IT1768 - Database Systems

Topic 3 :

Database Design

Unit 3 : Database Design

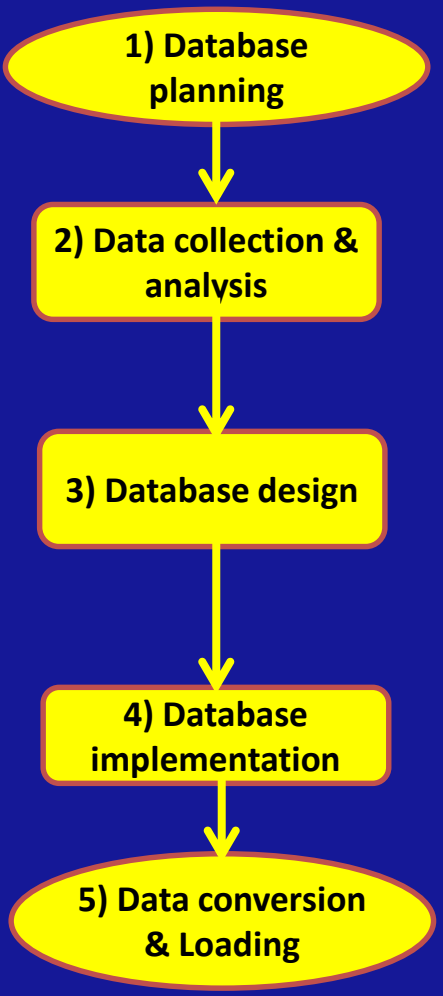
Objective :

- At the end of this unit, you should be able to:
  - describe the database development process.
  - list the developmental activities in each data development process.
  - label 3-level architecture of database and match it to the development process.

