

## Consolidation with Oracle Database 12c: Experiences from the Beta Program and Beyond

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### Agenda

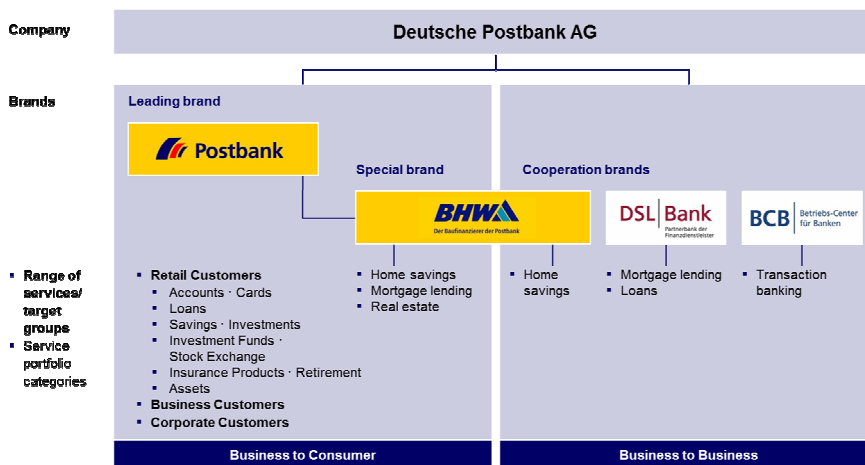
- Postbank – At a Glance
- Beta-Test ... why we joined the program ?
- What's new at the new release ?
- What we had a precise look on ?
- Standard Setup
- Pluggable Database
- Single-tenant vs. Multi-tenant vs. Non-CDB
- Flex ASM
- Conclusion

## One of Germany's Largest Consumer Banks

- 14 million customers (no. 1 in Germany), of which 300,000 business and corporate customers
- 19,000 employees and 3,000 mobile advisors
- Market leader in core products for the private customer business
- Most dense branch network of any bank in Germany
- Leader in online and telephone banking, most-used online offering
- Leading, fully integrated transaction bank in Germany



## Offers by Brands



## Some Figures (excerpt)

### Branches

- 1,100 own branches, 4,500 Deutsche Post branches
- 800 advice centers of Postbank Finanzberatung

### Mobile sales

- 3,000 mobile advisors
- House calls if requested

### Direct sales

- 24/7 call center
- Online banking and online brokerage
- Mobile banking and mobile brokerage
- Direct marketing
- 3,600 Postbank ATMs (incl. Shell) + Cash Group association
- 1,700 statement printers / service terminals

### Transaction Banking

- Processing of more than 7 billion payment transactions per year (including third-party business with e.g. Deutsche Bank, HypoVereinsbank, HSH Nordbank)
- Processing of roughly 2 million loans (including third-party business with DEVK, SwissLife, KfW)
- IT platform with standard software for clients



## Beta-Test ... Why we joined the beta program for Oracle 12c ?

- Development of internal technology roadmap
  - What can we make for the near future (→ time to market)
  - How to provide an even better quality to the customer
  - How to reduce internal expenses
  - What's possibly missing in the product
- Search and find problems - rather in the beta than in production
- Extending the know-how on expert level
- Cooperation care

But of course this includes a considerable internal effort on :

- Staff (expenses, availability)
- Hardware
- Traveling expenses

## What's really new at Oracle Database 12c ?

- 128 pages NEW FEATURES - each function only briefly sketched
- Many long desired small and large functions - but also unexpected features
  - „Auto-Num“ fields as well known from MS-Access (without Trigger)
  - Online „drop index“ and „drop constraint“
  - Online „move partition“ and even a „move datafile“
  - Datatype varchar2 now up to 32 kb
  - SQL-Net Data compression
  - Improvements for the Optimizer (e.g. automatic column group detection, dyn. Statistics)
  - ACFS-Support for all Database-Files
  - Flex ASM (Detach the database from the physical storage/ASM access)
  - Multi-tenancy of the Database „Pluggable Database“
  - Cross-Platform Backup & Restore including „Network Restore DB <-> DB“
  - RMAN „recover table“
  - Parallel Upgrade (using of all available CPU's)
  - Data Migration Assistant for Unicode (also for 10.2 / 11.1 and 11.2)
  - Application Continuity for Java

and much more ...

