

# Backup and Recovery: Overview

## Objectives



After completing this lesson, you should be able to:

- Identify the responsibilities of a DBA in database backup and recovery
- Identify the types of failure that can occur in an Oracle database
- Describe instance recovery
- Describe complete and incomplete recovery

## DBA Responsibilities

- Protect the database from failure wherever possible.
- Increase the mean time between failures (MTBF).
- Protect critical components by using redundancy.
- Decrease the mean time to recover (MTTR).
- Minimize the loss of data.

## Separation of DBA Duties

The `SYSBACKUP` administrative privilege:

- Includes permissions for backup and recovery (connecting to a closed database)
- Does not include data access privileges such as `SELECT ANY TABLE`
- Is granted to the `SYSBACKUP` user that is created during database installation
- Can be explicitly used in RMAN connections by a `SYSBACKUP` privileged user

```
$ rman target ''/ as sysbackup"  
connected to target database: ORCL (DBID=1297344416)
```

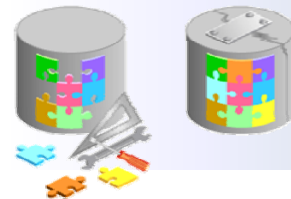
## Assessing Your Recovery Requirements

- Identify and prioritize critical data.
- Base recovery requirements on data criticality.
  - Recovery Point Objective (RPO): Tolerance for data loss
  - Recovery Time Objective (RTO): Tolerance for down time
  - Determine backup retention policy for on-site, off-site, and long-term backups.
- Assess data protection requirements.
  - Physical: Disasters, outages, failures, corruptions
  - Logical: Human errors, application errors

## Categories of Failure

Failures can generally be divided into the following categories:

- Statement failure
- User process failure
- Network failure
- User error
- Instance failure
- Media failure



## 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 the appropriate object or system privileges.
Attempts to allocate space that fails	Enable resumable space allocation. Increase owner quota. Add space to the tablespace.
Logic errors in applications	Work with developers to correct program errors.

## 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. The DBA should watch for trends.
A user's session is abnormally terminated.	
A user experiences a program error that terminates the session.	

## 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.

## User Error

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

Use Oracle LogMiner to query your online redo logs and archived redo logs through an Enterprise Manager or SQL interface.

## Instance Failure

### Typical Causes

Power outage  
Hardware failure  
Failure of one of the critical background processes  
Emergency shutdown procedures

### Possible Solutions

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.  
Investigate the causes of failure by using the alert log, trace files, and Enterprise Manager.

## Media Failure

### Typical Causes

Failure of a disk drive  
Failure of a disk controller  
Deletion or corruption of a file needed for a database operation  
Storage network failure  
Solid state storage corruption

### Possible Solution

1. Restore the affected file from backup.
2. Inform the database server of a new file location (if necessary).
3. Recover the file by applying redo information (if necessary).

## Data Failures

- **Inaccessible components:** Missing data files at the OS level, incorrect access permissions, offline tablespace
- **Physical corruptions:** Block checksum failures, invalid block header field values
- **Logical corruptions:** Inconsistent dictionary, corrupt row piece, index entry, or transaction
- **Inconsistencies:** Control file older or newer than the data files and online redo logs
- **I/O failures:** Limit on the number of open files exceeded, inaccessible channels, network or I/O error

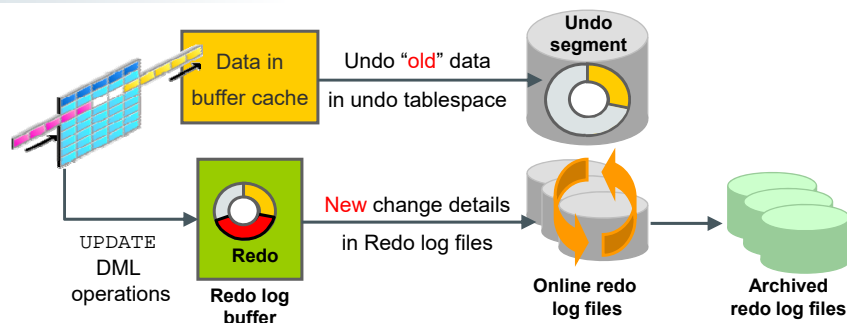


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1 - 13

## Database Log Mode



### NOARCHIVELOG mode

Closed database

Recovery to the last backup

Suitable for training and test environments, for data warehouses with infrequent loads