Video for self-study:
https://www.youtube.com/watch?v=6SH5FLccHi0

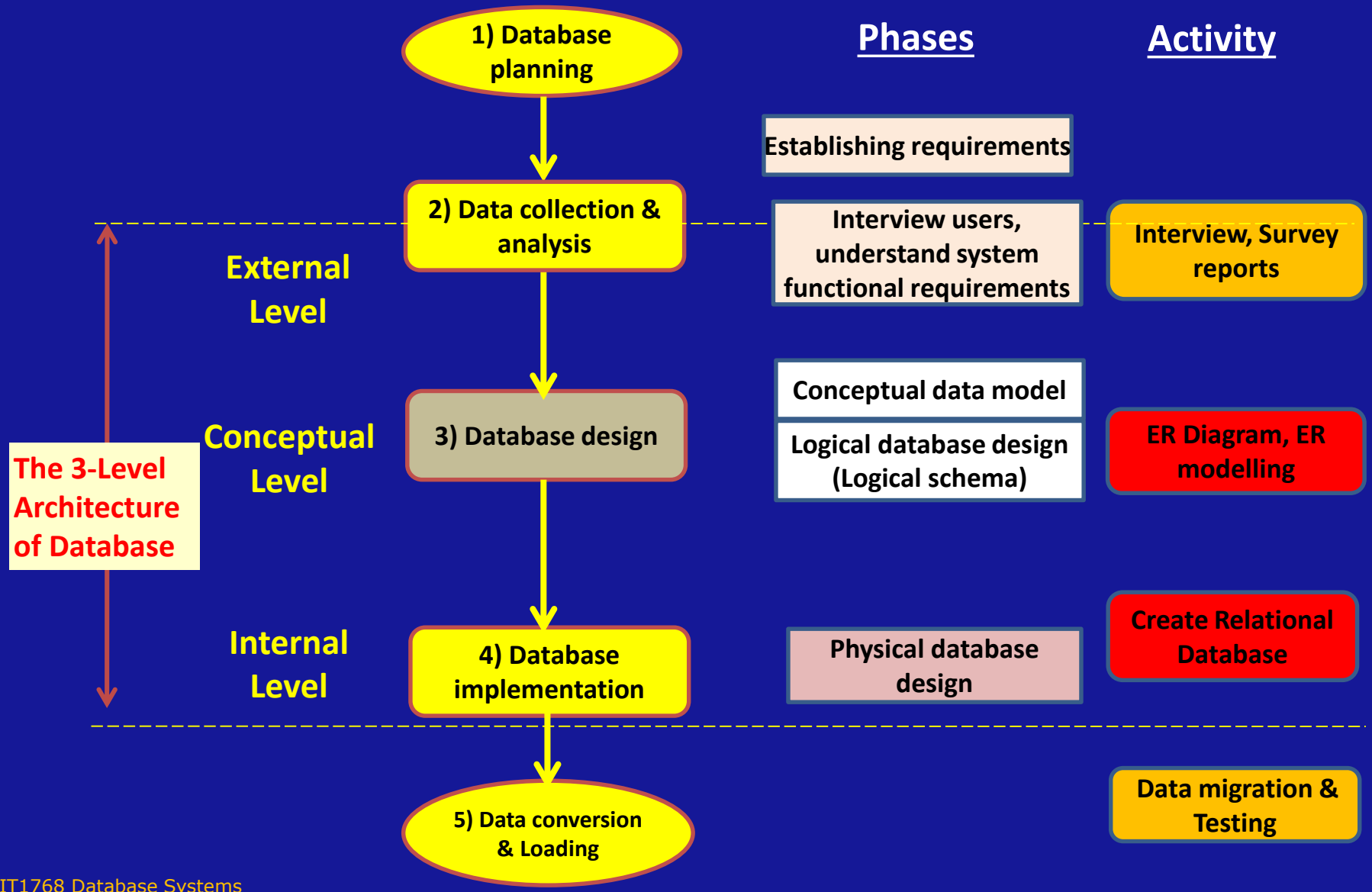
Database Development Process

The Database Development Process includes:

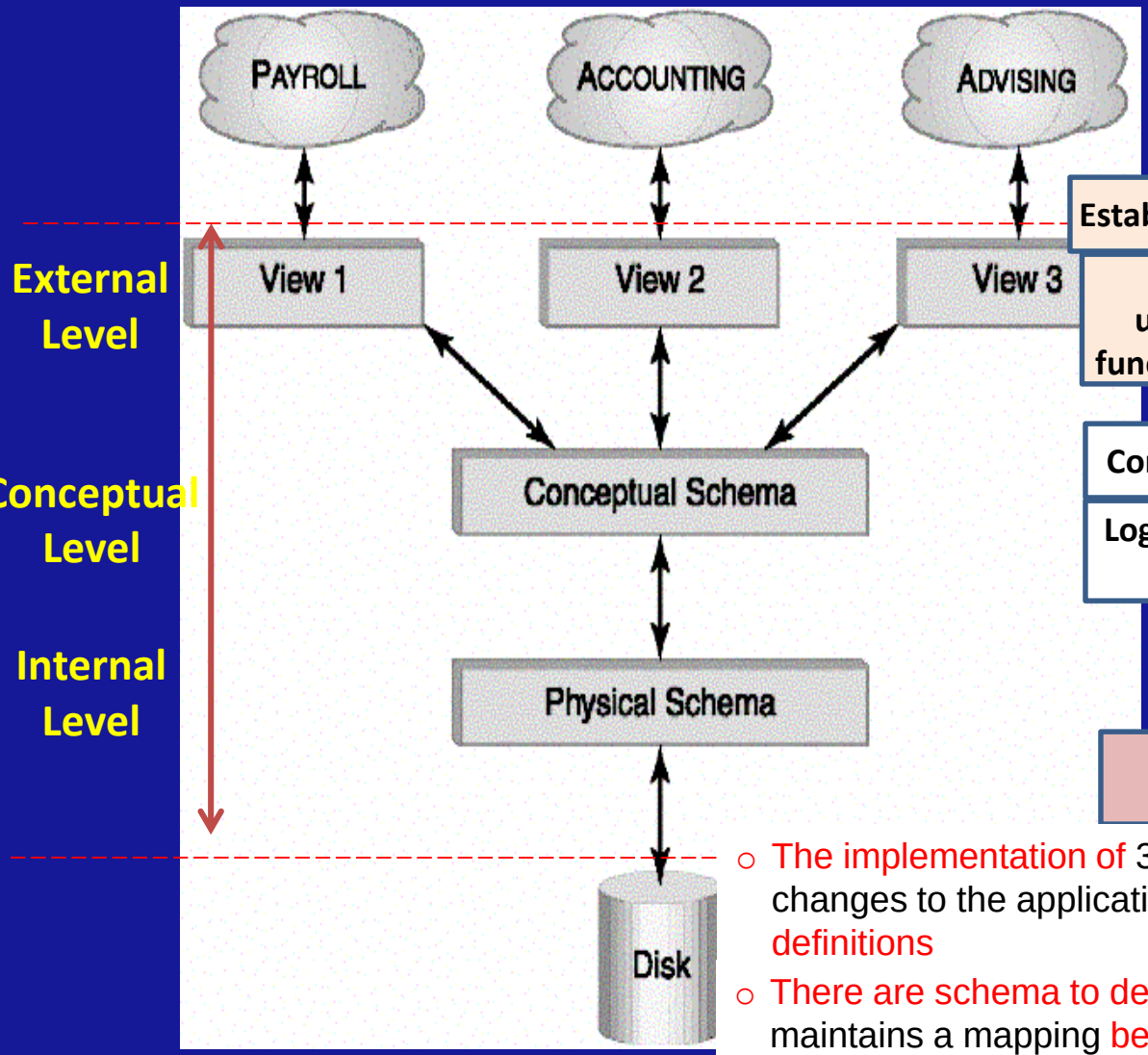


1) **Database planning**
   Examine system functions
   Evaluate system data requirement.
2) **Data collection and analysis**
   Interview users, understand system functional requirements
3) **Database design**
   a) Conceptual data modelling
   b) Logical database design (Relational model)
4) **Database implementation**
   Physical database design
   Create database, tables, logical schema etc.
5) **Data conversion and loading**
   Extract, filter & load data from old system
   Append new data

