

Migration to Oracle 23ai

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Oracle ACE
Pro

... about me

Oracle-Specialist since 1992

- 7 years: Presales at Oracle in Düsseldorf
- 6 years: Project Manager at Herrmann & Lenz Services GmbH
- 6 years: Technischer Direktor ADM Presales at Quest Software GmbH
- For 12 years: Managing Director at CarajanDB GmbH
- 2011: Designated as Oracle ACE
- 2019: DOAG Ambassador



Author of the several books:

- Oracle9i, Oracle10g, Oracle 11g Release 2 für den DBA

Hobbies:

- Kiting, both outdoors and indoors
- Motorcycling
- Singing in a choir
- Brewing beer



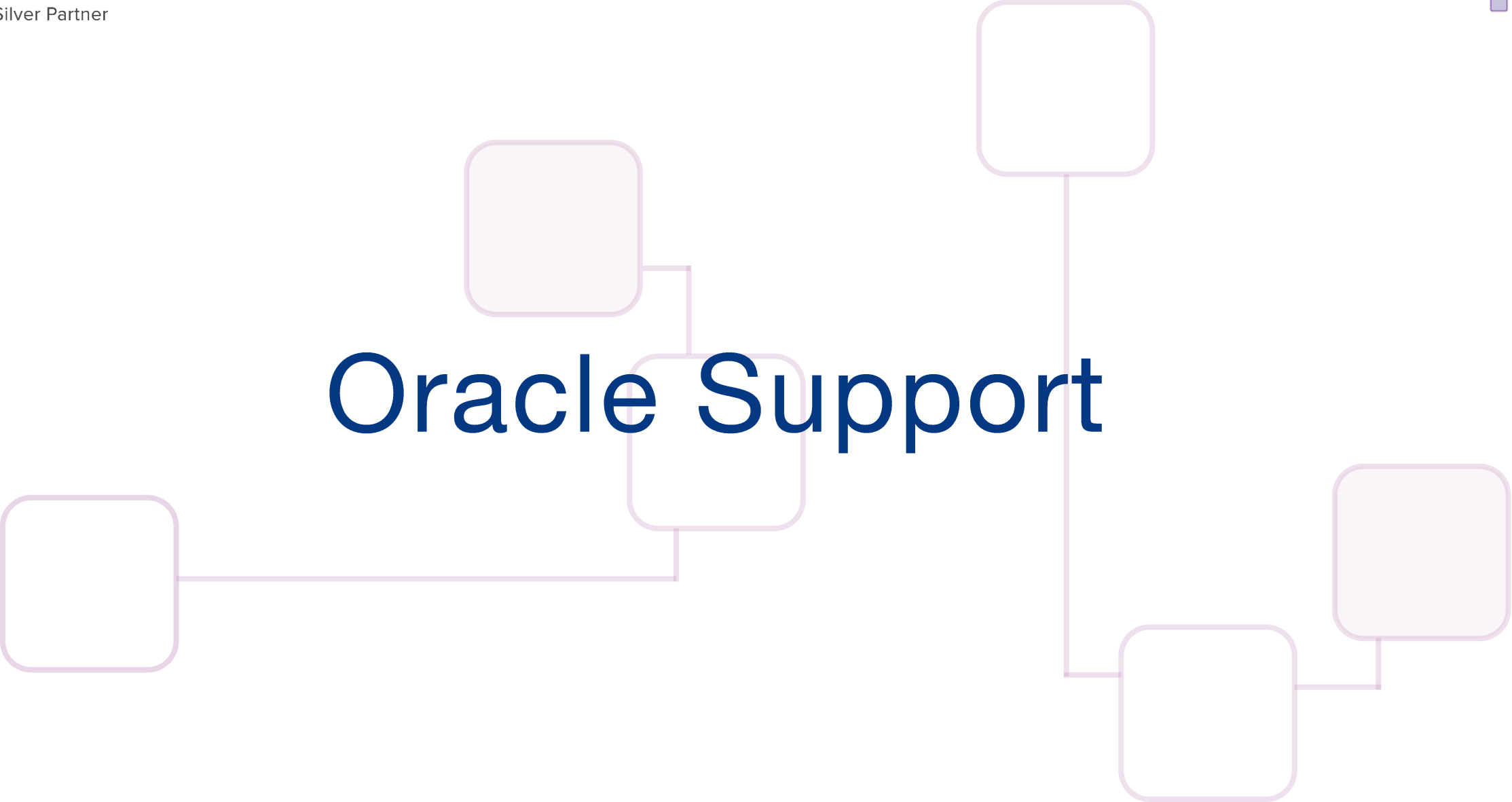
Oracle 23ai Enterprise Edition

Disclaimer

- The version has been available in OCI Cloud since March 2, 2024.
- All slides and statements refer to version 21c and earlier.
- Features of Oracle 23ai that are officially known at the time of the presentation (e.g., Oracle23aiFREE) will be introduced.



