IE301

Analysis and Design of Data Systems

Lecture 11

Enhanced ER (EER) Model

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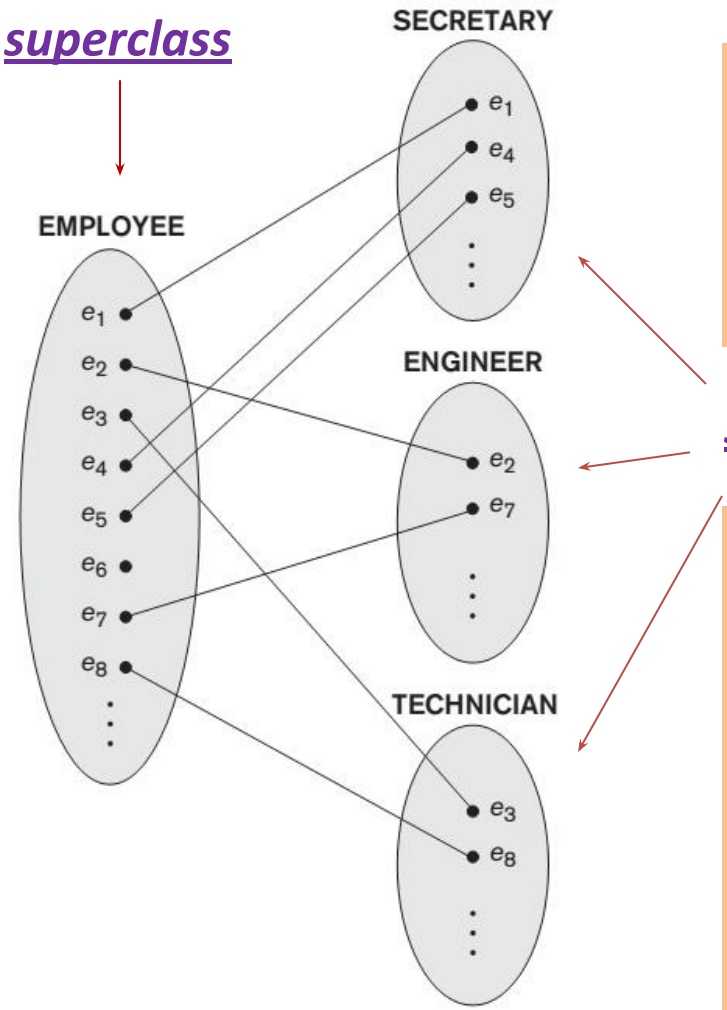
Enhanced ER (EER) Model

