Backup and Recovery Concepts

DBA Responsibilities

- ❑ Protect the database from failure wherever possible
- ❑ Increase the mean time between failures (MTBF)
  - ✓ Ensures that hardware is as reliable as possible.
  - ✓ operating system maintenance is performed in a timely manner.
  - ✓ advanced configuration options (RAK and Oracle Data Guard)
- ❑ Protect critical components by using redundancy
- ❑ Decrease the mean time to recover (MTTR)
  - ✓ practicing recovery procedures in advance and configuring backups so that they are readily available when needed
- ❑ Minimize the loss of data
  - ✓ Archive log files
  - ✓ Flashback technology

Backup and Recovery Concepts

Categories of Failure

Statement failure : A single database operation (select, insert, update, or delete) fails.

User process failure : A single database session fails.

Network failure : Connectivity to the database is lost.

User error : A user successfully completes an operation, but the operation (dropping a table or entering bad data) is incorrect.

Instance failure : The database instance shuts down unexpectedly.

Media failure : A loss of any file that is needed for database operation (that is, the files have been deleted or the disk has failed).

Backup and Recovery Concepts

Statement Failure

Typical Problems	Possible Solutions
Attempts to enter invalid data into a table	Work with users to validate and correct data.
Attempts to perform operations with insufficient privileges	Provide appropriate object or system privileges.
Attempts to allocate space that fails.	• Enable resumable space allocation. • Increase owner quota. • Add space to tablespace.
Logic errors in applications	Work with developers to correct program errors.

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User Process Failure

Typical Problems	Possible Solutions
A user performs an abnormal disconnect.	A DBA's action is not usually needed to resolve user process failures. • Instance background processes roll back uncommitted changes and release locks. • Watch for trends.
A user's session is abnormally terminated.	
A user experiences a program error that terminates the session.	

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Network Failure

Typical Problems	Possible Solutions
Listener fails	Configure a backup listener and connect-time failover
Network Interface Card (NIC) fails.	Configure multiple network cards.
Network connection fails.	Configure a backup network connection.

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User Error

Typical Causes	Possible Solutions
User inadvertently deletes or modifies data.	Roll back transaction and dependent transactions or rewind table.
User drops a table.	Recover table from recycle bin. Recover table from a backup.

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Instance Failure

Typical Causes	Possible Solutions
Power outage	Restart the instance by using the `STARTUP` command. Recovering from instance failure is automatic, including rolling forward changes in the redo logs and then rolling back any uncommitted transactions.
Hardware failure	
Failure of one of the critical background processes	Investigate the causes of failure by using the alert log, trace files, and Enterprise Manager
Emergency shutdown procedures	

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Media Failure

Typical Causes	Possible Solutions
Failure of disk drive	1. Restore the affected file from backup. 2. Inform the database about a new file location (if necessary). 3. Recover the file by applying redo information (if necessary).
Failure of disk controller	
Deletion or corruption of a file needed for database operation	

Backup and Recovery Concepts

incomplete vs. complete recovery.

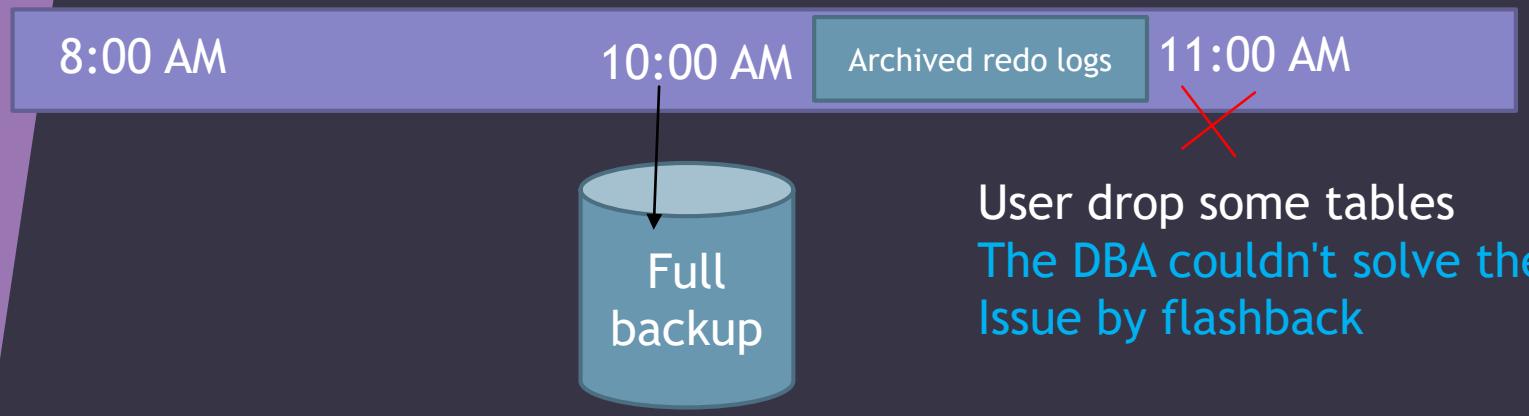
- Both terms are used to describe different methods of recovering the database from media failure

