Database Systems

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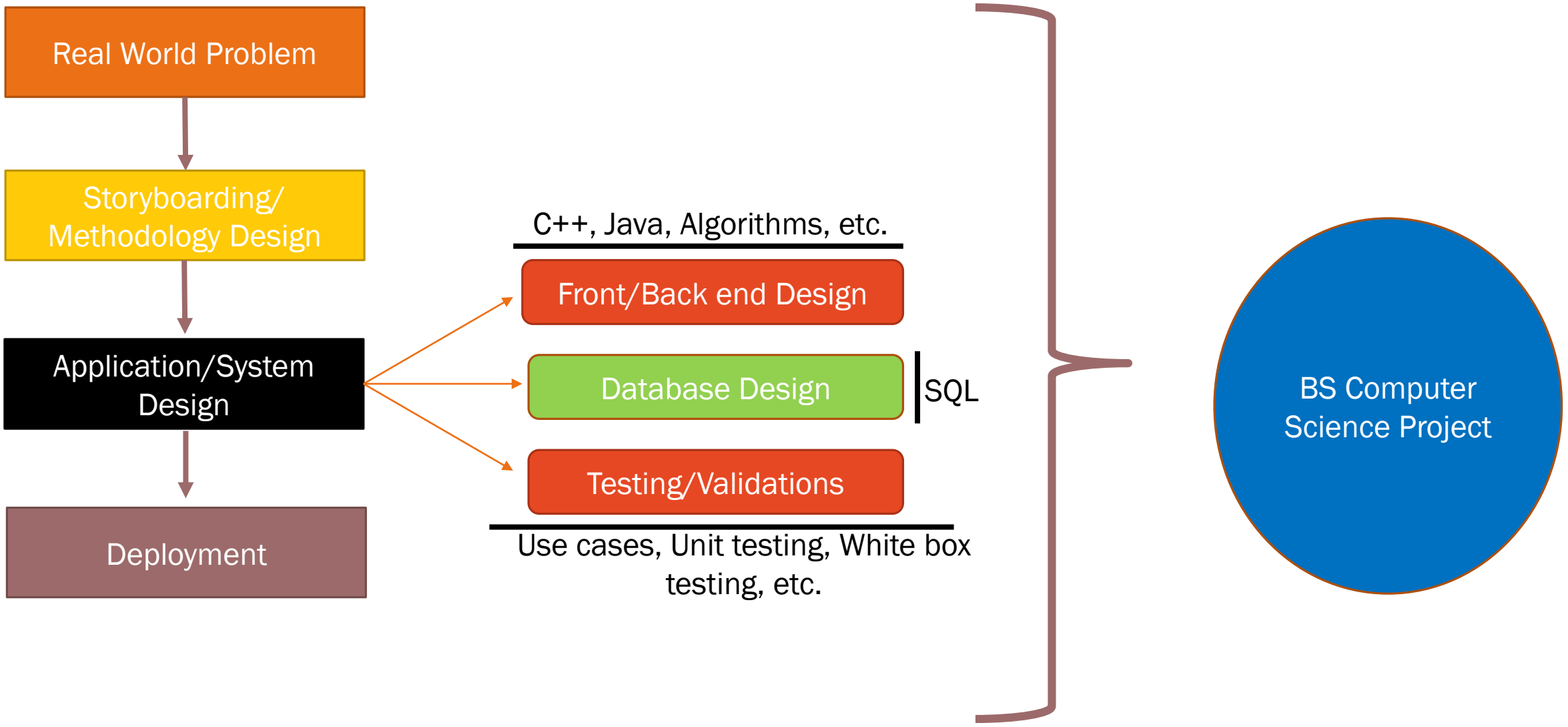

Real World Problem
Storyboarding/ Methodology Design
Application/System Design
Deployment
C++, Java, Algorithms, etc.
Front/Back end Design
Database Design
SQL
Testing/Validations
Use cases, Unit testing, White box testing, etc.
BS Computer Science Project

Contents

Introduction to Data, Information, Database & DBMS

Course Introduction

What is Data?