The EER model includes *all the modeling concepts of the ER model*

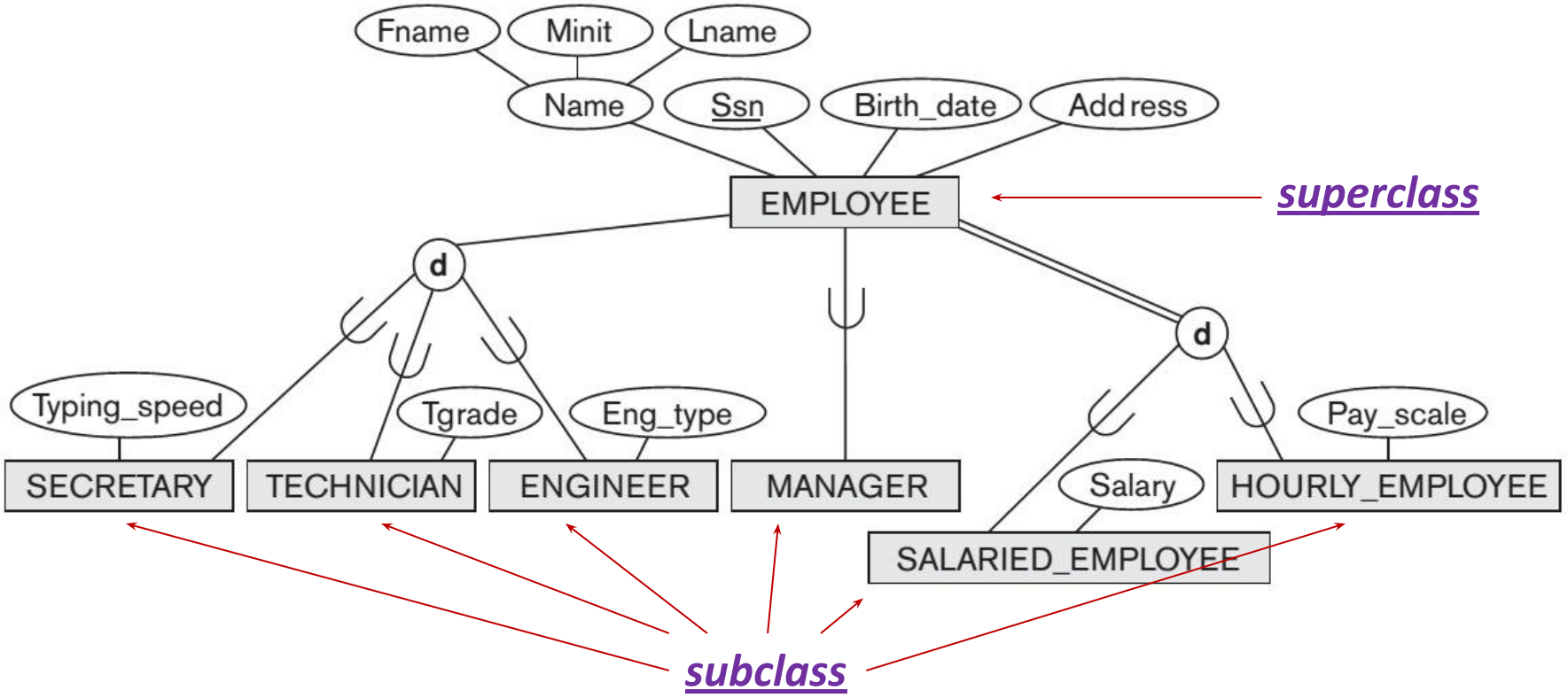
Subclasses and Superclasses



subclass

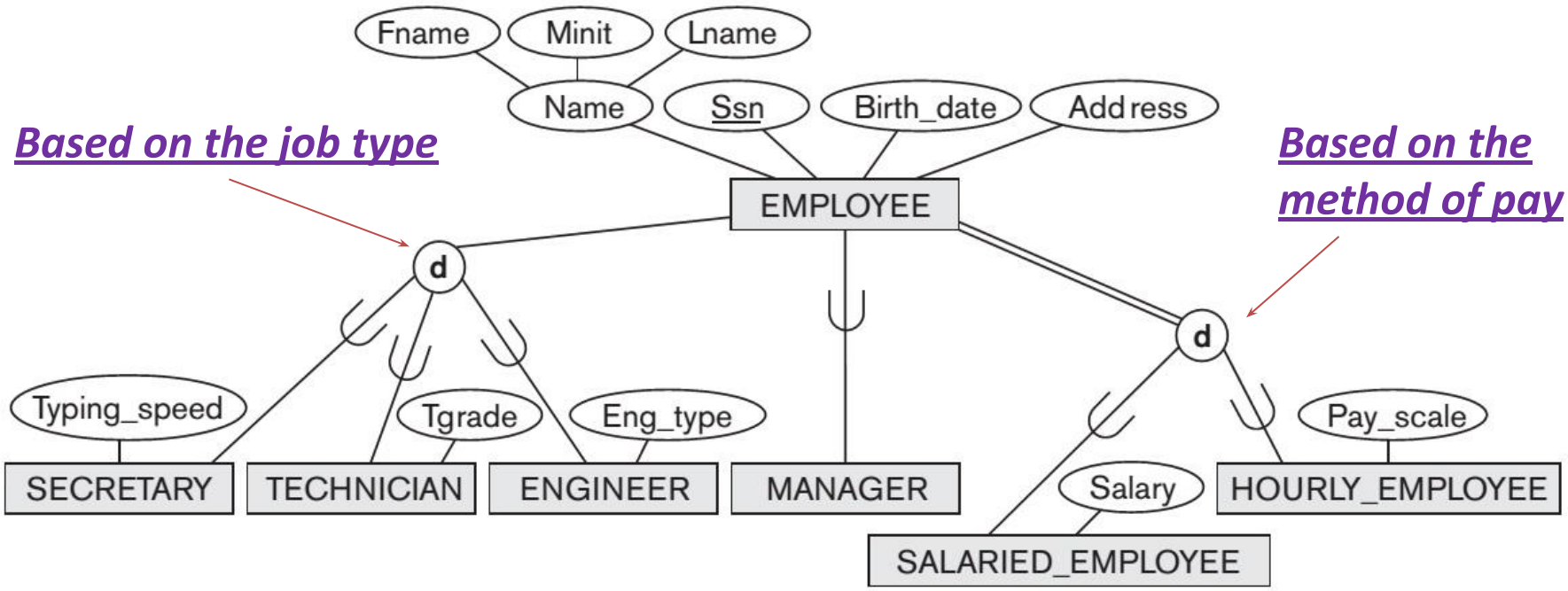
- An entity type can have numerous subgrupings that need to be represented explicitly because of their significance:
  - Each of these subgrupings is called a ***subclass***
- Each entity that is a member of a subclass is also an entity of a corresponding superclass (*secretary is also an employee)*
- It is not necessary that every entity in a superclass is a member of some subclass

Subclasses and Superclasses



Specialization

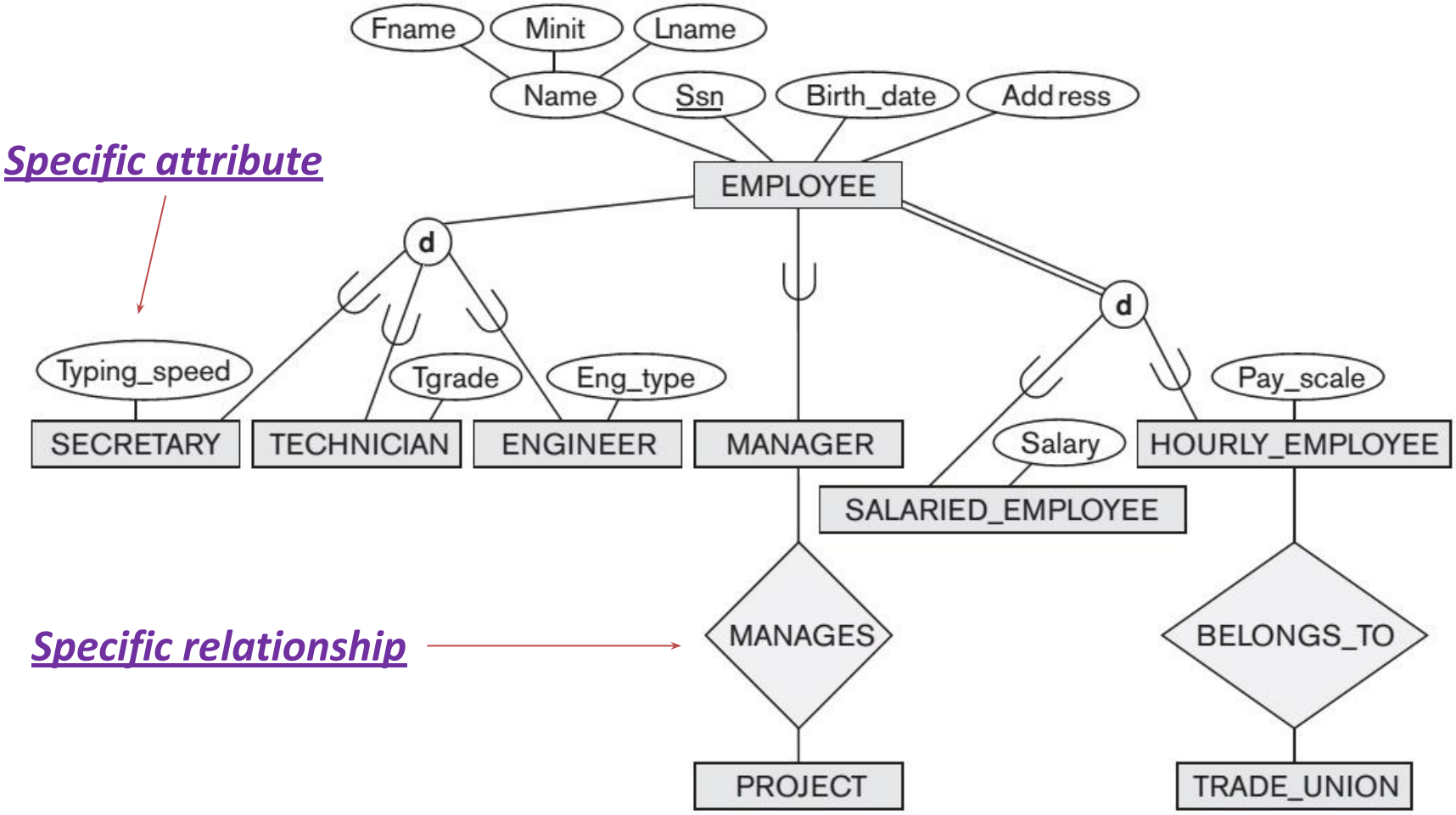
- Specialization is the process of defining a set of subclasses of an entity type
- The set of subclasses that forms a specialization is defined on the basis of some distinguishing characteristic of the entities in the superclass



