



# Oracle Cloud Infrastructure Database Migrations



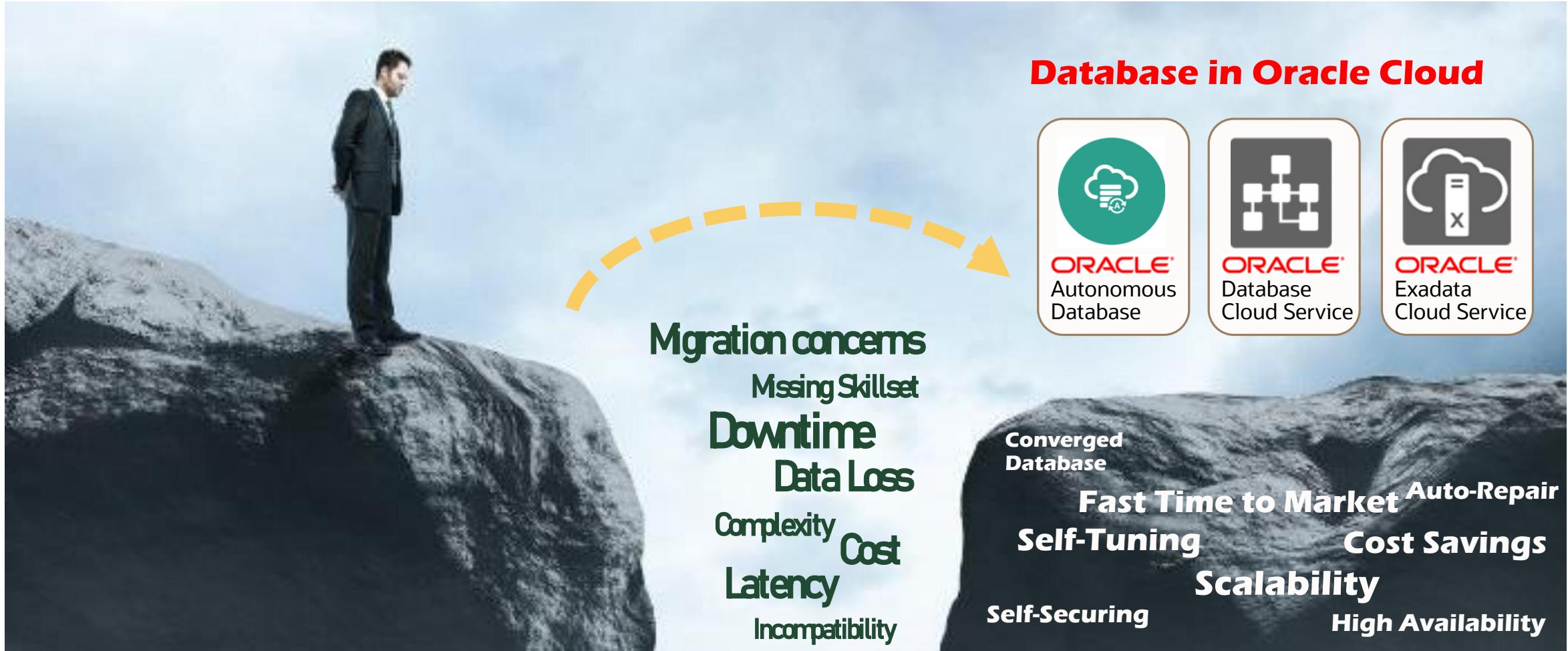
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Cloud Architect, Oracle Corporation



# The future of databases is here in Oracle Cloud

But... how to best get there?



# Different Migration Types

## ***Offline Migration***

- One-time copy of the database
- Requires applications to be offline during migration

## ***Physical Migration***

- Blockwise copy of database files
- Requires database vendors and versions be same on source and target
- No filtering or transformation
- Tools: RMAN, DataGuard

## ***Direct Connection***

- Source database can be accessed directly from target network
- Requires VPN/FastConnect for On-Prem

## ***Online Migration***

- Initial copy of database followed by change data capture during migration
- Applications can stay online during migration

## ***Logical Migration***

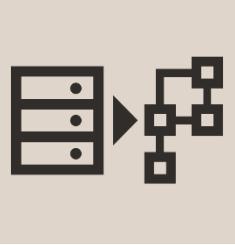
- Logically interpret database contents and copy to database in target format
- Source and target can be different
- Tools: Datapump, GoldenGate

## ***Indirect Connection***

- Source database cannot be accessed directly, behind firewall
- Requires migration tool with agent

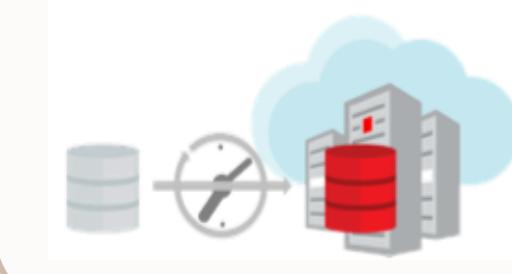
# Oracle Solutions to migrate databases to Oracle Cloud

## OCI Database Migration (DMS)



- Fully managed
  - Graphical guidance
  - Online and offline migrations
  - Autonomous Database target
- Based on Zero Downtime Migration

## Zero Downtime Migration (ZDM)



- User Managed Expert Tool
- Fleet Migrations
- Logical and Physical Migrations
- Migrations to ExaCC

## SQL Developer



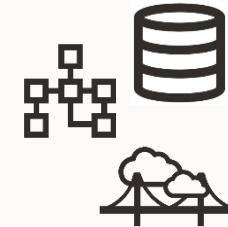
- Developer Experience
- Fine-grained transformations

## Enterprise Manager

**ORACLE**  
Enterprise Manager

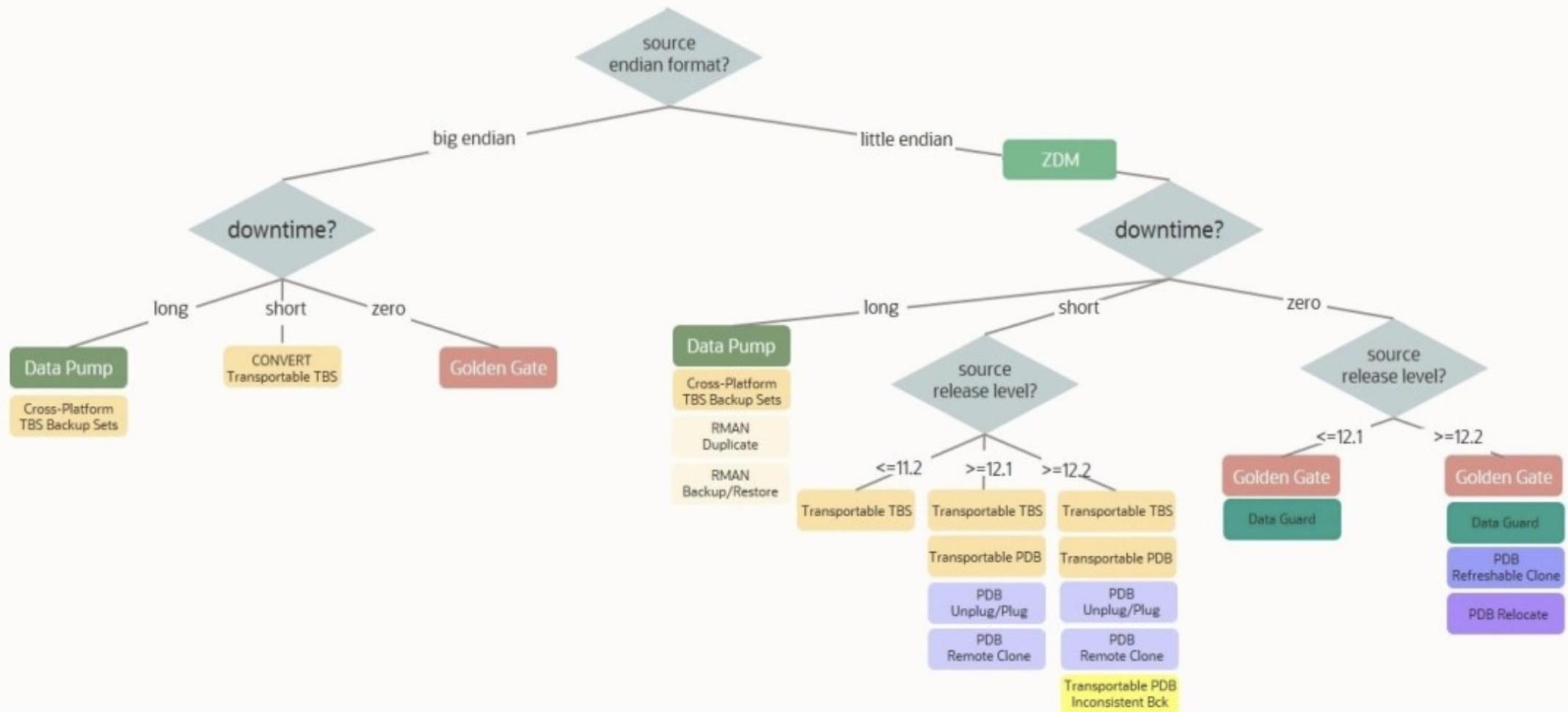
- Integrated with EM ecosystem
- Use as part of EM Automation and Monitoring

## Database Tools



- Manual use of DB Tools (RMAN, Data Guard, Datapump, GoldenGate)
- Full expert control
- Special use cases (bi-directional replication, etc.)