Facts that can be recorded. These facts can be stored in the form of text, numbers (traditional data), audio, images, video (multimedia data), etc.

What is Database?

Collection of ‘related’ datasets (files) that represents some real-world entities. Example, in a university related data would be data of faculty, data of students, etc. In a hospital, related data would be data of nurses, doctors, patients, etc.

If the changes are there in real-world entities, the changes should be reflected in the database.

Example, in a university website, there is a list of profiles of all the faculty. If a faculty member has left the university, the profile of the faculty should be deleted. If a faculty has been promoted in real-world, it should be updated in the profile, etc.

Course Introduction

What is Information?

Useful or meaningful data is ‘Information’.

Example, YouTube has a collection of all sorts of videos (data). Let’s say you want to search for database system videos, you will be displayed only the videos of database system. Therefore, those videos that you require are information for you.

What is Database Management System (DBMS)?

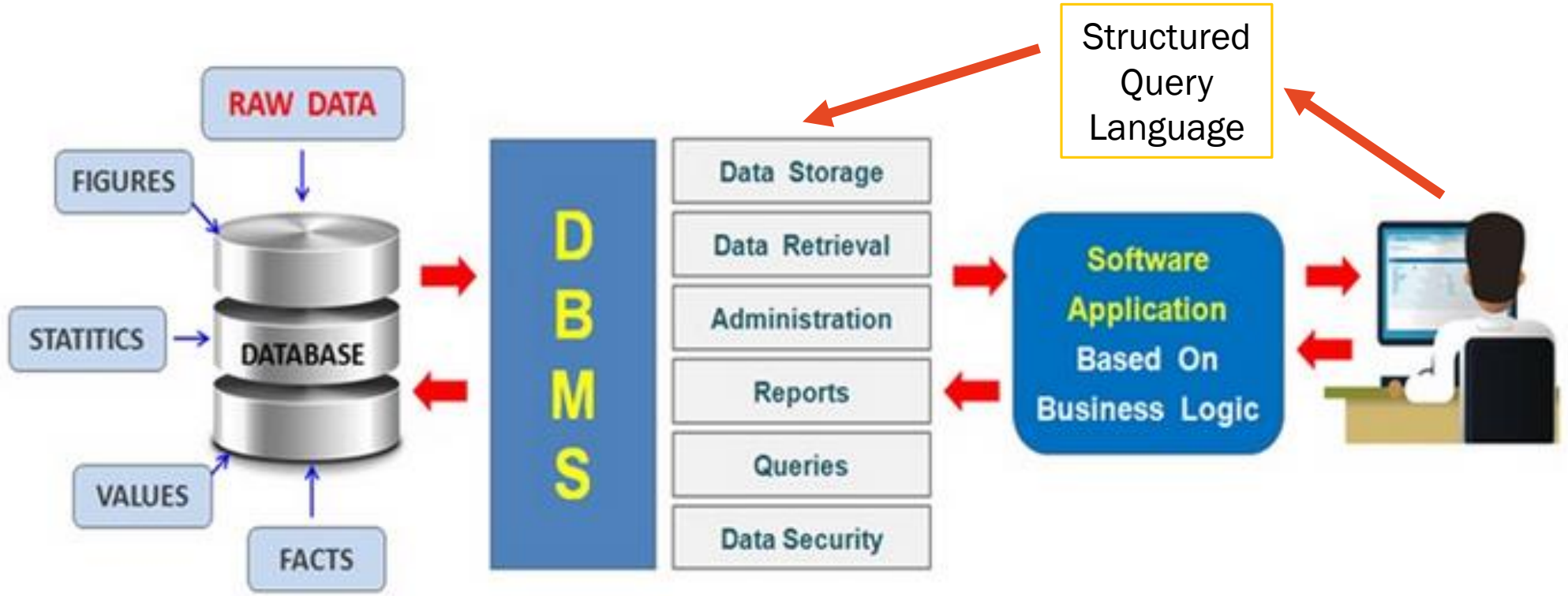
A software designed to create, store, retrieve, define, and manage data in a database.