## What we looked at in more detail?

- Migration of Databases from 10.2 and 11.2 to 12.1
- Compatibility with old applications
  - Network protocol (→ Adv.Security Opt. not longer required for Network-encryption)
  - PL/SQL
  - SQL
- SQL Executionplans
  - New statistics / statistical methods
  - Old method to influence and/or control execution plans
  - Methods to lock execution plans
- Pluggable Database from the point of
  - Consolidation
  - Security (in general and “Advanced Security Option”, better separation of duty in 12c)
  - Administration
  - Self-Service
- Resourcemanagement

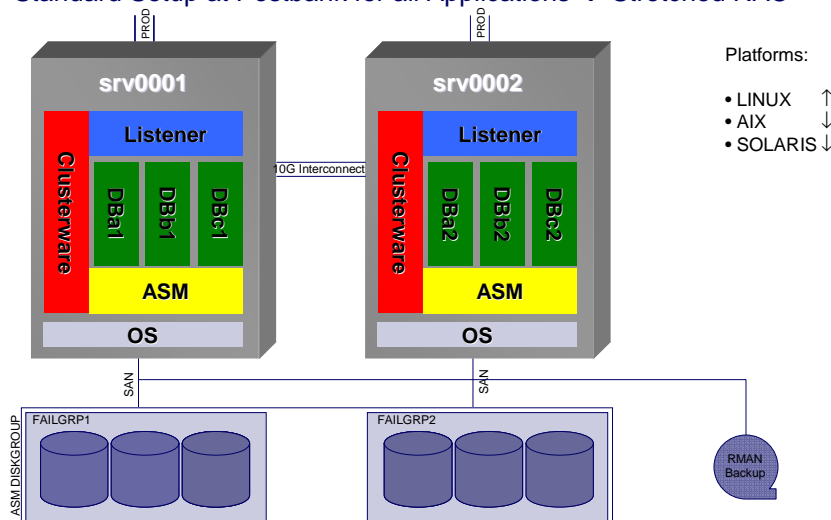
## Migration of Databases from 10.2 and 11.2 to 12.1

- Still possible via SQL scripts
- Supported by the improved DBUA Tool
- In-Place-Upgrade of the Database (post Upgrade of the Clusterware) possible
- The database has now has a (vi SQL-Plus) queryable Patch Repository  
 use: `select * from DBMS_QOPATCH;`  
 This eliminates the need for system login and enables a centrally management.
- Modification of the DB Character set is now much better supported by DMU (Database Migration Assistant for Unicode)
- Migrations using TTS or TDB are now supported by RMAN (incl. crossing endian boundaries)

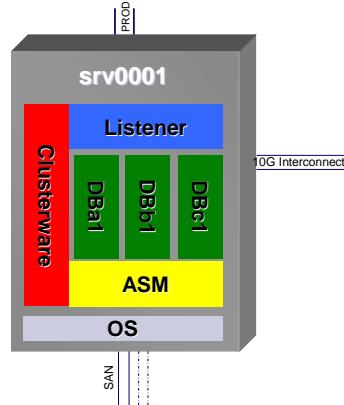
## Compatibility with old applications

- PL/SQL without any issues
- Caution by using SQL-Net-Driver of Version 8
- SQL-Executionplans can be influenced as before and the improved functions for creating the DB-Statistics (→ autom. column-group-stats) can have a positive effect on the run times and resource consumption

## Standard Setup at Postbank for all Applications → Stretched RAC



### Standard Setup - one Node in more detail ...

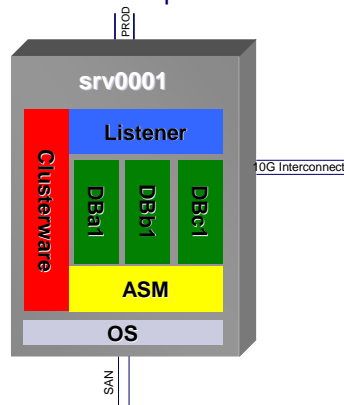


#### Hardware:

HP DL560 Gen8 (former: HP DL580 Gen7)  
 4 Socket - each 6 Core Intel Xenon CPU → 32 Core  
 512 GB RAM  
 2 \* 500 GB local mirrored Disk for OS and Software  
 2 \* 10 GBit Network for dedicated Interconnect A/A  
 2 \* 10 GBit Network for Production Network A/S (Bond)  
 At least 2 \* 8 GBit FibreChannel Disk-SAN  
 (DB with massive IO + 2 \* 8 GBit FibreChannel Disk-SAN)

