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Oracle Cloud Storage

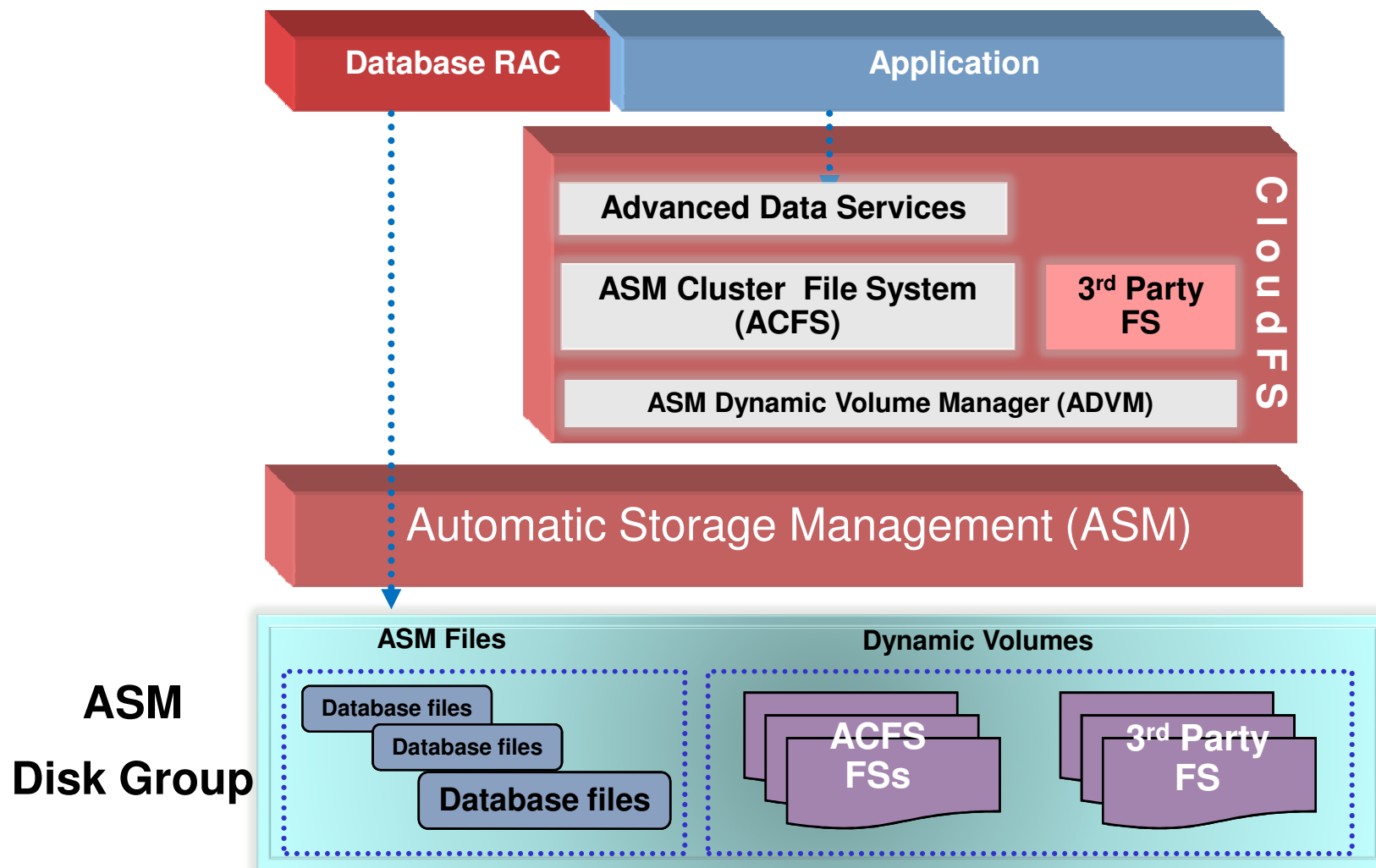
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Oracle Cloud Storage

- **Automatic Storage Management (ASM)**
- **Oracle Cloud File System**
 - ASM Dynamic Volume Manager (ADVM)
 - ASM Cluster File System (ACFS)
 - ACFS data services
 - Snapshot, replication, tagging, security, encryption
 - Included all editions of the database for storing:
 - Oracle Database files, Oracle application binaries, Oracle homes
 - Oracle software administrative and diagnostics files
 - All non-Oracle database and non-Oracle application files

