	FE56E9003D0B...	GOGOPDB	READ WRITE	NO	17-JUL-14 10.34.00....	2647487	283115520

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Oracle 19c Container Database Architecture

```
desc v$pdb_incarnation
Name                        Null Type
--------------------------- ---- ------------
DB_INCARNATION#                  NUMBER
PDB_INCARNATION#                 NUMBER
STATUS                           VARCHAR2(7)
INCARNATION_SCN                  NUMBER
INCARNATION_TIME                 DATE
BEGIN_RESETLOGS_SCN              NUMBER
BEGIN_RESETLOGS_TIME             DATE
END_RESETLOGS_SCN                NUMBER
END_RESETLOGS_TIME               DATE
PRIOR_DB_INCARNATION#            NUMBER
PRIOR_PDB_INCARNATION#           VARCHAR2(40)
FLASHBACK_DATABASE_ALLOWED       VARCHAR2(3)
CON_ID                           NUMBER
```

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Oracle 19c Container Database Architecture

```
select * from v$pdb_incarnation;
```

Script Output | Query Result

SQL | All Rows Fetched: 10 in 0.1 seconds

	...	P...	STATUS	INCARNA...	INCARN...	BEGIN_R...	BEGIN_RE...	END_...	END_RESE...	...	PRIOR_PDB_...	FLASH...	
1	2	0	CURRENT	1720082	16-MAR-14	1720082	16-MAR-14	1720082	16-MAR-14	1	0	YES	1
2	1	0	PARENT	1	24-MAY-13	1	24-MAY-13	1	24-MAY-13	0	(null)	YES	1
3	2	0	CURRENT	1720082	16-MAR-14	1720082	16-MAR-14	1720082	16-MAR-14	1	0	YES	2
4	1	0	PARENT	1	24-MAY-13	1	24-MAY-13	1	24-MAY-13	0	(null)	YES	2
5	2	0	CURRENT	1720082	16-MAR-14	1720082	16-MAR-14	1720082	16-MAR-14	1	0	YES	3
6	1	0	PARENT	1	24-MAY-13	1	24-MAY-13	1	24-MAY-13	0	(null)	YES	3
7	2	0	CURRENT	1720082	16-MAR-14	1720082	16-MAR-14	1720082	16-MAR-14	1	0	YES	4
8	1	0	PARENT	1	24-MAY-13	1	24-MAY-13	1	24-MAY-13	0	(null)	YES	4
9	2	0	CURRENT	1720082	16-MAR-14	1720082	16-MAR-14	1720082	16-MAR-14	1	0	YES	5
10	1	0	PARENT	1	24-MAY-13	1	24-MAY-13	1	24-MAY-13	0	(null)	YES	5

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Oracle 19c Container Database Architecture

```
desc dba_cdb_rsrc_plans
Name        Null     Type
---------- -------- --------------
PLAN_ID    NOT NULL NUMBER
PLAN                VARCHAR2(128)
COMMENTS            VARCHAR2(2000)
STATUS              VARCHAR2(128)
MANDATORY           VARCHAR2(3)
```

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Oracle 19c Container Database Architecture

```
select * from dba_cdb_rsrc_plans;
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.042 seconds

	PLAN_ID	PLAN	COMMENTS	STATUS	MANDATORY
1	16774	DEFAULT_CDB_PLAN	Default CDB plan	(null)	YES
2	16777	ORA$QOS_CDB_PLAN	QOS CDB plan	(null)	YES
3	16776	ORA$INTERNAL_CDB_PLAN	Internal CDB plan	(null)	YES
4	16775	DEFAULT_MAINTENANCE_PLAN	Default CDB maintenance plan	(null)	YES

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Oracle 19c Container Database Architecture

```
desc dba_cdb_rsrc_plan_directives
Name                    Null Type
----------------------- ---- --------------
PLAN                         VARCHAR2(128)
PLUGGABLE_DATABASE           VARCHAR2(128)
SHARES                       NUMBER
UTILIZATION_LIMIT            NUMBER
PARALLEL_SERVER_LIMIT        NUMBER
COMMENTS                     VARCHAR2(2000)
STATUS                       VARCHAR2(128)
MANDATORY                    VARCHAR2(3)
```

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Oracle 19c Container Database Architecture

```
select * from dba_cdb_rsrc_plan_directives;
```

Script Output | Explain Plan | Query Result

SQL | All Rows Fetched: 8 in 0.016 seconds

	PLAN	PLUGGABLE_DATABASE	SHARES	UTILI...	PARALLE...	COMMENTS	STATUS	MANDATORY
1	DEFAULT_CDB_PLAN	ORA$DEFAULT_PDB_DIRECTIVE	1	100	100	Default Directive	(null)	YES
2	DEFAULT_CDB_PLAN	ORA$AUTOTASK	(null)	90	100	Autotask Directive	(null)	YES
3	DEFAULT_MAINTENANCE_PLAN	ORA$DEFAULT_PDB_DIRECTIVE	1	100	100	Default Directive	(null)	YES
4	DEFAULT_MAINTENANCE_PLAN	ORA$AUTOTASK	(null)	90	100	Autotask Directive	(null)	YES
5	ORA$INTERNAL_CDB_PLAN	ORA$DEFAULT_PDB_DIRECTIVE	(null)	(null)	(null)	(null)	(null)	YES
6	ORA$INTERNAL_CDB_PLAN	ORA$AUTOTASK	(null)	(null)	(null)	(null)	(null)	YES
7	ORA$QOS_CDB_PLAN	ORA$DEFAULT_PDB_DIRECTIVE	1	100	100	Default Directive	(null)	YES
8	ORA$QOS_CDB_PLAN	ORA$AUTOTASK	(null)	90	100	Autotask Directive	(null)	YES

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Oracle 19c Container Database Architecture

Security within Container database and pluggable databases are similar

The same sys account may be used to access both the container and pluggable databases

A Pluggable database will be opened or closed with a sysdba or sysoper account

However a pluggable database will have its own administrator account

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Oracle 19c Container Database Architecture

The system account may also access the pluggable database as well as the new super user roles:

- SYSBACKUP
- SYSDG
- SYSKM

All users within a pluggable database are contained within that database

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Oracle 19c Container Database Architecture

The container database will be administered with the system account or another fully qualified account

The pluggable database may also be administered with the system account or the admin account created with the pluggable database

When a pluggable database is unplugged all used information will transport with the pluggable database

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Oracle 19c Container Database Architecture

oracle@huskers:/u01/app/oracle

File Edit View Search Terminal Help

```
[oracle@huskers oracle]$ sqlplus gogo/password1@huskers:1521/gogopdb

SQL*Plus: Release 12.1.0.1.0 Production on Thu Jul 17 15:11:41 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.

Last Successful login time: Thu Jul 17 2014 15:08:13 -04:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL>
```

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Oracle 19c Container Database Architecture

oracle@huskers:/u01/app/oracle

File Edit View Search Terminal Help

```
[oracle@huskers oracle]$ sqlplus hr/hr@huskers:1521/gogopdb

SQL*Plus: Release 12.1.0.1.0 Production on Thu Jul 17 15:13:43 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL>
```

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```
oracle@huskers:/u01/app/oracle
File  Edit  View  Search  Terminal  Help
[oracle@huskers oracle]$ . oraenv
ORACLE_SID = [orclcdb] ?
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers oracle]$ sqlplus system/password1

SQL*Plus: Release 12.1.0.1.0 Production on Thu Jul 17 15:17:15 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.

Last Successful login time: Thu Jul 17 2014 15:16:20 -04:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> select username from dba_users
  2  where username = 'HR';

no rows selected

SQL>
```

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oracle@huskers:/u01/app/oracle

File Edit View Search Terminal Help

```
[oracle@huskers oracle]$ sqlplus system/password1@huskers:1521/gogopdb

SQL*Plus: Release 12.1.0.1.0 Production on Thu Jul 17 15:18:01 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.

Last Successful login time: Thu Jul 17 2014 15:13:32 -04:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> select username from dba_users
  2  where username = 'HR';

USERNAME
--------------------------------------------------------------------------------
HR

SQL>
```

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- Summary
  - New Data Dictionary views
  - Container parameters

TriveraTech
TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

Oracle Logical Storage Structures

Oracle Physical Storage Structures

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Physical and Logical Structure

Database

Datafiles
- Physical files on the OS that contain your data
  - Tables, Indexes

Redo Log Files (Online Redo Log Files)
- Contains all database changes either DDL or DML

Control Files
- Contains names and locations of all database files
- Recommended to have at least 3 controlfiles
- Without the control files the database will not start

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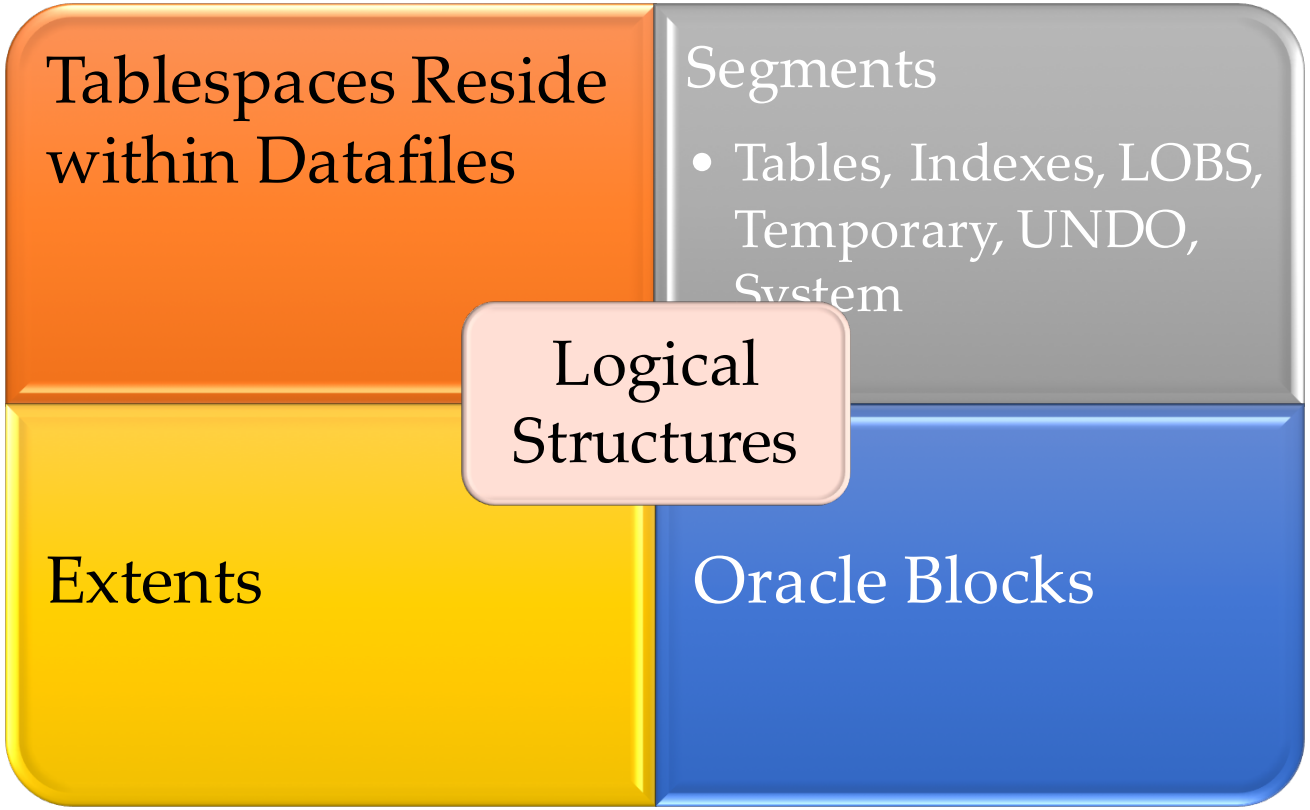
Physical and Logical Structure



- Logical Structures are not available unless the database is open

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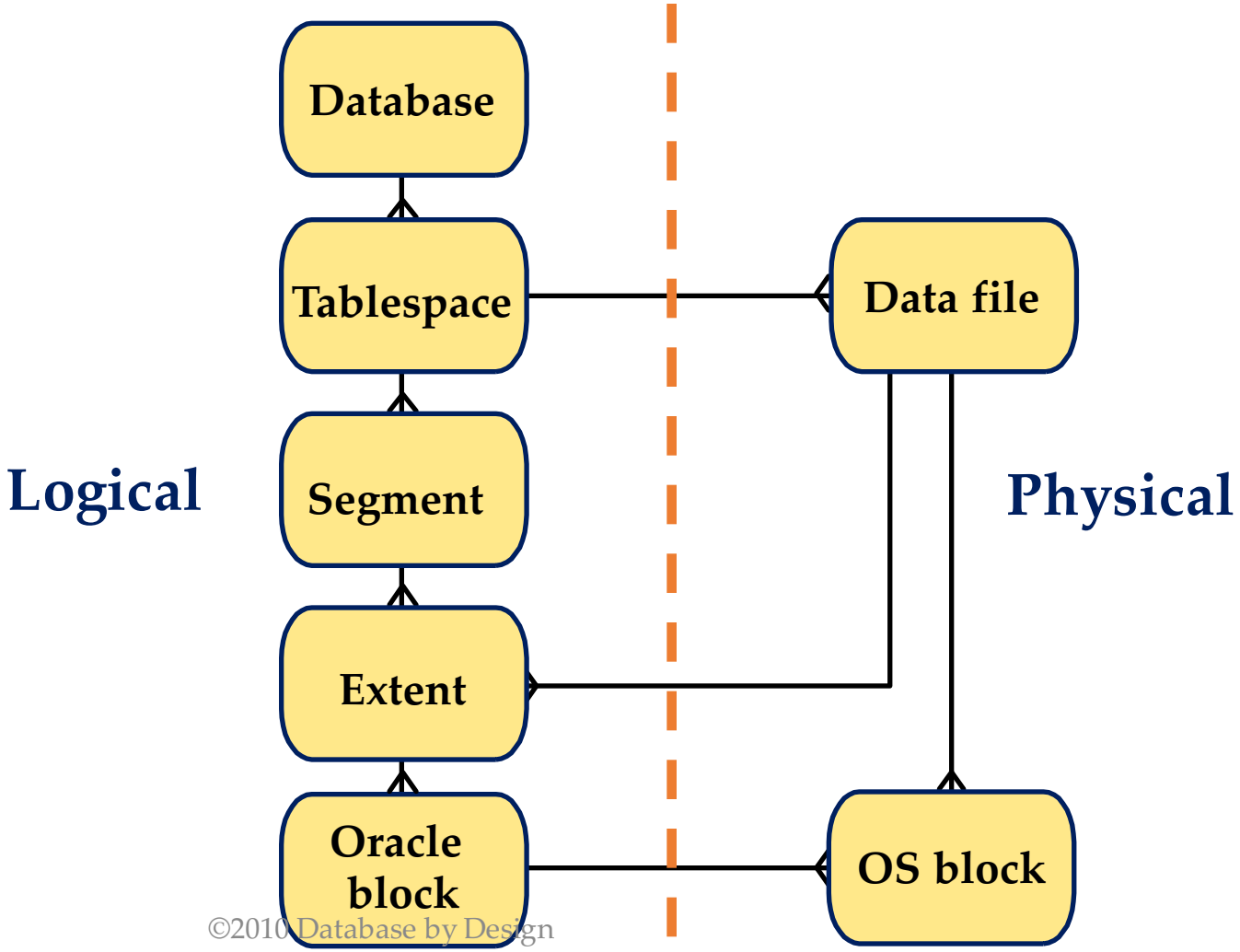
Database Storage Hierarchy



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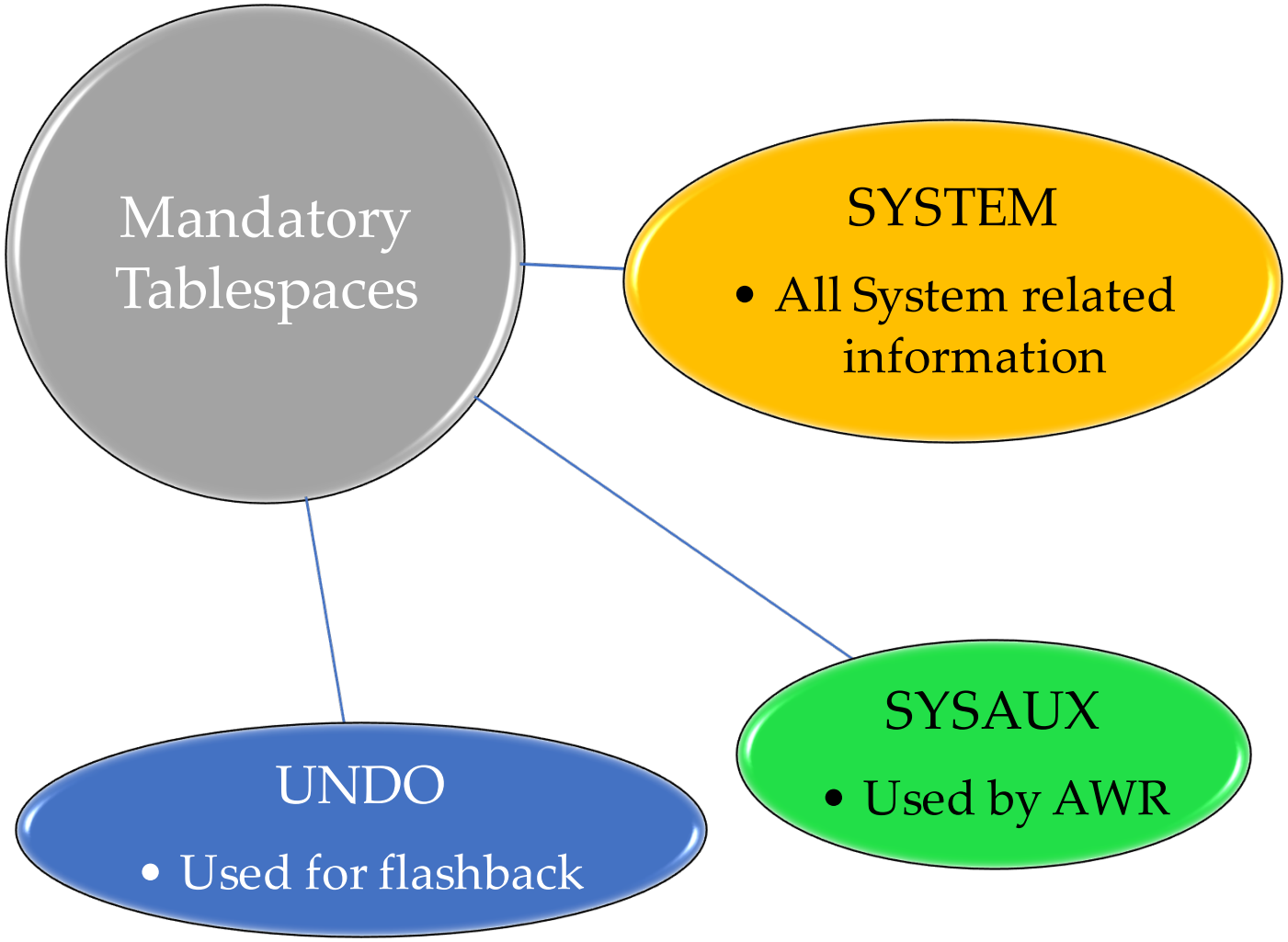
Physical and Logical Structure



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Physical and Logical Structure

Pluggable Database

Database schemas that appear as a single database

Container Database

The database that actually contains all the pluggable databases

This is also reffered to as the root container

Pluggable Databases Share

The Oracle Instance

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Physical and Logical Structure

Pluggable Databases will share

- Database instances
- Memory structures
- Control Files
- Redo Log Files
- Undo Tablespaces

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Physical and Logical Structure

Container Databases

- There is one root container database
- The root container database may contain multiple pluggable databases
- This is referred to as Multitenant Architecture

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Physical and Logical Structure

SYSTEM tablespace:

- Created with the database
- Contains the data dictionary
- Contains the **SYSTEM** undo segment
- SYSTEM/SYSAUX/UNDO

Non-**SYSTEM** tablespaces:

- Separate segments
- Ease space administration
- Control amount of space allocated to a user
- USERS
- TOOLS
- EXAMPLE

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Physical and Logical Structure

Smallfile tablespaces

- Default
- Many datafiles per tablespace

Bigfile tablespace

- One datafile per tablespace
- Factor of db_block_size
- Can be up to 128TB in size

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Physical and Logical Structure

db_create_file_dest = '/u01/oradata/orcl'

- Default location for all datafiles

db_create_online_log_dest_1='/u01/oradata/orcl/'

- Default location for control files and redo log files
- Can have up to 5 default locations

Oracle Managed Files (OMF)

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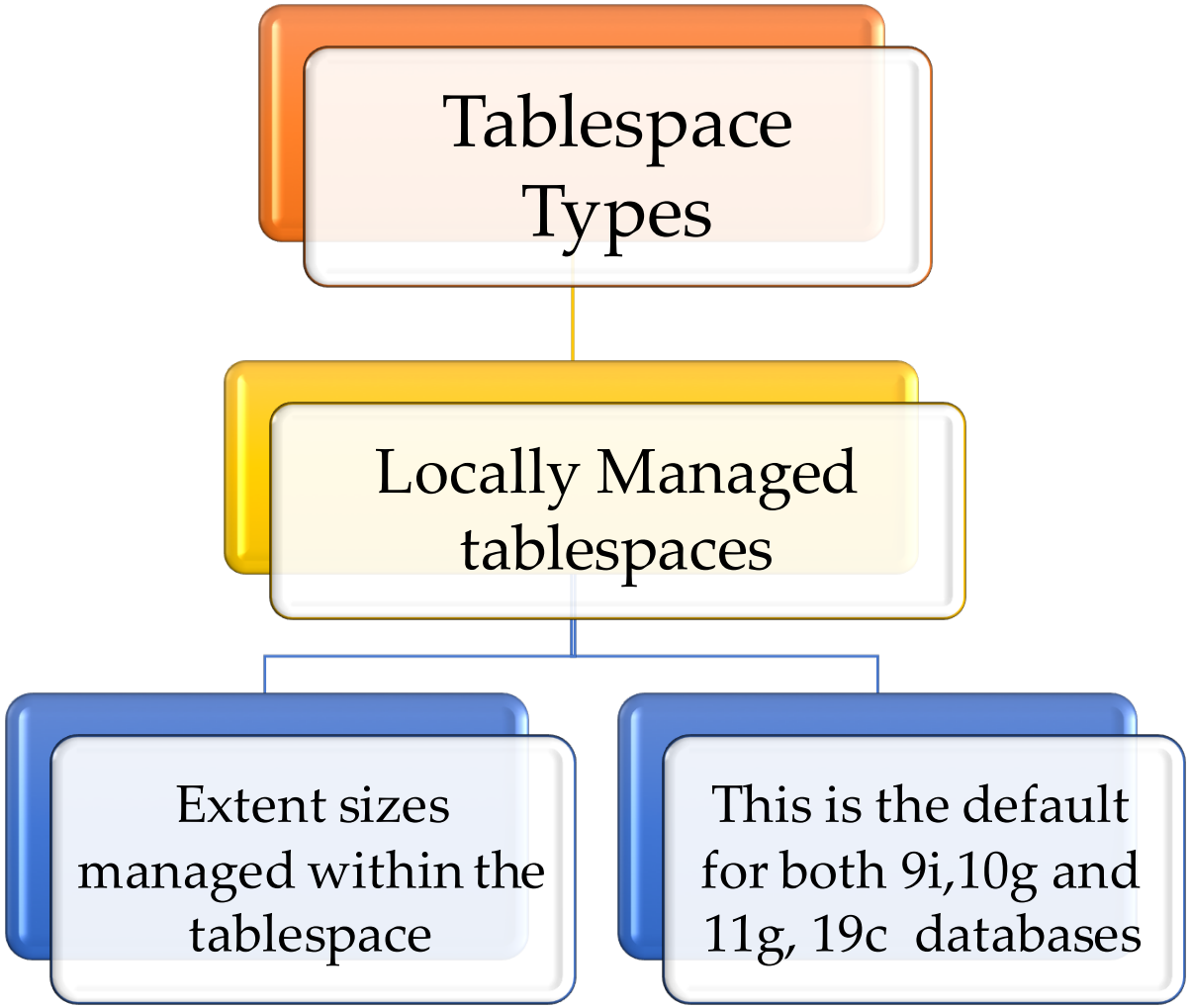
Physical and Logical Structure



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Physical and Logical Structure

Permanent tablespaces

- Contain tables and indexes

Undo Tablespaces

- Create undo tablespace undo_tbs
- Datafile '/u01/oradata/orcl/undo_tbs.dbf size 100m
- Used to hold undo segments

Temporary tablespaces

- Create temporary tablespace temp
- Tempfile '/u01/oradata/orcl/temp01.dbf' size 100m
- Contains sort segments or order by, group by and index creation

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Physical and Logical Structure

Tablespace information:

DBA_TABLESPACES	V$TABLESPACE

Data file information:

DBA_DATA_FILES	V$DATAFILE

Temp file information:

DBA_TEMP_FILES	V$TEMPFILE

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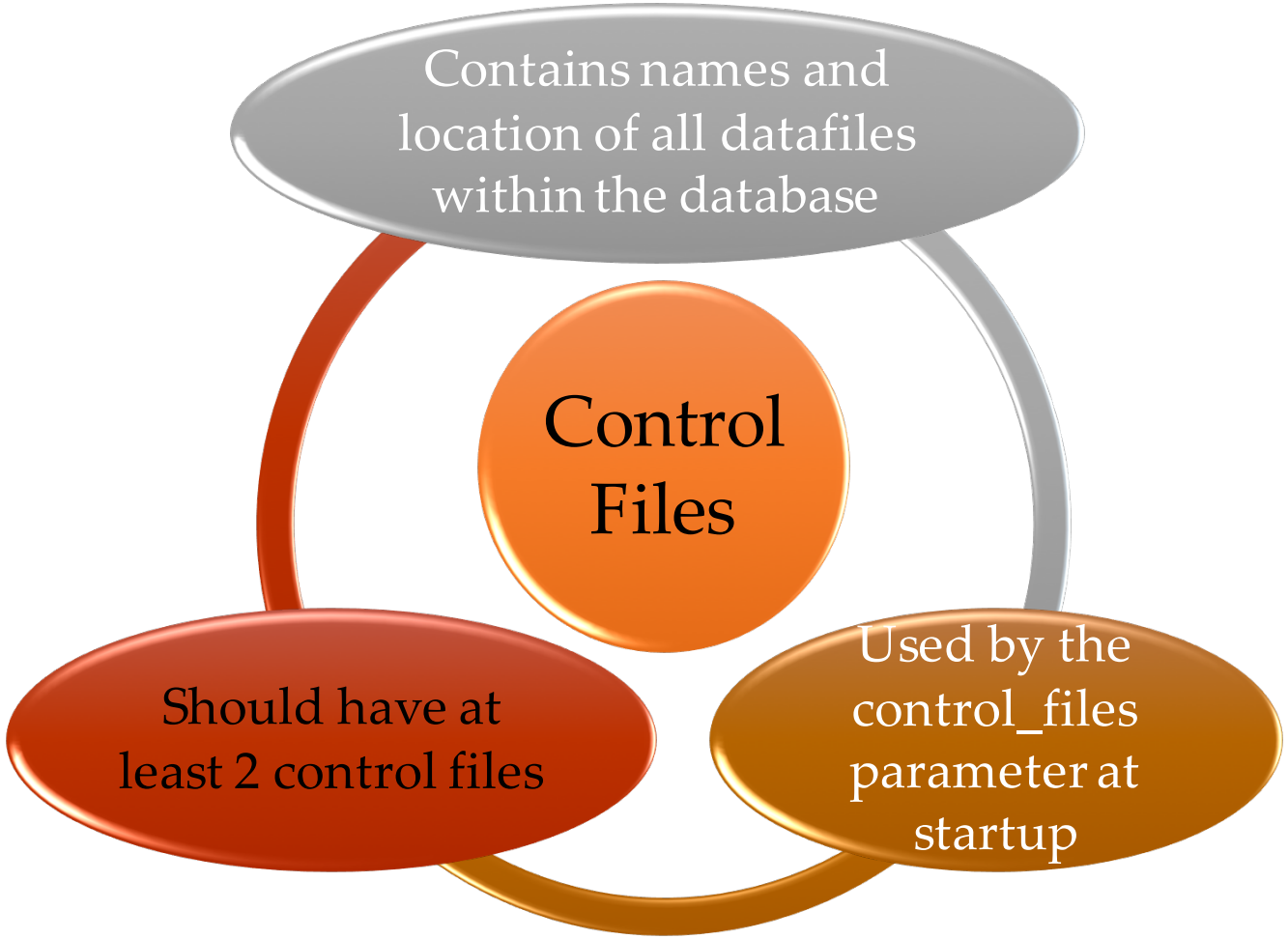
Physical and Logical Structure