If one Database on Cluster is larger than 500GB:  
 + 2 \* 8 GBit FibreChannel SAN for Backup (TDPO, Gresham)

### Standard Setup - one Node in more detail ...



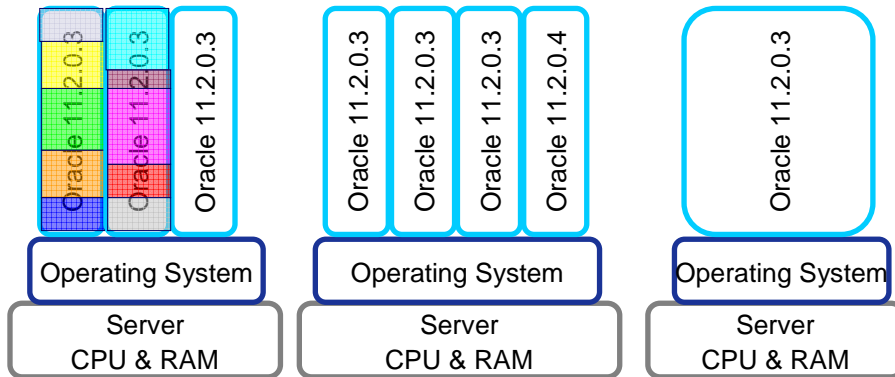
#### Software:

ORACLE Linux 6.3 (with UEK2)  
 ORACLE Clusterware  
 ORACLE Database EE  
 + Options for RAC, Adv.Security, Tuning/Diag.  
 ORACLE Cloud Control 12c

Bladelogic  
 Gresham  
 TDPO  
 MasterCell  
 Patrol  
 Intrusion Detection Software

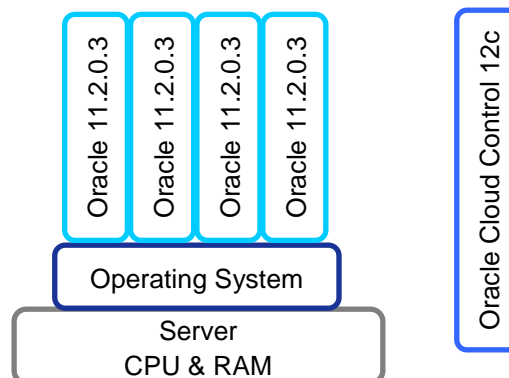
### Offered options at Postbank for Databases ...

- VDB („Database as a Schema“)
- Consolidated Database (default)
- Full DB-Server (high load / high criticality)



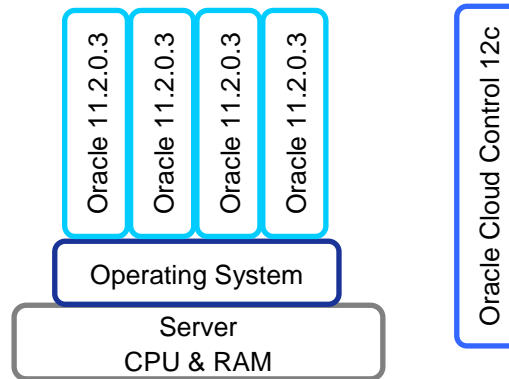
### Pluggable Database ...

- Previous (and still possible consolidation of databases)



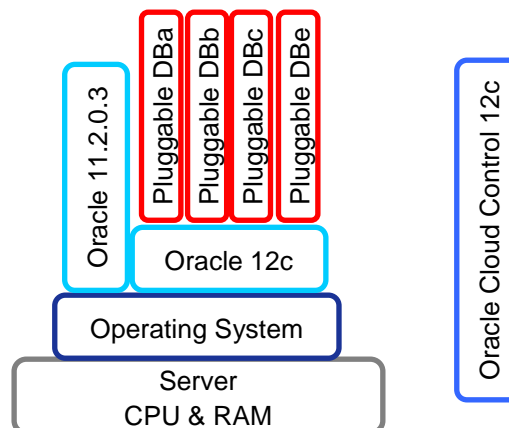
### Pluggable Database ...