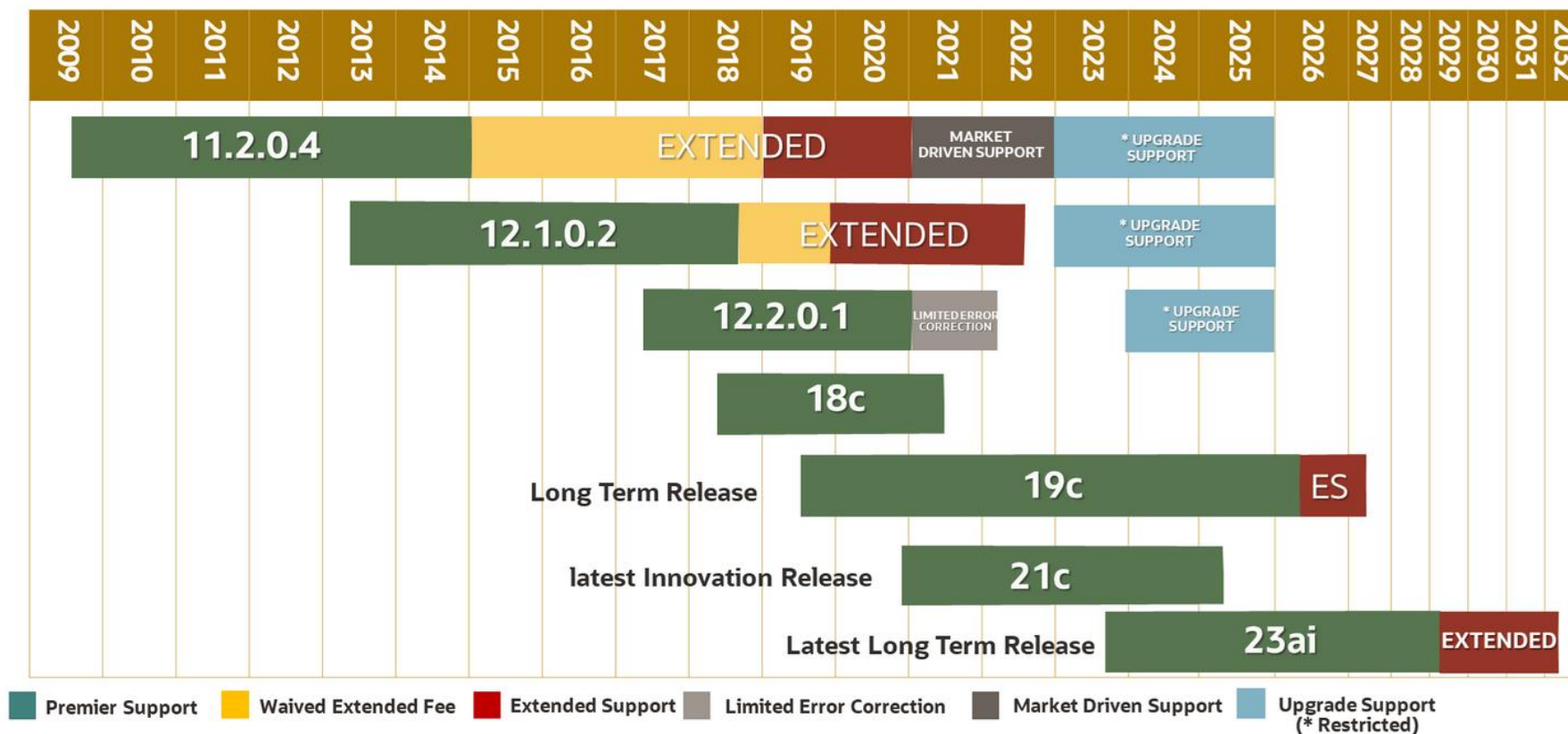
Oracle Support



Oracle Support

Release Schedule of Current Database Releases (Doc ID 742060.1)

Database Releases and Support Timelines



19c Long Term Support Release

- Premier Support (PS) ends April 30, 2026.
- Extended Support (ES) will be May 01, 2026 through April 30, 2027
- Error Correction / Patching is available through April 30, 2027 with paid ES. Without paid ES, patching is only available until April 30, 2026

Release Cycle

- Innovation Release:
 - new Features
 - no Extended Support
 - first used in 18c
 - 21c
- Terminal Release
 - final release of a cycle
 - 11.2.0.4 and 12.1.0.2
- Long Term Support Release
 - new name for Terminal Release
 - 19c and 23ai



Long Term or Innovation Release

- Long Term Release:
 - *Oracle Database Long Term Releases are ideal for use cases that benefit from less frequent upgrades to newer releases. Long Term Releases offer the highest level of stability and the longest length of error correction support. These releases have 5 years of Premier Support followed by 3 years of Extended Support. When combined with Extended Support, customers typically have almost 4 years to upgrade from one Long Term Release to the next Long Term Release.*
- Innovation Release:
 - *In between Oracle Database Long Term Releases, Oracle delivers Oracle Database Innovation Releases that include many enhancements and new capabilities which will also be included in the next Long Term Release. Innovation Releases are designed to enable customers to continuously use leading-edge technologies to rapidly develop or deploy new applications or augment existing applications. Support for Innovation Releases includes 2 years of Premier Support, but there is no Extended Support. Production workloads can be deployed on Innovation Releases if upgrading within 2 years to a newer release is factored into the deployment plan.*

... but

- + Security
- [2 New Features in 19c Release Updates](#)
- Release Update 19.7 Features
 - SQL Macros (SQM)
- Release Update 19.8 Features
 - Database In-Memory Base Level
 - CellMemory Level
- Release Update 19.9 Features
 - Oracle Grid Infrastructure SwitchHome
 - Support for DBMS_CRYPT0 Asymmetric Key Operations
- Release Update 19.10 Features
 - DBMS_CLOUD Package
 - New Database Initialization Parameters for Database Resident Connection Pooling (DRCP)
 - Oracle Blockchain Table
 - Oracle Instant Client Support for Linux for ARM
 - Support Per-PDB Capture for Oracle Autonomous Database
- Release Update 19.11 Features
 - Application Continuity Protection Check
 - Immutable Tables
 - New Database Initialization Parameter and View for Database Resident Connection

2 New Features in 19c Release Updates < >

This chapter describes the features that are new in Oracle Database 19c Release Updates (RUs).

Oracle Blockchain Table

Oracle Blockchain Table



Blockchain tables are append-only tables in which only insert operations are allowed. Deleting rows is either prohibited or restricted based on time. Rows in a blockchain table are made tamper-resistant by special sequencing and chaining algorithms. Users can verify that rows have not been tampered. A hash value that is part of the row metadata is used to chain and validate rows.

Blockchain tables can be used to implement blockchain applications where the participants trust the Oracle Database provider, but want means to verify that their data hasn't been tampered with. The participants are different database users who trust the Oracle Database provider to maintain a verifiable, tamper-resistant blockchain of transactions. All participants must have privileges to insert data into the blockchain table. The contents of the blockchain table are defined and managed by the application, with a few added metadata fields maintained by Oracle Database. By leveraging a trusted provider with verifiable crypto-secure data management practices, such applications can avoid the distributed consensus requirements. This provides most of the protection of the distributed peer-to-peer blockchains, but with much higher throughput and lower transaction latency compared to peer-to-peer blockchains using distributed consensus.

new in 19.9.0.0.201020

Password Rollover

Gradual Database Password Rollover for Applications



Starting with this release update, an application can change its database passwords without an administrator having to schedule downtime.

