



Migration to Oracle Autonomous Database

Part 3: Migrating

Oracle
DBAs
run the world





MIKE DIETRICH

Vice President
Database Upgrade, Migrations & Patching

 mikedietrich

 @mikedietrichde.com

 <https://mikedietrichde.com>





DANIEL OVERBY HANSEN

Distinguished Product Manager
Database Upgrade, Migrations & Patching

 dohdatabase

 @dohdatabase.com

 <https://dohdatabase.com>



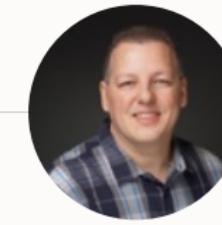
RODRIGO JORGE

Distinguished Product Manager
Database Upgrade, Migrations & Patching

 [rodrigoaraujorge](#)

 @dbarj.com.br

 <https://dbarj.com.br>



ALEX ZABALLA

Distinguished Product Manager
Database Upgrade, Migrations & Patching

 alexzaballa

 @alexzaballa.bsky.social

 <https://alexzaballa.com>



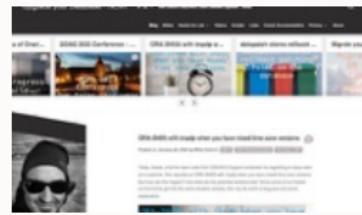
KLAUS GRONAU

Consulting Member of Technical Staff
Database Upgrade, Migrations & Patching



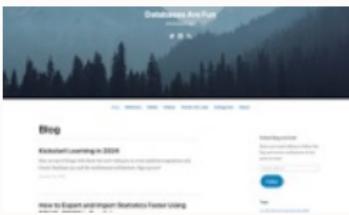
klaus-gronau-39a43aa9

Find Slides and Much More on Our Blogs



MikeDietrichDE.com

Mike.Dietrich@oracle.com



dohdatabase.com

Daniel.Overby.Hansen@oracle.com



DBArj.com.br

Rodrigo.R.Jorge@oracle.com

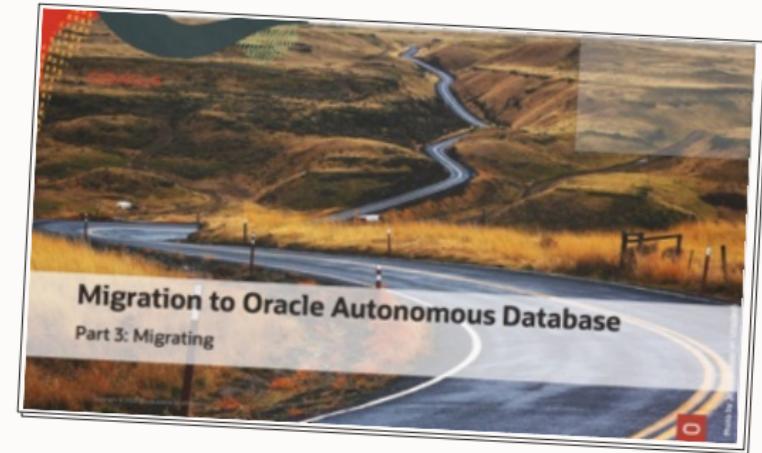


AlexZaballa.com

Alex.Zaballa@oracle.com

Download the Slides

<https://MikeDietrichDE.com/slides>



Virtual Classroom Seminars

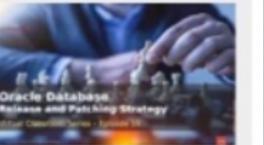
Slides

Episode 16

(replaces Episode 1 from Feb 2021)

[Oracle Database Release and Patching Strategy for 19c and 23c](#)

115 minutes – May 10, 2023



Episode 17

[From SR to Patch – Insights into the Oracle Database Development process](#)

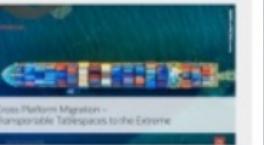
55 minutes – June 22, 2023



Episode 18

[Cross Platform Migration – Transportable Tablespaces to the Extreme](#)

145 min – February 22, 2024



Episode 19

[Move to Oracle Database 23ai – Everything you need to know about Multitenant PART 1](#)

145 min – May 16, 2024



Episode 20

[Move to Oracle Database 23ai – Everything you need to know about Multitenant PART 2](#)

100 min – June 28, 2024



Recorded Web Seminars

<https://MikeDietrichDE.com/videos>

More than 40 hours of technical content, on-demand, anytime, anywhere

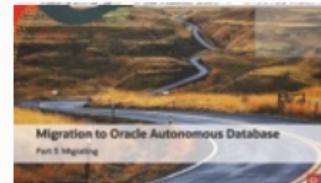
Let's Do This Together



Migration to Oracle Autonomous Database
Part 1: Planning



Migration to Oracle Autonomous Database
Part 2: Preparing



Migration to Oracle Autonomous Database
Part 3: Migrating



1 PLANNING

Watch [recording](#)
Get [slides](#)

2 PREPARING

Watch [recording](#)
Get [slides](#)

3 MIGRATING

Watch [soon](#)
Get [slides](#)

4 OPERATING

July 10, 15:00 CET
[Sign up](#)



Recap

What happened in Part 2?



Migration to Autonomous Database is always a **logical** migration

- Move the **data**, not the database

Getting an Overview

1

Estate Explorer



2

Cloud Premigration
Advisor Tool



3

Cloud Migration
Advisor

Getting an Overview

1

Estate Explorer



2

Cloud Premigration
Advisor Tool



3

Cloud Migration
Advisor

▼ Premigration Advisor Check Details List

Source Database

Expand All Close All

▼ Action Required (2 checks)

▼ OGG Minimal Supplemental Logging Not Enabled

Description: Minimal supplemental logging is not enabled on the Database.

Action: Make sure minimal supplemental logging data is enabled by using executing the SQL command ALTER DATABASE ADD SUPPLEMENTAL LOG DATA; This command can be done while the database is online and no restart is required.

More Details

► Relevant Objects (1 relevant object)

► OGG Replication Not Enabled

► Review Required (1 check)

A screenshot of a software interface titled 'Premigration Advisor Check Details List'. The interface is divided into sections: 'Source Database' (with 'Expand All' and 'Close All' buttons), 'Action Required (2 checks)', 'OGG Minimal Supplemental Logging Not Enabled' (with 'Description' and 'Action' details), 'Relevant Objects (1 relevant object)', 'OGG Replication Not Enabled', and 'Review Required (1 check)'. The 'OGG Minimal Supplemental Logging Not Enabled' section is expanded, showing a detailed description and an action step involving an SQL command.

Getting an Overview

2

Cloud Premigration Advisor Tool

Oracle Autonomous Database

Check Name: **has user defined objects in sys/system**

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Action Required

Solution: Move objects prior to migration.

User Defined Objects in SYS

Description: User-defined objects in SYS schemas will not be exported.

Action: Recreate required user-defined objects in SYS schemas prior to migration and update any hardcoded references to those objects. Consider dropping any user-defined objects that are no longer required.

User Defined Objects in SYSTEM

Description: User-defined objects in SYSTEM schemas cannot be imported in the ADB.

Action: Recreate required user-defined objects in SYSTEM schemas prior to migration or utilize Data Pump schema mapping parameters such as "REMAP_SCHEMA=SYSTEM:xxx" where "xxx" is an existing user in ADB. In either case, any hardcoded references to the user-defined objects from SYSTEM will need to be updated. Consider dropping any user-defined objects that are no longer required.



Evaluate an Oracle Database for compatibility with Autonomous Database

- Use Cloud Premigration Advisor Tool (CPAT)
- Download CPAT from [MOS Note: 2758371.1](#)



Databases - Recap

These are the databases we were going to migrate

Example Databases



In this series, we will use two databases:

- **The Simple Database**
- **The Complex Database**

Example Databases



In this series, we will use two databases:

- **The Simple Database**

Based on standard Oracle schemas



HR: Human Resources
CO: Customer Orders
SH: Sales History

`@hr_install.sql`
`@co_install.sql`
`@sh_install.sql`

- **The Complex Database**

Example Databases



In this series, we will use two databases:

- **The Simple Database**

- **The Complex Database**

Standard schemas and manually created objects



HR: Human Resources

CO: Customer Orders

SH: Sales History

External Tables

External Library

Tables with encrypted columns

Java Objects

Tables with XML columns

XML Schemas

Tables using Spatial

Profiles using custom password verification functions

Tables with ROWID columns

SQL Patches and SQL Plan Baselines

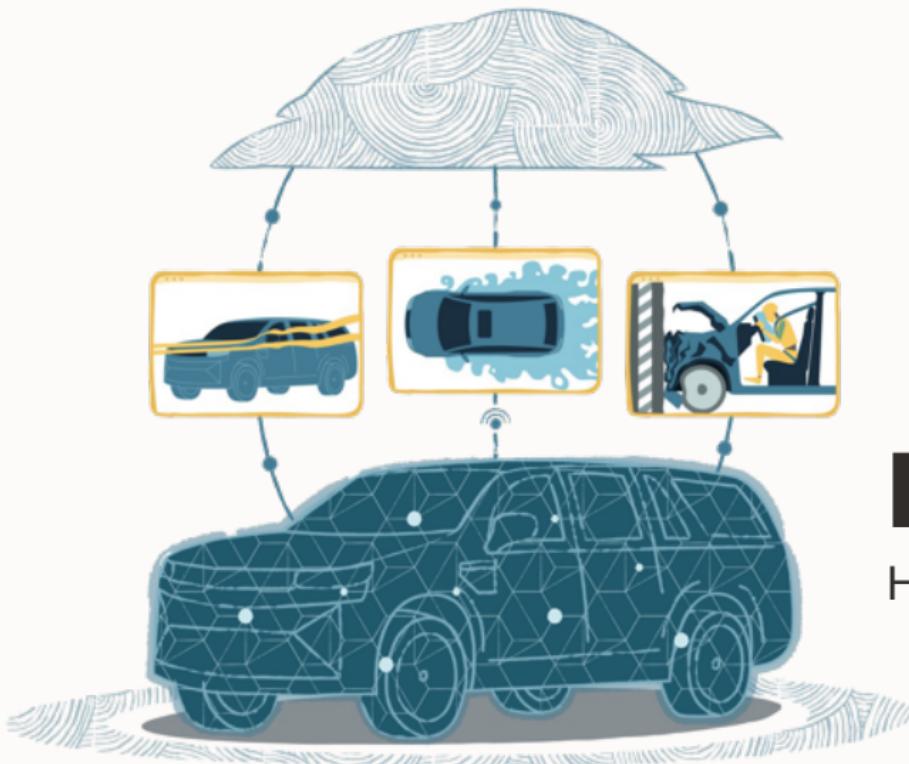
Table Clusters

Jobs using DBMS_JOB

Scheduler Jobs running external scripts

Procedure calling DBMS_SHARED_POOL + UTL_HTTP





Fixing

How did we fix the CPAT findings?

CPAT | Simple Database

--migrationmethod **datapump**

▼ Premigration Advisor Report Summary

Report Result

Review Required

Number of schemas analyzed:

3

List of schemas analyzed:

[PDBADMIN, CO, HR]

▼ Report Results Overview

Source Database		Target Database		Migration Method		Additional Tasks	
Action Required	0	Action Required	0	Action Required	0	Action Required	0
Review Required	0	Review Required	1	Review Required	0	Review Required	0
Review Suggested	1	Review Suggested	2	Review Suggested	0	Review Suggested	3
Passed	12	Passed	27	Passed	1	Passed	10

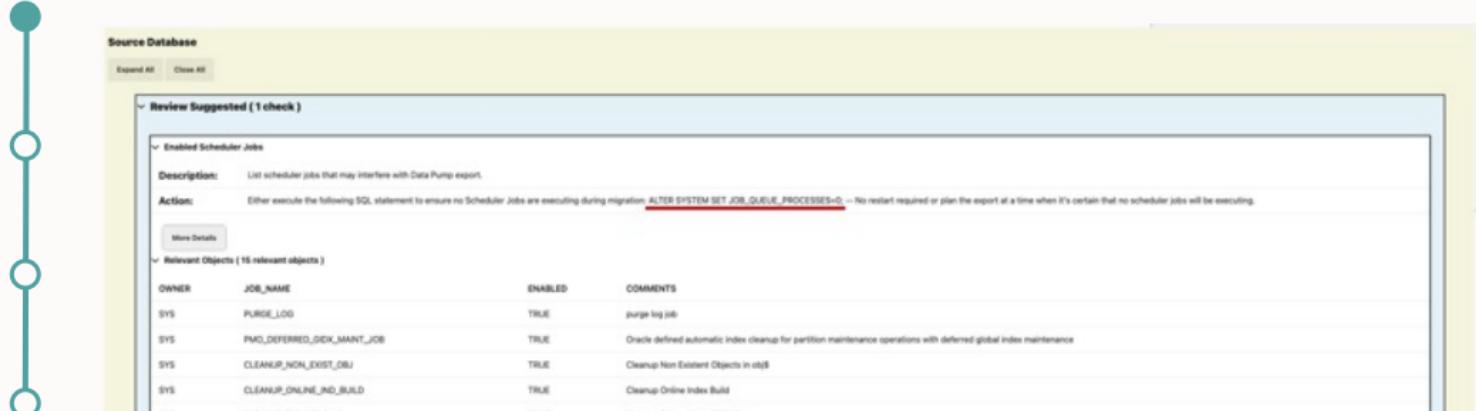
[Return to Table of Contents](#)

Fixing Findings | Simple Database

- Scheduler Jobs
- Directory Objects
- Trusted Server Entries
- Auditing

Fixing Findings

Scheduler Jobs



Source Database

Expand All Close All

Review Suggested (1 check)

Enabled Scheduler Jobs

Description: List scheduler jobs that may interfere with Data Pump export.

