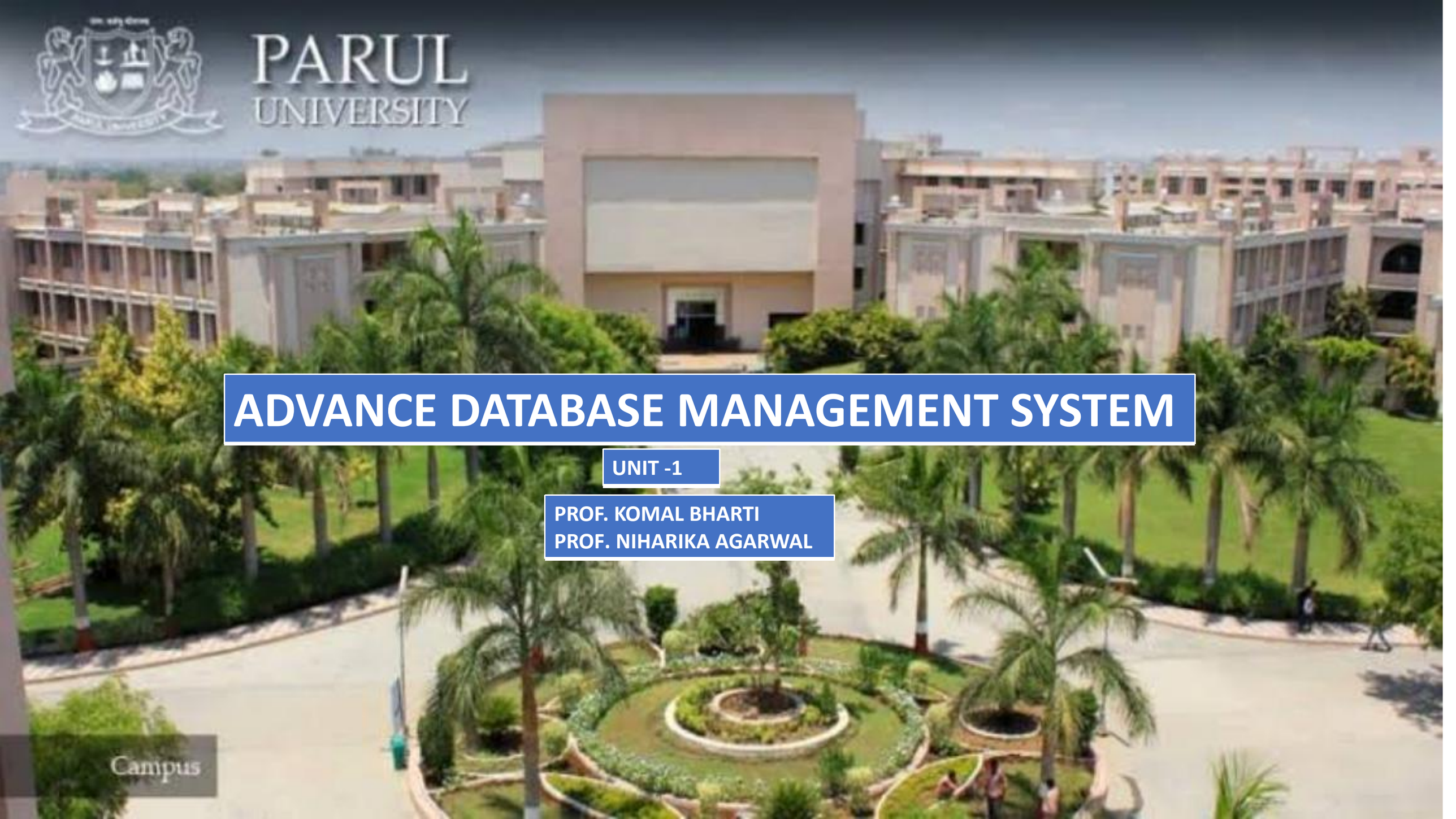

ADVANCE DATABASE MANAGEMENT SYSTEM

UNIT -1

PROF. KOMAL BHARTI
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What is Data?

What is Data?

In general, data is a distinct piece of information that is gathered and translated for some purpose. If data is not formatted in a specific way, it does not valuable to computers or humans. Data can be available in terms of different forms, such as bits and bytes stored in electronic memory, numbers or text on pieces of paper, or facts stored in a person's mind. Since the invention of computers, people have used the word data to mean computer information, and this information is transmitted or stored. There are different kinds of data; such are as follows:

Sound
Video
Single character
Number (integer or floating-point)
Picture
Boolean (true or false)
Text (string)

In a computer's storage, data is stored in the form of a series of binary digits (bits) that contain the value 1 or 0. The information can be in terms of pictures, text documents, software programs, audio or video clips, or other kinds of data.

The computer data may be stored in files and folders on the computer's storage, and processed by the computer's CPU which utilizes logical operations to generate output (new data) form input data.

As the data is stored on the computer in binary form (zero or one), which can be processed, created, saved, and stored digitally. This allows data to be sent from one computer to another with the help of various media devices or a network connection. Furthermore, if you use data multiple times, it does not deteriorate over time or lose quality.

Examples of computer data

0143 0157 0155 0160 0165 0164 0145 0162 0040 0150 0157 0160

Joe,Smith, 1234 Circle,SLC,UT,8404,8015553211

01100011011011110110110101110000011101010111010001100101011001000100000011010000000101

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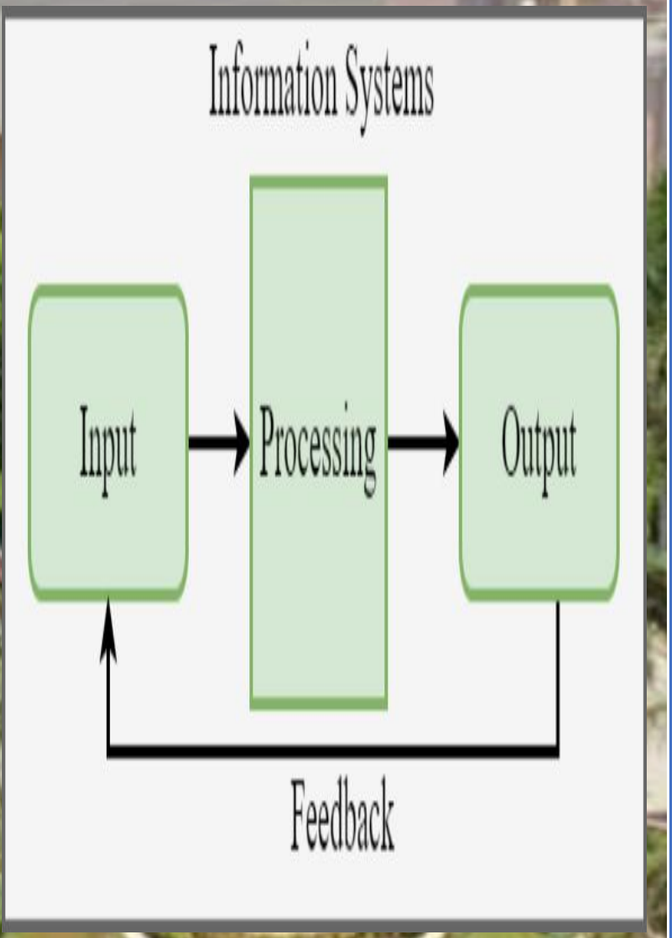
What is an Information ?

An information system is a way to work with information using computers and other technology. It combines different parts like computer programs, physical devices, and networks. Businesses use information systems to collect important data. They use this data to run their operations smoothly. Information systems also help businesses talk to their customers. Using information systems makes businesses work better than their competitors.

Some companies like eBay, Amazon, Alibaba, and Google are built completely on using information systems and technology to work. These companies cannot operate without using information systems. In this article, we are going to discuss Information systems in detail along with the components and working of Information Systems.



Examples of Information

Information systems are very important for businesses today. In the future, they will become even more important as more work is done by computers and AI. General information systems provide common services that many businesses need. For example, a database system helps organize all kinds of data. A company can use data in the database to understand trends, like what products customers buy at different times. Specialized information systems are designed for a specific purpose in a business. For example, an “expert system” can solve very complex problems in a specific area like medicine. The expert system can work faster and better than a person trying to solve the same problem alone.

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Difference between Information and Data

S.NO	DATA	INFORMATION
Definition	Data is defined as unstructured information such as text, observations, images, symbols, and descriptions. In other words, data provides no specific function and has no meaning on its own.	Information refers to processed, organized, and structured data. It gives context for the facts and facilitates decision making. In other words, information is processed data that makes sense to us.
Purpose	Data are the variables that help to develop ideas/conclusions.	Information is meaningful data.
Nature	Data are text and numerical values.	Information is refined form of actual data.
Dependence	Data doesn't rely on Information.	While Information relies on Data.
Measurement	Bits and Bytes are the measuring unit of data.	Information is measured in meaningful units like time, quantity, etc.
Structure	As tabular data, graphs, and data trees can be easily structured.	Information can also be structured as language, ideas, and thoughts.
Purposefulness	Data does not have any specific purpose	Information carries a meaning that has been assigned by interpreting data.
Knowledge Level	It is low-level knowledge.	It is the second level of knowledge.
Decision Making	Data does not directly help in decision making.	Information directly helps in decision making.
Meaning	Data is a collection of facts, which itself has no meaning.	Information puts those facts into context.
Example	Example of data is student test scores.	Example of information is average score of class that is derived from given data.

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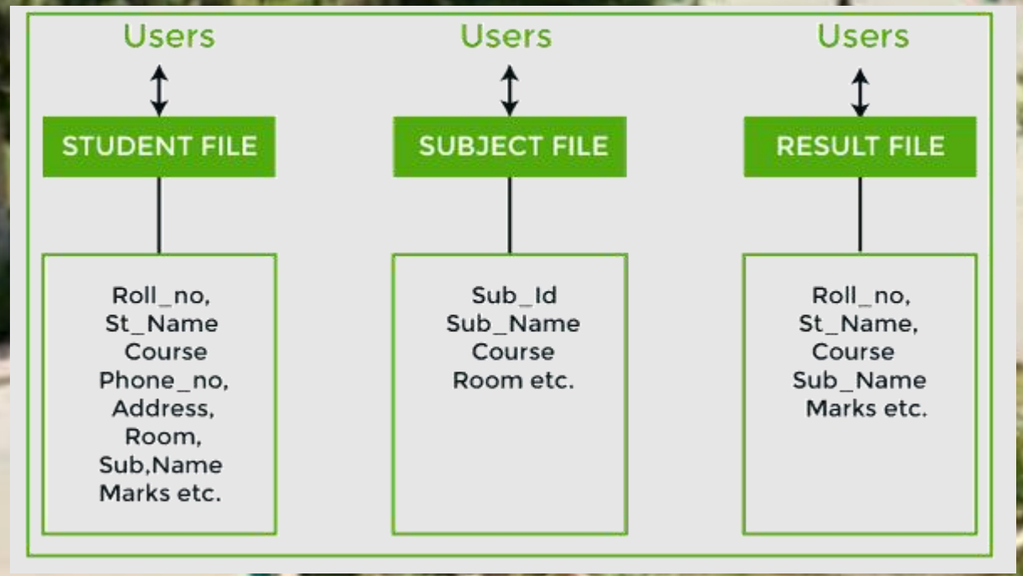
What is file based data management system

File System Approach

File based systems were an early attempt to computerize the manual system. It is also called a traditional based approach in which a decentralized approach was taken where each department stored and controlled its own data with the help of a data processing specialist. The main role of a data processing specialist was to create the necessary computer file structures, and also manage the data within structures and design some application programs that create reports based on file data.



