

AutoUpgrade 2.0 Internals and New Features

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dohdatabase



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<https://dohdatabase.com>





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Episode 1

Release and Patching Strategy

105 minutes – Feb 4, 2021



Episode 2

AutoUpgrade to Oracle Database 19c

115 minutes – Feb 20, 2021



Episode 3

Performance Stability, Tips and Tricks and Underscores

120 minutes – Mar 4, 2021



Episode 4

Migration to Oracle Multitenant

120 minutes – Mar 16, 2021



Episode 5

Migration Strategies – Insights, Tips and Secrets

120 minutes – Mar 25, 2021



Episode 6

Move to the Cloud – Not only for techies

115 minutes – Apr 8, 2021



Recorded Web Seminars

<https://MikeDietrichDE.com/videos>



Always use the latest
version of AutoUpgrade

Download from My Oracle Support (2485457.1)

Backwards Compatible

```
$ java -jar autoupgrade.jar -version
```

```
build.version 22.5.221011
```

```
build.date 2022/10/11 14:23:59 -0400
```

```
build.hash e9428661
```

```
build.hash_date 2022/10/11 12:55:45 -0400
```

```
build.supported_target_versions 12.2,18,19,21
```

```
build.type production
```

AutoUpgrade

Patching

Database Patching
Simple
Easy
Familiar

Encryption

Usability

Refreshable Clone

Distributed Upgrade

We made upgrading easy.
Now we make patching just as easy.

AutoUpgrade functionality extended to patching

Patching

1

Install Oracle Home
including Release Update
and additional patches
(MOS Doc ID 555.1)

2

Create a simple
configuration file

3

Start AutoUpgrade
in deploy mode

Patching

```
$ cat DB19.cfg
```

```
patch1.source_home=/u01/app/oracle/product/19.0.0.0/dbhome_19_15_0
```

```
patch1.target_home=/u01/app/oracle/product/19.0.0.0/dbhome_19_16_0
```

```
patch1.sid=DB19
```

```
$ java -jar autoupgrade.jar -config DB19.cfg -mode deploy
```

Patching



USE

Familiar interface
Console
Logging



ANALYZE

Prechecks
Summary report



PROTECT

Resumable
Restoration
Restore point
Fallback

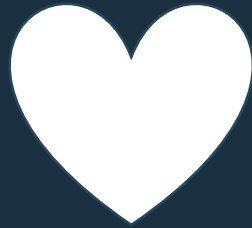


AUTOMATE

srvctl
/etc/oratab
Files
Datapatch



Patching



Encryption

Hot clone

Refreshable clone

RAC

Proactive fixups

Distributed upgrade

...

Patching



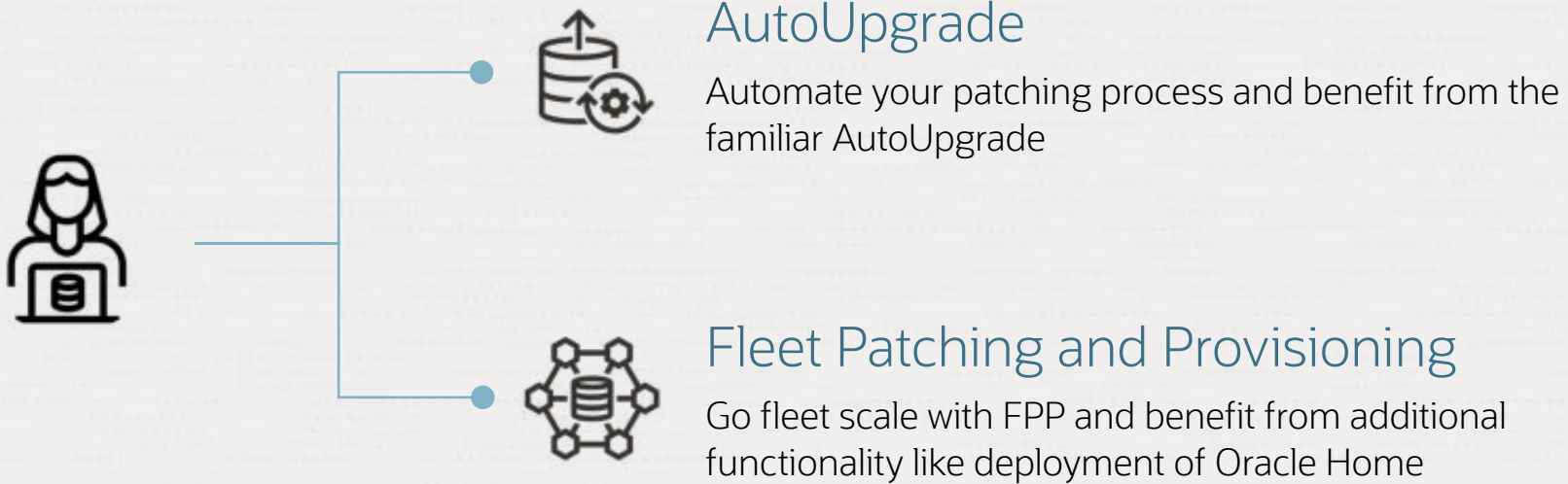
What's missing

Windows

RAC rolling

Data Guard standby-first

Patching



DEMO

Patching from 19.14.0 to 19.16.0

[Watch on YouTube](#)



AutoUpgrade

Patching

Encryption

Usability

Refreshable Clone

Unplug-plug upgrades
Non-CDB to PDB conversion
Minimal downtime

Distributed Upgrade

Non-CDB to PDB conversion is irreversible

What are your fallback options?

