Migration to Oracle Autonomous Database

Part 2: Preparing

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

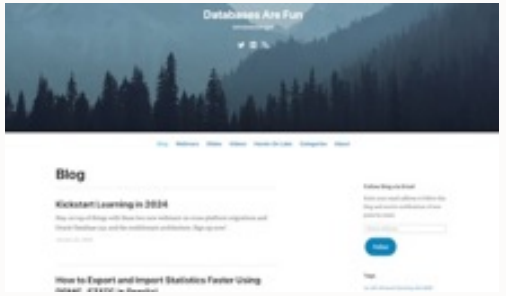
@alexzaballa.bsky.social

https://alexzaballa.com

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

Recorded Web Seminars

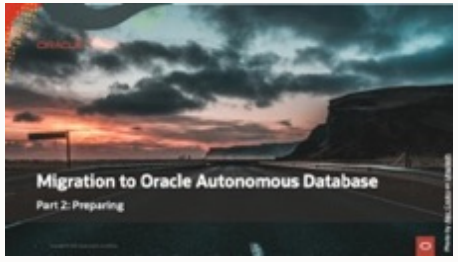
https://MikeDietrichDE.com/videos

More than 35 hours of technical content, on-demand, anytime, anywhere

Let's Do This Together

1 PLANNING

Watch recording
Get slides



2 PREPARING

3 MIGRATING

June 5, 15:00 CET
Sign up

4 OPERATING

July 10, 15:00 CET
Sign up

Recap

What happened in Part 1?

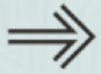
Migration to Autonomous Database is always a logical migration

- Move the data, not the database

Getting an Overview

1
Estate Explorer

2
Cloud Premigration Advisor Tool



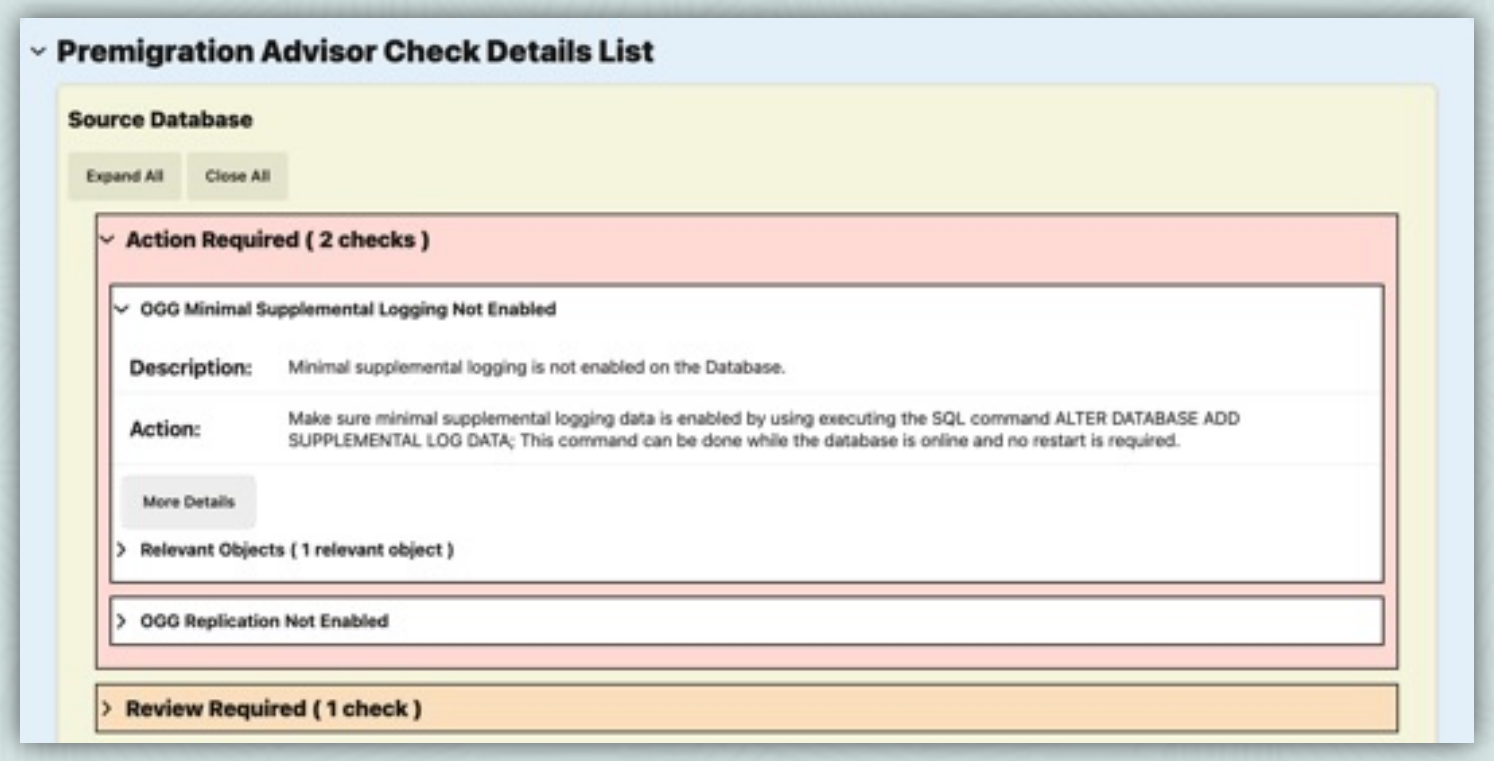
3
Cloud Migration Advisor

Getting an Overview

1 Estate Explorer

2 Cloud Premigration Advisor Tool

3 Cloud Migration Advisor



Getting an Overview

2

Cloud Premigration Advisor Tool

ORACLE

Sat Feb 22 20:59:55 UTC 2025

Cloud Premigration Advisor Tool (CPAT) Report

CPAT Version: 25.2.1-1
Version Date: Feb 17, 2025
Days Since Last CPAT Update: 38 days

Table of Contents

- Premigration Advisor Report Summary
- Report Details
- Report Analysis Notes
- Source Database Details
- Source Database Version Information
- Source Database Patch Information
- Source Database Redo Information
- Source Database Supplemental Information
- Source Database Schema Summary Information
- Premigration Advisor Check Details List
- Report Legend

Expand All | Close All

Premigration Advisor Report Summary

Report Result	Action Required
Number of schemas analyzed:	4
List of schemas analyzed:	[PDBUSER, CO, HR, MYAPP]

Report Results Overview

Evaluate an Oracle Database for compatibility with Autonomous Database

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

Databases

These are the databases we are 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

Download Scripts and Reports?

https://alexzaballa.com/webinar-migration-to-oracle-autonomous-database-sample-databases/

Webinar – Migration to Oracle Autonomous Database – Sample Databases

You can check the CPAT reports for these sample databases here:

Using options: --targetcloud **ATPS** --migrationmethod **DATAPUMP**

pdb_simple_premigration_advisor Download

pdb_complex_premigration_advisor Download

Using options: --targetcloud **ALL** --migrationmethod **ALL**

pdb_simple_all_premigration_advisor Download

pdb_complex_all_premigration_advisor Download

Preparation

Why is this so important?

"Success is no accident.
It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing."

Pelé

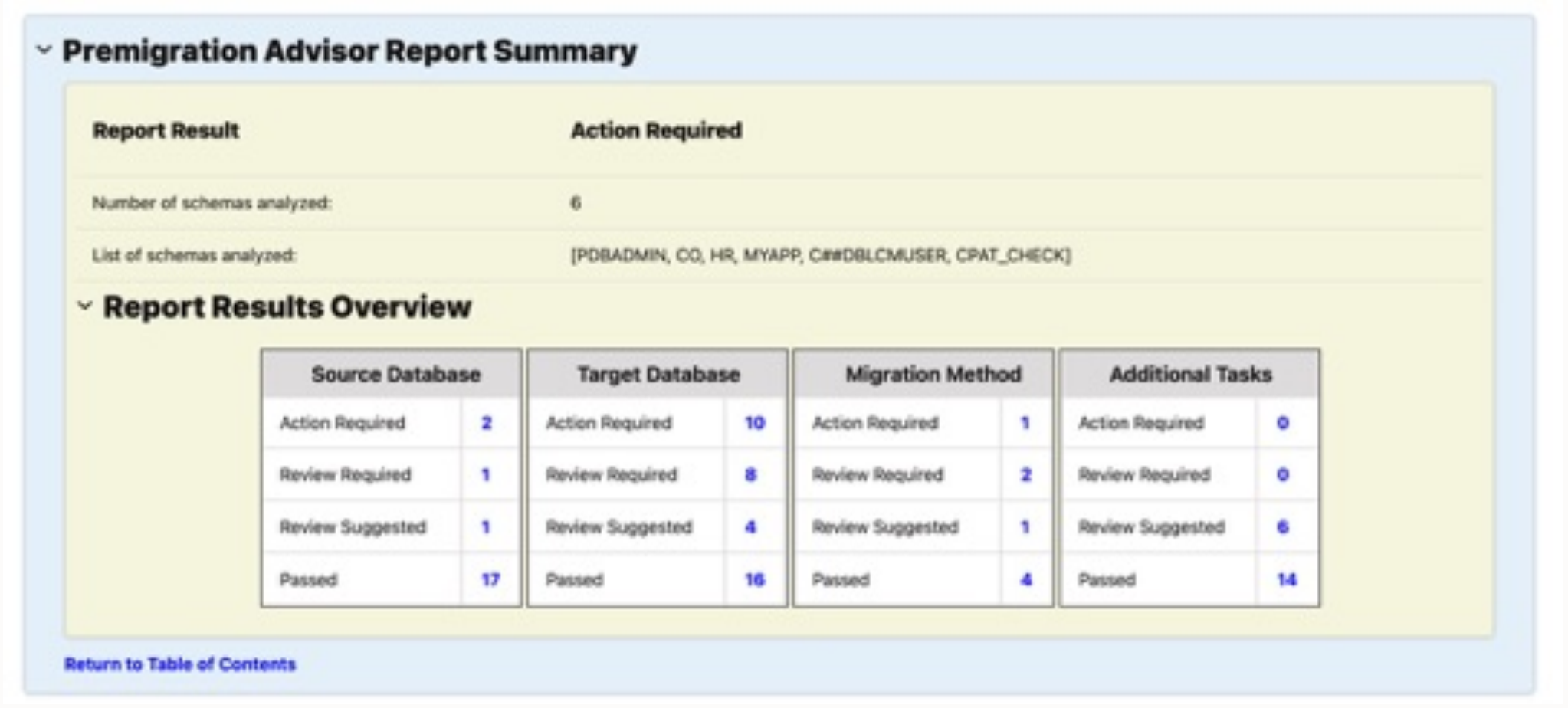
ADB Migration

A migration to Oracle Autonomous Database is different

- Full database export/import will not work
- Schema exports are incomplete

- Not everything is supported in ADB
- Some items have different names
- Structure may change

CPAT HTML Report Overview



Premigration Advisor Report Summary

Report Result	Action Required
Number of schemas analyzed:	6
List of schemas analyzed:	[PDBADMIN, CO, HR, MYAPP, C##DBLCMUSER, CPAT_CHECK]

Report Results Overview

Source Database		Target Database		Migration Method		Additional Tasks	
Action Required	2	Action Required	10	Action Required	1	Action Required	0
Review Required	1	Review Required	8	Review Required	2	Review Required	0
Review Suggested	1	Review Suggested	4	Review Suggested	1	Review Suggested	6
Passed	17	Passed	16	Passed	4	Passed	14

Return to Table of Contents

CPAT HTML Report Overview

Source Database		Target Database		Migration Method		Additional Tasks	
Action Required	2	Action Required	10	Action Required	1	Action Required	0
Review Required	1	Review Required	8	Review Required	2	Review Required	0
Review Suggested	1	Review Suggested	4	Review Suggested	1	Review Suggested	6
Passed	17	Passed	16	Passed	4	Passed	14

Don't run CPAT just a few days before the actual migration

- Run it weeks or months in advance
- Run it multiple times once you fixed issues

Some findings may require significant changes on the application side

- Plan enough time ahead, also for testing

CPAT

Running CPAT on our databases

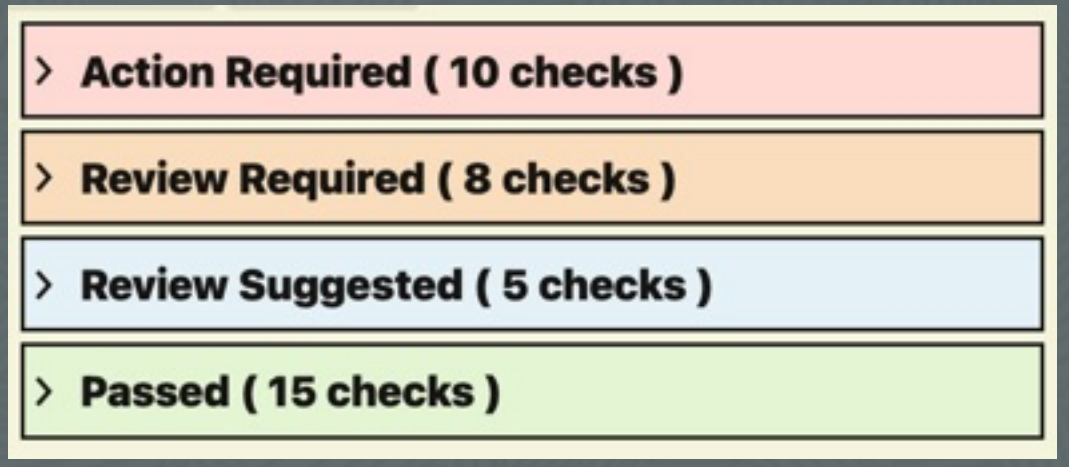

alex.zaballa@alex ~ % ssh opc@150.136.178.248

CPAT runs different specific checks for ADB Serverless and Dedicated

Read the CPAT report carefully

- For instance, REVIEW REQUIRED does **not** mean: Ignore it

CPAT Categories



Some CPAT findings are very common, others aren't seen this often

CPAT

More details explained

Source Database Details

Source Database Host Name:	db19c
Source Oracle SID:	ORCLDB
Source Database Created Date:	Thu Feb 27 17:13:07 UTC 2025
Source Database DBID:	2630149923
Source Database Unique Name:	ORCLDB_wjk_iad
Source Instance Name:	ORCLDB
Source Database Name:	ORCLDB
Source Database Username:	SYS
Source Database Port String:	x86_64/Linux 2.4.xx
Source Database Platform ID:	13
Source Database Container Name:	PDB_COMPLEX
Source DB Block Size in KB:	8
Source DB Combined Size of DATA, TEMP, LOG, and CONTROL File Usage in GB:	4.359
Source DB Size of DATA File Usage in GB:	1.133
Source DB Size of TEMP File Usage in GB:	0.187
Source DB Size of LOG File Usage in GB:	3.0
Source DB Size of CONTROL File Usage in GB:	0.04
Source Database Applications:	No Known Applications Detected

Return to Table of Contents

Source Database Redo Information

Log Mode: ARCHIVELOG

GV$SYSSTAT Redo Size Information

Instance ID	Size	Instance Open Date
1	409.91 MB	2025-04-16T14:47:48Z

Redo History Data

Thread ID	Completion Date	Number of Archive Logs	Size
1	2025-04-07T00:00:00Z	24	311.95 MB
1	2025-04-08T00:00:00Z	18	198.36 MB
1	2025-04-09T00:00:00Z	3	323.76 MB
1	2025-04-16T00:00:00Z	10	606.46 MB
1	2025-04-17T00:00:00Z	25	267.09 MB
1	2025-04-18T00:00:00Z	25	261.12 MB
1	2025-04-19T00:00:00Z	25	450.02 MB
1	2025-04-20T00:00:00Z	25	458.75 MB
1	2025-04-21T00:00:00Z	25	260.26 MB

Source Database Supplemental Information

Source DB High Water Mark Statistics

Database ID	Name	Version	High Water Value	Last Value
39496799	ACTIVE_SESSIONS	19.0.0.0.0	0	0
39496799	CPU_COUNT	19.0.0.0.0	0	0
39496799	DATAFILES	19.0.0.0.0	0	0
39496799	DB_SIZE	19.0.0.0.0	0	0
39496799	EXADATA_DISKS	19.0.0.0.0	0	0
39496799	Flex ASM	19.0.0.0.0	0	0
39496799	GLOBAL SERVICES	19.0.0.0.0	0	0
39496799	HWM_DBMS_SCHEDULER	19.0.0.0.0	0	0
39496799	INSTANCES	19.0.0.0.0	0	0
39496799	PART_INDEXES	19.0.0.0.0	0	0
39496799	PART_TABLES	19.0.0.0.0	0	0
39496799	PRIMARY SHARDS	19.0.0.0.0	0	0
39496799	QUERY_LENGTH	19.0.0.0.0	0	0
39496799	SEGMENT_SIZE	19.0.0.0.0	0	0
39496799	SESSIONS	19.0.0.0.0	0	0
39496799	SHARDS	19.0.0.0.0	0	0
39496799	SQL_NCHAR_COLUMNS	19.0.0.0.0	0	0
39496799	TABLESPACES	19.0.0.0.0	0	0
39496799	USER_INDEXES	19.0.0.0.0	0	0
39496799	USER_MV	19.0.0.0.0	0	0
39496799	USER_TABLES	19.0.0.0.0	0	0
2630149923	ACTIVE_SESSIONS	19.0.0.0.0	0	0
2630149923	CPU_COUNT	19.0.0.0.0	8	8
2630149923	DATAFILES	19.0.0.0.0	5	5
2630149923	DB_SIZE	19.0.0.0.0	1216086016	1216086016

Source DB Logon Triggers

Owner	Name	Type	Event	Table Owner	Object Type	Table Name	Column Name
SYS	DELETE_ENTRIES	AFTER EVENT	DROP	SYS	DATABASE		
SYS	OJDISBROLE_TRIGGER$	AFTER EVENT	DROP	SYS	DATABASE		
SYS	XDB_PI_TRIG	BEFORE EVENT	DROP OR TRUNCATE	SYS	DATABASE		

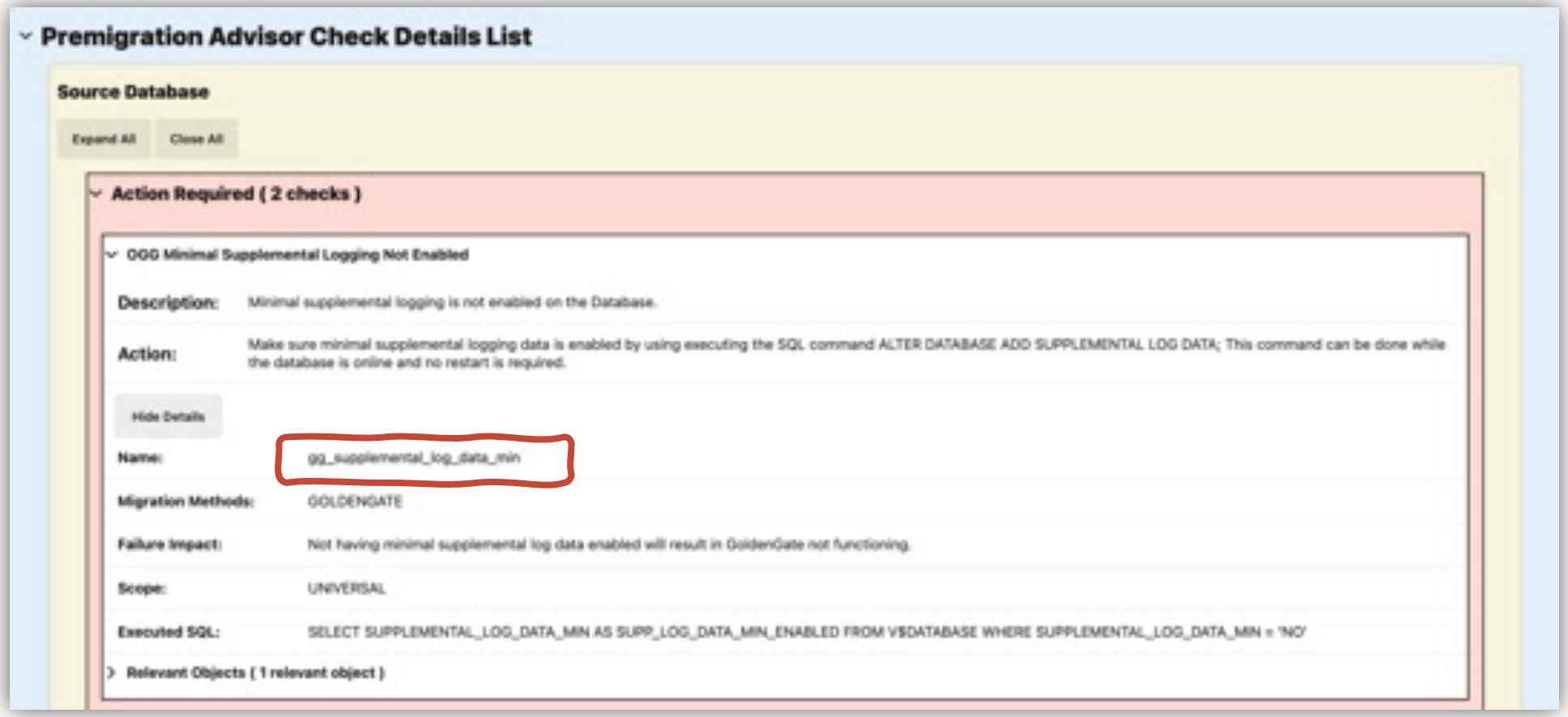
Some of the following findings may be handled automatically during migrations soon, possibly

- Data Pump, migration tooling and ADB teams work on it

There is proper documentation available for each of the individual CPAT findings

- **Oracle Database Utilities Guide**
  19.10 List of Checks Performed By the Premigration Advisor Tool

Example CPAT Check



Documentation

19.10.9 gg_supplemental_log_data_min

The Premigration Advisor Tool check `gg_supplemental_log_data_min` indicates that minimal supplemental logging is not enabled on the source database.

