

Using SAP NetWeaver with Oracle Database 12c Automatic Data Optimization and Information Lifecycle Management

Key Guidelines





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Introduction

The amount of data that SAP customers are storing and managing is growing rapidly. The rapid growth of data presents daunting challenges for SAP customers, both in cost and performance. Although the cost of storage keeps declining, fast-growing data volumes make storage one of the costliest elements of most IT budgets. In addition, the accelerating growth of data makes it difficult to meet performance requirements while staying within budget.

Using Oracle Database 12c Information Lifecycle Management (ILM) for SAP NetWeaver is intended to address these challenges by storing data in different compression tiers offering the possibility of optimizing storage for both cost savings and maximum performance.


In Oracle Database 12c, two new ILM-related features have been added to the Advanced Compression option. Heat Map automatically tracks modification and query timestamps at the row and segment levels, providing detailed insights into how data is being accessed. Automatic Data Optimization (ADO) automatically compresses data according to SAP-defined policies based on the information collected by Heat Map. Additional information on Heat Map and ADO policies can be found in the Oracle White Paper “Automatic Data Optimization with Oracle Database 12c” <http://www.oracle.com/technetwork/database/enterprise-edition/automatic-data-optimization-wp-12c-1896120.pdf>

ADO for SAP BW installations enables the use of Hybrid Columnar Compression (HCC) with row level locking on Oracle Exadata or Oracle SuperCluster.

Preface

This document describes the use and integration of ADO and ILM and the necessary configuration steps in the Oracle database with SAP Applications and SAP Solutions based on SAP NetWeaver Technology. Therefore this white paper is valid for SAP Products like SAP BW, SAP ERP, SAP CRM or SAP XI or SAP solutions like SAP IS-U, SAP IS-Banking or SAP IS-Retail.

By using ADO and ILM there is no more overhead when using table compression (Advanced Row Compression) in all SAP systems (including SAP BW) and it allows the use of HCC with row level locking in SAP BW environments (SAP BW, SAP SEM or SAP APO).



ADO row level policies can be created on any tablespace used by SAP. To provide compression tiering an additional ADO segment level policy can be created on tablespaces where already an ADO row level policy has been defined. It is recommended to use ADO segment level policies only on tablespaces where partitioned tables are stored such as BW tablespaces. Partitioning enables a separation of active and passive (cold/archive) data of table. By using a segment level policy on a tablespace with partitioned tables passive data can be compressed in a more dense format through HCC.

To achieve the highest disk space savings along with excellent throughput for an SAP database it is highly recommended to use ADO and the new Oracle Database 12c Advanced Index Compression (advanced low). Check SAP Note 1888485 on how to enable Oracle Database 12c advanced low index compression for an SAP database and SAP Note 2138262 for a description of advanced low index compression. Using ADO together with advanced low index compression provides compression for tables, indexes and LOBs (SecureFiles).

Prerequisites

To use ADO and ILM with SAP NetWeaver based products and solutions the following technical and business prerequisites must be met:

- Oracle Database 12c Release 1 Patch Set 1 (12.1.0.2) plus
 - UNIX/Linux: Oracle Database SAP Bundle Patch November 2015 (SAP12102P_1511) or newer
 - Windows: Windows DB Bundle Patch 12.1.0.2.12 or newer
- If Hybrid Columnar Compression is used then only with row level locking functionality
- SAP NetWeaver 7.40 SP 12 or newer
 - Full DDIC and System Copy support for ADO/ILM. Check SAP Note 2258061 for details.
- SWPM 1.0 SP08 or newer. Check SAP Note 2255992 for corrections in R3load and R3szchk.
- SAP BR*Tools 7.40 Patch 19 or newer
- Correct Licensing of the Oracle Advanced Compression option
 - For Oracle Full Use Customers the Advanced Compression option must be licensed (to use ADO, ILM and HCC with row level locking)
 - For ASFU Customers (Customers who have licensed Oracle Software through SAP) no additional cost as the Advanced Compression Option is included

SAP Note 2254866 will be updated on a regular base with corrections or future changes. Always check SAP Note 2254866 before using ADO and ILM with SAP NetWeaver based products.



