



Daniel Stori {turnoff.us}  
Thanks to [@jtomaszon](mailto:@jtomaszon)

Img source: [https://twitter.com/turnoff\\_us/status/1050722187794104320](https://twitter.com/turnoff_us/status/1050722187794104320)



CSCI 5408

**Dr. Saurabh Dey**  
**saurabh.dey@dal.ca**

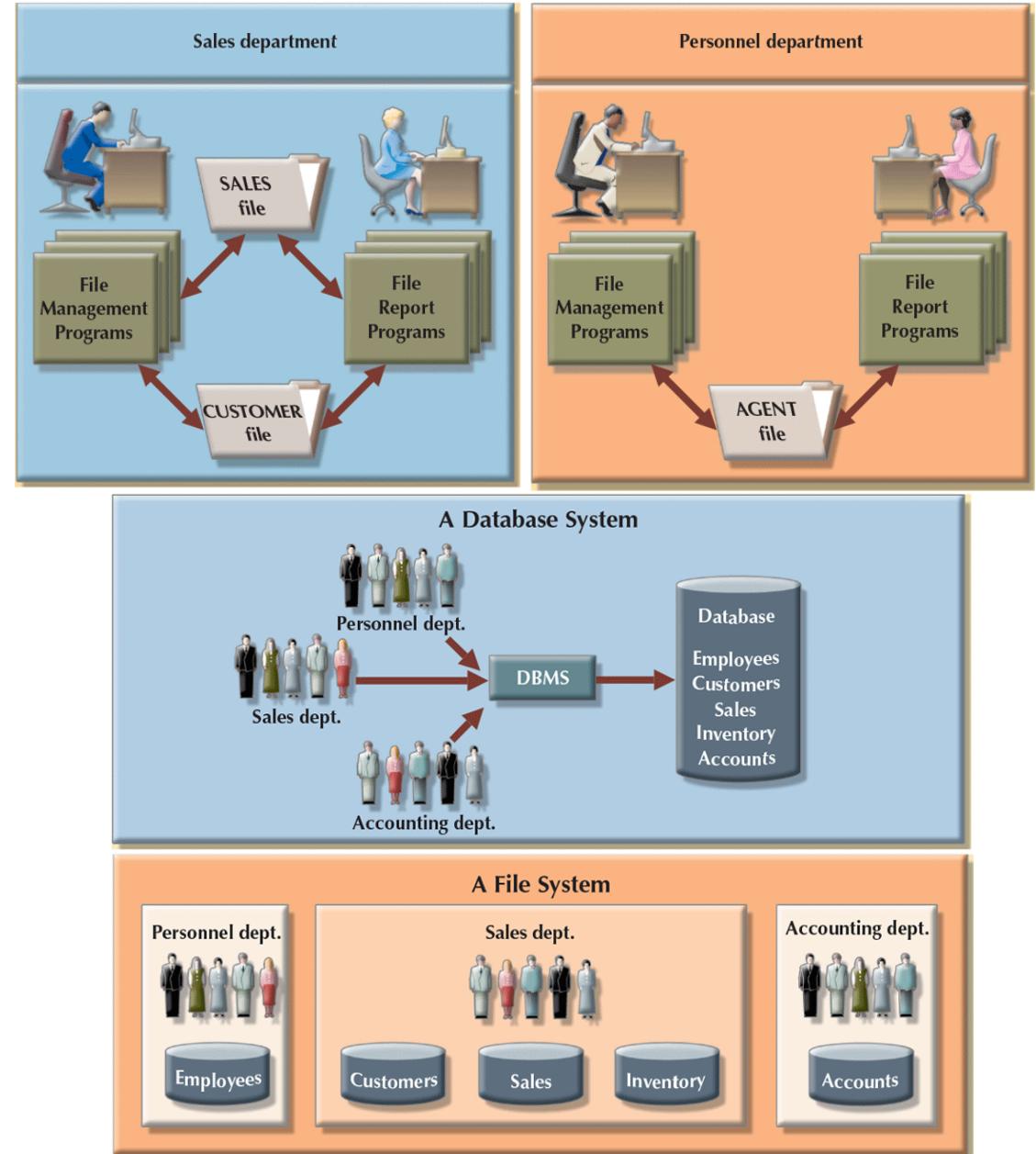
# Content

1. Why Database? What are the types?
2. Functions of DBMS
3. Data Modelling
4. Some key terms and definitions

# File System

## Problems with File system:

- Lengthy development times
- Difficulty of getting quick answers
- Complex system administration
- Lack of security and limited data sharing
- Extensive programming



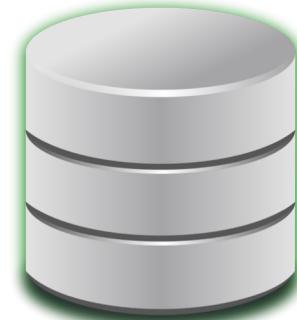
# Database Overview

## What is Database?

- Integrated computer structure that stores **data** [End-user data, Metadata].
- It could be shared.

## Database management system (DBMS)

- Collection of programs
- Manages the database structure
- Controls access to data stored in the database
- Enables data to be shared
- Presents the end user with an integrated view of data
- Provides more efficient and effective data management
- Improves sharing, security, integration, access, decision-making, productivity, etc.



# Some Important Definitions

## Data Dependence

- Data access are dependent on the physical data storage characteristics.

## Data Independence

- Data storage characteristics are changed without affecting the program's ability to access the data.

## Redundancy

- Same data at different places.

## Anomaly

- Develop when not all of the required changes in the redundant data are made successfully

# Database represents a Mini-World

---

A database represents some aspect of the real world, sometimes called the mini-world or the universe of the discourse (UoD). Changes to the mini-world are reflected in the database.



Img src: [https://www.cbc.ca/news/canada/nova-scotia/halifax-ferry-terminal-mill-cove-bedford-netzero-1.6075087](https://www.cbc.ca/news/canada/nova-scotia/halifax-ferry-terminal-mill-cove-bedford-net-zero-1.6075087)

