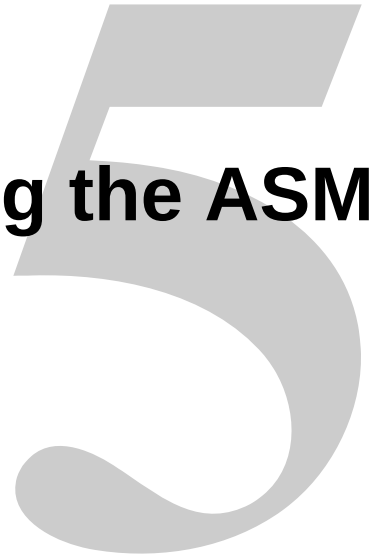


Managing the ASM Instance

Objectives

After completing this lesson, you should be able to:

- Describe the benefits of using ASM
- Manage the ASM instance
- Create and drop ASM disk groups
- Extend ASM disk groups
- Retrieve ASM metadata by using various utilities

ASM Benefits for Administrators

ASM eliminates:

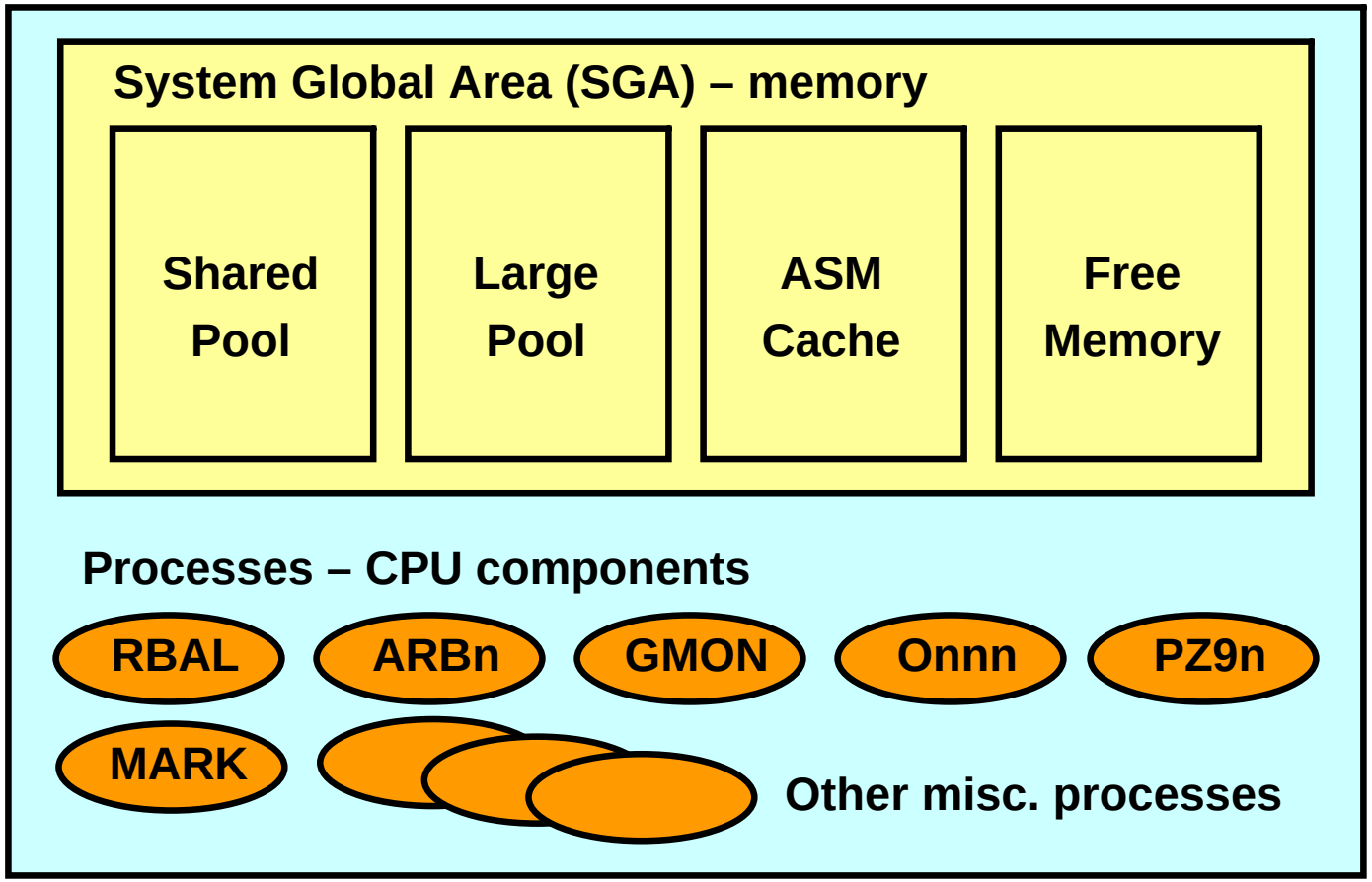
- I/O performance tuning
- Data file movements and reorganizations
- File name management
- Logical volume management
- File system management
- Cluster file system management
- Raw device management

ASM significantly reduces:

- Logical Unit Number (LUN) management
  - Fewer, larger LUNs
- Database administrator dependence on system administrator
- Likelihood of errors associated with manual maintenance tasks

ASM Instance

The ASM Instance is a combination of the process and memory components for ASM.



ASM Instance

ASM Components: ASM Instance—Primary Processes

The ASM instance primary processes are responsible for ASM-related activities.

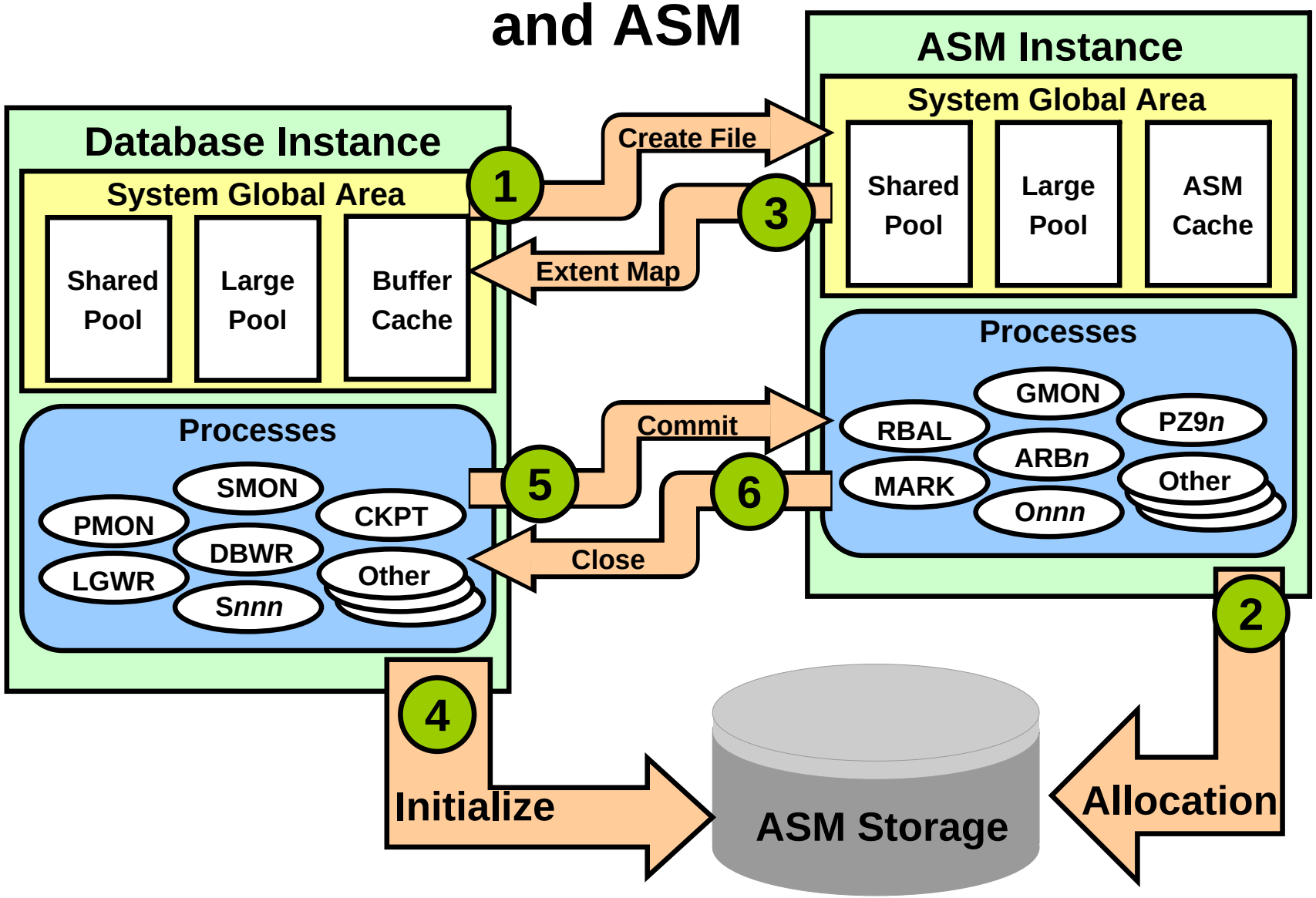
Process	Description
RBAL	Opens all device files as part of discovery and coordinates the rebalance activity
ARB*n*	One or more slave processes that do the rebalance activity
GMON	Responsible for managing the disk-level activities such as drop or offline and advancing the ASM disk group compatibility
MARK	Marks ASM allocation units as stale when needed
Onnn	One or more ASM slave processes forming a pool of connections to the ASM instance for exchanging messages
PZ9n	One or more parallel slave processes used in fetching data on clustered ASM installation from `GV$` views