Action: Either execute the following SQL statement to ensure no Scheduler Jobs are executing during migration: ALTER SYSTEM SET JOB_QUEUE_PROCESSES=0 -- No restart required or plan the export at a time when it's certain that no scheduler jobs will be executing.

More Details

Relevant Objects (16 relevant objects)

OWNER	JOB_NAME	ENABLED	COMMENTS
SYS	PURGE_LOG	TRUE	purge log job
SYS	PMO_DEFERRED_INDEX_MAINT_JOB	TRUE	Oracle defined automatic index cleanup for partition maintenance operations with deferred global index maintenance
SYS	CLEANUP_NON_EXIST_OBJ	TRUE	Cleanup Non Exist Objects in obj\$
SYS	CLEANUP_ONLINE_IND_BUILD	TRUE	Cleanup Online Index Build
SYS	CLEANUP_TAB_IOT_PMO	TRUE	Cleanup Tables after IOT PMO
SYS	CLEANUP_TRANSIENT_TYPE	TRUE	Cleanup Transient Types
SYS	CLEANUP_TRANSIENT_PKG	TRUE	Cleanup Transient Packages
SYS	CLEANUP_ONLINE_PMO	TRUE	Cleanup after Failed PMO
SYS	FILE_SIZE_UPD	TRUE	Update file size periodically

Fixing Findings

Directory Objects

Target Database

Expand All Close All

Review Required (1 check)

Directories

Description: Directory objects may reference locations that are not accessible in ADB

Action: Recreate the directories on the Autonomous database instance.

More Details

Relevant Objects (7 relevant objects)

OWNER	DIRECTORY_NAME	DIRECTORY_PATH
SYS	DBMS_OPTIM_ADMINDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/admin
SYS	DBMS_OPTIM_LOGDIR	/u01/app/oracle/product/19.0.0/dbhome_1/cfgtoollogs
SYS	ORACLE_OCM_CONFIG_DIR	/u01/app/oracle/product/19.0.0/dbhome_1/ocr/state
SYS	ORACLE_OCM_CONFIG_DIR2	/u01/app/oracle/product/19.0.0/dbhome_1/ocr/state
SYS	SDO_DIR_WORK	
SYS	XMLDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/xml
SYS	XSDDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/xml/schema

Fixing Findings

Trusted Server Entries

Target Database

Expand All Close All

✓ Review Suggested (2 checks)

✓ Trusted Server Entries

Description: TRUSTED_SERVER entries cannot be migrated to ADB

Action: When migrating via Data Pump specify "INCLUDE=TRUSTED_DB_LINK" to avoid any exceptions reported by Data Pump during import. Use Oracle Cloud Infrastructure Firewall features to control access to your ADB instance. For more information see <https://docs.oracle.com/en/solutions/deploy-virtual-firewall/index.html>

More Details

✓ Relevant Objects (1 relevant object)

TRUST	NAME
Trusted	All

✓ Default Tablespace is Not DATA

Description: Schema Owner's default tablespace must be 'DATA'.

Action: If a user has quota on multiple tablespaces, ensure that the proper quota is set post migration.

More Details

✓ Relevant Objects (3 relevant objects)

USERNAME	DEFAULT_TABLESPACE
POBADMIN	USERS
HR	USERS
CO	USERS



Fixing Findings

Auditing



Migration Method

Review Suggested (3 checks)

Standard Traditional Audit for ADB

Description: Traditional audit, deprecated since 21c, is unsupported starting with 23c. Traditional Audit configurations have been detected in this database.

Action: Delete the traditional auditing configurations using the instructions found in Oracle Support Document ID 2909718.1. The audit_sys_operations value, TRUE, is not correct and should be set to FALSE.

More Details

Index Organized Tables

Description: Index Organized tables are not allowed in Autonomous databases.

Action: No action required as the tables are created as non-IOT (regular table).

More Details

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME
HR	COUNTRIES

Modified Database Parameters for Serverless

Description: The modification of certain Database parameters is not allowed in ADB (Serverless Infrastructure).

Action: Please refer to the Oracle Autonomous Database documentation on the parameters that you are allowed to modify. For more information see <https://docs.oracle.com/en/cloud/paas/autonomous-database/autonomous-initialization-parameters.html>

More Details

Relevant Objects (35 relevant objects)

NAME
_datafile_write_errors_crash_instance

CPAT | Simple Database with Online

--migrationmethod all

▼ Premigration Advisor Report Summary

Report Result

Action Required

Number of schemas analyzed:

4

List of schemas analyzed:

[PDBADMIN, CO, HR, C##DBLCMUSER]

▼ Report Results Overview

Source Database		Target Database		Migration Method		Additional Tasks	
Action Required	<u>2</u>	Action Required	<u>1</u>	Action Required	<u>1</u>	Action Required	<u>0</u>
Review Required	<u>1</u>	Review Required	<u>2</u>	Review Required	<u>0</u>	Review Required	<u>0</u>
Review Suggested	<u>1</u>	Review Suggested	<u>2</u>	Review Suggested	<u>1</u>	Review Suggested	<u>5</u>
Passed	<u>17</u>	Passed	<u>33</u>	Passed	<u>6</u>	Passed	<u>15</u>

[Return to Table of Contents](#)

Fixing Findings | Simple Database with Online

- Scheduler Jobs
- Dictionary Objects
- Trusted Server Entries
- Auditing
- Supplemental Logging
- Streams Pool Size

Fixing Findings

Supplemental Logging



Source Database

[Expand All](#) [Close All](#)

✗ Action Required (2 checks)

✗ OGG Minimal Supplemental Logging Not Enabled

Description: Minimal supplemental logging is not enabled on the Database.

Action: Make sure minimal supplemental logging data is enabled by using executing the SQL command `ALTER DATABASE ADD SUPPLEMENTAL LOG DATA`; This command can be done while the database is online and no restart is required.

[More Details](#)

✗ Relevant Objects (1 relevant object)

`SUPP_LOG_DATA_MIN_ENABLED`

NO

✗ OGG Replication Not Enabled

Description: `ENABLE_GOLDENGATE_REPLICATION` init.ora parameter is not set.

Action: Make sure `ENABLE_GOLDENGATE_REPLICATION` is set to TRUE by using executing the SQL command: `ALTER SYSTEM SET ENABLE_GOLDENGATE_REPLICATION=TRUE SCOPE=BOTH`; This command can be done while the database is online and no restart is required.

[More Details](#)

✗ Relevant Objects (1 relevant object)

NAME	VALUE
<code>enable_goldengate_replication</code>	FALSE

Fixing Findings

Streams Pool



Source Database

Expand All Close All

Review Required (1 check)

Streams Pool Size for GoldenGate

Description: Verify the STREAMS_POOL_SIZE amount is large enough for GoldenGate.

Action: STREAMS_POOL_SIZE has not been pre-allocated. Please execute SQL such as: ALTER SYSTEM SET streams_pool_size=1250M SCOPE=BOTH; -- or larger depending on the number of OGG processes. And restart your instance if necessary. Extract interacts with an underlying logmining server in the source database and Replicat interacts with an inbound server in the target database. This section provides guidelines for managing the shared memory consumed by these servers. The shared memory that is used by the servers comes from the Streams pool portion of the System Global Area (SGA) in the database. Therefore, you must set the database initialization parameter STREAMS_POOL_SIZE high enough to keep enough memory available for the number of Extract and Replicat processes that you expect to run in integrated mode. Note that Streams pool is also used by other components of the database (like Oracle Streams, Advanced Queuing, and Data Pump export/import), so make certain to take them into account while sizing the Streams pool for Oracle GoldenGate. By default, one Extract requests the logmining server to run with MAX_SGA_SIZE of 1GB. As a best practice, keep 25 percent of the Streams pool available. Therefore, for a single process the minimum STREAMS_POOL_SIZE would be 1.25 GB. For more information see Oracle Support Document ID 2078459.1 and the Oracle GoldenGate documentation.

More Details

Relevant Objects (1 relevant object)

NAME	VALUE
streams_pool_size	0

[oracle@db19c cpat]\$

CPAT | Complex Database

--migrationmethod **datapump**

▼ Premigration Advisor Report Summary

Report Result

Number of schemas analyzed: 6

List of schemas analyzed: [POBADMIN, CO, HR, MYAPP, C##DBLCMUSER, CPAT__CHECK]

▼ Report Results Overview

Source Database		Target Database		Migration Method		Additional Tasks	
Action Required	0	Action Required	8	Action Required	0	Action Required	0
Review Required	0	Review Required	5	Review Required	1	Review Required	0
Review Suggested	1	Review Suggested	4	Review Suggested	0	Review Suggested	4
Passed	12	Passed	13	Passed	0	Passed	9

[Return to Table of Contents](#)

Fixing Findings | Complex Database

- 
- Previous Findings, plus ...
 - Libraries
 - System Privileges
 - XML Objects, Tables, Columns
 - Java Sources, Objects
 - Common Objects
 - Non-Exported Grants
 - Scheduler Jobs
 - External Tables
 - Restricted Packages
 - Directory Objects Accessibility

Libraries

Target Database

Expand All

Close All

▼ Action Required (8 checks)

▼ Libraries

Description: The CREATE LIBRARY statement is not allowed on ADB.

Applications must be updated to remove their dependencies on any listed libraries. Consider using OCI Marketplace EXTPROC Stack Application as a replacement. For more information on OCI Marketplace EXTPROC Stack Application see <https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/user-defined-functions-external.html#GUID-FB998DB9-82DC-455E-ACFA-CE06BAB6FC2B> Alternatively, using Functions for business logic previously implemented in external libraries. For more information see <https://docs.oracle.com/en-us/iaas/Content/Functions/>

[More Details](#)

▼ Relevant Objects (1 relevant object)

OWNER	LIBRARY_NAME	FILE_SPEC
-------	--------------	-----------

MYAPP	EXAMPLE_LIB	/home/oracle/libexample.so
-------	-------------	----------------------------

System Privileges

Target Database

[Expand All](#) [Close All](#)

✓ **System Privileges**

Description: Some system privileges used in the source DB are prohibited in the target ADB.

Action: Replace prohibited system privileges with alternatives that are available in ADB, for example, GRANT CREATE JOB TO <USER-WHO-HAD-CREATE-ANY-JOB>; for those schemas in ADB instances. Whether such alternatives are appropriate can only be determined by experts familiar with the applications in question and with testing.

[Hide Details](#)

Name: has_sys_privileges

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Operation failures due to system privilege issues.

Scope: SCHEMA

Executed SQL:

```
SELECT GRANTEE, PRIVILEGE FROM SYS.DBA_SYS_PRIVS WHERE grantee NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','CTE_TRANSLATION_PROFILE','BACKUP ANY TABLE','CREATE EXTERNAL JOB','CREATE ANY CREDENTIAL')
```

✓ **Relevant Objects (1 relevant object)**

GRANTEE	PRIVILEGE
MYAPP	CREATE ANY LIBRARY

XML Objects

Target Database

[Expand All](#) [Close All](#)

✗ **XML Schema Objects**

Description: XML Schema Objects will not migrate.

Action: Modify your application to not use XML Schema Objects.

[Hide Details](#)

Name: has_xmlschema_objects

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: XML Schemas are not supported in Autonomous Database.

