Database Technology

Topic 4: Enhanced Entity-Relationship (EER) Modeling

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Example

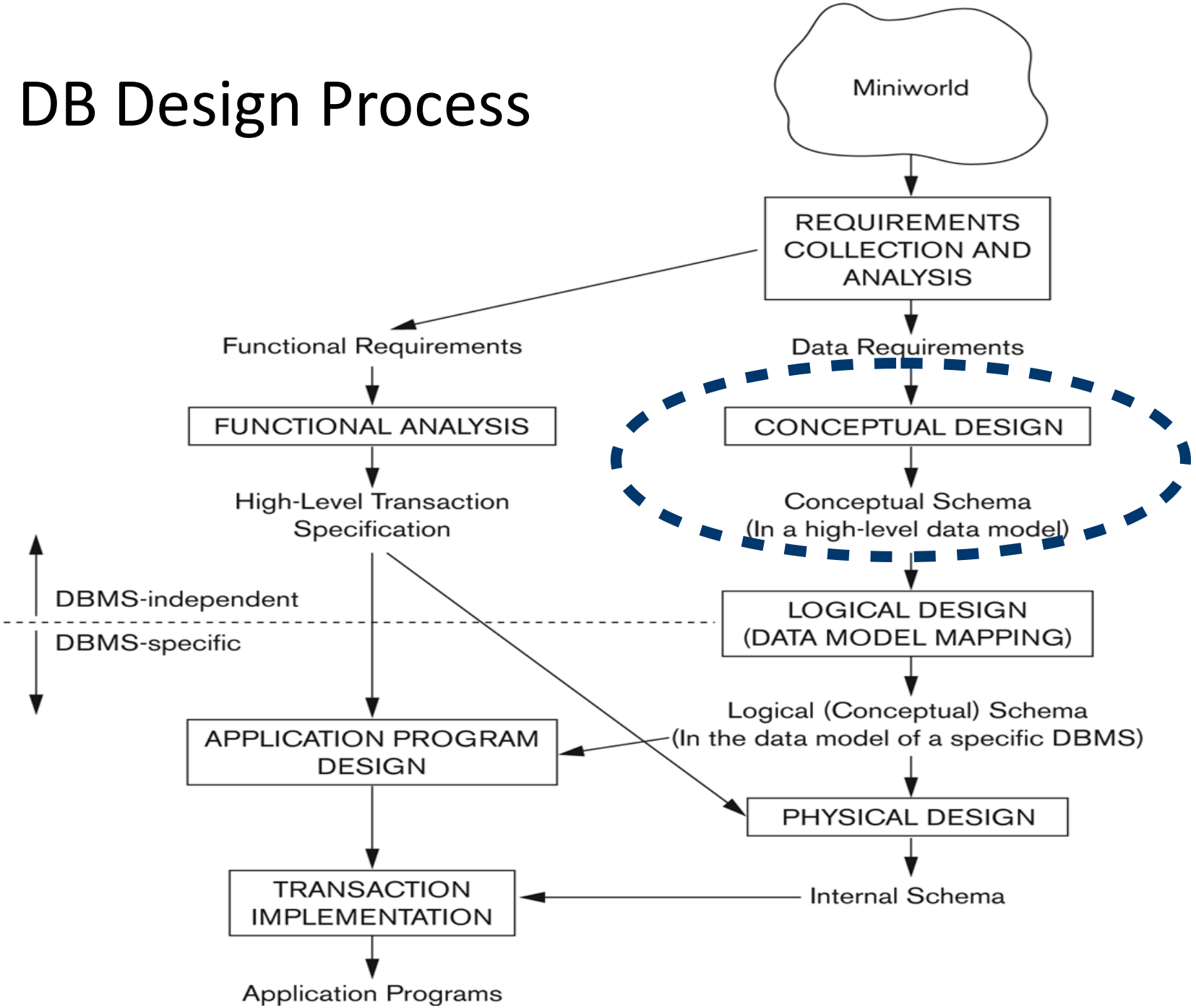
A taxi company needs to model their activities.

