



# Database Migration Workbench

with minimal downtime

Bharat Paliwal

Senior Director, Software Development

Harish Niddagatta

Product Management

Timothy Mooney

Product Marketing Director

The Oracle logo, consisting of the word "ORACLE" in a red, sans-serif, uppercase font.

**Enterprise Manager**  
**Deep Dive Series**

Watch Webcast



# Agenda

- Why Migrate?
- Enterprise Manager Migration Workbench
- Migration to Oracle Cloud
- New Migration Destinations
- Demo
- Q&A



# Announcing Enterprise Manager 13.5



## What's New



### Hybrid Cloud Management

Fleet monitoring, management and data movement across entire IT estate – on-premises and in the cloud



### Ops Automation

Enhanced automation and modernization of key management tasks



### Extensibility

Open standards-based extensions for interoperability with 3rd party ecosystems

# Hybrid Cloud Management

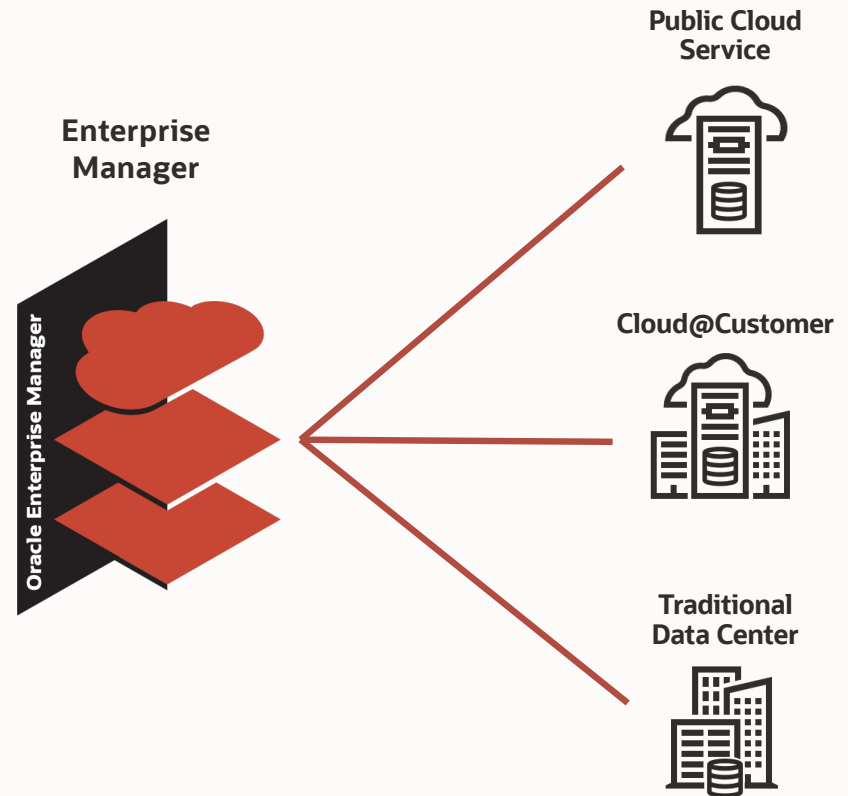
**Monitor and manage your hybrid fleet**  
from EM deployed on-premises or in the cloud

**Support for OCI Database resources** –  
Autonomous DB, ExaCS, ExaCC

Self-service deployment of databases across on-premises and OCI with **Hybrid DB-as-a-Service**

Simplify data movement from on-premises to OCI with **DB Migration Workbench**

Connect EM with OCI using **Cloud Bridge** for deep operational analytics





## Why Migrate?

Migrate to Oracle Cloud



Autonomous Database,  
Database Cloud Service,  
Exadata Cloud @ Customer,  
Exadata Cloud Service

Move to Multitenant



Consolidate,  
Manage Many as One

Upgrade Infrastructure



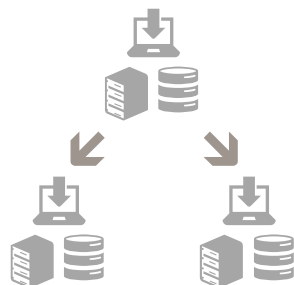
Hardware and Platform  
Upgrade



# Enterprise Manager

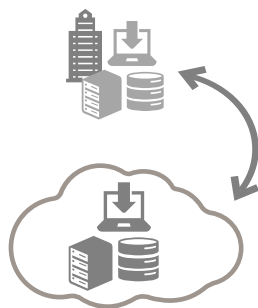
Single tool to Provision, Migrate, Monitor, Manage, Diagnose and Analyze

