



Patching in OCI
to patch
or
not to patch

Introduction



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Considerations when patching

- Minimal 2x each year (4x is preferred)
- Patch with minimal downtime for business application
- SE no dataguard
- EE and up dataguard included (requires 24x7 a 2nd host)
- Bonus: Cloud infra = disposable hardware (pay per use)



Standard patching database in OCI (via webinterface)

- **Db-system**

- Execute precheck: 11 minutes
- Execute patch: > 45 minutes downtime

- **CDB**

- Execute precheck: 10 minutes
- Execute patch: > 45 minutes downtime

- **Total downtime database** > 90 minutes

Main differences

Traditional patching

- ☹️ > 1,5-hour downtime of the database
- ☹️ Fallback scenario is the restore of the backup

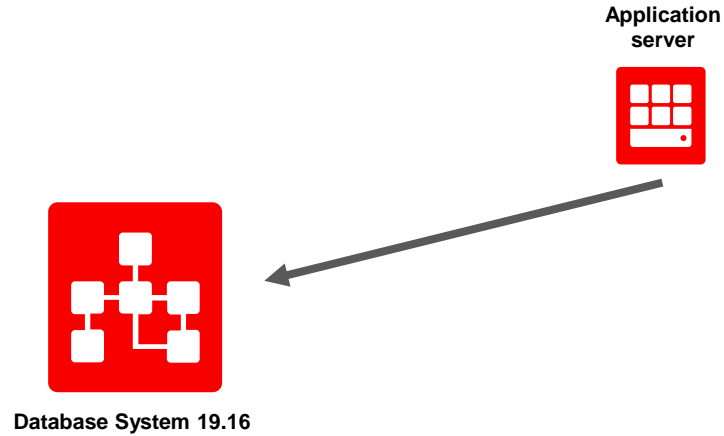
Patching using refreshable clone

- ☺️ Downtime of the database is limited to < 1 hour
- ☺️ Ultimate fallback scenario (old environment remains 100% intact)
- ☺️ Testing the complete procedure without business impact (more predictable)

The new patching high level:

- Provision new database system on the correct version
- Configure DB-system and Operating system
- Clone the PDB
- Complete synchronization (start downtime) < 5 minutes
- Validate completeness 5 minutes
- Open new PDB 5 minutes
- Execute datapatch 20 minutes
- Execute utlpr 15 minutes
- Modify database links, tnsnames.ora etc. < 5 minutes
- Back in business (end downtime)

Starting situation



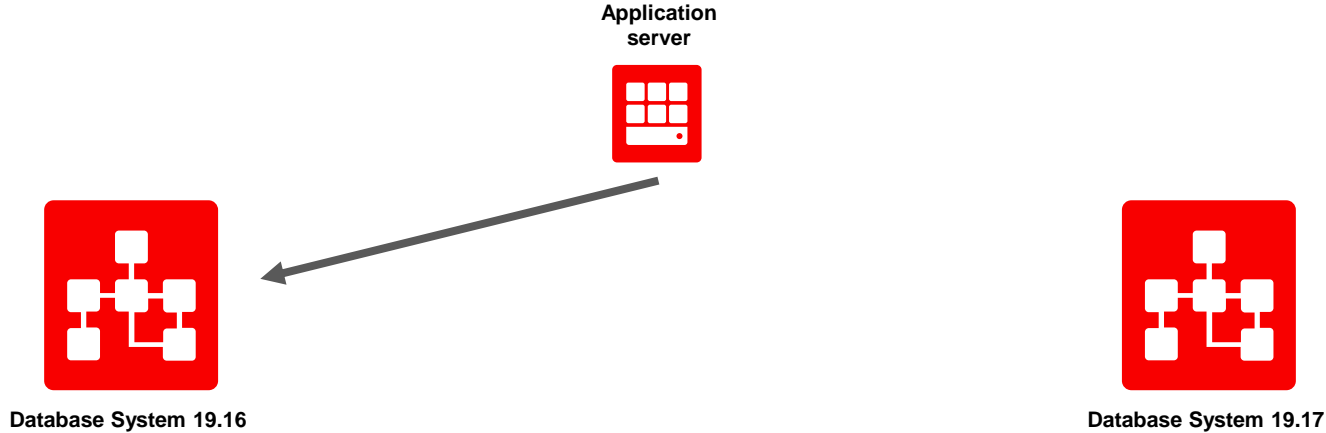
```
[oracle@host1916 ~]$ sqlplus / as sysdba
SQL*Plus: Release 19.0.0.0.0 - Production on Thu Nov 24 14:20:00 2022
Version 19.16.0.0.0

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Connected to:
Oracle Database 19c Standard Edition 2 Release 19.0.0.0.0 - Production
Version 19.16.0.0.0

SQL> █
```