More on Subclasses and Superclasses

- Each entity that is a member of a subclass can also be a member of another subclass (salaried employee who is also an engineer belongs to the two subclasses ENGINEER and SALARIED_EMPLOYEE of the EMPLOYEE entity type)
- Entity that is a member of a subclass ***inherits*** all the attributes of the entity as a member of the superclass
- Entity that is a member of a subclass also inherits all the relationships in which the superclass participates

Features of Subclasses



Reasons for including class/subclass relationships and specializations in a data model:

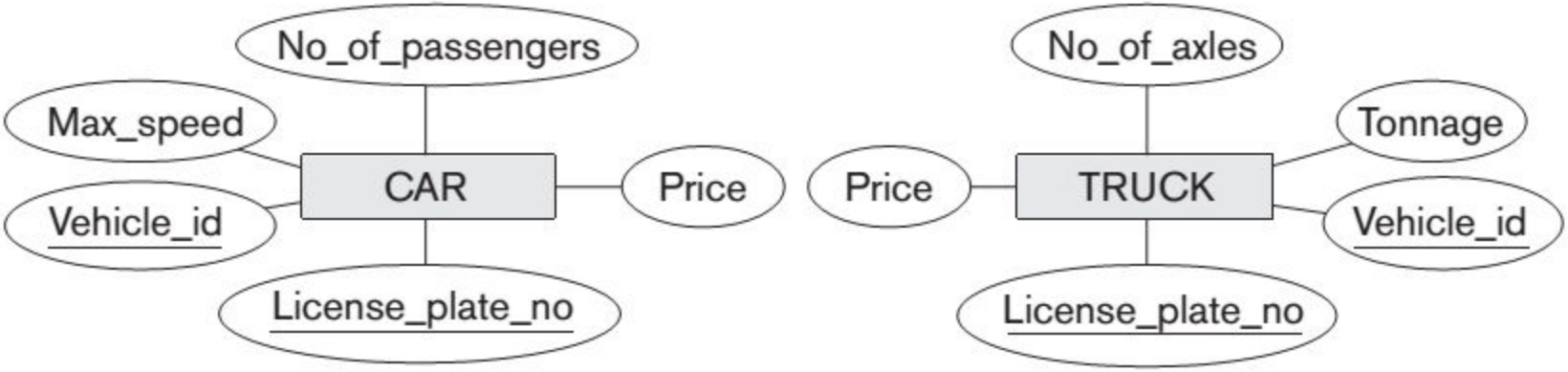
- Certain attributes may apply to some but not all entities of the superclass
- Some relationship types may be participated in only by entities that are members of the subclass.

Specialization process allows us to do the following:

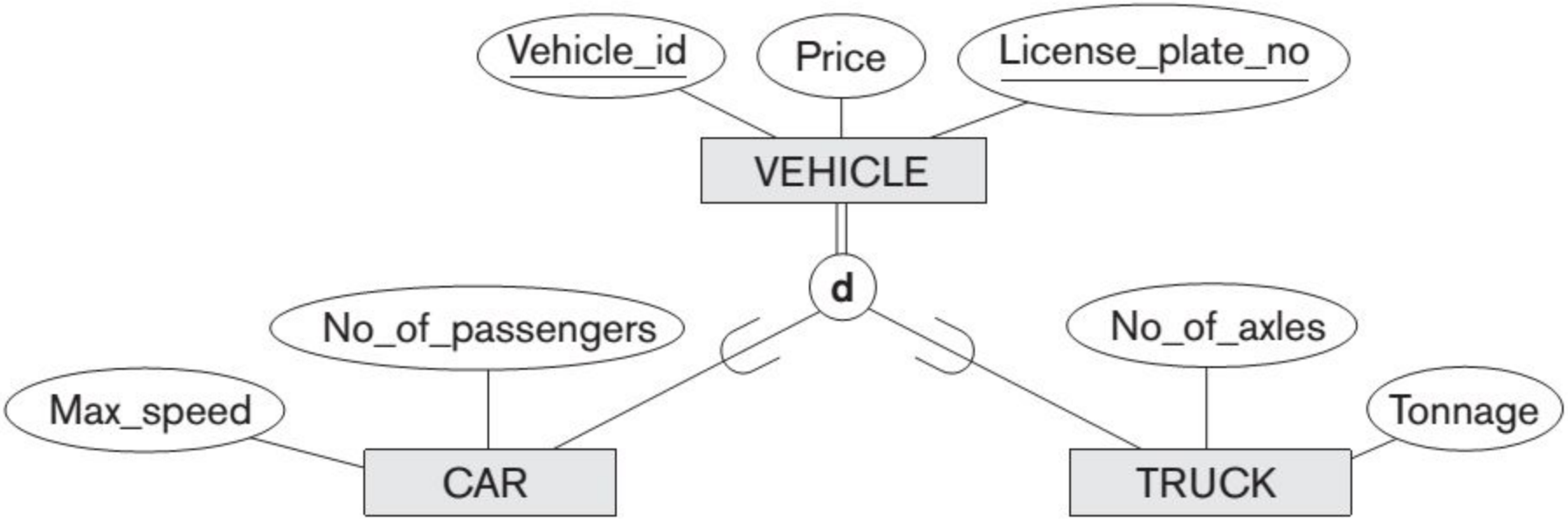
- Define a set of subclasses of an entity type
- Establish additional specific attributes with each subclass
- Establish additional specific relationship types between each subclass and other entity types or other subclasses

