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SAP Databases on Oracle Automatic Storage Management 11g Release 2

Configuration Guidelines for UNIX and Linux Platforms

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Preface

Starting with Oracle Database 11g Release 2 Oracle ASM is the preferred storage platform for SAP systems running on Oracle Real Application Clusters as well as for SAP systems running on a single instance Oracle Database.

This document is intended as complementary configuration guideline in addition to the “Oracle Grid Infrastructure Installation Guide” which is available on the Oracle Technology Network and in addition to the white paper “Moving your SAP database to Oracle Automatic Storage Management 11g Release 2 – A Best Practices Guide” which can be downloaded from SAP SDN.

Although most of the configuration guidelines in this document are the same for Oracle RAC databases with Oracle ASM and Oracle single instance databases with Oracle ASM this document only covers the configuration steps for Oracle single instance databases with Oracle ASM. Oracle RAC with Oracle ASM is discussed in detail in the according Oracle RAC specific white paper.

Before discussing the installation and configuration guidelines the document gives you an overview of the specific terminology used in the Oracle ASM environment. Furthermore, we will discuss some special considerations that should be kept in mind about how Oracle ASM works differently compared to conventional storage solutions and what the Oracle ASM disk group configuration recommendations and naming conventions are.

This document is based on Oracle Database Release 11.2.0.2 and 11.2.0.3.

Naming Conventions and Terms

The following naming conventions and terms are used in this document:

Name or Synonym	Description / Purpose
Oracle ASM	Oracle Automatic Storage Management is basically a volume manager for all Oracle Database related files and ACFS Volumes (Oracle ASM Cluster File System Volumes).

Oracle ASM Disk	An Oracle ASM disk is usually a physical disk with a logical partition on it. On Linux/Unix platforms the logical partition should span the whole physical disk.
Oracle ASM Disk Group	A number of Oracle ASM disks form an Oracle ASM disk group. An Oracle ASM disk group has 1 or more “failure groups”.
Failure Group	A named group to which an Oracle ASM disk belongs to. Oracle ASM guarantees not to store the same data twice within a failure group. Redundancy is achieved by distributing the same data to multiple failure groups.
OCR	Oracle Cluster Repository
RMAN	Oracle Recovery Manager
ACFS	Oracle ASM Cluster File System is a cluster file system that uses Oracle ASM as the underlying volume manager infrastructure.
<DGNAME>	<DGNAME> specifies the name of an ASM disk group. Example: '+ARCH'
<DBNAME> <dbname>	Specifies the name of the database (e.g. C11). <DBNAME> is derived from the Oracle initialization parameter 'db_name'. If 'db_unique_name' is set it is derived from 'db_unique_name'.
<DBSID> <dbsid>	Specifies the name of the database instance . For single instance databases <DBSID> usually equals <DBNAME> e.g. C11. With RAC the number of the instance is appended e.g. C111, C112, etc. The environment variable ORACLE_SID is usually set to <DBSID>.
<SAPSID> <sapsid>	Specifies the name of the SAP system id. It is used for OS user names like <SAPSID>adm e.g. c11adm as well as for authentication of the OS user with Oracle e.g. OPS\$<SAPSID>ADM.

OUI	Oracle Universal Installer is the installation tool for Oracle GRID and Oracle Database Software installations.
<IHRDBMS>	<p>RDBMS Software Installation Home. The <u>installation</u> Oracle Home directory where the Oracle RDBMS Software is installed.</p> <p>If you are running one database instance from the Oracle Home install the software to '/oracle/<DBNAME>/11202'.</p> <p>If you are running multiple databases from the same Oracle Home install the software to '/oracle/RDBMS/11202'.</p>
<OHGRID>	<p>The path of the Oracle Home where the GRID Software was installed.</p> <p>On Unix/Linux platforms it is</p> <p>'/oracle/GRID/11202', '/oracle/GRID/11203', ...</p> <p>Related environment variables: ORACLE_BASE='/oracle/BASE' (see SAP note #1521371) ORACLE_HOME='/oracle/GRID/11202' LD_LIBRARY_PATH or SHLIB_PATH='/oracle/GRID/11202/lib'</p>
<OHRDBMS>	<p>The <u>runtime</u> path of the Oracle Home where the RDBMS Software was installed. This is a symbolic link to <IHRDBMS>.</p> <p>If you are running one database from the Oracle Home: Examples '/oracle/<DBNAME>/112' -> '/oracle/<DBNAME>/11202' '/oracle/<DBNAME>/112' -> '/oracle/<DBNAME>/11203'</p> <p>If you are running multiple databases from the Oracle Home: Examples '/oracle/<DBNAME>/112' -> '/oracle/RDBMS/11202' '/oracle/<DBNAME>/112' -> '/oracle/RDBMS/11203'</p> <p>Related environment variables: ORACLE_BASE='/oracle' (see SAP note #1521371) ORACLE_HOME='/oracle/<DBNAME>/112' LD_LIBRARY_PATH or SHLIB_PATH='/oracle/<DBNAME>/112/lib'</p>