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Physical and Logical Structure

Control Files

- Alter database backup controlfile to trace or <file name>
- Or set the controlfile autobackup command in RMAN

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Physical and Logical Structure

Online Redo Log Files			
Must have multiple groups and members per group	Multiple members are used for high availability	Online Redo Logs are written too LGWR	Each group is sized accordingly

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Physical and Logical Structure

Online Redo Log Files

- Lgwr writes to the current online redo log group
- When a log group fills a log switch occurs
- If the database is in archivelog mode an archivelog file is created
- Writes to online redo log groups operate in a circular fashion

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Physical and Logical Structure

Example Online Redo Log writes

4 groups

Write to:

- Group 1 (switch)
- Group 2 (switch)
- Group 3 (switch)
- Group 4 (switch)
- Group 1 (switch)

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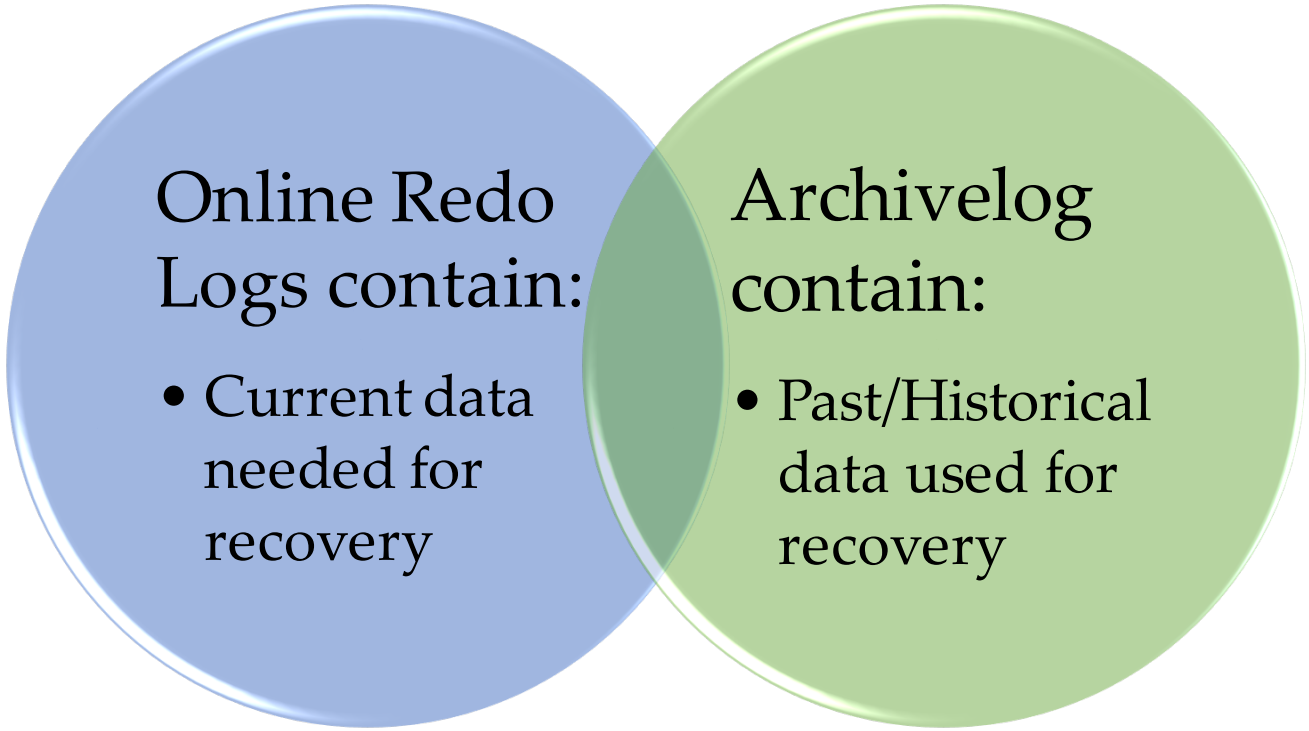
Physical and Logical Structure



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Physical and Logical Structure

Storage

Database may be stored on:

- ASM Instance
- File System
- ACFS file system

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Physical and Logical Structure

- Summary
  - Database Structure
  - Container Structure
  - Pluggable Structure

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TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- Create Tablespaces
- Create Container Databases
- Create Pluggable Databases
- Lab Create Tablespaces
- Lab:Create Container Databases

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Oracle 19c Maintaining DataFiles

Tablespaces are Oracle's logical unit of storage

Tablespaces will reside in a container database or a pluggable database

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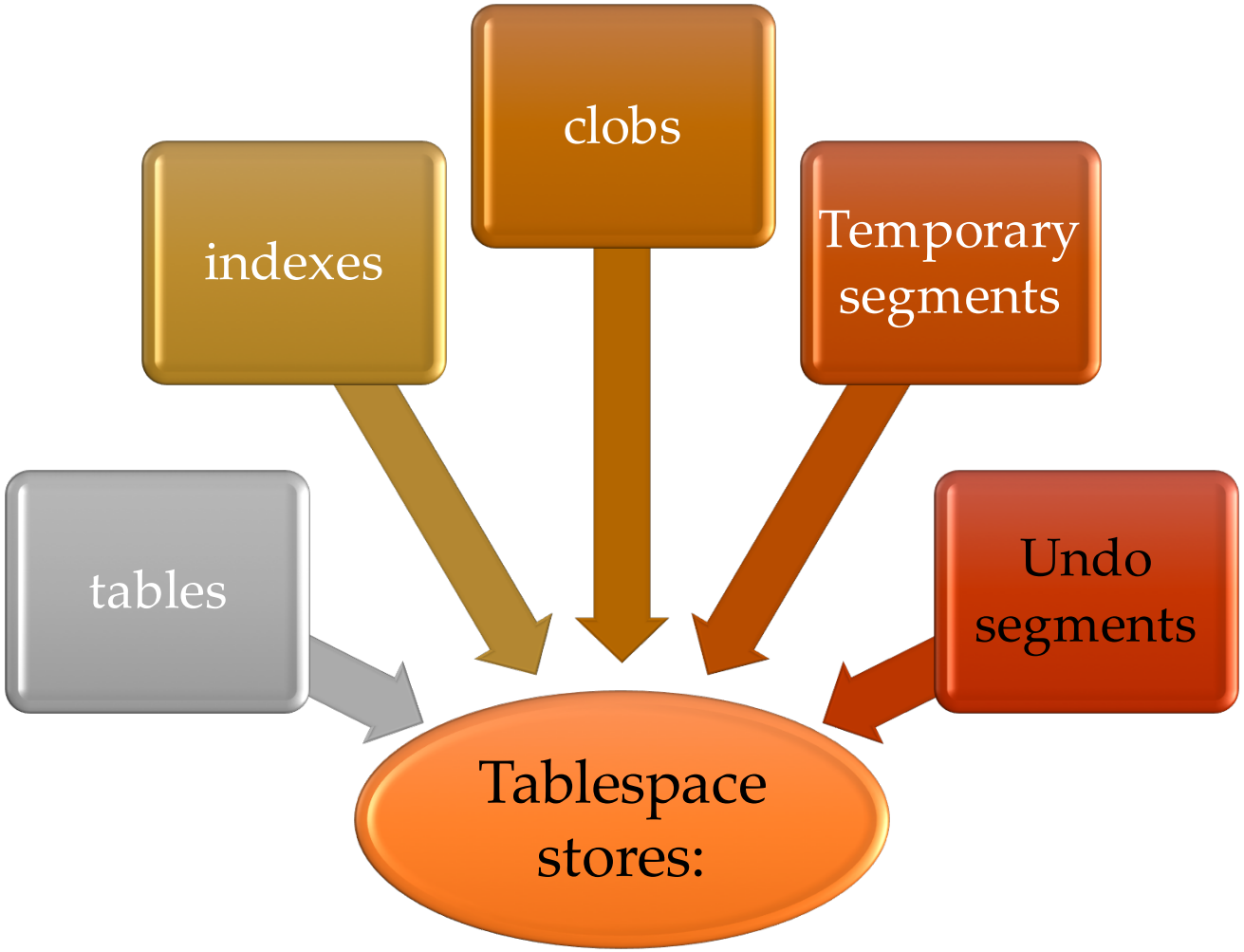
Oracle 19c Maintaining DataFiles



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Oracle 19c Maintaining DataFiles

Tablespaces are associated to datafiles

Datafiles may be either filesystem datafiles or ASM files

A traditional tablespace may be:

- smallfile – muiltiple datafiles
- bigfile – one datafile

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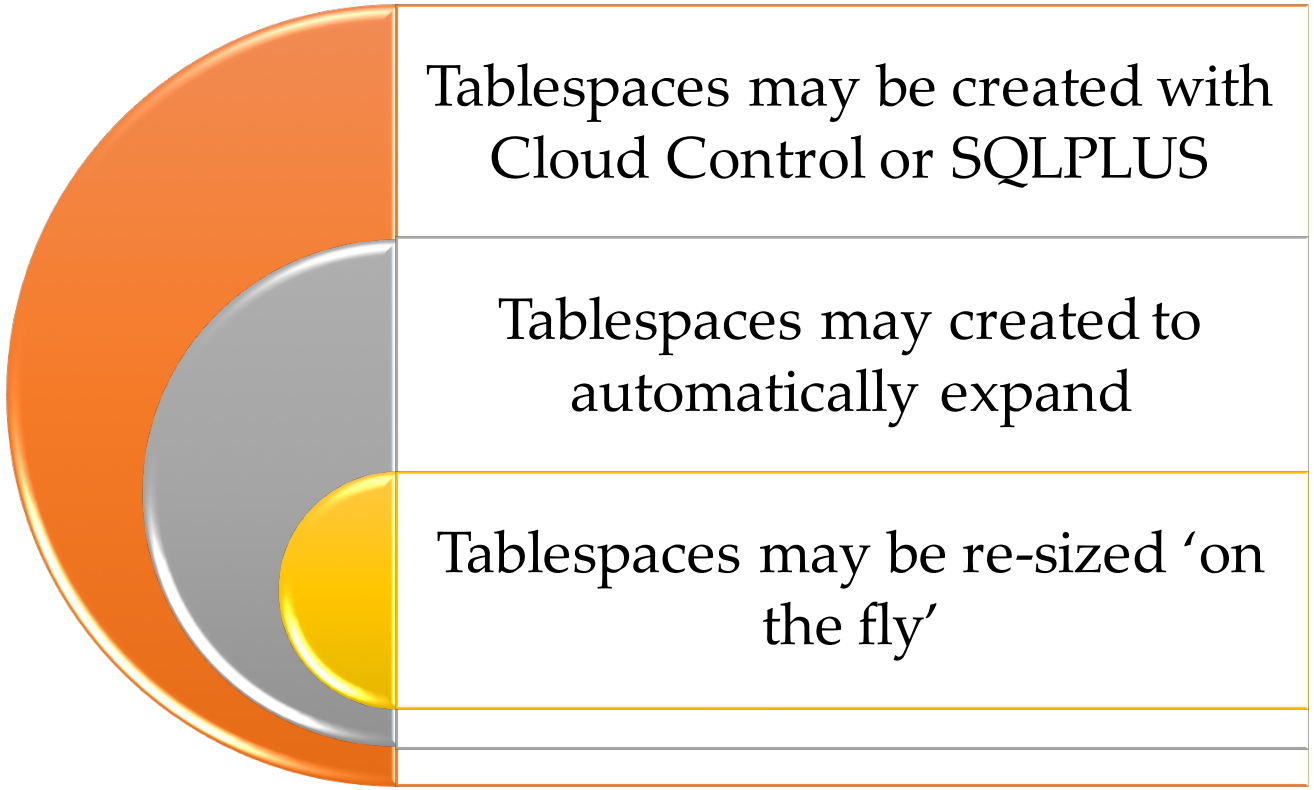
Oracle 19c Maintaining DataFiles



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Oracle 19c Maintaining DataFiles

File Edit View History Bookmarks Tools Help

orcl_cdb (Database Instance... | Summary of Servers - GCDo...

huskers https://huskers:7803/em/faces/db-list-dbList?_afrLoop=68098272034675&_afrWindowMode=

ORACLE Enterprise Manager Cloud Control 12c

Setup Help SYSMAN Log Out

Enterprise Targets Favorites History

Search Target Name

orcl_cdb (Container Database)

huskers.localdomain

Oracle Database Performance Availability Security Schema Administration

Page Refreshed Jul 16, 2014 4:14:01 PM EDT

Initialization Parameters
Storage
Oracle Scheduler
Replication
Migrate to ASM
ASM Home
Disk Groups
Resource Manager
Database Feature Usage

Auto Refresh Off

Summary

Status

Up Time	0 days, 0 hrs
Version	12.1.0.1.0
Load	0.14 average active sessions
Total Sessions	66
Last Backup	N/A
Available Space	0.12 GB
Used Space	3.56 GB
Total SGA	2,946.78 MB

Diagnostics

ADDM Findings 6

Incidents 1 0 0 0

Containers

Wait
User I/O
CPU
CPU Cores

0
4:12 PM

Resources

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Oracle 19c Maintaining DataFiles

File Edit View History Bookmarks Tools Help

orcl_cdb (Database Instance... | Summary of Servers - GCDo...

huskers https://huskers:7803/em/faces/db-list-dbList?_afrLoop=68098272034675&_afrWindowMode=

ORACLE Enterprise Manager Cloud Control 12c

Setup Help SYSMAN Log Out

Enterprise Targets Favorites History Search Target Name

orcl_cdb (Container Database) huskers.localdomain

Oracle Database Performance Availability Security Schema Administration

Page Refreshed Jul 16, 2014 4:14:01 PM EDT

Auto Refresh Off

Initialization Parameters
Storage
Oracle Scheduler
Replication
Migrate to ASM
ASM Home
Disk Groups
Resource Manager
Database Feature Usage

Home
Compression
Control Files
Datafiles
Tablespaces
Make Tablespace Locally Managed...
Temporary Tablespace Groups
Rollback Segments
Segment Advisor
Automatic Undo Management
Redo Log Groups
Archive Logs

Summary

Status

Up Time	0 days, 0 hrs
Version	12.1.0.1.0
Load	0.14 average active sessions
Total Sessions	66
Last Backup	N/A
Available Space	0.12 GB
Used Space	3.56 GB
Total SGA	2,946.78 MB

Diagnostics

ADDM Findings 6

Incidents 1 0 0 0

Wait
User I/O
CPU
CPU Cores

0
4:12 PM

Resources

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Oracle 19c Maintaining DataFiles

ORACLE Enterprise Manager Cloud Control 12c

Setup ▾ Help ▾ SYSMAN ▾ Log Out

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb (Container Database)

Logged in as system | huskers.localdomai

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Logged in as SYSTEM

Tablespaces

Object Type Tablespace

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Container

Object Name Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Create

Edit View Delete Actions Add Datafile Go

Select	Container	Name	Available Space Used(%) Alerts	Available Space Used(%)	Allocated Space Used(%)	Auto Extend	Allocated Size(MB)	Space Used(MB)	Allocated Free Space(MB)	Status	Da
◉	CDB$ROOT	SYSAUX	✓	2.4	92.1	YES	840.0	773.8	66.2	✓	
○	CDB$ROOT	SYSTEM	✓	2.4	99.3	YES	790.0	784.2	5.8	✓	
○	CDB$ROOT	TEMP	✓	0.0	7.0	YES	157.0	11.0	146.0	✓	
○	CDB$ROOT	UNDOTBS1	✓	0.0	12.3	YES	90.0	11.1	78.9	✓	

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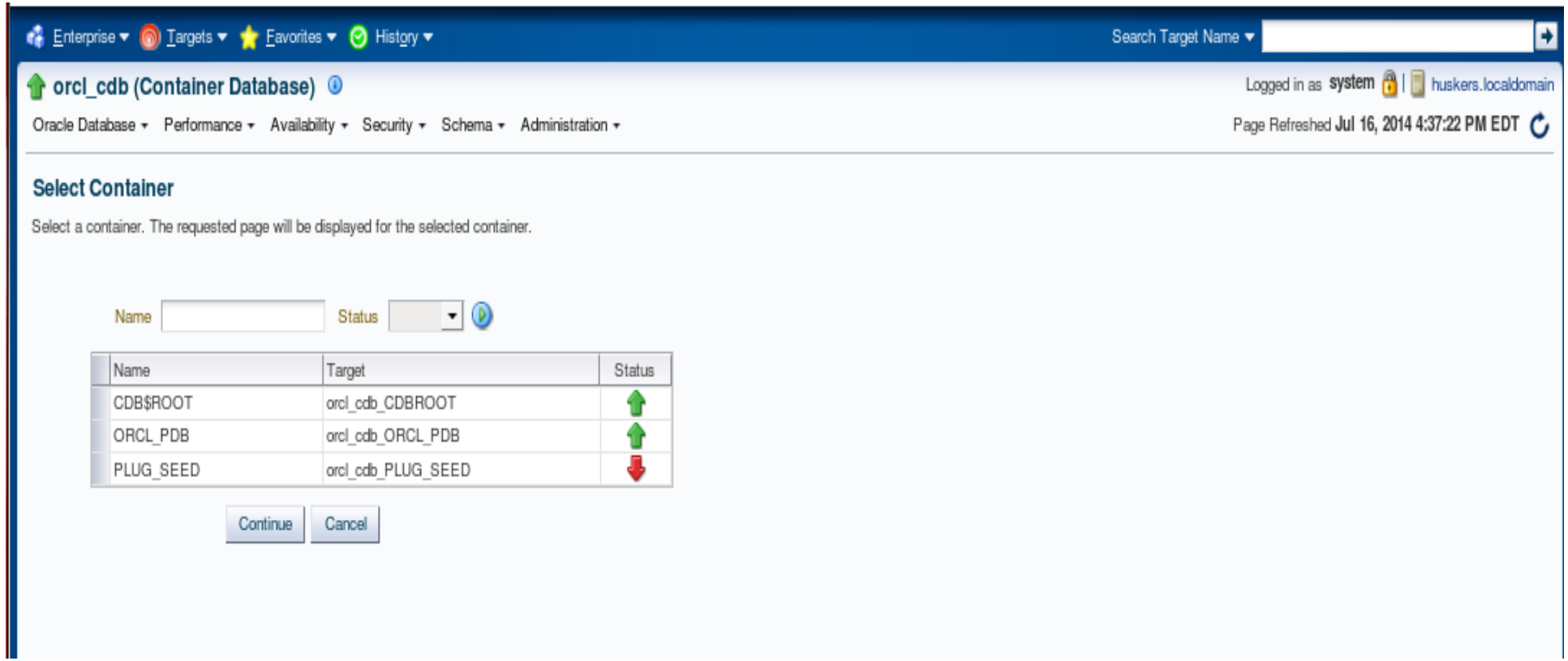
Oracle 19c Maintaining DataFiles



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Oracle 19c Maintaining DataFiles

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / ORCL_PDB huskers.localdom

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Tablespaces > Create Tablespace

Logged in as SYSTEM

Create Tablespace

Execute On Multiple Databases | Show SQL | Cancel | OK

General | Storage | Automatic Data Optimization

* Name

Extent Management

- (•) Locally Managed
- ( ) Dictionary Managed

Type

- (•) Permanent
  - [ ] Set as default permanent tablespace
  - [ ] Encryption — Encryption Options
- ( ) Temporary
  - [ ] Set as default temporary tablespace
- ( ) Undo

TIP Undo tablespaces can only be created in CDB$ROOT.

Status

- (•) Read Write
- ( ) Read Only
- ( ) Offline

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Oracle 19c Maintaining DataFiles

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / ORCL_PDB huskers.localdoma

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Tablespaces > Create Tablespace

Logged in as SYSTEM

Create Tablespace

Execute On Multiple Databases | Show SQL | Cancel | OK

General | Storage | Automatic Data Optimization

* Name gogo_pdb

Extent Management

- (•) Locally Managed
- ( ) Dictionary Managed

Type

- (•) Permanent
  - [ ] Set as default permanent tablespace
  - [ ] Encryption [Encryption Options]
- ( ) Temporary
  - [ ] Set as default temporary tablespace
- ( ) Undo

TIP Undo tablespaces can only be created in CDB$ROOT.

Status

- (•) Read Write
- ( ) Read Only
- ( ) Offline

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Oracle 19c Maintaining DataFiles

Tablespaces > Add Datafile

Logged in as SYSTEM

Add Datafile

Cancel Continue

Storage Type: Automatic Storage Management

* DiskGroup: DATA

Template: <Default>

Alias Directory:

Alias Name:

Tablespace: GOGO_PDB

File Size: 100 MB

☐ Reuse Existing File

Storage

☑ Automatically extend datafile when full (AUTOEXTEND)

Increment: 100 MB

Maximum File Size: ○ Unlimited ◉ Value 6 GB

TIP Changes made on this page will NOT take effect until you click "OK" button on the Tablespace page.

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Oracle 19c Maintaining DataFiles

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Oracle 19c Maintaining DataFiles

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / ORCL_PDB

Logged in as system | huskers.localdoma

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Logged in as SYSTEM

Update Message

The object has been created successfully

Tablespaces

Object Type Tablespace

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Object Name Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single

Create

Edit View Delete Actions Add Datafile Go

Select	Name	Available Space Used(%) Alerts	Available Space Used(%)	Allocated Space Used(%)	Auto Extend	Allocated Size(MB)	Space Used(MB)	Allocated Free Space(MB)	Status	Datafiles	Type
◉	GOGO_PDB	✓	0.0	1.0	YES	100.0	1.0	99.0	✓	1	PERMA
○	SYSAUX	✓	31.1	94.5	YES	620.0	586.0	34.0	✓	1	PERMA

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Oracle 19c Maintaining DataFiles

- Container Databases contain multiple pluggable databases
- This is Oracle's Multitenant architecture
- They may only be one root container database
- Container databases may be created with DBCA

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Oracle 19c Maintaining DataFiles

oracle@huskers:/u01/app/oracle/product/12.1.0/dbhome_1/bin

File Edit View Search Terminal Help

```
[oracle@huskers bin]$ pwd
/u01/app/oracle/product/12.1.0/dbhome_1/bin
[oracle@huskers bin]$ ./dbca
```

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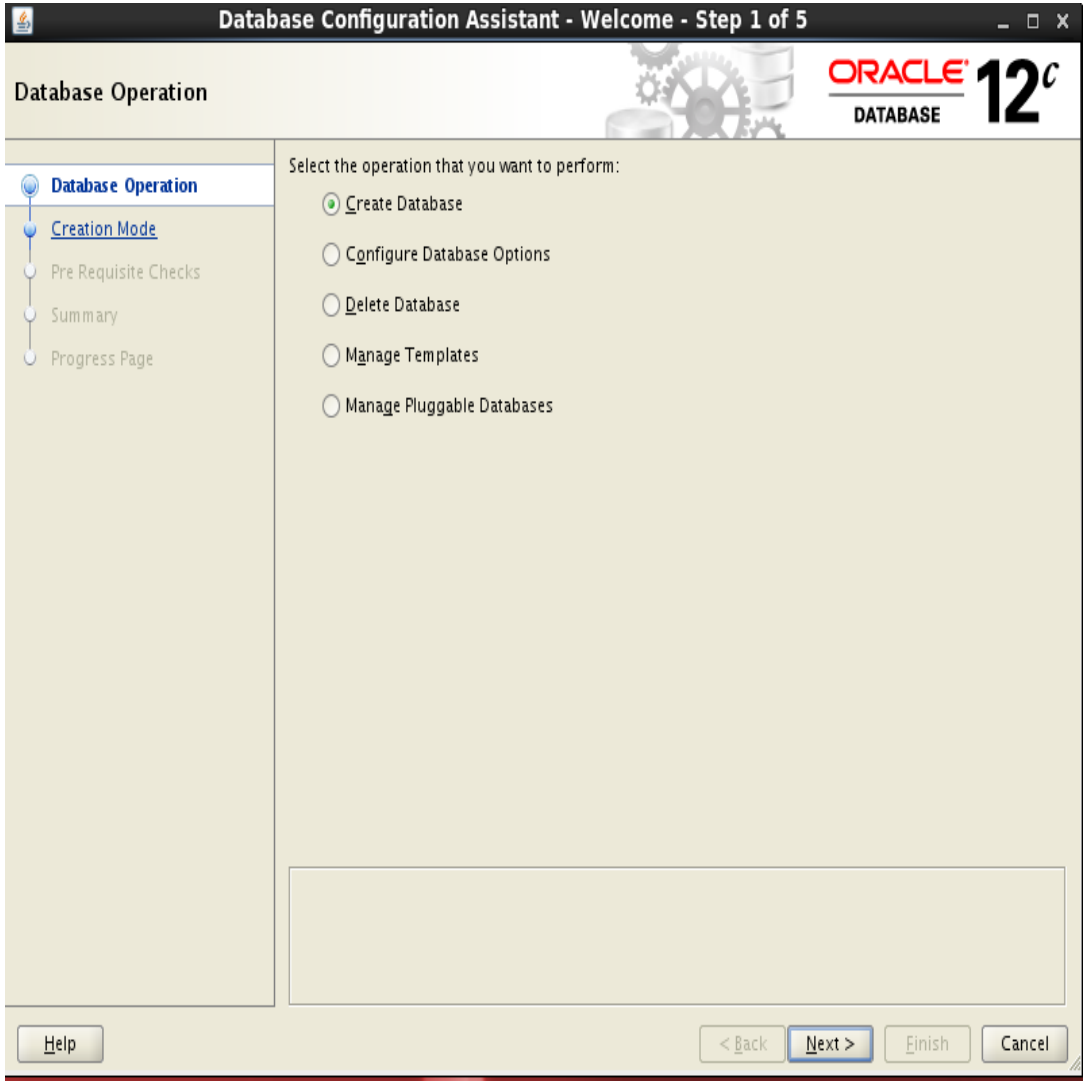

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Database Configuration Assistant - Create Database - Step 2 of 5

Creation Mode

ORACLE DATABASE 12c

- Database Operation
- Creation Mode
- Pre Requisite Checks
- Summary
- Progress Page

Create a database with default configuration

Global Database Name: gogodcb

Storage Type: Automatic Storage Management (ASM)

Database Files Location: +DATA Browse...

Fast Recovery Area: +FRA Browse...

Database Character Set: WE8MSWIN1252 - MS Windows Code Page 1252 8-bit Wes...

Administrative Password : ••••••••••

Confirm Password: ••••••••••

Create As Container Database

Pluggable Database Name: gogopdb

Advanced Mode

Messages:

Administrative Password : The password entered does not conform to the Oracle recommended standards. A password should have minimum of 8 characters in length. In addition, the password must contain at least one upper case character, one lower case character and one digit.