# Database Migration Decision Tree



# Migration requirements and constraints

What you should know before you design a migration strategy...

Source Database	Target Database	Runtime Constraints
<ul style="list-style-type: none"><li>• Database version</li><li>• Database size and number of database tables</li><li>• Workload Type</li><li>• Usage and performance requirements</li><li>• Single/Multi-tenant Architecture</li><li>• Endian format</li><li>• Character set</li></ul>	<ul style="list-style-type: none"><li>• Database Type</li><li>• Database version</li><li>• HA and DR requirements</li></ul>	<ul style="list-style-type: none"><li>• Bandwidth and Connectivity</li><li>• Fallback Capability</li><li>• Down-time requirements for migration</li><li>• Project resources available for migration</li></ul>

# Oracle Cloud Database

Range of options



The Right Cloud Database for Every Use Case

100%  
Administrator  
Operated

Economic,  
Managed DB Service,  
100% Configurable

Max Performance & Consolidation,  
Integrated Database HW/SW

Fully Autonomous Operation,  
Dynamic Scalability

# Plug/Unplug

## Migration Methodology

### Source databases:

- CDB Databases 18c, 19c
- Non-CDB or CDB Databases 12c
- Non-CDB Databases 11g (via Upgrade)



### Target databases:

- DBaaS VM, DBaaS BM, ExaCS, ExaCC
- Versions: 12c, 18c, 19c

### When to use

- ✓ Source DB is Little-endian
- ✓ Supports small to large databases
- ✓ Migrate from non-CDB to CDB
- ⚠ Requires knowledge of migration tools like RMAN and Data Pump
- ⚠ Requires some down-time
- ⚠ Upgrade before migrate for 11g and lower versions



Simple



Flexible  
Architecture



Enterprise fleet-  
scale migrations



Free



# Recovery Manager (RMAN)

Reliable and Versatile offline migration tool

## Source databases:

- CDB/PDB Databases 12c, 18c, 19c
- Non-CDB Databases 11g, 12c, 18c, 19c



## Target databases:

- DBaaS VM, DBaaS BM, ExaCS, ExaCC
- Versions: 12c, 18c, 19c

## When to use

- ✓ Cross-platform migration possible
  - ✓ Allows point-in time recovery
  - ✓ Migrate from non-CDB to CDB
  - ✓ Small to Large Database size
- ⚠ Requires knowledge of various RMAN methods
- ⚠ Requires some down-time



Point-in-Time  
Recovery



Interoperability  
with versions



Enterprise fleet-  
scale migrations



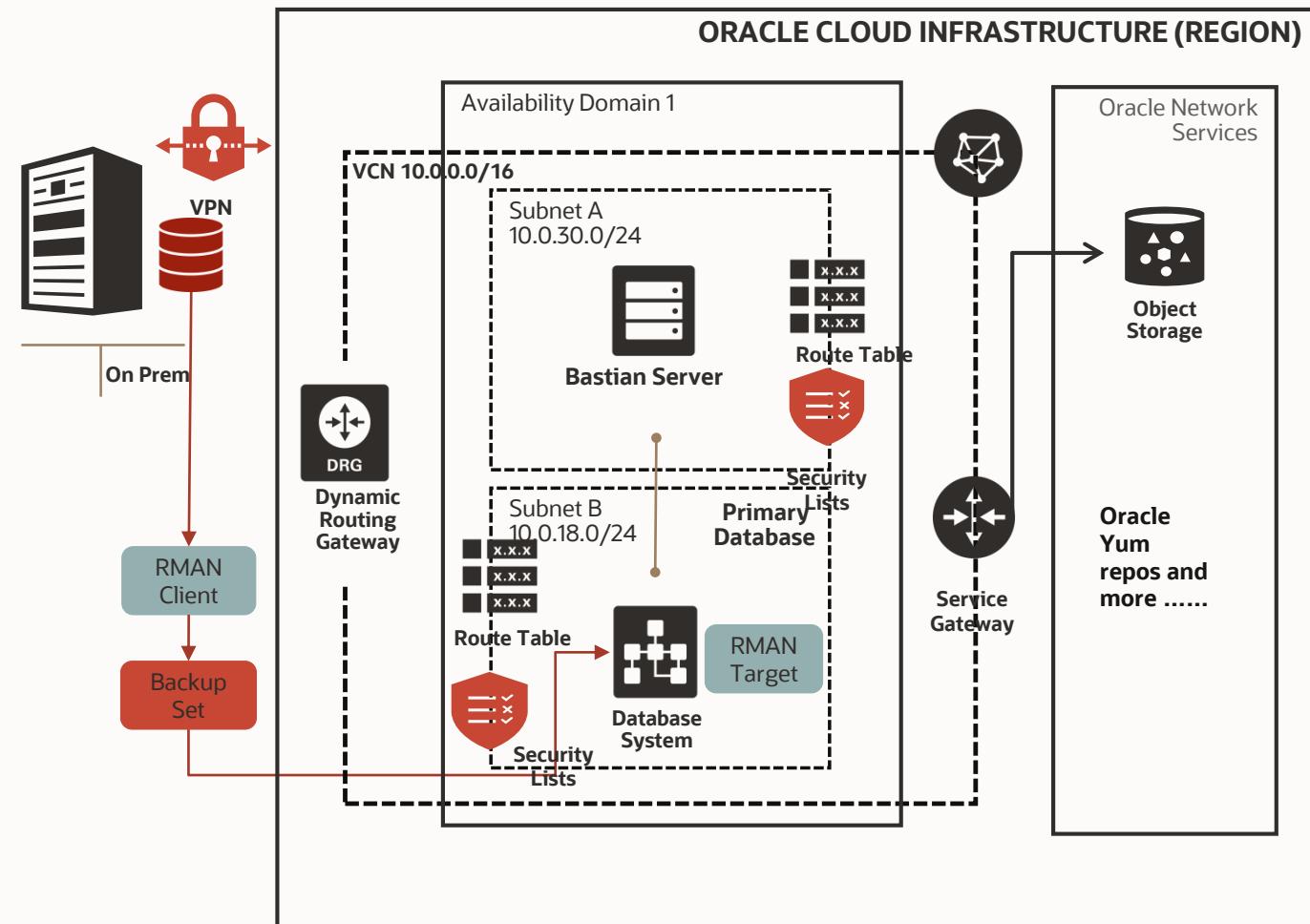
Free



# RMAN Reference Architecture

## Migration Steps

- On-premises Target Database – perform backup & recovery operations
- RMAN Client – command line interface to interpret and execute
- RMAN Methods
  - RMAN Cross-Platform Transportable PDB
  - RMAN Cross-Platform Transportable Tablespace Backup Sets
  - RMAN Transportable Tablespace with Data Pump
  - RMAN DUPLICATE from an Active Database
  - RMAN CONVERT Transportable Tablespace with Data Pump

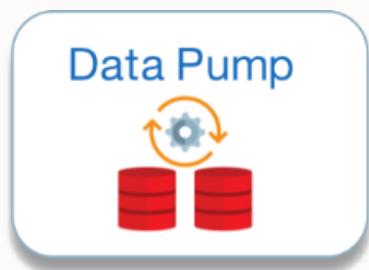


# Data Pump

Fast, full offline database migration tool

## Source databases:

- CDB/PDB Databases 12c, 18c, 19c
- Non-CDB Databases 11g, 12c, 18c, 19c



## Target databases:

- DBaaS VM, DBaaS BM, ExaCS, ExaCC
- Versions: 12c, 18c, 19c

## When to use

- ✓ Supports small to large databases
- ✓ Supports cross-endian and character-set
- ✓ In-flight Upgrade possible
- ✓ Changes to database structure possible
- ⚠ Requires knowledge of various methods
- ⚠ Requires some down-time