This data is stored in tables in form of rows & columns. Rows/Tuples contain the information of a single entity/person, Columns are the attributes.

User interacts with the DBMS through query-based language – SQL

DBMS examples include: Oracle, MySQL, Microsoft Access, SQL Server, SQLite, etc.

Database System = DB + DBMS



Database System

History of DBMS

History of DBMS

1960 - Charles Bachman designed first DBMS system

1970 - Codd introduced IBM'S Information Management System (IMS)

1976- Peter Chen coined and defined the Entity-relationship model also know as the ER model

1980 - Relational Model becomes a widely accepted database component

1985- Object-oriented DBMS develops.

1990s- Incorporation of object-orientation in relational DBMS.

1991- Microsoft ships MS access, a personal DBMS and that displaces all other personal DBMS products.

1995: First Internet database applications

1997: XML applied to database processing. Many vendors begin to integrate XML into DBMS products.

Characteristics/ Objectives of DBMS

Characteristics of DBMS

Provides security and removes redundancy

Stores data in one central location

Support of multiple views of the data

Allows data to be shared by many users

DBMS allows entities and relations among them to form tables

Controls who can access and edit the data

Characteristics of DBMS

Real-world entity – A modern DBMS is more realistic and uses real-world entities to design its architecture. It uses the behavior and attributes too. For example, a school database may use students as an entity and their age as an attribute.

Relation-based tables – DBMS allows entities and relations among them to form tables. A user can understand the architecture of a database just by looking at the table names.

Less redundancy – DBMS follows the rules of normalization, which splits a relation when any of its attributes is having redundancy in values. Normalization is a mathematically rich and scientific process that reduces data redundancy.

Query Language – DBMS is equipped with query language, which makes it more efficient to retrieve and manipulate data. A user can apply as many and as different filtering options as required to retrieve a set of data.

Characteristics of DBMS

Multiuser and Concurrent Access – DBMS supports multi-user environment and allows them to access and manipulate data in parallel.

Multiple views – DBMS offers multiple views for different users. A user who is in the Sales department will have a different view of database than a person working in the Production department. This feature enables the users to have a concentrate view of the database according to their requirements.

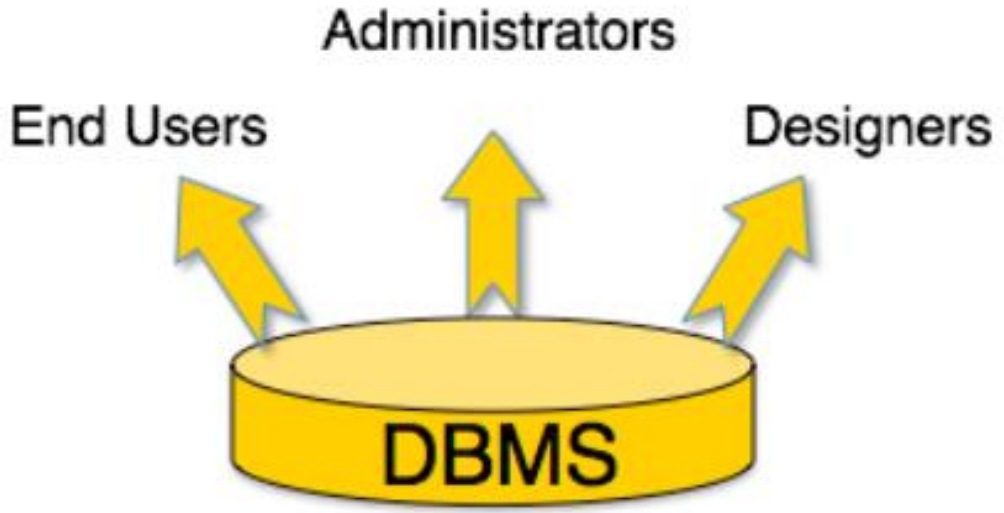
Security – Features like multiple views offer security to some extent where users are unable to access data of other users and departments.

