



# AUTOUPGRADE 2.0 INTERNALS AND NEW FEATURES

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ORACLE

## MICHIGAN ORACLE USERS SUMMIT 2022

Wednesday October 26, 2022

IN-PERSON event





## Roy Swonger

Vice President

Database Upgrade, Utilities & Patching

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royfswonger



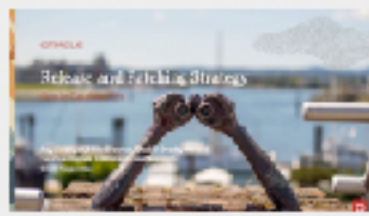
@royfswonger



Episode 1

Release and Patching Strategy

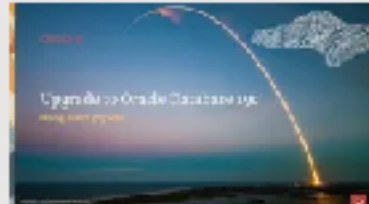
105 minutes - Feb 4, 2021



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

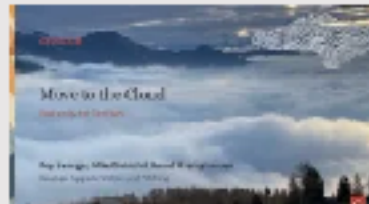
120 minutes - Mar 25, 2021



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



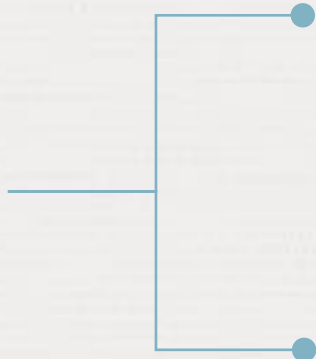
## What's missing

Windows

RAC rolling

Data Guard standby-first

# Patching



## AutoUpgrade

Automate your patching process and benefit from the familiar AutoUpgrade



## Fleet Patching and Provisioning

Go fleet scale with FPP and benefit from additional functionality like deployment of Oracle Home





