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Cloud Migration

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dohdatabase.com/slides

Introduction | Birds-Eye

Build → Sync → Switch
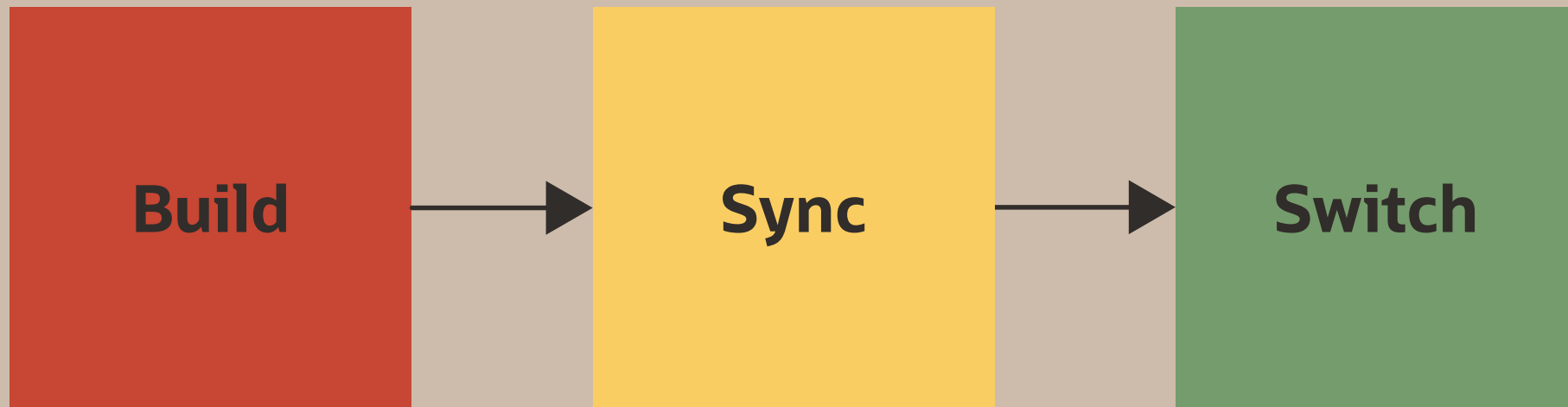
Introduction | Key Features

Zero Downtime Migration
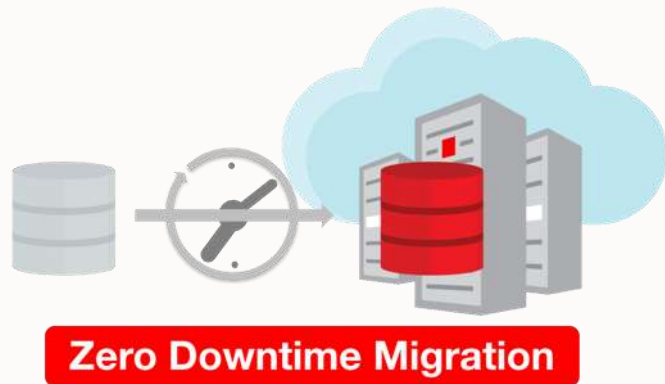
- Simple

- Reliable

- Scalable

- Secure

- Proven

- Free

Prerequisites And Features | Location

Location

Release

Platform

Edition

Architecture

Encryption

Source database can be located

- On-premises
- Oracle Cloud Infrastructure Classic (OCI-C)
- Oracle Cloud Infrastructure (OCI)
    - Cross-region / cross-location migration
    - System migration

Prerequisites And Features | Release

Location

Release

Platform

Edition

Architecture

Encryption

Source databases

- 11.2.0.4

- And anything newer

Target databases

- Physical migrations: Database release must be the same
- Logical migrations: Database release can be the same or higher

Pro Tip: It is possible to migrate to a higher
patch level. If needed, ZDM invokes `datapatch`

Prerequisites And Features | Platform

Location

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Encryption

Supported source platform

- Linux

Supported target platforms

- Autonomous (dedicated and shared)
    - ATP
    - ADW
- DB Systems (VM, BM and Exadata)
- Exadata Cloud at Customer
- Exadata (on-prem)

Prerequisites And Features | Edition

Location

Release

Platform

Edition

Architecture

Encryption

Supported editions

- Enterprise Edition

- Standard Edition

Standard Edition restriction:

For zero downtime approach select logical migration

Migration between editions

- Restrictions apply

Pro Tip: True *Zero Downtime* requires an MAA compliant application

Prerequisites And Features | Architecture

Location

Release

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Architecture

Encryption

Any architecture supported (non-CDB and CDB)

- Non-CDB
  - Migrate directly into a PDB
  - Keep it as a non-CDB
  - Convert to PDB

- CDBs
  - Migrate entire CDB
  - Migrate one PDB only

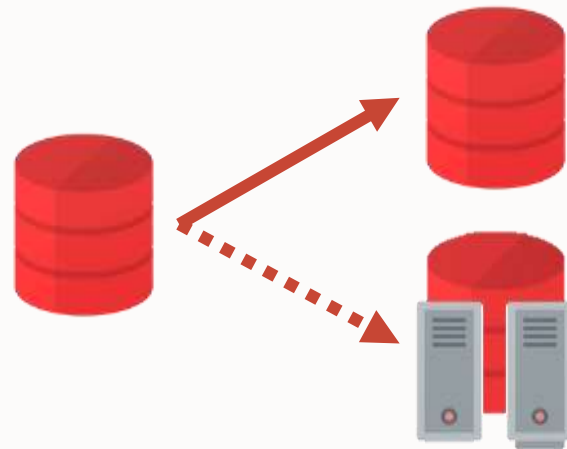# Prerequisites And Features | Architecture

Location

Release

Platform

Edition

Architecture

Encryption

Any type (single instance, RAC One Node, RAC)

- Single instance can be migrated to RAC
- RAC One Node will be migrated to RAC (physical only)
- RAC will be migrated to RAC (physical only)

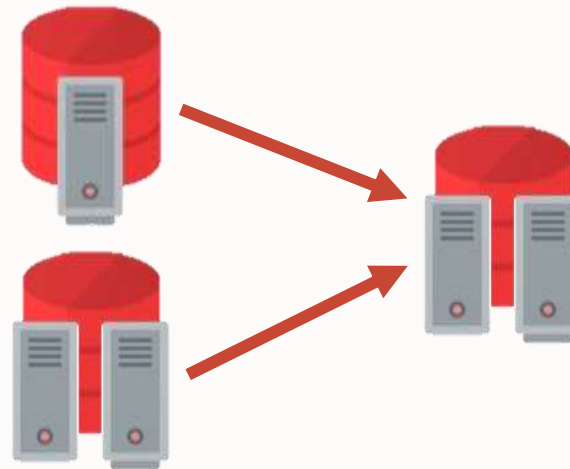# Prerequisites And Features | Architecture

Location

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Any type (single instance, RAC One Node, RAC)

- Single instance can be migrated to RAC
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- RAC will be migrated to RAC (physical only)

Prerequisites And Features | Encryption

Location

Release

Platform

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Architecture

Encryption

Source database

- Unencrypted

- Encrypted

Target database

- Is always encrypted

- Unencrypted databases gets encrypted on-the-fly

Network connectivity

- Always and transparently encrypted

Migration | Options

PHYSICAL

Online: Data Guard + switchover

Offline: Backup + restore

Standard Edition - offline only

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Video 1

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

Video 4

Install

ZDM Service Host

Service Host | Prerequisites

- Oracle Linux 7

- Install on dedicated server (recommended)

- Network connectivity to source and target database host

- Check the documentation

Service Host | SSH Key Format

SSH key format must be PEM format

```
$ ssh-keygen -t rsa -m PEM

$ cat ~/.ssh/id_rsa


-----BEGIN RSA PRIVATE KEY-----
MIIG5QIBAAKCAYEA0GPlWoSFfU8+6zgOymj47d9NTxRJYr5U9seFAcz3/aaWEP5k
ZT0FjipCIziBcnYzs0jKPLSrSoPnYGJxJuYbDj6pwMNH/f0SfhAibjHD3+Buj5cc
...
```

Service Host | Installation

Video 6

Migration

Physical

Migration | Options

PHYSICAL

LOGICAL

Online: Data Guard + switchover

Online: Data Pump + GoldenGate

Offline: Backup + restore

Offline: Data Pump

Via dump file or database link

Standard Edition - offline only

Standard Edition - any approach

Physical Migration | Demo

Video 2

Video 3

Physical Migration | Benefits

- Well-known method

- Seemless switchover with properly configured application

- Excellent fallback
  - Requires license for ASO on-prem

- Migrate entire database
  - AWR
  - SQL Plan Baseline
  - SQL Profiles
  - ...