ASM Instance Initialization Parameters

The ASM instance uses a small subset of the parameters that an Oracle Database instance uses.

```
INSTANCE_TYPE = ASM
ASM_POWER_LIMIT = 1
ASM_DISKSTRING = '/dev/sda1','/dev/sdb*'
ASM_DISKGROUPS = DATA2, FRA
ASM_PREFERRED_READ_FAILURE_GROUPS = DATA.FailGroup2
DIAGNOSTIC_DEST = /u01/app/oracle
LARGE_POOL_SIZE = 12M
REMOTE_LOGIN_PASSWORDFILE = EXCLUSIVE
```

Interaction Between Database Instances and ASM



ASM Instance: Dynamic Performance Views

The ASM instance hosts memory-based metadata tables presented as dynamic performance views.

- Accessed by ASM utilities to retrieve metadata-only information using the SQL language
- Contains many dedicated ASM-related views such as:

V$ASM_ALIAS	V$ASM_ATTRIBUTE	V$ASM_CLIENT
V$ASM_DISK	V$ASM_DISK_IOSTAT	V$ASM_DISK_STAT
V$ASM_DISKGROUP	V$ASM_DISKGROUP_STAT	V$ASM_FILE
V$ASM_OPERATION	V$ASM_TEMPLATE	

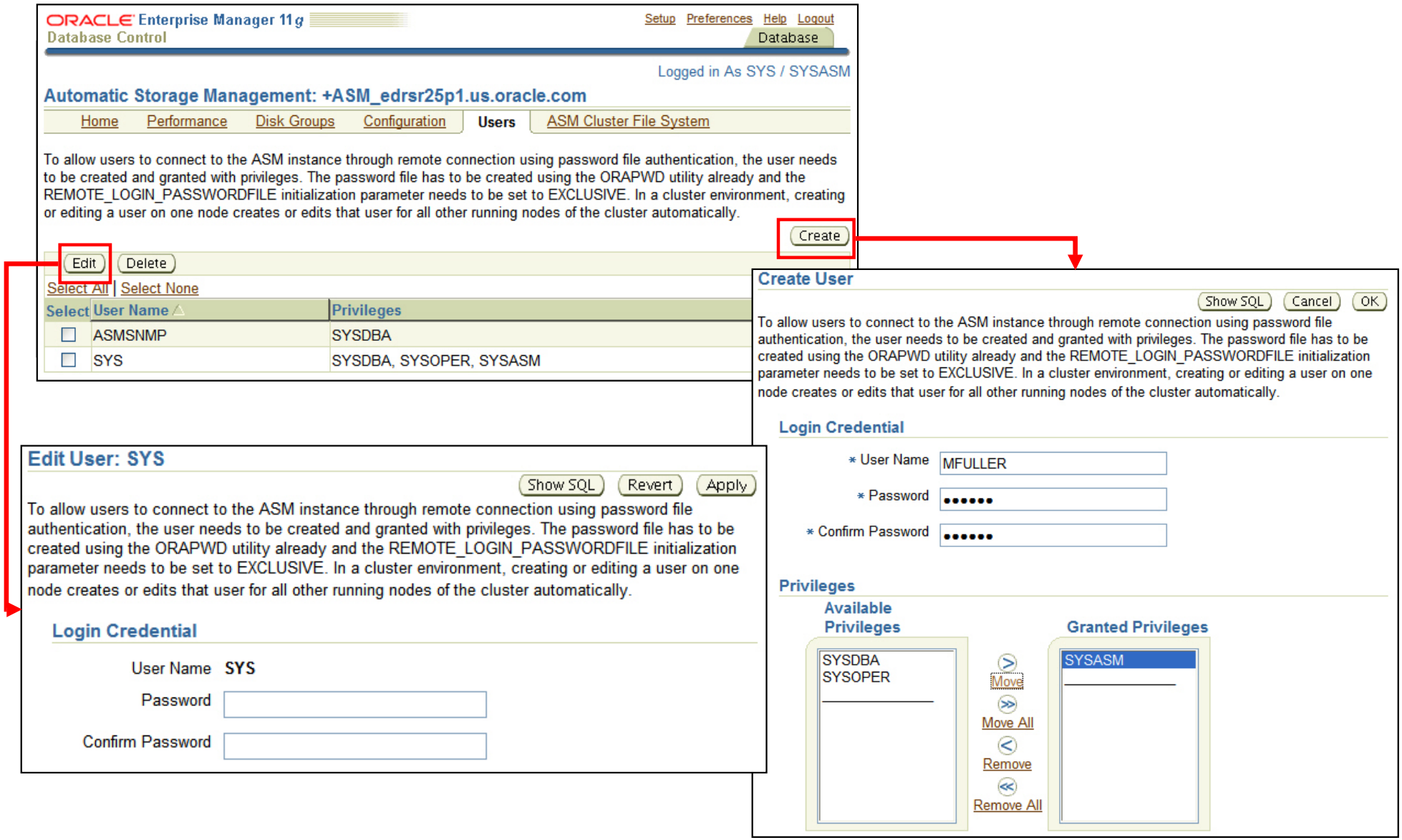
ASM System Privileges

- An ASM instance does not have a data dictionary, so the only way to connect to ASM is by using these system privileges.

ASM Privilege	Privilege Group (Suggested)	Privilege
SYSASM	OSASM (asmadmin)	Full administrative privilege
SYSDBA	OSDBA (asmdba)	Access to data stored on ASM, and SYSASM in the current release
SYSOPER	OSOPER (asmoper)	Limited privileges to start and stop the ASM instance along with a set of nondestructive ALTER DISKGROUP commands

- The SYS user is automatically created with the SYSASM privilege.

Using Enterprise Manager to Manage ASM Users



Starting and Stopping ASM Instances Using SQL*Plus

Using SQL*Plus to start and stop ASM instances is similar to the way in which you start and stop database instances.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ sqlplus / AS SYSASM
SQL*Plus: Release 11.2.0.1.0 - Production on Wed Jul 8 20:46:46 2009
Copyright (c) 1982, 2009, Oracle.  All rights reserved.
Connected to an idle instance.
SQL> startup
ASM instance started

Total System Global Area  284565504 bytes
Fixed Size                  1336028 bytes
Variable Size             258063652 bytes
ASM Cache                  25165824 bytes
ASM diskgroups mounted
ASM diskgroups volume enabled
SQL> shutdown abort
```

Starting and Stopping ASM Instances Using `srvctl`

The Server Control utility (`srvctl`) can be used to start and stop ASM instances.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
    ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
    /u01/app/oracle
$ srvctl start asm -o mount
$ srvctl stop asm -f
```

The Sever Control utility (`srvctl`) can be used to check the status of ASM instances.

```
$ srvctl status asm
ASM is running on edrsr25p1
```

