

Database Technology

Topic 4: Enhanced Entity-Relationship (EER) Modeling

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Example

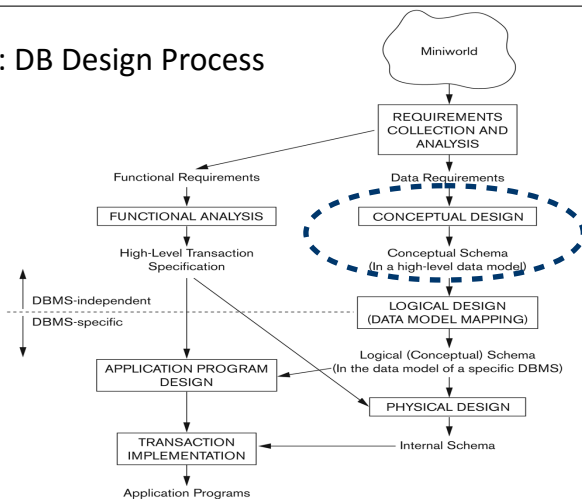
A taxi company needs to model their activities.

There are two types of **employees** in the company: **drivers** and **operators**. For drivers it is interesting to know the **date of issue** and **type** of the driving license, and the **date of issue** of the taxi driver's certificate. For all employees it is interesting to know their **personal number**, **address** and the available **phone numbers**.

The company owns a number of **cars**. For each car there is a need to know its **type**, **year of manufacturing**, **number of places** in the car and **date of the last service**.

The company wants to have a record of car **trips**. A taxi may be picked on a street or ordered through an **operator** who assigns the order to a certain **driver** and a **car**. **Departure** and **destination addresses** together with **times** should also be recorded.

Recall: DB Design Process

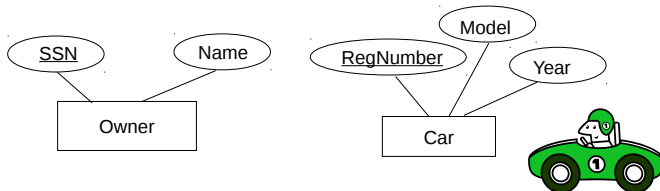


Entity-Relationship (ER) Model

- High-level conceptual data model
 - An overview of the database
 - Easy to discuss with non-database experts
 - Easy to translate to data model of DBMS
- ER diagram
 - Diagrammatic notation associated with the ER model

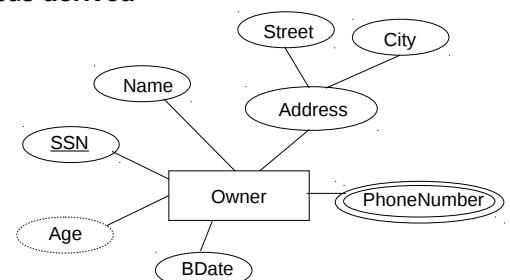
Entities and Entity Types

- **Entity**: a "thing" in the real world with an independent existence
- **Attributes**: Properties that describe an entity
- **Entity type**: A collection of entities that have the same set of attributes



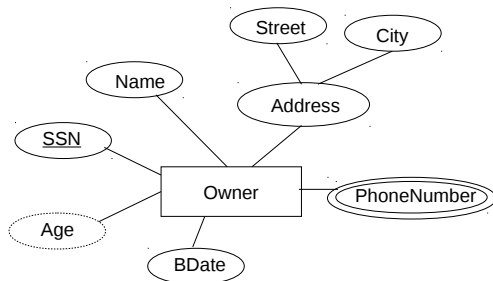
Attributes

- **simple** versus **composite**
- **single-valued** versus **multivalued**
- **stored** versus **derived**



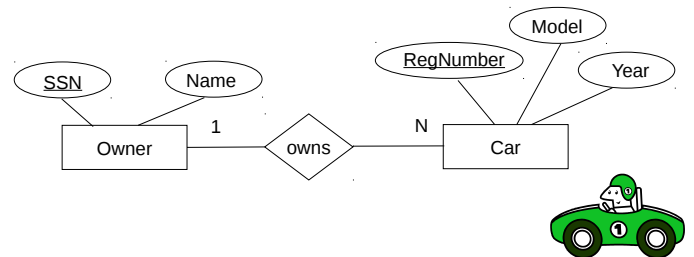
Constraints on Attributes

- Value sets (domains) of attributes
- Key attributes



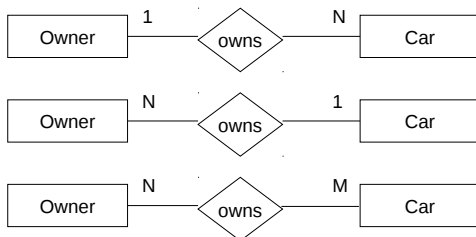
Relationship Types

- Relationship type: Association among entity types



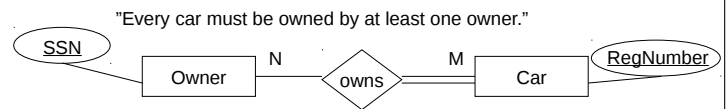
Constraints on Relationship Types

- Cardinality ratio: *Maximum* number of relationships an entity can participate in
- Possible cardinality ratio: 1:1, 1:N, N:1, and N:M