Restrictions

ADO Policies

ADO policies can only be created on tablespaces and not on individual tables and/or partitions in the database.

ADO policies can only be created and deleted, not enabled and disabled.

For new SAP installations the ADO policies on tablespaces will be created by the SAP utility SWPM (Software Provisioning Manager formerly called SAPIInst).

For existing SAP installations it is required to reorganize/move all objects into a new tablespace with an ADO policy defined on it. The required steps should be performed by the SAP utility BRSPACE.

Hybrid Columnar Compression (HCC)

Only HCC with row level locking can be used. It is not supported to use HCC without row level locking as it causes deadlocks in the SAP application due to the coarse lock granularity at the compression unit level. SAP applications require the use of row level locking for all objects in the database.

HCC with row level locking can only be specified at the tablespace level and not at the individual table or partition level. This restriction may be lifted in a future major database version and newer SAP versions.

Multitenant Configuration

With Oracle Database 12c Release 1 you cannot use ADO and ILM in a Multitenant configuration.

Note: Oracle Multitenant is not yet certified by SAP (planned for late Q2CY2016). So this is currently not an issue.

Using older SAP NetWeaver Releases (versions below 7.40 SP 12)

Creation or conversion of a table via the SAP DDIC

If an ADO policy is defined on the tablespace then the newly created table will inherit the ADO policy from the tablespace. A conversion of the table will uncompress all data (Note: Using SP12 and newer will compress all data). The converted table will have the ADO policy.

The exception list for tables where no ADO policy makes sense is not used. So for instance all SAP Cluster, Pool or INDX tables incorrectly have an ADO policy when being moved or changed (for instance when applying an SAP support package).

Required Configuration Steps to use ADO with SAP NetWeaver

Heat Map

Heat Map automatically tracks usage information at the row and segment levels. Data modification times are tracked at the row level and aggregated to the block level.

To enable heat map in the database you need to add the following init.ora parameter:

```
HEAT_MAP = ON
```

or change the value by using the alter system command:

```
ALTER SYSTEM SET HEAT_MAP = ON;
```

With RAC all instances must have the same value.

ILM Background Processing

All compression activities defined by the ADO policies are performed by additional background processes ora_jnnn_<SID> of a database instance. These processes become active during the Oracle Scheduler Maintenance Windows.

By doing all compression activities asynchronously in the background there is no more compression overhead for SAP online transactions or batch jobs.

To not impact the throughput of an SAP system it is required to limit the resources for the ILM background jobs when they run during the Scheduler Maintenance Window. To change the required parameters of the ILM jobs the dbms_ilm_admin package is used. Execute the following dbms_ilm_admin commands as sysdba:

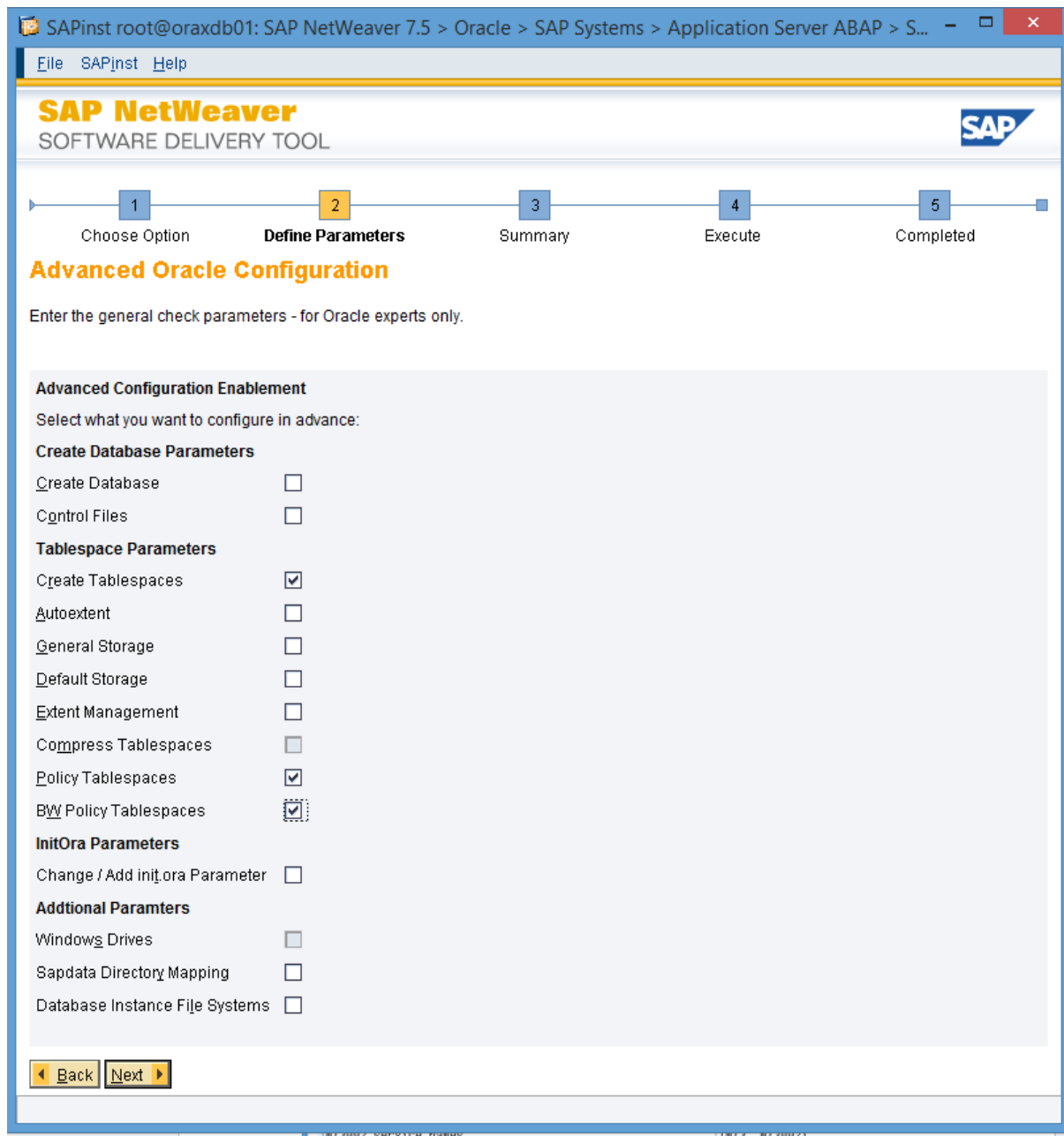
```
REM Up to maximum 2 ilm jobs performing block compression
begin
  dbms_ilm_admin.customize_ilm(DBMS_ILM_ADMIN.ABS_JOBLIMIT, 2);
end;
/
REM No parallel execution of ilm jobs
begin
  dbms_ilm_admin.customize_ilm(DBMS_ILM_ADMIN.DEG_PARALLEL, 1);
end;
/
```

Large scale testing in real customer environments have shown that by using the above settings for the ILM jobs no impact to the overall SAP throughput occurs.

ADO Integration with SWPM

During the installation of a new SAP system through SWPM it is now possible to define ADO policies at tablespace level. You need to select the Advanced Oracle Configuration in SWPM to do this

The following SWPM screens show the definition of ADO policies for an SAP installation on an Oracle Exadata system. All SWPM screens before entering the Advanced Oracle Configuration are not shown here.



You need to select tablespaces for the definition of ADO policies. In this configuration also additional ADO policies on BW Tablespaces will be defined. In general SAP BW, SEM or APO systems should use separate tablespaces (see SAP Note 502989).

SAP NetWeaver
SOFTWARE DELIVERY TOOL

1 Choose Option 2 **Define Parameters** 3 Summary 4 Execute 5 Completed

Oracle Tablespaces

Enter the general tablespace parameters - for Oracle experts only.