Step 1a Preparation



- Provision new DB-system

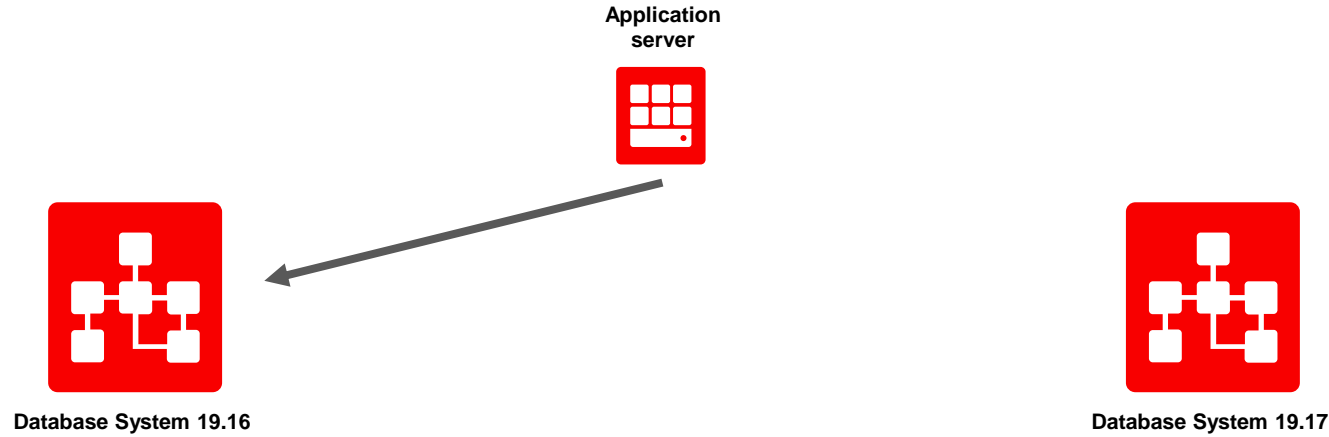
```
[oracle@host1917 ~]# sqlplus / as sysdba
SQL*Plus: Release 19.0.0.0.0 - Production on Thu Nov 24 13:19:50 2022
Version 19.17.0.0.0

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Connected to:
Oracle Database 19c Standard Edition 2 Release 19.0.0.0.0 - Production
Version 19.17.0.0.0

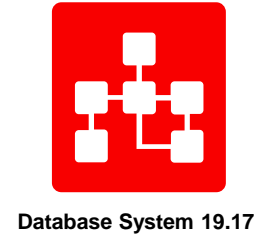
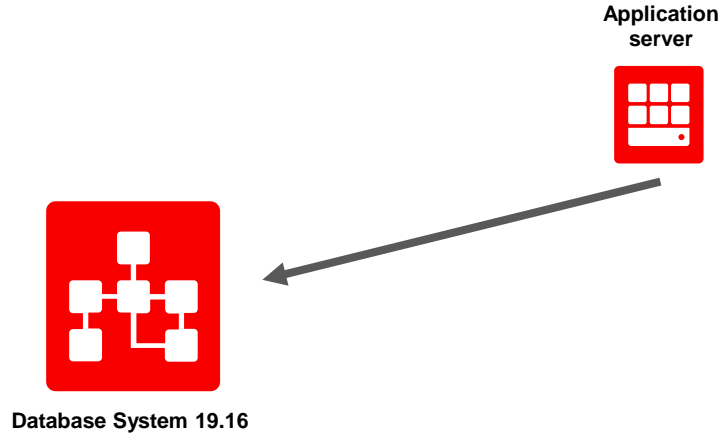
SQL> █
```


Step 1b Preparation



- Configure new DB-system
 - Scripts on OS
 - CDB specific configuration
 - Etc. etc.