Help | < Back | Next > | Finish | Cancel

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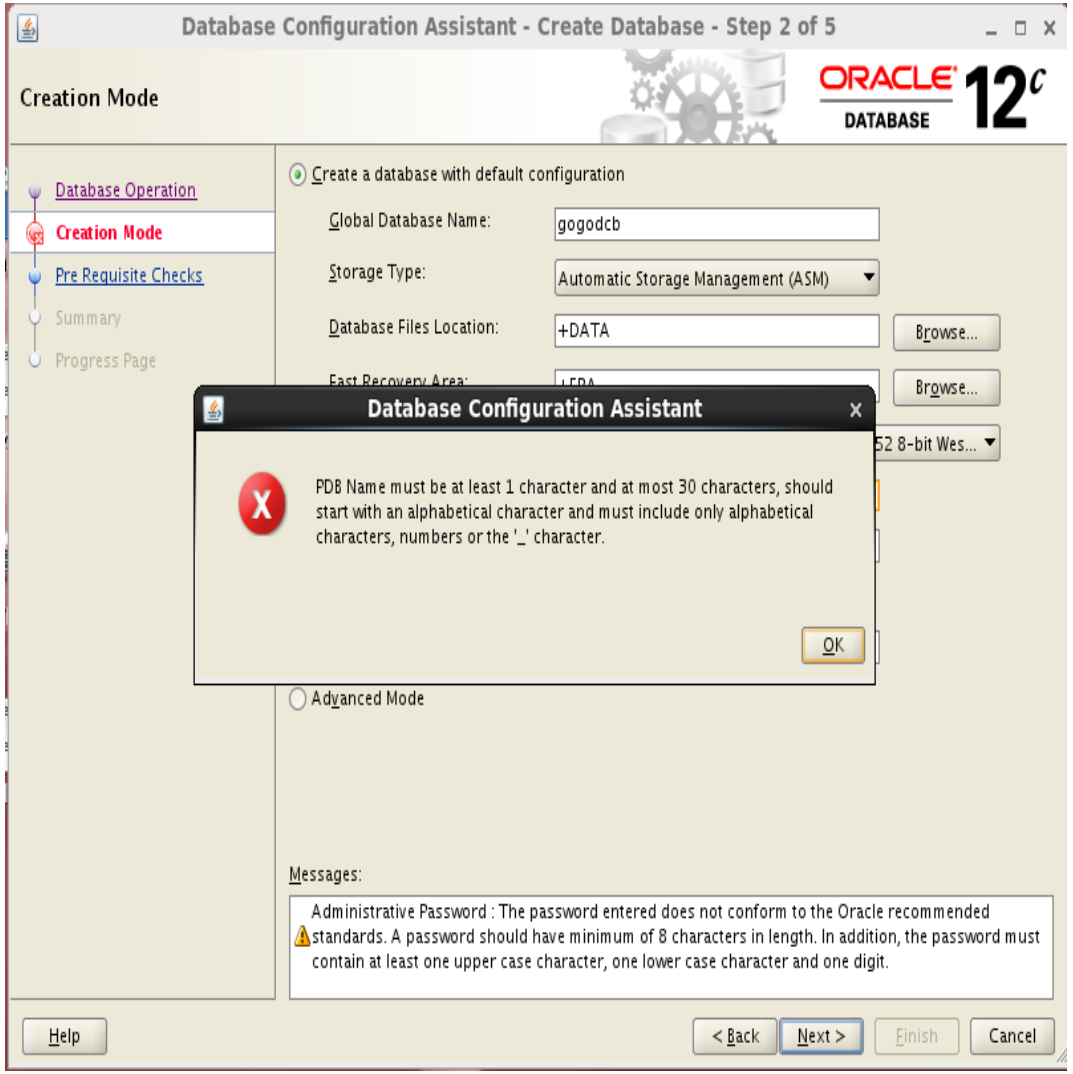

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Database Configuration Assistant - Create Database - Step 4 of 5

Summary

ORACLE DATABASE 12c

- Database Operation
- Creation Mode
- Pre Requisite Checks
- Summary
- Progress Page

Database Configuration Assistant: Summary

Create Database – Summary

Database Configuration Summary

Global Database Name: gogodcb
Database Configuration Type: Oracle Restart Enabled Single Instance
SID: gogodcb
Create As Container Database Yes
Number of Pluggable Databases: 1
Pluggable Database Name: gogopdb
Storage Type: Automatic Storage Management (ASM)
Memory Configuration Type: Automatic Shared Memory Management
Template Name: General Purpose or Transaction Processing

Database Configuration Details

Database Components

Component	Selected
Oracle JVM	true
Oracle Text	true
Oracle Multimedia	true
Oracle OLAP	true

Help | < Back | Next > | Finish | Cancel

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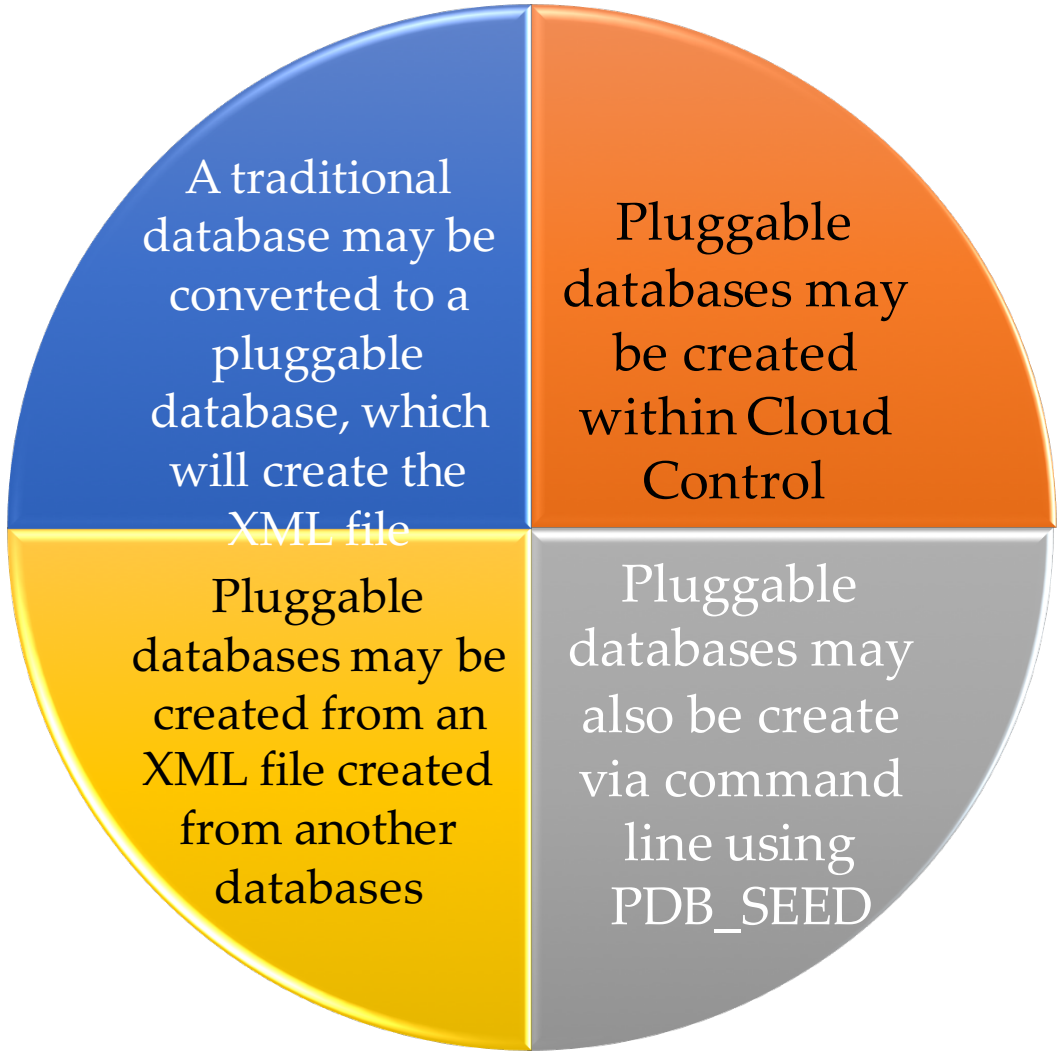
Oracle 19c Maintaining DataFiles



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Oracle 19c Maintaining DataFiles

```
File  Edit  View  Search  Terminal  Help
[oracle@huskers alert]$ . oraenv
ORACLE_SID = [orclcdb] ?
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers alert]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 17:07:13 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> get create_pdb
  1  create pluggable database gogopdb
  2* admin user gogo identified by password1
SQL> /

Pluggable database created.

SQL>
```

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Oracle 19c Maintaining DataFiles

File Edit View Navigate Run Versioning Tools Help

Connections | Reports

Connections
- gogo_system
- orcl
- orcl_system
- orcldb_chr
- orcldb_system
- orcltcn_hr
- orcltcn_hr_lab6
- orcltcn_sys
- orcltcn_system

Cloud Connections

DBA

Connections
- gogo_system

Start Page | orcldb_system

Worksheet | Query Builder

```
select * from dba_pdbs;
```

Query Result

SQL | All Rows Fetched: 4 in 0.208 seconds

	PDB_ID	PDB_NAME	DBID	CON_UID	GUID	STATU
1	3	ORCL_PDB	3572335755	3572335755	F4BD285D15A68B6FE043650AA8C02DCF	NORMAL
2	2	PDB$SEED	4084953685	4084953685	F4BD06A7D07F7EC2E043650AA8C017C4	NORMAL
3	4	PLUG_SEED	1835756340	1835756340	F54B5AA7721970D8E043650AA8C08856	NORMAL
4	5	GOGOPDB	4049108937	4049108937	FE56E9003D0BADC3E043650AA8C073B8	NEW

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Oracle 19c Maintaining Datafiles

- Summary
  - Container tablespaces
  - Container Datafiles

TriveraTech
TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

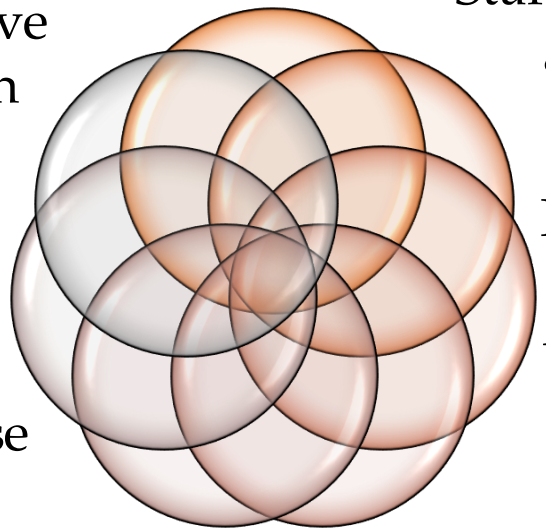
19c Multi Tenant

Lesson Topics

Connect to a container/pluggable databases

Lab Demo Solution: Preserve Pluggable open mode

Startup/Shutdown a container database



Lab Demo Solution: Start/Stop a container database

Preservation of PDB mode upon restart of CDB

Lab: Preserve Pluggable open mode

Lab: Start/Stop a container database

Oracle 19c Managing Container Databases

The database may be started via command line, Cloud Control or Enterprise Express

The database may be started in these modes

- startup
- startup nomount
- startup mount
- startup restrict
- startup force
- startup upgrade

Oracle 19c Managing Container Databases

orcl_cdb (Database Instance) - Oracle Enterprise Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

orcl_cdb (Database Instance... | Summary of Servers - GCDo...

huskers https://huskers:7803/em/faces/db-list-dbList?_afrLoop=68098272034675&_afrWindowMode=

ORACLE Enterprise Manager Cloud Control 12c

Setup Help SYSMAN Log Out

Enterprise Targets Favorites History

Search Target Name

orcl_cdb (Container Database)

huskers.localdomain

Oracle Database Performance Availability Security Schema Administration

Page Refreshed Jul 16, 2014 4:13:13 PM EDT

Home
Monitoring
Diagnostics
Control
Job Activity
Information Publisher Reports
Logs
Provisioning
Configuration

Startup/Shutdown
Open/Close Pluggable Database
Create Blackout...
End Blackout...

egions that fetch real-time data from target database will not be displayed.

Auto Refresh Off

Incidents and Problems

View Target Local target and related targets Category All

Summary	Target	Severity	Status	Escalation level	Type	Time since last update
The pluggable database orcl_cdb_PLUG_SEE			New	-	Incident	0 days 0 hours
Problem: java.lang.NumberFormatException:ja			New	-	Problem	30 days 7 hours

LUG_SEED

Oracle 19c Managing Container Databases

Startup (Open)

- Starts instance
- Opens database

Startup nomount

- Used to create a database
- Used to recover a database w/o controlfile

Startup Mount

- Recover a database
- Place a database in archivelog mode

Oracle 19c Managing Container Databases

Startup Restrict	• Used for accounts with restricted session privilege
Startup Force	• Used as a last Resort if Startup Force does not work
Startup upgrade	• Used to upgrade from 11g to 19c
Startup Open Read Only Restrict	
Startup Open Read Write Restrict	• Default Read/Write

Oracle 19c Managing Container Databases

- The container database must be started first
- To start a pluggable database first connect to the container database
- Then connect to the pluggable database and simply open the pluggable database
- Since pluggable databases share the same SGA as the container database the instance is already started

Oracle 19c Managing Container Databases

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ . oraenv
ORACLE_SID = [orclcdb] ?
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers alert]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 15:55:21 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.

Connected to an idle instance.

SQL> startup
```

Oracle 19c Managing Container Databases

oracle@huskers:~/Desktop

File Edit View Search Terminal Help

```
[oracle@huskers Desktop]$ . oraenv
ORACLE_SID = [orclcdb] ?
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers Desktop]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Sat Sep 27 19:53:45 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL>
```

Oracle 19c Managing Container Databases

```
SQL> select name,open_mode
  2  from v$pdbs;

NAME                           OPEN_MODE
------------------------------ ----------
PDB$SEED                       READ ONLY
ORCL_PDB                       MOUNTED
PLUG_SEED                      MOUNTED
GOGOPDB                        READ WRITE

SQL>
```

Oracle 19c Managing Container Databases

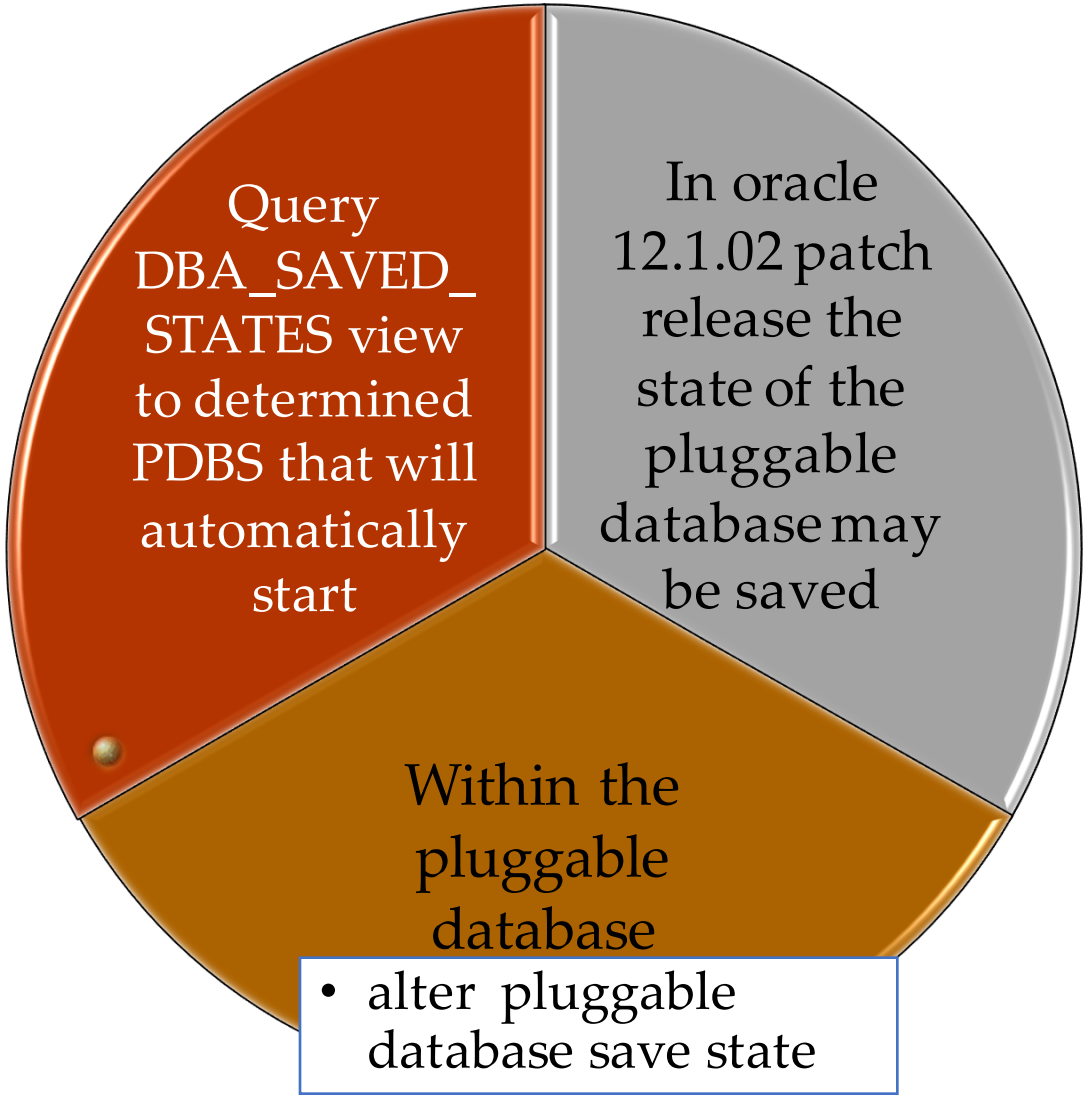
```
SQL> connect sys/password1@huskers:1521/orcl_pdb as sysdba
Connected.
SQL> alter pluggable database open;
```

```
SQL> select name,open_mode
  2  from v$pdbs;

NAME                           OPEN_MODE
------------------------------ ----------
ORCL_PDB                       READ WRITE

SQL>
```

Oracle 19c Managing Container Databases



- alter pluggable database save state

Oracle 19c Managing Container Databases

Prior to Oracle 12.1.0.2 a database trigger must be created to preserve startup state

Create or replace trigger open_pdbs after startup on database

```
begin
        execute immediate 'alter pluggable
database all open';
end';
```

All may be substituted for the specific database to open

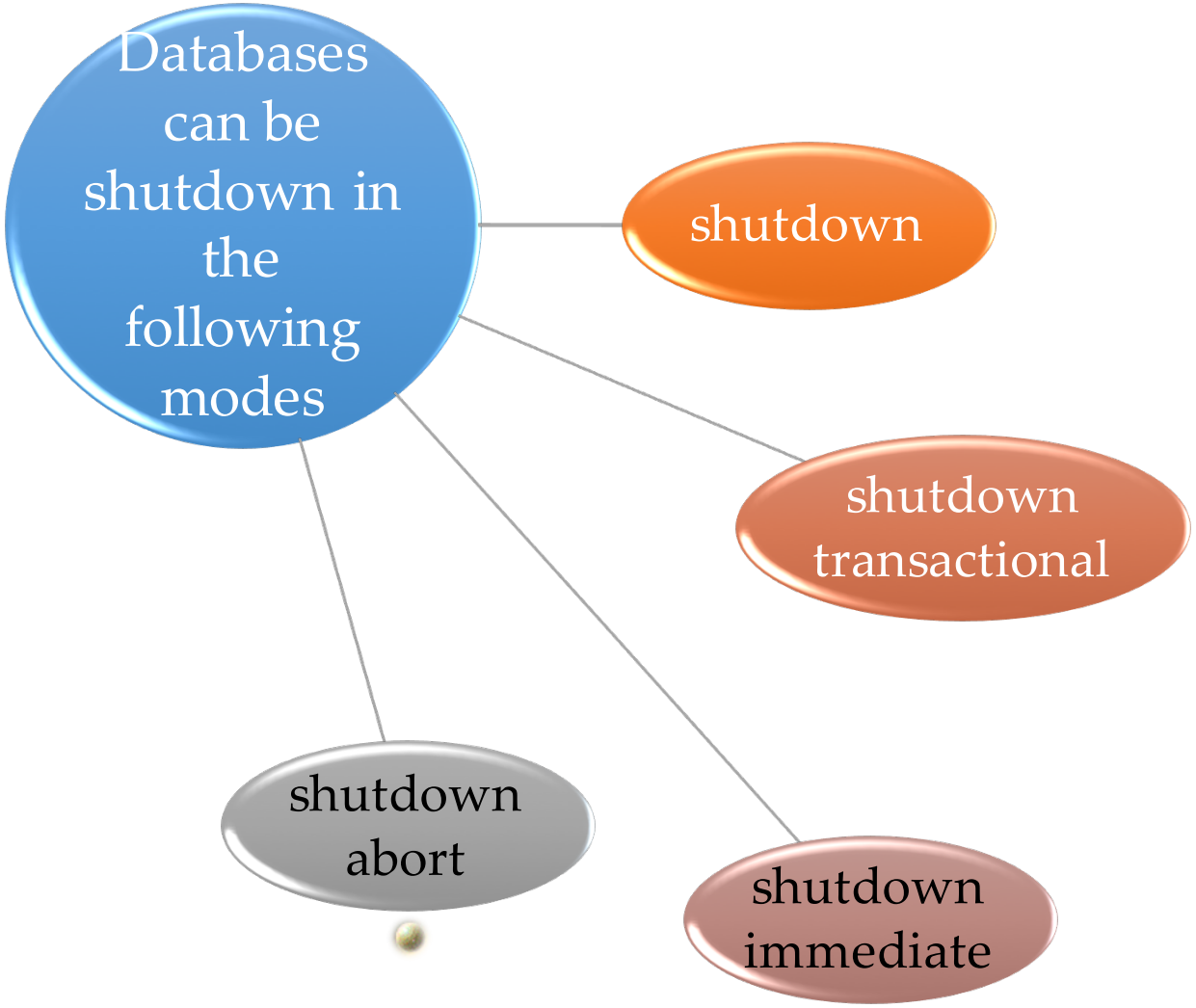
Oracle 19c Managing Container Databases

Database will be shutdown in a similar fashion as there are opened

Pluggable database may be closed independent of container database

Shutting down the container database will close all pluggable databases within that container

Oracle 19c Managing Container Databases



Oracle 19c Managing Container Databases

Shutdown

- Waits for everyone to exit

Shutdown transactional

- Waits for transactions to end

Shutdown immediate

- Waits for processing to stop

Shutdown abort

- Instance failure

```
oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert
File  Edit  View  Search  Terminal  Help
[oracle@huskers alert]$ sqlplus sys/password1@huskers:1521/orcl_pdb as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 16:03:30 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> alter pluggable database close;

Pluggable database altered.
```

```
oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert
File  Edit  View  Search  Terminal  Help
[oracle@huskers alert]$ sqlplus sys/password1 as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 16:05:26 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> shutdown immediate;
```
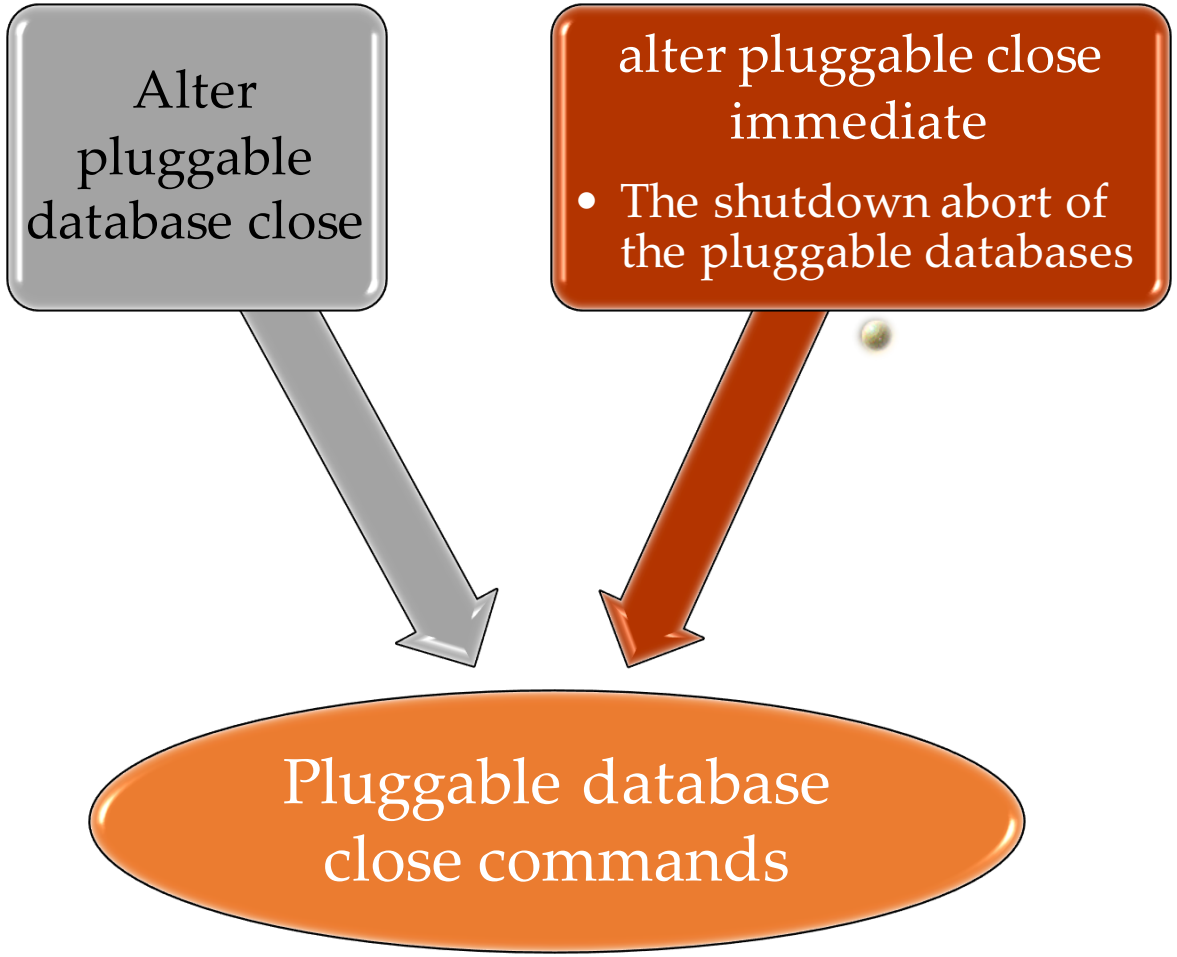

Oracle 19c Managing Container Databases

- Opening a container database will only 'mount' the pluggable database.
- Using Oracle 12.1.0.2 a startup mode may be preserved
- Query V$PDBS to determine the startup mode
- Query DBA_SAVED_STATES to determine the pluggable databases that will automatically start
- Pluggable and container databases share the same SGA

Oracle 19c Managing Container Databases



Multitenant Startup/Shutdown

- Summary
  - Start Database
  - Open Containers
  - V$containers
  - V$pdbs

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Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

Manage Container Database

Start and Stop Container and Pluggable Database

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Managing Container Database Architecture

The database parameter file is used to configure upon startup

It is located in the:

- $ORACLE_HOME/dbs directory

There are two types of files

- init.ora – ASCII text file maintained and managed manually by the DBA
- spfile.ora – Binary file maintained by proper database commands
  - Used for persistent settings when the database is bounced

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Managing Container Database Architecture

The ASCII file is originally created when the database is create and then converted to a spfile

To create a spfile from a pfile use

- sql> create pfile from spfile
- This will create an init<sid>.ora in the $ORACLE_HOME/dbs directory

To create a pfile in another location enter

- sql>create pfile = '/home/oracle/initcdb.ora' from spfile;

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/product/12.1.0/dbhome_1/bin

File Edit View Search Terminal Help

```
SQL> l
  1* create pfile = '/home/oracle/initcdb.ora' from spfile
SQL> /

File created.

