

Oracle Database World

Meet the Experts

30 Minutes Database Migration

Deep Dive

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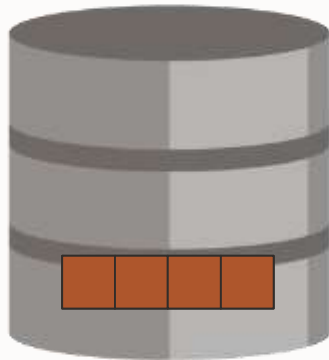


william-beauregard-3053791

Migration

What do we call a migration?

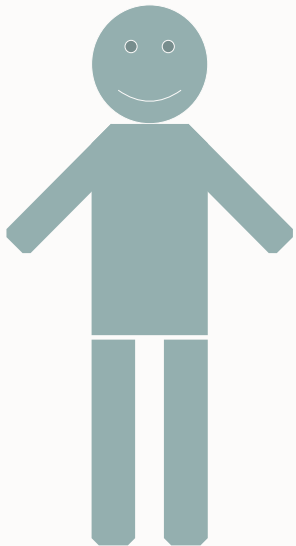
Move data from A to B



Upgrade vs **Migration** vs Patching

Database Upgrade

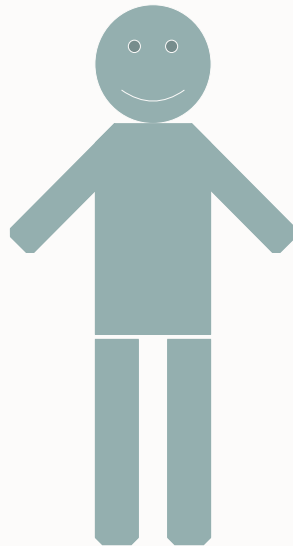
- AutoUpgrade



Oracle 18.6.0 → Oracle 19.12.0

Database Migration

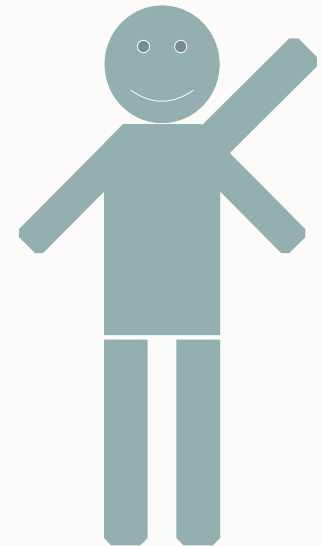
- Data Pump, TTS, FTEX



Oracle 11.2.0.3 → Oracle 19.12.0

Database Patching

- opatch



Oracle 19.3.0 → Oracle 19.12.0

Upgrade vs Migration vs Patching

Database Upgrade

- AutoUpgrade
- New binaries
- Same OS family
- Same or new hardware
- Requires always downtime
- Amount of data irrelevant

Database Migration

- Data Pump, TTS, FTEX
- New binaries
- Often different OS
- Often different HW
- Upgrade happens implicitly
- Requires always downtime
- Amount of data **very** relevant

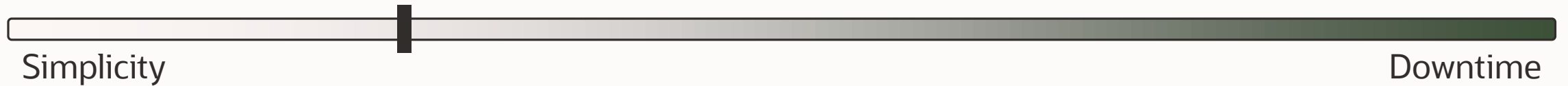
Database Patching

- opatch
- New binaries
- Ideally a new home
- Same hardware
- No upgrade done
- No downtime only with RAC
- Amount of data irrelevant

Which one is the best technique?



Migration Techniques



Techniques include:

- Data Pump
- Transportable Tablespaces
- Full Transportable Export/Import
- Data Guard
- Incremental Backups
- Oracle GoldenGate
- ...