The 3-Level Architecture of Database



The 3-Level Architecture of Database

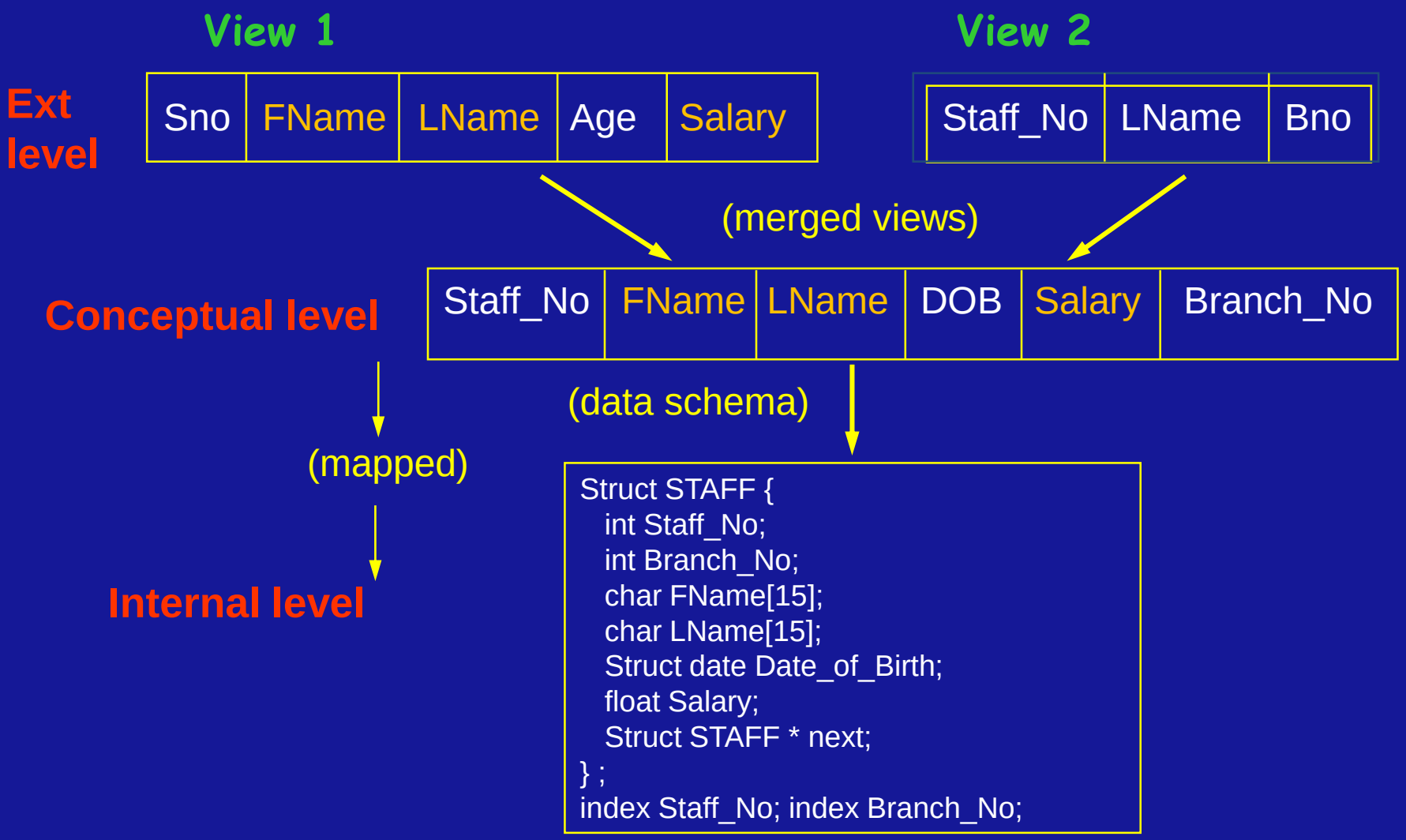


Phases

- **Establishing requirements**
  - Interview users, understand system functional requirements
- **Conceptual data model**
  - Logical database design (Logical schema)
- **Physical database design**

- The implementation of 3-level architecture helps to minimize changes to the application when there are changes to the data definitions
- There are schema to describe the data in each level. DBMS maintains a mapping between external to conceptual level, and conceptual to internal mapping. So that upper level is immune to the changes at the lower level.

3-Level Architecture database schema - Example



1) Database Planning

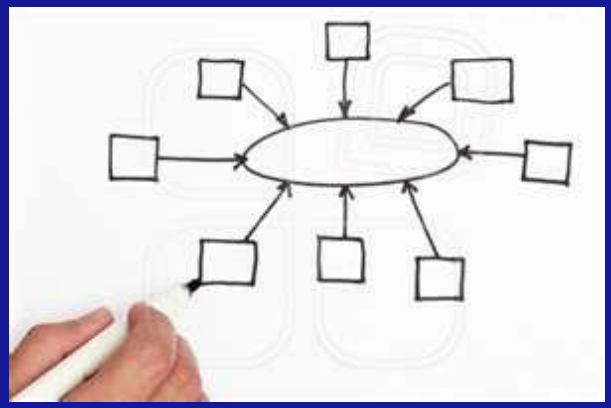
- Examining the expected functional requirements of system.
  - It involves How, Where, What and Who the requirements can be gathered.
- Establishing requirements involves **interviewing** all the users on:
  - the detailed functional requirements of the database systems with respect to their roles.
  - what persistent data they want to store, the meaning and interpretation of the data elements.
  - any constraints applied and relationships that hold between the data items.
  - any business legal and ethical issues within the organization that impact on the data requirements.

The data requirements document is used to confirm the understanding of requirements with users. The document should give a concise summary of all users' requirements.

2) Data Collection & Analysis

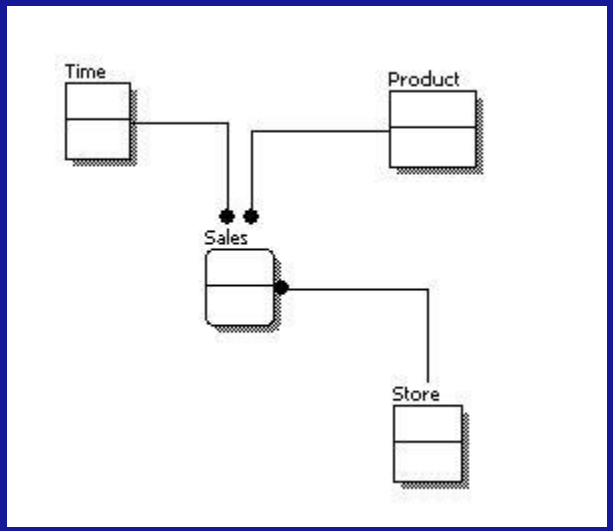
- From the established data plan, data to be collected in a systematic, well-organized manner.
  - This could be done through **interviews, surveys** conducted with the users and, consultation with data administrator.
  - Theses gathered data requirements would facilitate the effective analysis of data in constructing a profound database.
- It aims to obtain a detailed description of the data that will suit user requirements. (for example: minimum inventory quantity of items. Possible start date of programs etc.)

