



Standard Edition und Multitenant

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- Oracle Spezialist seit 1992
 - 1992: Presales bei Oracle in Düsseldorf
 - 1999: Projektleiter bei Herrmann & Lenz Services GmbH
 - 2005: Technischer Direktor ADM Presales bei Quest Software GmbH
 - 2011: Geschäftsführer CarajanDB GmbH
- 2011 → Ernennung zum Oracle ACE
- Autor der Bücher:
 - Oracle9i für den DBA, Oracle10g für den DBA, Oracle 11g Release 2 für den DBA
- DOAG Themenverantwortlicher Datenbankadministration, Standard Edition
- Hobbies:
 - Drachen steigen lassen (Kiting) draußen wie drinnen (Indoorkiting)
 - Motorradfahren (nur draußen)



Warum Standard Edition?

Standard Edition 2

- Verfügbar seit dem 01. September 2015
- Maximal 2 Sockets
 - Dabei darf der Server nicht mehr als 2 Sockets haben (egal ob belegt oder leer)
- Maximal 16 CPU Threads
 - Hyperthreading wird mitgezählt
- Oracle RAC enthalten (allerdings auch nur bis gesamt max. 2 Sockets)

Oracle Database Standard Edition 2 may only be licensed on servers that have a maximum capacity of 2 sockets. When used with Oracle Real Application Clusters, Oracle Database Standard Edition 2 may only be licensed on a maximum of 2 one-socket servers. In addition, notwithstanding any provision in Your Oracle license agreement to the contrary, each Oracle Database Standard Edition 2 database may use a maximum of 16 CPU threads at any time. When used with Oracle Real Application Clusters, each Oracle Database Standard Edition 2 database may use a maximum of 8 CPU threads per instance at any time. The minimums when licensing by Named User Plus (NUP) metric are 10 NUP licenses per server.

(<http://www.oracle.com/us/corporate/pricing/databaselicensing-070584.pdf>)



Datenbank Konfiguration

Database Configuration Assistant - Create a database - Step 4 of 14@mey.carajandb.local

Specify Database Identification Details **18c ORACLE Database**

Provide a unique database identifier information. An Oracle database is uniquely identified by a Global database name, typically of the form "name.domain".

Global database name: REINHARD

SID: REINHARD

Service name:

☒ **Create as Container database**

A Container database can be used for consolidating multiple databases into a single database, and it enables database virtualization. A Container database (CDB) can have zero or more pluggable databases (PDB).

☒ **Use Local Undo tablespace for PDBs**

☒ **Create an empty Container database**

☐ **Create a Container database with one or more PDBs**

Number of PDBs: 1

PDB name: pdb

[Help](#) [< Back](#) [Next >](#) [Finish](#) [Cancel](#)

Möglichst Keine Optionen!

Database Configuration Assistant - Create 'REINHARD' database - Step 8 of 15@mey.carajandb.local

18^c ORACLE[®] Database

Select Database Options

- Database Operation
- Creation Mode
- Deployment Type
- Database Identification
- Storage Option
- Fast Recovery Option
- Network Configuration
- Database Options**
- Configuration Options
- Management Options
- User Credentials
- Creation Option
- Summary
- Progress Page
- Finish

Database components

Select the standard database components you want to configure for use in your database. Oracle recommends that you always install these components in your database. Deselecting these components may cause you to no longer be able to choose some components on the subsequent page.

Select Component	Tablespace	Include in PDBs
☐ Oracle J [®] VM	SYSTEM	☐
☐ Oracle T [®] ext	SYS [®] AUX	☐
☐ Oracle M [®] ultimedia	SYS [®] AUX	☐
☐ Oracle OLAP	SYS [®] AUX	☐
☐ Oracle Spatial	SYS [®] AUX	☐
☐ Oracle L [®] abel Security	SYSTEM	☐
☐ Oracle A [®] pplication Express	SYS [®] AUX	☐
☐ Oracle Database V [®] ault	SYS [®] AUX	☐