# 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

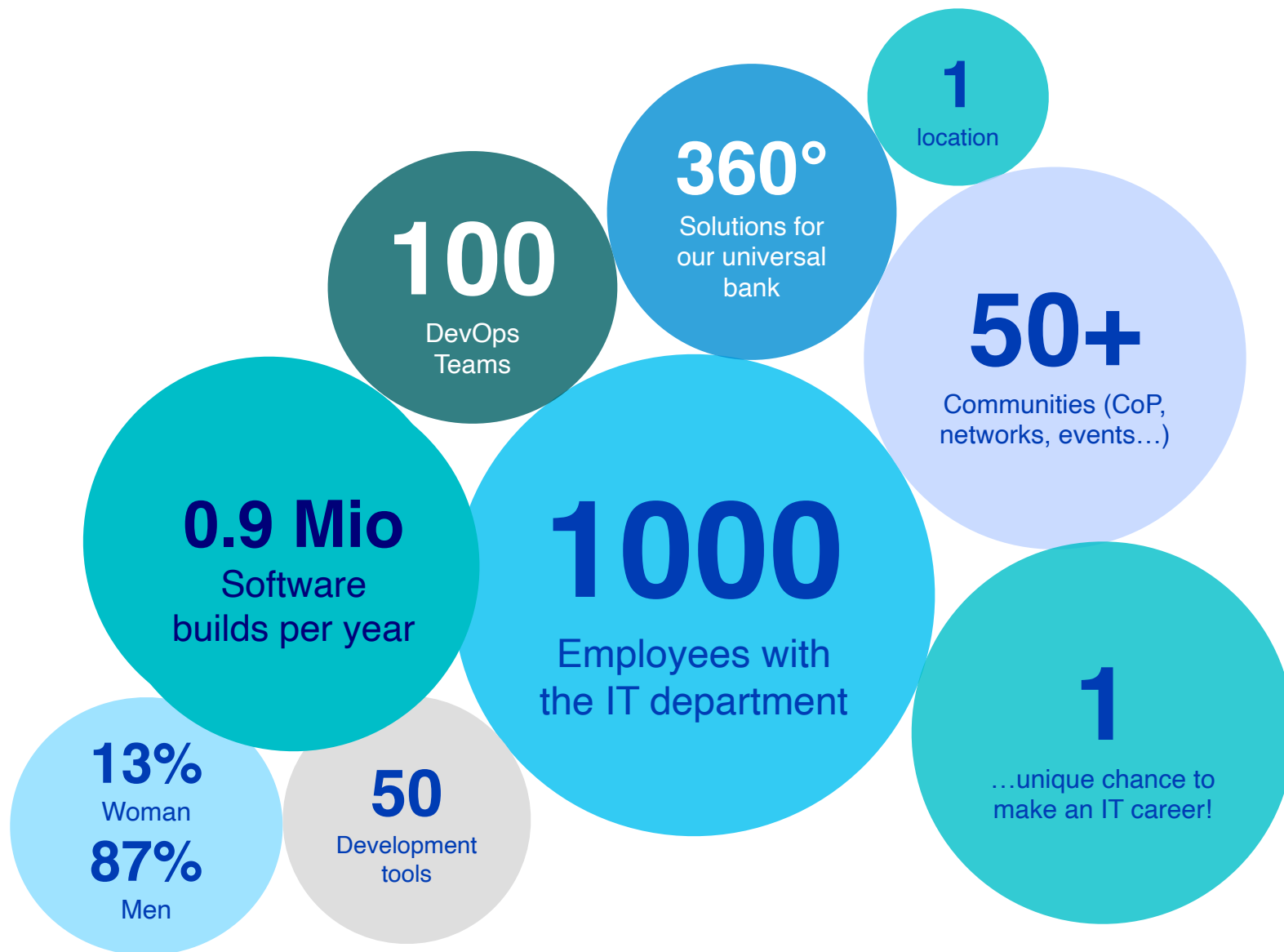


- the bank for the **people of Zurich** since 1870
- with over **5'100 employees** one of the biggest employers in the canton of Zurich
- a globally networked **full-service bank** with strong regional and local roots

# IT made in Chreis 5

# 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

 [www.linkedin.com/in/christian\\_marquardt\\_ch](https://www.linkedin.com/in/christian_marquardt_ch)

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 <https://oracle-beer.blog>

X [#ITmadeInChreis5](#)



# current situation

- 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

# preparation

## 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';
```



# migration - the config file

```
> cat migrateTESTDDs.cfg
test40.log_dir=/home/oracle/logs_TEST40
global.autoupg_log_dir=/home/oracle/AUTUPG
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 ...
```

# migration – in progress

```

[Job#|DB_NAME| STAGE|OPERATION| STATES|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| STATES|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| STATES|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 [a] is running every 60 seconds. PRESS ENTER TO EXIT
-----+-----+-----+-----+-----+-----+-----+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|  START TIME|UPDATED| MESSAGE|
-----+-----+-----+-----+-----+-----+-----+-----+
| 106|      | CLONEDD| STOPPED|  ERROR|Oct-03 09:50|      | DPG-4010|
| 107|      | COMPLETED| STOPPED|FINISHED|Oct-03 09:50|      |      |
| 108|      | COMPLETED| STOPPED|FINISHED|Oct-03 09:50|      |      |
-----+-----+-----+-----+-----+-----+-----+-----+
Total jobs 3

The command [a] is running every 60 seconds. PRESS ENTER TO EXIT
-----+-----+-----+-----+-----+-----+-----+-----+
|Job#|DB_NAME|  STAGE|OPERATION|  STATUS|  START TIME|UPDATED| MESSAGE|
-----+-----+-----+-----+-----+-----+-----+-----+
| 106|      | CLONEDD| STOPPED|  ERROR|Oct-03 09:50|      | DPG-4010|
| 107|      | COMPLETED| STOPPED|FINISHED|Oct-03 09:50|      |      |
| 108|      | COMPLETED| STOPPED|FINISHED|Oct-03 09:50|      |      |
-----+-----+-----+-----+-----+-----+-----+-----+
Total jobs 3

The command [a] is running every 60 seconds. PRESS ENTER TO EXIT

ump?
ump> exit
There is 1 job in program. 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)

# errors during migration

**1st error:** archive logs on source DB missing during refresh of the 18TB DB

solution: restore archive logs 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

