Recovery Manager

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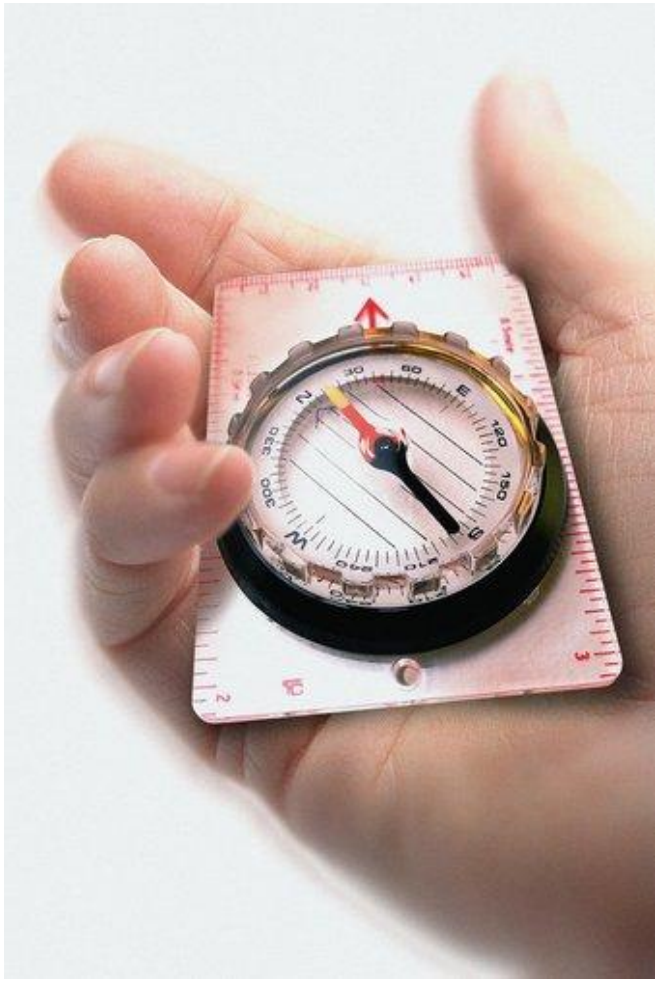
Course objectives

By completing this course, you will be able to:



- Describe the RMAN repository and recovery catalog
- Configure database parameters that affect RMAN
- Change RMAN default settings with `CONFIGURE`
- Use the RMAN `BACKUP` command
- Use various files for diagnostic purposes
- Control the size and location of trace files

Course topics

Course's plan:

- Managing RMAN
- Using Recovery Manager
- Diagnostic sources

Managing RMAN

Preview

- Describe the **RMAN** repository and recovery catalog
- Describe the Media Management Library interface
- Configure database parameters that affect **RMAN**
- Change **RMAN** default settings with **`CONFIGURE`**

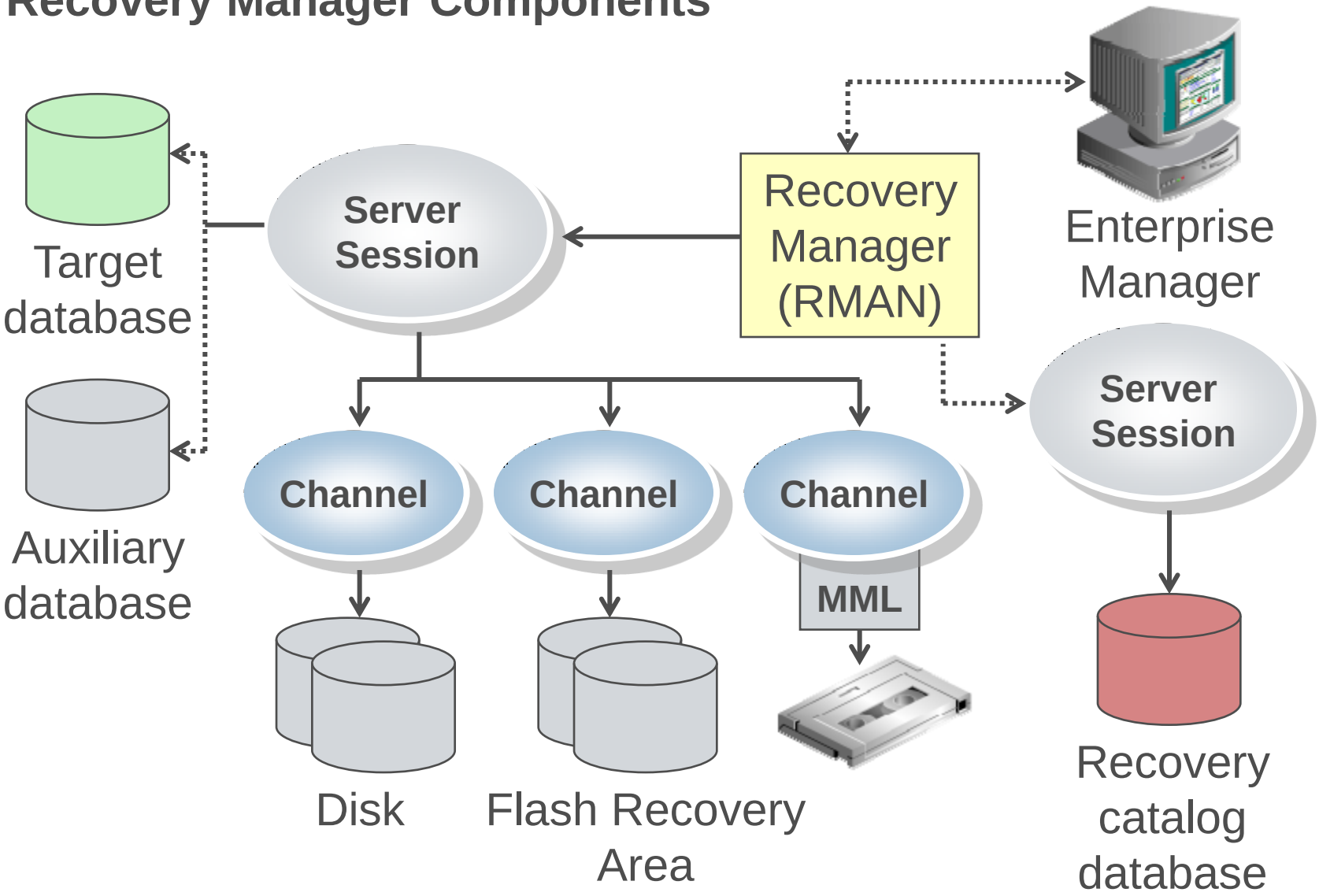
Describe the RMAN repository and recovery catalog

Recovery Manager Features

- **RMAN** provides a flexible way to:
  - Back up the database, tablespaces, data files, control files, and archived redo logs
  - Manage backup and recovery tasks
  - Perform incremental block-level backup and block-level media recovery
  - Detect corrupted blocks during backup
  - Use binary compression when creating backups

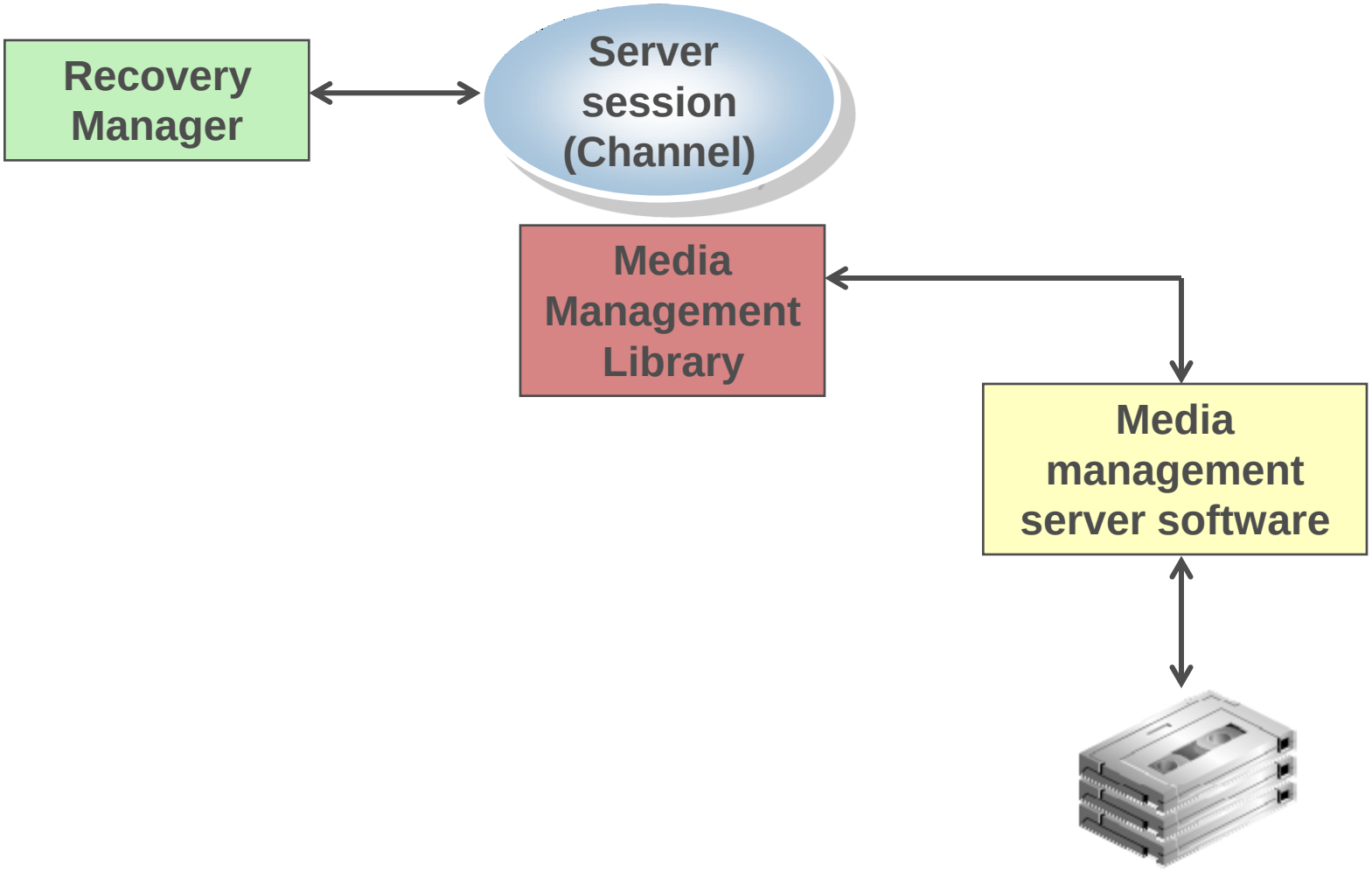
Describe the RMAN repository and recovery catalog

Recovery Manager Components



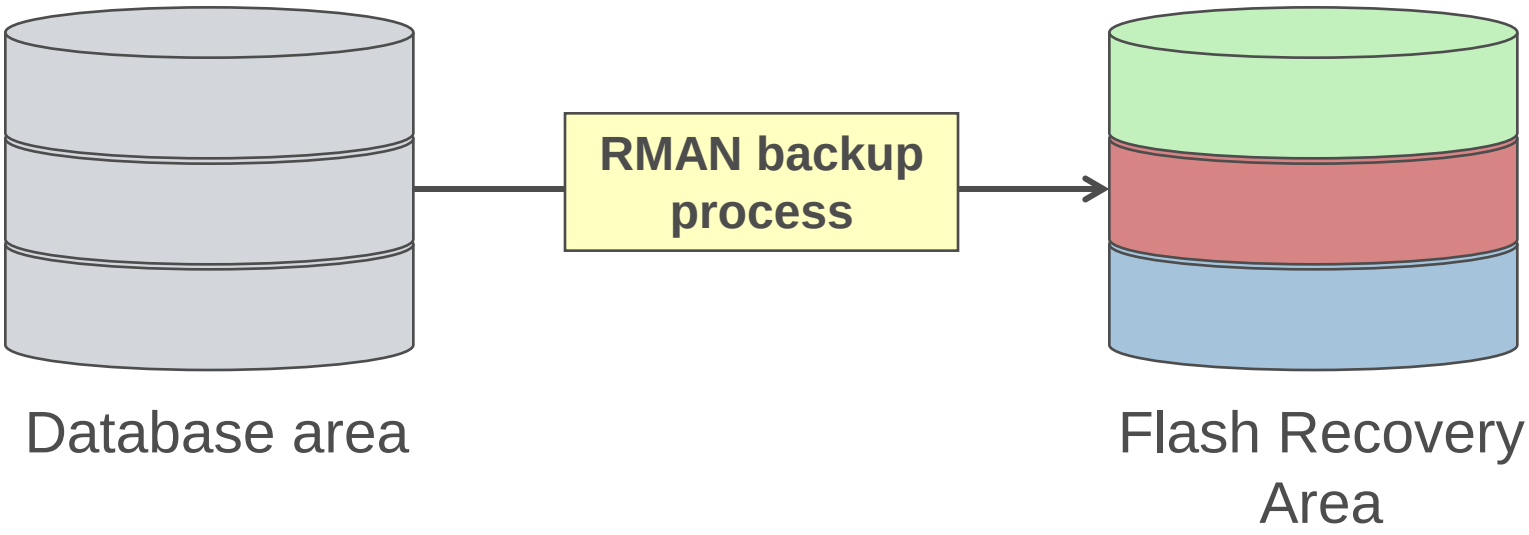
Describe the Media Management Library interface

Media Management



Describe the Media Management Library interface

Using a Flash Recovery Area with RMAN



Configure database parameters that affect RMAN

Setting Parameters for RMAN

- Database initialization parameters:
  - **CONTROL_FILE_RECORD_KEEP_TIME**
  - **DB_RECOVERY_FILE_DEST** and **DB_RECOVERY_FILE_DEST_SIZE**
- Environment variables:
  - **NLS_DATE_FORMAT**
  - **NLS_LANG**

