

# Introduction to Databases

This presentation introduces fundamental database concepts. We'll explore why databases are essential. The history and evolution of database systems will be highlighted. A comparison with traditional file processing will be covered.



# Basic Concepts: Data and Information

## Data

**Data:** Raw, unorganized facts needing processing. Example: A student's name, age, and major.

## Information

**Information:** Processed, organized data making it useful. Example: Student's GPA.

## Data Volume

IBM estimates 2.5 quintillion bytes of data are created daily.

# Core Database Definitions



## Database

Organized data collection.



## DBMS

Software managing the database (e.g., MySQL).



## Schema

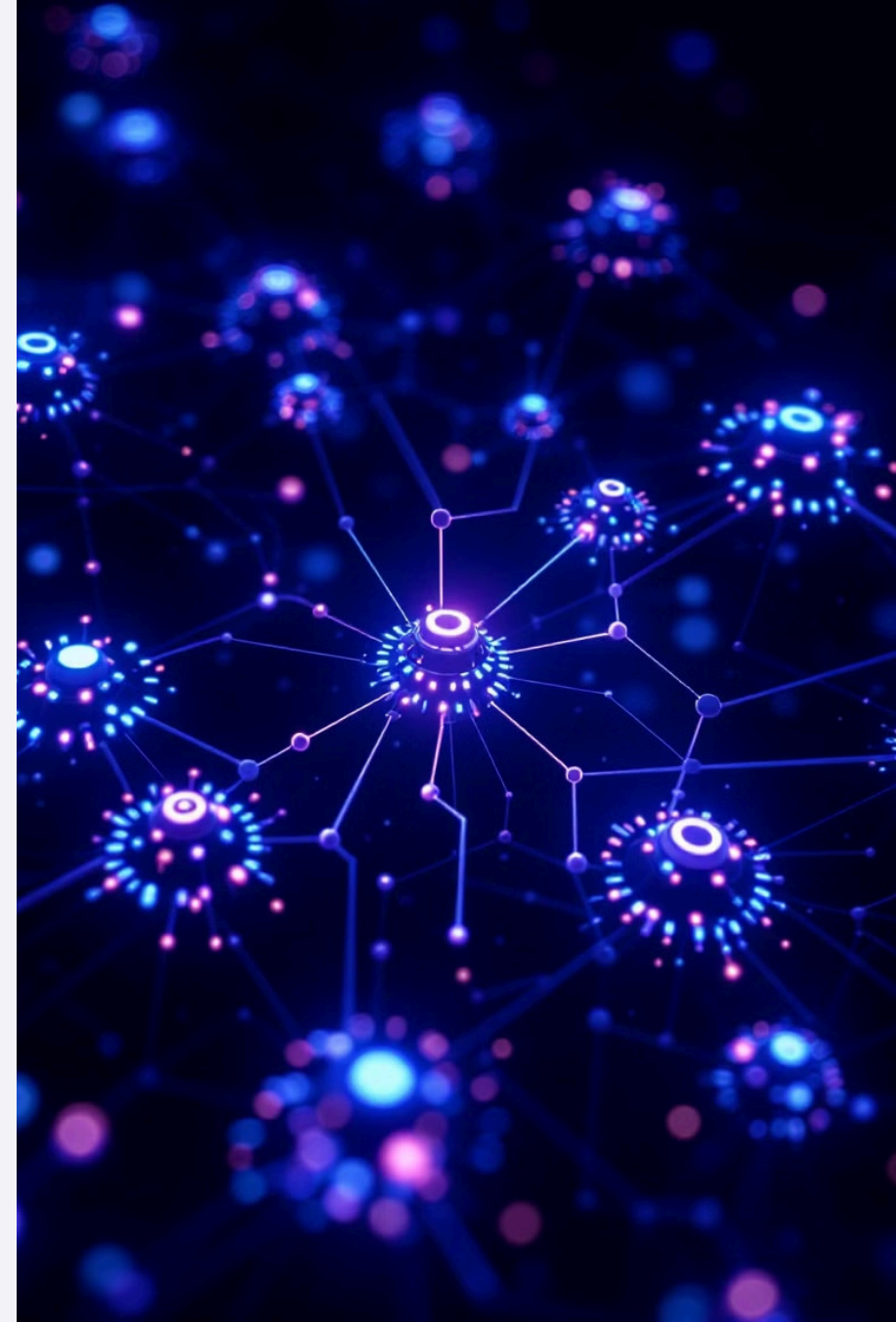
Logical structure.