PDB Conversion

FALLBACK



Backup / restore

Ensure you have a recent backup and requires time to restore and recover



Copy data files

Requires time and disk space to hold a copy of the data files

PDB Conversion

FALLBACK



Backup / restore

Ensure you have a recent backup and requires time to restore and recover



Copy data files

Requires time and disk space to hold a copy of the data files



Refreshable clone

Requires ~~time and~~ disk space to hold a copy of the data files

Requires Oracle Database 12.2 or newer

Refreshable Clone



CREATE

Create PDB from non-CDB over a database link



REFRESH

Apply redo from non-CDB to keep PDB up-to-date



OUTAGE

Disconnect users and refresh PDB for the last time



CONVERT

To become a proper PDB, it must be converted

Refreshable Clone

Source non-CDB

Target CDB



```
CREATE USER dblinkuser  
  IDENTIFIED BY ... ;  
  
GRANT CREATE SESSION,  
  CREATE PLUGGABLE DATABASE,  
  SELECT_CATALOG_ROLE TO dblinkuser;  
  
GRANT READ ON sys.enc$ TO dblinkuser;
```

```
CREATE DATABASE LINK CLONEPDB  
  CONNECT TO dblinkuser  
  IDENTIFIED BY ...  
  USING 'noncdb-alias';
```

Refreshable Clone

Source non-CDB

Target CDB



```
upg1.source_home=/u01/app/oracle/product/12.2.0.1  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=NONCDB1  
upg1.target_cdb=CDB1  
upg1.source_dblink.NONCDB1=CLONEPDB  
upg1.target_pdb_name.NONCDB1=PDB1
```

Refreshable Clone

Source non-CDB

Target CDB



```
upg1.source_home=/u01/app/oracle/product/12.2.0.1  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=NONCDB1  
upg1.target_cdb=CDB1  
upg1.source_dblink.NONCDB1=CLONEPDB 300  
upg1.target_pdb_name.NONCDB1=PDB1
```

Refreshable Clone

Source non-CDB

Target CDB



```
upg1.source_home=/u01/app/oracle/product/12.2.0.1
upg1.target_home=/u01/app/oracle/product/19
upg1.sid=NONCDB1
upg1.target_cdb=CDB1
upg1.source_dblink.NONCDB1=CLONEPDB 300
upg1.target_pdb_name.NONCDB1=PDB1
upg1.start_time=22/10/2022 02:00:00
--Specify relative start time
--upg1.start_time=+1h30m
```