Transparency

Users of DBMS

Users of the DBMS

A typical DBMS has users with different rights and permissions who use it for different purposes. Some users retrieve data and some back it up. The users of a DBMS can be broadly categorized as follows:



Users of the DBMS

Administrators – Administrators maintain the DBMS and are responsible for administrating the database. They are responsible to look after its usage and by whom it should be used. They create access profiles for users and apply limitations to maintain isolation and force security. Administrators also look after DBMS resources like system license, required tools, and other software and hardware related maintenance.

Designers – Designers are the group of people who actually work on the designing part of the database. They keep a close watch on what data should be kept and in what format. They identify and design the whole set of entities, relations, constraints, and views.

End Users – End users are those who actually acquire the benefits of having a DBMS. End users can range from simple viewers who pay attention to the logs or market rates to sophisticated users such as business analysts.

Applications of DBMS

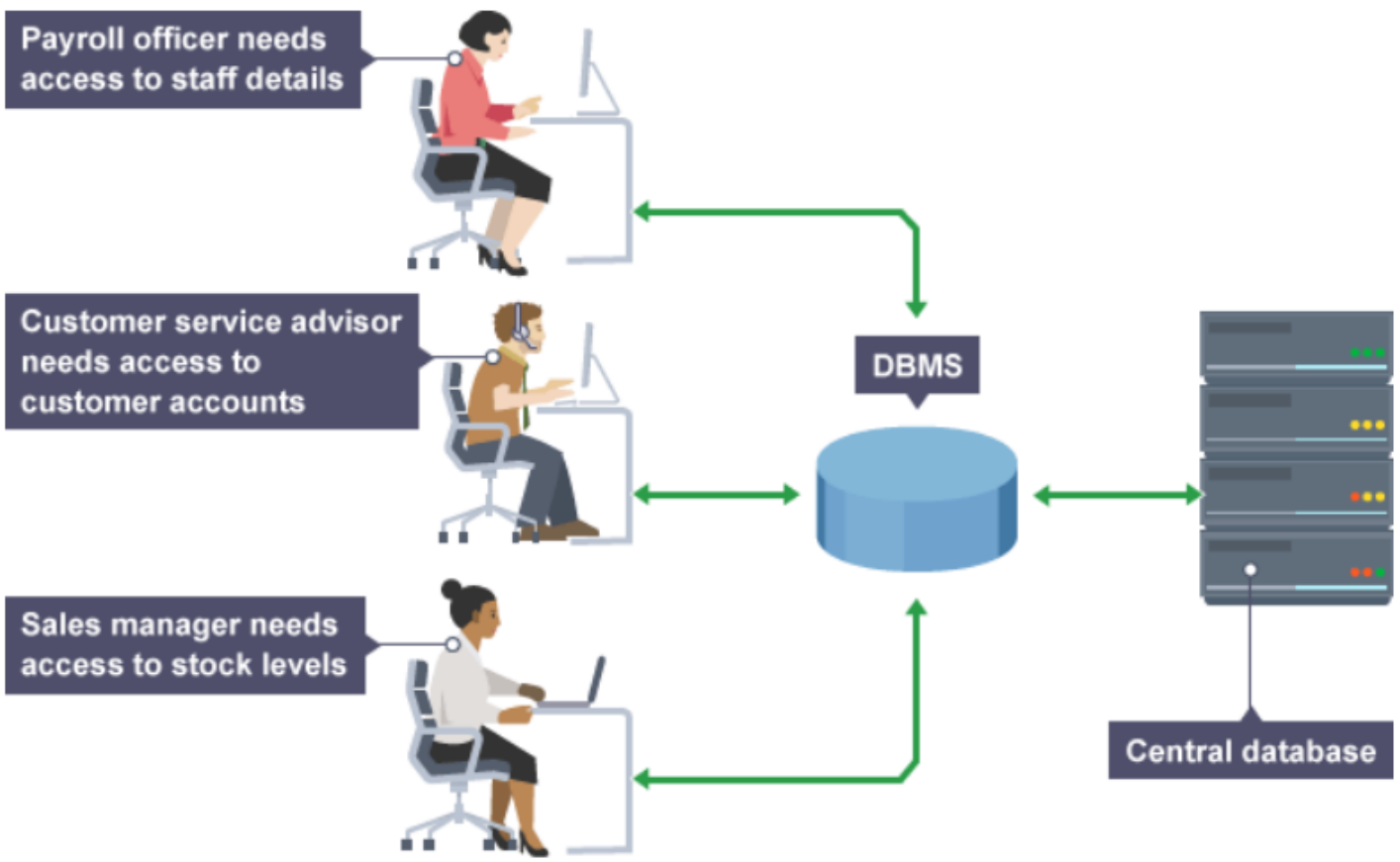
Applications of DBMS

Sector	Use of DBMS
Banking	For customer information, account activities, payments, deposits, loans, etc.
Airlines	For reservations and schedule information.
Universities	For student information, course registrations, colleges and grades.
Telecommunication	It helps to keep call records, monthly bills, maintaining balances, etc.
Finance	For storing information about stock, sales, and purchases of financial instruments like stocks and bonds.
Sales	Use for storing customer, product & sales information.
Manufacturing	It is used for the management of supply chain and for tracking production of items. Inventories status in warehouses.
HR Management	For information about employees, salaries, payroll, deduction, generation of paychecks, etc.

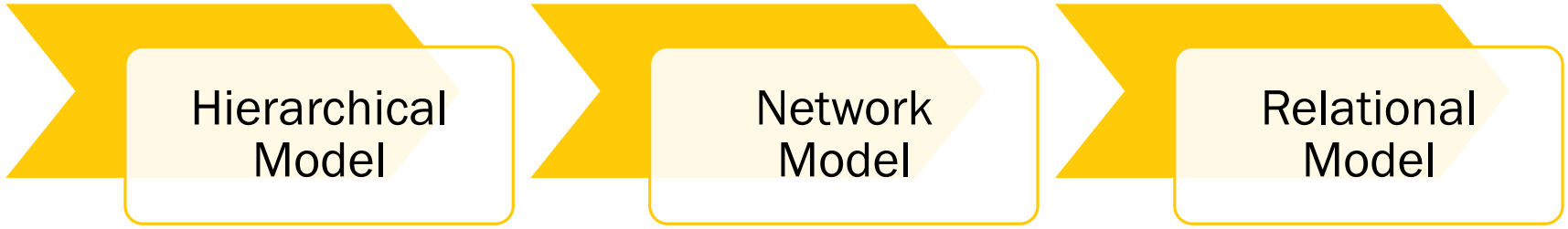
Example: Mobile Operator Company DBMS

A database in a DBMS could be viewed by lots of different people with different responsibilities.

Each employee in the company will have different levels of access to the database with their own customized front-end application.