Tablespace Definition

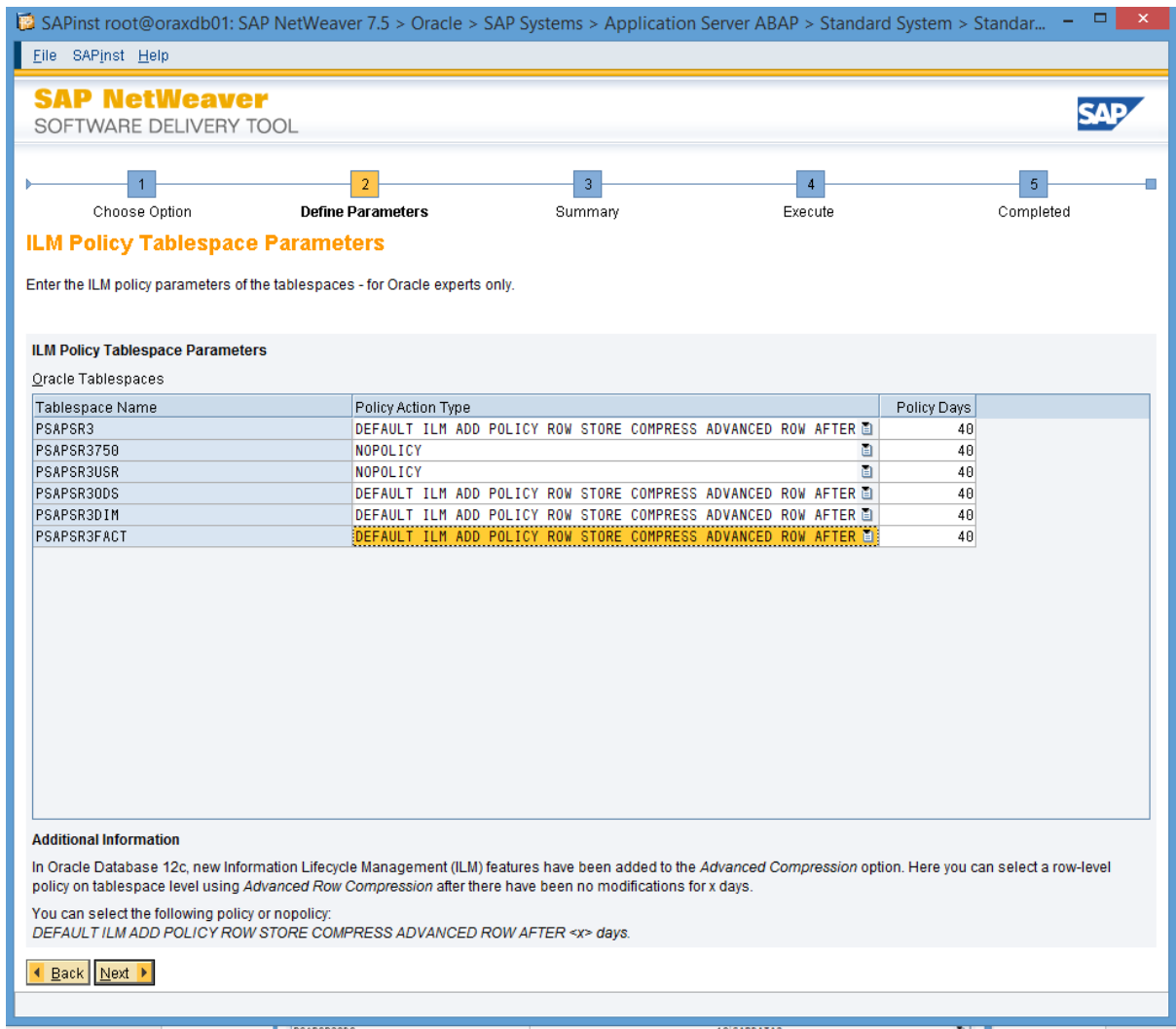
Oracle Tablespaces

Tablespace	Size [MB]	Sapdata Directory
PSAPSR3	2000	SAPDATA2
PSAPSR3	2000	SAPDATA2
PSAPSR3	2000	SAPDATA2
PSAPSR3	2000	SAPDATA2
PSAPSR3	2000	SAPDATA2
PSAPSR3	1540	SAPDATA2
PSAPSR3750	2000	SAPDATA3
PSAPSR3750	2000	SAPDATA3
PSAPSR3750	2000	SAPDATA3
PSAPSR3750	2000	SAPDATA3
PSAPSR3750	1010	SAPDATA3
PSAPSR3USR	20	SAPDATA4
PSAPUNDO	700	SAPDATA1
PSAPTEMP	350	SAPDATA1
SYSTEM	350	SAPDATA1
SYSAUX	200	SAPDATA1
PSAPUNDO001	700	SAPDATA1
PSAPUNDO002	700	SAPDATA1
PSAPSR3ODS	10	SAPDATA2
PSAPSR3DIM	10	SAPDATA2
PSAPSR3FACT	10	SAPDATA2