Simple



Interoperability  
with versions



Enterprise fleet-  
scale migrations

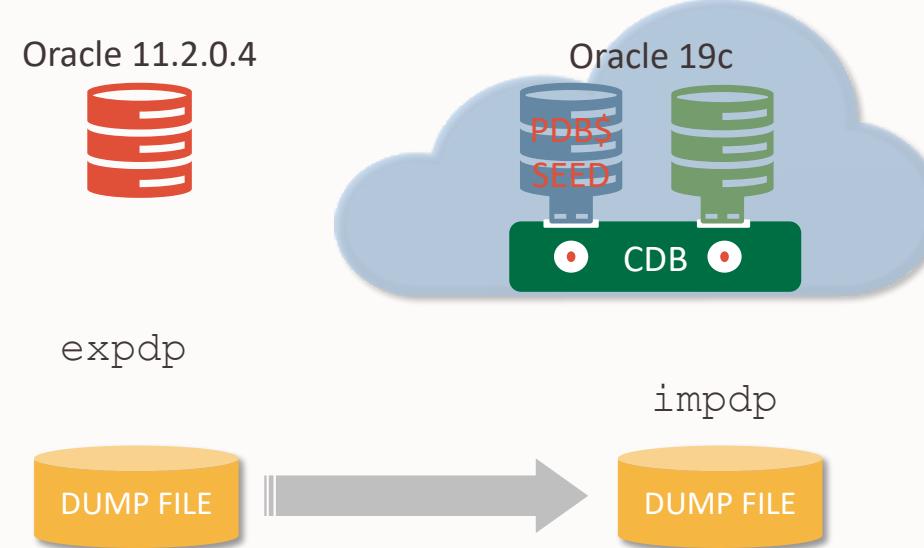


Free

# Data Pump

## Features and Capabilities

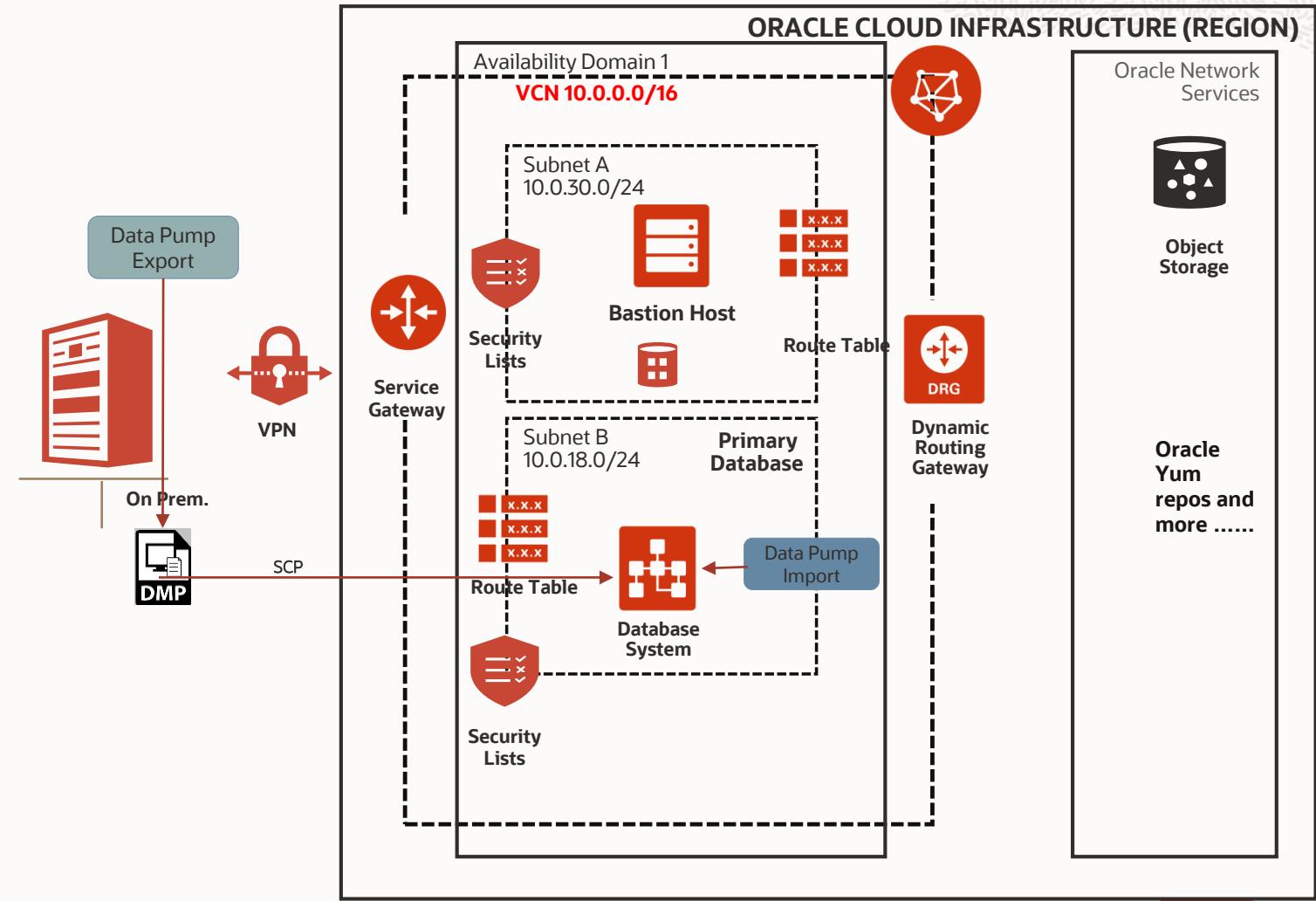
- Oracle Data Pump enables high-speed movement of data and metadata from one database to another
- Oracle Data Pump is available on Oracle Database 10g & later
- There are five different modes of data unloading
  - **Schema Mode** - default mode, specific schemas
  - **Table Mode** - specified set of tables dependent objects
  - **Tablespace Mode** - the tables in the specified tablespace
  - **Transportable Tablespace Mode** - only the metadata for the tables and dependent objects within a specified set of tablespaces
  - **Full Export Mode** - entire database



# Use Case: Data Pump Migration Conventional Export/Import

## Migration Steps

- Invoke Data Pump Export on-premises DB
- Secure copy the dump file to the OCI Database System
- On OCI DB System invoke Data Pump Import
- Validate the import



# Data Guard

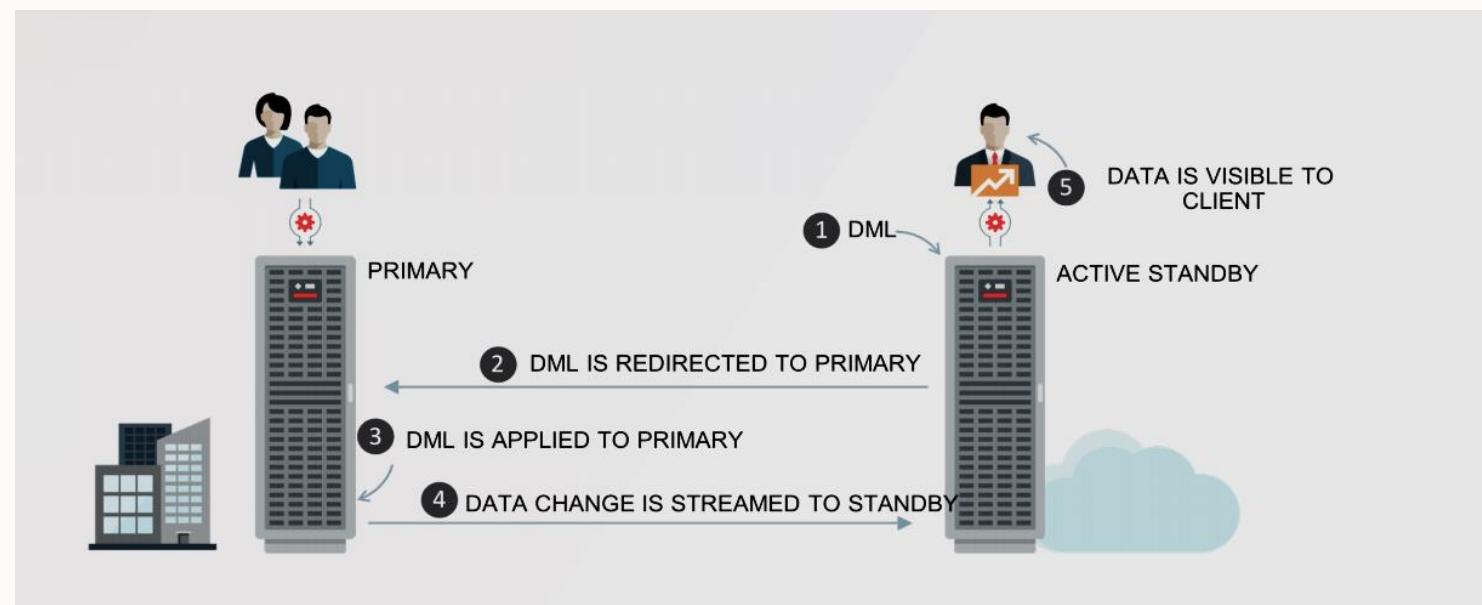
## Real-time Data Protection & Availability

### When to use

- ✓ Provides HA and DR solutions
- ✓ Minimal downtime migration
- ✓ Source version 11.2.0.4, 12.1.0.2, 12.2.0.1, 18, 19
- ✓ Only for Little Endian platforms  
Only non-CDB to non-CDB or PDB to PDB
- ⚠ No structural changes
- ⚠ No upgrade to new version