## Instance

Snapshot in time.

The database software market is projected to reach \$162.18 billion by 2032.



# Traditional File Processing Systems

## Overview

Data stored in individual files. Each file is managed by a specific application. Student records in one file, course information in another.

## Lack of Control

There is no centralized control or coordination in this system.





# Problems: Data Redundancy

1

## Multiple Storage

Same data stored in multiple files.

2

## Wasted Space

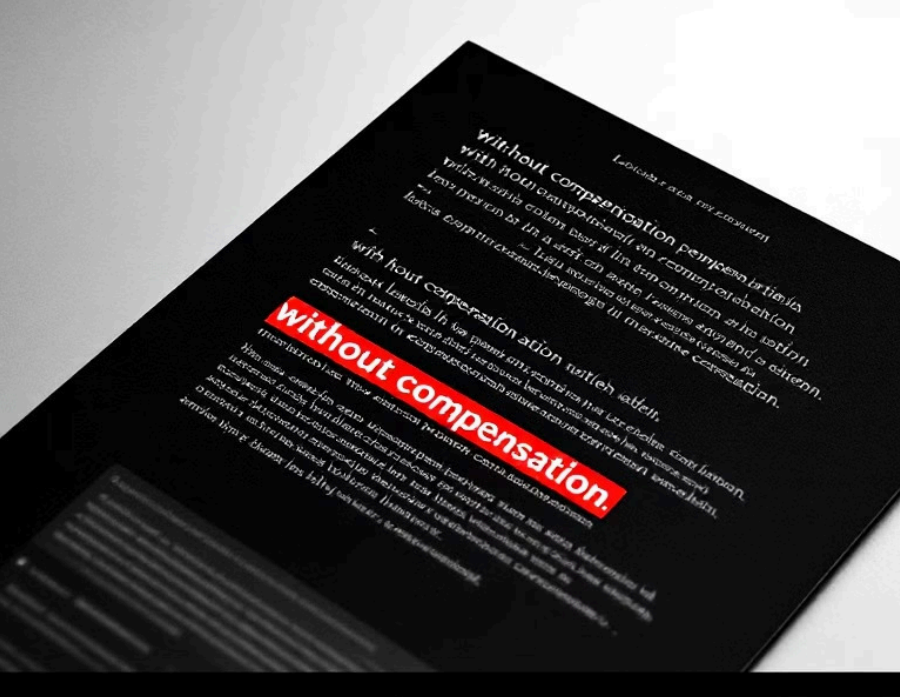
Leads to wasted storage (25% redundant).

3

## Inconsistency

Increased data inconsistency risk.

Data integration costs U.S. businesses \$3.1 trillion per year due to redundancy.



# File Processing Issues: Inconsistency

## Conflicting Copies

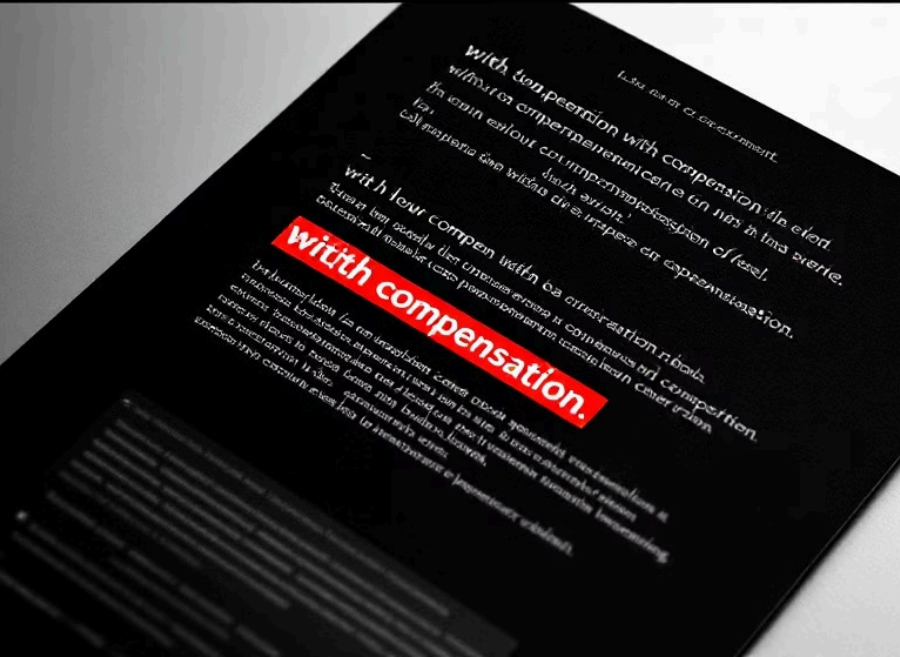
Different copies of the same data may disagree.