Help < Back Next > Finish Cancel

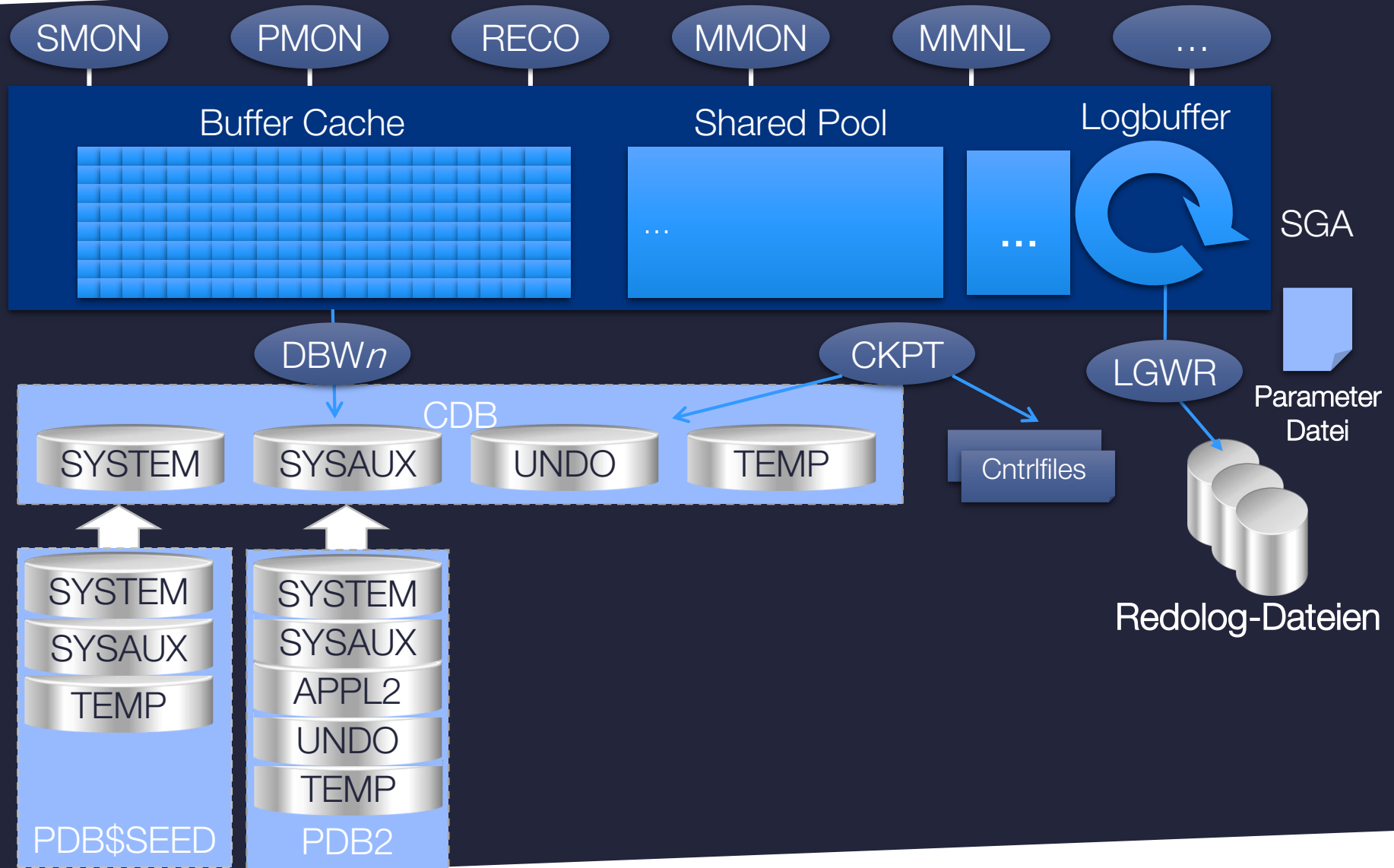


Warum Multitenant Database?