Oracle Cloud Storage

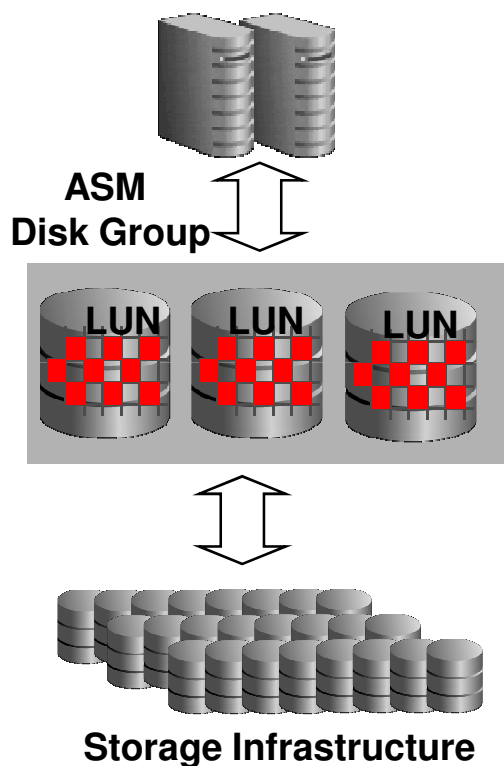
High level architecture



Automatic Storage Management (ASM)

Automatic Storage Management

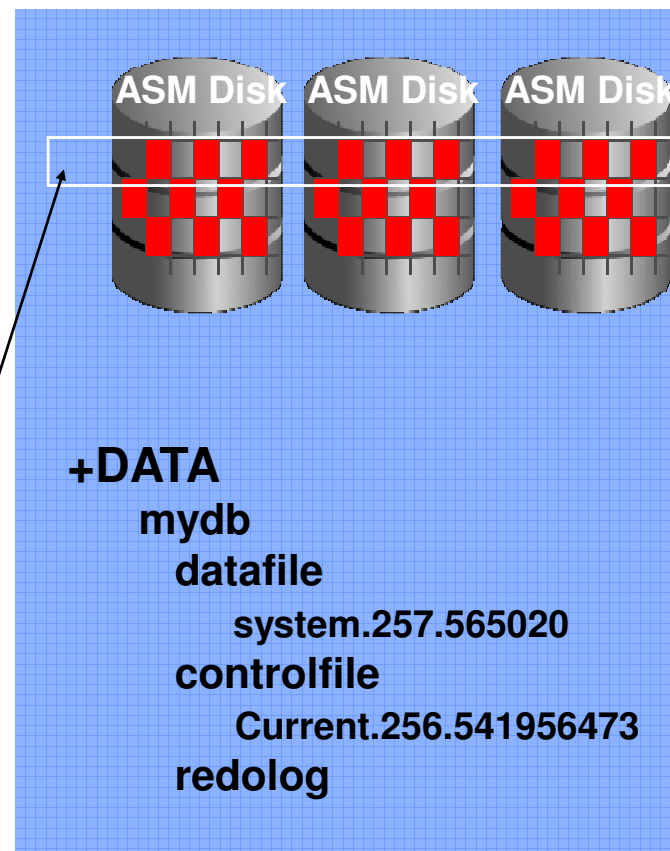
An integrated **storage manager** for Oracle Database files