Generalization

Generalization is a reverse process to Specialization

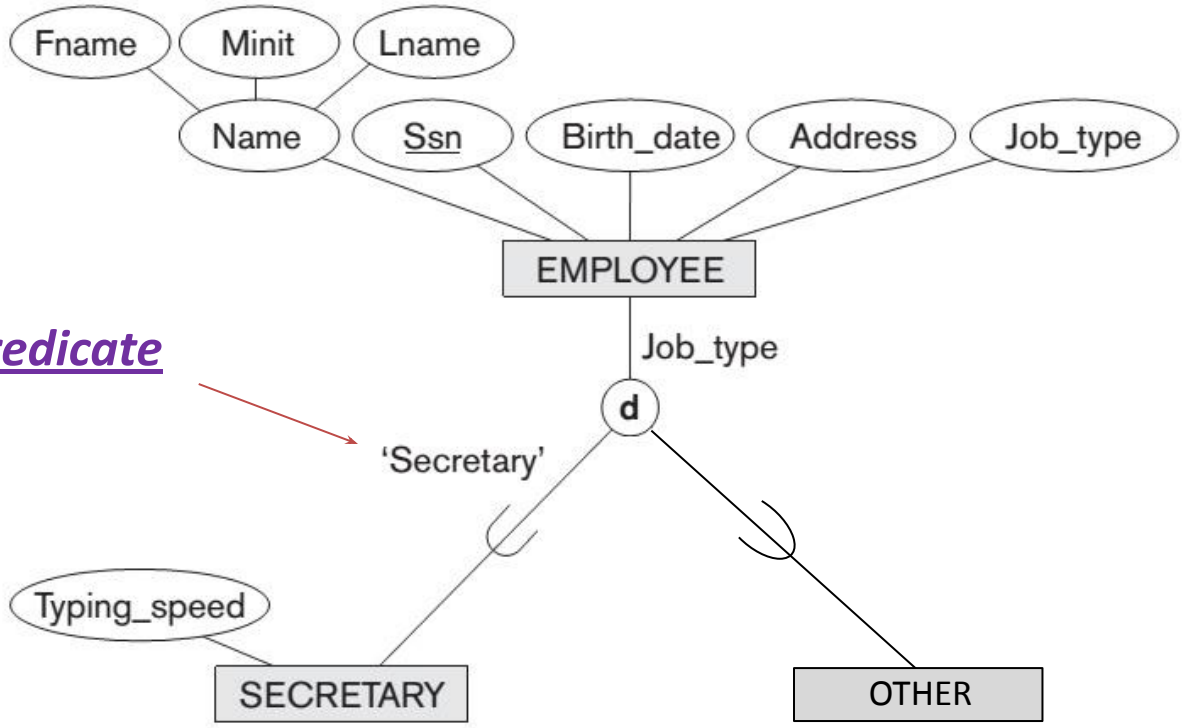


Generalization



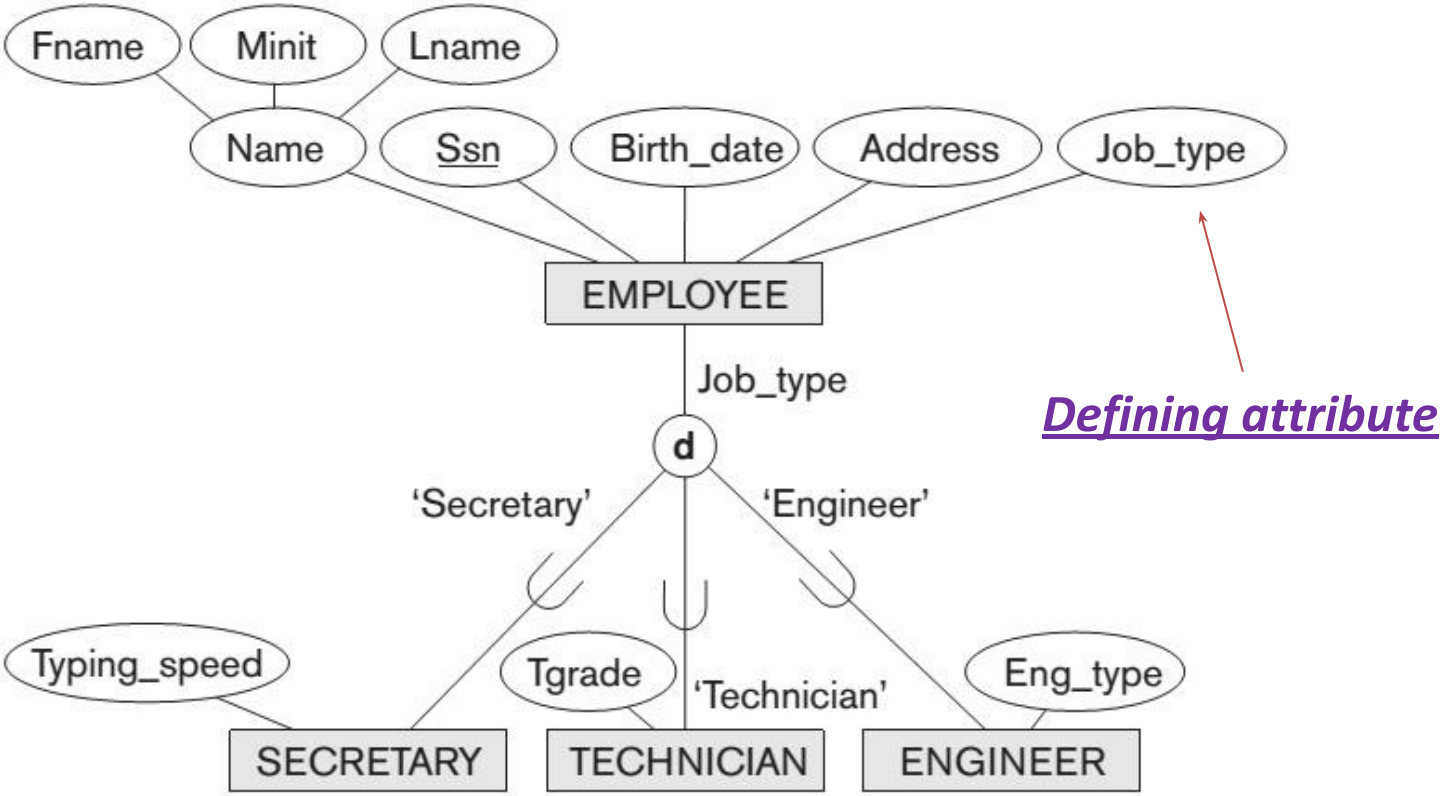
Constraints on Specializations

- By placing a condition on the value of some attribute of the superclass we can determine exactly the entities that will become members of each subclass. Such subclasses are called **predicate-defined subclasses.**