- Because of long term experiences we limit the amount of Databases to a maximum of 20 per Cluster:
- sum. amount of processes (→ RT processes)
  - Manageability (Patches / Downtimes etc.)
  - Influences between different Database workloads
  - Max. 2 different patch level of DB on one Cluster



### Pluggable Database ...

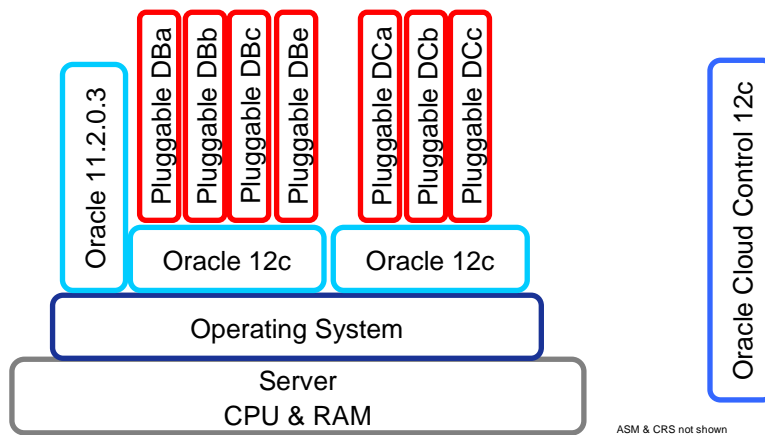
- New functionality that will make the use of VM's in many cases unnecessary





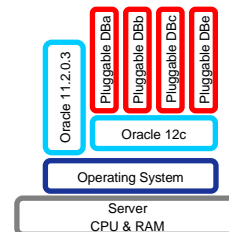
## Pluggable Database ...

You may also use this setup (if you want - we will do so)



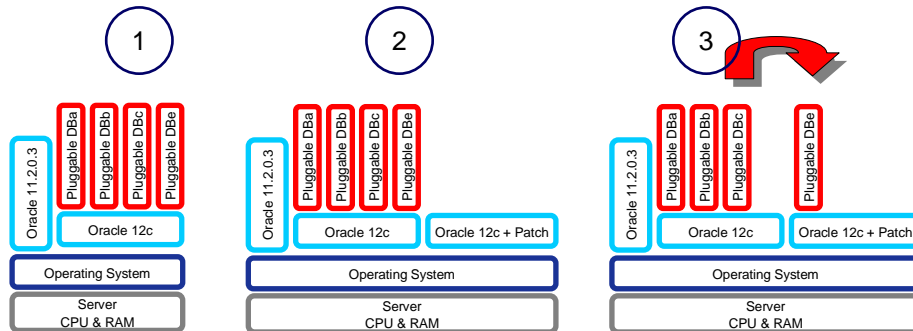
## Pluggable Database ... what is different ?

- Previously you could only assign the numbers of CPUs to each database CPU (cpu\_count) and Load sharing between databases, for example the IO, was not really possible
- Each database had its own exclusive resources
  - SGA
  - PGA
  - SYSTEM / UNDO / TEMP / SYSAUX Tablespaces
  - PL/SQL & table definitions
- Pluggable Databases have:
  - Shared SGA
  - Shared PGA
  - Shared SYSTEM / UNDO / TEMP / SYSAUX Tablespaces
  - Oracle PL/SQL-Packages & Data dictionary definition shared
  - Differences thereof - in their own Tablespaces
  - Thereby an upgrade is much faster ...



## Pluggable Database ... Upgrade

- Installation of new release / patch (out of place)
- ALTER PLUGGABLE DATABASE DBe UNPLUG INTO '/oracle/data/DBe\_pdb.xml';
- DROP PLUGGABLE DATABASE DBe KEEP DATAFILES;
- CREATE PLUGGABLE DATABASE DBe using '/oracle/data/DBe\_pdb.xml';  
(optional with/using move file\_name\_convert = ('DBe','DCe'); )

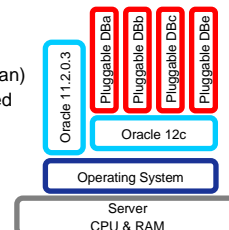


## Pluggable Database ... Security

- Until now we haven't found a way to break out of a Pluggable Database
- The compromising read of "foreign" statements from the SGA is not possible for the PDB
- The global DBA will still find everything (as it was in the past) from the perspective of the CDB-DB (=root)
- External data communication furthermore only by using DB link, external tables or applications
- Granting of permissions and inheritance of users only from PDB to CDB and never backwards