	<p>Note: In cluster environments it is recommended to place <OHRDBMS> on a shared cluster file system.</p>
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Configuration Guidelines

Operating System specific Configuration Steps

Mandatory OS Software Components and Kernel Parameters

Refer to the Oracle platform specific installation guide of your OS platform for a list of mandatory OS software components and install them before you proceed to install Oracle GRID or Oracle RDBMS Software. For Linux there is a list of required rpm's for each distribution supported by Oracle. Modify the UNIX/Linux kernel parameters and OS limits to meet the requirements.

Accessing Attached Disks

multipath and udev

In order to make the disk devices destined for Oracle ASM visible in a schematic manner with clearly speaking device names we recommend to use multipath and udev rules. This is especially important for more complex Oracle ASM configurations with multiple storage subsystems at different locations where the disks need to be identified and mapped to the same device names by each clusternode. These configurations are discussed in the whitepaper '*SAP with Oracle Real Application Clusters 11g Release 2 and Oracle Automatic Storage Management 11g Release 2 - Advanced Configurations & Techniques*'.

It is very important to configure disk drivers and multipath to report IO errors as fast as possible because the upper layers (Oracle Clusterware and Oracle ASM) depend on fast response times. If failed IO's are not recognized fast enough or retried for several seconds or minutes Oracle Clusterware may evict cluster nodes or Oracle Database may run into timeouts (controlfile enqueue, IO, ...).

On Linux make sure the following parameters are set in multipath.conf:

```
dev_loss_tmo=2
fast_io_fail_tmo=1
fail_if_no_path
```

Oracle ASMLIB

On Linux platforms Oracle ASMLIB can be used as an alternative to multipath and udev. Oracle ASMLIB consists of a Linux kernel module and administration utilities and needs to be downloaded and installed separately (several rpm's). It allows you to "stamp" each Oracle ASM disk with a symbolic name using the 'oracleasm' tool. In addition it will fade in the disk devices into the Linux device tree at '/dev/oracleasm/disks/<symbolic name>'.

Oracle ASMLIB has to be installed by user 'root'!

OS groups

Group	Comments
dba	OS group that is required for OS-authentication for 'connect / as sysdba'. Users belonging to this group can be removed from the group after the installation if you want to disable OS-authentication and use password file authentication instead.
oper	OS group that is required for OS-authentication for 'connect / as sysoper'. Users belonging to this OS group can be removed from the group after the installation if you want to disable OS-authentication and use password file authentication instead.
oinstall	This OS group will be set as the group for all directories and files that will be installed during the software installation. Only the oracle executable will be changed to owner 'oracle:asmadmin'. This will be discussed later in this document.
asmadmin	The membership in this OS group guarantees read/write access to the Oracle ASM disks (= the devices).
asmdba	Required to be able to create files on Oracle ASM.
asmoper	Optional OS group for users that should be able to start/stop the Oracle ASM instance.

Example:

```
groupadd -g 500 dba
groupadd -g 501 oinstall
groupadd -g 502 asmadmin
groupadd -g 503 oper
groupadd -g 504 asmdba
groupadd -g 505 asmoper
```