Database Design Models



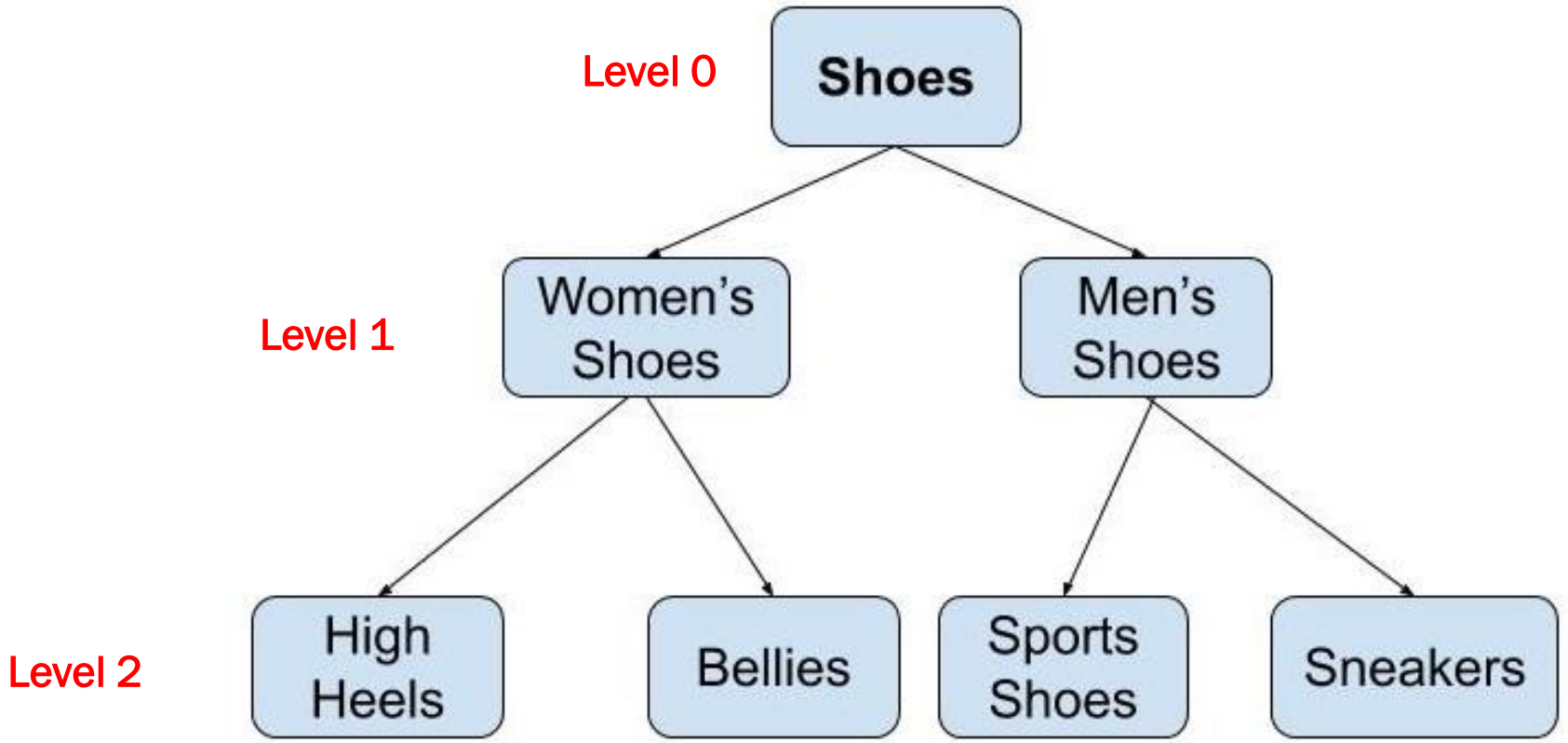
Database Design Models

1. Hierarchical Model

In a Hierarchical database, model data is organized in a tree-like structure.

Data is Stored Hierarchically (top down or bottom up) format.

Data is represented using a parent-child relationship. In Hierarchical DBMS parent may have many children, but children have only one parent.