## Resources

- No need to create a dedicated TEMP, UNDO for PDB's (lower Storage-Footprint)
- Each PDB can have „guaranteed“ CPU-Resources and a configured maximum of CPU's
- The total Server-load is controlled by the „root-Database“  
using the parameter CPU\_COUNT=xx  
(→ additionally root can use PROCESSOR\_GROUP\_NAME (cgroup) )
- IO-Resources are manageable globally and as a subset per PDB (resourceplan)
- SGA and PGA are configured and managed by the „root-Database“ – but used shared between all PDB's.  
Pay attention on AUTOMATIC\_MEMORY\_MANAGEMENT  
and autom. resizing of PGA vs. SGA



## Pluggable Database ... Consolidation

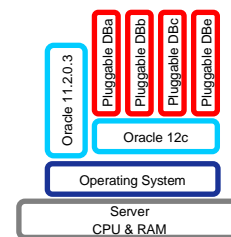
### ■ Considerations for Real Time (RT) Processes in general

- A Real Time process can only run on one CPU (core) at a time
- The usage the CPU is typically short

- One Oracle RAC instance has typically at least one RT process (LMS) per default
- An Oracle ASM instance has one RT process
- Oracle Clusterware uses various RT processes

- In order to guarantee optimized performance and reliability, the general rule of thumb for RAC is:  
→ The aggregated number of LMS RT processes per server should not exceed [cores per server]-1
  - See MOS note: 558185.1 for details

- With Pluggable Databases you can lift this limitation massively
- All PDB shares the CDB – so e.g. 15 PDB uses only 1 RT process



## Pluggable Database ... Consolidation

### ■ Memory Consumption

Because of PGA and SGA-sharing it's possible to reduce the sum(memory\_target of previous DBs)

- In our Testcases we were able to save more than 1/3 of memory without any negative impact, even with better sort and buffer-hitrate

- We were able to manage more than the double amount of DBs on a single Server  
The final limitation was the IO and also the separation of risks ...

### ■ Easy deployment of new (empty) PDB

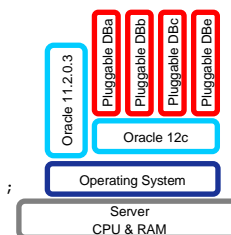
```
CREATE PLUGGABLE DATABASE mynewdb FROM seed;
```

### ■ Deployment of a Clone – just with a simple command

```
CREATE PLUGGABLE DATABASE myclone FROM mysource;
```

### ■ If Clone is deployed on ACFS – it's extremely fast (copy on write / snapshot)

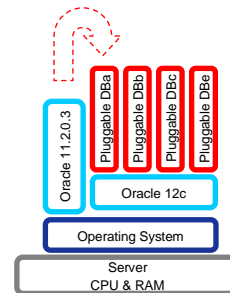
```
CREATE PLUGGABLE DATABASE myclone FROM mysource  
SNAPSHOT COPY  
PATH_PREFIX = '/u01/acfsmounts/data_volumel/MYDB/';
```



## ORACLE DB 11g Migration to a PDB

- Upgrade the 11g Database to a “normal” 12c Database (non-CDB)
- Create the XML-definition
  - Switch Non-CDB to `READ ONLY` mode
  - Create the Manifest-file for Non-CDB
 

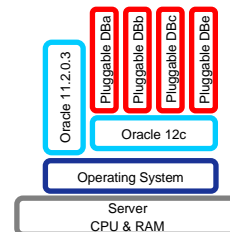
```
execute DBMS_PDB.DESCRIBE ('/path/to/manifest_file.XML');
```
  - Shutdown the Non-CDB
- Plug in the Non-CDB into the CDB (will be restricted open)
- Remove unnecessary metadata from new PDB
  - Just run the script: `noncdb_to_pdb.sql`
- Just a final SHUTDOWN and OPEN (normal) of the new PDB