Migration



Oracle Database 19c is currently
the release to which you should migrate

your key to

Successful Database Migrations

Step 1

Download and
install **Oracle 19c**

Step 2

Download and
install **newest RU**

Step 3

Choose the best
migration method

Step 4

Performance Stability
with SPM, STA and RAT



Patching



You should always apply the latest Release Update to your target

Pro tip: Download Release Updates using [Download Assistant \(Doc ID 2118136.2\)](#)

Data Pump Best Practices

Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Do not add parameters on the command line

Certain characters must be escaped

Escape characters vary by operating system

Use a parameter file:

```
expdp ... parfile=export.par
```

Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

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Cloud

Perform consistent exports using

- Point in time - `flashback_time=systimestamp`
- Specific SCN - `flashback_scn=<scn>`

Requires UNDO

Pro tip: Export from your [standby database](#)



Data Pump | **Best Practices**

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Ensure dictionary statistics are current

- Before export
- After import

```
SQL> begin
        dbms_stats.gather_schema_stats('SYS');
        dbms_stats.gather_schema_stats('SYSTEM');
    end;
```

Pro tip: You can also use the procedure
GATHER_DICTIONARY_STATS



Data Pump | **Best Practices**

Parameter file

Consistency

Statistics

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Dump files

Cloud

Exclude optimizer statistics from export

```
#Regular export
expdp ... exclude=statistics

#Transportable tablespaces
expdp ... exclude=table_statistics,index_statistics
```

After import:

- Gather statistics in target database
- Or transport statistics using DBMS_STATS

Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Always include diagnostics in logfile

```
expdp ... logtime=all metrics=yes
```

If you need help, we will always ask for it

Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Use parallel to speed up the exports and imports

```
expdp ... parallel=n
```

Degree of parallelism

- Cloud Number of OCPUs
- On-prem CPU cores x 2

Pro tip: Hyperthreaded
cores does not count



Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Always transform LOBs to SecureFile LOBs

```
impdp ... transform=lob_storage:securefile
```

It is faster to import LOBs when they are transformed to SecureFile LOBs

Data Pump | **Best Practices**

Parameter file

Consistency

Statistics

Diagnostics

Parallel

LOBs

Dump files

Cloud

Always export to multiple files

```
expdp ... dumpfile=dumpfile%L.dmp
```

Optionally, split the files

```
expdp ... filesize=5G
```

Pro tip: You can also use the old %U format



Data Pump | Best Practices

Parameter file

Consistency

Statistics

Diagnostics

Parallel

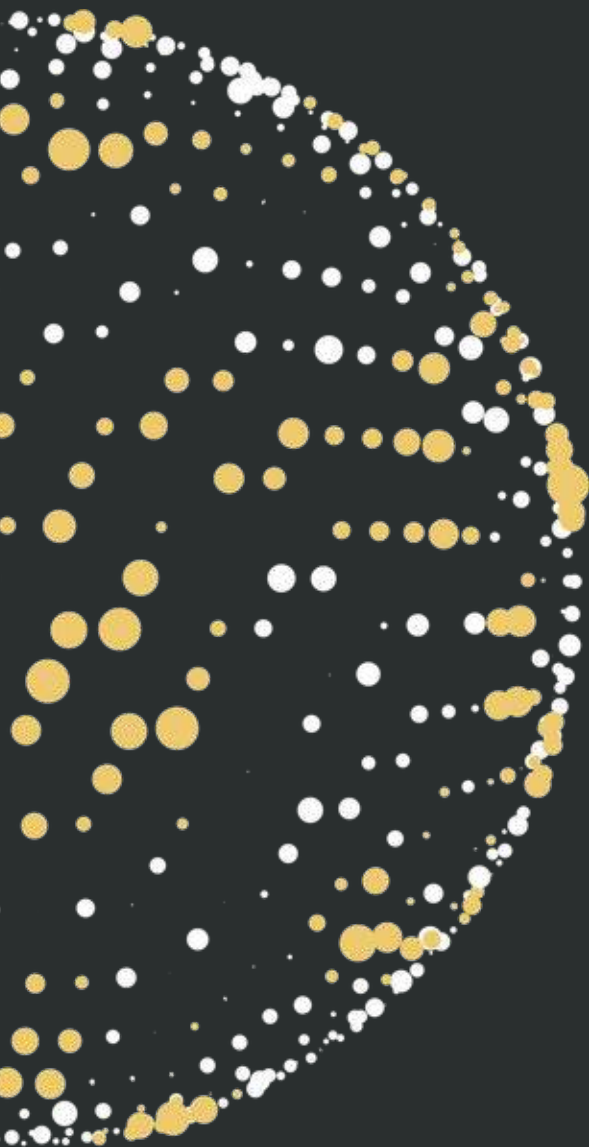
LOBs

Dump files

Cloud

When migrating to Oracle Cloud Infrastructure,
use schema based export

```
expdp ... schemas=sales,hr
```



Super Patch

Better and faster patching

Super Patch | Overview

What is it? A merge patch ...