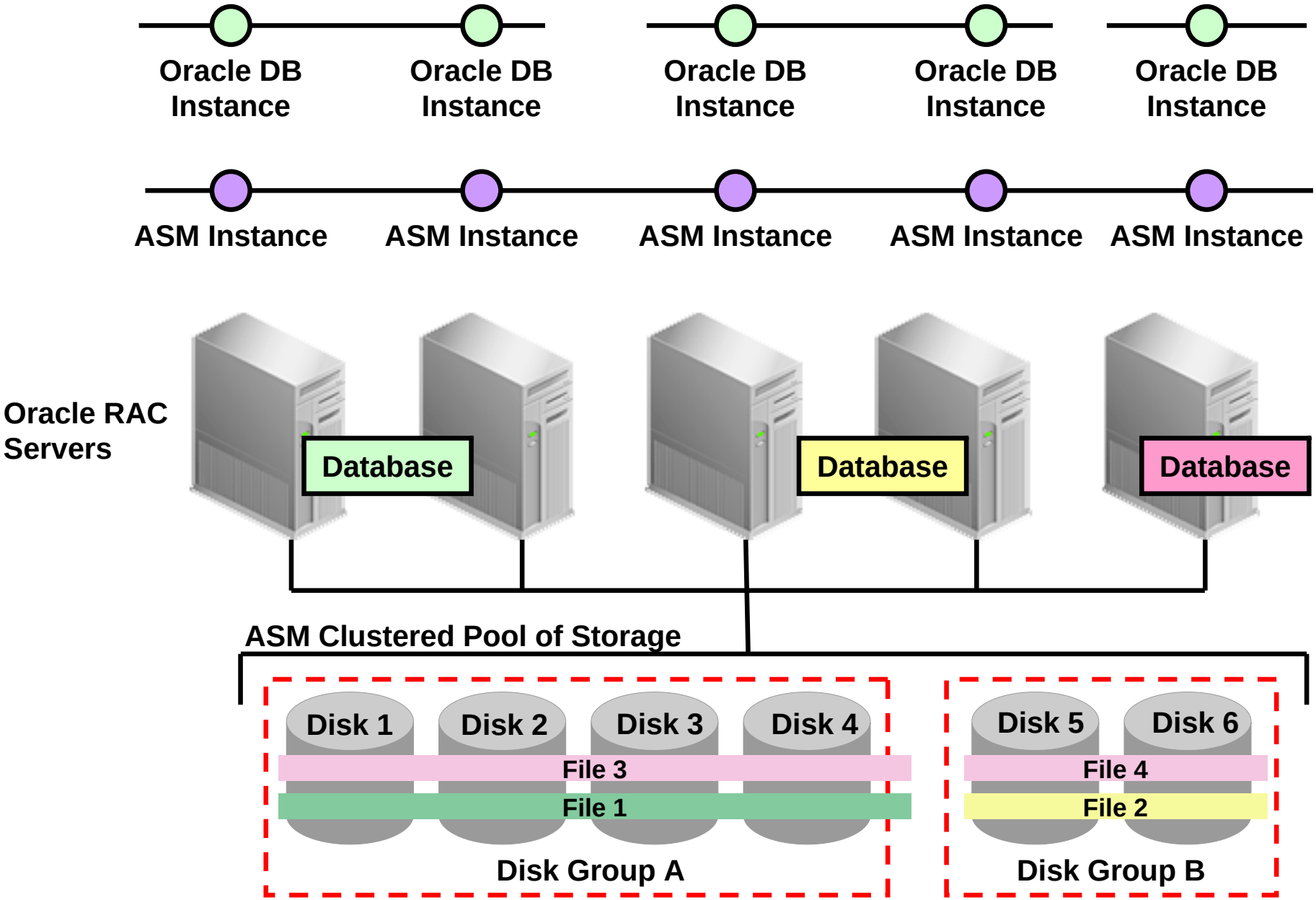
Starting and Stopping ASM Instances Using `asmcmd`

The `asmcmd` utility provides a command-line interface to ASM without using the SQL language.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ asmcmd
Connected to an idle instance.
ASMCMD> startup
ASM instance started