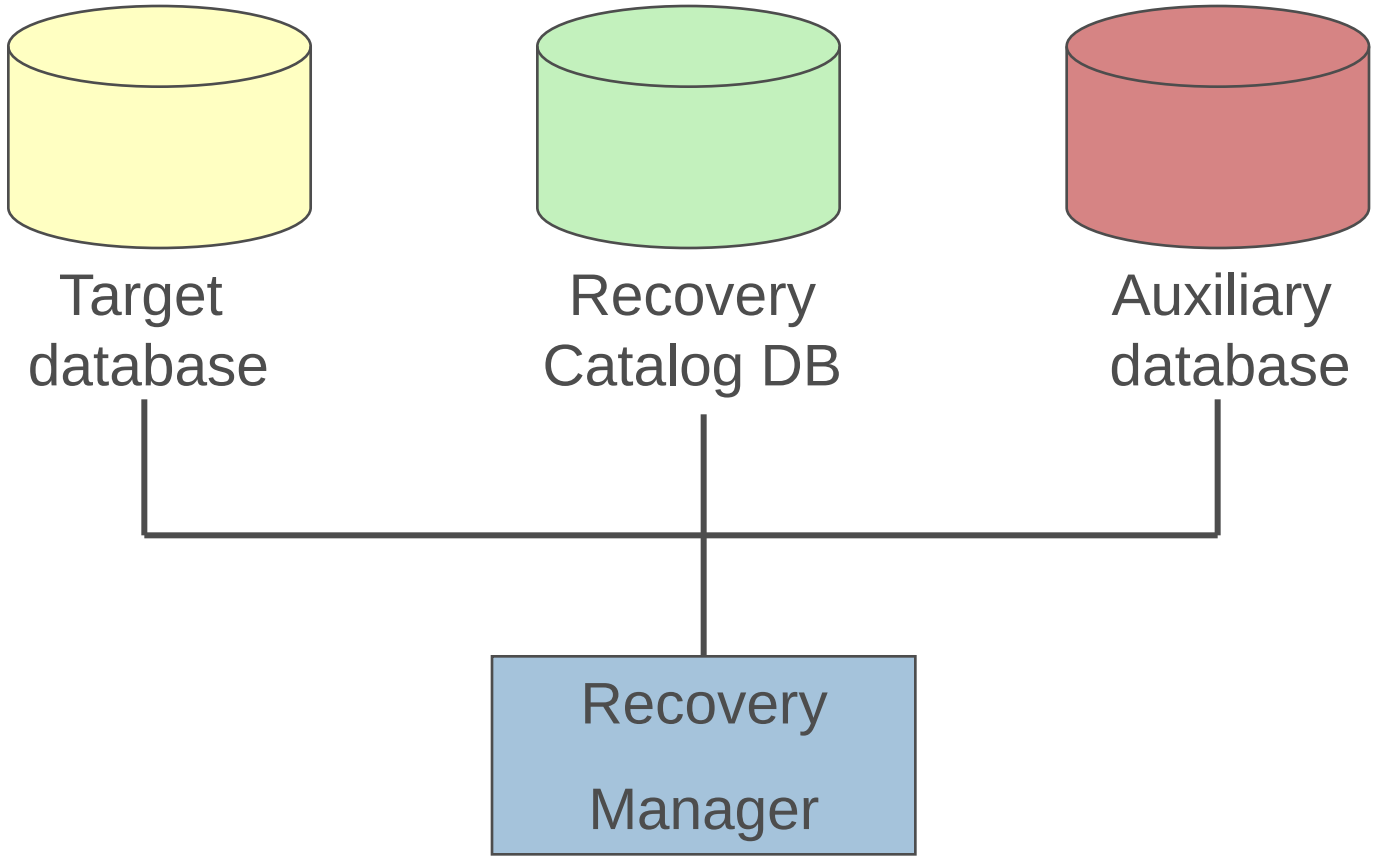
Configure database parameters that affect RMAN

RMAN Usage Considerations

- Resources: Shared memory, more processes.
- Privileges given to users
  - Database: SYSDBA.
  - Operating System: Access to devices.
- Remote operations
  - Set up the password file.
  - Ensure that the password file is backed up.

Configure database parameters that affect RMAN

Connection Types with RMAN



Configure database parameters that affect RMAN

Starting RMAN

- Starting **RMAN** locally:

```
UNIX : $ ORACLE_SID=DB01; export ORACLE_SID
       $ rman target system/manager
```

```
Windows NT :  C:\> set ORACLE_SID=DB01
              C:\> rman target /
```

- Starting **RMAN** remotely:

```
rman target sys/password@DB01
```

Configure database parameters that affect RMAN

Additional RMAN Command Line Arguments

- Writing **RMAN** output to a log file:

```
$ rman TARGET sys/oracle
   LOG $HOME/oradata/u03/rman.log APPEND
```

- Executing a command file when **RMAN** is invoked:

```
$ rman TARGET sys/oracle
   CMDFILE='$HOME/scripts/my_rman_script.rcv'
```

- Establishing database connections on **RMAN** startup:

```
$ rman TARGET SYS/sys_pwd@orcl CATALOG
rman/rman@rcat AUXILIARY sys/aux_pwd@aux1
```

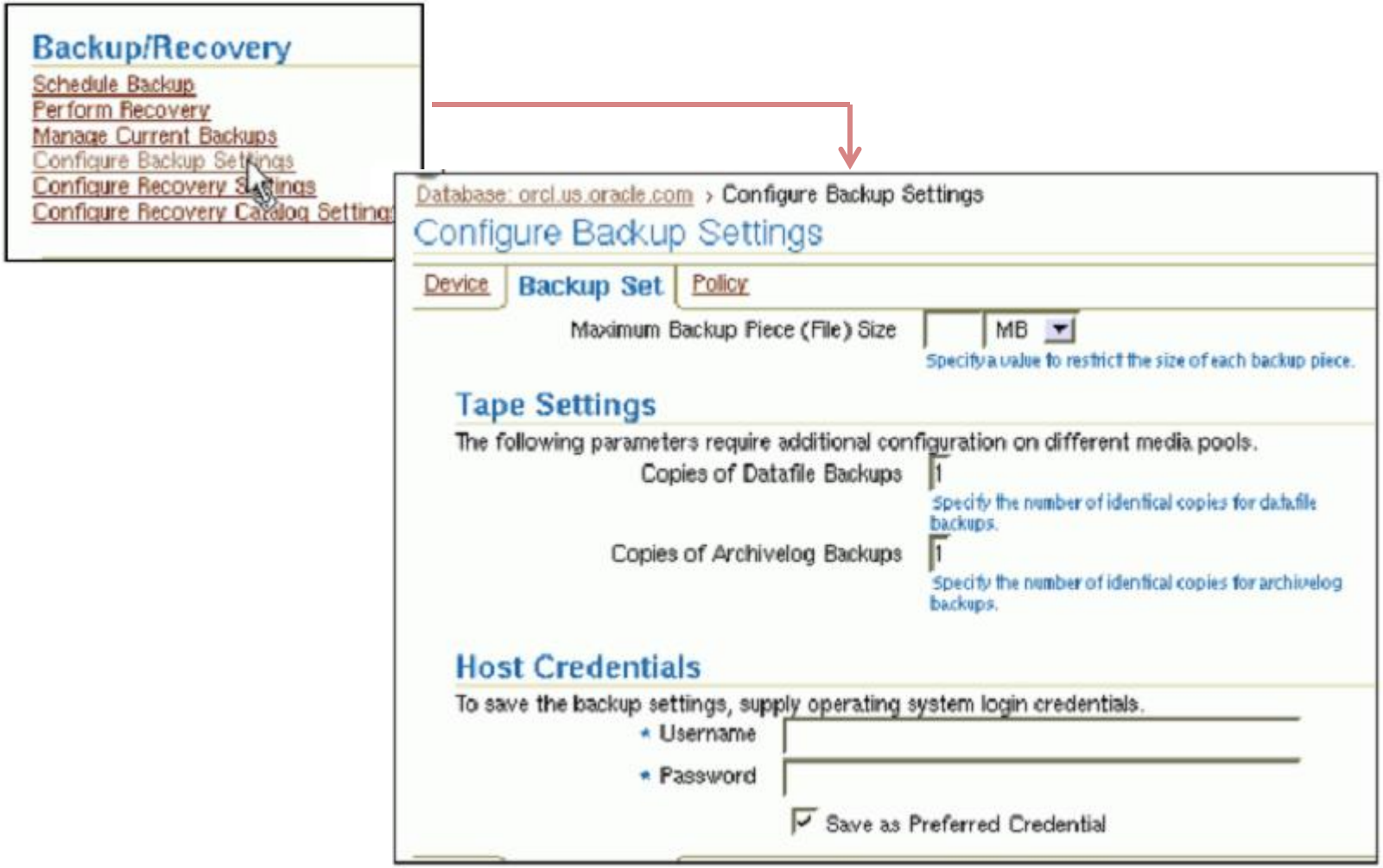
Change RMAN default settings with `CONFIGURE`

Configuring Persistent Settings for RMAN

- **RMAN** is preset with default configuration settings.
- Use the **`CONFIGURE`** command to:
  - Configure automatic channels.
  - Specify the backup retention policy.
  - Specify the number of backup copies to be created.
  - Set the default backup type to **`BACKUPSET`** or **`COPY`**.
  - Limit the size of backup sets.
  - Exempt a tablespace from backup.
  - Enable and disable backup optimization.
  - Configure automatic backups of control files.

Change RMAN default settings with CONFIGURE

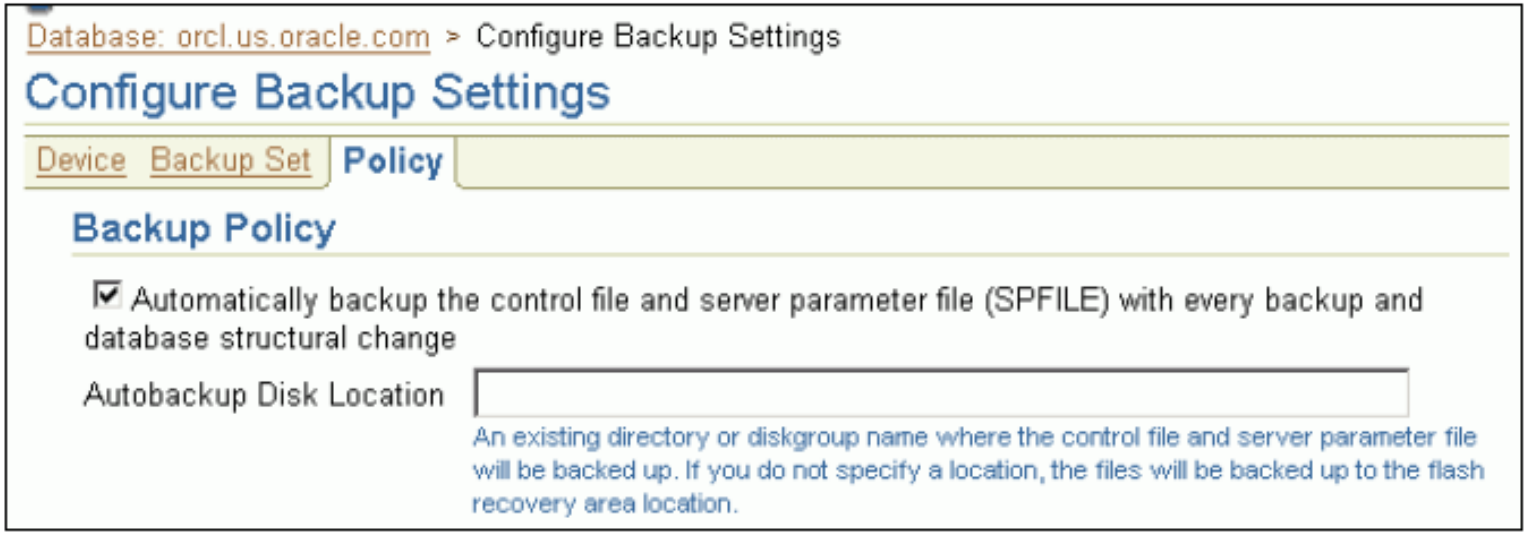
Configuring RMAN Settings Using EM



Change RMAN default settings with CONFIGURE

Control File Auto backups

```
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP ON;
```



Change RMAN default settings with `CONFIGURE`

Retention Policies

- A retention policy describes which backups will be kept and for how long.
- There are two types of retention policies:
  - Recovery window: Establishes a period of time within which point-in-time recovery must be possible.
  - Redundancy: Establishes a fixed number of backups that must be kept (Backups that are in excess of this can be deleted).
- These policies are mutually exclusive and can be set with the **`CONFIGURE`** command.

Change RMAN default settings with CONFIGURE

Managing Persistent Settings

- Use the **SHOW** command to list current settings:

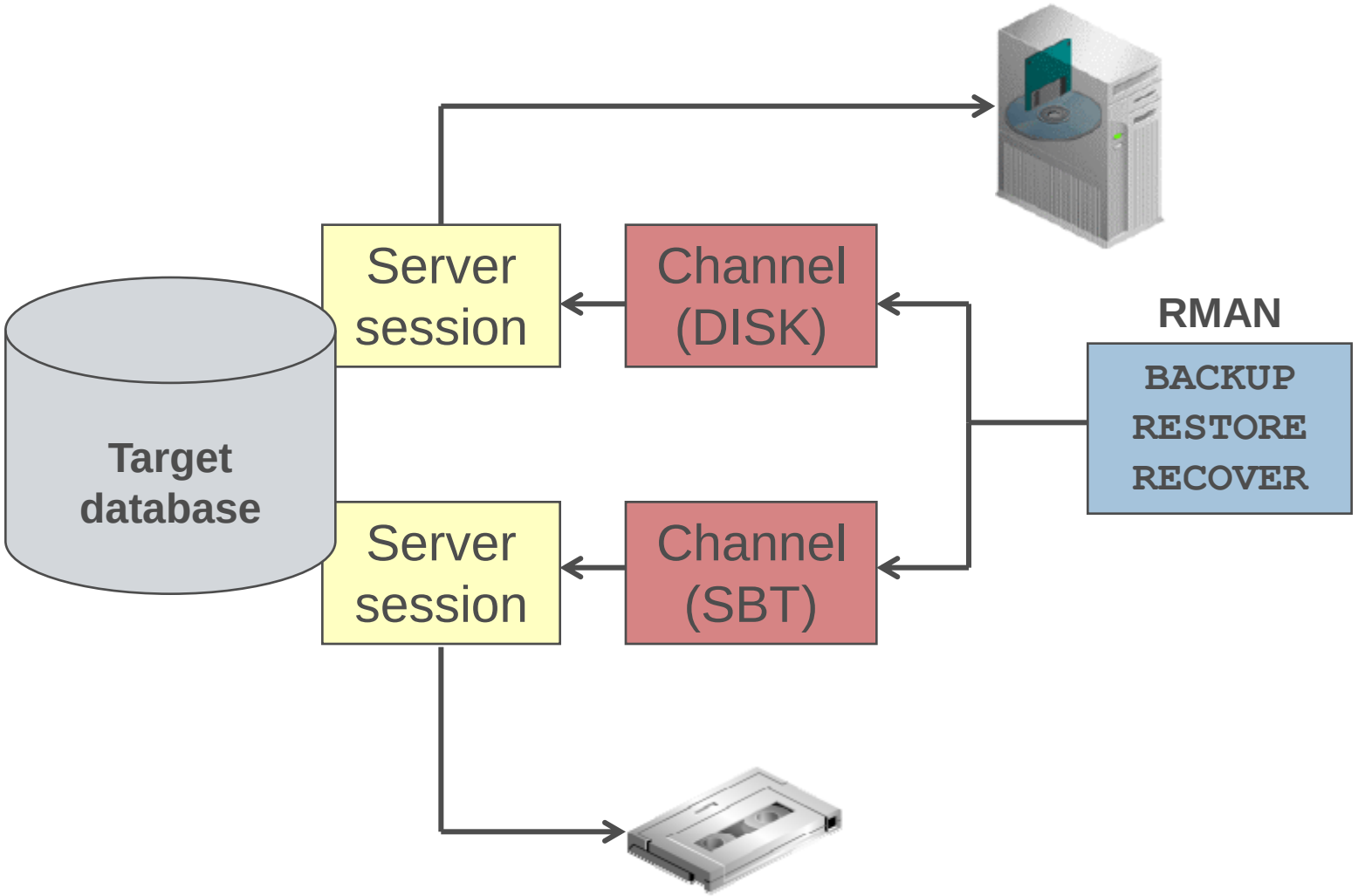
```
RMAN> SHOW CONTROLFILE AUTOBACKUP FORMAT;
RMAN> SHOW EXCLUDE;
RMAN> SHOW ALL;
```