Consider an example of a student's file system. The student file will contain information regarding the student (i.e. roll no, student name, course etc.). Similarly, we have a subject file that contains information about the subject and the result file which contains the information regarding the result.

Some fields are duplicated in more than one file, which leads to data redundancy. So to overcome this problem, we need to create a centralized system, i.e. DBMS approach.

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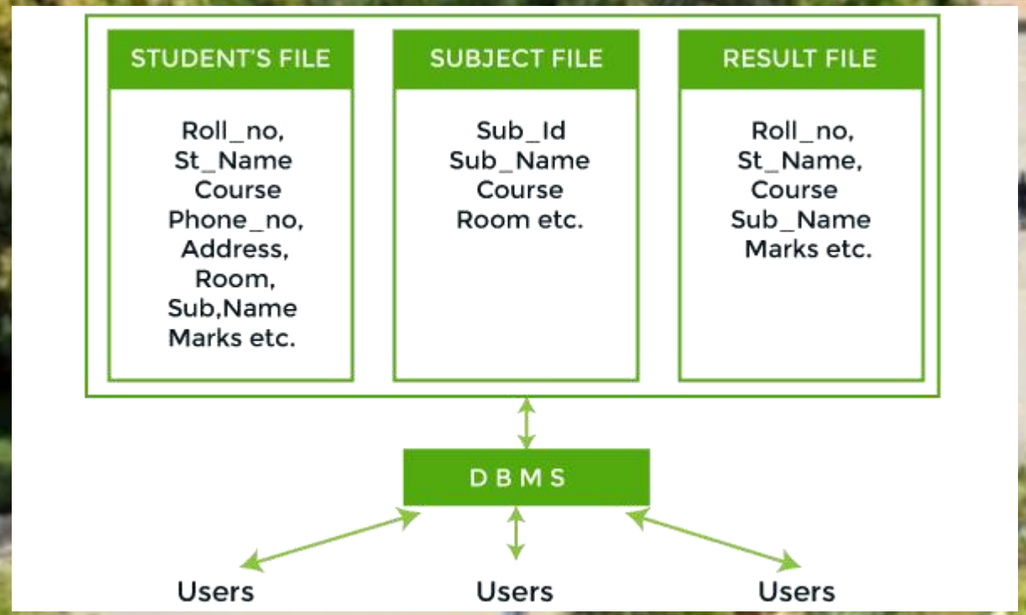
DBMS:

A database approach is a well-organized collection of data that are related in a meaningful way which can be accessed by different users but stored only once in a system. The various operations performed by the DBMS system are: Insertion, deletion, selection, sorting etc.

In the above figure,

In the above figure, duplication of data is reduced due to centralization of data.



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There are the following differences between DBMS and File systems:

Basis	DBMS Approach	File System Approach
Meaning	DBMS is a collection of data. In DBMS, the user is not required to write the procedures.	The file system is a collection of data. In this system, the user has to write the procedures for managing the database.
Sharing of data	Due to the centralized approach, data sharing is easy.	Data is distributed in many files, and it may be of different formats, so it isn't easy to share data.
Data Abstraction	DBMS gives an abstract view of data that hides the details.	The file system provides the detail of the data representation and storage of data.
Security and Protection	DBMS provides a good protection mechanism.	It isn't easy to protect a file under the file system.
Recovery Mechanism	DBMS provides a crash recovery mechanism, i.e., DBMS protects the user from system failure.	The file system doesn't have a crash mechanism, i.e., if the system crashes while entering some data, then the content of the file will be lost.
Manipulation Techniques	DBMS contains a wide variety of sophisticated techniques to store and retrieve the data.	The file system can't efficiently store and retrieve the data.
Concurrency Problems	DBMS takes care of Concurrent access of data using some form of locking.	In the File system, concurrent access has many problems like redirecting the file while deleting some information or updating some information.
Where to use	Database approach used in large systems which interrelate many files.	File system approach used in large systems which interrelate many files.
Cost	The database system is expensive to design.	The file system approach is cheaper to design.
Data Redundancy and Inconsistency	Due to the centralization of the database, the problems of data redundancy and inconsistency are controlled.	In this, the files and application programs are created by different programmers so that there exists a lot of duplication of data which may lead to inconsistency.
Structure	The database structure is complex to design.	The file system approach has a simple structure.
Data Independence	•In this system, Data Independence exists, and it can be of two types.Logical Data Independence •Physical Data Independence	In the File system approach, there exists no Data Independence.
Integrity Constraints	Integrity Constraints are easy to apply.	Integrity Constraints are difficult to implement in file system.
Data Models	•In the database approach, 3 types of data models exist:Hierarchal data models •Network data models •Relational data models	In the file system approach, there is no concept of data models exists.
Flexibility	Changes are often a necessity to the content of the data stored in any system, and these changes are more easily with a database approach.	The flexibility of the system is less as compared to the DBMS approach.
Examples	Oracle, SQL Server, Sybase etc.	Cobol, C++ etc.

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Advantage of File Based system

- The file Based system is not complicated and is simpler to use.
- Because of the above point, this system is quite inexpensive.

- Because the file based system is simple and cheap, it is normally suitable for home users and owners of small businesses.

- Since the file based system is used by smaller organisations or individual users, it stores comparatively lesser amount of data. Hence, the data can be accessed faster and more easily.

Disadvantages Of File based System

- The File based system is limited to a smaller size and cannot store large amounts of data.

- This system is relatively uncomplicated but this means it cannot support complicated queries, data recovery etc.

- There may be redundancy of data in the file based system as it does not have a complex mechanism to get rid of it.

- The data is not very secure in a file based system and may be corrupted or destroyed.
- The files in the file based system may be stored across multiple locations. Consequently, it is difficult to share the data easily with multiple

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What is database

A **database** is an organized collection of data stored in a computer system and usually controlled by a database management system (DBMS). The data in common databases is modeled in tables, making querying and processing efficient. Structured query language (SQL) is commonly used for data querying and writing.

The **Database** is an essential part of our life. We encounter several activities that involve our interaction with databases, for example in the bank, in the railway station, in school, in a grocery store, etc. These are the instances where we need to store a large amount of data in one place and fetch these data easily.

Scenario: Online Grocery Store

1. Database Structure

The online grocery store uses a database to manage different types of information. Here's a simplified structure of the database:

Tables: The database consists of several tables, each representing a different aspect of the store.

- **Products Table: Contains information about products available in the store.**
  - **Columns: ProductID, Name, Description, Price, StockQuantity, CategoryID**
- **Categories Table: Organizes products into categories for easier browsing.**
  - **Columns: CategoryID, CategoryName**
- **Customers Table: Stores customer information for order processing and personalization.**
  - **Columns: CustomerID, Name, Email, Address, PhoneNumber**
- **Orders Table: Manages order details, including the customer and the products ordered.**
  - **Columns: OrderID, CustomerID, OrderDate, TotalAmount**
- **OrderItems Table: Records the individual items in each order.**
  - **Columns: OrderItemID, OrderID, ProductID, Quantity, Price**

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DATABSE SYSTEM	Database Systems: Use Case Example
Database management system is a software which is used to manage the database. For example: MySQL,Oracle etc are a very popular commercial database which is used in different applications. DBMS provides an interface to perform various operations like database creation, storing data in it, updating data, creating a table in the database and a lot more. It provides protection and security to the database. In the case of multiple users, it also maintains data consistency.	Database Systems: Use Case Example Let’s explore a hotel reservation system as a use case to illustrate how database systems operate and provide functionality. This example will help explain the key components and operations involved in managing data within such a system. Use Case: Hotel Reservation System Database Structure In a hotel reservation system, the database might include several tables to manage various aspects of the system: Rooms Table: Contains information about each room in the hotel. Columns: RoomID, RoomNumber, RoomType, PricePerNight, AvailabilityStatus Guests Table: Stores details about the guests staying at the hotel. Columns: GuestID, Name, Email, PhoneNumber, Address Reservations Table: Manages information about reservations made by guests. Columns: ReservationID, GuestID, RoomID, CheckInDate, CheckOutDate, TotalAmount Payments Table: Records payment details for reservations. Columns: PaymentID, ReservationID, PaymentDate, Amount, PaymentMethod

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Organization of Database

•Understanding Records and Fields •Understanding how databases are organized can help you retrieve information more efficiency, Information about each item in a database is called record.

•Elements of an individual record are called fields. Fields can be used as points of access when searching a data in database.

A record in a periodical data in database would include information about a periodical article(author,source,date,title,etc)

•We might try visualizing a record in an electronic database as being part of a table.

•The table below represents what an database of students in a class might look like:

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Organization of Database

If you wanted a list off students who were In second class you could target the “class” field. And you could get data of Aayush and Anika. Same for birth date If you want that students who born in February month you target the birthdate and we can get output of krisha and aayush. The organization of a database is very basic, regardless of who produce

Last Name	First Name	Class	Hometown	Birthdate
PATEL	KRISHA	FIRST CLASS	ANAND	1-2-89
SHAH	AAYUSH	SECOND CLASS	VADODARA	8-2-91
SHARMA	ANJALI	FIRST CLASS	MUMBAI	8-5-90
GUPTA	ANIKA	Second class	MUMBAI	8-6-96

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Characteristics of Data in Database

1. Real World Entity

The reality of DBMS (Database Management System) is one of the most important and easily understandable characteristics.

The DBMS (Database Management System) is developed in such a way that it can manage huge business organizations and store their business data with security.

The Database can store information such as the cost of vegetables, milk, bread, etc. In DBMS (Database Management System), the entities look like real-world entities.