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



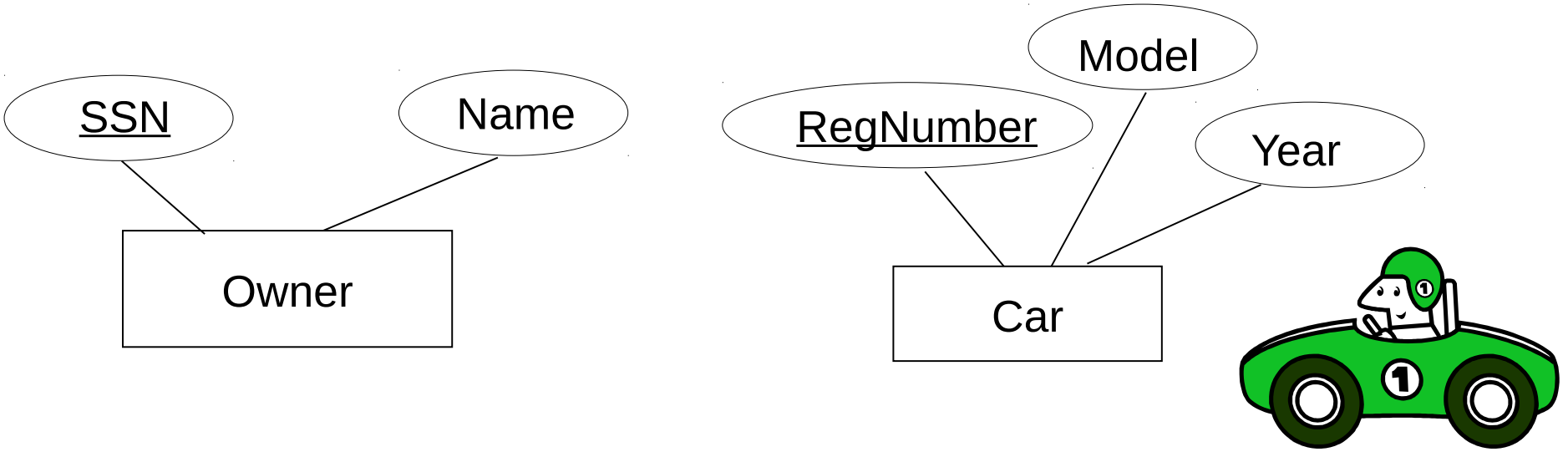
Entity-Relationship (ER) Model

- 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

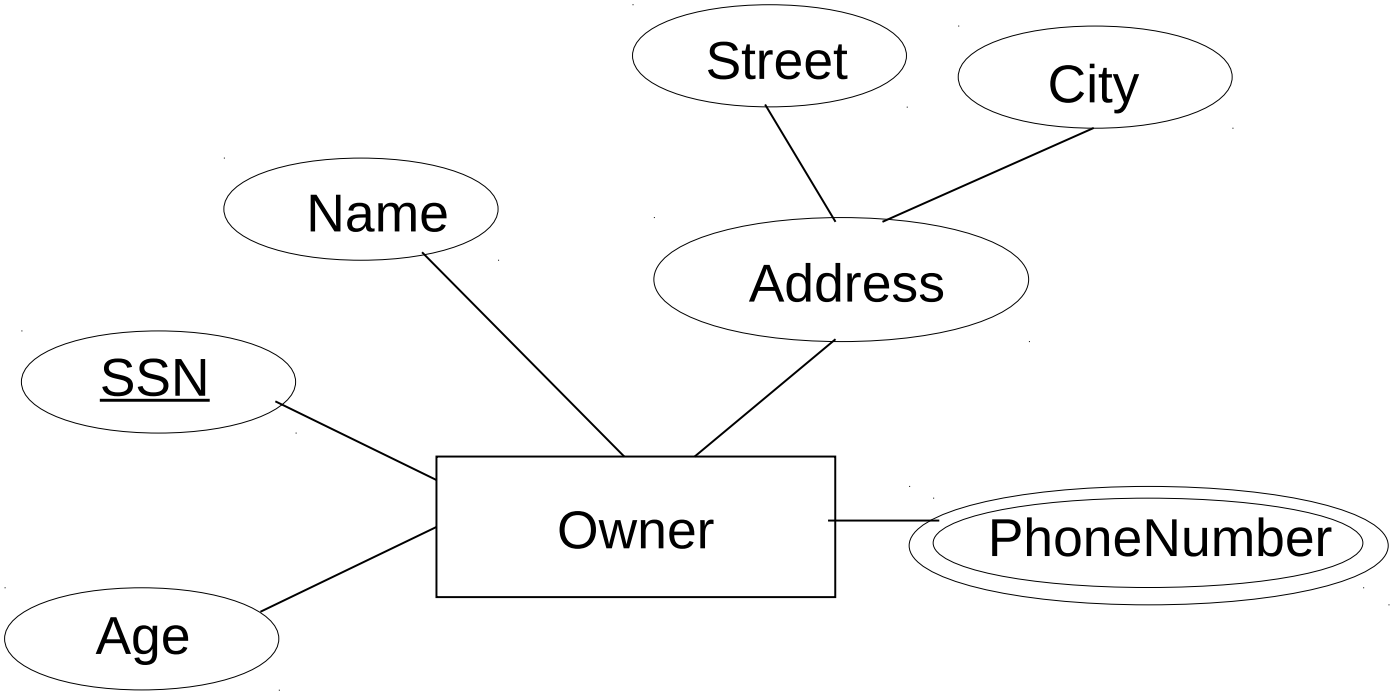
Entities and Entity Types