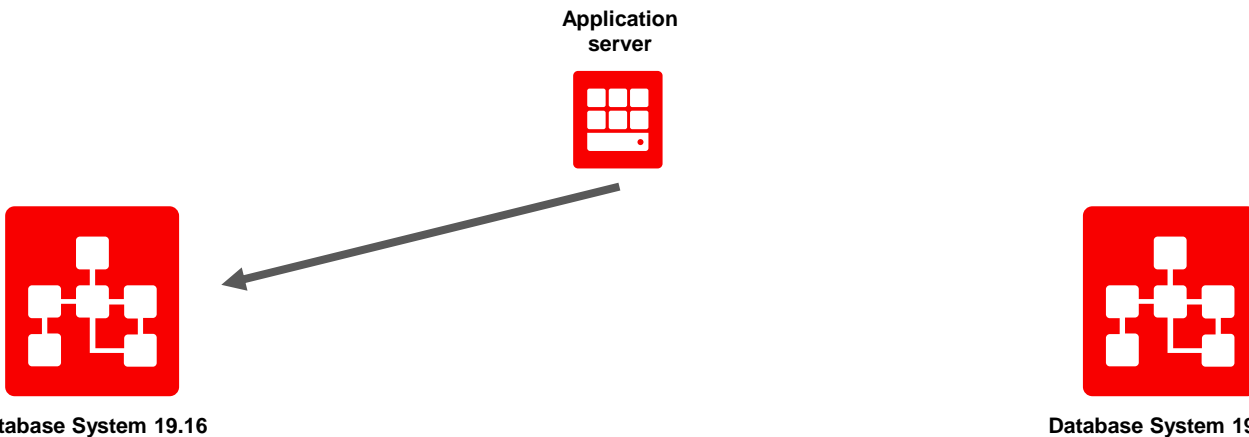
Step 2a Prepare database clone



- Set global_name on false

```
SQL> show parameter global_name
NAME                                TYPE          VALUE
-----
global_names                         boolean      TRUE
SQL> alter system set global_names=false scope=both;
System altered.
SQL> show parameter global_name
NAME                                TYPE          VALUE
-----
global_names                         boolean      FALSE
SQL>
```

Step 2b Prepare database clone



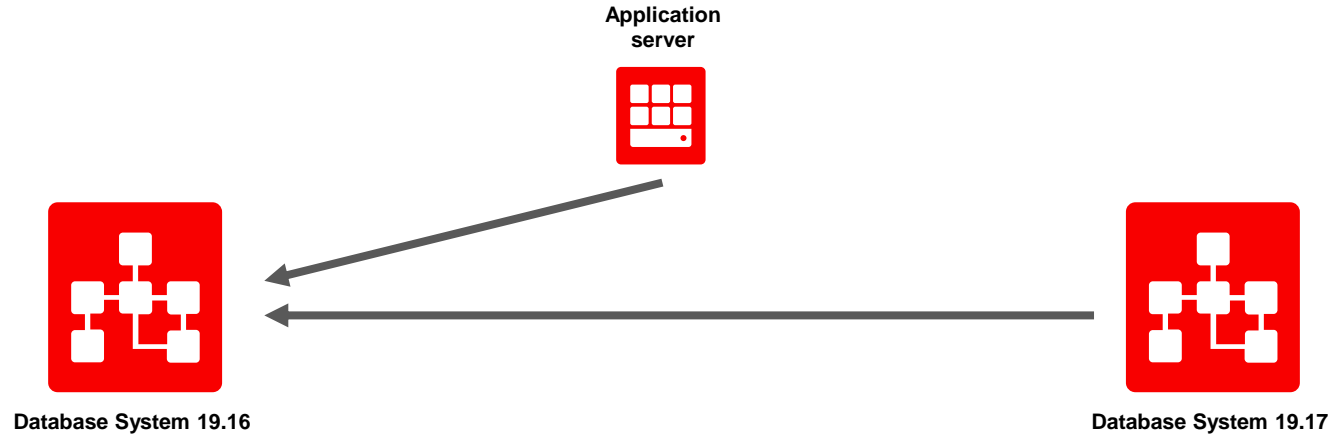
- Create specific clone user in source CDB

```
SQL> CREATE USER c##remote_clone_user IDENTIFIED BY "Geheim01!!" CONTAINER=ALL;
User created.
SQL> GRANT CREATE SESSION, CREATE PLUGGABLE DATABASE TO c##remote_clone_user CONTAINER=ALL;
Grant succeeded.
SQL> █
```