User

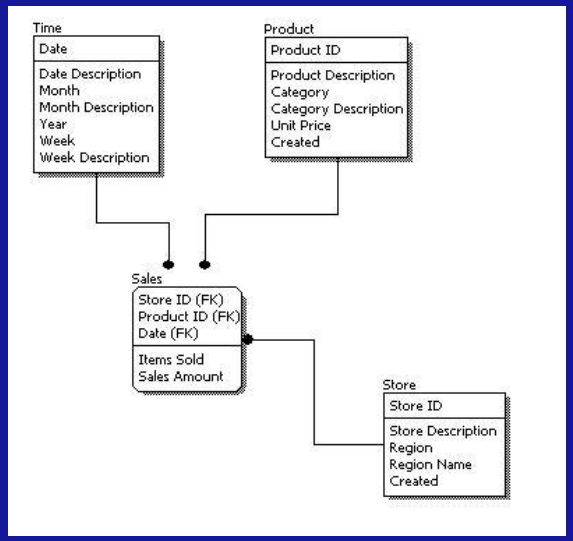


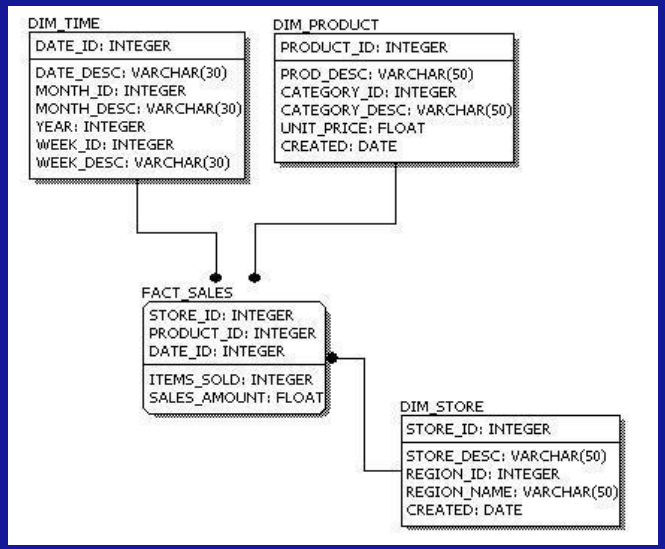
3) Database Design ... core development phase

a) Conceptual data model



b) Logical data modelling

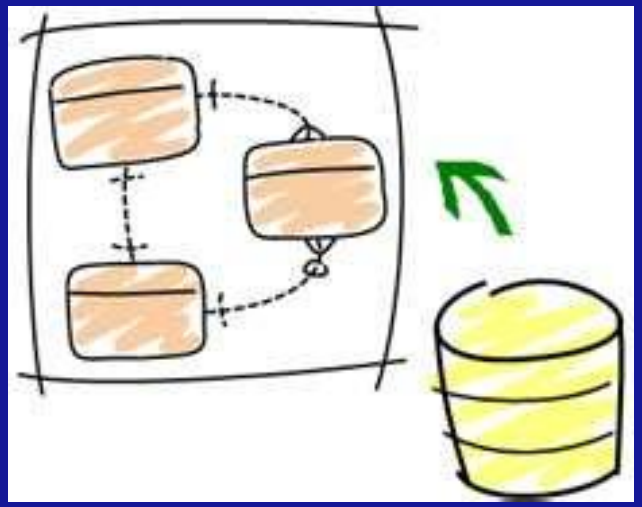




c) Physical data modelling

3a) Conceptual Data Modelling

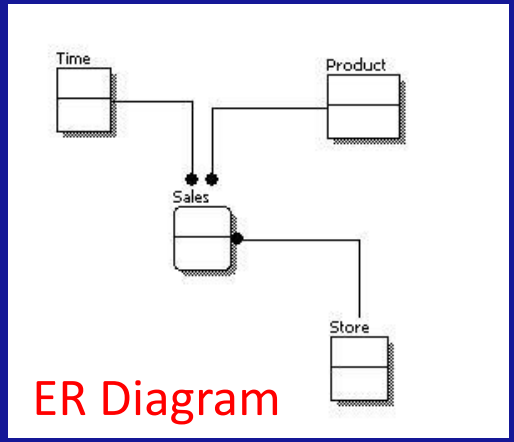
- It focuses on 'What is required' in the database.
  - It describes what data is being stored, their relationships among the data.
- It concerned with the **meaning and structure of data**, involving:
  - entities, data types, user operations, relationships and constraints that the data must satisfy.