- **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



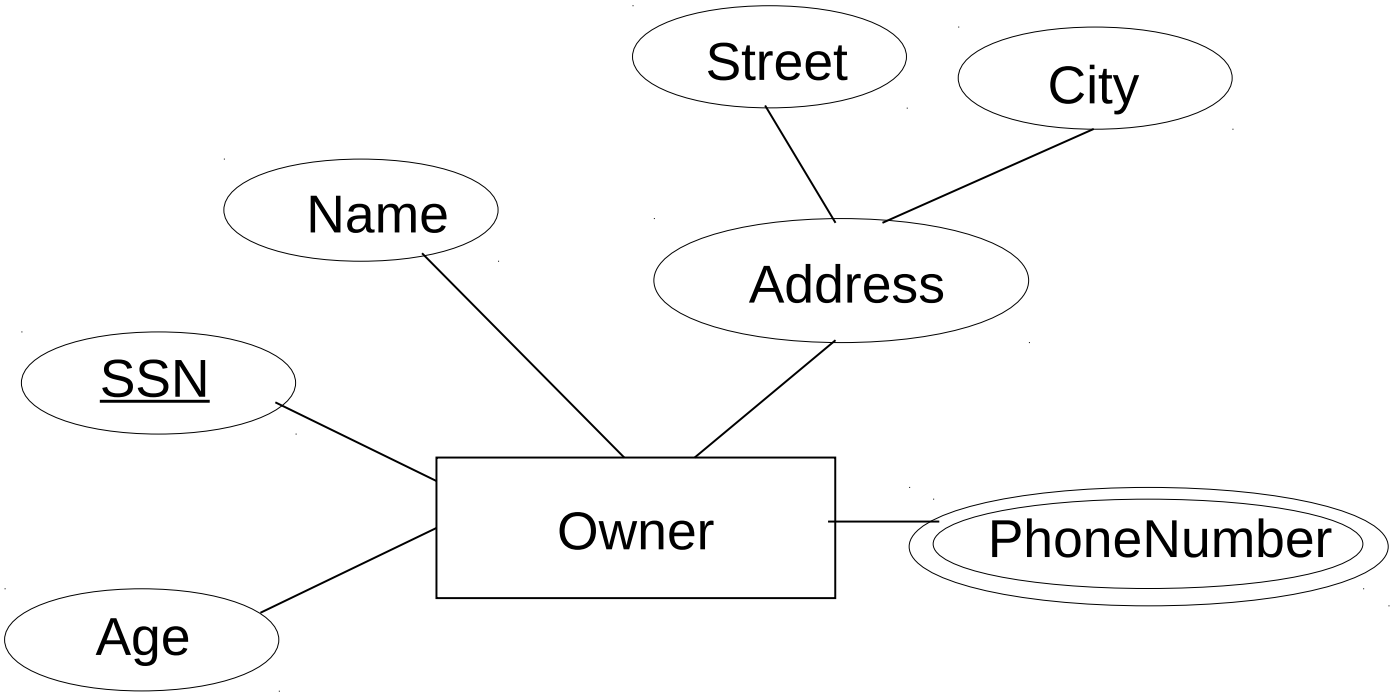
Attributes

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



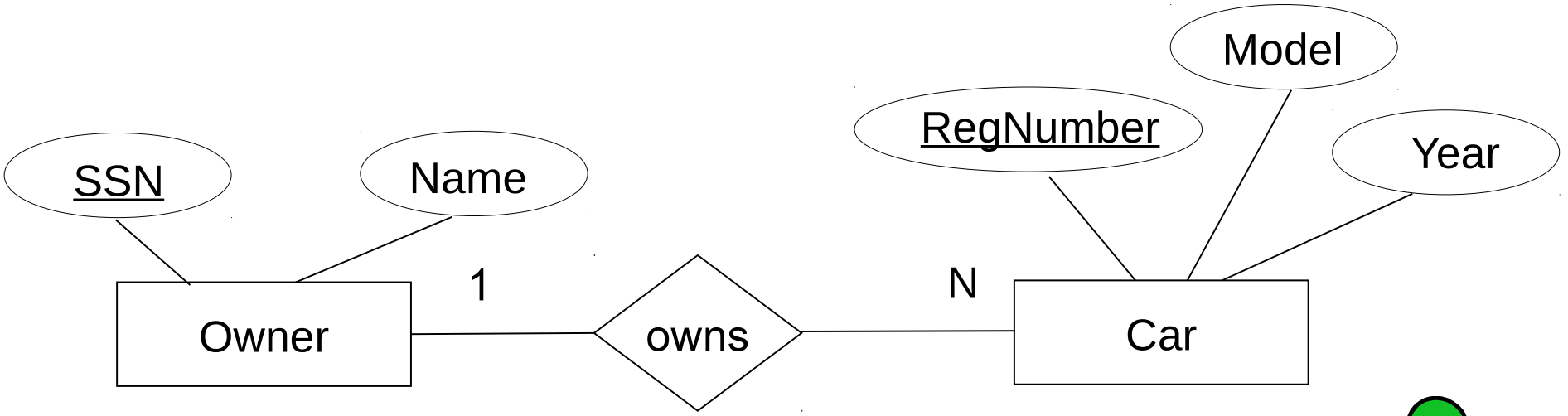
Constraints on Attributes

- Value sets (domains) of attributes
- Key attributes