- Use the **CLEAR** command to reset any persistent setting to its default value:

```
RMAN> CONFIGURE BACKUP OPTIMIZATION CLEAR;
RMAN> CONFIGURE MAXSETSIZE CLEAR;
RMAN> CONFIGURE DEFAULT DEVICE TYPE CLEAR;
```

Change RMAN default settings with CONFIGURE

Channel Allocation



Change RMAN default settings with CONFIGURE

Automatic and Manual Channel Allocation

- Change the default device type for automatic channel allocation:

```
RMAN>CONFIGURE DEFAULT DEVICE TYPE TO sbt;
```

- Manually allocate a channel:

```
RMAN>RUN {
   2>ALLOCATE CHANNEL c1 DEVICE TYPE disk;
   3>BACKUP DATAFILE '/u01/oradata/user01.dbf';
   4>}
```

Change RMAN default settings with CONFIGURE

Channel Control Options

- Configure parallelism:

```
RMAN> CONFIGURE DEVICE TYPE DISK PARALLELISM 3;
```

- Specify the maximum backup piece size:

```
RMAN> CONFIGURE CHANNEL DEVICE TYPE DISK
   2> MAXPIECESIZE 2G;
```

- Format the name of generated backup files:

```
RMAN> RUN {
   2> ALLOCATE CHANNEL d1 DEVICE TYPE DISK
   3> FORMAT '/disk1/backups/%U';
   4> BACKUP DATABASE PLUS ARCHIVELOG; }
```

Part 1 Summary

- Describe the RMAN repository and recovery catalog
- Describe the Media Management Library interface
- Configure database parameters that affect RMAN
- Change RMAN default settings with `CONFIGURE`

Part 1 Stop-and-think

Do you have any questions ?

Using Recovery Manager

Preview

- Use the **RMAN `BACKUP`** command
- Manage the backups with **RMAN**

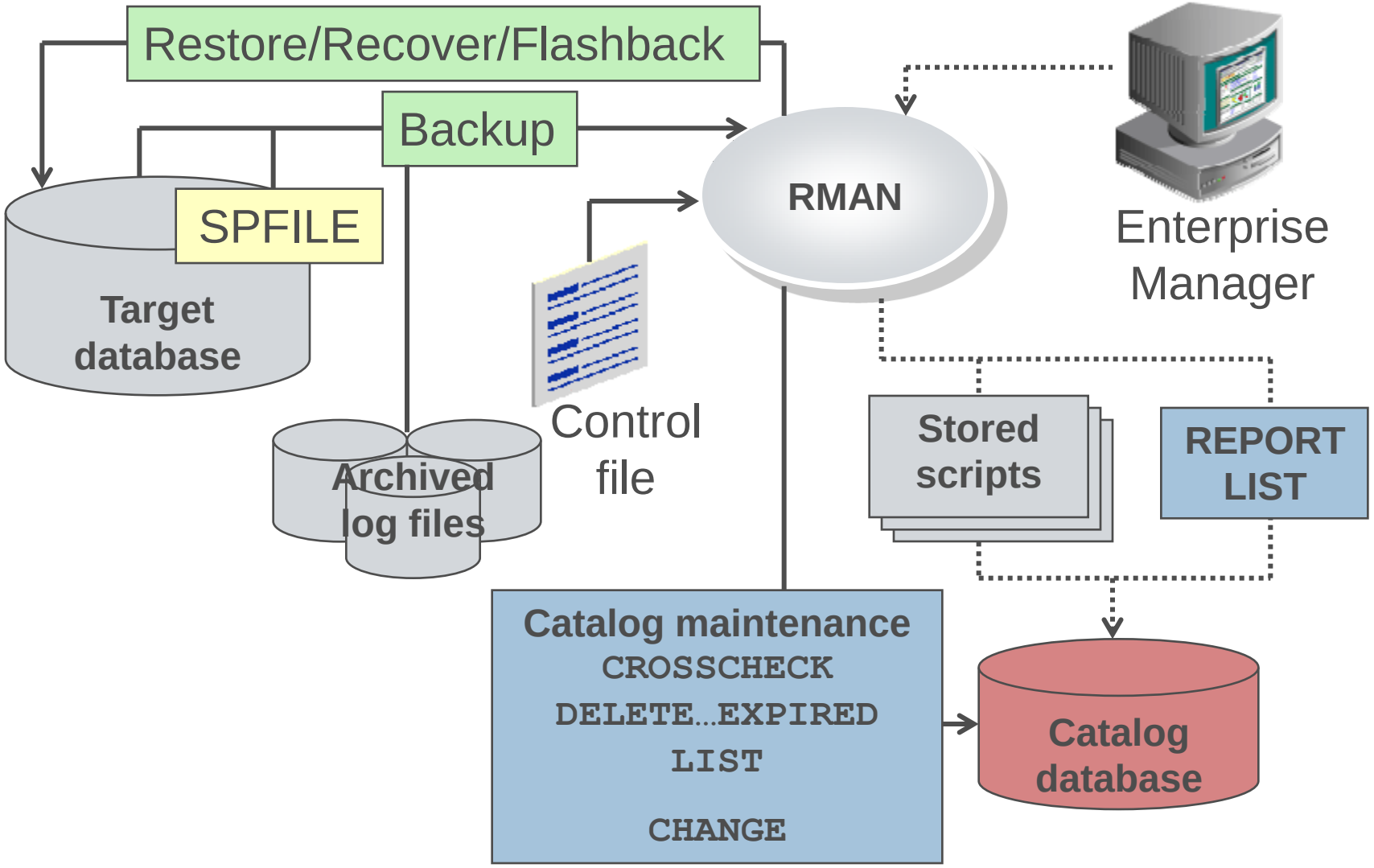
Use the RMAN `BACKUP` command

Issuing Recovery Manager Commands

- Interactive client
  - Type commands at **RMAN** prompt.
  - Use when doing analysis, running reports or stored scripts.
- Batch mode
  - Use with automated jobs.
  - Specify a command file when starting **RMAN.**
  - Set the log file to obtain information.
- Pipe interface
  - Specify the `PIPE` command line argument.
  - Use to communicate data between sessions or between **RMAN** and an external application.

Use the RMAN BACKUP command

RMAN Command Overview



Use the RMAN `BACKUP` command

RMAN Commands

- **RMAN** commands are of the following types:
  - Stand-alone
    - Executed individually at the **RMAN** prompt.
    - Cannot appear as subcommands within **`RUN`**.
  - Job
    - Must be within the brackets of **`RUN`**.
    - Executed as a group.
  - Stand-alone or job
    - Can be executed at the **RMAN** prompt and run individually.
    - Can be run within the brackets of **`RUN`** and executed within a group.

Use the RMAN BACKUP command

Job Command: Example

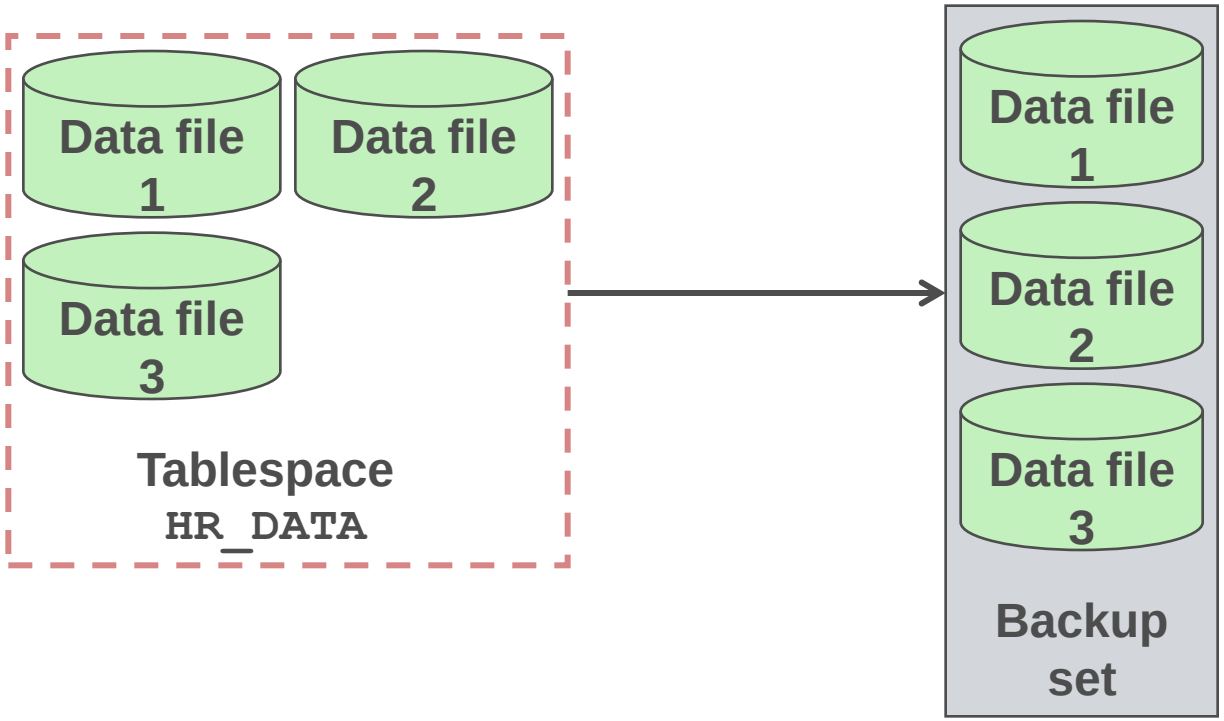
- **RUN** command:

```
RMAN> RUN {
   2> BACKUP AS BACKUPSET
   3> FORMAT '/u01/db01/backup/%d_%s_%p'
   4> DURATION 10:00 MINIMIZE LOAD
   5> (DATABASE);
   6> SQL'alter system archive log current';
   7> }
```

Use the RMAN BACKUP command

The BACKUP Command

```
RMAN> BACKUP AS BACKUPSET
   2> FORMAT '/BACKUP/df_%d_%s_%p.bus'
   3> TABLESPACE hr_data;
```



Use the RMAN BACKUP command

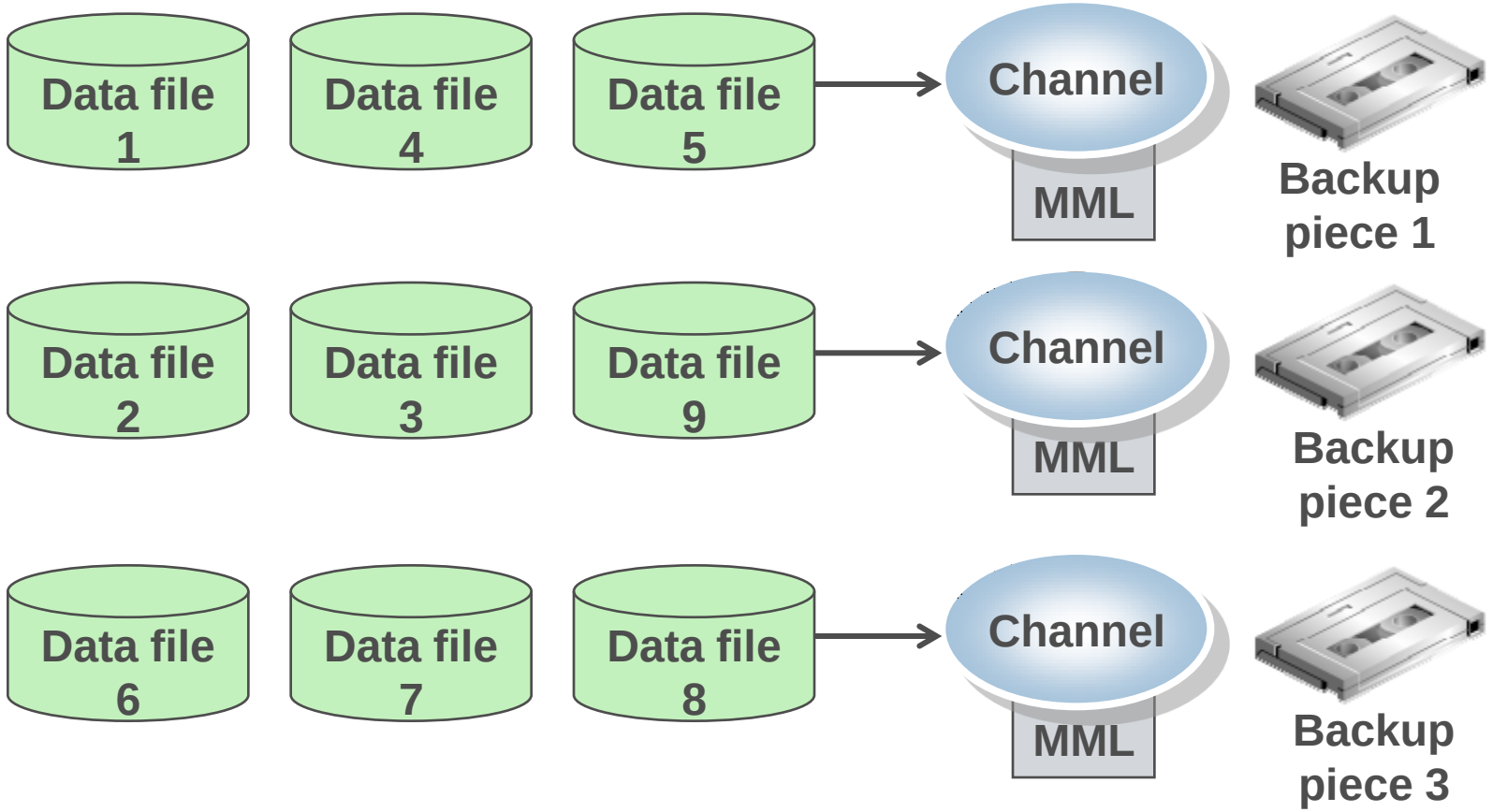
Backup Constraints

- The database must be mounted or opened.
- Online redo log backups are not supported.
- Only “clean” backups are usable in **NOARCHIVELOG** mode.
- Only “current” data file backups are usable in **ARCHIVELOG** mode.

