Oracle Database 12.2 Application Containers
Unsafe Harbor

- This room is an unsafe harbor
- You can rely on the information in this presentation to help you protect your data, your databases, your organization, and your career
- No one from Oracle has previewed this presentation
- No one from Oracle knows what I'm going to say
- No one from Oracle has supplied any of my materials
- Everything I will present is existing, proven, functionality
Introduction
Daniel Morgan

Oracle ACE Director Alumni

Oracle Educator
- Curriculum author and primary program instructor at University of Washington
- Consultant: Harvard University
- University Guest Lecturers
  - APAC: University of Canterbury (NZ)
  - EMEA: University of Oslo (Norway)
  - Latin America: Universidad Cenfotec, Universidad Latina de Panama, Technologico de Costa Rica

IT Professional
- First computer: IBM 360/40 in 1969: Fortran IV
- Oracle Database since 1988-9 and Oracle Beta tester
- The Morgan behind www.morganslibrary.org
- Member Oracle Data Integration Solutions Partner Advisory Council
- Vice President Twin Cities Oracle Users Group (Minneapolis-St. Paul)
- Co-Founder International GoldenGate Oracle Users Group

Principal Adviser: Sirius Meta7
The library is a spam-free on-line resource with code demos for DBAs and Developers. If you would like to see new Oracle database functionality added to the library... just email us. Oracle Database 12cR2 is now available in the Cloud. If you are not already working in a 12cR1 CDB database... you are late to the party and you are losing your competitive edge.

Next Event: Indiana Oracle Users Group

Oracle Events

Click on the map to find an event near you

ACE News

Would you like to become an Oracle ACE?

Learn more about becoming an ACE

- ACE Directory
- ACE Google Map
- ACE Program
- Stanley's Blog
Just In Time IT Procurement
Consider The Following

- Oracle 18.1 has been released for Exadata and in the Oracle Cloud
  - Oracle Database 18.2 is scheduled for release in April
  - 18.3 in Q3, 18.4 in Q4
  - And 19.1 in just 10 months
- 
  `./runInstaller` ais significantly changed to be more Cloud compatible
- Oracle is moving to eliminate SYSDBA
  - We now have users named GGSYS, SYSBACKUP, SYSDG, SYSKM, SYSRAC
- The Oracle Database on Linux is moving to rpms with installation and patching fully automated from a YUM server
- The database's kernel is being rewritten so that very few patches will require an outage
- Expect OEM and other tools to manage the database through the REST API
A Brief History of the Oracle Database

- 1978: Oracle 1
- 1979: Oracle 2
- 1982: Oracle 3
- 1984: Oracle 4

Redo Logs
A Brief History of the Oracle Database

- **1978**: Oracle 1
- **1979**: Oracle 2
- **1982**: Oracle 3
- **1984**: Oracle 4
- **1986**: Oracle 5
- **1989**: Oracle 6

**Events**:
- Rollback Segments
- Redo Logs
- Triggers
A Brief History of the Oracle Database

- **1978**: Oracle 1
- **1979**: Oracle 2
- **1982**: Oracle 3
- **1984**: Oracle 4
- **1986**: Oracle 5
- **1989**: Oracle 6
- **1993**: Oracle 7

Key Features:
- **Rollback Segments**
- **Redo Logs**
- **PL/SQL Procedures & Packages**
- **Triggers**
A Brief History of the Oracle Database

- **1978**: Oracle 1
- **1979**: Oracle 2
- **1982**: Oracle 3
- **1984**: Oracle 4
- **1986**: Oracle 5
- **1989**: Oracle 6
- **1993**: Oracle 7
- **1997**: Oracle8
- **1999**: Oracle8i
- **2001**: Oracle9i
- **2004**: Oracle 10g
- **2007**: Oracle 11g
- **2013**: Oracle 12c