For example, if we want to create a student database, we need some entity. Any student stores their data.

In the Database, then, it should be the real-world entity. The most commonly used properties in the student database are name, age, gender, roll number, etc.

2. Self-explaining nature

In DBMS (Database Management System), the Database contains another database, and another database also contains metadata.

Here the term metadata means data about data.

For example, in a school database, the total number of rows and the table's name are examples of metadata.

So the self-explaining nature means the Database explains all the information automatically itself. This is because, in the Database, all the data are stored in a structured format.

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Characteristics of Data in Database

4.Atomicity of Operations (Transactions)

Here, atomicity means either the operation should be performed or not performed. i.e., it should complete the operation on 0% or 100%.

Here DBMS (Database Management System) provides atomicity as a characteristic. This is the most important and useful characteristic of the DBMS (Database Management System). You can completely understand the atomicity with the help of the below example.

For example, every bank has its own Database, and the Database contains all the information about its customers. Let transaction is the most common atomic operation of the bank. If Sona wants to transfer 1000 rupees to the Archita account, it is possible with the help of the atomicity feature of the Database. If there is a problem in the Archita account, if there is a problem in the atomicity of the Database, then the money will be deducted from the Sona account but not credited to the Archita account.

5. Stores Any Kind of Structured Data

The Database has the ability to store the data in a structured format.

In most of the websites, we see that only student database examples are given for a better understanding, but the important fact is that the Database has the ability to store an unlimited amount of data.

DBMS has the ability to store any type of data that exists in the real world, and these data are structured way. It is another type of very important characteristic of DBMS.

Benefits of Database Management System

Better use of data or information - We can easily and efficiently access well-managed and synchronized forms of data with the help of DBMS. It makes data handling simple, provides an integrated perspective of how a certain business is operating and also aids in keeping track of how one element of the business affects another portion.

Secured Data - The likelihood of security problems increases as a database becomes more functional and accessible. The danger to data security rises as a result of the rate at which data is shared or transferred growing along with the user base. It is frequently utilized in the business world where organizations spend a lot of time, money, and effort making sure data is protected and handled effectively. Data management systems (DBMS) offer a stronger framework for data privacy and security policies, assisting businesses in enhancing data security.

Fast Data Sharing - Database administration makes it possible for consumers to access more and better-managed data. DBMS enables end users to quickly scan their environment and react to any alterations made there.

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Benefits of Database Management System.

Increases Privacy - The privacy rule in a database specifies the privacy restrictions that can only be accessed by authorized users. A user can only view the data he is permitted to view since there are different degrees of database access. For instance, on social networking sites, different accounts that a user wishes to access have varying access restrictions and a user can only see his/her account details, not others.

User Friendly - Data are presented in a straightforward and logical manner by database management systems (DBMS). It is simple to carry out many activities, such as the **addition, deletion, or creation of files or data.**

Data Abstraction - In order to give users an abstract overview of the data, database systems are primarily used. Since numerous intricate algorithms are employed by developers to boost the effectiveness of databases that are concealed from users by several degrees of data abstraction, consumers can easily engage with the system.

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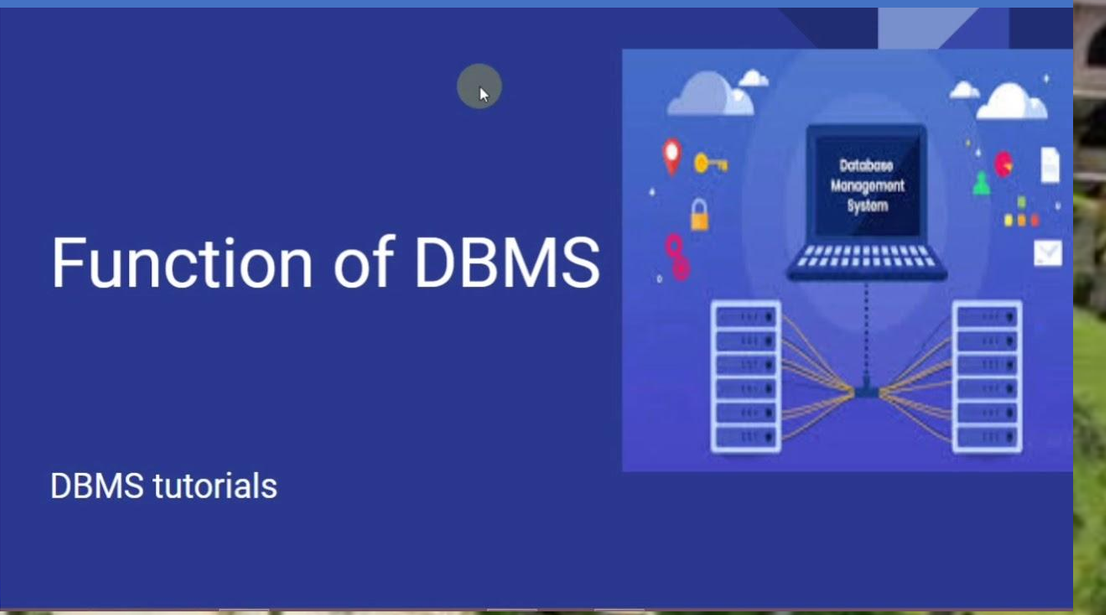
Functions of DBMS

- Data Dictionary Management,
- Data Storage Management,
- Data Transformation and Presentation,
- Security Management,
- Multi user Access Control,
- Backup and Recovery Management,
- Data Integrity Management,
- Database Access Languages and Application Programming Interfaces and
- Database Communication interfaces.



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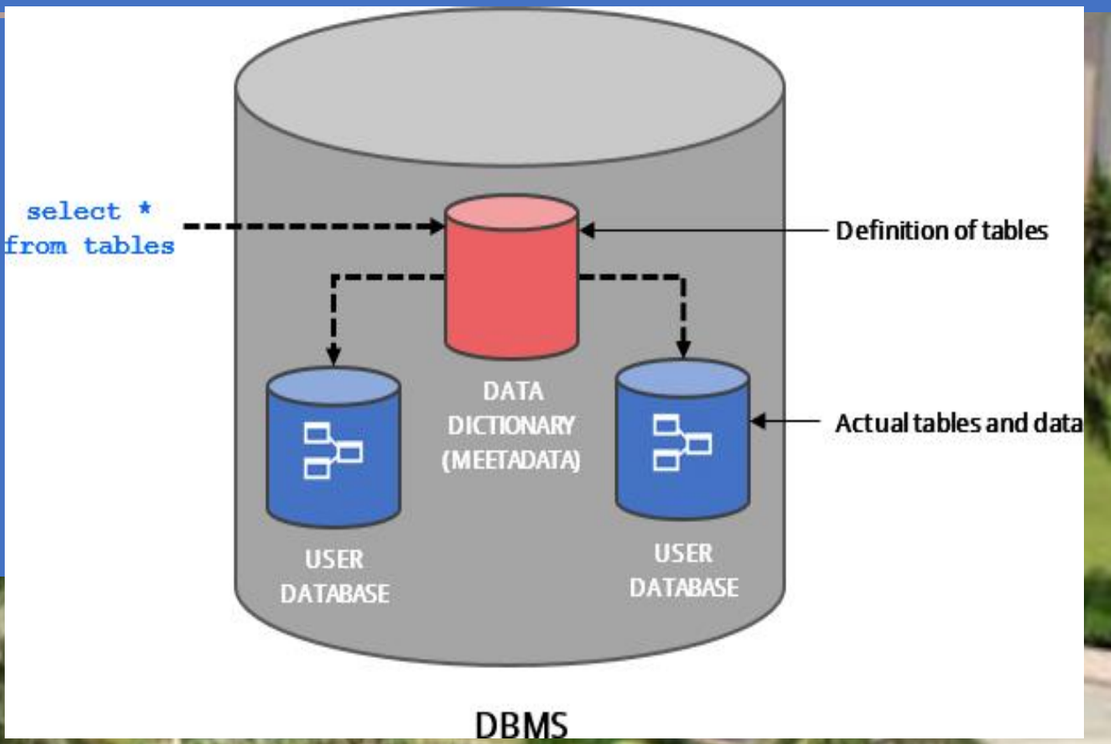
Functions of DBMS

Data Dictionary Management Data Dictionary Management is the one of the most important function of DBMS. That is, data that provides information about the database's tables, views, constraints, stored procedures, etc. stored within the database.
If we take a table as an example, the dictionary will store information such as: its name and other attributes.



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Functions of DBMS

2.Data Storage Management

One of the most important tasks for DBMS is to create a database for complex data and manage the data.

It gives relief to the user by creating a structure for the complex data sets so that users can access

it and manipulate them very easily. Modern database systems not only provide storage for the data but they store and manage the metadata (data of data) like data procedural rules

3. Data transformation and presentation

The database management system transforms entered data in to required data structures.

The database management system relieves you of the chore of making a distinction between the logical data format and the physical data format.

That is, the database management system formats the physically retrieved data to make it conform to the user's logical expectations.

For example, imagine an enterprise database used by a MNC company. An end user in England would expect to enter data such as July 12, 2009, as "12/07/2009." In contrast, the same date would be entered in the United States as "07/12/2009." Regardless of the data presentation format, the database management system must manage the date in the proper format for each country.

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Functions of DBMS

4. Security Management Security Management is another important function of DBMS. The database management creates a security system that enforces user security and data privacy. Security rules determine which authorized users can access the database, which data items each user can access, and which data operations (read, add, delete, or modify) the user can perform. This is important in multiuser database systems.

5. Multi User Access Control Multiuser access control is another important database management system Function. To provide data integrity and data consistency, the database management system uses sophisticated algorithms to ensure that multiple users can access the database concurrently without compromising the integrity of the database.

6. Backup and Recovery Management . The database management system provides backup and data recovery to ensure data safety and integrity. Current database management systems provide special utilities that allow the DBA to perform routine and special backup and restore procedures. Recovery management deals with the recovery of the database after a data failure, such as a bad sector in the disk or a power failure. Such capability is critical to preserving the database accuracy and integrity.

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Functions of DBMS

7. Data Integrity Management Data integrity management.
is another important database management system function. The database management system promotes and enforces integrity rules, thus minimizing data redundancy of data and maximizing data consistency. The data relationships stored in the data dictionary are used to enforce data integrity of data. Ensuring data integrity is important database management system functionality in transaction-oriented database systems

8. Database Access Languages and Application Programming Interfaces(API)
The database management system provides data access through a query language. A SQL query language is a non procedural language—one that lets the user specify what must be done without having to specify how it is
to be done.
SQL is the defector query language and data access standard supported by the majority of database management system vendors

9.Database Communication Interfaces Current-generation. DBMS's accept end-user requests via multiple, different network environments. For example, the DBMS might provide access to the database via the Internet through the use of Web browsers such as Mozilla Firefox or Microsoft Internet Explorer. In this environment, communications can be accomplished in several ways: - End users can generate answers to queries by filling in screen forms through their preferred Web browser. - The DBMS can automatically publish predefined reports on a Website. - The DBMS can connect to third-party systems to distribute information via e-mail or other productivity applications.