Refreshable Clone



`autoupgrade.jar ... -mode deploy`

`upg1.start_time=22/10/2022 02:00:00`



The source non-CDB stays intact
to allow fallback





Works for unplug-plug upgrades as well



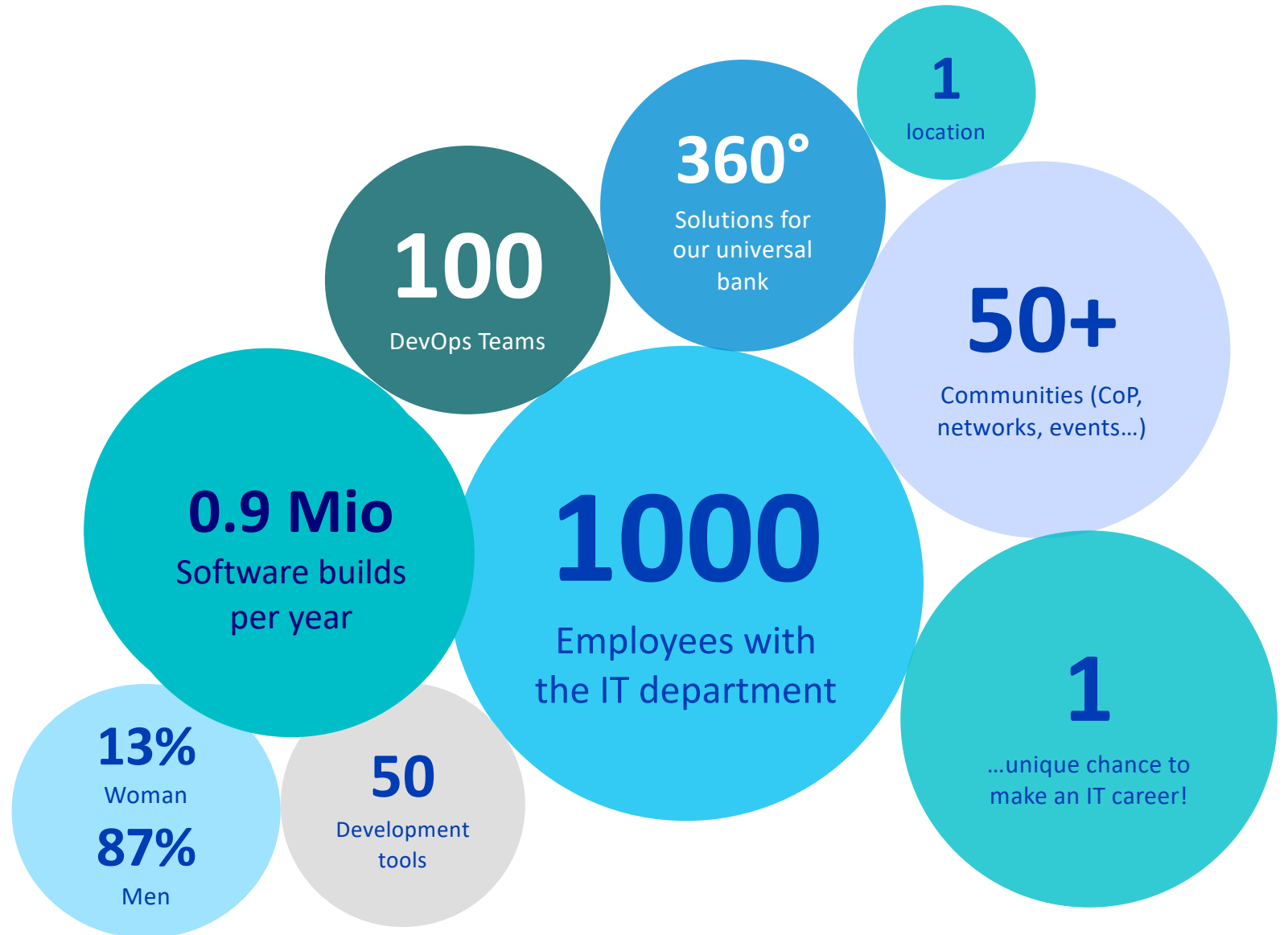
we have been a reliable partner for almost 150 years



- the bank for the **people of Zurich** since 1870
- with over **5'100 employees** one of the biggest employers in the canton of Zurich
- a globally networked **full-service bank** with strong regional and local roots

650

+applications like eBanking, Mobile Banking and ZKB Twint (mobile payment)





about me

- 45 years old, married, 8 year old daughter
- working with Oracle since 1997
- DBA at Zürcher Kantonalbank since 2011
- now DBA & Solution architect for Oracle topics
- Organizer of Oracle Beer ZH Meetup Events



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- Oracle databases on old OS and on Oracle Exadata
- till end of 2023: migrating all databases from old OS to Exadata compute nodes
- starting 2024: consolidating all databases to Multitenant and Oracle's next generation long-term release
- planned solution: **AutoUpgrade** utility

3 test databases

- Exadata X6-2 compute node
- 7 Storage-Cells (2x X6-2L / 3x X7-2L / 2x X8-2L)
- Oracle rdbms 19.15
- no additional options

Source	Size / GB
TEST40 (108)	165
TEST42 (107)	555
TEST41 (106)	18'496

create the DB-Link-User

```
create user dblinkuser identified by Oracle_4UOracle_4U;
```

grant permissions

```
grant CONNECT, RESOURCE, CREATE PLUGGABLE DATABASE,  
select_catalog_role to dblinkuser;  
grant all on sys.enc$ to dblinkuser;
```

create DB link on destination DB

```
create database link test42.domain connect to dblinkuser identified  
by oracle_4uoracle_4u using 'test42.domain';
```

```
> cat migrateTESTDBs.cfg
test40.log_dir=/home/oracle/logs_TEST40
global.autoupg_log_dir=/home/oracle/AULOG
test40.source_home=/app/oracle/product/19.15.0.0.220419
test40.target_home=/app/oracle/product/19.15.0.0.220419
test40.sid=TEST40
test40.target_cdb=CDBTST02
test40.source_dblink.TEST40=TEST40.domain 3600
test40.target_pdb_name.TEST40=TEST40X
test40.target_pdb_copy_option.TEST40=file_name_convert=NONE
test42.log_dir=/home/oracle/logs_TEST42
test42.source_home=/app/oracle/product/19.15.0.0.220419
test42.target_home=/app/oracle/product/19.15.0.0.220419
test42.sid=TEST42
test42.target_cdb=CDBTST02
test42.source_dblink.TEST42=TEST42.domain 3600
test42.target_pdb_name.TEST42=TEST42X
test42.target_pdb_copy_option.TEST42=file_name_convert=NONE
test41.log_dir=/home/oracle/logs_TEST41
test41.source_home=/app/oracle/product/19.15.0.0.220419
test41.target_home=/app/oracle/product/19.15.0.0.220419
test41.sid=TEST41
test41.target_cdb=CDBTST02
test41.source_dblink.TEST41=TEST41.domain 3600
test41.target_pdb_name.TEST41=TEST41X
test41.target_pdb_copy_option.TEST41=file_name_convert=NONE
```

