18

Backup and Recovery Concepts

Objectives

After completing this you should be able to do the following:

- Describe the basics of database backup, restore and recovery.
- List the types of failure that may occur in an Oracle Database.
- Describe ways to tune instance recovery.

What is Backup and Recovery?

- **In general, backup and recovery refers to the various strategies and procedures involved in protecting your database against data loss and reconstructing the database after any kind of data loss**

- **A backup is a copy of data from your database that can be used to reconstruct that data. Backups can be divided into physical backups and logical backups.**

Physical Backups

- **Physical backups are backups of the physical files used in storing and recovering your database, such as datafiles, control files, and archived redo logs.**
- **Ultimately, every physical backup is a copy of files storing database information to some other location, whether on disk or some offline storage such as tape**

Logical Backups

- **Logical backups contain logical data (for example, tables or stored procedures) exported from a database with an Oracle export utility and stored in a binary file.**
- **Re-importing into a database using the corresponding Oracle import utility.**
- **Logical backups are a useful supplement to physical backups in many circumstances but are not sufficient protection against data loss without physical backups.**

Backup and Recovery Issues

The administrator's duty is to:

- **Protect the database from failure wherever possible.**
- **Increase the Mean-Time-Between-Failures (MTBF).**
- **Decrease the Mean-Time-To-Recover (MTTR).**
- **Minimize the loss of data.**

Categories of Failures

Failures can generally be divided into the following categories:

- **Statement failure:** A single database operation (select, insert, update, 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 was incorrect (dropping a table, entering incorrect data).
- **Instance failure:** The database instance shuts down unexpectedly.
- **Media failure:** One or more of the database files are lost (deleted, failed disk).

Statement Failures

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 fail	Enable resumable space allocation. Increase user quota. Add space to tablespace.
Logic errors in applications	Work with developers to correct program errors.

User Process Failure

Typical Problems	Possible Solutions
User performed an abnormal disconnect.	DBA action is not usually needed to resolve user process failures. Instance background processes roll back uncommitted changes and release locks.
User's session was abnormally terminated.	
User experienced a program error which terminated the session.	

Network Failure

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

User Errors

Typical Causes	Possible Solutions
User inadvertently deletes or modifies data.	Roll back or use flashback query to recover.
User drops a table.	Recover table from recycle bin.

Instance Failure

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

Instance Recovery

Instance or crash recovery:

- **Is caused by attempts to open a database whose files were not synchronized on shutdown**
- **Uses information stored in redo log groups to synchronize files**
- **Involves two distinct operations**
  - **Rolling forward: Data files are restored to their state before the instance failed.**
  - **Rolling back: Changes made but not committed are returned to their original state.**

Media Failure

Typical Causes	Possible Solutions
Failure of disk drive	1. Restore the affected file from backup. 2. If necessary, inform the database of a new file location. 3. If necessary, recover the file by applying redo information.
Failure of disk controller	
Deletion or corruption of database file	

Configuring for Recoverability

To configure your database for maximum recoverability:

- **Schedule regular backups**
- **Multiplex control files**
- **Multiplex redo log groups**
- **Retain archived copies of redo logs**

Summary

In this lesson you should have learned how to:

- Describe the basics of database backup, restore and recovery
- List the types of failure that may occur in an Oracle Database
- Describe ways to tune instance recovery