## Data Accuracy

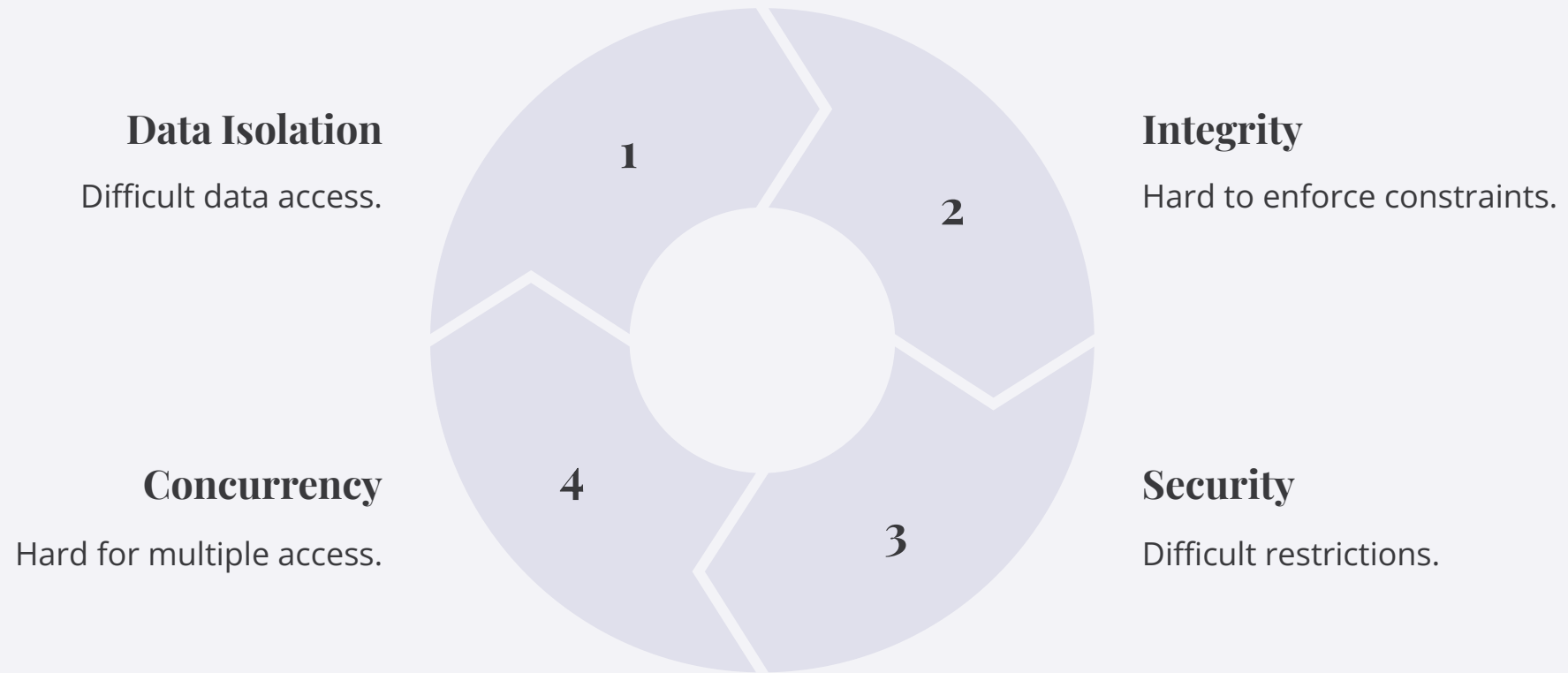
Difficult to ensure data accuracy and reliability.