Scope: UNIVERSAL

Executed SQL:

```
SELECT OWNER, SCHEMA_URL FROM ( SELECT S.OWNER, S.SCHEMA_URL FROM SYS.DBA_XML_SCHEMAS S WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','UNION SELECT S.OWNER, S.SCHEMA_URL FROM SYS.DBA_XML_SCHEMAS S, SYS.DBA_OBJECTS O WHERE S.INT_OBJNAME = O.OBJECT_NAME AND S.OWNER IN ('SYSTEM') AND O.OBJTYPE = 'XMLSCHEMA') T
```

✗ **Relevant Objects (1 relevant object)**

OWNER	SCHEMA_URL
MYAPP	http://www.example.com/xwarehouses.xsd

XML Tables

Target Database

[Expand All](#) [Close All](#)

XML Type Tables

Description: XMLType Tables will not migrate unless the STORAGE_TYPE is BINARY.

Action: XMLType Tables with CLOB or Object-Relational storage is not supported in Autonomous Database. Change the XMLType storage option to BINARY. When the relevant objects column XMLSCHEMA is not empty this indicates your application uses XML Schema Objects and additional work may be required. For non-schema based storage types, the BINARY storage option must be used. See Oracle Support Document ID 1581065.1 for information converting CLOB columns to BINARY. When migrating via Data Pump specify "TRANSFORM=XMLTYPE_STORAGE_CLAUSE='BINARY XML'" to transform CLOB to Securefile Binary XML.

[Hide Details](#)

Name: has_xmtype_tables

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Any applications relying on XMLType tables not stored as BINARY will fail.

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, TABLE_NAME, STORAGE_TYPE, XMLSCHEMA, SCHEMA_OWNER FROM SYS.DBA_XML_TABLES WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS') AND (XMLSCHEMA IS NOT NULL OR STORAGE_TYPE != 'BINARY') ORDER BY 1,2
```

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	STORAGE_TYPE	XMLSCHEMA	SCHEMA_OWNER
MYAPP	XWAREHOUSES	OBJECT-RELATIONAL	http://www.example.com/xwarehouses.xsd	MYAPP

XML Columns

Target Database

Expand All **Close All**

XML Type Columns

Description: Tables with XMLType column will not migrate unless the STORAGE_TYPE is BINARY.

Action: Tables with XMLType columns defined with CLOB or Object-Relational storage are not supported in Autonomous Database. When the relevant objects column XMLSCHEMA is not empty this indicates your application uses XML Schema Objects and additional work may be required. For non-schema types the BINARY storage option must be used. See Oracle Support Document ID 1581065.1 for information converting CLOB columns to BINARY. When migrating via Data Pump specify 'TRANSFORM=XMLTYPE_STORAGE_CLAUSE="BINARY XML"' to transform CLOB to Securefile Binary XML.

Hide Details

Name: has_tables_with_xmlype_column

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Any applications relying on XMLType columns not stored as BINARY will fail.

Scope: SCHEMA

Executed SQL:

```
SELECT XTC.OWNER, XTC.TABLE_NAME, XTC.COLUMN_NAME, XTC.STORAGE_TYPE, XTC.XMLSCHEMA, XTC.SCHEMA_OWNER FROM SYS.DBA_XML_TAB_COLS XTC ,SYS.DBA_TAB_COLS TC WHERE XTC.OWNER = TC.OWNER AND XTC.TABLE_NAME = TC.TABLE_NAME AND XTC.COLUMN_NAME = TC.COLUMN_NAME AND XTC.XMLSCHEMA IS NOT NULL AND XTC.STORAGE_TYPE != 'BINARY' AND TC.OWNER IN ('APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS') AND (XTC.XMLSCHEMA IS NOT NULL OR XTC.STORAGE_TYPE != 'BINARY') AND TC.OWNER = XTC.OWNER AND TC.TABLE_NAME = XTC.TABLE_NAME AND TC.COLUMN_NAME = XTC.COLUMN_NAME
```

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	COLUMN_NAME	STORAGE_TYPE	XMLSCHEMA	SCHEMA_OWNER
MYAPP	XML_CLOB	XML_DOC	CLOB		

Java Sources

Target Database

[Expand All](#) [Close All](#)

Java Sources

Description: Java sources will not migrate by default.

Action: Enable the JAVAVM feature on the target system by executing this SQL, and then restart your instance BEGIN DBMS_CLOUD_ADMIN.ENABLE_FEATURE(feature_name => 'JAVAVM'); END; / For more information on enabling the JAVAVM feature see the instructions here: <https://docs.oracle.com/en/cloud/paas/autonomous-database/adbsa/autonomous-oracle-java.html#GUID-2516EE33-B3BD-4270-BE52-30A4F9014E8B>

[Hide Details](#)

Name: has_java_source

Migration Methods: DATAPUMP,DATAPIPE,DBLINK,GOLDENGATE

Failure Impact: When the JAVAVM feature is not enabled on the target system, any applications relying on Java objects will fail.

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE, STATUS FROM SYS.DBA_OBJECTS WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS') AND OBJECT_TYPE = 'JAVA SOURCE' ORDER BY 1,2
```

Relevant Objects (1 relevant object)

OWNER	OBJECT_NAME	OBJECT_TYPE	STATUS
MYAPP	HELLOCLASSSRC	JAVA SOURCE	VALID

Java Objects

Target Database

[Expand All](#) [Close All](#)

▼ Java Objects

Description: Java objects will not migrate by default.

Action: Enable the JAVAVM feature on the target system by executing this SQL and then restart your instance BEGIN DBMS_CLOUD_ADMIN.ENABLE_FEATURE(feature_name => 'JAVAVM'); END; / For more information on enabling the JAVAVM feature see the instructions here: <https://docs.oracle.com/en/cloud/paas/autonomous-database/adbsa/autonomous-oracle-java.html#GUID-2516EE33-B380-4270-BE52-30A4F9014E8B>

[Hide Details](#)

Name: has_java_objects

Migration Methods: DATAPUMP,DATAPUMP_DBLINK,GOLDENGATE

Failure Impact: When the JAVAVM feature is not enabled on the target system, any applications relying on Java objects will fail.

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE, STATUS FROM SYS.DBA_OBJECTS WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS'); AND OBJECT_TYPE IN ('JAVA CLASS','JAVA RESOURCES','JAVA DATA') ORDER BY 1,2
```

▼ Relevant Objects (1 relevant object)

OWNER	OBJECT_NAME	OBJECT_TYPE	STATUS
MYAPP	HelloClass	JAVA CLASS	VALID

Common Objects

Target Database

[Expand All](#) [Close All](#)

▼ **Common Objects**

Description: Common objects are not migrated by Data Pump and are not supported on ADB.

Action: Those common objects needed by applications must be recreated on the target system prior to migration. When targeting ADB the needed common objects must be recreated as local objects. This can be done using DBMS_METADATA.GET_DDL as shown in Oracle Support Document ID 2739952.1

[Hide Details](#)

Name: has_common_objects

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Anything dependent on the common objects will fail to be migrated properly.

Scope: INSTANCE

Executed SQL:

```
SELECT USERNAME AS OBJECT_NAME, 'USER' AS OBJECT_TYPE FROM SYS.DBA_USERS WHERE (COMMON='YES' OR UPPER(USERNAME) LIKE 'C##%') AND ORACLE_MAINTAINED =<> 'Y' UNION ALL SELECT ROLE AS OBJECT_NAME, 'ROLE' AS OBJECT_TYPE FROM SYS.DBA_ROLES R WHERE (COMMON='YES' OR UPPER(ROLE) LIKE 'C##%') AND ORACLE_MAINTAINED =<> 'Y' UNION ALL SELECT UNIQUE PROFILE AS OBJECT_NAME, 'PROFILE' AS OBJECT_TYPE FROM SYS.DBA_PROFILES WHERE COMMON='YES' OR UPPER(PROFILE) LIKE 'C##%' AND UPPER(PROFILE) NOT IN ('ORA_ADMIN_PROFILE','ORA_APP_PROFILE','ORA_MANDATORY_PROFILE')
```

▼ **Relevant Objects (2 relevant objects)**

OBJECT_NAME	OBJECT_TYPE
C##DBLCMUSER	USER
C##DBLCMPROFILE	PROFILE

Non-Exported Objects Grants

Source Database

Expand All Close All

Review Required (5 checks)

Non-Exported Object Grants

Description: Not all object grants are exported by Data Pump.

Action: Recreate any required grants on the target instance. See Oracle Support Document ID 1911151.1 for more information. Note that any SELECT grants on system objects will need to be replaced with READ grants; SELECT is no longer allowed on system objects.

Name: has_noexport_object_grants

Migration Methods: DATAPUMP,DATAPIPE,DLINK,GOLDEDGATE

Failure Impact: Object grants required for your application may be missing on the target instance.

Scope: SCHEMA

Executed SQL:

```
SELECT GRANTEE, OWNER AS OBJECT_OWNER, TABLE_NAME AS OBJECT_NAME, PRIVILEGE AS PRIVILEGE, GRANTOR FROM SYS.DBA_TAB_PRIVS WHERE (GRANTEE NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS')) AND GRANTEE IN (SELECT USERNAME FROM SYS.DBA_USERS) OR GRANTEE IN (SELECT ROLE FROM SYS.DBA_ROLES WHERE SYS.DBA_ROLES.ORACLE_MAINTAINED <> 'Y' AND ROLE IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS')) AND NOT (OWNER = 'SYS' AND TABLE_NAME LIKE 'QT%$_BUFFER_ESCAPE') AND (OWNER IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS')) ORDER BY GRANTEE, OBJECT_OWNER, OBJECT_NAME, PRIVILEGE, GRANTOR
```

Relevant Objects (1 relevant object)

GRANTEE	OBJECT_OWNER	OBJECT_NAME	PRIVILEGE	GRANTOR
MYAPP	SYS	DBMS_SHARED_POOL	EXECUTE	SYS

Scheduler Jobs

Source Database

Expand All Close All

✓ Incompatible Scheduler Jobs

Description: Scheduler Jobs and Programs other than PLSQL_BLOCK or STORED_PROCEDURE are not supported on ADB.

Action: Recreate required Job or Programs using types allowed in ADB.

[Hide Details](#)

Name: has_incompatible_jobs

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Scheduler Jobs and Programs types such as EXECUTABLE and EXTERNAL_SCRIPT will not run on ADB

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, NAME, TYPE, LOCUS FROM ( SELECT OWNER, JOB_NAME AS NAME, JOB_TYPE AS TYPE, 'DBA_SCHEDULER_JOBS' AS LOCUS FROM SYS.DBA_SCHEDULER_JOBS WHERE ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','AND JOB_TYPE NOT IN ('CHAIN','STORED_PROCEDURE','PLSQL_BLOCK')) UNION ALL SELECT OWNER, PROGRAM_NAME AS NAME, PROGRAM_TYPE AS TYPE, 'DBA_SCHEDULER_PROGRAMS' AS LOCUS FROM SYS.DBA_SCHEDULER_PROGRAMS WHERE ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','AND PROGRAM_TYPE NOT IN ('STORED_PROCEDURE','PLSQL_BLOCK')) ) ORDER BY 1, 2, 3
```

✓ Relevant Objects (1 relevant object)

OWNER	NAME	TYPE	LOCUS
MYAPP	PROCESS_DATA_JOB	EXECUTABLE	DBA_SCHEDULER_JOBS

External Tables

Source Database

Expand All Close All

External Tables for Serverless

Description: External tables in ADB must be recreated using Object Storage Service or File Storage Service.

Action: Drop the empty imported table. Use the DBMS_CLOUD package to create External Tables using Cloud Object Storage Service or use File Storage Service for more info see <https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/load-oci-file-storage.html#GUID-B9A7E58E-E1C0-4859-B16B-EF88942704BF>.

Name: has_external_tables_serverless

Migration Methods: DATAPUMP,DATAPUMP_DBLINK,GOLDENGATE

Failure Impact: Attempting to create external tables that are neither Cloud Object Storage nor File Storage Service will result in those tables being created as empty non-External tables.

