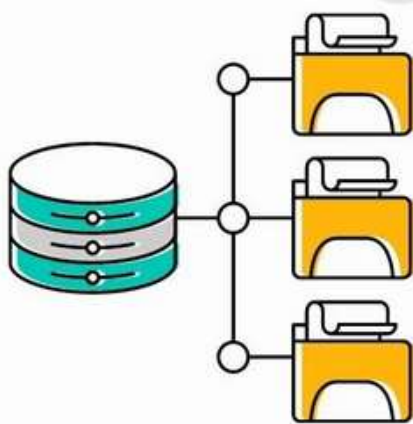


## Different types of DBMS

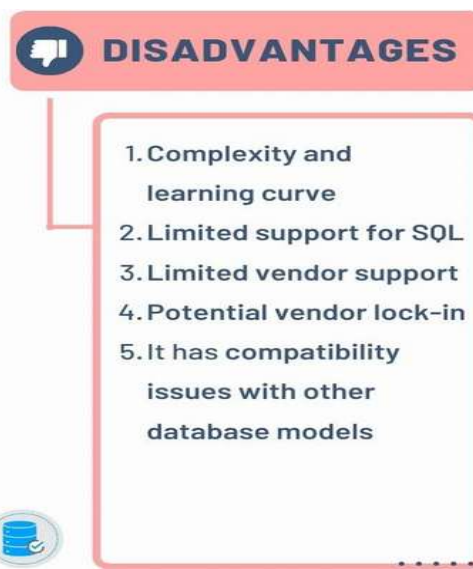
### 1. Object Oriented Database

The ODBMS which is an abbreviation for object-oriented database management system is the data model in which data is stored in form of objects, which are instances of classes. These classes and objects together make an object-oriented data model.



In an object-oriented database, data is organized and stored as objects, which are self-contained units that contain both data and the operations or methods that can be performed on that data.

### Components of Object-Oriented Database Model



Advantages and Disadvantages

## Object-Oriented Database Examples

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01	<b>ObjectStore</b> It was first commercially available object-oriented DBMS. It provides flexibility in modeling complex data relationships compared to relational databases.
02	<b>Versant</b> Versant is an OODBMS optimized for speed, scalability, and handling complex data models. It can be used in transactional applications that require real-time performance.
03	<b>Objectivity/DB</b> Objectivity/DB is an OODBMS designed for distributed architectures and horizontal scalability across many servers. It can handle large volumes of constantly changing data.
04	<b>InterSystems Caché</b> It is a high performance hybrid OODBMS that combines features of relational databases and OODBMS. It provides an SQL interface for easier querying.
05	<b>db4o</b> db4o is an open source, embeddable OODBMS for .NET and Java developers. It provides simple object persistence without mapping objects to table schemas.
06	<b>MongoDB</b> It is a popular document-oriented NoSQL database. While not a pure OODBMS, it incorporates some object-oriented concepts like dynamic schemas and storing objects.
07	<b>ObjectDB</b> ObjectDB is a Java-based OODBMS for transparent, seamless persistence of Java objects. It enhances standard Java SE with transparent persistence and database capabilities.

## 2. Geographic DBMS

Geographic database (or geodatabase) is a georeferenced spatial database, used for storing and manipulating geographic data (or geodata, i.e., data associated with a location on Earth), especially in geographic information systems (GIS). Almost all current relational and object-relational database management systems now have spatial extensions, and some GIS software vendors have developed their own spatial extensions to database management systems.

Examples of Geographic DBMS include:

- **PostGIS:** An extension for the PostgreSQL relational database that adds support for spatial objects and geospatial queries.
- **Oracle Spatial:** A component of the Oracle Database that provides spatial data management and analysis capabilities.
- **Microsoft SQL Server Spatial:** Includes spatial data types and spatial indexing for managing and querying spatial data in Microsoft SQL Server.

### Advantages of Geographic DBMS:

1. **Smart Analysis:** Helps analyze location-based data easily.
2. **Quick Retrieval:** Finds information fast with special data indexing.
3. **GIS Friendliness:** Works seamlessly with GIS tools for visualizing data.
4. **Precision:** Represents locations accurately with various coordinate systems.
5. **Network Insights:** Useful for analyzing connections in transportation and logistics.

6. **Time Tracking:** Keeps track of changes over time for historical data.
7. **Handles Big Data:** Designed to handle large datasets effectively.
8. **Data Compatibility:** Supports common geospatial data formats for easy sharing.