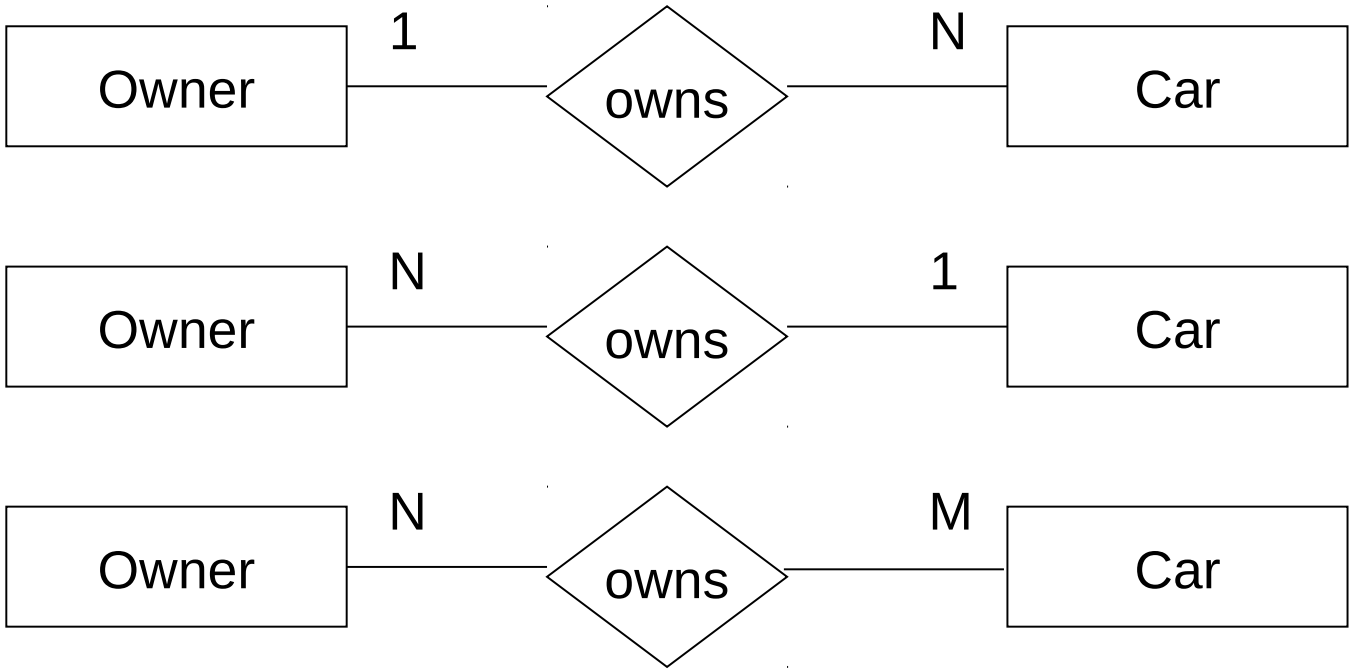
Relationship Types

- Relationship type: Association among entity types



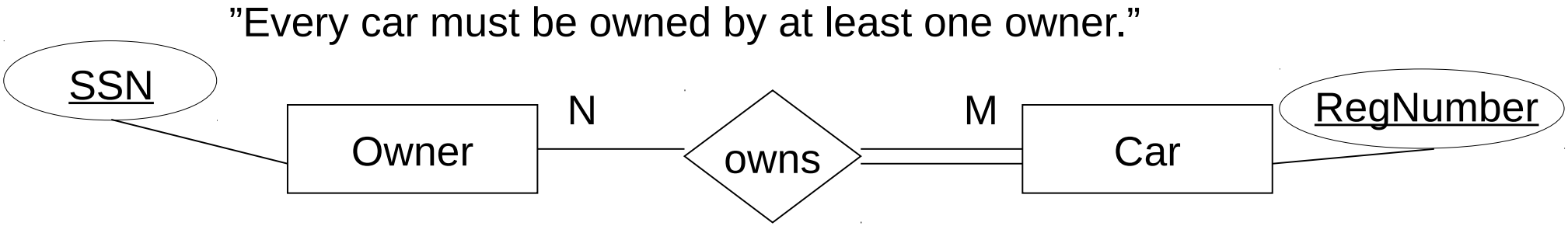
Constraints on Relationship Types

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



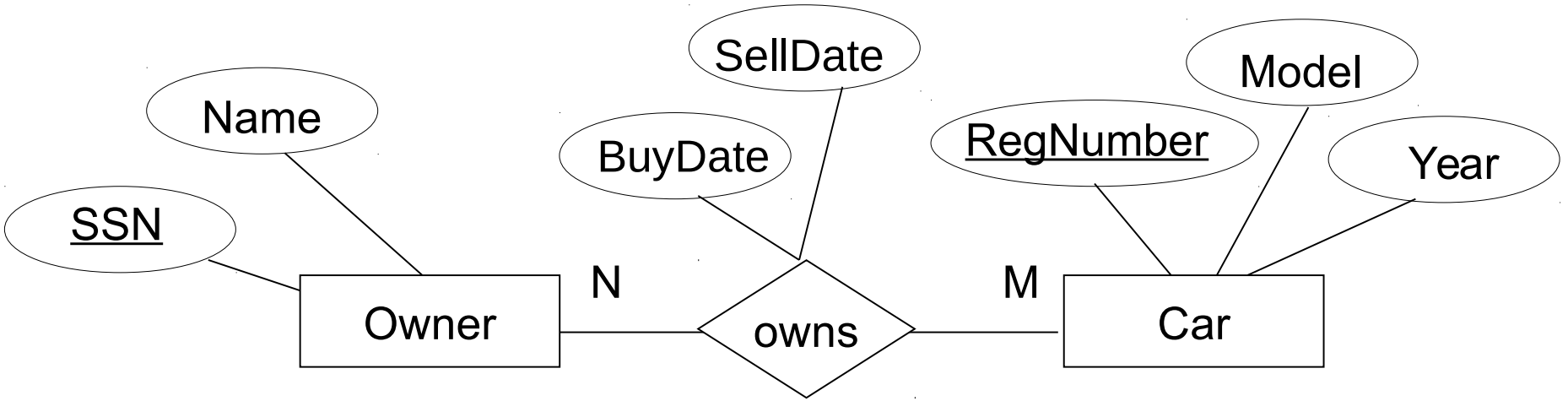