**Key Features**

- Rollback Segments
- Redo Logs
- PL/SQL Procedures & Packages
- Triggers
- Container Architecture
New Physical Architecture
New 12cR1 Container Database Architecture
New 12cR2 Container Database Architecture

Version 2 to 11

Version 12cR1

PDB Administrator for hrpdb

Version 12cR2+

Root (CDB$ROOT)

Seed (PDB$SEED)

hrpdb1

Link to emp2

hrpdb2

Scene 3:

Application Root

sales_app

cust2_pdb

cust1_pdb

Application PDBs

Scene 2:

Application Container

Scene 1:
New 12cR1 Container Database Architecture
New 12cR1 Container Database User Architecture

- Oracle-Supplied
  - SYS, SYSTEM

- CDB Common User

- User-Created
  - Name must begin with C## or c##

- Common User
  - Same Identity in Every Container

- Local User
  - Identity Restricted to One PDB
New 12cR2 Container Database User Architecture

- **Oracle-Supplied**
  - SYS, SYSTEM

- **User-Created**
  - Name must begin with C## or c##

- **CDB Common User**

- **Common User**
  - Same Identity in Every Container

- **Application Common User**

- **Local User**
  - Identity Restricted to One PDB
New: 12cR1
AUDSYS
GSMADMIN_INTERNAL
GSMCATUSER
GSMUSER
PDBADMIN
SYSBACKUP
SYSDG
SYSKM

New: 12cR2
APEX_050100
APEX_INSTANCE_ADMIN_USER
APEX_LISTENER
APEX_REST_PUBLIC_USER
DBJSON
DBSFWUSER
GGSYS
HRREST
OBE
ORDS_METADATA
ORDS_PUBLIC_USER
REMOTE_SCHEDULER_AGENT
RESTFUL
SYS$UMF
SYSRAC
XDBEXT
XDBPM
XFILES

Dropped
SPATIAL_WFS_USR
## New Users With Escalated Privilges

<table>
<thead>
<tr>
<th>USERNAME</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGSYS</td>
<td>The internal account used by Oracle GoldenGate. It should not be unlocked or used for a database login.</td>
</tr>
<tr>
<td>SYSBACKUP</td>
<td>This privilege allows a user to perform backup and recovery operations either from Oracle Recovery Manager (RMAN) or SQL*Plus.</td>
</tr>
<tr>
<td>SYSDG</td>
<td>This privilege allows a user to perform Data Guard operations can use this privilege with either Data Guard Broker or the DGMGRL command-line interface.</td>
</tr>
<tr>
<td>SYSKM</td>
<td>This privilege allows a user to perform Transparent Data Encryption keystore operations.</td>
</tr>
<tr>
<td>SYSRAC</td>
<td>This privilege allows the Oracle agent of Oracle Clusterware to perform Oracle Real Application Clusters (Oracle RAC) operations.</td>
</tr>
<tr>
<td></td>
<td>SYSRAC facilitates Oracle Real Application Clusters (Oracle RAC) operations by connecting to the database by the Clusterware agent on behalf of Oracle RAC utilities such as SRVCTL.</td>
</tr>
</tbody>
</table>
In Business Computing Only Two Things Matter

QoS

TCO
Technical and Business Considerations

- Increased QoS
  - Enhanced security
  - New features such as Lockdown Profiles

- Lower TCO
  - Substantial consolidation
  - Fewer manual operations required to support
    - Patching
    - Replatforming
    - Migration
The Perfect Case for Applications Containers

- An SaaS service provider like SalesForce.com
- Prior to application containers they have three choices

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put every customers data into shared tables</td>
<td>Security is provided by application code</td>
</tr>
<tr>
<td></td>
<td>No physical separation of customer's data</td>
</tr>
<tr>
<td></td>
<td>A breach compromises everyone's data</td>
</tr>
<tr>
<td>Put each customer into a separate schema</td>
<td>Each new customer requires creation of a new user</td>
</tr>
<tr>
<td></td>
<td>Each new customer requires creation of new tablespaces</td>
</tr>
<tr>
<td>Put every customer into a separate database</td>
<td>If each database requires 4GB of memory ... do the math</td>
</tr>
</tbody>
</table>