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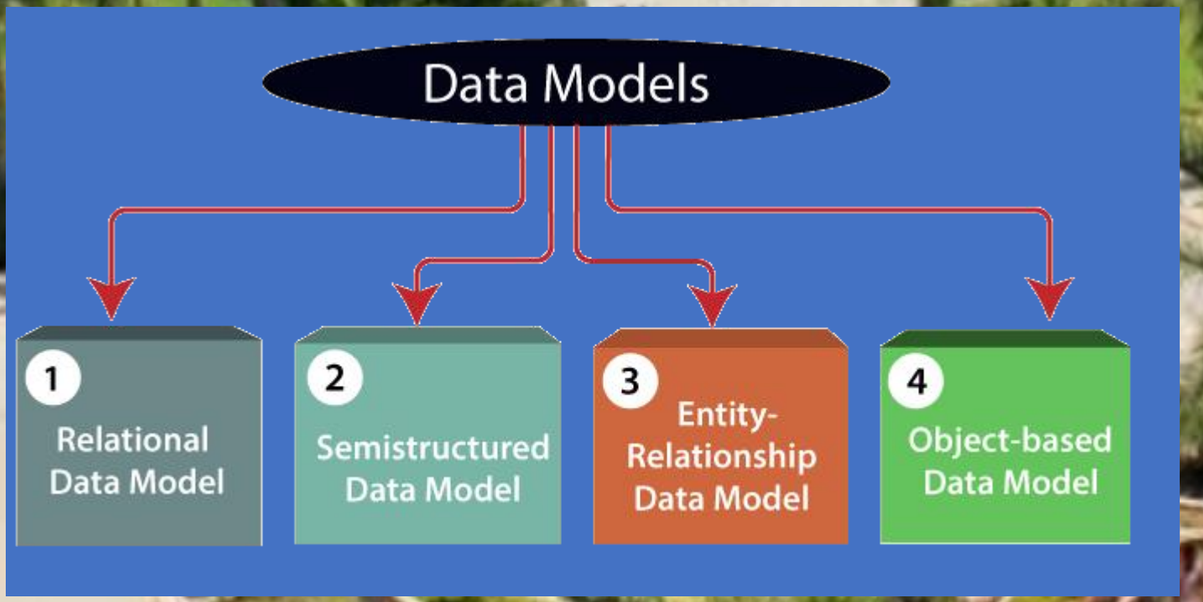
Data Models

Data Model is the modeling of the data description, data semantics, and consistency constraints of the data. It provides the conceptual tools for describing the design of a database at each level of data abstraction. Therefore, there are following four data models used for understanding the structure of the database:



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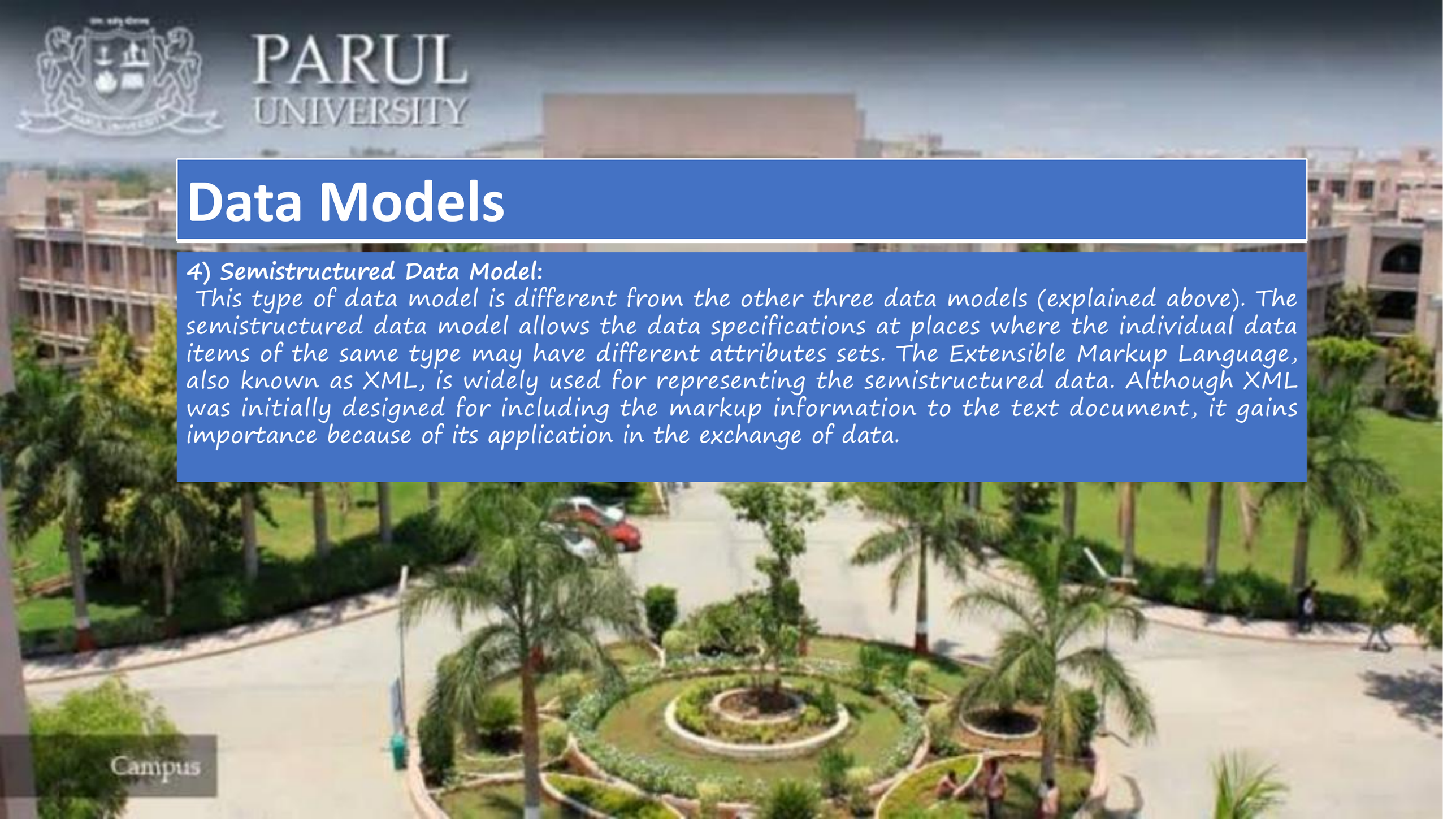
Data Models

1) **Relational Data Model**: This type of model designs the data in the form of rows and columns within a table. Thus, a relational model uses tables for representing data and in-between relationships. Tables are also called relations. This model was initially described by Edgar F. Codd, in 1969. The relational data model is the widely used model which is primarily used by commercial data processing applications.

2) **Entity-Relationship Data Model**: An ER model is the logical representation of data as objects and relationships among them. These objects are known as entities, and relationship is an association among these entities. This model was designed by Peter Chen and published in 1976 papers. It was widely used in database designing. A set of attributes describe the entities. For example, student_name, student_id describes the 'student' entity. A set of the same type of entities is known as an 'Entity set', and the set of the same type of relationships is known as 'relationship set'.

3) **Object-based Data Model**: An extension of the ER model with notions of functions, encapsulation, and object identity, as well. This model supports a rich type system that includes structured and collection types. Thus, in 1980s, various database systems following the object-oriented approach were developed. Here, the objects are nothing but the data



Data Models

4) Semistructured Data Model:

This type of data model is different from the other three data models (explained above). The semistructured data model allows the data specifications at places where the individual data items of the same type may have different attributes sets. The Extensible Markup Language, also known as XML, is widely used for representing the semistructured data. Although XML was initially designed for including the markup information to the text document, it gains importance because of its application in the exchange of data.

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Database Schema Architecture

Database architecture uses programming languages to design a particular type of software for businesses and organizations. The Database architecture focuses on the design, development, implementation and maintenance of computer programs that store and organized an information for businesses, agencies and institutions. A database architect develops and implements software to meet the needs of its audience and users.

- *The three schema architecture is also called ANSI/SPARC architecture or three-level architecture.*
- *This framework is used to describe the structure of a specific database system.*
- *The three schema architecture is also used to separate the user applications and physical database.*
- *The three schema architecture contains three-levels. It breaks the database down into three different categories.*

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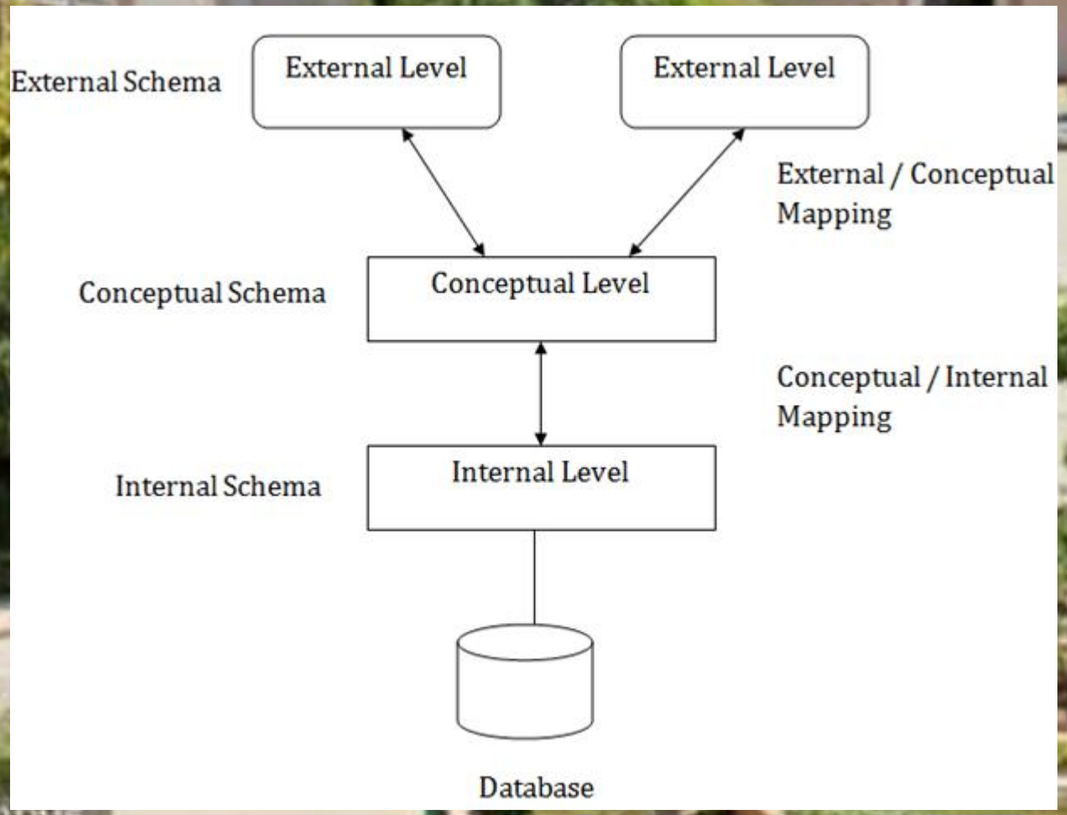
Database Schema Architecture