## PROVISIONING



**Quick provisioning on Private or Public Cloud**

## MIGRATION TOOLS



**Migrate database workloads with zero re-tooling and zero downtime**

## CENTRALIZED MANAGEMENT



**Easily upgrade and centrally manage databases**

## CLOUD INTEGRATION



**Integration with Object Store, Autonomous or non-Autonomous Databases**

**COMMON ARCHITECTURE, STANDARDS AND PRODUCTS**

# Enterprise Manager Migration Workbench

Consolidate, Migrate and Analyze



# Migration Workbench Benefits



## Simple

Unified guided workflow for migrating to On-Premises, DBCS, and OCI



## End-to-End Automation

First class automation with DevOps tools by leveraging JSON



## Minimal Downtime

Real time monitoring of migration progress

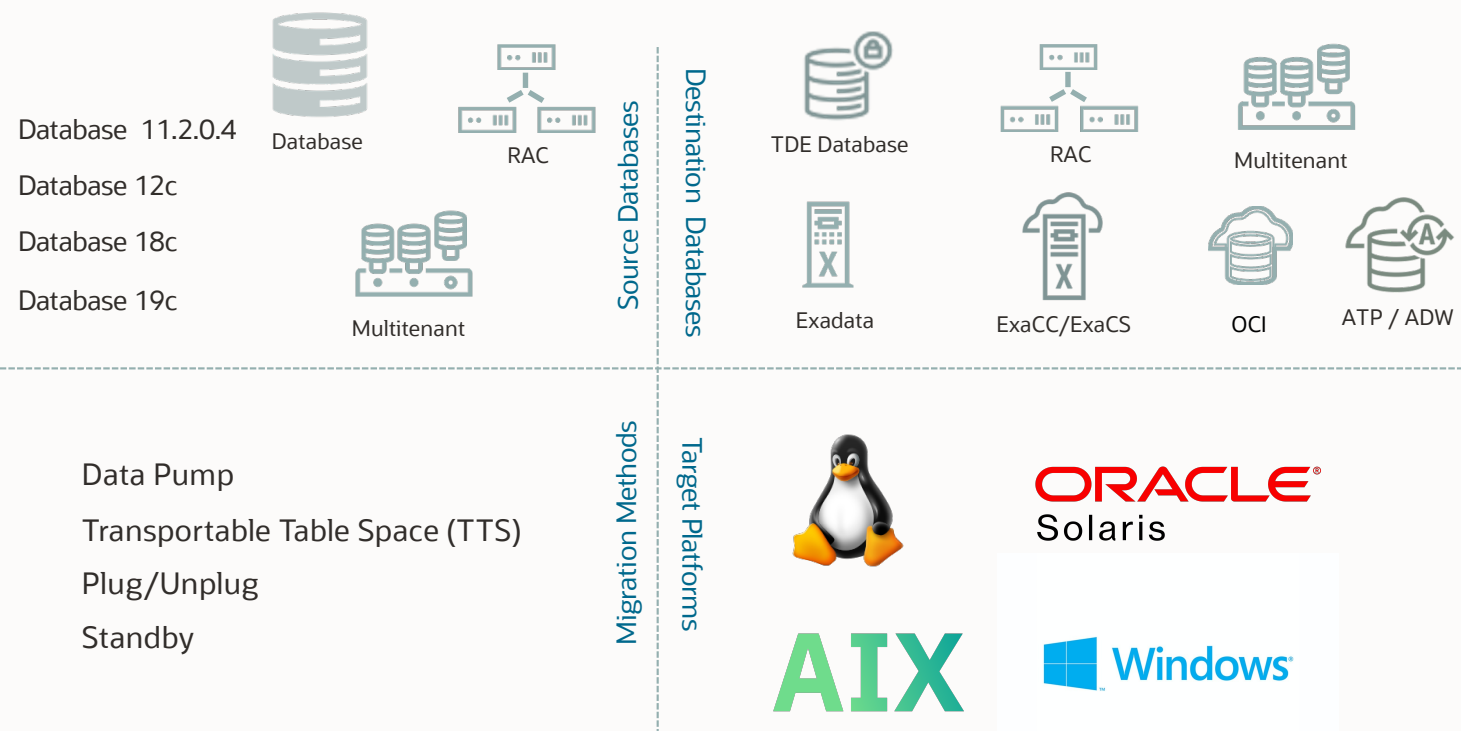
Insight into time left to complete migration