### ARCHIVELOG mode

Open database

Recovery to last committed transaction

Suitable for production environments

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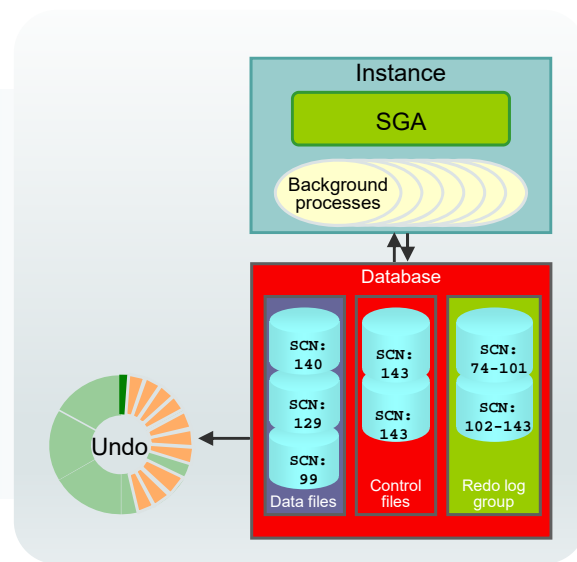
1 - 14

## Automatic Instance Recovery or Crash Recovery

- Is caused by attempts to open a database whose files are not synchronized on shutdown
- Uses information stored in redo log groups to synchronize files
- Involves two distinct operations:
  - **Rolling forward:** Redo log changes (both committed and uncommitted) are applied to data files.
  - **Rolling back:** Changes that are made but not committed are returned to their original state.

## Phases of Instance Recovery

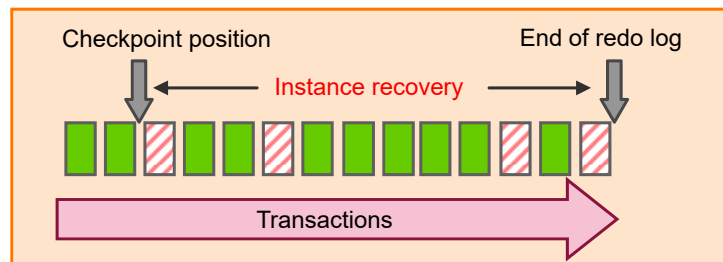
1. Instance startup (data files are out of sync)
2. Roll forward (redo)
3. Committed and uncommitted data in files
4. Database opened
5. Roll back (undo)
6. Committed data in files





## Tuning Instance Recovery

- During instance recovery, the transactions between the checkpoint position and the end of the redo log must be applied to data files.
- You tune instance recovery by controlling the difference between the checkpoint position and the end of the redo log.



## Using the MTTR Advisor

- Specify the desired time in seconds or minutes.
- The default value is 0 (disabled).
- The maximum value is 3,600 seconds (one hour).

Logged in as DBA1

### Recovery Settings

Show SQL Revert Apply

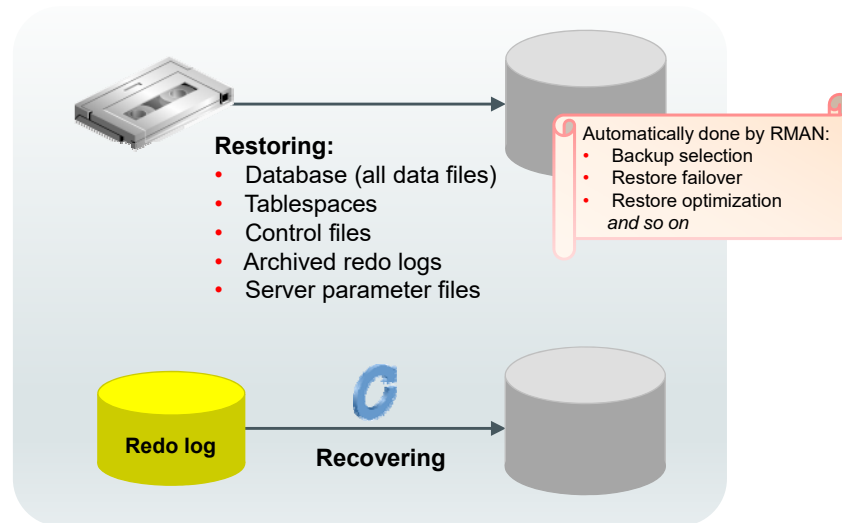
#### Instance Recovery

The fast-start checkpointing feature is enabled by specifying a non-zero desired mean-time to recover (MTTR) value, which will be used to set the FAST\_START\_MTTR\_TARGET initialization parameter. This parameter controls the amount of time the database takes to perform crash recovery for a single instance. When fast-start checkpointing is enabled, Oracle automatically maintains the speed of checkpointing so that the requested MTTR is achieved. Setting the value to 0 will disable this functionality.