# Types of Databases

## Database by Users:

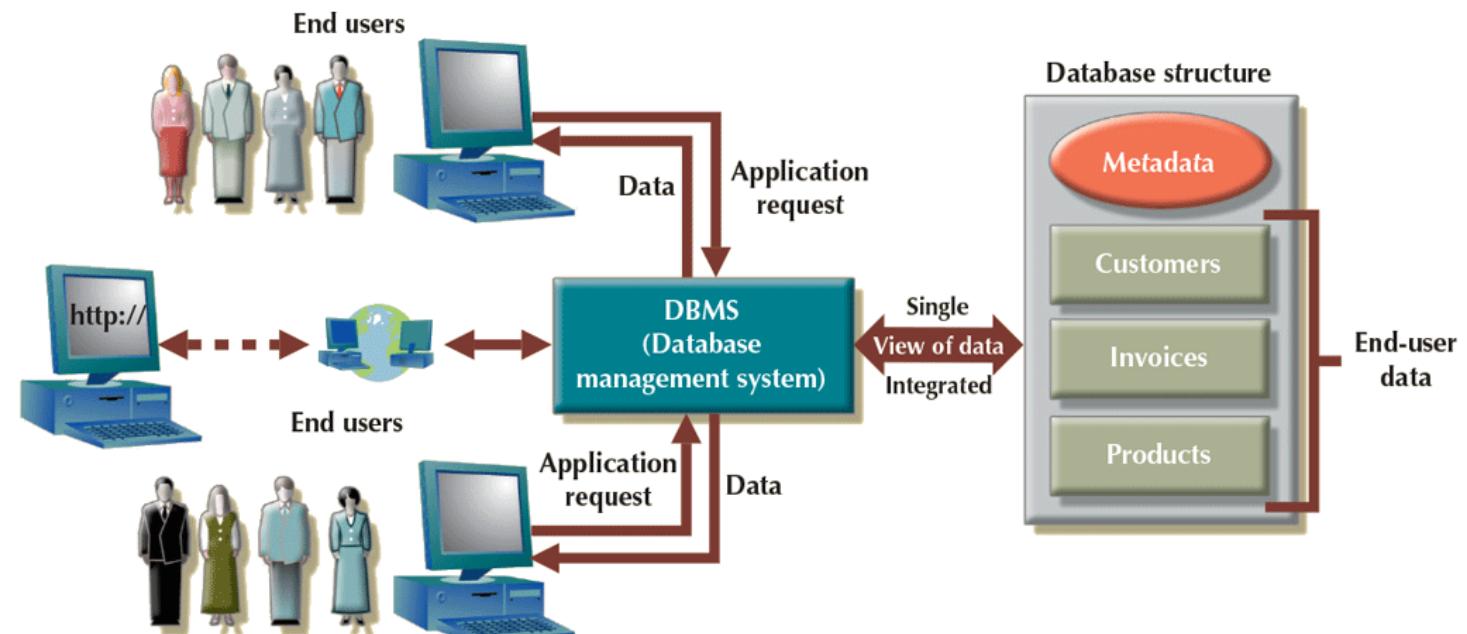
Single user, Multi-user

## Database by Location:

Centralized, Distributed, Cloud

## Database by Data type:

General-purpose, Discipline-specific,  
Operational



# Why Database Design is important?

- **Well-designed database:** facilitates data management and generates accurate and valuable information
- **Poorly designed database:** causes difficult-to-trace errors that may lead to poor decision making

# A Well-designed Database supports

- Capturing Data efficiently in correct format
- Efficient retrieval of data in correct format, which reflects the most updated value of the data.
- Record only what we need to avoid misuse of storage space
- tools and technologies that the project demands