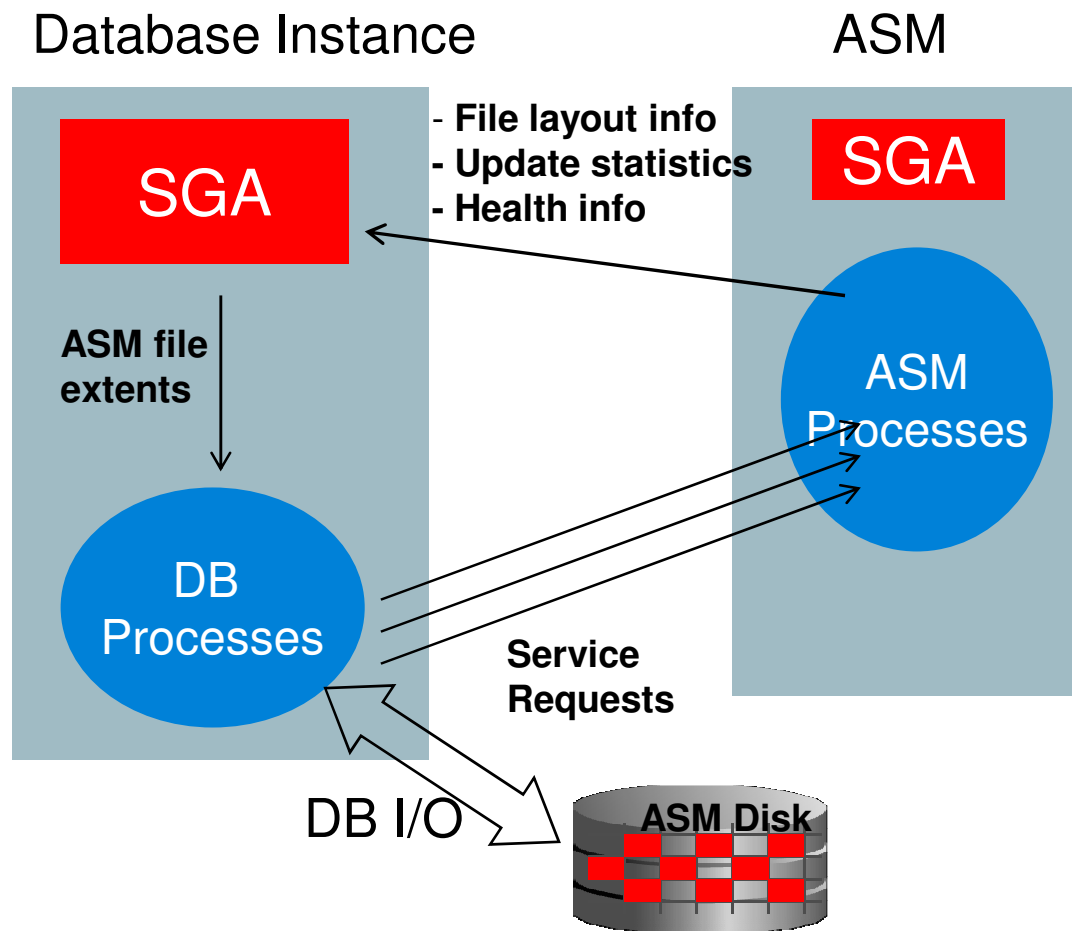
- Integrated volume manager
 - Flexible mirroring and striping
- High performance file system
- Automated features:
 - Data re-balancing
 - Variable size extents
 - Auto bad block detection & correction
- Highly scalable
- Cluster and Single node file system
- SQL, EM and ASMCMD management

ASM Key Components

- **ASM Disk Group**
 - Shared storage pool
 - Highest level object managed by ASM
 - Collection of ASM disks
- **ASM disk**
 - LUNs, partitions, volumes, NAS files
 - Read/write accessible by *Oracle User*
 - ASM Disks are divided into Allocation Units
- **ASM file**
 - Appears as normal file to database kernel
 - File name starts with '+', for example
`+DATA/mydb/datafile/system.257.565020`



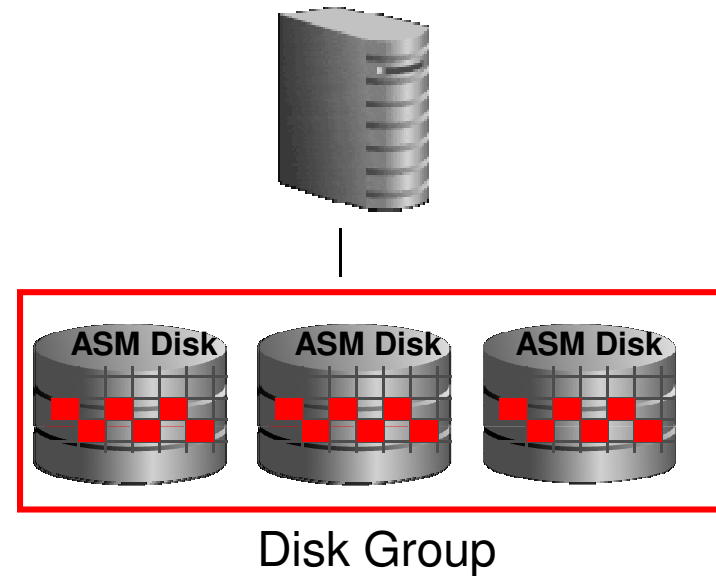
ASM Process Architecture



- Integrated Solution
- ASM manages meta-data
 - NOT in IO path
 - Same performance as raw