- SQL-net connection to source environment (tnsnames.ora, routing etc.) :

```
CDB1916 =
(DESCRIPTION =
  (ADDRESS = (PROTOCOL = TCP)(HOST = host1916.private.amis.oraclevcn.com) PORT = 1521))
  (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = cdb1916_fra1dw.private.amis.oraclevcn.com)
  )
)
```

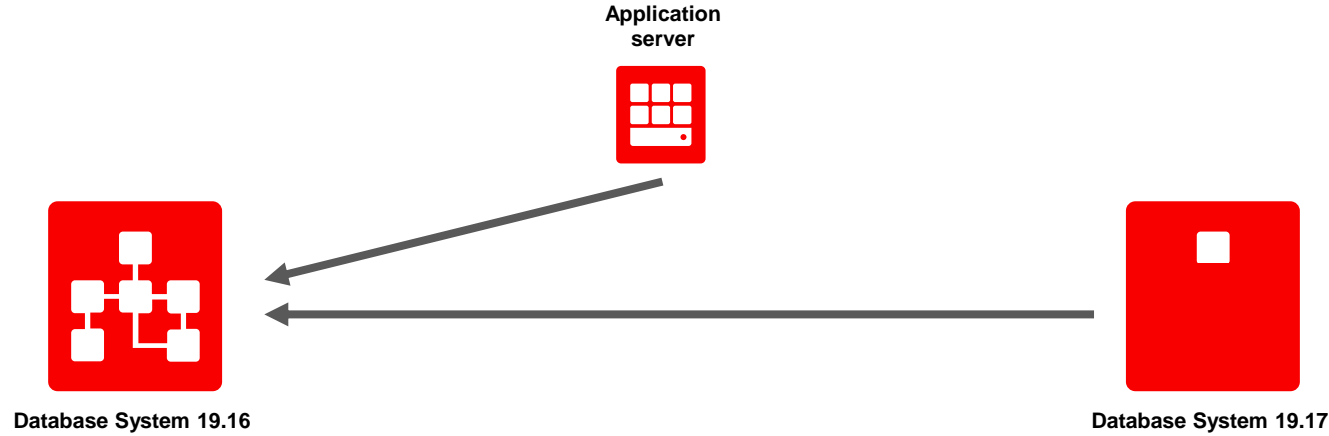
Step 2c Prepare database clone



- Create database-link

```
SQL> CREATE DATABASE LINK clone_link CONNECT TO c##remote_clone_user IDENTIFIED BY "GEheim01!!" USING 'CDB1916';
Database link created.
SQL> select sysdate from dual@clone_link;
SYSDATE
-----
24-NOV-22
SQL> █
```

Step 2d Prepare database clone



- Remove PDB in target CDB

```
SQL> alter pluggable database pdb1917 close;
Pluggable database altered.
SQL> drop pluggable database pdb1917 including datafiles;
Pluggable database dropped.
SQL> show pdbs

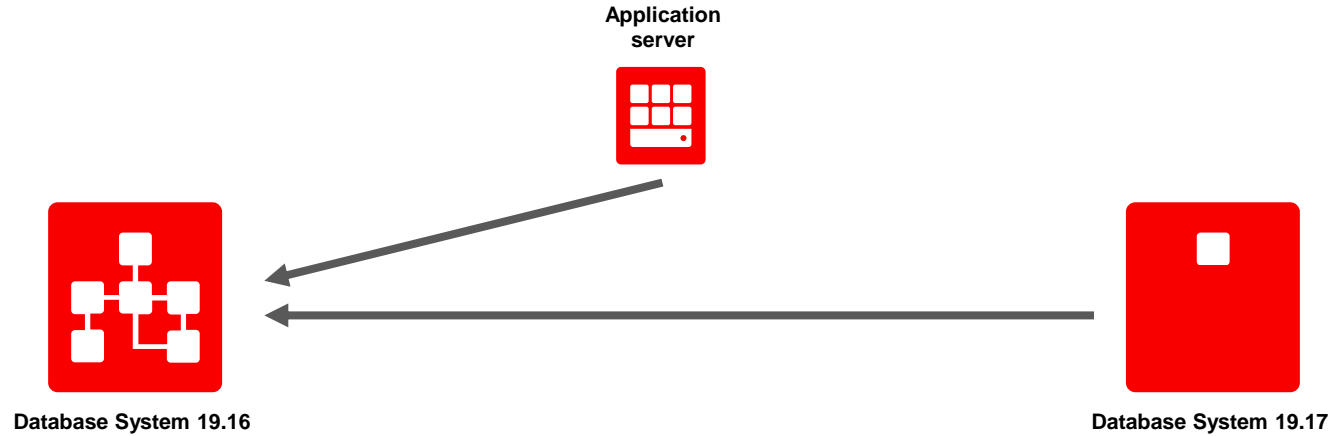
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO

```
SQL>
```

Check ASM

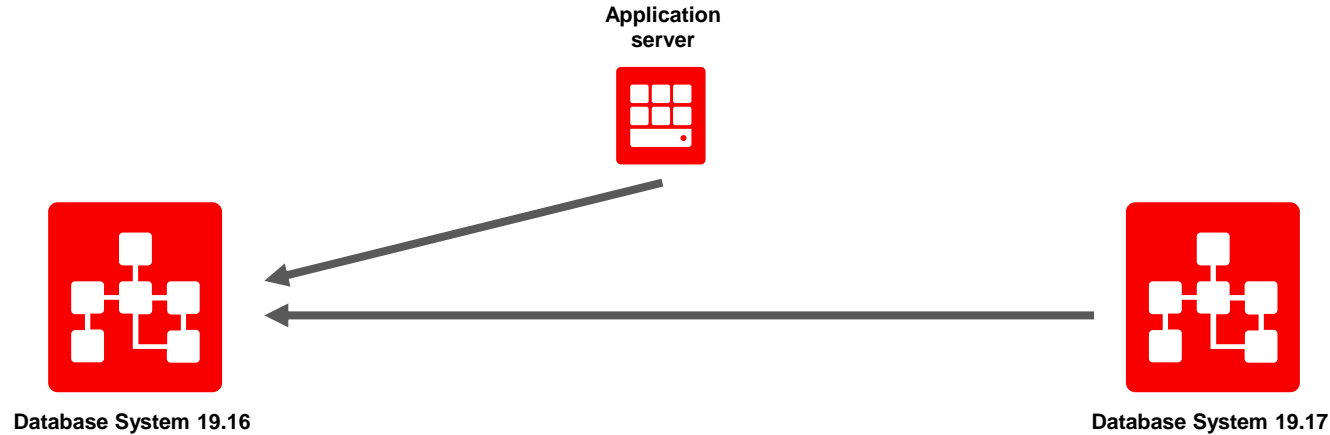
Step 3 Create database clone



- Start clone process from SQL-Plus (in screen!!!)

