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Oracle Zero Downtime Migration (ZDM) 21.4

Introduction and Technical Overview

Public

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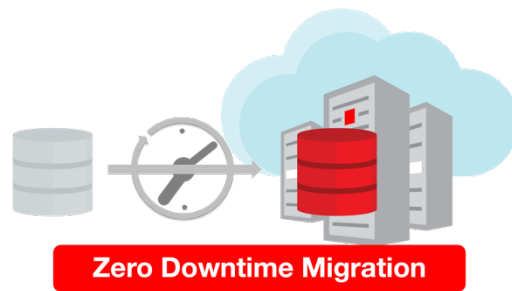List of Figures

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Figure 1. Oracle Zero Downtime Migration Logo comprising of a database, a clock with an arrow pointing to a database deployed in the Cloud

Purpose

Oracle customers are moving Oracle workloads into the Oracle Cloud or onto Engineered Systems at a growingly rapid pace. However, migrating workloads has been a source of challenges for many years. In particular, migrating database workloads from one system to another or into the Cloud is easier said than done.

Based on years of experience migrating Oracle workloads, Oracle has developed Zero Downtime Migration (ZDM). ZDM is Oracle's premier solution for a simplified and automated migration experience, providing zero to negligible downtime for the production system depending on the migration scenario. ZDM allows you to migrate your Oracle Databases directly and seamlessly to and between any Oracle-owned infrastructure, including Exadata Database Machine on-premises, Exadata Cloud at Customer (ExaC@C), and Oracle Cloud Infrastructure. Oracle ZDM supports a wide range of Oracle Database versions and, as the name implies, ensures minimal to no production database impact during the migration.

ZDM follows Oracle Maximum Availability Architecture (MAA) principles and incorporates products such as GoldenGate and Data Guard to ensure High Availability and an online migration workflow that leverages technologies such as the Recovery Manager, Data Pump, and Database Links.

Furthermore, since 21.1, Oracle ZDM has supported Oracle's Autonomous Database as a Cloud Target, allowing customers to move their existing workloads into Oracle's premier database cloud service, leveraging its self-driving, self-securing, and self-repairing capabilities. Oracle ZDM migrates on-premises databases to Oracle Autonomous Transaction Processing and Oracle Autonomous Data Warehouse, both on Shared and Dedicated offerings.

Starting in 21.2, Oracle ZDM introduced support for Oracle Databases on AWS RDS; This expands ZDM's list of sources and provides customers with a broader choice of migration possibilities. In release 21.3, Oracle ZDM further expands its support of migrations from AWS RDS sources, enhances its Data Guard support, and adds full cross-platform support for its logical migration workflow.

In release 21.4, Oracle ZDM further expands its functionality for physical and logical migration, enhancing control, automation, and ease of use for database migrations.

This technical brief provides an overview of Oracle Zero Downtime Migration 21.4, the latest version, explaining its underlying workflow and how you can use it to efficiently and seamlessly migrate your Oracle Databases.

For more information on Oracle Zero Downtime Migration, please visit ZDM's product website.[1]

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[1] https://www.oracle.com/goto/zdm

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Zero Downtime Migration

Architecture

Oracle Zero Downtime Migration (ZDM) is the Oracle Maximum Availability Architecture (MAA)-recommended solution to migrate Oracle Databases to the Oracle Cloud. ZDM's inherent design keeps in mind the migration process as straightforward as possible to ensure the most negligible impact on production workloads. The Source Database to be migrated can be on-premises, deployed on Oracle Public Cloud Gen 1, Oracle Cloud Infrastructure, or 3rd Party Clouds like AWS. The Target Database deployment can be in a Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, Exadata On-Premises, or Autonomous Database on Shared or Dedicated Exadata Infrastructure. ZDM automates the entire migration process, reducing the chance of human errors. ZDM leverages Oracle Database-integrated High Availability (HA) technologies such as Oracle Data Guard and Oracle GoldenGate and follows all MAA best practices that ensure no significant downtime of production environments. Oracle ZDM supports both Physical and Logical Migration workflows.