**Oracle Data Guard** ensures high availability, data protection, and disaster recovery for enterprise data.

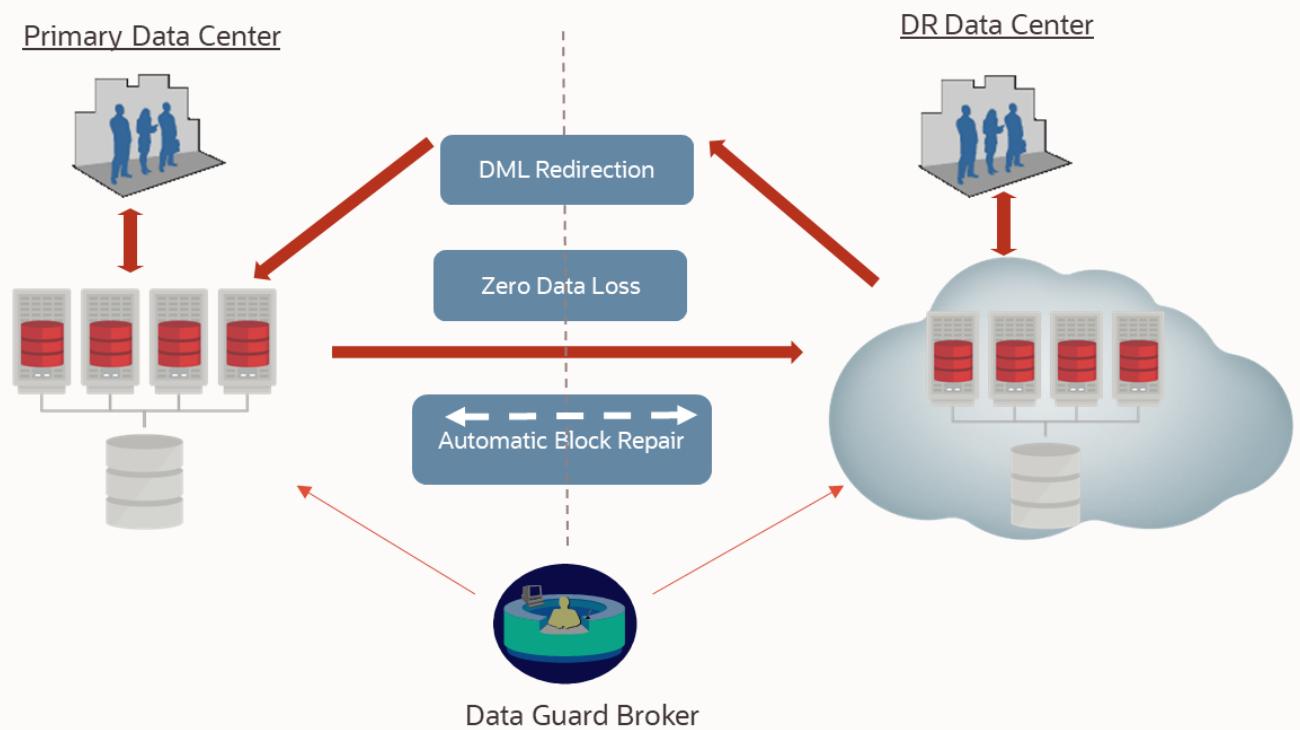
It provides a comprehensive set of services that create, maintain, manage, and monitor one or more standby databases.



# Active Data Guard

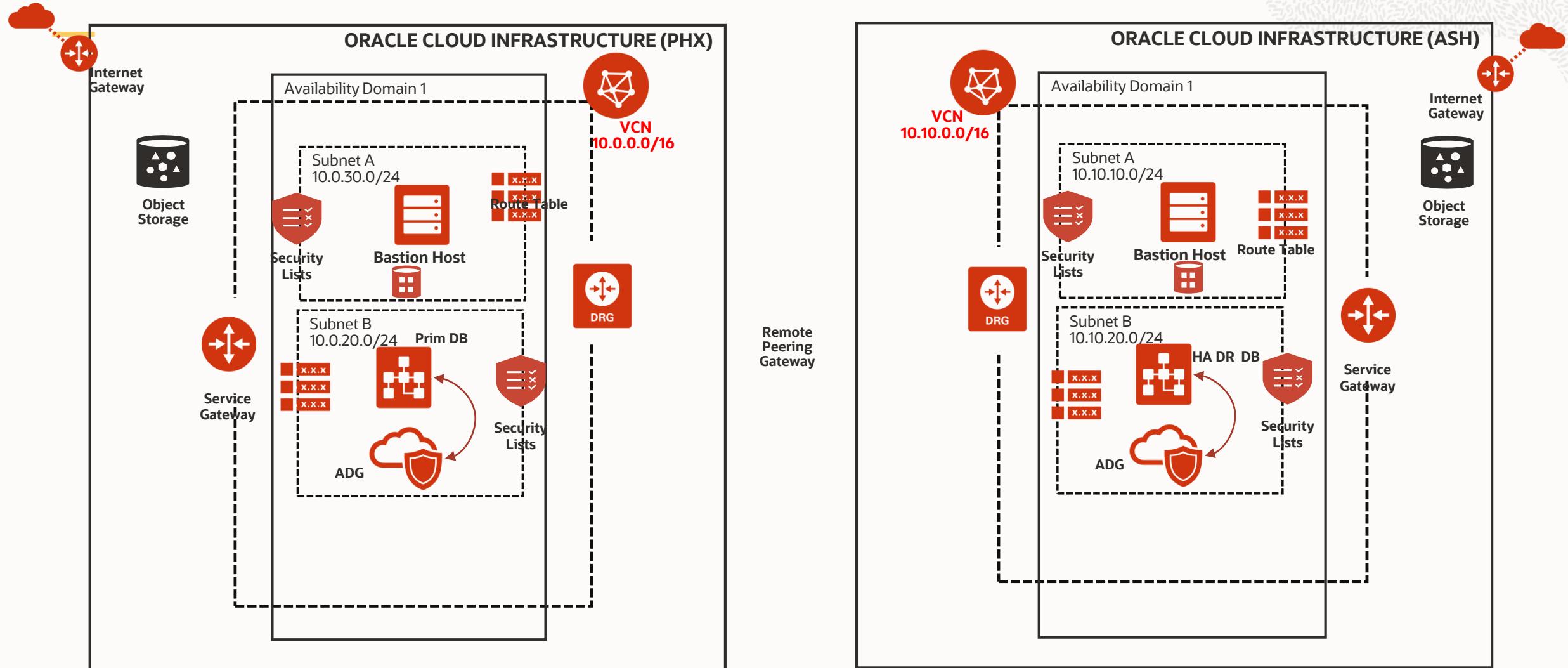
Oracle solution for Active Disaster Recovery

- Eliminates single point of failure
- Efficiently uses network bandwidth
- Provides unique levels of data protection
- Fast-Start failover to the standby
- Switchover to a standby
- Read Write mode on Standby.
- A True Sync between Primary and Secondary Instances.



# Disaster Recovery Across Regions – Reference Architecture

## Active Data Guard

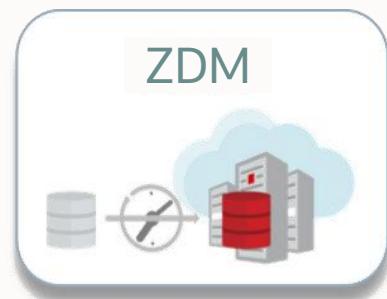


# Zero Downtime Migration (ZDM)

Simple migration tool for lift and shift use cases

## Source databases:

- CDB/PDB Databases 12c, 18c, 19c
- Non-CDB Databases 11g, 12c, 18c, 19c



## OCI Target database:

- DBaaS VM, DBaaS BM, ExaCS, ExaCC
- Versions: 11g, 12c, 18c, 19c

## When to use

- ✓ Free, easy to use tool
- ✓ Small to Large Database sizes
- ✓ Lift and Shift like to like versions
- ✓ Requires no downtime
- ⚠ In-Flight upgrade not possible
- ⚠ Cross-endian/ Cross-platform not possible



Simple



MAA Enabled



Enterprise fleet-  
scale migrations



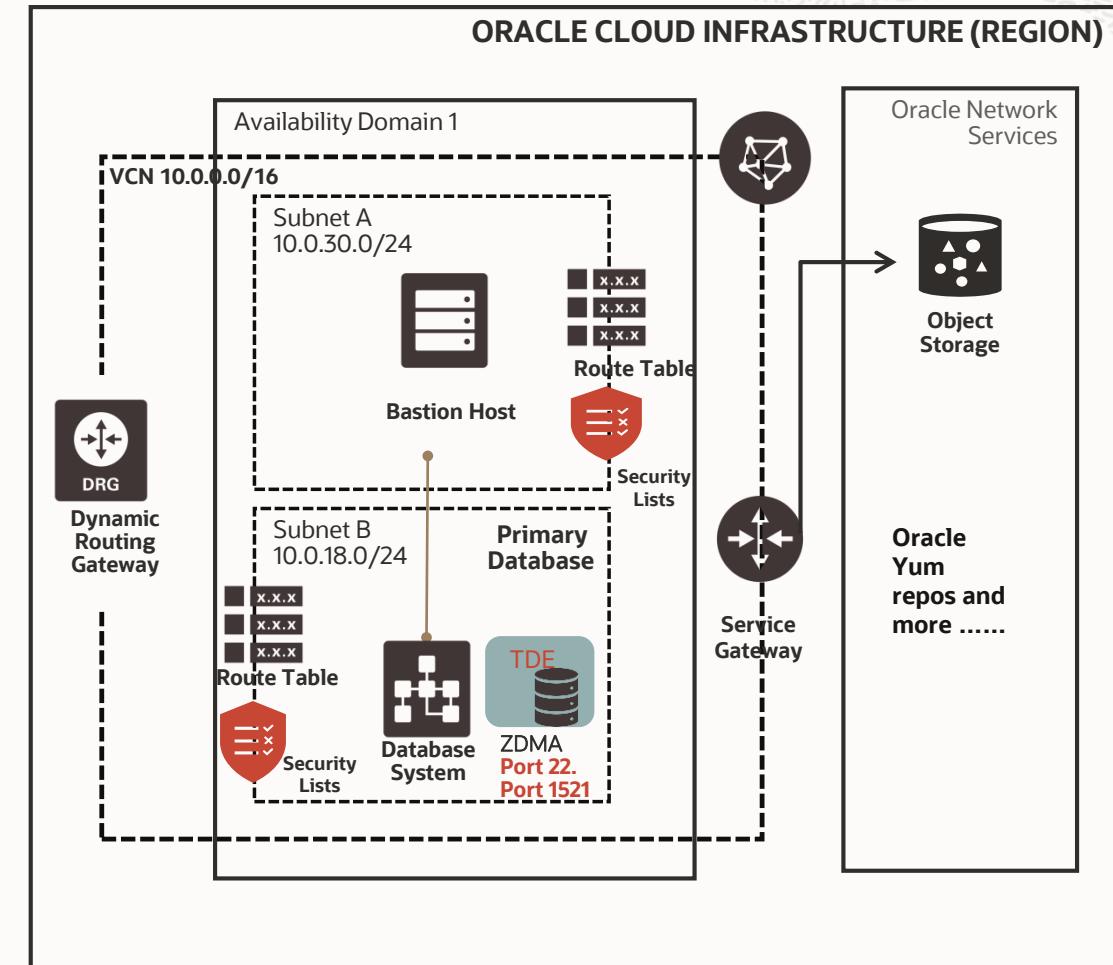
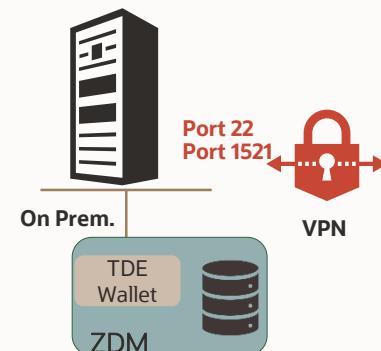
Free