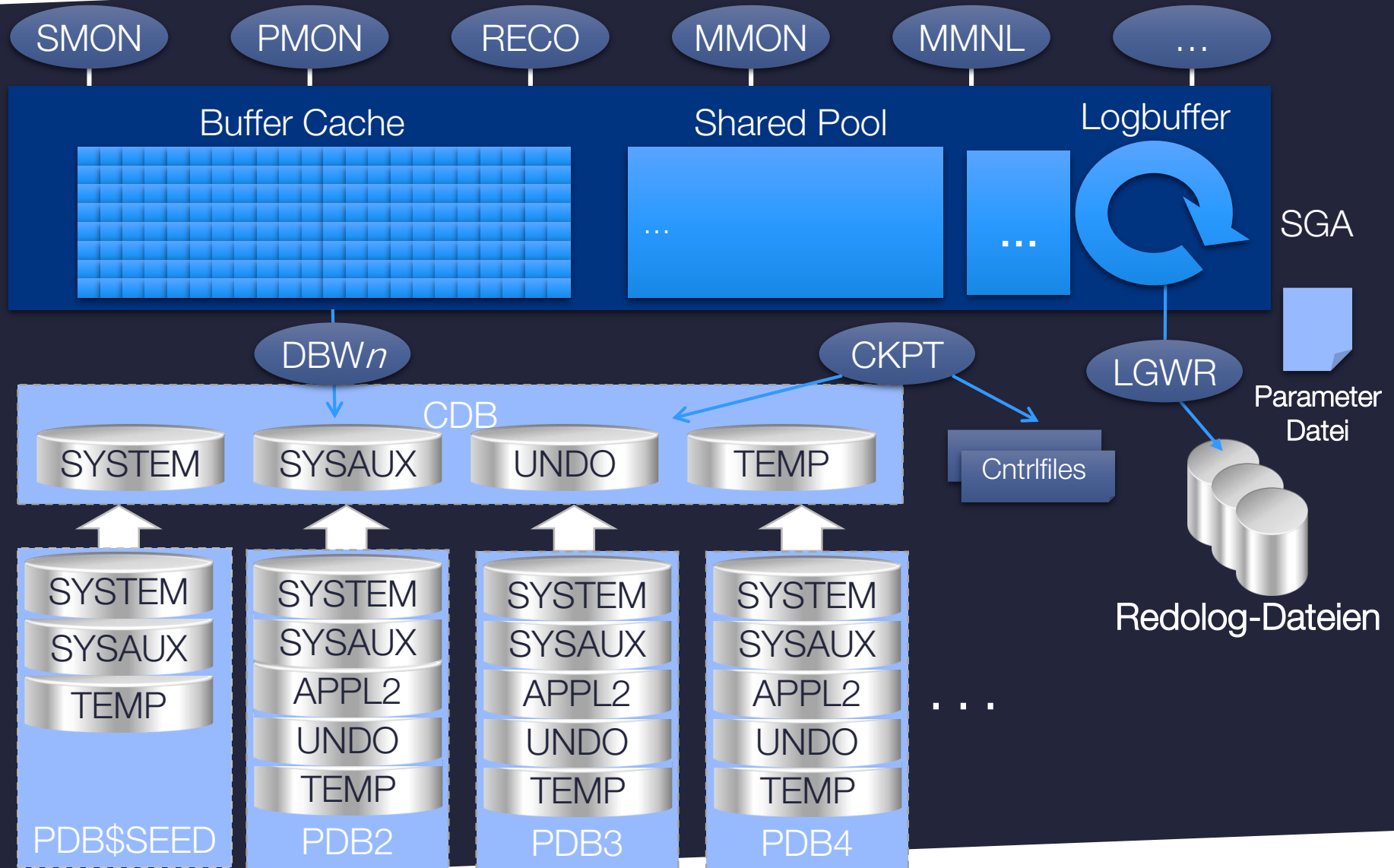
- NON-CDB
 - Architektur bis Oracle 11.2
- Multitenant Architektur
 - Alternative Architektur ab Version 12.1.1 für alle Editionen
- Multitenant Option
 - Kostenpflichtig für die Enterprise Edition
 - Bis zu 252 PDBs pro CDB (Exadata ab 12.2 4096 PDBs)

The non-CDB architecture was deprecated in Oracle Database 12c. It can be desupported and unavailable in a release after Oracle Database 12c Release 2. Oracle recommends use of the CDB architecture.

Multitenant Database Architecture



Multitenant Database Option





New Paradigms for Rapid Patching and Upgrades

The investment of time and effort to patch one multitenant container database results in patching all of its many pluggable databases. To patch a single pluggable database, you simply unplug/plug to a multitenant container database at a different Oracle Database software version.

To upgrade all hosted pluggable databases in a container database, simply upgrade the container database and all hosted pluggable databases are upgraded 'in-place'. To upgrade a single PDB, you simply unplug/plug the pluggable database in to a container database at a higher version and upgrade the pluggable database as described in the [Database Upgrade Guide](#).

<http://www.oracle.com/technetwork/database/multitenant/overview/index.html>

ALTERNATIVE FAKTEN

Multitenant Lizenzierung

- SE2: Standard Edition Two
- EE: Enterprise Edition
- EE-ES: EE on Engineered Systems
- DBCS: Database Cloud Service
- EE-HP: DBCS EE High Performance
- EE-EP: DBCS EE Extreme Performance
- ExaCS: Exadata Cloud Service