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, TABLE_NAME, TYPE_OWNER, TYPE_NAME, DEFAULT_DIRECTORY_OWNER, DEFAULT_DIRECTORY_NAME
FROM SYS.DBA_EXTERNAL_TABLES
WHERE OWNER NOT IN ('ANONYMOUS', 'APEX_030200', 'APEX_040000', 'APEX_040100', 'APEX_040200', 'APEX_050000', 'APEX_LISTENER', 'APEX_PUBLIC_USER', 'APEX_REST_PUBLIC_USER', 'APPQOSSYS', 'AUDSYS')
ORDER BY 1, 2
```

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	TYPE_OWNER	TYPE_NAME	DEFAULT_DIRECTORY_OWNER	DEFAULT_DIRECTORY_NAME
MYAPP	COUNTRIES_EXT	SYS	ORACLE_LOADER	SYS	EXT_TAB_DATA

Restricted Packages

Source Database

Expand All Close All

▼ Restricted Packages Use for Serverless

Description: Some packages are either not supported or only partially supported in ADB

Action: Applications referencing unsupported packages must be modified before migration to ADBS; Applications referencing partially supported packages require testing and validation to ensure they only utilize unrestricted functions and procedures.

[Hide Details](#)

Name: has_refs_to_restricted_packages_serverless

Migration Methods: DATAPUMP, DATAPUMP_DBLINK, GOLDENGATE

Failure Impact: Applications that reference packages that are unsupported or restricted-use on ADB may fail

Scope: SCHEMA

Executed SQL:

```
SELECT OWNER, NAME, TYPE, REFERENCED_NAME, SUPPORT FROM ( SELECT OWNER, NAME, TYPE, REFERENCED_NAME, 'UNSUPPORTED' AS SUPPORT FROM SYS.DBMS_DEPENDENCIES WHERE REFERENCED_NAME IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','DBMS_DEBUG_JDWP','DBMS_DEBUG_JDWP_CUSTOM','UTL_INADDR','DBMS_SYSTEM','DBMS_SYS_SQL') UNION ALL SELECT OWNER, NAME, TYPE, REFERENCED_NAME, 'PARTIALLY SUPPORTED' AS SUPPORT FROM SYS.DBMS_DEPENDENCIES WHERE REFERENCED_NAME IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER','APPQOSSYS','AUDSYS','DBMS_SHARED_POOL','DBMS_PIPE','DBMS_LDAP','DBMS_NETWORK_ACL_ADMIN')) WHERE OWNER <> 'PUBLIC' AND TYPE = 'PACKAGE' AND REFERENCED_NAME NOT IN ('DBMS_DEBUG_JDWP','DBMS_DEBUG_JDWP_CUSTOM','UTL_INADDR','DBMS_SYSTEM','DBMS_SYS_SQL')
```

▼ Relevant Objects (2 relevant objects)

OWNER	NAME	TYPE	REFERENCED_NAME	SUPPORT
MYAPP	GET_HTTP_RESPONSE	PROCEDURE	UTL_HTTP	PARTIALLY SUPPORTED
MYAPP	MANAGE_SHARED_POOL	PROCEDURE	DBMS_SHARED_POOL	PARTIALLY SUPPORTED

Directory Objects Accessibility

Source Database

Expand All Close All

Directories

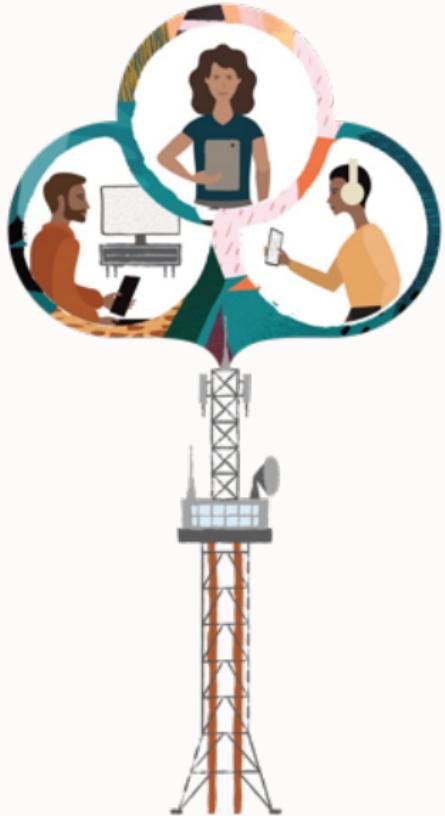
Description: Directory objects may reference locations that are not accessible in ADB

Action: Recreate the directories on the Autonomous database instance.

More Details

Relevant Objects (9 relevant objects)

OWNER	DIRECTORY_NAME	DIRECTORY_PATH
SYS	DBMS_OPTIM_ADMINDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/admin
SYS	DBMS_OPTIM_LOGDIR	/u01/app/oracle/product/19.0.0/dbhome_1/cfgtoollogs
SYS	EXT_TAB_DATA	/external_data
SYS	ORACLE_OCM_CONFIG_DIR	/u01/app/oracle/product/19.0.0/dbhome_1/ocr/state
SYS	ORACLE_OCM_CONFIG_DIR2	/u01/app/oracle/product/19.0.0/dbhome_1/ocr/state
SYS	SCRIPT_DIR	/home/oracle/scripts/
SYS	SSO_DIR_WORK	
SYS	XMLDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/xml
SYS	XSDDIR	/u01/app/oracle/product/19.0.0/dbhome_1/rdbms/xml/schema



Connections

What's the best option?

Predefined Database Service Names



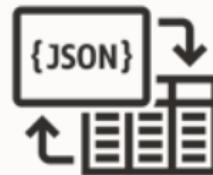
Autonomous DWH

dbname_high
dbname_medium
dbname_low



Autonomous TP

dbname_tpurgent
dbname_tp
dbname_high
dbname_medium
dbname_low



Autonomous JSON

dbname_tpurgent
dbname_tp
dbname_high
dbname_medium
dbname_low

Notes for Importing with Oracle Data Pump

<https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/load-data-data-pump-notes.html>

“For the best import performance use the **HIGH** database service for your import connection and set the parallel parameter to one quarter the number of ECPUs (.25 x ECPU count).

If you are using OCPU compute model, set the parallel parameter to the number of OCPUs (1 x OCPU count).”

Connections

For migrations, clearly **TPURGENT** usually provides best results

- For Autonomous Data Warehouse (ADW), you can request this service by creating a Service Request (SR)

Concurrency

Database Service Name	Concurrent Statements with Compute Auto Scaling Disabled	Concurrent Statements with Compute Auto Scaling Enabled
tpurgent	$75 \times \text{number of ECPUs}$	$75 \times \text{number of ECPUs}$
tp	$75 \times \text{number of ECPUs}$	$75 \times \text{number of ECPUs}$
high	3	9
medium	$0.25125 \times \text{number of ECPUs}$ A decimal result is truncated.	$0.75375 \times \text{number of ECPUs}$ A decimal result is truncated.
low	$75 \times \text{number of ECPUs}$	$75 \times \text{number of ECPUs}$

<https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/manage-service-concurrency.html#GUID-6E4DCD27-CDAA-432D-A90B-485C19EF72B0>

Concurrency Limits

Database Service Name	Concurrent Statements with OCPU Auto Scaling Disabled	Concurrent Statements with OCPU Auto Scaling Enabled
tpurgent	$300 \times \text{number of OCPUs}$	$300 \times \text{number of OCPUs}$
tp	$300 \times \text{number of OCPUs}$	$300 \times \text{number of OCPUs}$
high	3	9
medium	$1.26 \times \text{number of OCPUs}$	$3.78 \times \text{number of OCPUs}$
low	$300 \times \text{number of OCPUs}$	$300 \times \text{number of OCPUs}$

<https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/manage-service-concurrency.html#GUID-6E4DCD27-CDAA-432D-A90B-485C19EF72B0>



Storage

What's the best option?



NFS vs Object Storage?

- It depends ...

NFS vs Object Storage

Usually, NFS (or FSS) is recommended over object storage for the migration

- Easy to setup
- Performance seems to be better
- NFS requires "private endpoint access only"
- Object storage's advantage: **pre-authenticated**



The screenshot shows the 'Create File System' wizard. On the left, a sidebar box titled 'Private endpoint access only' contains the text: 'Restrict access to a private endpoint within an OCI VCN.' The main panel is titled 'Create File System' and contains the following content:

This workflow creates a new File System. To get started, choose the type of File System you want to create. Then, you can keep the provided information or click **Edit details** to change it. Click **Create** to finish.

File System for NFS
Create a File System and an associated Export in a Mount Target. You can mount and access the File System as soon as it is created. [Learn more about mounting File Systems.](#)

File System for Replication
Create an unexported File System. Unexported File Systems can be used as target File Systems for replicated data. [Learn more about replication.](#)

High Performance Storage

Use HPMT (High Performance Mount Target)

OPTION	THROUGHPUT	INCLUDED
HPMT-20	up to 20 Gbs	20 TB
HPMT-40	up to 40 Gbs	40 TB
HPMT-80	up to 80 Gbs	80 TB

- <https://docs.oracle.com/en-us/iaas/releasenotes/filestorage/high-performance-mount-targets.htm>
- <https://docs.oracle.com/en-us/iaas/Content/Resources/Assets/whitepapers/file-storage-performance-guide.pdf>



Use High Performance Mount Target
during migration for better throughput

- 30 days minimum subscription



Latency

Have a closer look

Connection and latency test tool - adbping (Doc ID 2863450.1)

- Diagnose high-latency issues in customer workloads
- Validate if the ADB service is healthy and not the root cause of latency

Latency

```
[oracle@db19coz adbping]$ ./adbping -u admin -p |_____| \
> -s atpaz_high -w \
> /home/oracle/wallet -j /u01/app/oracle/product/19.0.0/dbhome_1/javavm/jdk/jdk8 \
> -d 30
+++Test Summary+++
  Test Client: sqlplus
  Number of concurrent threads: 1
  Duration (Secs): 30
  SQL executed: select 1 from dual;
  Pass: 27 Fail: 0
  Test start date: 2025-06-02 15:25:21.517810+00:00
  Test end date: 2025-06-02 15:25:52.126871+00:00
  SQL Execution Time(ms) : Min:0 Max:10 Avg:1.111 Median:0 Perc90:10 Perc95:10 Perc99:10
  Connect + SQL Execution Time(ms) : Min:1115.78 Max:1292.391 Avg:1131.607 Median:1123.914 Perc90:1155.317 Perc95:1155.977 Perc99:1292.391
```

Interpretation of the results

1. Pass/Fail count: Indicates the total number of connections passed/failed in defined duration by the defined number of threads.
2. SQL execution time: Time taken to just execute the SQL. Connection time not included.
For sqlplus, this would be the elapsed time reported by sqlplus.
3. Connect + SQL Execution Time: Time taken to connect and execute SQL.
For sqlplus, this would be the time to connect and run the sql.
For java, it would be time taken to getConnection() and execute the query.
4. Java connection pool stats: Reports the time taken to setup the java connection pool and the initial and max size.
All query executions do a getConnection() and execute the SQL.
5. Perc90, Perc95, Perc99: This is the percentile value indicating 90%, 95% or 99% of the latencies are below the respective value.

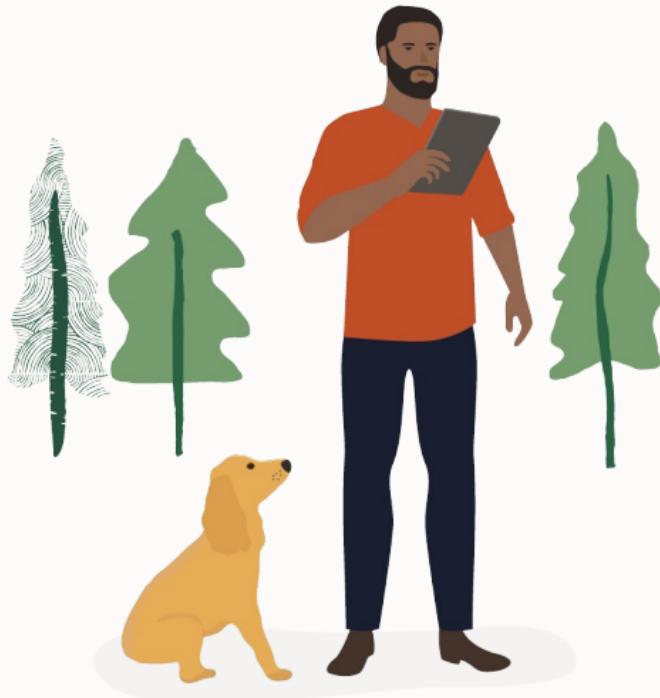
Latency

```
[oracle@db19caz adbping]$ ./adbping -u admin -p [REDACTED] \
> -s atpaz_high -w \
> /home/oracle/wallet -j /u01/app/oracle/product/19.0.0/dbhome_1/javavm/jdk/jdk8 \
> -d 30
+++Test Summary+++
  Test Client: sqlplus
  Number of concurrent threads: 1
  Duration (secs): 30
  SQL executed: select 1 from dual;
  Pass: 27 Fail: 0
  Test start date: 2025-06-02 15:25:21.517810+00:00
  Test end date: 2025-06-02 15:25:52.126871+00:00
  SQL Execution Time(ms) : Min:0 Max:10 Avg:1.111 Median:0 Perc90:10 Perc95:10 Perc99:10
  Connect + SQL Execution Time(ms) : Min:1115.78 Max:1292.391 Avg:1131.607 Median:1123.914
  Perc90:1155.317 Perc95:1155.977 Perc99:1292.391
```

Latency