Result Criticality

Action required

Has Fixup

Yes

Target Cloud

- ADWD Autonomous Data Warehouse Dedicated
- ADWS Autonomous Data Warehouse Shared
- ATPD Autonomous Transaction Processing Dedicated
- ATPS Autonomous Transaction Processing Shared
- Default (an Oracle Database instance that is not Oracle Autonomous Database)

Scope

`UNIVERSAL`

Description

This check applies to schemas for Oracle GoldenGate migrations. Minimal supplemental logging, a database-level option, is required for an Oracle source database when using Oracle GoldenGate. This configuration adds row chaining information, if any exists, to the redo log for update operations.

CPAT | Check Slide Format explained

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

Review Suggested

Solution

Here we are going to explain shortly how you can solve something.

Check Name

`check_name_listed_here`

CPAT Checks and Findings

Common and simple

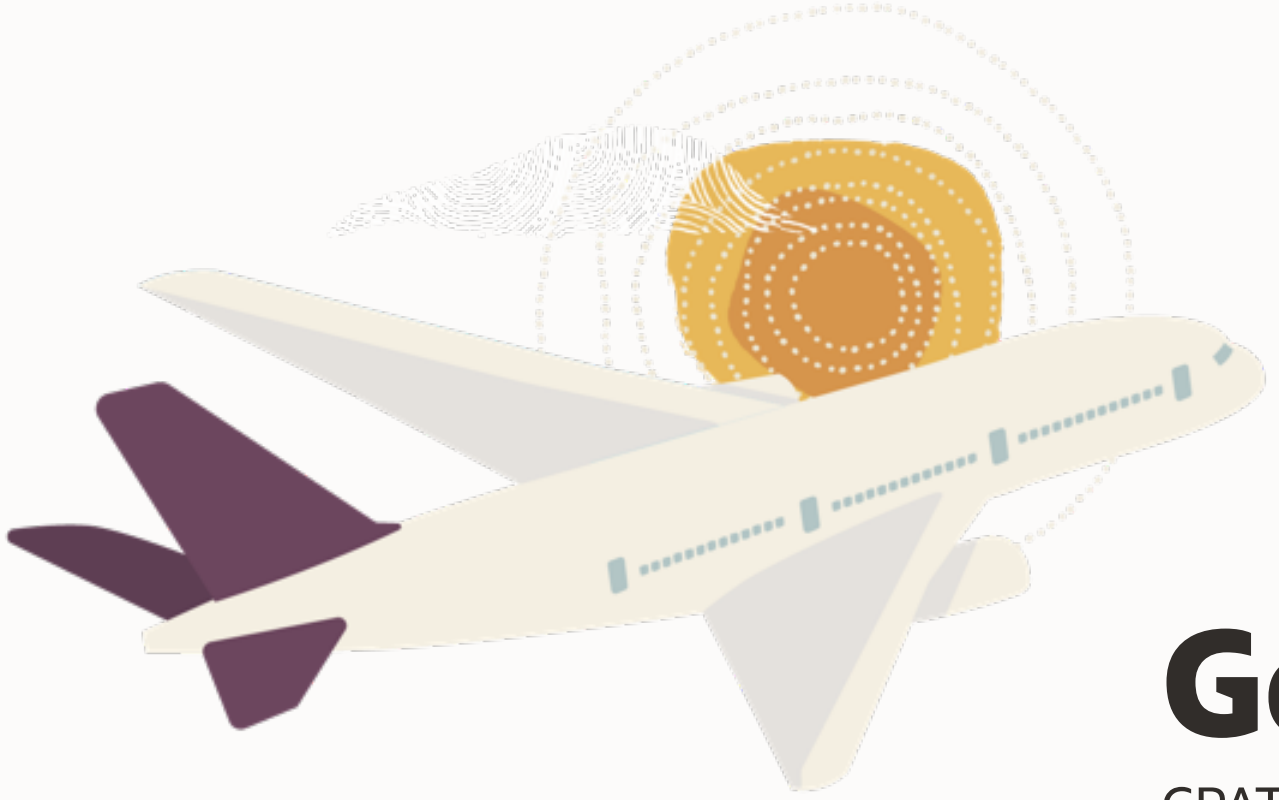
- GoldenGate
- Tablespaces
- Objects in SYS and SYSTEM
- No Quota
- Passwords
- Time Zone
- Java

Common but complex

- Directories
- External Tables
- Database Links
- Privileges

Uncommon Findings

- Unsupported Objects and Types
- XML



Golden Gate

CPAT checks for Online Migrations

Skip Oracle GoldenGate checks if you don't plan an ONLINE migration

- This will make your CPAT report easier to read and process

```
# -m,--migrationmethod
# Avoid GoldenGate checks? Use the default or set DATAPUMP

./premigration.sh \
   --connectstring jdbc:oracle:thin:@<host>:<port>/<service> \
   --migrationmethod datapump
```


If you intend to do an online migration, then include the GoldenGate checks

```
# -m,--migrationmethod
# Use GOLDENGATE to trigger checks for online migrations

./premigration.sh \
   --connectstring jdbc:oracle:thin:@<host>:<port>/<service> \
   --migrationmethod goldengate
```


Collect required data for uploading it into Cloud Migration Advisor (CMA)

```
# -m,--migrationmethod
# Use ALL when you plan to load your data into CMA

./premigration.sh \
   --connectstring jdbc:oracle:thin:@<host>:<port>/<service> \
   --migrationmethod all
```

You can also skip individual CPAT checks

How to skip a CPAT check?

1. Add into file `premigration_advisor_analysis.properties`
   - Multiple properties need to be comma separated

```
SourceAnalysisProp.SKIP_CHECKS=gg_supplemental_log_data_min
```

2. Call CPAT pointing to the properties file

```
./premigration.sh \
   --connectstring jdbc:oracle:thin:@<host>:<port>/<service> \
   --analysisprops premigration_advisor_analysis.properties
```

Summary

1

Offline migration?
`-m datapump`

2

Online migration?
`-m goldengate`

3

Load into CMA?
`-m all`

4

Alternative:
Skip checks with properties files

CPAT contains a lot of checks for Oracle GoldenGate online migrations

- Many of them can be fixed easily in the source database

CPAT | GoldenGate Replication enabled?

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

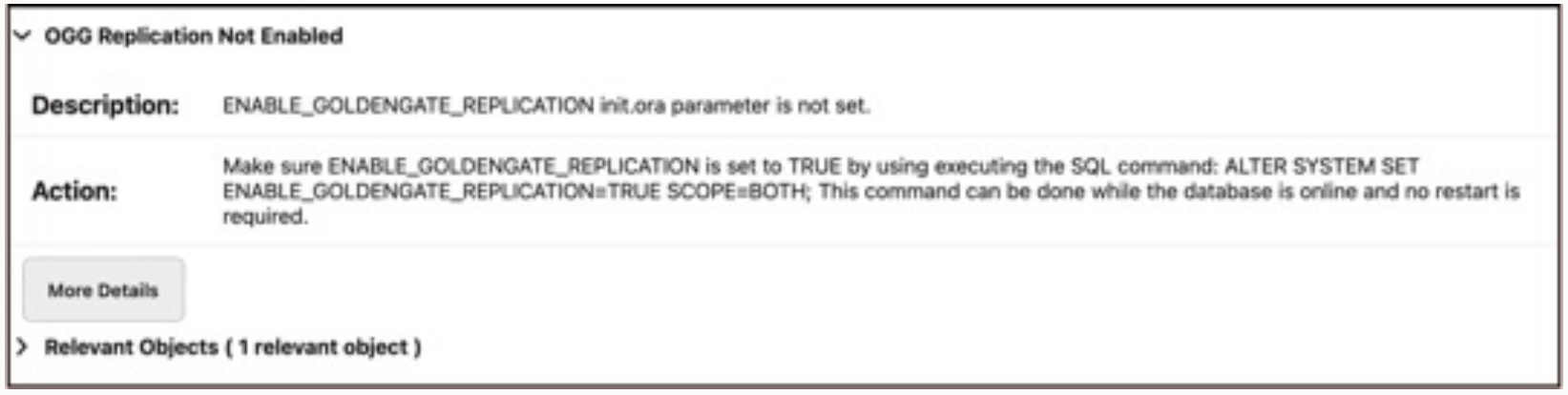
Action Required

Solution

```
ALTER SYSTEM SET
ENABLE_GOLDENGATE_REPLICAT
ION=TRUE SCOPE=BOTH;
```

Check Name

`gg_enabled_replication`



CPAT | Force Logging enabled?

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Review Required

Solution

Turn it ON in MOUNT or OPEN state of the database

```
ALTER DATABASE FORCE LOGGING;
```

Check Name

`gg_force_logging`

CPAT | Streams Pool Size

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Runtime

Solution

Increase pre-allocated streams pool in source:

```
ALTER SYSTEM SET
streams_pool_size=1250M
SCOPE=BOTH;
```

Check Name

`gg_has_low_streams_pool_size`

CPAT | Unique Keys?

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

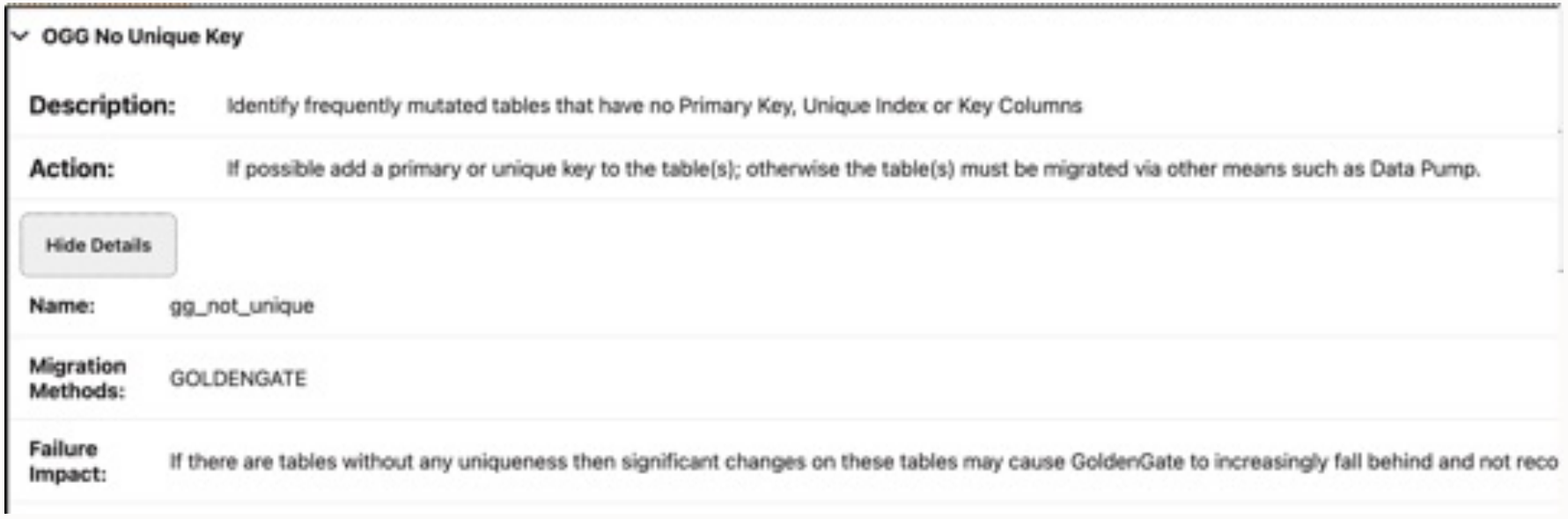
Review Required

Solution

If possible, add a primary or unique key to the table(s)

Check Name

`gg_not_unique`



CPAT |

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

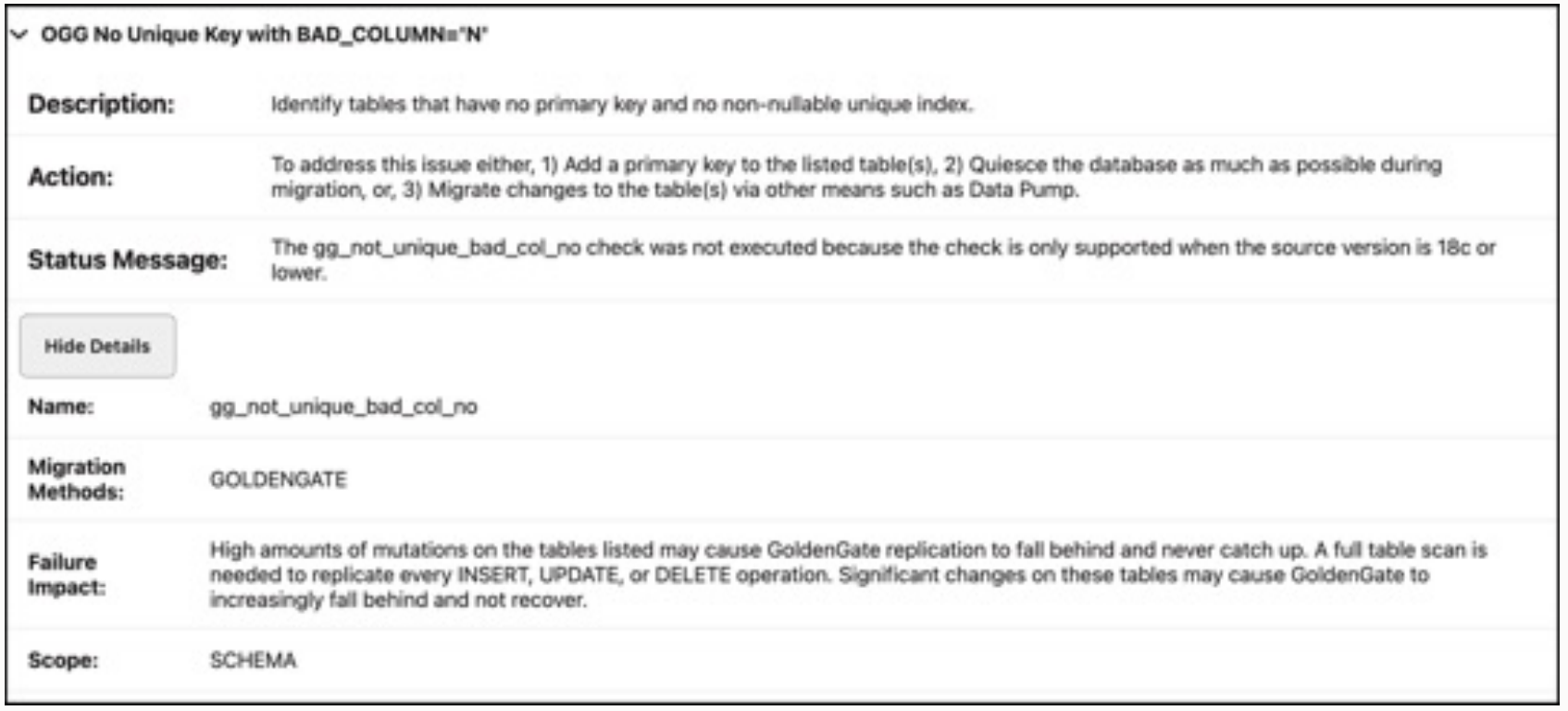
Review Required

Solution

1. Add a primary key to the listed table(s)
2. Quiesce the database as much as possible during migration
3. Migrate changes to the table(s) via other means such as Data Pump

Check Name

`gg_not_unique_bad_col_no`



OGG No Unique Key with BAD_COLUMN='N'

Description:	Identify tables that have no primary key and no non-nullable unique index.
Action:	To address this issue either, 1) Add a primary key to the listed table(s), 2) Quiesce the database as much as possible during migration, or, 3) Migrate changes to the table(s) via other means such as Data Pump.
Status Message:	The gg_not_unique_bad_col_no check was not executed because the check is only supported when the source version is 18c or lower.

Hide Details

Name:	gg_not_unique_bad_col_no
Migration Methods:	GOLDENGATE
Failure Impact:	High amounts of mutations on the tables listed may cause GoldenGate replication to fall behind and never catch up. A full table scan is needed to replicate every INSERT, UPDATE, or DELETE operation. Significant changes on these tables may cause GoldenGate to increasingly fall behind and not recover.
Scope:	SCHEMA

CPAT | No Unique Key with BAD_COLUMN='Y'

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

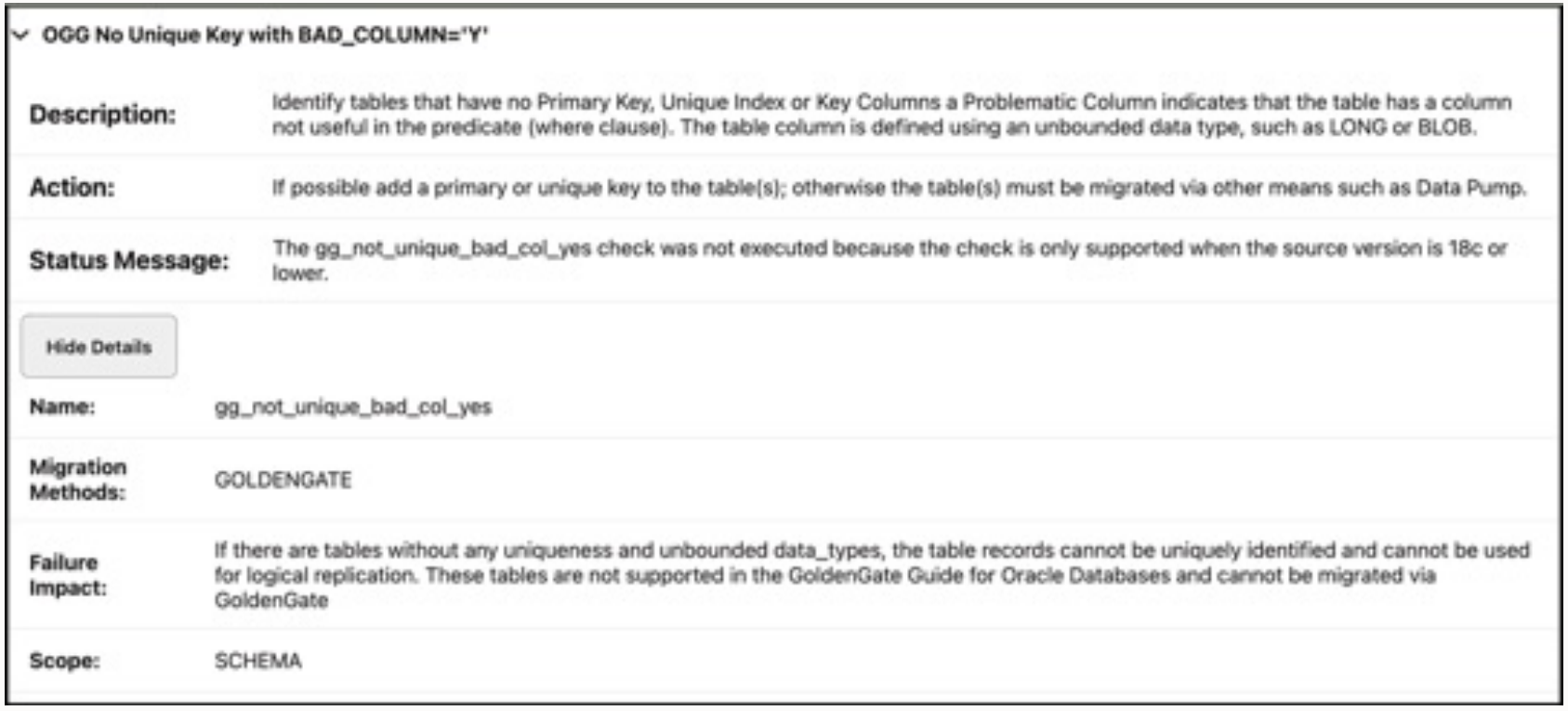
Action Required

Solution

If possible, add a primary or unique key to the table(s); otherwise, the table(s) must be migrated via other means such as Data Pump.