Defining predicate

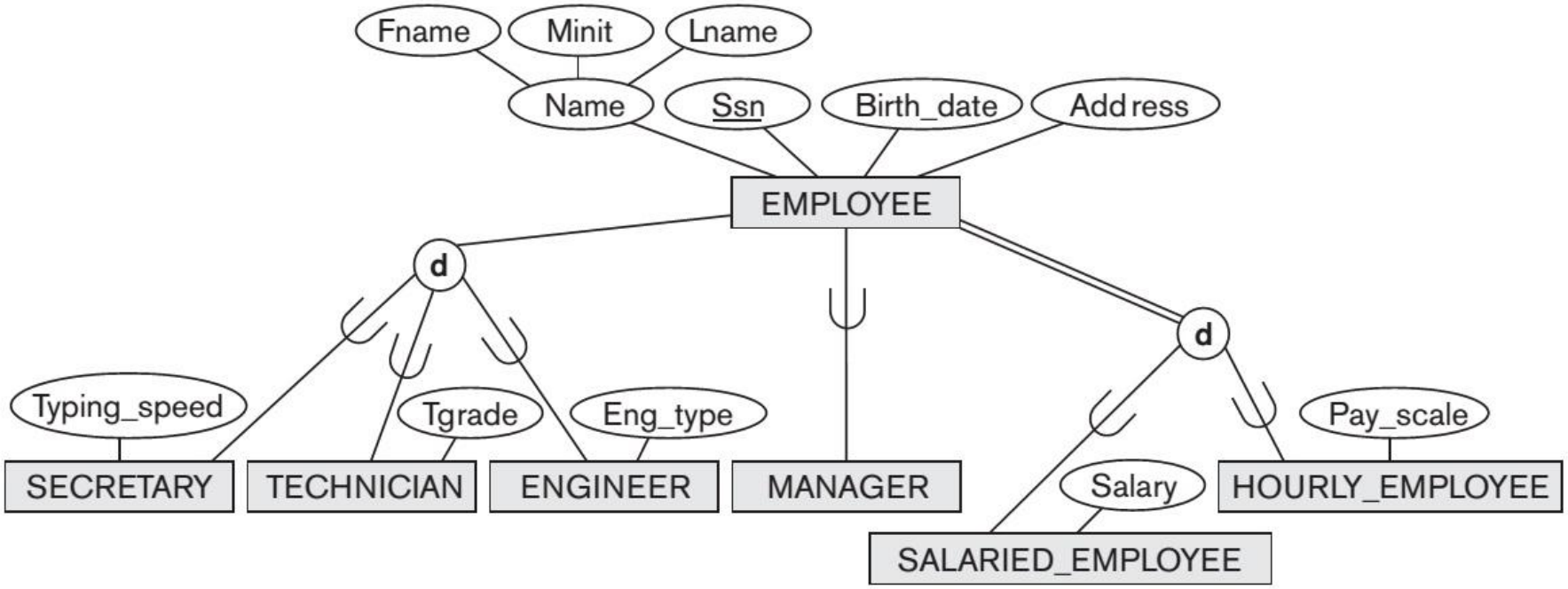
If *all* subclasses in a specialization have their membership condition on the *same* attribute of the superclass, the specialization itself is called an **attribute-defined specialization**



When we do not have a condition for determining membership in a subclass, the subclass is called **user-defined**

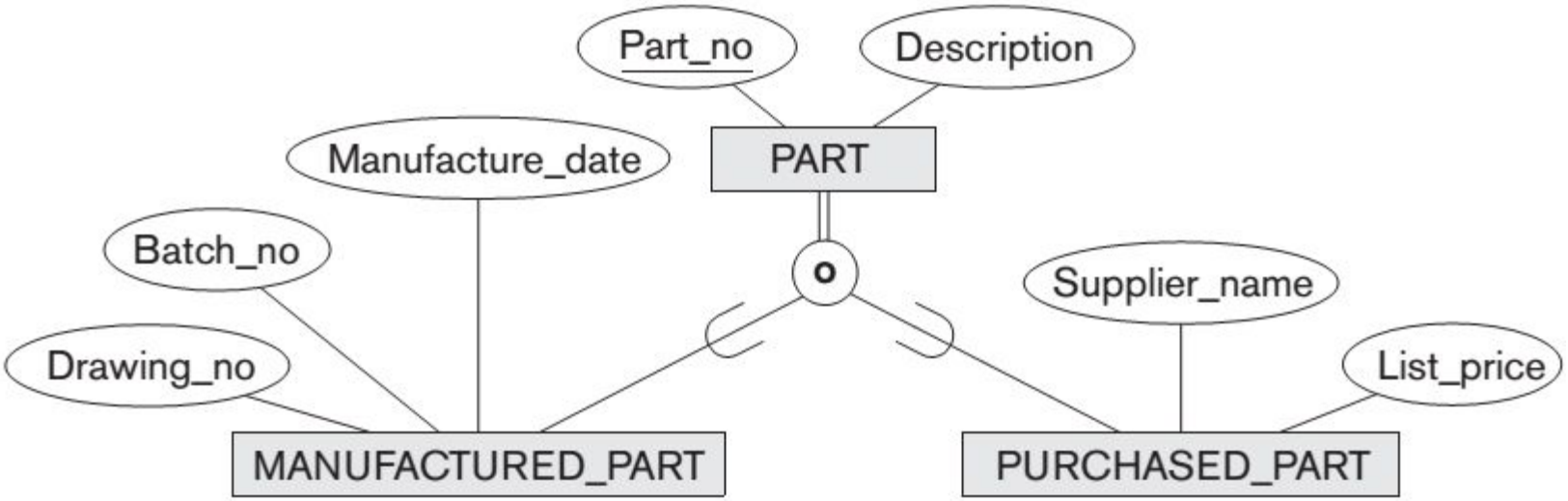
Disjointness constraint specifies that an entity can be a member of *at most* one of the subclasses of the specialization.