- 19 single patches that fix most known issues
- Available on top of 19.10 and following Release Updates

Pro tip: This [blog post](#) gives you further details



Super Patch | **Benefits**

What does it do? Better and faster patching ...

- Faster
- Fewer invalidations
- Less contention



Super Patch | Benefits

What does it do? Better and faster patching ...

- Increases performance
 - 60-90% faster elapsed time to install a patch with `dpload.sql` apply script
 - Under a minute for subsequent invocations
- Decreases invalid objects
 - 50-90% decrease (down to ~10)
 - Zero with subsequent invocations
- Decreases contention issues
 - Reduced because `dpload.sql` has fewer operations for applying a patch



Super Patch | Details

How can I get it?

- Download via Patch ID [32919937](#)
 - Bug [32551008](#) – CONSOLIDATED BUG OF IMPROVEMENTS TO DATA PUMP / MDAPI PATCHING PROC
- Installable as
 - RAC rolling
 - Standby-first
 - Hot patchable
- Inclusion in a **future** Release Update (RU)



AutoUpgrade

Multitenant | License



In Oracle Database 19c and 21c you can have up to 3 user-created PDBs **without** any additional license

And **AutoUpgrade** does this for you!

AutoUpgrade | Plug-in and convert

Fully automated plug-in

```
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=DB19  
upg1.target_cdb=CDB2
```

Command

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

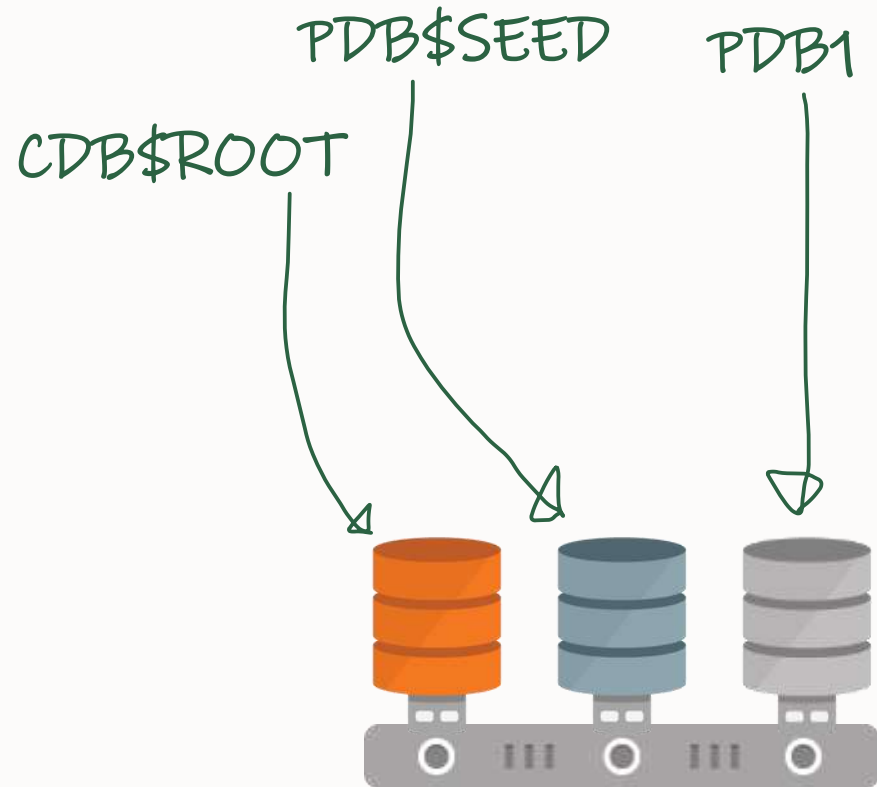
Pro tip 1: You must create the target CDB beforehand

Pro tip 2: Always get latest version of AutoUpgrade from MOS [2485457.1](#)



You are using **Multitenant** already?

Upgrade | **Unplug-plug**



Can **AutoUpgrade** do this for you?

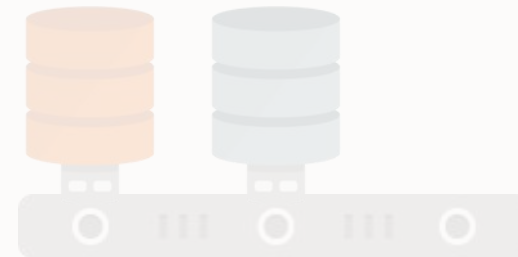
Even across different servers or VMs?