#### **Disadvantages of Geographic DBMS:**

1. **Can Be Tricky:** Learning to use it might be a bit challenging.
2. **Costly:** Setting up and maintaining it can be expensive.
3. **Slower with Big Data:** Might slow down with really large datasets.
4. **Not Always Smooth Integration:** Could face issues when connecting with other types of databases.
5. **Not One-Size-Fits-All:** No universal rules for data standards, which can cause compatibility hiccups.
6. **Needs Extra Security:** Handling sensitive data requires extra attention to security.
7. **Maintenance Work:** Keeping data accurate and up-to-date needs regular effort.
8. **Tied to Specific Brands:** Might limit choices as it depends on specific vendors.

### **3. Multimedia database**

Multimedia database is the collection of interrelated multimedia data that includes text, graphics (sketches, drawings), images, animations, video, audio etc and have vast amounts of multisource multimedia data. The framework that manages different types of multimedia data which can be stored, delivered and utilized in different ways is known as multimedia database management system. There are three classes of the multimedia database which includes static media, dynamic media and dimensional media.

Popular multimedia database systems include Oracle Multimedia, Microsoft SQL Server with multimedia extensions, and open-source solutions like MongoDB with GridFS for handling large multimedia files.

#### **Content of Multimedia Database management system :**

1. **Media data** – The actual data representing an object.
2. **Media format data** – Information such as sampling rate, resolution, encoding scheme etc. about the format of the media data after it goes through the acquisition, processing and encoding phase.
3. **Media keyword data** – Keywords description relating to the generation of data. It is also known as content descriptive data. Example: date, time and place of recording.
4. **Media feature data** – Content dependent data such as the distribution of colors, kinds of texture and different shapes present in data.

#### **Advantages of Multimedia Databases:**

1. **Stores All Kinds of Media:** Keeps text, images, audio, and video together for a complete picture.
2. **More Fun to Use:** Gives exciting and immersive experiences compared to just reading.
3. **Easy to Find Things:** Helps find stuff by what's actually in the content, not just the name.
4. **Works Everywhere:** Useful for entertainment, learning, health, marketing, and lots of other things.

5. **Handles Complicated Connections:** Deals with links between different types of media.
6. **Shows Trends and Patterns:** Helps see trends and time-based patterns in the data.
7. **Helps Make Multimedia Content:** Useful for creating and managing videos, music, and other media.
8. **Great for Teamwork:** Makes it easy to share and work together on multimedia stuff.

#### **Disadvantages of Multimedia Databases:**

1. **Needs Tech Skills:** Requires knowing how to handle different kinds of media.
2. **Takes Up a Lot of Space:** High-quality videos and music need a lot of room.
3. **Can Be Expensive:** Setting up and keeping it running might cost a lot.
4. **Not Easy for Everyone:** Some people might find it hard to use, especially if they have disabilities.
5. **Might Not Work Everywhere:** Different devices and apps might not understand the same media.
6. **Sometimes Confusing:** People might get mixed up if the content doesn't match the message.
7. **Needs Extra Security:** Requires extra protection to keep media content safe.
8. **Needs Regular Checkups:** Keeping everything in good shape takes regular updates and checks.

#### **4. Engineering DBMS**

An Engineering Database Management System (EDBMS) is a type of specialized database management system designed to handle and manage engineering-related data and information. It caters specifically to the needs of engineering applications, where complex and structured data is common. The use of EDBMS is prevalent in various engineering disciplines such as civil engineering, mechanical engineering, electrical engineering, and more. Here are key features and aspects of Engineering DBMS:

**Diverse Data Support:** Handles various engineering data types, including CAD models, technical specifications, and numerical data.

1. **Complex Relationships:** Manages intricate relationships between components, materials, and processes in engineering projects.
2. **CAD Integration:** Integrates with Computer-Aided Design (CAD) software for storing and retrieving design models and blueprints.
3. **Version Control:** Supports versioning to manage changes over time and maintain a history of revisions.
4. **Metadata Management:** Organizes data with detailed metadata, facilitating effective organization and retrieval.
5. **Document Management:** Manages engineering documents, including manuals, technical documentation, and project reports.
6. **Simulation and Analysis Support:** Integrates with simulation and analysis tools, storing results and analytical data.

7. **Collaboration and Workflow:** Facilitates teamwork with multiple user support, permissions, and workflow management.
8. **Materials and Properties:** Stores information about materials, properties, and compatibility for informed decision-making.
9. **Project Lifecycle Management:** Covers the entire project lifecycle, from conceptual design to decommissioning.
10. **Integration with PLM Systems:** Integrates with Product Lifecycle Management (PLM) systems for coordination across project stages.
11. **Security and Access Control:** Implements robust security measures and access controls to protect engineering data.