Supported Configurations

Oracle ZDM supports Oracle Database versions 11.2.0.4, 12.1.0.2, 12.2.0.1, 18c, 19c & 21c. ZDM's physical migration workflow requires the Source and Target Databases to be in the same database release. Starting with ZDM 21c and introducing the Logical Migration workflow, ZDM now supports database cross-version migration, thus providing an in-flight upgrade while migrating to the Oracle Cloud.

Oracle ZDM supports Source Oracle Databases hosted on Linux, Solaris, and AIX operating systems. Oracle ZDM supports single-instance databases, Oracle RAC One Node databases, or Oracle RAC databases as sources. Oracle ZDM supports Oracle Database Enterprise & Standard Edition as Source and Target Databases.

Oracle ZDM allows the source database to be a non-CDB or a container database (CDB) with one or more Pluggable Databases (PDBs). Starting with release 21.1, Oracle ZDM allows non-CDB Databases to be migrated to Pluggable Databases on the fly, allowing for total conversion and adding more versatility to the migration workflow.

Migration Paths

Oracle ZDM supports on-premises databases to be migrated to a variety of targets:

- Oracle Base Database Service

- Exadata Database Service on Dedicated Infrastructure

- Exadata Database Service on Cloud@Customer

- Oracle Exadata Database Machine on-premises

- Oracle Autonomous Database
    - Autonomous Transaction Processing on Shared and Dedicated Exadata Infrastructure
    - Autonomous Data Warehouse on Shared and Dedicated Exadata Infrastructure

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Benefits

- **Simple & Efficient**

  - Oracle ZDM's automated workflow makes moving your Oracle Database to the Oracle Cloud seamless. By eliminating the need for manual configurations and operations, Oracle ZDM ensures an error-free and efficient migration to Oracle Cloud or Oracle Database Machine on-premises.

- **Highly Available**

  - Oracle ZDM is Oracle Maximum Availability Architecture compliant; the tight integration with Oracle Database technologies such as Oracle Data Guard and Oracle GoldenGate ensures that your migration completes with zero downtime and no production impact.

- **Flexible**

  - Depending on your requirements and business needs, you can directly migrate your Oracle Database to the Oracle Cloud and the Exadata Database Machine on-premises from various source databases.

- **Validation**

  - Oracle ZDM performs extensive checks before and post-migration, allows for pausing and resuming your migration tasks if required, and includes an evaluation mode to preempt any issues during your database migration.

- **Cost-Effective**

  - The Oracle ZDM engine is available at no extra cost.

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What's New in Oracle Zero Downtime Migration 21.4

Physical Migration Enhancements

- **Pause option for Redo Apply catch-up**: new response file parameter, ZDM_APPLY_LAG_MONITORING_INTERVAL, adds a new phase to the migration workflow. For use cases where the migration job is paused for extended periods before the switchover, this new phase queries the current redo apply lag. It reports it on the migration job periodically.

- **Target Time Zone file upgrade**: new response file parameter, ZDM_TGT_UPGRADE_TIMEZONE, adds a post-migration task that upgrades the target database time zone file.

- **Enhanced handling of DB_NK_Cache_Size values**: new automation in ZDM that copies these values from the source's init file to the target database, benefitting databases with tablespaces of variable block size in use. This does not apply to Non-CDB to CDB migration scenarios.

- **Resume capability after manual Data Guard switchover**: If a manual switchover is performed for some unforeseen reason, ZDM can now be instructed to acknowledge a successful switchover and resume the migration job. This is instructed to ZDM while resuming a migration job and specifying the -skip SWITCHOVER option.

- **SPFILE-less source database support (offline migration)**: source databases without an SPFILE can now be migrated offline.

- **TDE Wallet with WALLET ROOT Support**: ZDM can now migrate all wallet files and sub-directories under WALLET_ROOT.

- **Configurable RMAN section size**: new response file parameter, ZDM_RMAN_SECTION_SIZE, allows manual recovery manager section size configuration.

