Mindtree
A Larsen & Toubro Group Company

OSS to Azure Cloud Database Migration:
## A Mindtree Approach

CONTENTS

Introduction

Gone are the days of large-scale database systems that offer more than a thousand functionalities. Customers use less than 20% of these functionalities provided by the specific DBMS/RDBMS systems, and hence, end users are moving towards database systems which offer focused services. It has also been observed that in case an end customer is to integrate more than two-three small-scale database systems for multiple functionalities, it becomes easier and cost effective. Interestingly, most such databases are open source in nature. At the same time, the trend to move things to cloud has also been established as a standard.

In this whitepaper, we have attempted at summarizing a few ways of migrating some of the major open source databases and enterprise databases (like Oracle) to cloud database (predominantly PaaS).

High Level Architecture

The overall high-level architecture follows the process of Assess, Migration, and Optimize to ensure that workloads are ready to meet production demands on the Azure platform.

A high level solution architect is flexible enough to cater to various different RDBMS (heterogeneous) needs by using tools like ORA2PG .DMA SSMA.
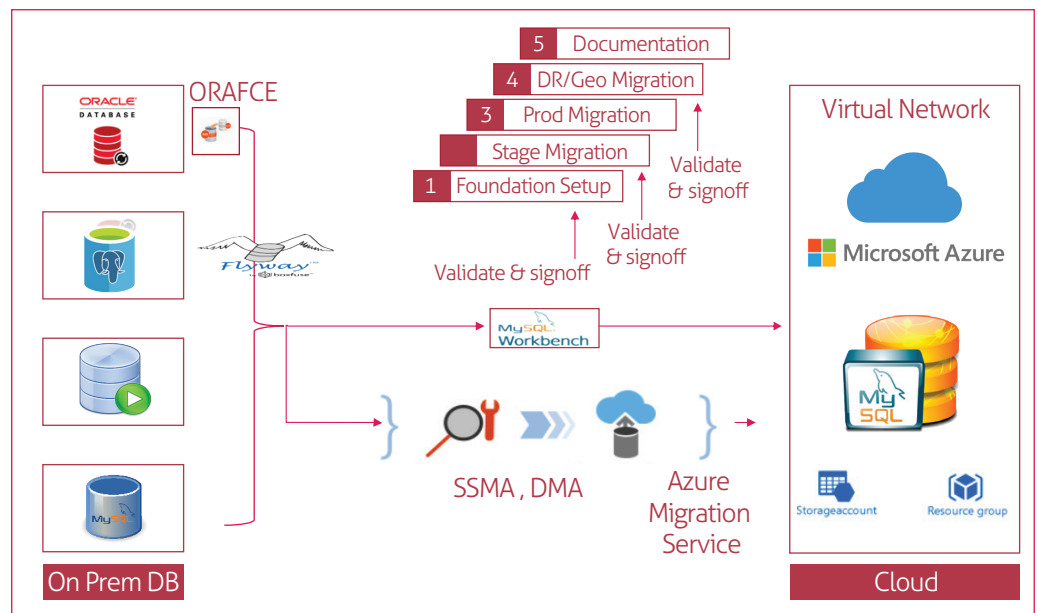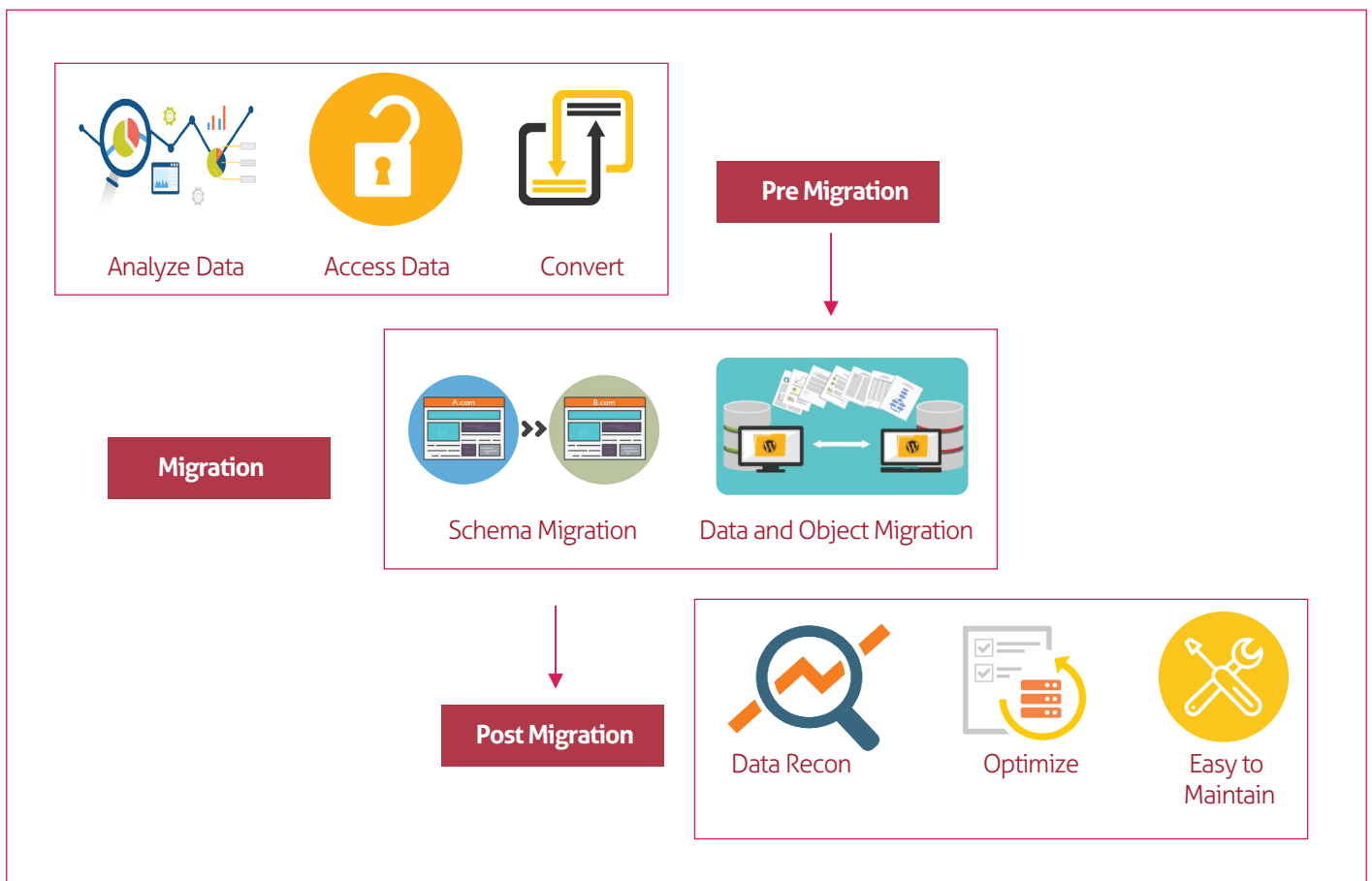