Constraints on Relationship Types

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



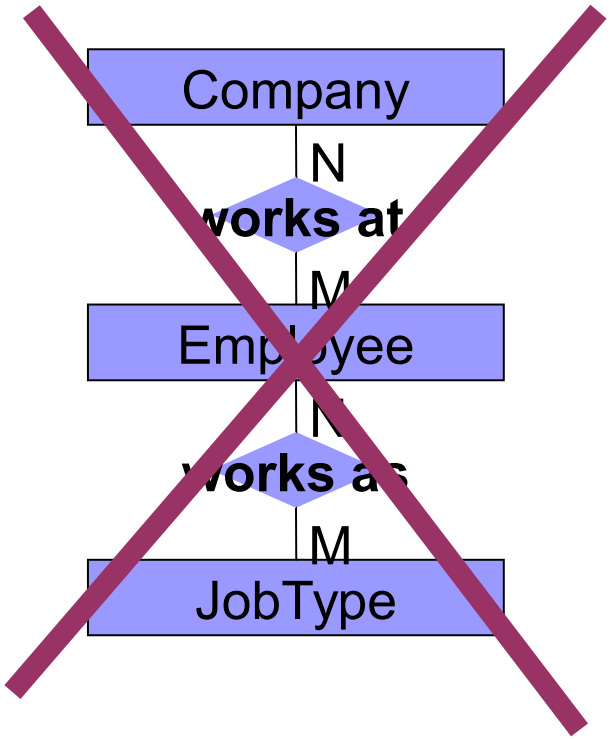
Attributes of Relationship Types

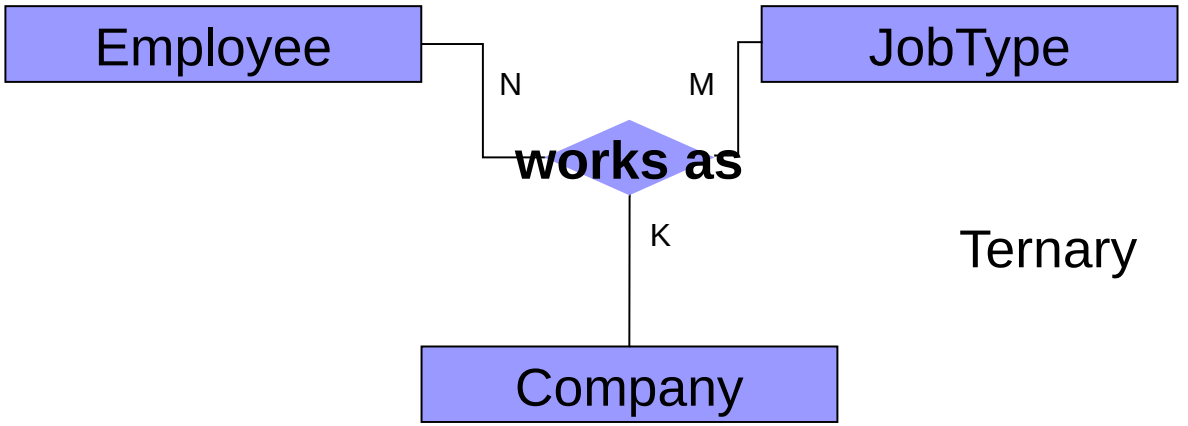
”Store information on who owned which car and during which period of time”



