Database Research

Task 1

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1. Comparison Assignment:

Definitions:

Flat File Systems:

A simple way of storing data in plain text files, usually with no clear structure, making data management difficult when data grows large.

Relational Databases:

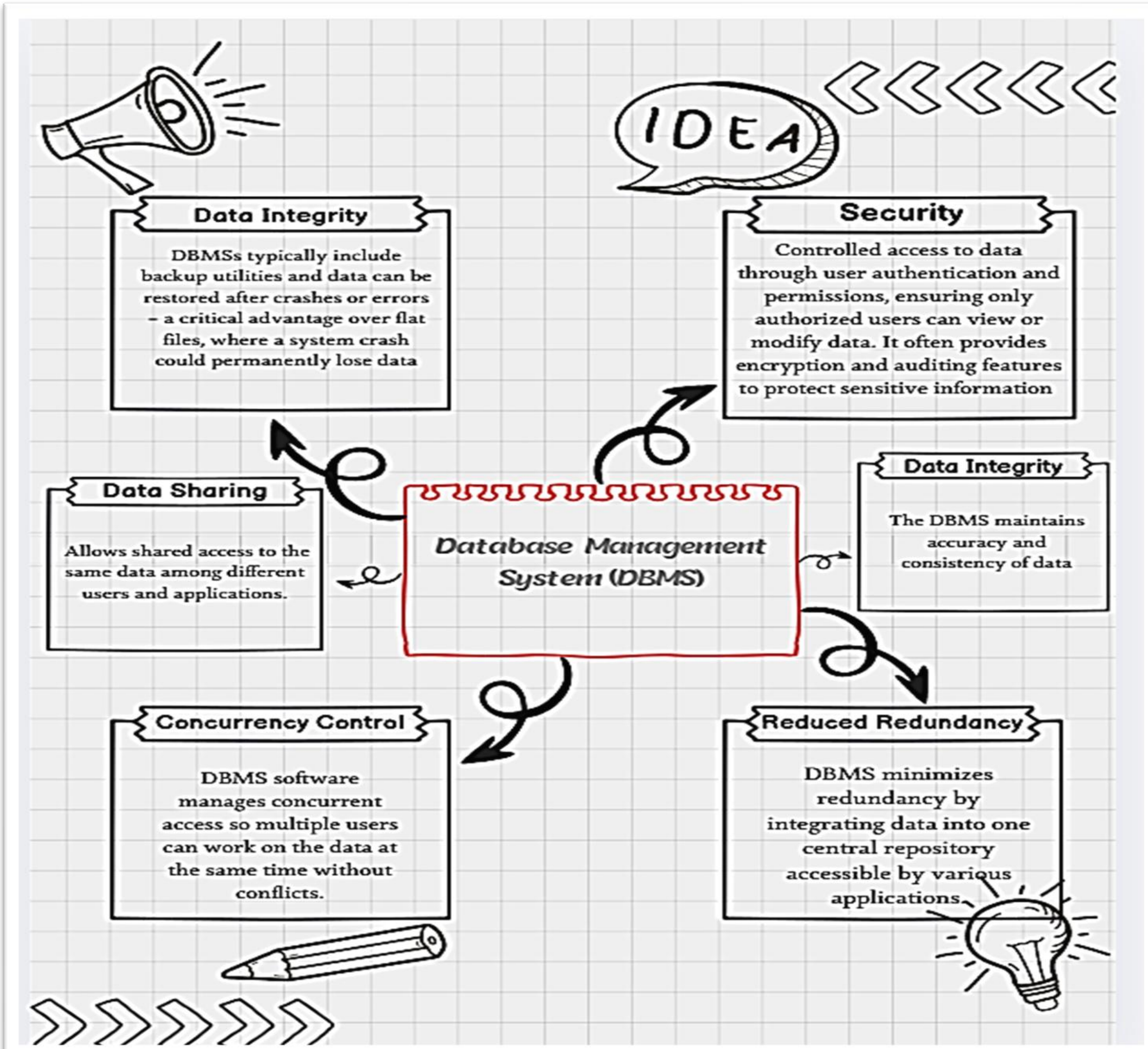
An organized way of storing data in tables (rows and columns), where information is connected using unique IDs, making it easy to manage large amounts of structured data.

Flat File Systems vs. Relational Databases

	Flat File Systems	**Relational Databases**
Structure	Simple, unstructured	Structured tables with rows and columns, defined schemas
Data Redundancy	High; data repeated often	Low; data stored efficiently with minimal repetition
Relationships	Difficult or nonexistent	Easily established using primary and foreign keys
Example Usage	Log files, simple configuration files	Banking systems, inventory management, customer databases
Drawbacks	Redundant, difficult to maintain, poor scalability	Complex setup requires specialized knowledge, higher initial costs

2. DBMS Advantages:

Using a Database Management System (DBMS) provides numerous advantages over flat file systems. The mind map below illustrates key benefits of a DBMS, including enhanced security, data integrity, reliable backups, reduced redundancy, support for concurrent access, and improved data sharing:



3. Roles in a Database System:

In any substantial database project, a team of specialists collaborates to design, implement, and maintain the system. Key roles and their typical responsibilities include:

System Analyst:
Understands the user’s needs and requirements and translates these into specifications for the database.