Our approach to database migration, in general, could be summarized as:

- Pre-migration check-list preparation (Install DMA, assess database compatibility)
- Offline versus online migrations to determine whether the downtime is acceptable; if not, to be prepared for online/minimal down time migration options (DMS, Transactional Replication)
- Preparation of target Azure Postgre Database
- Validate the migration steps
  - Create a migration project
  - Analyze and access source and target
  - Add databases and plan
  - Select login
  - Migration to Azure Postgre Database
  - Verify data in Azure Postgre Database
- Post-migration: Optimum utilization and to ensure smooth functioning wherever possible
- Remediate procedures/ steps
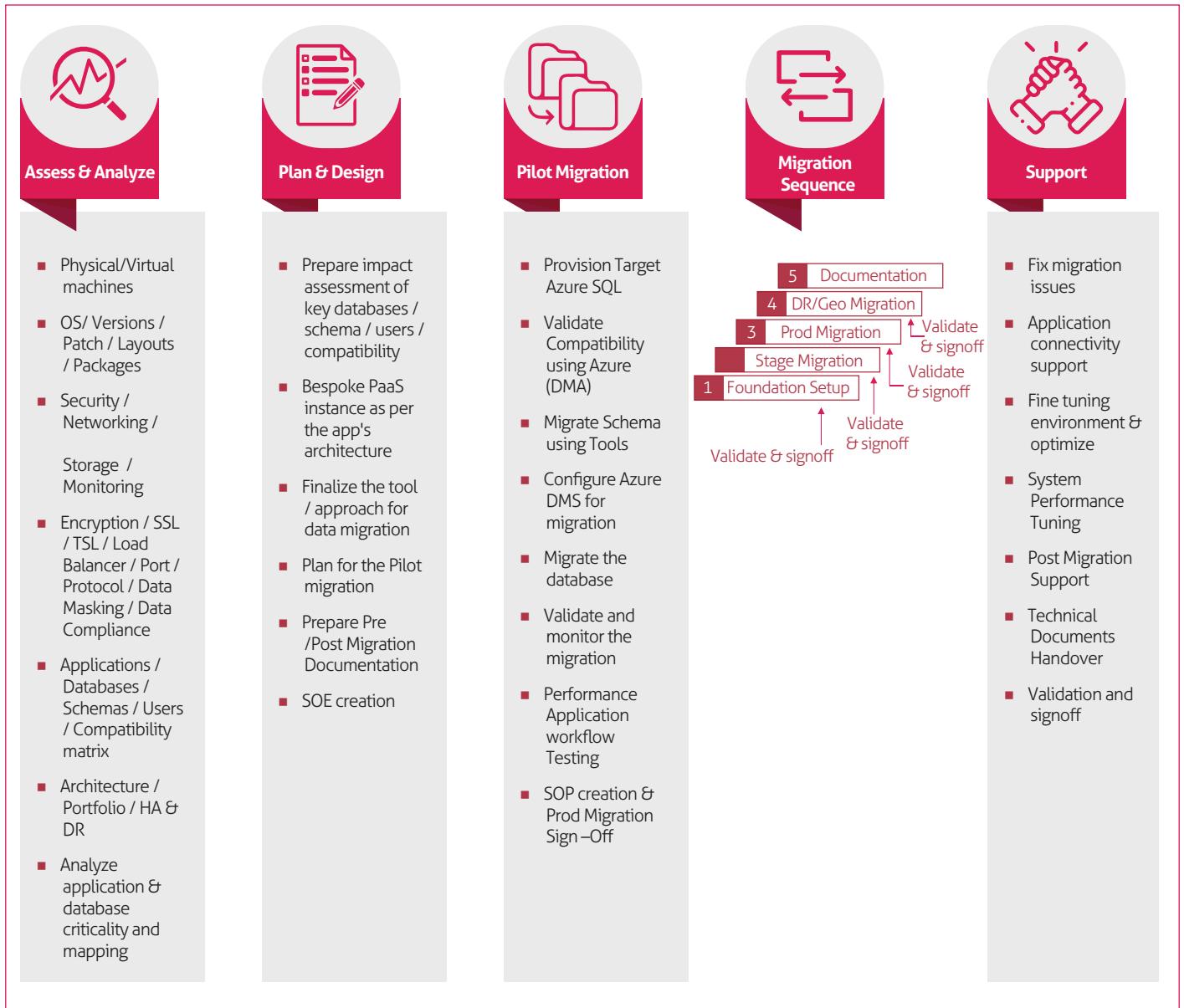
Migration Strategy

Gone are the days of large-scale database systems that offer more than a thousand functionalities. Customers use less than 20% of these functionalities provided by the specific DBMS/RDBMS systems, and hence, end users are moving towards database systems which offer focused services. It has also been observed that in case an end customer is to integrate more than two-three small-scale database systems for multiple functionalities, it becomes easier and cost effective. Interestingly, most such databases are open source in nature. At the same time, the trend to move things to cloud has also been established as a standard.

In this whitepaper, we have attempted at summarizing a few ways of migrating some of the major open source databases and enterprise databases (like Oracle) to cloud database (predominantly PaaS).