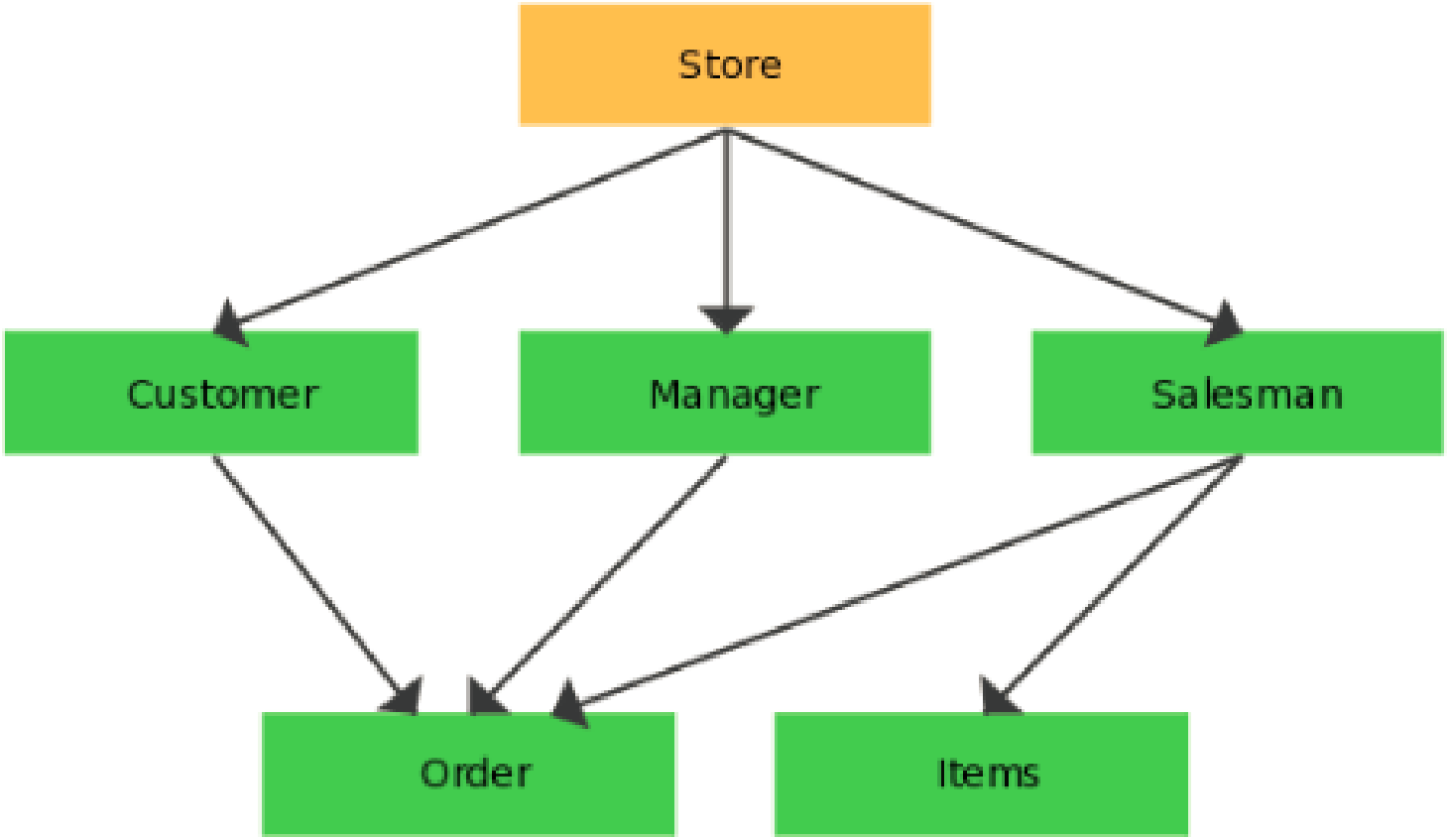
Hierarchical Model

2. Network Model

The network database model allows each child to have multiple parents.

It helps you to address the need to model more complex relationships like as the orders/parts many-to-many relationship.

In this model, entities are organized in a graph which can be accessed through several paths.