SQL>
```

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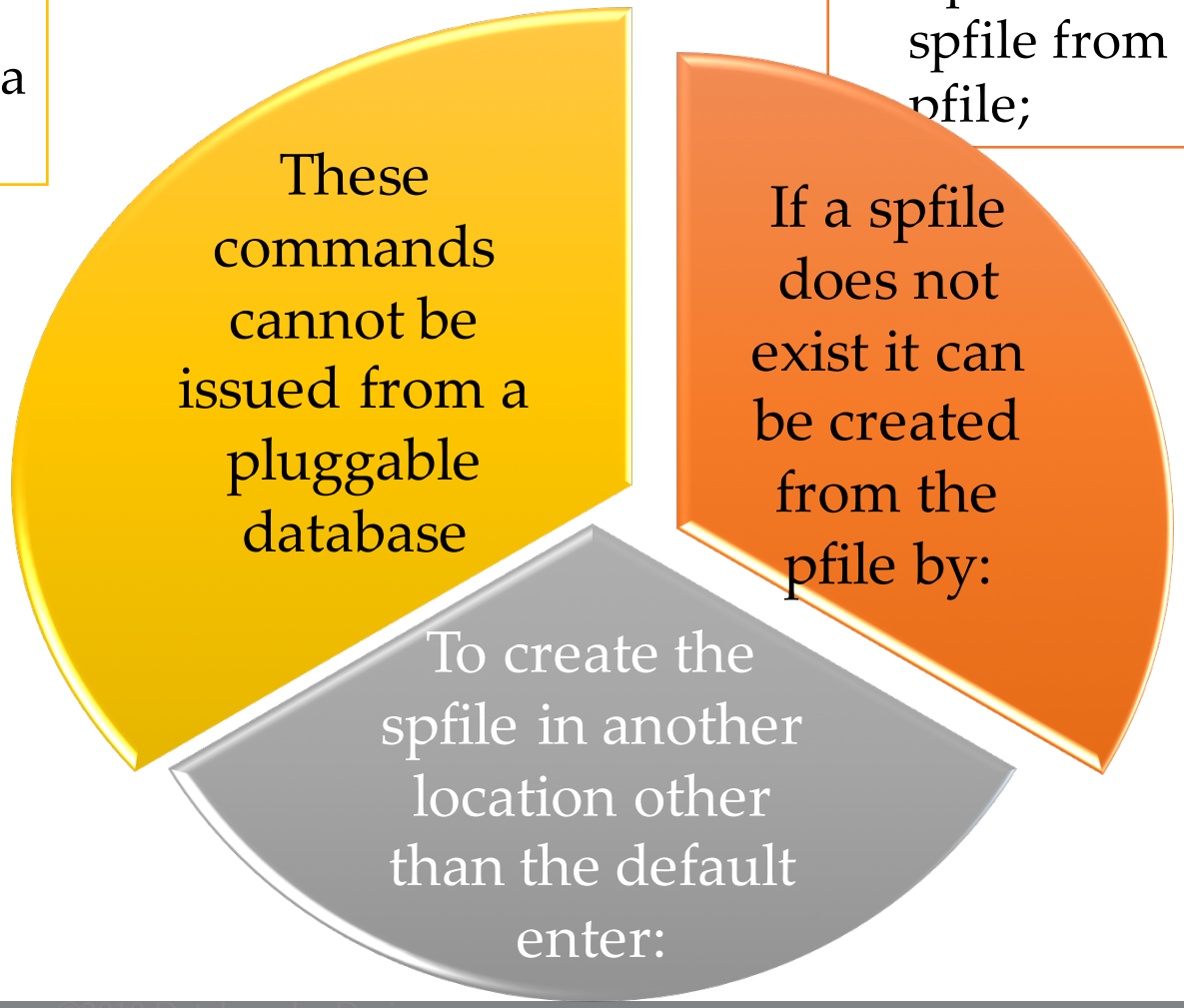
Managing Container Database Architecture

- sql> create spfile = '/home/oracle/spfilecdb.ora' from pfile

- sql> create spfile from pfile;



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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/product/12.1.0/dbhome_1/bin

File Edit View Search Terminal Help

```
SQL> create spfile='/home/oracle/spfilecdb.ora' from pfile;

File created.

SQL>
```

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Managing Container Database Architecture

To change database parameters using an spfile:

- alter system set <parameter name> = value scope = {both, memory, spfile}
- The default scope is both which means the change will both be written to the spfile and memory
- The scope value of spfile means the change will not take affect until the next database bounce
- The scope value of memory means the change will only take effect in memory and will not be persistent across database bounces

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Managing Container Database Architecture

The parameters are read in this order

Search order

Spfile<dbname>.ora

Spfile.ora

Init<dbanme>.ora

Init.ora

The first existence of the file is what Oracle will use to start up the database

The parameter file is the 'car battery' of the Oracle database

It must be present to start

Does not have to be present to run

Must be present to restart

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Managing Container Database Architecture

In Oracle 19c there is only 1 spfile which controls both the container databases and pluggable databases

Changes to a pluggable database will be written to the common parameter file and be used by that database

Changes to a pluggable database will be assumed to apply to the current container

- alter system set <parameter> =value – will default to the current contrainer
- or
- alter system set <parameter> =value container=current

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Managing Container Database Architecture

Select * from v$spparameter

The changes will not be seen in the spfile file

Changes to a pluggable database parameter will only be seen in the data dictionary

To view the changes for a specific PDB query the pdb_spfile$ view

- select name,value$,pdb_id from pdb_spfile$

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```
oracle@huskers:~
File  Edit  View  Search  Terminal  Help
orclcdb.__data_transfer_cache_size=0
orclcdb.__db_cache_size=2264924160
orclcdb.__java_pool_size=16777216
orclcdb.__large_pool_size=33554432
orclcdb.__oracle_base='/u01/app/oracle'#ORACLE_BASE set from environment
orclcdb.__pga_aggregate_target=1040187392
orclcdb.__sga_target=3103784960
orclcdb.__shared_io_pool_size=150994944
orclcdb.__shared_pool_size=587202560
orclcdb.__streams_pool_size=16777216
*.audit_file_dest='/u01/app/oracle/admin/orcl_cdb/adump'
*.audit_trail='db'
*.compatible='12.1.0.0.0'
*.control_files='+DATA/ORCL_CDB/CONTROLFILE/current.273.842359333','+FRA/ORCL_CD
B/CONTROLFILE/current.264.842359335'
*.db_block_size=8192
*.db_create_file_dest='+DATA'
*.db_domain=''
*.db_name='orcl_cdb'
*.db_recovery_file_dest='+FRA'
*.db_recovery_file_dest_size=4800m
*.diagnostic_dest='/u01/app/oracle'
*.dispatchers='(PROTOCOL=TCP) (SERVICE=orclcdbXDB)'
"initpdb.ora" 29L, 1046C                                  2,1           Top
```

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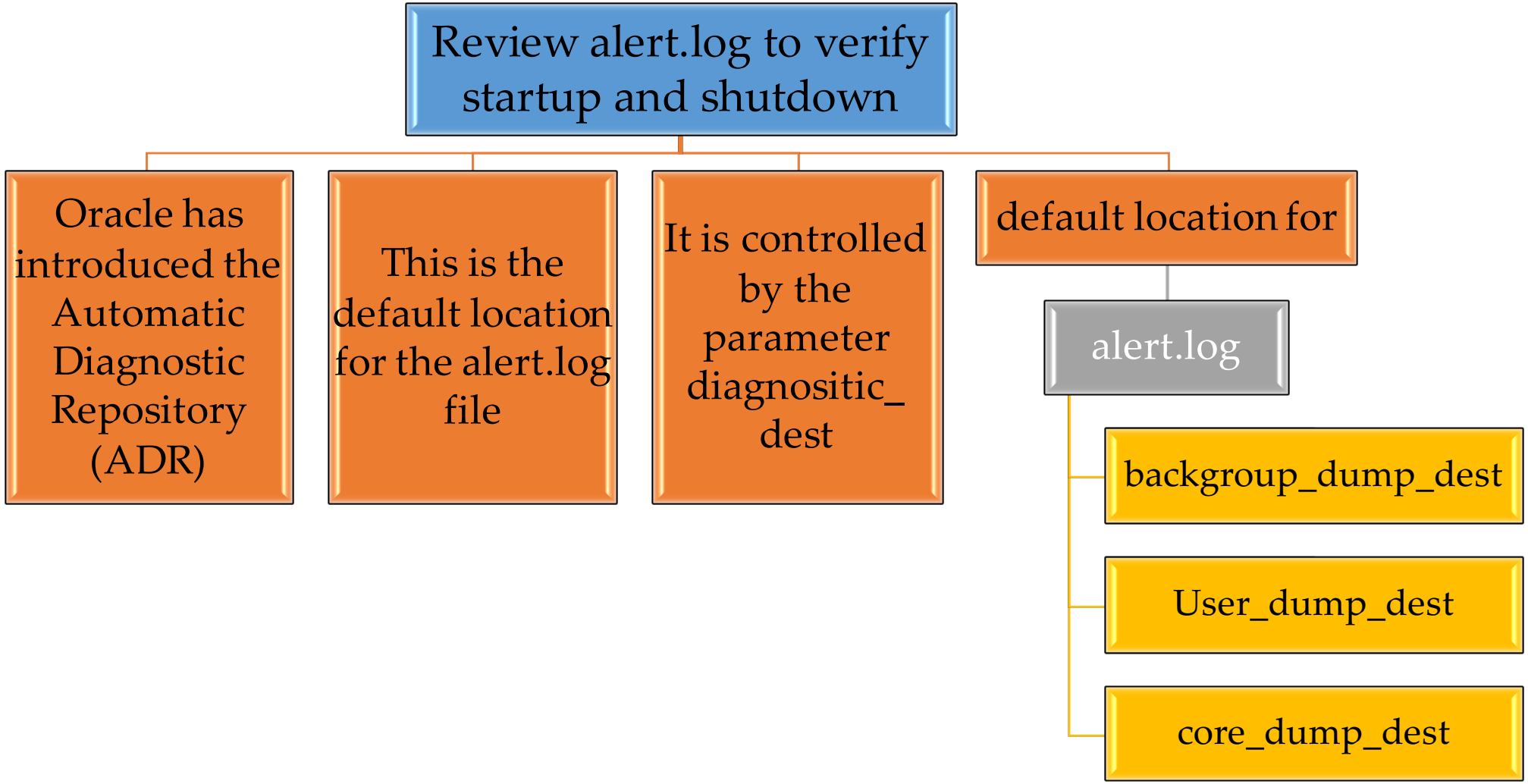
Managing Container Database Architecture



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Managing Container Database Architecture

```
SQL> show parameter diag

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
diagnostic_dest                      string      /u01/app/oracle
SQL>
```

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Managing Container Database Architecture

```
oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo
File  Edit  View  Search  Terminal  Help
[oracle@huskers gogo]$ ls
alert  hm        incpkg  lck  metadata      metadata_pv  sweep
cdump  incident  ir      log  metadata_dgif  stage        trace
[oracle@huskers gogo]$ pwd
/u01/app/oracle/diag/rdbms/gogo/gogo
[oracle@huskers gogo]$
```

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/trace

File Edit View Search Terminal Help

```
[oracle@huskers trace]$ pwd
/u01/app/oracle/diag/rdbms/gogo/gogo/trace
[oracle@huskers trace]$ ls aler*
alert_gogo.log
[oracle@huskers trace]$
```

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ pwd
/u01/app/oracle/diag/rdbms/gogo/gogo/alert
[oracle@huskers alert]$ ls
log.xml
[oracle@huskers alert]$
```

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Managing Container Database Architecture

The ASCII version of the alert.log file will be in the ADR trace directory

The XML version will be in the ADR log directory

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ pwd
/u01/app/oracle/diag/rdbms/gogo/gogo/alert
[oracle@huskers alert]$ ls
log.xml
[oracle@huskers alert]$
```

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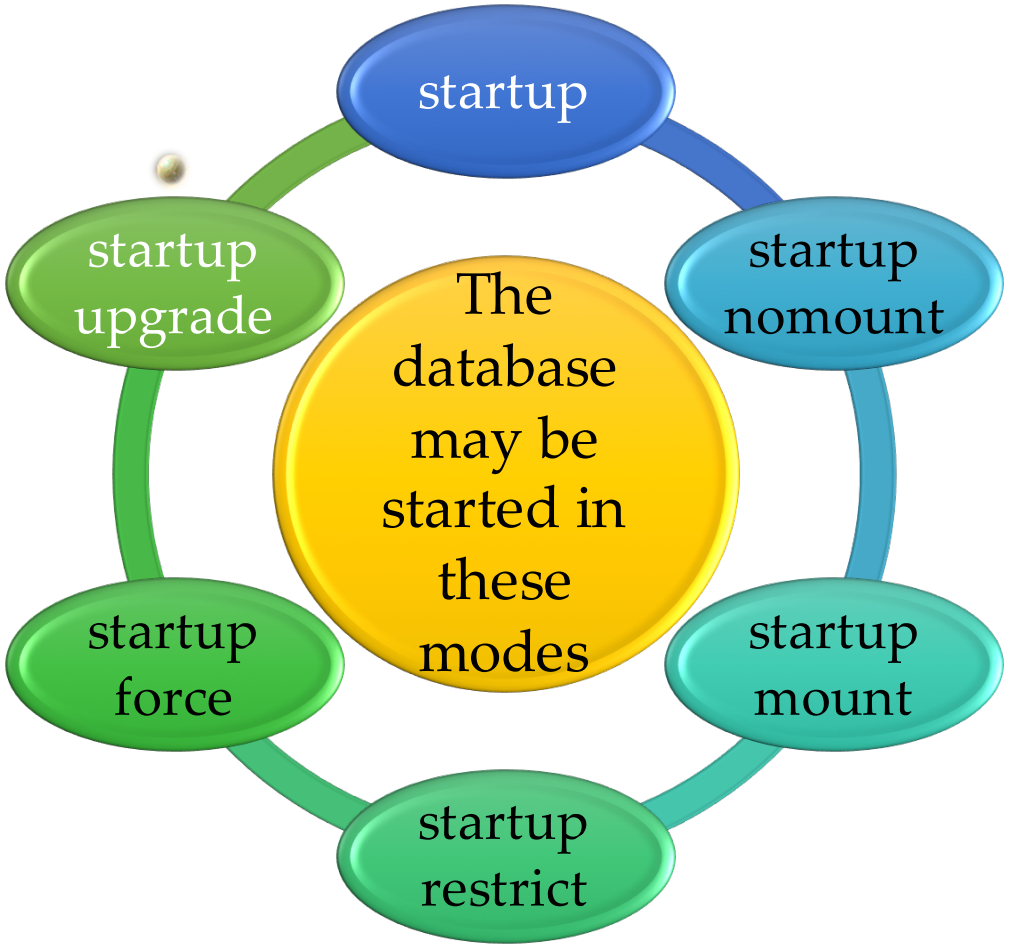
Managing Container Database Architecture

- The database may be started via command line, Cloud Control or Enterprise Express



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Oracle 19c Managing the Database Instance

orcl_cdb (Database Instance) - Oracle Enterprise Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

orcl_cdb (Database Instance... | Summary of Servers - GCDo...

huskers https://huskers:7803/em/faces/db-list-dbList?_afrLoop=68098272034675&_afrWindowMode=

ORACLE Enterprise Manager Cloud Control 12c

Setup Help SYSMAN Log Out

Enterprise Targets Favorites History Search Target Name

orcl_cdb (Container Database) huskers.localdomain

Oracle Database Performance Availability Security Schema Administration

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Monitoring
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Configuration

Startup/Shutdown
Open/Close Pluggable Database
Create Blackout...
End Blackout...

egions that fetch real-time data from target database will not be displayed.

Auto Refresh Off

Incidents and Problems

View Target Local target and related targets Category All

Summary	Target	Severity	Status	Escalation level	Type	Time since last update
The pluggable database orcl_cdb_PLUG_SEE			New	-	Incident	0 days 0 hours
Problem: java.lang.NumberFormatException:ja			New	-	Problem	30 days 7 hours

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Managing Container Database Architecture

Startup (Open)	Startup nomount	Startup Mount
Starts instance	Used to create a database	Recover a database
Opens database	Used to recover a database w/o controlfile	Place a database in archivelog mode

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Managing Container Database Architecture

Startup Restrict	• Used for accounts with restricted session privilege
Startup Force	• Used as a last Resort if Startup Force does not work
Startup upgrade	• Used to upgrade from 11g to 19c

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Managing Container Database Architecture

- The container database must be started first
- To start a pluggable database first connect to the container database
- Then connect to the pluggable database and simply open the pluggable database
- Since pluggable databases share the same SGA as the container database the instance is already started

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ . oraenv
ORACLE_SID = [orclcdb] ?
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers alert]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 15:55:21 2014

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Connected to an idle instance.

SQL> startup
```

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Managing Container Database Architecture

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
SQL> connect sys/password1@huskers:1521/orcl_pdb as sysdba
Connected.
SQL> alter database open;

Database altered.

SQL>
```

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Managing Container Database Architecture

Database will be shutdown in a similar fashion as there are opened

Pluggable database may be closed independent of container database

Shutting down the container database will close all pluggable databases within that container

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Managing the Database Instance

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ sqlplus sys/password1@huskers:1521/orcl_pdb as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 16:03:30 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> alter pluggable database close;

Pluggable database altered.
```

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Managing the Database Instance

oracle@huskers:/u01/app/oracle/diag/rdbms/gogo/gogo/alert

File Edit View Search Terminal Help

```
[oracle@huskers alert]$ sqlplus sys/password1 as sysdba

SQL*Plus: Release 12.1.0.1.0 Production on Wed Jul 16 16:05:26 2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> shutdown immediate;
```

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Managing Container Database Architecture

- Summary
  - Start a container
  - Close a container
  - Container database parameters

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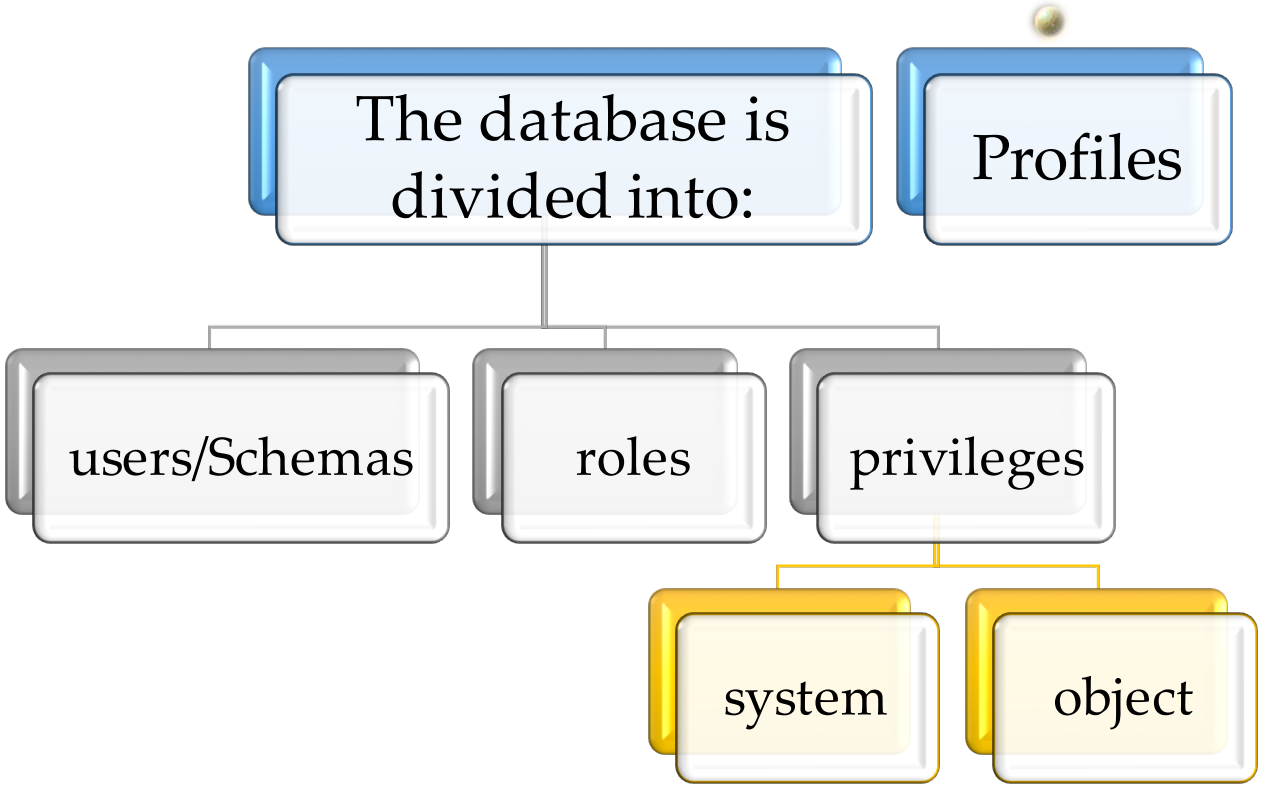
Oracle 19c Multi Tenant

19c Multi Tenant

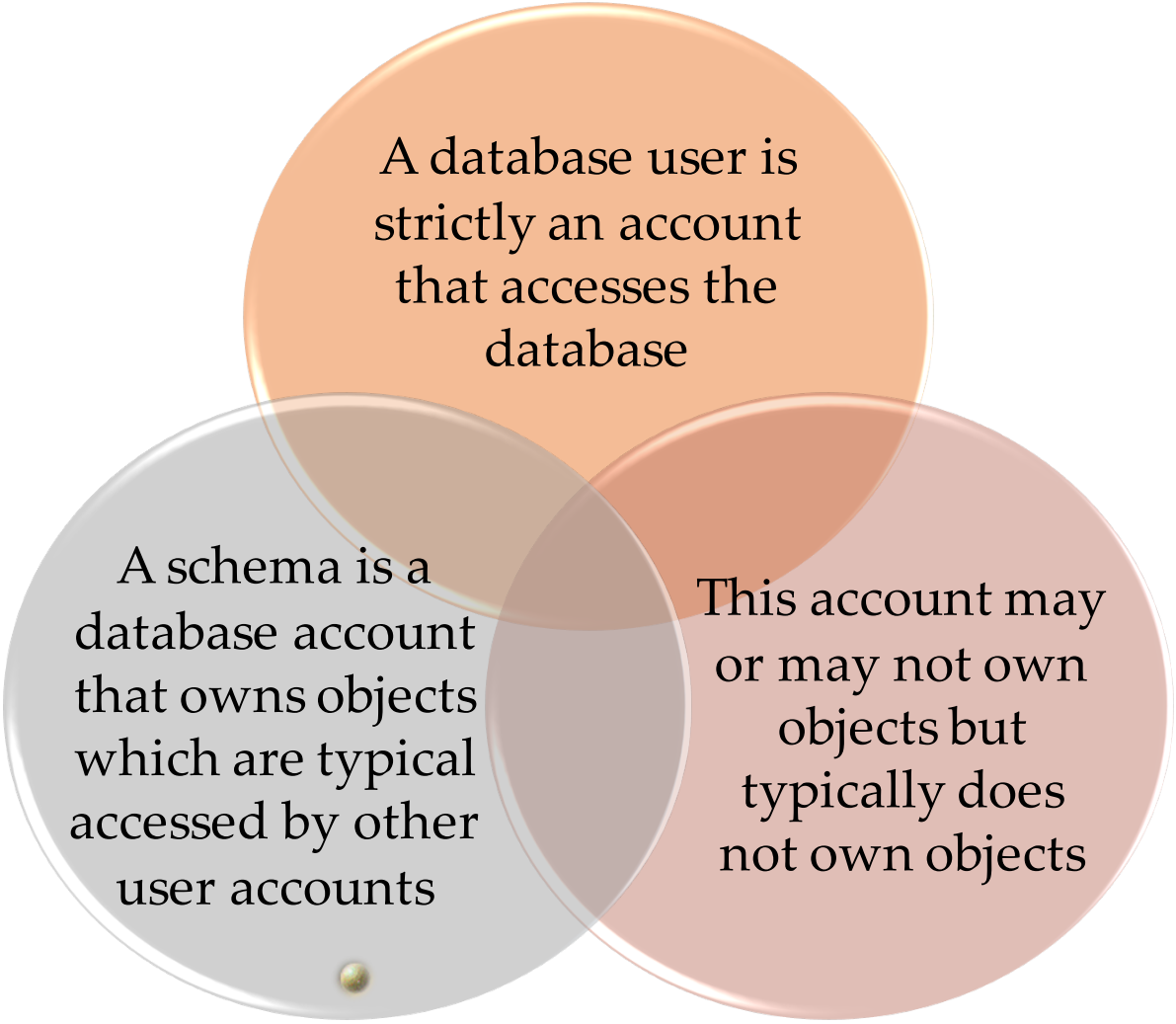
Lesson Topics

- Create container users
- Create Container Roles
- Create Container Profiles
- Grant local privileges
- Lab: Create local users
- Lab: Create local roles
- Lab: Grant local privileges
- Lab Demo Solution: Create local users
- Lab Demo Solution: Create local roles
- Lab Demo Solution: Grant local privileges

Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges

A role is a placeholder for privileges

- A user may have many roles
- Roles may be assigned to other roles

A Profile is used for password rules and resource limitations

Oracle 19c Container Database Privileges

Database privileges are broken down into two categories

System Privileges	• similar to ddl • 'any' keyword
Object Privileges	• similar to dml

Oracle 19c Container Database Privileges

The database comes standard with certain accounts and these accounts are available to both container and pluggable databases;

- SYS
  - owns the database
- SYSTEM
  - Oracle supplied DBA account
- SYSBACKUP
  - Used by RMAN for backup and recovery operations

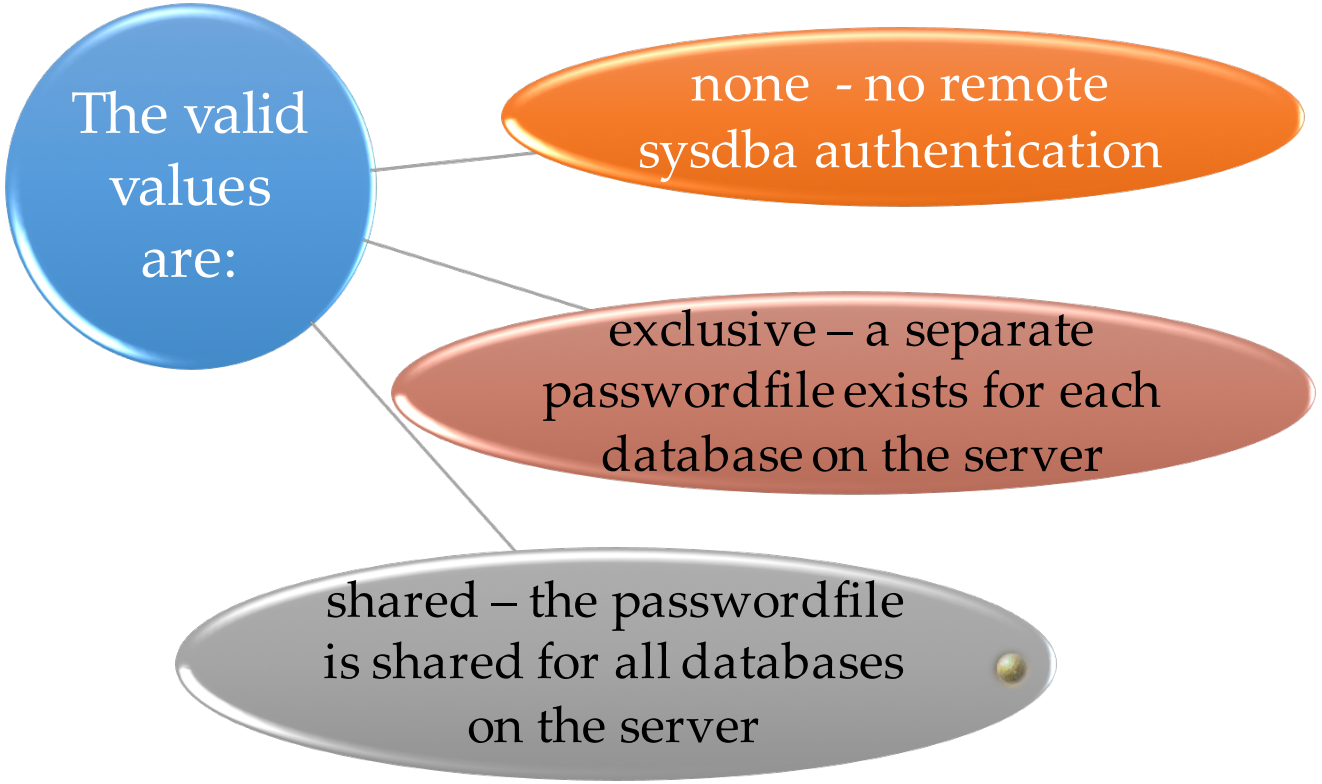
Oracle 19c Container Database Privileges

The database comes standard with certain accounts and these accounts are available to both container and pluggable databases;

SYSDG	• Used by Data Guard
SYSKM	• Use for transparent Data Encryption
SYSOPER	• Used to Start/Stop and perform complete recovery of the database
SYSDBA	• Used to Create,Start,Stop,Complete, and Incomplete recovery of the database

Oracle 19c Container Database Privileges

- For remote authentication a password file may be used
- This is determined by the
  - remote_login_passwordfile parameter



Oracle 19c Container Database Privileges

The password file is created with the 'orapwd' utility