migration - autoupgrade start

```
> java -jar /app/oracle/product/19.15.0.0.220419/rdbms/admin/autoupgrade.jar -config [REDACTED].cfg -mode deploy
AutoUpgrade 22.5.220913 launched with default internal options
Processing config file ...
```

```
+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|START_TIME|  UPDATED|  MESSAGE|
+-----+
| 106|  | CLONEPDB|EXECUTING| RUNNING| 09:50:39|!!!17381s ago|Creating pluggable database|
| 107|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
| 108|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
+-----+
Total jobs 3

The command lsj is running every 60 seconds. PRESS ENTER TO EXIT

+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|START_TIME|  UPDATED|  MESSAGE|
+-----+
| 106|  | CLONEPDB|EXECUTING| RUNNING| 09:50:39|!!!17441s ago|Creating pluggable database|
| 107|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
| 108|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
+-----+
Total jobs 3

The command lsj is running every 60 seconds. PRESS ENTER TO EXIT

+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|START_TIME|  UPDATED|  MESSAGE|
+-----+
| 106|  | CLONEPDB|EXECUTING| RUNNING| 09:50:39|!!!17501s ago|Creating pluggable database|
| 107|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
| 108|  |COMPLETED| STOPPED|FINISHED| 09:50:40|  |  |
+-----+
Total jobs 3

The command lsj is running every 60 seconds. PRESS ENTER TO EXIT
```

Source	Runtime/Min
TEST40 (108)	26
TEST42 (107)	ongoing
TEST41 (106)	ongoing

migration – “finished”

```
The command lsj is running every 60 seconds. PRESS ENTER TO EXIT
+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|  START_TIME|UPDATED| MESSAGE|
+-----+
| 106|  | CLONEPDB|  STOPPED|  ERROR|Oct-03 09:50|  |UPG-4016|
| 107|  |COMPLETED|  STOPPED|FINISHED|Oct-03 09:50|  |  |
| 108|  |COMPLETED|  STOPPED|FINISHED|Oct-03 09:50|  |  |
+-----+
Total jobs 3

The command lsj is running every 60 seconds. PRESS ENTER TO EXIT
+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|  START_TIME|UPDATED| MESSAGE|
+-----+
| 106|  | CLONEPDB|  STOPPED|  ERROR|Oct-03 09:50|  |UPG-4016|
| 107|  |COMPLETED|  STOPPED|FINISHED|Oct-03 09:50|  |  |
| 108|  |COMPLETED|  STOPPED|FINISHED|Oct-03 09:50|  |  |
+-----+
Total jobs 3

The command lsj is running every 60 seconds. PRESS ENTER TO EXIT

upg>
upg> exit
There is 1 job in progress. if you exit it will stop
Are you sure you wish to leave? [y|N] y
----- Final Summary -----
Number of databases      [ 3 ]

Jobs finished             [2]
Jobs failed               [1]
```

Source	Runtime/Min
TEST40 (108)	26
TEST42 (107)	226 (~3.5h)
TEST41 (106)	1770 (29h)

1st error: archivelogs on source DB missing during refresh of the 18TB DB

solution: restore archivelogs needed from backup

2nd error: user profile with idle_time defined; an idle session was killed because of idle_time setting

solution: different profile for sourcedb_user configured and migration restarted

3rd error: ORA-600 [4293]

still under investigation

Tip: think about these kind of errors before starting a long-running migration



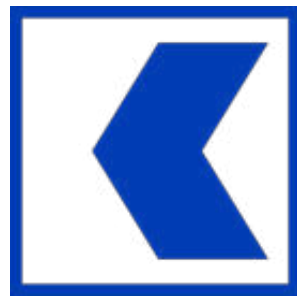
**comfortable to
use
(does everything
automatically)**