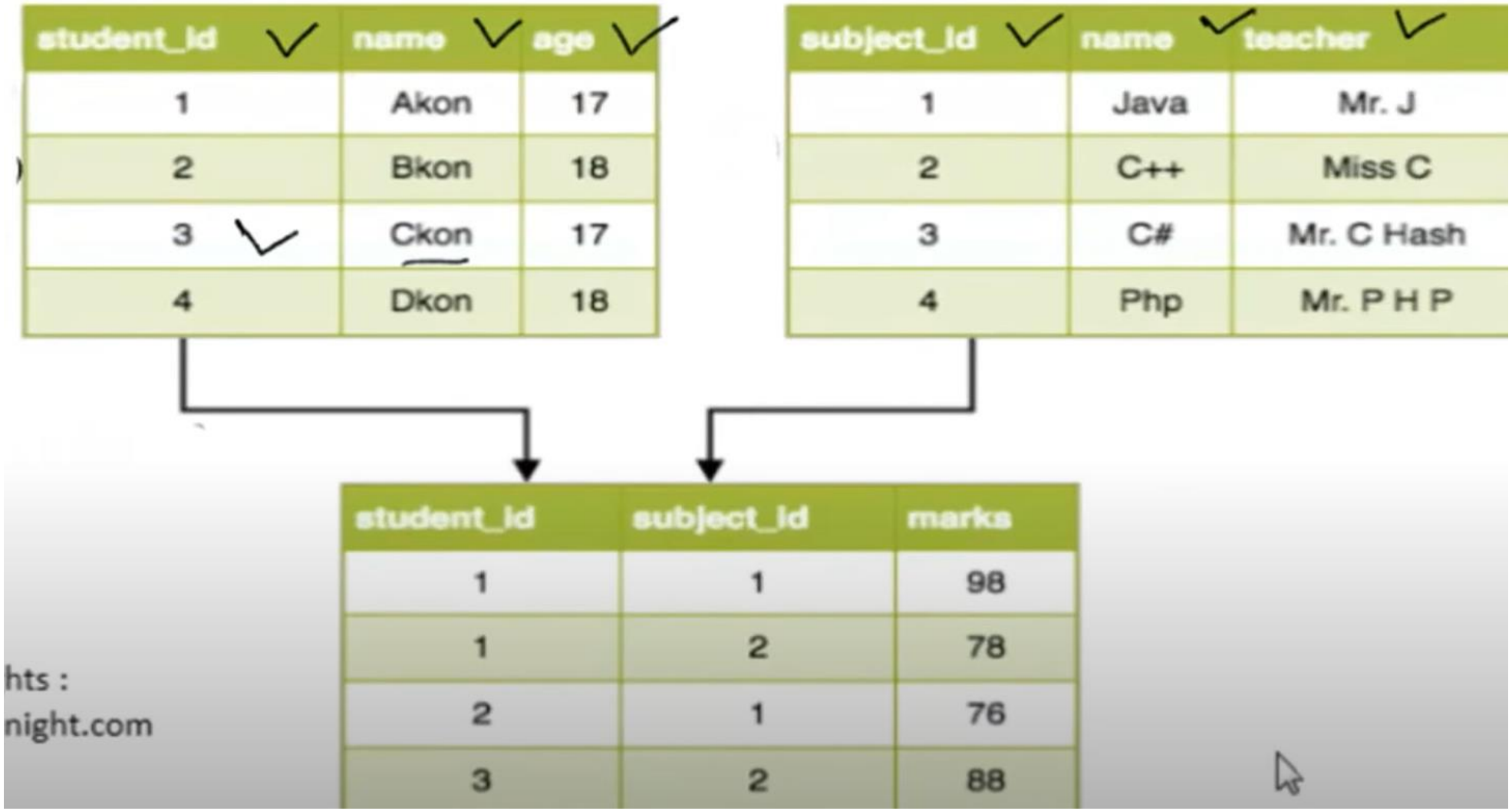

Store
Customer
Manager
Salesman
Order
Items

3. Relational Model

Relational DBMS is the most widely used DBMS model because it is one of the easiest. Has a name and its respective attributes

This model is based on normalizing data in the rows and columns of the tables.

Relational model stored in fixed structures and manipulated using SQL.



student_id	name	age
1	Akon	17
2	Bkon	18
3	Ckon	17
4	Dkon	18

subject_id	name	teacher
1	Java	Mr. J
2	C++	Miss C
3	C#	Mr. C Hash
4	Php	Mr. P H P

student_id	subject_id	marks
1	1	98
1	2	78
2	1	76
3	2	88

Lecture 03

- Database Architectures
- Database Development Life Cycle
- Database Techniques
  - Normalization
  - ER Modeling