Dynamic Rebalancing

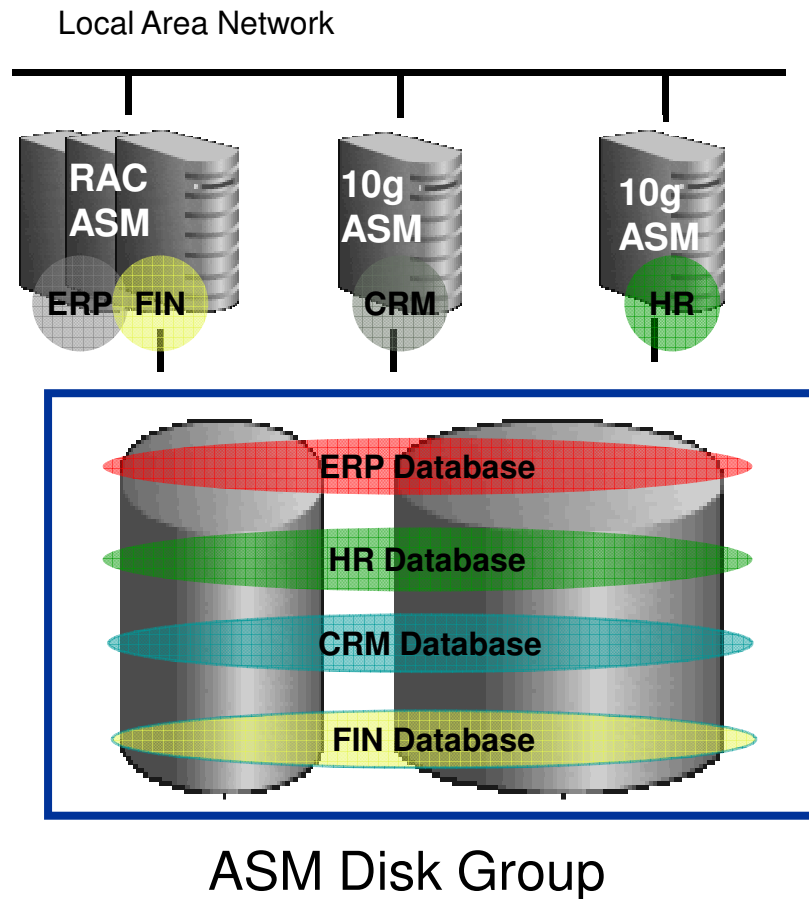
- Simple provisioning
 - Add, drop or resize



Benefits:

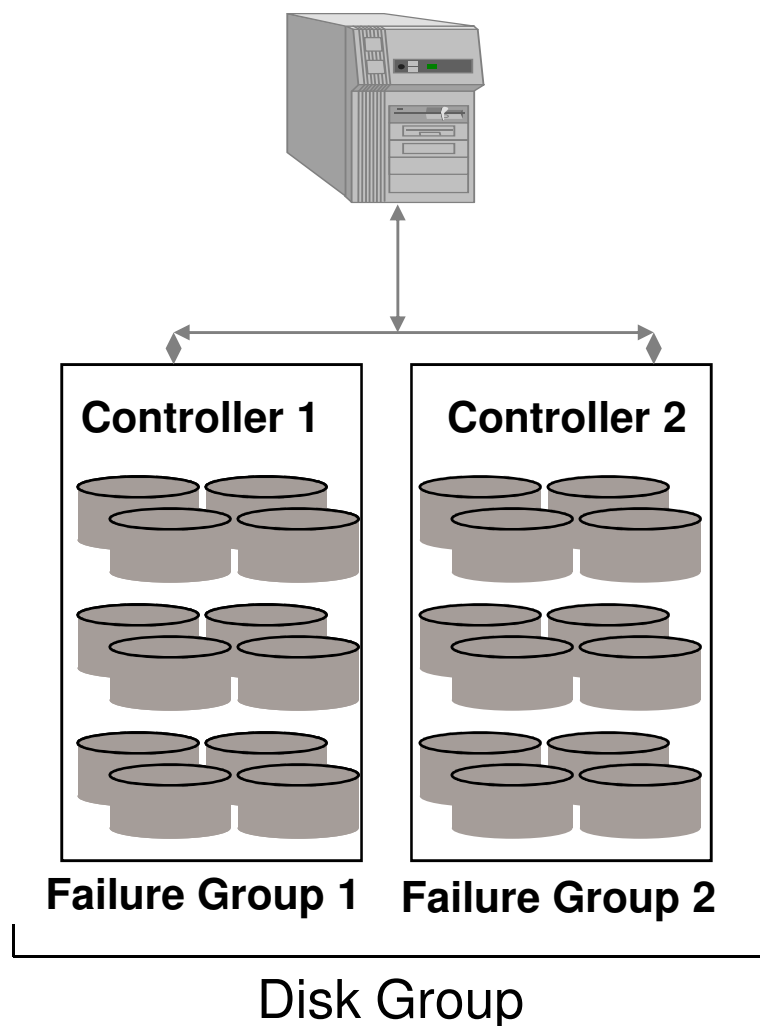
- On-line capacity management
- Eliminates manual I/O tuning
- Maintain optimal performance
- Storage migration on line