OS users

User	Comments
oracle	<p>The 'oracle' user is used for the <u>installation of the Oracle GRID software as well as for the installation of Oracle RDBMS software</u>. This includes all patchset installations with OUI and patch installations with 'opatch' and/or 'mopatch'. This user is the software owner <u>and</u> the user under which the oracle software will be run.</p> <p>Primary group: oinstall Additional groups: dba, oper, asmadmin, asmdba, asmoper</p> <p>Example: \$ useradd -g oinstall \ -G dba,oper,asmdba,asmoper,asmadmin \ oracle</p>
<sapsid>adm	<p>The <sapsid>adm user is the owner of the SAP system software. For DB specific tasks (e.g. sqlplus and SAP BR*Tools) it also requires membership in the some RDBMS / Oracle ASM specific groups.</p> <p>Primary group: sapsys Additional groups: dba, oper, asmdba, asmoper</p> <p>Example: \$ useradd -g sapsys \ -G dba,oper,asmdba,asmoper \ c11adm</p> <p>Important: <SAPSID>adm requires the environment variable SAPDATA_HOME to be set to '/oracle/<DBNAME>'. Example: SAPDATA_HOME=/oracle/C11</p>

Example:

```
useradd -g oinstall -G dba,oper,asmdba,asmoper,asmadmin
oracle
useradd -g sapsys -G dba,oper,asmdba,asmoper c11adm
```

Notes

- The 'grid' user mentioned in various Oracle documents cannot be used in SAP environments as it will cause certain SAP administrations tasks to fail.
- In SAP installations with Oracle ASM the 'ora<dbname>' user is not required anymore! It is recommended to remove this user.
- After removing ora<dbname> user from the OS you should drop the corresponding database user 'OPS\$ORA<DBNAME>' and create the user OPS\$ORAORACLE instead.
 SQL> drop user "OPS\$ORA<DBNAME>"
 SQL> create user "OPS\$ORAORACLE" identified externally;
 SQL> grant SAPDBA to "OPS\$ORAORACLE"
- The default home directory for the 'oracle' user is '/home/oracle'.

Directories

Directory	Owner	Access Bits	Comments
/oracle	oracle:oinstall	drwxr-xr-x	Oracle base directory under which all Oracle specific subdirectories (e.g. for software installations or diagnostic files) will be created.
/oracle/<DBNAME>/saparch /oracle/<DBNAME>/sapbackup /oracle/<DBNAME>/sapcheck /oracle/<DBNAME>/sapprof /oracle/<DBNAME>/sapreorg /oracle/<DBNAME>/saptrace	oracle:oinstall	drwxrwxr-x	SAP BR*Tools specific subdirectories

/oracle/GRID/11202	oracle:oinstall	drwxr-x---	<u>Installation</u> Oracle Home for the GRID Software Stack (<OHGRID>)
/oracle/<DBNAME>/11202	oracle:oinstall	drwxr-xr-x	<u>Installation</u> Oracle Home for the RDBMS Software (<IHRDBMS>)

Note that the <OHGRID> and <IHRDBMS> directories are created by OUI during software installation. Please refer to SAP note 1524205.

Symbolic Links

A symbolic link is created automatically if you use the 'RUNINSTALLER' script attached to SAP note 1524205 (patch level 15 or later). If you do not use the script you have to create the link manually. The path '/oracle/<DBNAME>/112' is used as the runtime Oracle Home (<OHRDBMS>) for the RDBMS Software.

'/oracle/<DBNAME>/112' → '/oracle/<DBNAME>/11202'

Example:

```
$ cd /oracle/C11
$ ln -s 11202 112
```

The table below shows an example of the paths and the 'term' we use for it:

/oracle/C11/11202	<IHRDBMS>
/oracle/GRID/11202	<OHGRID>
/oracle/C11/112	<OHRDBMS>

Environment of the 'oracle' user

Because the 'oracle' user owns all Oracle software, and because all Oracle programs are run by this user, it is required to be able to switch the environment of this user in order to run programs (e.g. sqlplus, imp, exp, srvctl, crsctl) under their specific Oracle Home.

Therefore we recommend creating shell scripts you can *source* to change the user's environment setting as needed (see SAP note 1554661).