```
SQL> CREATE PLUGGABLE DATABASE PDB1917 FROM PDB1916@CLONE_LINK KEYSTORE IDENTIFIED BY "welkom_123" REFRESH MODE EVERY 5 MINUTES;  
Pluggable database created.  
SQL> █
```

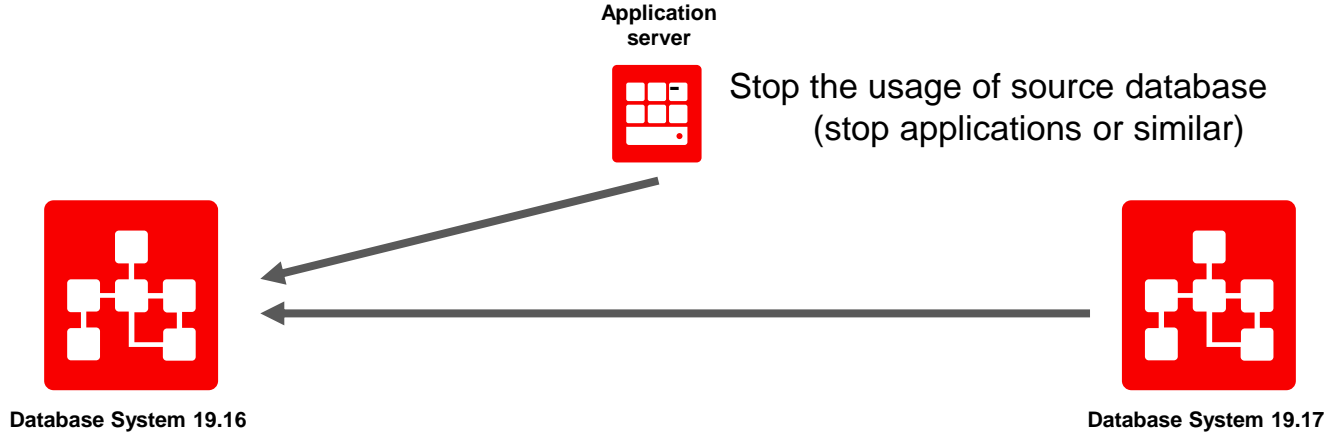
Step 4 Monitor the refresh process



- Monitor via alert log

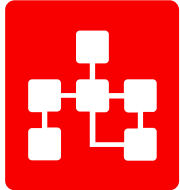
```
2022-11-24T13:55:15.168714+00:00
PDB1917(3):alter pluggable database refresh
2022-11-24T13:55:15.907609+00:00
Applying media recovery for pdb-4099 from SCN 2924124 to SCN 2924274
Remote log information: count-1
thr-1,seq-15,logfile-/u03/app/oracle/fast_recovery_area/CDB1916_FRA1DW/foreign_archive/LOG/PDB1916/2022_11_24/o1_mf_1_15_kqxy3kb_.arc,los-2922562
PDB1917(3):Media Recovery Start
2022-11-24T13:55:15.917759+00:00
PDB1917(3):Serial Media Recovery started
PDB1917(3):max_pdb is 5
2022-11-24T13:55:16.006413+00:00
PDB1917(3):Media Recovery Log /u03/app/oracle/fast_recovery_area/CDB1916_FRA1DW/foreign_archive/LOG/PDB1916/2022_11_24/o1_mf_1_15_kqxy3kb_.arc
2022-11-24T13:55:16.323081+00:00
PDB1917(3):Incomplete Recovery applied until change 2924274 time 11/24/2022 14:55:15
2022-11-24T13:55:16.326557+00:00
PDB1917(3):Media Recovery Complete (cdb1917)
PDB1917(3):Completed: alter pluggable database refresh
```

Step 5a Start migration

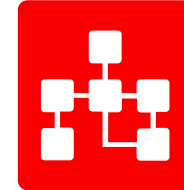


Step 5b Start migration

Application server



Database System 19.16



Database System 19.17

- Job queue processes to 0 (CDB & PDB)

- Stop clone process
(implicit last refresh executed)

```
SQL> alter system set job_queue_processes=0;
System altered.

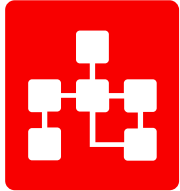
SQL> alter session set container=pdb1916;
Session altered.

SQL> alter system set job_queue_processes=0;
System altered.
```

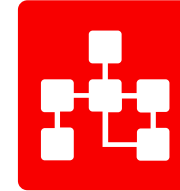
```
2022-11-24T14:07:05.739333+00:00
alter pluggable database pdb1917 refresh mode none
2022-11-24T14:07:06.144364+00:00
PDB1917(3):Pluggable database PDB1917 pseudo opening
PDB1917(3):SUPLOG: Initialize PDB SUPLOG SGA, old value 0x0, new value 0x18
PDB1917(3):Autotune of undo retention is turned on.
PDB1917(3):Undo initialization recovery: Parallel FPTR failed: start:4071541 end:4071544 diff:3 ms (0.0 seconds)
PDB1917(3):Undo initialization recovery: err:0 start: 4071540 end: 4071577 diff: 37 ms (0.0 seconds)
PDB1917(3):[41355] Successfully online Undo Tablespace 2.
PDB1917(3):Undo initialization online undo segments: err:0 start: 4071577 end: 4071594 diff: 17 ms (0.0 seconds)
PDB1917(3):Undo initialization finished serial:0 start:4071540 end:4071596 diff:56 ms (0.1 seconds)
PDB1917(3):Database Characterset for PDB1917 is AL32UTF8
PDB1917(3):Pluggable database PDB1917 pseudo closing
PDB1917(3):JIT: pid 41355 requesting stop
PDB1917(3):Closing sequence subsystem (4071661497).
2022-11-24T14:07:06.763129+00:00
PDB1917(3):Buffer Cache flush started: 3
PDB1917(3):Buffer Cache flush finished: 3
Completed: alter pluggable database pdb1917 refresh mode none
```

Step 6 Validate data completeness (starting in version 21)

Application server



Database System 19.16

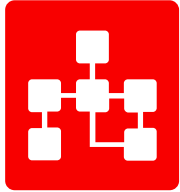


Database System 19.17

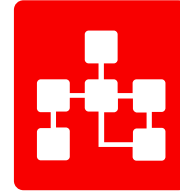
- "Select count(*) from" on most important tables
- ↔
- Open pdb in readonly mode
- "Select count(*) from" on most important tables

Step 7 Job queue processes

Application server



Database System 19.16



Database System 19.17

- Open nieuwe pdb (restricted mode)
- Job queue processes to 0 (CDB & PDB)