Total System Global Area  284565504 bytes
Fixed Size                  1336028 bytes
Variable Size             258063652 bytes
ASM Cache                  25165824 bytes
ASM diskgroups mounted
ASM diskgroups volume enabled
ASMCMD> shutdown --abort
ASM instance shut down
Connected to an idle instance.
```

Disk Group Overview



ASM Disks

ASM disks:

- Are the storage devices provisioned to ASM disk groups
- Are accessed through normal O/S interfaces
- Must be read and write accessible by the ASM owner
- Must be accessible by all nodes in a cluster
- May have different O/S names or paths on different nodes
- May be:
  - An entire physical disk or partition of a physical disk
  - A disk or partition from a storage array
  - Logical volumes (LV) or logical units (LUN)
  - Network-attached files (NFS)

Allocation Units

ASM disks are divided into allocation units (AU):

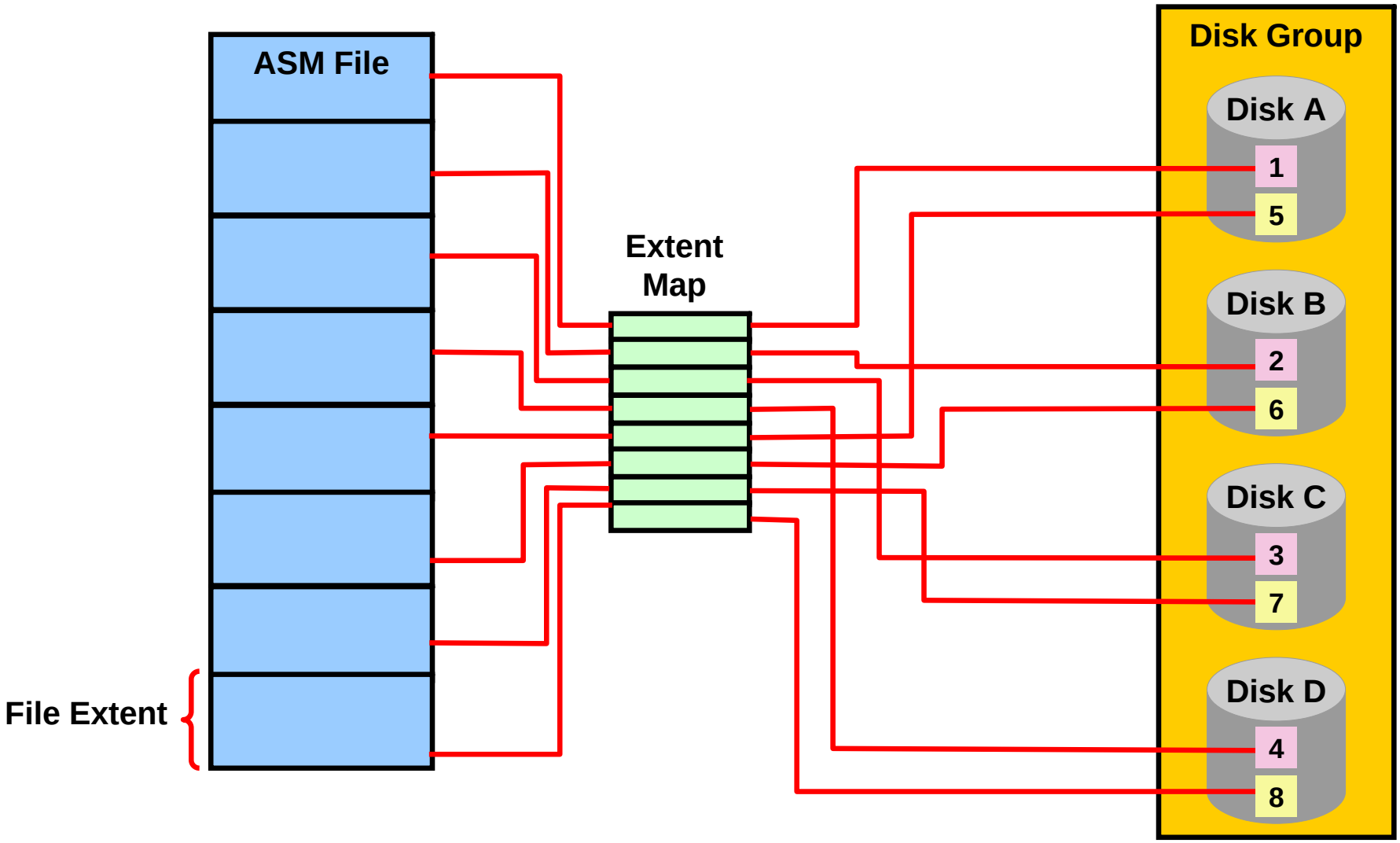
- AU size is configurable at disk group creation.
- Default AU size is 1 MB:
  - Small enough to be cached by database and large enough for efficient sequential access
- Allowable AU sizes:
  - 1, 2, 4, 8, 16, 32, or 64 MB
  - Large AUs may be useful in very large database (VLDB) scenarios or when using specialized storage hardware