- **Pre-migration:** Analyze the data and create a feasibility report for migration

- **Migration:** Schema Migration and Test Data Migration (Batch Data and Full Load)

- **Post-migration:** Data Reconciliation using Count of Data at Record Level and Column Level, Optimize the tools to ease the process and ensure Ease of Maintenance

Approach using Migration Framework

Assess & Analyze

- Physical/Virtual machines
- OS/ Versions / Patch / Layouts / Packages
- Security / Networking / Storage / Monitoring
- Encryption / SSL / TSL / Load Balancer / Port / Protocol / Data Masking / Data Compliance
- Applications / Databases / Schemas / Users / Compatibility matrix
- Architecture / Portfolio / HA & DR
- Analyze application & database criticality and mapping

Plan & Design

- Prepare impact assessment of key databases / schema / users / compatibility
- Bespoke PaaS instance as per the app's architecture
- Finalize the tool / approach for data migration
- Plan for the Pilot migration
- Prepare Pre /Post Migration Documentation
- SOE creation

Pilot Migration

- Provision Target Azure SQL
- Validate Compatibility using Azure (DMA)
- Migrate Schema using Tools
- Configure Azure DMS for migration
- Migrate the database
- Validate and monitor the migration
- Performance Application workflow Testing
- SOP creation & Prod Migration Sign –Off

Migration Sequence

5	Documentation
4	DR/Geo Migration
3	Prod Migration
	Stage Migration
1	Foundation Setup

Validate & signoff

Validate & signoff

Validate & signoff

Validate & signoff

Support

- Fix migration issues
- Application connectivity support
- Fine tuning environment & optimize
- System Performance Tuning
- Post Migration Support
- Technical Documents Handover
- Validation and signoff

In order to support the above-mentioned migration strategy, the framework is divided into five major areas as mentioned below at a high level.

- **Assess and analyze:** Pre-migration Feasibility Report and Analysis

- **Plan and Design:** Migration Plan and Design Documentation, Impact Analysis Roll Back Plan

- **Pilot Migration:** Provision Target Azure SQL DB and Validate Schema and Sample Data

- **Migration Sequence:** Schema, Data, Object, Validate and Verify data

- **Post Migration Support :** Documentation, Support , Fix Bug and Fine Tuning Validation and Signoff

OSS Use Cases (RDBMS to Azure)

Various use cases for OSS Open Source System are outlined below:

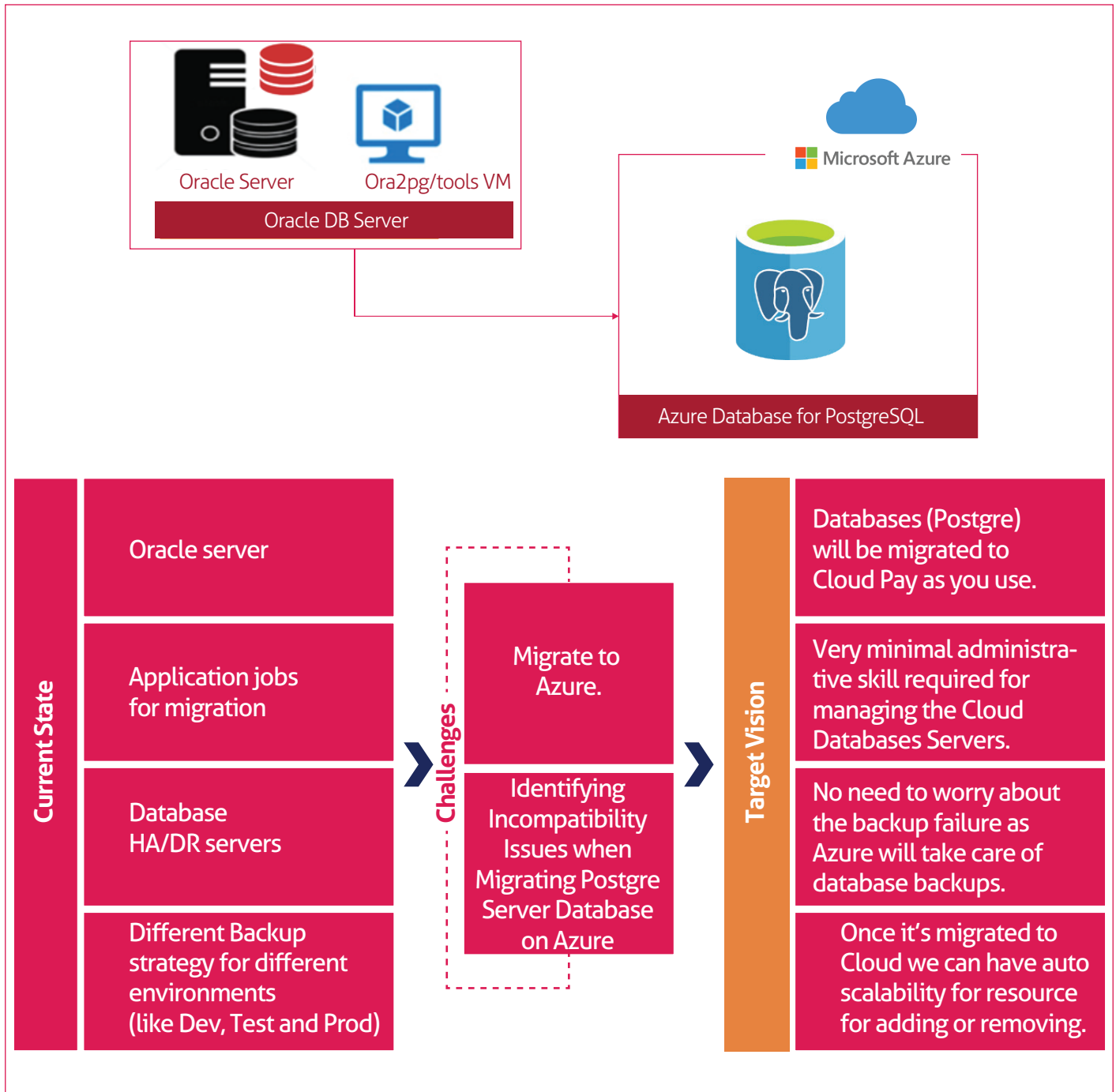For E.g.: Azure Database for PostgreSQL: Oracle ==> Azure Database for PostgreSQL

Target System: Azure Postgre | **Environment:** Oracle 10g R2, Data Vol 1+ TB, Instances 6+ and Database 5+

Customer: Leading airlines in the Middle East | **Tools:** Ora2pg, Flyway, DMA, DMS….etc.

Use Cases at Mindtree 1/2

Source	Target Azure	Environment	Customer	Tools and Methodology
ORACLE DATABASE	(PostgreSQL)	■ Oracle 10gR2 ■ Data Vol 1TB+ ■ Instances 6+ ■ Databases 5+	■ Leading A leading Airline in Middle East	■ Ora2pg Flyway DMS
MySQL	Azure Data Lake Storage Gen2	■ MySQL ver. 5.7x ■ Legacy Systems ■ Data Vol 5TB+ ■ Instances 50+ ■ Databases 100+	■ A leading telecommunications and IT service provider in Europe	■ Workbench ■ DMS ■ DMA ■ SSMA
MySQL	MySQL	■ MySQL 5.6x, 5.7x ■ Data Vol 10TB+ ■ Instances 200+ ■ Databases 1000+	■ Hi-Tech Media Networks Pvt. Ltd., USA	■ Workbench ■ DMS
ORACLE DATABASE	MySQL	■ Oracle 12.1 ■ Data Vol 1TB+ ■ Instances 2+ ■ Databases 2+	■ Insurance Client	■ Flyway ■ Ora2pg ■ DMS