- And each of these solutions requires that
  - Security is provided by application code
  - You abandon any hope of separation of duties
  - You ignore GDPR
  - You perform application patching and maintenance once per customer
With application containers the application exists in only one place ... where it is logically and physically isolated inheriting the data dictionary from ROOT

- Install once for all customers
- Patch once for all customers
- Maintain once for all customers
The Perfect Case for Applications Containers

- Each customer, isolated in their own PDB, inherits the application by pointer from the **Application Root**
  - Metadata Sharing (DDL)
  - Data Sharing (DDL + data)
The Perfect Case for Applications Containers (2:2)

- Create version two of the application in a new Application Root
The Perfect Case for Applications Containers (2:2)

- Migrate your customers one-at-a-time to the new version in seconds with no outage or impact to any other customer
Create Application Root Container
CREATE PLUGGABLE DATABASE <pdb_name> AS <APPLICATION CONTAINER | SEED>
ADMIN USER <admin_user_name> IDENTIFIED BY <password>
[ROLES = ("comma_delimited_list_of_roles")]
[PARALLEL <integer>]
[DEFAULT TABLESPACE <tablespace_name>]
[<pdb_storage_clause>]
[<file_name_convert_clause>]
[<service_name_convert_clause>]
[<path_prefix_clause>]
[TEMPFILE REUSE]
[<user_tablespace_clause>]
[<standby_database_clause>]
[<LOGGING | NOLOGGING | FILESYSTEM LIKE LOGGING>]
[<create_file_dest_clause>]
[HOST = '<host_name>']
[PORT = <port_number>];
conn sys@orabase as sysdba
Enter password:
Connected.

sho con_id
CON_ID
1

show con_name
CON_NAME
CDB$ROOT

SELECT name, open_mode, application_root, application_pdb, application_seed, pdb_count
FROM v$containers
ORDER BY con_id;

NAME OPEN_MODE APP APP APP PDB_COUNT
---------- --------------- --- --- --- ----------
CDB$ROOT READ WRITE NO NO NO 2
PDB$SEED READ ONLY NO NO NO 0
PDBDEV READ WRITE NO NO NO 0

-- as desirable as it would be to do so you cannot use special characters in a PDB name
CREATE PLUGGABLE DATABASE uwapp_root
AS APPLICATION CONTAINER
ADMIN USER uwAdmin IDENTIFIED BY uwAdmin
ROLES = (CDB_DBA)
DEFAULT TABLESPACE uwapp_tbs
FILE_NAME_CONVERT = ('/pdbseed', '/uwapp/')
USER_TABLESPACES = NONE
LOGGING;

Pluggable database created.

SELECT name, open_mode, application_root, application_pdb, application_seed, pdb_count
FROM v$containers
ORDER BY con_id;

NAME OPEN_MODE APP APP APP PDB_COUNT
---------- --------------- --- --- --- ----------
CDB$ROOT READ WRITE NO NO NO 3
PDB$SEED READ ONLY NO NO NO 0
PDBDEV READ WRITE NO NO NO 0
UWAPP_ROOT MOUNTED YES NO NO 0

ALTER PLUGGABLE DATABASE uwapp_root OPEN;

Pluggable database altered.
```sql
SELECT name, creation_date, clb_goal, pdb
FROM v$services
ORDER BY 1;
```