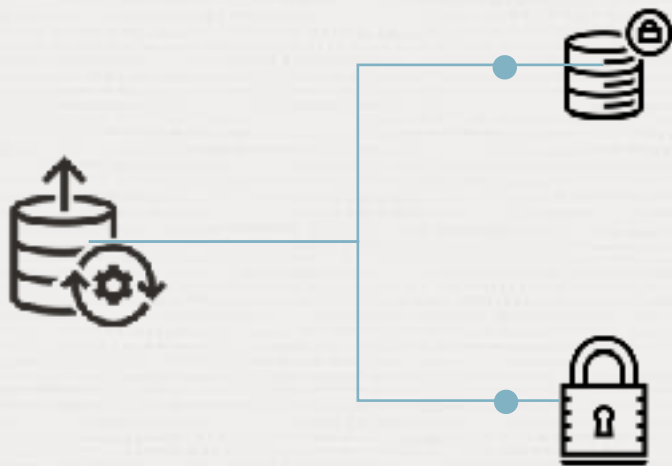
```
CREATE PLUGGABLE DATABASE ... KEYSTORE IDENTIFIED BY <password>
```

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

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

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

# Encryption



## Secure External Password Store

Operator stores database keystore password in a Secure External Password Store

## AutoUpgrade Keystore

Operator loads database keystore password into AutoUpgrade keystore ahead of upgrade