```
[oracle@huskers ~]$ orapwd
Usage: orapwd file=<fname> entries=<users> force=<y/n> asm=<y/n>
       dbuniquename=<dbname> format=<legacy/12> sysbackup=<y/n> sysdg=<y/n>
       syskm=<y/n> delete=<y/n> input_file=<input-fname>
```

Oracle 19c Container Database Privileges

```
[oracle@huskers dbs]$ pwd
/u01/app/oracle/product/12.1.0/dbhome_1/dbs
[oracle@huskers dbs]$ ls ora*
orapwgogo  orapworcl  orapworclcdb  orapworclplug  orapworcltcn  orapwplugdb
[oracle@huskers dbs]$
```

The password file must exist in the $ORACLE_HOME/dbs directory

It must have the naming convention

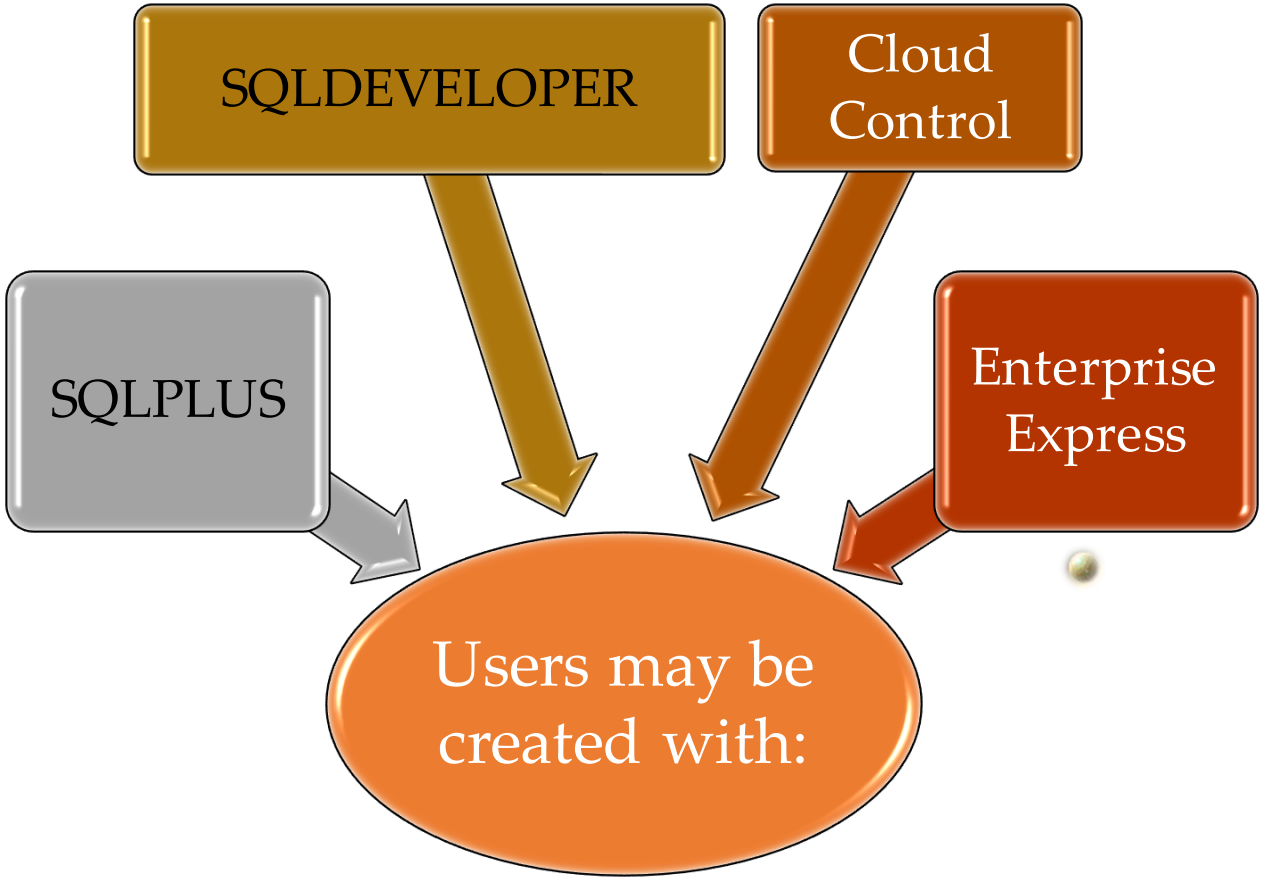
- orapwd<sid>

Oracle 19c Container Database Privileges

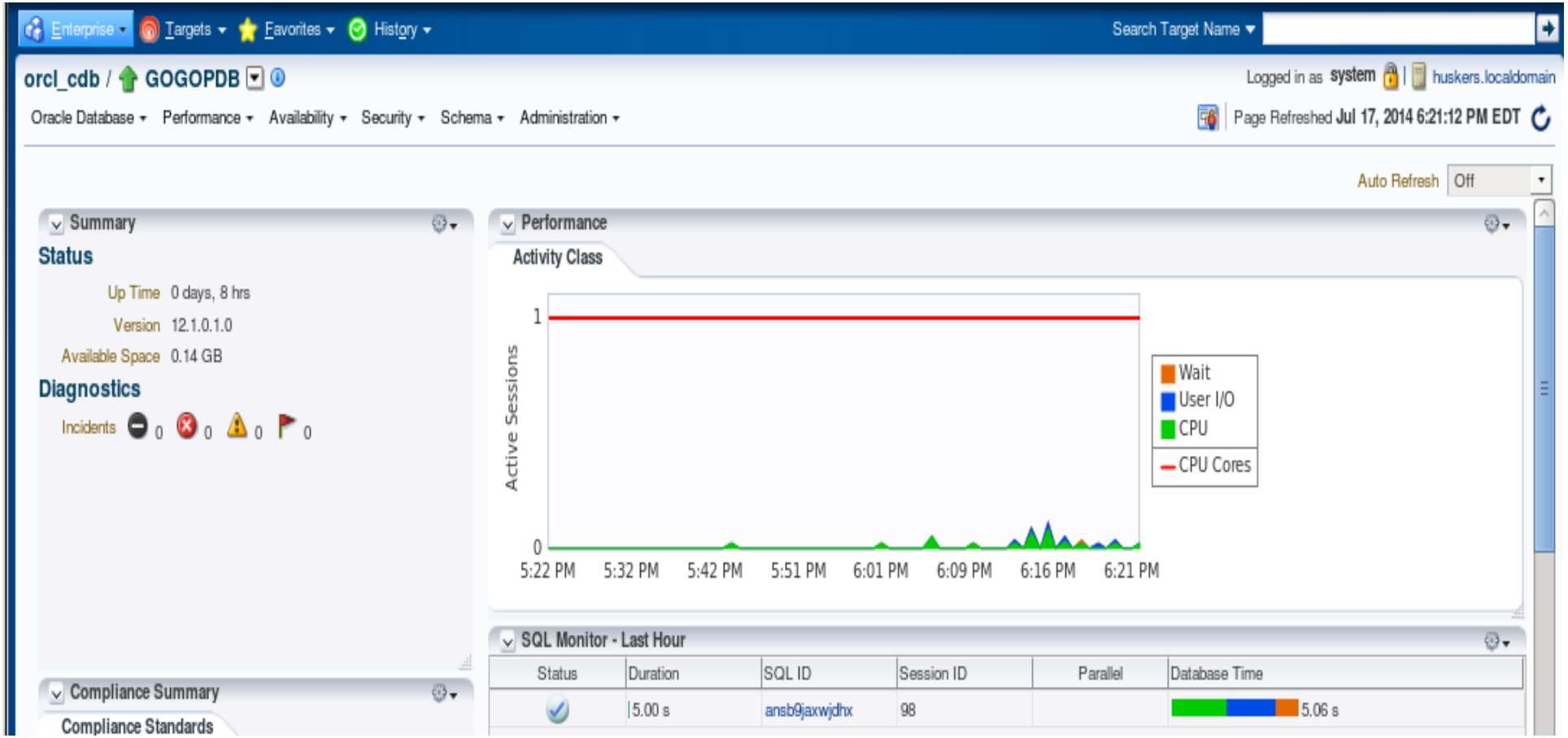
All user account will be authenticated by a:		
password	external (OS)	Global – LDAP

- Passwords in Oracle 19c are case sensitive

Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

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Auto Refresh Off

- Users
- Database Objects
- Programs
- Materialized Views
- User Defined Types
- Database Export/Import
- Change Management
- Application Data Models
- Data Subsetting
- XML Database
- Text Manager
- Workspaces

Summary

Status

Up Time 0 days, 8 hrs

Version 12.1.0.1.0

Available Space 0.14 GB

Diagnostics

Incidents 0 0 0 0

Wait
User I/O
CPU
CPU Cores

5:42 PM 5:51 PM 6:01 PM 6:09 PM 6:16 PM 6:21 PM

SQL Monitor - Last Hour

Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	5.00 s	ansb9jaxwjdhx	98		5.06 s

Compliance Summary

Compliance Standards

View Trends

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Logged in as SYSTEM

Users

Object Type User

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Object Name Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single Create

Edit View Delete Actions Create Like Go Previous 1-25 of 38 Next 13

Select	UserName	Account Status	Expiration Date	Default Tablespace	Temporary Tablespace	Profile	Common User	Created
◉	ANONYMOUS	EXPIRED & LOCKED	May 24, 2013 1:20:02 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:19 PM EDT
○	APEX_040200	EXPIRED & LOCKED	May 24, 2013 1:10:01 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 1:09:01 PM EDT
○	APEX_PUBLIC_USER	EXPIRED & LOCKED	May 24, 2013 1:09:01 PM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 1:09:01 PM EDT
○	APPQOSSYS	EXPIRED & LOCKED	May 24, 2013 12:17:10 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:10 PM EDT
○	AUDSYS	EXPIRED & LOCKED	May 24, 2013 11:51:49 AM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 11:51:49 AM EDT
○	CTXSYS	EXPIRED & LOCKED	May 24, 2013 12:30:51 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:30:51 PM EDT
○	DBSNMP	OPEN	Nov 20, 2013 12:17:08 PM EST	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:08 PM EDT
○	DIP	EXPIRED & LOCKED	May 24, 2013 12:10:18 PM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 12:10:18 PM EDT

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Create User

Execute On Multiple Databases | Show SQL | Cancel | OK

General | Roles | System Privileges | Object Privileges | Quotas | Consumer Group Privileges | Proxy Users

* Name: gogo_user

Profile: DEFAULT

Authentication: Password

* Enter Password: ••••••••

* Confirm Password: ••••••••

For Password choice, the user is authorized via password.

☐ Expire Password now

Default Tablespace:

Temporary Tablespace:

Status: ○ Locked ◉ Unlocked

Note: Created user will be a local user since you are in PDB container.

Execute On Multiple Databases | Show SQL | Cancel | OK

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Create User

Execute On Multiple Databases | Show SQL | Cancel | OK

General | **Roles** | System Privileges | Object Privileges | Quotas | Consumer Group Privileges | Proxy Users

Edit List

Role	Admin Option	Default	Common Across All Containers
CONNECT	☐	☑	NO
RESOURCE	☐	☑	NO

Execute On Multiple Databases | Show SQL | Cancel | OK

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Modify Roles

Cancel OK

Available Roles

ADM_PARALLEL_EXECUTE_TASK*
APEX_ADMINISTRATOR_ROLE*
APEX_GRANTS_FOR_NEW_USERS_ROLE*
AQ_ADMINISTRATOR_ROLE*
AQ_USER_ROLE*
AUDIT_ADMIN*
AUDIT_VIEWER*
AUTHENTICATEDUSER*
CAPTURE_ADMIN*
CDB_DBA*

Move
Move All
Remove
Remove All

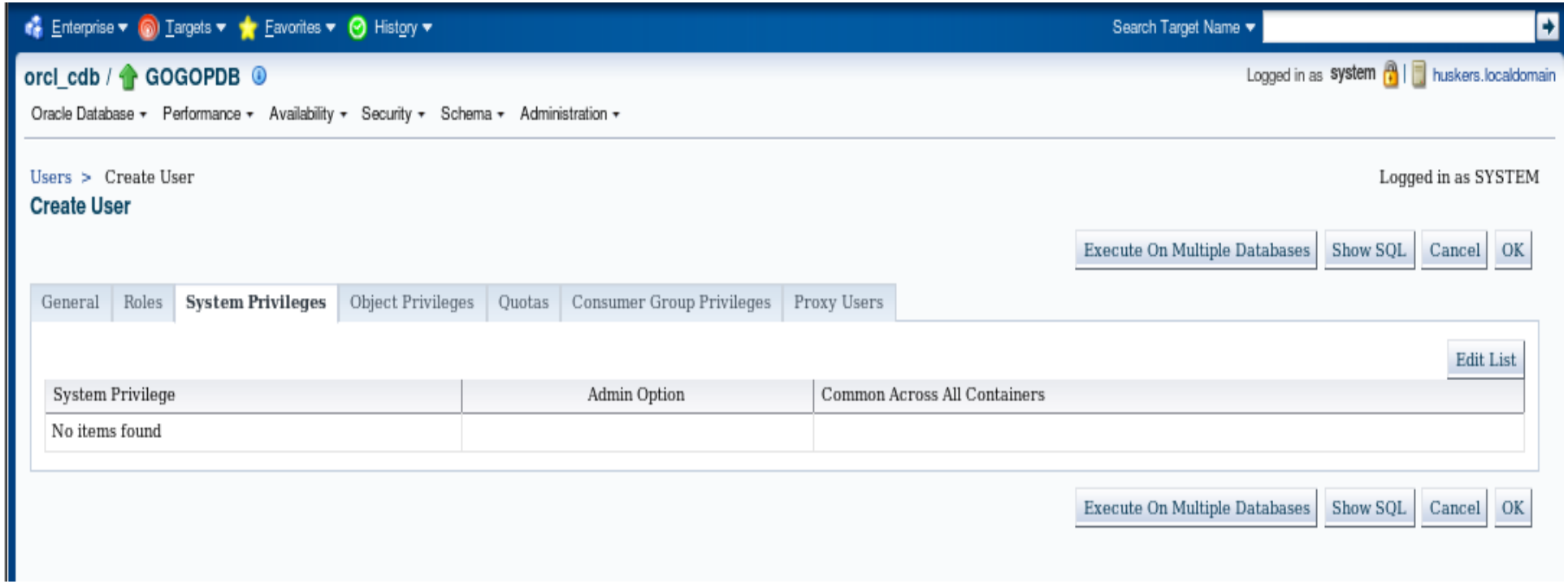
Selected Roles

CONNECT*

Roles suffixed with * are common roles.
Note: Common roles granted across all containers are not shown in the lists above as they can not be revoked in PDB container. Such roles can only be revoked in the CDB$ROOT container.

Cancel OK

Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Modify System Privileges

Cancel OK

Available System Privileges

ACCESS_ANY_WORKSPACE
ADMINISTER ANY SQL TUNING SET
ADMINISTER DATABASE TRIGGER
ADMINISTER KEY MANAGEMENT
ADMINISTER RESOURCE MANAGER
ADMINISTER SQL MANAGEMENT OBJECT
ADMINISTER SQL TUNING SET
ADVISOR
ALTER ANY ASSEMBLY
ALTER ANY CLUSTER

Move
Move All
Remove
Remove All

Selected System Privileges

UNLIMITED TABLESPACE

Note: Privileges granted across all containers are not shown in the lists above as they can not be altered in PDB container. Such privileges can only be revoked in the CDB$ROOT container.

Cancel OK

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Edit User: GOGO

Logged in as SYSTEM

Edit User: GOGO

Actions Create Like Go | Execute On Multiple Databases | Show SQL | Revert | Apply

General | Roles | **System Privileges** | Object Privileges | Quotas | Consumer Group Privileges | Proxy Users

Edit List

System Privilege	Admin Option	Common Across All Containers
UNLIMITED TABLESPACE	☑	NO

Actions Create Like Go | Execute On Multiple Databases | Show SQL | Revert | Apply

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Edit User: GOGO

Logged in as SYSTEM

Edit User: GOGO

Actions Create Like Go | Execute On Multiple Databases | Show SQL | Revert | Apply

General | Roles | System Privileges | **Object Privileges** | Quotas | Consumer Group Privileges | Proxy Users

Select Object Type Chain Add

Select	Object Privilege	Schema	Object	Grant Option	Common Across All Containers
	No items found				

Actions Create Like Go | Execute On Multiple Databases | Show SQL | Revert | Apply

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdoma

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Add Table Object Privileges

Cancel OK

* Select Table Objects

hr.employees

(SchemaName.Table,...)

Select object and then choose privileges to assign

Available Privileges		Selected Privileges
ALTER	Move	SELECT
DELETE	Move All	
INDEX	Remove	
INSERT	Remove All	
REFERENCES		
UPDATE		

Cancel OK

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Create User

Execute On Multiple Databases | Show SQL | Cancel | OK

General | Roles | System Privileges | **Object Privileges** | Quotas | Consumer Group Privileges | Proxy Users

Select Object Type Chain Add

Delete

Select	Object Privilege	Schema	Object	Grant Option	Common Across All Containers
◉	SELECT	HR	EMPLOYEES	☑	NO

Execute On Multiple Databases | Show SQL | Cancel | OK

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Users > Create User

Logged in as SYSTEM

Show SQL

Execute On Multiple Databases | Return

```
CREATE USER "GOGO_USER" PROFILE "DEFAULT" IDENTIFIED BY "*******" ACCOUNT UNLOCK
GRANT UNLIMITED TABLESPACE TO "GOGO_USER"
GRANT SELECT ON "HR"."EMPLOYEES" TO "GOGO_USER" WITH GRANT OPTION
GRANT "CONNECT" TO "GOGO_USER"
GRANT "RESOURCE" TO "GOGO_USER"
```

Execute On Multiple Databases | Return

Oracle 19c Container Database Privileges

orcl_cdb / GOGOPDB

Logged in as system | huskers.localdoma

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

◉	ANONYMOUS	EXPIRED & LOCKED	May 24, 2013 1:20:02 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:19 PM EDT
○	APEX_040200	EXPIRED & LOCKED	May 24, 2013 1:10:01 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 1:09:01 PM EDT
○	APEX_PUBLIC_USER	EXPIRED & LOCKED	May 24, 2013 1:09:01 PM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 1:09:01 PM EDT
○	APPQOSSYS	EXPIRED & LOCKED	May 24, 2013 12:17:10 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:10 PM EDT
○	AUDSYS	EXPIRED & LOCKED	May 24, 2013 11:51:49 AM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 11:51:49 AM EDT
○	CTXSYS	EXPIRED & LOCKED	May 24, 2013 12:30:51 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:30:51 PM EDT
○	DBSNMP	OPEN	Nov 20, 2013 12:17:08 PM EST	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 12:17:08 PM EDT
○	DIP	EXPIRED & LOCKED	May 24, 2013 12:10:18 PM EDT	SYSTEM	TEMP	DEFAULT	YES	May 24, 2013 12:10:18 PM EDT
○	DVF	EXPIRED & LOCKED	May 24, 2013 1:20:02 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 1:19:38 PM EDT
○	DVSYS	EXPIRED & LOCKED	May 24, 2013 1:19:51 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 1:19:38 PM EDT
○	FLOWS_FILES	EXPIRED & LOCKED	May 24, 2013 1:10:01 PM EDT	SYSAUX	TEMP	DEFAULT	YES	May 24, 2013 1:09:01 PM EDT
○	GOGO	OPEN	Jan 12, 2015 5:08:39 PM EST	SYSTEM	TEMP	DEFAULT	NO	Jul 16, 2014 5:08:39 PM EDT
○	GOGO_USER	OPEN	Jan 13, 2015 6:29:19 PM EST	SYSTEM	TEMP	DEFAULT	NO	Jul 17, 2014 6:29:19 PM EDT

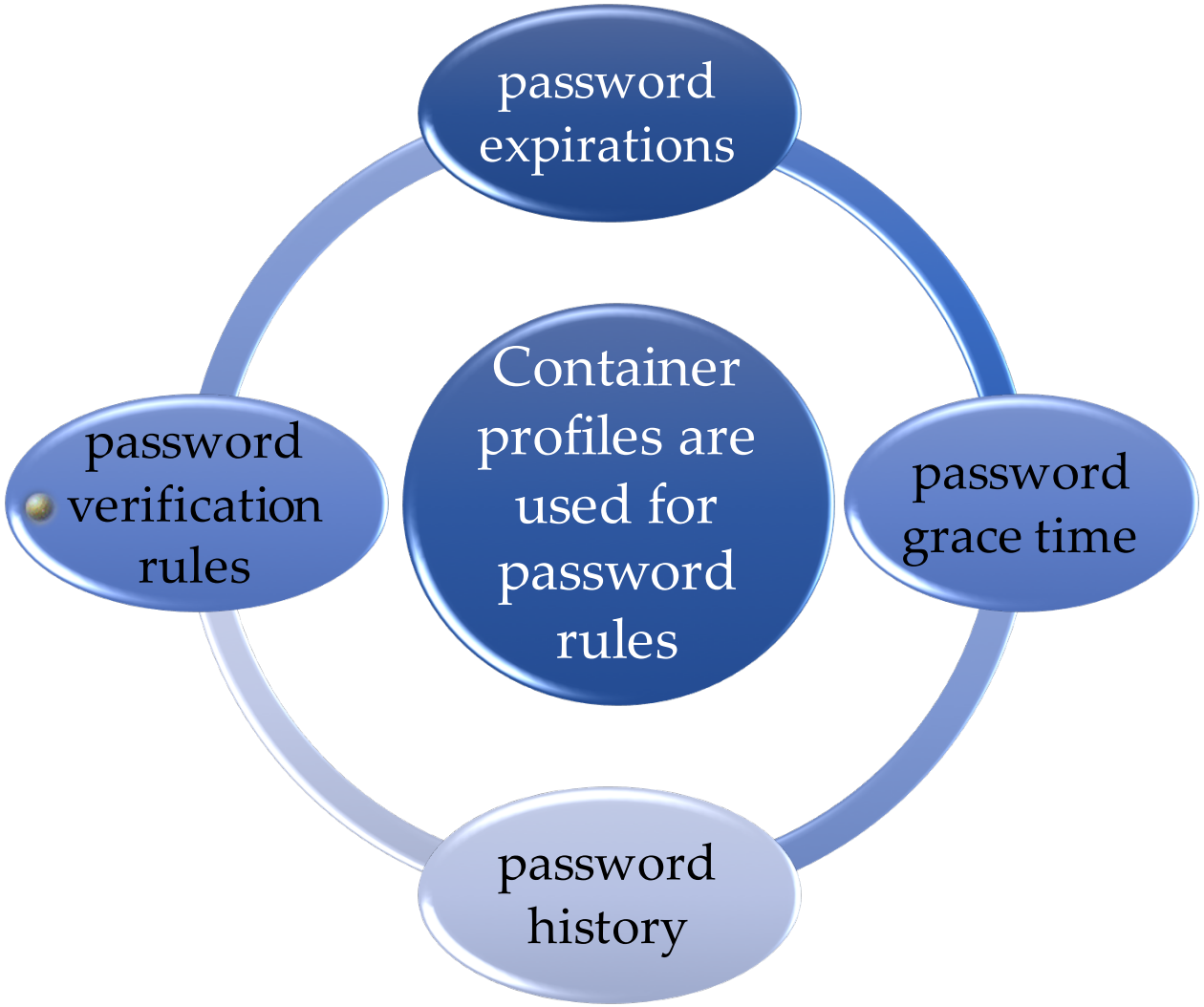
Oracle 19c Container Database Privileges

With the exception of the SYS* users all users in 19c will be unique to a pluggable database

All privileges will be assigned to that user

When a pluggable database is moved to another container database the privileges transfer

Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges

Container profiles are also used for resource limitations

resource_limit=true

- (default value = false)

Only one profile may be assigned to a user at a given time

Profile cannot contain other profiles

Oracle 19c Container Database Privileges

Container profiles may be created

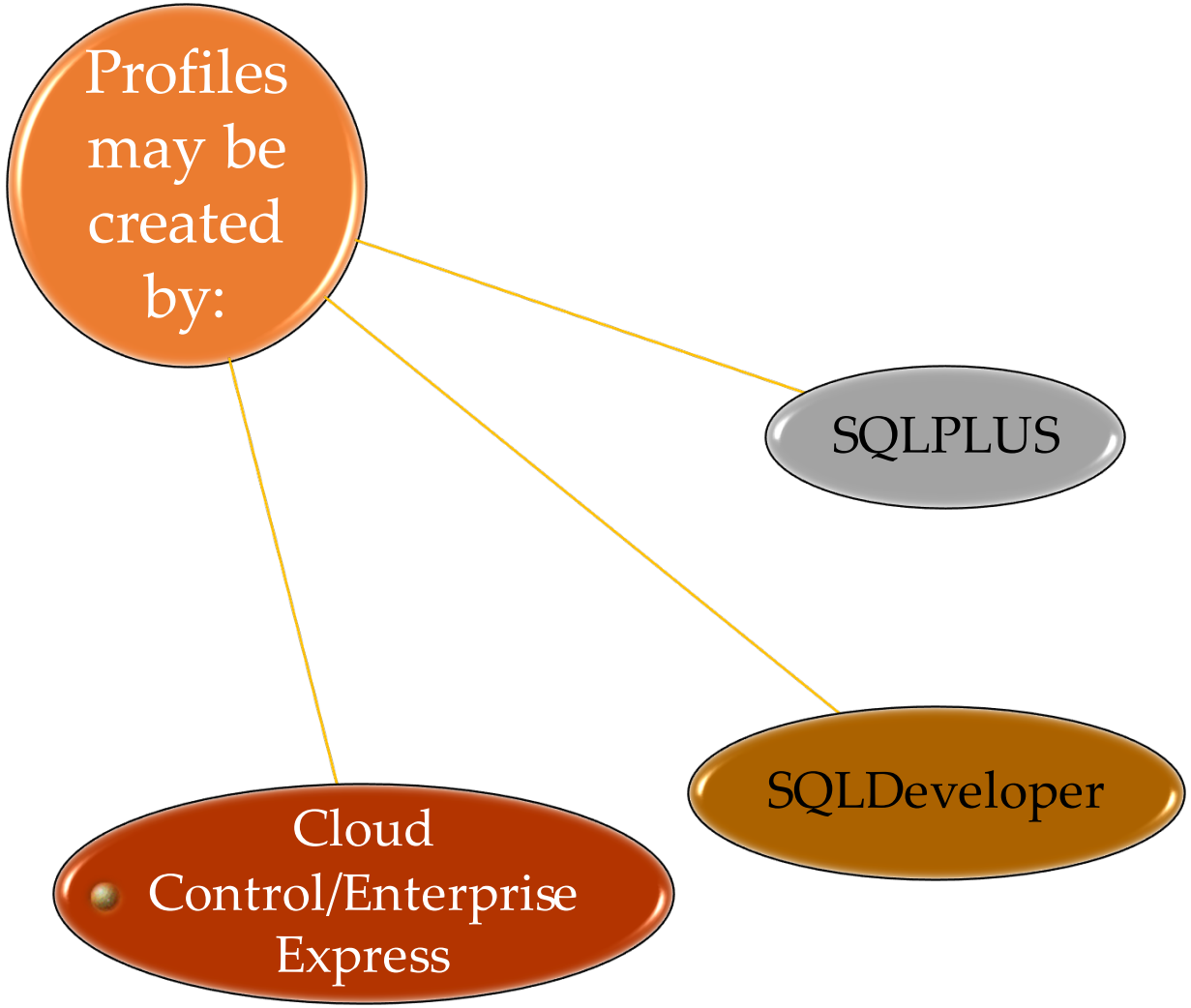
c###_profile name

The profile may be used across all pluggable databases

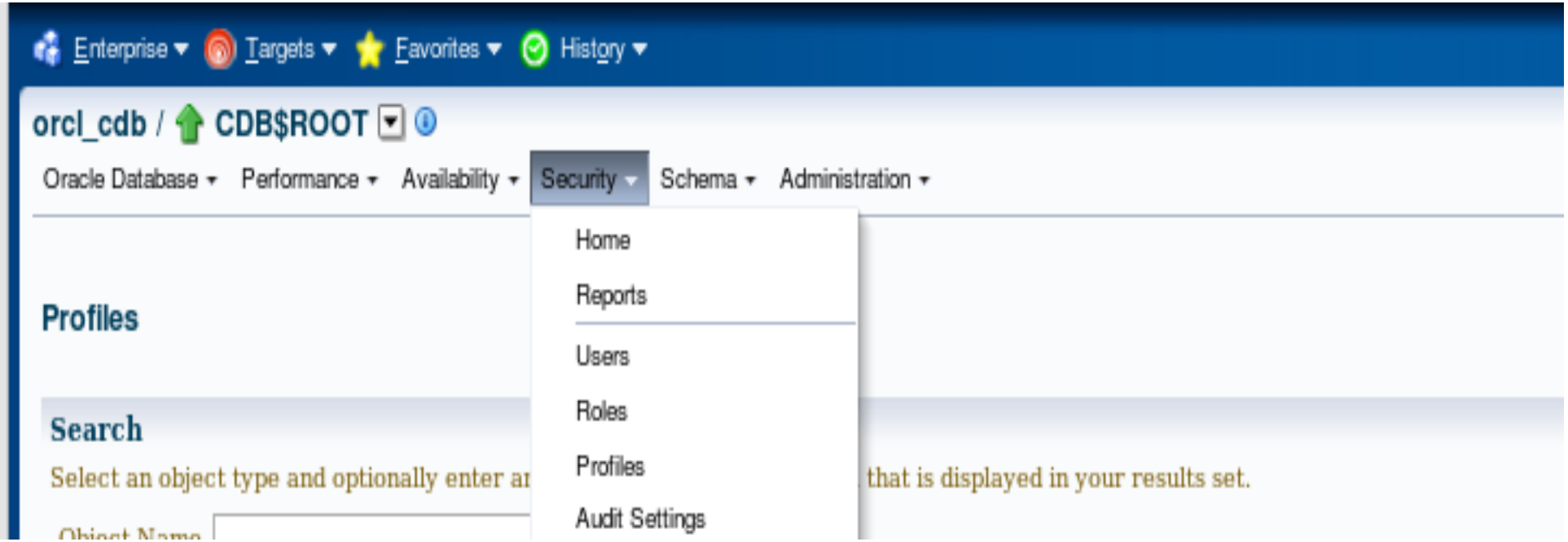
Pluggable database profiles may be created/ Used solely the in the specific pluggable database

create profile <profile_name>

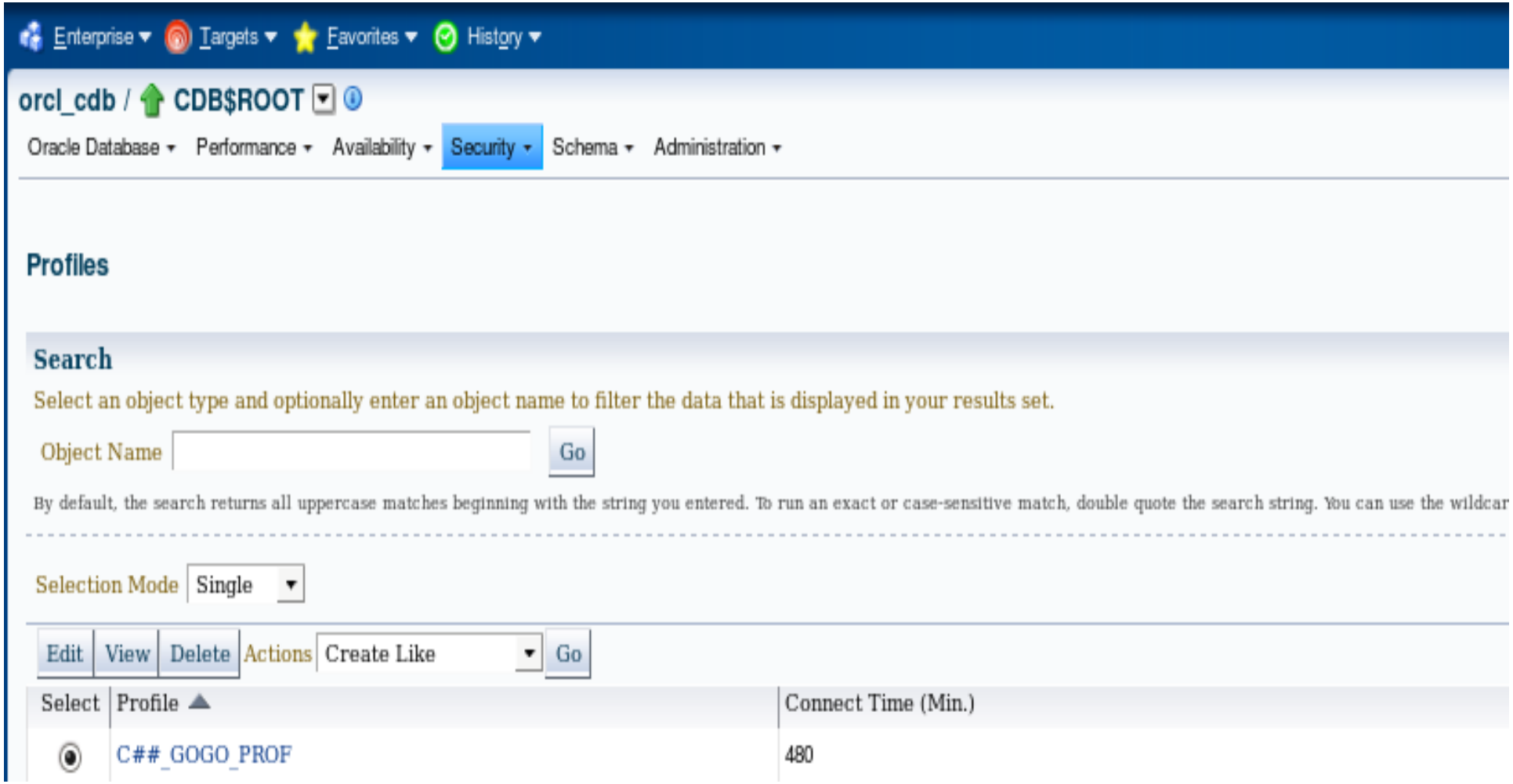
Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges



Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search

orcl_cdb / GOGOPDB

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Profiles

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Object Name [ ] Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single

Edit View Delete Actions Create Like Go

Select	Profile	Connect Time (Min.)	Concurrent Sessions
◉	C##_GOGO_PROF	480	DEFAULT
○	DEFAULT	UNLIMITED	UNLIMITED

Oracle 19c Container Database Privileges

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Targe

orcl_cdb / GOGOPDB

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Update Message

The object has been created successfully

Profiles

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Object Name [ ] Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single

Edit View Delete Actions Create Like Go

Select	Profile	Connect Time (Min.)	Concurrent Sessions
◉	C##_GOGO_PROF	480	DEFAULT
○	DEFAULT	UNLIMITED	UNLIMITED
○	GOGO_PROFILE	480	DEFAULT

Multitenant Privileges

- Common objects
  - Users
  - Roles
  - Profiles
- Issue container = all or container = container name to apply to a specific container
  - Grant connect to username container = all

Multitenant Security

- Summary
  - Container users
  - Container privileges
  - Default sys accounts

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TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- Backup sets
- Image copies
- Non-compressed backups
- Compressed backups
- Incremental backups
- Backup ASM files
- Backup the Recovery Area
- Lab: Database backup

Oracle 19c RMAN Backups

Backup Types

- Backup Sets
- Incremental backups
- Image Copies
- Incremental Image Copies
- Tape Backups
- Disk Backups
- Backup Compression

Oracle 19c RMAN Backups

Backup information stored in the target databases controlfile