Use Cases at Mindtree 2/2

Source	Target Azure	Environment	Customer	Tools and Methodology
PostgreSQL	Azure PostgreSQL	■ PostgreSQL 9.5, 10 ■ Data Vol 1TB+ ■ Instances 5+ ■ Database 10+	■ A leading Biotechnology organization	■ Ora2PG ■ Third party Tools
MySQL	MariaDB	■ MySQL 5.7+ ■ Data Vol 500GB ■ Instances 5+ ■ Databases 50+	■ Global technology Company	■ Using logical backup (such as MySQL dump, Mysql pump or and restore is the only option
mongoDB	Cosmos DB	■ MongoDB 3.4, 4.0 ■ Legacy System ■ Data Vol 2TB+ ■ Instances 15+	■ Global technology Company	■ DMA ■ DMS
SQL	SQL	■ SQL Server 2014 ■ Data Vol 700GB+ ■ Instance 2+ ■ Databases 2+	■ A leading brand in FMCG in India	■ SSMA ■ DMA

PoC: Oracle to Azure PostgreSQL Using Compass and Ora2pg

Oracle Server | Ora2pg/tools VM
Oracle DB Server

Microsoft Azure

Azure Database for PostgreSQL

Current State
- Oracle server
- Application jobs for migration
- Database HA/DR servers
- Different Backup strategy for different environments (like Dev, Test and Prod)

Challenges
- Migrate to Azure.
- Identifying Incompatibility Issues when Migrating Postgre Server Database on Azure

Target Vision
- Databases (Postgre) will be migrated to Cloud Pay as you use.
- Very minimal administrative skill required for managing the Cloud Databases Servers.
- No need to worry about the backup failure as Azure will take care of database backups.
- Once it's migrated to Cloud we can have auto scalability for resource for adding or removing.

PostgreSQL is open source, and has become the choice for several enterprise developers. We will be able to deploy scalable PostgreSQL deployments in minutes on Azure with a cost-effective solution.

As part of this exercise, we have classified the solution into the following sections:

- **Current State:** Oracle Server, Database, Object, Applications for Migration

- **Challenges:** Schema and Object (PLSQL Code) Migration, Data Challenges

- **Target Version:** End State Flexible, Scalable and Durable Solution

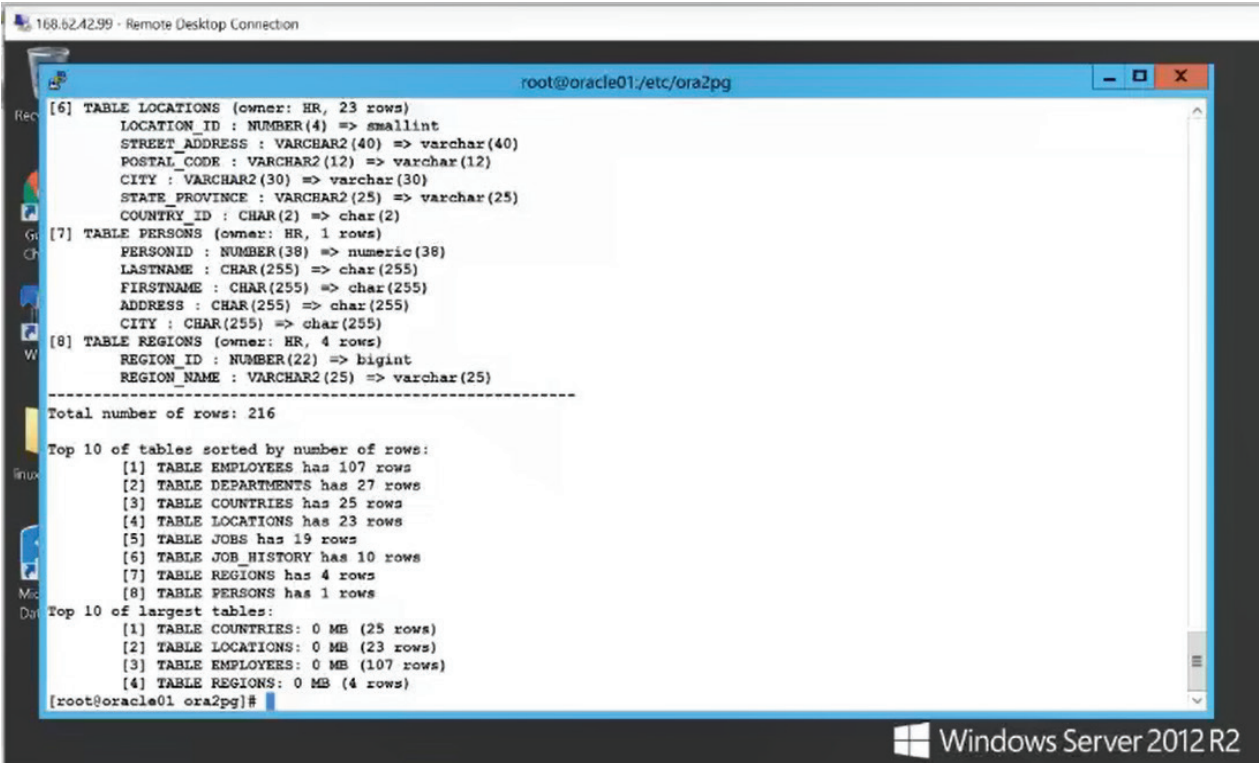# Recommended Tools for Migration (Compass)