To accomplish this, a database administrator can associate a profile having a non-zero limit for the `PASSWORD_ROLLOVER_TIME` password profile parameter, new with this release, with an application schema. This allows the database password of the application user to be altered while allowing the older password to remain valid for the time specified by the `PASSWORD_ROLLOVER_TIME` limit. During the rollover period of time, the application instance can use either the old password or the new password to connect to the database server. When the rollover time expires, only the new password is allowed.

Before this enhancement, an administrator normally took the application down when the application database password was being rotated. This is because the password update requires changes on both the database and the application side. With the gradual database password rollover enhancement, the application can continue to use the older password until the new password is configured in the application.

In addition to the new clause `PASSWORD_ROLLOVER_TIME` in the `CREATE PROFILE` and `ALTER PROFILE` statements, the `ALTER USER` statement has a new clause, `EXPIRE PASSWORD ROLLOVER PERIOD`. The `ACCOUNT_STATUS` column of the `DBA_USERS` and `USER_USERS` data dictionary views have several new statuses indicating values to indicate rollover status.

new in 19.12.0.0.210719



What about Oracle Standard Edition 2?

The Proof

```
SQL*Plus: Release 21.0.0.0.0 - Production on Tue May 14 10:29:08 2024  
Version 21.3.0.0.0
```

```
Copyright (c) 1982, 2021, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 23ai Standard Edition 2 Release 23.0.0.0.0 - Production  
Version 23.4.0.24.05
```

```
SQL> SELECT sysdate;
```

```
SYSDATE
```

```
-----  
14-MAY-24
```

Oracle 23ai Standard Edition

- Available in OCI
- Now usable for ODA X-10
 - Special Agreement:
„For the purposes of licensing Oracle Database Standard Edition 2 on Oracle Database Appliance running multi-chip modules, where each chip in a multi-chip module is counted as an occupied socket for licensing purposes, you may exceed the 2 sockets per server limit. Oracle Database Standard Edition 2 requires one processor license for every 8 enabled cores on Oracle Database Appliance running multi-chip modules. If the number of enabled cores is not divisible by 8, the quotient must be rounded up to the nearest whole number to determine the number of Oracle Database Standard Edition 2 processor licenses required.“

Quelle: <https://docs.oracle.com/en/engineered-systems/oracle-database-appliance/19.22/cmtli/oracle-database-appliance-licensing-overview.html>

23ai New Features



SQL*Plus Enhancements

Oracle Error Tool OERR in SQL*Plus :

```
SQL> oerr ora 1555
Message: "snapshot too old: rollback segment number %s with name \"%s\" too small"
Cause: rollback records needed by a reader for consistent read are
       overwritten by other writers
Action: If in Automatic Undo Management mode, increase undo_retention
       setting. Otherwise, use larger rollback segments
```

TNSPing in SQL*Plus as „ping“:

```
SQL> ping JOHANNES
SQL> Network service name mapping file:
/u01/app/oracle/product/23aise/dbhome_1/network/admin/tnsnames.ora
Attempting to contact: (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP) (HOST = ...) (PORT =
1521)) (CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = ...)))
SP2-1683: Ping failed with error TNS-12543.
Help: https://docs.oracle.com/error-help/db/sp2-1683/
```


Priority Transactions (1)

- Allows assigning a priority to transactions.
- Allows high-priority transactions to terminate low-priority transactions.
 - Controlled by system parameter „txn_auto_rollback_high_priority_wait_target
Session Parameter „txn_priority = (LOW|MEDIUM|HIGH)”
 - Useful in blocking sessions, row locks, etc.
 - The terminated transaction will be rolled back.
 - Generates an alert log entry in the following format:

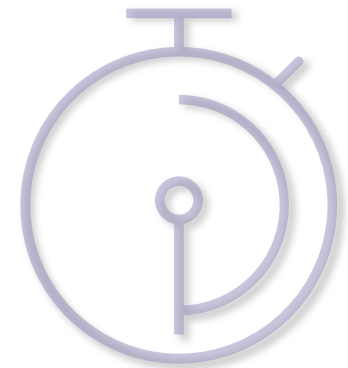
```
PDB(#):Sessioninformationen(...txn_priority:"LOW") terminated by  
Sessioninformationen(...txn_priority:"HIGH"...) because of the parameter  
"txn_auto_rollback_high_priority_wait_target = 20
```

Priority Transactions Example (1)

- Adjusting the parameter
- Timeout 30 Seconds

```
SQL> ALTER SESSION SET container=CARLOS;  
Session altered.
```

```
SQL> ALTER SYSTEM SET txn_auto_rollback_high_priority_wait_target = 30;  
System altered.
```



Priority Transactions Example (2)

Session 1

```
ALTER SESSION SET txn_priority=MEDIUM;
Session altered.
```

```
UPDATE customers SET firstname = 'ANTONY'
WHERE custid=100005;
```

1 row updated.

Elapsed: 00:00:00.00

```
SELECT firstname FROM customers
WHERE persid=100005;
```

```
ERROR at line 1:
ORA-03113: end-of-file on communication
channel
Process ID: 4132Session ID: 299 Serial
number: 29547
```

Session 2

```
UPDATE customers SET firstname = 'Berta'
WHERE custid=100005;
```

1 row updated.

Elapsed: 00:00:30.02

```
SELECT firstname FROM customers
WHERE persid=100005;
```

```
FIRSTNAME
```

```
-----
```

```
Berta
```

Priority Transactions Example (3)

Alert File:

```
2023-11-17T15:47:18.956730+01:00
```

```
CARLOS(3):Session (sid: 299, serial: 29547, xid: 3.12.580, txn_priority: "MEDIUM")  
terminated by transaction (sid: 46, serial: 2931, xid: -1.-1.-1, txn_priority: "HIGH")  
because of the parameter "txn_auto_rollback_high_priority_wait_target = 30"
```

Container Native

- Natively containerized through the Oracle Database Operator for Kubernetes.
- Linking the advantages of containers with Oracle's performance without manual tweaking.
- Anyone familiar with Kubernetes and similar tools will find their way around:
<https://github.com/oracle/oracle-database-operator>
- Those who don't:
<https://blogs.oracle.com/coretec/post/oracle-database-jetzt-containernative>

Read Only Oracle Home

introduced in 18c

default in 21c

optional in 23ai

- Oracle Homes include executable configuration and log files.
- Read-Only Homes separate these into their own directories.
 - Easier patching, configuring, etc.
 - Increased security
- The feature works flawlessly but is no longer the default.