The three-schema architecture is as follows:



In the above diagram:

- *It shows the DBMS architecture.*
- *Mapping is used to transform the request and response between various database levels of architecture.*
- *Mapping is not good for small DBMS because it takes more time.*
- *In External / Conceptual mapping, it is necessary to transform the request from external level to conceptual schema.*
- *In Conceptual / Internal mapping, DBMS transform the request from the conceptual to internal level.*

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Database Schema Architecture

Objectives of Three schema Architecture

The main objective of three level architecture is to enable multiple users to access the same data with a personalized view while storing the underlying data only once. Thus it separates the user's view from the physical structure of the database. This separation is desirable for the following reasons:

- Different users need different views of the same data.
- The approach in which a particular user needs to see the data may change over time.
- The users of the database should not worry about the physical implementation and internal workings of the database such as data compression and encryption techniques, hashing, optimization of the internal structures etc.

- All users should be able to access the same data according to their requirements.
- DBA should be able to change the conceptual structure of the database without affecting the user's
- Internal structure of the database should be unaffected by changes to physical aspects of the storage.

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Database Schema Architecture

1. Internal Level

The internal level has an internal schema which describes the physical storage structure of the database.
The internal schema is also known as a physical schema.
It uses the physical data model. It is used to define that how the data will be stored in a block.
The physical level is used to descry
Storage space allocations.
For Example: B-Trees, Hashing etc.
Access paths.
For Example: Specification of primary and secondary keys, indexes, pointers and sequencing.
Data compression and encryption techniques.
Optimization of internal structures.
Representation of stored fields.
be complex low-level data structures in detail.

- The lowest level of data abstraction.
- It shows How the data are actually stored on storage devices.
- It is also known as physical level.
- It is a internal view of physical storage of data.
- It deals with complex low level data structures, file structures and access all the methods in detail.
- It also deals with Data Compression and Encryption techniques, if used.

Internal view

STORED_EMPLOYEE record length 60

Empno	:	4 decimal offset 0 unique
Ename	:	String length 15 offset 4
Salary	:	8,2 decimal offset 19
Deptno	:	4 decimal offset 27
Post	:	string length 15 offset 31

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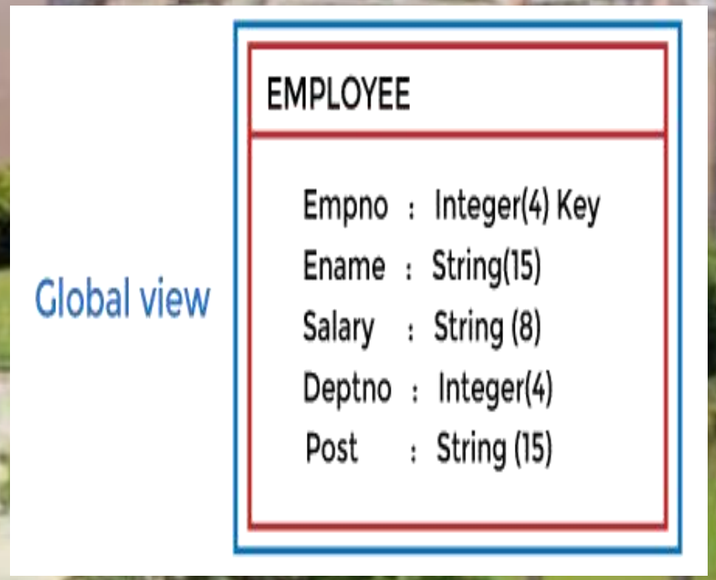
Database Schema Architecture

•The conceptual schema describes the design of a database at the conceptual level. Conceptual level is also known as logical level.
•The conceptual schema describes the structure of the whole database.
•The conceptual level describes what data are to be stored in the database and also describes what relationship exists among those data.
•In the conceptual level, internal details such as an implementation of the data structure are hidden.
•Programmers and database administrators



- It is a next higher level than internal level of data abstraction. .
- It describes What or how data are stored in the database and What relationships exist among those data.
- It is also known as Logical level.
- It hides low level complexities of physical storage of database.
- Database administrator and designers work at this level to determine What or how data to keep in database. Application developers also work in this level .

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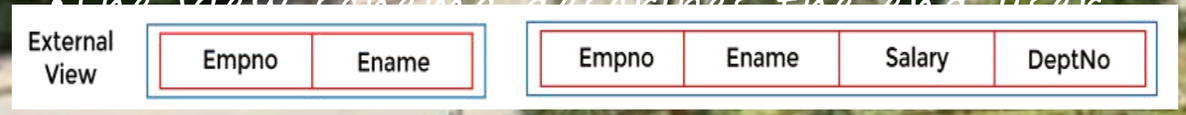
Database Schema Architecture

3. External Level

•At the external level, a database contains several schemas that sometimes called as subschema. The subschema is used to describe the different view of the database.
•An external schema is also known as view schema.
•Each view schema describes the database part that a particular user group is interested and hides the remaining database from that user group.
•The view schema describes the end user



• It is a highest level of data abstraction.
• It describes only one part of the entire database that a end user concern. • It is also known as an view level. • End users need to access only part of the database rather than entire database. • Different user need different views of database. And so, there can be many view level abstractions of the same database.

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Components Of DBMS

There are five major components in the database system environment
and their interrelationship is.

- Hardware
- Software
- Data
- Users
- Procedures

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Components Of DBMS

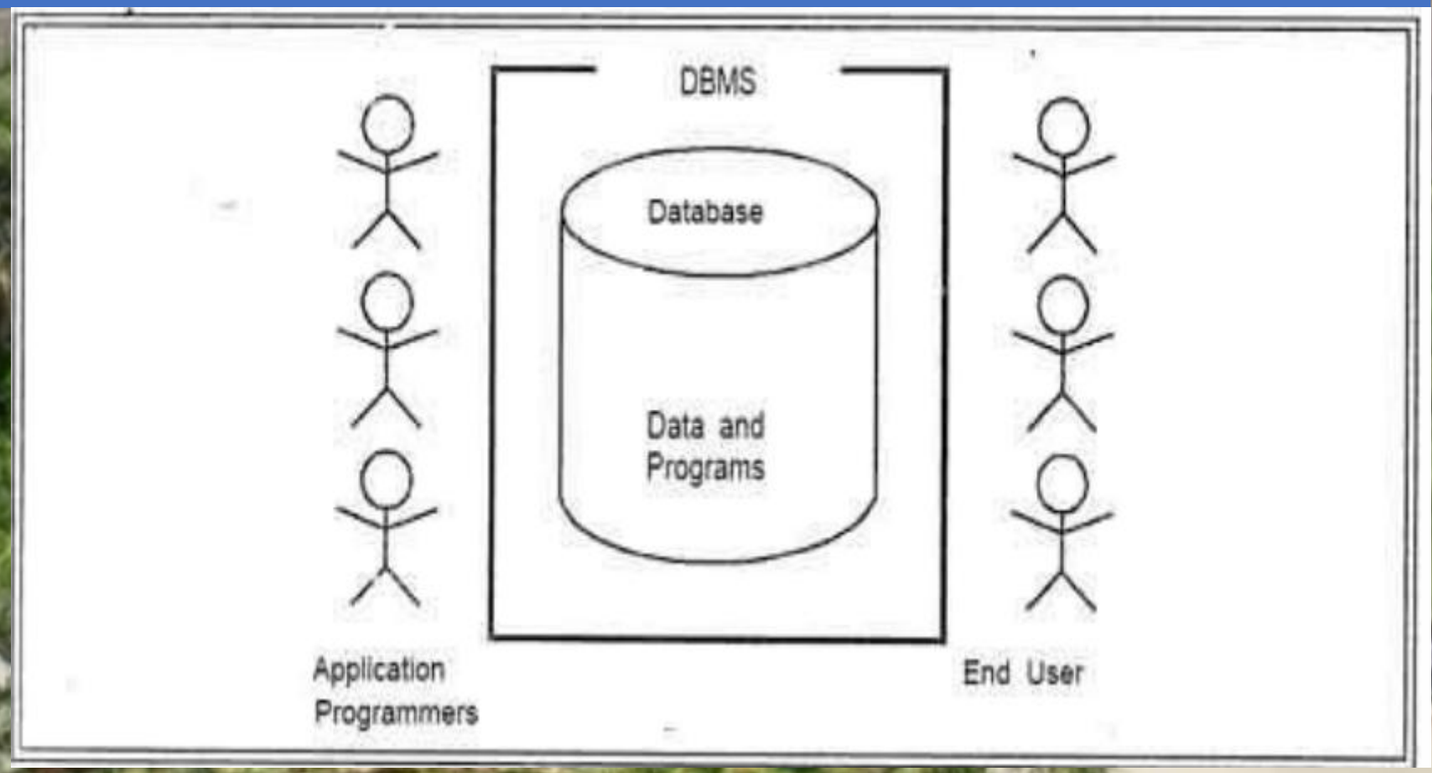
1. Hardware:

• The hardware is the actual computer system used for keeping and accessing the data in database.

• Conventional database management system hardware consists of secondary storage devices, usually hard disks, on which the database physically resides, together with the associated Input Output devices, device controllers and· so forth.

• Databases run on some range of machines, from Microcomputers to large mainframes computer.

• Other hardware issues for a database management system includes database machines, which is hardware designed specifically to support a database system.



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Components Of DBMS

2. Software:

• The software is the actual database management system. Within the physical databases itself (i.e. the data actually stored) and the users of the system is a layer of software, usually called the DBMS.

• All requests from users for access to the database are handled by the database management system. One general function provided by the database management system is thus the shielding of database users from complex hardware-level detail.