<table>
<thead>
<tr>
<th>NAME</th>
<th>CREATION_DATE</th>
<th>CLB_G</th>
<th>PDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS$BACKGROUND</td>
<td>26-JAN-2017 13:54:44</td>
<td>SHORT</td>
<td>CDB$ROOT</td>
</tr>
<tr>
<td>SYS$USERS</td>
<td>26-JAN-2017 13:54:44</td>
<td>SHORT</td>
<td>CDB$ROOT</td>
</tr>
<tr>
<td>uwapp_root</td>
<td>26-MAR-2017 17:09:28</td>
<td>LONG</td>
<td>UWAPP$ROOT</td>
</tr>
<tr>
<td>pdbdev</td>
<td>02-MAR-2017 07:57:37</td>
<td>LONG</td>
<td>PDBDEV</td>
</tr>
<tr>
<td>orabase</td>
<td>02-MAR-2017 07:52:46</td>
<td>LONG</td>
<td>CDB$ROOT</td>
</tr>
<tr>
<td>orabaseXDB</td>
<td>02-MAR-2017 07:52:46</td>
<td>LONG</td>
<td>CDB$ROOT</td>
</tr>
</tbody>
</table>

```
ALTER SESSION SET CONTAINER=uwapp_root;
```

Session altered.

```
sho con_id
```

<table>
<thead>
<tr>
<th>CON_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

```
show con_name
```

```
CON_NAME
-----------------------------
UWAPP$ROOT
```
SELECT tablespace_name TBS_NAME, file_name
FROM dba_data_files
UNION
SELECT tablespace_name, file_name
FROM dba_temp_files
ORDER BY 1;

TBS_NAME  FILE_NAME
--------- ------------------
SYSAUX     /u01/app/oracle/oradata/orabase/uwapp/sysaux01.dbf
SYSTEM     /u01/app/oracle/oradata/orabase/uwapp/system01.dbf
TEMP       /u01/app/oracle/oradata/orabase/uwapp/temp012017-03-02_07-53-20-031-AM.dbf
UNDOTBS1   /u01/app/oracle/oradata/orabase/uwapp/undotbs01.dbf
Application Installation
ALTER PLUGGABLE DATABASE APPLICATION

{ app_name
  BEGIN INSTALL 'app_version' [ COMMENT 'comment' ]
  END INSTALL [ 'app_version' ]
  BEGIN PATCH number [ MINIMUM VERSION 'app_version' ] [ COMMENT 'comment' ]
  END PATCH [ number ]
  BEGIN UPGRADE 'start_app_version' TO 'end_app_version' [ COMMENT 'comment' ]
  END UPGRADE [ TO 'end_app_version' ]
  BEGIN UNINSTALL
  END UNINSTALL
  SET PATCH number
  SET VERSION 'app_version'
  SET COMPATIBILITY VERSION { 'app_version' | CURRENT }
  SYNC }

{ ALL SYNC }
ALTER PLUGGABLE DATABASE APPLICATION uw_app BEGIN INSTALL '1.0';

Pluggable database altered.

CREATE TABLESPACE uwapp_tbs
DATAFILE '/u01/app/oracle/oradata/orcl12c/uwapp/uwapp_tbs'
SIZE 25M AUTOEXTEND ON NEXT 25M;

Tablespace created.

-- create user
CREATE USER uwapp_user IDENTIFIED BY uwapp_user
DEFAULT TABLESPACE uwapp_tbs
TEMPORARY TABLESPACE temp
QUOTA UNLIMITED ON uwapp_tbs;

User created.

GRANT create session TO uwapp_owner;
GRANT create procedure TO uwapp_owner
GRANT create table TO uwapp_owner;
GRANT create view TO uwapp_owner;

Grant succeeded.
CREATE OR REPLACE PROCEDURE uwapp_owner.who_am_i AUTHID DEFINER IS
BEGIN
    dbms_output.put_line('I do not know');
END who_am_i;
/

CREATE TABLE uwapp_owner.t1 (tid NUMBER(10), last_name VARCHAR2(20));
ALTER TABLE uwapp_owner.t1 ADD PRIMARY KEY (tid);

CREATE TABLE uwapp_owner.t2 (tid NUMBER(10), last_name VARCHAR2(20));
ALTER TABLE uwapp_owner.t2 ADD PRIMARY KEY (tid);