## Negative Outcomes

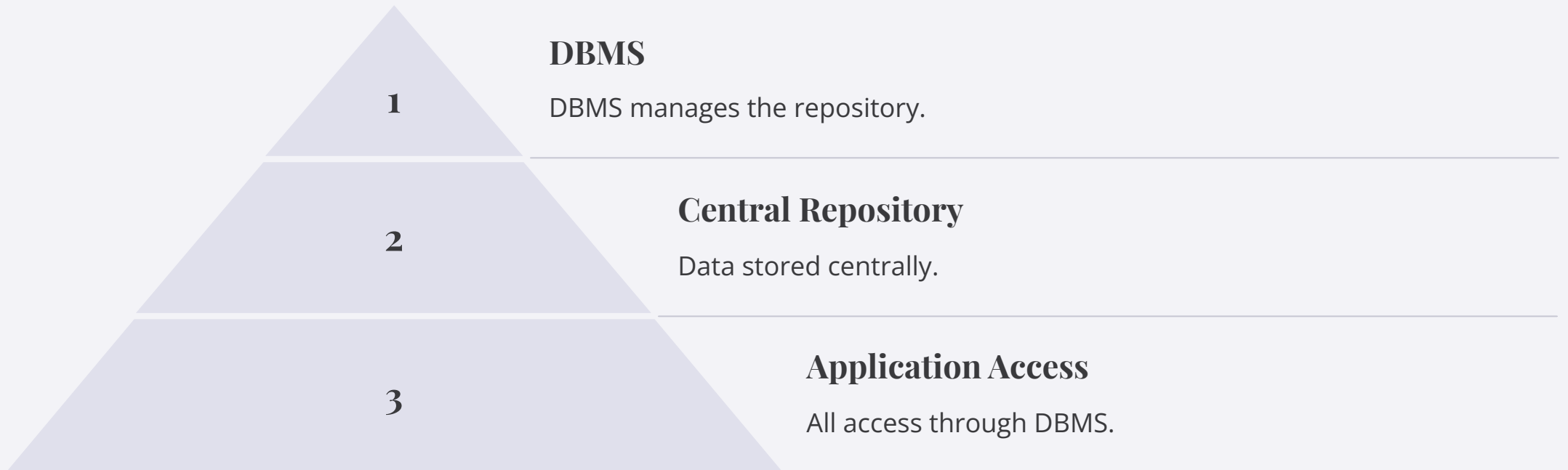
88% of companies have negative outcomes from inaccurate data.



# More File Processing Problems



# The Database Approach



The database approach promotes data sharing and reduces redundancy.



## Database Advantages

### Clipboard Adventlist:



Improved Data Integrity



Enhanced Security



Increased Scalability



Better Data Accessibility



Simplified Data Management

# Advantages of the Database Approach

- Reduced Redundancy
  - Data Consistency
    - Data Integration
      - Enhanced Security

With a database approach, it's easier to combine data, enforce integrity, and control concurrent access.

# Conclusion

## Better Solution

Databases better than file processing.

