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CHAPTER-7

BACKUP AND RECOVERY IN DBMS

BACKUP IN DBMS

- Backup refers to storing a copy of original data which can be used in case of data loss.
- Backup is considered one of the approaches to data protection.
- Important data of the organization needs to be efficiently backed up to protect valuable data.
- Backup can be achieved by storing a copy of the original data separately or in a database on storage devices.
- There are various types of backups available like full backup, incremental backup, Local backup, mirror backup, etc.
- **Example:** An example of Backup can be SnapManager which makes a backup of everything in the database.

BACKUP IN DBMS

Advantages of Backup

•Protection against data loss.

•Ensuring smooth workflow.

•Enables recovery of previous data.

•User can back up the data and delete it from their system to free the space or memory.

Disadvantages of Backup

•Hardware and software expenses are higher.

•Maintenance cost of hardware and software increases.

•Failure to properly backup critical data can result in irreversible loss.

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BACKUP IN DBMS

Backup Techniques

There are different types of Backup Techniques. Some of them are listed below.

•**Full database Backup:** In this full database including data and database, Meta information needed to restore the whole database, including full-text catalogs are backed up in a predefined time series.

•**Differential Backup:** It stores only the data changes that have occurred since the last full database backup. When some data has changed many times since the last full database backup, a differential backup stores the most recent version of the changed data. For this first, we need to restore a full database backup.

BACKUP IN DBMS

•**Transaction Log Backup:** In this, all events that have occurred in the database, like a record of every single statement executed is backed up.

• It is the backup of transaction log entries and contains all transactions that had happened to the database.

•Through this, the database can be recovered to a specific point in time. It is even possible to perform a backup from a transaction log if the data files are destroyed and not even a single committed transaction is lost.

RECOVERY IN DBMS

- Recovery refers to restoring lost data by following some processes.
- Even if the data was backed up still lost so it can be recovered by using/implementing some recovery techniques.
- When a database fails due to any reason then there is a chance of data loss, so in that case recovery process helps in improve the reliability of the database.
- **Example:** Recuva is a data recovery tool. Using Recuva you can restore lost and deleted files.

RECOVERY IN DBMS

Advantages of Recovery

•It prevents permanent loss of data.

•Use of recovery tools is cost-effective.

•Helps in disaster recovery.

Disadvantages of Recovery

•Data Recovery is not always guaranteed.

•The Data Recovery tools may be expensive.

•Using untrustworthy or poorly developed data recovery software increases security risk.

RECOVERY IN DBMS

Types of Recovery Techniques in DBMS

Database recovery techniques are used in database management systems (DBMS) to restore a database to a consistent state after a failure or error has occurred. The main goal of recovery techniques is to ensure data integrity and consistency and prevent data loss.

There are mainly two types of recovery techniques used in DBMS

- **Rollback/Undo Recovery Technique**
- **Commit/Redo Recovery Technique**
- **CheckPoint Recovery Technique**

RECOVERY IN DBMS

Rollback/Undo Recovery Technique

The rollback/undo recovery technique is based on the principle of backing out or undoing the effects of a transaction that has not been completed successfully due to a system failure or error.

This technique is accomplished by undoing the changes made by the transaction using the log records stored in the transaction log.

The transaction log contains a record of all the transactions that have been performed on the database.

The system uses the log records to undo the changes made by the failed transaction and restore the database to its previous state.

RECOVERY IN DBMS

Commit/Redo Recovery Technique

The commit/redo recovery technique is based on the principle of reapplying the changes made by a transaction that has been completed successfully to the database.

This technique is accomplished by using the log records stored in the transaction log to redo the changes made by the transaction that was in progress at the time of the failure or error.

The system uses the log records to reapply the changes made by the transaction and restore the database to its most recent consistent state.

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RECOVERY IN DBMS

Checkpoint Recovery Technique

Checkpoint Recovery is a technique used to improve data integrity and system stability, especially in databases and distributed systems.

It entails preserving the system's state at regular intervals, known as checkpoints, at which all ongoing transactions are either completed or not initiated.

This saved state, which includes memory and CPU registers, is kept in stable, non-volatile storage so that it can withstand system crashes. In the event of a breakdown, the system can be restored to the most recent checkpoint, which reduces data loss and downtime.

The frequency of checkpoint formation is carefully regulated to decrease system overhead while ensuring that recent data may be restored quickly.

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Current Trends In Database Technologies

1. Old Guard Losing Out to Cloud DBs

Not so long ago, Oracle, IBM, SAP, Teradata, and Software AG were the bigwigs of the database world. They all began life as on-premises systems and all have attempted to transition to the cloud, with varying degrees of success. However, cloud-based databases have largely taken over and cloud-native databases dominate the market. Microsoft is now the leader, with Amazon Web Services (AWS), Google Cloud Platform (GCP), and Alibaba Cloud close behind.

2. Artificial Intelligence in Databases

On average, database administrators (DBAs) spend 90 percent of their time on maintenance tasks, according to Oracle's Cloud Business Group surveys. AI is being added to database management as a way to greatly lower the maintenance burden. When well-integrated with databases and their underlying infrastructure, AI helps DBAs spot storage and memory bottlenecks and other issues that inhibit database operations.

Current Trends In Database Technologies

3. In-Memory Databases

Today's mission-critical software solutions require minimal database latency for optimal performance. Unfortunately, traditional database management systems (DBMS) rely on sluggish disk read/write operations for storing data on media (e.g., hard disk drives). For this reason, in-memory databases—databases that store entire datasets in read only memory (RAM)—have become strong alternatives for these critical use cases. Records stored and retrieved directly to and from RAM make faster, more reliable performance possible. Additionally, popular solutions such as Redis—an in-memory data structure store—make it possible for databases to support more data structure types and custom access patterns, allowing for the simplification of software code without data structure conversion or serialization.

Current Trends In Database Technologies

4. All-Flash Databases

Memory-based databases are great, but can be very expensive. All-flash arrays provide similar performance at a better price, while also providing a lot more capacity. As a result, more databases now run inside all-flash arrays than on in-memory systems. An example of this is JP Morgan Chase, which was seeing a 30 percent increase or more in data storage needs annually. Greg Johnson, executive director of Global Electronic Trading Services, transitioned from disk-based systems to all-flash arrays to provide the capacity and speed his databases need for transactional and other mission-critical systems.

Current Trends In Database Technologies

5. Stronger Database Security Layers

With cyber attacks and data breaches continuing to dominate headlines in the technology world, more focus has been placed on securing the data layer of the software application. In turn, more vendors are augmenting their offerings with stronger built-in security features. Oracle now integrates always-on encryption and automated patching at the database level, for example, while Amazon RDS includes a built-in firewall for rules-based database access. Similarly, database users need far more safeguards related to privacy, data residency, sovereignty, and localization, and DBAs must pay attention to where data is stored and where it is going. Vendors are now introducing location-tracking features into their storage arrays and databases to make it possible to verify compliance.