ASM Files

ASM files:

- Are a collection of ASM extents composed of AUs
  - Variable sized extents support large files
- Appear as normal files to the database kernel
- Have file names that start with '+'
  - For example, `+DATA/orcl/datafile/system.256.689832921`
- May be associated with an optional alias file name
  - For example, `+DATA/dbfiles/mydb/system01.dbf`
- Are evenly distributed across disks in a disk group
- Are mirrored according to the policies defined in the disk group

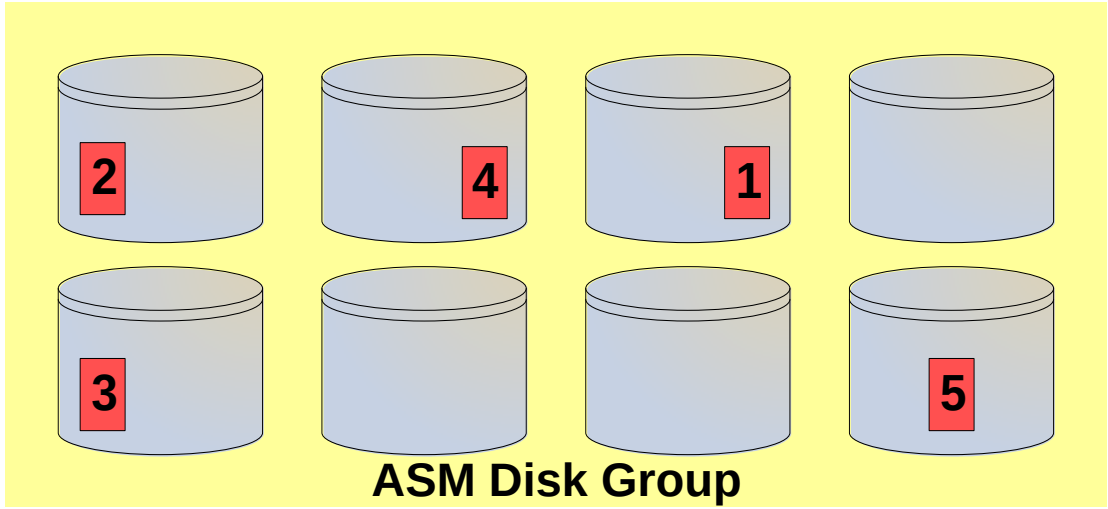
Extent Maps



Striping Granularity

ASM separates striping for load balance and striping for latency:

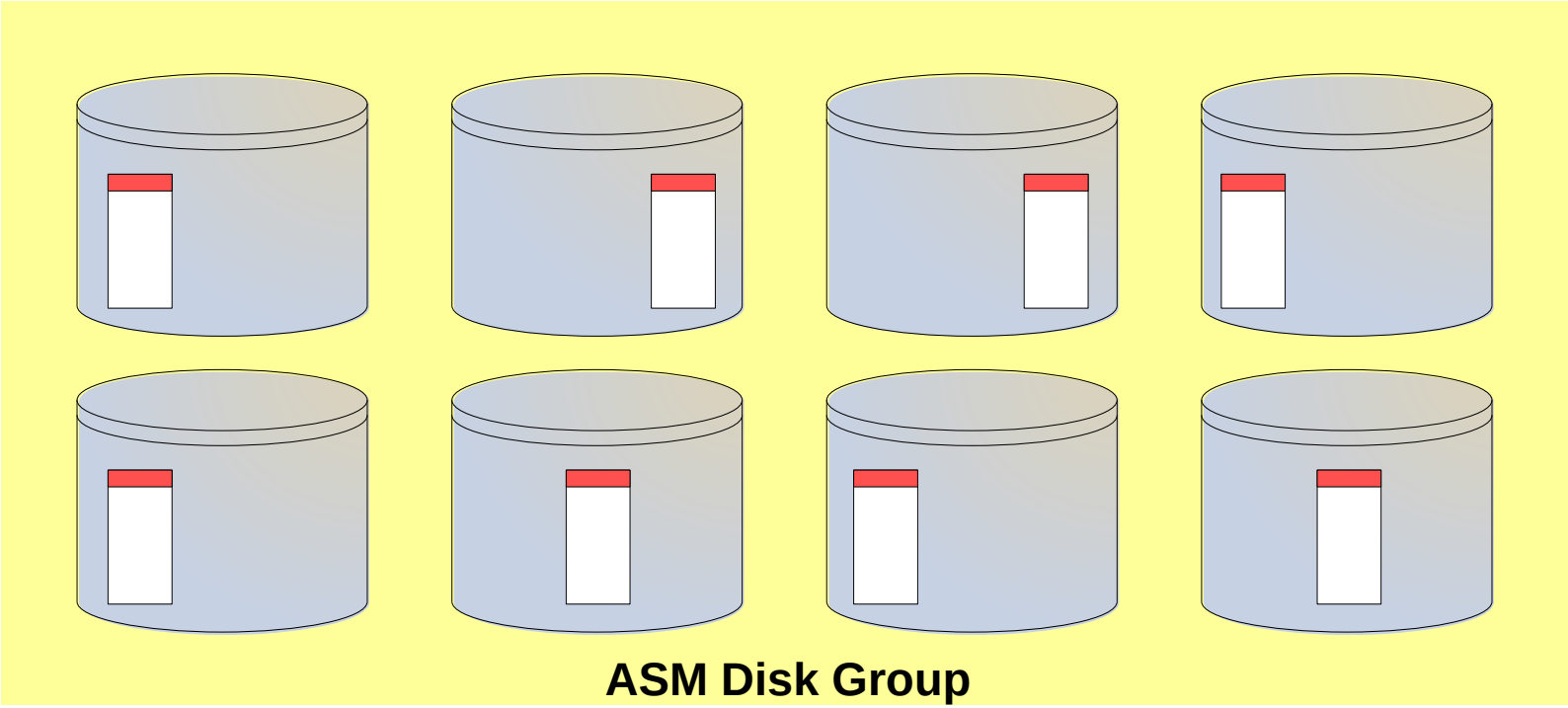
- Coarse-grain striping concatenates allocation units for load balancing.
  - For example:



Fine-Grained Striping

Fine-grain striping puts 128 KB stripe units across groups of allocation units to improve latency.

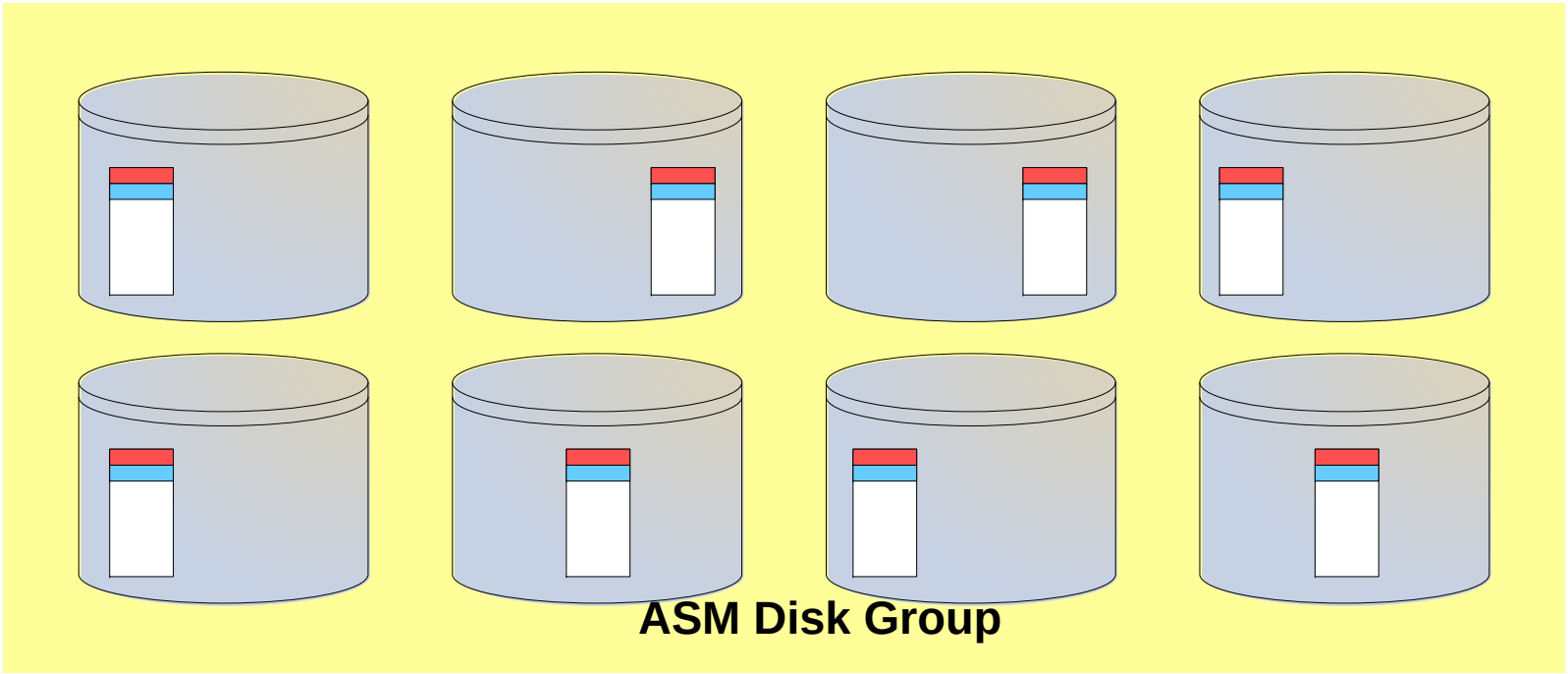
- Disk group with 8 disks and external redundancy
- Default AU size of 1 MB in use
- First 1 MB extent written as 128 KB stripes across 8 AUs



Fine-Grained Striping

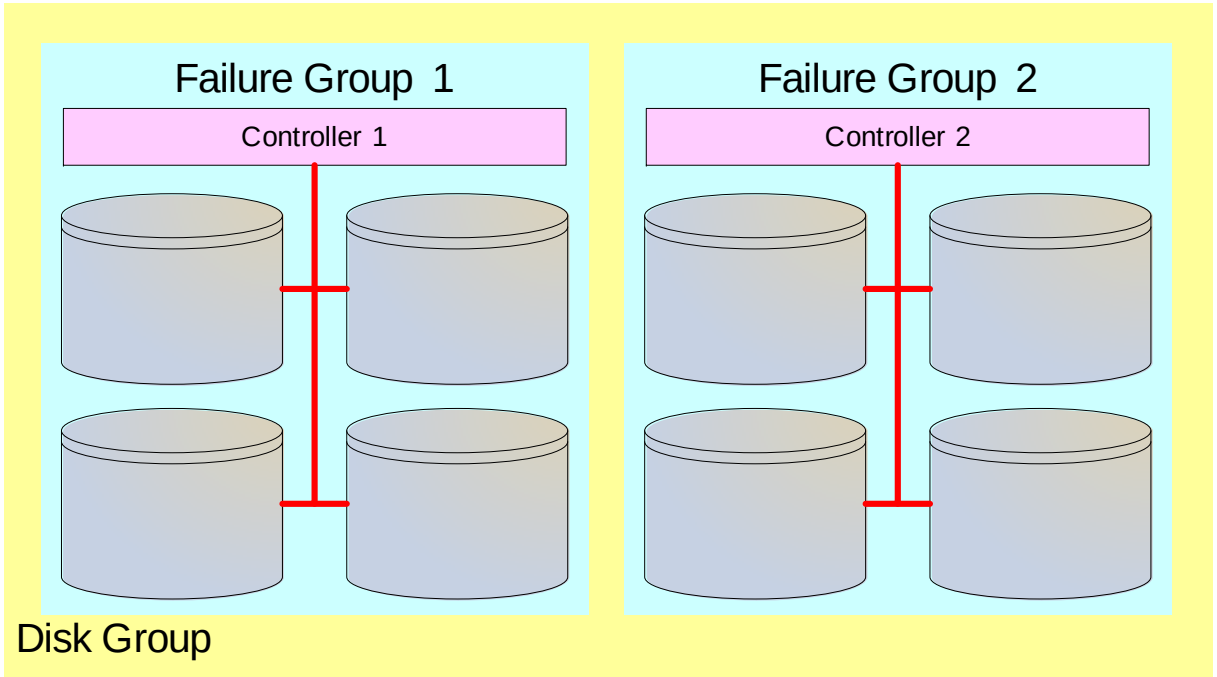
Example:

- Disk group with 8 disks and external redundancy
- Default AU size of 1 MB in use