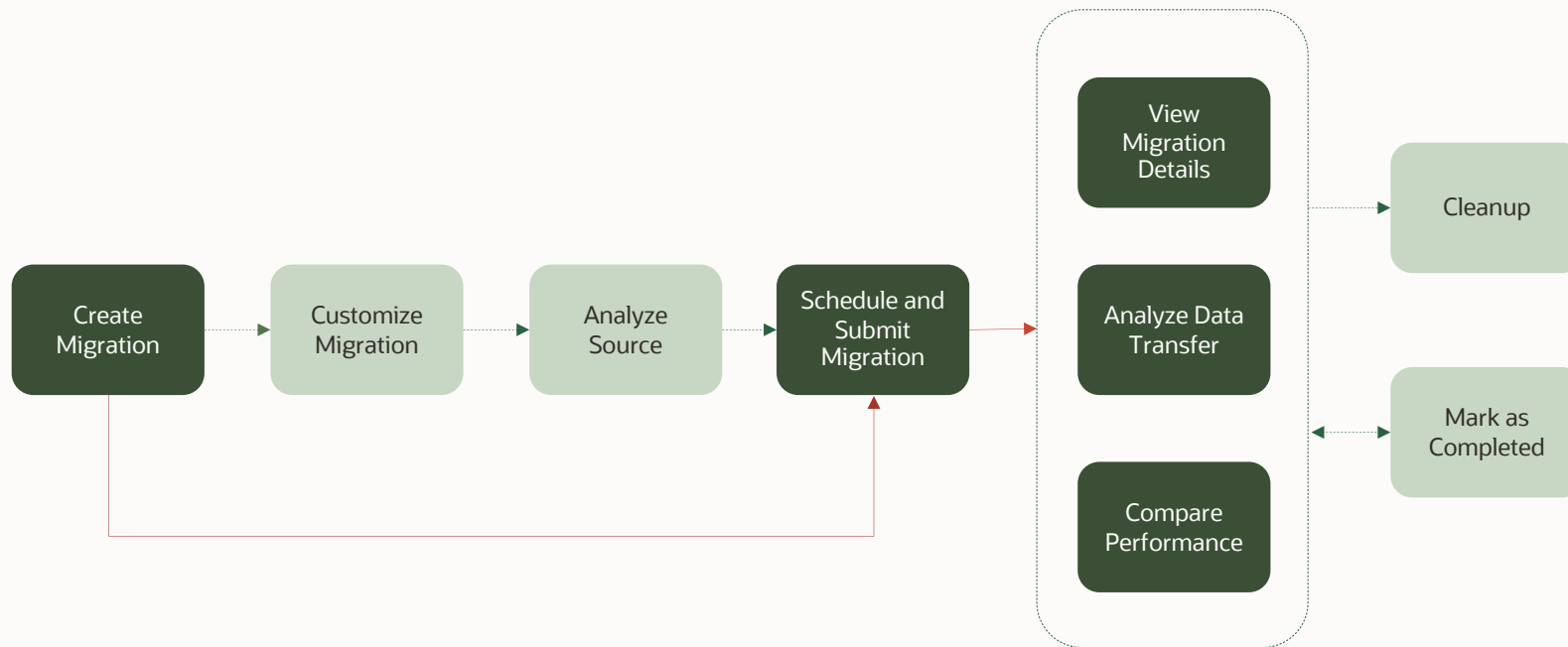
## Accuracy

Automatic comparison of performance before and after migration

# Migration Workbench Landscape



# Complete Migration Process with Database Migration Workbench



# Migrate your databases in 3 easy steps



## Plan

### Identify databases to migrate

Unified guided wizard for all migrations  
Analyze database schema before migration



## Migrate

### Customize, Schedule, Rollback

Pause, resume and monitor progress  
Integration with 3<sup>rd</sup> party tools using APIs



## Analyze

### Optimize for desired performance

Post Migration Analyzer  
Post Migration Performance Analysis with SPA

# Database Migration Workbench

Launchpad for guided migration

- Single workbench that integrates all needs for migration – sizing, performance comparison
- Track migration in real-time
  - Currently in progress
  - Done in last 24 hours, 7 days or all
- Customizable migration workflows
  - Custom pre and post scripts
  - Export and Import options
  - Compare performance after migration
- Pause, Rollback or Cancel the entire workflow

Plan

Migration Activities

All in Last 7 Days  
4 Activities

In Progress  
0 Activities

Problems in Last 7 Days  
1 Problems

Scheduled in Next 7 Days  
1 Activities

Completed in Last 7 Days  
2 Activities

Create Migration

Search Attributes

Activity	Status	Source	Destination	Start	End	Elapsed Time
Migrate CRMOnPremises2 to CRMADW	Scheduled	CRM_Onpremises	CRM_OnCloud	2019-09-06T21:01:34.786	—	—
Migrate CRMOnPremises1 to CRMADW	Completed	CRM_Onpremises	CRM_OnCloud			rs, 0 s
Migrate HROnPremises to HRATPS	Completed	HR_Onpremises	HR_OnCloud			rs, 0 s
Migrate SalesOnPremises to Sales_OnCloud	Failed	Sales_Onpremises	Sales_OnCloud			rs, 30

Pause

Rollback

Cancel

View Details

View Analysis

Compare Performance





# Pre-Migration Advisor Tool

Runs on existing schema and generates a summary of migration status including

- Objects that cannot migrate due to lockdowns or restrictions on certain data types.
- Oracle Database Options that do not apply on destination database
- Objects that will migrate with certain corrective actions
- List of automated corrective actions

## Database Migration

[Migration Activities](#) > Schema Advisor Report

Schema Advisor Report : cdb.us.oracle.com\_PDB1

### ATPD SCHEMA MIGRATION REPORT FOR EXPUSER

ADB Advisor Version	: 19.3
Instance Name	: cdb
Database Name	: CDB
Host Name	: slc09esm
Database Version	: 12.1.0.2.0
Pluggable Database	: PDB1
Schemas Analyzed	: EXPUSER
Analyzing for	: Autonomous Transaction Processing (Dedicated)
Report date	: 05-DEC-2019 23:20