```
$rman target un/pw
```

```
rman>backup database
```

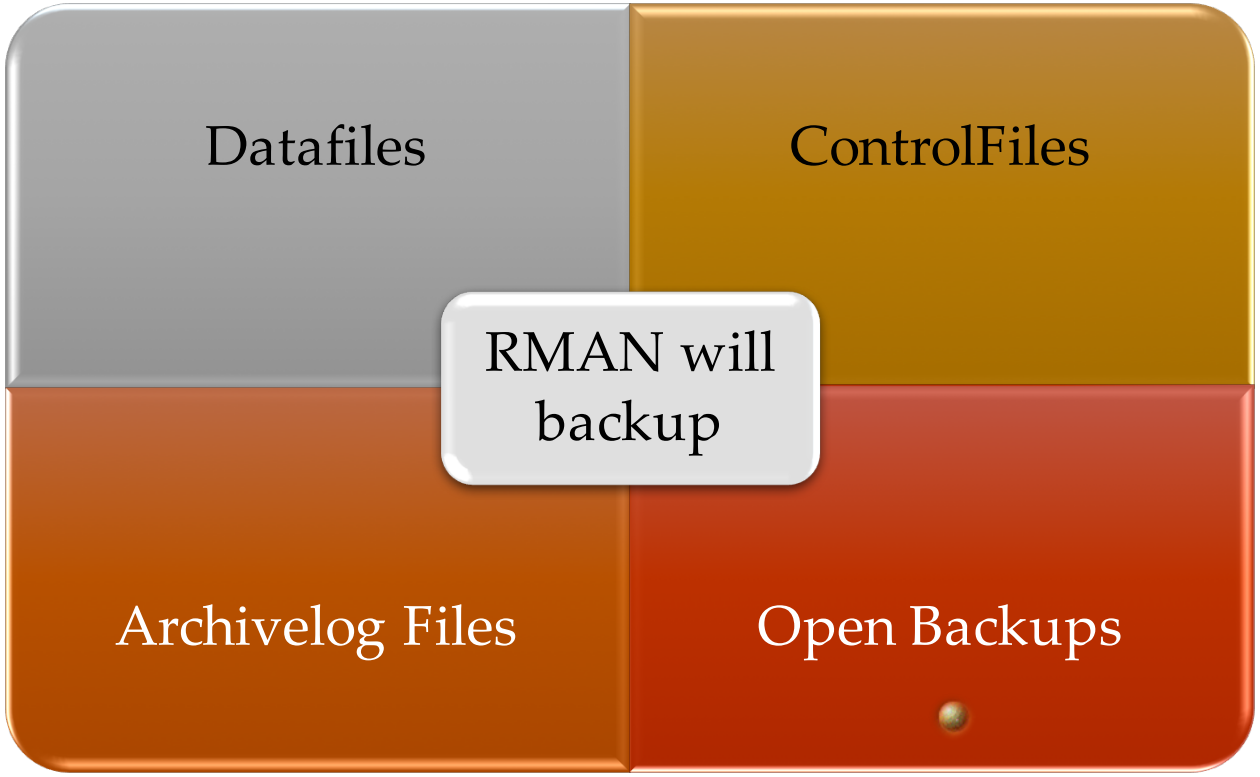
```
rman>backup archivelog
all delete all input
```

Oracle 19c RMAN Backups

CONTROL_FILE_RECORD_KEEP_TIME

- Retains the backup information in the target databases controlfile for n days
- Cannot contain scripts

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

RMAN will backup

Closed Backups (Mount)

By Default backups placed in the FRA

Only used data blocks

Corrupt block detection

spfile

Online Redo Logs are not backedup

Oracle 19c RMAN Backups

RMAN will backup

- Closed Backups (Mount)
- Only used data blocks
- spfile
- Corrupt block detection
- By Default backups placed in the FRA

Oracle 19c RMAN Backups

Backups may be performed at the CDB level

backup database root

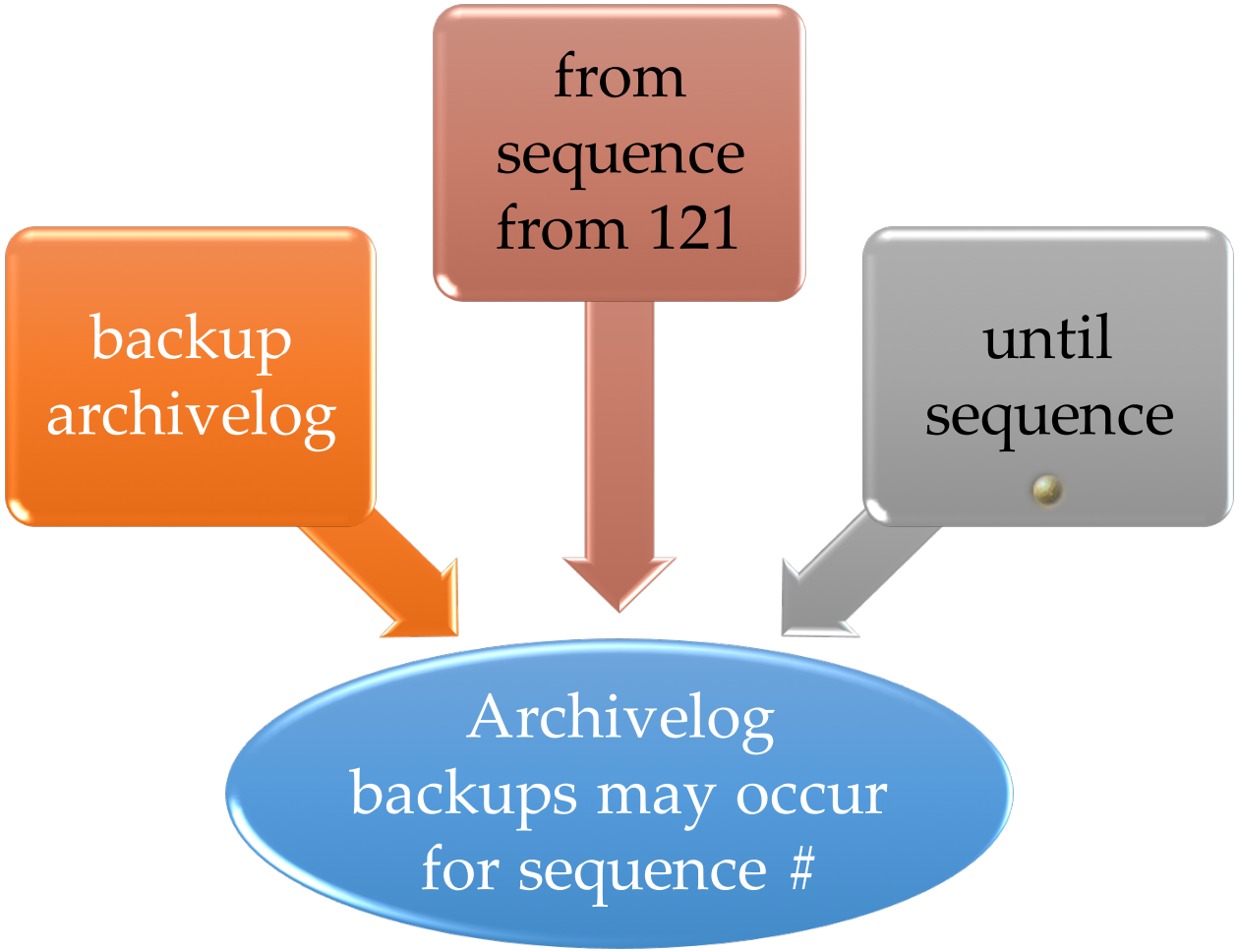
Backups may be performed at the PDB Level

backup pluggable database

Does not backup archive redo logs

Tablespaces within a pluggable databases may be backed up

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

```
$ rman target un/pw
```

```
rman>backup database;
```

```
rman> run
```

```
rman{backup database;
```

```
backup archivelog all;}
```

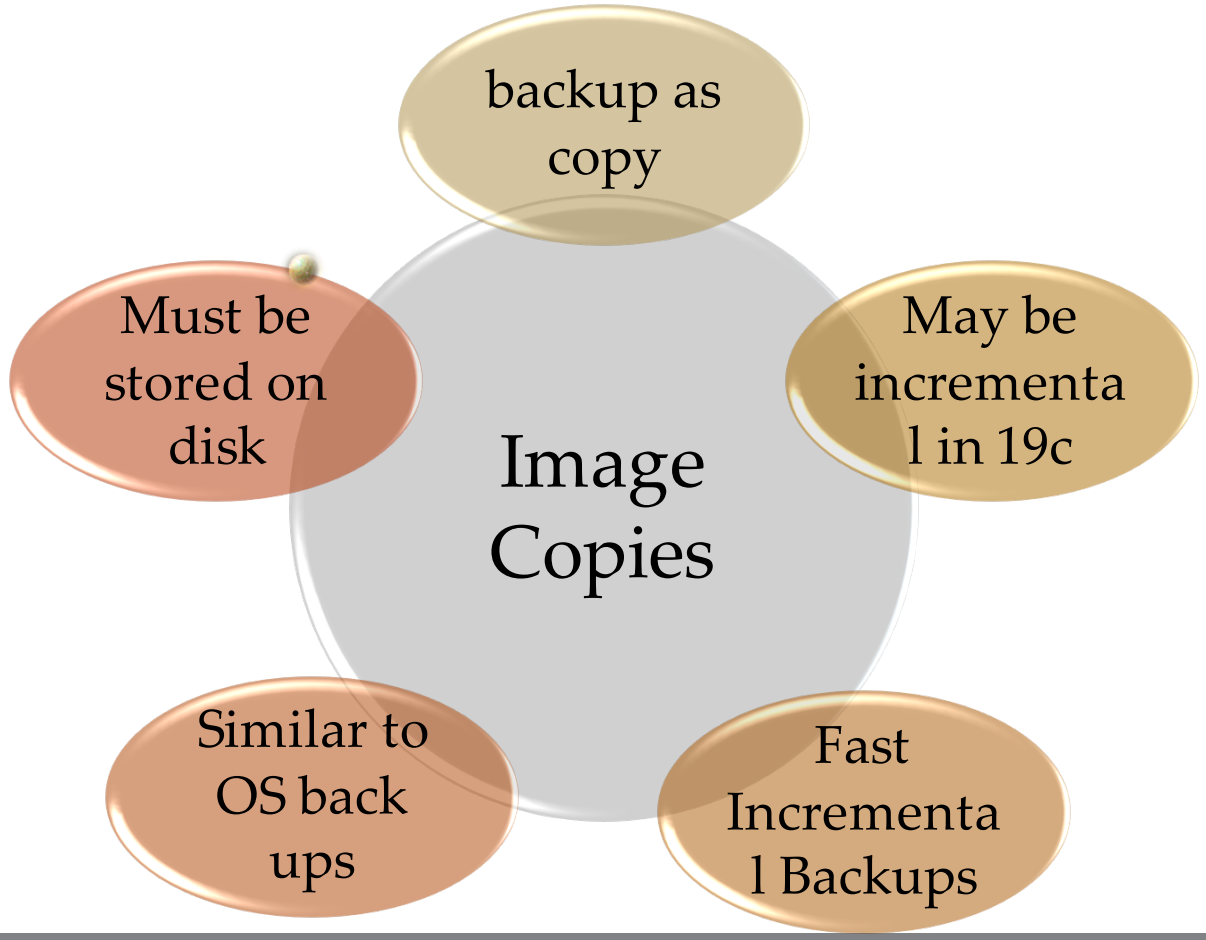
```
up
```

Oracle 19c RMAN Backups

- Controlfile
- Datafile
- May be Compressed
  - 5:1 Ratio
- Only Backs up used data blocks
- Corrupt block detection
- Incremental

Backup Sets

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

- Reads the target databases control file to identify the files that need to be backed up
- Backups, unless otherwise specified, are placed in the FRA
- RMAN allocates channels to communicate with the target database
- Multiple Channels Identifies degrees of parallelism
- Files may be split up
- Default settings may be overridden
- interfile parallel backups

Oracle 19c RMAN Backups

Rman can be used to backup a database in archivelog or noarchivelog mode

To backup a database in noarchivelog the database must only be mounted

- Applies also to pluggable databases

If the database is in archivelog mode it may be backed up either hot or cold

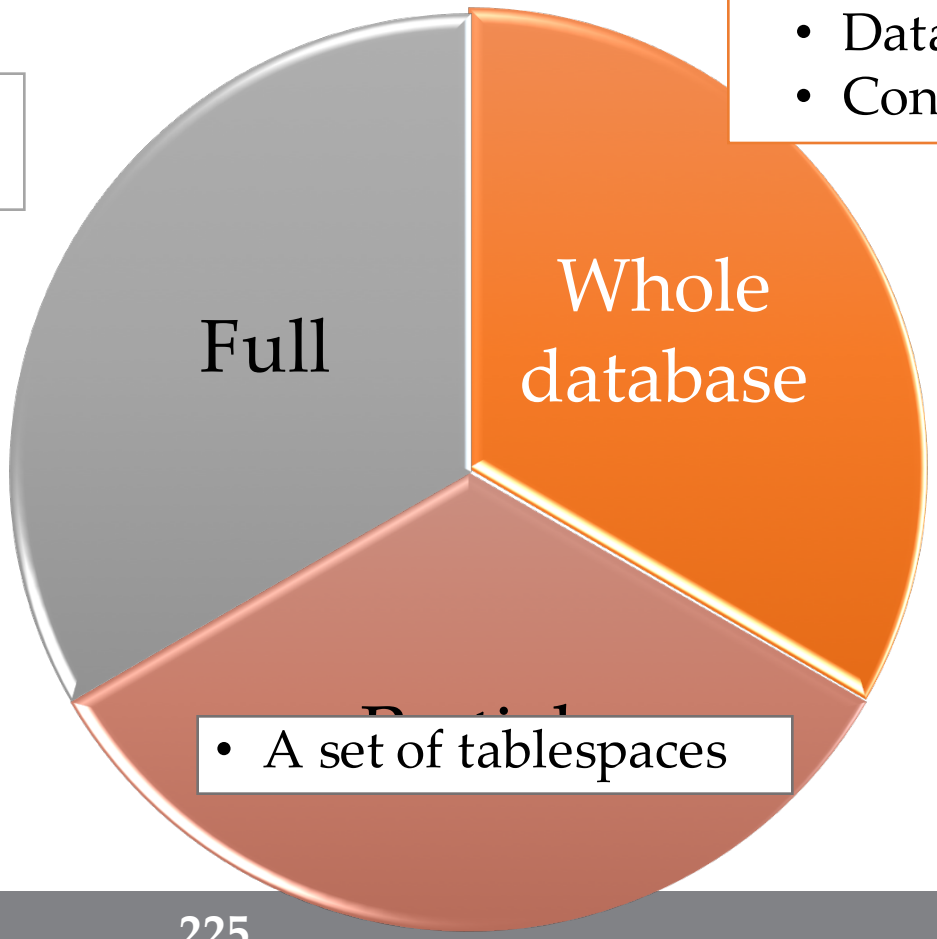
Oracle 19c RMAN Backups

RMAN may restore:

Databases	• Cold
Datafiles	• Hot/Cold
Tablespaces	• Hot
Controlfiles	• Cold
Spfile	• Hot/Cold

Oracle 19c RMAN Backups

- All blocks in a whole or a partial



- Usually cold
  - Datafiles
  - Controlfiles

- A set of tablespaces

Oracle 19c RMAN Backups

Inconsistent	• Cold
Consistent	• Hot
Incremental	• Changed blocks
Cumulative	• Changed blocks since last level 0

Oracle 19c RMAN Backups

Fast Incremental Backups		
Creates and index file for changed blocks	Must be implemented prior to the next level 0	Alter system enable block change tracking using 'filename'

Oracle 19c RMAN Backups

An incremental level 0 is always the beginning of an incremental backup, this is the same as a full backup

- rman>backup incremental level 0 database;

A differential or cumulative backup is

- rman>backup incremental level 1 cumulative database;

This command will append to the existing RMAN backups so the restore will only require one set of backups rather than many, as the incremental would require

Oracle 19c RMAN Backups

orcl_cdb (Database Instance) - Oracle Enterprise Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

orcl_cdb (Database Instance) - ...

huskers https://huskers:7803/em/faces/core-uifwk-console-overview?_afrLoop=11317534622247&_afrWindowMode=0&_afrWindowId=

ORACLE Enterprise Manager Cloud Control 12c

Enterprise Targets Favorites History

orcl_cdb (Container Database)

Oracle Database Performance Availability Security Schema Administration

High Availability Console
MAA Advisor
Backup & Recovery
Add Standby Database...

Schedule Backup...
Manage Current Backups
Backup Reports
Restore Points
Perform Recovery...
Transactions
Backup Settings
Recovery Settings
Recovery Catalog Settings

Summary

Status

Up Time 0 days, 4 hrs
Version 12.1.0.1.0
Load 0.00 average active sessions
Total Sessions 65
Last Backup Sep 6, 2014 5:20:57 PM
Available Space 0.06 GB
Used Space 2.96 GB
Total SGA 2,946.78 MB

Diagnostics

ADDM Findings 7

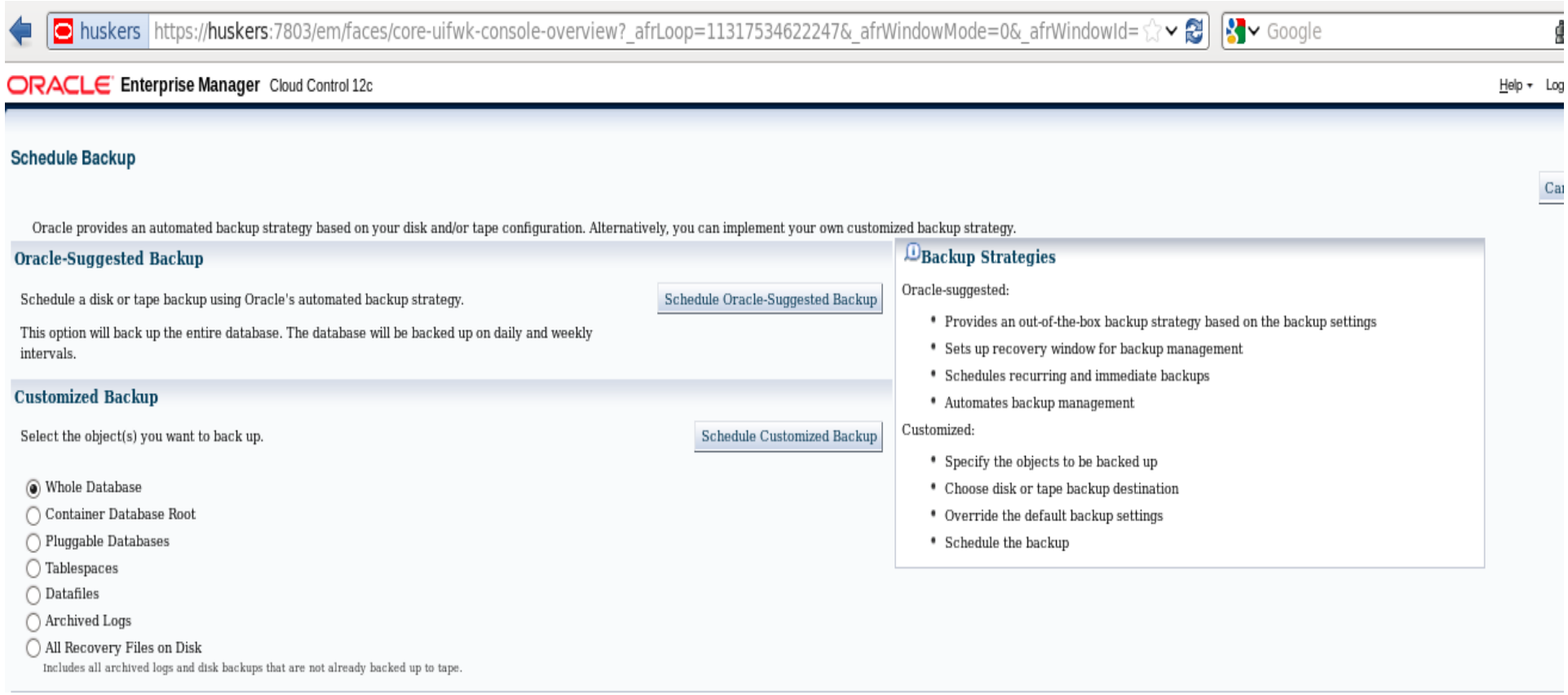
mance

Class Services Containers

Wait
User I/O
CPU
CPU Cores

2:24 PM 2:34 PM 2:44 PM 2:54 PM 3:04 PM 3:14 PM 3:24 PM

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

Pluggable Databases | Options | Settings | Schedule | Review

Schedule Customized Backup: Options

Database **orcl_cdb**
Backup Strategy **Customized Backup**
Object Type **Pluggable Databases**

Cancel | Back | Step 2 of 5 | Next

Backup Type

- (●) Full Backup
  - [ ] Use as the base of an incremental backup strategy
- ( ) Incremental Backup
  - [ ] Refresh the latest datafile copy on disk to the current time using the incremental backup
  - [x] Perform differential instead of cumulative backup
    Enabling results in faster daily backups that use less disk space. Disabling results in faster recovery since fewer incremental backups need to be applied during recovery.

Advanced

- [x] Also back up all archived logs on disk
  - [x] Delete all archived logs from disk after they are successfully backed up
- [ ] Delete obsolete backups
  Delete backups that are no longer required to satisfy the retention policy.
- [ ] Use proxy copy supported by media management software to perform a backup
  If proxy copy of the selected files is not supported, a conventional backup will be performed.

Maximum Files per Backup Set

▷ Encryption

Return to Schedule Backup

Cancel | Back | Step 2 of 5 | Next

Oracle 19c RMAN Backups

Pluggable Databases | Options | Settings | Schedule | Review

Schedule Customized Backup: Pluggable Databases

Database **orcl_cdb**
Backup Strategy **Customized Backup**
Object Type **Pluggable Databases**

Cancel | Step 1 of 5 | Next

Add the pluggable databases you want to back up.

Add

Remove

Select All | Select None

Select	Pluggable Database Name	Pluggable Database ID	Status	Creation SCN	Open Mode
☐	GOGOPDB	5	NORMAL	2647487	MOUNTED
☐	ORCL_PDB	3	NORMAL	2250867	MOUNTED

TIP Pluggable databases with a Status of UNDEFINED cannot be operated on and are not available for selection.

Return to Schedule Backup

Cancel | Step 1 of 5 | Next

Oracle 19c RMAN Backups

Pluggable Databases | Options | Settings | Schedule | Review

Schedule Customized Backup: Settings

Database **orcl_cdb**
Backup Strategy **Customized Backup**
Object Type **Pluggable Databases**

Cancel | Back | Step 3 of 5 | Next

Select the destination media for this backup. You can also override the default backup settings.

(•) Disk

Disk Backup Location +FRA

( ) Tape

Media Management Vendor (MMV) Library Parameters Not specified

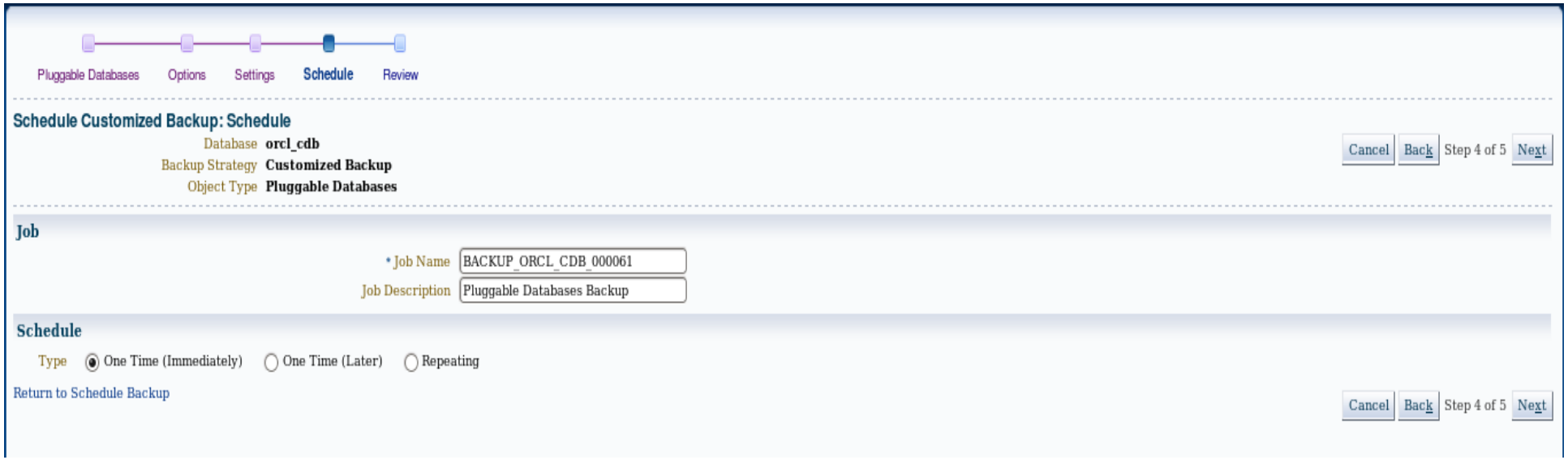
View Default Settings | Override Default Settings

Changed settings will only apply to the current backup.

Return to Schedule Backup

Cancel | Back | Step 3 of 5 | Next

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

Pluggable Databases — Options — Settings — Schedule — Review

Schedule Customized Backup: Review

Database **orcl_cdb**
Backup Strategy **Customized Backup**
Object Type **Pluggable Databases**

Cancel | Edit RMAN Script | Back | Step 5 of 5 | Submit Job

Settings

Destination **Disk**
Backup Type **Full Backup**
Backup Mode **Online Backup**
Fast Recovery Area **+FRA**

RMAN Script

The RMAN script below is generated based on previous input.