```
[oracle@db19caz oci]$ ./connping11 -l admin/ @atpaz_high --period=5

RWP*Connect/OCIPing Release 3.2.1.0 Production on Mon, 02 Jun 2025 15:32:39 UTC
Connected default database with reconnect to:
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud and Engineered Systems
connect:114.25 ms, ociping:0.959 ms, dualping:0.998 ms, sid=55917, inst#=8, time=1.1
connect:117.93 ms, ociping:1.004 ms, dualping:0.997 ms, sid=43883, inst#=8, time=2.1
connect:115.45 ms, ociping:1.120 ms, dualping:1.138 ms, sid=13832, inst#=8, time=3.1
connect:115.62 ms, ociping:1.206 ms, dualping:1.357 ms, sid=13832, inst#=8, time=4.1
connect mean=115.81, stddev=1.33, min=114.25, max=117.93
ociping mean=1.07, stddev=0.10, min=0.96, max=1.21
dualping mean=1.12, stddev=0.15, min=1.00, max=1.36
```



Maintenance

What else do you need to take care on?

Choose Maintenance Plan

Two maintenance plans are available

- You can adjust it later on if needed



The screenshot shows a user interface for choosing a maintenance plan. At the top, there is a section titled "Maintenance" with a dropdown menu. The dropdown menu is open, showing two options: "Patch level" and "Regular". The "Regular" option is selected. Below the dropdown, there are two buttons: "Early" and "Regular". The "Regular" button is highlighted with a blue border. At the bottom of the interface, there is a text box containing the message: "Your database will be patched on a regular schedule.".

▼ Maintenance

Patch level

Regular

Early

Regular

Your database will be patched on a regular schedule.

Choose Maintenance Plan

Maintenance happens weekly

- Typically, on weekends
- Window will be always the same
- Assigned during creation

Take note for your migration!!

Maintenance

You can obtain information about system events, maintenance, and other important information for the operation of your Autonomous Database instance. [Learn more](#)

Patch level	Regular	Edit
Your database will be patched on a regular schedule.		
Next maintenance	Sat, Jun 7, 2025, 19:00:00 UTC - 21:00:00 UTC	View history
Target component	Database	

```
--Query your recent maintenance window on ADB Serverless
--Note: Exact timing for upcoming maintenance
--       window is available 24 hours before.
```

```
select actual_start_date, actual_end_date,
       maintenance_status
  from db_notifications
 where type = 'maintenance' and time > sysdate -7;
```

ACTUAL_START_DATE	ACTUAL_END_DATE	MAINTENANCE_STATUS
2025-05-24 19:00:02 GMT	2025-05-24 21:00:24 GMT	Completed 2 hours 22 seconds



If you want to change the maintenance window, you must open an SR

- Only ± 2 hours possible



Data Pump

The simple approach



Data Pump Bundle Patch aren't yet applied in ADB Serverless *(June 2025)*

- You may request one-off fixes via an SR



Allocate a sufficient number of ECPUs

- 32 should be the **minimum** when you import



Export: **PARALLEL** 2x of physical cores



Import: **PARALLEL**=ECPU/4, or higher

- Scale up to the maximum for migrations



Ensure `CLUSTER_DATABASE=TRUE`

- Allows Data Pump workers across nodes

NAME	TYPE	VALUE
<code>cluster_database</code>	boolean	TRUE

Most simple method: Data Pump



Datapump with Files



Datapump with DB Links

Datapump with Dump Files

- More control over parallelism
- Storage Overhead
- No source-target connection interoperability requirement
- Requires Object Storage / File Storage setup

Datapump with DB Links

- Network throughput and latency dependency
- Faster for smaller databases
- Requires DB Link setup
- And there is more ...



Be aware of network link import limitations

- May have a significant impact on performance

Network Link Imports - LOBs

- A network round trip is required for reach row with a LOB
- If you have millions of LOB rows and a high latency connection to ADB, this may have a significant negative impact
- Check your latency from source database to ADB instance using
 - [How to measure network latency for Oracle Database applications in OCI \(Doc ID 3008087.1\)](#)
 - [Connection and latency test tool - adbping \(Doc ID 2863450.1\)](#)

```
./ociping -l user/password@myadb_high --period=5
RWP*OCIPing Release 3.2.1.0 Production on Fri, 30 May 2025 15:23:35 UTC
Connected default database to:
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle
Cloud and Engineered Systems
0.998 0.0
1.008 1.0
0.987 2.0
0.999 3.0
1.054 4.0
ociping (ms) mean=1.009, stddev=0.023, min=0.987, max=1.054
```

Network Link Imports - Metadata

- A network link import does not import metadata in parallel
- On complex schemas this may have a significant negative impact
- If a network link import is required,
 - Import metadata before migration - CONTENTS=METADATA_ONLY
 - Load rows only during the migration - CONTENTS=DATA_ONLY

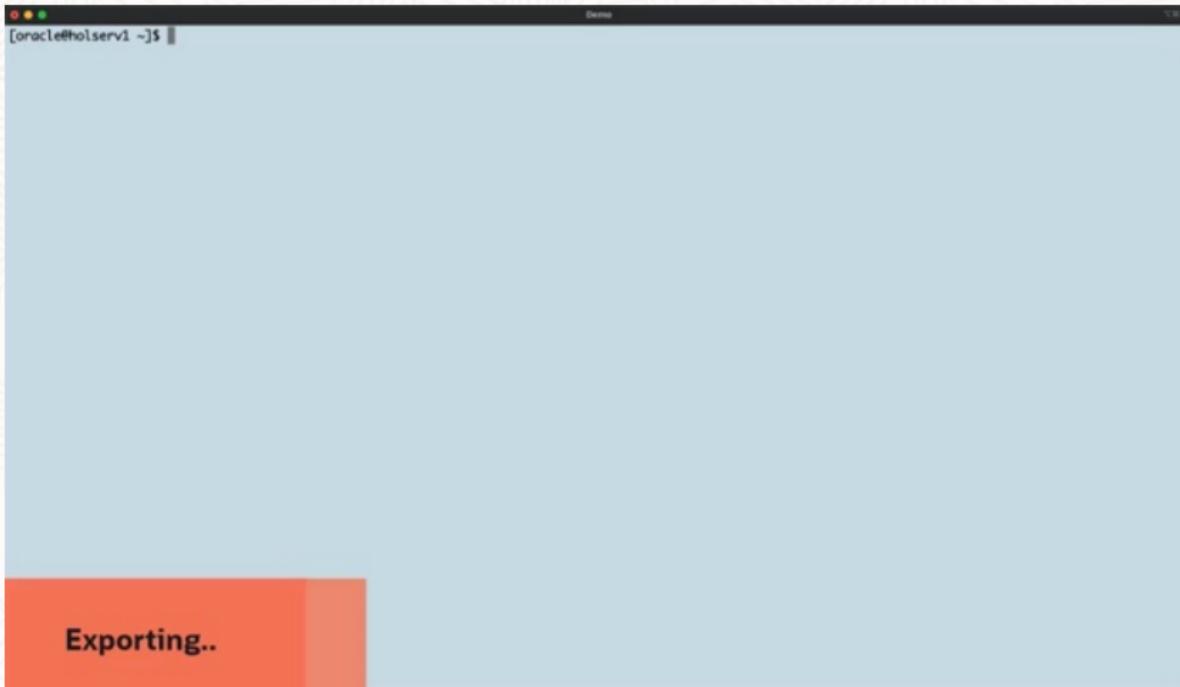
ADB Migration Overview



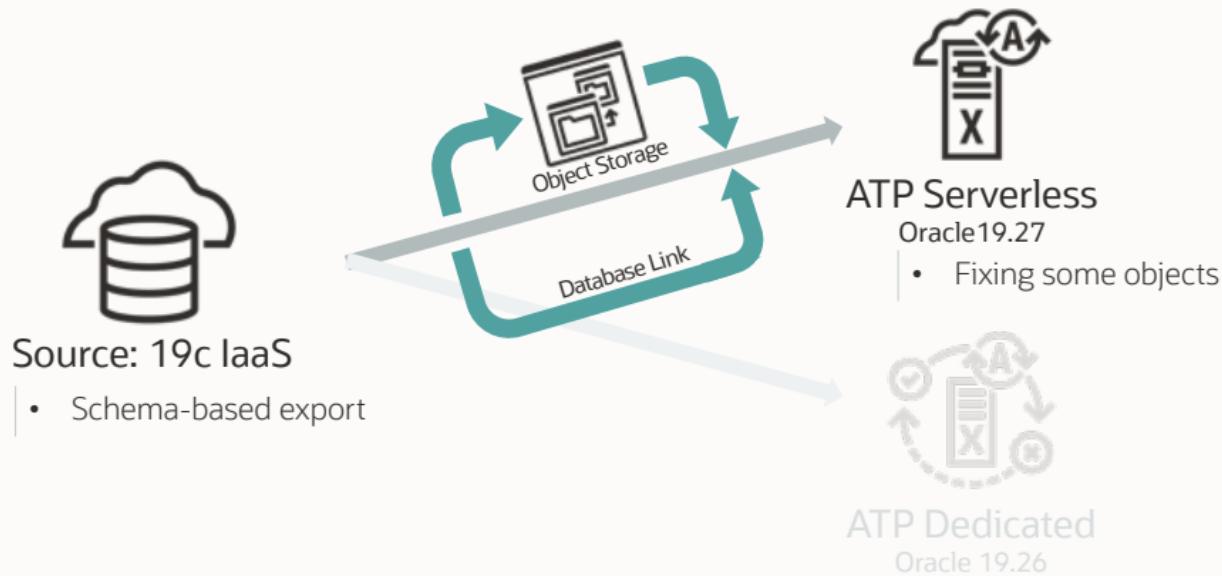
ADB Dedicated | Migration Example



ADB Dedicated | Demo



ADB Serverless | Migration Example



ADB Serverless | Demo





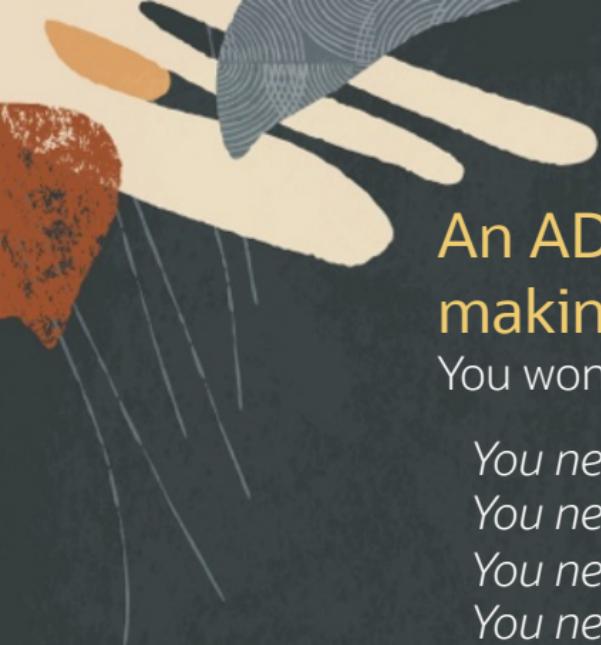
Automation

How AMA scripts ease migrations

What is AMA?

Autonomous Database Migration Automation (AMA)

- Simple migration solution for ADB Serverless
- Script based
- Single configuration file
- Migrates in phases
- Can act fully automated
- Not a new product, just a **solution** to ease migrations



An ADB-S migration is a bit like making a movie

You won't start with filming right away

You need a script book

You need to cast actors

You need a film set

You need ...

Now you can start filming your scenes

And then there's plenty of work
on editing and cutting the movie





AMA Workflow



- Examination of source database (CPAT)
- Create migration directories
- Configure AMA parameter file