Physical Migration | Considerations

- Migrate to same version only

- Convert to PDB requires additional downtime

- Entire database is migrated
  - *Old bagage*

- Standard Edition if offline only (backup/restore)

Physical Migration | Different Patch Level

You can migrate to a higher patch level
- Example: 19.7.0 to 19.11.0

Procedure
- Switch over to OCI database
- ZDM executes `datapatch`
- Patch on-premises Oracle Home

Oracle Patch Assurance - Data Guard Standby-First Patch Apply (Doc ID 1265700.1)

Physical Migration | Fallback

Caution: Fallback requires license for Advanced Security Option on source database

Procedure:

```
$ $ZDM_HOME/bin/zdmcli abort job –jobid n

--OCI database
SQL> ALTER DATABASE COMMIT TO SWITCHOVER TO PHYSICAL STANDBY;

--On-premises database
srvctl modify database -d CDB1 -role primary -startoption open
SQL> ALTER DATABASE COMMIT TO SWITCHOVER TO PRIMARY;
SQL> ALTER DATABASE OPEN;
```

- MAA Practices for Cloud Migration Using ZDM (Doc ID 2562063.1)

Migration

Logical

Photo by eelias on Unsplash

Logical 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

Logical Migration | Demo

Video 7

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

Logical Migration | GoldenGate

Video 5

Logical Migration | Recommendations

Use Data Pump in schema mode

```
DATAPUMPSETTINGS_JOBMODE=SCHEMA
INCLUDEOBJECTS-1=owner:SH
INCLUDEOBJECTS-2=owner:OE
```

ZDM automatically adds Data Pump parallel option

• Usually, the defaults are good

Optionally, change the ignorable Data Pump errors

• Default: ORA-31684, ORA-39111, ORA-39082

Pro Tip: ZDM automatically adds compression and encryption to Data Pump exports

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Logical Migration | CPAT

Get up-to-date recommendations on your migration

- You can run CPAT manually
- Replace CPAT in ZDM with newer version

Cloud Premigration Advisor Tool (CPAT) Analyzes Databases for Suitability of Cloud Migration (Doc ID 2758371.1)

Logical Migration | CPAT

Sample output

```
Premigration advisor output:
Cloud Premigration Advisor Tool Version 21.0.0
Cloud Premigration Advisor Tool completed with overall result: WARNING
Cloud Premigration Advisor Tool generated report location:
/u01/app/oracle/zdm/zdm_SALES_fra3wg_1/out/premigration_advisor_report.json
 RESULT: WARNING

Schemas Analyzed (1): SH
A total of 15 checks were performed
There were 0 checks with FATAL results
There were 0 checks with BLOCKER results
There were 3 checks with WARNING results
```

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Logical Migration | CPAT

Sample output

```
timezone_table_compatibility_higher

RESULT: WARNING

DESCRIPTION: The source database TZ_VERSION cannot be lower than the target
TZ_VERSION.

ACTION: Request that Cloud Database Support change the Timezone Version on
your target Database.
```

Logical Migration | **Benefits**

- Free features
  - GoldenGate
  - DataPump Compression
  - Data Pump Encryption

- Optionally, remodel your schema and data
  - Migrate to SecureFile LOBs is default

- Migrate to higher release

- Migrate directly into a PDB

- Online option for SE2

Logical Migration | Considerations

- Target database time zone file version must be equal to or higher than source

```
SQL> select * from v$timezone_file;
```

- Possibly patches are recommended on source database
  - 11g
  - 12c and newer

- GoldenGate supported data types

Logical Migration | Considerations

- Export or re-create public and other not exported objects
  - Synonyms
  - Database links
  - ...

- Diagnostic and tuning related information
  - AWR
  - SQL Plan Baselines
  - SQL Profiles
  - SQL Patches
  - ...