Read Only Oracle Home

- Enabled with the following command

```
$ $ORACLE_HOME/bin/roohctl -enable
Enabling Read-Only Oracle home.
Update orabasetab file to enable Read-Only Oracle home.
Orabasetab file has been updated successfully.
Create bootstrap directories for Read-Only Oracle home.
Bootstrap directories have been created successfully.
Bootstrap files have been processed successfully.
Read-Only Oracle home has been enabled successfully.
Check the log file /u01/app/oracle/cfgtoollogs/roohctl/roohctl-
210726PM023845.log for more details.
```

- Can only be executed if no database or listener is associated with this **ORACLE_HOME**

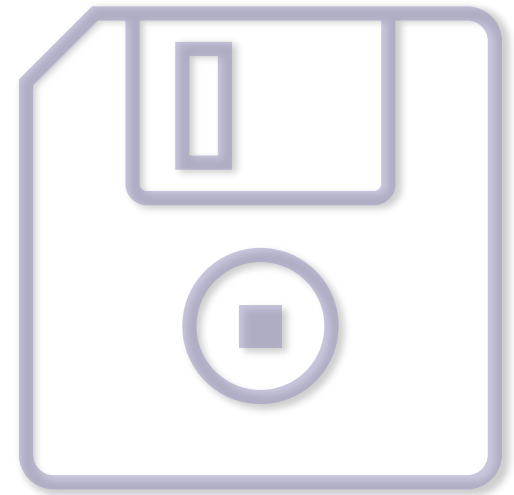
New Directory layout

```
$ cd /u01/app/oracle
$ tree dbs homes
dbs
homes
├── OraDB19Home1
│   ├── assistants
│   │   └── dbca
│   │       └── templates
│   ├── dbs
│   ├── install
│   ├── network
│   ├── admin
│   ├── log
│   └── trace
├── rdbms
│   ├── audit
│   └── log
└──
```

13 directories, 0 files

Backup

- Immutable RMAN Backups for OCI
 - Enables protection of backups in OCI.
 - Backup files are immutable and cannot be deleted for a chosen period.
 - Not even by administrators!
- Better integration for highly available environments.



Security Features (1)

- Schema Privileges

- ermissions can finally be granted on a schema basis
- Example:

```
GRANT SELECT ANY TABLE ON SCHEMA Fabian TO Johannes;
```

- SQL Firewall

- Inspects all incoming SQL statements.
- Only allows explicitly permitted SQL.
- SE2 probably not, as it's an option.
- Build into the Oracle Kernel



Security Features (2)

- Maximum password length now 1024 Bytes
 - Currently only 30 Byte
- Database support for TLS 1.3



SQL Features – Farewell DUAL

- Select without „FROM“
 - no need for „DUAL“

```
SQL> SELECT SYSDATE;
```

```
SYSDATE
-----
17-NOV-23
```

- IF [NOT] EXISTS for DDL

```
SQL> CREATE TABLE blub1 (ID NUMBER);
Table created.
```

```
SQL> CREATE TABLE IF NOT EXISTS blub1
      (ID NUMBER, BERMERKUNG VARCHAR2(20));
Table created.
```

```
SQL> desc blub1
```

Name	Null?	Type
ID		NUMBER

IF [NOT] EXISTS

```
SQL> CREATE TABLE quest1 (ID NUMBER);  
Table created.
```

```
SQL> CREATE TABLE IF NOT EXISTS quest1  
      (ID NUMBER, DESCRIPTION VARCHAR2(20));  
Table created.
```

```
SQL> desc quest1  
Name                Null?      Type  
-----  
ID                   NUMBER
```

```
SQL> DROP TABLE quest1;  
Table dropped.
```

```
SQL> DROP TABLE quest1;  
Table dropped.
```

Lockfree Reservations

```
SQL> CREATE TABLE myseq (  
    id NUMBER CONSTRAINT id_pk PRIMARY KEY,  
    myvalue NUMBER RESERVABLE CONSTRAINT myvalue_ck NOT NULL);
```

Table created.

Session 1

```
UPDATE myseq  
  SET myvalue= myvalue+1  
WHERE id=1;
```

1 row updated.

Session 2

```
UPDATE myseq  
  SET myvalue= myvalue+1  
WHERE id=1;
```

1 row updated.

Session 3

```
UPDATE myseq  
  SET myvalue= myvalue+1  
WHERE id=1;
```

1 row updated.

Spatial and Graph Data

Available without extra cost in all Editions

Table 1-13 Spatial and Graph Data

Feature / Option / Pack	XE	SE2	EE	EE-ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS /CC	Notes
Oracle Spatial and Graph	Y	Y	Y	Y	Y	Y	Y	Y	Y	Oracle Spatial and Graph no longer requires an extra cost license. See Oracle Database Insider blog post for more information.
Property Graph and RDF Graph Technologies (RDF/OWL)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Property Graph and RDF Graph Technologies (RDF/OWL) no longer requires an extra cost license. See Oracle Database Insider blog post for more information.

Machine Learning

Available without extra cost in all Editions

Feature / Option / Pack	XE	SE2	EE	EE-ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS /CC	Notes
Oracle Machine Learning (formerly Advanced Analytics)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Oracle Machine Learning no longer requires an extra cost license. See Oracle Database Insider blog post for more information.

Encryption

Native network encryption and services, such as Kerberos, are now part of all licensed Oracle databases and no longer require Advanced Security.

Oracle Wallet

An Oracle Wallet is a PKCS#12 container used to store authentication and encryption keys. The Oracle database secure external password store feature stores passwords in an Oracle Wallet for password-based authentication to the Oracle database. The Oracle Wallet may also be used to store credentials for PKI authentication to the Oracle Database, configuration of network encryption (SSL/TLS), and Oracle Advanced Security transparent data encryption (TDE) master encryption keys. Network encryption (native network encryption, network data integrity, and SSL/TLS) and strong authentication services (Kerberos, PKI, and RADIUS) are no longer part of Oracle Advanced Security and are available in all licensed editions of all supported releases of Oracle Database.