```
backup device type disk tag '%TAG' pluggable database 'GOGOPDB', 'ORCL_PDB' ;
backup device type disk tag '%TAG' archivelog all not backed up delete all input;
```

Return to Schedule Backup

Cancel | Edit RMAN Script | Back | Step 5 of 5 | Submit Job

Oracle 19c RMAN Backups

Summary

'Suspend' will wait for the currently running steps to complete. 'Resume' will resume a previously suspended job at the next step. 'Stop' will stop running steps if it can.

Log Report | Stop | Suspend

Status	Running
Scheduled	Sep 30, 2014 3:38:47 PM GMT-04:00
Started	Sep 30, 2014 3:38:53 PM GMT-04:00
Ended	
Elapsed Time	10 seconds

Type	Database Backup
Owner	SYSMAN
Description	Pluggable Databases Backup
Execution ID	044E53AFA22A62D6E053650AA8C059B8
Backup Strategy	advanced
Version 10g or higher	YES
Database Connect String	(DESCRIPTION=(ADDRESS_LIST=(ADDR...
Database Name	ORCL_CDB
Blackout	NO
Encryption Mode	None
Offline Backup	NO
Oracle Home	/u01/app/oracle/product/12.1.0/d...
Oracle SID	orclcdb
Backup Script	Show

Targets

Status All

Go

Expand All | Collapse All

Name	Targets	Status	Started	Ended	Elapsed Time
∇ Execution: orcl_cdb	orcl_cdb	Running	Sep 30, 2014 3:38:53 PM GMT-04:00		10 seconds
Step: Pre-Backup	orcl_cdb	Succeeded	Sep 30, 2014 3:38:53 PM GMT-04:00	Sep 30, 2014 3:38:55 PM GMT-04:00	2 seconds
Step: Backup	orcl_cdb	Running	Sep 30, 2014 3:38:56 PM GMT-04:00		7 seconds

Debug | Delete Run | Edit | View Definition

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TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- RMAN encrypted backups
- Oracle Transparent Data Encryption
- Password Encryption
- Dual Mode Encryption

Oracle 19c RMAN Backups

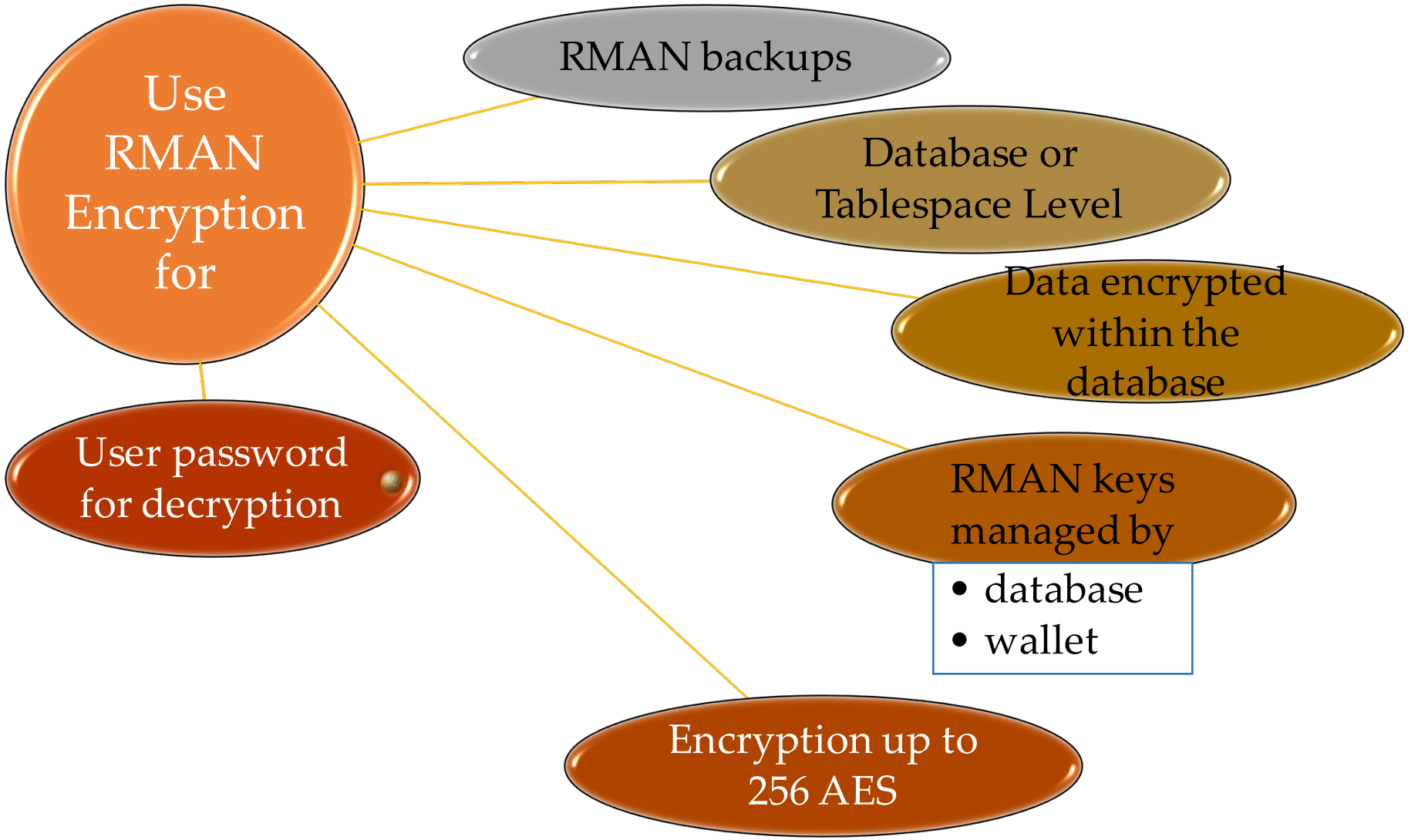
RMAN may create encrypted backups on
- Disk
- Tape

Encryption may be password based or held in an Oracle Wallet

Data is encrypted by RMAN prior to being transmitted to disk or tape

Oracle's Secure Backup may also be used
- Backups the entire File system

Oracle 19c RMAN Backups

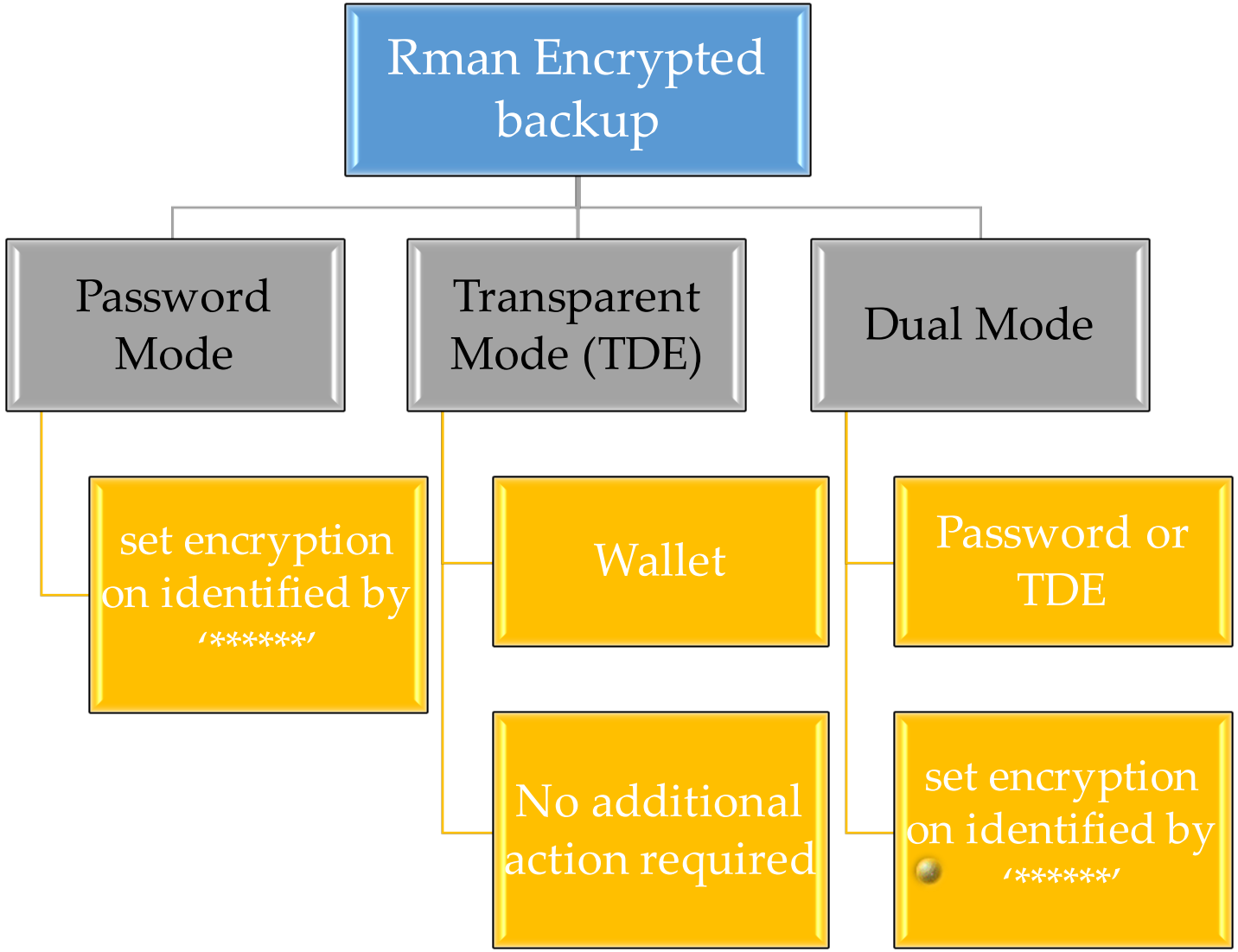


Oracle 19c RMAN Backups

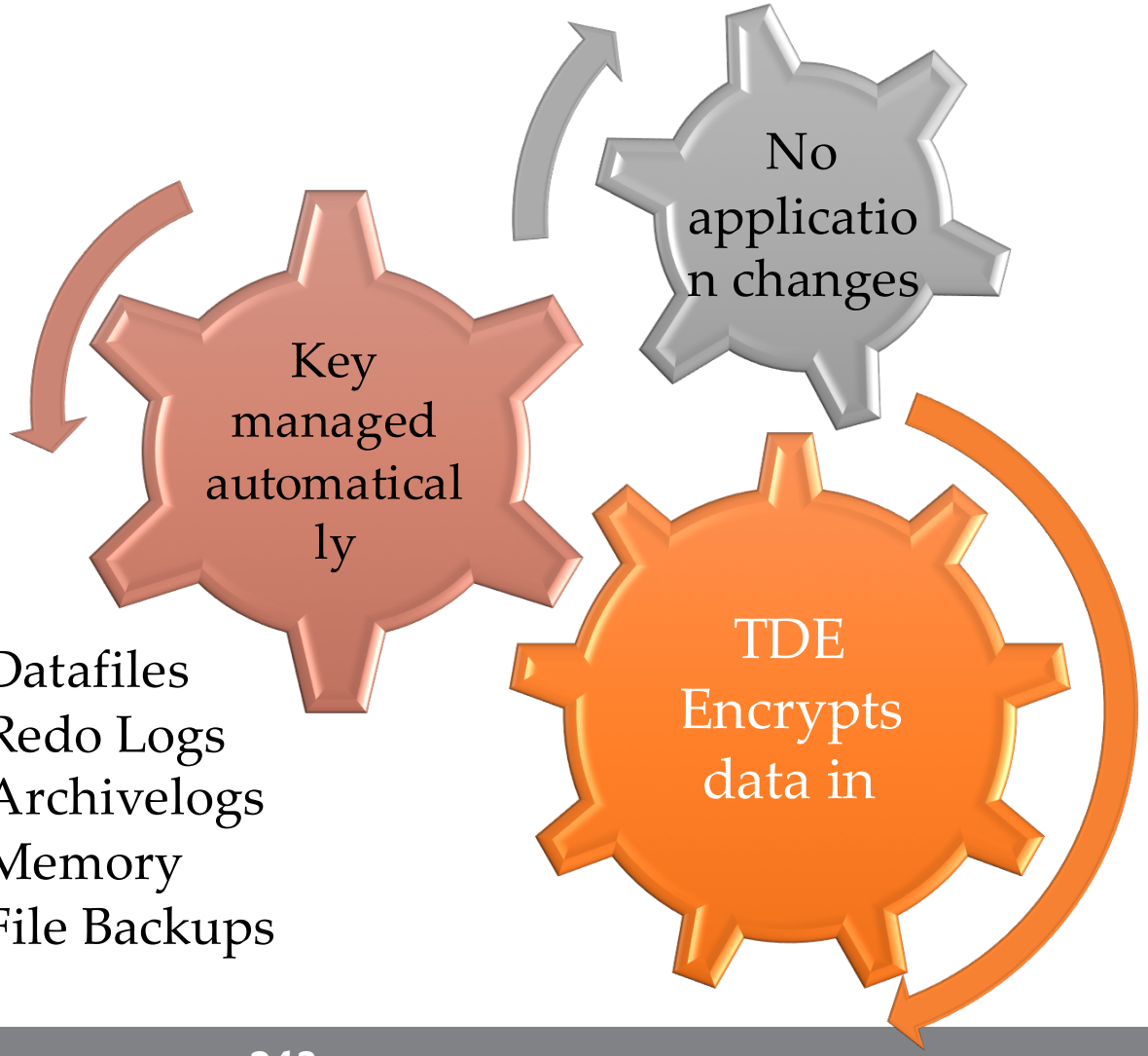
Use Oracle Secure Backup for (OSB)

- RMAN or OS backup
- Global or Host level
- Data encryption on client
- Encryption keys managed by OSB
- Encryption keys
  - AES 128, 192,256
- Seamless within the domain

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups



- Datafiles
- Redo Logs
- Archivelogs
- Memory
- File Backups

Oracle 19c RMAN Backups

TDE is enabled is part of Oracle's Advanced security Option

Enabled in SQLNET.ORA

```
• ENCRYPTION_WALLET_LOCATION =
  • (SOURCE =
  •  (METHOD = FILE)
  •  (METHOD_DATA =
  •    (DIRECTORY =
•
  /u01/app/admin/orcl/wallet)))
```

Oracle 19c RMAN Backups

- For TDE keystores must be created
- In Oracle 19c use SYSKM user

Create the keystore

Administer key management create keystore

'/u01/app/wallet/

Identified by password

Administer key management set keystore open

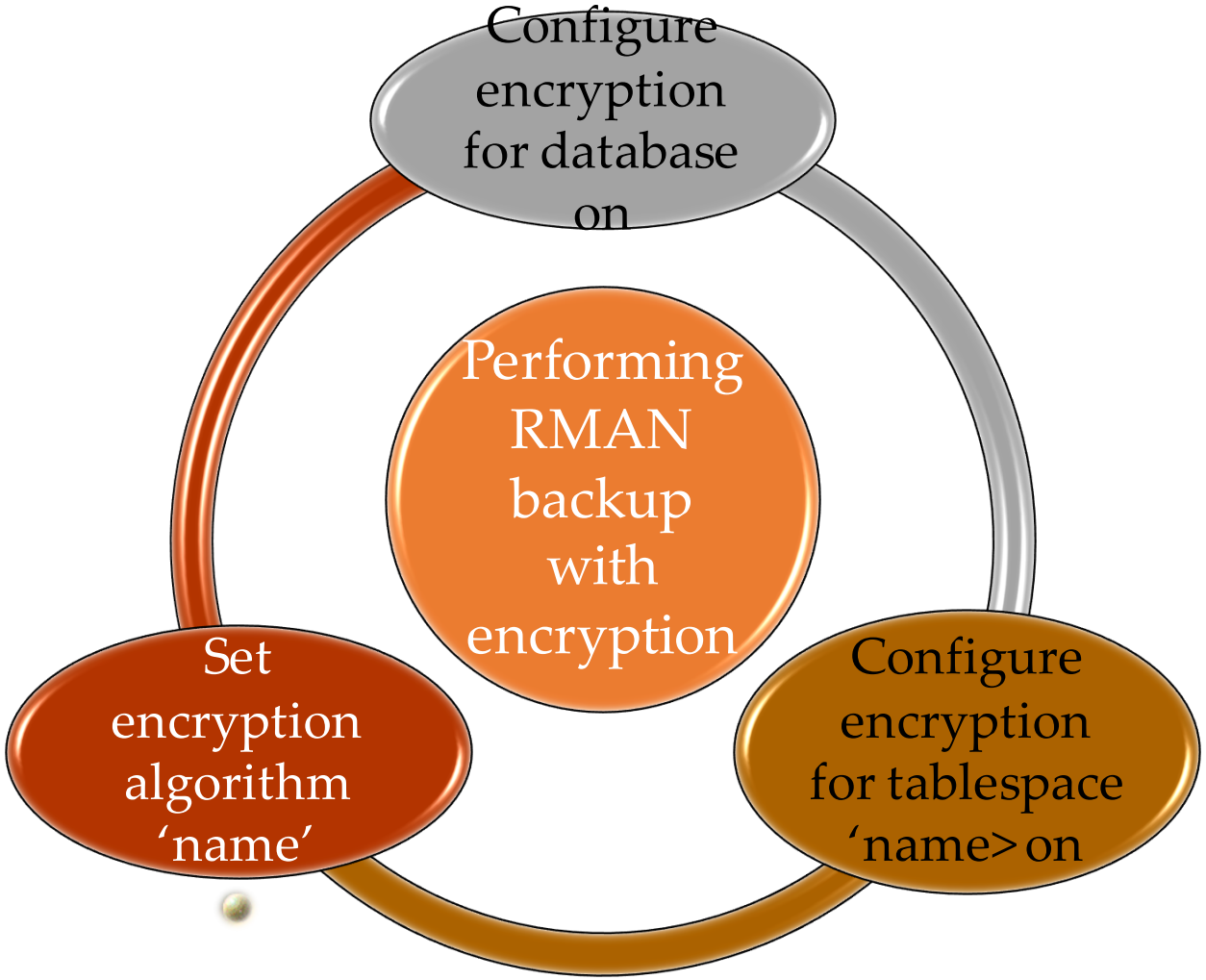
Identified by password

Administer key management set key

Identified by password

With backup using 'for_19c';

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