Check Name

`gg_not_unique_bad_col_yes`



CPAT | OGG objects requiring advanced config

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Review Required

Solution

Consult the Oracle GoldenGate documentation to see how objects with the listed SUPPORT_MODE values can be successfully replicated.

Check Name

`gg_objects_not_supported`

OGG Objects Requiring Additional Configuration

Description: Ensure all objects can be replicated using Oracle GoldenGate.

Action: Consult the Oracle GoldenGate documentation to see how objects with the listed SUPPORT_MODE values can be successfully replicated.

Hide Details

Name: gg_objects_not_supported

Migration Methods: GOLDENGATE

Failure Impact: Listed relevant objects typically won't be replicated successfully without additional configuration.

Scope: SCHEMA

Executed SQL:

```
with GGSM as (select unsupp.owner owner, unsupp.table_name object_name, ( case when (unsupp.gensby = 3) then 'NONE' when (unsupp.gensby
'DVF', 'DVSYS', 'EXDSYS', 'EXFSYS', 'GGSYS', 'GSMADMIN_INTERNAL', 'GSMCATUSER', 'GSMROOTUSER', 'GSMUSER', 'LBACSYS', 'MDSYS', 'MG
and unsupp.table_name not like 'OGG$%' and unsupp.table_name not like 'RUPD$%' and unsupp.table_name not like 'SYS_C%' and unsupp.table
('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_050100','APEX_180100','APEX_180200','AP
AND SUPPORT_MODE IN ('INTERNAL','ID KEY')
```

Relevant Objects (1 relevant object)

OWNER	OBJECT_NAME	SUPPORT_MODE
MYAPP	EMPLOYEE_R	ID KEY

CPAT | Add supplemental log data

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Action Required

Solution

```
ALTER DATABASE ADD
SUPPLEMENTAL LOG DATA;
```

Check Name

```
gg_supplemental_log_data_min
```

CPAT |

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

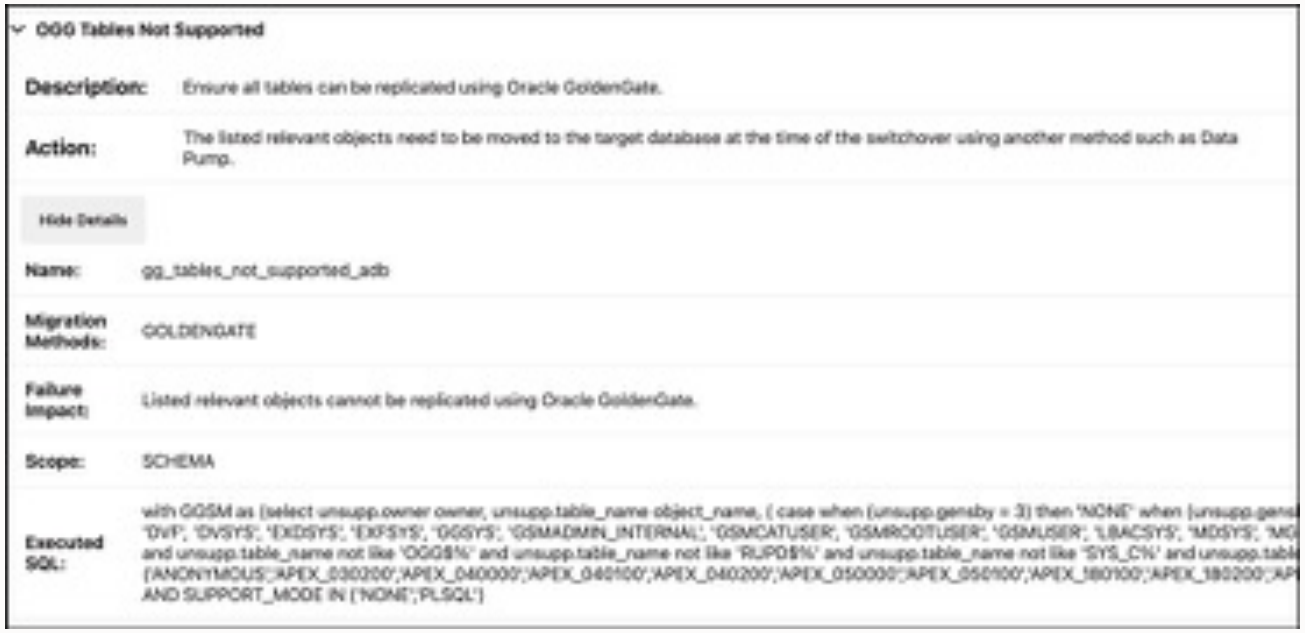
Action Required

Solution

The listed relevant objects can't be moved by OGG. At the time of the switchover you must move them using another method such as Data Pump.

Check Name

`gg_tables_not_supported_adb`



CPAT |

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Action Required

Solution

The listed relevant objects can't be moved by OGG. At the time of the switchover you must move them using another method such as Data Pump.

Check Name

`gg_tables_not_supported_default`

OGG Tables Not Supported

Description:	Ensure all tables can be replicated using Oracle GoldenGate.
Action:	The listed relevant objects need to be moved to the target database at the time of the switchover using another method such as Data Pump.

Hide Details

Name:	gg_tables_not_supported_default
Migration Methods:	GOLDENGATE
Failure Impact:	Listed relevant objects cannot be replicated using Oracle GoldenGate.
Scope:	SCHEMA
Executed SQL:	with GGSM as (select unsupp.owner owner, unsupp.table_name object_name, (case when (unsupp.gensby = 3) then 'NONE' when (unsupp.gens 'DVF', 'DVSYS', 'EXDSYS', 'EXFSYS', 'GGSYS', 'GSMADMIN_INTERNAL', 'GSMCATUSER', 'GSMROOTUSER', 'GSMUSER', 'LBACSYS', 'MDSYS', 'MG and unsupp.table_name not like 'OGG$%' and unsupp.table_name not like 'RUPD$%' and unsupp.table_name not like 'SYS_C%' and unsupp.table ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_050100','APEX_180100','APEX_180200','AP AND SUPPORT_MODE IN ('NONE')

CPAT |

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Action Required

Solution

Exclude these schemas from Oracle GoldenGate data migration.

Check Name

`gg_user_objects_in_ggadmin_schemas`

Solution?

Fix CPAT findings for Oracle GoldenGate in source

- `ALTER SYSTEM SET ENABLE_GOLDENGATE_REPLICATION=TRUE SCOPE=BOTH;`
- `ALTER DATABASE FORCE LOGGING;`
- `ALTER SYSTEM SET streams_pool_size=1250M SCOPE=BOTH;`
- `ALTER DATABASE ADD SUPPLEMENTAL LOG DATA;`

Tablespaces

CPAT checks for tablespaces

ADB-S vs ADB-D

ADB Serverless

```
SQL> set role PDB_DBA;

Role set.

SQL> create tablespace users;
create tablespace users
*
ERROR at line 1:
ORA-01031: insufficient privileges
```

ADB Dedicated

```
SQL> set role PDB_DBA;

Role set.

SQL> create tablespace users;

Tablespace USERS created.
```

ADB Serverless | Tablespace size limit

- 4 billion (2^{32}) blocks
- 32TB for a tablespace with 8k blocks
- Limit is 384TB of storage (32TB x 12)
- +DATA_[1-11] are automatically provisioned by ADB-S engine

It is absolutely possible to exceed 384TB

- File a Service Request at Oracle Cloud Support

CPAT | Data in Custom Tablespaces

Oracle Autonomous Database

Dedicated

Cloud Premigration Advisor Tool

Migration Method

Action Required

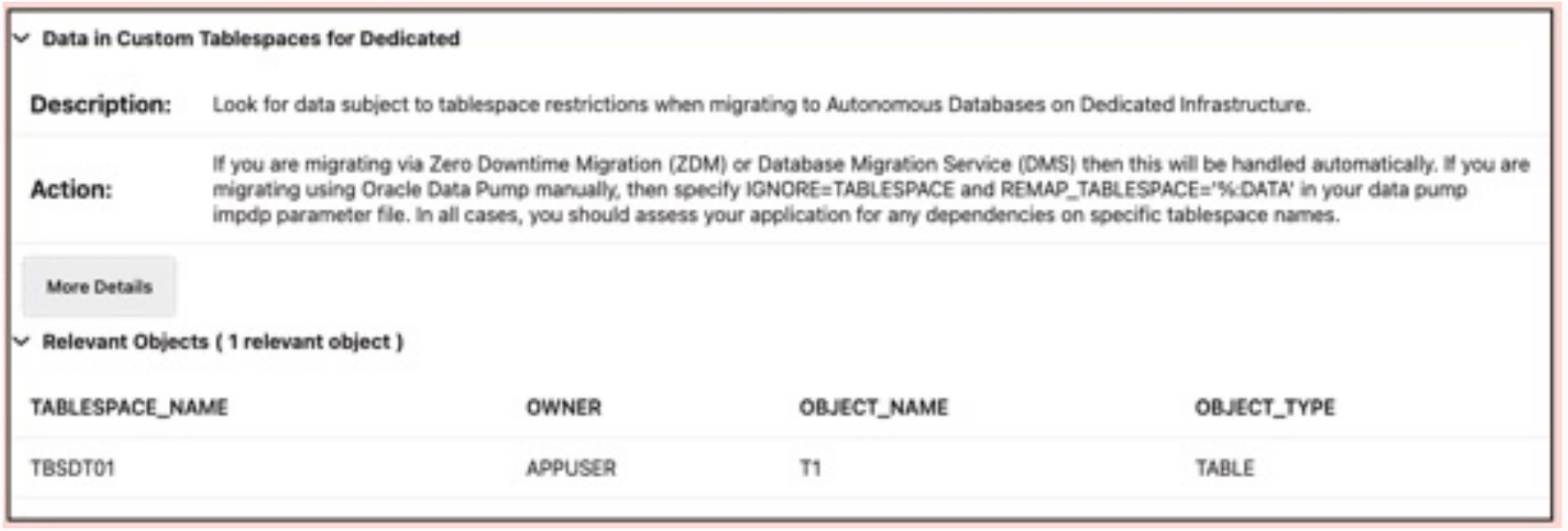
Solution

Tablespaces must be pre-created. This gets automatically handled by ZDM or OCI DMS.

Tablespaces can be remapped in Data Pump using:
`REMAP_TABLESPACE='%:DATA'`

Check Name

`has_data_in_other_tablespaces_dedicated`



Data in Custom Tablespaces for Dedicated

Description: Look for data subject to tablespace restrictions when migrating to Autonomous Databases on Dedicated Infrastructure.

Action: If you are migrating via Zero Downtime Migration (ZDM) or Database Migration Service (DMS) then this will be handled automatically. If you are migrating using Oracle Data Pump manually, then specify IGNORE=TABLESPACE and REMAP_TABLESPACE='%:DATA' in your data pump impdp parameter file. In all cases, you should assess your application for any dependencies on specific tablespace names.

More Details

Relevant Objects (1 relevant object)

TABLESPACE_NAME	OWNER	OBJECT_NAME	OBJECT_TYPE
TBSDT01	APPUSER	T1	TABLE

```
-- Create the missing tablespace
create tablespace TBSDT01 size 100G;


-- or remap tablespace name during impdp
impdp ... remap_tablespace='%:DATA'
```

CPAT | Data in Custom Tablespaces

Oracle Autonomous Database

Serverless

Cloud Premigration Advisor Tool

Migration Method

Review Required

Solution

TABLESPACE clause gets ignored during ADB-S imports. Pay close attention to quotas..

Check Name

`has_data_in_other_tablespaces_serverless`

CPAT |

Oracle Autonomous Database

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

```
ALTER USER <user-name>
DEFAULT TABLESPACE
<valid-tablespace-
name>;
```

Check Name

`has_absent_temp_tablespace`

- Happens rarely
- Schema's default and temp tablespaces must exist
- Avoid ORA-00959 errors
- `ALTER USER <user-name> DEFAULT TABLESPACE <valid-tablespace-name>;`

CPAT |

Oracle Autonomous Database

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

.

Check Name

`has_absent_default_tablespace`

- Happens rarely
- Schema's default and temp tablespaces must exist
- Avoid ORA-00959 errors
- `ALTER USER <user-name> DEFAULT TABLESPACE <valid-tablespace-name>;`

CPAT |

Oracle Autonomous Database

Serverless

Cloud Premigration Advisor Tool

Target Database

Review Suggested

Solution

Sum up quotas for schemas and add them combined to the data tablespace in ADB.

Check Name

`has_default_tablespace_not_data`

- Happens very often
- Schema's default and temp tablespaces must exist
- Automatically remapped to DATA tablespace by ADB auto-transform
- Check user quota post-migration

```
-- Source
alter user APPUSER quota 10M on TS_USERS;
alter user APPUSER quota 20M on TS_DATA;
alter user APPUSER quota 30M on TS_SALES;
alter user APPUSER quota 40M on TS_ORDERS;

-- ADB
alter user APPUSER quota 100M on DATA;
```


Objects in SYS

How do you handle such objects best?

... and no one should create any tables in the schema of the user SYS.

—

Administrator's Guide
Oracle8*i*

CPAT | User-defined objects in SYS/SYSTEM

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

Action Required

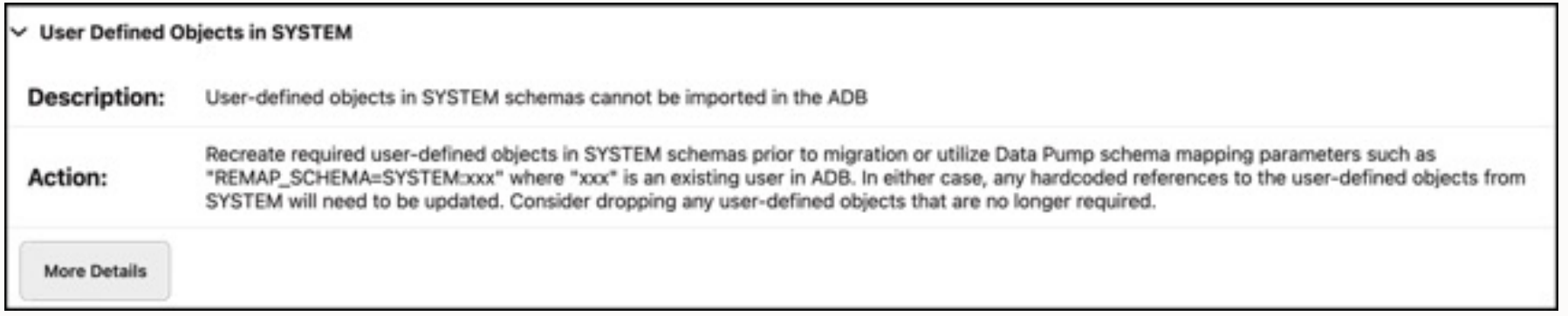
Solution

Move objects prior to migration.

Check Name

`has_user_defined_objects_in_sys/system`

`has_refs_to_user_objects_in_sys`



```
--Move objects from SYSTEM schema during import
--Doesn't work for SYS objects

impdp ... remap_schema=SYSTEM:DEEP_THOUGHT
```


Move objects out of SYS/SYSTEM prior to migration

```
--Create schema that can't log on
--and grant required privileges directly
create user deep_thought no authentication;
grant select on dba_data_files to deep_thought;

--Expose SYS/SYSTEM functionality through an interface
create or replace function deep_thought.answer return number is
   l_number NUMBER;
begin
   select count(*) into l_number from dba_data_files;
   return l_number*42;
end;
/

--Grant execute on interface
grant execute on deep_thought.answer to douglas;
```


```
--Create schema that can't log on
--and grant required privileges directly
create user deep_thought no authentication;
grant select on dba_data_files to deep_thought;

--Expose SYS/SYSTEM functionality through an interface
create or replace function deep_thought.answer return number is
   l_number NUMBER;
begin
   select count(*) into l_number from dba_data_files;
   return l_number*42;
end;
/

--Grant execute on interface
grant execute on deep_thought.answer to douglas;
```

```
--Create schema that can't log on
--and grant required privileges directly
create user deep_thought no authentication;
grant select on dba_data_files to deep_thought;

--Expose SYS/SYSTEM functionality through an interface
create or replace function deep_thought.answer return number is
   l_number NUMBER;
begin
   select count(*) into l_number from dba_data_files;
   return l_number*42;
end;
/

--Grant execute on interface
grant execute on deep_thought.answer to douglas;
```

No Quota

How to deal with these users?

Schemas with NO QUOTA or various quotas can become tricky in migrations

- This will require manual determination

```
# Example scenario

create tablespace mytbs datafile size 10m;
create user myuser no authentication;
alter  user myuser quota unlimited on mytbs;

create table myuser.mytab (id number) tablespace mytbs;
insert into  myuser.mytab values (1);
commit;

alter user myuser quota 0 on mytbs;
```


CPAT | Users with Objects but No Quota

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

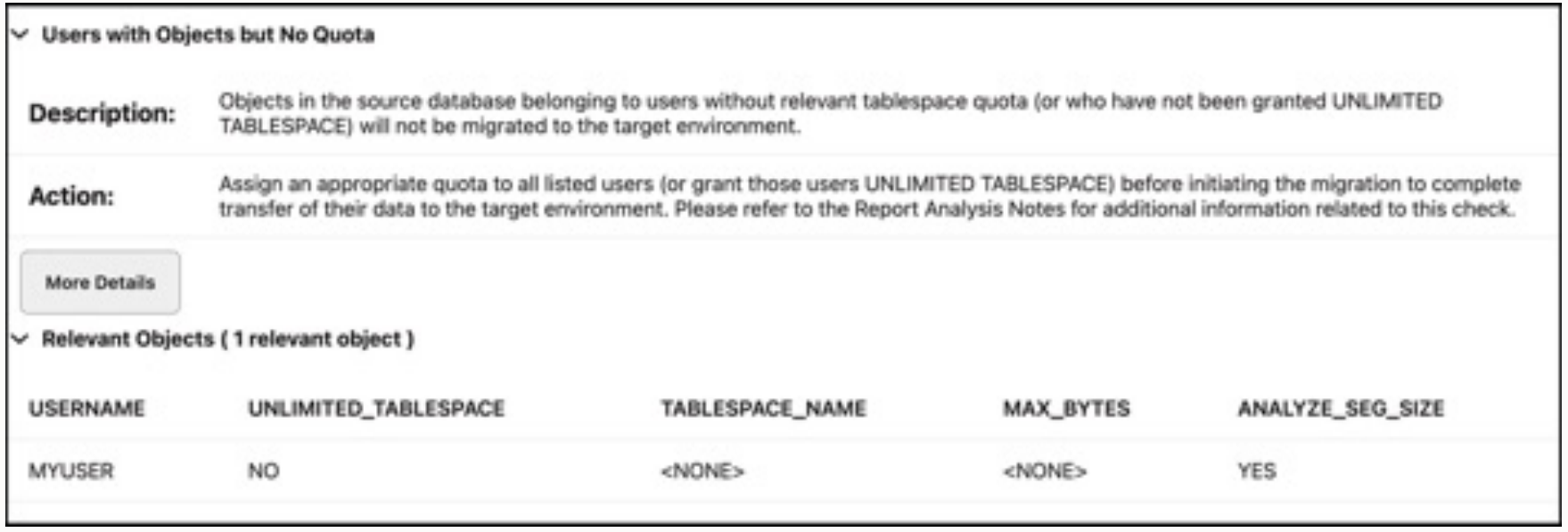
Action Required

Solution

Assign appropriate quota to listed schemas before export, and adjust it back after migration completed

Check Name

`has_users_objects_no_quota`



Users with Objects but No Quota

Description: Objects in the source database belonging to users without relevant tablespace quota (or who have not been granted UNLIMITED TABLESPACE) will not be migrated to the target environment.