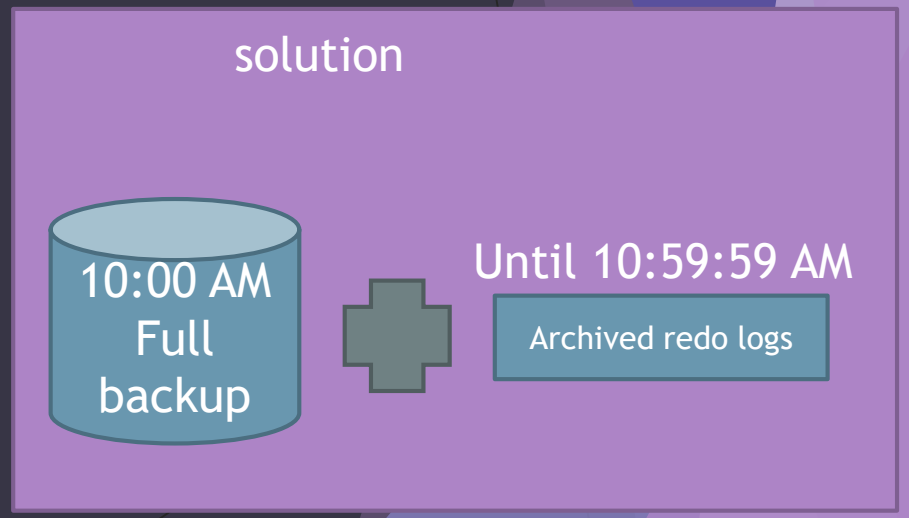
That is when you lose actual database data files and not just restart your Oracle instance after it has crashed.

- **complete recovery**: you bring your database to the state where it is fully up to date including all completed transactions and database modifications up to the present date and time.

- incomplete recovery which brings your database to a specific point in time in the test.

This is also known as point in time recovery, or PITR



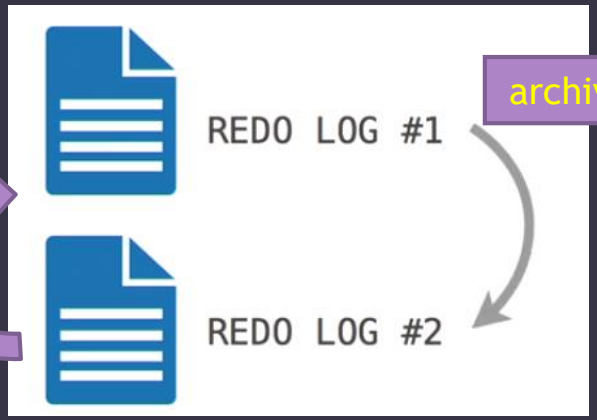


Backup and Recovery Concepts

redo logs and archived redo logs

- the Oracle redo logs contain a log of all transactions which have been applied to your Oracle database. Every single insert, delete, or update statement is recorded in the redo logs.