▶ ATPD OBJECTS NOT MIGRATED

▶ ATPD OBJECTS MIGRATED WITH CHANGES

▶ ATPD MIGRATION ADDITIONAL INFO

# Migration Workbench Landscape

Unified experience for all migration scenarios

**Database Migration**

Create Migration Activity

Name Activity

Migrate SalesOnPremises Database to Autonomous Database Warehouse

Select Source Database Type

ORACLE Database 11g

ORACLE Database 12c

ORACLE Database 18c

19c ORACLE Database

Select Destination Database Cloud Service Type

ORACLE Database Cloud Service Bare Metal

ORACLE Database Cloud Service Virtual Machines

ORACLE Database Cloud Service Exadata Cloud Service

ORACLE Database Cloud Service Exadata Cloud at Customer

ORACLE Autonomous Transaction Processing Dedicated Deployments

Autonomous Databases  
*Data Pump*

Exadata Cloud @ Customer  
*Data Pump, RMAN, nZDT*

Exadata Cloud Service  
*Data Pump, RMAN, nZDT*

Databases running on VM and BM  
*Data Pump, RMAN, nZDT, Continuous Refresh*

Databases running on OCI Compute  
*Data Pump, RMAN, nZDT, Continuous Refresh*

Databases within own Data Center  
*Data Pump, RMAN, nZDT, Continuous Refresh*

# Database Migration Workbench

## Choice of tools

### Functionality available via

- User Interface
- Command Line Interface
- Rest API

### Complete control of DevOps

### Integrate with Enterprise Automation Standards

ORACLE®  
ENTERPRISE MANAGER

13<sup>c</sup>

UI

CLI

Rest API

Database Migration

Migration Activities

All in Last 7 Days 4 Activities

In Progress 0 Activities

Problems in Last 7 Days 1 Problems

Scheduled in Next 7 Days 1 Activities

Completed in Last 7 Days 2 Activities

Create Migration

Search Attributes

Activity	Status	Source	Destination	Start	End	Elapsed Tls
Migrate CRMOnPremises2 to CRMADW	Scheduled	CRM_OnPremises	CRM_OnCloud	2019-08-08T21:01:34.786	—	—
Migrate CRMOnPremises2 to CRMADW	Completed	CRM_OnPremises	CRM_OnCloud	2019-08-03T21:01:34.787	2019-08-04T05:01:34.787	8 hours, 0 m
Migrate HROnPremises to HRATPS	Completed	HR_OnPremises	HR_OnCloud	2019-08-03T21:01:34.787	2019-08-04T05:01:34.787	8 hours, 0 m
Migrate SalesOnPremises to SalesOnCloud	Failed	Sales_OnPremises	Sales_OnCloud	2019-08-04T16:01:34.787	2019-08-04T16:31:34.787	1 hours, 30

```
emcli migrate_db
-file=<Mapping JSON file>
[-exec_mode=<Execution Mode>]
[-ignore_pre_req]

-exec_mode
➤ FULL : Fully automated migrations
➤ PRE_DOWNTIME : run all steps before
downtime
➤ DOWNTIME: run all steps requiring
downtime

"PAYLOAD_BODY":{
  "emcliHostName":"b1r2213239_idc.oracle.com",
  "emcliCmdPath":"/ade/bkrkrish_132pgv3/oracle/work/omsOracleHome/bin/emcli",
  "emStageDir":"/tmp",
  "scriptRunAsLamaCredName":"HostCredsBkr",
  "emcliLamaCredName":"EmcliCredsSystem",
  "dbId":"4149685324",
  "dbId":"71CE37408D401D7998C8588085A7E1AE",
  "dbId":"806AFAE43F3B32FA4845F1F34168FB6701",
  "standbyDb":"true",
  "sqlCompName":"Demo Script",
  "sqlCompDirPath":"DemoSdl",
  "sqlScriptFileName":"PDB1.sql",
  "dbCredName":"NC_CDB_SYS",
  "dbHostCredName":"NC_HOST_SHY",
  "ossCredName":"OssCred1",
  "ossUrl":"https://us2.storage.oraclecloud.com/v1/Storage-gse00011403",
  "ossContainerName":"BalaDemo",
  "dataSourceName":"Snapshot Standby DB backup 2",
  "backupTag":"Backup_Tag_2",
  "dataSourceDesc":"Testing for lift and shift workflow to be submitted from OMC",
}
```

## Minimum Downtime Migration

Online migration to minimize downtime of source database

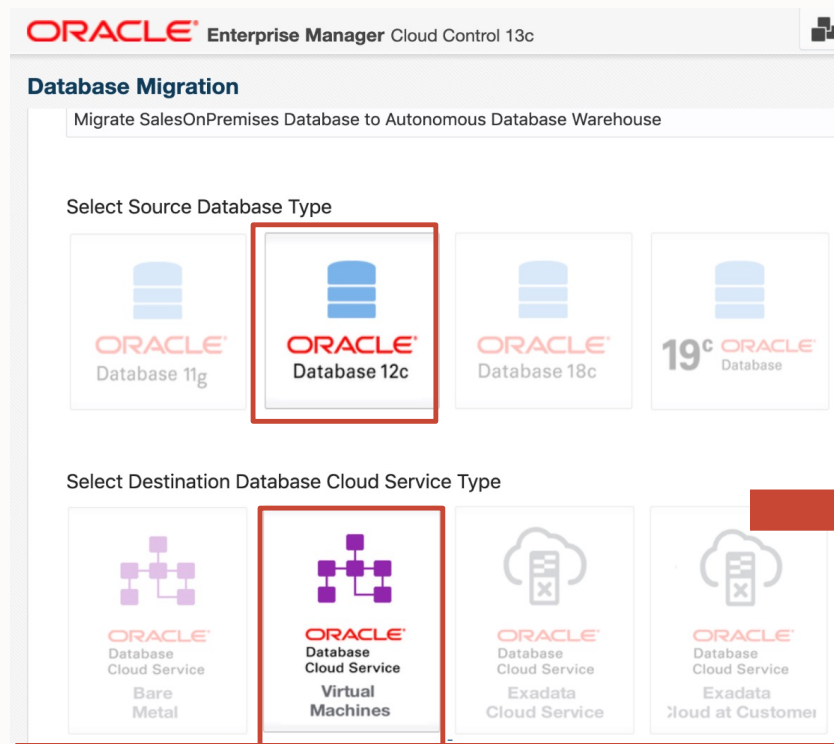
- Minimizes downtime of source Database
- Online Migration using **Oracle Data Guard Standby**
- Best practices for MAA
- Create a standby database on Oracle Cloud
- Only downtime required during switch-over from primary to standby
- Options to run manual or fully automated migration using **EMCLI**

```
emcli migrate_db
    -file=<Mapping JSON file>
    [-exec_mode=<Execution Mode>]
    [-ignore_pre_req]
-exec_mode
```

- **FULL** : Fully automated migrations
- **PRE\_DOWNTIME** : run all steps before downtime
- **DOWNTIME** : run all steps requiring downtime

# Migration Options for all configurations

Automatic recommendations for applicable migration methods



- Single workbench integrating all migration methods.
- Automatic recommendations for suitable migration methods.