Action: Assign an appropriate quota to all listed users (or grant those users UNLIMITED TABLESPACE) before initiating the migration to complete transfer of their data to the target environment. Please refer to the Report Analysis Notes for additional information related to this check.

More Details

Relevant Objects (1 relevant object)

USERNAME	UNLIMITED_TABLESPACE	TABLESPACE_NAME	MAX_BYTES	ANALYZE_SEG_SIZE
MYUSER	NO	<NONE>	<NONE>	YES

Passwords

Password functions and 10g passwords

Oracle Autonomous Database does not support `SEC_CASE_SENSITIVE_LOGON=FALSE`

```
-- Check it by yourself in your source database
-- Then reassign a new or the old password to the user

SELECT USERNAME, PASSWORD_VERSIONS
  FROM SYS.DBA_USERS
 WHERE USERNAME NOT IN
('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200',
 'APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_REST_PUBLIC_USER',
 'APPQOSSYS','AUDSYS','CTXSYS','DBSFWUSER','DBSNMP','DIP','DVF','DVSYS',
 'EXFSYS','FLOWS_030000','FLOWS_030100','FLOWS_FILES','GGSYS',
 'GSMADMIN_INTERNAL','GSMCATUSER','GSMUSER','LBACSYS','MDSYS','MGDSYS',
 'OJVMSYS','OLAPSYS','ORACLE_OCM','ORDDATA','ORDPLUGINS','ORDSYS','OUTLN',
 'REMOTE_SCHEDULER_AGENT','SI_INFORMTN_SCHEMA','SYS','SYS$UMF','SYSBACKUP',
 'SYSDG','SYSKM','SYSRAC','SYSTEM','TSMSYS','WMSYS','XDB','XS$NULL','CSMIG')
  AND ( RTRIM(PASSWORD_VERSIONS) = '10G'
   OR   RTRIM(PASSWORD_VERSIONS) = '10G HTTP')
 AND USERNAME <> 'ANONYMOUS'
 ORDER BY 1
```

Solution?

Adjust user schemas beforehand to avoid issues

- `ALTER USER hugo IDENTIFIED BY DontLogOn;`

The migration will work fine – but the application may not be able to connect

- ORA-1017 is the usual error message you may see in case of failure

CPAT | 10g Password Versions

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Source Database

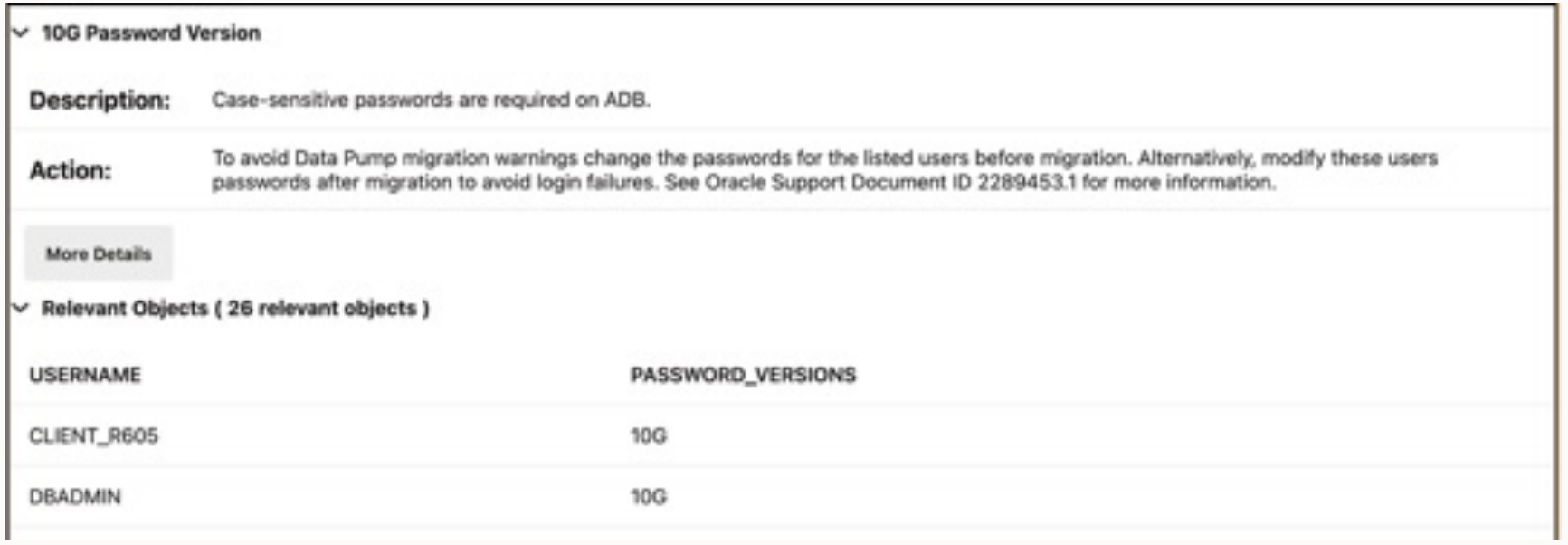
Review Required

Solution

Modify users beforehand. See MOS Note: 2289453.1 for further information

Check Name

`has_users_with_10g_password_version`



10G Password Version

Description: Case-sensitive passwords are required on ADB.

Action: To avoid Data Pump migration warnings change the passwords for the listed users before migration. Alternatively, modify these users passwords after migration to avoid login failures. See Oracle Support Document ID 2289453.1 for more information.

More Details

Relevant Objects (26 relevant objects)

USERNAME	PASSWORD_VERSIONS
CLIENT_R605	10G
DBADMIN	10G

CPAT | User-defined PW verification

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Suggested

Solution

Use a profile with a Password Verification Function provided by ADB.

Check Name

`has_user_defined_pvfs`

User-defined objects in the `SYS` or `SYSTEM` schemas can't be imported into Oracle ADB. Attempts to import a `PROFILE` that uses user-defined Password Verification Functions will result in `ORA-39460`.

Time Zone

Migration pitfalls

Time Zone Checks

Source database has a higher time zone than target

- Affects `TIMESTAMP WITH LOCAL TIME ZONE` datatypes
- Only applicable when `DBTIMEZONE` differs between the source and target
- How is it stored/retrieved?
  - Oracle **stores** the timestamp in the **database time zone**.
  - Oracle **converts** the value **automatically** to the **session time zone** when you query it

- Typical import error:

```
ORA-39405: Oracle Data Pump does not support importing from a source
database with TSTZ version n+1 into a target database with TSTZ version n.
```

CPAT | DBTIMEZONE Mismatch

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

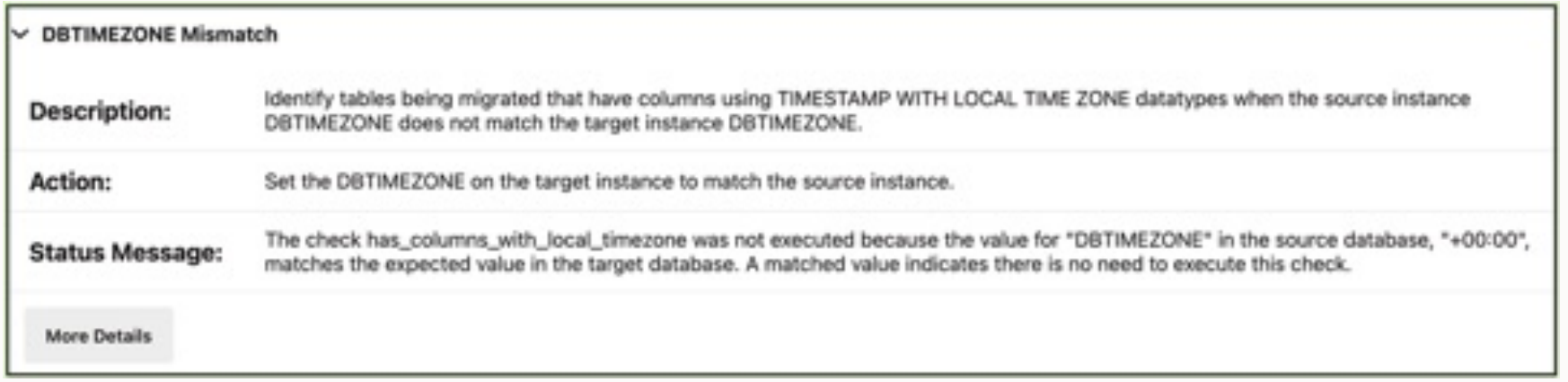
Review Required

Solution

Set the DBTIMEZONE on the target instance to match the source instance

Check Name

`has_columns_with_local_timezone`



CPAT | Time Zone Compatibility

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

Runtime

Solution

ADB Dedicated:
Enable time-zone update

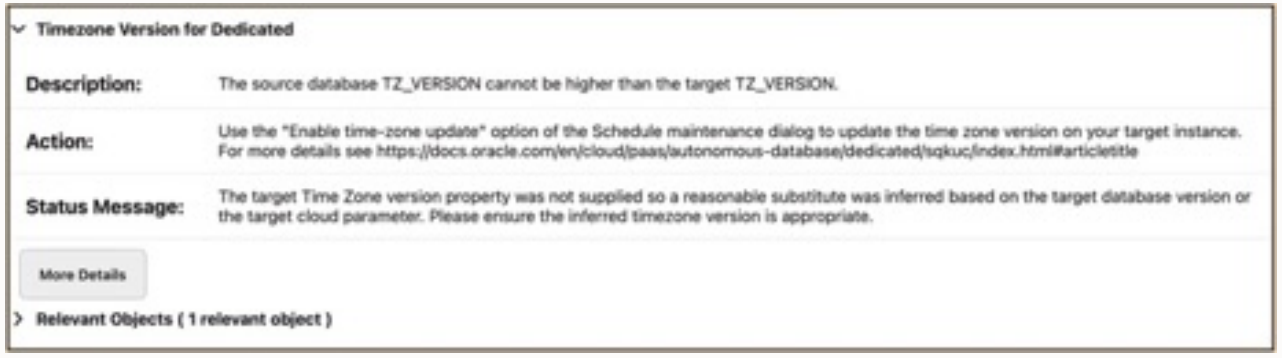
ADB Serverless:

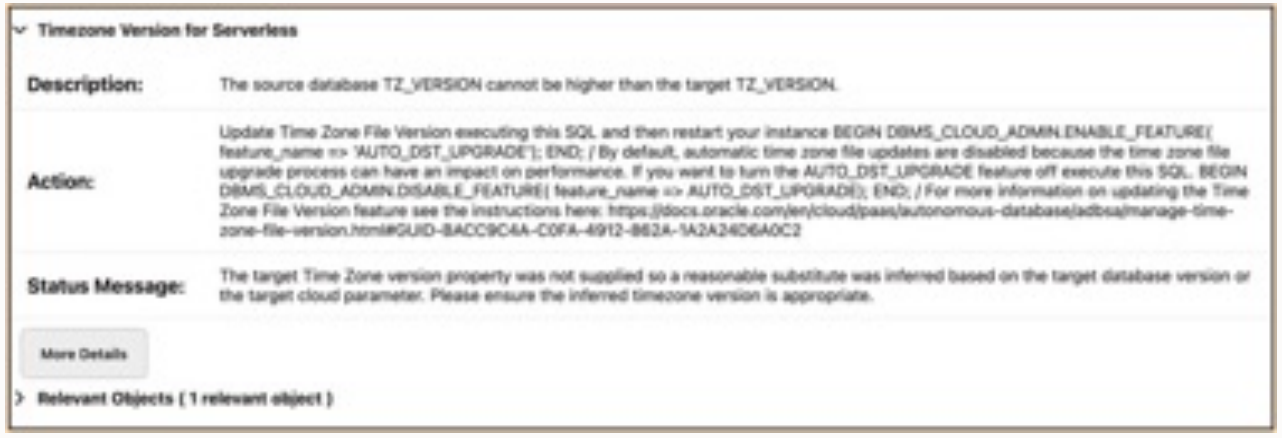
```
BEGIN
DBMS_CLOUD_ADMIN.ENABLE_FEATURE
( feature_name =>
'AUTO_DST_UPGRADE');
END;
/
```

Check Name

`timezone_table_compatibility_higher_dedicated`

`timezone_table_compatibility_higher_serverless`



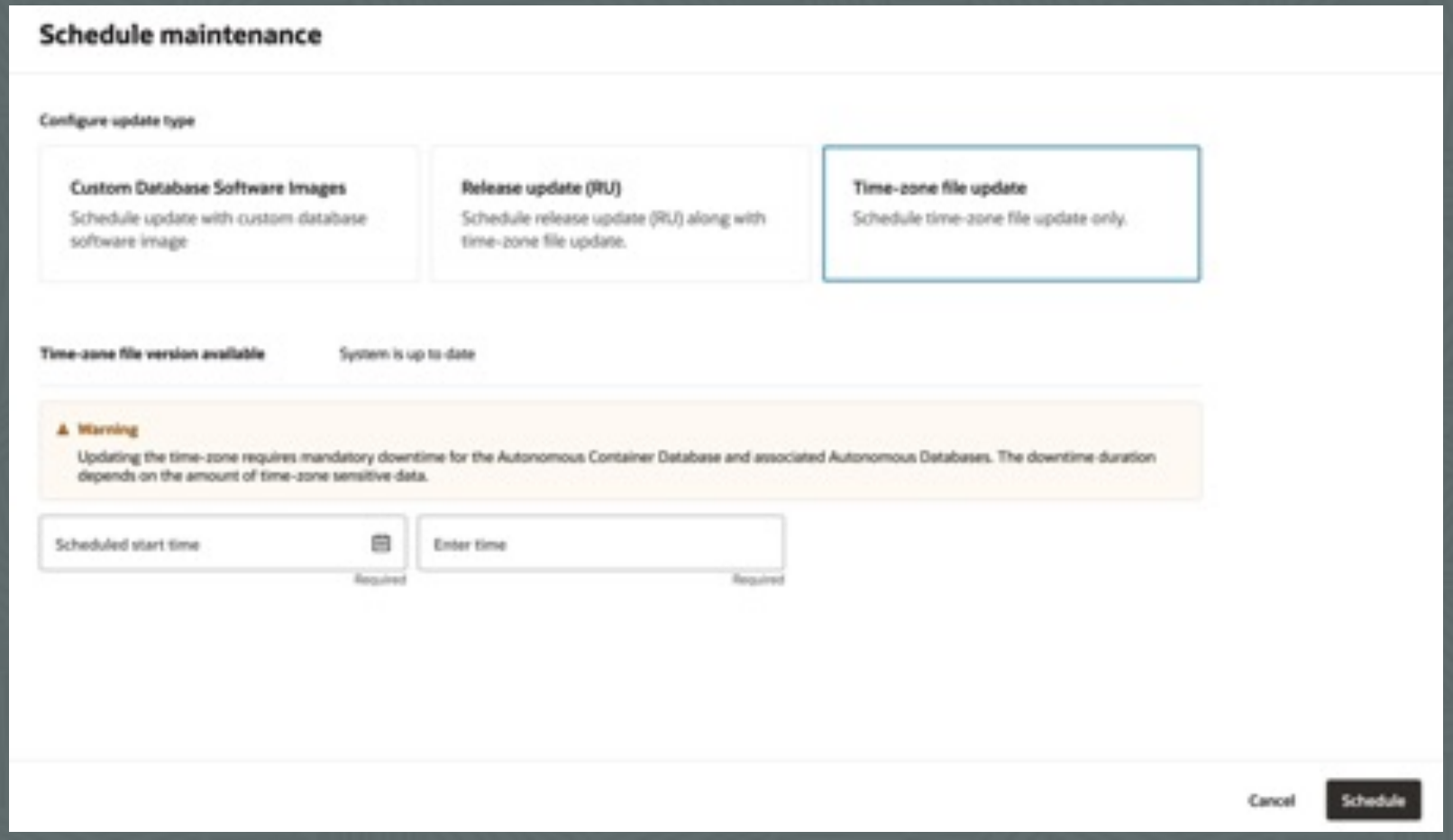


Change ADB Time Zone

- Match with your source environment
- `ALTER DATABASE SET TIME_ZONE='America/New_York';`
- Restart of your ADB instance required to take effect

Solution for ADB Dedicated?

Change it in the Schedule Maintenance screen:



Solution for ADB Serverless?

Change time zone:

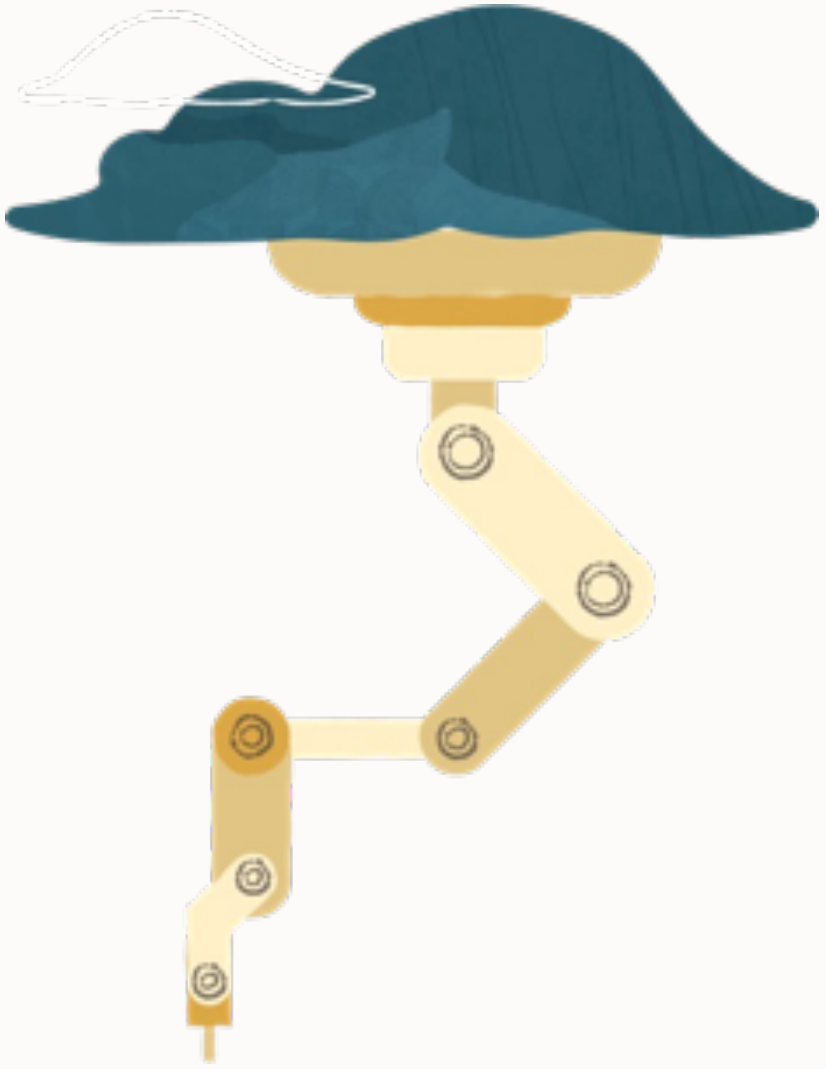
```
EXEC DBMS_CLOUD_ADMIN.ENABLE_FEATURE(
     feature_name => 'AUTO_DST_UPGRADE' );
```

Restart ADB instance:

```
EXEC DBMS_CLOUD_ADMIN.DISABLE_FEATURE(
     feature_name => 'AUTO_DST_UPGRADE' );
```


New features coming soon to Data Pump in ADB to reduce TZ errors

- Will ignore when there is no TZ data in dump file
- Bug 37041429 – DATAPUMP : REMOVE RESTRICTION TO DO IMPORT FROM HIGHER TSTZ VERSION TO LOWER VERSION



Java and more

Do you use Java or Libraries?