CREATE VIEW uwapp_owner.t1t2_view AS
SELECT t1.tid, t2.last_name
FROM uwapp_user.t1, uwapp_user.t2
WHERE t1.tid = t2.tid;
INSERT INTO uwapp_owner.t1 VALUES (1, 'MORGAN');
INSERT INTO uwapp_owner.t1 VALUES (2, 'KYTE');
INSERT INTO uwapp_owner.t1 VALUES (3, 'LEWIS');
INSERT INTO uwapp_owner.t2 VALUES (1, 'TOWNSEND');
INSERT INTO uwapp_owner.t2 VALUES (2, 'KURIAN');
COMMIT;

SELECT * FROM uwapp_user.t1t2_view;

SQL> SELECT * FROM uwapp_user.t1t2_view;

<table>
<thead>
<tr>
<th>TID</th>
<th>LAST_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TOWNSEND</td>
</tr>
<tr>
<td>2</td>
<td>KURIAN</td>
</tr>
</tbody>
</table>

ALTER PLUGGABLE DATABASE APPLICATION uw_app END INSTALL;

Pluggable database altered.
col app_name format a10
col app_version format a12

SELECT app_name, app_version, app_status, app_implicit
FROM dba_applications
WHERE app_name = 'UW_APP';

APP_NAME   APP_VERSION  APP_STATUS   A
---------- -------------- ---------- -
UW_APP     1.0           NORMAL       N

-- if there are application PDBs, under the application root
-- container, exit and synchronize them with their root with
-- ALTER APPLICATION PDB
SQL> CREATE TABLE servers (  2  srvr_id NUMBER(10),  3  network_id NUMBER(10),  4  status VARCHAR2(1),  5  latitude FLOAT(20),  6  longitude FLOAT(20),  7  netaddress VARCHAR2(15));
Table created.

SQL> CREATE TABLE serv_inst  2   SHARING=METADATA (  3  siid NUMBER(10),  4  si_status VARCHAR2(15),  5  type VARCHAR2(5),  6  installstatus VARCHAR2(1),  7  location_code NUMBER(10),  8  custacct_id VARCHAR2(10),  9  srvr_id NUMBER(10), 10* ws_id NUMBER(10));
SHARING=METADATA
*
ERROR at line 9:
ORA-00922: missing or invalid option

SQL> show parameter default_sharing

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>default_sharing</td>
<td>string</td>
<td>METADATA</td>
</tr>
</tbody>
</table>
SQL> ALTER PLUGGABLE DATABASE APPLICATION uw_app BEGIN INSTALL '1.0';
ALTER PLUGGABLE DATABASE APPLICATION uw_app BEGIN INSTALL '1.0'
ERROR at line 1:
ORA-65221: application UW_APP exists already

SQL> ALTER PLUGGABLE DATABASE APPLICATION uw_app
2 BEGIN UPGRADE '1.0' TO '2.0'
3 COMMENT 'Adding New Table With Sharing';

SQL> CREATE TABLE serv_inst
2 SHARING=METADATA (siid NUMBER(10),
3 si_status VARCHAR2(15),
4 type VARCHAR2(5),
5 installstatus VARCHAR2(1),
6 location_code NUMBER(10),
7 custacct_id VARCHAR2(10),
8 srvr_id NUMBER(10),
9* ws_id NUMBER(10));

Table created.
SQL> ALTER PLUGGABLE DATABASE APPLICATION uw_app END UPGRADE;

SQL> desc dba_applications
Name Null? Type
----------------------- -------- --------------
APP_NAME                VARCHAR2(128)
APP_ID                  NUMBER
APP_VERSION             VARCHAR2(30)
APP_STATUS              VARCHAR2(12)
APP_IMPLICIT            VARCHAR2(1)
APP_CAPTURE_SERVICE     VARCHAR2(64)
APP_CAPTURE_MODULE      VARCHAR2(64)

col app_name format a37

SQL> SELECT app_name, app_id, app_version, app_status, app_implicit
  2  FROM dba_applications;