Use the RMAN BACKUP command

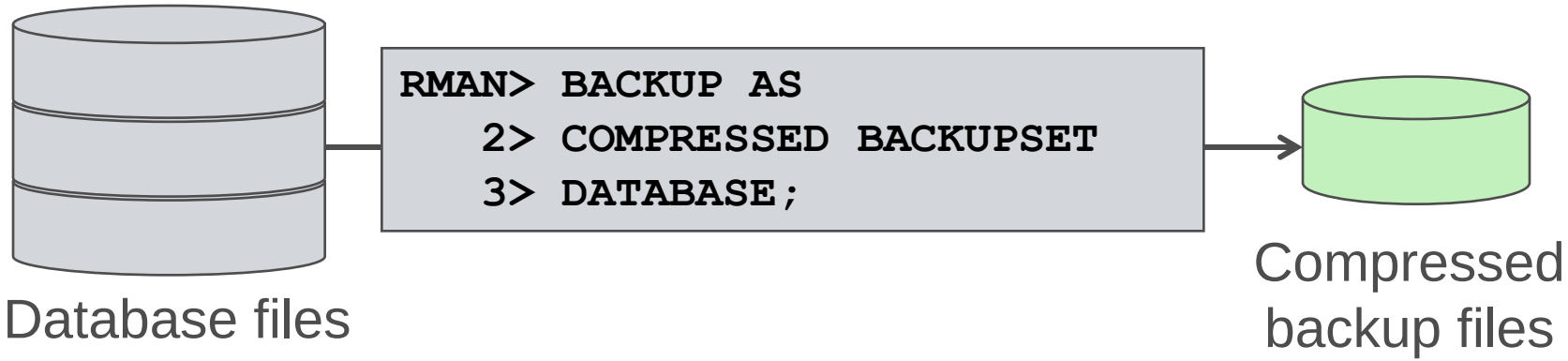
Parallelization of Backup Sets

- Allocate multiple channels and assign files to specific channels.



Use the RMAN BACKUP command

Compressed Backups

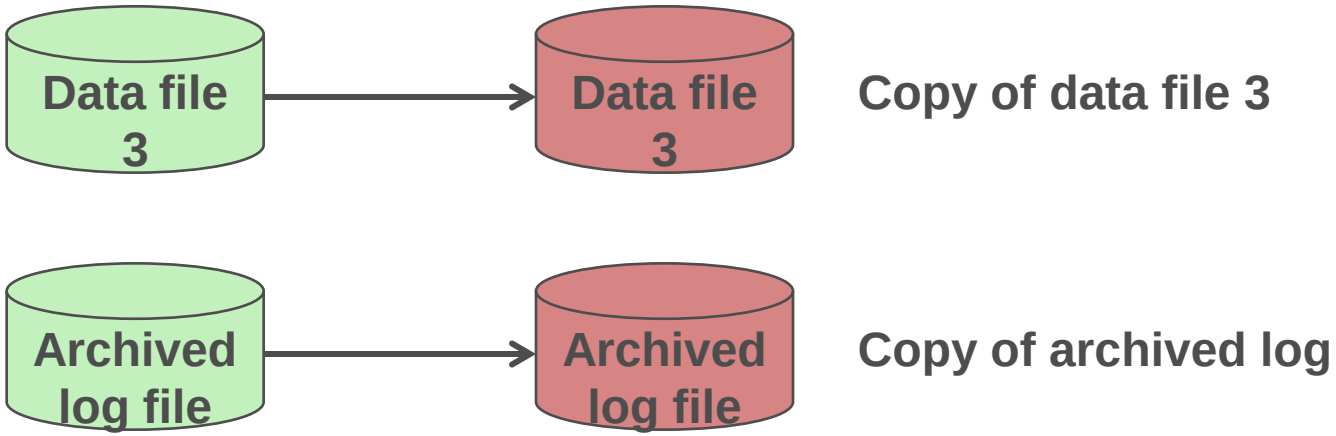



```
RMAN> CONFIGURE DEVICE TYPE
   2> DISK PARALLELISM 2
   3> BACKUP TYPE TO
   4> COMPRESSED BACKUPSET;
```

Use the RMAN BACKUP command

Image Copy

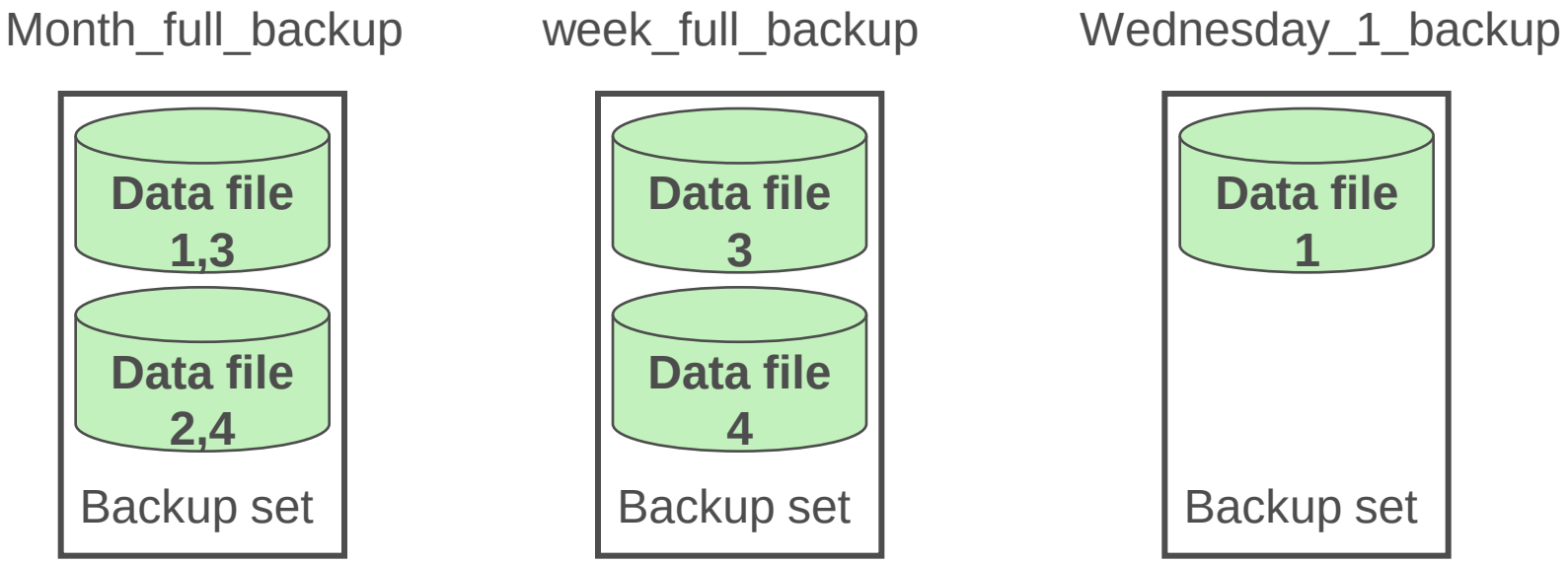
```
RMAN> BACKUP AS COPY
   2> DATAFILE '/ORADATA/users_01_db01.dbf'
   3> FORMAT '/BACKUP/users01.dbf' tag=DF3;
RMAN> BACKUP AS COPY
   2> ARCHIVELOG LIKE 'arch_1060.arc'
   3> FORMAT 'arch_1060.bak';
```



Use the RMAN BACKUP command

Tags for Backups and Image Copies

- A tag is a logical name assigned to a backup set or image copy.



Use the RMAN BACKUP command

BACKUP Options

- Check for physical block corruptions.
- Scan for logical corruptions in addition to physical corruptions.
- Set a threshold on the number of detected corruptions allowed before aborting.
- Validate the target input files before performing a backup operation.
- Duplex the backup set.
- Overwrite an existing backup set or image copy.
- Pass control over the data transfer between storage devices and the data files on disk to the media management layer.

Use the RMAN BACKUP command

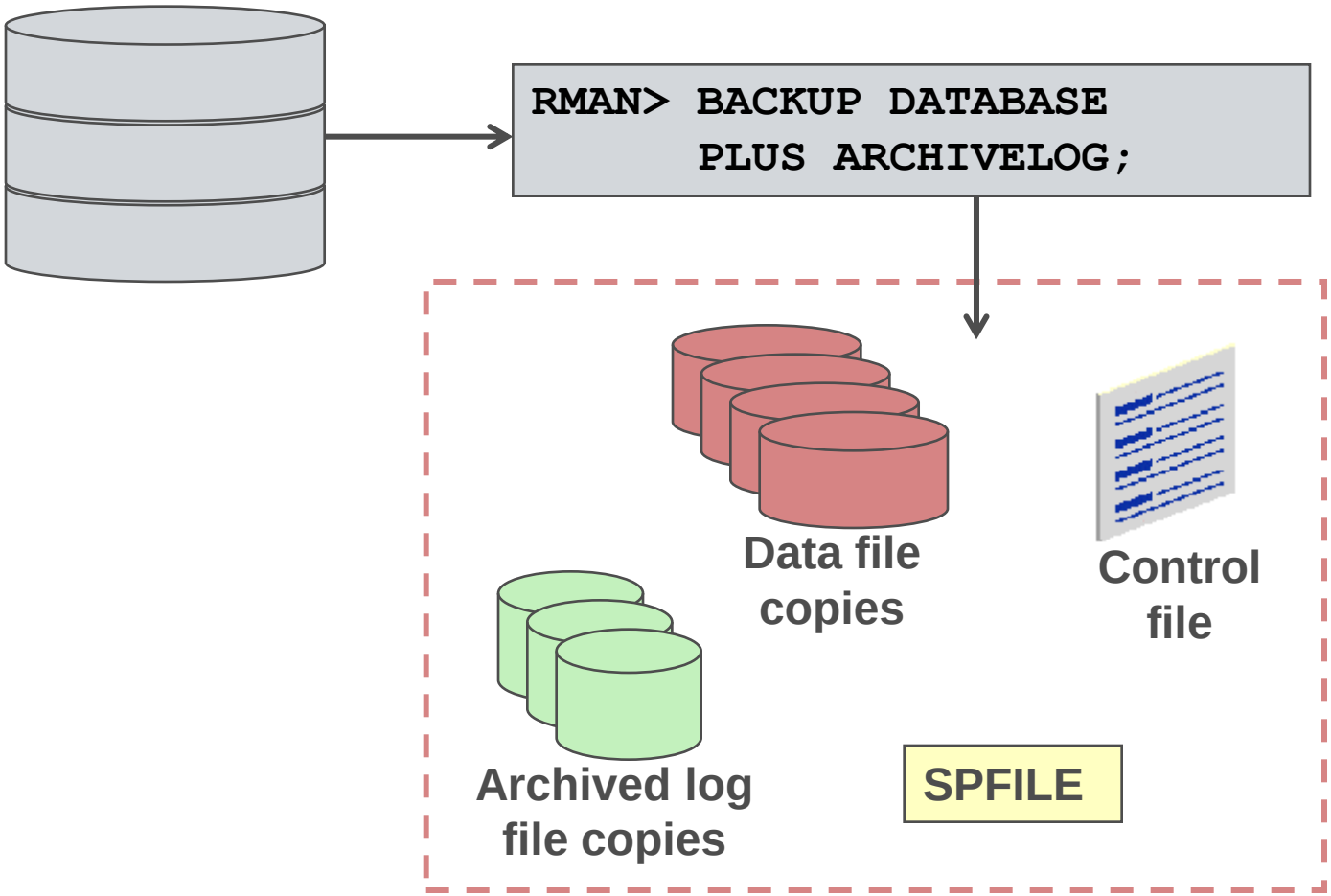
Backing Up Archived Redo Logs

- Online redo log file switch is automatic.
- Archived log failover is performed.
- You can specify a range of archived redo logs to back up.
- Backup sets include only archived redo log files.

```
RMAN> BACKUP
   2> FORMAT '/disk1/backup/ar_%t_%s_%p'
   3> ARCHIVELOG FROM SEQUENCE=234
   4> DELETE INPUT;
```