## Business Reliance

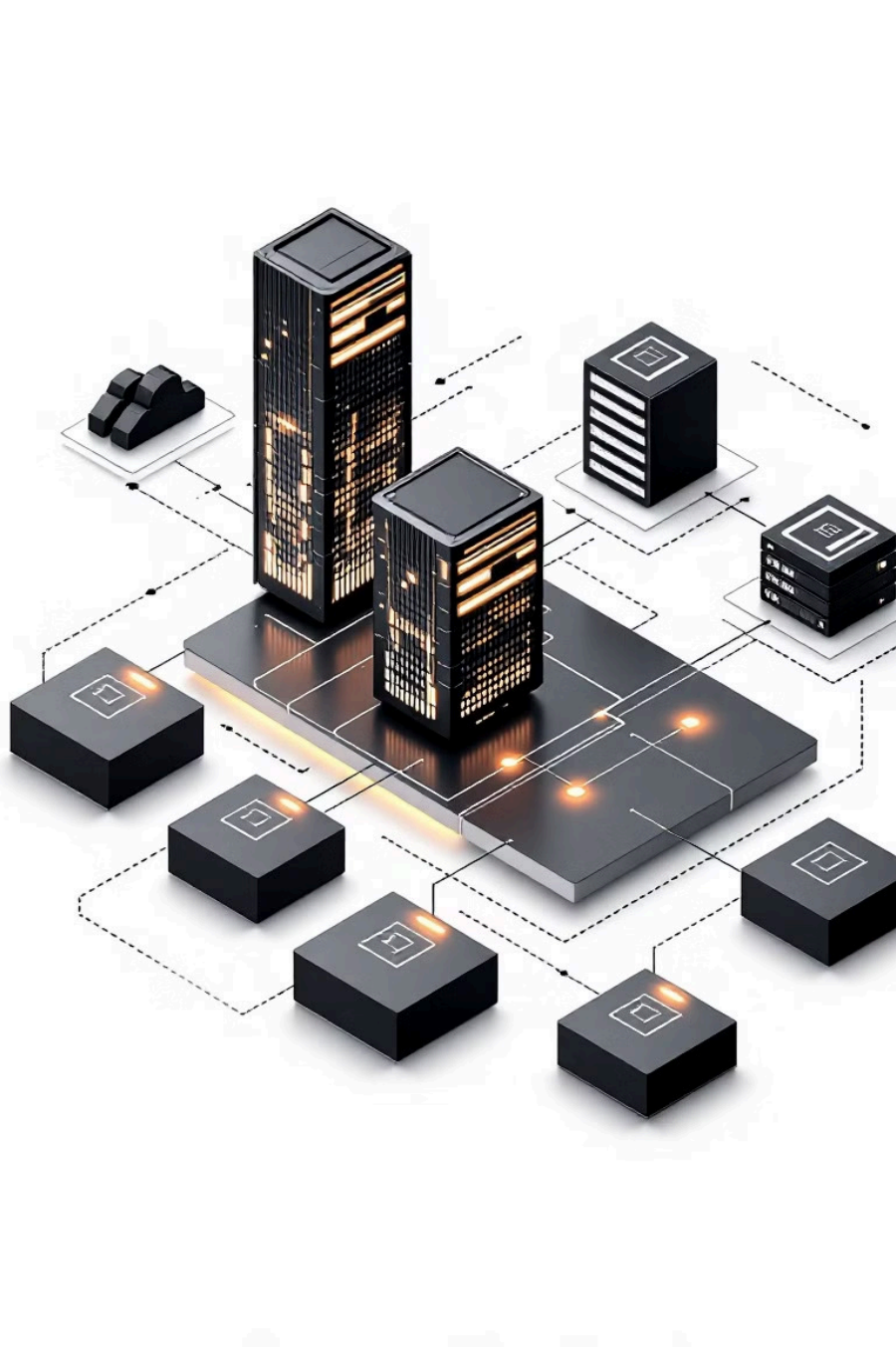
Businesses rely on databases for data.

Databases are essential for efficient data management and better decision-making.

## Key Advantages

Reduced redundancy & improved consistency.





# Introduction to Database Environments

Databases are the backbone of modern information systems. They are critical for storing, managing, and retrieving data efficiently. This presentation provides an overview of the key components, applications, and development process. The global database market is projected to reach \$117.63 billion by 2027.

# Hardware Components

## Servers

Physical machines hosting the Database Management System (DBMS). Examples include Dell PowerEdge, HP ProLiant, and IBM Power Systems. Performance metrics include CPU speed, RAM, and storage capacity. Costs range from \$5,000 to \$100,000+.

## Storage Devices

Persistent storage for database files and backups. Types include SSDs, HDDs, and NAS. Performance metrics include IOPS and Latency. Examples include AWS EBS, Azure Blob Storage, and SAN.

# Software Components



## DBMS

Core software for managing the database. Examples include Oracle, MySQL, SQL Server, and MongoDB. Key functions: data storage, retrieval, security, and transaction management.



## Operating System

Underlying system software supporting the DBMS. Examples include Windows Server, Linux, and Unix. Compatibility with DBMS certified versions is crucial.



## Applications

Front-end applications interacting with the database. Examples: web applications, mobile apps, desktop software, and reporting tools.





# Data Components

## Data

The raw facts and figures stored in the database. Types include structured, semi-structured, and unstructured data. Volume ranges from TB to PB. Data quality is critical.

- Customer data
- Product catalogs
- Financial transactions

## Metadata

Data about data; describes the structure and properties of the database. Examples include table definitions, column types, indexes, and constraints. Facilitates data discovery and management.



# People Components

## Database Administrator (DBA)

Responsible for database design, implementation, security, and performance. Skills include SQL, scripting, OS administration. Average salary: \$98,000/year.

## Database Developers

Build and maintain database applications. Skills include programming languages and data modeling. Average salary: \$85,000/year.