```
--Create migration directories
--Copy parameter file into INPUT
--Edit parameter file and make adjust with your values

mkdir -p /home/oracle/CPAT_MIG_SCRIPTS/INPUT
mkdir -p /home/oracle/CPAT_MIG_SCRIPTS/OUTPUT

cp CPAT_MIGRATION_PARAMETERS.txt /home/oracle/CPAT_MIG_SCRIPTS/INPUT

vi /home/oracle/CPAT_MIG_SCRIPTS/INPUT/CPAT_MIGRATION_PARAMETERS.txt
```

Parameter File

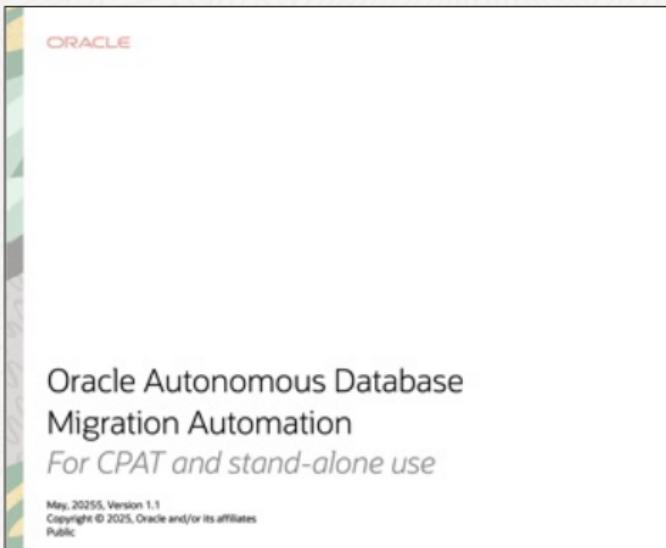
Adjust:

- Connect strings source and target
- Data Pump encryption
- Storage (FSS or Object Store)
- Format: TAB or SCRIPT

Documentation

AMA Documentation is available at request

- Documents the entire flow and all options and parameters



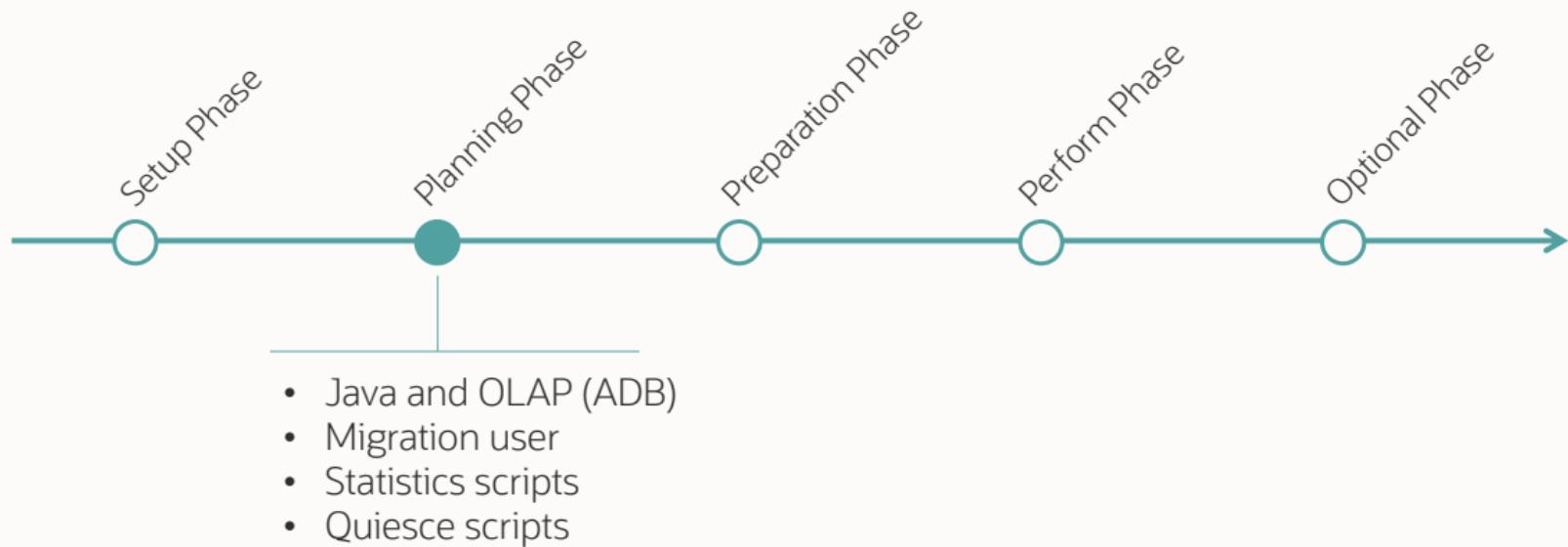
ORACLE	
Table of contents	
Introduction	3
Current restrictions	3
Workflow	4
Setup	4
Planning Phase	4
Prep Phase	4
Perform Phase	5
Post Phase	5
Optimize Phase	6
How to use AMA	7
Setup and execute AMA	7
How to setup the shared storage	10
Setting up an NFS Share for the migration	10
OCI Console	10
Associate Mount Target	11
Linux	11
Windows	11
Setting up an Object Storage Bucket for the migration	11
Pre-Authenticated URLs	14
APPENDIX A - AMA Migration Parameters	16
CONNECT_SRC	16
CONNECT_TRG	16
URI	16
PWD	16
ENCRYPT_USER	16
SP_ENCRYPTION_PWD	16
USE_FSS_CDR	16
DUMP_OUTPUT_PATH	17
AOR_Dump File Storage Related Parameters	17
CONFIRM_FILE_FORMAT	17
USE_DB_ANTRUE	17
CPAT_OUTPUT_CDR	18
APPENDIX B - The AMA Configuration File	19
APPENDIX C - AMA Walkthrough including Output (Linux)	21

AMA Demonstration

Part 1 - Configuration



AMA Workflow



AMA | Planning Phase

On-Prem - Source

ADB-S - Target

Enable OLAP / JAVA in ADB-S

Gather stats for SYS / SYSTEM

Create Migration user

Enable restricted session

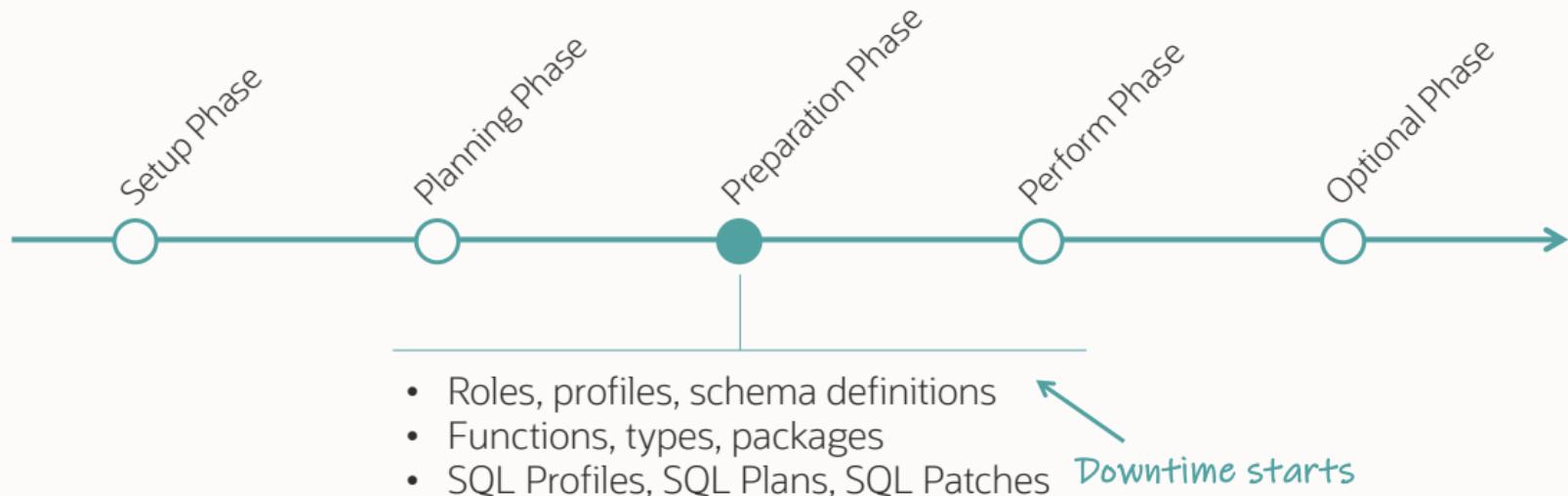
Set JOB_QUEUE_PROCESSES=0

```
[oracle@ephx31vm1-jlosd1 OUTPUT]$ cat __US3BLDW_MIGRATION_CONTROL_FILE.ctl
```

```
---  
---  
--- PLAN PHASE ---  
--- All steps in this phase affect the source database ---  
--- * You can collect the statistics or create the migration user in advance ---  
--- * Get familiar with the restricted session privilege and how to prepare it ---  
--- * shortly before the migration starts make sure no unwanted user is connected ---  
--- to the source database, turn on restricted session and disable the scheduler ---  
---  
---  
  
