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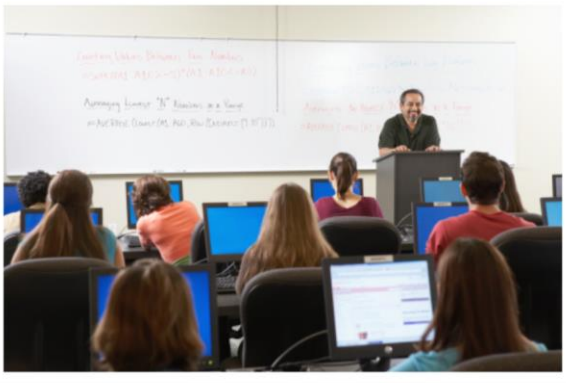
Database Design

7-2

Hierarchies and Recursive Relationships



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Objectives

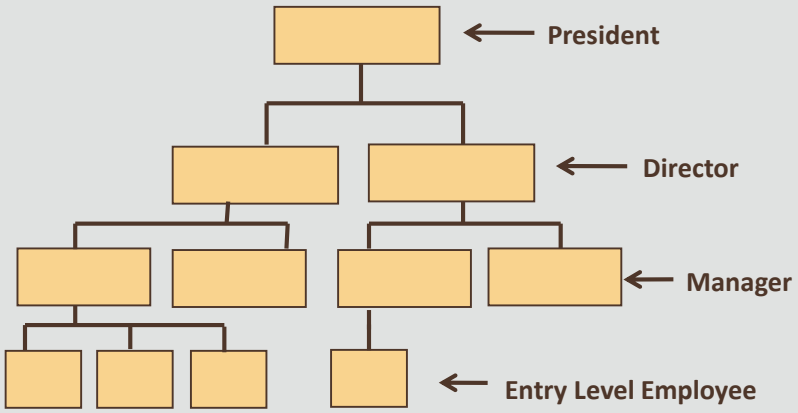
- This lesson covers the following objectives:
  - Define and give an example of a hierarchical relationship
  - Identify the UIDs in a hierarchical model
  - Define and give an example of a recursive relationship
  - Represent a recursive relationship in an ERD given a scenario
  - Construct a model using both recursion and hierarchies to express the same conceptual meaning

Purpose

- Often, roles are organized by hierarchy -- at work (manager, crew chief, front-counter clerk, food preparers), or in school (headmaster or principal, assistant headmaster or assistant principal, teachers, staff)
- Hierarchical data is very common
- Understanding it will help you model:
  - Business organizational charts
  - Building structures
  - Family trees
  - and many other hierarchies found in the real world

Relationships in an Organizational Chart

- An Organization's reporting hierarchy can be represented by this organizational chart



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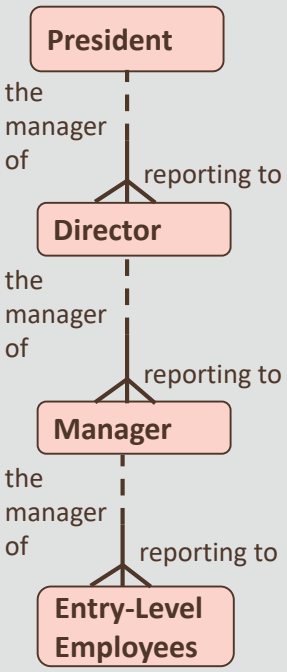
Other hierarchical structures include: government, military, biology (species, genus ….).

Relationships in an Organizational Chart

- An organizational chart can be represented by this data model
- We create an entity for each level, with a relationship to the next level
- What are the UIDs for each entity?



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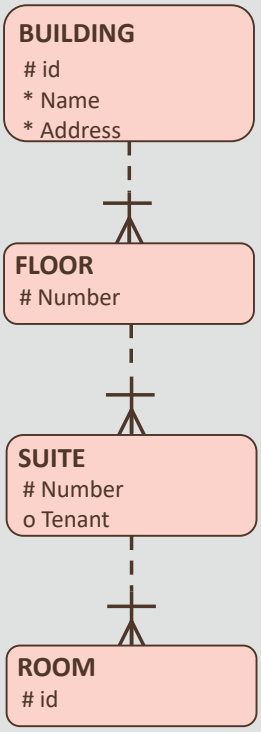
The UIDs would probably be an employee ID or number for each entity.