Logical Migration | Considerations

- Fallback

Details

Pro Tips | Troubleshooting

ZDM service host

- `$ZDM_BASE/chkbase/scheduled`
- `$ZDM_BASE/crsdata/`hostname`/rhp`

Source and target hosts

- `/tmp/zdm-`nnn`/zdm/log`
- `/u01/app/oracle/zdm`

Clear ZDM logs for easier troubleshooting

```
$ $ZDM_HOME/bin/zdmservice stop
$ rm $ZDM_BASE/crsdata/*/rhp/rhpserver.log*
$ rm $ZDM_BASE/chkbase/scheduled/*
$ $ZDM_HOME/bin/zdmservice start
```

Pro Tip: You can abort a job using
`zdmcli abort job -jobid n`

Pro Tips | Troubleshooting

Other sources:

- Alert log

- Data Pump process trace file DM00

- Data Pump log file
  - Directory referenced by directory object
  - `$ORACLE_HOME/rdbms/log/<PDB GUID>`

Pro Tips | Troubleshooting

Oracle Zero Downtime Migration 21.1 Release Notes
- Troubleshooting
- Known Issues

Move to Oracle Cloud Using Zero Downtime Migration
- Troubleshooting

Pro Tips | ZDM Log File

Tailing migration log file:

```
$ $ZDM_HOME/bin/zdmcli migrate database \
     -rsp /home/zdmuser/std.rsp \
     ...


$ tail -n 50 -f "`ls -td /u01/app/oracle/chkbase/scheduled/* | head -1`"


zdmhost: 2021-05-06T18:14:25.590Z : Starting zero downtime migrate operation ...
zdmhost: 2021-05-06T18:14:25.625Z : Executing phase ZDM_VALIDATE_TGT
zdmhost: 2021-05-06T18:14:25.634Z : Fetching details of user-managed OCI database "ocid1.database..."
zdmhost: 2021-05-06T18:14:26.840Z : Lifecycle state of OCI database "ocid1.database...": "Available"
zdmhost: 2021-05-06T18:14:29.365Z : Type of OCI database "ocid1.database...": "Virtual Machine Database System"
zdmhost: 2021-05-06T18:14:29.466Z : Verifying configuration and status of target database "sales"
zdmhost: 2021-05-06T18:14:33.889Z : Global database name: SALES.SUB02121342350.DANIEL.ORACLEVCN.COM
zdmhost: 2021-05-06T18:14:33.890Z : Target PDB name : SALES
zdmhost: 2021-05-06T18:14:33.891Z : Database major version : 19
zdmhost: 2021-05-06T18:14:36.711Z : Database parameter ENABLE_GOLDENGATE_REPLICATION is set to true.
zdmhost: 2021-05-06T18:14:36.713Z : Oracle GoldenGate database admin user "GGADMIN" has required privileges.
zdmhost: 2021-05-06T18:14:36.714Z : Execution of phase ZDM_VALIDATE_TGT completed
zdmhost: 2021-05-06T18:14:36.742Z : Executing phase ZDM_VALIDATE_SRC
```

Pro Tips | Custom Scripts

Run your own script before or after any phase

The script is executed on either source or target
- Autonomous DB only .sql scripts are possible

Relevant information is available as environment variables
- Database
- Oracle Home
- ZDM Phase
- ...

Pro Tip:
To list all phases: `zdmcli migrate database -rsp .... -listphases`

Pro Tips | GoldenGate Certificate

GoldenGate Hub provided by OCI Marketplace image comes with a self-signed certificate

Best:

- Implement your own properly signed certificates

Or, for test environments:

- GoldenGate and self signed certificate? Zero Downtime Migration - GoldenGate Hub Certificate Known Issues (Doc ID 2768483.1)

Pro Tips | GoldenGate Privileges

Replicat process connects a regular database user

Determine how to grant privileges:

- DBA role
- `INSERT ANY, DELETE ANY, UPDATE ANY`
- Connor McDonald's schema grant

In doubt? Do like in Autonomous Databases...

Pro Tips | GoldenGate Health Check

Generate report:

- Check prerequisites
- Database characteristics
- Find database objects of interest
- Extract/replicat statistics

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Pro Tips | GoldenGate Health Check

Generate report by:

- Installing objects in database: `ogghc_install.sql`
- Execute health check: `ogghc_run.sql`
- Optionally, clean-up objects: `ogghc_uninstall.sql`

For GoldenGate MicroServices Architecture find the scripts:

`/u01/app/ogg/oraclenn/lib/sql/healthcheck`

Finally …

It is time to wrap up

Migration | Comparison

PHYSICAL	LOGICAL
Migrate entire database	Migrate schemas
No data customization	Remodel your data
Same version / same architecture	Cross-version / cross-architecture
Well-known	New skills
No online option for SE2	Online option for SE2
Excellent fallback	Complicated fallback

Wrapping Up | YouTube

[YouTube Playlist](#)