Current Estimated Mean Time To Recover (seconds) 19

Desired Mean Time To Recover  Minutes ▾

## Restoring and Recovering



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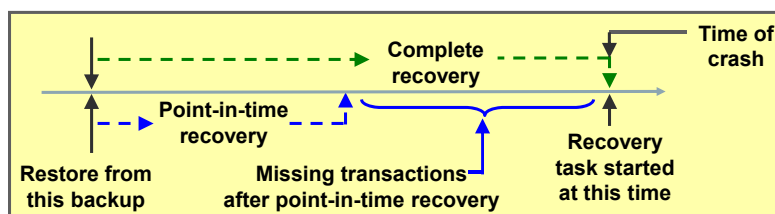
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1 - 19

## Comparing Complete and Incomplete Recovery

Recovery can have two kinds of scope:

- **Complete recovery:** Brings the database or tablespace up to the present, including all committed data changes made to the point in time when the recovery was requested
- **Incomplete or point-in-time recovery (PITR):** Brings the database or tablespace up to a specified point in time in the past, before the recovery operation was requested

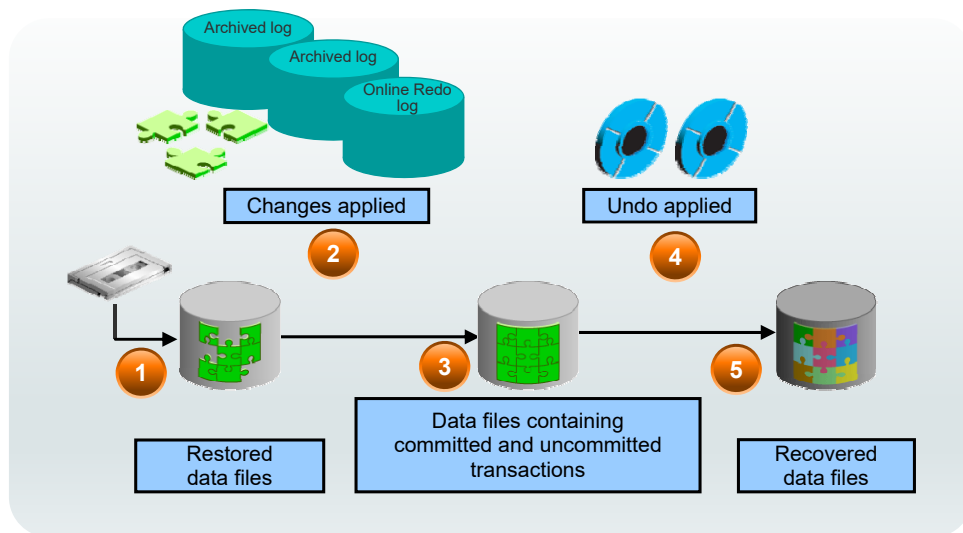


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1 - 20

## The Complete Recovery Process

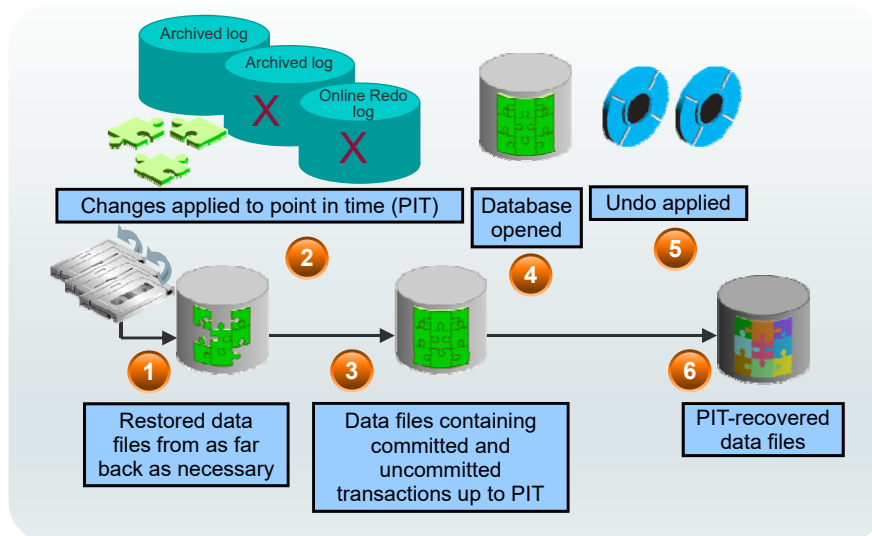


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1 - 21

## The Point-in-Time Recovery Process



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1 - 22

## Oracle Data Protection Solutions

Backup and Recovery Objective	Recovery Time Objective (RTO)	Oracle Solution
Physical data protection	Hours/Days	Recovery Manager Oracle Secure Backup
Logical data protection	Minutes/Hours	Flashback Technologies
Recovery analysis	Minimize time for problem identification and recovery planning	Data Recovery Advisor

Disaster Recovery Objective	Recovery Time Objective (RTO)	Oracle Solution
Physical data protection	Seconds/Minutes	Data Guard Active Data Guard

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1 - 23

## Flashback Technology

Use Flashback technology for:

- Viewing past states of data
- Winding data back and forth in time
- Assisting users in error analysis and recovery



### For error analysis:

Oracle Flashback Query  
Oracle Flashback Versions Query  
Oracle Flashback Transaction Query

### For error recovery:

Oracle Flashback Transaction Backout  
Oracle Flashback Table  
Oracle Flashback Drop  
Oracle Flashback Database

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1 - 24

## Summary

In this lesson, you should have learned how to:

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- Identify the types of failure that can occur in an Oracle database
- Describe instance recovery
- Describe complete and incomplete recovery