#####      S O U R C E      #####  
  
PLAN TARGET 00001 01 ..... 00001_US3BLDW_SQL_ENABLE_OLE_AP_JAVA.sh  
PLAN SOURCE 00002 01 00002_US3BLDW_SQL_OPTIONAL_SOURCE_STATS.sh  
PLAN SOURCE 00003 01 00003_US3BLDW_SQL_CREATE_MIG_USER_SRC.sh  
PLAN SOURCE 00004 01 00004_US3BLDW_SQL_SET_JOB_QUEUE_PROCESSES.sh  
PLAN SOURCE 00005 01 00005_US3BLDW_SQL_ENABLE_RESTRICTED_SESSION.sh  
---  
|-----|  
#####      T A R G E T      #####
```



AMA Workflow



AMA | Preparation Phase

On-Prem - Source

ADB-S - Target

Collect allowed ROLES	Create ROLES
Collect PROFILES	Create PROFILES
Export schema definition	Create storage credential (NFS, Object Store)
Export FUNCTIONS, TYPES, PACKAGES	Import schema definition
Collect SQL Profiles, SQL Plans, SQL Patches	Import FUNCTIONS, TYPES, PACKAGES
	Granting migration privileges
	Alter user profiles
	Create SQL Profiles, SQL Plans, SQL Patches

--- PREPARATION PHASE ---

--- All steps in this phase will prepare the source and target database ---

--- The scripts depend on each other, so execute in this phase one script after the other ---

SOURCE

TARGET





AMA Workflow



- Export schemas and audit trail
- Copy files (if necessary)
- Import schemas and audit trail

AMA | Perform Phase

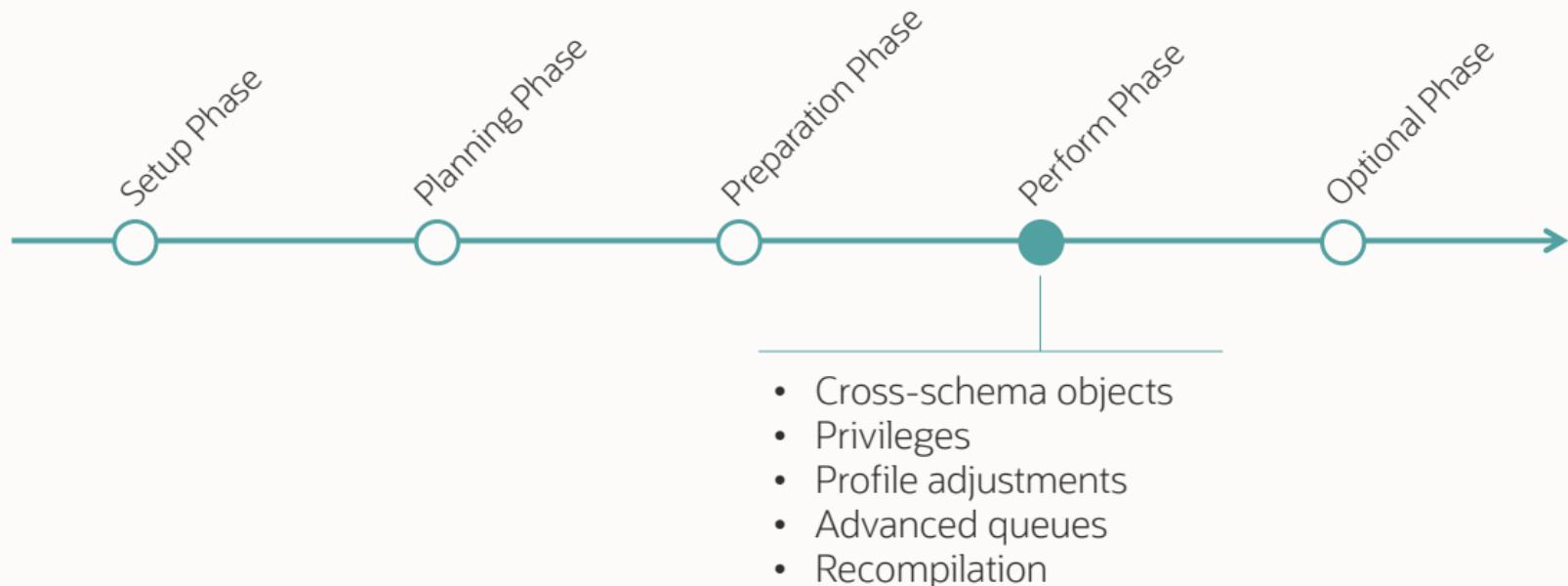
On-Prem - Source

ADB-S - Target





AMA Workflow



--- **PERFORM PHASE** ---

--- Commonly in this phase nothing depends on each other (except you for example have objects that depend on objects stored in other schema) ---
--- So export jobs can be started in parallel and imports once the export finished ---

#### SOURCE ####	#### TARGET ####
PERFORM SOURCE 00014 01 00014_US3BLDW_EXPDP_AUDIT_TRAILS.sh	
PERFORM TARGET 00014 02	00014_US3BLDW_IMPDP_AUDIT_TRAILS.sh
PERFORM SOURCE 00015 01 00015_US3BLDW_SQL_GEN_SQL_PROFILE_STAGE_TAB.sh	
PERFORM SOURCE 00015 02 00015_US3BLDW_EXPDP_SQL_PROFILES.sh	
PERFORM TARGET 00015 03	00015_US3BLDW_IMPDP_SQL_PROFILES.sh
PERFORM TARGET 00015 04	00015_US3BLDW_SQL_APPL_SQL_PROFILE_STAGE_TAB.sh
PERFORM SOURCE 00016 01 00016_US3BLDW_SQL_GEN_SQL_PATCHES_STAGE_TAB.sh	
PERFORM SOURCE 00016 02 00016_US3BLDW_EXPDP_SQL_PATCHES.sh	
PERFORM TARGET 00016 03	00016_US3BLDW_IMPDP_SQL_PATCHES.sh
PERFORM TARGET 00016 04	00016_US3BLDW_SQL_APPL_SQL_PATCHES_STAGE_TAB.sh
PERFORM SOURCE 00017 01 00017_US3BLDW_EXPDP_SCHEMA_FUSION.sh	
PERFORM TARGET 00017 02	00017_US3BLDW_IMPDP_SCHEMA_FUSION.sh
PERFORM SOURCE 00018 01 00018_US3BLDW_EXPDP_SCHEMA_FUSION_OCSERVER11G.sh	
PERFORM TARGET 00018 02	00018_US3BLDW_IMPDP_SCHEMA_FUSION_OCSERVER11G.sh
...	

AMA | Perform Phase

On-Prem - Source

Export network ACLs

ADB-S - Target

FOREIGN KEYS cross-schemas

INDEXES cross-schemas

FUNCTIONAL INDEXES enableing

REVOKE transition privileges

GRANT privs SYS, SYSTEM, CTXSYS, objects

Restore final profiles

Set tablespace quotas

Import network ACLS

Enable Advanced Queues

Recompilation

--- POST PHASE ---

--- Here execute again all scripts one after the other as they might have dependencies again ---

SOURCE

TARGET

#### SOURCE ####	#### TARGET ####
POST TARGET 00082 01	00082_US3BLDW_SQL_REMOVE_MIG_ROLE.sh
POST TARGET 00083 01	00083_US3BLDW_SQL_SYS_PRIVS.sh
POST TARGET 00084 01	00084_US3BLDW_SQL_CTXSYS_PRIVS.sh
POST TARGET 00085 01	00085_US3BLDW_SQL_DATAMINING_PRIVS.sh
POST TARGET 00086 01	00086_US3BLDW_SQL_OBJECT_PRIVS.sh
POST TARGET 00087 01	00087_US3BLDW_SQL_ROLE_PRIVS.sh
POST TARGET 00088 01	00088_US3BLDW_SQL_TBS_QUOTES.sh
POST TARGET 00089 01	00089_US3BLDW_SQL_DETACH_FSS.sh
POST SOURCE 00090 01 00090_US3BLDW_EXPDP_NETWORK_ACL.sh	
POST TARGET 00090 02	00090_US3BLDW_IMPDP_NETWORK_ACL.sh
POST TARGET 00091 01	00091_US3BLDW_SQL_SET_AQ_STATUS.sh
POST TARGET 00092 01	00092_US3BLDW_SQL_RECOMPILE.sh

--- END OF MIGRATION ---



AMA Workflow



- Object comparison
- Row export/import comparison
- OLAP Analytic Workspace

AMA Demonstration

Part 2 - Migration



Done!!



AMA can run a migration **fully automated** and **completely unattended**

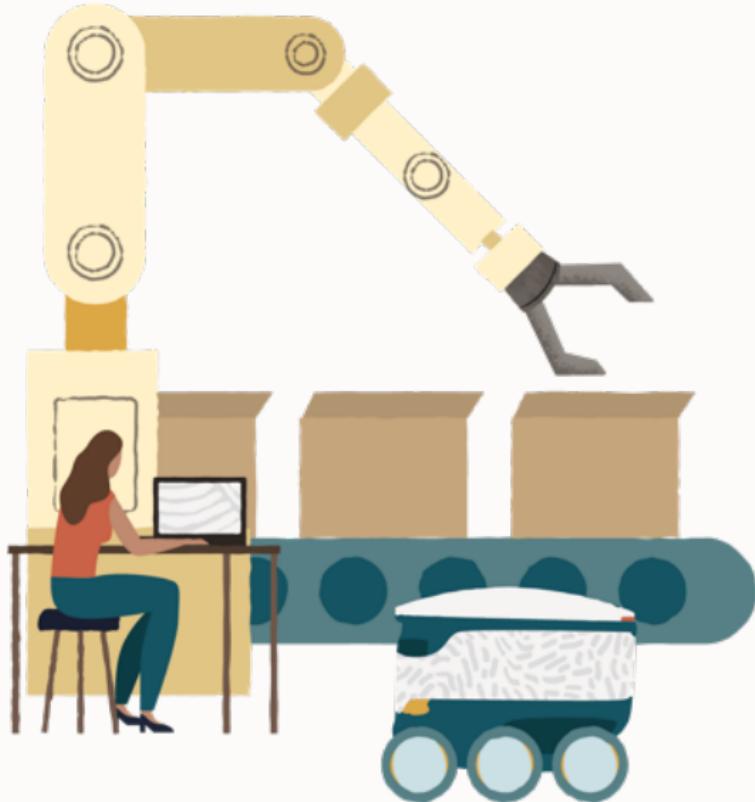


Works with MS Windows as source database



Database links, directories, external tables,
XML binary objects, APEX applications

- Work-in-progress

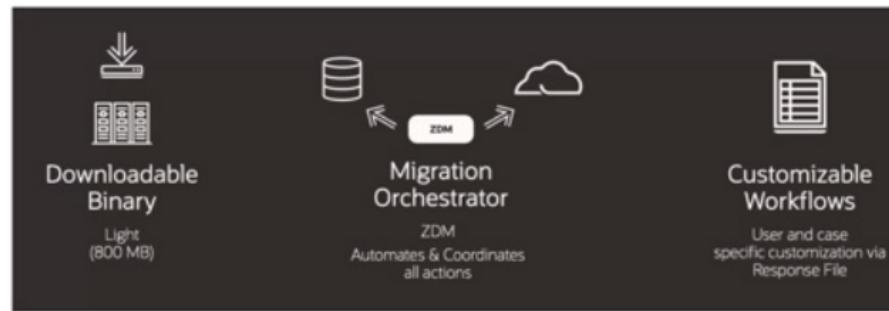


ZDM

Zero Downtime Migration

Oracle Zero Downtime Migration

Oracle Zero Downtime Migration



[Watch on YouTube](#)



DMS

Data Migration Service



Oracle Zero Downtime Migration



[Watch on YouTube](#)



ADB@Azure

Using ZDM to migrate to Azure

Autonomous Database @ Azure



[Watch on YouTube](#)

Autonomous Database @ Azure

[Zero Downtime Migration documentation](#)

[Exploring NFS Storage Options for Oracle ZDM Migrations to Oracle Database@Azure](#)

[Network topology and connectivity for Oracle Database@Azure - Migration connectivity design](#)

[Step-by-step Guide: Logical Offline Migration to ADB-S on Oracle Database@Azure](#)

[Step-by-step Guide: Logical Online Migration to ADB-S on Oracle Database@Azure](#)



Success

Validating a migration



How can you proof that no data was lost
during the migration?

Validating the Migration

It's a logical migration into a **different** database platform

- ADB performs a lot of transformations:
IOTs to heap tables, external tables to heap tables
- Database links are different:
Uses credentials and a different connection string
- Different kinds of storage:
tablespace, removing table storage customization,
changing to binary XML etc.
- And so on ...



Start by validating
the Data Pump export and import

```
Import: Release 19.0.0.0.0 - Production on Mon Apr 28 08:49:43 2025
Version 19.27.0.0.0
Copyright (c) 1982, 2019, Oracle and/or its affiliates. All rights reserved.
```

```
Connected to: Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
28-APR-25 08:49:44.678: W-1 Startup took 0 seconds
```

```
28-APR-25 08:51:05.528: Job "DPUSER"."ADB_MIGR" successfully completed at Mon Apr 28 08:51:05 2025 elapsed 0 00:01:21
```

```
Import: Release 19.0.0.0.0 - Production on Mon Apr 28 08:49:43 2025
Version 19.27.0.0.0
Copyright (c) 1982, 2019, Oracle and/or its affiliates. All rights reserved.
```

```
Connected to: Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
28-APR-25 08:49:44.678: W-1 Startup took 0 seconds
```

```
28-APR-25 08:51:05.528: Job "DPUSER"."ADB_MIGR" successfully completed at Mon Apr 28 08:51:05 2025 elapsed 0 00:01:21
28-APR-25 08:51:05.528: Job "DPUSER"."ADB_MIGR" completed with 56 error(s) at Mon Apr 28 08:51:05 2025 elapsed 0 00:01:21
```

--Is this an ignorable error?

ORA-31684: Object type USER:"APPUSER" already exists

--Is this an ignorable error?

**ORA-39082: Object type VIEW:"APPUSERS"."MyCaseSensitiveView"
created with compilation warnings**

--Is this an ignorable error?

ORA-01653: unable to extend table APPUSER.T1 by 8192

ORA-39171: Job is experiencing a resumable wait

--Is this an ignorable error?

ORA-12899: value too large for column (actual: 3, maximum: 2)

-- How do you deal with large Data Pump import log files?
-- In this example, the Data Pump import log file has almost 200.000 lines

```
$ du -h import.log  
29M  import.log
```

```
$ wc -l import.log  
189931 import.log
```

```
$ python3 dpla.py import.log
```

```
=====
Data Pump Log Analyzer
=====
```

...

Operation Details

```
~~~~~
```

Operation:	Import
Data Pump Version:	19.22.0.0.0
DB Info:	Oracle Database 19c EE Extreme Perf Release 19.0.0.0.0
Job Name:	DPJOB1
Status:	COMPLETED

Processing: -

Errors:	1267
ORA- Messages:	1267
Start Time:	2024-04-11 09:30:55
End Time:	2024-04-12 10:33:01
Runtime:	25:03:06

Data Processing

```
~~~~~
```

Parallel Workers:	128
Schemas:	27
Objects:	224755
Data Objects:	188084
Overall Size:	13.16 TB

```
$ python3 dpla.py import.log -e
```

```
=====
Data Pump Log Analyzer
=====
```

```
...
```

```
ORA- MESSAGES DETAILS
```

```
~~~~~(sorted by count):
```

Message	Count
ORA-39346: data loss in character set conversion for object COMMENT	919
ORA-39082: Object type PACKAGE BODY created with compilation warnings	136
ORA-39346: data loss in character set conversion for object PACKAGE_BODY	54
ORA-39082: Object type TRIGGER created with compilation warnings	36
ORA-39082: Object type PROCEDURE created with compilation warnings	29
ORA-31684: Object type USER already exists	27
ORA-39111: Dependent object type PASSWORD_HISTORY skipped, base object type USER already exists	27
ORA-39346: data loss in character set conversion for object PACKAGE	18
ORA-39082: Object type PACKAGE created with compilation warnings	10
ORA-39082: Object type VIEW created with compilation warnings	7
ORA-39346: data loss in character set conversion for object PROCEDURE	2
ORA-39082: Object type FUNCTION created with compilation warnings	2
<hr/>	
Total	1267
<hr/>	

≡ Data Pump Log Analyzer

Table Details

Search for Table...