# Functions of DBMS

Dictionary  
Management

Storage  
Management

Transformation  
& Presentation  
Management

Security  
Management

## Functions of DBMS

Multiuser access control

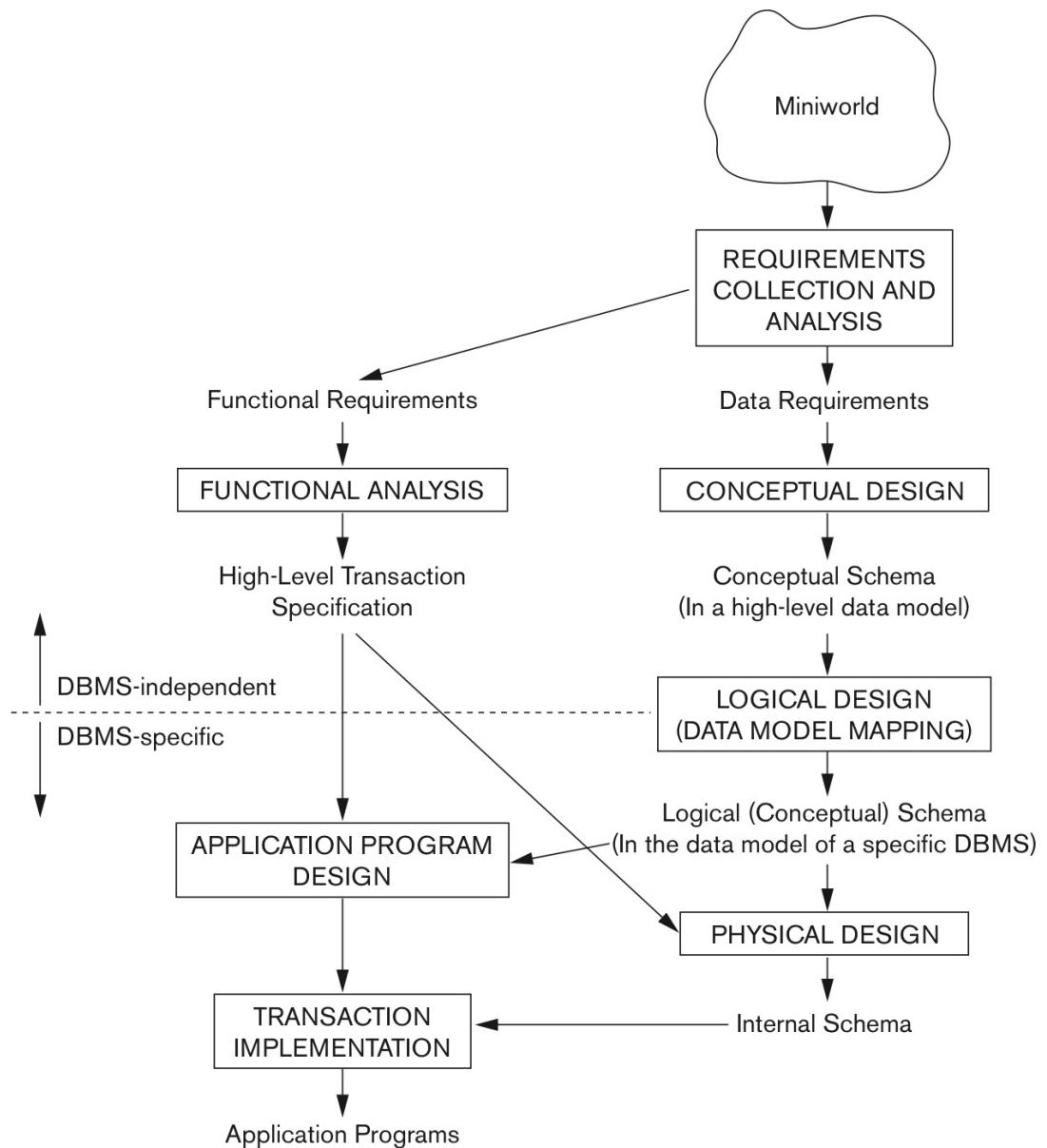
Backup & Recovery  
Management

Data Integrity  
Management

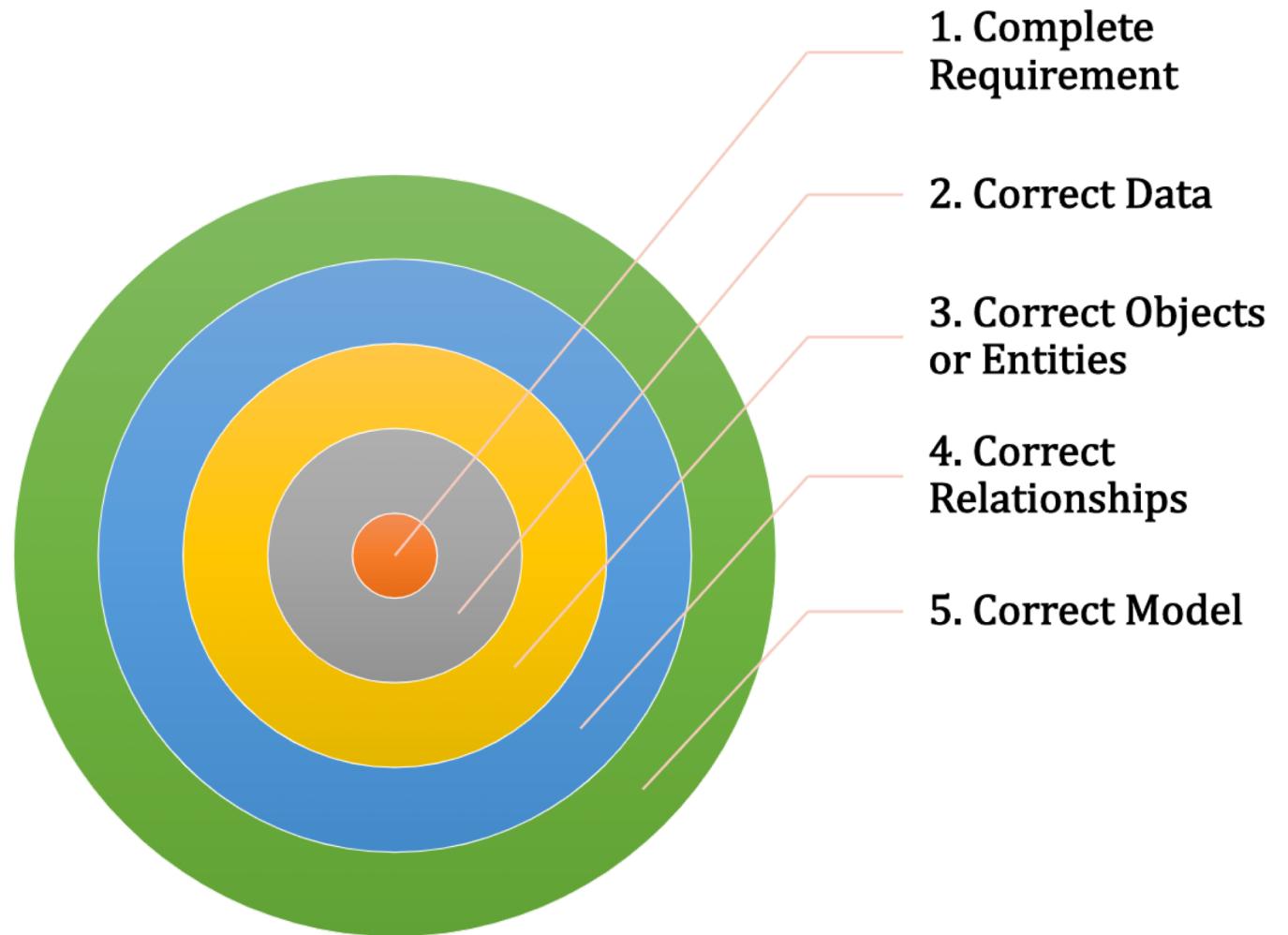
Database access  
languages & application  
programming interfaces

# Database Design Phases

- Two main activities:
  - Database design
  - Applications design



# Important Steps in Database Building



# Data Modelling

- High-level and abstract design phase, referred to as conceptual design
- Improves communication in the business
- Displays how data elements are related

“Data modeling is a representation of the data structures in a table for a company’s database and is a very powerful expression of the company's business requirements. This data model is the guide used by functional and technical analysts in the design and implementation of a database.

Data models are used for many purposes, from high-level conceptual models to physical data models.”

