The Entity-Relationship Model

ER Model Basics

- **Entity**: Real-world object distinguishable from other objects. An entity is described (in DB) using a set of **attributes**
- **Entity Set**: A collection of similar entities. E.g., all employees
  - All entities in an entity set have the same set of attributes
  - Each entity set has a **key**
  - Each attribute has a **domain**

ER Model Basics (Contd.)

- **Relationship**: Association among two or more entities.
  - E.g., Attishoo works in Pharmacy department.
- **Relationship Set**: Collection of similar relationships,
  - An n-ary relationship set R relates n entity sets E1, ..., En
  - Each relationship in R involves entities e1 in E1, ..., en in En

Relationships

- **Want to capture supervisor-subordinate relationship**
Want to capture information that a Supplier supplies Part to Department.

How are these different?

An employee can work in many departments; a dept can have many employees.

Each employee works in at least one department according to the participation constraint on Works_In.

What does this mean?
Weak Entities

- A weak entity can be identified uniquely only by considering the primary key of another (owner) entity.
  - Owner entity set and weak entity set must participate in a one-to-many relationship set (one owner, many weak entities).
  - Weak entity set must have total participation in this identifying relationship set.

ISA ("is a") Hierarchies

- As in C++, or other PLs, attributes are inherited.
  - If we declare A ISA B, every A entity is also considered to be a B entity.
- Overlap constraints: Can Joe be an Hourly_Emps as well as a Contract_Emps entity? (Allowed/disallowed)
- Covering constraints: Does every Employees entity also have to be an Hourly_Emps or a Contract_Emps entity? (Yes/no)
- Reasons for using ISA:
  - To add descriptive attributes specific to a subclass.
  - To identify entities that participate in a relationship.

Aggregation

- Used when we have to model a relationship involving (entity sets and) a relationship set.
  - Aggregation allows us to treat a relationship set as an entity set for purposes of participation in (other) relationships.
- Aggregation vs. ternary relationship:
  - Monitors is a distinct relationship, with a descriptive attribute.
  - Also, can say that each sponsorship is monitored by at most one employee.

Conceptual Design Using the ER Model

- Design choices:
  - Should a concept be modeled as an entity or an attribute?
  - Should a concept be modeled as an entity or a relationship?
  - Identifying relationships: Binary or ternary? Aggregation?
- Constraints in the ER Model:
  - A lot of data semantics can (and should) be captured.
  - But some constraints cannot be captured in ER diagrams.

Summary of Conceptual Design

- Conceptual design follows requirements analysis
- ER model popular for conceptual design
- Basic constructs: entities, relationships, and attributes
- Some additional constructs: weak entities, ISA hierarchies, and aggregation.
- Note: There are many variations on ER model.