Add Remove

Back Next

PSAPSR3ODS, PSAPSR3DIM and PSAPSR3FACT are separate tablespaces for SAP BW.



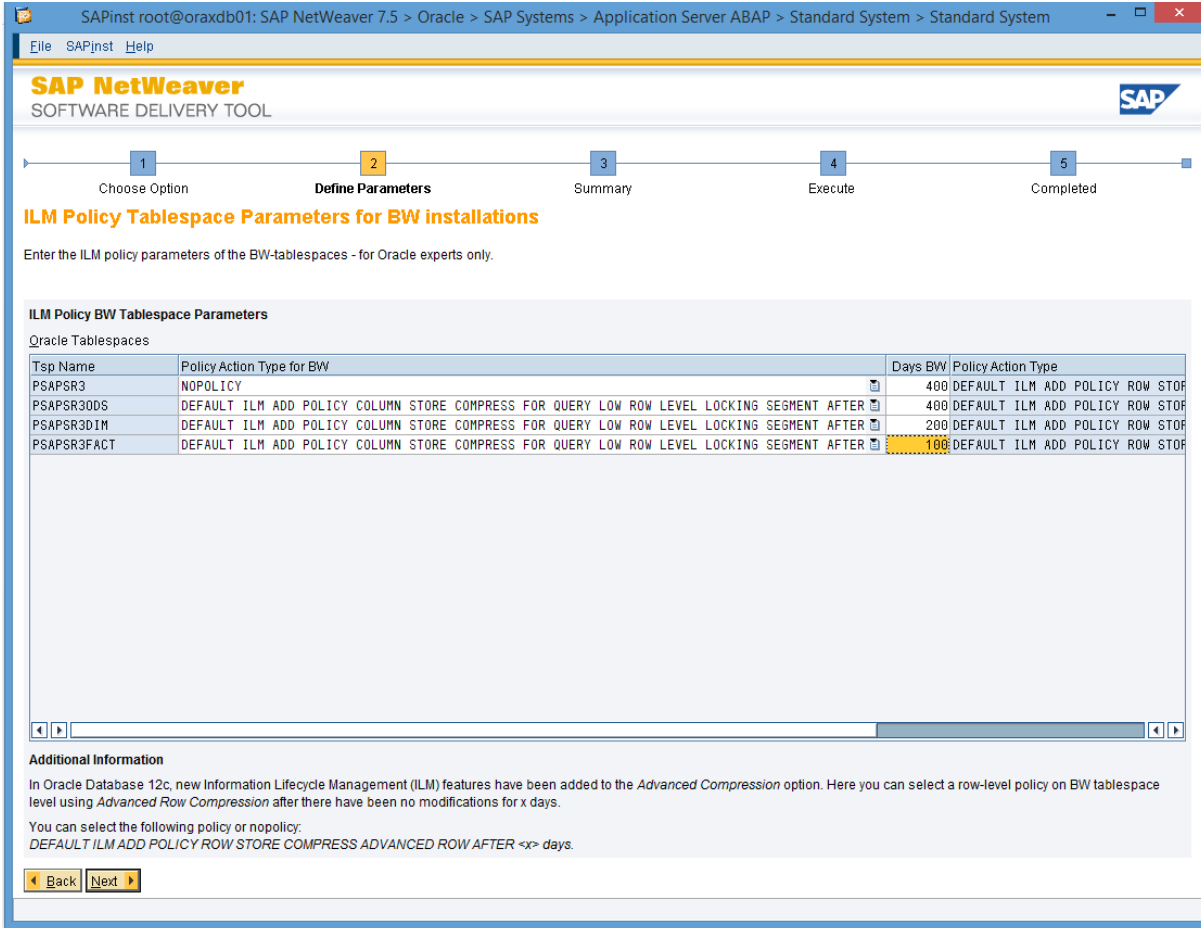
You can choose if you want an ADO policy defined on a tablespace or not. You can change the number of days when the policy will become active.