• The database management system allows the users to communicate with the database. In a sense, it is the mediator within the database and the users.

3. Data:

• It is the most important component of database management system environment from the end users point of view.

• As shown in observes that data acts as a bridge within the machine components and the user components. The database contained the operational data and the meta-data, the 'data about data'.

• The database should be contain all the data needed by the a organization. One of the major features of data in databases is that the actual data are separated from the programs that use the data.

• A database should always be designed, built and populated for a particular audience, user and for a specific purpose.

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Components Of DBMS

4. Users:

• There are a number of users who can access or retrieve data on the demand using the applications and interfaces provided by the database management system.

• Each type of user needs different type of software capabilities. The users of a database system can be classified in the following groups, depending on their degrees of expertise or the mode of their interactions with the database management system. The users can be:

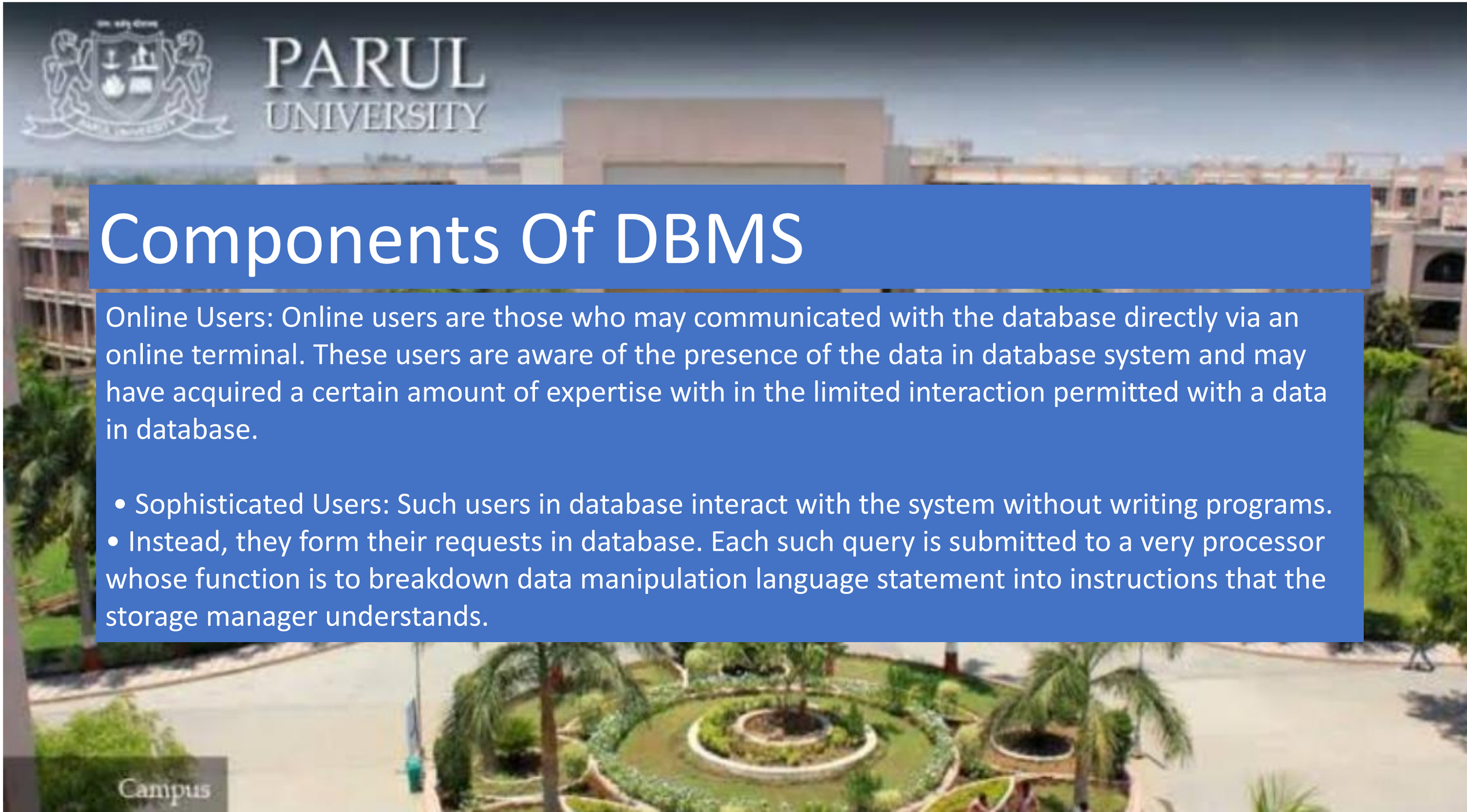
• Naive Users
• Online Users
• Application Programmers
• Sophisticated Users
• Data Base Administrator

• Naive Users :

Naive Users are those users who must need not be aware of the presence of the database system or any other system supporting their usage. Naive users are end users of the database who work with a menu driven application program, where the type and range of response is always indicated to the audience or user .

• A full user of an Automatic Teller Machine falls in this category. The one by one user is instructed through each step of a transaction. Then responds by pressing a coded key. The operations that can be performed by valve users are very limited and affect only a precise portion of the data in database.

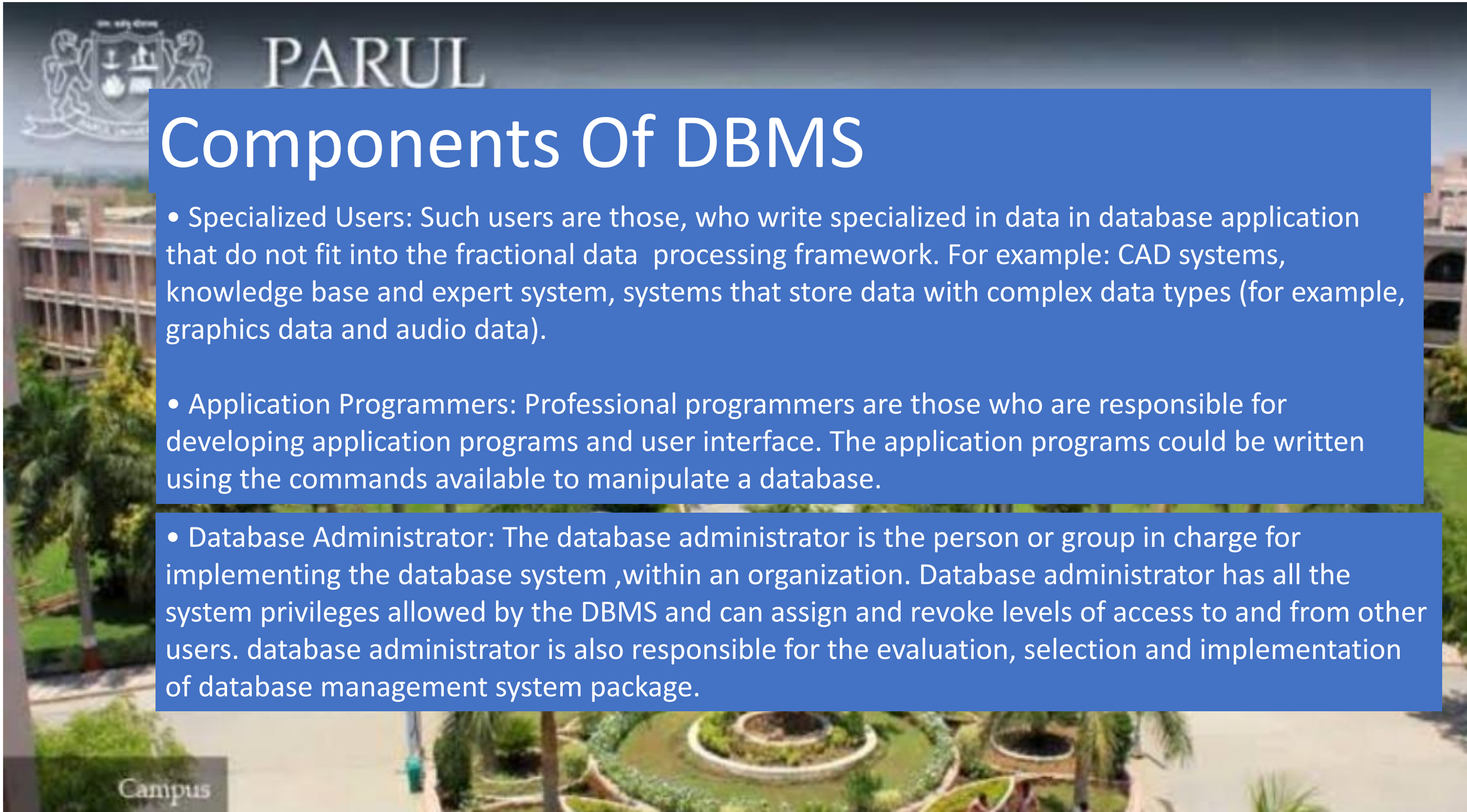
For example, in the case of the user of the ATM, user's action affects only one or more of his/her own accounts.



Components Of DBMS

Online Users: Online users are those who may communicated with the database directly via an online terminal. These users are aware of the presence of the data in database system and may have acquired a certain amount of expertise with in the limited interaction permitted with a data in database.

- Sophisticated Users: Such users in database interact with the system without writing programs.
- Instead, they form their requests in database. Each such query is submitted to a very processor whose function is to breakdown data manipulation language statement into instructions that the storage manager understands.



Components Of DBMS

• Specialized Users: Such users are those, who write specialized in data in database application that do not fit into the fractional data processing framework. For example: CAD systems, knowledge base and expert system, systems that store data with complex data types (for example, graphics data and audio data).

• Application Programmers: Professional programmers are those who are responsible for developing application programs and user interface. The application programs could be written using the commands available to manipulate a database.

• Database Administrator: The database administrator is the person or group in charge for implementing the database system ,within an organization. Database administrator has all the system privileges allowed by the DBMS and can assign and revoke levels of access to and from other users. database administrator is also responsible for the evaluation, selection and implementation of database management system package.