Unplug / Plug / Upgrade | Preparation

Clone User

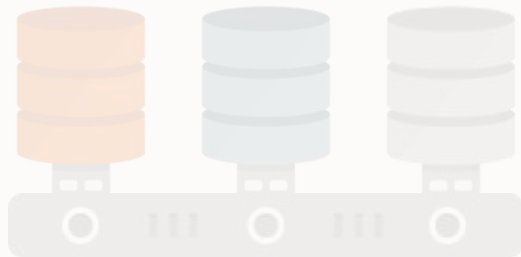
```
CREATE USER c##borg  
IDENTIFIED BY oracle  
DEFAULT TABLESPACE users  
TEMPORARY TABLESPACE temp  
CONTAINER=ALL;
```

```
GRANT  
CREATE SESSION,  
CREATE PLUGGABLE DATABASE,  
SELECT_ANY_CATALOG  
TO c##borg  
CONTAINER = ALL;
```

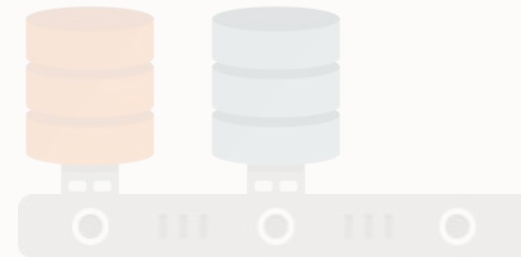


Unplug / Plug / Upgrade | Preparation

Database link into source PDB



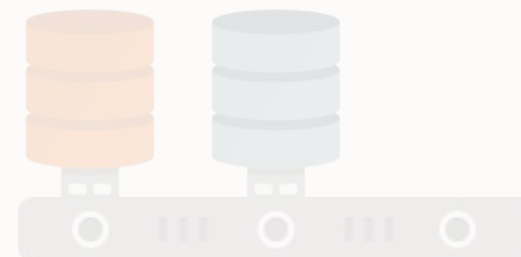
```
CREATE DATABASE LINK clonePDB1  
CONNECT TO c##borg  
IDENTIFIED BY oracle  
USING 'tns-or-ezconnect';
```