CPAT | Java Sources and Objects

Java sources and objects are relatively easy to migrate

- You need to enable Java in ADB before migration

```
BEGIN
  DBMS_CLOUD_ADMIN.ENABLE_FEATURE( feature_name => 'JAVAVM' );
END;
/
```

CPAT | Java Sources and Objects

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Action Required

Solution

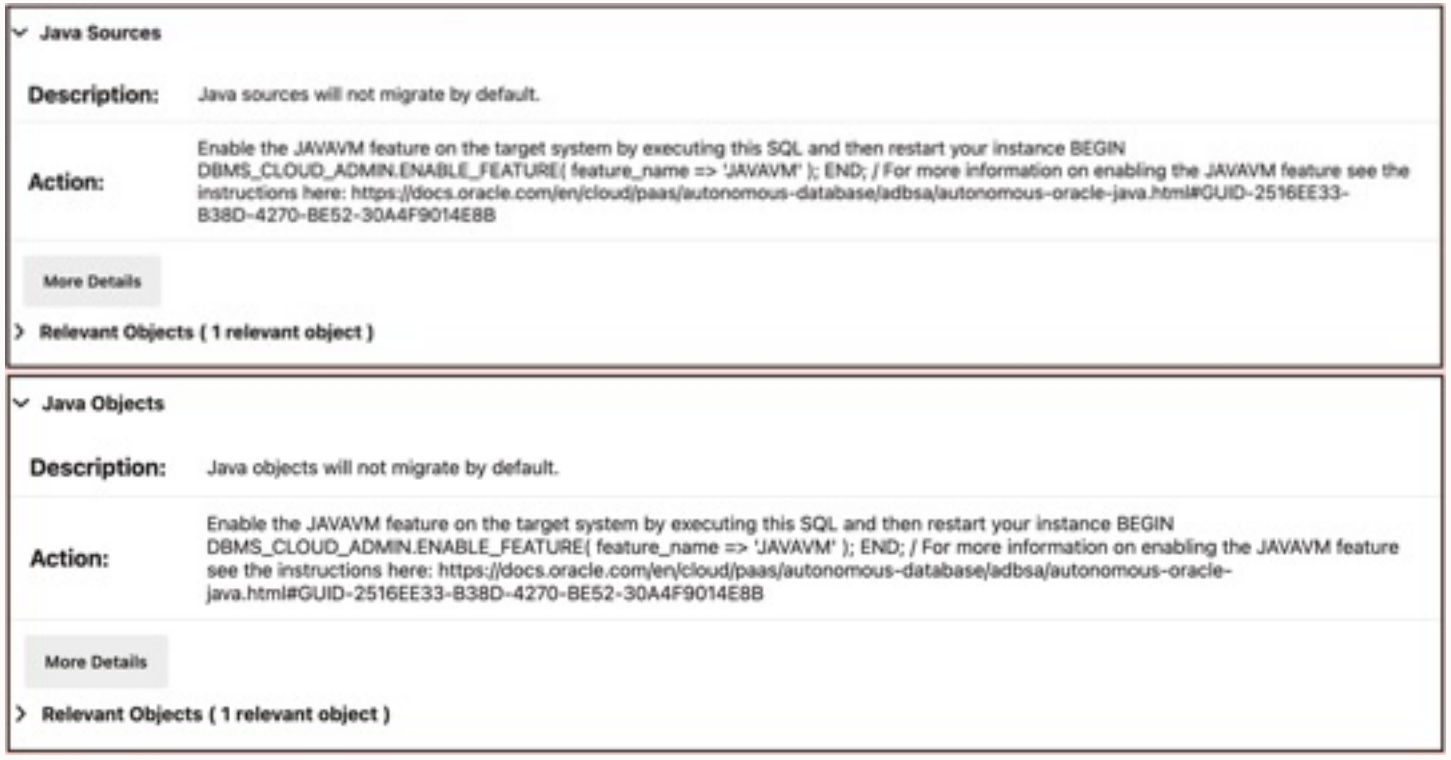
Enable Java on the ADB side before migration.

```
BEGIN
DBMS_CLOUD_ADMIN.ENABLE_FEATURE
( feature_name => 'JAVAVM' );
END;
/
```

Check Name

`has_java_objects`

`has_java_source`



CPAT | Libraries

Libraries can't be migrated to Oracle Autonomous Database

- Applications require update
- Dependencies on libraries must be removed
- Consider replacing library functionality with functions
  - https://docs.oracle.com/en-us/iaas/Content/Functions/
- Alternative would be EXTRPROC into an OCI Marketplace Image
  - https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/user-defined-functions-external.html#GUID-FB998DB9-82DC-455E-ACFA-CE06BAB6FC2B

CPAT | Libraries

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Action Required

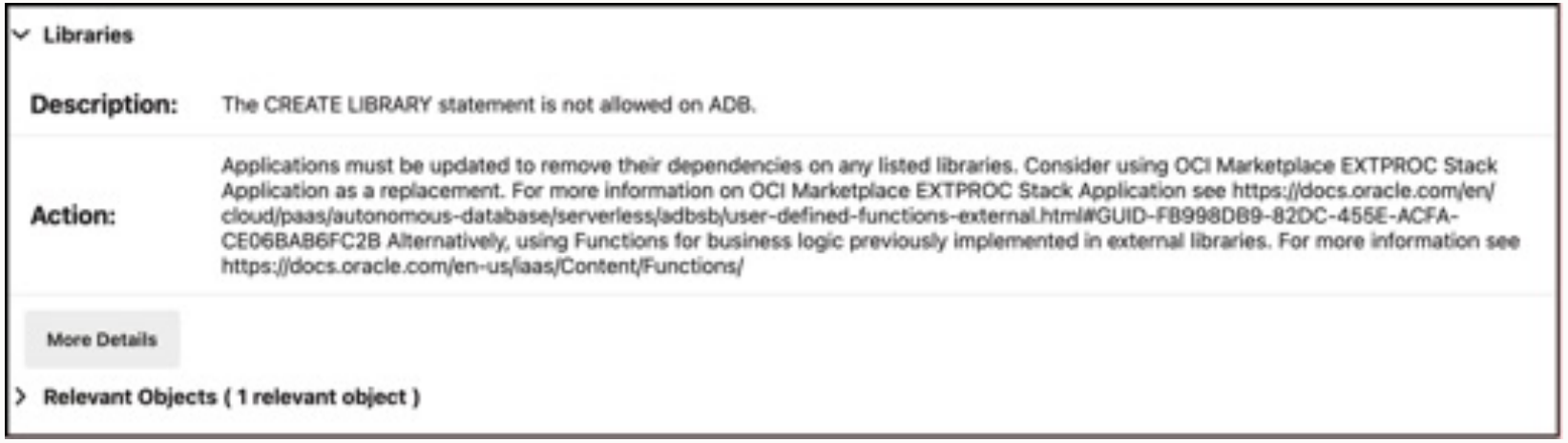
Solution

There is no simple solution. Usually, it will require reprogramming or design changes in the source or after migration.

Check Name

`has_libraries_serverless`

`has_libraries_dedicated`



CPAT Checks and Findings

Common and simple

- GoldenGate
- Tablespaces
- Objects in SYS and SYSTEM
- No Quota
- Passwords
- Time Zone
- Java

Common but complex

- Directories
- External Tables
- Database Links
- Privileges

Uncommon Findings

- Unsupported Objects and Types
- XML

Directories

Can you migrate directories easily?

Directories

```
SQL> select * from dba_directories

DIRECTORY_NAME DIRECTORY_PATH
SALES          /u02/app/oracle/sales
HR             /mount/nfs/hr
```

```
SQL> select * from dba_directories

DIRECTORY_NAME DIRECTORY_PATH
SALES          /u02/app/oracle/sales
HR             /mount/nfs/hr
```

Where can I put my files?

- CPAT check ***has_directories***

CPAT | Database has Directory Objects

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

Recreate directories in ADB. Different handling between ADB-S and ADB-D required.

Check Name

`has_directories`

Autonomous Database offers several ways of sharing data

Directories

In Autonomous Database

1. Local file system
2. OCI File Storage
3. Network File System (NFS)

Directories

1

Local file system

```
SQL> create or replace directory sales as 'data/sales';

SQL> select directory_path
     from dba_directories
     where directory_name='SALES';

DIRECTORY_PATH
--------------------------------------------------------------------------------
/u02/data/dbfs/o2ctrgh6/331FC6B374CF578FE063C600000AF0FE/data/sales
```

You don't have access to the local file system

```
--Move data to/from object storage and a local file system directory
--using DBMS_CLOUD.GET_OBJECT and DBMS_CLOUD.PUT_OBJECT

BEGIN
   DBMS_CLOUD.GET_OBJECT(
      credential_name => '...',
      object_uri => '...',
      directory_name => 'SALES');
END;
/
```


Directories

2 + 3

OCI File Storage / Network File System (NFS)

- A durable, scalable, secure, enterprise-grade network file system
- Connect same file system to other databases or instances
- Even outside your VCN

Directories

2 + 3

OCI File Storage / Network File System (NFS)

- Attach an existing Network File System, even from on-prem
- Supports NFSv3 and NFSv4

Directories

2 + 3

OCI File Storage / Network File System (NFS)

```
SQL> create or replace directory sales as 'SALESFS';

SQL> BEGIN
        DBMS_CLOUD_ADMIN.ATTACH_FILE_SYSTEM (
           file_system_name      => 'SALESFS',
           file_system_location  => '.../salesfs',
           directory_name        => 'SALES');
     END;
/
```

Recreate directories with `CREATE OR REPLACE DIRECTORY`

- Preserves privileges on the directory
- **`DROP`** and **`CREATE`** does not preserve privileges

Additional Information

Create directories

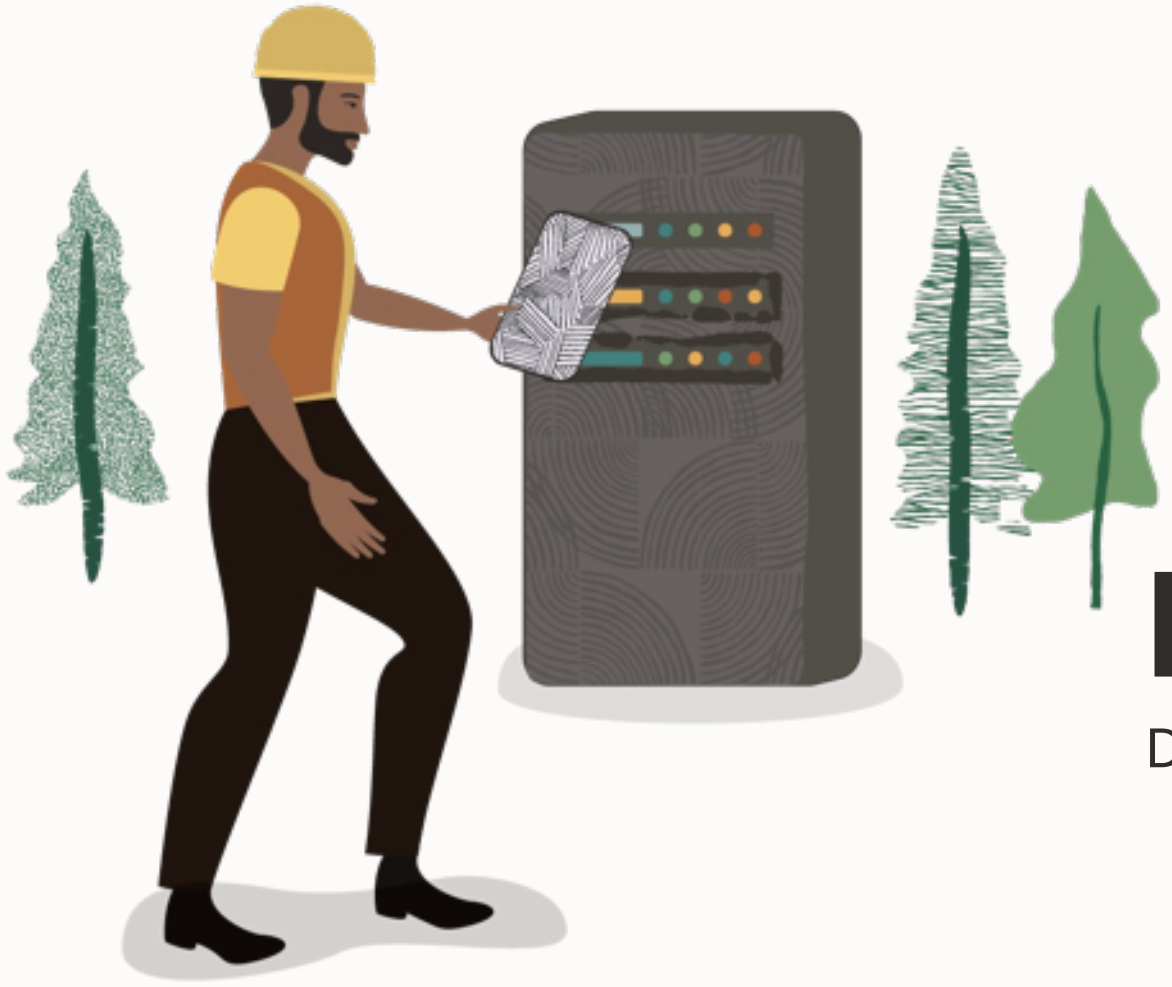
- Serverless and Dedicated

No access to local file system

- Serverless and Dedicated

File Storage / NFS

- Serverless and Dedicated



External Tables

Different handling for ADB-D and ADB-S

Why External Tables?

- Efficient Data Loading
- Seamless SQL Access to Flat Files
- Staging for ETL Processes
- Data Integration

1 TB / Month

US$ 25.24

Standard Storage - Object Storage

US$ 2.57

Archive Storage - Object Storage

$300.00

Storage - File Storage

$115.60

ADB Storage

https://www.oracle.com/cloud/costestimator.html as of 21/Apr/2025

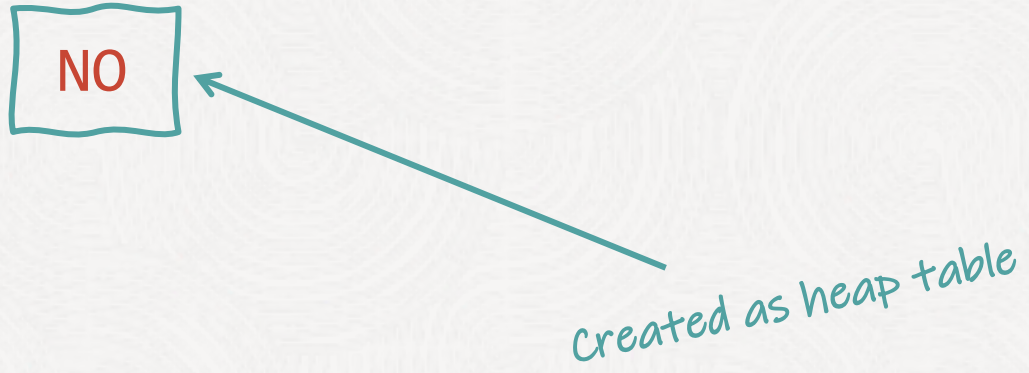
In ADB-S, the "`external`" clause gets ignored completely

- Created as Heap Tables

```
SQL> CREATE TABLE ext_min (id NUMBER)
       ORGANIZATION EXTERNAL (
          TYPE ORACLE_LOADER
          DEFAULT DIRECTORY ext_dir
          ACCESS PARAMETERS ( FIELDS TERMINATED BY ',' (id) )
          LOCATION ('data.csv')
       );

Table created.
```


```
SQL> CREATE TABLE ext_min (id NUMBER)
       ORGANIZATION EXTERNAL (
          TYPE ORACLE_LOADER
          DEFAULT DIRECTORY ext_dir
          ACCESS PARAMETERS ( FIELDS TERMINATED BY ',' (id) )
          LOCATION ('data.csv')
       );

Table created.
```

```
SQL> select table_name, external from user_tables;

TABLE_NAME    EXT
------------- ---
EXT_MIN       NO
```



ADB Development is working on a solution to automate this conversion

CPAT | External Tables

Oracle Autonomous Database

Serverless

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

Tables must be dropped and recreated using DBMS_CLOUD.

Check Name

`has_external_tables_serverless`

External Tables for Serverless

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

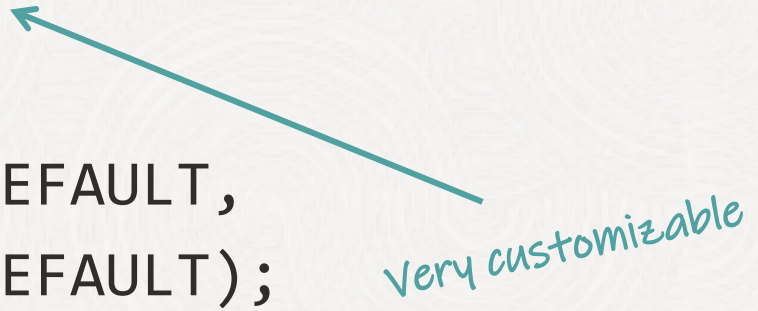
Action: Drop the empty imported table. Use the DBMS_CLOUD package to create External Tables using Cloud Object Storage Service or use File Storage Service for more info see https://docs.oracle.com/en/cloud/paas/autonomous-database/serverless/adbsb/load-oci-file-storage.html#GUID-B9A7E58E-E1C0-4859-B16B-EF88942704BF.

More Details

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	TYPE_OWNER	TYPE_NAME	DEFAULT_DIRECTORY_OWNER	DEFAULT_DIRECTORY_NAME
APPUSER	EXT_MIN	SYS	ORACLE_LOADER	SYS	DATA_PUMP_DIR

```
DBMS_CLOUD.CREATE_EXTERNAL_TABLE (
    table_name          IN VARCHAR2,
    credential_name     IN VARCHAR2 DEFAULT NULL,
    file_uri_list       IN CLOB,
    column_list         IN CLOB,
    field_list          IN CLOB DEFAULT,
    format              IN CLOB DEFAULT);
```



file_uri_list

Cloud source file URIs

External files in the supported cloud object storage services

Table Hyperlink URL

You can generate and manage Table Hyperlinks to access data on Autonomous Database.

Directory

This includes Network File System

file_uri_list

Cloud source file URIs

External files in the supported cloud object storage services

- Oracle Cloud Infrastructure Object Storage Native URI Format
- Oracle Cloud Infrastructure Object Storage Swift URI Format
- Oracle Cloud Infrastructure Object Storage URI Format Using Pre-Authenticated Request URL
- URI Format Using Public URL
- Oracle Cloud Infrastructure Object Storage Classic URI Format
- Amazon S3 URI Format
- Azure Blob Storage or Azure Data Lake Storage URI Format
- Amazon S3 Compatible URI Format
- GitHub Raw URL Format
- Additional Customer-Managed URI Formats

file_uri_list

Table Hyperlink URL

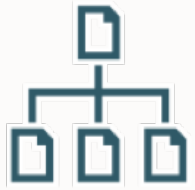
You can generate and manage Table Hyperlinks to access data on Autonomous Database.

1. Identify the table or view or select statement that you want to share.

2. Run DBMS_DATA_ACCESS.GET_PREAUTHENTICATED_URL to generate the Table Hyperlink and specify group by columns option for viewing with a browser.

3. Share the result.

file_uri_list



Directory

This includes Network File System

- Can specify one directory and one or more file names
- Use a comma separated list of directories and file names.
- The format to specify a directory is:`'MY_DIR:filename.ext'`

In ADB-D, the "`external`" clause is fully respected

- Created as External Tables

```
SQL> CREATE TABLE ext_min (id NUMBER)
        ORGANIZATION EXTERNAL (
            TYPE ORACLE_LOADER
             DEFAULT DIRECTORY ext_dir
             ACCESS PARAMETERS ( FIELDS TERMINATED BY ',' (id) )
             LOCATION ('data.csv')
     );

Table created.
```


```
SQL> select table_name, external from user_tables;

TABLE_NAME   EXT
------------ ---
EXT_MIN      YES
```


CPAT | External Tables

Oracle Autonomous Database

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

Tables must be dropped and recreated with DBMS_CLOUD only if external files are moved from directory to object storage

- Recreating objects will wipe their privileges.

Check Name

`has_external_tables_dedicated`

External Tables for Dedicated

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

Action: 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/dedicated/anfra/#articletitle.