**without
extra
license
costs**

**very
stable**

**easy
syntax**

**perfect for
pre-
migration
tests**



Zürcher
Kantonalbank

AutoUpgrade

Patching

Encryption

Fully supported
TDE Tablespace Encryption
Dedicated keystore

Usability

Refreshable Clone

Distributed Upgrade



Upgrading and converting
encrypted databases are fully supported



Encryption

- Certain database operations require passwords or secrets

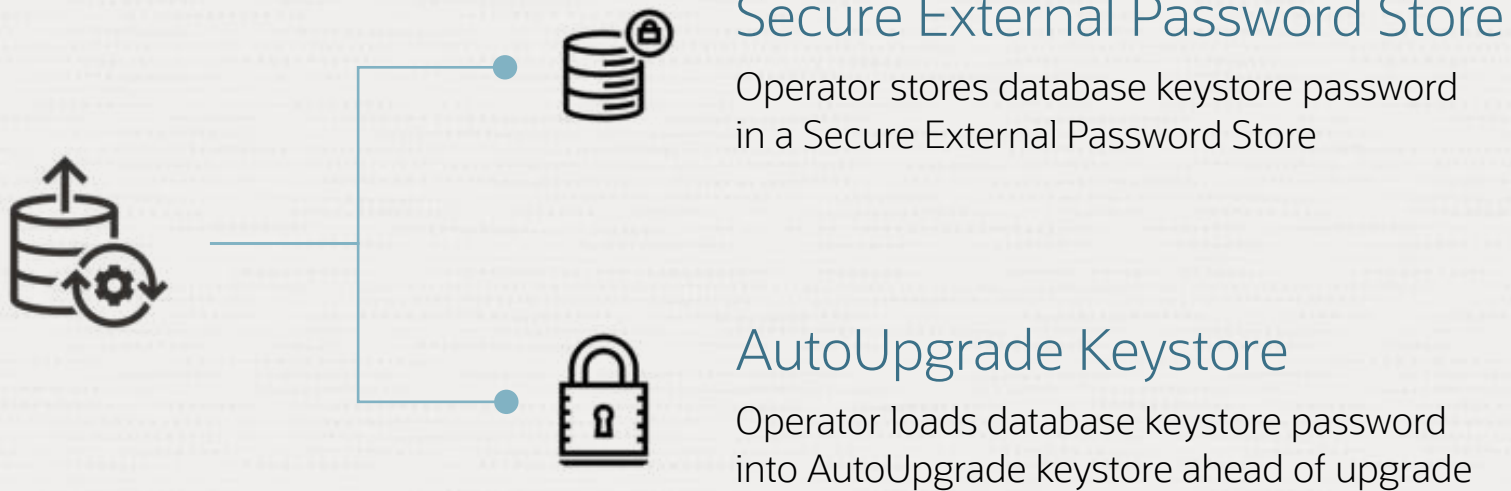
```
CREATE PLUGGABLE DATABASE ... KEYSTORE IDENTIFIED BY <password>
```

```
ALTER PLUGGABLE DATABASE ... UNPLUG INTO ... ENCRYPT USING <secret>
```

```
CREATE PLUGGABLE DATABASE ... DECRYPT USING <secret>
```

```
ADMINISTER KEY MANAGEMENT ... KEYSTORE IDENTIFIED BY <password>
```

Encryption



Encryption | Configuration

- To configure an AutoUpgrade keystore

```
$ cat DB12.cfg  
  
global.keystore=/etc/oracle/keystores/autoupgrade/DB12  
global.autoupg_log_dir=/u01/app/oracle/cfgtoollogs/autoupgrade  
upg1.source_home=/u01/app/oracle/product/12.2.0.1  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=DB12
```

Encryption | Analysis

- Analyze the database for upgrade readiness

```
$ java -jar autoupgrade.jar -config PDB1.cfg -mode analyze
```

- Summary report will show which keystore passwords are needed:

REQUIRED ACTIONS	
=====	
1. Perform the specified action ...	
ORACLE_SID	Action Required
-----	-----
CDB1	Add TDE password
CDB2	Add TDE password



DEMO

Upgrading an encrypted database and converting to PDB

[Watch on YouTube](#)



AutoUpgrade

Patching

Encryption

Usability

Refreshable Clone

Distributed Upgrade

RAC feature
Performance enhancement
PDB availability

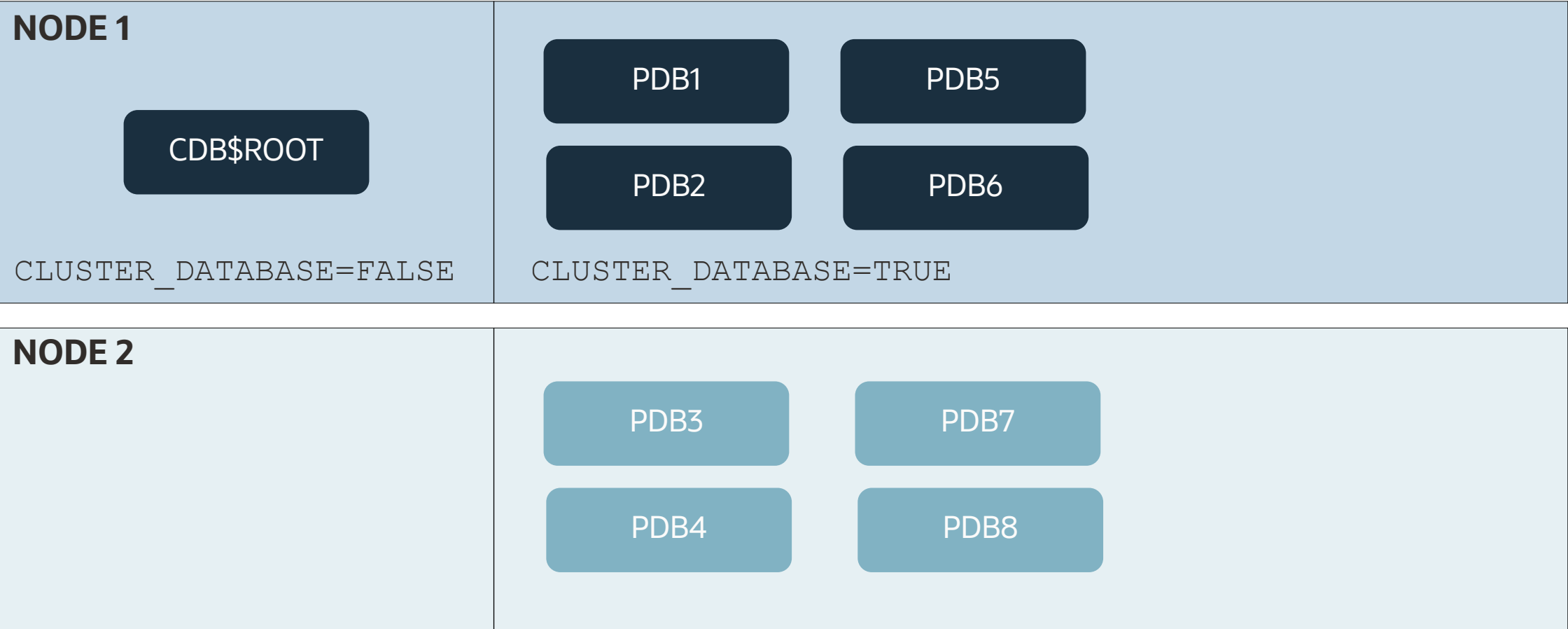
Distributed upgrade uses all nodes resulting in faster upgrades of CDBs