Another Relationship Example

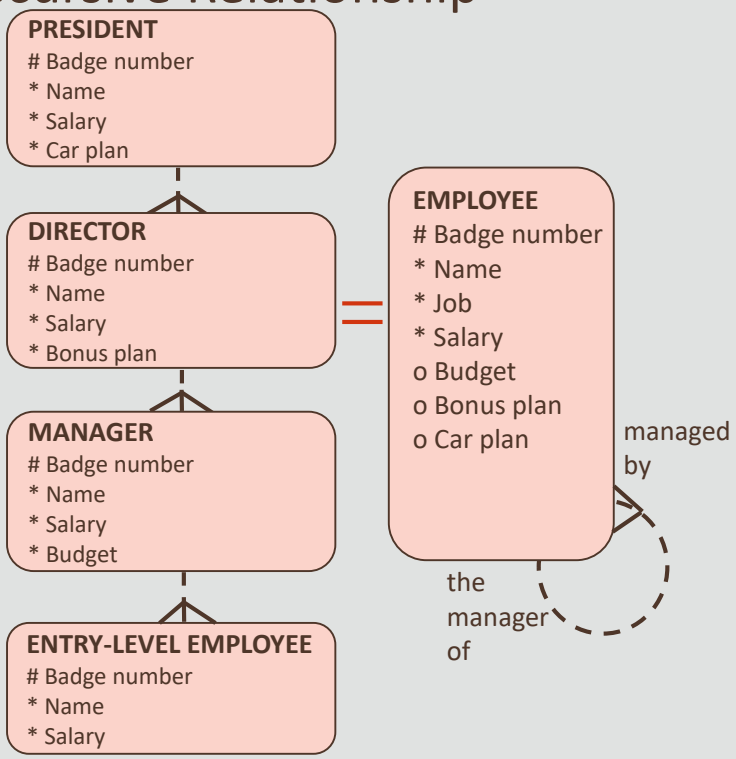
- Notice the barred relationships
- Here you have a case of the cascading UIDs:
  - the UID of FLOOR is the combination of FLOOR number and the BUILDING id
  - the UID of SUITE is the combination of SUITE number and the FLOOR number and the BUILDING id
  - the UID of ROOM is the combination of ROOM id and SUITE number and FLOOR number and the BUILDING id



This may be convenient in the sense that the UID of a ROOM will also tell you the SUITE and FLOOR and BUILDING that it's in.
However, this makes for a rather long UID. Unique independent, artificial codes may be more practical. Also, if the hierarchical structure changes often, use artificial identifiers. (If we were to add a level called APARTMENT in between FLOOR and SUITE, think of how that would affect the UIDs of all SUITEs and ROOMs!)

Hierarchy Versus Recursive Relationship

- Both of these models represent all employees
- The one on the left is a hierarchical structure
- The one on the right uses a recursive relationship



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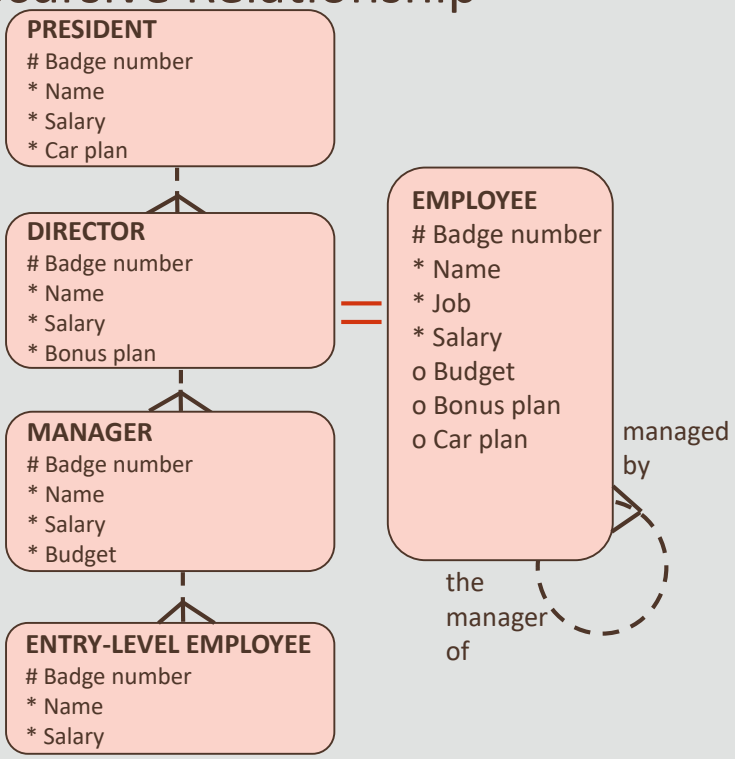
Hierarchical relationship: A series of relationships that reflect entities organized into successive levels.
Recursive relationship: A relationship between an entity and itself.
The mandatory attributes specific to an entity (bonus plan, car plan, and budget) become optional in the recursive model.
This recursive relationship is fully optional, otherwise, the hierarchy would not have a top or bottom. For example: “Who manages the president?” No one! One instance of the entity does not have a manager. Entry-Level Employees do not manage anyone, hence, the relationship must be fully optional in the recursive model.