Further Reading

dohdatabase.com/zdm

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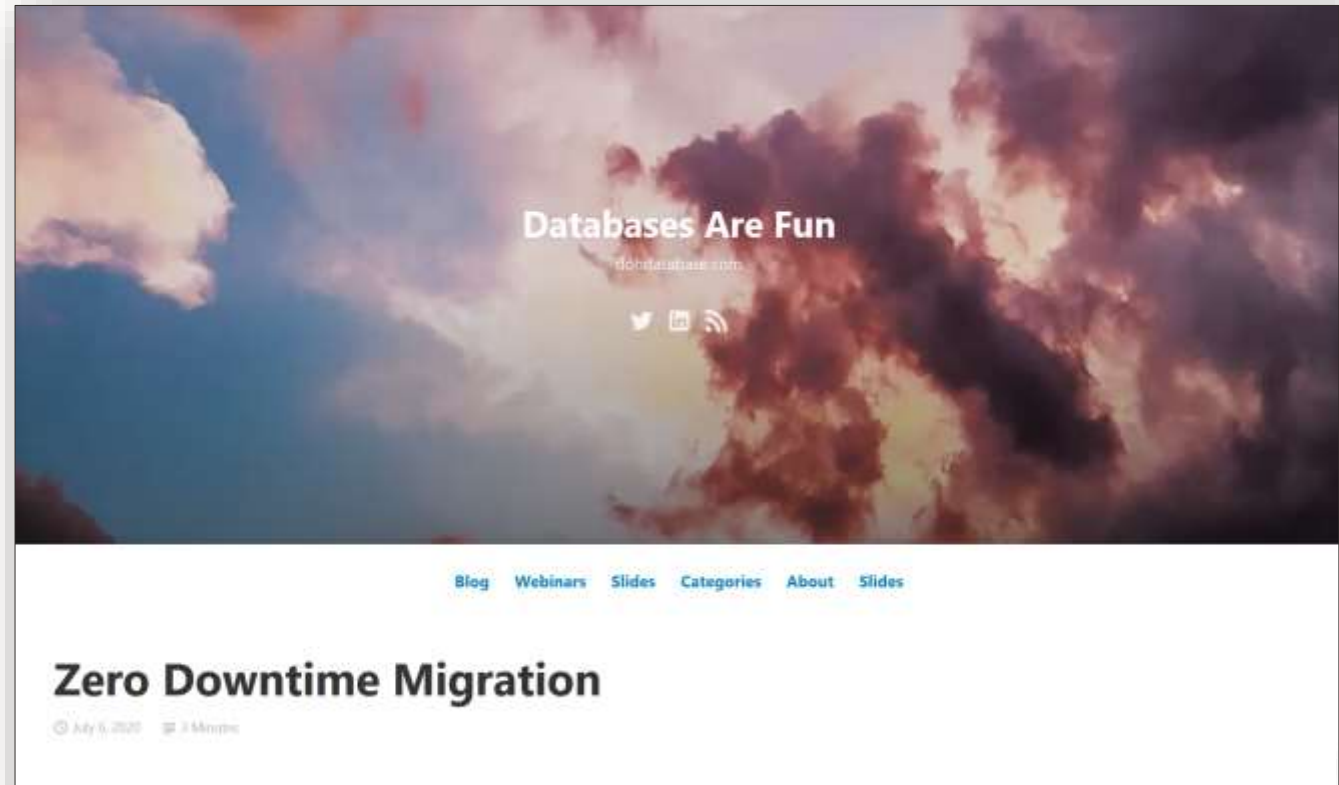
Wrapping Up | Further Information

Oracle Zero Downtime Migration Product Page

Oracle Zero Downtime Migration Documentation

Oracle Zero Downtime Migration Release Notes

Oracle Zero Downtime Migration Whitepaper

MAA Practices for Cloud Migration Using ZDM (Doc ID 2562063.1)

Hybrid Data Guard to Oracle Cloud Infrastructure

Enjoy 18 hours of high-quality tech

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- Release and Patching Strategy
- AutoUpgrade to Oracle Database 19c
- Performance Stability, Tips and Tricks and Underscores
- Migration to Oracle Multitenant
- Migration Strategies – Insights, Tips and Secrets
- Move to the Cloud – Not only for techies
- Cool Features – Not only for DBAs
- Database Upgrade Internals – and so much more
- Performance Stability for Cloud Migration

Thank you!