Applies to RAC and multitenant architecture only

Distributed Upgrade



Distributed Upgrade



RAC | Distributed Upgrade

- To enable distributed upgrade:

```
$ cat RACDB.cfg

global.autoupg_log_dir=/u01/app/oracle/cfgtoollogs/autoupgrade
upg1.log_dir=/u01/app/oracle/cfgtoollogs/autoupgrade/RACDB
upg1.source_home=/u01/app/oracle/product/12.2.0.1
upg1.target_home=/u01/app/oracle/product/19
upg1.sid=RACDB
upg1.tune_setting=distributed_upgrade=true

$ java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```


RAC

41%

In benchmark, time saved by using distributed upgrade

- 2 node RAC database
- 4 CPUs each
- CDB with 8 PDBs





By default, AutoUpgrade uses two nodes



RAC | Distributed Upgrade

- To enable more nodes:

```
$ cat RACDB.cfg

global.autoupg_log_dir=/u01/app/oracle/cfgtoollogs/autoupgrade
upg1.log_dir=/u01/app/oracle/cfgtoollogs/autoupgrade/RACDB
upg1.source_home=/u01/app/oracle/product/12.2.0.1
upg1.target_home=/u01/app/oracle/product/19
upg1.sid=RACDB
upg1.tune_setting=distributed_upgrade=true,active_nodes_limit=n