Multi-tenancy: multiple app hosting, storage pooling, provisioning and consolidation



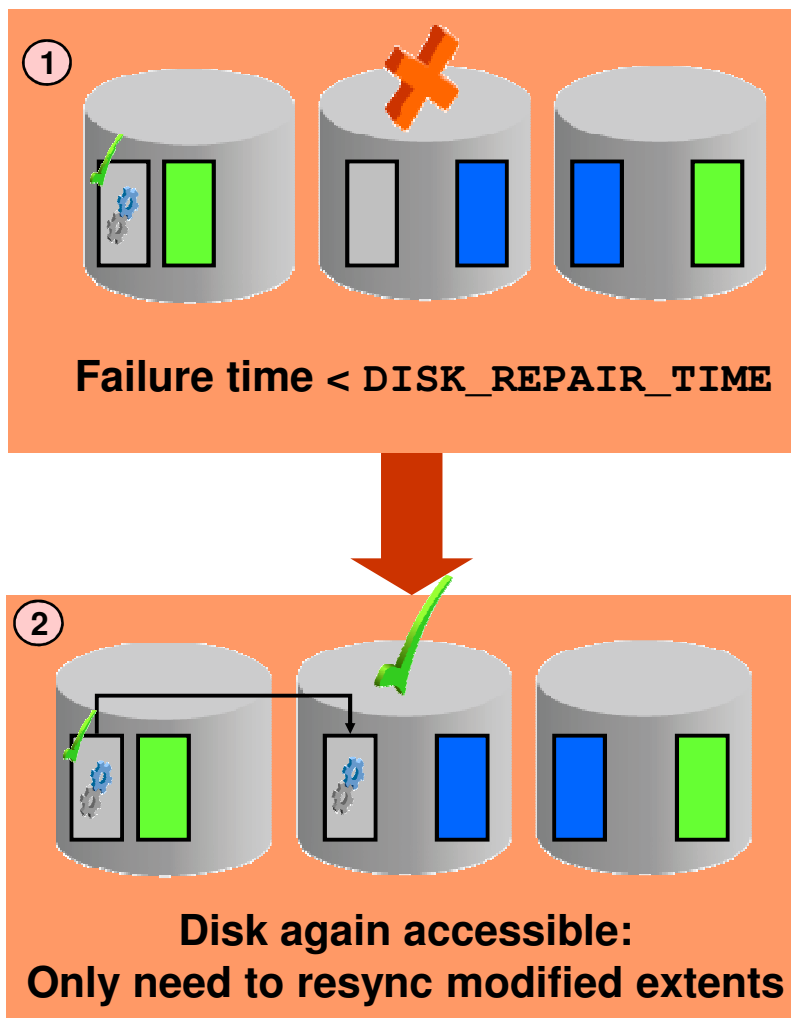
- Shared storage across several databases
 - RAC and Single Instance
 - Servicing multiple clients with security
- Benefits:
 - Simplified and Centralized management
 - Higher storage utilization
 - Higher performance

Intelligent Mirroring



- Efficient extent-based mirroring and striping
 - 128KB striping for small writes
 - Extent size striping for large I/O
- A *Failure Group* is a set of disks sharing a common resource whose failure needs to be tolerated
- Up to 3-way mirroring
- Automatic bad block detection and correction

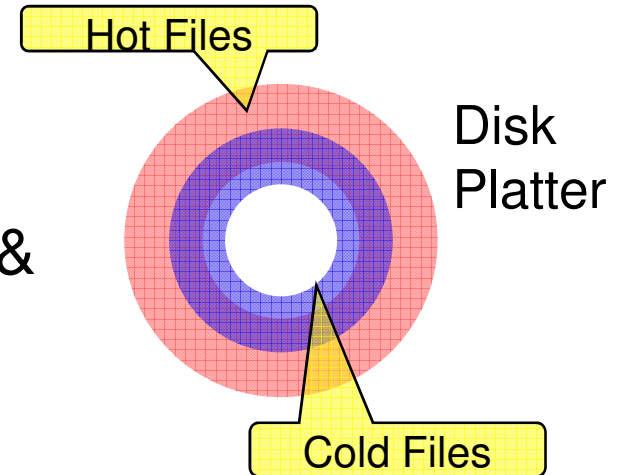
ASM Fast Mirror Resync



- Fraction of time to re-establish redundancy
- Only changed blocks are resync'ed
- Benefits:
 - Fast recovery from transient failures
 - Enables pro-active maintenance