- Next 1 MB extent written as 128 KB stripes across the same 8 allocation units until they are full



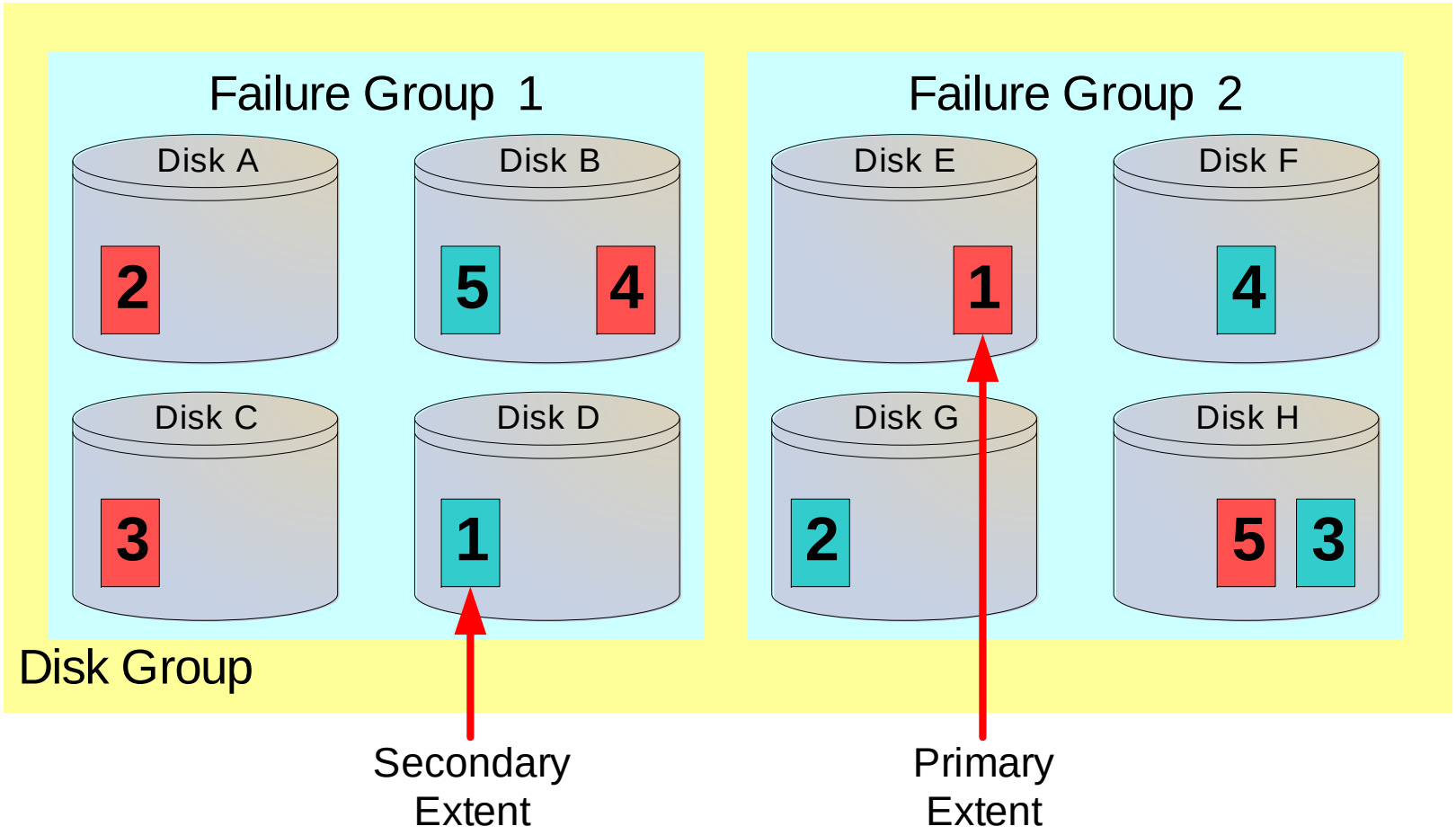
ASM Failure Groups

- A set of disks sharing a common resource whose failure needs to be tolerated
- Mirrored extent copies stored in separate failure groups
- Storage hardware dictates failure group boundaries
  - Example based on isolating disk controllers:



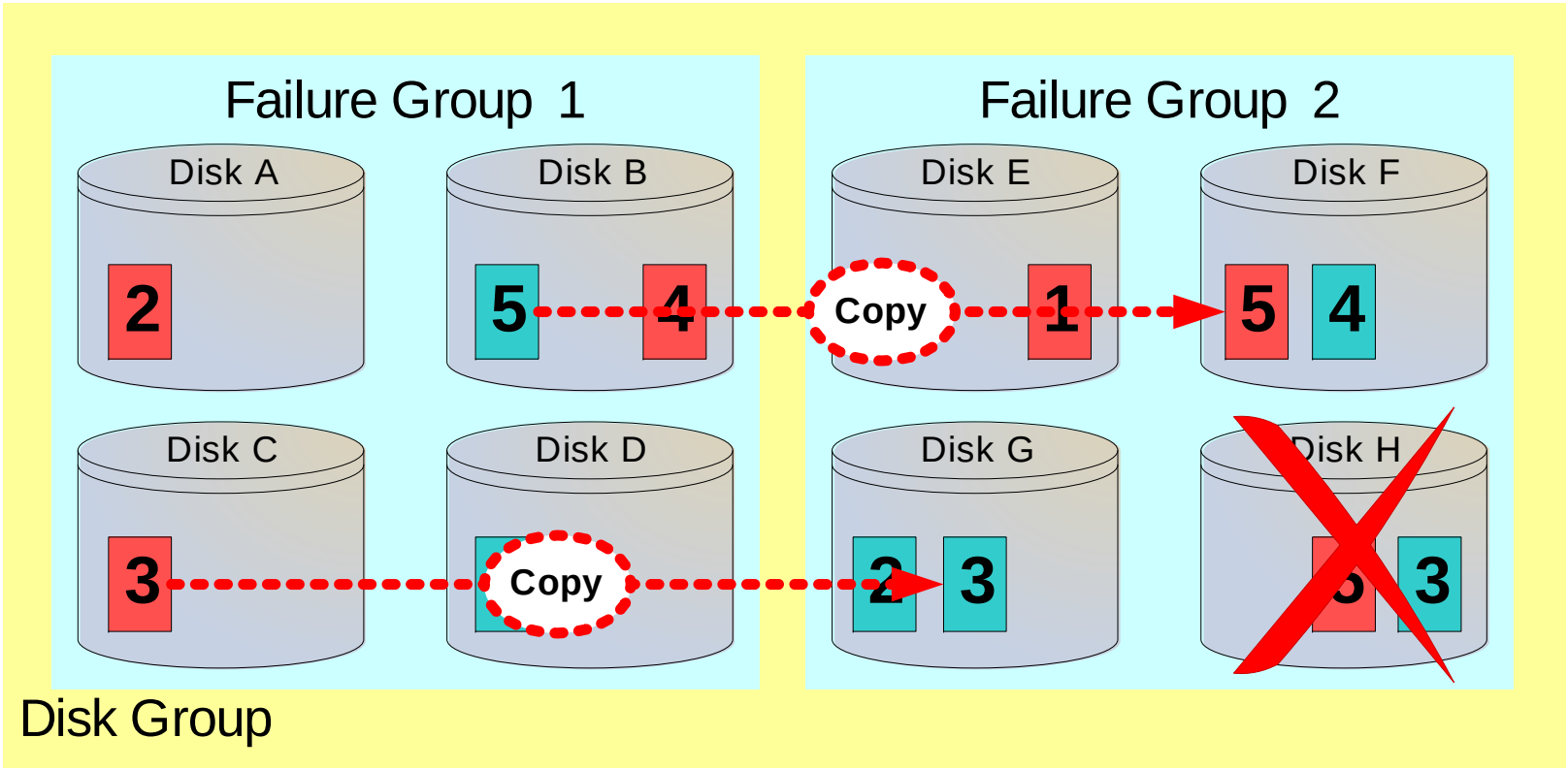
Stripe and Mirror Example

Normal redundancy disk group with eight disks in total, spread across two failure groups.

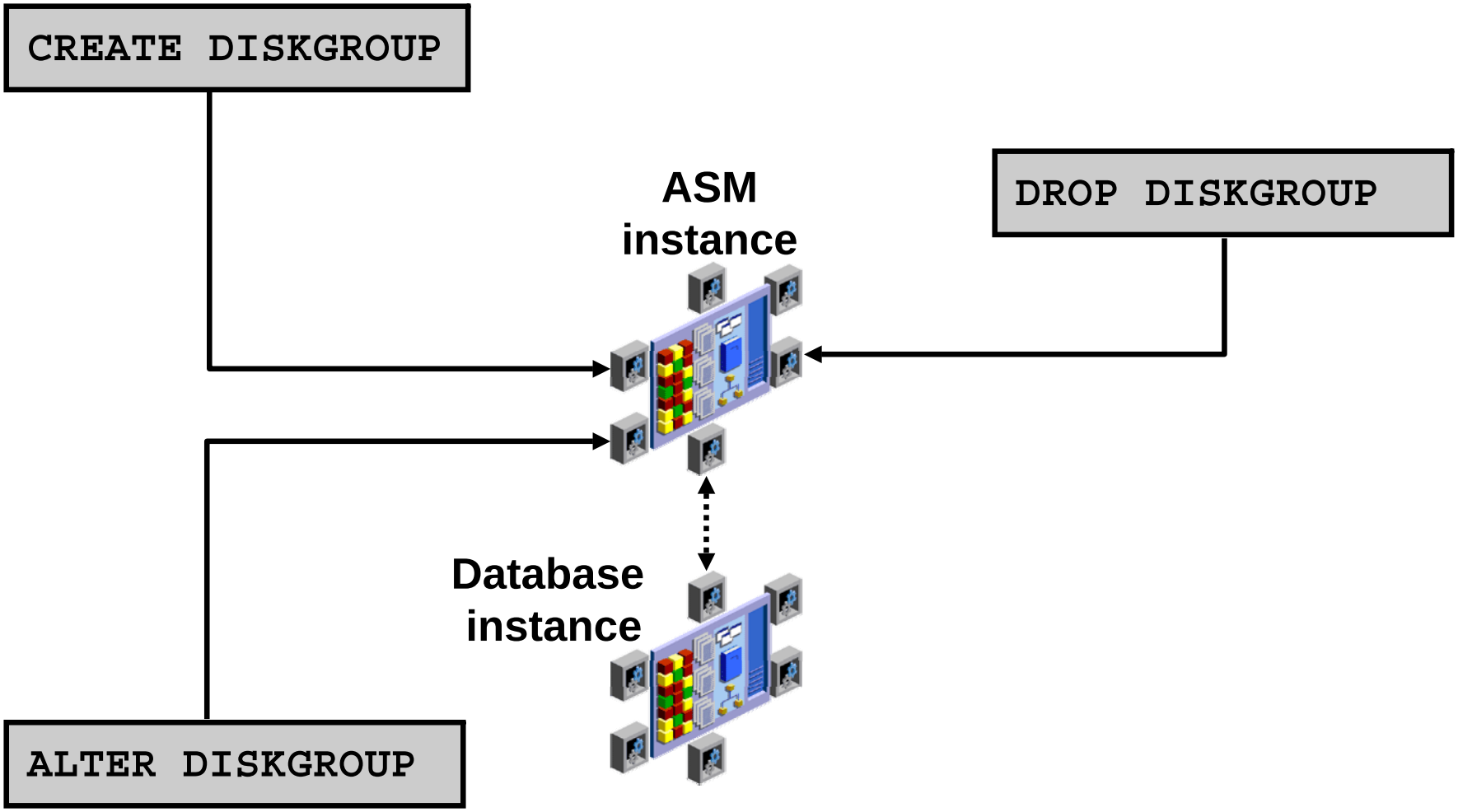


Failure Example

If disk H fails, then the extents it contained are re-created on surviving disks from surviving mirrors.



Managing Disk Groups



Creating and Dropping Disk Groups Using SQL*Plus

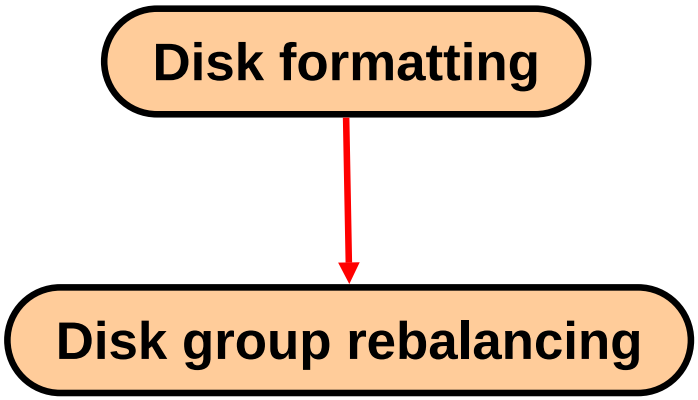
```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ sqlplus / AS SYSASM
SQL*Plus: Release 11.2.0.1.0 - Production on Wed Jul 8 20:46:46 2009
Copyright (c) 1982, 2009, Oracle.  All rights reserved.
..
SQL> CREATE DISKGROUP dgroupA NORMAL REDUNDANCY
FAILGROUP controller1 DISK
   '/devices/A1' NAME diskA1 SIZE 120G FORCE,
   '/devices/A2',
FAILGROUP controller2 DISK
   '/devices/B1',
   '/devices/B2';
```