$ java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```

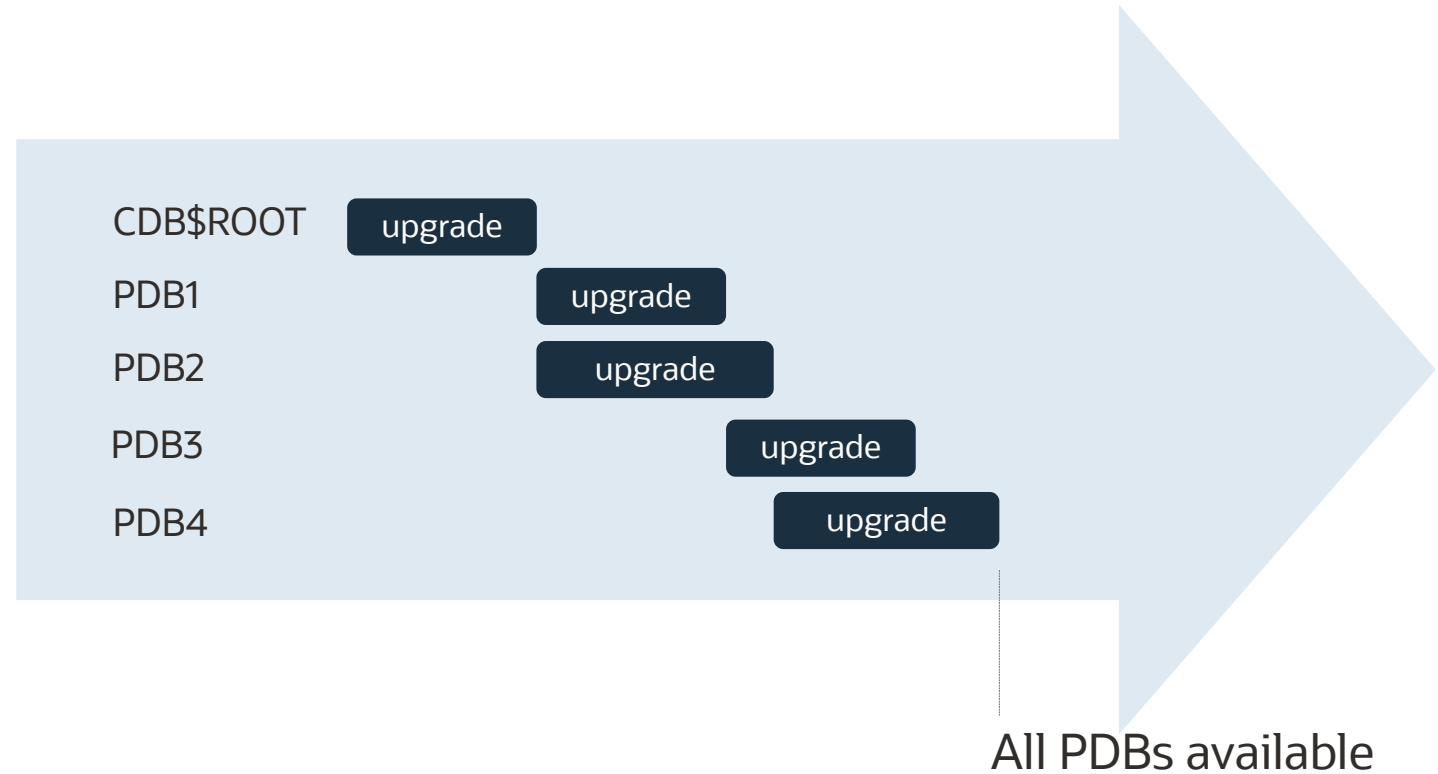
Some PDBs are more important

Control the order of upgrade

PDB Availability

DEFAULT

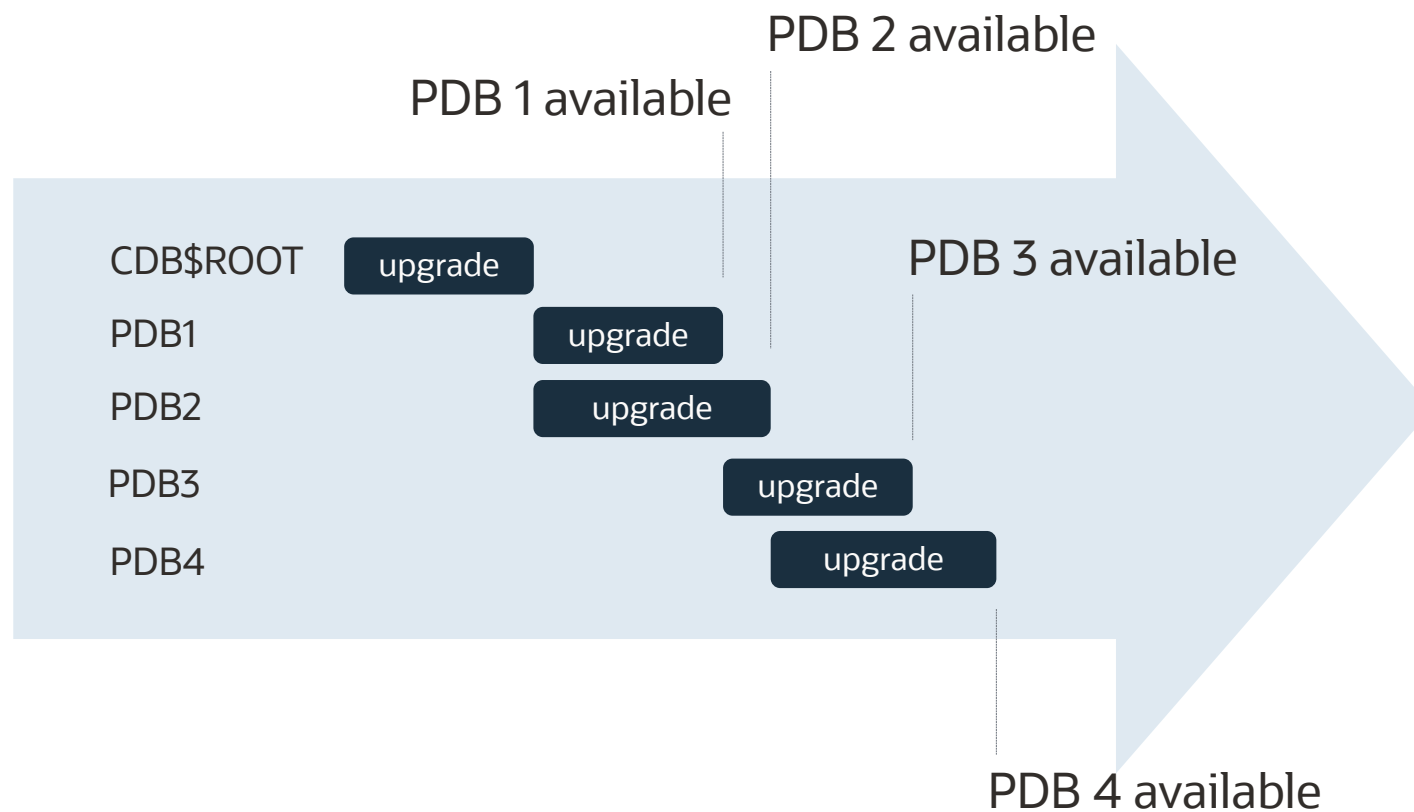
`make_pdb_available=false`



PDB Availability

IMMEDIATELY AVAILABLE

```
make_pdb_available=true
```



PDB Availability

```
alter pluggable database SALESPROD priority 1;
```

```
alter pluggable database SALESDEV priority 2;
```