APP_NAME                              APP_ID APP_VERSION APP_STATUS A
------------------------------------- ------- -------- --------------
APP$4BFAF1A01C5964D55E0530100007F821B 2 1.0       NORMAL       Y
UW_APP                                  21 2.0      NORMAL       N
Application Seed Creation
CREATE PLUGGABLE DATABASE AS SEED FROM uwapp_root
ADMIN USER uwappAdmin IDENTIFIED BY uwappAdmin
FILE_NAME_CONVERT = ('/uwapp/', '/uwappseed/')
LOGGING;

SQL> SELECT con_id, name, open_mode, application_root, application_pdb, application_seed
  2  FROM v$containers
  3  ORDER BY con_id;

<table>
<thead>
<tr>
<th>CON_ID</th>
<th>NAME</th>
<th>OPEN_MODE</th>
<th>APP</th>
<th>APP</th>
<th>APP</th>
</tr>
</thead>
<tbody>
<tr>
<td>-------</td>
<td>------------------</td>
<td>---------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>4</td>
<td>UWAPP_ROOT</td>
<td>READ WRITE</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>6</td>
<td>UWAPP_ROOT$SEED</td>
<td>MOUNTED</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

SQL> ALTER PLUGGABLE DATABASE uwapp_root$seed OPEN;

Warning: PDB altered with errors.

SQL> ALTER PLUGGABLE DATABASE uwapp_root$seed OPEN READ ONLY;

Warning: PDB altered with errors.
SQL> host
[oracle@vbgeneric ~]$ cd $ORACLE_BASE/diag/orabase/orabase/trace
[oracle@vbgeneric trace]$ tail alert_orabase.log

UWAPP_ROOT$SEED(6): Opatch validation is skipped for PDB UWAPP_ROOT$SEED (con_id=0)
UWAPP_ROOT$SEED(6): WARNING: Pluggable Database UWAPP_ROOT$SEED with pdb id - 6 is altered with errors or warnings. Please look into
UWAPP_ROOT$SEED(6): PDB_PLUG_IN_VIOLATIONS view for more details.
UWAPP_ROOT$SEED(6):***************************************************************
2017-04-19T18:45:58.662039-04:00
UWAPP_ROOT$SEED(6): Opening pdb with no Resource Manager plan active
Pluggable database UWAPP_ROOT$SEED opened read only
UWAPP_ROOT(4): Completed: ALTER PLUGGABLE DATABASE uwapp_root$seed OPEN READ ONLY

[oracle@vbgeneric ~]$exit

SQL> col time format a29
SQL> col name format a16
SQL> col type format a6
SQL> col cause format a30
SQL> col action format a22

SQL> SELECT time, name, cause, status, action
2* FROM pdb_plug_in_violations;

<table>
<thead>
<tr>
<th>TIME</th>
<th>NAME</th>
<th>CAUSE</th>
<th>STATUS</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-APR-17 06.45.57.958082 PM</td>
<td>UWAPP_ROOT$SEED</td>
<td>Non-Application PDB to Application PDB</td>
<td>PENDING</td>
<td>Run pdb_to_apppdb.sql.</td>
</tr>
</tbody>
</table>
Applicaiton Containers Demo 4: Create Seed