Use the RMAN BACKUP command

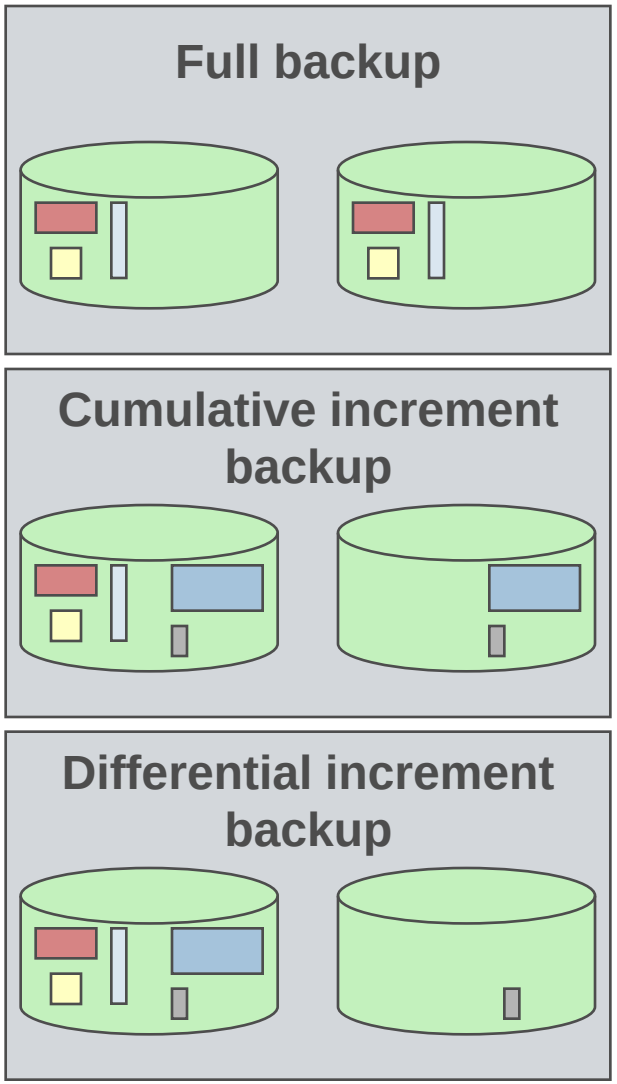
Copying the Whole Database



Use the RMAN `BACKUP` command

Making Incremental Backups

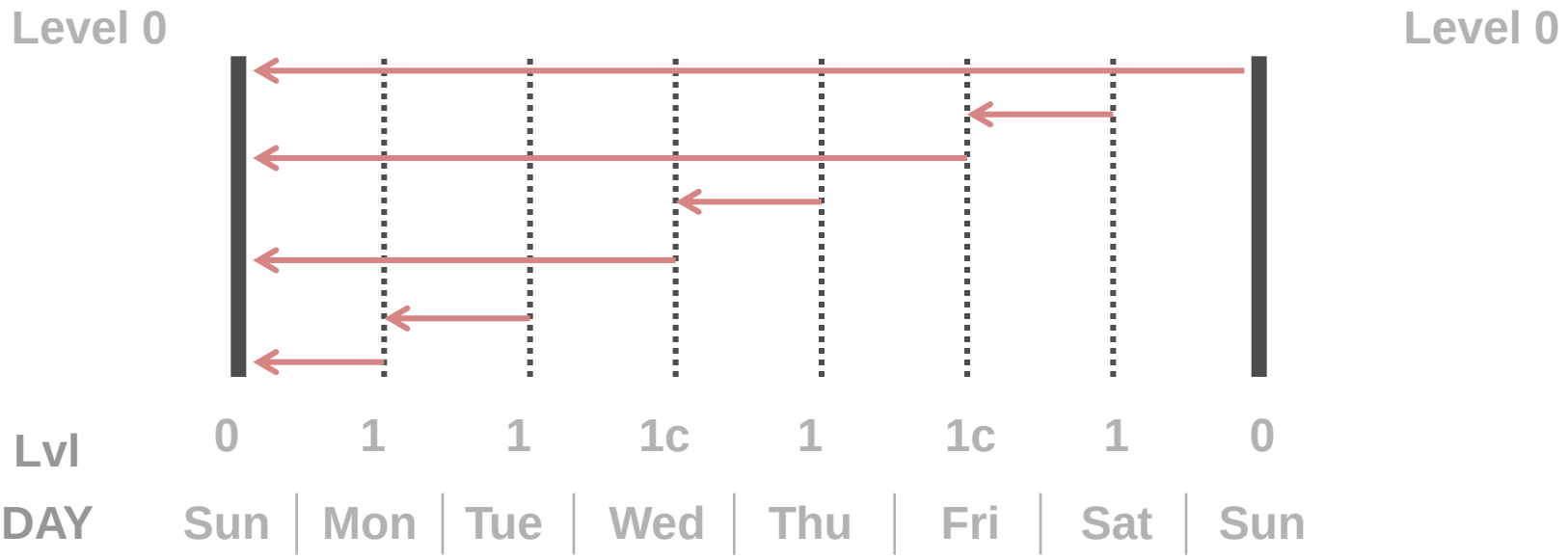
- A *level 0 incremental backup*, similar to a full backup, contains all data file blocks.
- A *cumulative level 1 incremental backup* contains only blocks modified since the last level 0 incremental backup.
- A *differential level 1 incremental backup* contains only blocks modified since the last incremental backup.



Use the RMAN BACKUP command

Incremental Backup: Example

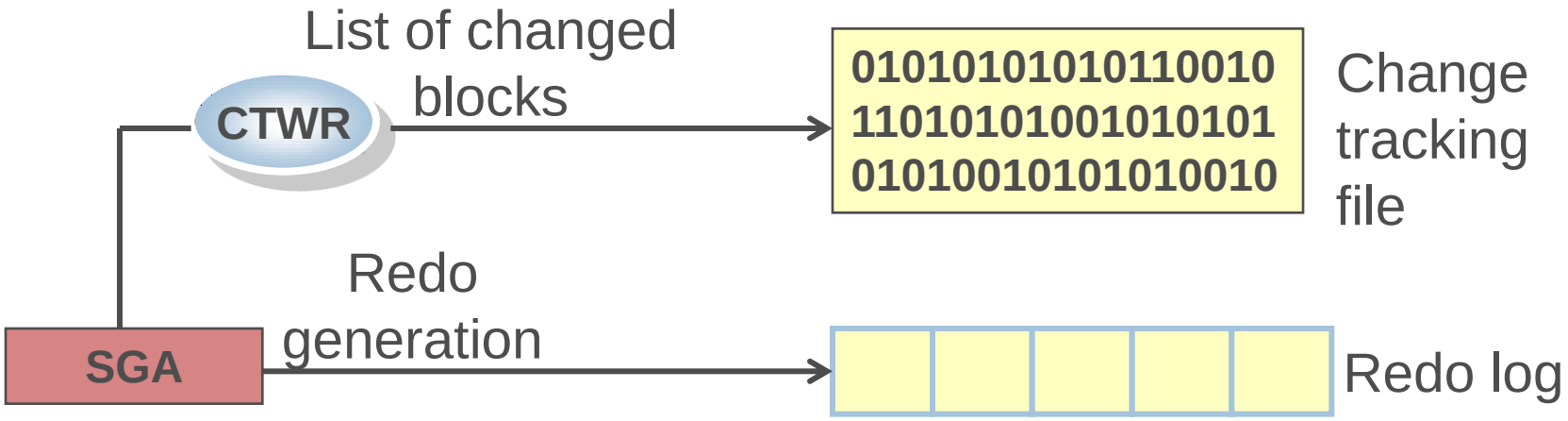
- A differential incremental backup contains all blocks changed since the last incremental backup.
- A cumulative incremental backup contains all blocks changed since the last level 0 incremental backup.



Use the RMAN BACKUP command

Block Change Tracking

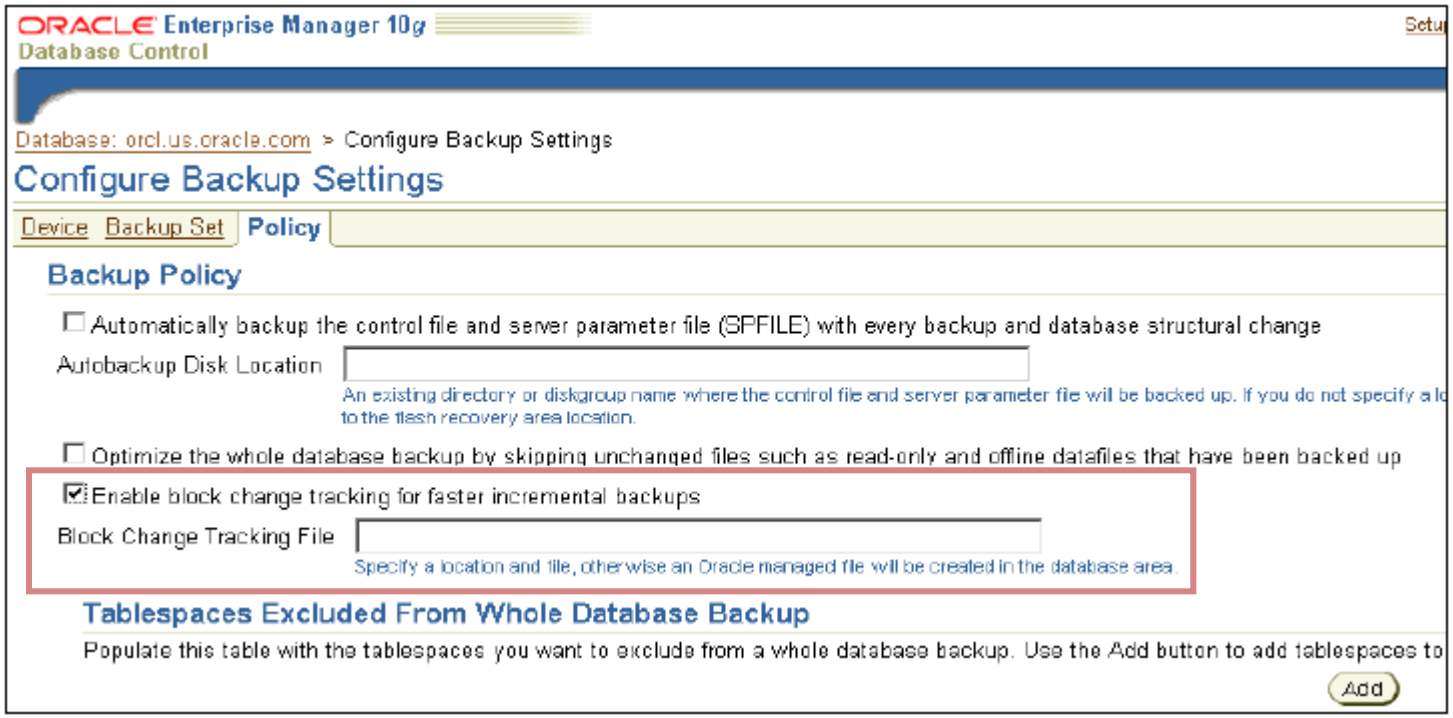
- Records changed blocks in a change tracking file.
- Is used automatically by **RMAN** if enabled.
- Optimizes incremental backups by avoiding full data file scans during backup.



Use the RMAN BACKUP command

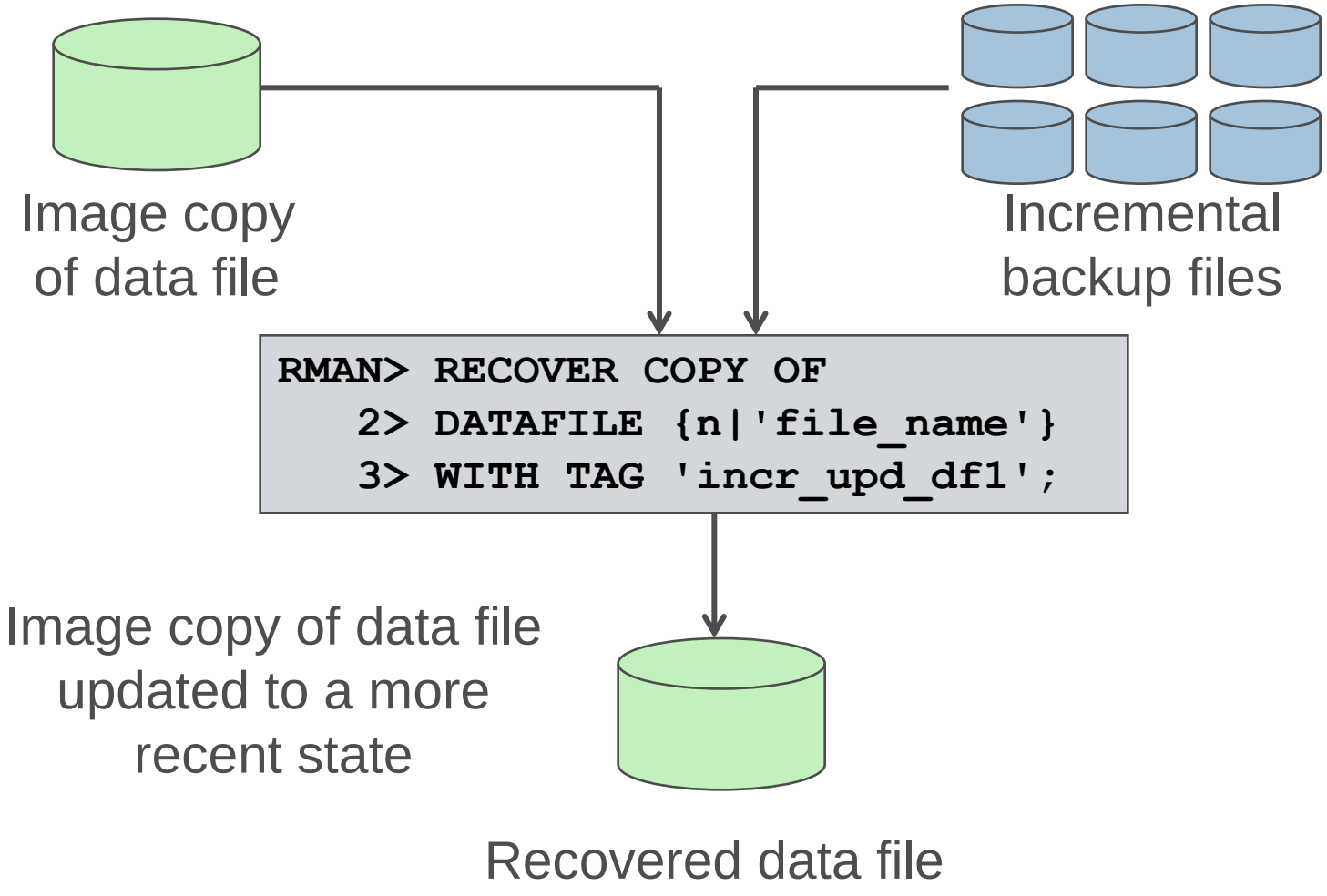
Enabling Block Change Tracking

```
SQL> ALTER DATABASE ENABLE
  2> BLOCK CHANGE TRACKING
  3> USING FILE '/mydir/rman_change_track.f'
  4> REUSE;
```



Use the RMAN BACKUP command

Incrementally Updating Backups



Use the RMAN BACKUP command

LIST Command Operations

- List backup sets and copies of data files :

```
RMAN> LIST BACKUP OF DATABASE;
```

```
RMAN> LIST BACKUP OF DATAFILE
   2> '/db01/ORADATA/u03/users01.dbf';
```

- Lists backup sets and copies of any data file for a specified tablespace :

```
RMAN> LIST COPY OF TABLESPACE "SYSTEM";
```

- Lists backup sets and copies containing archive logs for a specified range :

```
RMAN> LIST COPY OF DATABASE ARCHIVELOG
   2> FROM TIME='SYSDATE-7';
```

Use the RMAN BACKUP command

The REPORT Command

- Produces a detailed analysis of the repository.
- Produces reports to answer :
  - Which files need a backup?
  - Which backups can be deleted?
  - Which files are unrecoverable?

Use the RMAN BACKUP command

- **The REPORT NEED BACKUP Command**
  - Lists all data files that require a backup.
  - Assumes the most recent backup is used during a restore.
  - Provides four options :
    - Incremental.
    - Days.
    - Redundancy.
    - Recovery window.
  - Uses the current retention policy configuration if no options are specified.