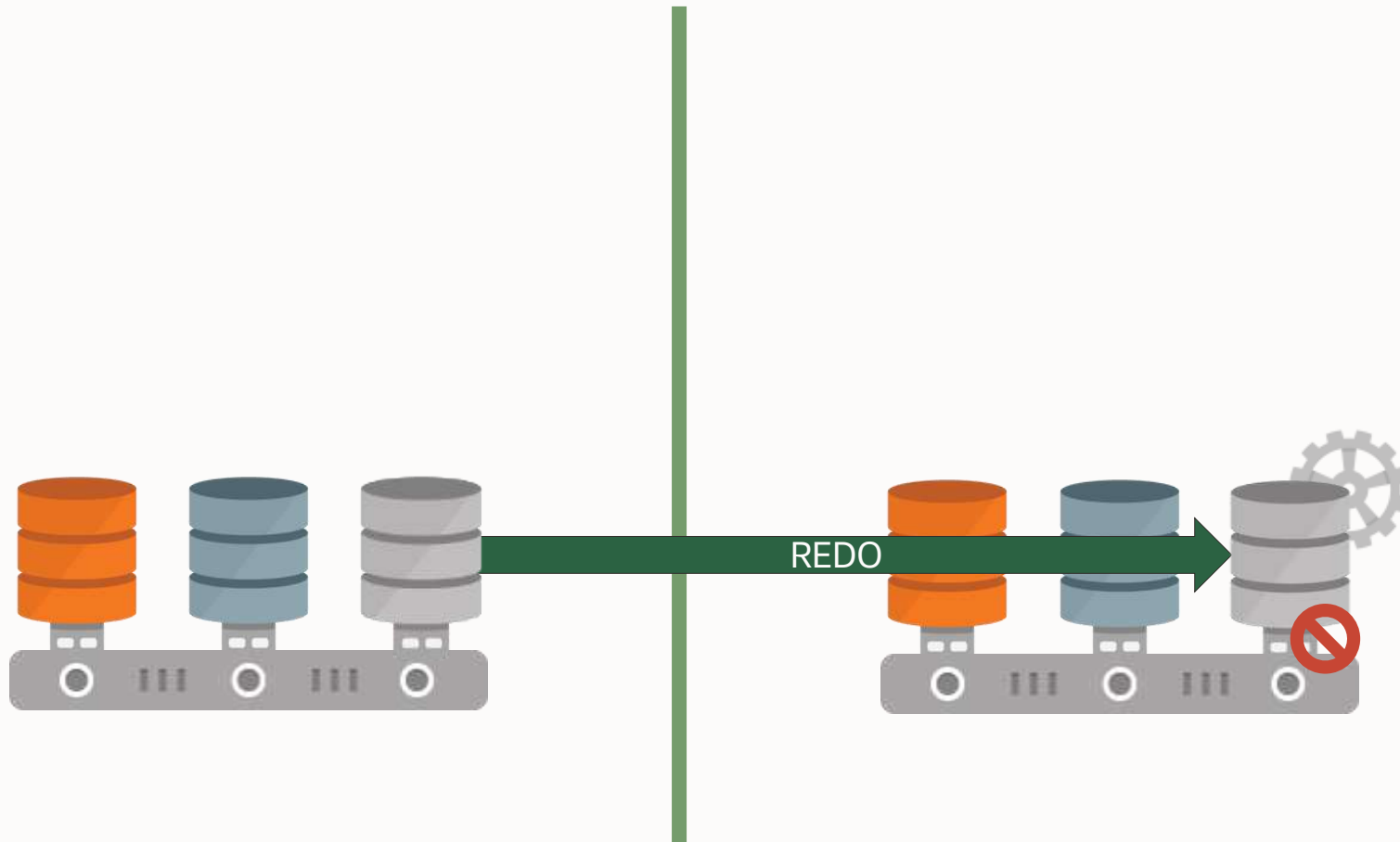
Unplug / Plug / Upgrade | AutoUpgrade

Fully automated relocation with upgrade

```
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/21  
upg1.sid=CDB1  
upg1.pdbs=pdb1  
upg1.target_cdb=CDB3  
upg1.source_dblink.pdb1=clonePDB1
```



AutoUpgrade | Unplug-plug via Refreshable Clone PDB



AutoUpgrade | What if ... an upgrade fails?

1. Create zip file

```
$ java -jar autoupgrade.jar -config config.cfg -zip
```

2. Optionally, add opatch lsinventory

```