```
SQL> alter pluggable database pdb1917 open;
Warning: PDB altered with errors.
SQL> alter system set job_queue_processes=0;
System altered.
SQL> alter session set container=pdb1917;
Session altered.
SQL> alter system set job_queue_processes=0;
System altered.
SQL> show parameter job_queue
NAME                                TYPE          VALUE
-----
job_queue_processes                 integer       0
SQL> exit
Disconnected from Oracle Database 19c Standard Edition 2 Release 19.0.0.0.0 - Production
Version 19.17.0.0.0
[oracle@host1917 ~]$ $ORACLE_HOME/OPatch/datapatch -verbose
```

Step 8 Execute datapatch

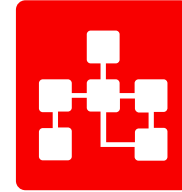
Application
server



```
[oracle@host1917 ~]$ $ORACLE_HOME/OPatch/datapatch
SQL Patching tool version 19.17.0.0.0 Production on Wed Nov 30 15:39:13 2022
Copyright (c) 2012, 2022, Oracle. All rights reserved.

Log file for this invocation: /u01/app/oracle/cfgtoollogs/sqlpatch/sqlpatch_8

Connecting to database...OK
Gathering database info...done
```



Database System 19.17

```
Installing patches...
Patch installation complete. Total patches installed: 3

Validating logfiles...done
Patch 34086870 rollback (pdb PDB1917): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/34086870/24803071/34086870_rollback_CDB1917_PDB1917_2022Nov30_15_39_48.log (no errors)
Patch 34419443 apply (pdb PDB1917): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/34419443/24972075/34419443_apply_CDB1917_PDB1917_2022Nov30_15_39_59.log (no errors)
Patch 34411846 apply (pdb PDB1917): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/34411846/24917919/34411846_apply_CDB1917_PDB1917_2022Nov30_15_39_59.log (no errors)

Automatic recompilation incomplete; run utlrl.sql to revalidate.
PDBs: PDB1917

SQL Patching tool complete on Wed Nov 30 15:41:08 2022
[oracle@host1917 ~]$
```

Step 9a Execute UTLRP

```
Version 19.17.0.0.0
[oracle@host1917 ~]$ sqlplus / as sysdba;

SQL*Plus: Release 19.0.0.0.0 - Production on Mon Dec 5 09:53:38 2022
Version 19.17.0.0.0

Copyright (c) 1982, 2022, Oracle. All rights reserved.

Connected to:
Oracle Database 19c Standard Edition 2 Release 19.0.0.0.0 - Production
Version 19.17.0.0.0

SQL> alter session set container=pdb1917;
Session altered.

SQL> @$ORACLE_HOME/rdbms/admin/utlrb.sql
Session altered.

TIMESTAMP
-----
COMP_TIMESTAMP UTLRP_BGN          2022-12-05 09:53:50
```

```
Function created.

PL/SQL procedure successfully completed.

Function dropped.

PL/SQL procedure successfully completed.

SQL > █
```

```
PL/SQL procedure successfully completed.

TIMESTAMP
-----
COMP_TIMESTAMP UTLRP_END          2022-12-05 09:36:41

DOC> The following query reports the number of invalid objects.
DOC>
DOC> If the number is higher than expected, please examine the error
DOC> messages reported with each object (using SHOW ERRORS) to see if they
DOC> point to system misconfiguration or resource constraints that must be
DOC> fixed before attempting to recompile these objects.
DOC>#

OBJECTS WITH ERRORS
-----
0

DOC> The following query reports the number of exceptions caught during
DOC> recompilation. If this number is non-zero, please query the error
DOC> messages in the table UTL_RECOMP_ERRORS to see if any of these errors
DOC> are due to misconfiguration or resource constraints that must be
DOC> fixed before objects can compile successfully.
DOC> Note: Typical compilation errors (due to coding errors) are not
DOC> logged into this table: they go into DBA_ERRORS instead.
DOC>#