Popular relational database management systems (RDBMS) like MySQL, PostgreSQL, or Oracle Database can be customized for engineering applications. Additionally, there are industry-specific EDBMS solutions designed to address the unique requirements of engineering disciplines.

#### **Advantages of EDBMS:**

1. **Easy Engineering Data Management:**
  - Efficiently manages all engineering data for easy access and use.
2. **CAD Compatibility:**
  - Works seamlessly with design software for saving and finding models.
3. **Project Lifecycle Coverage:**
  - Handles everything from project start to finish and cleanup.
4. **Smart Decision Support:**
  - Provides information for informed decisions about materials and properties.
5. **Simulation Handling:**
  - Integrates with analysis tools, storing simulation results in one place.
6. **Document Management:**
  - Manages engineering documents, making them easily accessible.

#### **Disadvantages of EDBMS:**

1. **Setup Complexity:**
  - Setting up and using EDBMS may require specialized knowledge.
2. **Cost Consideration:**
  - Incurs expenses for software, hardware, and training.
3. **Compatibility Issues:**
  - May face challenges when working with different engineering tools.
4. **Maintenance Requirements:**

- Regular updates and checks are needed for smooth operation.

#### **5. Learning Curve:**

- Users may need time to learn and adapt to EDBMS features.

#### **6. Data Migration Complexity:**

- Transitioning from old systems to EDBMS may require careful planning.

### **5. Decision Support DBMS**

A Decision Support Database Management System (DDBMS) is a type of database management system designed to support decision-making processes within an organization. It focuses on providing tools and capabilities that assist users, typically decision-makers and analysts, in making informed and strategic decisions. Here are key features and aspects of Decision Support DBMS:

#### **1. Data Warehousing:**

- Often includes a data warehouse, a centralized repository for historical and current data, optimized for decision support.

#### **2. Query and Reporting Tools:**

- Offers powerful query and reporting tools that enable users to retrieve and analyze data easily, generating reports for decision-making.

#### **3. Data Visualization:**

- Incorporates data visualization tools to present information in a visually comprehensible manner, aiding decision-makers in understanding trends and patterns.

#### **4. Performance Optimization:**

- Optimizes performance for complex queries and large datasets, ensuring timely access to critical information.

#### **5. Decision Modeling:**

- Supports decision modeling and scenario analysis, allowing users to simulate different scenarios and evaluate their potential impact.

#### **6. User-Friendly Interfaces:**

- Provides user-friendly interfaces that cater to the needs of decision-makers, often with dashboards and intuitive tools.

#### **7. Data Security:**

- Implements robust data security measures to protect sensitive information, especially important in decision-making processes.

#### **8. Historical Data Analysis:**

- Allows for the analysis of historical data trends, enabling decision-makers to understand past performance and make informed predictions.

Decision Support DBMS is commonly used in business intelligence, strategic planning, financial analysis, and other areas where informed decision-making is critical. These systems play a crucial role in helping organizations extract actionable insights from their data to support strategic and operational decisions.

### **Decision support system components**

A typical DSS consists of three different parts: knowledge database, software and user interface.

**Knowledge base.** A knowledge base is an integral part of a decision support system database, containing information from both internal and external sources. .

**Software system.** The software system is composed of model management systems. A model is a simulation of a real-world system with the goal of understanding how the system works and how it can be improved.

**User interface.** The user interface enables easy system navigation.

### **Advantages of DSS DBMS:**

#### **1. All-in-One Data View:**

- Shows all important data from different sources for better decision-making.

#### **2. Made for Analysis:**

- Works well for digging deep into data with tools like data mining and analytics.

#### **3. Easy Querying and Reporting:**

- Helps quickly ask questions and generate reports with powerful tools.

#### **4. See Data Clearly:**

- Uses visuals to help understand information easily.

#### **5. Quick Access to Big Data:**

- Handles complex questions and big datasets without slowing down.

#### **6. Simple Interfaces for Users:**

- Provides easy-to-use interfaces, like dashboards, for decision-makers.

#### **7. Team Collaboration:**

- Makes it easy for teams to work together, sharing insights and ideas.

### **Disadvantages of DSS DBMS:**

#### **1. Setting Up is Not Easy:**

- Getting it ready and running can be tricky, needing special skills.

#### **2. Can Cost a Lot:**

- Requires investment in software, hardware, and training.

#### **3. Takes Time to Learn:**

- Users may need time to get used to the special features.

#### **4. Needs Skilled People:**

- Requires skilled people to use effectively, and training may be necessary.

#### **5. Quality of Data Matters:**

- How well it works depends a lot on how good the input data is.