Environment variable	Path
PATH	Has to include '/oracle/<DBNAME>/112/bin'
ORACLE_BASE	'/oracle' or /oracle/<DBNAME> (see SAP note 1521371)
ORACLE_HOME	'/oracle/<DBNAME>/112'
LD_LIBRARY_PATH or SHLIB_PATH	'/oracle/<DBNAME>/112/lib'

Example for running programs from <OHGRID>

```
ORACLE_BASE=/oracle/BASE
ORACLE_SID=+ASM (Single Instance)
ORACLE_SID=+ASM1 (on first RAC node)
ORACLE_SID=+ASM2 (on 2nd RAC node)
PATH=./usr/kerberos/bin:/usr/local/bin:/bin:/usr/bin:
/oracle/GRID/11202/bin
ORACLE_HOME=/oracle/GRID/11202
```

Example for running programs from a <OHRDBMS>

```
ORACLE_BASE=/oracle
ORACLE_SID=C11
PATH=./usr/kerberos/bin:/usr/local/bin:/bin:/usr/bin:
/oracle/C11/112/bin
ORACLE_HOME=/oracle/C11/112
```

Oracle Grid Infrastructure Software Configuration Guidelines

Removing old Oracle Grid Infrastructure software

If you want to install the Oracle Grid Infrastructure software stack **from scratch** and you still have the same or an older version of the software installed, it should be removed first.

- use the 'deinstall' script under <OHGRID>/deinstall
- remove directory '/oracle/GRID'
`rm -rf /oracle/GRID`
- remove '/etc/oracle/ocr.loc'

Please refer to the according Oracle documentation on how to completely remove the Oracle Grid Infrastructure software stack.

If you want to start a new Oracle Inventory remove '/oracle/oraInventory'.

If you have **upgraded** your Oracle Grid Infrastructure software stack (e.g. from 11.2.0.2 to 11.2.0.3) the steps to remove the old Oracle Grid Infrastructure software stack are:

```
export ORACLE_HOME=${<OHGRID>}
```

```
## To detach old 11.2.0.2 GRID_HOME:  
$NEW_GRID_HOME/oui/bin/runInstaller -detachHome -silent  
ORACLE_HOME=<OHGRID>
```

```
## To confirm the $OLD_GRID_HOME is removed from central inventory:  
$NEW_GRID_HOME/OPatch/opatch lsinventory -all
```

```
## To remove files in old 11.2.0.2 GRID_HOME on all nodes manually:  
rm -rf <old-11.2.0.2-GRID_HOME>
```

```
unset ORACLE_HOME
```

Oracle ASM disks

As described in the chapter "Planning Oracle ASM Disk Group Configuration" you should have prepared at least 5 disks (high redundancy) that can be used for the Oracle ASM disk group '+OCR'.

On the Linux platform the disks should be stamped.

Example:

```
oracleasm createdisk OCR0000 /dev/hdc1
oracleasm createdisk OCR0001 /dev/hdd1
.
.
oracleasm createdisk OCR0004 /dev/hdg1
```

In addition you may want to prepare other disks for other Oracle ASM disk groups (e.g. '+DATA', '+RECO', '+ARCH').

Installing and configuring the GRID Software Stack

- Log on as user 'oracle' and switch to your <OHGRID> environment.
- Unpack the GRID software bundle to a staging directory (e.g. '/oracle/stage/grid').
- Unpack the RDBMS software bundle to a staging directory (e.g. '/oracle/stage/database').
- AIX only: You may need to run rootpre.sh before you install the software.
- Set your DISPLAY variable and start OUI to install the GRID Software Stack. Remember that you may have to issue 'xhost +' under the original user.

Example: /oracle/stage/grid/runInstaller

- When you are asked for Oracle Base and <OHGRID> enter '/oracle' and '/oracle/GRID/11202'.
- When you are asked for OS groups enter 'asmdba', 'asmoper' and 'asmadmin' and complete the software installation.
- Run '/oracle/GRID/11202/root.sh' and '/oracle/GRID/11202/orainstroot.sh'
- Use the 'asmca' utility to create and manage Oracle ASM disk groups.

Installing the Oracle RDBMS Software

Log on as user 'oracle' and switch to your <OHRDBMS> environment and use the script 'RUNINSTALLER' provided on the appropriate SAP installation DVD to install the Oracle RDBMS Software and create the symbolic link (<OHRDBMS> -> <IHRDBMS>) after the software has been properly installed. For more information refer to SAP note 1524205.

Oracle Executable OS Group ID's

After installation of the RDBMS Software, the ownership of the Oracle binary under <OHRDBMS>/bin is oracle:oinstall and the Oracle binary contains some OS group id's that are linked-in when the Oracle binary is linked during software installation.

Unless a new database is created using the 'dbca' tool (which is very uncommon in the SAP environment) it is important to adjust the ownership and linked-in group id's of the binary manually by executing a script located under <OHGRID>/bin.