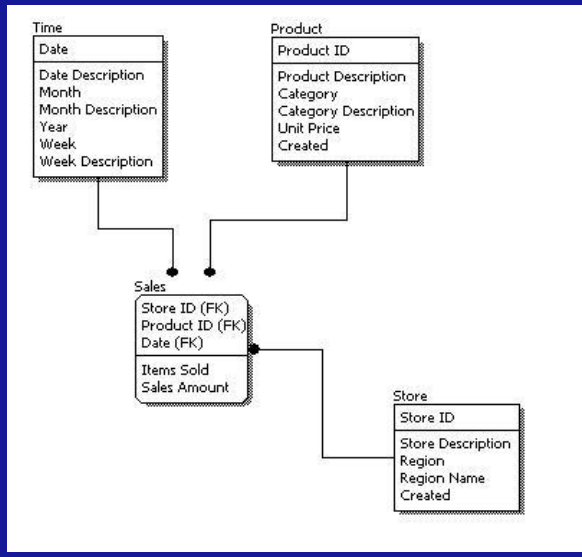
1) Database planning
2) Data requirement collection and analysis
3) **Database design**
   a) **Conceptual data modelling (ERD)**
   b) **Logical database design (tables)**
   c) **Physical database design**
4) Database implementation
5) Data conversion and loading

3b) Logical Database Design

- It uses the relational representation of the conceptual data model as input and produces the logical schema.
  - it is a detailed relational specification of all the tables and constraints satisfying the description of the data in the conceptual data model.



- It is the tables defined by the logical schema that determine what data are stored and how they may be manipulated in the database.
  - This will determine the specific type of database system (network, relational, object-oriented) that is required.



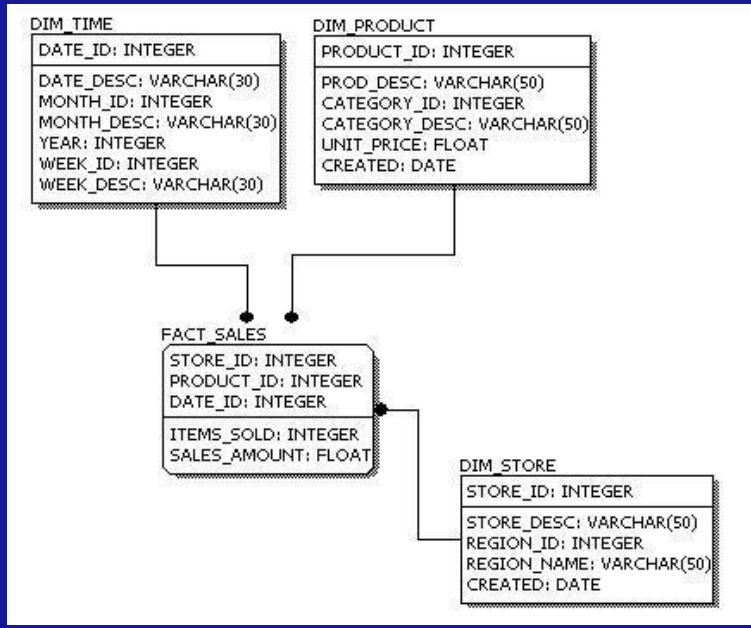
4) Database Implementation

❑ Physical database design

- It deals with the 'how' in the database design.

  - It involves the construction of a database according to the specification of a logical schema with best available implementing tools on the storage media.

  - Implementation includes entering data into tables, data types, indexing options, roles of users, efficient access of data, integrity constraints and security measures.



5) Data Conversion and Loading

- In pre-existing database system, some data were stored in heterogeneous platforms. Hence, these computer data are required to be converted from one format into another. While necessary, ETL (Extract, Transform and Load) process is used for filtering records with incomplete/missing values.
- To transfer any existing data into the new database and convert any existing applications to run on the new database.

External Internal

Self Assessment

External Planning process

(To answer, simply drag your answers to the cells.)

External Conceptual level

1) Database development process starts from :	
2) 3-Level architecture of database starts from _____ level.	
3) Which level deals with user survey, interview, evaluate system requirements?	
4) Data collection & analysis corresponds to the ____ level of architecture of database?	
5) Which level deals with conceptual data model and logical database design ?	
6) Database design deals with :	
7) Physical database design deals with :	
8) Physical database design matches to the ____ level in 3-level architecture of database?	

Creation of database ER Modelling

Self Assessment (Model solution)

1) Database development process starts from :	Planning process
2) 3-Level architecture of database starts from _____ level.	External
3) Which level deals with user survey, interview, evaluate system requirements?	External
4) Data collection & analysis corresponds to the ____ level of architecture of database?	External
5) Which level deals with conceptual data model and logical database design ?	Conceptual level
6) Database design deals with :	ER Modelling
7) Physical database design deals with :	Creation of database
8) Physical database design matches to the ____ level in 3-level architecture of database?	Internal

End of Topic 3