Hierarchy Versus Recursive Relationship

- A relationship cannot be both hierarchical and recursive at the same time
- Which one do you think is better?



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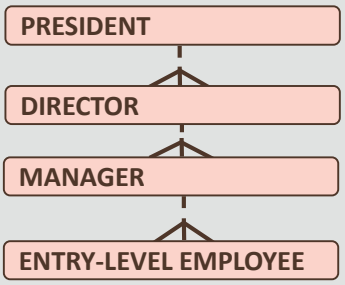
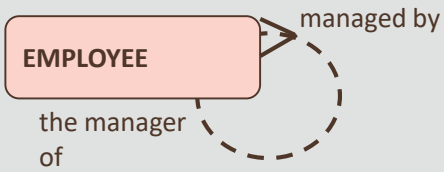
Hierarchy Versus Recursive Relationship

- Hierarchical:
  - Hierarchical structures are more explicit and are easier for most people to understand because they are very similar to an organizational chart
  - Each entity can have its own mandatory attributes and relationships, if the business requires this (instead of all optional attributes and relationships, as you would have in a recursive)
  - In this way, your data model truly reflects the business rules



Hierarchy Versus Recursive Relationship

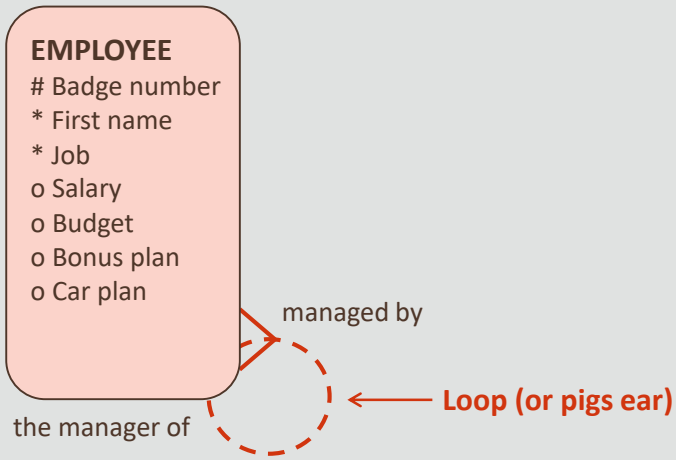
- Recursive:
  - Recursive relationships tend to be simpler because you are using only one entity
  - Your diagram will be less “busy”
  - However, they are less specific – you cannot have mandatory attributes or relationships unless they are mandatory in all instances of the entity



Another thing to consider when modeling these types of relationships is how often the structure changes. If it changes often, then a recursive relationship is easier to maintain. If it is fairly fixed, then you may consider the more explicit hierarchy.

Drawing Convention

- The ERD convention to show a recursive relationship is drawn as a loop, also known as a “pig’s ear”



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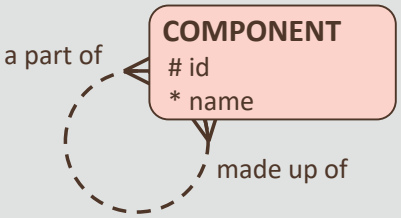
Each EMPLOYEE may be the manager of one or more EMPLOYEES.
Each EMPLOYEE may be managed by one and only one EMPLOYEE

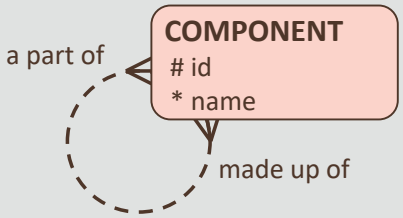
Automobile Manufacturing Business Scenario

- For an automobile manufacturing organization, consider all elementary parts, subassemblies, assemblies, and products as instances of an entity called COMPONENT
- The model can be created as a simple recursive relationship



Automobile Manufacturing Business Scenario

- Model Bill of Materials data as a many-to-many recursive relationship:
  - Each COMPONENT may be a part of one or more COMPONENTS
  - Each COMPONENT may be made up of one or more COMPONENTS



Terminology

- Key terms used in this lesson included:
  - Hierarchal relationship
  - Recursive relationship

Summary

- In this lesson, you should have learned how to:
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