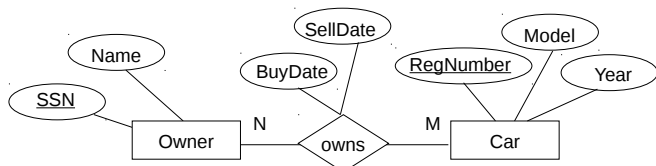
Constraints on Relationship Types

- Participation constraint
 - Total participation:** Every entity participates in *at least one* relationship with another entity



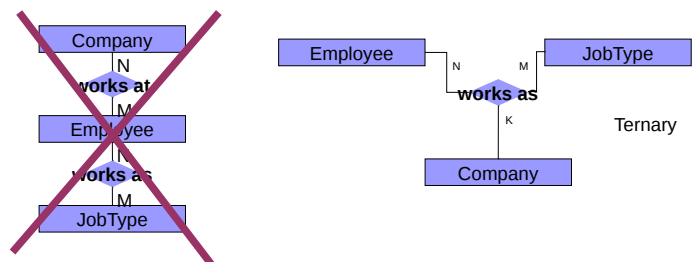
Attributes of Relationship Types

"Store information on who owned which car and during which period of time"



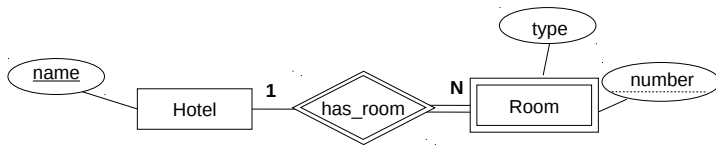
n-ary Relationships

- Example: A person works as an engineer at one company and as a gym instructor at another company



Weak Entity Types

- Identified by their relationship to a specific entity from another entity type
- Do not have key attributes of their own
 - Only partial key
 - The identifying entity has the rest of the key

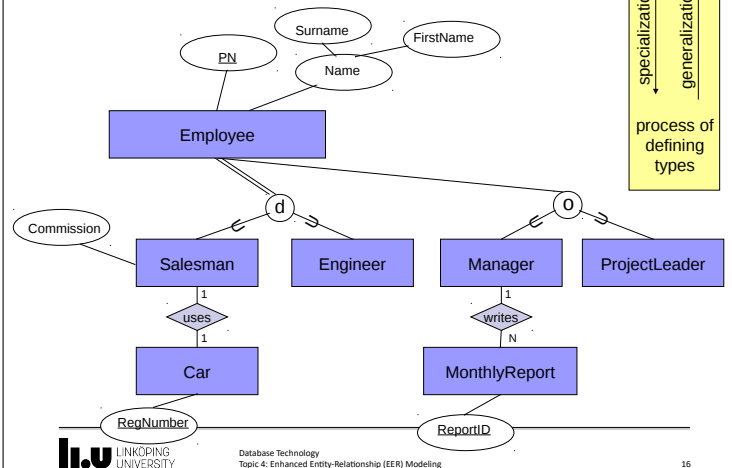


Enhanced Entity-Relationship (EER) Model

Enhanced ER (EER) Model

- Why more?
 - To support more complex data requirements
 - Example: Only some employees can use a company car, only managers have to write a monthly report, but all employees have assigned personal number, salary account and a place in the office.
- What more?
 - Specialization / generalization
 - Subtype / supertype
 - Union subtypes
 - Attribute and relationship inheritance

Subtype / Supertype



Constraints on Subtypes

- Disjointness constraint**
 - Specifies that the subclasses of the specialization must be disjoint
 - Otherwise "overlapping"
- Completeness constraint (or totalness constraint)**
 - Specifies that every superclass entity must be in a subclass
 - Otherwise "partial"
- Disjointness and completeness are *independent* constraints
 - i.e., four cases are possible
 - disjoint and total
 - disjoint and partial
 - overlapping and total
 - overlapping and partial

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Total Participation Constraint

- **Total participation:** Every entity participates in *at least* one relationship with another entity
- Alternative notations:
 - either double line (as in my earlier lecture slides)
 - or lower-bound cardinality (as in the video lecture)
- Example: "Every car must be owned *by at least* one owner."