```
SQL> DROP DISKGROUP dgroupA INCLUDING CONTENTS;
```

Adding Disks to Disk Groups

```
ALTER DISKGROUP dgroupA ADD DISK
  '/dev/sde1' NAME A5,
  '/dev/sdf1' NAME A6,
  '/dev/sdg1' NAME A7,
  '/dev/sdh1' NAME A8;
```

```
ALTER DISKGROUP dgroupA ADD DISK '/devices/A*';
```



Miscellaneous ALTER Commands

Remove a disk from dgroupA:

```
ALTER DISKGROUP dgroupA DROP DISK A5;
```

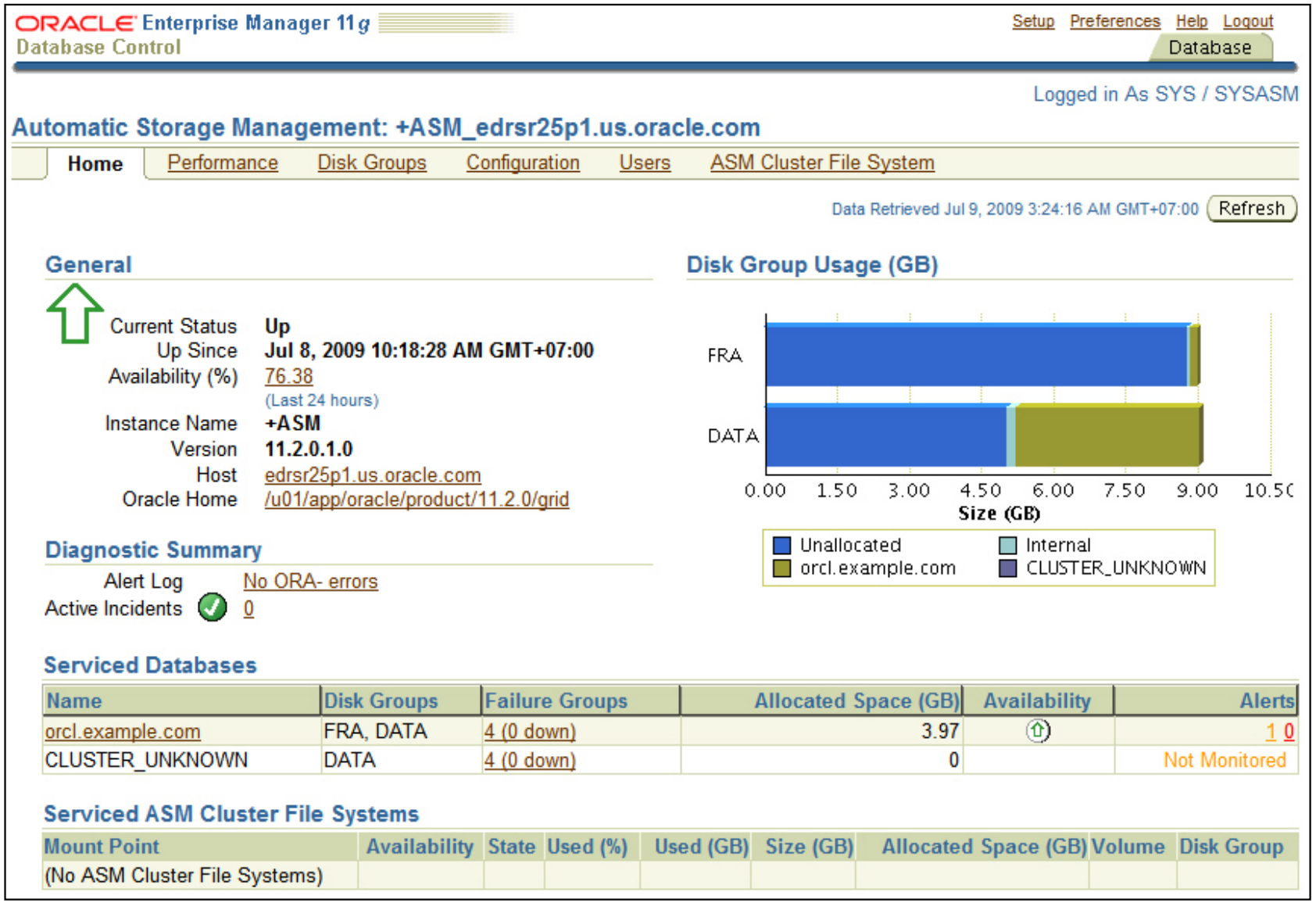
Add and drop a disk in a single command:

```
ALTER DISKGROUP dgroupA
 DROP DISK A6
 ADD FAILGROUP controller3
          DISK '/dev/sdi1' NAME A9;
```

Cancel a disk drop operation:

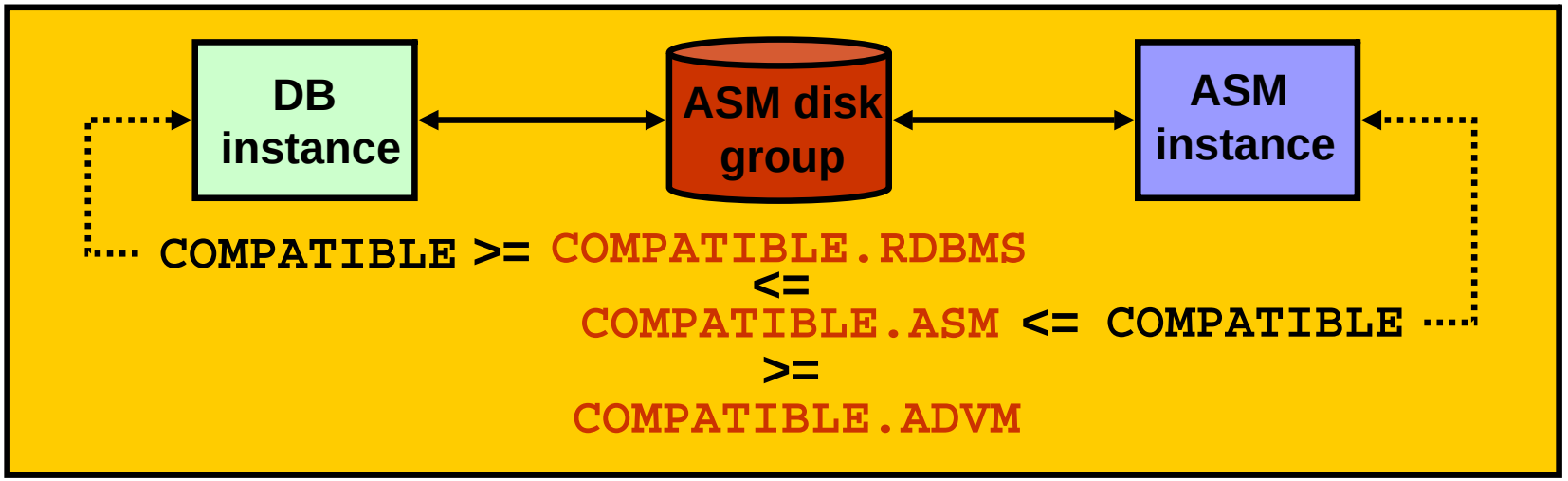
```
ALTER DISKGROUP dgroupA UNDROP DISKS;
```

ASM Management Using Enterprise Manager



ASM Disk Group Compatibility

- Compatibility of each disk group is separately controllable:
  - ASM compatibility controls ASM metadata on-disk structure.
  - RDBMS compatibility controls minimum consumer client level.
  - ADVM compatibility determines whether a disk group can contain Oracle ASM volumes.
- Setting disk group compatibility is irreversible.

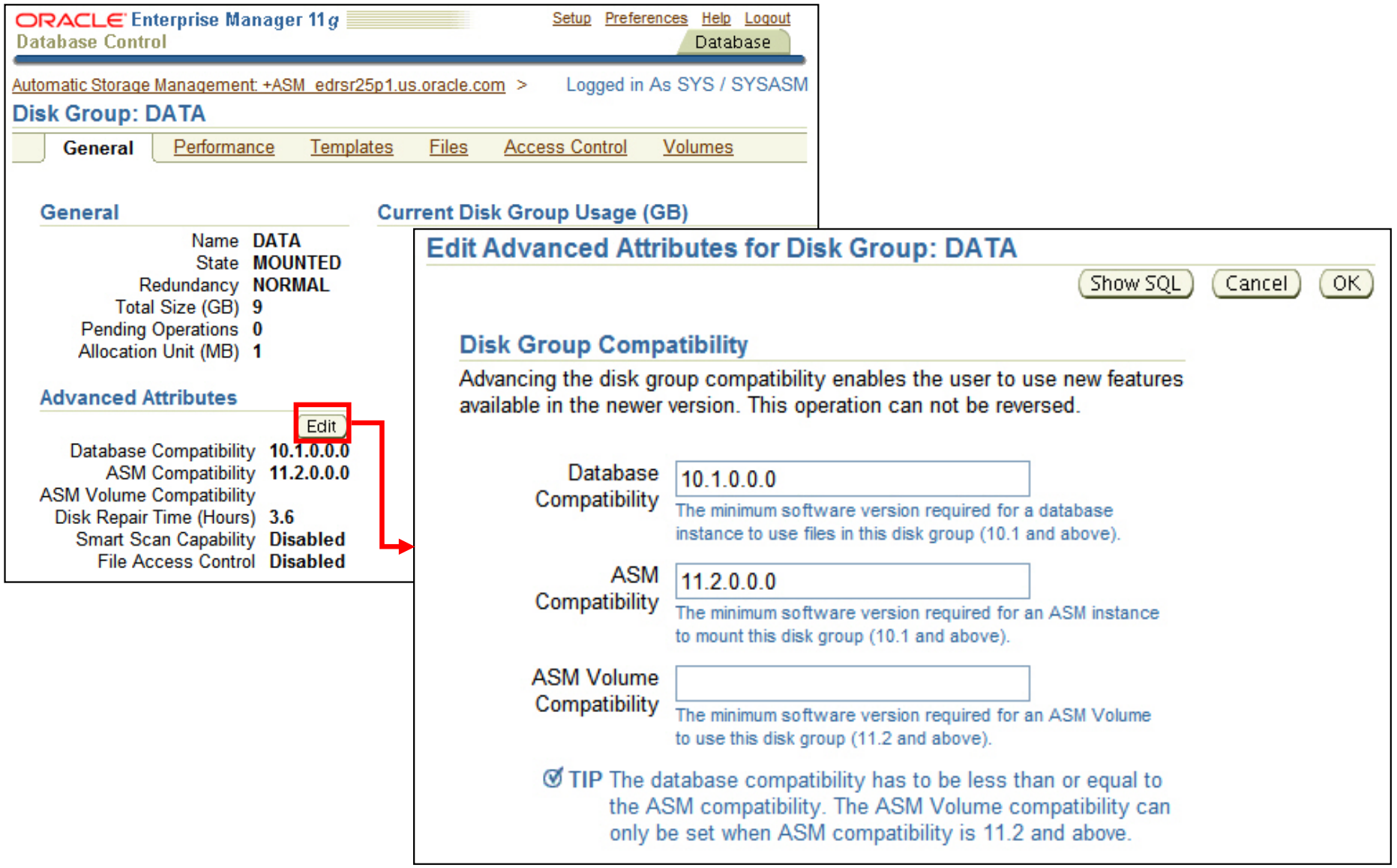


ASM Disk Group Attributes

Name	Property	Values	Description
au_size	Create, Alter	1|2|4|8|16|32|64MB	Size of allocation units in the disk group
compatible.rdbms	Create, Alter	Valid database version	Format of messages exchanged between DB and ASM
compatible.asm	Create, Alter	Valid ASM instance version	Format of ASM metadata structures on disk
compatible.advm	Create, Alter	Valid ASM instance version	Allows Oracle ASM volumes in disk group
disk_repair_time	Create, Alter	0 M to 2^{32} D	Length of time before removing a disk once OFFLINE
template.*tname*. redundancy	Alter	UNPROTECT|MIRROR|HIGH	Redundancy of specified template
template.*tname*. stripe	Alter	COARSE|FINE	Striping attribute of specified template