- **Non-CDB to CDB conversion database naming**: ZDM's automated workflow for converting non-multitenant sources into pluggable databases allows target database naming via a new response file parameter.

- **Configurable RMAN Compression:** the recovery manager setting for compression can now be disabled.

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Logical Migration Enhancements

- **GoldenGate Replicat performance profile**: a new parameter (GOLDENGATESETTINGS_REPLICAT_PERFORMANCEPROFILE) allows for automated tuning of the GoldenGate replicat. Currently, users have different parameters to achieve this. A new unified parameter allows for a more direct experience and offers modes for setting up the replicat performance profile.

- **Auto login wallet:** a new parameter (WALLET_SOURCEADMIN) allows for specifying the absolute path for the auto login wallet file (cwallet.sso.)

- **Support for tables with XML data types:** XML Data Types stored CLOBS can now be migrated via Data Pump automated conversion to BINARY STORAGE. Oracle ZDM expands the use of the DATAPUMPSETTINGS_METADATATRANSFORMS parameter to allow users to specify the data to be converted, allowing for its migration as part of ZDM's overall workflow.

- **Object Storage Pre-authenticated URL support**: ZDM now supports pre-authenticated URLs for migration jobs using OCI Object Storage as the transfer medium for backups, providing easy access to the storage buckets.

- **Data and Metadata migration in separate phases**: new migration workflow can now perform regular export and a phased import for metadata Import. This allows the handling of USER and PROFILE creation and then handling of METADATA creation, finishing with the import of DATA. Users benefit from this approach when custom scripts or workflow customization is required.

- **Data Pump error handling**: ZDM reports all relevant logs and ORA-type errors to the user after all phases involved in Data Pump jobs. Two new parameters (IGNOREEXPORTERRORS & IGNOREIMPORTERRORS) allow users to specify which errors ZDM should ignore on the resume of a migration job. ZDM will attempt a re-import or re-export, accordingly, ignoring the specified errors.

- **Auto-start profiles for Oracle GoldenGate**: ZDM will now ensure auto-start and restart profiles for the Oracle GoldenGate replicat and extract by default. This provides the resiliency of these components in case of any failure during the migration job.

- **CPAT log transfer option**: For easy troubleshooting in a unified location, users can now request that CPAT logs be transferred from the source database server to the ZDM host server.

- **Sudo-less migration**: a new authentication plug-in allows migration without non-privileged users for source and target node access. This new feature applies to logical migration and with restrictions on specific components of the physical migration workflow.

- **Best Practices**: a new section with in-depth advice and guidance for logical migration is now part of the product documentation.

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Migrations Workflows

Physical Migration

Offline Migration with a backup location

A standard physical offline migration with a backup location will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration
3. ZDM Connects the Source Database to the Backup Location.
4. ZDM Orchestrates Transfer of Database Backup Files.
5. ZDM Instantiates the Target Database.
6. ZDM Switches Over and Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, and Exadata on-premises.

Online Migration with a backup location

A standard physical online migration with a backup location will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration
3. ZDM Connects the Source Database to the Backup Location.
4. ZDM Orchestrates Transfer of Database Backup Files.
5. ZDM Instantiates a Standby Database on the Target.
6. ZDM Synchronizes Primary and Standby.
7. ZDM Switches Over and Swaps Roles.
8. ZDM Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, and Exadata on-premises.

Online Migration with direct data transfer

A standard physical online migration with direct data transfer will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration
3. ZDM Orchestrates a Restore from Service between Source and Target.
4. ZDM Instantiates a Standby Database on the Target.
5. ZDM Synchronizes Primary and Standby.
6. ZDM Switches Over and Swaps Roles.
7. ZDM Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, and Exadata on-premises.

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Online Migration with standby database as the initial source

A standard physical online migration with a standby database as the initial source will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration
3. ZDM Orchestrates a Restore from Service between Source Standby and Target.
4. ZDM Instantiates a Standby Database on the Target.
5. ZDM uses Primary Database from the Source to Synchronize the Target Standby.
6. ZDM Switches Over and Swaps Roles.
7. ZDM Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, and Exadata on-premises. This workflow is only supported with direct data transfer using restore from service.