# 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

## NODE 1

CDB\$ROOT

PDB1

PDB3

PDB5

PDB7

PDB2

PDB4

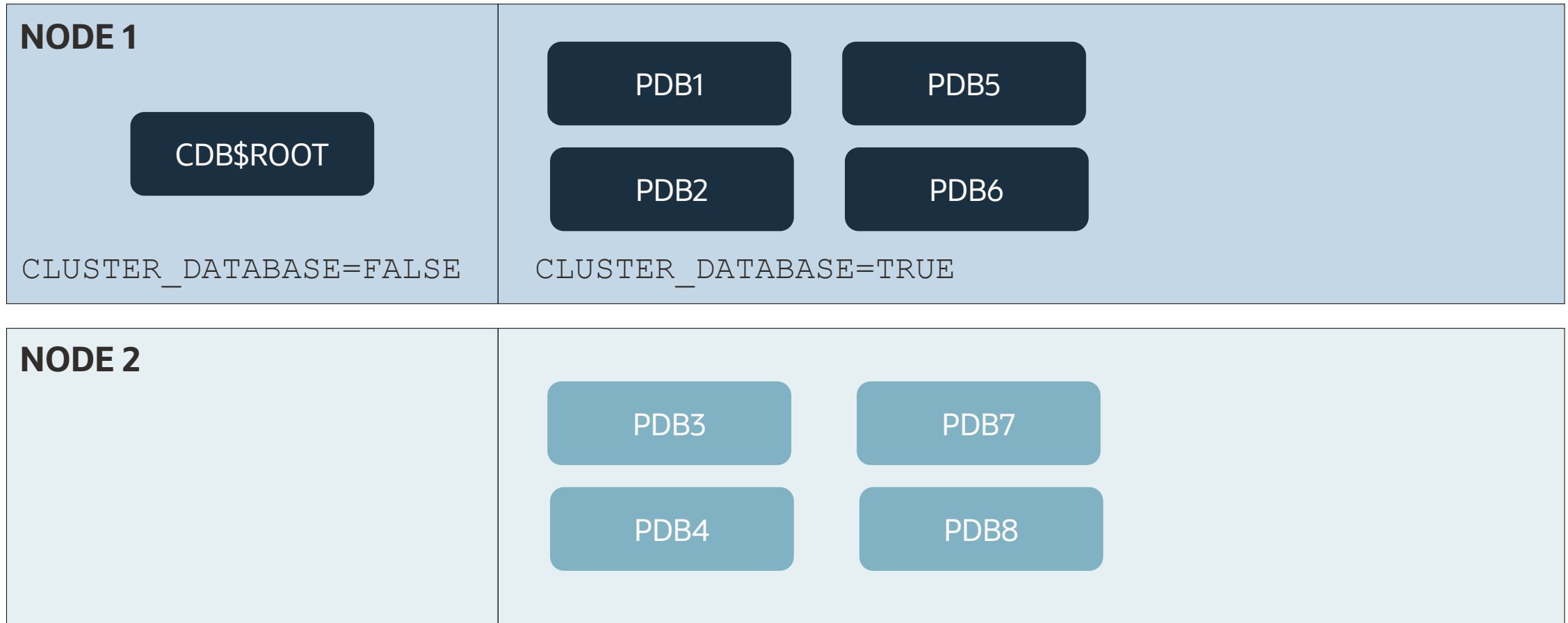
PDB6

PDB8

CLUSTER\_DATABASE=FALSE

## NODE 2

# 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

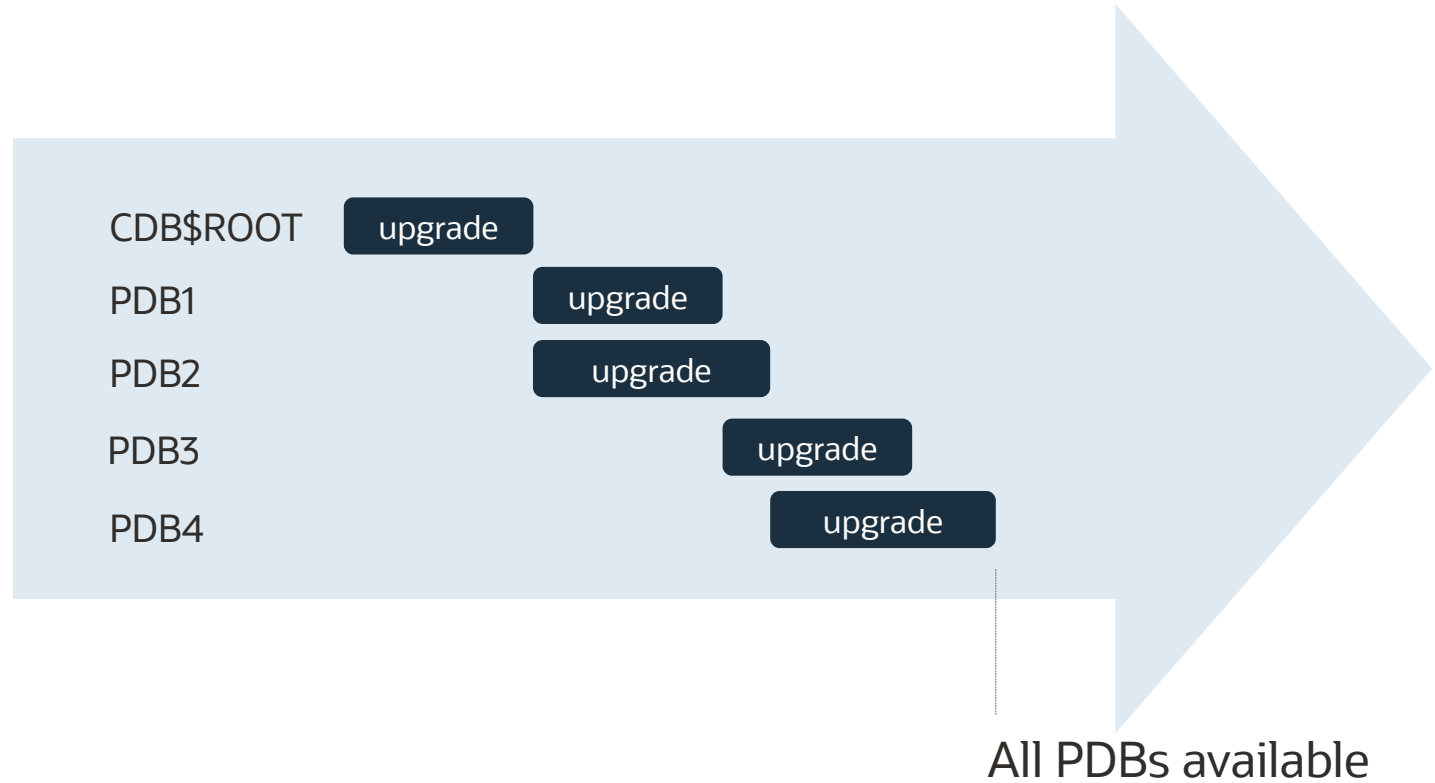
Control the order of upgrade



# PDB Availability

## DEFAULT

```
make_pdb_available=false
```

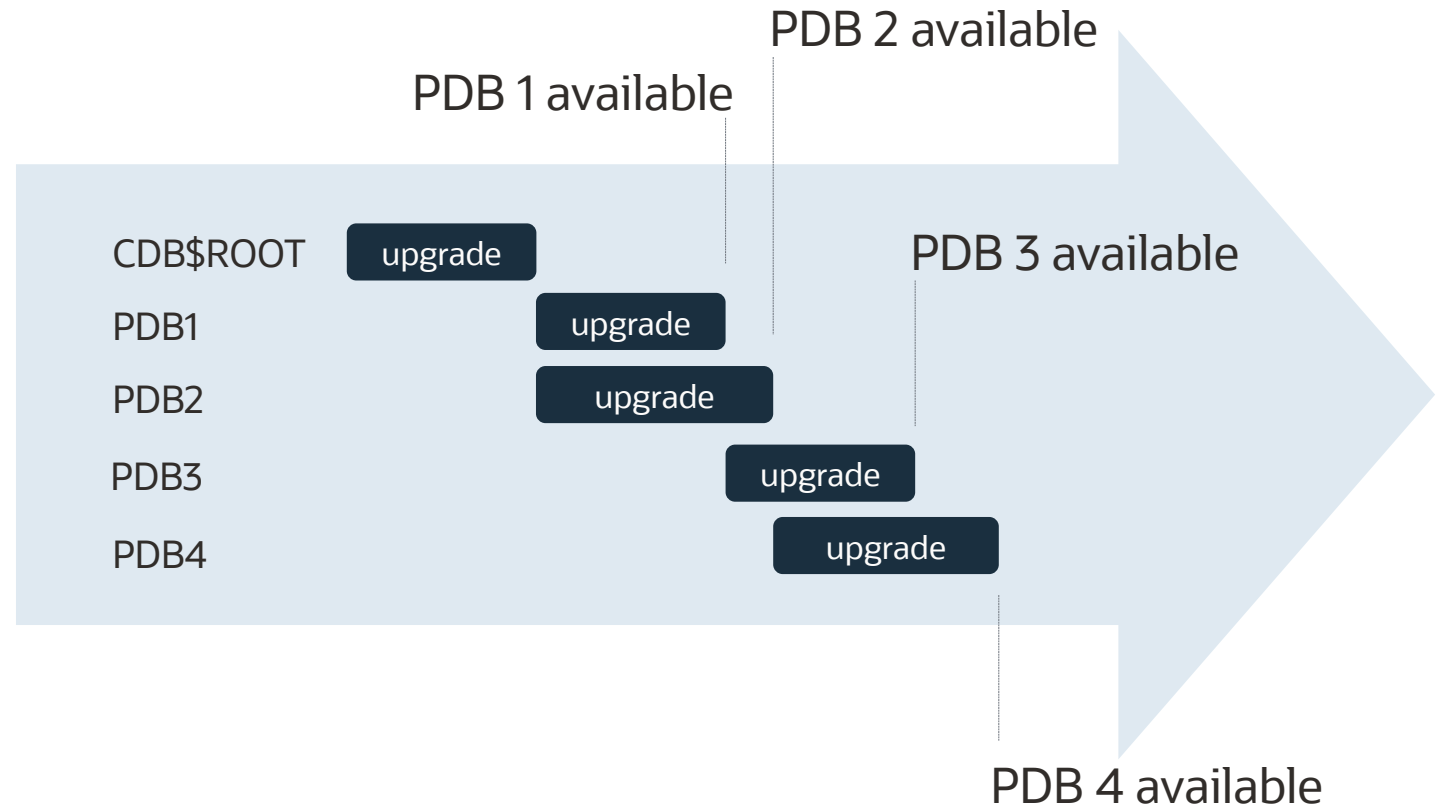