# Migration Process using Zero Downtime Migration Tool

## Migration Steps

1. Network Configuration
2. Installing ZDM Tool
3. Setting up communication
4. Checking Encryption Wallet
5. Configuring ZDM Tool
6. Migration pre-check
7. Migrate the Database



# Oracle Cloud Infrastructure – Database Migration

Fully managed, easy to use database migrations into Oracle Cloud

## Database Migrations

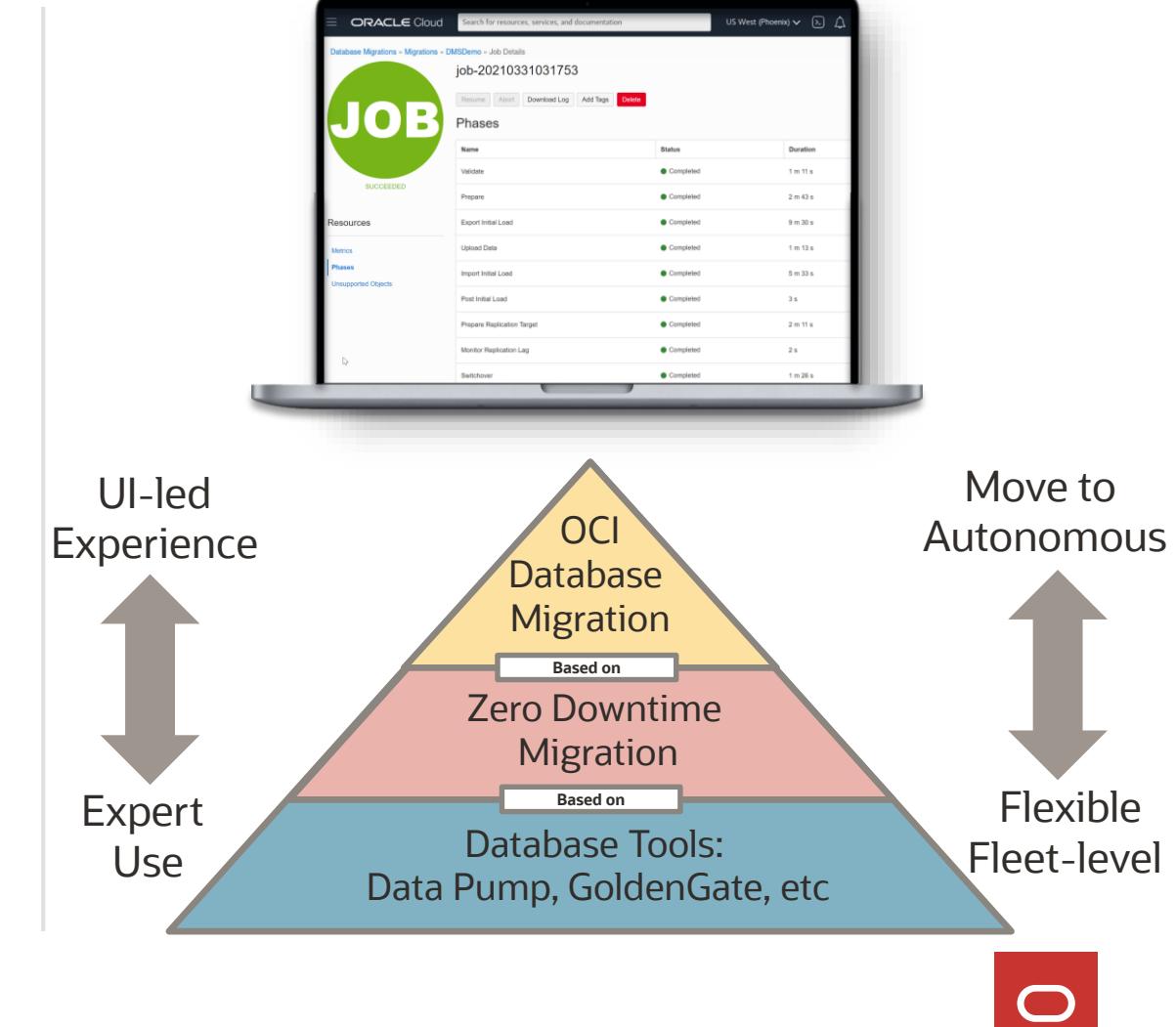
- Reduce cost and improve performance in Oracle Cloud
- Migrate databases, free for 6 months per migration

## Core Use Cases

- Machine-assisted migrations for Oracle Databases, Data Marts and Data Warehouses into Oracle Cloud

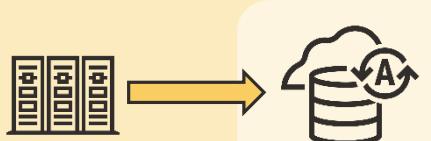
## Differentiated Use Cases

- Simplifies underlying technologies and resources
- Logical Offline and Online Migrations
- Schema/Metadata Migration
- Based on enterprise-strength Oracle tools Zero Downtime Migration, GoldenGate, and Data Pump

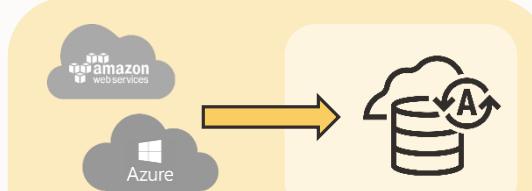


# OCI Database Migration - Use Cases

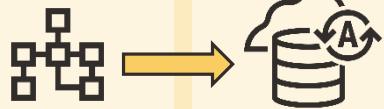
## All Source Locations



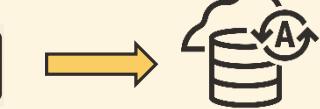
Migrate On-Premises  
to OCI Cloud



Migrate Third-party  
Cloud to OCI Cloud

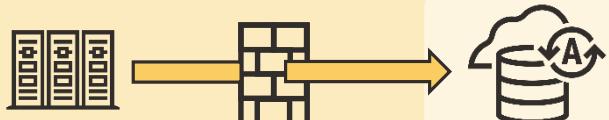


Migrate Oracle legacy  
cloud to OCI Cloud



Migrate Within OCI  
Cloud

## With or Without Direct Connection



Offline Migration from behind  
firewall using Agent

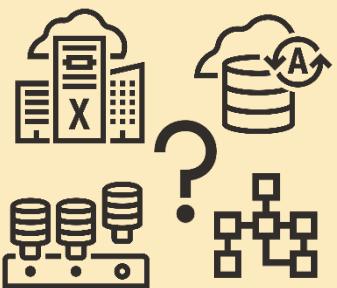


Offline Migration using  
FastConnect/VPN connection



Online Migration using  
FastConnect/VPN connection

# Tools for all Steps of the Migration Process



## Decision

Which Oracle Cloud Solution should I use?

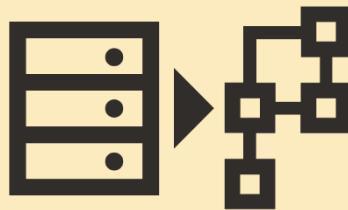
Oracle.com  
Cloud Services Navigator  
Migration Method Advisor



## Planning

Is my data supported for migration?

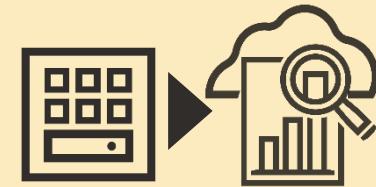
Cloud Premigration Advisor Tool (CPAT)



## Database Migration

How to move my Databases?

OCI Database Migration



## Application Migration

How to move applications and VMs to the cloud?