Migration Method \*

Data Pump

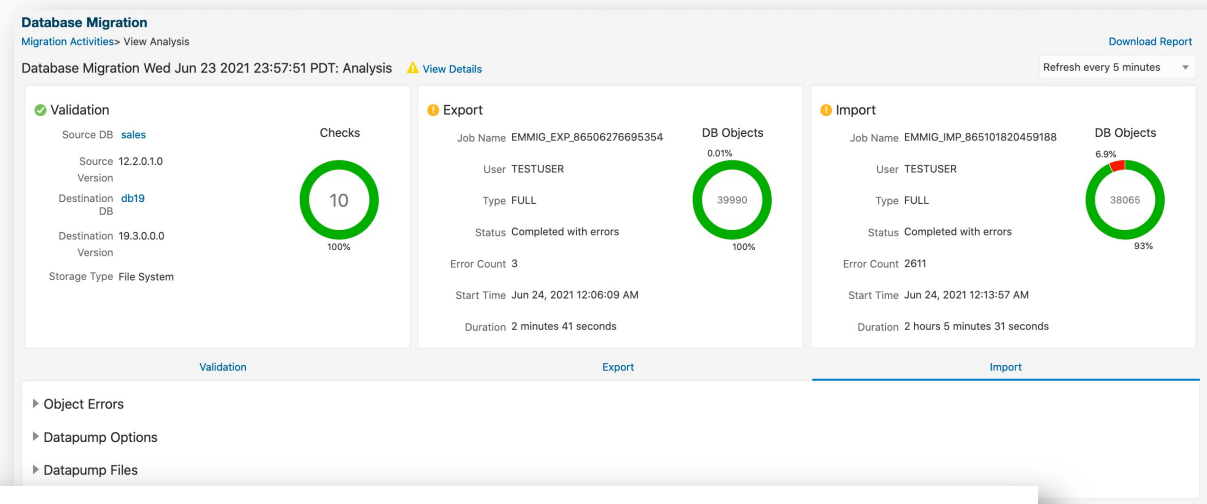
Data Pump

Transportable Tablespace

# Analyze Migration Workflow

Identify and remediate failures efficiently

- Step-by-step analysis of migration
- Drill-down at the object level migration
- What objects succeeds or fail
- Deep insights and reasoning for failed objects



## Object Errors

Schema	Object Type	Object Name	Processed	Errors	Error Message
SALES	USER	NA	1	1	
	USER	EXPUSER	1	1	ORA-31684: Object type USER:"EXPUSER" already exists
SALES	CONSTRAINT	NA	2	2	
	CONSTRAINT	SYS_IOT_TOP_001	1	1	ORA-00001: unique constraint (SALES.SYS_IOT_TOP_001) violated
	CONSTRAINT	SYS_IOT_TOP_002	1	1	ORA-00001: unique constraint (SALES.SYS_IOT_TOP_002) violated

Analyze

# Performance Comparison

## Comparison using SQL Performance Analyzer

Compare SQL performance before and after migration

Based on historic transactional data, analyze potential impact on application

Comparison based on

- Elapsed Time
- CPU Time
- User I/O Time
- Buffer Gets
- Physical I/O
- Optimizer Cost
- I/O Interconnect Bytes

Database Migration

Migration Activities > Compare Performance

Database Migration Wed Jun 23 2021 23:57:51 PDT : Performance Comparison

Show performance comparison with no indexes

Performance Comparison Report

General Information

Task Information:		Workload Information:	
Task Name	: SPA_TASK_EM_DP_1624518317762	SQL Tuning Set Name	: STS_EM_DP_REMAP_1624518317762
Task Owner	: TESTUSER	SQL Tuning Set Owner	: TESTUSER
Description	:	Total SQL Statement Count	: 186

Execution Information:

Execution Name	: CE_EM_DP_1624518317762	Started	: 06/24/2021 02:20:50
Execution Type	: COMPARE PERFORMANCE	Last Updated	: 06/24/2021 02:20:52
Description	:	Global Time Limit	: UNLIMITED
Scope	: COMPREHENSIVE	Per-SQL Time Limit	: UNUSED
Status	: COMPLETED	Number of Errors	: 20
Number of Unsupported SQL	: 36		

Analysis Information:

Before Change Execution:		After Change Execution:	
Execution Name	: TS_EM_DP_1624518317762	Execution Name	: TD_EM_DP_1624518317762
Execution Type	: CONVERT SQLSET	Execution Type	: TEST EXECUTE
Scope	: COMPREHENSIVE	Scope	: COMPREHENSIVE
Status	: COMPLETED	Status	: COMPLETED
Started	: 06/24/2021 02:20:12	Started	: 06/24/2021 02:20:12
Last Updated	: 06/24/2021 02:20:12	Last Updated	: 06/24/2021 02:20:50
Global Time Limit	: UNLIMITED	Global Time Limit	: UNLIMITED
Per-SQL Time Limit	: 300	Per-SQL Time Limit	: 300