$ $ORACLE_HOME/OPatch/opatch lsinventory > opatch.txt  
$ zip -r AUPG_210419_0735_461.zip opatch.txt
```

3. Upload it to My Oracle Support



Transportable



Photo by [Florian Klauer](#) on [Unsplash](#)

Transportable Tablespaces with Cross-Platform Incremental Backup

Basics

Transportable | Transportable Tablespace Concept

This strategy works when:

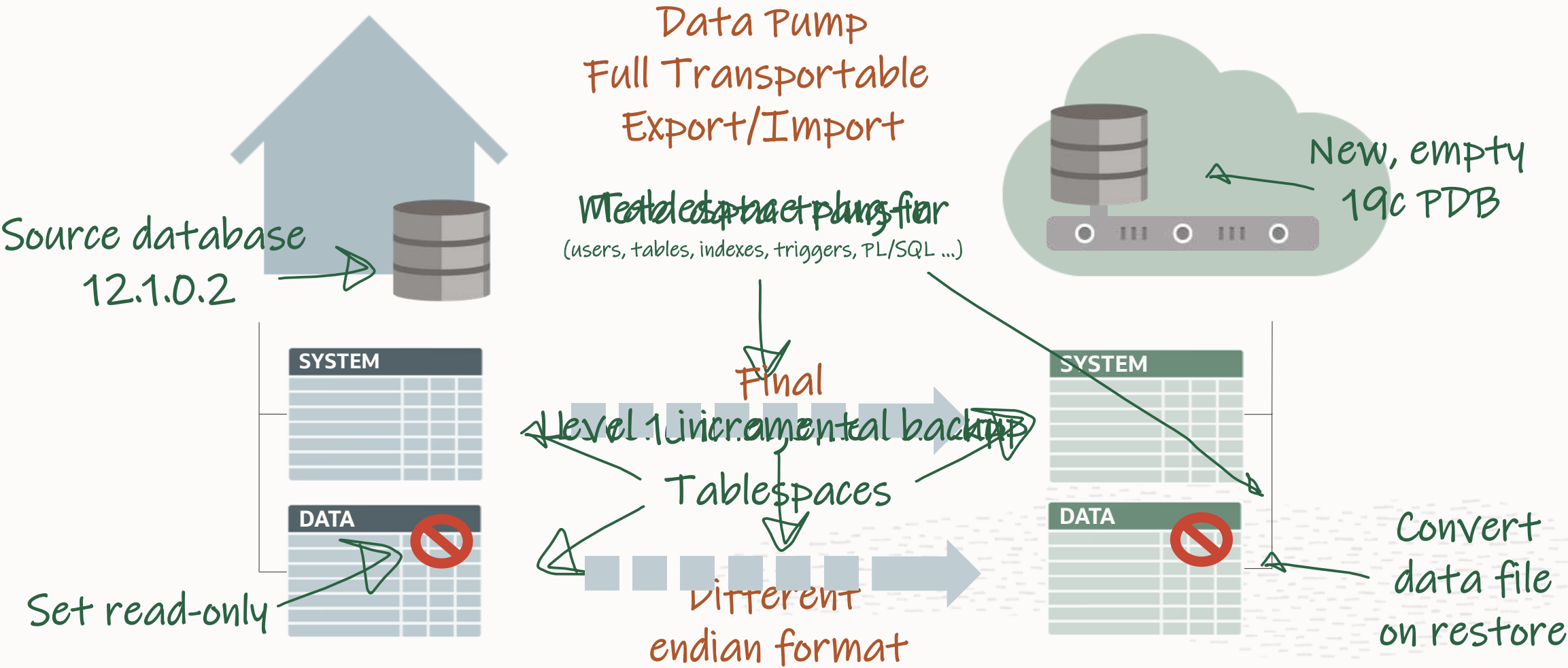
- Business can tolerate some downtime
- Endianness Migration
- To the **same or newer** database version
- For non-CDB to PDB conversion (and vice-versa)