Migration and Upgrade

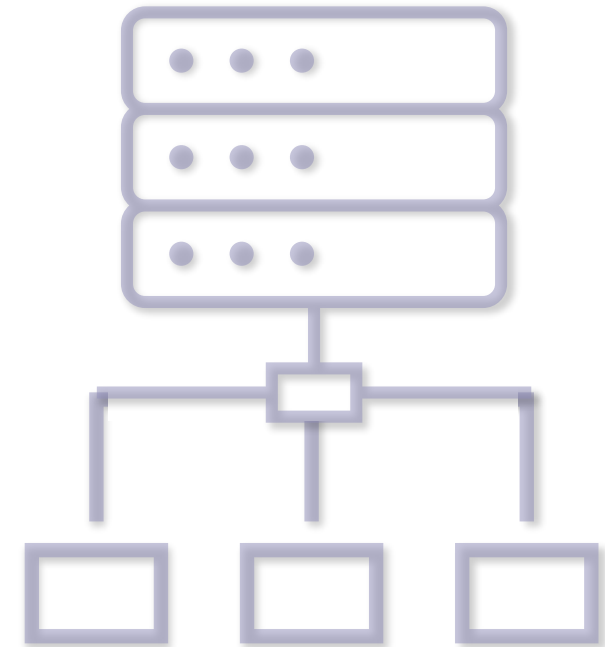


Multitenant Architecture (1)

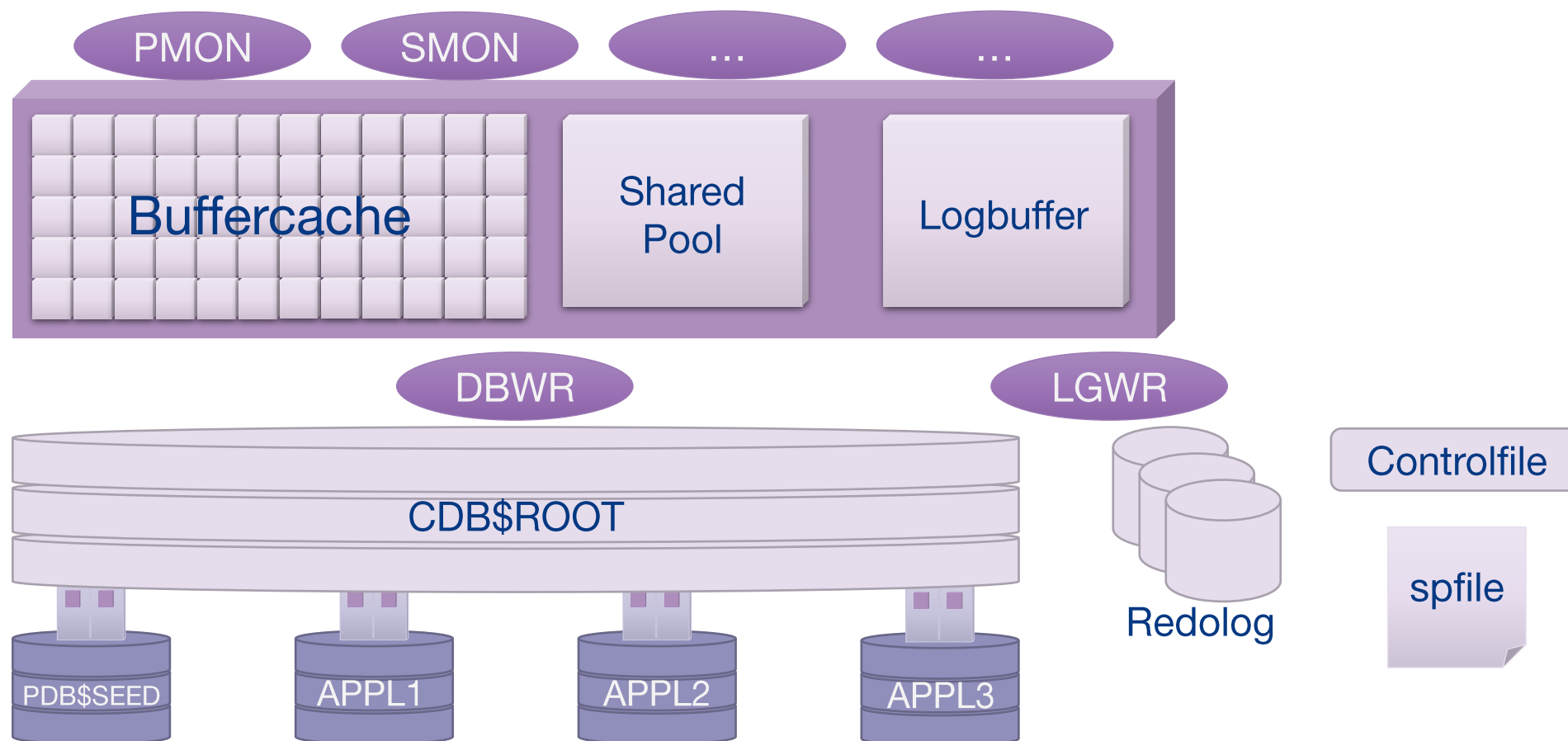
Announced for years, it is now here:

Multitenant is mandatory, NON-CDB is desupported and is no longer possible

- Since the Innovation Release 21c
- you can still have 3 PDBs at no additional cost
- with the Multitenant option allowing for a maximum of 254 PDBs per CDB



Multitenant Architecture (2)



Myths and Truths



New Paradigms for Rapid Patching and Upgrades

The investment of time and effort to patch one multitenant container database results in patching all of its many pluggable databases. To patch a single pluggable database, you simply unplug it to a multitenant container database at a different Oracle Database software version.

To upgrade all hosted pluggable databases in a container database, simply upgrade the container database and all hosted pluggable databases are upgraded 'in-place'.

To upgrade a single PDB, you simply unplug/plug the pluggable database in to a container database at a higher version and upgrade the pluggable database as described in the [Database Upgrade Guide](#).