Other Key ASM Features and Benefits

- Intelligent Data Placement
 - Tune for optimal performance by placing hot data on outer tracks & less demanding data on the inner
- Multiple Allocation Units
 - Delivers optimal performance based on OLTP, DW and batch
- Fast Mirror Resync
 - Fast recovery from transient failures
- Preferred Mirror Read
 - Eliminate network latency in extended clusters



Oracle Cloud File System

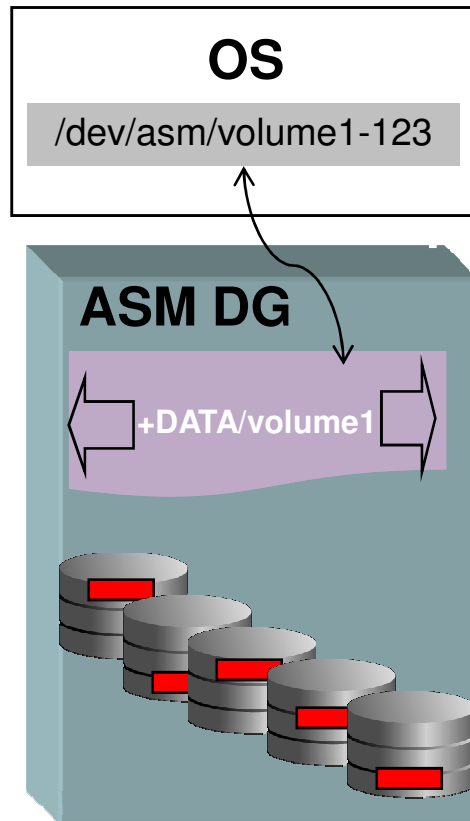
ASM Dynamic Volume Manager (ADVM)

ASM Cluster File System (ACFS)

ACFS data services

ASM Dynamic Volume Manager (ADVDM)

General Purpose Volume Manager



- General purpose volume platform
 - Supports ACFS and 3rd party file systems
 - Eliminates the need for 3rd party VMgrs
- ASM volume management service
 - Cluster and single host volumes
 - Loadable kernel driver
- ‘Dynamic Volume’ is an ASM file
 - +DATA/volume1 → /dev/asm/volume1-123
 - Leverages ASM features
 - Easy on line provisioning
- Cross platform (Linux, Windows, UNIX)
- Managed using ASMCMD, EM and SQL

Leveraging the Power of ASM

- Even distribution of data
 - Dynamic provisioning
- Dynamic volumes and ACFS FS may be resized leveraging ASM file resize features