Database Designer:
Designs the structure of the database (tables, fields, relationships) based on the analyst's specifications.

Database Developer:
Implements the database design, creating the tables, indexes, and procedures to manage data efficiently.

Database Administrator (DBA):
Manages the database system daily, ensures its security, performance, backups, and recovery.

Application Developer:
Build applications or software that interact with the database, making data usable for end-users.

BI Developer:
Creates tools, reports, and dashboards that help businesses analyze and visualize data for decision-making.

4. Types of Databases:

Databases can be categorized in various ways based on their data model and deployment architecture. Here in a table, we discuss several major types of databases, along with use-case examples for each:

Type	Explanation	Examples	Use Cases
Relational	Stores data in structured tables with defined relationships. Uses SQL queries.	MySQL, PostgreSQL, Oracle	Banking, Online stores, accounting systems
Non-Relational (NoSQL)	Stores data flexibly, without fixed table schemas, ideal for large, changing datasets.	MongoDB, Cassandra	Social media, Real-time analytics, IoT applications

If your data is highly structured and you need multi-object transactions or complex SQL queries a relational DB is usually the best. However, if you deal with large volumes of unstructured or variably structured data, or require extreme horizontal scalability and fast data distribution, a non-relational solution can be more suitable.

Type	Explanation	Examples	Use Cases
Centralized	Single database on one server. All data managed centrally.	Microsoft Access, single-server MySQL.	Small businesses, Single-location inventory.
Distributed	Data stored across multiple servers or locations, synchronized to act as a single database.	Cassandra, Apache Hadoop.	Large companies, global services like Netflix.
Cloud Databases	Database hosted by cloud service providers, easily scalable and accessible online.	AWS RDS, Google Cloud SQL, Azure Database.	Mobile apps, startups, fast-scaling companies.

5. Cloud Storage and Databases:

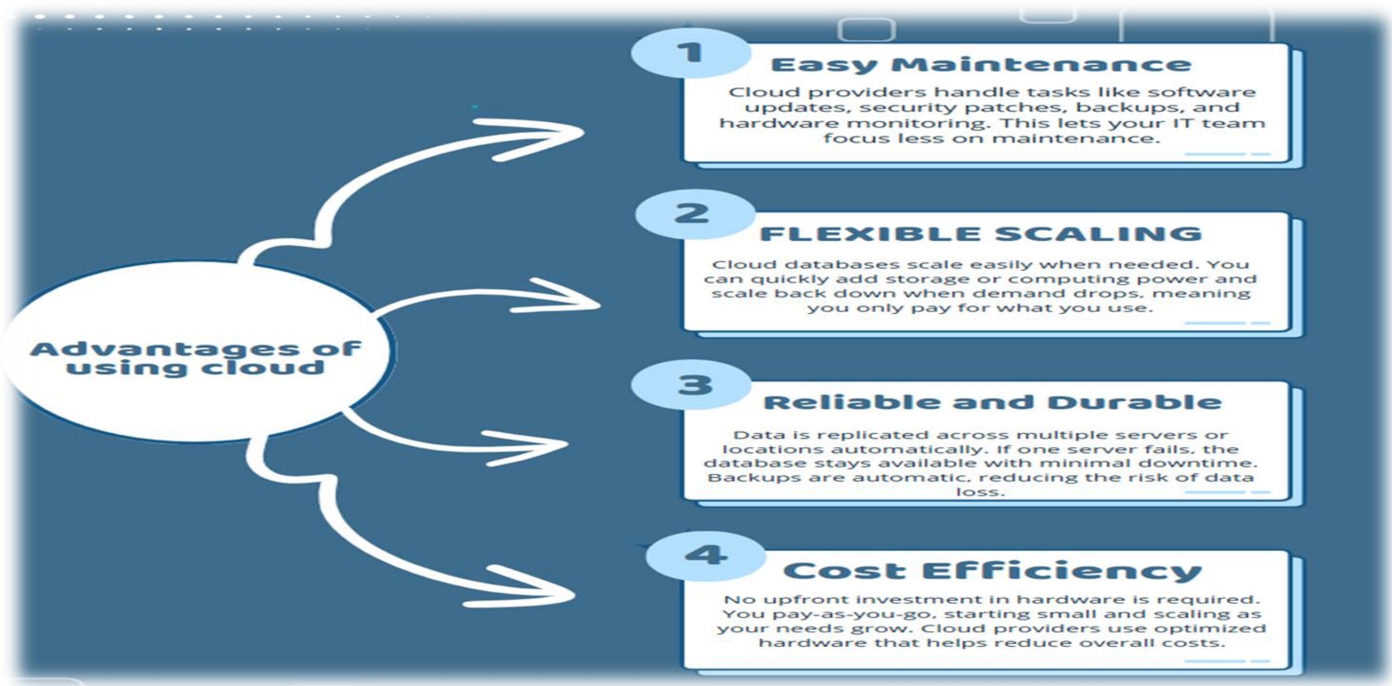
What is Cloud Storage?