ALTERNATIVE FACTS

Multitenant Migrationsprojekt

- Project duration min. 6 Month
 - New Views
 - New naming conventions
 - Modification for scripts
 - new Security rules (Common vs. Locale)
 - No simple `sqlplus / as sysdba`

```
SQL> SELECT * FROM cdb_pdbs;
```

```
PDBNAME=?  
CDBNAME=?
```

```
SELECT sum(bytes) FROM cdb_data_files
```

```
CREATE USER C##MYDBA ...
```

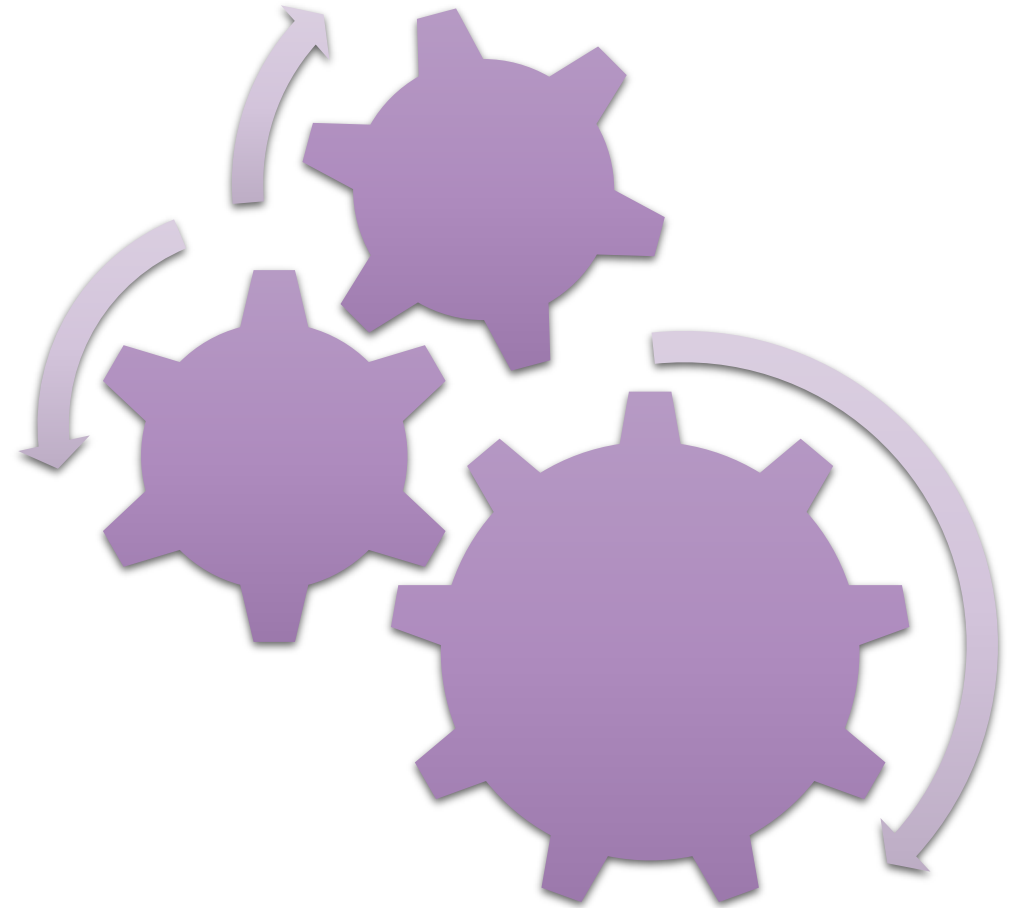
```
ALTER SESSION SET CONTAINER
```

Auto-Upgrade in 23ai (1)

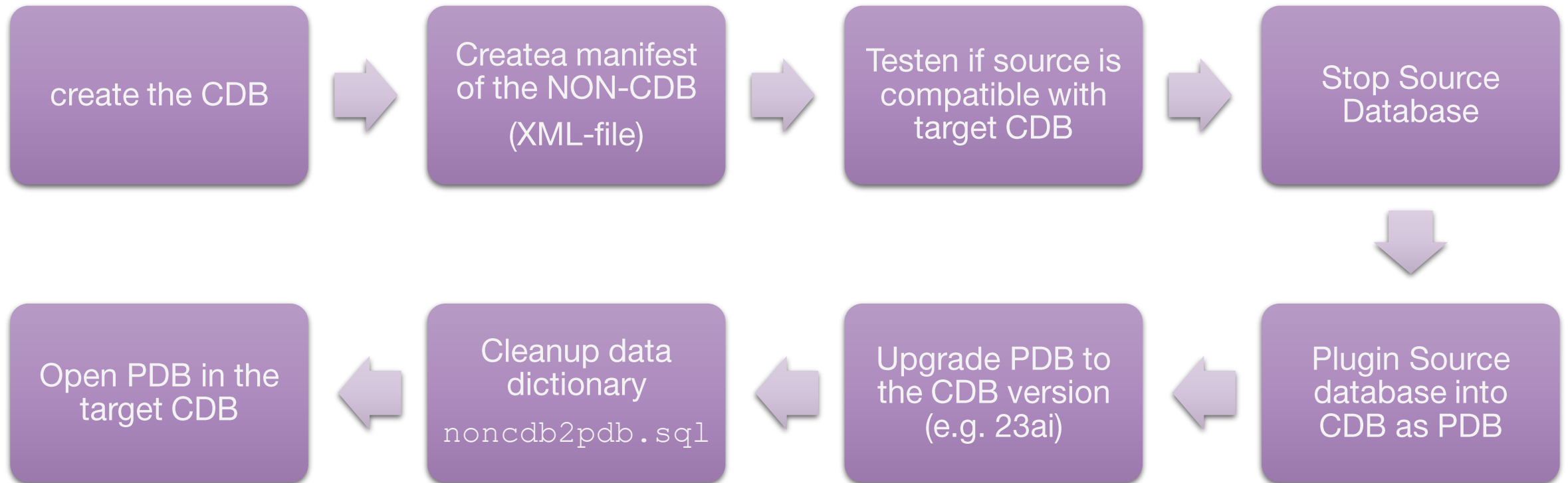
- The easiest Upgrade tool
 - For Multitenant migration
 - For Upgrades (to 23ai).
 - Out-of-Place Oracle Home Release Update Patching
- Allows automatic degree of parallelism (nur EE).
 - calculates available system resources (cpu, memory).
- dbua is deprecated with 23ai