`% asmcmd volresize dga vol1 -s 50G`

- Can also use Enterprise Manager for management and threshold alerts

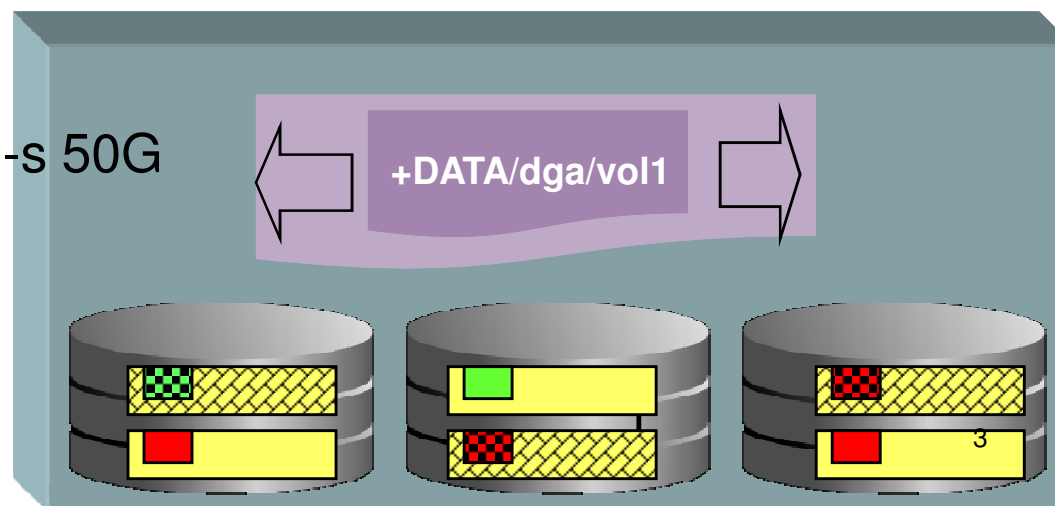
ACFS File System: /usr1

ACFS file A Mirrored

ACFS file B Mirrored

Linux: /dev/asm/vol1

Win: \\.\asm_dgname_volname



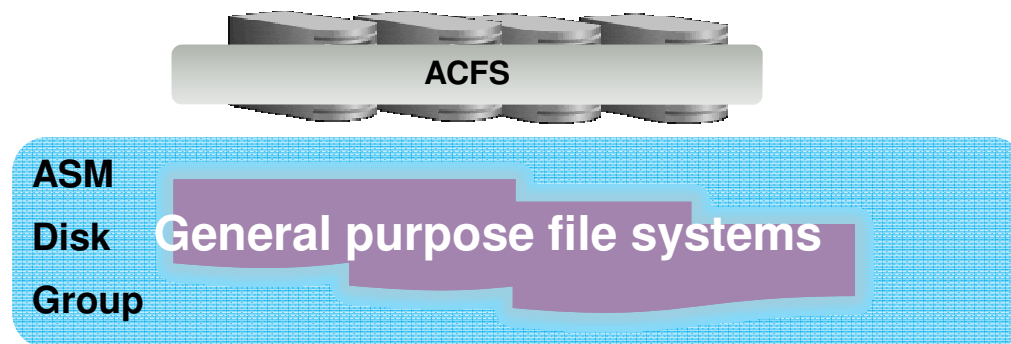
Primary ASM File Extent

Mirrored ASM file Extents

ASM Cluster File System (ACFS)

A General Purpose File System

- Standards based general purpose cluster file system
 - POSIX, X/OPEN for UNIX/Linux for standard user interface
 - Windows file system compliant
 - Ideal for Oracle database, applications and middleware binaries (homes), administrative files and external BFILEs
- Cache coherent file system with global name space
- Supports NFS and CIFS network protocols
- Easy to manage cross OS platform
 - Linux, Windows, Solaris and AIX
 - Managed thru native OS interfaces and Oracle system mgt tool





ACFS Snapshots

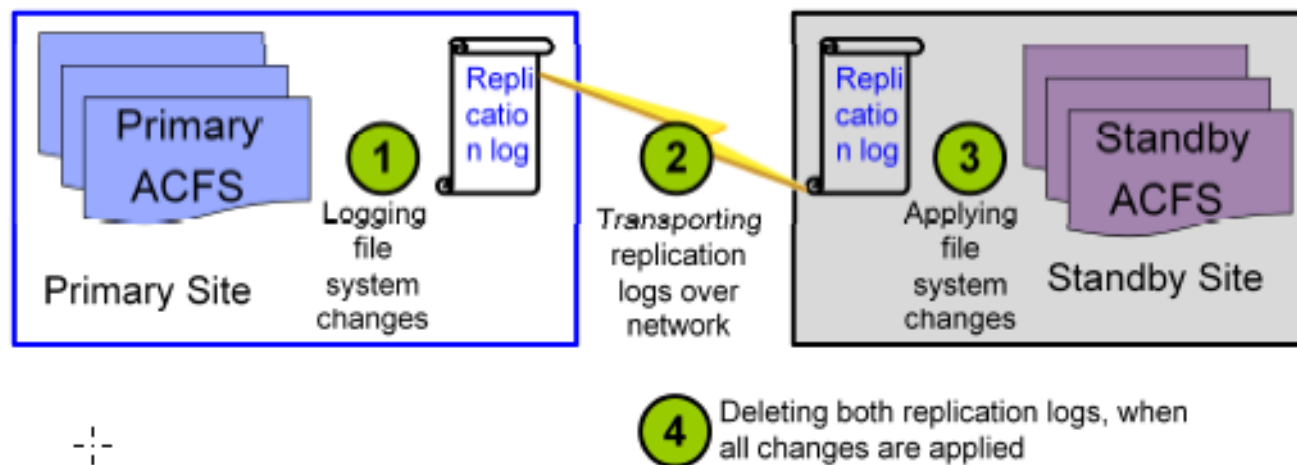
- Dynamic, fast, space efficient, “point in time” read-only or read-write copies of ACFS file system files
 - Captures ASM FS file block/extent updates - Copy on Write

- An enabler for:
 - On-line, disk-based, file backup model using snapshots
 - Individual file recoveries
 - Use snapshot copy of production data for test and development
 - Offload backups using snapshot image

- Up to 63 snapshot images per ASM file system
 - Policy based snapshots:
 - Schedule snapshots on an interval basis: every 5 seconds, every 30 minutes, daily, ...