```
CREATE DISKGROUP DATA2 NORMAL REDUNDANCY
DISK '/dev/sda1','/dev/sdb1'
ATTRIBUTE 'compatible.asm'='11.2';
```

Using Enterprise Manager to Edit Disk Group Attributes



Retrieving ASM Metadata

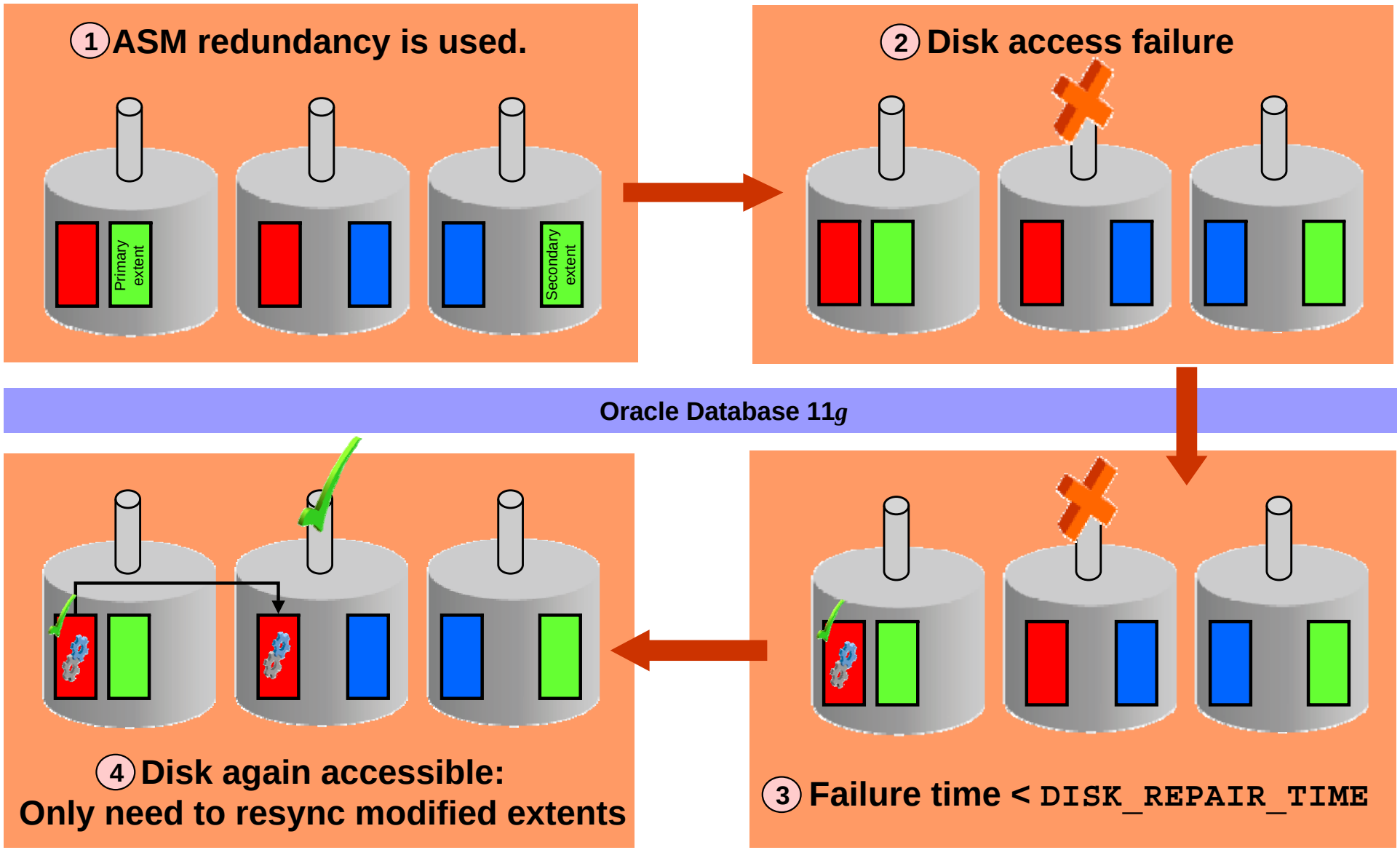
- Using SQL*Plus:

```
SQL> SELECT f.type, f.redundancy, f.striped, f.modification_date,
a.system_created, a.name FROM v$asm_alias a, v$asm_file f WHERE
a.file_number = f.file_number and a.group_number = f.group_number
and type='DATAFILE';
TYPE        REDUND   STRIPE   MODIFICAT   S   NAME
--------    ------   ------   ---------   -   --------------------
DATAFILE    MIRROR   COARSE   08-JUL-09   Y   SYSTEM.256.689832921
DATAFILE    MIRROR   COARSE   08-JUL-09   Y   SYSAUX.257.689832923
..
```

- Using `asmcmd`:

```
ASMCMD> ls -l +DATA/orcl/datafile
Type        Redund   Striped   Time              Sys   Name
DATAFILE    MIRROR   COARSE    JUL 08 21:00:00   Y SYSTEM.256.689832921
DATAFILE    MIRROR   COARSE    JUL 08 21:00:00   Y SYSAUX.257.689832923
..
```

ASM Fast Mirror Resync Overview



Quiz

Which parameter is required for an ASM instance?

1. INSTANCE_TYPE
2. ASM_DISKGROUPS
3. LARGE_POOL_SIZE
4. None of the above

Quiz

Fine-grain striping, by default, is used for _____ and _____.

1. Data files
2. Control files
3. Temp files
4. Online redo logs
5. SPFILE

Summary

In this lesson, you should have learned how to:

- Manage the ASM instance by using SQL*plus, `asmcmd`, and Enterprise Manager
- Create and drop ASM disk groups
- Specify ASM compatibility attributes
- Extend ASM disk groups
- Compare methods of retrieving ASM metadata

Practice 5 Overview: Managing the ASM Instance

This practice covers the following topics:

- Creating an ASM disk group with `asmcmd`
- Dropping an ASM disk group with EM
- Viewing ASM metadata