- ✔ A specialization that is attribute-defined implies the disjointness constraint
- ✔ Disjointness also applies to user-defined subclasses of a specialization

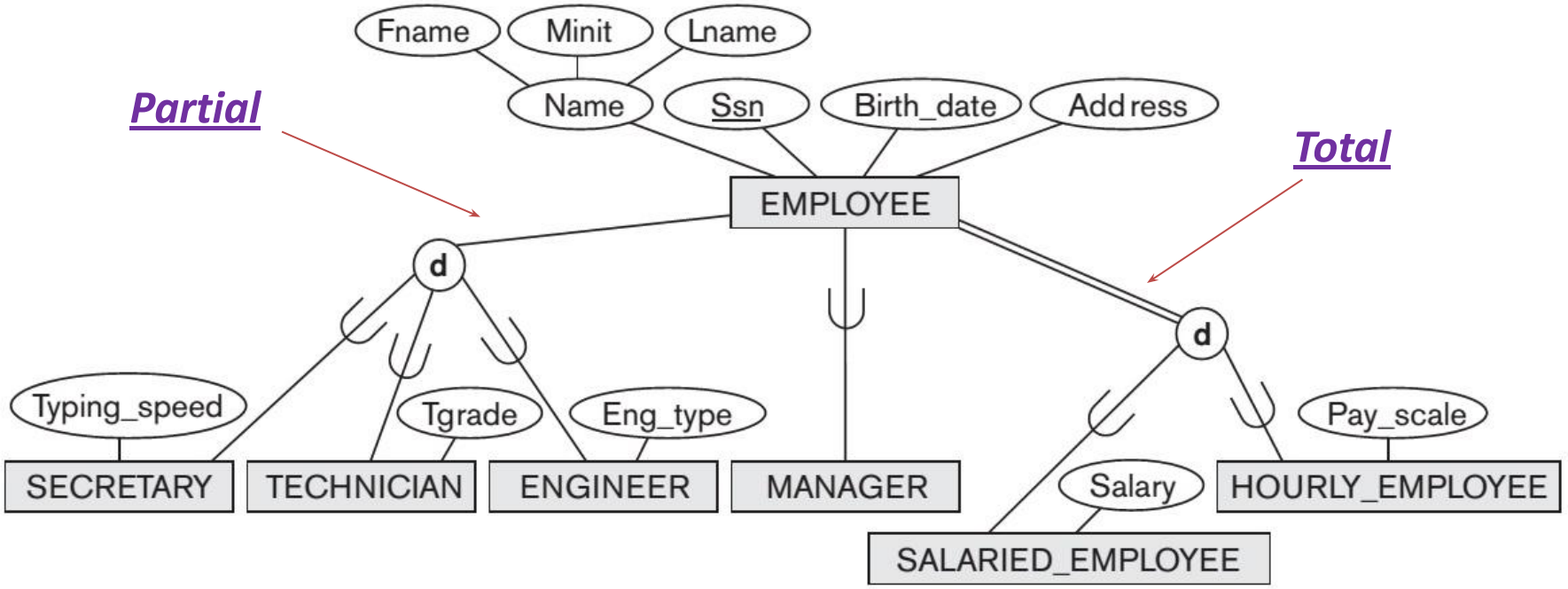


If the subclasses are not constrained to be disjoint, their sets of entities may be **overlapping**

- ✔ that is, the same (real-world) entity may be a member of more than one subclass of the specialization



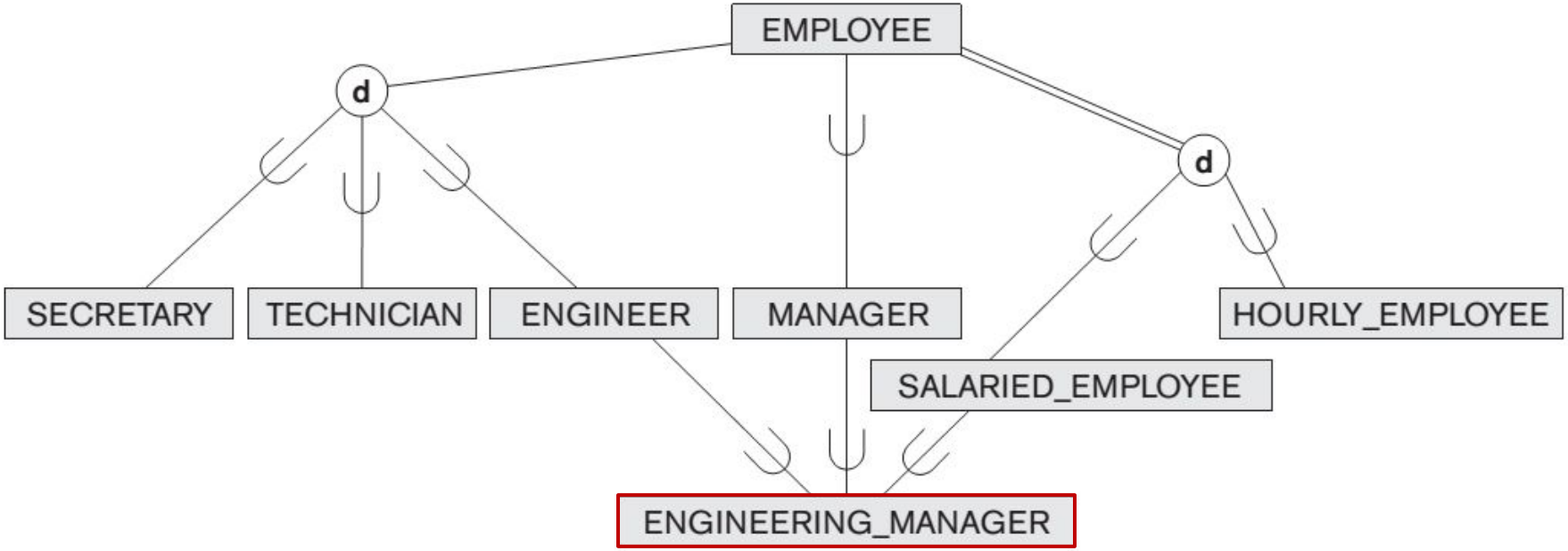
A **total specialization** constraint specifies that *every* entity in the superclass must be a member of at least one subclass in the specialization