Use the RMAN BACKUP command

REPORT NEED BACKUP: Examples

- Files needing three or more incremental backups for recovery:

```
RMAN> REPORT NEED BACKUP incremental 3;
```

- Files have not been backed up for three days:

```
RMAN> REPORT NEED BACKUP days 3;
```

- Backup needed if there are not two or more:

```
RMAN> REPORT NEED BACKUP redundancy 2;
```

- Backup needed to recover 3 days past:

```
RMAN> REPORT NEED BACKUP
   2> recovery window of 3 days;
```

Use the RMAN BACKUP command

REPORT OBSOLETE and DELETE OBSOLETE

- Find all obsolete recovery files using the current retention policy settings:

```
RMAN> REPORT OBSOLETE;
```

- List the obsolete recovery files, if no more than two backup copies are needed:

```
RMAN> REPORT OBSOLETE REDUNDANCY 2;
```

- Delete the backup set with a backup set key of 4:

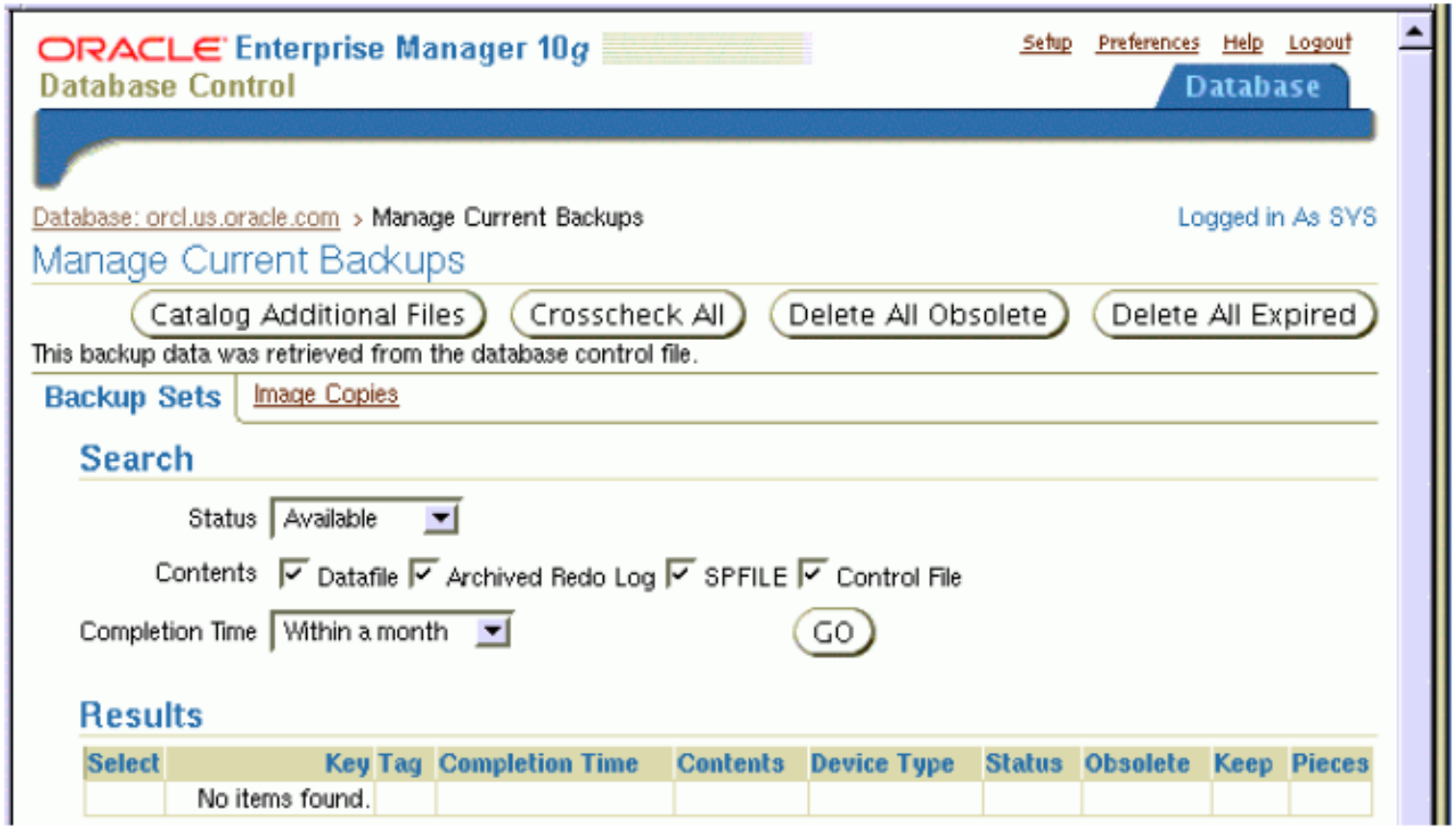
```
RMAN> DELETE BACKUPSET 4;
```

- Delete the recovery files considered obsolete, because they have more than two backups:

```
RMAN> DELETE OBSOLETE REDUNDANCY 2;
```

Manage the backups with RMAN

Managing Backups with Enterprise Manager



Manage the backups with RMAN

RMAN Dynamic Views

- V$ARCHIVED_LOG
- V$BACKUP_CORRUPTION
- V$BACKUP_DEVICE
- V$BACKUP_FILES
- V$BACKUP_PIECE
- V$BACKUP_REDOLOG
- V$BACKUP_SET
- V$BACKUP_SPFILE
- V$COPY_CORRUPTION
- V$RMAN_CONFIGURATION

Manage the backups with RMAN

Monitoring RMAN Backups

- Correlate server sessions with channels using the **SET COMMAND ID** command.
- Query **V$PROCESS** and **V$SESSION** to determine which sessions correspond to which **RMAN** channels.
- Query **V$SESSION_LONGOPS** to monitor the progress of backups and copies.
- Use an operating system utility to monitor the process or threads.

Part 2 Summary

Use the RMAN `BACKUP` command

Manage the backups with RMAN

Part 2 Stop-and-think

Do you have any questions ?

Diagnostic sources

Preview

- Use various files for diagnostic purposes
- Use Enterprise Manager to view alerts
- Adjust thresholds for tracked metrics
- Control the size and location of trace files

Use various files for diagnostic purposes

Diagnostic Files

- The `alert.log` file.
- Trace files.
- Core dump files.
- System log files.

Use various files for diagnostic purposes

The Alert Log

- The Alert Log contains:
  - All internal errors.
  - Administrative operations, such as **`CREATE`**, **`ALTER`**, and **`DROP`** statements.
  - Shared server errors.
  - Materialized view refresh errors.
  - Initialization parameter values.

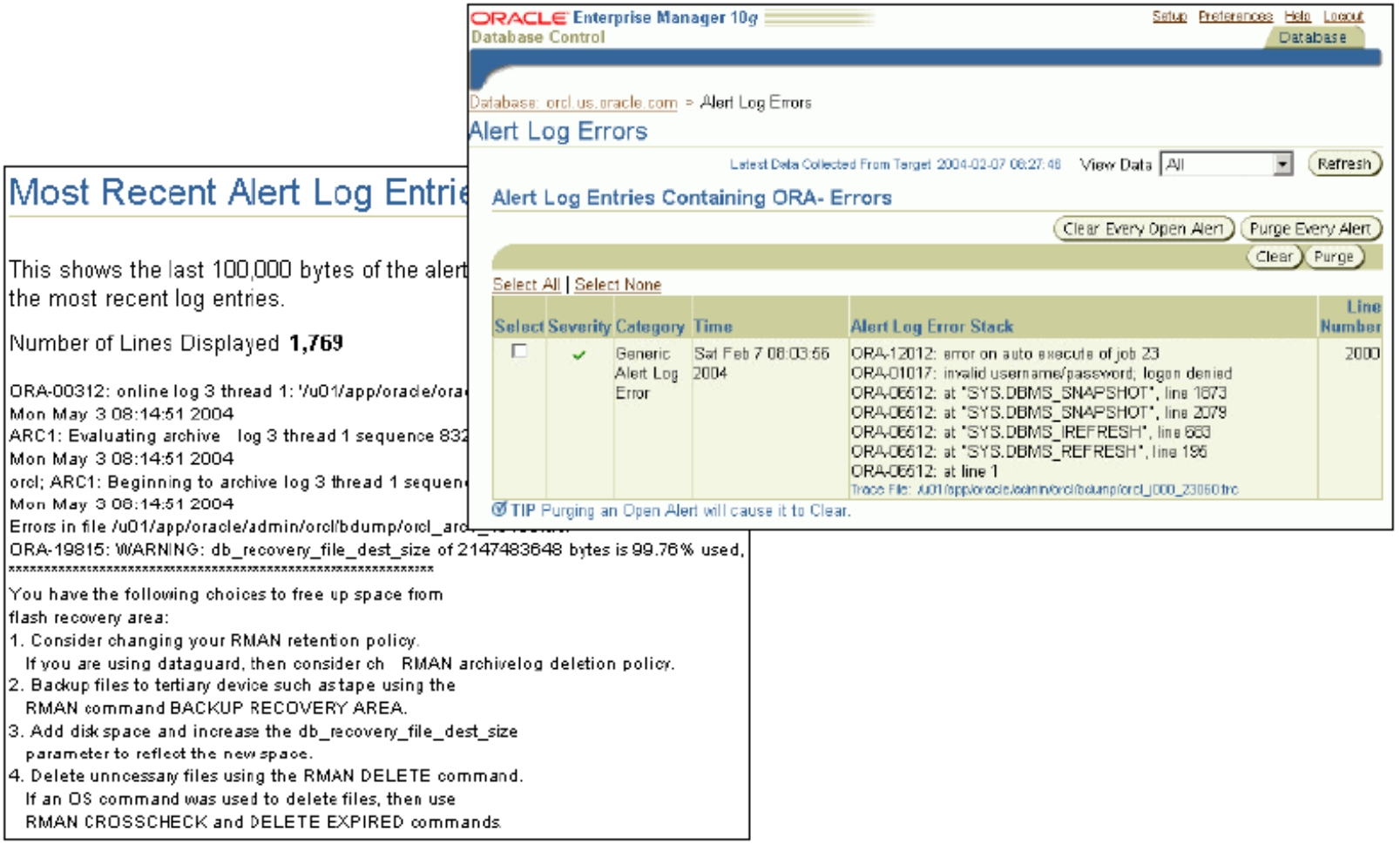
Use various files for diagnostic purposes

What is in the `alert.log` File ?

- Every instance generates a file called **`alert.log`**, which logs the following information:
  - Diagnostic data from background and foreground processes.
  - Summary information regarding errors and pointers to trace files for detailed information.
  - Information since database creation (unless purged) that might be useful in backtracking a problem.

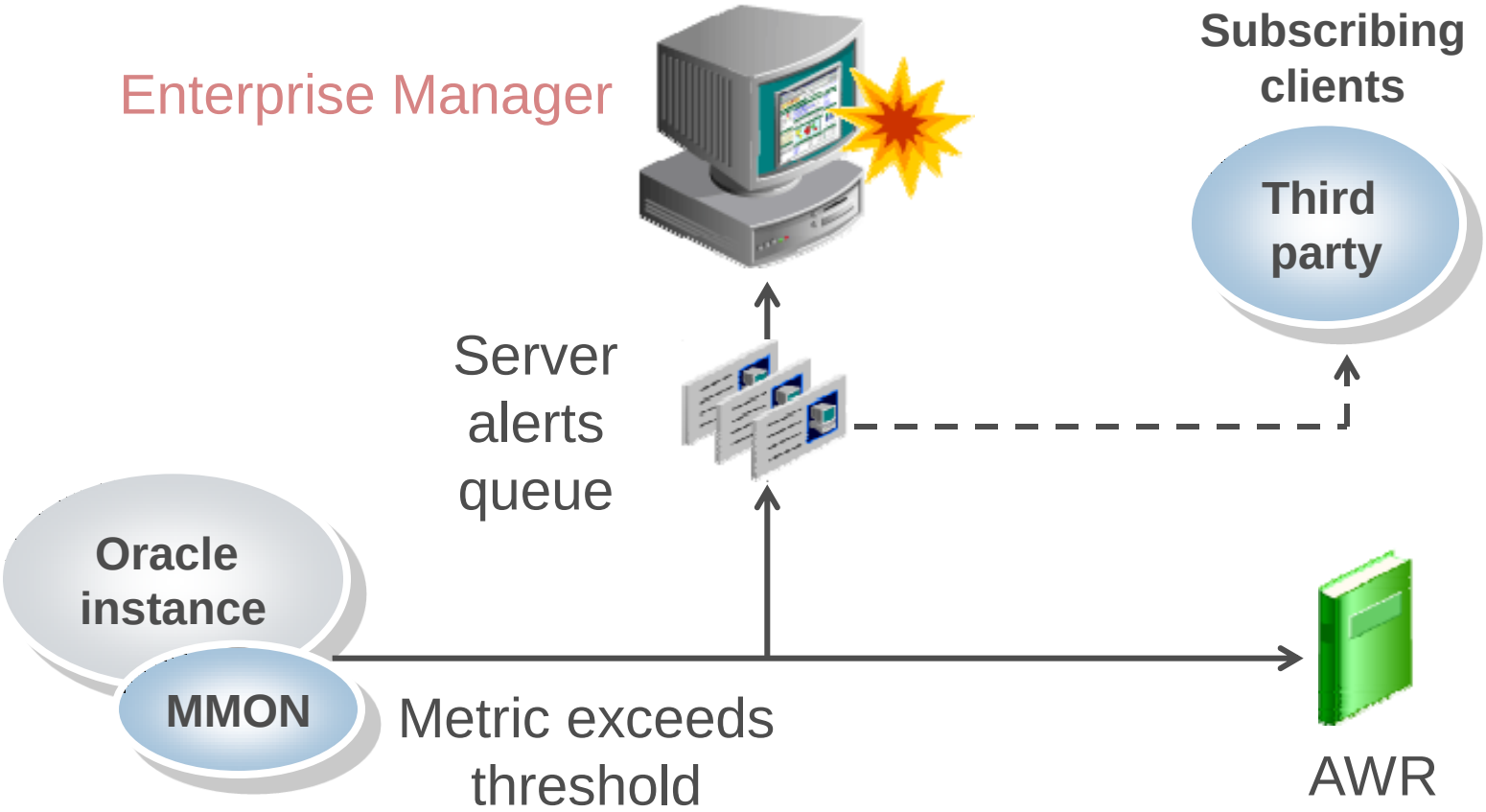
Use various files for diagnostic purposes

Viewing Recent Alert Log Entries



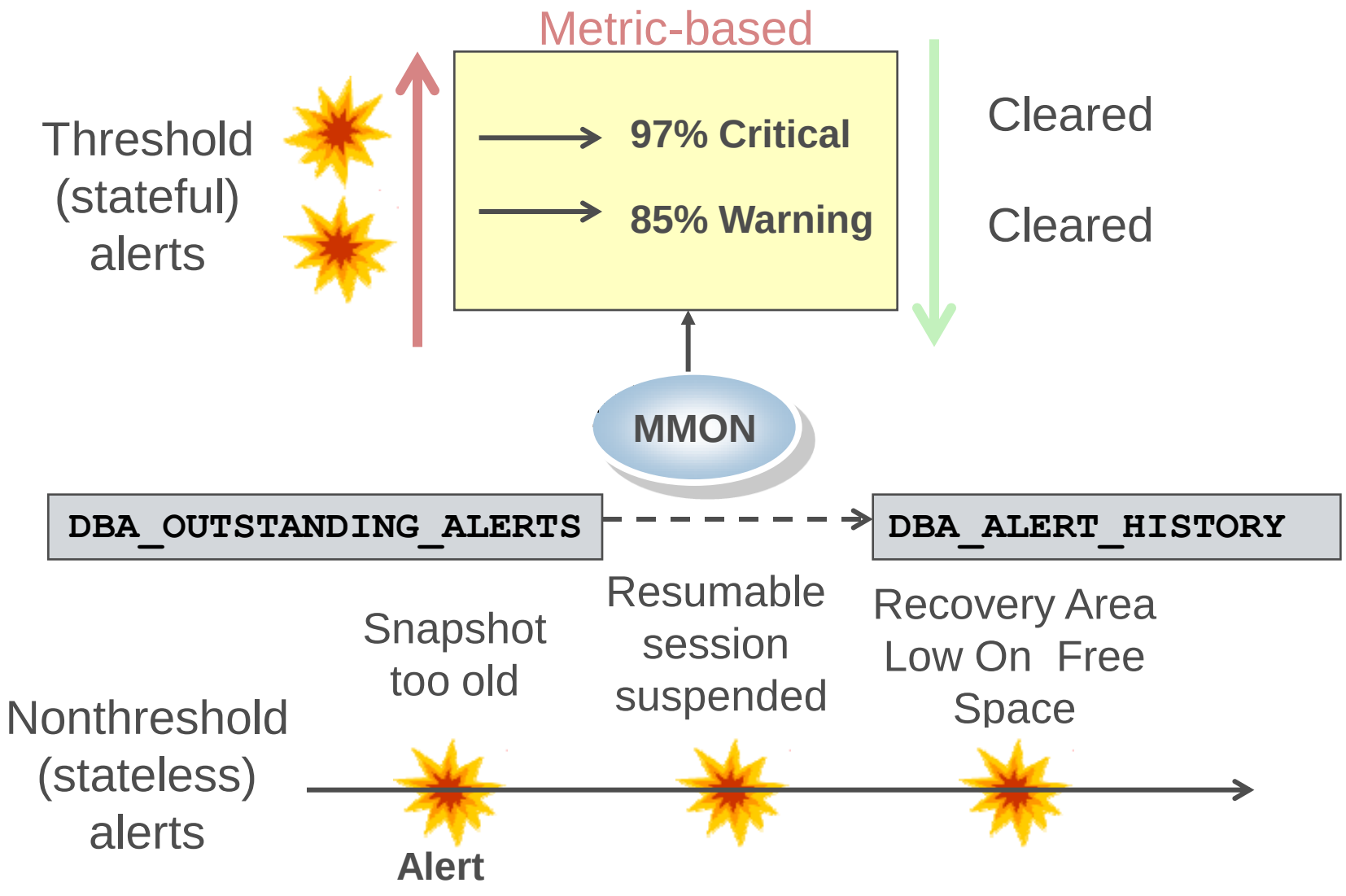
Use various files for diagnostic purposes