Auto-Upgrade in 23ai (2)

- Unplug-Plugin of PDBs to a different server during Upgrades
 - the older version could only be used with migration on the same server
 - allows cloud migrations as well
- build in REST APIs
 - Oracle REST Data Services (ORDS)
 - Oracle Cloud Interface (OCI)

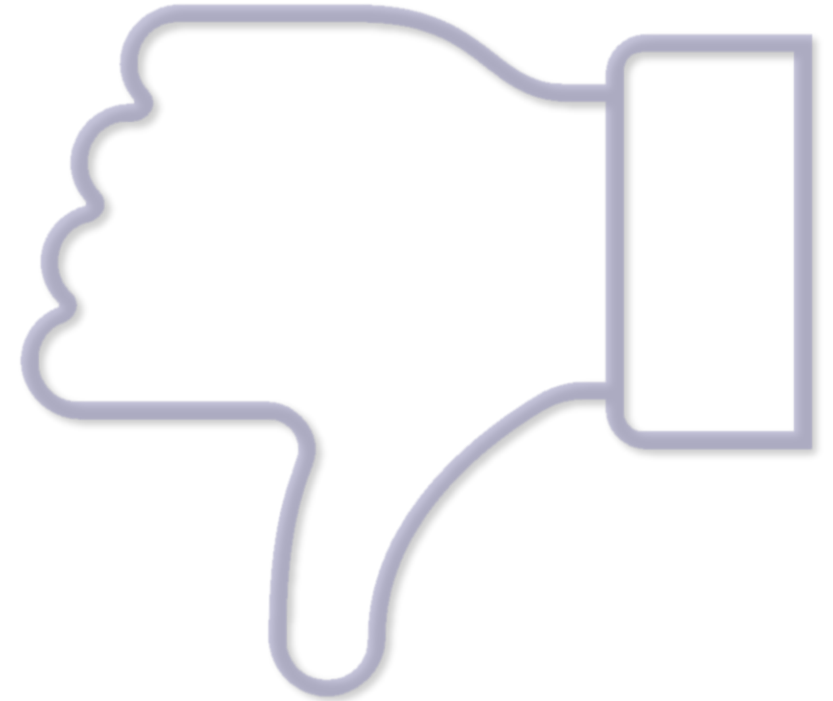


Migrationsphases



Disadvantages

- The database / PDB is not available during the upgrade procedure
- If you migrate the original source the rollback is time critical and costly
 - NON-CDB to PDB



Cloud Migration Advisor | New Project

Oracle Cloud Migration Advisor

mike.dietrich@oracle.com

Home

Guided Mode

Create Project

My Available Projects

Download Collectors

File Exchange with Custom...

REST Services

Help

Oracle Cloud Migration Advisor

Welcome to the Cloud Migration Advisor (CMA)

Oracle Cloud Migration Advisor brings you the expert technical knowledge of Oracle Database upgrade and migration development teams, combined with more than a century of combined real-world experience with customer migrations, to give your customer the **best possible migration advice**.

With **Guided Mode**, CMA will quickly tell you

- Which databases can be **most easily migrated** to Oracle Autonomous Database, or
- What is the **best migration method** to move chosen databases to a desired Oracle Cloud platform?

For more options, you can

- Create and configure migration scenarios using **Create Project**, or
- Access your existing migration projects and scenarios with **My Available Projects**.

Now it is time to start - let's move to the Oracle Cloud!

Guided Mode My Available Projects **Create New Project**

Cloud Migration Advisor | Solution - Methods

Migration Methods

<p>Data Pump Conventional Export/Import Complexity: 36 Downtime: Medium</p> <p>You can use this method regardless of the endian format and database character set of the source database. You can also use Data Pump to migrate data between different versions of Oracle Database. This method is simple to implement, provides the broadest cross-platform support and enables you to physically re-organize your target database.</p> <p><input type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>	<p>Data Pump Import with DBLink Complexity: 36 Downtime: Medium</p> <p>The Oracle Data Pump Import command-line mode NETWORK_LINK parameter enables an import from a source database identified by a valid database link. The data from the source database instance is written directly back to the connected database instance.</p> <p><input type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>	<p>Remote Cloning Non-CDB + Upgrade + Convert Complexity: Downtime: Medium</p> <p>Since Oracle 12.2.0.1 or higher (or with undo restrictions in 12.1.0.2 already), you have the freedom to plugin a non-CDB at first via a database link, and then upgrade and adjust it.</p> <p><input checked="" type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>
<p>Unplugging/Plugging Non-CDB + Upgrade + Convert Complexity: Downtime: Medium</p> <p>You can use the unplug/plugin method to migrate an Oracle Database non-CDB to a PDB. This method provides a way to consolidate several non-CDB databases into a single Oracle Database multitenant database on the Database service. Finally, you run dbupgrade to bring it to the target version.</p> <p><input type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>	<p>Data Pump Full Transportable Complexity: Downtime: Medium</p> <p>You can use the Data Pump full transportable method to copy an entire database from your on-premises host to the database on a Database service database deployment.</p> <p><input checked="" type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>	<p>Database Migration Workbench Physical Online Complexity: Downtime: Medium</p> <p>MWB uses RMAN Transportable Tablespace. TTS provides a Near Zero Downtime (NZDT) way to create a duplicate database from incremental backups of the source database while retaining the original target database.</p> <p><input type="checkbox"/> Select <input type="button" value="Read Instructions"/></p>