partial specialization allows an entity not to belong to any of the subclasses

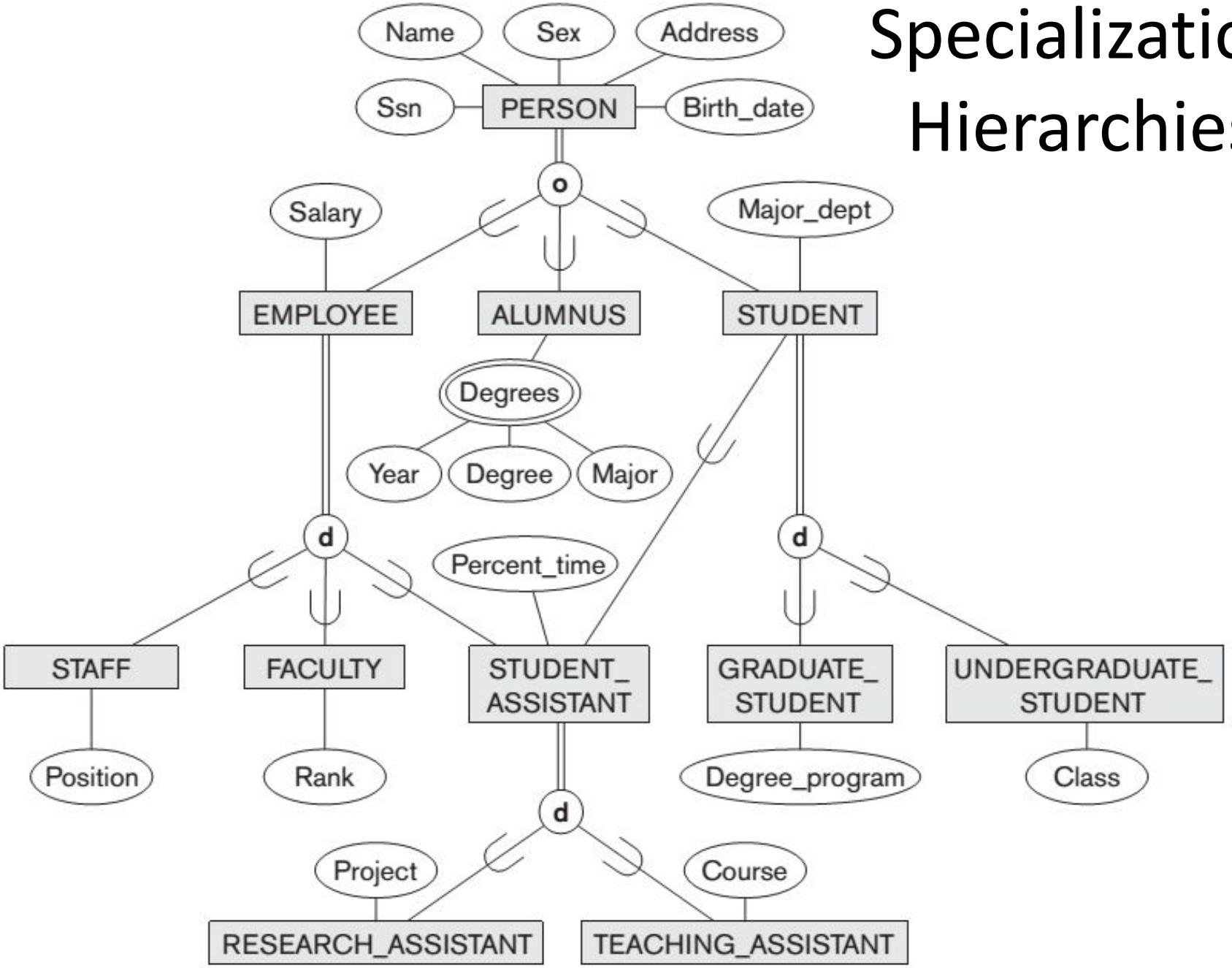
Shared sublasses

A subclass with *more than one* superclasses is called a ***shared subclass***



Shared sublcasses inherit attributes and relationships from multiple classes. That concept is known as ***multiple inheritance***