Transportable | Conversion Platform String

```
SQL> SELECT platform_name, endian_format
       FROM v$transportable_platform
       WHERE endian_format!='Little';
```

PLATFORM_NAME	ENDIAN_FORMAT
AIX-Based Systems (64-bit)	Big
Apple Mac OS	Big
HP-UX (64-bit)	Big
HP-UX IA (64-bit)	Big
IBM Power Based Linux	Big
IBM zSeries Based Linux	Big
Linux OS (S64)	Big
Solaris[tm] OE (32-bit)	Big
Solaris[tm] OE (64-bit)	Big

Transportable | Concept



Transportable | Tablespace Concept

To move data we need two things:

META DATA

How is the following defined:

User/schema

Table

Columns

Indexes

Triggers

Grants

PL/SQL

...

DATA

The actual rows



Transportable | Overview

For minimal downtime

[V4 PERL Scripts to reduce Transportable Tablespace Downtime using Cross Platform Incremental Backup \(doc ID 2471245.1\)](#)

Blog posts:

- [Overview](#)
- [Step-by-step](#)

Other options with Transportable Tablespace exist

Data Guard | Transportable

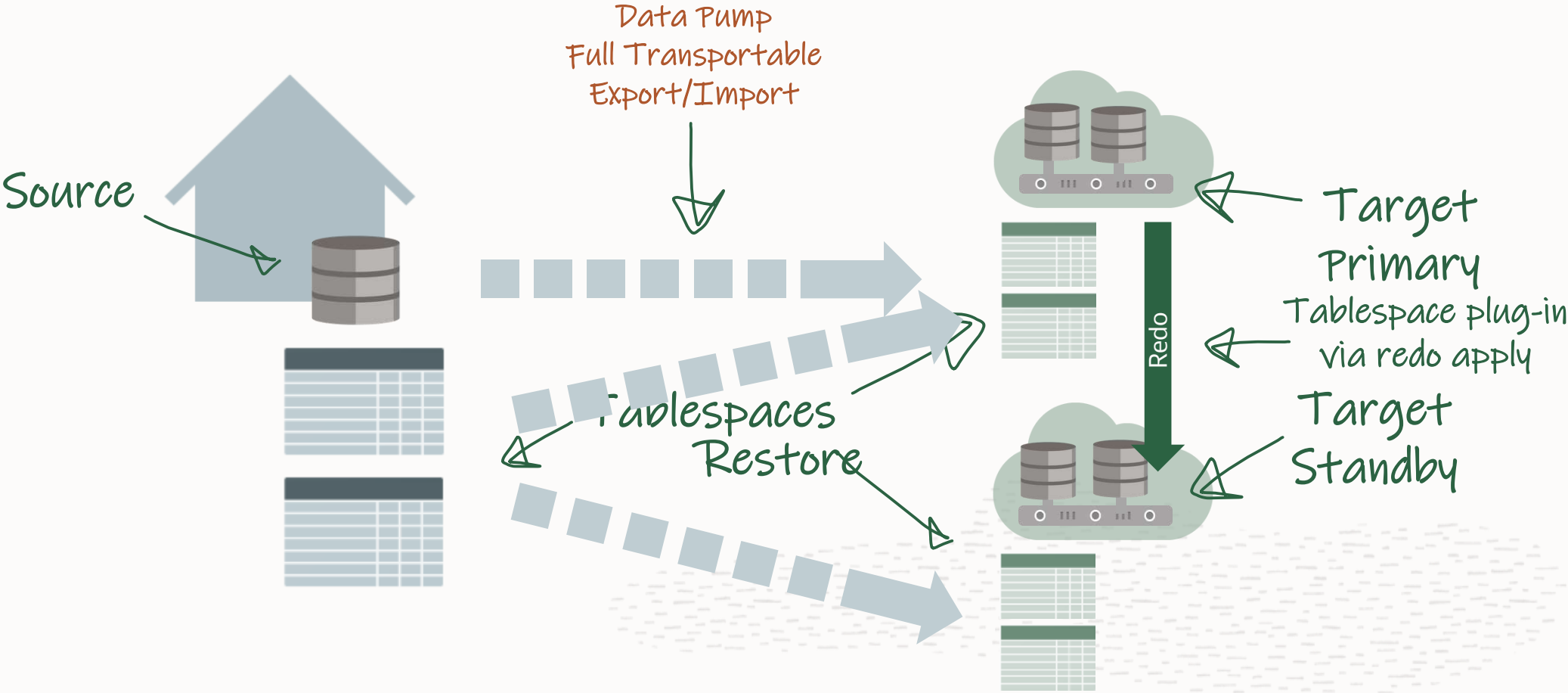




Photo by [Sebastian Herrmann](#) on [Unsplash](#)

Transport

Checklist

Transportable | Starter Checklist

Database Creation

Backup / Recovery
TDE

Target database requirements

- COMPATIBLE must be the same or higher

Target database requirements with workarounds

- Identical character set
- Identical national character set
- Identical time zone (only with `TIMESTAMP WITH LOCAL TIME ZONE`)
- Identical time zone file version (only with `TIMESTAMP WITH TIME ZONE`)

Transportable | Starter Checklist

Database Creation

Backup / Recovery

TDE

Enable Block Change Tracking on source
for incremental backups

```
SQL> SELECT status, filename FROM V$BLOCK_CHANGE_TRACKING;  
SQL> ALTER DATABASE ENABLE BLOCK CHANGE TRACKING;
```

- Conversion on destination is usually faster than on source
- PERL scripts will do the conversion
- Requires
 - Enterprise Edition (on-prem)
 - Enterprise Edition Extreme Performance (DBCS)
 - Exadata



Transportable | Starter Checklist

Database Creation

Backup / Recovery

TDE

TDE Encryption

- Not supported
- Only for same-Endianness migration

Transportable | Nice to know

Fallback option

- Original database is preserved

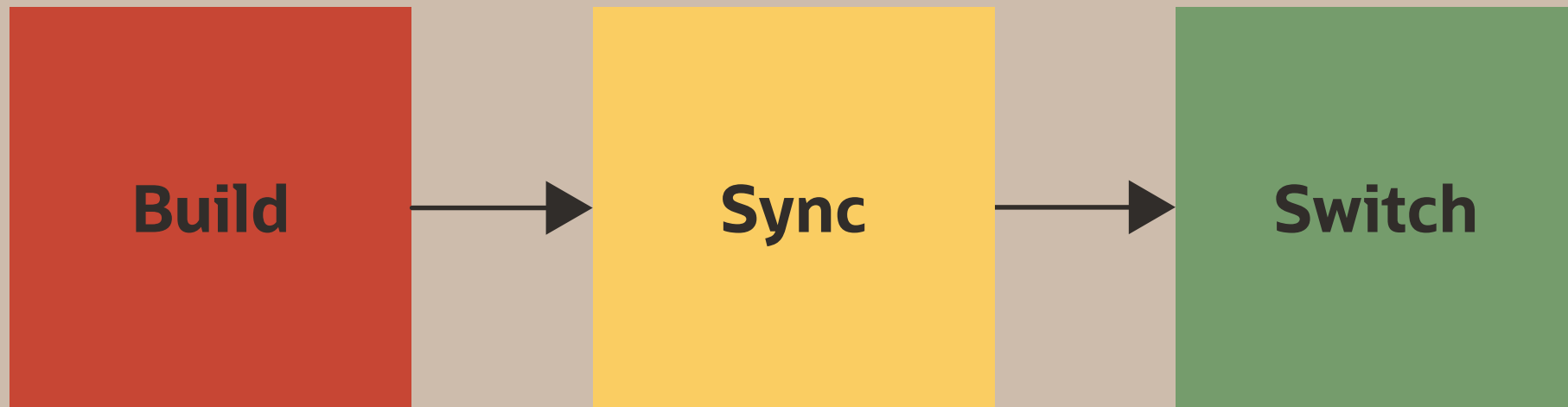
Fast - just final incremental and FTEX import