OCI Application Migration



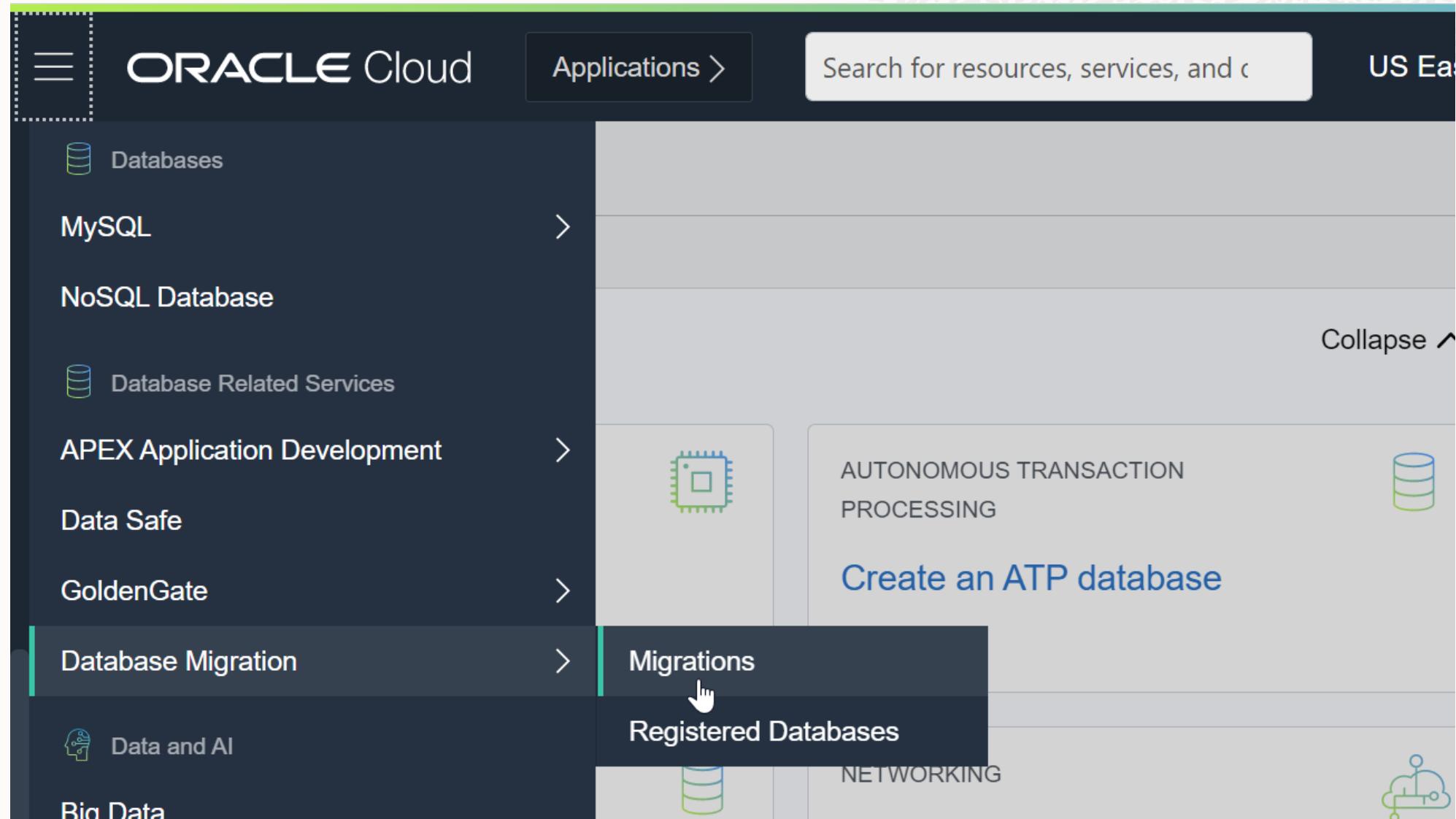
## Validation

Was my data completely migrated?

GoldenGate Veridata



# Step 1: Open Database Migration on the OCI Console



# Step 2: Register Source and Target Databases

Provide reusable connection information and credentials for databases

## Register Database

[Help](#)

**1 Database Details**

Name: MySourcePDB

Compartment: DMS\_LA  
ggsstage (root)/DMS\_LA

Vault in DMS\_LA [\(Change Compartment\)](#)  
DMS\_Vault

Encryption Key in DMS\_LA  
[\(Change Compartment\)](#)  
DMS\_Key

Select Database  
 Manually Configure Database

Database Type: Database (Bare Metal, VM, Exadata)

Database System in DMS\_LA  
[\(Change Compartment\)](#)  
SourceDB

## Register Database

[Help](#)

**1 Database Details**

Name: MyTargetATP

Compartment: DMS\_LA  
ggsstage (root)/DMS\_LA

Vault in DMS\_LA [\(Change Compartment\)](#)  
DMS\_Vault

Encryption Key in DMS\_LA  
[\(Change Compartment\)](#)  
DMS\_Key

Select Database  
 Manually Configure Database

Database Type: Autonomous Database

Database in DMS\_LA [\(Change Compartment\)](#)  
TargetATP



# Step 3: Create Migration

Select migration method and other settings to move a database to the cloud

### Create Migration

[Help](#)

**1 Add Details**

Name  [Change Compartment](#)

Compartment  [Change Compartment](#)

ggsstage (root)/DMS\_LA

Direct connection to source database  
The source database is directly accessible from the Cloud

No direct connection to source database  
Requires you to download and install an agent to use as a bridge to the source database

Vault in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

Encryption Key in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

**2 Select Databases**

**3 Migration Options**

[Next](#) [Cancel](#)

### Create Migration

[Help](#)

**1 Add Details**

**2 Select Databases**

**3 Migration Options**

**Source Database**

Registered Database in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

Database is pluggable database (PDB)

Registered Container Database in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

**Target Database**

Registered Database in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

[Previous](#) [Next](#) [Cancel](#)

### Create Migration

[Help](#)

**1 Add Details**

**2 Select Databases**

**3 Migration Options**

Initial Load  Datapump via Database Link  Datapump via Object Storage

Object Storage Bucket in DMS\_LA [\(Change Compartment\)](#)  [Change Compartment](#)

**Export Directory Object**

Name [\(i\)](#)  Path [\(i\)](#)  [Change Compartment](#)

Use Online Replication

GoldenGate Hub URL [\(i\)](#)

GoldenGate Administrator Username

GoldenGate Administrator Password

**Source Database**

GoldenGate Deployment Name

[Previous](#) [Create](#) [Cancel](#)



# Step 4: Validate Migration

Confirm all prerequisites, permissions, and connectivity to source and target

The screenshot shows the Oracle Cloud Migration Service (OCM) interface. On the left, there is a large green circle with 'DM' in white, labeled 'ACTIVE'. In the center, there is a yellow circle with 'JOB' in white, labeled 'IN PROGRESS'. The main area displays the 'MyMigration' page.

**Migration Information:**

- OCID: ...lgaxuq [Show](#) [Copy](#)
- Compartment: ggsstage (
- Created: Wed, Mar 31, 2021
- Encryption Vault: [DMS\\_Vault](#)
- Encryption Key: [DMS\\_Key](#)

**Validation Status:** Migration requires validation before it can be started. Select the Validate action button to initiate validation process.

**Action Buttons:** Validate (highlighted with a red box), Start, Clone, Move Resource, More Actions ▾

**Job Details:** Validation in progress at phase "Validate Target" (Phase 1 of 5).  
job-20210331030633

**Job Information:** OCID: ...jdwsna [Show](#) [Copy](#), Type: Evaluation  
Created: Wed, Mar 31, 2021, 03:06:33 UTC

**Resources:** Metrics, Phases (highlighted), Unsupported Objects

**Phases:**

Name	Status	Duration
Validate Target	Started	3 s
Validate Source	Pending	1 s

# Step 5: Start Migration

Initiate the migration job to move database into the cloud

The screenshot shows the Oracle Database Migration Service (DM) interface. On the left, there's a large green circle labeled 'DM ACTIVE'. Below it, under 'Resources', there are tabs for 'Metrics' (selected), 'Jobs' (highlighted with a blue border), and 'Excluded Objects'. In the center, under 'Jobs', there's a table with one row:

Name	State
<a href="#">job-20210331031341</a>	Succeeded

To the right of the table, there's a large orange circle labeled 'JOB IN PROGRESS'. Below it, under 'Resources', there's a table with two tabs: 'Metrics' (selected) and 'Phases'. The 'Metrics' tab shows a single row: 'Validate' with a status of 'Completed'. The 'Phases' tab shows two rows: 'Validate' (Completed, 1 m 11 s) and 'Prepare' (Started, 55 s, 50% progress). At the top of the main content area, there's a message: 'Migration validation completed and can be started from the Start action button.' Below this message, the 'Start' button is highlighted with a red box and a cursor icon.

**Migration Information**

OCID: ...lgaxuq Show Copy  
Compartment: ggsstage (root)  
Created: Wed, Mar 31, 2021  
Encryption Vault: DMS\_Vault  
Encryption Key: DMS\_Key

**Migration in progress at phase "Prepare" (Phase 2 of 10).**

**job-20210331031753**

Resume Abort Download Log Add Tags Delete

Job Information Tags

OCID: ...2jxcka Show Copy Type: Migration  
Created: Wed, Mar 31, 2021, 03:17:53 UTC