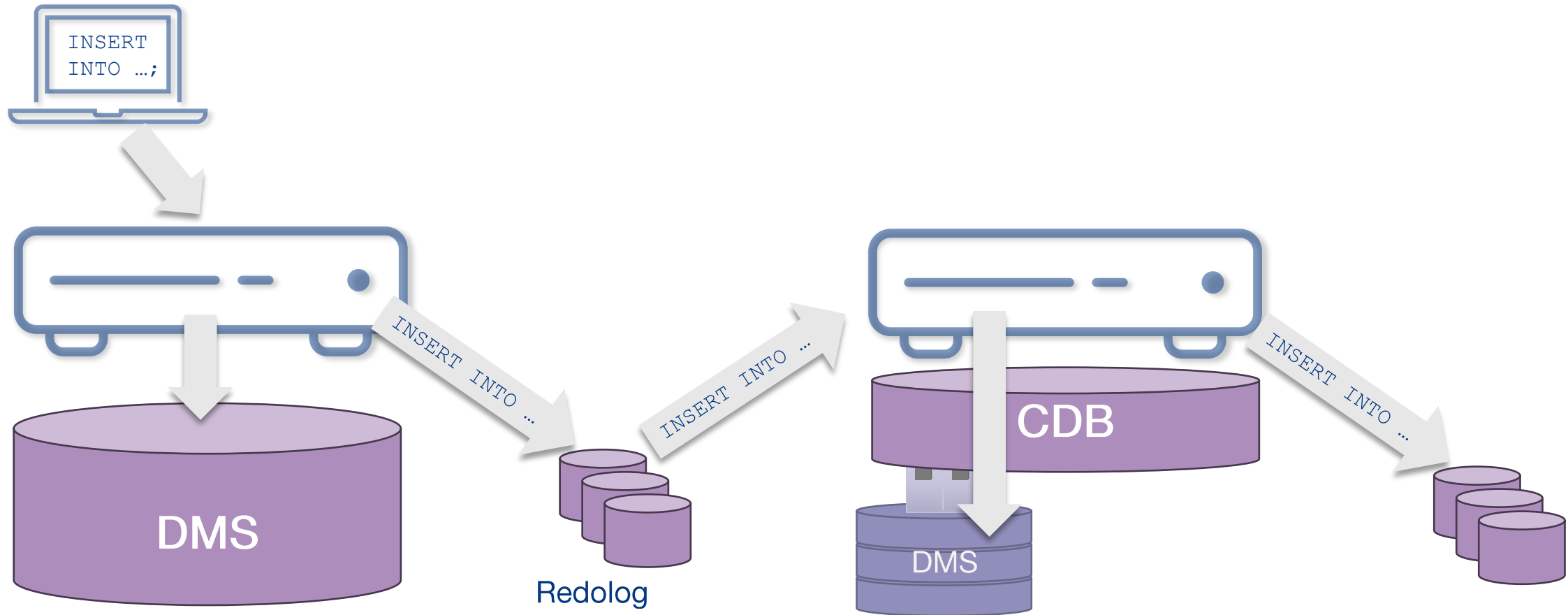


Minimum Downtime



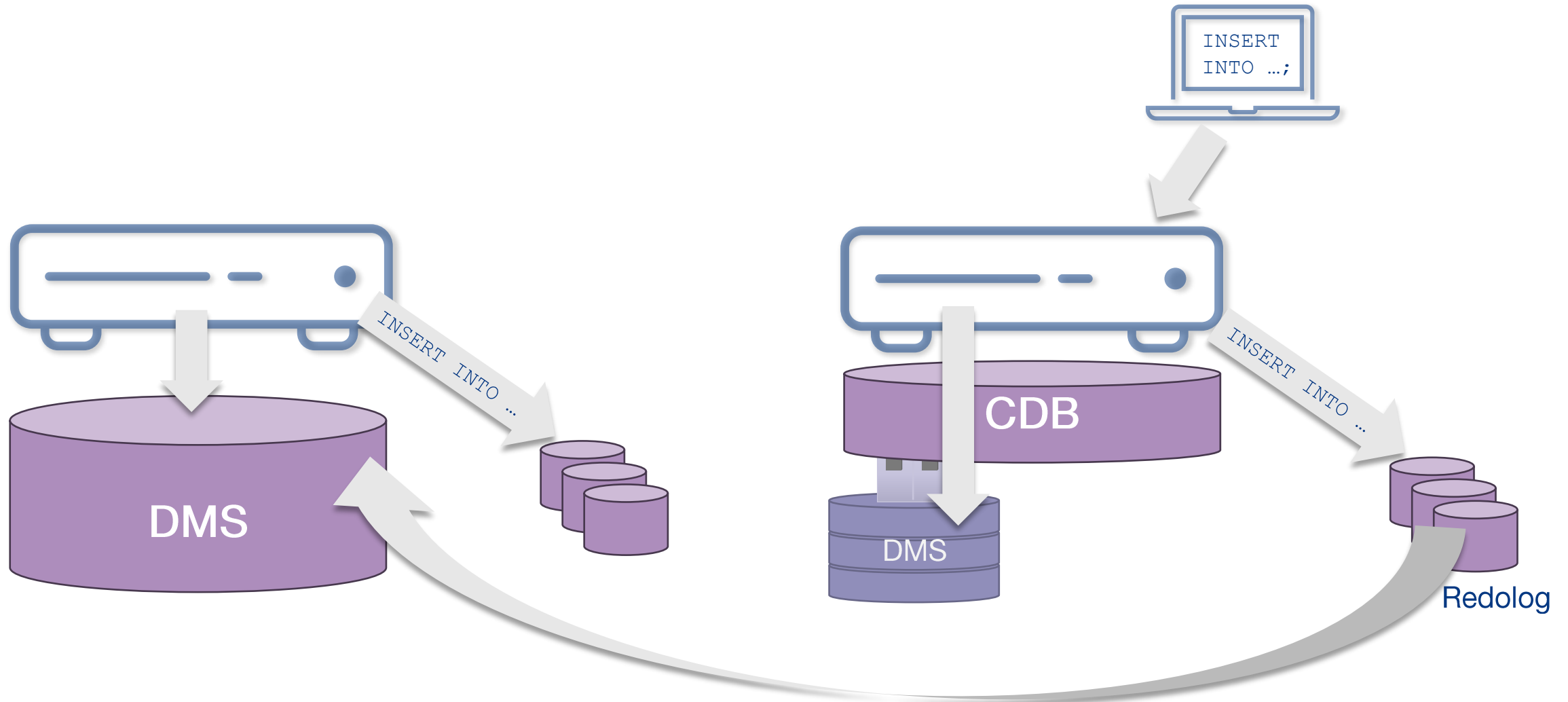
Minimum Downtime with SharePlex

Before Migration



Minimum Downtime with SharePlex

After Migration



Challenges?

- Themes:
 - Oracle 23ai Upgrade
 - Multitenant Database Migration
 - Unicode Migration
 - PostgreSQL Migration
- Handle it as a project with a minimum duration of 3 months



We help you!

Questions?

... and answers