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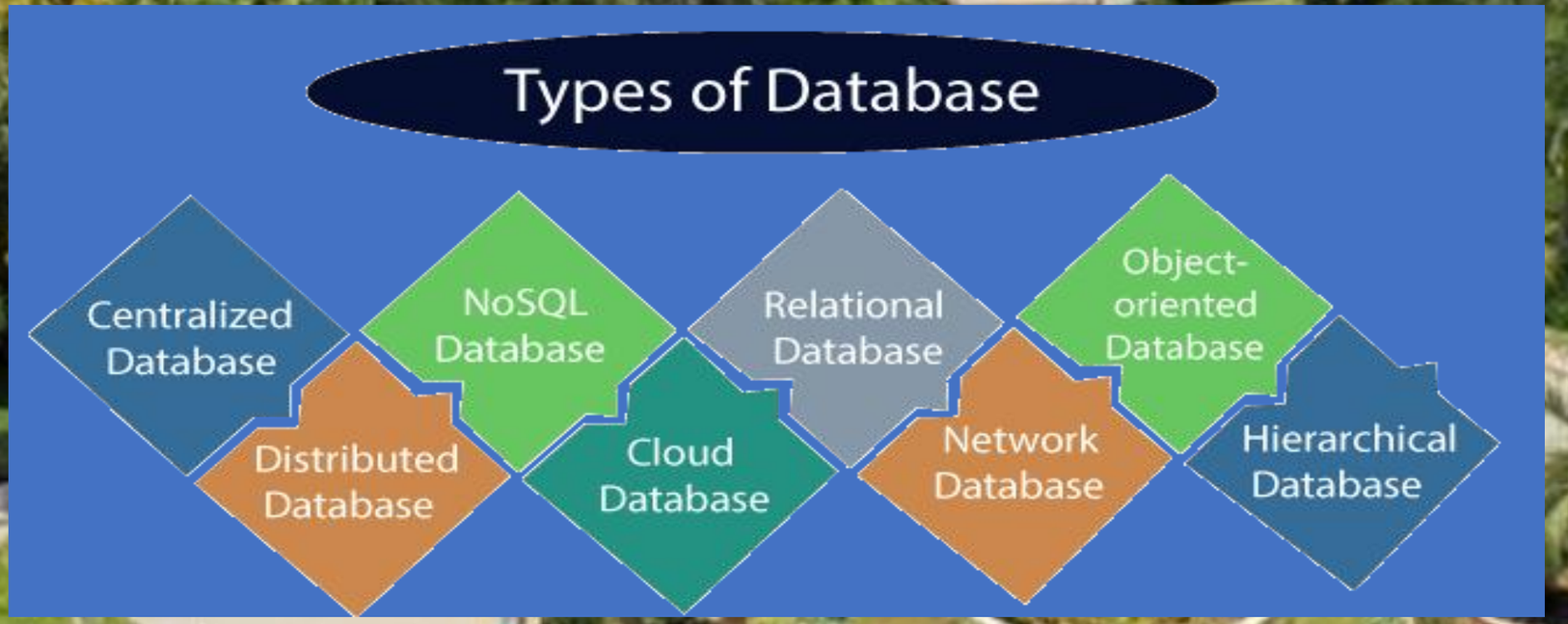
Types Of Database

There are various types of databases used for storing different varieties of data:



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Types Of Database

1) Centralized Database

It is the type of database that stores data at a centralized database system. It comforts the users to access the stored data from different locations through several applications. These applications contain the authentication process to let users access data securely. An example of a Centralized database can be Central Library that carries a central database of each library in a college/university.

Advantages of Centralized Database

- It has decreased the risk of data management, i.e., manipulation of data will not affect the core data.
- Data consistency is maintained as it manages data in a central repository.
- It provides better data quality, which enables organizations to establish data standards.
- It is less costly because fewer vendors are required to handle the data sets.

Disadvantages of Centralized Database

- The size of the centralized database is large, which increases the response time for fetching the data.
- It is not easy to update such an extensive database system.
- If any server failure occurs, entire data will be

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Types Of Database

Distributed Database

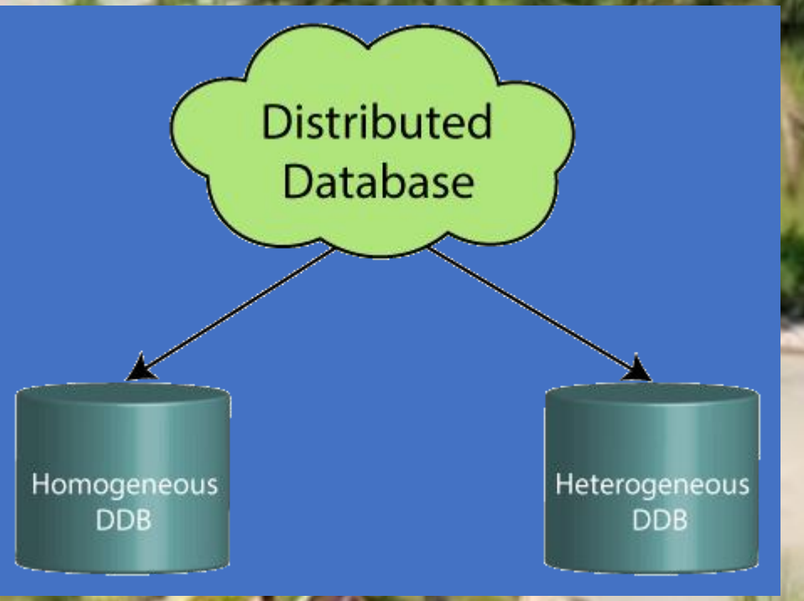
Unlike a centralized database system, in distributed systems, data is distributed among different database systems of an organization. These database systems are connected via communication links. Such links help the end-users to access the data easily. **Examples** of the Distributed database are Apache Cassandra, HBase, Ignite, etc.

We can further divide a distributed database system into:

- **Homogeneous DDB:** Those database systems which execute on the same operating system and use the same application process and carry the same hardware devices.
- **Heterogeneous DDB:** Those database systems which execute on different operating systems under different application procedures, and carries different hardware devices.

Advantages of Distributed Database

- Modular development is possible in a distributed database, i.e., the system can be expanded by including new computers and connecting them to the distributed system.
- One server failure will not affect the entire data set.



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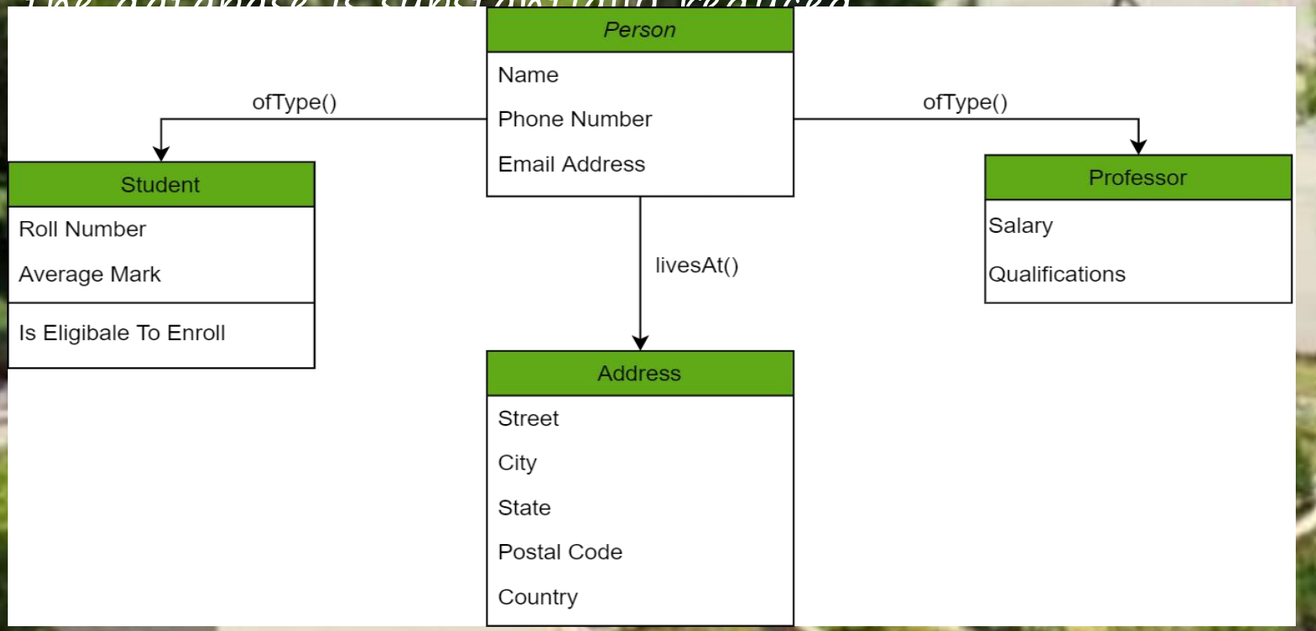
Types Of Database

Object-Oriented Databases

Those familiar with the Object-Oriented Programming Paradigm would be able to relate to this model of databases easily. Information stored in a database is capable of being represented as an object which response as an instance of the database model. Therefore, the object can be referenced and called without any difficulty. As a result, the workload on the database is substantially reduced



In the chart above, we have different objects linked to one another using methods; one can get the address of the Person (represented by the Person Object) using the livesAt() method. Furthermore, these objects have attributes which are in fact the data elements that need to be defined in the database.

An example of such a model is the Berkeley DB software library which uses the same conceptual background to deliver quick and highly efficient responses to database queries from the embedded database.

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Types Of Database

Relational Databases

Considered the most mature of all databases, these databases lead in the production line along with their management systems. In this database, every piece of information has a relationship with every other piece of information. This is on account of every data value in the database having a unique identity in the form of a record.

Note that all data is tabulated in this model. Therefore, every row of data in the database is linked with another row using a primary key. Similarly, every table is linked with another table using a foreign key. Refer to the diagram below and notice how the concept of 'Keys' is used to link two tables.