# PDB Availability

## IMMEDIATELY AVAILABLE

```
make_pdb_available=true
```



# PDB Availability

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

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

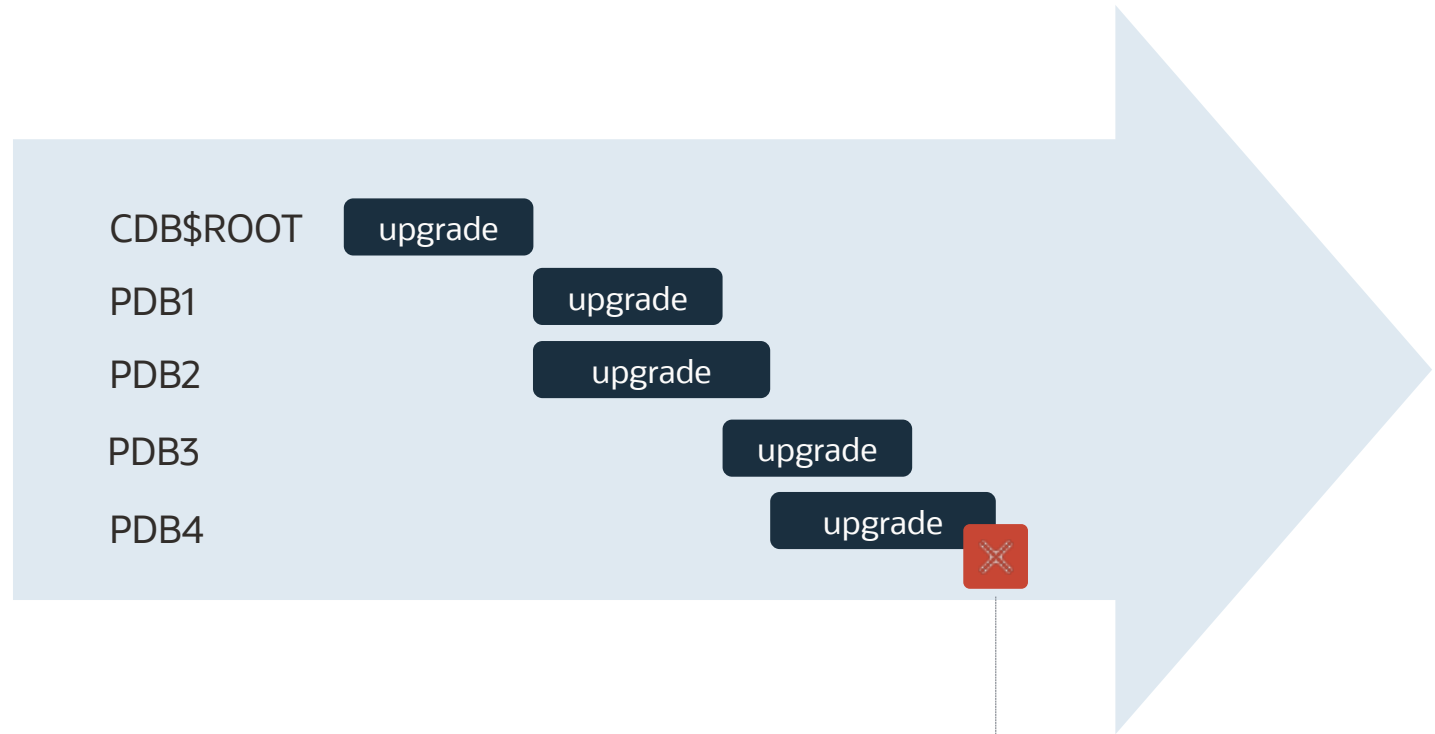
```
alter pluggable database SALESUAT priority 2;
```

```
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
```

# SAVE THE DATE

- ASCEND CONFERENCE 2023

June 11-14, 2023

Caribe Royale Resort

Orlando, Florida

<https://ascendusersconference.com>



- MOUS 2023

October 25, 2023

Schoolcraft College - VisTaTech Center,  
18600 Haggerty Rd, Livonia, MI

<https://www.mous.us>



THANK YOU

[www.mous.us](http://www.mous.us)



# SURVEYS

- Session Surveys

Please complete the session survey for this session.

The survey will be provided to each attendee.



THANK YOU

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