Table 1-2 Consolidation

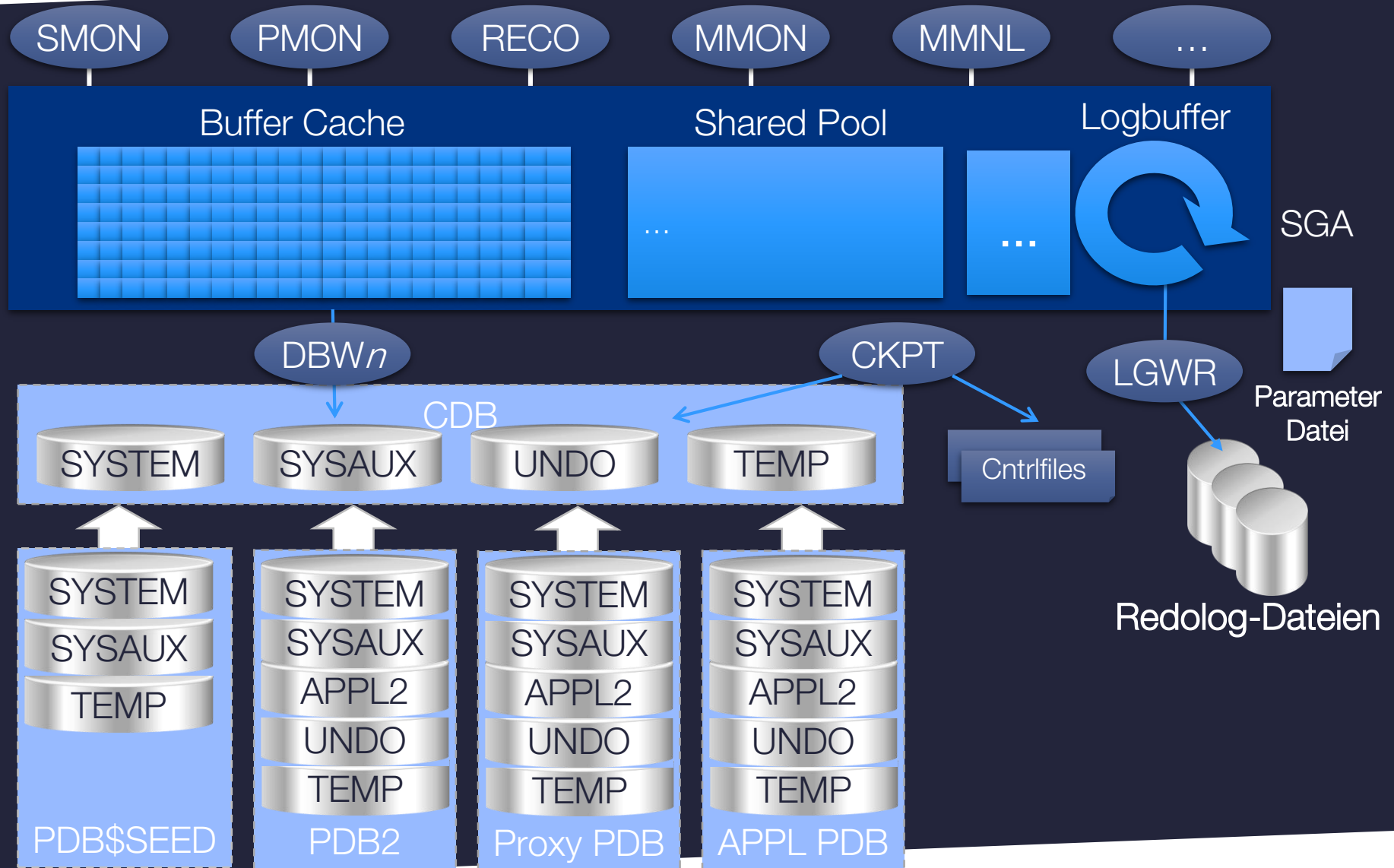
Feature / Option / Pack	SE2	EE	EE-ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS	Notes
Oracle Multitenant - # of PDBs	1	252	4096	1	1	4096	4096	4096	The number value in each column indicates the maximum number of pluggable databases (PDBs) that can be created for each offering. - For all offerings, if you are not licensed for Oracle Multitenant, then the container database architecture is available in single-tenant mode, that is, with one user-created PDB, one user-created application root, and one user-created proxy PDB. - EE: Extra cost option; if you are licensed for Oracle Multitenant, then you can create up to 252 PDBs. - EE-ES: Extra cost option; if you are licensed for Oracle Multitenant, then you can create up to 4096 PDBs. - DBCS EE-HP, DBCS EE-EP, and ExaCS: Included option; you can create up to 4096 PDBs.
CDB Fleet Management	N	N	Y	N	Y	Y	Y	Y	
PDB Snapshot Carousel	N	N	Y	N	Y	Y	Y	Y	
Refreshable PDB switchover	N	N	Y	Y	Y	Y	Y	Y	

Quelle: Database Licensing Information User Manual 18c E87202-07 October 2018

- For all offerings, if you are not licensed for Oracle Multitenant, then the container database architecture is available in single-tenant mode, that is, with one user-created PDB, one user-created application root, and one user-created proxy PDB.