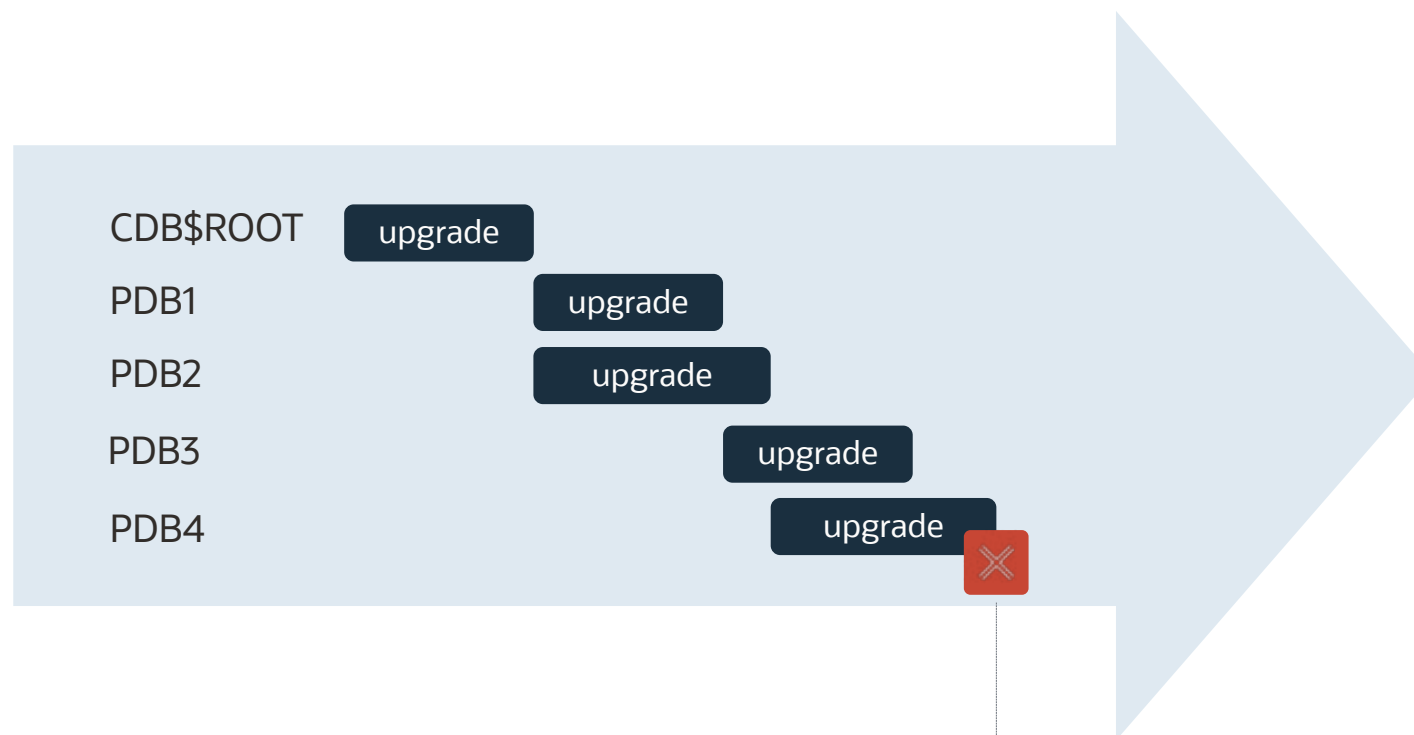
```
alter pluggable database SALESUAT priority 2;
```

```
alter pluggable database SALESTEST priority 3;
```

PDB Availability

IMMEDIATELY AVAILABLE

`make_pdb_available=true`



PDB 4 crash ...

Flashback entire CDB?



AutoUpgrade

Patching

Encryption

Usability

Repeating commands
History
Fixup lists

Refreshable Clone

Distributed Upgrade

DEMO

Enhancing the console experience

[Watch on YouTube](#)



New Console Commands

--Repeat lsj command every 10 seconds

lsj -a 10

--Repeat status command every 10 seconds

status -jobid *n* -a 10

--Repeat last command

/

--Show history of commands

h

--Repeat command number *n* from history

/n

--Show fixups for a job

fxlist -job *n*

--Disable a fixup

--Example: fxlist -job 100 -c DB12 alter
OLD_TIME_ZONES_EXIST run no

fxlist -job *n* -c <container> alter <fixup>
run no



ORACLE
CloudWorld

Thank you

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