Cross-platform and cross-endian format

Migrate from lower release without upgrading

Zero Downtime Migration

Introduction | **Birds-Eye**



Migration | Options

PHYSICAL

Online: Data Guard + switchover

Offline: Backup + restore

Standard Edition - offline only

LOGICAL

Online: Data Pump + GoldenGate

Offline: Data Pump

Via dump file or database link

Standard Edition - any approach



Migration | Comparison

PHYSICAL

Migrate entire database

No data customization

Same version / same architecture

Well-known

No online option for SE2

Excellent fallback

LOGICAL

Migrate schemas

Remodel your data

Cross-version / cross-architecture

New skills

Online option for SE2

Complicated fallback



When I say Oracle GoldenGate

What do **you** say?

Logical Migration | GoldenGate

”

Oracle GoldenGate for Oracle – Database Migrations can be used for 183 days to perform migrations into Oracle databases located in Oracle Cloud Infrastructure using the following tools:

Oracle Zero Downtime Migration

Oracle Cloud Infrastructure Database Migration

[Cloud Marketplace: Oracle GoldenGate for Oracle – Database Migrations](#)

- Applies to the Cloud Marketplace image **only**
- Covers the source and target database
- For migration to OCI only

Logical Migration | GoldenGate

Installation

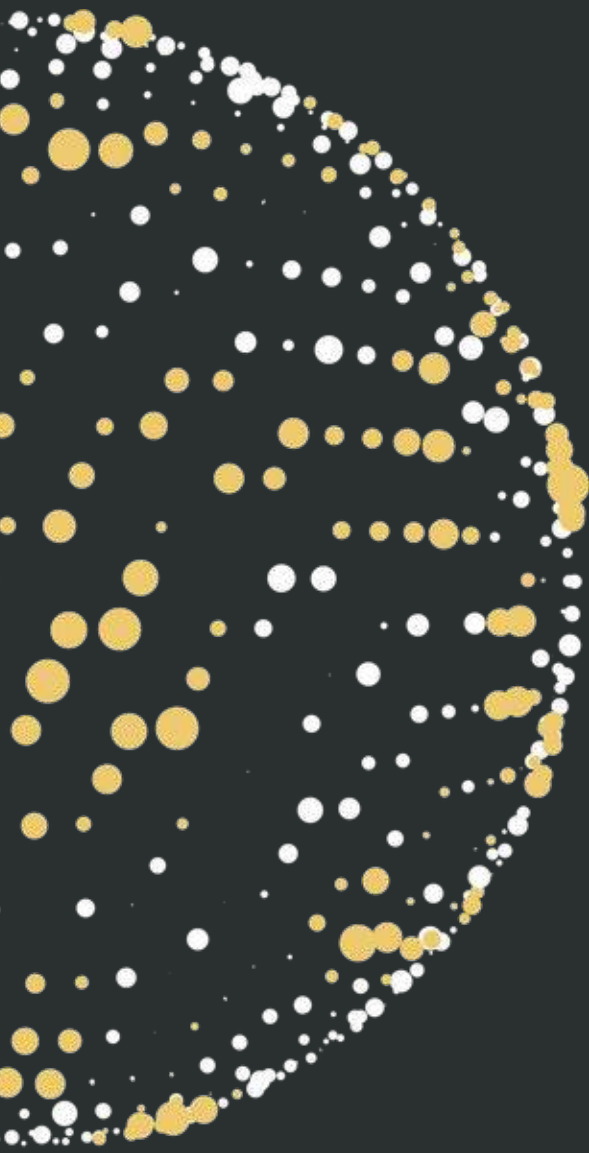
Deploy from Cloud Marketplace

Configuration

Handled by ZDM

Monitoring

Via GoldenGate Hub



Want to know more?

<https://dohdatabase.com/zdm>

Q&A

Wrapping Up



your key to

Successful Database Migrations

Step 1

Download and
install **Oracle 19c**

Step 2

Download and
install **newest RU**

Step 3

Choose the best
migration method

Step 4

Performance Stability
with SPM, STA and RAT





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BLOGS

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[Daniel](#)

[Rodrigo](#)



VIDEOS

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Q&A

Thank You