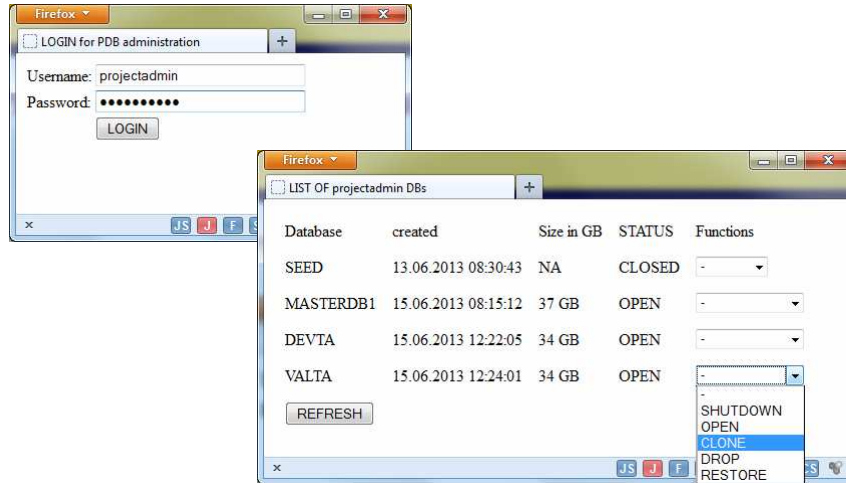
The only way “back” from PDB to non-CDB is DataPump.  
But you wont need that.

## Single-tenant vs. Multi-tenant vs. Non-CDB

- Multi-tenant is an extra-cost option only for EE ☹
- Single-tenant is free of charge vor SE / SE1 / EE ☺
- There is no performance-impact of Non-CDB vs Single-tenant (PDB) ☺
- Unplug/plugin brings you a new functionality for data-transport – better than DataPump
- Unplug/plugin into an empty CDB brings you the new paradigm for fast patching of Oracle Versions
- You get familiar with the new concepts and you will be able to certify your software for this



## Pluggable Database ... Self Service



## ASM ... the Upgrade and new functionality ...

If ASMCA detects an Oracle ASM instance from a previous release, then ASMCA prompts whether you want to upgrade the instance. Oracle recommends that you respond **NO** this prompt.

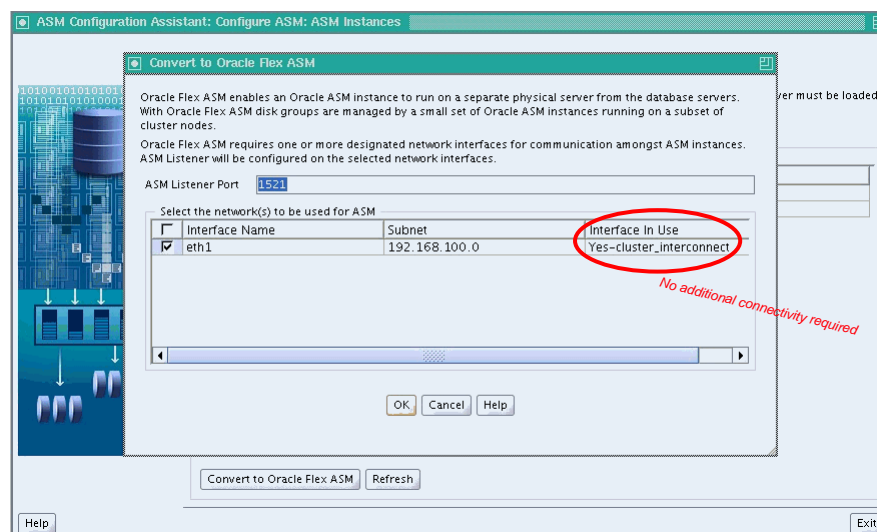
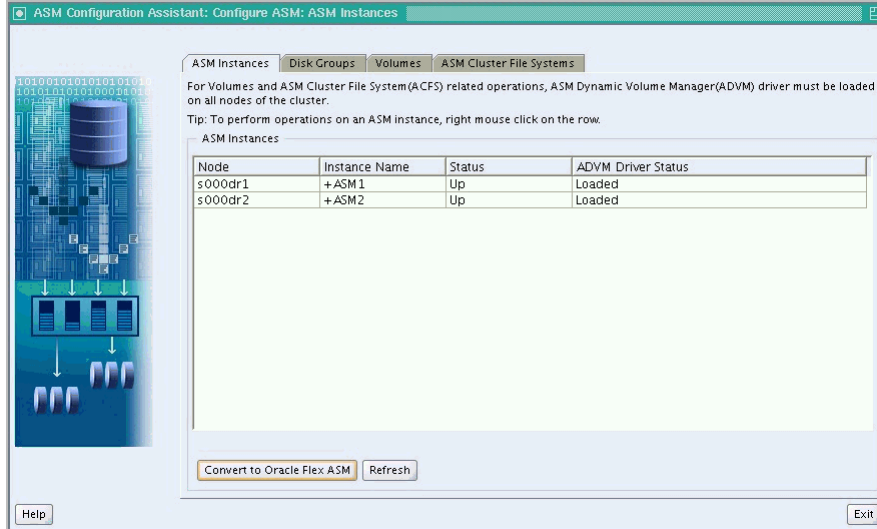
An Oracle ASM instance should be upgraded with Oracle Universal Installer (OUI). OUI automatically defaults to upgrade mode when it detects an Oracle ASM instance at a previous release level.