Run SPA on source

Capture SQL Tuning Set

Run trial before migration

Migrate Database

Run trial after migration

Compare SQL Performance

Analysis and Reporting



# Performance Comparison

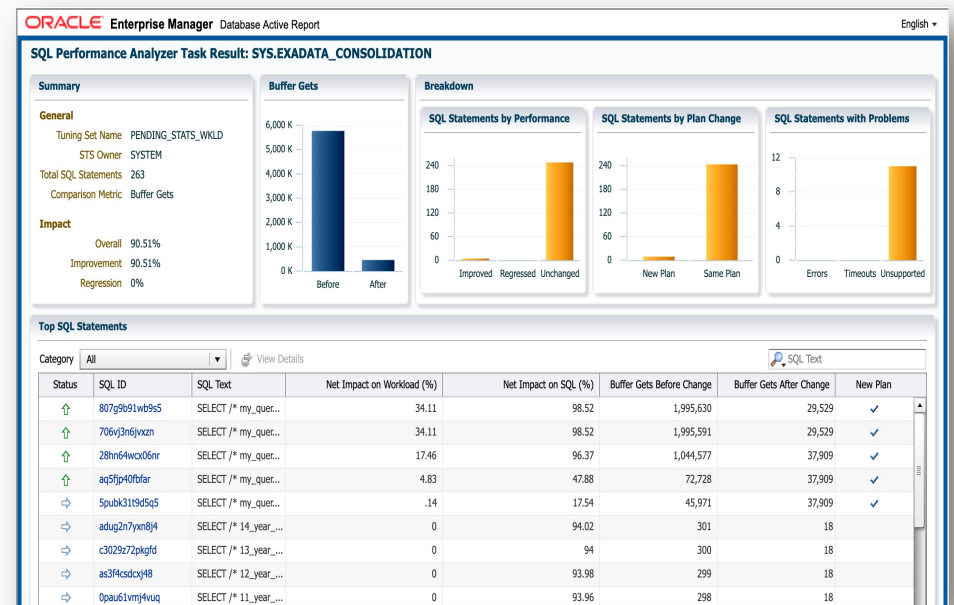
Simple and flexible

## DevOps

- Out-of-Box Solution
- No preparation required
- Simple and automatic

## Production

- User need to enable STS before start of migration
- This STS used to compare performance after migration
- Accurate and flexible





# Migrate your databases in 3 easy steps



## Plan

### Identify databases to migrate

Unified guided wizard for all migrations  
Analyze database schema before migration



## Migrate

### Customize, Schedule, Rollback

Pause, resume and monitor progress  
Integration with 3<sup>rd</sup> party tools using APIs



## Analyze

### Optimize for desired performance

Post Migration Analyzer  
Post Migration Performance Analysis with SPA

# On-Premises to Cloud

# On-Premises to Autonomous Migration

- Simplifies the migration of on-premises databases to Oracle Cloud Infrastructure with unified guided workflow
- Expedites the migration process by automating end-to-end workflow
- Reduces downtime by providing real-time progress of the migration
- Improves the accuracy of migrations by providing an automatic comparison of performance before and after migration

The screenshot displays the 'Database Migration' wizard in Oracle Enterprise Manager Cloud Control 13c. The interface is divided into three main sections: 'Add Details', 'Customize', and 'Review & Submit'. The 'Add Details' section is currently active, showing the 'Source' and 'Destination' configurations. The 'Source' section is for a 'sales' Oracle Database 12c instance, with fields for 'Database Instance' (slc06shu.us.oracle.com) and 'Database Credentials' (Preferred). The 'Destination' section is for an 'atpdtgt' Autonomous Transaction Processing (Dedicated) instance, with fields for 'Monitoring Agent Host' (den02wah.us.oracle.com), 'Database Credentials' (Preferred), 'Agent Host Credentials' (Preferred), and 'Service Name' (rohaprastest1\_high\_tis (TCPS)). The 'Review & Submit' section shows the 'Action' configuration, including 'Migration Method' (Data Pump), 'Compare Performance After Migration' (checked), 'Source Data Pump Directory', 'Encryption Password', 'Confirm Password', 'Cloud Storage URL' (objectstorage.(region).oraclecloud.com), 'Bucket Name', and 'OCI Credential'. The top navigation bar includes 'Enterprise', 'Targets', 'Favorites', 'History', 'Setup', and a search icon. The user 'TESTSUPERADMIN' is logged in.



# On-Premises to New Destinations

On-Premises, Exadata, ExaCC, ExaCS, DBCS (Bare Metal, VM)