More Details

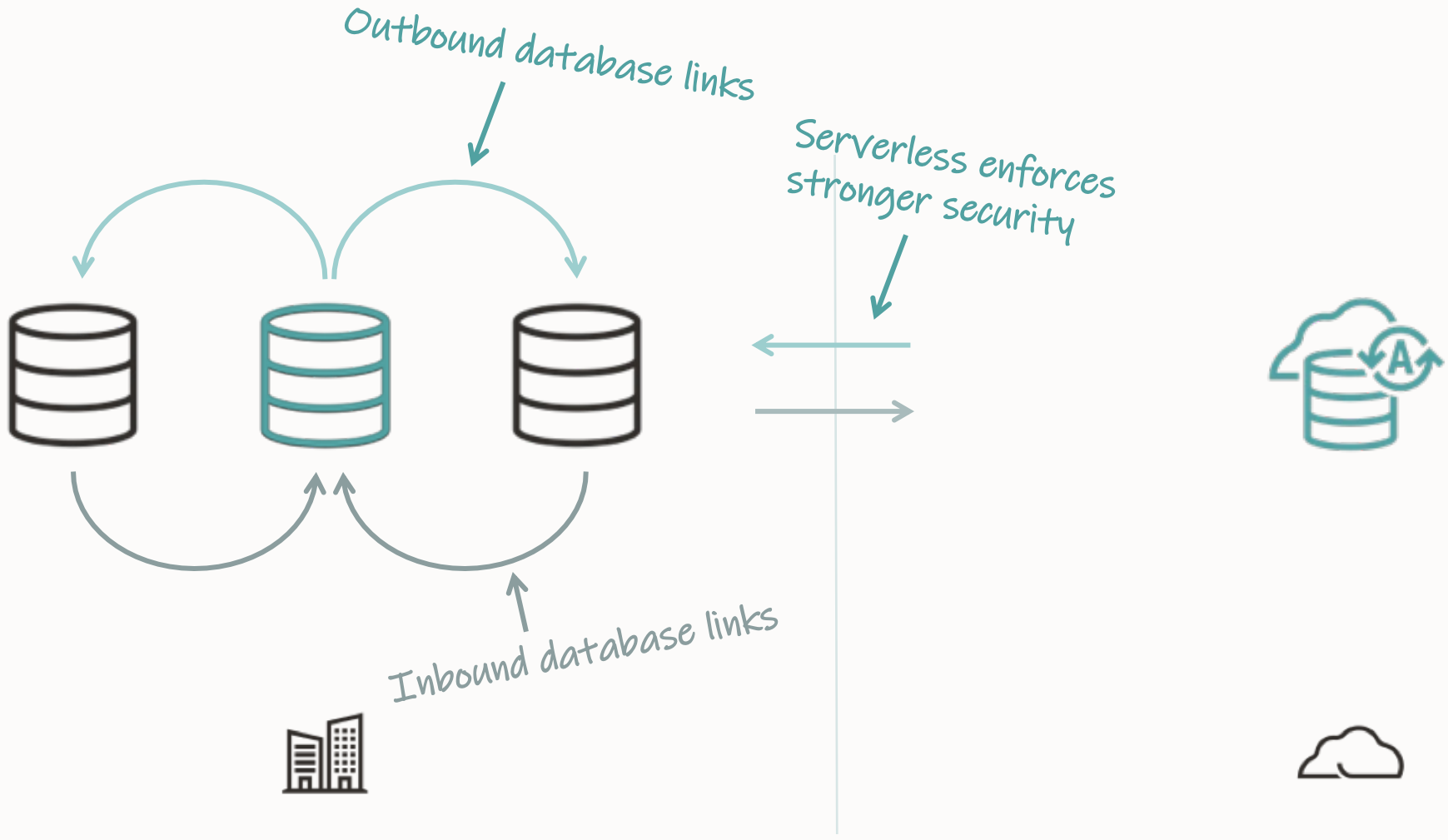
Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	TYPE_OWNER	TYPE_NAME	DEFAULT_DIRECTORY_OWNER	DEFAULT_DIRECTORY_NAME
APPUSER	EXT_MIN	SYS	ORACLE_LOADER	SYS	DATA_PUMP_DIR

Database Links

How do you migrate them to ADB-D and ADB-S?

Database Links



Autonomous Database Serverless supports secure connections only

Database Links

mTLS

- Secure connection over TCPS
- Uses a key in a wallet
- Rotate wallet at regular intervals
- Via port 1522

TLS

- Secure connection over TCPS
- Validates server certificate
- No wallet rotation
- Via port 1521
- Can be faster and with lower latency

Autonomous Database Dedicated also supports TCP connections

Dealing with outbound database connections

Autonomous Database can connect to other databases including on-prem

- Remote database must be 12.1 or higher
- No support for 11.2.0.4 databases

Tell me about Autonomous Database Serverless

- CPAT check *has_db_links*

CPAT | Database Links

Oracle Autonomous Database

Serverless

Check Name

`has_dblinks`

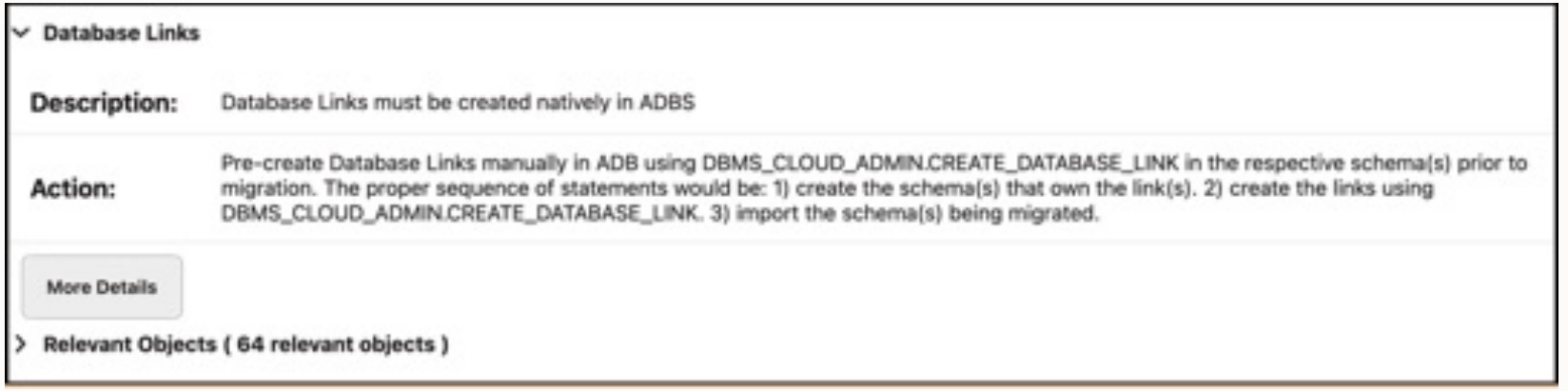
Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

Database Links must be recreated using the DBMS_CLOUD package. They can't be migrated directly into ADB Serverless.



```
--You can't create database links in ADB-S using
--CREATE DATABASE LINK statement

SQL> create database link ... ;

ORA-01031: insufficient privileges
```


```
exec dbms_cloud_admin.create_database_link(
    db_link_name => 'SALESLINK',
    hostname => 'my-host',
    port => '1521',
    service_name => 'my-service',
    ssl_server_cert_dn => NULL,
    credential_name => 'DB_LINK_CRED',
    directory_name => NULL,
    private_target => TRUE);
```

Simple connect string

Safely store username/password in a credential

Data Pump can't create your database links in Autonomous Database Serverless

- There are too many unknowns

Outbound Database Links - Serverless

Why doesn't Data Pump create the database links?

- Data Pump can't tell whether you want to use mTLS or TLS
- In case of mTLS, you need to perform work on the remote database
- On-prem database links can use a complex connection string; not supported in ADB - you need to simply it
- On-prem database links may use a TNS alias; not possible to *unfold* it during import

Outbound Database Links - Serverless

- Certain network requirements exist

- The remote database must be Oracle Database 12.1 or higher
  - No support for connections to Oracle Database 11.2.0.4

- Oracle recommends remote database be 19.16.0
  - ORA-01555 Snapshot Too Old fixed by 33843368
  - Patch Requirement For Database Links Between ADB-S And Other Oracle Databases (Doc ID 2874244.1)

Case insensitive password not allowed in remote database

- `sec_case_sensitive_logon` must be `true` (default)
- Else, `ORA-28040: No matching authentication protocol`

Manually create database links in ADB-S before starting the migration

- Avoid errors during import caused by dependent objects

Outbound Database Links - Serverless

In Autonomous Database

1. Create schemas owning the database links
2. Create credentials
3. Create database links
4. Complete migration

Outbound Database Links - Serverless

1

Create schemas owning the database links

```
impdp ... include=schemas
```

or

```
impdp ... include=schemas sqlfile=schemas.txt
```

or

```
l_ddl := dbms_metadata.get_ddl('USER', <schema1>);
```

Outbound Database Links - Serverless

2

Create credentials

- Get a list of users used by database links
- Create credentials
- You must know the password
  - You can't extract the password in clear-text
  - You can't use password hashes

```
select username from dba_db_links

exec dbms_cloud_admin.create_credential(
   username => 'username',
   password => 'password',
   credential_name => 'cred1');
```

Outbound Database Links - Serverless

3

Create database links

```
exec dbms_cloud_admin.create_database_link(
   db_link_name => 'SALESLINK',
   hostname => '["my-host1","my-host2"]',
   port => '1521',
   service_name => 'my-service',
   ssl_server_cert_dn => NULL,
   credential_name => 'CRED1',
   directory_name => NULL,
   private_target => TRUE);
```

SCAN not allowed, connect directly to hosts

```
create database link ... using 'alias1';

alias1 =
   (DESCRIPTION =
      (CONNECT_TIMEOUT=90)(RETRY_COUNT=50) ...
      (ADDRESS_LIST =
         (LOAD_BALANCE=on)
         (ADDRESS = (PROTOCOL = TCP)
            (HOST=my-host-scan)(PORT=1521))
      )
      (CONNECT_DATA=(SERVICE_NAME=my-service)
      )
   )
```

Convert regular database links into `DBMS_CLOUD_ADMIN` calls using a script

- Available on request
- Just send us an e-mail

```
@Convert_DBLINKS_2_ADB.sql
```

```
BEGIN
   DBMS_CLOUD.CREATE_CREDENTIAL(
      CREDENTIAL_NAME => 'SCHEMA1_DBLINK1_CRED',
      USERNAME => 'SCHEMA1',
      PASSWORD => '...');
END;
/

BEGIN
   DBMS_CLOUD_ADMIN.CREATE_DATABASE_LINK(
      DB_LINK_NAME => DBLINK1,
      HOSTNAME => 'host1',
      PORT => 1521,
      SERVICE_NAME => 'SALESSVC',
      CREDENTIAL_NAME => 'SCHEMA1_DBLINK1_CRED',
      PUBLIC_LINK => FALSE,
      ... );
END;
/
```

Creates credential for each db link owner

Converts each database link to a DBMS_CLOUD_ADMIN call

Converts connect strings and tries to resolve TNS aliases

Database links from ADB-S on Oracle Database@Azure

ADB-S on Oracle Database@Azure

- Database link must connect to a host name
- For ADB-S to resolve the database link host name, create an A-record in OCI DNS to resolve the FQDN of the remote database
- Find instructions in Oracle Zero Downtime Migration – Logical Offline Migration to ADB-S on Oracle Database@Azure (similar to description *Add NFS mount point FQDN to OCI DNS VCN Resolve)*

Tell me about Autonomous Database Dedicated

```
--Autonomous Database Dedicated allows the use of
--CREATE DATABASE LINK syntax

SQL> create database link saleslink
     using 'host:port/service';

Database link SALESLINK created.
```


```
--Use Easy Connect syntax, tnsnames.ora not available for lookup

SQL> create database link saleslink
     using 'host:port/service';

Database link SALESLINK created.
```


Dealing with inbound database connections

Identify incoming database links using Unified Auditing

- CPAT has no check for this

```
--Create an audit policy that captures logons
create audit policy <name> actions logon;
audit policy <name>;
```

```
--Create an audit policy that captures logons
create audit policy <name> actions logon;
audit policy <name>;

--Monitor incoming connections over time
select userhost, dblink_info from unified_audit_trail
where  action_name='LOGON'
       and dblink_info is not null;
```


```
SQL> select userhost, dblink_info from unified_audit_trail
     where  action_name='LOGON'
            and dblink_info is not null;


USER_HOST DBLINK_INFO
--------- ----------------------------------------------------------------------
dbhost1   SOURCE_GLOBAL_NAME=<global_name>, SOURCE_DB_NAME=<db_name>,
          DBLINK_NAME=<db_link_name>, SOURCE_AUDIT_SESSIONID=<audit_id>
```


On-prem databases can connect to Autonomous Database using mTLS

- 19.16 or patch 33843368 recommended
- No support for releases earlier than 19c

Autonomous Database Dedicated also accepts TCP connections

In your maintenance window, change incoming database links

- Work required in remote database

Database Links

```
SQL> create database link ...
     using 'my-tns-alias';
```

Easier to update

Invalidates dependent objects

Inbound Database Links

Facilitate easier change of database link details by using centrally managed connection strings:

- Oracle Unified Directory
- Oracle Internet Directory
- Other LDAP options
- Oracle Connection Manager

```
SQL> create database link adblink ...
     using 'my-tns-alias';
```


```
SQL> create database link adblink ...
     using 'my-tns-alias';
```

```
$ cat tnsnames.ora
```

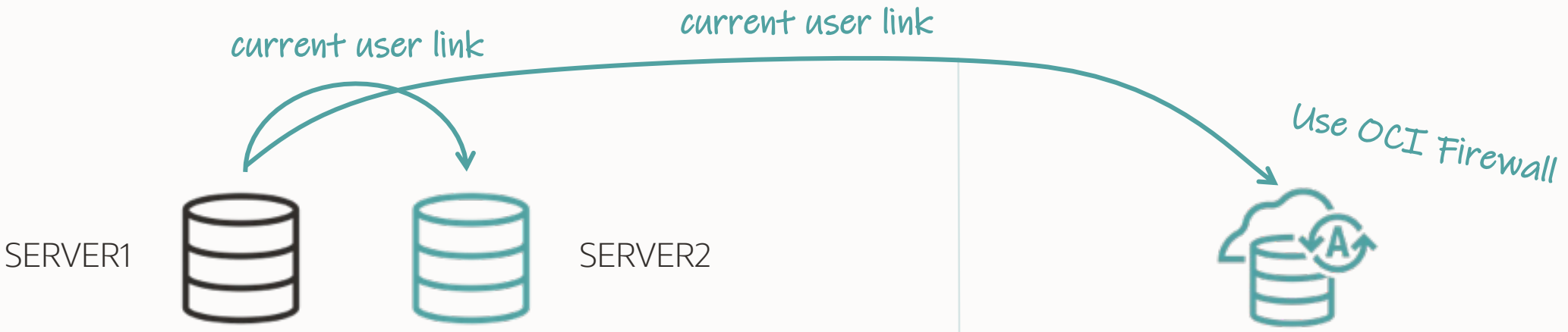
```
my-tns-alias = (description=
   (retry_count=20)(retry_delay=3)
   (address=(protocol=tcps)(port=1522)(host=example1.oraclecloud.com))
   (connect_data=(service_name=my_adb_high.adb.oraclecloud.com))
   (security=(my_wallet_directory=/u01/wallets/my_adb)
             (ssl_server_dn_match=true)
   )
)
```

Create and test database links
before the migration maintenance window

Trusted incoming database links

- CPAT check *has_trusted_server_entries*

Trusted Database Links




```
SQL> create database link
     ...
     connect to current_user
     ... ;
```

```
SQL> select *
     from trusted_servers;

TRUST      NAME
Untrusted  All
Trusted    SERVER1
```

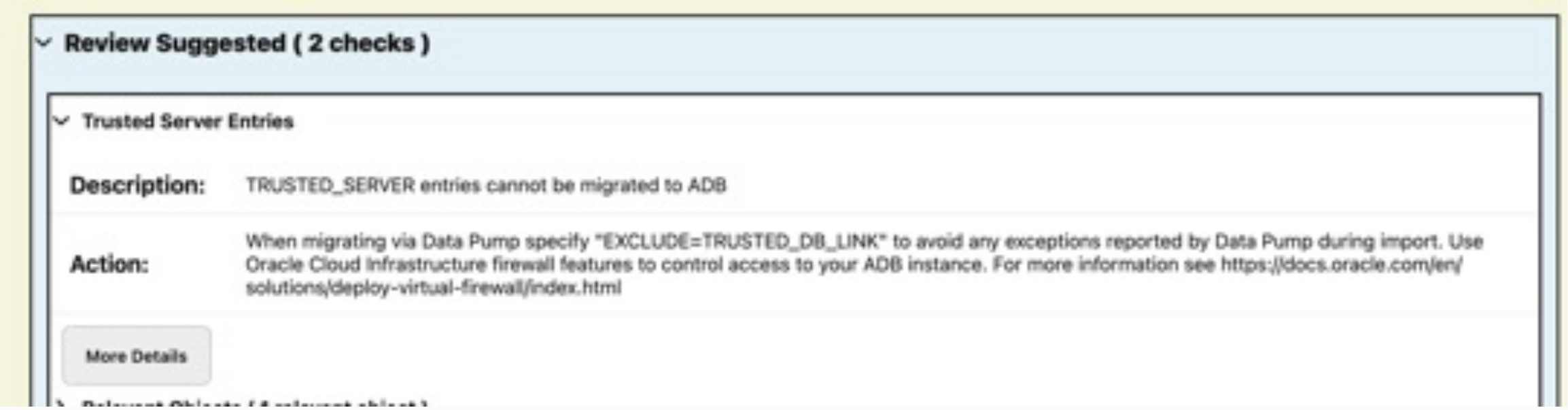
```
SQL> select *
     from trusted_servers;

TRUST      NAME
Trusted    All
```

Trusted Database Links

- Incoming `current_user` links continue to work after migration
- But you must exclude trusted server entries in Data Pump
  - `exclude=trusted_db_links`

- You add trusted server entries using `DBMS_DISTRIBUTED_TRUST_ADMIN`
- Package does not exist in Autonomous Database
- Restrict access similar to trusted servers using OCI firewall features

Trusted Database Links



General recommendations

Modernize your architecture with cloud links

- Read-only data sharing between databases in OCI

An mTLS connection uses an expiring wallet

- You can use issue multiple wallets
- Check wallet readme for expiration date

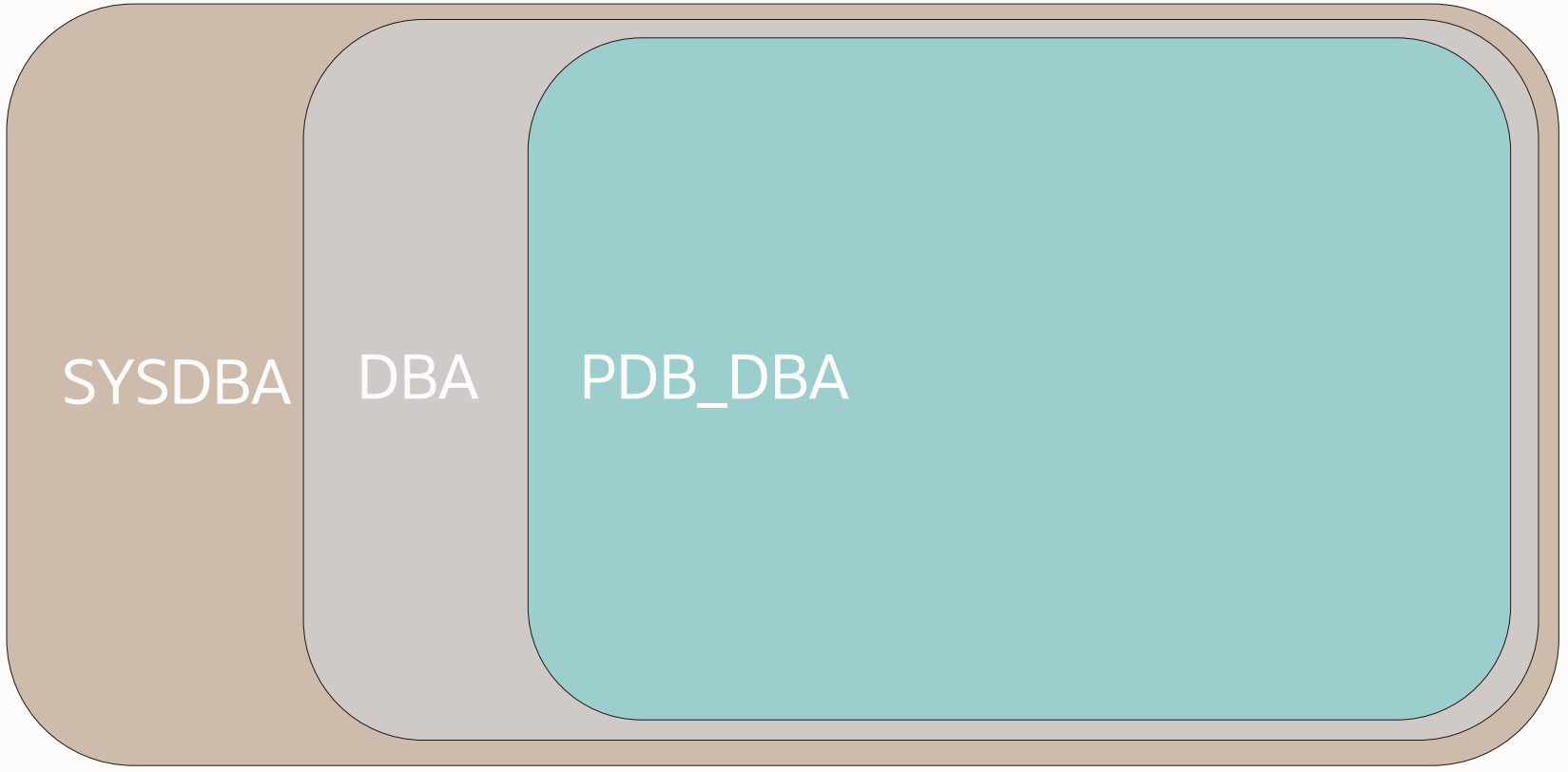
Privileges

Roles and Grants

ADB is a managed service

- Oracle responsabilites include Securing, Performance, Patching and Upgrade
- Must restrict PDB capabilities