Logical Migration

Offline Migration with a backup location

A standard logical offline migration with a backup location will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration.
3. ZDM Connects the Source Database to the Backup Location
4. ZDM Exports Via Data Pump from Source to Backup Location.
5. ZDM Imports Data Dump Files from Backup Location to Target.
6. ZDM Instantiates Target Database.
7. ZDM Switches Over and Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, Exadata on-premises, and the Autonomous Database.

Offline Migration with database links

A standard logical offline migration with database links will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration
3. ZDM Connects Source and Target via Database Links.
4. ZDM Exports / Imports Via Data Pump from Source to Target.
5. ZDM Validates Target Database.
6. ZDM Switches Over and Finalizes the Migration Process.

This workflow supports Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, Exadata on-premises, and the Autonomous Database.

Online Migration with database links

A standard logical online migration with database links will take the following steps:

1. Download and Configure ZDM.
2. ZDM Starts Database Migration.
3. ZDM Connects Source and Target via Database Links.
4. ZDM Configures GoldenGate Extract and Captures Source Transactions
5. ZDM Exports / Imports Via Data Pump from Source to Target.
6. ZDM Configures GoldenGate Replicat and Starts Applying Changes to Target
7. ZDM Switches Over and Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, Exadata on-premises, and the Autonomous Database.

Online Migration with a backup location

A standard logical online migration will take the following steps:

1. Download & Configure ZDM.
2. ZDM Starts Database Migration.
3. ZDM Connects to the Source, Target, and Backup Location.
4. ZDM Configures GoldenGate and Captures Source Transactions.
5. ZDM Exports via Data Pump from Source to Backup Location.
6. ZDM Imports Data Dump Files from Backup Location to Target.
7. ZDM Configures GoldenGate and Starts Applying changes.
8. ZDM Switches Over and Finalizes the Migration Process.

This workflow is supported for Oracle Base Database Service, Exadata Database Service on Dedicated Infrastructure, Exadata Database Service on Cloud@Customer, Exadata on-premises, and the Autonomous Database.

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Summary

Oracle Zero Downtime Migration is Oracle's premier and automated solution for database cloud migration. Oracle ZDM provides customers with a direct and seamless migration for Oracle Databases to Oracle Cloud and Exadata Database Machine on-premises, supporting a wide range of Oracle Database versions as sources and Oracle Database Cloud Services as targets. Customers have a wide array of Source Oracle Database for their migration; Oracle ZDM supports Oracle databases on Solaris, Linux, AIX, and AWS RDS.

Oracle ZDM supports Standard Edition and Enterprise Edition Oracle Databases, offering different migration approaches ranging from offline backup and restore, over Data Pump and Database Links-based migrations, to using technologies such as Oracle Data Guard and Oracle GoldenGate for physical as well as logical migration workflows. Customers can leverage features like ZDM's Physical Direct Data Transfer to avoid using a backup location and thus achieve a faster and more efficient migration.

Migration to the Oracle Cloud can be achieved in as little as six simple steps for offline migrations and eight steps for online-based migrations. In any scenario, Oracle ZDM provides a Maximum Availability Architecture-compliant migration, ensuring high availability, data protection, and disaster recovery for your journey to the Oracle Cloud.

Oracle ZDM offers fleet-level migrations, catering to all single instance, Oracle RAC, and RAC One Node database migration scenarios, making it the Best-In-Class solution for moving your databases to the Oracle Cloud and Exadata Database Machine on-premises. It provides:

- A Wide Array of Migration Sources and Targets

- Multiple Migration Workflows

- Best-in-Class Features & Functionality

- Fully Automated Migrations

- Cost-effective migration support

For more information, step-by-step guides, and product documentation, please visit the Oracle Zero Downtime Migration website at: www.oracle.com/goto/zdm.

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