--Techopedia

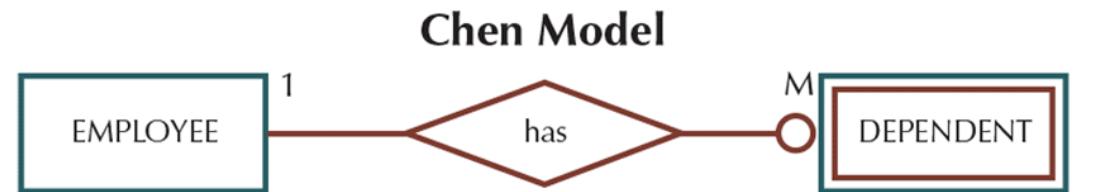
# ER Design

## Entity Relationship (ER) Design

**Entity:** Object of interest

**Attribute:** Characteristics of entities (Single valued, Multi-valued, simple, composite, derived)

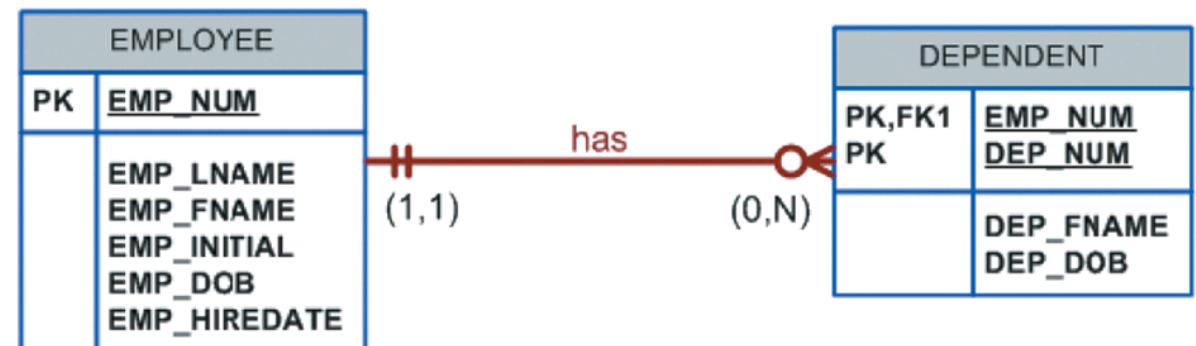
**Relationship:** Relationships describe associations among data. Most relationships describe associations between two entities.



EMP\_NUM  
EMP\_LNAME  
EMP\_FNAME  
EMP\_INITIAL  
EMP\_DOB  
EMP\_HIREDATE

EMP\_NUM  
DEP\_NUM  
DEP\_FNAME  
DEP\_DOB

**Crow's Foot Model**



# Relationship Types

1:1 [consider learning center a tutor is also a student]

Tutor **guides** Student (1:1)

1:N between instructor entity and student entity

Instructor **teaches** Class (1:N)

M instructor (entity) P Student (entity) N Course (entity)

**M** Instructor **teaches** **N** Course to **P** Student

**N** Course are **taught** by **M** Instructor to **P** Student

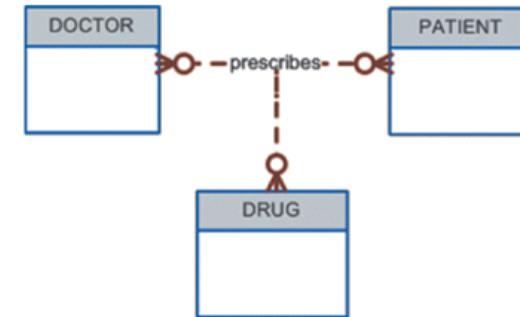
Unary relationship



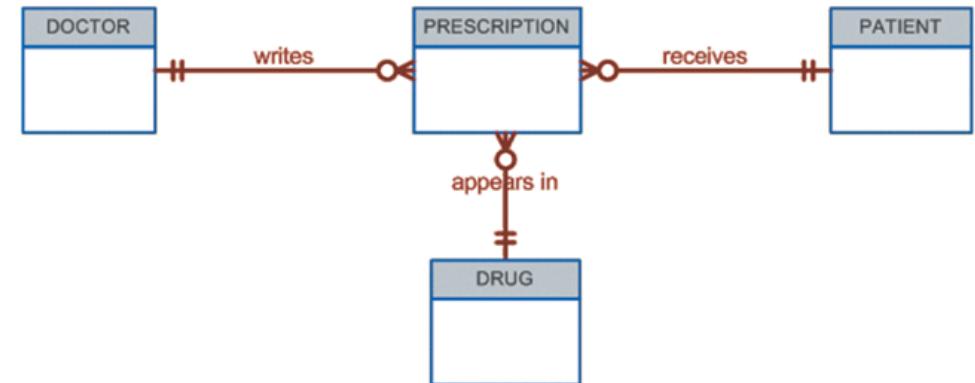
Binary relationship



Ternary relationship (Conceptual)