SQL> @?/rdbms/admin/pdb_to_apppdb.sql
SQL> SET FEEDBACK 1
SQL> SET NUMWIDTH 10
SQL> SET LINESIZE 80
SQL> SET TRIMSPOOL ON
SQL> SET TAB OFF
SQL> SET PAGESIZE 100
SQL>
SQL> WHENEVER SQLERROR EXIT;
SQL>
SQL> VARIABLE cdbname VARCHAR2(128)
SQL> VARIABLE pdbname VARCHAR2(128)
SQL> VARIABLE appname VARCHAR2(128)
SQL> BEGIN
2 -- Disallow script in non-CDB
3 SELECT sys_context('USERENV', 'CDB_NAME')
4 INTO :cdbname
5 FROM dual
6 WHERE sys_context('USERENV', 'CDB_NAME') is not null;
7 -- Disallow script in CDB Root
8 -- Disallow script in PDB$SEED (Bug 22550952)
9 SELECT sys_context('USERENV', 'CON_NAME')
10 INTO :pdbname
11 FROM dual
12 WHERE sys_context('USERENV', 'CON_NAME') <> 'CDB$ROOT'
13 AND sys_context('USERENV', 'CON_NAME') <> 'PDB$SEED';
14 -- Disallow script outside of Application Container
15 SELECT sys_context('USERENV', 'APPLICATION_NAME')
16 INTO :appname
17 FROM dual
18 WHERE sys_context('USERENV', 'APPLICATION_NAME') is not null;
19 -- Disallow script in Proxy PDB (Bug 22550952). This query works
20 -- because remote mapping in Proxy PDB has been disabled using
21 -- the underscore parameter.
22 SELECT /*+ OPT_PARAM('_ENABLE_VIEW_PDB', 'FALSE') */ name
23 INTO :pdbname
24 FROM v$pdb
25 WHERE proxy_pdb='NO';
26 END;
27 /

ERROR at line 1:
ORA-01422: exact fetch returns more than requested number of rows
ORA-06512: at line 22

Disconnected from Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production [oracle@vbgeneric ~]$
On dissecting the pdb_to_apppdb.sql script the following was identified as the root cause of the error:

```sql
SQL> SELECT /*+ OPT_PARAM('_ENABLE_VIEW_PDB', 'FALSE') */ name
2  FROM v$pdb
3  WHERE proxy_pdb='NO';
```

<table>
<thead>
<tr>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>UWAPP_ROOT</td>
</tr>
<tr>
<td>UWAPP_ROOT$SEED</td>
</tr>
</tbody>
</table>

Further examination of the script(s) found numerous examples of this:

```sql
select TO_NUMBER('NOT_IN_APPLICATION_PDB') from v$pdb
where con_id=sys_context('USERENV', 'CON_ID') and application_pdb<>'YES';
```

Clearly the script has no choice but to fail.

More news on this in our Slack group as it becomes available.
TNSNAMES.ORA
TNSNAMES Configuration

- Every time you add a new PDB ... you must also make a manual entry to TNSNAMES.ORA

```plaintext
# tnsnames.ora Network Configuration File:
C:\app\oracle\product\12.1.0\dbhome_1\network\admin\tnsnames.ora
# Generated by Oracle configuration tools.

PDBDEV =
  (DESCRIPTION =
   (ADDRESS_LIST =
    (ADDRESS = (PROTOCOL = TCP)(HOST = 127.0.0.1)(PORT = 1521))
   )
   (CONNECT_DATA =
    (SERVICE_NAME = pdbdev)
   )
  )
PDBTEST =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = 127.0.0.1)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = pdbtest)
   )
  )

ORACLRF_CONNECTION_DATA =
  (DESCRIPTION =
   (ADDRESS_LIST =
    (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
   )
   (CONNECT_DATA =
    (SID = CLRExtProc)
    (PRESENTATION = RO)
   )
  )
PDBPROD =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = 127.0.0.1)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = pdbprod)
   )
  )

ORABASE =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = 127.0.0.1)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = orabase)
   )
  )
```

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Conclusion

- Read the docs
- Download it
- Install it
- Learn it

- For demos that work in SQL*Plus
  [www.morganslibrary.org/library.html](http://www.morganslibrary.org/library.html)
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—Aaron De Los Reyes, Senior Director, Oracle Technology, Cognizant

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ERROR at line 1:
ORA-00028: your session has been killed

Questions? dmorgan@forsythe.com