Roll no.	Student Name	Marks Awarded
1	Raman Triphati	86
2	Rajan Govindan	94
3	Mahesh Nandalal	94

Key = 94

Marks Awarded	Student Name	Rank	Scholarship
94	Rajan Govindan	17	Yes
94	Mahesh Nandlal	16	Yes

Section	Student Name	Marks Awarded	Rank
A	Raman Tripathi	86	43
B	Rajan Govindan	94	17
C	Mahesh Nandlal	94	16

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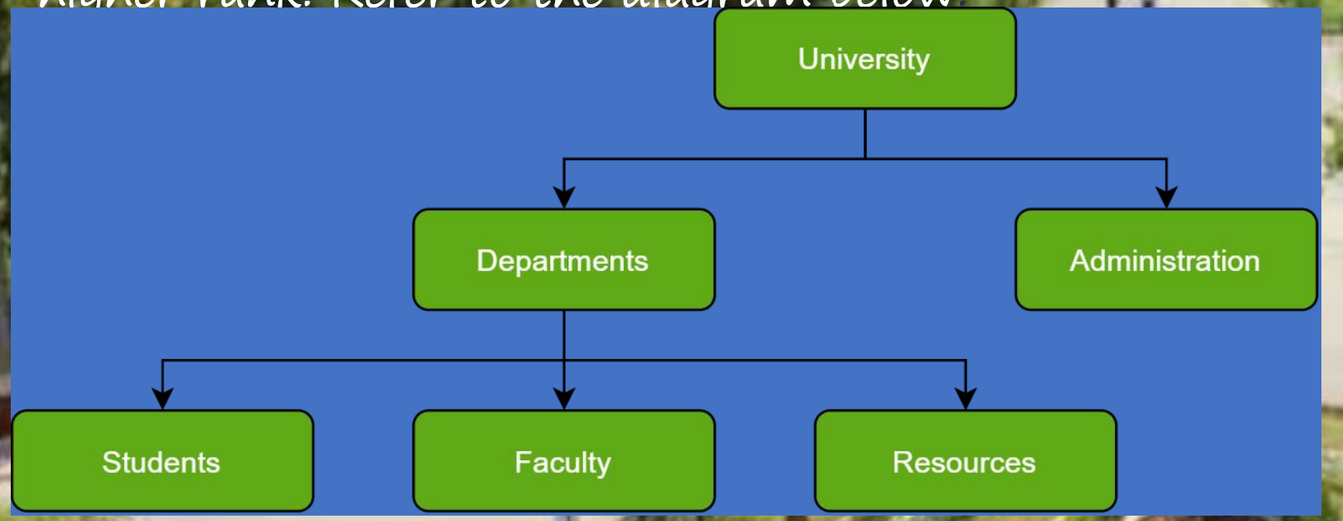
Hierarchical Databases

Just as in any hierarchy, this database follows the progression of data being categorized in ranks or levels, wherein data is categorized based on a common point of linkage. As a result, two entities of data will be lower in rank and the commonality would assume a higher rank. Refer to the diagram below



Do note how Departments and Administration are entirely unlike each other and yet fall under the domain of a University. They are elements that form this hierarchy.

Another perspective advises visualizing the data being organized in a parent-child relationship, which upon addition of multiple data elements would resemble a tree.

The child records are linked to the parent record using a field, and so the parent record is allowed multiple child records. However, vice versa is not possible.

Notice that due to such a structure, hierarchical databases are not easily salable; the addition of data elements requires a lengthy traversal through

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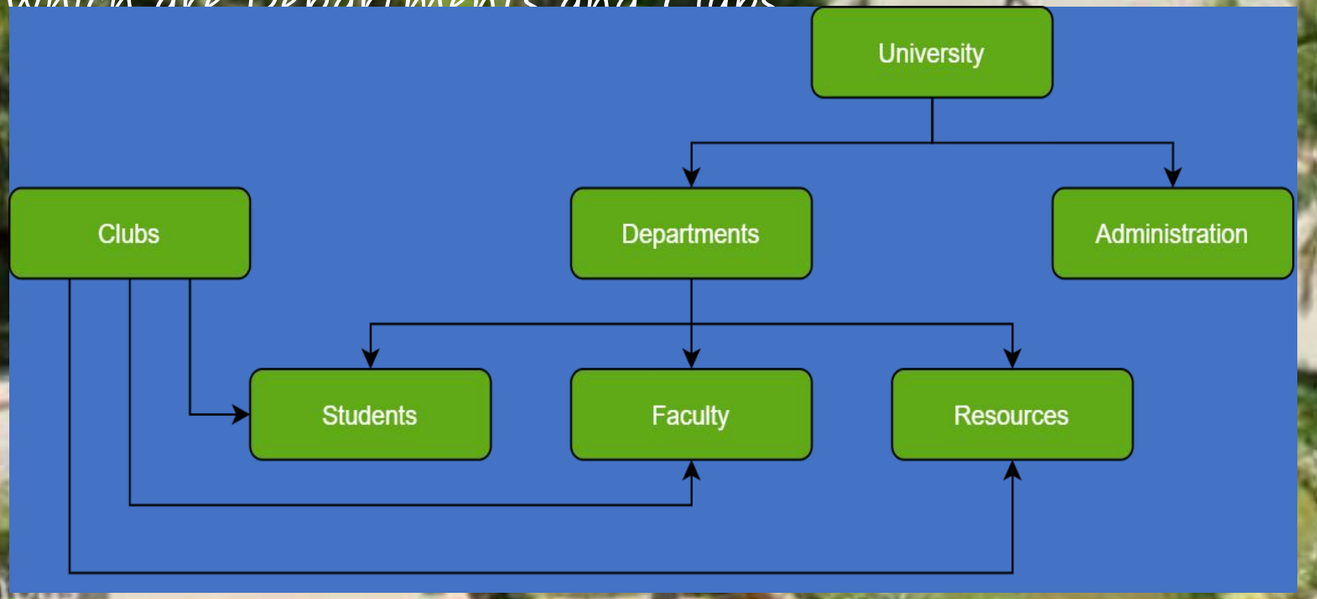
Types Of Database

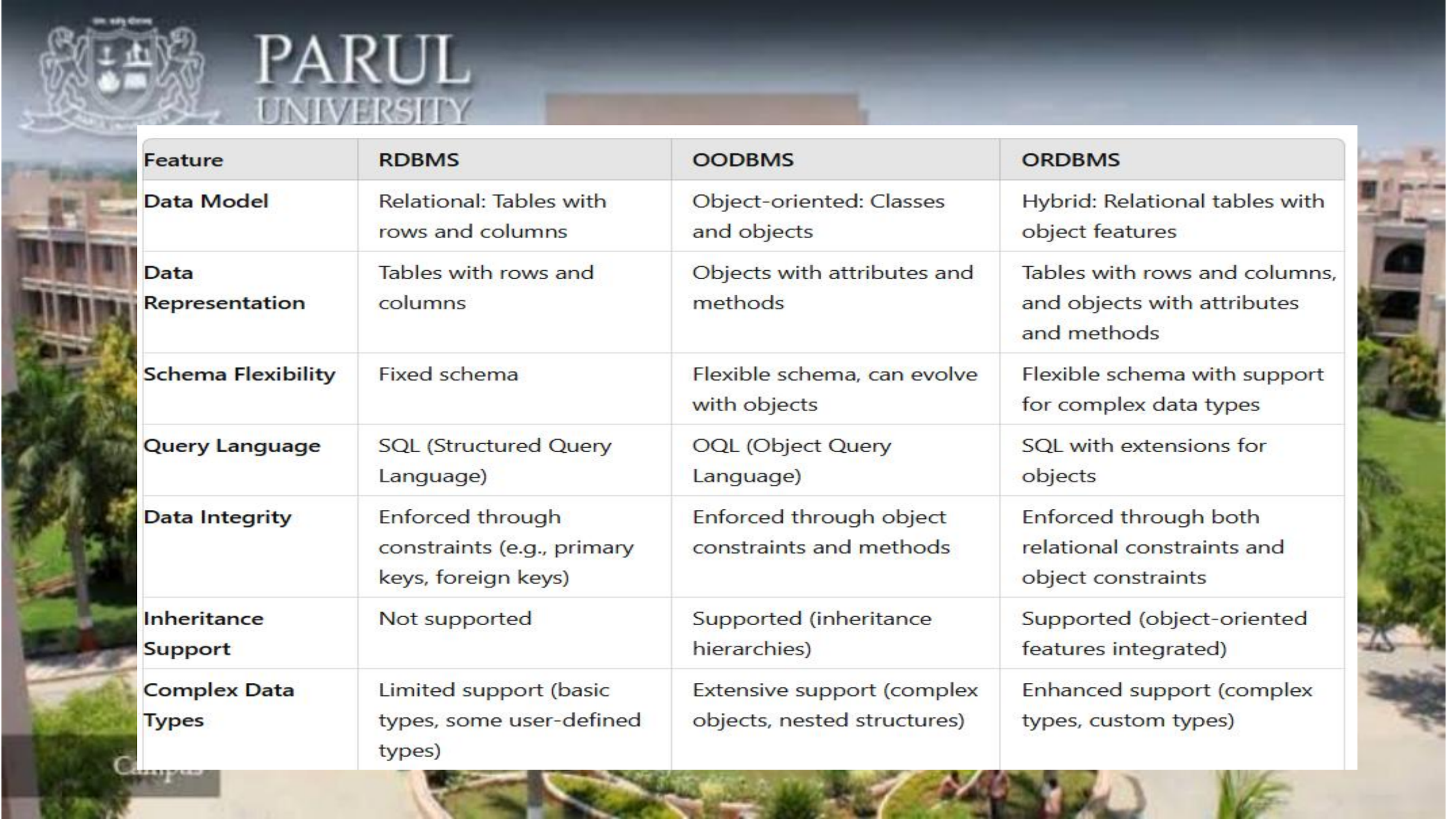
Network Databases

In Layman's terms, a network database is a hierarchical database, but with a major tweak. The child records are given the freedom to associate with multiple parent records. As a result, a network or net of database files linked with multiple threads is observed. Notice how the Student, Faculty, and Resources elements each have two-parent records, which are Departments and Clubs.



Certainly, a complex framework, network databases are more capable of representing two-directional relationships. Also, conceptual simplicity favors the utilization of a simpler database management language.

The disadvantage lies in the inability to alter the structure due to its complexity and also in it being highly structurally dependent.



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Feature	RDBMS	OODBMS	ORDBMS
Data Model	Relational: Tables with rows and columns	Object-oriented: Classes and objects	Hybrid: Relational tables with object features
Data Representation	Tables with rows and columns	Objects with attributes and methods	Tables with rows and columns, and objects with attributes and methods
Schema Flexibility	Fixed schema	Flexible schema, can evolve with objects	Flexible schema with support for complex data types
Query Language	SQL (Structured Query Language)	OQL (Object Query Language)	SQL with extensions for objects
Data Integrity	Enforced through constraints (e.g., primary keys, foreign keys)	Enforced through object constraints and methods	Enforced through both relational constraints and object constraints
Inheritance Support	Not supported	Supported (inheritance hierarchies)	Supported (object-oriented features integrated)
Complex Data Types	Limited support (basic types, some user-defined types)	Extensive support (complex objects, nested structures)	Enhanced support (complex types, custom types)

Performance	Efficient for simple, structured data	Efficient for complex data structures, object manipulation	Balances efficiency between structured and complex data
ACID Properties	Strongly supported	May vary, depends on implementation	Strongly supported, with extended support for complex types
Transaction Management	Well-defined, with robust transaction control	Varies, but generally supports transactions	Robust transaction management with support for complex transactions
Examples	MySQL, PostgreSQL, Oracle, SQL Server	db4o, ObjectDB, Versant	PostgreSQL (with object-relational extensions), Oracle (with object features)