ERRORS DURING RECOMPILATION
-----
0
```

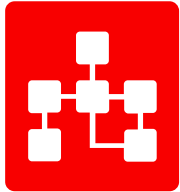
Step 9b Check PDB PLUGIN VIOLATIONS

```
set pages 100
SQL> select cast(time as date), name,cause,type,message,status,action from PDB_PLUG_IN_VIOLATIONS;
```

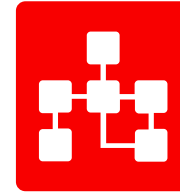
CAST(TIME NAME)	CAUSE	TYPE	MESSAGE	STATUS	ACTION
17-OCT-22 PDB\$SEED	OPTION	ERROR	Database option XQO mismatch: PDB installed version 19.0.0.0. CDB installed version NULL.	RESOLVED	Fix the database option in the PDB or the CDB
17-OCT-22 PDB\$SEED	SQL Patch	ERROR	Interim patch 34411846/24917919 (OJVM RELEASE UPDATE: 19.17.0.0.221018 (34411846)): Installed in the CDB but not in the PDB	RESOLVED	Call datapatch to install in the PDB or the CDB
17-OCT-22 PDB\$SEED	SQL Patch	ERROR	'19.17.0.0 Release_Update 2209242240' is installed in the CDB but no release updates are installed in the PDB	RESOLVED	Call datapatch to install in the PDB or the CDB
24-NOV-22 PDB1917	Parameter	WARNING	CDB parameter wallet_root mismatch: Previous '/opt/oracle/dcs/commonstore/wallets/cdb1916_fraldw' Current '/opt/oracle/dcs/commonstore/wallets/cdb1917_fral7q'	PENDING	Please check the parameter in the current CDB

Step 10 Final tasks

Application
server



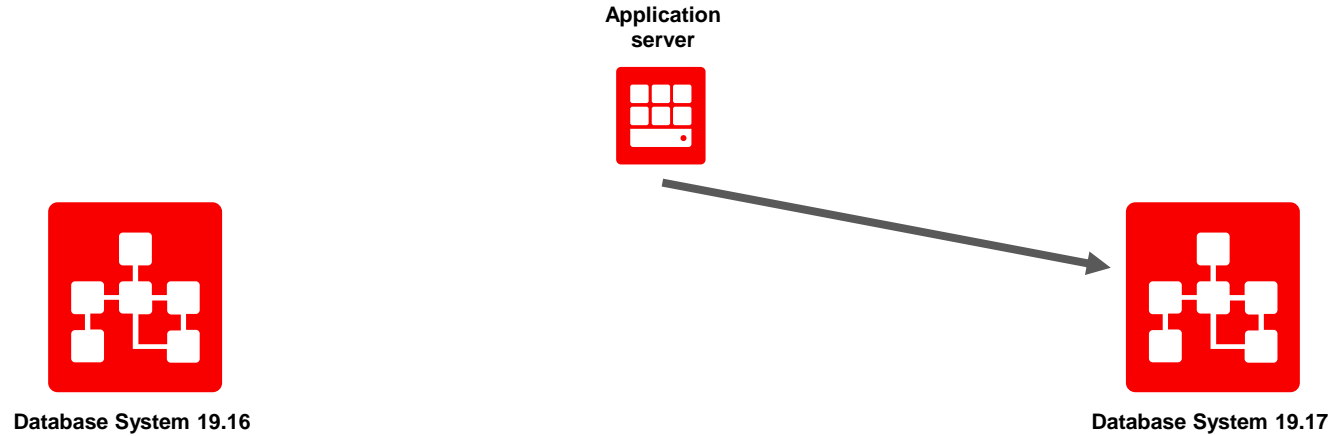
Database System 19.16



Database System 19.17

- (Central) tnsnames.ora
- Incoming database links
- Other connections
- Job queue processes

Step 11 Database available again



- Restart application usage
- Back in business



Lessons learned

- Infrastructure as code (Terraform)
- Configuration as code (Ansible)
- Rman might clean archive.log files required by the refresh process
- Partial archive.log files might fill up the FRA
- Plugin violations
- Wallets and their locations
- Check, check, double check.