In above example 40 days (which is the default chosen by SAP to not perform any action before business month-end closing) are chosen. So in above case all data will be compressed in Advanced Row Compression (OLTP) format which have not been modified within the last 40 days.

So the ADO policy defined on tablespace PSAPSR3 is:

```
alter tablespace PSAPSR3 default ilm add policy row store compress advanced row after 40 days of no modification;
```

NOTE: All table (heap) data initially loaded by R3load into a tablespace with an ADO policy will be compressed in Advanced Row Compression (OLTP) format. All LOB data will be compressed with a degree of LOW. All future added data will not be compressed immediately but delayed according to the defined ADO policy. This mechanism guarantees that online transactions or batch operations are not impacted at all when using database compression.



You can define an additional ADO segment level policy on a tablespace or not. In above example an ADO segment level policy is defined on BW tablespaces PSAPSR3ODS, PSAPSR3DIM and PSAPSR3FACT. You can change the number of days when the policy becomes active.

In above example all data will be HCC (with row level locking) compressed in tablespaces PSAPSR3ODS, PSAPSR3DIM and PSAPSR3FACT after they have not been modified the last 400 (default), 200 or 100 days.

So the ADO policy defined on tablespace PSAPSR3FACT is:

```
alter tablespace PSAPSR3FACT default ilm add policy column store compress for query low row level locking
segment after 100 days of no modification;
```

Note: You can only define an ADO segment level policy on a tablespace where already a row level ADO policy is defined. The number of days for the segment level policy to become active must be greater than the number of days defined for the row level policy. You always want data to be compressed more dense after a longer period of time.

SAP System Copies and ADO

There are several ways of creating a copy of an existing SAP database. The different approaches depend on the following scenarios:

- Same platform/OS is used for the new database. Here you can use a backup/restore mechanism, RMAN duplicate database, Data Guard physical standby, R3load or ACS services O2O/OOO.
- Different platform/OS is used for the new database. Here you can use SAP R3load, RMAN transportable tablespace or ACS services O2O/OOO.
- A Unicode Migration of the SAP system is done. Here you need to use SAP R3load.

In all approaches where you maintain the same physical structure of the database (backup/restore, RMAN duplicate database, Data Guard physical standby, RMAN transportable tablespaces) you cannot introduce ADO/ILM. If ADO/ILM was already used in the source database then it is available in the target database as well.

Note: A new SAP installation using Oracle Database 12c Release 1 with SWPM does not allow you to define compression at a tablespace level. This change was necessary to avoid SAP throughput issues when all tables and LOBs (SecureFiles) were compressed in the database. SWPM with Oracle Database 12c Release 1 will still initially compress all data when loaded via R3load when an ADO policy is defined on a tablespace. Newly inserted data through the SAP application will be compressed according to the ADO policy. If you want to maintain exactly the compression characteristics of the tablespace(s) and the tables then you need to perform a system copy which does not change the physical structure of the database. So a system copy using backup/restore, RMAN duplicate database, RMAN transportable tablespace or Data Guard physical standby needs to be done.

System Copy using R3load

When doing a system copy it is required to run the ABAP report SMIGR_CREATE_DDL on the source system. If you use ADO policies on tablespaces in the target system you have to run SMIGR_CREATE_DDL with option "Generate DDLs with COMPRESSION" to have the initial loaded data compressed in Advanced Row Compression (OLTP) format.

If you already have ADO policies in the source system and want to use ADO policies in the target system then you do not have to run SMIGR_CREATE_DDL with the option "Generate DDLs with COMPRESSION".

How to enable ADO in an existing SAP database

If you want to implement ADO/ILM in an existing database you can do this step by step by moving a set of tables or all tables into one or more new tablespaces where an ADO policy has been defined. So basically there are two major steps required.