# Migration Destinations and Methods

## Migration destinations

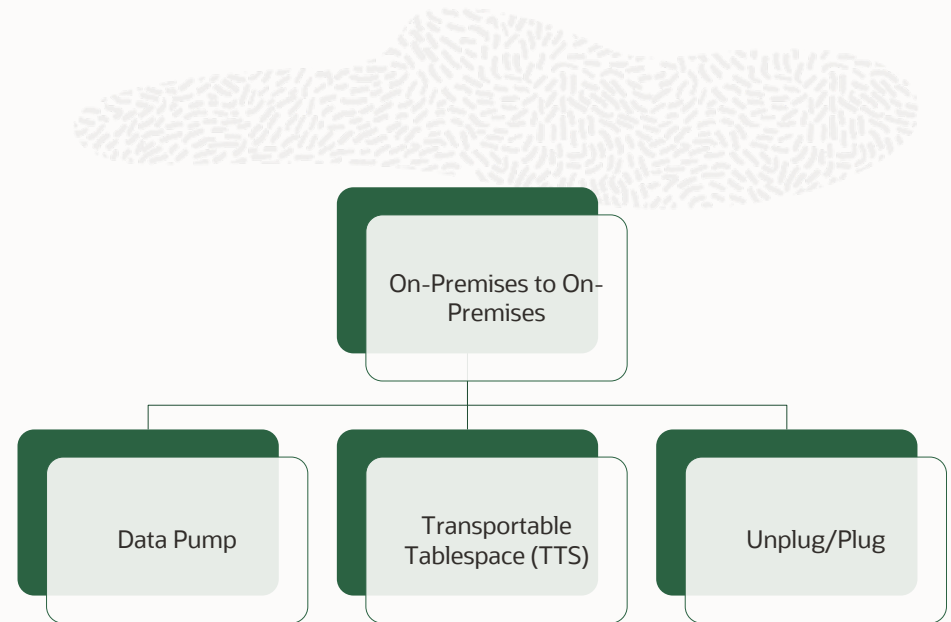
- On-Premises to On-Premises
- ExaCC, ExaCS
- DBCS - Bare Metal, VM

## Multiple methods to support migration from On-Premises to On-Premises

- Data Pump
- Transportable Tablespace (TTS)
- Unplug/Plug

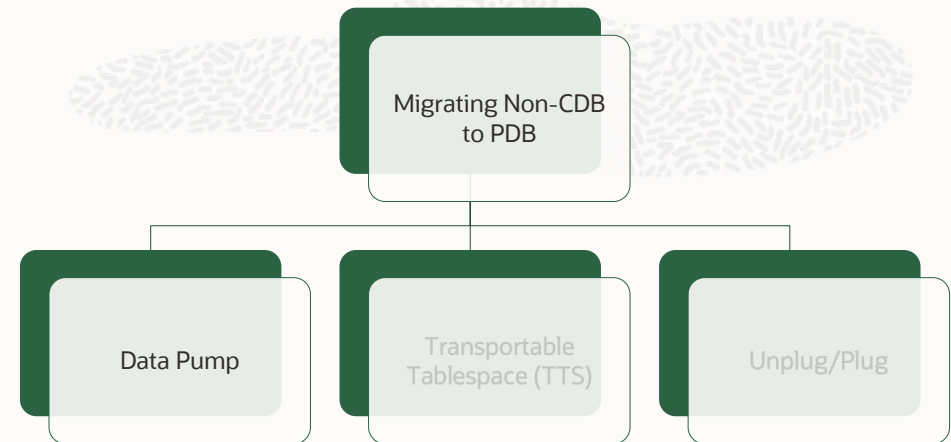
Various database configuration support – Single Instance, RAC and PDB

UI and EMCLI based migrations to integrate with existing workflows



# Migration to Multitenant

- Data Pump Export/Import
- Supported DB Versions – 11.2.0.4 and above
- Benefits:
  - Schema based or Full Database
  - Cross Platform
  - Different Character Set compatibility
- Recommended for smaller databases
- Post migration report to check migration status



Source

sales

ORACLE

Oracle Database 11c

Type	Database Instance
Host	den02wai.us.oracle.com
Platform	Linux x86_64
Version	11.3.0.0.0
CPU core	8
Storage Used/Total	1.54 GB/2.22 GB
Database Credential Type	Preferred
Database Credential Name	DBCredsNormal
Host Credential Type	Preferred
Host Credential Name	HostCredsNormal

dept

ORACLE

Oracle Database 19c

Type	Database Instance (Container Database)
Host	den00imb.us.oracle.com
Platform	Linux x86_64
Version	19.3.0.0.0
CPU core	6
Storage Used/Total	-/-
Database Credential Type	Named
Database Credential Name	DEST_DB_CREDS_NEWPDB
Host Credential Type	Preferred
Host Credential Name	HostCredsNormal

New Pluggable Database

Name	demo_pdb1
Administrator Name	admin
Data Pump Directory Name	mwb_pdb1
Data Pump Directory Path	/scratch/ankchatu/data_pump

Action

Data Pump

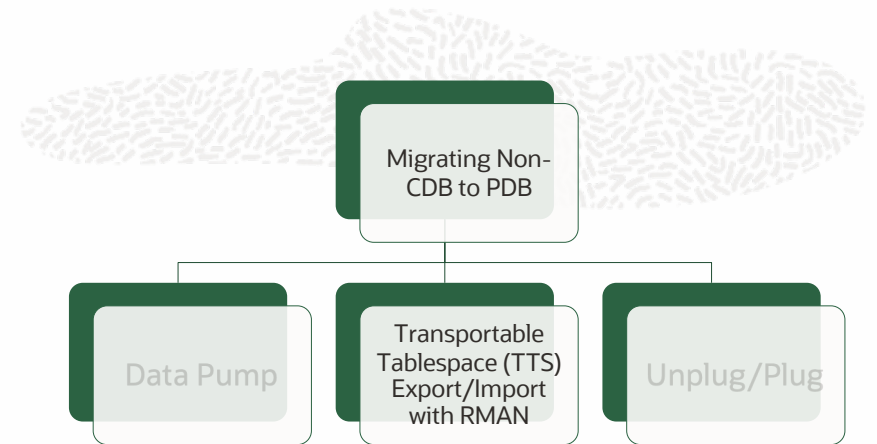
Migration Type	Full Database
Export Options	statistics
EXCLUDE	ALL
ENCRYPTION	ALL
ENCRYPTION_ALGORITHM	AES128
PARALLEL	8
CONTENT	ALL
DIRECTORY	DATA_PUMP_DIR
Default Export Options	
Import Options	SKIP
TABLE_EXISTS_ACTION	mwb_pdb1
DIRECTORY	
Default Import Options	
Transfer Options	
Data Pump Directory Sh...	No
Pre-Migration Script	No
Post-Migration Script	No
Post-Migration SQL Script	No
Recompile Invalid Objects...	No
Compare Performance Aft...	Yes
SPA STS Option	Create SQL Tuning Set (STS) from AWR
Duration (days)	Snapshot
Snapshot	7
SPA Default Options	