About Compass:

- Compass is Mindtree's accelerator to discover, analyze, assess, plan and mitigate risks
- It enables accelerated cloud adoption by performing and orchestrating all the activities
- Extended Performance Monitoring (EPM) creates performance reports for the server
- The infrastructure profile provides you with an overview of the datacenter
- Creates application profiles to modernize your application
- Servers for particular applications and create application profile
- Performs scanning in agentless and agent-based approach
- Groups all the servers in the cluster and creates an infrastructure profile
- Provides suggestions for storage advisory and to modernize your application
- Delivers PaaS recommendation for the workload which can be migrated AS-IS

Recommended Tools for Migration (Ora2pg)

Ora2pg helped ease the process of migration. Here, we migrated the sample HR database from an on-premises Oracle 11g to an Azure PostgreSQL database by using the Ora2pg and Azure Database Migration Service.

Here are a few key technical benefits of using Azure PostgreSQL:

- Database migration assessment from Oracle to Postgre
- Ease in creation of migration projects and plan
- Automated discovery using Oracle Database Discovery
- Automation (full and delta) in database schema export
- Ease in automatic conversion of PL/SQL to PLPGSQL
- Allow autonomous transaction

Benefits:

- Below are long-term benefits in terms of the demo performed for Oracle to Azure PostgreReduction in cost (Open Source Licenses)
- No licenses fees (No Fee for the Community Edition on Postgre)
- Scalable on demand on Azure
- Flexible, fast and predictable storage
- Reduction in efforts, monitoring and metrics
- Global reach, high availability
- Ease of conversion, isolation and security
- Reduction in operation cost due to easy and managed deployments

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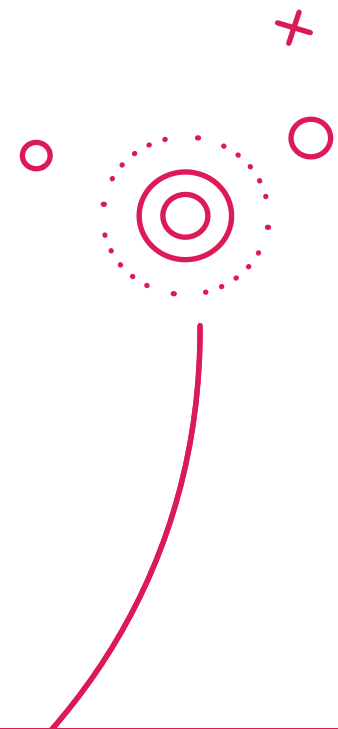
Welcome to possible

About Mindtree

Mindtree [NSE: MINDTREE] is a global technology consulting and services company, helping enterprises marry scale with agility to achieve competitive advantage. "Born digital," in 1999 and now a Larsen & Toubro Group Company, Mindtree applies its deep domain knowledge to 280+ enterprise client engagements to break down silos, make sense of digital complexity and bring new initiatives to market faster. We enable IT to move at the speed of business, leveraging emerging technologies and the efficiencies of Continuous Delivery to spur business innovation. Operating in more than 15 countries across the world, we're consistently regarded as one of the best places to work, embodied every day by our winning culture made up of over 21,800 entrepreneurial, collaborative and dedicated "Mindtree Minds".

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