Alert Models Architecture



Use various files for diagnostic purposes

Server-Generated Alert Types



Use Enterprise Manager to view alerts

Viewing Alerts with Enterprise Manager

- Alert General View:

Severity	Category	Name	Message	Alert Triggered	Last Value	Time
✖	Alert Log	Archiver Hung Alert Log Error	The archiver hung at time/line number: Sat May 1 05:51:59 2004/10382.	May 3, 2004 8:18:22 AM	0	May 3, 2004 8:18:22 AM

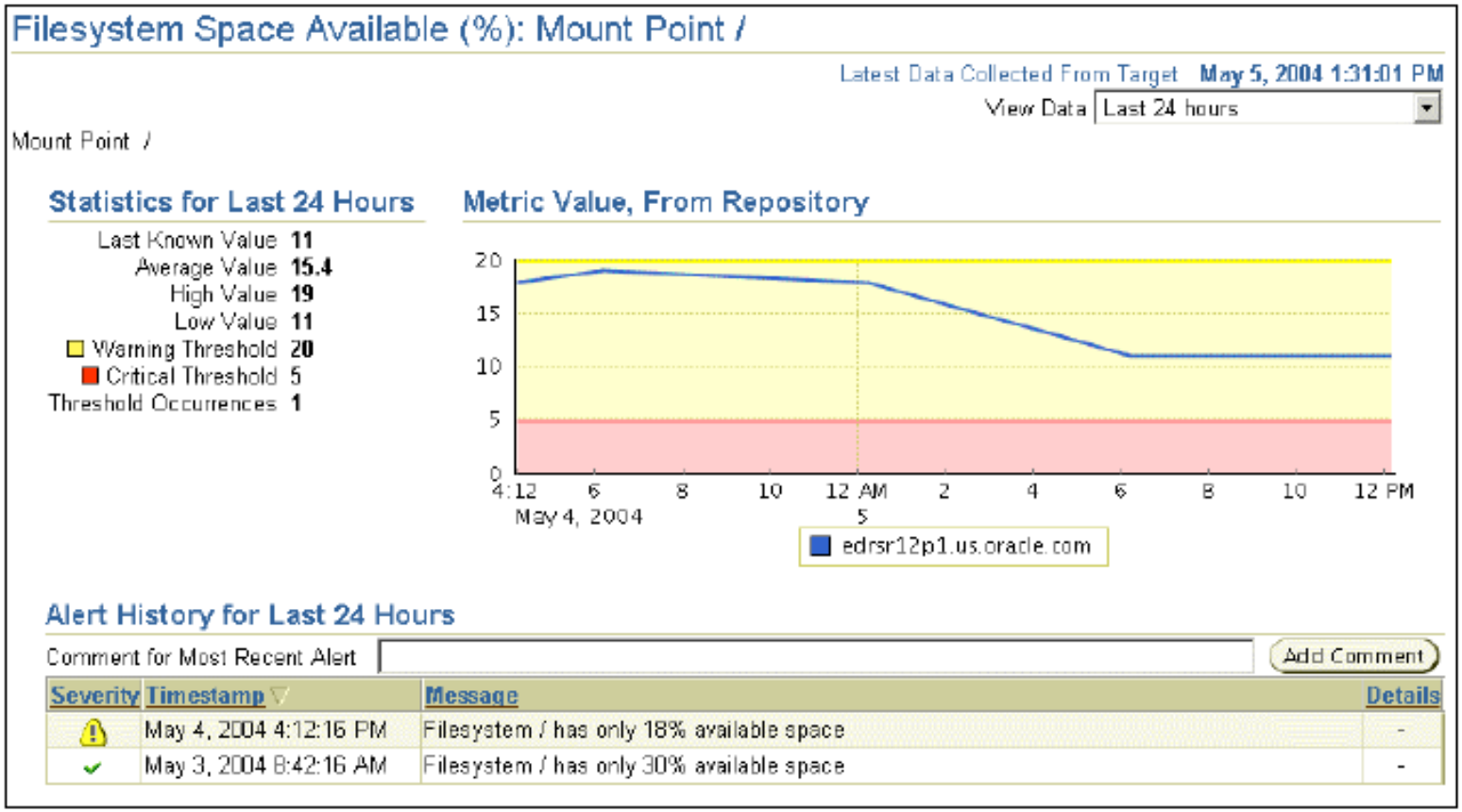
Related Alerts

Severity	Target Name	Target Type	Category	Name	Message	Alert Triggered	Last Value	Time
⚠	edrsr12p1.us.oracle.com	Host	Filesystems	Filesystem Space Available (%)	Filesystem / has only 18% available space	May 4, 2004 4:12:16 PM	11	May 5, 2004 12:12:16 PM

Use Enterprise Manager to view alerts

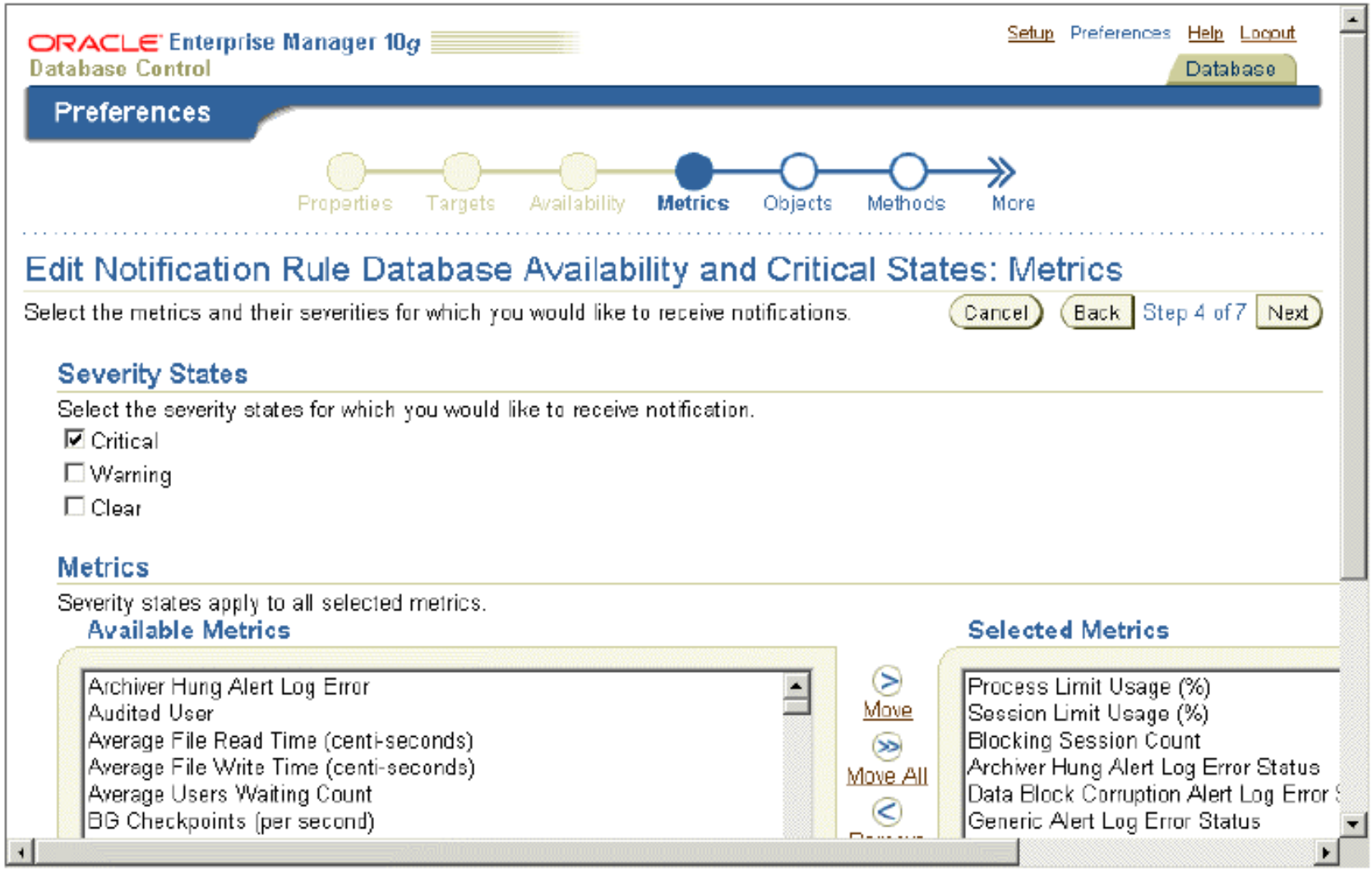
Viewing Alerts with Enterprise Manager

- Alert Details:



Use Enterprise Manager to view alerts

Alerts Notification



Use Enterprise Manager to view alerts

Alert Log Monitoring Configuration

Generic Alert Log Error Monitoring Configuration

Oracle Enterprise Manager can raise an Alert Log Error alert for each distinct sequence of ORA- errors it finds in the alert log. If there are ORA- errors occurring in the alert log that should not contribute to database alerts, use the Filter Expression to suppress the errors. Every distinct ORA- error that is not filtered will result in a separate Alert Log Error alert.

Alert Log Filtering

If there is an ORA- error occurring in the alert log that should not be considered a Generic Alert Log Error, it can be filtered out by supplying a Filter Expression. When the ORA- error stack fully matches this expression, Oracle Enterprise Manager will ignore the ORA- error entirely.

Alert Log Filter Expression: `.*ORA-0*(54|1142|1146)\D.*`

TIP This expression must be a Perl-style regular expression and only an exact match of the pattern will suppress.
Example To match "ORA-00600: internal error code, arguments [qerfxFetch_01], [], [], [], [], [], []" you might give the pattern ".*ORA-00600:.*\[qerfxFetch[^\]]*\].*"

Alert Thresholds

You can modify the critical and warning thresholds for the Generic Alert Log Error alert.

Critical Threshold for Generic Alert Log Errors:

Warning Threshold for Generic Alert Log Errors: `ORA-0*(600?|7445|4[0-9|[0-9]|[0-9]|[^0-9|`

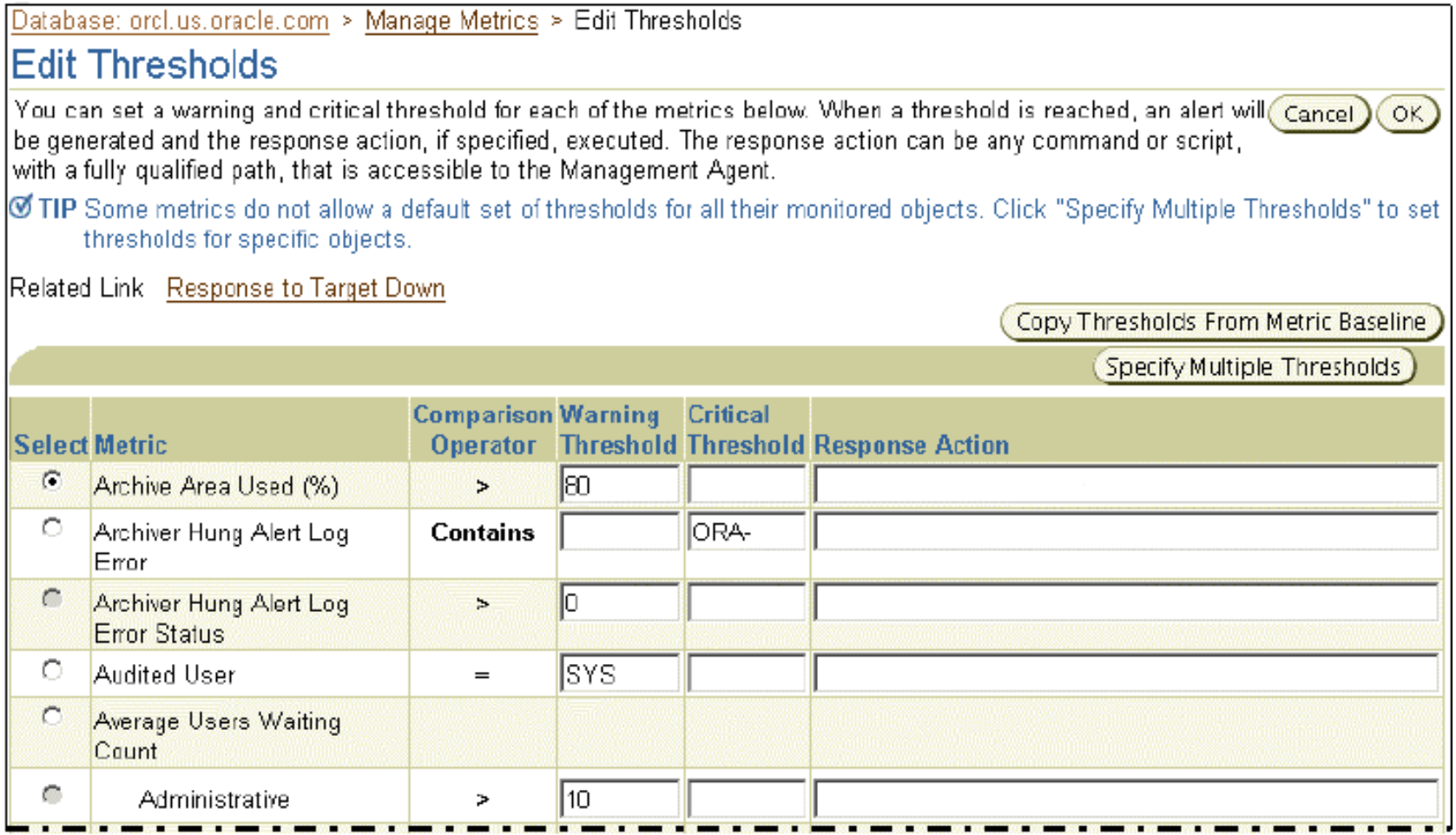
TIP This expression must be a Perl-style regular expression and any occurrence of the pattern found in the error stack is considered to be a match.
Example To match "ORA-00600: internal error code, arguments [qerfxFetch_01], [], [], [], [], [], [], []" you might give the pattern "00600.*\[qerfxFetch[^\]]*\]"

Note The Alert Log Error Filter also affects the Generic Alert Log Error Status alert.
Note To modify thresholds of all other Alert Log Error alerts, visit the Edit Metric Thresholds page.