ACFS Replication

- Enables replication of ACFS file systems across the network to a remote site
- Compliments Data Guard and provides a complete Oracle DR solution for all files
- Replication logs are used to replicate from primary to standby asynchronously





ACFS Tagging

- ACFS Tagging assigns a common naming attribute to a group of files
- What problem does it solve
 - File operations can be performed based on tagging attributes on files spread throughout multiple file systems
- Example: You can now replicate all files tagged “Oracle Home”
 - Achieve complete DR solution for Oracle homes and database file (through Data Guard)

ACFS Security

- ACFS Security uses Realms, Rules, RuleSets, and Command Rules to enforce security
 - Managed by ‘Security Administrator’
- Realm is a virtual container of
 - Users
 - Files and directories, access defined by security filters
 - Rules and rule sets defining access
 - Command rules to allow/disallow operations
- What problem does it solve
 - Fine grained access control in addition to OS ACLs
 - Example: Grant operator Joe read only access to MedicalRecords between 9-11pm for backup purposes.

ACFS Encryption

- Enable users to encrypt data stored on disk
 - Flexibility to encrypt the entire file system and/or just individual files and directories
 - Transparent to users and applications
- What problem does it solve
 - Protects data-at-rest through encryption
 - Prevents unauthorized use of data in case of data loss or theft
- Secure encryption keys to decode data
 - File Encryption Key (FEK) – to encrypt file data
 - Volume Encryption Key (VEK) – to encrypt FEK



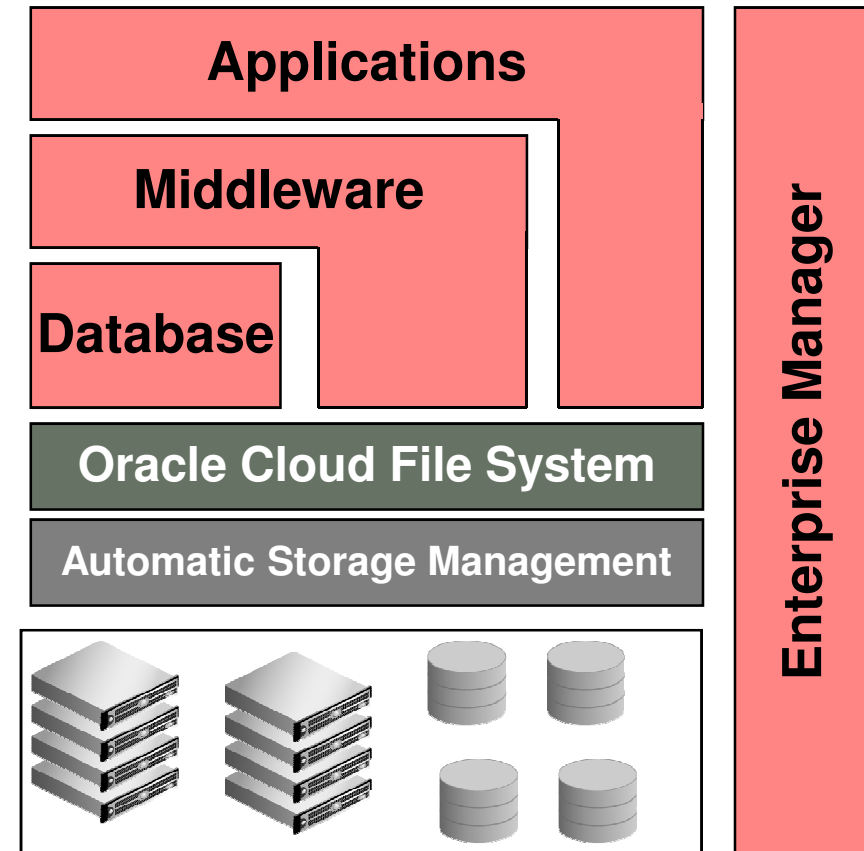
ACFS Use Cases

File system for non-database files

- System, Database, Application and Middleware files on ACFS
 - Shared homes in a cluster configuration
 - Shared administrative/diagnostic files, log files, staging area files
 - *Oracle database backup sets, archive logs and dumpsets*
- Business Data on ACFS
 - Storing DB external files (large objects) business data stored outside of DB tablespaces
- ACFS configuration alternatives
 1. Shared cache coherent cluster file system on all cluster nodes
 - A better (faster and more reliable) alternative to traditional NFS Filers
 2. NFS/CIFs network file servers
 - Export NFS/CIFs files to clients on the network

CloudFS Meets Key Cloud Computing Requirements

- Simplifies **pooling of storage** across databases, middleware, and applications in a cloud
- Provides **network accessible** storage with unified namespace for databases and files
- Supports rapid **elasticity** through online storage provisioning
- **Multi-tenancy** servicing multiple clients with exclusivity



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