“DBA” privileges



CPAT | Role Privileges

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

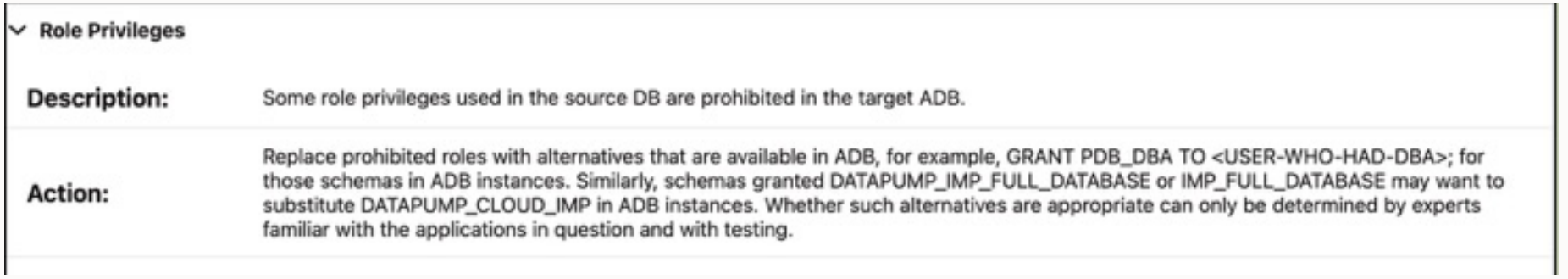
Action Required

Solution

Replace powerful role privileges with designated roles in ADB., e.g.:
`DBA → PDB_DBA`

Check Name

`has_role_privileges`



Role Privileges

Description:	Some role privileges used in the source DB are prohibited in the target ADB.
Action:	Replace prohibited roles with alternatives that are available in ADB, for example, GRANT PDB_DBA TO <USER-WHO-HAD-DBA>; for those schemas in ADB instances. Similarly, schemas granted DATAPUMP_IMP_FULL_DATABASE or IMP_FULL_DATABASE may want to substitute DATAPUMP_CLOUD_IMP in ADB instances. Whether such alternatives are appropriate can only be determined by experts familiar with the applications in question and with testing.

CPAT | SYS Privileges

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Action Required

Solution

Replace SYS privileges with designated and available privileges in ADB.

Check Name

`has_sys_privileges`

Solution?

Fix CPAT findings for roles and SYS privileges not available in ADB:

- Replace powerful role privileges
  - `DBA` → `PDB_DBA`
  - `IMP_FULL_DATABASE` or `DATAPUMP_IMP_FULL_DATABASE` → `DATAPUMP_CLOUD_IMP`

- Consult the documentation
- Proper application testing is required

CPAT | Object GRANTs

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

Solution

Manually export the missing GRANTs. See MOS Note 1911151.1 for further information.

Check Name

`has_noexport_object_grants`

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.

More Details

Relevant Objects (1 relevant object)

GRANTEE	OBJECT_OWNER	OBJECT_NAME	PRIVILEGE	GRANTOR
APPUSER	SYS	DBA_USERS	SELECT	SYS

Solution?

Fix CPAT findings for non-exported object GRANTs

- Manually export privileges granted to SYS objects
  - MOS Note 1911151.1
- Included by datapump on 21c
  - New SCHEMA_EXPORT/ORACLE_OBJECT_GRANT/OBJECT_GRANT

```
-- new object type path: SCHEMA_EXPORT/USER
 CREATE USER "APPUSER" IDENTIFIED BY VALUES '...'
      DEFAULT TABLESPACE "USERS"
      TEMPORARY TABLESPACE "TEMP";
-- new object type path: SCHEMA_EXPORT/SYSTEM_GRANT
GRANT CREATE SESSION TO "APPUSER";
-- new object type path: SCHEMA_EXPORT/ORACLE_OBJECT_GRANT/OBJECT_GRANT
-- CONNECT SYS
GRANT EXECUTE ON "SYS"."DBMS_STATS" TO "APPUSER";
GRANT READ ON "SYS"."DBA_USERS" TO "APPUSER";
-- new object type path: SCHEMA_EXPORT/DEFAULT_ROLE
-- CONNECT MYDBA
 ALTER USER "APPUSER" DEFAULT ROLE ALL;
```

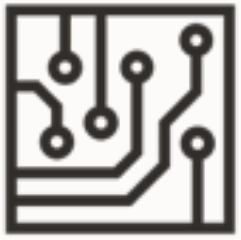
CPAT Checks and Findings

Common and simple

- GoldenGate
- Tablespaces
- Objects in SYS and SYSTEM
- No Quota
- Passwords
- Time Zone
- Java

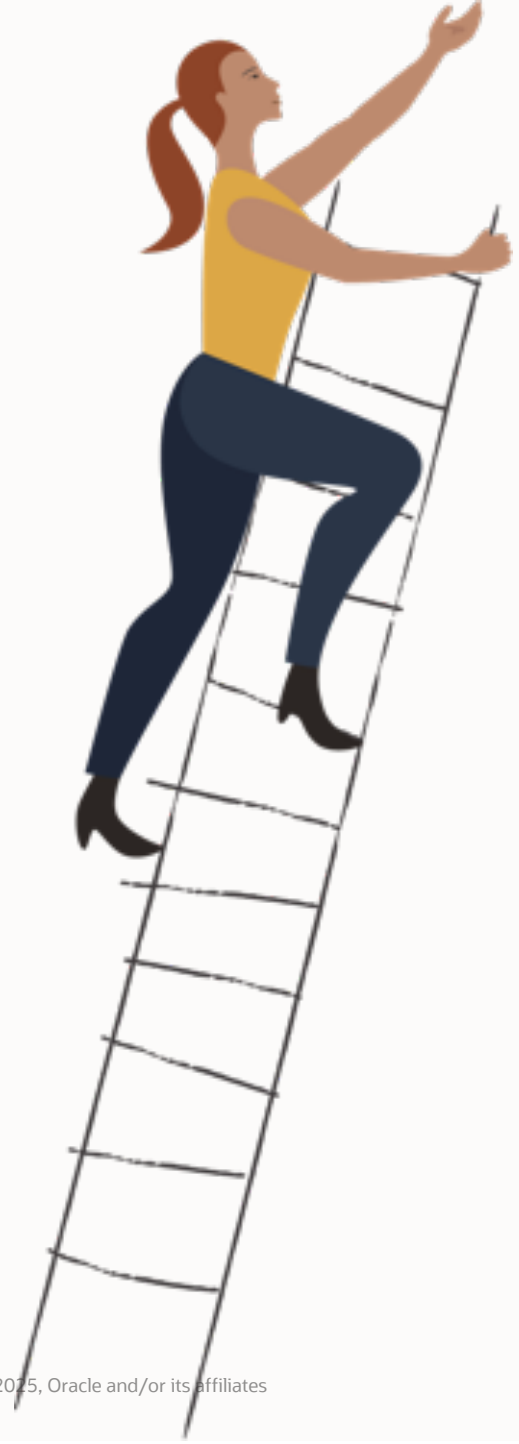
Common but complex

- Directories
- External Tables
- Database Links
- Privileges



Uncommon Findings

- Unsupported Objects and Types
- XML



Unsupported

Data types, Schemas and more

Oracle Autonomous Database is continuously evolving with new capabilities

- Check the documentation for feature updates
- Rely on CPAT findings since it gets constantly updated

CPAT | Source has clustered tables

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Suggested

Solution

While no action is required for migration do proper performance testing to be certain of no adverse effects.

Check Name

`has_clustered_tables`

Clustered Tables

Description: Table clusters are not allowed in ADB.

Action: While no action is required for migration customers may want to do performance testing to be certain of no adverse effects.

More Details

Relevant Objects (2 relevant objects)

OWNER	TABLE_NAME
MYAPP	DEPT
MYAPP	EMPL

CPAT | ROWID columns in source

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Action Required

Solution

```
ALTER SYSTEM SET
ALLOW_ROWID_COLUMN_TYPE=
TRUE SCOPE=BOTH;
```

Check Name

`has_columns_of_rowid_type`

ROWID/UROWID Type Columns

Description:	The ROWID and UROWID data types are not enabled by default in Dedicated Infrastructure Autonomous Database deployments
Action:	The ROWID and UROWID data types can be enabled by setting the ALLOW_ROWID_COLUMN_TYPE initialization parameter to true on the target ADBD instance using the SQL command ALTER SYSTEM SET ALLOW_ROWID_COLUMN_TYPE=TRUE SCOPE=BOTH; However, if you enable it, be aware that ROWID and UROWID columns are incompatible with rolling upgrade operations and other internal operations that physically move a row. At a minimum, database activities involving these datatypes should be suspended during upgrades. Applications using ROWID or UROWID columns should introduce correctness validation to mitigate against logical errors in the application if a row relocates. Note that the behavior of ADB-D ROWID/UROWID on ADBD is no different from what one would find when using Oracle database on premises.

More Details

Relevant Objects (1 relevant object)

OWNER	TABLE_NAME	COLUMN_NAME
MYAPP	EMPLOYEE_R	COLREF

CPAT | Multimedia types in ADB

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

Action Required

Solution

MOS Note: 2555923.1 and
MOS Note: 2347372.1

Check Name

`has_columns_with_media_data_types_adb`

Multimedia Type Columns for ADB

Description:	Multimedia object types such as those from ORDSYS cannot be used in Autonomous databases.
Action:	Follow the instructions in the Oracle Multimedia README.txt file in <ORACLE_HOME>/ord/im/admin/README.txt, or Oracle Support Document ID 2555923.1 to determine if Oracle Multimedia methods and packages are being used. If Oracle Multimedia is being used, refer to Oracle Support Document ID 2347372.1 for suggestions on replacing Oracle Multimedia. Refer to Oracle Support Document ID 2375644.1 "How To Migrate Data From Oracle Multimedia Data Types to BLOB columns" for information on how to move data stored in Oracle Multimedia object types to SecureFiles LOBs.

Hide Details

Name:	has_columns_with_media_data_types_adb
Migration Methods:	DATAPUMP,DATAPUMP_DBLINK,GOLDENGATE
Failure Impact:	Columns with Media data types are not allowed in Autonomous Database. Migration of tables with multimedia columns will fail.
Scope:	SCHEMA
Executed SQL:	SELECT OWNER, TABLE_NAME, COLUMN_NAME, DATA_TYPE FROM SYS.DBA_TAB_COLUMNS WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_RE AND DATA_TYPE IN ('ORDIMAGE','ORDIMAGESIGNATURE','ORDAUDIO','ORDVIDEO', 'ORDDOC','ORDSOURCE','ORDDICOM','ORDDATASOURCE', "

CPAT | Multimedia types in non-ADB

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

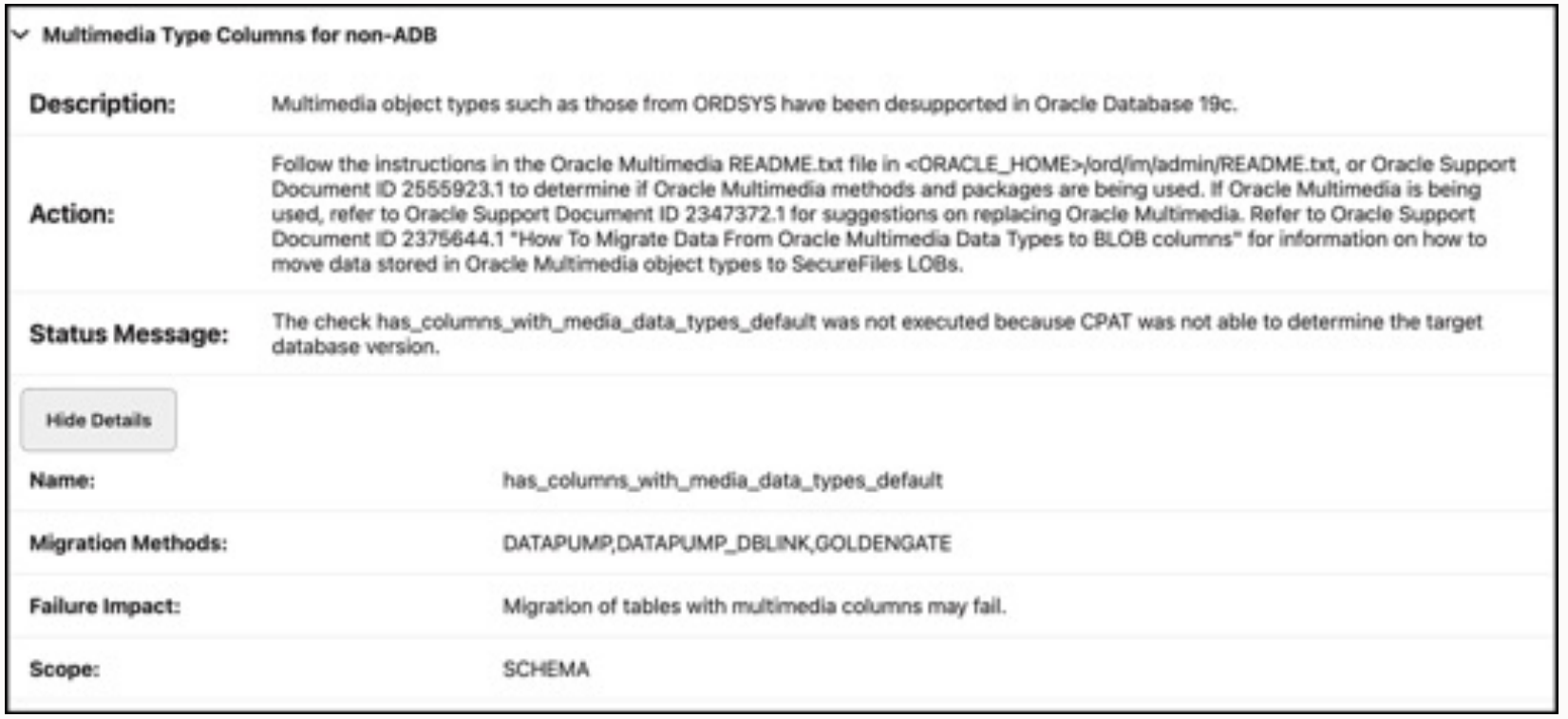
Action Required

Solution

MOS Note: 2555923.1 and
MOS Note: 2347372.1

Check Name

`has_columns_with_media_data_types_default`



CPAT | Spatial

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Review Required

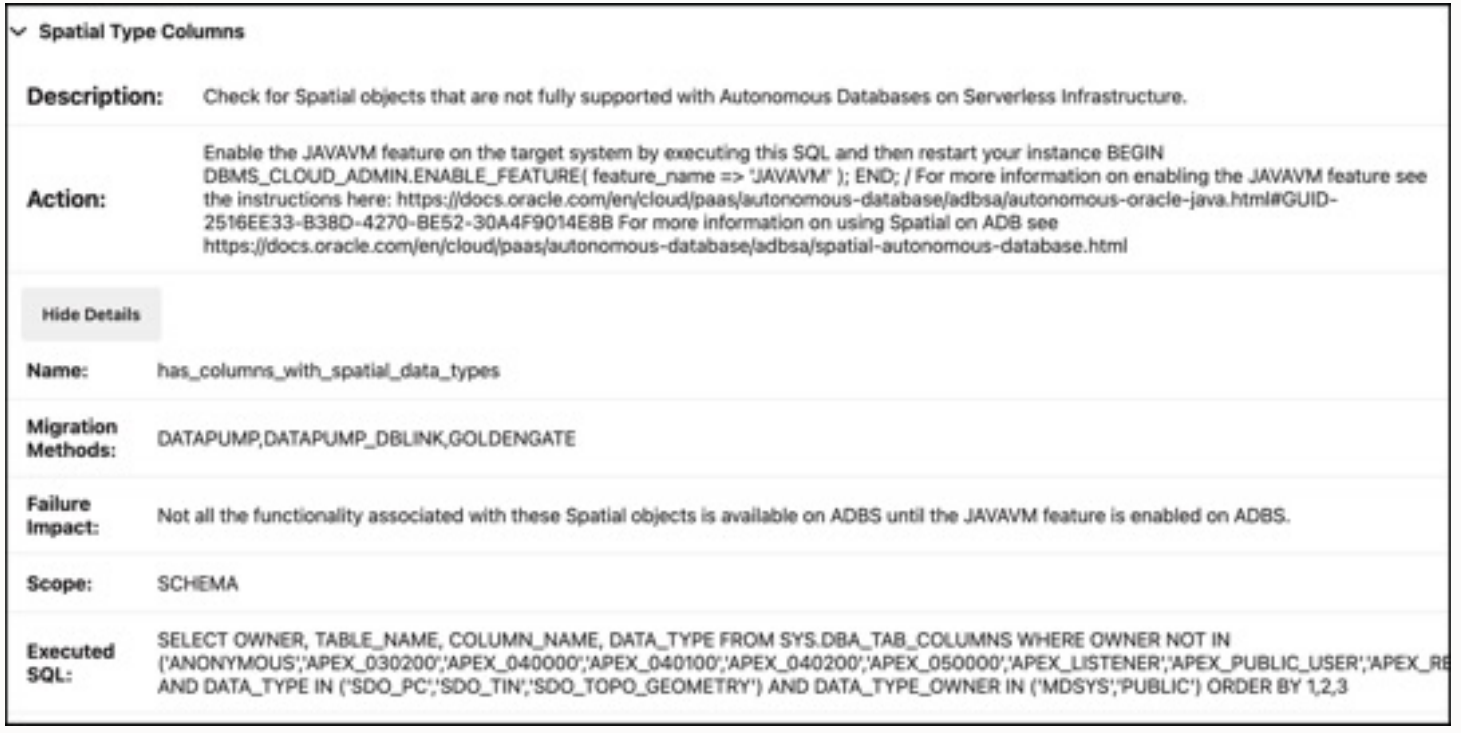
Solution

Enable the JAVAVM feature on the target system

```
DBMS_CLOUD_ADMIN.ENABLE_FEATURE( feature_name => 'JAVAVM' );
```

Check Name

```
has_columns_with_spatial_data_types
```



Spatial Type Columns

Description:	Check for Spatial objects that are not fully supported with Autonomous Databases on Serverless Infrastructure.
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-B38D-4270-BE52-30A4F9014E8B For more information on using Spatial on ADB see https://docs.oracle.com/en/cloud/paas/autonomous-database/adbsa/spatial-autonomous-database.html

Hide Details

Name:	has_columns_with_spatial_data_types
Migration Methods:	DATAPUMP,DATAPUMP_DBLINK,GOLDENGATE
Failure Impact:	Not all the functionality associated with these Spatial objects is available on ADBS until the JAVAVM feature is enabled on ADBS.
Scope:	SCHEMA
Executed SQL:	SELECT OWNER, TABLE_NAME, COLUMN_NAME, DATA_TYPE FROM SYS.DBA_TAB_COLUMNS WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_RE AND DATA_TYPE IN ('SDO_PC','SDO_TIN','SDO_TOPO_GEOMETRY') AND DATA_TYPE_OWNER IN ('MDSYS','PUBLIC') ORDER BY 1,2,3

CPAT | Index Organized Tables

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

Review Suggested

Solution

No action required. Table simply gets created as non-IOT without any error.