Quelle: Database Licensing Information User Manual 18c E87202-07 October 2018

Multitenant Database Architecture




```
SQL*Plus: Release 18.0.0.0.0 - Production on Wed Nov 7 16:18:42 2018  
Version 18.3.0.0.0
```

```
Copyright (c) 1982, 2018, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 18c Standard Edition 2 Release 18.0.0.0.0 - Production  
Version 18.3.0.0.0
```

```
SQL> show parameter max_pdb
```

NAME	TYPE	VALUE
max_pdb	integer	5

```
SQL> show pdbs
```

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

```
SQL> ALTER SYSTEM SET max_pdb=1;
```

```
System altered.
```

```
SQL> show pdbs
```

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

```
SQL> CREATE PLUGGABLE DATABASE anabelle
ADMIN USER pdb_admin IDENTIFIED BY manager
DEFAULT TABLESPACE users
4 DATAFILE size 100M AUTOEXTEND ON NEXT 10M MAXSIZE 1000M;
CREATE PLUGGABLE DATABASE anabelle
*
```

```
ERROR at line 1:
```

```
ORA-65010: maximum number of pluggable databases created
```

- Es ist irrelevant, ob die PDB geöffnet ist oder nicht

Proxy PDB

Proxy PDB



- Quelle: Common User

```
CREATE USER c##johannes IDENTIFIED BY manager CONTAINER=ALL;  
GRANT create session, sysoper, sysdba TO c##johannes CONTAINER=ALL;
```

- Ziel: Database Link

```
CREATE DATABASE LINK udo  
CONNECT TO c##johannes IDENTIFIED BY manager  
USING 'UDO';
```

```
CREATE PLUGGABLE DATABASE anabelle AS PROXY FROM cello@udo;
```

```
ALTER PLUGGABLE DATABASE anabelle OPEN;
```

```
ALTER PLUGGABLE DATABASE anabelle SAVE STATE;
```

```
show pdbs
```

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

```
SQL> ALTER SESSION SET CONTAINER=anabelle;
```

```
Session altered.
```

```
SQL> show pdbs
```

```
ERROR:
```

```
ORA-01017: invalid username/password; logon denied
```

```
SP2-1545: This feature requires Database availability.
```



```
oracle@mey[REINHARD]% sqlplus demo/demo@mey/ANABELLE
```

```
...
```

```
SQL> select count(*) from personen;
```

```
COUNT (*)
```

```
-----
```

```
10000
```

```
SELECT d.name AS datafile, round(d.bytes/1024/1024) MByte
FROM v$datafile WHERE con_id=3;
```

- Original (UDO)

DATAFILE	MBYTE
-----	-----
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_system_fy5zf72y_.dbf	210
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_sysaux_fy5zf73d_.dbf	165
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_undotbs1_fy5zf73f_.dbf	155
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_users_fy5zfgsq_.dbf	100

- Proxy (REINHARD)

DATAFILE	MBYTE
-----	-----
/u02/oradata/REINHARD/7A161E860F5D2075E053CB6410ACEE09/datafile/o1_mf_system_fy62p3rn_.dbf	210
/u02/oradata/REINHARD/7A161E860F5D2075E053CB6410ACEE09/datafile/o1_mf_sysaux_fy62p3rp_.dbf	165
/u02/oradata/REINHARD/7A161E860F5D2075E053CB6410ACEE09/datafile/o1_mf_undotbs1_fy62p3rq_.dbf	155

```
SELECT d.file_name AS datafile, round(d.bytes/1024/1024) MByte
FROM cdb_data_files d WHERE con_id=3;
```

- Original (UDO)

DATAFILE	MBYTE
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_system_fy5zf72y_.dbf	210
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_sysaux_fy5zf73d_.dbf	165
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_undotbs1_fy5zf73f_.dbf	155
/u02/oradata/UDO/7A155AE705960D3FE0530100007F7B1E/datafile/o1_mf_users_fy5zfgsq_.dbf	100

- Proxy (REINHARD)

```
no rows selected
```

Proxy Datafiles

- SYSTEM, SYSAUX und UNDO werden lokal gepflegt
- Anwendungstabespaces werden in der Originalen Datenbank gepflegt

```
sqlplus system/manager@lindenberg/CELLO
```

```
SQL> SELECT username FROM dba_users WHERE oracle_maintained='N';
```

```
USERNAME
```

```
-----
```

```
DEMO
```

```
PDB_ADMIN
```

```
DOAG
```

```
C##JOHANNES
```

```
SQL> CONNECT doag/konferenz@lindenberg/CELLO
```

```
SQL> SELECT count(*) FROM demo.personen;
```

```
COUNT (*)
```

```
-----
```

```
10000
```

Warum Proxy PDB?

- Umzug der Anwendung
- Andere Oracle Version
- Umzug in die Cloud
- Test

- Warum nicht?
 - Netzwerkbandbreite!