Table	Rows	Size	Seconds	Part	Subpart
SALES.ORDERS	118914251151	1.73 TB	878854	278	4448
SALES.INVOICES	115668171592	4.33 TB	805901	588	9408
SALES.TRANSACTIONS	115720037994	3.61 TB	611891	451	7216
FINANCE.EXPENSES	35091517646	258.14 GB	112962	367	0
MARKETING.CAMPAIGNS	11621627768	458.93 GB	82801	16	0
HR.EMPLOYEES	19433932893	296.19 GB	66156	2254	0
SALES.DOCUMENTS	4743542596	345.97 GB	48117	589	9424
SALES.REPORTS	4744610748	263.63 GB	42904	440	7040
INVENTORY.EQUIPMENT	9824954344	51.01 GB	33290	130	0
HR PARTNERS	3983265247	83.62 GB	16388	3046	0

Data Pump Log Analyzer

- Free to use
- Download from [GitHub](#)
- Not an official Oracle tool
- Created by [Marcus Doeringer](#)
Our migration superstar





Also, usable for diagnostics
and performance tuning



Then, validate your database



Validate Your Database

1 Objects

2 Rows

3 Data



Validate Your Database

1

Objects

1. Recompile invalid objects
2. Compare number of objects

```
--Generate a list of objects in the source  
--subtract the objects in target to find missing objects
```

```
select owner, object_type, object_name, status  
from dba_objects@sourcedb
```

minus

```
select owner, object_type, object_name, status  
from dba_objects;
```

```
--Constraints are not listed in DBA_OBJECTS
```

```
select    owner, table_name, count(table_name)
from      dba_constraints@sourcedb
where     constraint_name not like 'BIN%'
group by  owner, table_name
```

```
minus
```

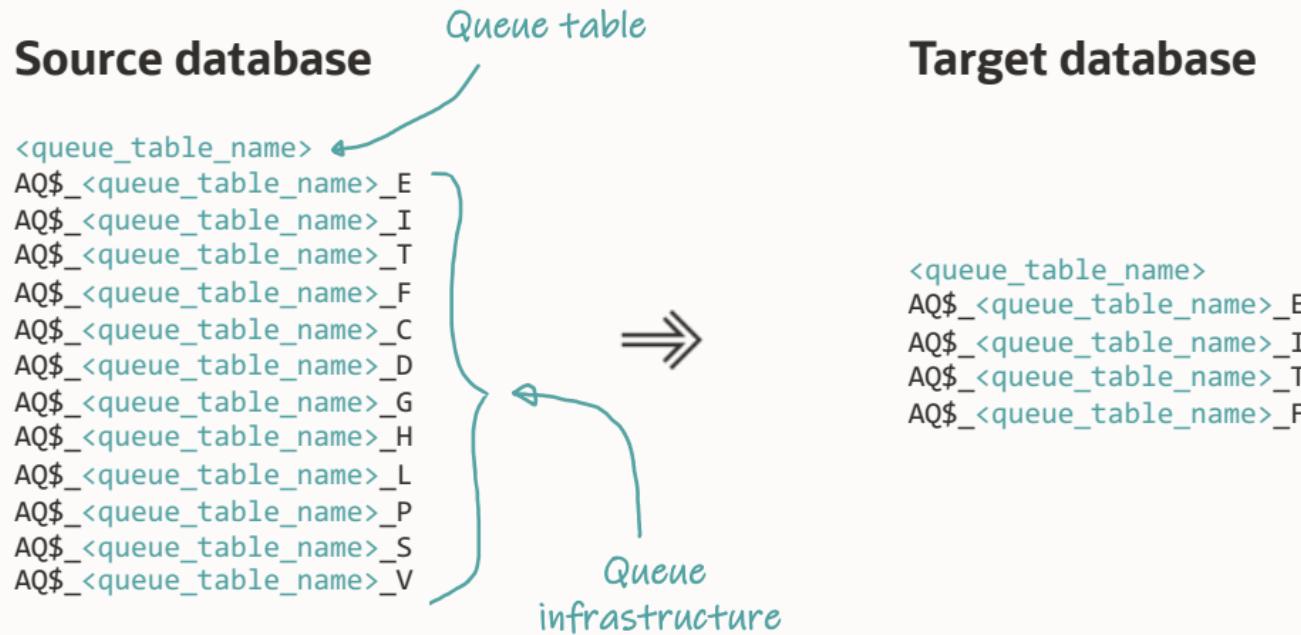
```
select    owner, table_name, count(table_name)
from      dba_constraints
where     constraint_name not like 'BIN%'
group by  owner, table_name;
```



Using Advanced Queueing

- AQ creates some queue structures on demand only
- [Blog post](#)

Validate Your Database





Take into account in comparing source and target database object count

- Understanding How Advanced Queueing (AQ) Objects Are Exported And Imported. (Doc ID [2291530.1](#))



Other objects also change
- like database links and directories

Validate Your Database

- Validate objects using
 - @?/rdbms/admin/utlrp, or
 - @?/rdbms/admin/utlprp n
- Use DBA_ERRORS to find cause of invalidation
- [What Objects Are Created When Creating a Queue Table ? \(Doc ID 224027.1\)](#)
- [Things to Consider When Importing Advanced Queues using Oracle Data Pump](#)



Validate Your Database

1 Objects

2 Rows

3 Data



Validate Your Database

2

Rows

1. Compare number of rows exported and imported
2. Count and compare number of rows



Data Pump keeps tracks of unloaded and loaded rows

```
cat export.log

;;
Export: Release 19.0.0.0.0 - Production on Mon Jun 2 13:57:40 2025
Version 19.27.0.0

Copyright (c) 1982, 2019, Oracle and/or its affiliates. All rights reserved.
Connected to: Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
.

.

.

Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/CONSTRAINT
. . exported "APPUSER"."T1"                      119.0 KB    105 rows
. . exported "APPUSER"."T2"                      13.29 GB  32411047 rows
. . exported "APPUSER"."T3"                      35.20 GB  78910231 rows
. . exported "APPUSER"."T4"                      19.02 MB   57174 rows
Master table DPUSER. "SYS_EXPORT_SCHEMA_02" successfully loaded/unloaded
*****
Dump file set for DPUSER.SYS_EXPORT_SCHEMA_02 is:
 /home/oracle/dpdir/appuser.dmp
Job "DPUSER"."SYS_EXPORT_SCHEMA_02" successfully completed at Mon Jun 2 13:58:05 2025 elapsed 0 00:00:23
```

```
grep -w exported export.log | grep -w rows | awk '{print $4,$7}' > exp.txt
```

```
"APPUSER"."T1" 105  
"APPUSER"."T2" 32411047  
"APPUSER"."T3" 78910231  
"APPUSER"."T4" 57174
```

```
grep -w exported export.log | grep -w rows | awk '{print $4,$7}' > exp.txt
```

```
grep -w imported import.log | grep -w rows | awk '{print $4,$7}' > imp.txt
```

```
diff exp.txt imp.txt
```



How do you validate the row count when using Oracle GoldenGate?

```
spool count_source.log
select /*+ parallel */ 'APPUSER.T1' || count(1) from appuser.t1;
select /*+ parallel */ 'APPUSER.T2' || count(1) from appuser.t2;
select /*+ parallel */ 'APPUSER.T3' || count(1) from appuser.t3;
select /*+ parallel */ 'APPUSER.T4' || count(1) from appuser.t4;
```

Counting Rows

- Requires either a full table or index scan
- Counting rows is usually faster with an index on a NOT NULL column
- Don't use parallel query on small tables
- The bigger the database, the longer it takes



Validate Your Database

1 Objects

2 Rows

3 Data



Validate Your Database

3

Data

1. Ensure data matches on source and target
2. Different techniques
 - Oracle GoldenGate Veridata
 - DBMS_COMPARISON
 - DBMS_CRYPTO and STANDARD_HASH

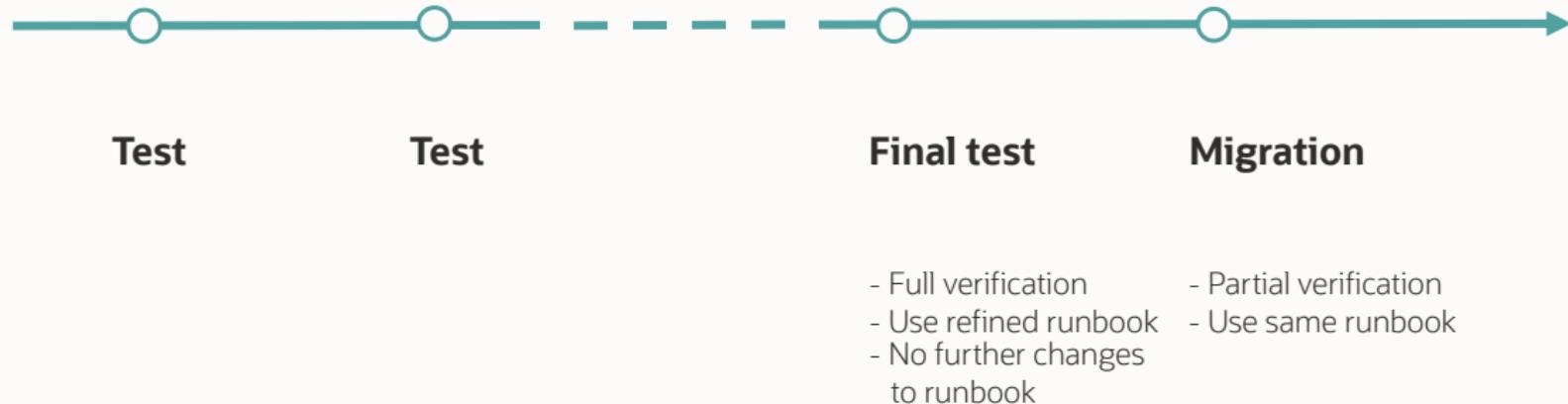
Validate Your Database

- Oracle GoldenGate Veridata
- Details on DBMS_COMPARISON, DBMS_CRYPTO and STANDARD_HASH



Do you have time for a full verification
in your migration window?

Full Verification



Partial Verification

You decide on the scope of the partial verification

- Tolerated and maximum downtime
- Data criticality
- Verify entire table or a sample
- Business requirements
- Audit requirements
- Regulations

Partial Verification

Build a plan that satisfies the requirements:

- | | | |
|--------------|-------------------|------------------------------|
| • APPUSER.T1 | Business data | Sample 10 % |
| • APPUSER.T2 | Insert-only table | No verification |
| • APPUSER.T3 | Generated data | No verification |
| • APPUSER.T4 | Regulated data | Full verification |
| • APPUSER.T5 | Rarely updated | Verify last 3 months of data |



Be sure to automate your verification

- Save the output and log files



Try it out, please!!

- We are looking for reference customers
- Get in touch with us when you tested it

Find Slides and Much More on Our Blogs



MikeDietrichDE.com

Mike.Dietrich@oracle.com



dohdatabase.com

Daniel.Overby.Hansen@oracle.com



DBArj.com.br

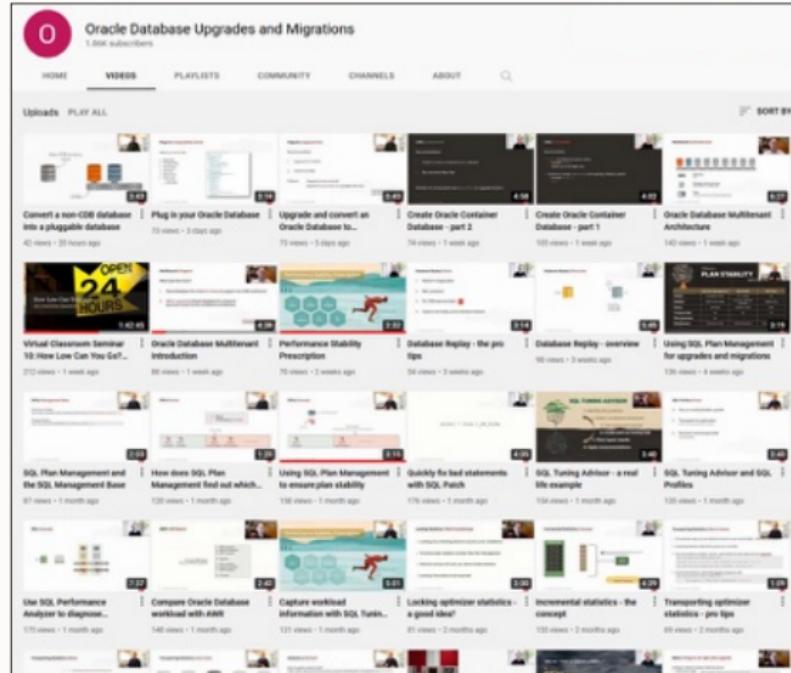
Rodrigo.R.Jorge@oracle.com



AlexZaballa.com

Alex.Zaballa@oracle.com

YouTube | @UpgradeNow



[Link](#)

- 300+ videos
- New videos every week
- No marketing
- No buzzwords
- All tech



Thank You