Cloud storage refers to storing data on remote servers hosted on the Internet (the "cloud") rather than on local on-premises servers. A cloud storage provider maintains the underlying infrastructure and allows users to save and retrieve data over network connections. Essentially, your data is kept in off-site data centers managed by the provider, which offers virtually unlimited capacity and on-demand access.

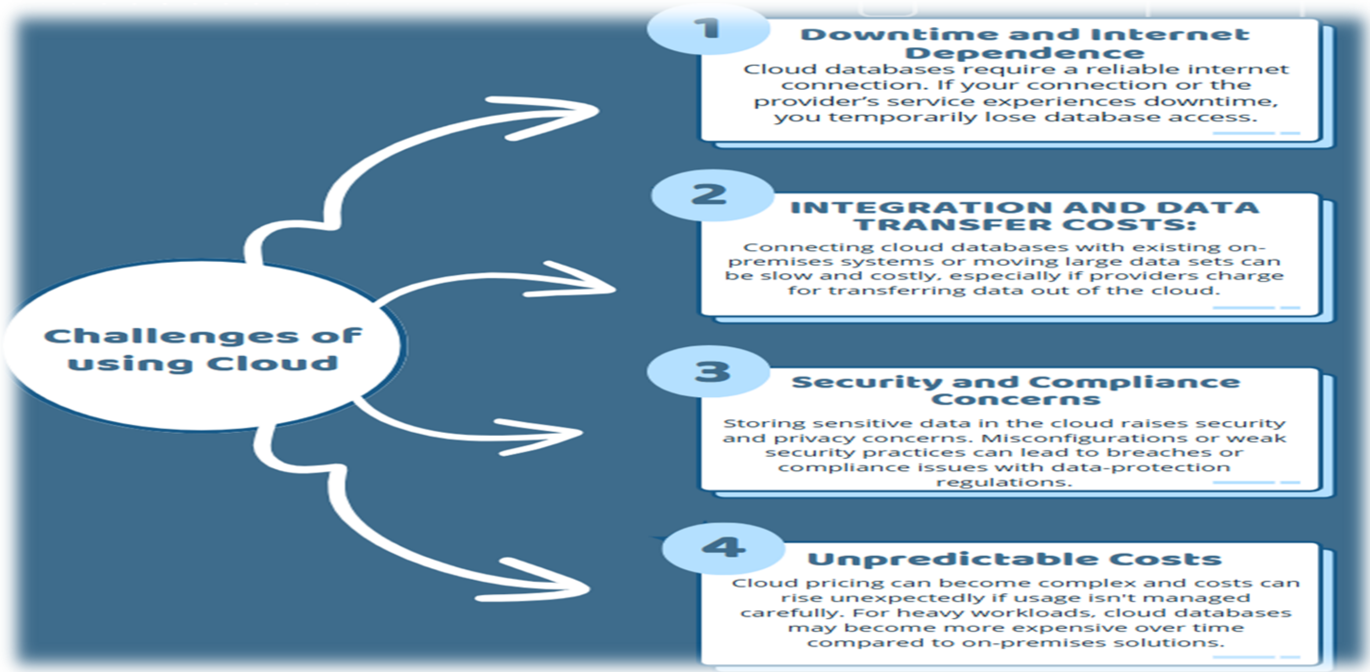
How does Cloud Storage support database functionality?

Cloud databases use cloud storage to store their data securely and reliably. Cloud storage lets databases scale easily without needing physical hardware upgrades. Data is distributed across multiple servers and locations, ensuring high availability and durability. Additionally, cloud storage simplifies database backups and recovery. In short, cloud storage provides flexibility and resilience that makes cloud databases efficient and scalable.

Advantages of Cloud-Based Databases:



Challenges of cloud-based databases:



6. Conclusion:

In conclusion, cloud-based databases offer a powerful combination of ease, scalability, and reliability, which is why they are widely adopted in modern systems. Services like Azure SQL, Amazon RDS/Aurora, and Google Cloud Spanner exemplify how cloud providers can deliver robust database functionality on demand. However, teams must also weigh the downsides such as dependency on providers, potential cost pitfalls, and ensuring security in a cloud environment before moving their data infrastructure to the cloud.

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