PDB Cloning

- PDB Cloning
 - NON-CDB (klassische Architektur)
 - PDB einer anderen Datenbank
- Über Datenbank Link

```
SQL> ALTER SYSTEM SET max_pdb=2;
```

```
SQL> CREATE PLUGGABLE DATABASE cello  
      FROM cello@udo;
```

```
SQL> ALTER PLUGGABLE DATABASE cello OPEN;
```

```
SQL> ALTER PLUGGABLE DATABASE cello SAVE STATE;
```



```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	ANABELLE	READ WRITE	NO
4	CELLO	READ WRITE	NO

```
SQL> CONNECT demo/demo@mey/ANABELLE
```

```
SQL> execute demopkg.proc_personen(2000);
```

```
SQL> SELECT count(*) FROM personen;
```

```
COUNT (*)
```

```
-----
```

```
12000
```

```
SQL> CONNECT demo/demo@mey/CELLO
```

```
SQL> SELECT count(*) FROM personen;
```

```
COUNT (*)
```

```
-----
```

```
10000
```

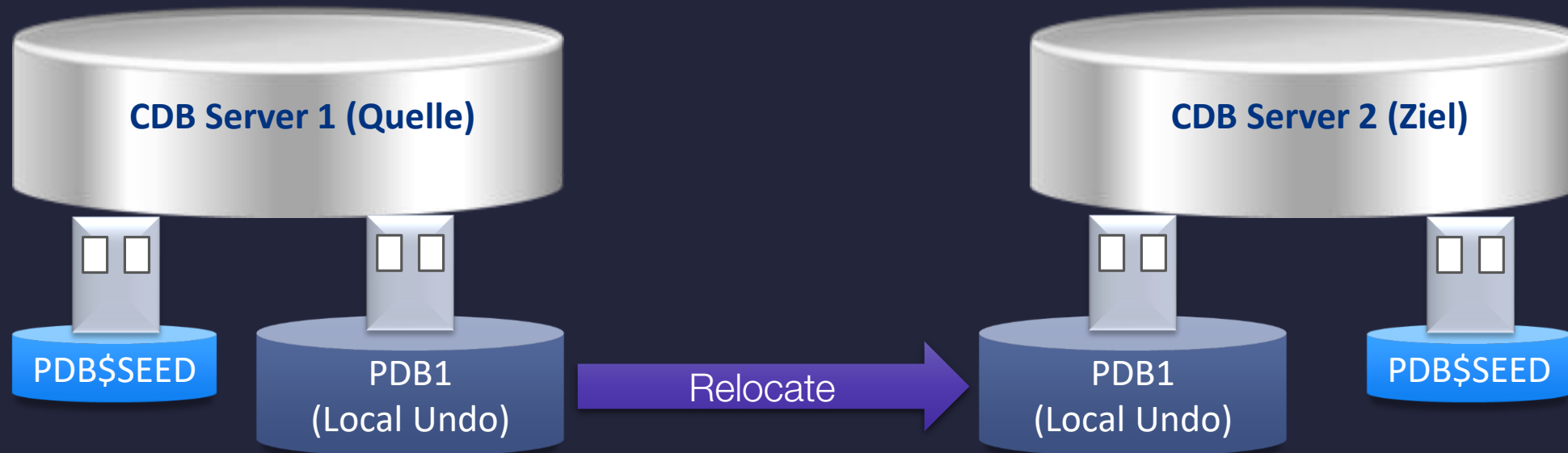
Warum PDB Cloning?

- Schnelle Kopien für Entwickler
- Migration in die Cloud
- Migration zwischen Cloudanbietern

Relocate PDB

Relocate PDB

- Verschieben einer PDB von einer CDB in eine andere
- Voraussetzung
 - Local Undo
 - Quell-CDB im Archivelog Modus



```
SQL> show pdbs
```

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

- Darf ich das überhaupt?

```
SELECT con_id, name, proxy_pdb, local_undo, open_mode, restricted  
FROM v$Pdb;
```

CON_ID	NAME	PRO	LOCAL_UNDO	OPEN_MODE	RES
2	PDB\$SEED	NO	1	READ ONLY	NO
3	ANABELLE	YES	1	READ WRITE	NO

- Create Pluggable Database

```
SQL> CREATE PLUGGABLE DATABASE johann12 FROM johann12@CARL RELOCATE;
```

Pluggable database created.

- Quelle:

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	JOHANN12	READ WRITE	NO

- Ziel:

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	JOHANN12	MOUNTED	NO

- Ziel:

```
SQL> ALTER PLUGGABLE DATABASE JOHANN12 OPEN;
```

```
Warning: PDB altered with errors.
```

- Quelle:

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	JOHANN12	MOUNTED	

- Quelle:

```
SELECT p.name AS pdbname, d.name AS datafile, round(d.bytes/1024/1024) MByte
FROM v$pdb p, v$datafile d
WHERE d.con_id = p.con_id(+)
ORDER BY p.con_id NULLS FIRST;
```

PDBNAME	DATAFILE	MByte
	/u02/oradata/CARL/datafile/o1_mf_system_f0mcnxsm_.dbf	700
	/u02/oradata/CARL/datafile/o1_mf_undotbs1_f0mcpglk_.dbf	230
	/u02/oradata/CARL/datafile/o1_mf_sysaux_f0mcoo9w_.dbf	850
	/u02/oradata/CARL/datafile/o1_mf_users_f0mcqyok_.dbf	10
PDB\$SEED	/u02/oradata/CARL/5DDF3C9E4B6F6393E053171E10AC50F1/datafile/o1_mf_undotbs1_f0mcpj7f_.dbf	220
PDB\$SEED	/u02/oradata/CARL/5DDF3C9E4B6F6393E053171E10AC50F1/datafile/o1_mf_sysaux_f0mcp769_.dbf	295
PDB\$SEED	/u02/oradata/CARL/5DDF3C9E4B6F6393E053171E10AC50F1/datafile/o1_mf_system_f0mcob2d_.dbf	210

```
SQL> !ls -l /u02/oradata/CARL/5EF540EAE0F360E3E053171E10AC252C/datafile/
total 0
```

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	ANABELLE	READ WRITE	NO
4	JOHANN12	MIGRATE	YES

```
SQL> SELECT message FROM pdb_plug_in_violations WHERE con_id=4;
```

```
MESSAGE
```

```
-----  
PDB's version does not match CDB's version: PDB's version 12.2.0.1.0. CDB's  
version 18.0.0.0.0.
```

```
oracle@mey[REINHARD]% dbupgrade -c JOHANN12
```

```
Argument list for [/u01/app/oracle/product/18/dbhome_1/rdbms/admin/catctl.pl]
```

```
Run in                c = JOHANN12
```

```
...
```

```
Number of Cpus        = 1
```

```
Database Name         = REINHARD
```

```
DataBase Version      = 18.0.0.0.0
```

```
Generated PDB Inclusion:[JOHANN12]
```

```
CDB$ROOT Open Mode = [OPEN]
```

```
Components in [JOHANN12]
```

```
    Installed [CATALOG CATPROC OWM XDB]
```

```
Not Installed [APEX APS CATJAVA CONTEXT DV EM JAVAVM MGW ODM OLS ORDIM RAC SDO WK XML XOQ]
```

```
...
```

```
Total Upgrade Time:           [0d:0h:42m:21s]
```

```
    Time: 2553s For PDB(s)
```

```
Grand Total Time: 2553s
```

```
LOG FILES:
```

```
(/u01/app/oracle/product/18/dbhome_1/cfgtoollogs/REINHARD/upgrade20181108163304/catupgrd*.log)
```

```
Grand Total Upgrade Time:      [0d:0h:42m:33s]
```

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN	MODE	RESTRICTED
2	PDB\$SEED	READ ONLY		NO
3	ANABELLE	READ WRITE		NO
4	JOHANN12	MOUNTED		