Check Name

`has_index_organized_tables`

Index Organized Tables

Description:	Index Organized tables are not allowed in Autonomous databases.
Action:	No action require as the tables gets created as non-IOT (regular table).
Hide Details	
Name:	has_index_organized_tables
Migration Methods:	DATAPUMP;DATAPUMP_DBLINK;GOLDENGATE
Failure Impact:	Index-organized tables are not supported, but attempting to create one does not generate an error. Instead, a heap-organized table with a primary
Scope:	SCHEMA
Executed SQL:	SELECT OWNER, TABLE_NAME FROM SYS.DBA_ALL_TABLES WHERE OWNER NOT IN ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_LISTENER','APEX_PUBLIC_USER','APEX_RE AND IOT_TYPE='IOT' AND TABLE_NAME NOT LIKE 'AQ$%' AND TABLE_NAME NOT LIKE 'DR$%' AND TABLE_NAME NOT LIKE 'DM$%' ORDER B

Relevant Objects (2 relevant objects)

OWNER	TABLE_NAME
HR	COUNTRIES
MYAPP	LOCATIONS

CPAT | Logging off for tables

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Additional Tasks

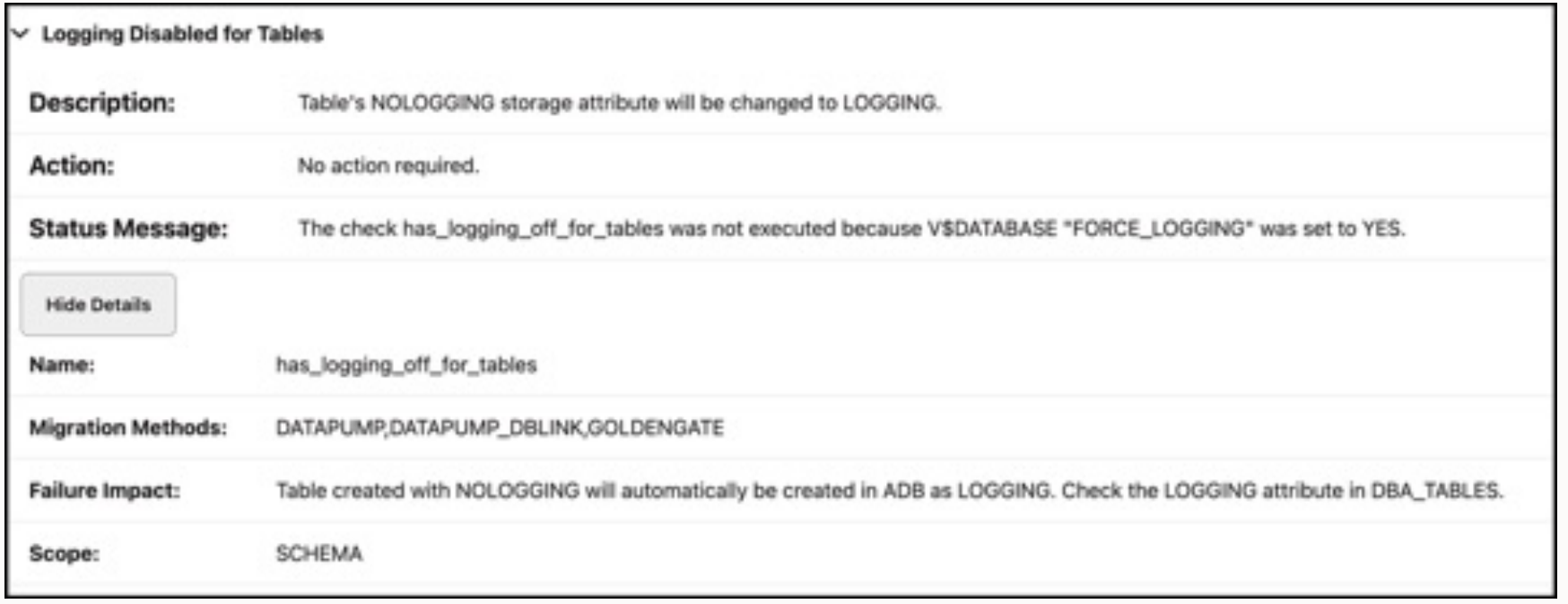
Review Suggested

Solution

No action required. Table with logging OFF will automatically created with logging without an error.

Check Name

`has_logging_off_for_tables`



CPAT | Unsupported tables over DB Link

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Migration Method

Action Required

Solution

Use Data Pump without NETWORK_LINK.

Check Name

`has_tables_that_fail_with_dblink`

Data Pump NETWORK_LINK Tables

Description:	Tables with LONG/LONG RAW data types may not migrate over a NETWORK_LINK with Data Pump.
Action:	Use Data Pump without NETWORK_LINK. If using NETWORK_LINK is absolutely required then also using ACCESS_METHOD=DIRECT_PATH may also be necessary. See Oracle Support Document ID 552424.1 for more information on how ACCESS_METHOD use. See Oracle Support Document ID 1947791.1 for more information on potential NETWORK_LINK issues.

Hide Details

Name:	has_tables_that_fail_with_dblink
Migration Methods:	DATAPUMP_DBLINK
Failure Impact:	Applications relying on tables with LONG data types may fail.
Scope:	SCHEMA
Executed SQL:	WITH EXPORT_FAILS AS (SELECT TC1.OWNER AS OWNER ,TC1.TABLE_NAME AS TABLE_NAME ,TC1.COLUMN_NAME LONG_COLUMN ,TC1.DAT ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_050100','APEX_180100','APEX_180200','AP AND TC1.DATA_TYPE IN('LONG','LONG RAW')), IMPORT_EXPORT_FAILS AS (SELECT TC1.OWNER ,TC1.TABLE_NAME ,TC2.COLUMN_NAME ,TC2 ('ANONYMOUS','APEX_030200','APEX_040000','APEX_040100','APEX_040200','APEX_050000','APEX_050100','APEX_180100','APEX_180200','AP AND TC1.OWNER = TC2.OWNER AND TC1.TABLE_NAME = TC2.TABLE_NAME AND TC1.DATA_TYPE IN('LONG','LONG RAW') AND (TC2.DATA_TYP

XML

Can you migrate XML objects and schemas?

Having XML types, schemas and objects can become problematic in ADB migrations

- Missing features may be available in the future

```
Processing object type SCHEMA_EXPORT/TABLE/TABLE
ORA-39151: Table "APPUSER"."EXT_MIN" exists. All dependent metadata and data will be skipped due
to table_exists_action of skip

ORA-39083: Object type TABLE:"APPUSER"."XML_CLOB_TABLE" failed to create with error:
ORA-01031: insufficient privileges

Failing sql is:
CREATE TABLE "APPUSER"."XML_CLOB_TABLE" OF XMLTYPE  OID '3360C921F83D3D3DE063A54F4664798A'
  SEGMENT CREATION IMMEDIATE  XMLTYPE STORE AS SECUREFILE CLOB ( TABLESPACE "USERS" ENABLE
STORAGE IN ROW CHUNK 8192 NOCACHE LOGGING  NOCOMPRESS  KEEP_DUPLICATES  STORAGE(INITIAL 106496
NEXT 1048576 MINEXTENTS 1 MAXEXTENTS 2147483645 PCTINCREASE 0 BUFFER_POOL DEFAULT FLASH_CACHE
DEFAULT CELL_FLASH_CACHE DEFAULT)) PCTFREE 10 PCTUSED 40 INITRANS 1 MAXTRANS 255  NOCOMPRESS
LOGGING STORAGE(INITIAL 65536 NEXT 1048576 MINEXTENTS 1 MAXEXTENTS 2147483645 PCTINCREASE 0
FREELISTS 1 FREELIST GROUPS 1 BUFFER_POOL DEFAULT FLASH_CACHE DEFAULT CELL_FLASH_CACHE DEFAULT)
TABLESPACE "USERS"
```

XMLType Table vs Column

```
SQL> CREATE TABLE
MYXMLTABLE1 OF XMLTYPE;
```

```
SQL> CREATE TABLE
MYXMLTABLE2 (C1 XMLTYPE);
```

CPAT | XML Type Tables

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

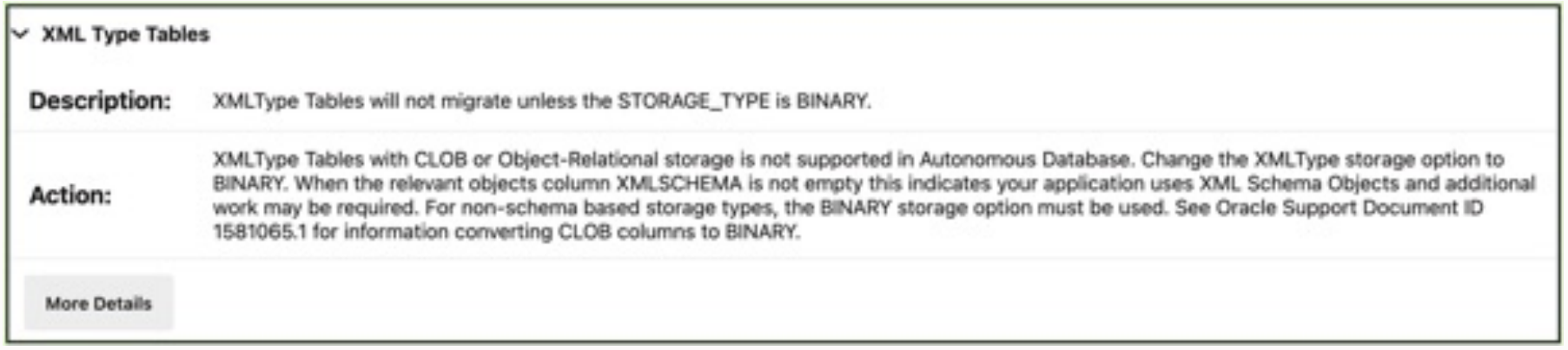
Action Required

Solution

Convert CLOB or Object-Relational storage to BINARY. See MOS Note 1581065.1.

Check Name

`has_xmltype_tables`



Solution?

Convert CLOB or Object-Relational storage to BINARY

- MOS Note 1581065.1
- CLOB storage was deprecated on 12.1

Import using:

- `TRANSFORM=SEGMENT_ATTRIBUTES:N` or
- `TRANSFORM=XMLTYPE_STORAGE_CLAUSE:\"BINARY XML\"`

TRANSPORTABLE BINARY XML

- New storage type `TRANSPORTABLE BINARY XML`
- Backported to 19c/21c in Cloud deployments
- Self-contained binary format.
  - Does not store the metadata used to encode or decode XML data in a central table.
  - Simplifies the XML data storage and makes it easier to transport.
- Default on 23ai when `COMPATIBLE = 23.0.0.0`

XML Type Columns need to be handled the same way as XML Type Tables

- Convert columns to binary XML type

CPAT | XML Type Columns

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

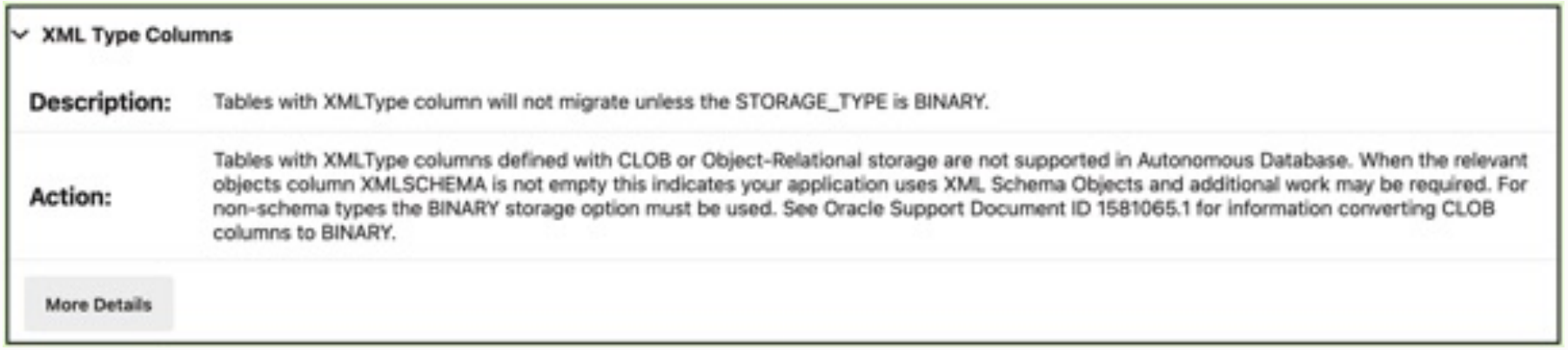
Action Required

Solution

Convert CLOB or Object-Relational storage to BINARY. See MOS Note 1581065.1.

Check Name

`has_tables_with_xmltype_column`



CPAT | Unstructured XML Indexes

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

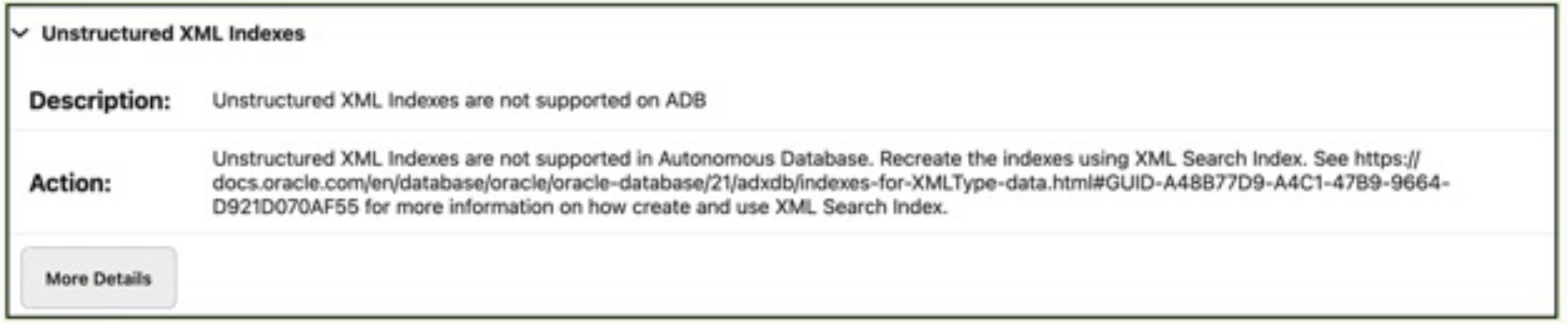
Review Required

Solution

Convert to XML Search Indexes. Follow the documentation link for further instructions.

Check Name

`has_unstructured_xml_indexes`



Solution?

Convert to XML Search Indexes

- https://docs.oracle.com/en/database/oracle/oracle-database/23/adxdb/Indexing_XML_Data_Full-Text_Queries.html

Unstructured XML Indexes are deprecated starting with Oracle 23ai

- Superseded by XML Search Indexes

XML schemas are not supported in ADB

- They must be dropped
- Support may be added later

CPAT | XML Schema Objects

Oracle Autonomous Database

Serverless

Dedicated

Cloud Premigration Advisor Tool

Target Database

Action Required

Solution

Convert CLOB or Object-Relational storage to BINARY. See MOS Note 1581065.1.

Check Name

`has_xmlschema_objects`

Solution?

XML schemas must be dropped

How to safely drop an XML schema?

1. Check for dependencies
   - `ALL_XML_TABLES WHERE XMLSCHEMA = '...'`
   - `ALL_XML_TAB_COLS WHERE XMLSCHEMA = '...'`
2. Migrate XMLType storage to unstructured format if needed
3. Backup XML data before making changes
4. Drop an XMLSchema

```
BEGIN
    DBMS_XMLSCHEMA.DELETESCHEMA('http://example.com/myschema.xsd');
END;
/
```


Wrapping Up

Try it out, please!!

- We are looking for reference customers
- Get in touch with us

Let's Do This Together

1 PLANNING

2 PREPARING

3 MIGRATING

June 5, 15:00 CET
Sign up

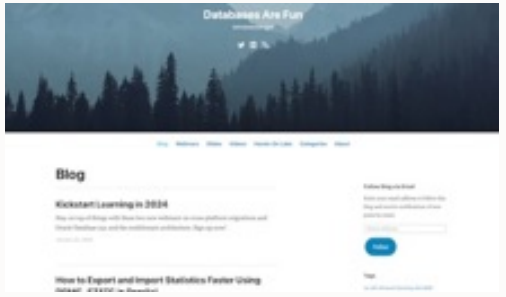
4 OPERATING

July 10, 15:00 CET
Sign up

Find Slides and Much More on Our Blogs

MikeDietrichDE.com

Mike.Dietrich@oracle.com



dohdatabase.com

Daniel.Overby.Hansen@oracle.com

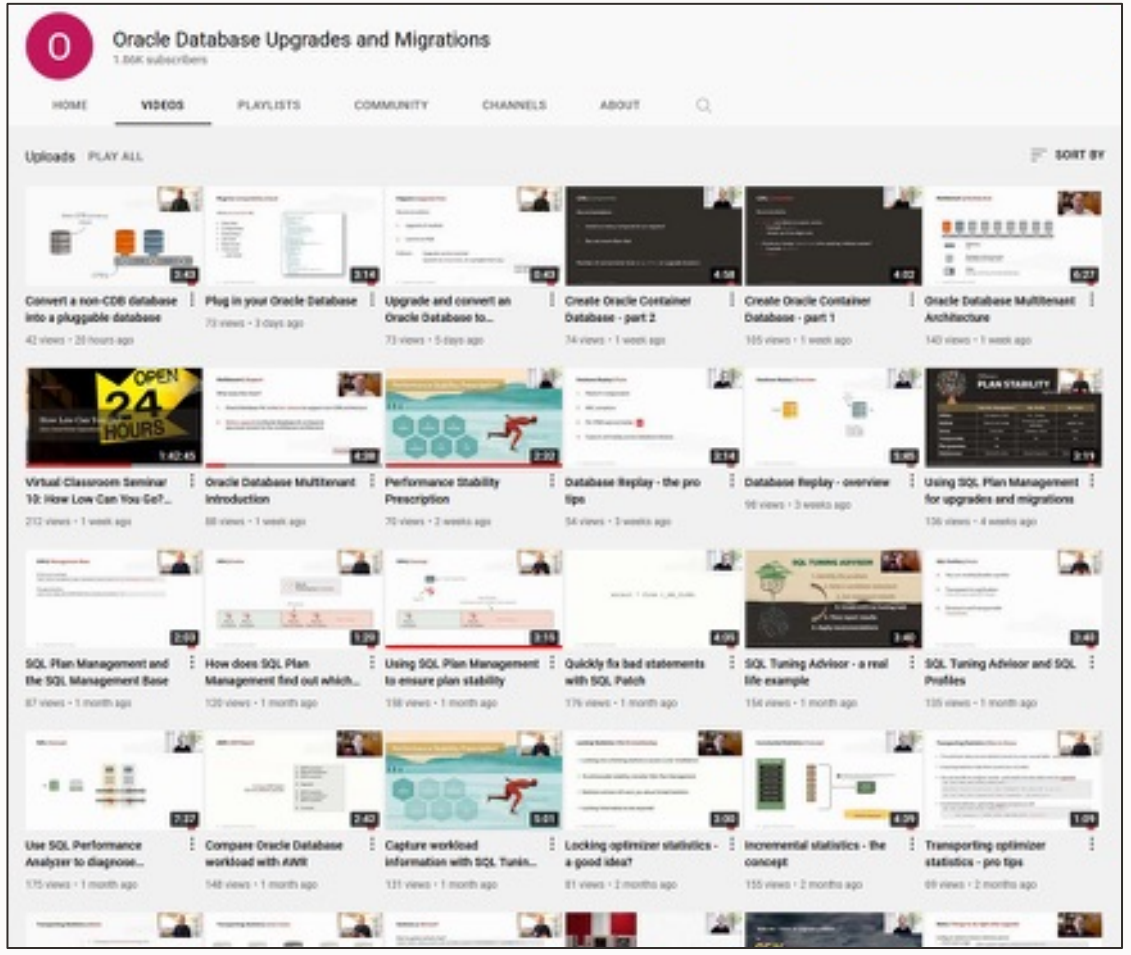
DBArj.com.br

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

SCAN ME

Thank You