The script must be executed after every software installation, patch installation and re-link of the Oracle binary.

```
[oracle@oracx3v3 dbs]$ ls -la /oracle/C11/112/bin/oracle
-rwsr-s--x 1 oracle oinstall 228886468 Nov 29 15:29
/oracle/C11/112/bin/oracle
```

```
/oracle/GRID/11202/bin/setasmgidwrap
o=/oracle/C11/112/bin/oracle
```

```
[oracle@oracx3v3 dbs]$ ls -la /oracle/C11/112/bin/oracle
-rwsr-s--x 1 oracle asmadmin 228886468 Nov 29 15:29
/oracle/C11/112/bin/oracle
```

Post Database Creation

After the database has been created by 'sapinst' or manually it is necessary to run some post db creation tasks:

Task	Comment
Register the new database and <OHRDBMS> with the GRID stack. Example: srvctl add database -d RM1 -o /oracle/C11/112 -p	mandatory

<code>/oracle/C11/112/dbs/spfileRM1.ora -a "ACFS, DATA, RECO, ARCH"</code>	
Turn off Oracle default maintenance tasks (SAP note 974781)	mandatory
Lock all the DB user accounts you don't need	recommended
Configure the 'asmnmp' user.	recommended

Oracle SQL*Net Configuration

Oracle Listener

In a GRID environment there is usually one Oracle listener for all database instances configured. The listener is run from the <OHGRID>/bin directory and controlled by the GRID infrastructure. Therefore the listener should be started and stopped by using the 'srvctl' utility instead of 'lsnrctl' like in non-Oracle ASM environments. The listener should always use the Oracle default port 1521. This allows all Oracle database instances to register their services with the listener without the need to set 'local_listener' parameters in the pfile or spfile.

Example configuration:

sqlnet.ora:

```
# sqlnet.ora Network Configuration File:
/oracle/GRID/112/network/admin/sqlnet.ora
# Generated by Oracle configuration tools.
```

```
NAMES.DIRECTORY_PATH= (TNSNAMES, EZCONNECT)
```

```
ADR_BASE = /oracle
```

listener.ora:

```
# listener.ora Network Configuration File:
/oracle/GRID/112/network/admin/listener.ora
# Generated by Oracle configuration tools.
```

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = IPC) (KEY = EXTPROC1521))
      (ADDRESS = (PROTOCOL = TCP) (HOST = uxi337) (PORT =
1521))
    )
  )
```

```
ADR_BASE_LISTENER = /oracle
ENABLE_GLOBAL_DYNAMIC_ENDPOINT_LISTENER=ON #line added by
Agent
```

SQL*Net Configuration in <OHRDBMS>

sqlnet.ora:

```
# sqlnet.ora Network Configuration File:
/oracle/C11/112/network/admin/sqlnet.ora
# Generated by Oracle configuration tools.
```

```
NAMES.DIRECTORY_PATH= (TNSNAMES, EZCONNECT)
```

```
ADR_BASE = /oracle
```

tnsnames.ora:

```
# tnsnames.ora Network Configuration File:
/oracle/C11/112/network/admin/tnsnames.ora
# Generated by Oracle configuration tools.
```

```
C11 =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP) (HOST = uxi337) (PORT =
1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = C11)
    )
  )
```

Major Differences between Installations with and without ASM

OS User 'ora<dbname>'

With Oracle ASM the OS user 'ora<dbname>' should not be defined any longer. Almost every file or directory is now owned by user 'oracle' with its primary group 'oinstall'. SAP BR*Tools are started from the environment of the OS user '<sapsid>adm' (see below).

Exceptions:

Directory or File	Owner	Access Bits	Comments
/oracle/<DBNAME>/112/bin/oracle	oracle:asmadmin	-rwsr-s—x	Oracle executable
/oracle/<DBNAME>/saparch /oracle/<DBNAME>/sapbackup /oracle/<DBNAME>/sapcheck /oracle/<DBNAME>/saprof /oracle/<DBNAME>/sapreorg /oracle/<DBNAME>/saptrace	oracle:oinstall	drwxrwxr-x	SAP BR*Tools specific sub-directories (see SAP note 1598594)

Note: 'saprof' is a new directory where the SAP BR*Tools profile 'init<DBNAME>.sap' is located. Beside the profile file BR*Tools create a spfile copy (as 'pfile') and some temporary files in this directory.

Server Parameter File

For customers who run their database and Oracle ASM on a single host or a RAC cluster with a shared <OHRDBMS> it is recommended to place the spfile for the database instance under <OHRDBMS>/dbs. Placing the spfile outside Oracle ASM allows much easier handling.

Example:

```
SQL> create spfile='spfileRM1.ora' from pfile='initRM1.ora';
File created.
SQL>
```

Customers who do not run a RAC cluster with a shared file system for <OHRDBMS> or customers who want to place the spfile on Oracle ASM for any other reason can use the following command to create the spfile on Oracle ASM.

Example:

```
create spfile='+DATA/RM1/spfileRM1.ora' from pfile='initRM1.ora';
```

Please note that 'spfileRM1.ora' is just an alias on Oracle ASM:

Example:

```
Oracle ASMCMD> ls -l
Type                Redund  Striped    Sys  Name
                   N       spfileRM1.ora =>
+DATA/RM1/PARAMETERFILE/spfile.267.737217857
```

Although it is recommended that you use 'srvctl' to startup and shutdown your database, it may be necessary to startup and shutdown the database with 'sqlplus'. In this case you need an additional pfile under <OHRDBMS>/dbs which points to the spfile on Oracle ASM.

Example:

```
initRM1.ora:
SPFILE='+DATA/RM1/spfileRM1.ora'
```

SAP BR*Tools

All SAP BR*Tools run under user 'oracle' as their **effective** user id.

SAP BR*Tools should be executed as <sapsid>adm user to ensure that the environment for the administration of a given database instance (ORACLE_SID, ORACLE_HOME, ORACLE_BASE, etc.) is already set correctly. When you decide to perform database administration as user 'oracle', you have to set the environment for the target database first as described in SAP note 1554661.

Make sure the BR*Tools (BRARCHIVE, BRBACKUP, BRCONNECT, BRRECOVER, BRRESTORE, BRSPACE, BRTOOLS) are owned by user 'oracle' with 'oinstall' as their primary group as described in SAP note 1598594.

Example:

```
OS> su - root
OS> cd /usr/sap/<SAPSID>/SYS/exe/run
OS> chown oracle:oinstall \
    brarchive brbackup brconnect brrecover brrestore \
    brspace brtools
OS> chmod 6774 \
    brarchive brbackup brconnect brrecover brrestore \
    brspace brtools
```

```
OS> ls -l br*
-rwsrwsr-- 1 oracle oinstall .. brarchive*
-rwsrwsr-- 1 oracle oinstall .. brbackup*
-rwsrwsr-- 1 oracle oinstall .. brconnect*
-rwsrwsr-- 1 oracle oinstall .. brrecover*
-rwsrwsr-- 1 oracle oinstall .. brrestore*
-rwsrwsr-- 1 oracle oinstall .. brspace*
-rwsrwsr-- 1 oracle oinstall .. brtools*
```

Initialization Parameters

Oracle ASM introduces new Oracle initialization parameters that allow you to omit names of directories and filenames in some SQL statements. New directories and files are created automatically according to the "Oracle Managed Files (OMF)" naming rules.

Example:

```
alter tablespace PSAPSTABD add datafile size 1000m;
```

Parameter	Value / Comments
db_create_file_dest	+DATA Default Oracle ASM disk group for new datafiles.
db_create_online_log_dest_1	+DATA Default Oracle ASM disk group for the first online redo log group member (= origlog).
db_create_online_log_dest_2	+RECO Default Oracle ASM disk group for the second online redo log group member (= mirrlog)

Besides of these Oracle ASM specific parameters the following parameters should also be set accordingly:

Parameter	Value / Comments
compatible	11.2.0.2 (see SAP note 1431798)
control_files	'+DATA/<DBNAME>/cntrl<DBNAME>.dbf', '+ARCH/<DBNAME>/cntrl<DBNAME>.dbf', '+RECO/<DBNAME>/cntrl<DBNAME>.dbf'
audit_file_dest	/oracle/<DBNAME>/saptrace/audit
db_recovery_file_dest	+RECO
db_recovery_file_dest_size	Depends on the size of the Oracle ASM disk group.

diagnostic_dest	/oracle/<DBNAME>/saptrace
log_archive_dest_1	<p>Oracle archive logs are written to an Oracle ASM disk group.</p> <p>Specify the location for the archive logs as follows (see SAP note 1431798):</p> <p>For Single instance: 'LOCATION=+ARCH'</p> <p>For RAC: 'LOCATION=+<DGNAME>/<DBNAME>/ORAARCH'</p> <p>Use asmcmd to create this location. Example: \$ asmcmd ASMCMD> mkdir ARCH/C11/ORARCH</p>

Please refer to SAP note 1431798 about general parameter recommendations for Oracle Database 11g Release 2.

Miscellaneous

Transparent Data Encryption (TDE)

If you are using TDE it is important to know that your TDE encryption wallet cannot be copied directly to an Oracle ASM disk group with Oracle release 11.2. On Linux it is recommended to create a shared ACFS volume on which you can place the encryption wallet. On other platforms you could use a shared NFS mount or place the encryption wallet on a local file system. Refer to SAP note 947876.

Incremental RMAN Backups

For incremental RMAN backups where customers use a block change tracking file it is recommended to place the file on Oracle ASM and to use an alias as the filename.

Example:

```
SQL> alter database enable block change tracking using file
'+DATA/<DBNAME>/bctf<DBNAME>.ora';
```

Please refer to SAP note 964619 for more information.

Summary of important SAP notes

Oracle ASM specific notes	
1550133	Oracle Automatic Storage Management (Oracle ASM)
1524205	Oracle 11.2.0: Database Software Installation
1431800	Oracle 11.2.0: Central Technical Note
1431798	Oracle 11.2.0: Database Parameter Settings
1554661	Configuration of Environment for 'oracle' user
1598594	BR*Tools Configuration for Oracle inst. under 'oracle' user
1521371	Setting of ORACLE_BASE in SAP Environments
Oracle feature notes	
974876	Transparent Data Encryption (TDE)
974781	Oracle internal maintenance jobs
966073	Oracle Flash Recovery Area/Fast Recovery Area
964619	RMAN: Incremental backups with Block Change Tracking

Planning Oracle ASM Disk Group Configuration

For SAP on Oracle with Oracle ASM we recommend to choose one out of three variants on how to name and configure your Oracle ASM disk groups. Which variant you should choose depends on your backup concept which in turn usually depends on the size of your database and required availability.

Oracle ASM Redundancy

With Oracle ASM the database instance implements several levels of redundancy: external, normal and high.

External redundancy: The database instance never writes the same data to more than one failure group. If the underlying disks are not mirrored somehow a failure of a single disk means data loss. This mode is recommended for non-clustered environments where redundancy is achieved by the storage subsystem.

Normal redundancy: The database writes the same data to two different failure groups.

High redundancy: The database writes the same data to three different failure groups.

Please note that with Oracle ASM redundancy is achieved by the database instance by multiplexing an IO going to one disk (within a failure group) to one or two additional disks (within one or two other failure groups). This is different to traditional storage solutions where data redundancy is achieved by raid implementations where a piece of data needs to be written only once by the host and the IO bandwidth required for mirroring is provided by the storage system. Therefore it may be necessary to increase the IO bandwidth between server and storage or disks by using multipath software or by adding additional physical IO channels.

Example:

If you configure 2 redo log members per redo log group and place them on a Oracle ASM disk group with normal redundancy the database instance has to do 4 IO's - one for each redo log member and one for each disk.

Nevertheless it is not recommended to run your database with just one online redo log member per group!!!

Oracle ASM Disk Group Naming Conventions

Independent from how you configure your Oracle ASM disk groups for running your Oracle Database(s) it is recommended to configure one Oracle ASM disk group with “high redundancy” exclusively for Oracle Clusterware. This Oracle ASM disk group stores the Oracle Cluster Repository and the Oracle ASM parameter file.

The recommended name for this Oracle ASM disk group is “+OCR”.

The minimal size of each Oracle ASM disk in the OCR disk group is 4GB. Note that each Oracle ASM disk defines a separate failure group within the disk group.

For RAC it is required to have a dedicated Oracle ASM disk group for the Oracle ASM Cluster File System ACFS. The disk group and the ACFS file system on it should be configured large enough to store the required number of Oracle RDBMS Homes. Keep in mind that much more disk space may be required than just for one Oracle Home when it comes to patching or out of place upgrades which are basically full installations since 11gR2 and need to be installed next to the old Oracle Home.

The recommended name for this Oracle ASM disk group is “+ACFS”.

Variant 1 – small to medium data volumes, restore time not critical

Customer has small or medium sized databases where backup and/or restore + recovery of **all** databases can be accomplished by RMAN in a timely fashion.

Example:

If a complete Oracle ASM disk group with data files from one or more databases is broken and all data files from all databases need to be restored to a newly created Oracle ASM disk group using RMAN.

Oracle ASM disk group recommendation:

Oracle ASM Disk Group Name	Stores
+DATA	<ul style="list-style-type: none"> - All data files - All temp files - Control file (first copy)

	- Online redo logs (first copy)
+ARCH	- Control file (second copy) - Archived redo logs
+RECO	- Control file (third copy) - Online redo logs (second copy) - RMAN backups (optional) - Fast recovery area (optional)

Variant 2 – medium to large data volumes, restore time important

Customer has medium to large sized databases where backup and/or restore + recovery of all databases cannot be accomplished in a timely fashion.

Usually customers will use RMAN and Split-Mirror techniques in combination.

Major differences to Variant 1 are:

- Separate Oracle ASM disk group for each database
- <DBNAME>+“_” is used as a prefix for the name of the DATA disk group.
- The number of the DATA disk group is appended if the database spans over more than one DATA disk group.
- No online redo logs are located in the “data” disk groups. Instead an additional disk group is used for the first member of each online redo log group.

Important: Please consider that only a maximum of 63 Oracle ASM disk groups can be configured.

Oracle ASM disk group recommendation:

Oracle ASM Disk Group Name	Stores
+<DBNAME>_DATA[#] e.g. ERP_DATA, ERP_DATA1,	- All data files - All temp files - Control file (first copy)

CRM_DATA1	
+OLOG	- Online redo logs (first copy)
+ARCH	- Control file (second copy) - Archived redo logs
+RECO	- Control file (third copy) - Online redo logs (second copy) - RMAN backups - Fast recovery area

Variant 3 – very large data and data change volumes, restore time crucial

Customer has very large databases where backup and/or restore + recovery of a single databases cannot be accomplished in a timely fashion.

Usually customers will use RMAN and Split-Mirror techniques in combination.

In this variant each relevant database file type is separated to different Oracle ASM disk groups.

Important: Please consider that only a maximum of 63 Oracle ASM disk groups can be configured.

Oracle ASM disk group recommendation:

Oracle ASM Disk Group Name	Stores
+<DBNAME>_DATA[#] e.g. ERP_DATA, ERP_DATA1, CRM_DATA	- All data files - All temp files - Control file (first copy) You can append a number to the name of the Oracle ASM disk group if you need additional disk groups for 'DATA'.
+<DBNAME>_ARCH	- Control file (second copy)

e.g. ERP_ARCH, CRM_ARCH	- Archived redo logs
+<DBNAME>_RECO e.g. ERP_RECO, CRM_RECO	- Control file (third copy) - RMAN backups - Fast recovery area
+<DBNAME>_OLOG e.g. ERP_OLOG, CRM_OLOG	- Online redo logs (first copy)
+<DBNAME>_MLOG e.g. ERP_MLOG, CRM_MLOG	- Online redo logs (second copy)

Important: Always place all files from one database into the according Oracle ASM disk groups of that database. Never place a file from database “ERP” into a disk group that belongs to database “CRM”.

Oracle ASM Compatibility Attributes

The disk group attributes that determine compatibility are 'compatible.asm', 'compatible.rdbms' and 'compatible.advm'. The 'compatible.asm' and 'compatible.rdbms' attribute settings determine the minimum Oracle Database software version numbers that a system can use for Oracle ASM and the database instance types respectively. For example, if the Oracle ASM compatibility setting is 11.2, and RDBMS compatibility is set to 11.1, then the Oracle ASM software version must be at least 11.2, and the Oracle Database client software version must be at least 11.1. The 'compatible.advm' attribute determines where the Oracle ASM Dynamic Volume Manager feature can be used to create Oracle ASM volumes in disk groups.

Make sure that 'compatible.asm' and 'compatible.rdbms' are set to '11.2.0.2.0' for all Oracle ASM disk groups.

For more information please refer to “Moving your SAP database to Oracle Automatic Storage Management 11g Release 2 – A Best Practices Guide”



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