## Data Architects

Design the data strategy and architecture for the organization. Skills: Data modeling, ETL processes. Average salary: \$140,000/year

# simul ary hore

We en ary aret ist ecently your raelly fiiclatly ands  
dayle of your on the der your yourr animation.

Special OFert

Step Now

## Transaction Processing (OLTP)



### Real-time Transactions

Supports real-time transactions, essential for e-commerce and banking.



### ACID Properties

Ensures Atomicity, Consistency, Isolation, and Durability of data.



### High Performance

Processes a high volume of short transactions with low response time.

# Data Warehousing and BI

## Data Warehousing

Centralized repository for historical data, supporting analytical queries and reporting. The global data warehousing market is projected to reach \$34.4 billion by 2026.

## Business Intelligence (BI)

Tools and techniques for analyzing data and generating insights. Examples include reporting dashboards, data mining, and predictive analytics.

# Specialized Databases



## **Spatial Databases**

Store and manage geographic data, used in GIS and mapping applications.



## **Time-Series Databases**

Store and analyze time-stamped data, common in financial markets and IoT.



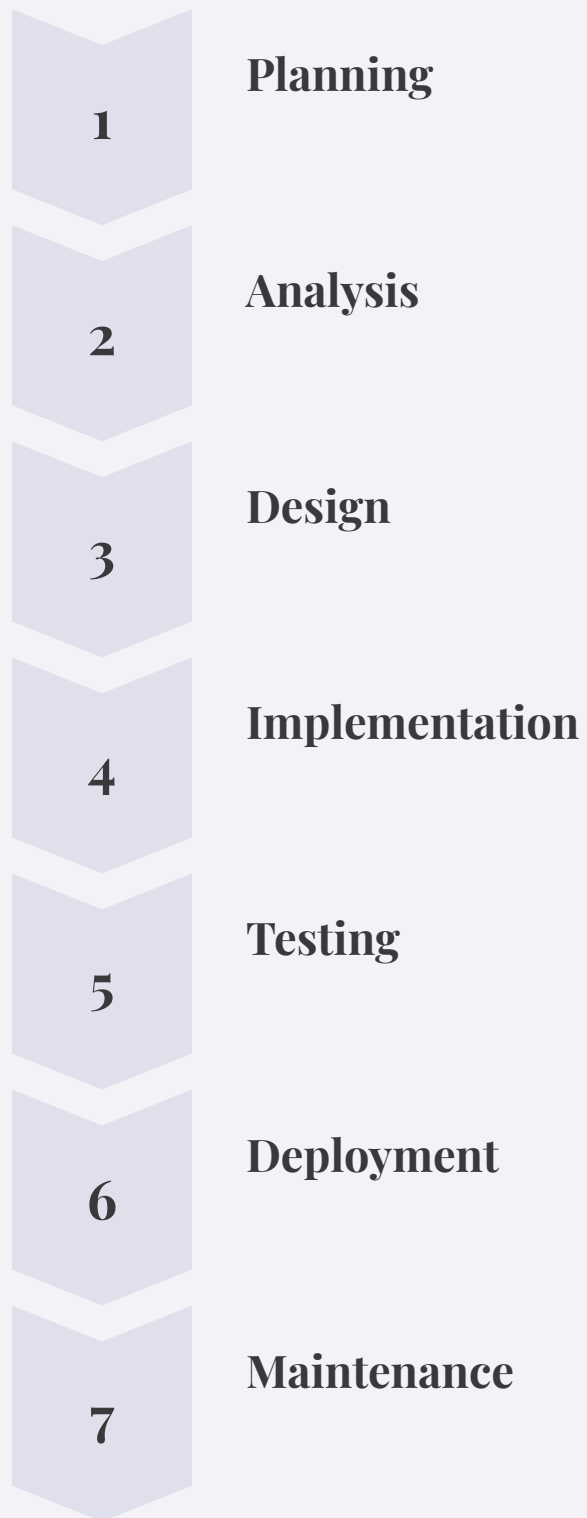
## **Graph Databases**

Store and analyze relationships between data entities, used in social networks.





# The Database Development Process



# Conclusion: The Power of Effective Database Management

Databases are essential for modern organizations. A well-designed and managed database environment enables efficient data storage and retrieval. It leads to improved decision-making. Enhanced business processes provide a competitive advantage. Continuous monitoring and optimization are critical for long-term success.