n-ary Relationships

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

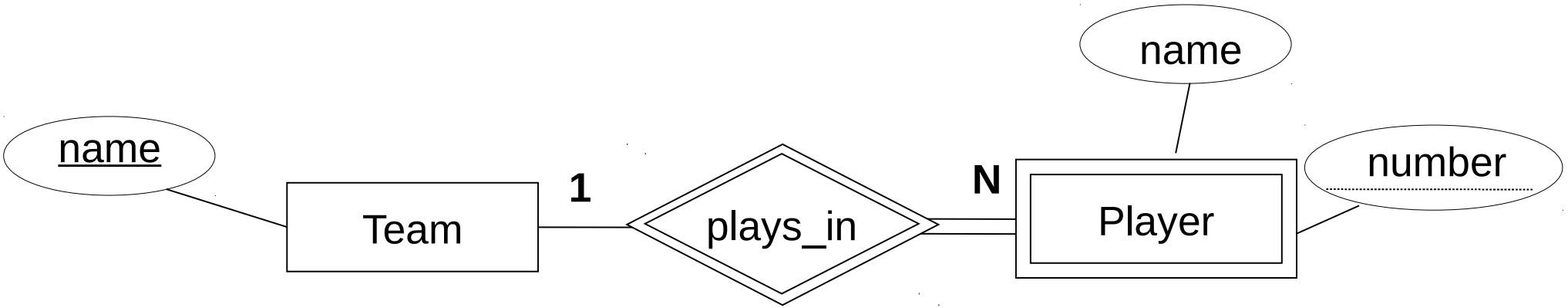




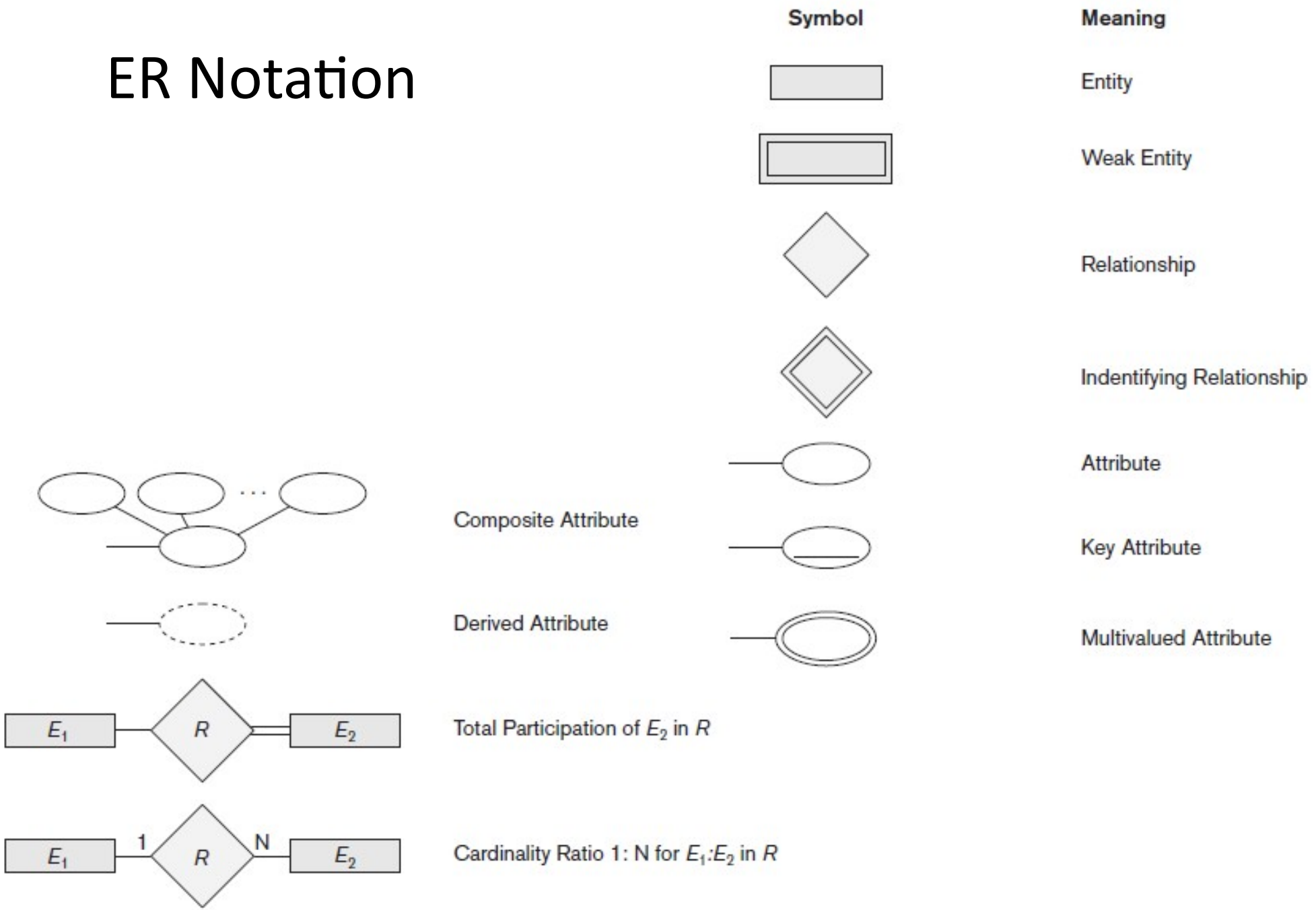
Ternary

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



ER Notation

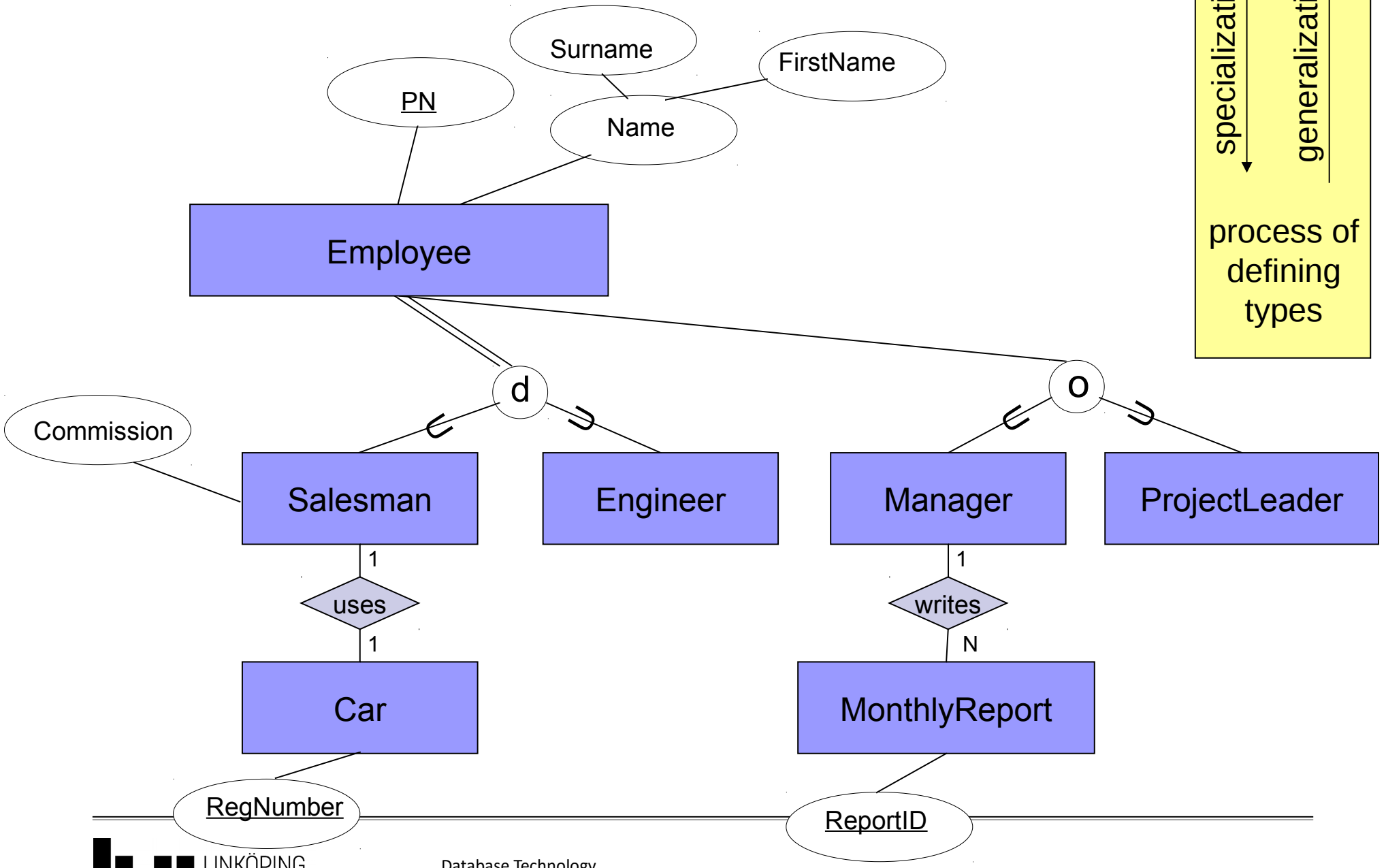

Symbol
Meaning
Entity
Weak Entity
Relationship
Indentifying Relationship
Attribute
Key Attribute
Multivalued Attribute
Composite Attribute
Derived Attribute
E_1
R
E_2
Total Participation of E_2 in R
E_1
1
R
N
E_2
Cardinality Ratio 1: N for E_1:E_2 in R