```
using target database control file instead of recovery catalog
RMAN configuration parameters for database with db_unique_name ORCL_CDB are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '%F'; # default
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO BACKUPSET; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE 'DEFAULT' OPTIMIZE FOR LOA
D TRUE ; # default
CONFIGURE RMAN OUTPUT TO KEEP FOR 7 DAYS; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/u01/app/oracle/product/12.1.0/dbhome_1/
dbs/snapcf_orclcdb.f'; # default
```

Oracle 19c RMAN Backups

Performing RMAN backup with encryption

- Configure encryption for database on
- Configure encryption for tablespace ‘name> on
- Set encryption algorithm ‘name’

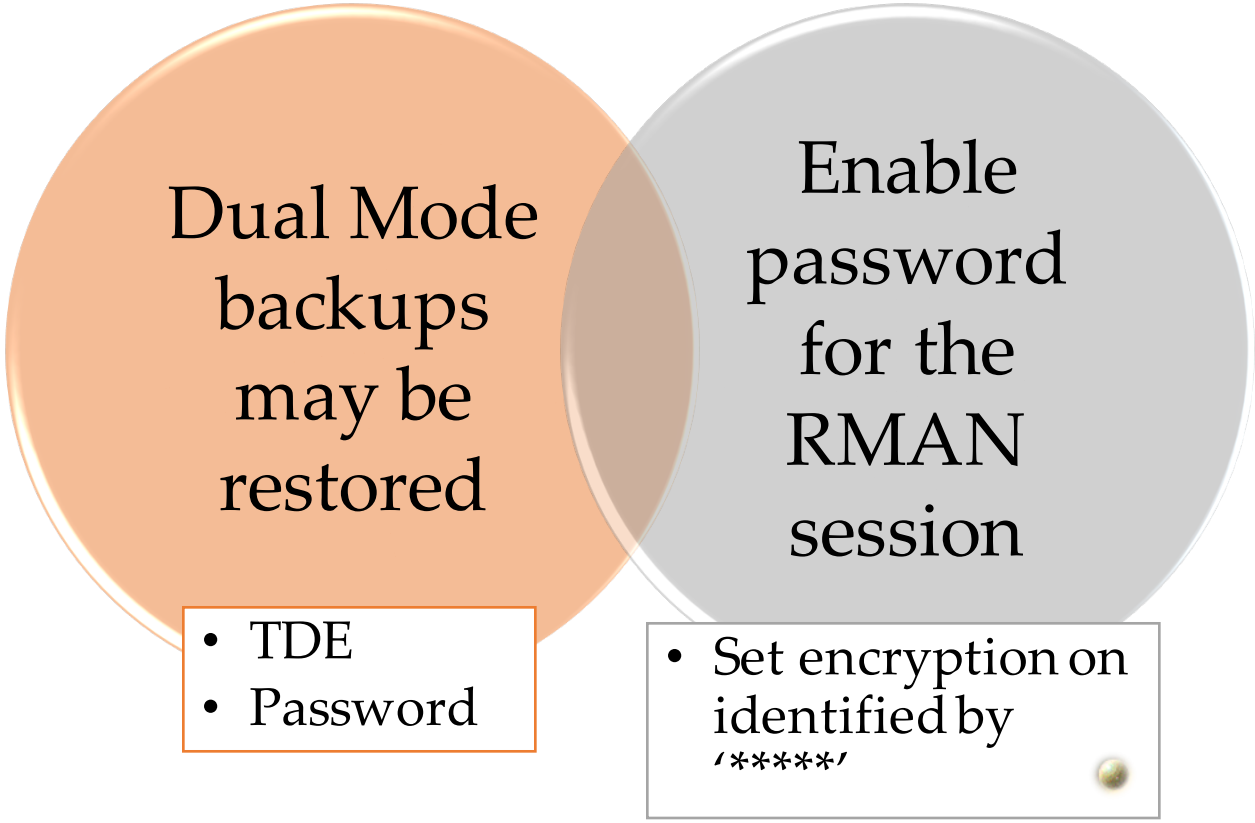
Oracle 19c RMAN Backups

Use case: Secure transport of backups to remote location

Enable password mode encryption:

- Only for the duration of an RMAN session
- set encryption on identified by '8888' only
- Must provide password for backup creation
- Must provide password for backup restoration

Oracle 19c RMAN Backups



Oracle 19c RMAN Backups

RMAN Encryption Issues

- Image backups may not be encrypted

Query V$RMAN_ENCRYPTION to determine the list of possible algorithms

A new encryption key is used for each new encrypted backup

Multiple channels increases performance

The master key may change without affecting TDE backups

Backup Encryption

- Summary
  - Backup Encryption
  - Encryption Modes
    - Dual
    - TDE
    - Password

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TECHNOLOGY TRAINING

Oracle 19c Multi Tenant

19c Multi Tenant

Lesson Topics

- Define Database Auditing
- Identify Database Auditing Parameters
- Set up database auditing
- Lab: Setup Database Auditing

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Oracle 19c Database Auditing

What is Database Auditing

- Tracks what had been done
- Does not track changes
- Tracks successful or unsuccessful attempts
- Can be enabled for users as well as the sys account

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Oracle 19c Database Auditing

Standard Based Auditing

- Enabled at the database level
- Tracks who has attempted to perform an action

Value Based Auditing

- Tracks changes
- Usually implemented by database triggers

Fine Grain Auditing

- Enabled by a policy
- Tracks specific attempts on a table by columns queried under certain conditions

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Oracle 19c Database Auditing

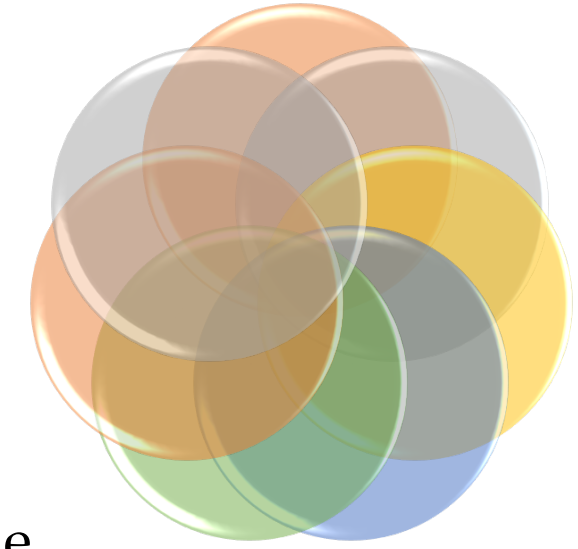
What Can be Audited

Users and roles

Context Values

Privileges

Oracle Database Real Application Security



Actions

Oracle Database Vault

Oracle Data Pump

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Oracle 19c Database Auditing

What Can be Audited

- Oracle Label Security
- Oracle Recovery Manager (RMAN)
- SQL * Loader

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Oracle 19c Database Auditing

What activities can be audited by default

Create/Alter/Drop Audit policy

Audit/NoAudit

- Enables/Disables Auditing

Execute or DBMs_FGA

Any 'alter table' command against the AUDSYS tables

Anything by:

- SYSDBA.SYSOPER
- SYSKM
- SYSBACKUP,SYSDG

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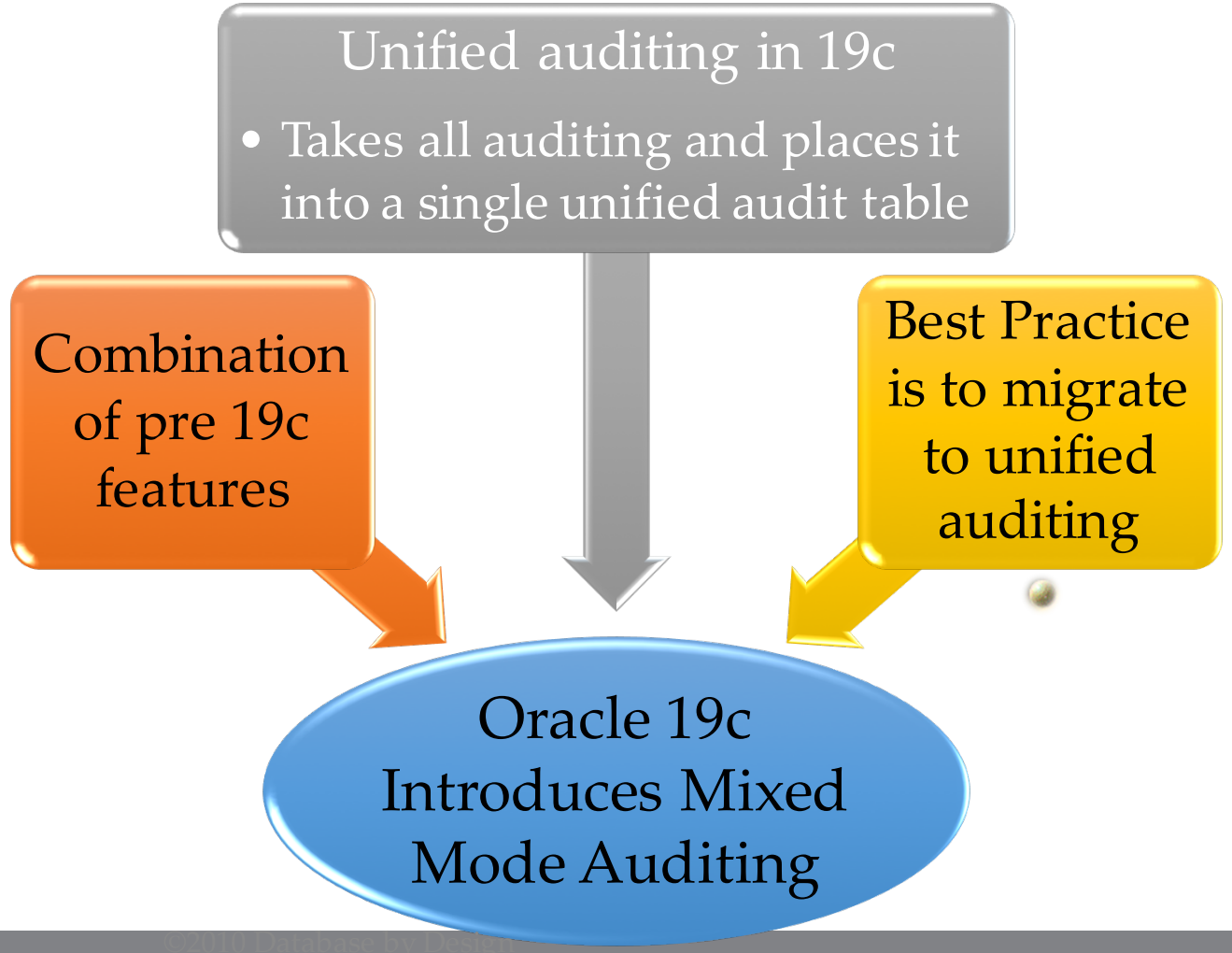
Oracle 19c Database Auditing



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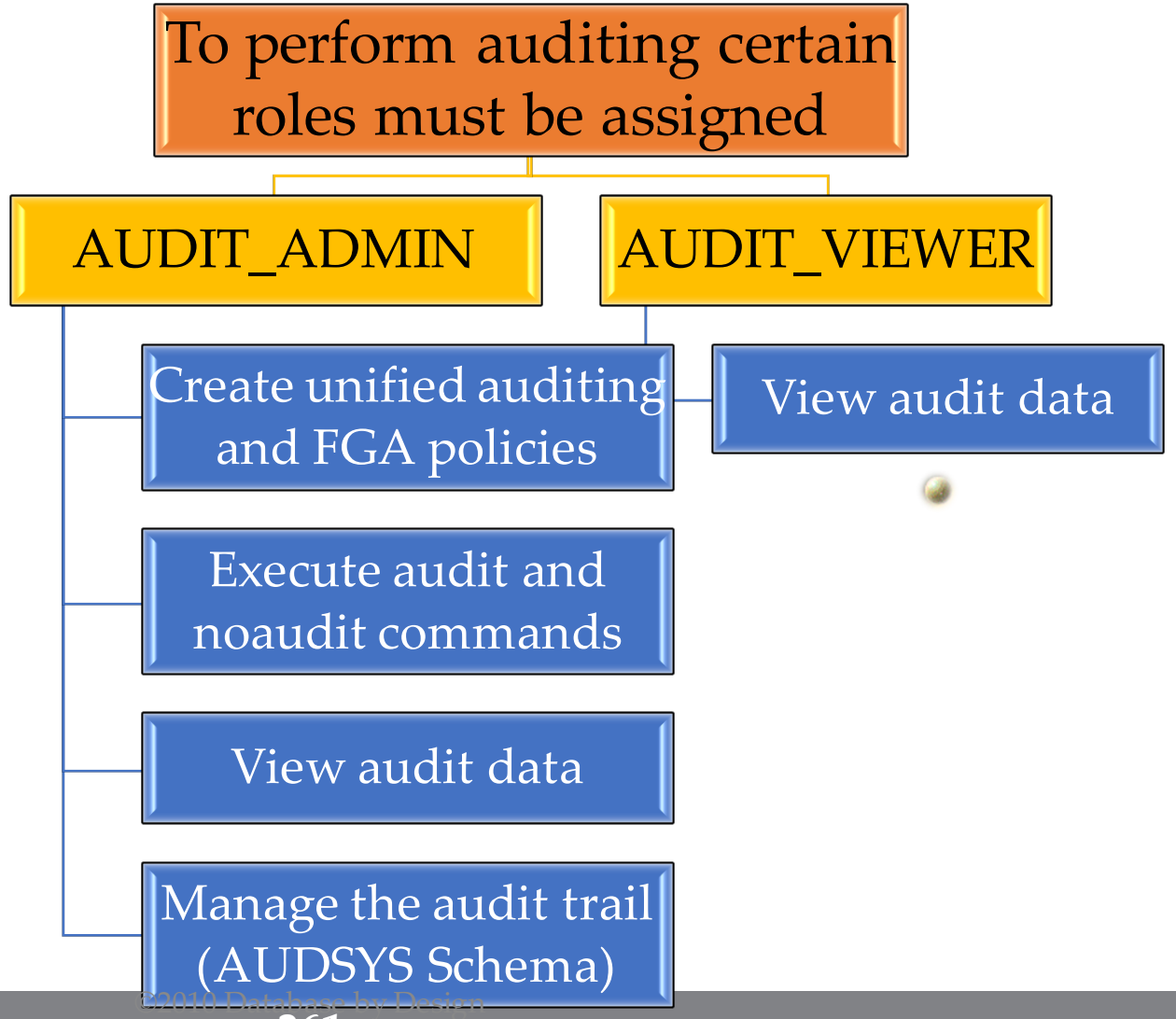

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Oracle 19c Database Auditing

New Unified Auditing

Controlled by the AUDSYS schema

UNIFIED_AUDIT_TRAIL table

To clear out auditing

- exec dbms_audit_mgmt.flush_unified_audit_Trail

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Oracle 19c Database Auditing

- Shutdown the database
- Stop the listener
- From the OS enable unified auditing
  - cd $ORACLE_HOME/rdbms/lib
  - make –f ins_rdbms.mk uniaud_on ioracle ORACLE_HOME=$ORACLE_HOME
- Start the listener
- Start the database

Enable Unified Auditing

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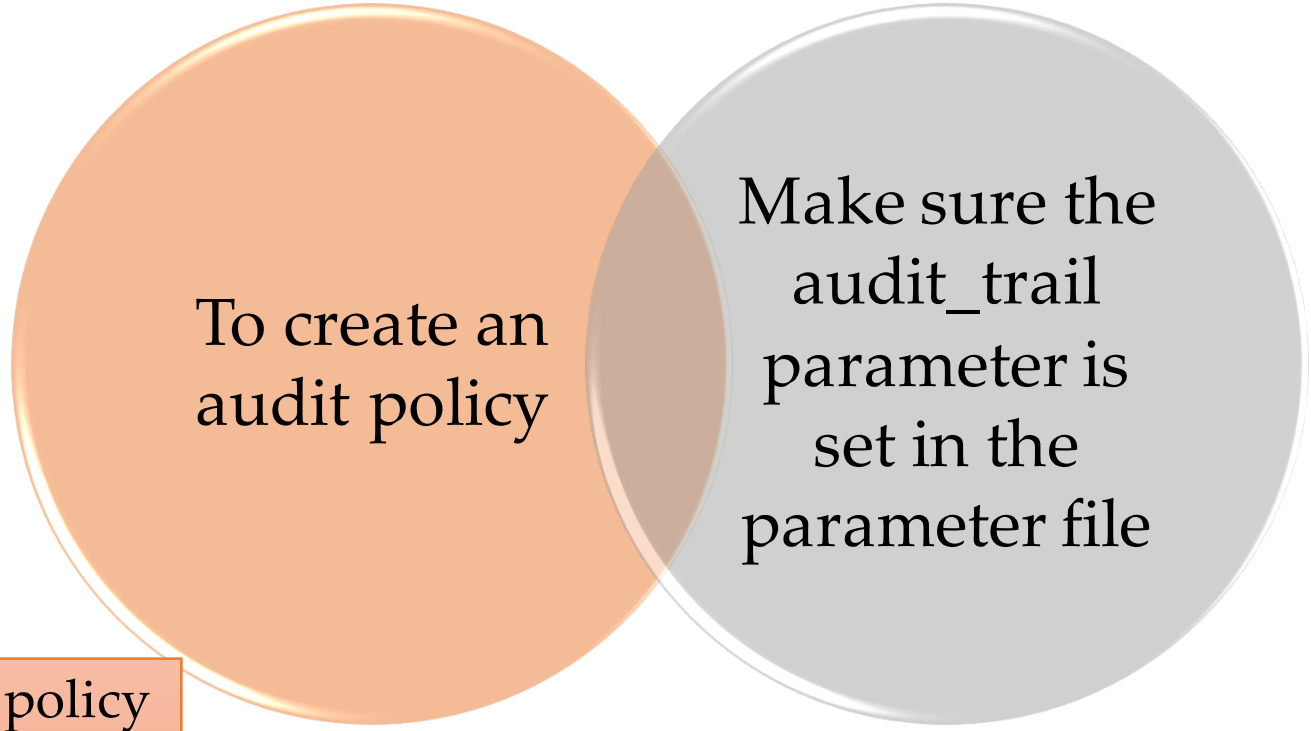
Oracle 19c Database Auditing



- Create audit policy select_policy
- Actions select on hr.employees

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Oracle 19c Database Auditing

To create an audit policy

- Create audit policy select_policy
- Actions select on hr.employees

Make sure the audit_trail parameter is set in the parameter file

Create the audit policy first

Enable the audit polic

sql>audit policy select_policy by scott

sql> audit policy by scott whenever not successful

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Oracle 19c Database Auditing

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Logged in as SYSTEM

Execute On Multiple Databases | Show SQL | Revert | Validate with SPA | SPA Validation Results | Apply

! You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.

Initialization Parameters

Current | SPFile

The parameter values listed here are currently used by the running instance(s).

Name | Basic: All | Modified: All | Dynamic: All | Category: All | Go

Filter on a name or partial name

☐ Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Save to File | Show All

Previous | 1-50 of 367 | Next 50

Name	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
audit_file_dest		/u01/app/oracle/admin/orcl/adum		String		✓	✓	Security and Auditing
audit_trail		DB		String		✓		Security and Auditing

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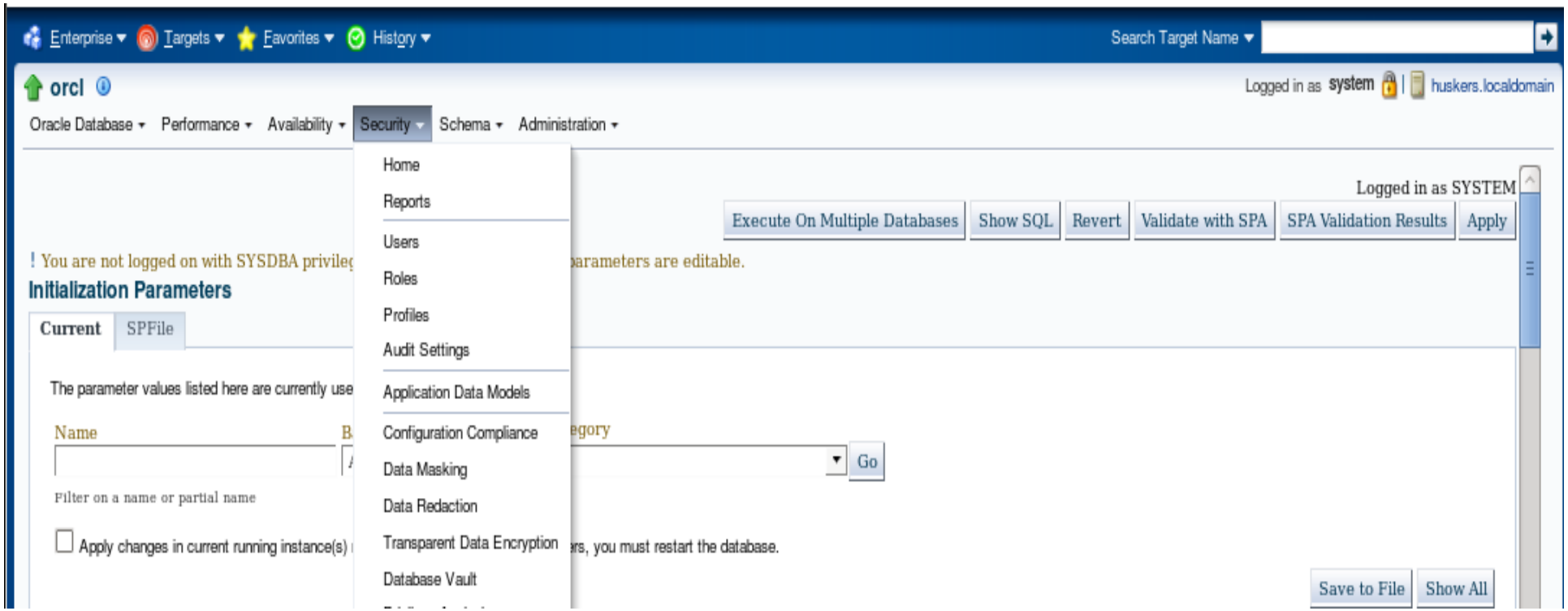
Oracle 19c Database Auditing



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Oracle 19c Database Auditing

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

orcl

Logged in as system | huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Page Refreshed Jul 22, 2014 10:03:40 PM EDT

Audit Settings

General

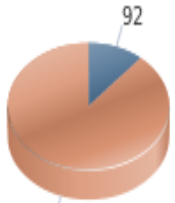
Audit Mode	Unified + Traditional
Policies	1 4
OS Audit Files	19
Tablespace	SYSAUX(4.16% Full)
Purge Jobs	Not Set
Last Archived On	Not Set
Last Purged On	Not Set

Audit Trail By Component

Show data for last 1 day 1 week 1 month

Audit Trail By Policy

Show data for last 1 day 1 week 1 month



Actions ▾ Create Create Like Edit Delete Show Enable Disable

Audit Policy	Comments	System Privileges	Roles	Component Actions	Object Actions	Conditional	Enabled	Audit	Users
ORA_ACCOUNT_MGMT		0	0	9	0				
ORA_DATABASE_PARAMETER		0	0	3	0				
ORA_RAS_POLICY_MGMT		0	0	32	0				
ORA_RAS_SESSION_MGMT		0	0	14	0				
ORA_SECURECONFIG		29	0	18	0		✓	By	ALL USERS

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Oracle 19c Database Auditing

Privileges and Roles | Component Actions | Object Actions | Conditions | Review

Create Audit Policy : Privileges and Roles

Back | Step 1 of 5 | Next | Cancel

* Name: gogo_audit

Comments:

Specify System Privileges and Roles audited by this policy. Oracle recommends that you audit individual privileges because privileges for a role can change between database releases.

Privileges AVAILABLE	SELECTED
CREATE INDEXTYPE	CREATE LIBRARY
CREATE JOB	CREATE MATERIALIZED VIEW
CREATE PUBLIC SYNONYM	CREATE MEASURE FOLDER
CREATE ROLE	CREATE MINING MODEL
CREATE ROLLBACK SEGMENT	CREATE OPERATOR
CREATE RULE	CREATE PLUGGABLE DATABASE
CREATE RULE SET	CREATE PROCEDURE
CREATE SEQUENCE	CREATE PROFILE
CREATE SESSION	CREATE PUBLIC DATABASE LINK
CREATE SQL TRANSLATION PROFILE	
CREATE SYNONYM	

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Oracle 19c Database Auditing

Privileges and Roles | Component Actions | Object Actions | Conditions | Review

Create Audit Policy : Component Actions

Back | Step 2 of 5 | Next | Cancel

Specify component specific actions such as Oracle Real Application S

Add Component | Remove Component

Component

No Components have been added

Add Component

All fields are mandatory.
Oracle Label Security(OLS) to be aux

Component: Standard

System Actions: Select / Select All

AVAILABLE	SELECTED
ADMINISTER KEY MANAGEMENT	ALTER ASSEMBLY
ALTER FLASHBACK ARCHIVE	ALTER AUDIT POLICY
ALTER FUNCTION	ALTER CLUSTER
ALTER INDEX	ALTER DATABASE
ALTER INDEXTYPE	ALTER DATABASE LINK
ALTER JAVA	ALTER DIMENSION
ALTER LIBRARY	ALTER DISK GROUP
ALTER MATERIALIZED VIEW	
ALTER MATERIALIZED VIEW LOG	
ALTER MATERIALIZED ZONEMAP	

OK | Cancel

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Oracle 19c Database Auditing

Privileges and Roles | Component Actions | Object Actions | Conditions | Review

Create Audit Policy : Object Actions

Back | Step 3 of 5 | Next | Cancel

Specify object specific actions to be audited by this policy. The audit can include both DDL and DML statements that were used on the object.

Add Object | Remove Object

Type	Action	Schema
No Object has been added		

Add Object

All fields are mandatory.

Schema: APEX_040200

Type:

Object:

Action:

OK | Cancel

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Oracle 19c Database Auditing

ORACLE Enterprise Manager Cloud Control 12c

Help ▾ Log Out

Privileges and Roles | Component Actions | **Object Actions** | Conditions | Review

Create Audit Policy : Object Actions

Back | Step 3 of 5 | Next | Cancel

Specify object specific actions to be audited by this policy. The audit can include both DDL and DML statements that were used on the object.

Add Object | Remove Object

Type	Action	Schema	Name
TABLE	ALL	APEX_040200	APEX$ARCHIVE_HISTORY

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Oracle 19c Database Auditing

Privileges and Roles | Component Actions | Object Actions | Conditions | Review

Create Audit Policy : Review

Back | Step 5 of 5 | Submit | Cancel

General

Name gogo_audit

Comments

Condition

Conditions

Privileges

Privileges
CREATE LIBRARY
CREATE MATERIALIZED VIEW
CREATE MEASURE FOLDER
CREATE MINING MODEL
CREATE OPERATOR

Roles

Roles
ADM_PARALLEL_EXECUTE_TASK
APEX_ADMINISTRATOR_ROLE
APEX_GRANTS_FOR_NEW_USERS_ROLE
AQ_ADMINISTRATOR_ROLE
AQ_USER_ROLE

Component Actions

Component	Action
Standard	ALTER ASSEMBLY
Standard	ALTER AUDIT POLICY

Object Actions

Schema	Type	Action	Object
APEX_040200	TABLE	ALL	APEX$ARCHIVE_HISTORY

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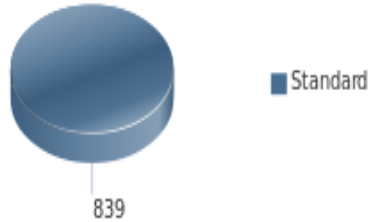
Oracle 19c Database Auditing

Audit Settings

General

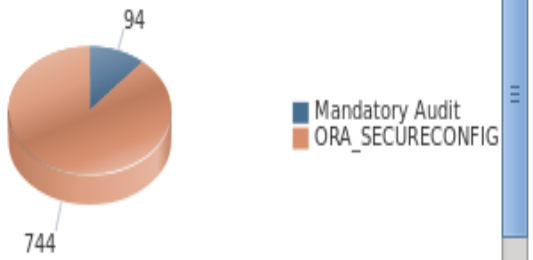
Audit Mode Unified + Traditional
Policies 1 5
OS Audit Files 19
Tablespace SYSAUX(4.17% Full)
Purge Jobs Not Set
Last Archived On Not Set
Last Purged On Not Set

Audit Trail By Component



Audit Trail By Policy

Show data for last 1 day 1 week 1 month



Actions ▾ Create Create Like Edit Delete Show Enable Disable

Audit Policy	Comments	System Privileges	Roles	Component Actions	Object Actions	Conditional	Enabled	Audit	Users
GOGO_AUDIT		9	87	7	1				
ORA_ACCOUNT_MGMT		0	0	9	0				
ORA_DATABASE_PARAMETER		0	0	3	0				

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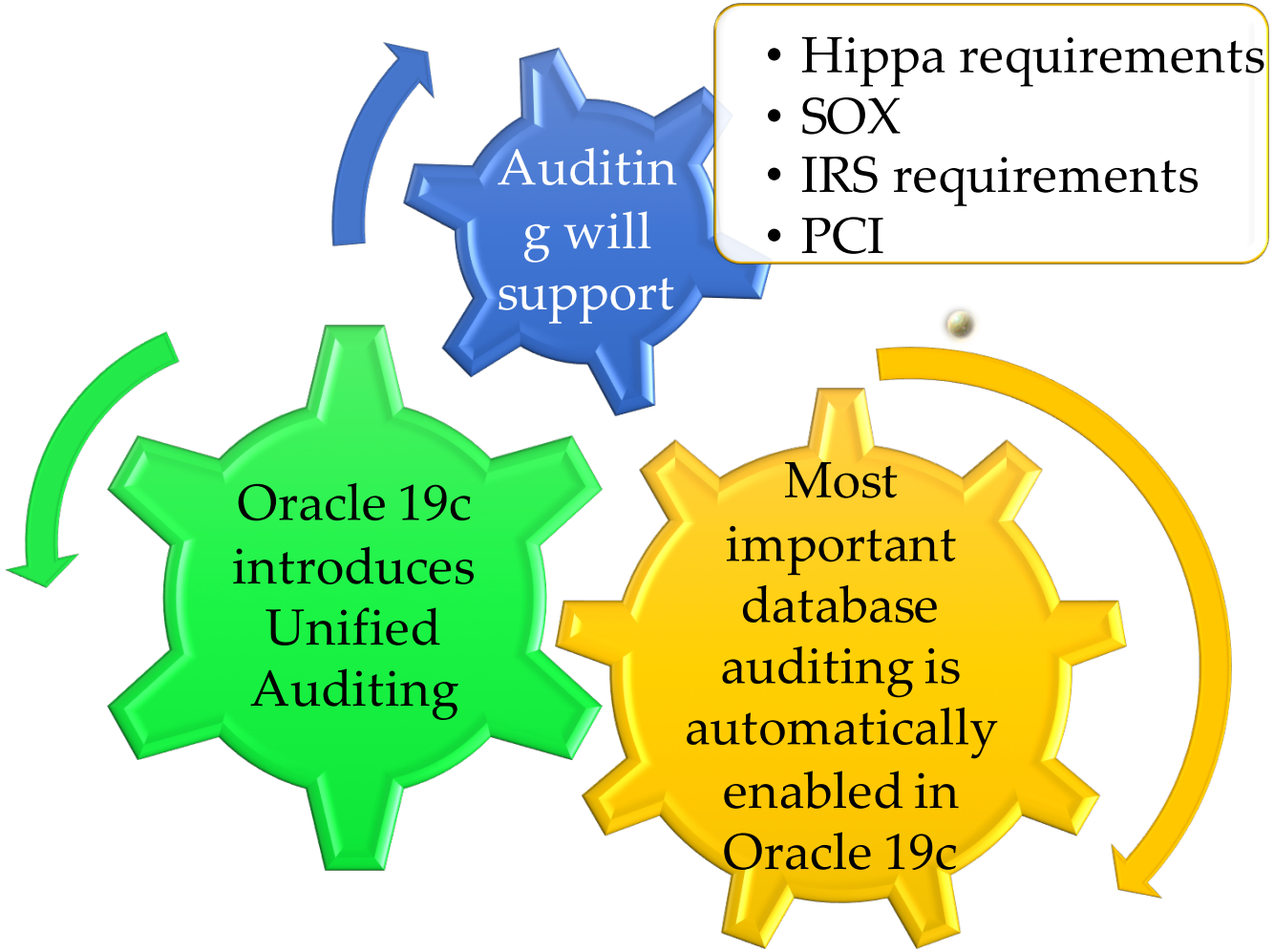
Oracle 19c Database Auditing



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Oracle 12 Auditing

- Summary
  - What can be audited
  - Pluggable Auditing
  - Unified Auditing