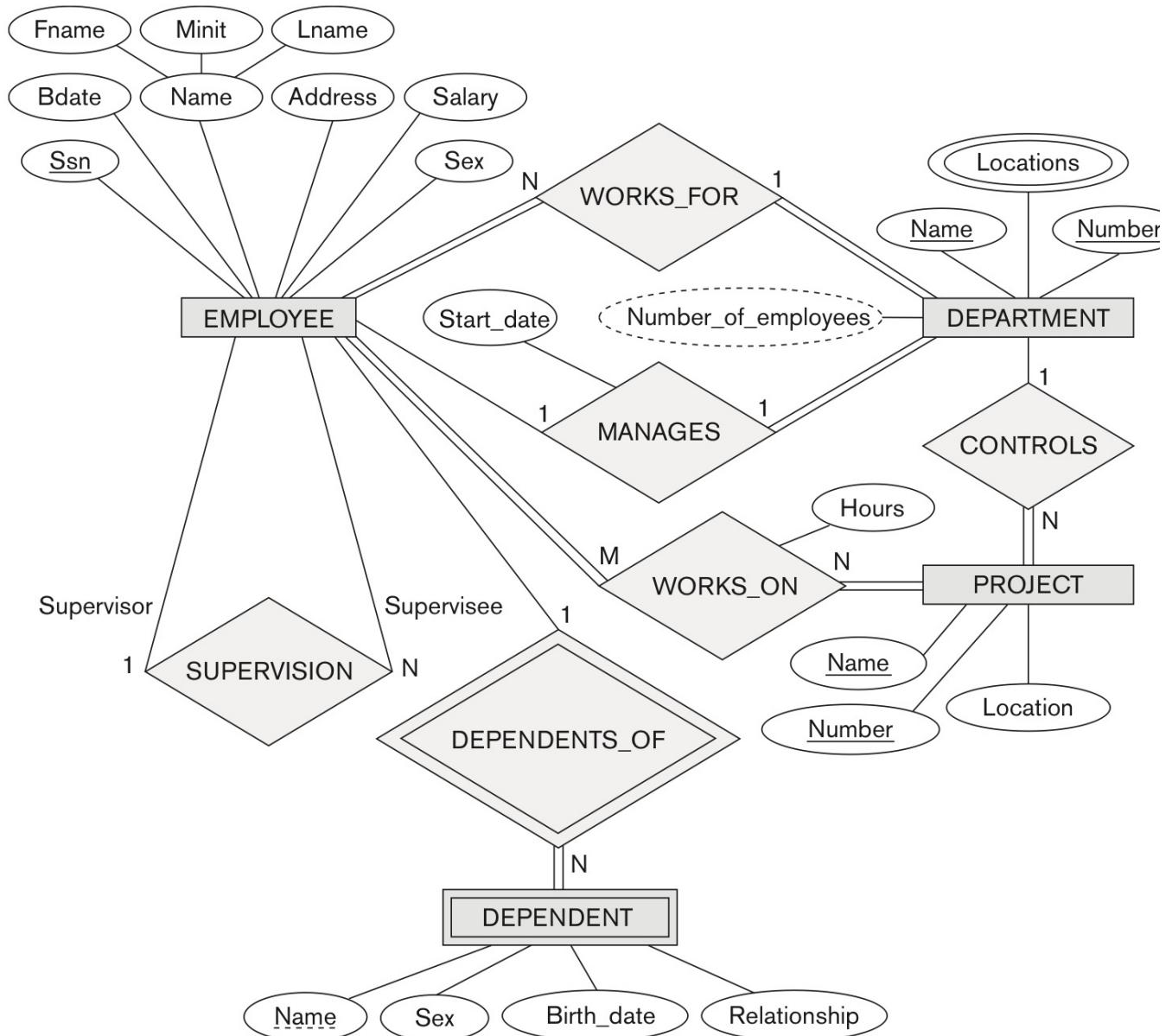


Ternary relationship (Logical)



# ER Schema Diagram

- Identify:
- Primary Key
- Weak Entity
- Total Participation
- Existence Dependency
- Partial Key
- Multivalued Attribute
- Composite Attribute
- Derived Attribute
- Partial Dependency
- Transitive Dependency



# End of Lecture Questions

1. A text file contains a single entry of a student's name, B00#, and address. Does it qualify as a relational database?
2. If general purpose database exists, then what is the need of other types of databases?
3. Can you build a database without using existing database technologies?