```
SQL> ALTER PLUGGABLE DATABASE JOHANN12 OPEN;
```

Pluggable database altered.

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN	MODE	RESTRICTED
2	PDB\$SEED	READ ONLY		NO
3	ANABELLE	READ WRITE		NO
4	JOHANN12	READ WRITE		NO

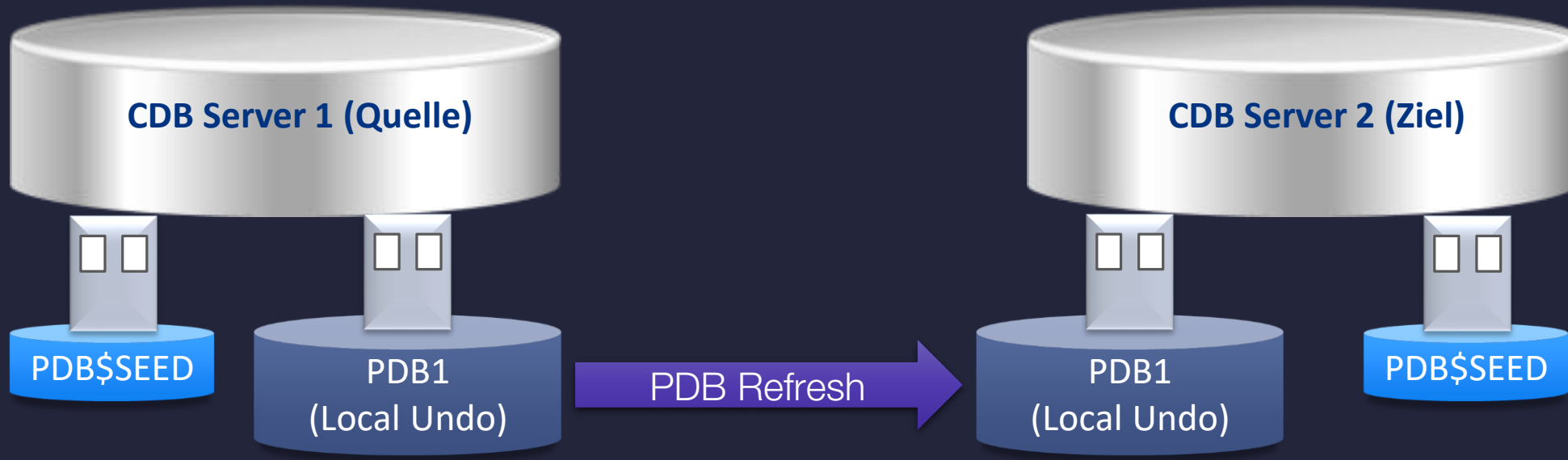
Warum Relocate PDB?

- Migration und Upgrade mit minimaler Downtime
- Migration Non-CDB nach PDB

Refreshable PDB

- Disaster Recover für eine PDB
- Automatische Synchronisation zwischen Quell- und Ziel-PDB
- Gedacht für Test und Entwicklung
- Refreshmodes:
 - None
 - Manual
 - Every n Minutes
- Ziel-PDB bleibt geschlossen

Refreshable PDB



- Erstellung über Datenbank Link

```
SQL> CREATE PLUGGABLE DATABASE cello  
2 FROM cello@udo  
3 REFRESH MODE EVERY 1 MINUTES;
```

Pluggable database created.

Warum Refreshable PDBs?

- Höhere Verfügbarkeit
- Alte Stände sichern

- Lokale Administratoren
 - DBA Berechtigung auf PDB Ebene beschränkt
 - Darf ...
 - User anlegen / löschen
 - Tablespaces anlegen / löschen
 - Any Privileg haben
 - Darf nicht ...
 - Datenbankinstanz starten / stoppen
 - Backup der Datenbank machen
 - „alles“ sehen
- Ideal für DevOps(?)

Aus aktuellem Anlass

- OJVM in der Datenbank
- Oracle Security Alert for CVE-2018-3110

CVE#	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	CVSS VERSION 3.0 RISK (see Risk Matrix Definitions)									Supported Versions Affected	Notes
					Base Score	Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confidentiality	Integrity	Availability		
CVE-2018-3110	Java VM	Create Session	Oracle Net	No	9.9	Network	Low	Low	None	Changed	High	High	High	11.2.0.4, 12.1.0.2, 12.2.0.1, 18	

MOS Note: 2217053.1

RAC Rolling Install Process for the "Oracle JavaVM Component Database PSU" (OJVM PSU) Patches

*"Beginning with the Jan2017 OJVM PSU patchset for 11.2.0.4 and for 12.1.0.2, this document defines a few specific situations where the OJVM PSU patchset can be postinstalled into each database **while the database remains in unrestricted "startup" mode**. This will allow a "Conditional Rolling Install" ability for the OJVM PSU patchsets for 11.2.0.4 and for 12.1.0.2"*

- Oracle 12.2. mit Release Update 180717 (Juli 2018)
- Bug 26430323 : ORA-07445[KKQGBPCHECKVALIDITYDP] WHEN SELECTING FROM DUAL
- “As you are running your 12.2.0.1 version on Windows platform, one off patches are not available for Windows. On Windows bug fixes are released in quarterly patch bundles. The bug will be fixed in Windows although cannot give you a timeframe when this will happen.”

- 22.11. 09 Uhr Oracle 18c XE
- 23.11. DOAG Schulungstag „Oracle XE, die kostenlose Oracle Datenbank“

DOAG



DOAG 2019 Datenbank

3. und 4. Juni 2019 in Düsseldorf

datenbank.doag.org

**DOAG 2019 Datenbank:
Call for Papers gestartet!**

- Experten mit über 25 Jahren Oracle Erfahrung
- Firmensitz in Erftstadt bei Köln
- Spezialisten für
 - Oracle Datenbank Administration
 - Hochverfügbarkeit (RAC, Data Guard, Failsafe, etc.)
 - Einsatz der Oracle Standard Edition
 - Oracle Migrationen (HW, Unicode, Standard Edition)
 - Replikation
 - Performance Tuning
 - Datenbank Cloning (Delphix, Actifio, CloneDB)
- Fernwartung
- Schulung und Workshops (Oracle, Toad)