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



specialization

generalization

process of defining types

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

Example

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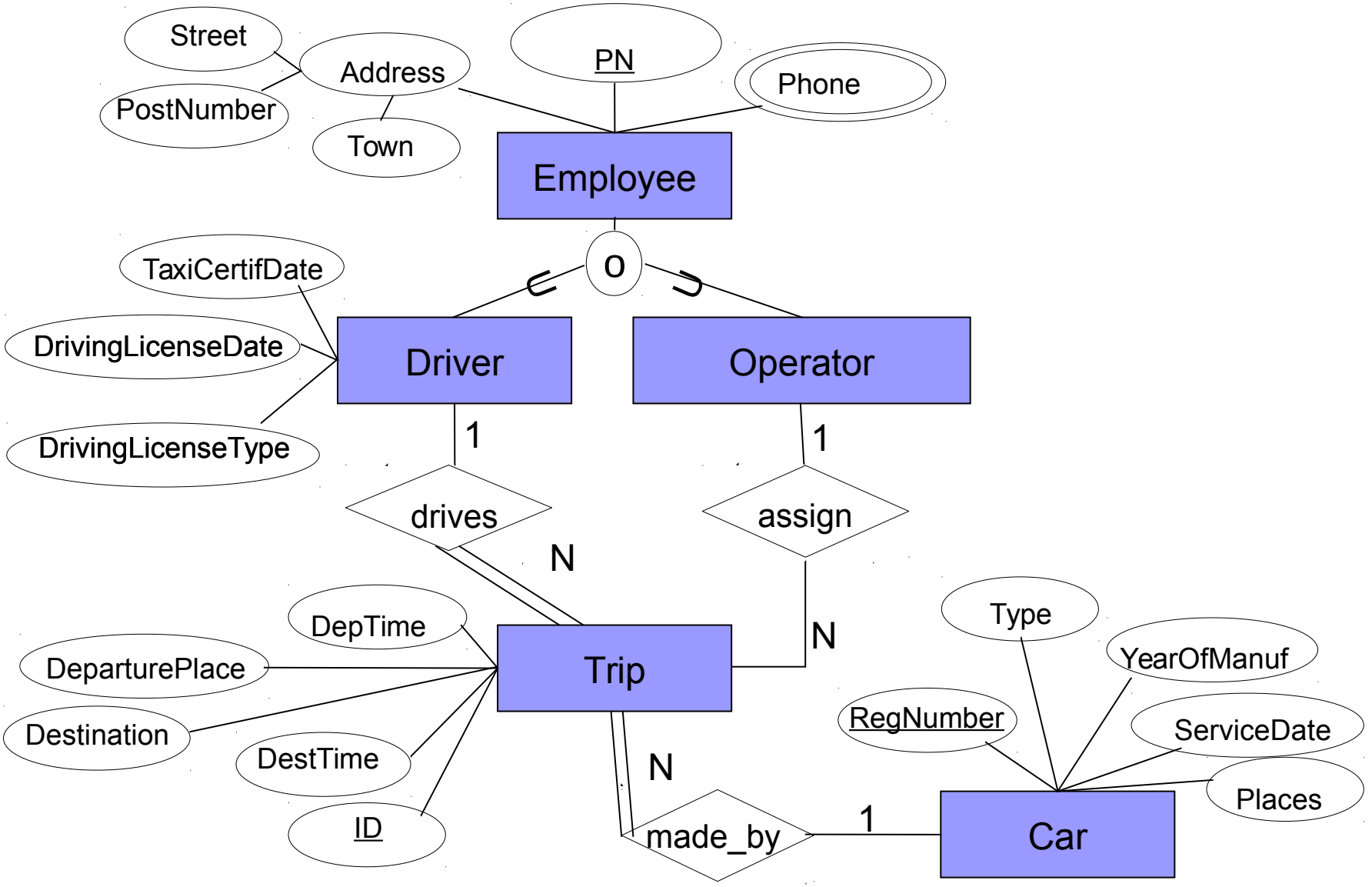
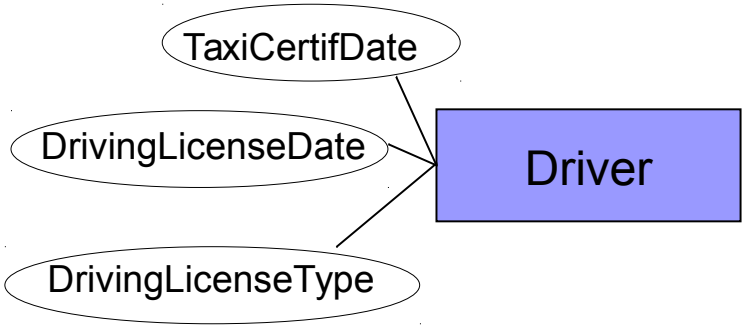
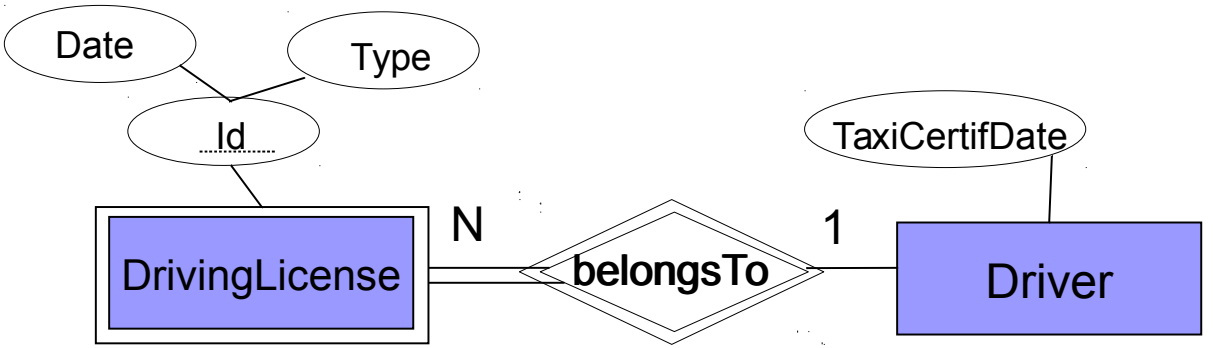
Example

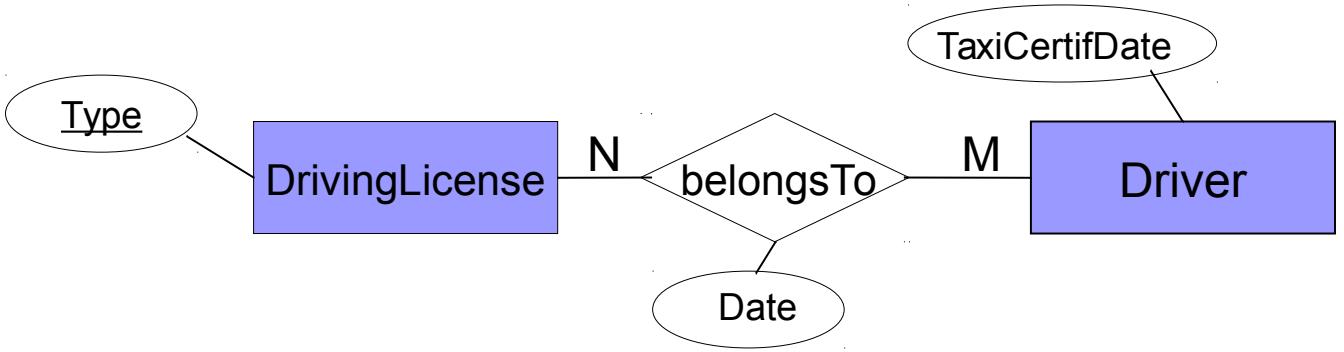

Street
Address
PostNumber
Town
PN
Phone
Employee
o
TaxiCertifDate
DrivingLicenseDate
DrivingLicenseType
Driver
Operator
1
1
drives
assign
N
N
DepTime
DeparturePlace
Destination
DestTime
ID
Trip
N
1
made_by
Type
YearOfManuf
RegNumber
ServiceDate
Places
Car

Example (cont'd)

A driver may have many driving licenses (types)







Summary

Summary

- Entity-relationship (ER) model: a graphical way to model the world
- Main concepts:
  - Entity type
  - Relationship type
  - Attributes
- Different types of constraints
- Enhanced ER model