**Resources**

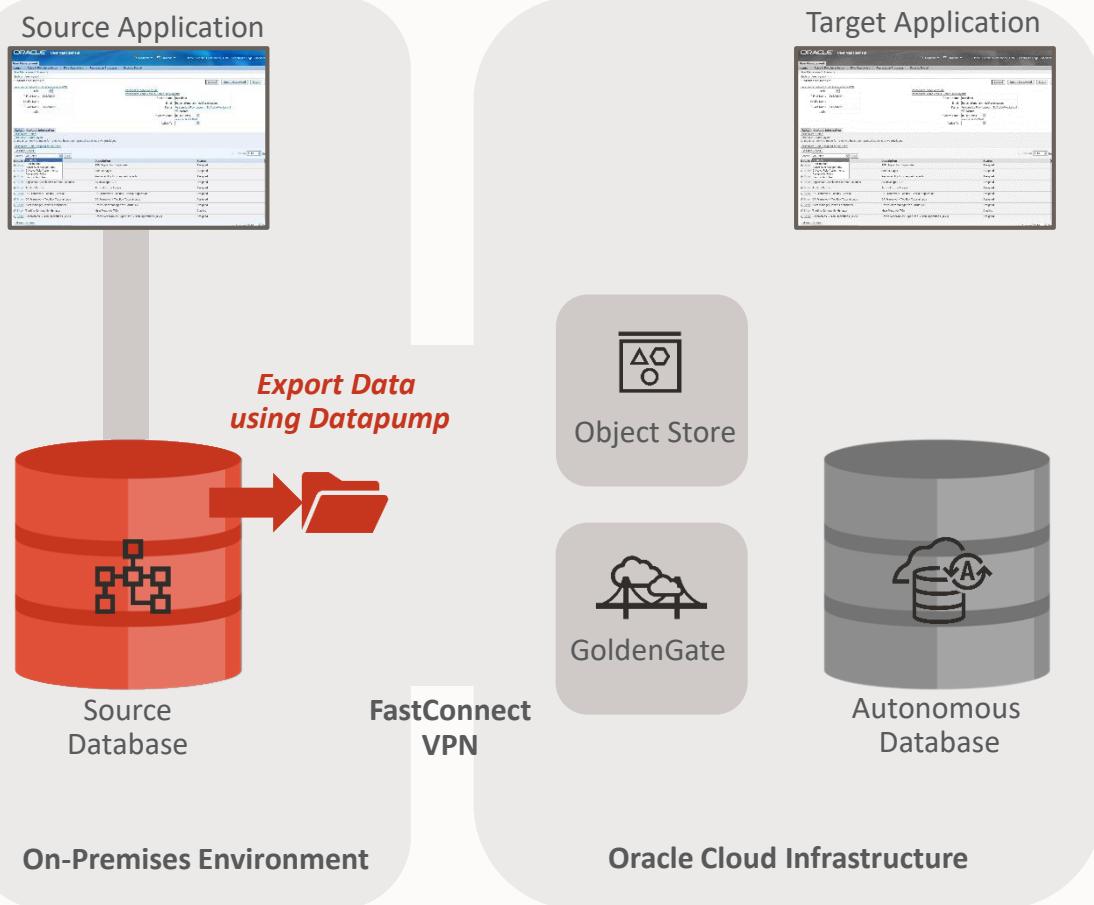
**Metrics**

**Phases**

Name	Status	Duration
Validate	Completed	1 m 11 s
Prepare	Started	55 s

# Start Migration – Export Initial Load

Current DB state is exported to files using datapump



## Phases

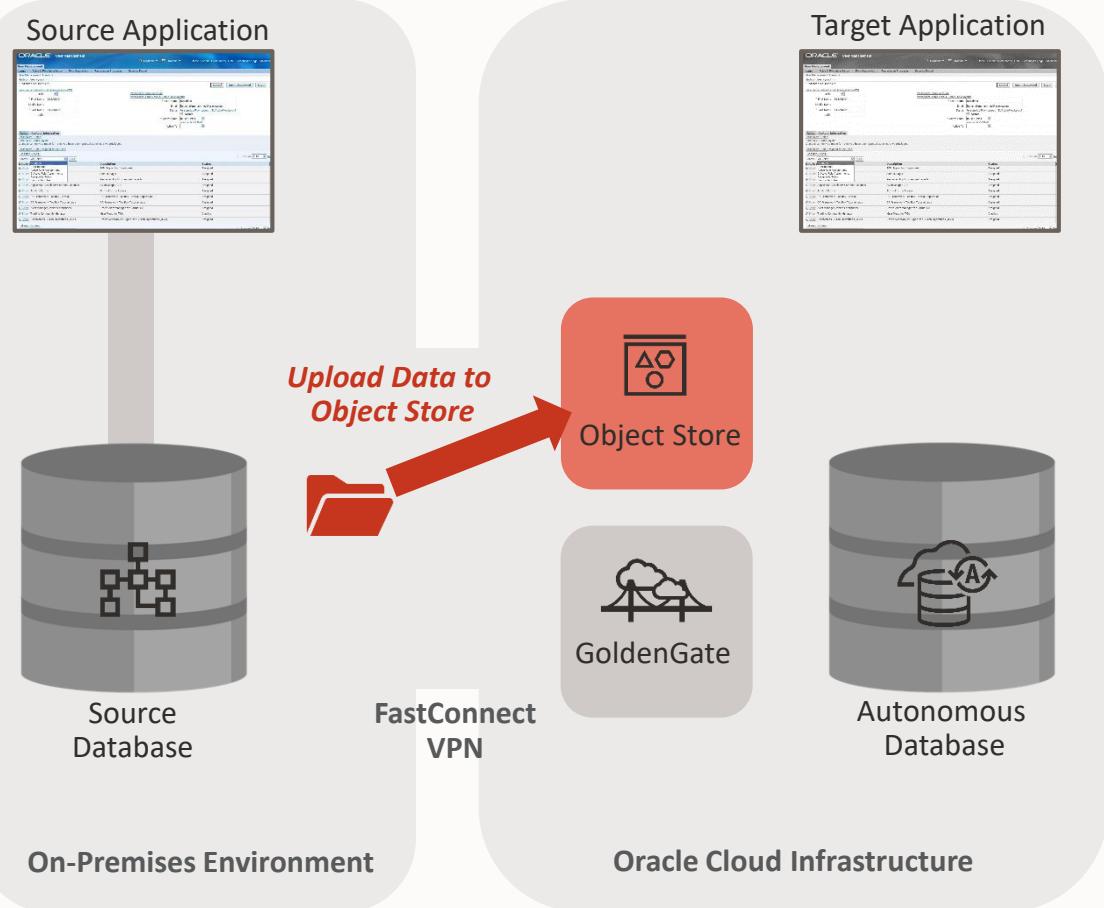
Name	Status	Duration
Validate	Completed	1 m 11 s
Prepare	Completed	2 m 43 s
Export Initial Load	Started <div style="width: 66%;"> </div> 66%	3 m 38 s
Upload Data	Pending	—
Import Initial Load	Pending	—
Post Initial Load	Pending	—
Prepare Replication Target	Pending	—
Monitor Replication Lag	Pending	—
Switchover	Pending	—
Cleanup	Pending	—

Showing 10 Items < 1 of 1 >



# Start Migration – Upload Data

Datapump export is uploaded to Object Store

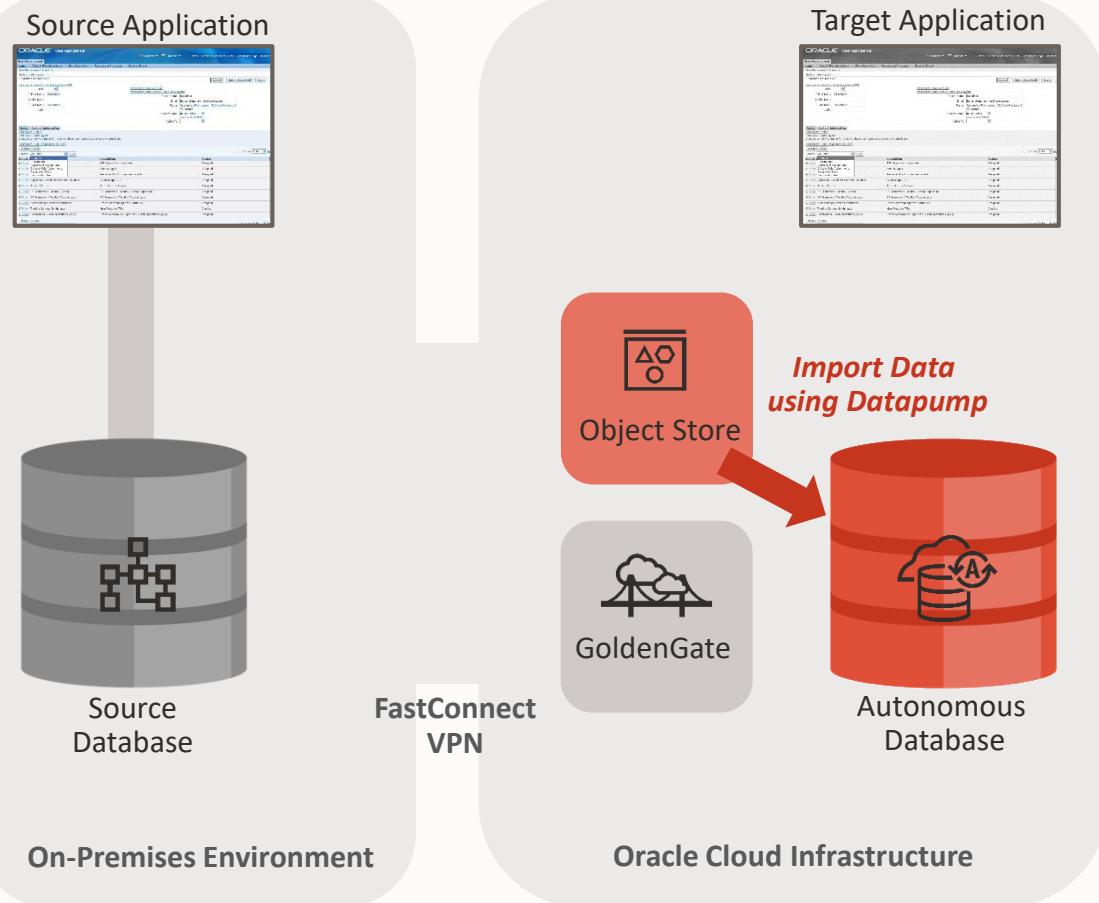


Phases		
Name	Status	Duration
Validate	Completed	1 m 11 s
Prepare	Completed	2 m 43 s
Export Initial Load	Completed	9 m 30 s
Upload Data	Started	26 s
Import Initial Load	Pending	—
Post Initial Load	Pending	—
Prepare Replication Target	Pending	—
Monitor Replication Lag	Pending	—
Switchover	Pending	—
Cleanup	Pending	—
Showing 10 Items < 1 of 1 >		