# Migration to Multitenant

- Transportable Tablespace (TTS) with incremental RMAN backups to minimize downtime
- Supported DB Versions – 11.2.0.4 and above
- Benefits:
  - Schema based or Full Database
  - Cross Platform
  - Compatible Character Set
  - Minimal Downtime
- Recommended for larger databases
- Post migration report to check migration status



Source	Destination	Action
 d18 Oracle Database 11c	 c19 Oracle Database 11c	 Transportable Tablespace
Type Host Platform Version CPU core Storage Used/Total	Database Instance (Container Database) Host Platform Version CPU core Storage Used/Total	Migration Type Tablespaces to be Migrated
Database Instance slc06shu.us.oracle.com Linux x86_64 18.3.0.0.0 4 1.80 GB/4.24 GB	emccqa009.subnetring2phsu.emdevinfraphx1.oraclecn.com Linux x86_64 19.3.0.0.0 2 5.42 GB/9.10 GB	Full Database TBSP1,TBSP10,TBSP11,TBSP12,TBSP13,TBSP14,TBSP15,TBSP...
Database Credential Type Database Credential Name Host Credential Type Host Credential Name	Named NC_SYS Named NC_RCHAPRAS	Source Staging Directory Destination Staging Direct... Destination Storage Direct...
		Pre-Migration Script Post-Migration Script Post-Migration SQL Script
		Compare Performance Aft... SPA STS Option Duration (days) SPA Default Options
		No No No Yes Create SQL Tuning Set (STS) from AWR Snapshot 7



# Why customers are choosing Enterprise Manager Migration Workbench



## One Tool for all Migrations

Unified migration experience for all types of migrations



## Variety of Migration Targets

On-Premises, Exadata, DBCS (ExaCC/ExaCS, BM, VM) and Autonomous Database



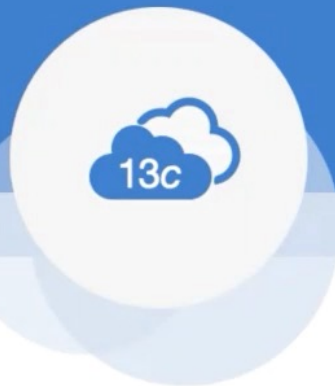
## Integrated Performance Analyzer

Insights on performance comparison before and after migration using proven technologies like SPA





# Demo

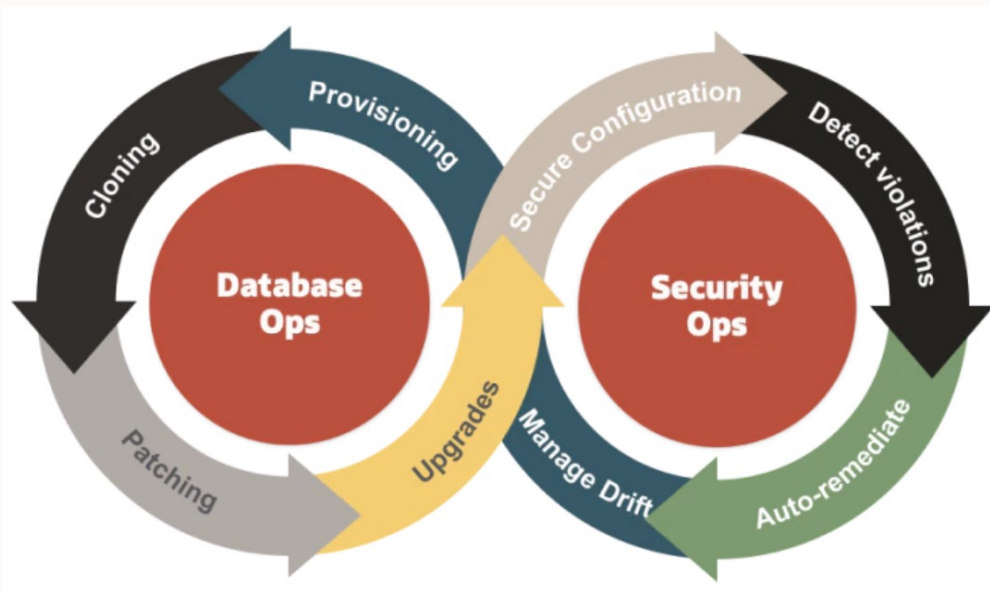


## Enterprise Manager Cloud Control 13c

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## What Questions Do You Want The Answers To?



Documentation:  
EM 13.5 DB Lifecycle Management  
>> Go to Database Migration

Webcasts/Workshops:  
Enterprise Manager Deep Dives

Where can I find the slides, replay, resources?  
Blogs.oracle.com/manageability ...

Demonstration migrating to Autonomous Database [Youtube]

Product Information:  
oracle.com/enterprise-manager/#rc30p2  
>> Go to Database Ops Automation

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