Step 1: Creation of one or more new tablespaces with an ADO policy defined at the tablespace level

Step 2: Reorganization (online or offline) of a set of tables or all tables into the new tablespace(s). If all tables of a tablespace have been moved the old tablespace(s) can be dropped. This step should be performed by BRSPACE.

Here is a BRSPACE example performing the necessary steps for all tables of the tablespace PSAPSR3:

```
brspace -u / -f tscreate -t PSAPSR3NEW -y standard
```

This will create a new tablespace PSAPSR3NEW with the SAP standard ADO policy (row store compress advanced row after 40 days of no modification).

```
brspace -u / -f tbreorg -a reorg -s PSAPSR3 -t allsel -n PSAPSR3NEW -p 4
```

This will move all tables from tablespace PSAPSR3 to tablespace PSAPSR3NEW.

```
brspace -u / -f tsdrop -t PSAPSR3
```

This will drop the empty tablespace PSAPSR3.

```
brspace -u / -f tsalter -a rename -t PSAPSR3NEW -n PSAPSR3
```

This will change the tablespace name from PSAPSR3NEW to PSAPSR3.

SAP Note 2254836 describes all options and features of BRSPACE for the management and administration of ADO and ILM in an SAP database.

Checking for correct ADO Policies

To check if the correct and supported ADO policies are in place on one or more tablespaces you can use the following queries:

```
SELECT * from DBA_ILMPOLICIES;

SELECT POLICY_NAME, ACTION_TYPE, SCOPE,
       COMPRESSION_LEVEL, CONDITION_TYPE, CONDITION_DAYS
from   DBA_ILMDATAMOVEMENTPOLICIES;
```

Here is an example from an SAP database on an Exadata platform:

```
POLICY_NAME POLICY_TYPE TABLESPACE ENA DEL
-----
P1          DATA MOVEMENT PSAPSR3          YES NO
P2          DATA MOVEMENT PSAPSR3FACT        YES NO
P3          DATA MOVEMENT PSAPSR3FACT        YES NO

POLICY_NAME ACTION_TYPE SCOPE COMPRESSION_LEVEL
-----
CONDITION_TYPE          CONDITION_DAYS
-----
P1          COMPRESSION ROW          ADVANCED
LAST MODIFICATION TIME          40

P2          COMPRESSION ROW          ADVANCED
LAST MODIFICATION TIME          40

P3          COMPRESSION SEGMENT QUERY LOW ROW LEVEL LOCKING
LAST MODIFICATION TIME          400
```

At the moment only ADO policies for data compression at the row and segment level are allowed. Only hybrid columnar compression (HCC) with row level locking is allowed.



ADO Space Savings Statistics

To monitor how much space in tables and/or partitions is saved by using ILM the following query can be used:

```
SELECT sum(value)/1024/1024/1024 "Saved Bytes in GB (by ILM)"
FROM sys.ilm_result_stat$ r, v$statname n
WHERE r.statistic#=n.statistic# AND name= 'HSC OLTP Space Saving';
```

Here is an example from an SAP ECC system with ILM enabled:

```
SQL> select sum(value)/1024/1024/1024 "Saved Bytes in GB (by ILM)"
  2 from sys.ilm_result_stat$ r, v$statname n
  3 where r.statistic#=n.statistic# and name = 'HSC OLTP Space Saving';
```

Saved Bytes in GB (by ILM)

```
-----
141.69366
```



References

SAP Notes

- 2254866 – Using Oracle Database 12c Advanced Data Optimization with SAP NetWeaver
- 2255992 – R3load and R3szchk: New Oracle feature for database ILM policy
- 2258061 – Additions for ADO/ILM with table conversion or system copy with SMIGR_CREATE_DDL
- 2254836 – BR*Tools Support for Oracle ADO/ILM
- 2138262 – Oracle Database 12c Advanced Compression for SAP Systems
- 1888485 – Oracle Database Parameter for Oracle Database 12c Release 1 (12.1)
- 502989 – SAPinst: Missing BW tablespaces

White Papers





<http://www.oracle.com/technetwork/database/enterprise-edition/automatic-data-optimization-wp-12c-1896120.pdf>

Documentation

<http://www.oracle.com/technetwork/database/enterprise-edition/documentation/index.html>



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Hardware and Software, Engineered to Work Together

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