# Start Migration – Import Initial Load

Exported dump files are imported to ADB



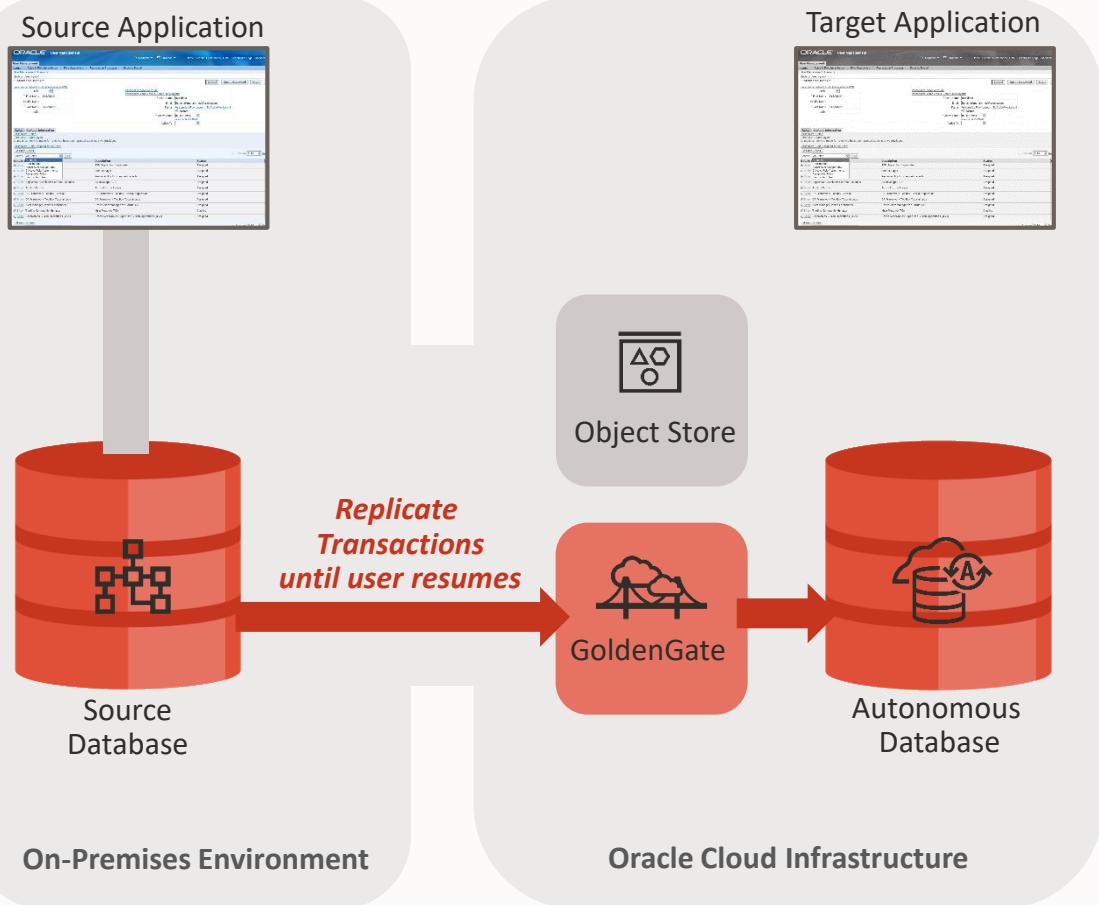
Name	Status	Duration
Validate	Completed	1 m 11 s
Prepare	Completed	2 m 43 s
Export Initial Load	Completed	9 m 30 s
Upload Data	Completed	1 m 13 s
Import Initial Load	Started 50%	3 m 30 s
Post Initial Load	Pending	—
Prepare Replication Target	Pending	—
Monitor Replication Lag	Pending	—
Switchover	Pending	—
Cleanup	Pending	—

Showing 10 Items < 1 of 1 >



# Start Migration – Replication

DB transactions are replicated using GoldenGate until user resumes the next phase



## Phases

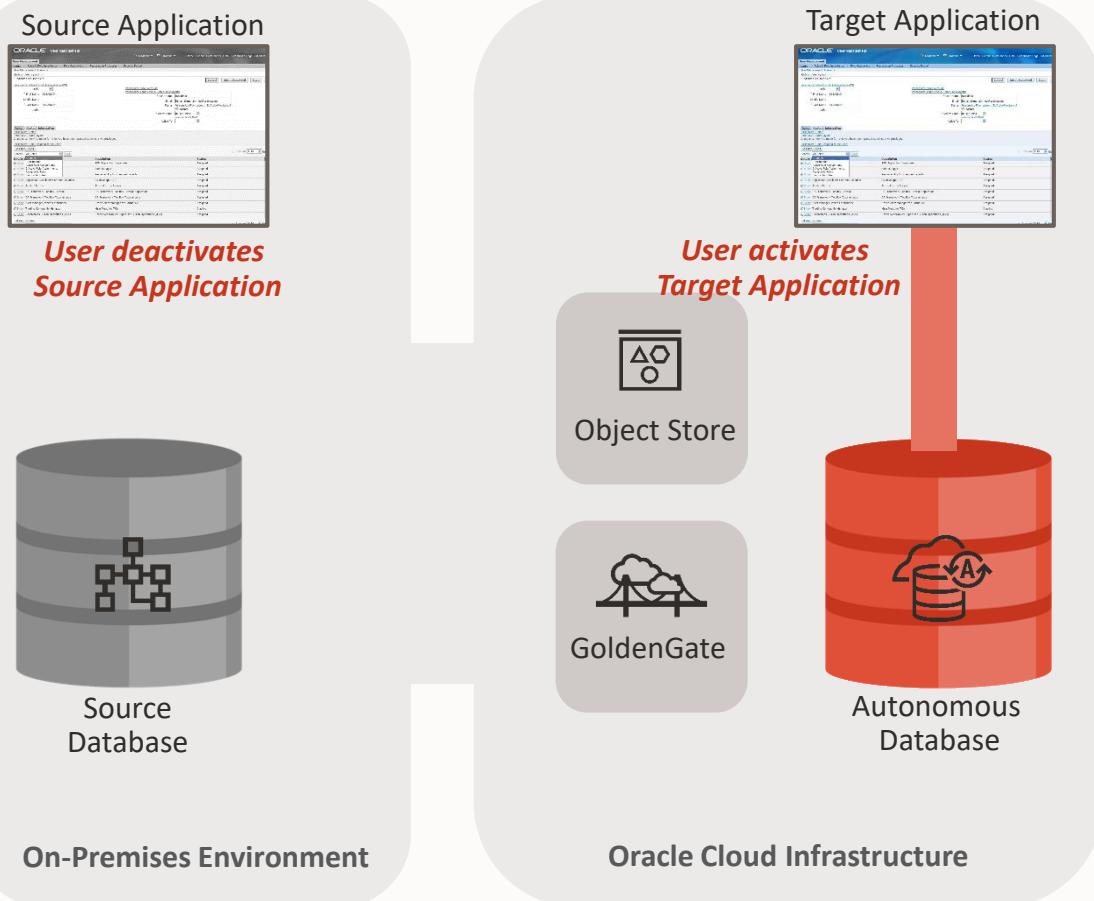
Name	Status	Duration
Validate	● Completed	1 m 11 s
Prepare	● Completed	2 m 43 s
Export Initial Load	● Completed	9 m 30 s
Upload Data	● Completed	1 m 13 s
Import Initial Load	● Completed	5 m 33 s
Post Initial Load	● Completed	3 s
Prepare Replication Target	● Completed	2 m 11 s
Monitor Replication Lag	● Completed	2 s
Switchover	● Pending	—
Cleanup	● Pending	—

Showing 10 Items < 1 of 1 >



# Start Migration – Switchover

Wait until last transaction is replicated to let user switch over applications



## Phases

Name	Status	Duration
Validate	● Completed	1 m 11 s
Prepare	● Completed	2 m 43 s
Export Initial Load	● Completed	9 m 30 s
Upload Data	● Completed	1 m 13 s
Import Initial Load	● Completed	5 m 33 s
Post Initial Load	● Completed	3 s
Prepare Replication Target	● Completed	2 m 11 s
Monitor Replication Lag	● Completed	2 s
Switchover	● Completed	1 m 26 s
Cleanup	● Pending	—

Showing 10 Items < 1 of 1 >



# Migration Succeeded

### job-20210331031753

Resume Abort Download Log Add Tags Delete

Job Information Tags

OCID: ...2jxcka Show Copy Type: Migration  
Created: Wed, Mar 31, 2021, 03:17:53 UTC

Resources Phases

Metrics Phases Unsupported Objects

Name	Status	Duration
Validate	Completed	1 m 11 s
Prepare	Completed	2 m 43 s
Export Initial Load	Completed	9 m 30 s
Upload Data	Completed	1 m 13 s
Import Initial Load	Completed	5 m 33 s
Post Initial Load	Completed	3 s
Prepare Replication Target	Completed	2 m 11 s
Monitor Replication Lag	Completed	2 s
Switchover	Completed	1 m 26 s
Cleanup	Completed	39 s

Showing 10 Items < 1 of 1 >



ORACLE