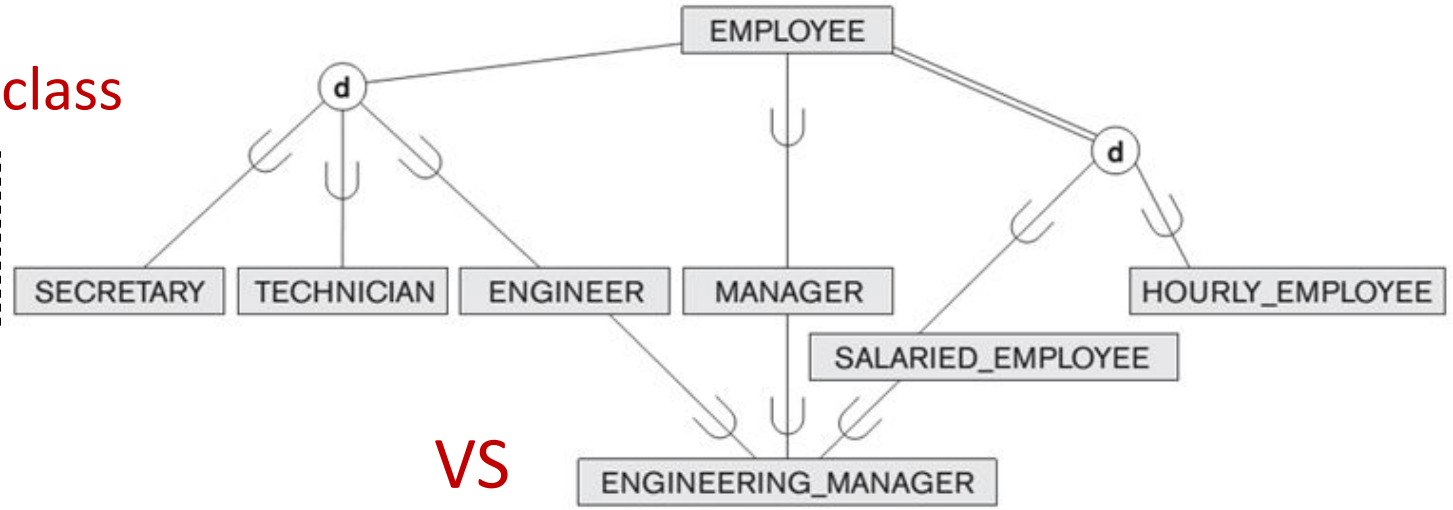
Specialization Hierarchies



UNION Subclasses

Shared Subclass

Superclasses must all have the same key



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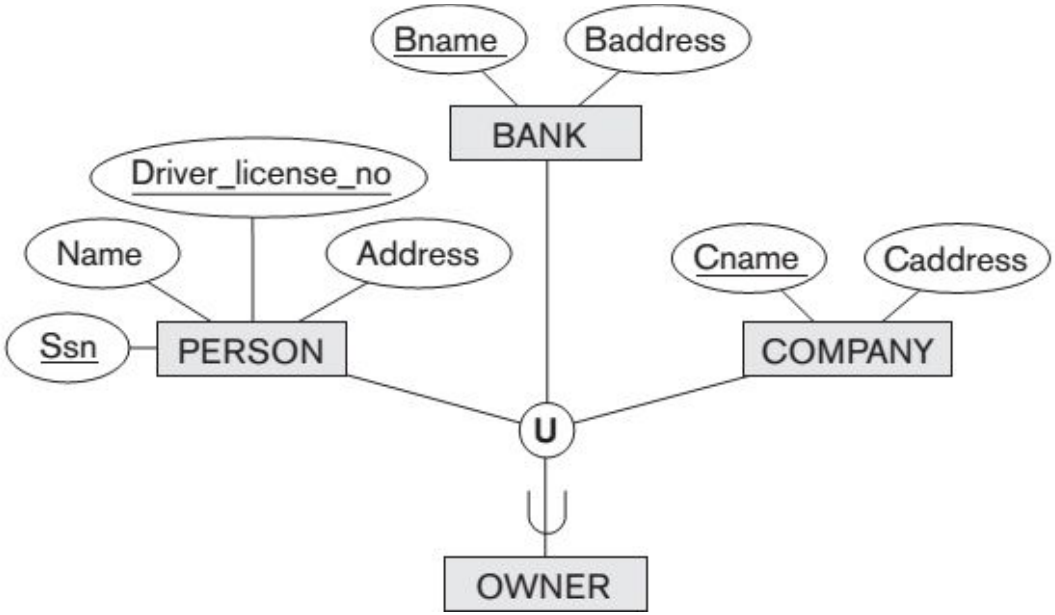


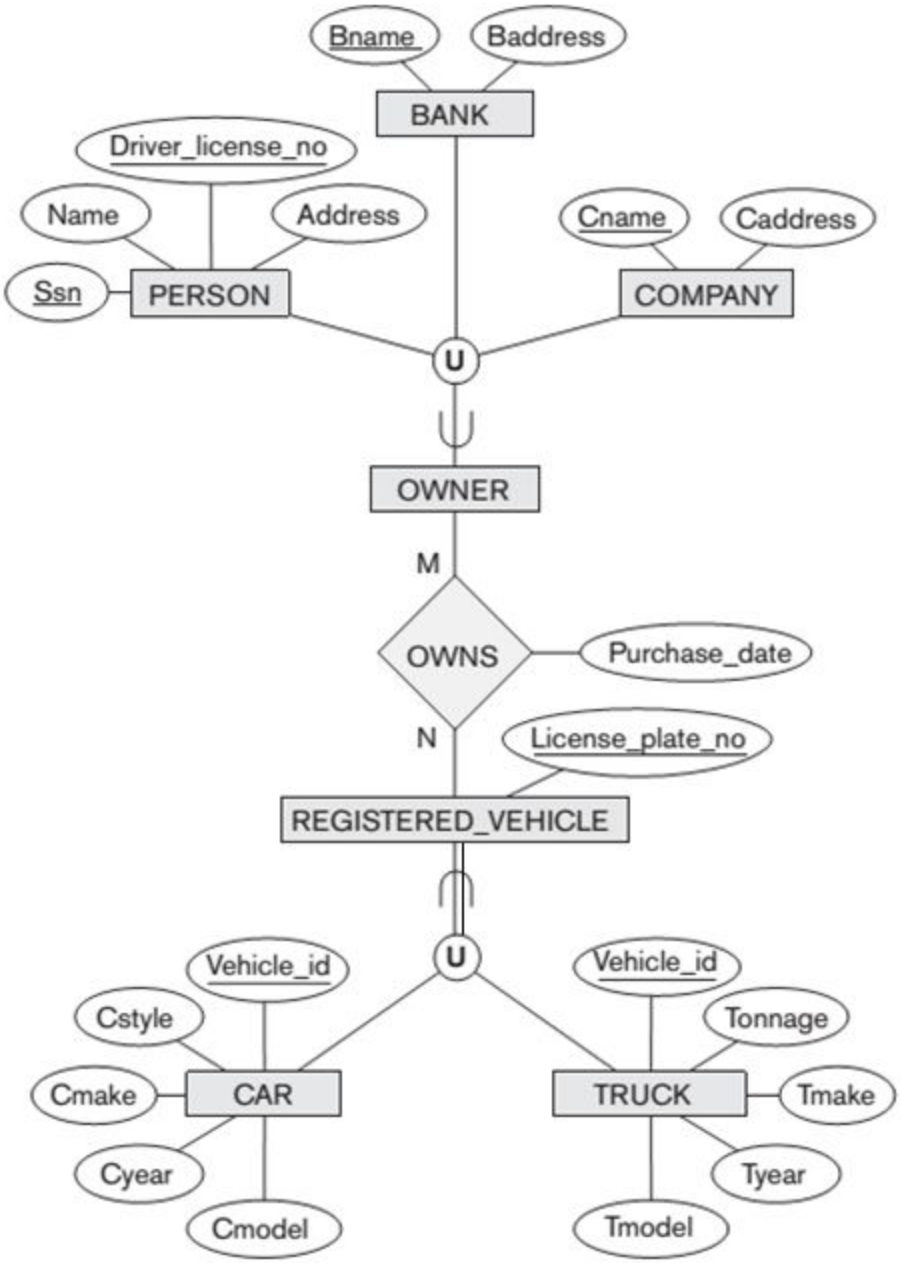
Union Subclass

Superclasses can have different keys

UNION Subclasses

ENGINEERING_MANAGER is a subclass of *each of* the three superclasses ENGINEER, MANAGER, and SALARIED_EMPLOYEE, so an entity that is a member of ENGINEERING_MANAGER must exist in *all three.*
This represents the constraint that an engineering manager must be an ENGINEER, a MANAGER, *and* a SALARIED_EMPLOYEE simultaneously;
that is, ENGINEERING_MANAGER is a subset of the *intersection* of the three classes (sets of entities).
Shared subclass such as ENGINEERING_MANAGER inherits *all* the attributes of its superclasses SALARIED_EMPLOYEE, ENGINEER, and MANAGER

Union subclass is a subset of the *union* of its superclasses.
Hence, an entity that is a member of OWNER must exist in *only one* of the superclasses. This represents the constraint that an OWNER may be a COMPANY, a BANK, *or* a PERSON.
Union subclass such as OWNER entity inherits the attributes of a COMPANY, a PERSON, or a BANK, depending on the superclass to which the entity belongs.



UNION Subclasses

A Union Subclass can be **total** or **partial**. A total category holds the *union* of all entities in its superclasses, whereas a partial category can hold a *subset of the union*. A total category is represented diagrammatically by a double line connecting the category and the circle, whereas a partial category is indicated by a single line.