#### **6. Might Confuse if Used Wrong:**

- Visualization tools might cause confusion if not used carefully.

#### **7. Human Judgment Still Important:**

- Relying only on the system may not be enough for big strategic decisions; human judgment is crucial too.

### **6. Mobile and Personal DBMS**

Mobile databases are separate from the main database and can easily be transported to various places. Even though they are not connected to the main database, they can still communicate with the database to share and exchange data.

The mobile database includes the following components –

- The main system database that stores all the data and is linked to the mobile database.
- The mobile database that allows users to view information even while on the move. It shares information with the main database.
- The device that uses the mobile database to access data. This device can be a mobile phone, laptop etc.
- A communication link that allows the transfer of data between the mobile database and the main database.

Mobile and Personal DBMS are commonly used for managing personal information, keeping track of schedules, and organizing various types of personal data. They provide a convenient and flexible solution for individuals who want to have control over their data on their mobile devices.

#### **Advantages of Mobile Databases**

Some advantages of mobile databases are –

- The data in a database can be accessed from anywhere using a mobile database. It provides wireless database access.
- The database systems are synchronized using mobile databases and multiple users can access the data with seamless delivery process.
- Mobile databases require very little support and maintenance.
- The mobile database can be synchronized with multiple devices such as mobiles, computer devices, laptops etc.



## Disadvantages of Mobile Databases

Some disadvantages of mobile databases are –

- The mobile data is less secure than data that is stored in a conventional stationary database. This presents a security hazard.
- The mobile unit that houses a mobile database may frequently lose power because of limited battery. This should not lead to loss of data in database.

## 7. Parallel Database

A parallel DBMS is a DBMS that runs across multiple processors or CPUs and is mainly designed to execute query operations in parallel, wherever possible. The parallel DBMS link a number of smaller machines to achieve the same throughput as expected from a single large machine.

In Parallel Databases, mainly there are three architectural designs for parallel DBMS. They are as follows:

1. **Shared Memory:** Nodes share a central memory.
2. **Shared Disk:** Nodes have local memory but share storage.
3. **Shared Nothing:** Nodes operate independently with no shared resources.

Parallel databases are particularly well-suited for scenarios involving complex analytical processing, data warehousing, and decision support applications where large datasets and intricate queries are common. By dividing the processing workload among multiple nodes, parallel databases deliver improved performance and efficiency compared to traditional single-node databases, making them a key technology for handling big data challenges in modern computing environments.

### Advantages of parallel DBMS :

- **Speed**  
The servers from parallel DBMS are able to break up user database request into parts and it dispatches each of the parts to separate computers. This speeds up most of the data requests, allowing faster access to very large databases.
- **Reliability**  
The database server can sense that a specific computer is not responding, and it can reroute its work to the remaining computers.
- **Capacity**  
As more and more users request access to the database, the computer administrators add more computers to the parallel server, boosting its overall capacity to the max,

### **Disadvantage of Parallel DBMS :**

- **Cost**  
Parallel DBMS needs lots of processors and disks in the first place. At the end, it is never cheap to implement parallel DBMSs.
- **Resources**  
Implementing DBMS requires the users or the company to have renewal of resources, changing or maintaining resources, or even replacement of resources.
- **Difficulty of Managing Systems**  
When there needs to be a software update, a replacement, or maintenance that all of the system needs to do, it will be time consuming and resource consuming.

## **8. Distributed Database**

A distributed database is basically a database that is not limited to one system, it is spread over different sites, i.e, on multiple computers or over a network of computers. A distributed database system is located on various sites that don't share physical components. This may be required when a particular database needs to be accessed by various users globally. It needs to be managed such that for the users it looks like one single database.

Distributed databases are widely used in scenarios where large-scale data management, scalability, and fault tolerance are essential, such as in cloud computing environments, global enterprises, and applications requiring high availability and performance across distributed locations.

### **Advantages of Distributed Database System :**

- 1) There is fast data processing as several sites participate in request processing.
- 2) Reliability and availability of this system is high.
- 3) It possess reduced operating cost.
- 4) It is easier to expand the system by adding more sites.
- 5) It has improved sharing ability and local autonomy.

### **Disadvantages of Distributed Database System :**

- 1) The system becomes complex to manage and control.
- 2) The security issues must be carefully managed.
- 3) The system require deadlock handling during the transaction processing otherwise the entire system may be in inconsistent state.
- 4) There is need of some standardization for processing of distributed database.

### **Uses for distributed databases**

- The corporate management information system makes use of it.
- Multimedia apps utilize it.
- Used in hotel chains, military command systems, etc.
- The production control system also makes use of it