Cancel Apply

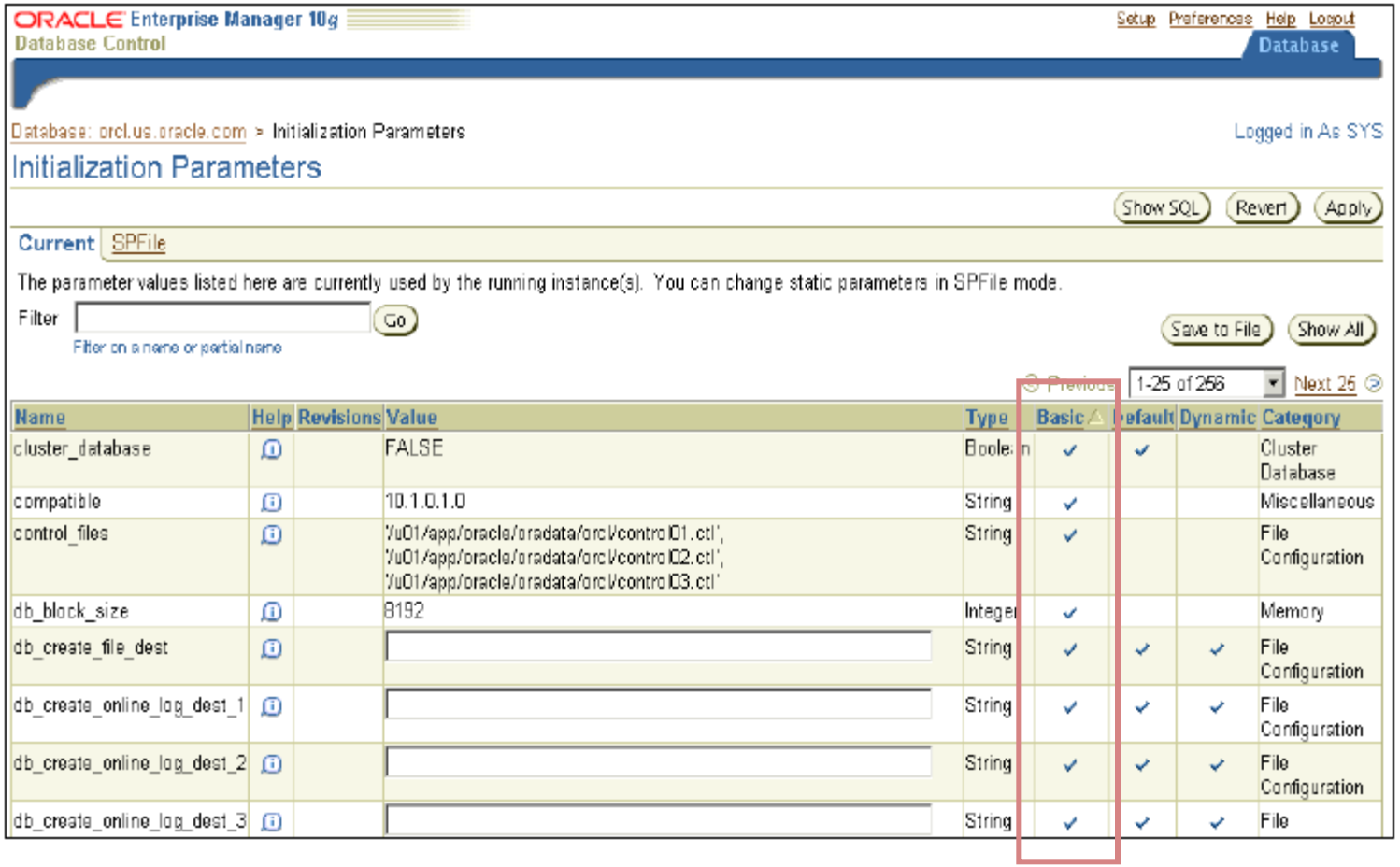
Adjust thresholds for tracked metrics

Editing Thresholds



Adjust thresholds for tracked metrics

Viewing Initialization Parameters



Control the size and location of trace files

Trace Files

- Every server process, on encountering an exception, writes diagnostic data to a trace file.
- The trace file header contains the following information:
  - OS and version.
  - Oracle version and options installed.
  - Instance name.
  - Process ID.

Control the size and location of trace files

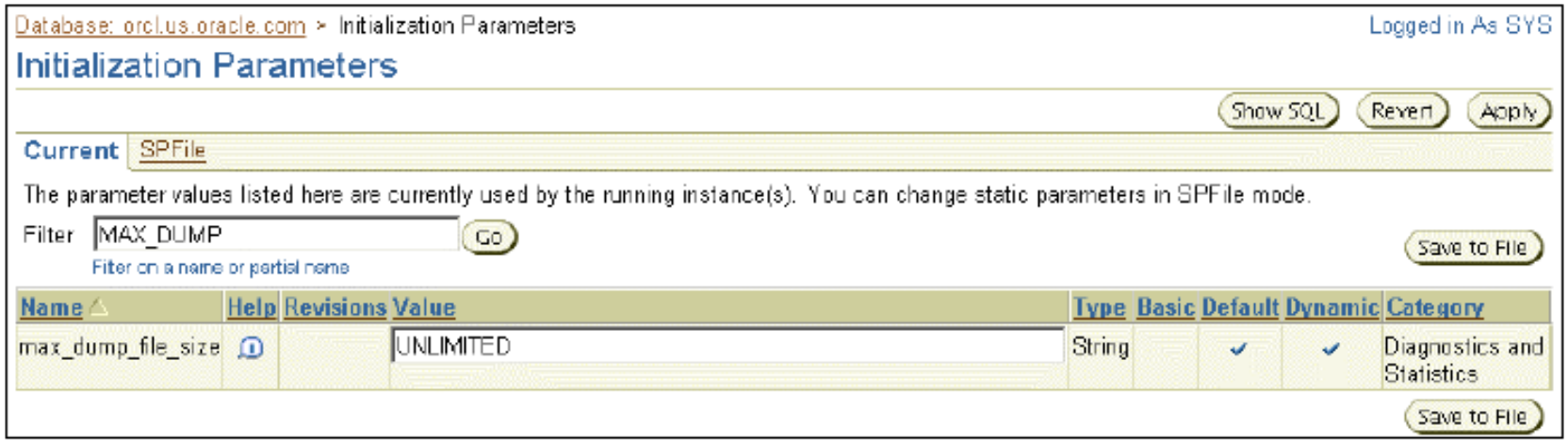
Specifying the Location of Trace Files

- Initialization parameters controlling the location and size of trace files include:
  - **BACKGROUND_DUMP_DEST**
  - **USER_DUMP_DEST**
  - **MAX_DUMP_FILE_SIZE**

Control the size and location of trace files

Controlling Trace File Size

- Using Enterprise Manager:



Control the size and location of trace files

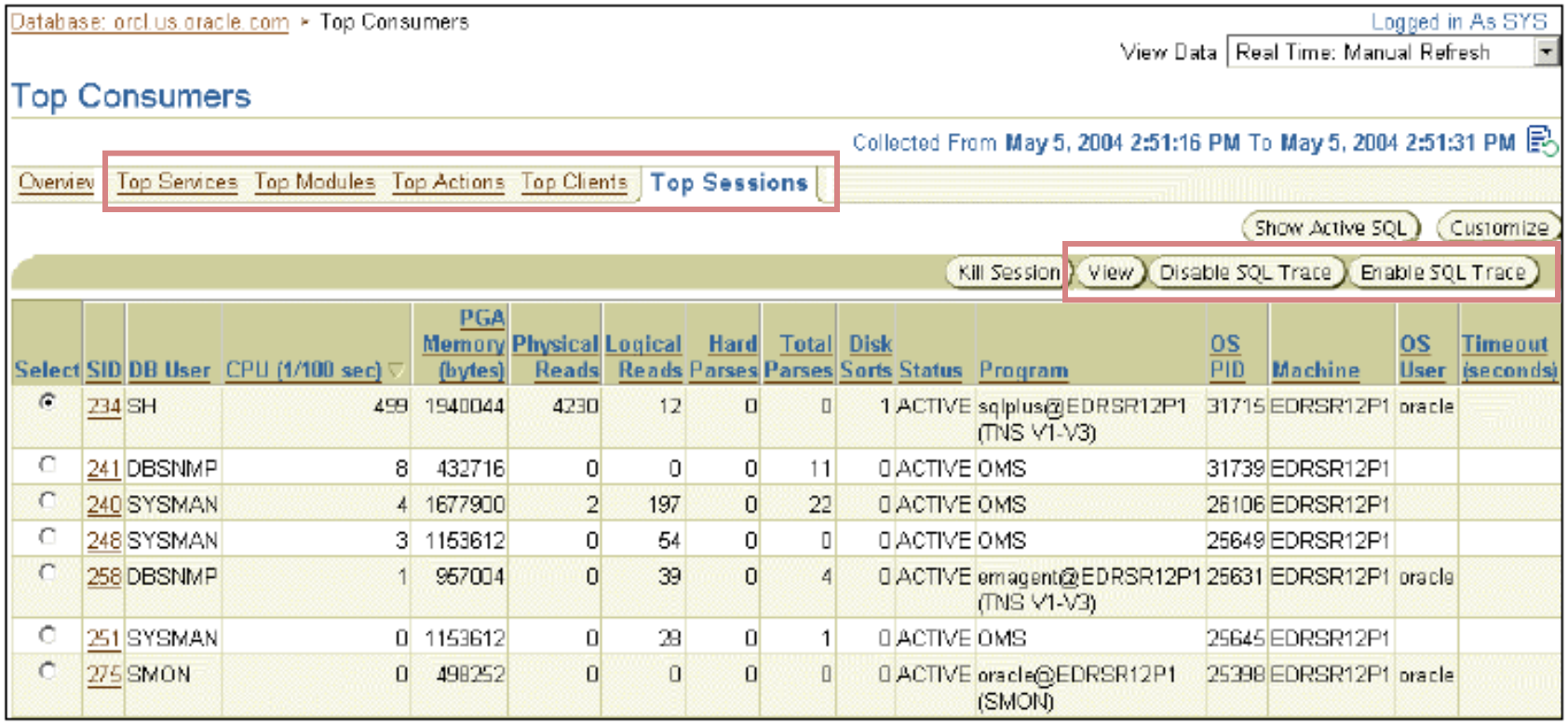
Controlling Trace File Writes

- Trace files are usually generated by a server process upon encountering an error.
- Some background processes like **ARC*n***, have parameters that control the amount and type of trace information generated.
- In some instances, trace files can be generated for server processes at user request.

```
SQL> ALTER SESSION SET SQL_TRACE TRUE;
```

Control the size and location of trace files

Using Enterprise Manager to Enable and View SQL Tracing



Select	SID	DB User	CPU (1/100 sec)	PGA Memory (bytes)	Physical Reads	Logical Reads	Hard Parses	Total Parses	Disk Sorts	Status	Program	OS PID	Machine	OS User	Timeout (seconds)
◉	234	SH	499	1940044	4230	12	0	0	1	ACTIVE	sqlplus@EDRSR12P1 (TNS V1-V3)	31715	EDRSR12P1	oracle	
○	241	DBSNMP	8	432716	0	0	0	11	0	ACTIVE	OMS	31739	EDRSR12P1		
○	240	SYSMAN	4	1677900	2	197	0	22	0	ACTIVE	OMS	26106	EDRSR12P1		
○	248	SYSMAN	3	1153612	0	54	0	0	0	ACTIVE	OMS	25649	EDRSR12P1		
○	258	DBSNMP	1	957004	0	39	0	4	0	ACTIVE	emagent@EDRSR12P1 (TNS V1-V3)	25631	EDRSR12P1	oracle	
○	251	SYSMAN	0	1153612	0	28	0	1	0	ACTIVE	OMS	25645	EDRSR12P1		
○	275	SMON	0	498252	0	0	0	0	0	ACTIVE	oracle@EDRSR12P1 (SMON)	25398	EDRSR12P1	oracle	

```
SQL> SELECT * FROM dba_enabled_traces;
```

Control the size and location of trace files

System Log Files

- System log files capture error messages and exceptions encountered at the OS level.
- These would be useful if a hardware or OS problem is suspected.

Part 3 Summary

Use various files for diagnostic purposes

Use Enterprise Manager to view alerts

Adjust thresholds for tracked metrics

Control the size and location of trace files

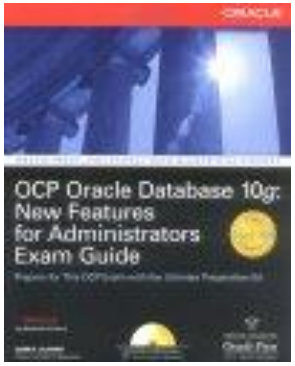
Part 3 Stop-and-think

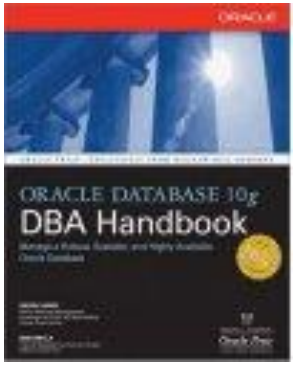
Do you have any questions ?

For more

If you want to go into these subjects more deeply, …

Publications





http://www.oracle.../bookstore/

Courses

Cursus: Merise & SQL

Cursus: PL/SQL

Cursus: DBA1 & DBA2

Cursus: DWH, OAS & BIS

Web sites

http://www.labo-oracle.com

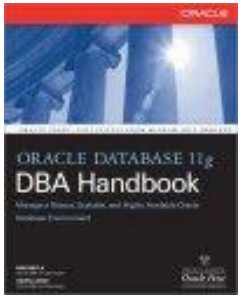
http://www.oracle.com

http://otn.oracle.com

Certifications

1Z0-042

1Z0-043



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The end


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