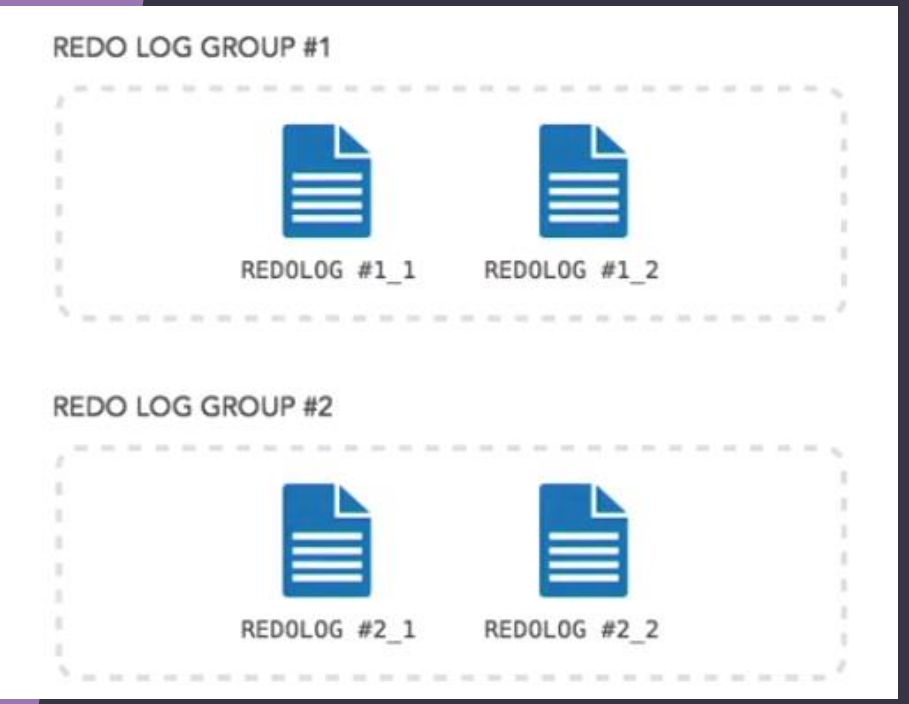
- The Oracle database requires at least two Redo Log Files at any given time, as it writes to them in a cyclic manner.
- The database writes to the first Redo Log File, and once that Redo Log File is filled up, the database will start writing to the second Redo Log File. This is called a Redo Log switch



the archiver process is very straightforward. It is responsible to copy the Oracle redo log files to a remote storage device after a redo log switch has occurred. The archiver process will copy the redo log file and place it on any external storage of your choosing.

Backup and Recovery Concepts

Redo Log groups



Oracle allows creating Redo Log groups, which allow us to store a copy of each Redo Log in more than one location
Why? because the Redo Logs are so critical to the function of the database

We call this: multiplexing the Redo Logs

Each file in the Redo Log group is called a member.
So group number one has two members: 1_1 and 1_2.
Group number two also has two members: member 2_1 and member 2_2

If we multiplex our Oracle Redo Logs and use the Redo Log groups, the Oracle log writer background process will write to a group and all of its members at the same time, instead of just writing to an individual Redo Log

the file extensions for the Redo Log File is .log.
Be carful not to delete them

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Prerequisites of point-in-time-recovery

In order for us to be able and perform point-in-time-recovery, using a combination of database backups and database archived read logs, there's several prerequisites and configuration options we need to configure

- we need to make sure our Oracle database is set to ARCHIVELOG mode.
  you can execute this command ARCHIVE LOG LIST;

It should give you that:
Automatic archival : Enabled

- you will also need to have a database backup of all your data files from before the target SCN, or time stamp to which you want to restore your database to.
  for example, if you want to restore your database to 12PM you will need a full database backup that was completed before 12 PM

- you will need to make sure that you have all of the archived read logs the database generated

Backup and Recovery Concepts

Oracle Backup Technologies

1. User-managed hot backups

The DBA takes periodic backups of the database data files and review logs using operating system commands

2. Oracle Recovery Manager (RMAN)

is a command-line utility that can take database backups for you, and also manage your database backups and perform database recovery (supports incremental database backups)

3. Data Pump

Database export-import utility. (it creates logical exports of your database)

4. Flashback

Flashback database technologies are often used as a quick way to recover from human errors
Flashback technologies in Oracle are not suited for recovering from media or disk failure, as Flashback will not work if the database itself isn't online

Backup and Recovery Concepts

Enabling ARCHIVELOG mode

- When Archive mode is enabled, Oracle turns each active redo log file into an archived redo log file when it finishes writing to it.

- Archive mode is essential for running online or hot backups in Oracle, as well as for enabling Oracle's Flashback Database technologies.

- ❑ Connect sys as sysdba
- ❑ Make sure you are in the root
- ❑ Do this: ARCHIVE LOG LIST; to see if option is enabled or no
- ❑ If not then
- ✓ Shutdown immediate;
- ✓ STARTUP MOUNT;
- ✓ alter database archivelog;
- ✓ ALTER DATABASE OPEN;
- ✓ ALTER PLUGGABLE DATABASE ALL OPEN;

Backup and Recovery Concepts

Configuring fast recovery area

- The fast recovery area is an Oracle managed directory file system, or Oracle automatic storage management disk group that provides centralized storage for backup and recovery files.

- The fast recovery area is usually used to store the Oracle archived redo logs, the database flashback change logs and RMAN backup sets

- Two parameters control the fast recovery area.

1. db_recovery_file_dest
2. db_recovery_file_dest_size

```
Alter system set DB_RECOVERY_FILE_DEST_SIZE = 20G;
Alter system set DB_RECOVERY_FILE_DEST = '/u01/app/oracle/fast_recovery_area';
```