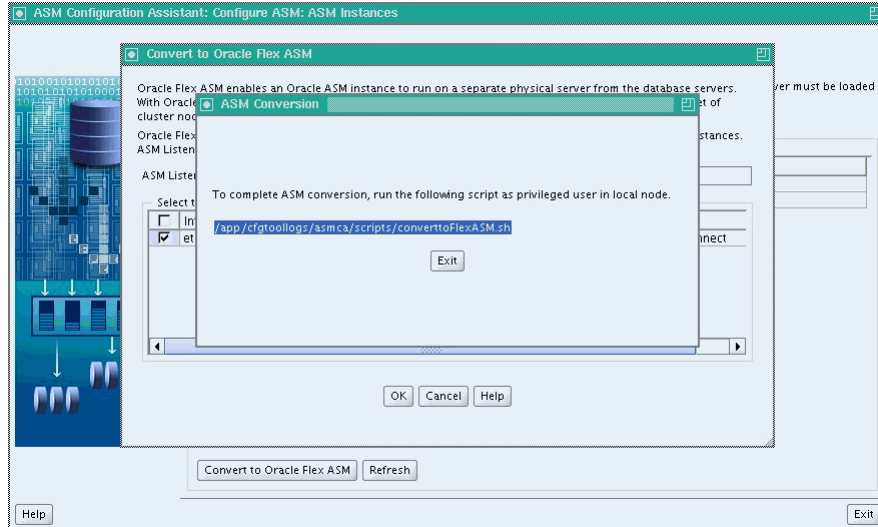
Post upgrade you should enable the new Flex ASM feature :

```
asmca [-silent] -convertToFlexASM -asmNetworks eth1/192.168.100.0 -asmListenerPort 1521
```

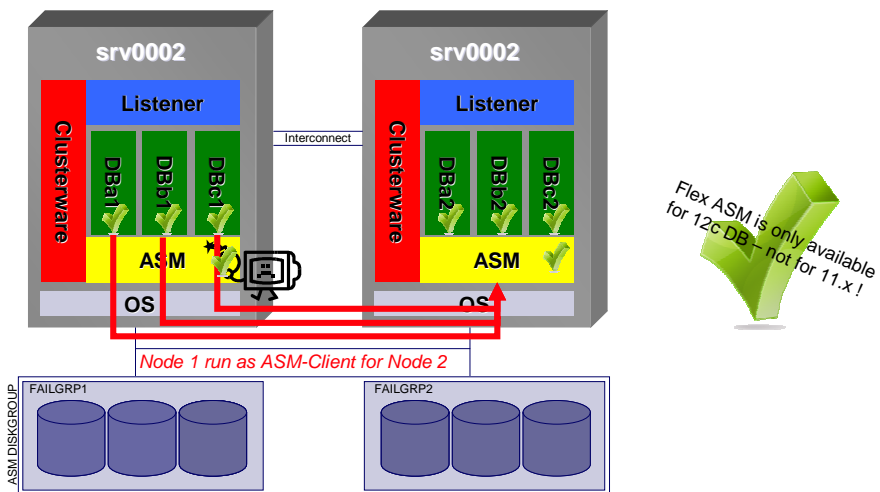


## Flex ASM ... Enable the new Storage Availability





### ASM – with Oracle 12c and Flex ASM





## Conclusion / Last but not least ...

- Lots and lots of great new features and options (→ training & testing is a must !)
  - A huge amount of tests – and we continue ... to find and define our internal limits for production
  - Delayed several times - to fix the lasted problems found
  - Finally available ...
  - **READY for use ...**
- 
- **MANY THANKS** to Bryn Llewellyn / Lynn Snider and the Team @Oracle for outstanding Support during the complete Beta



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