Introduction to Entities, Attributes, and Relationships

Overview

Why conceptual modeling?

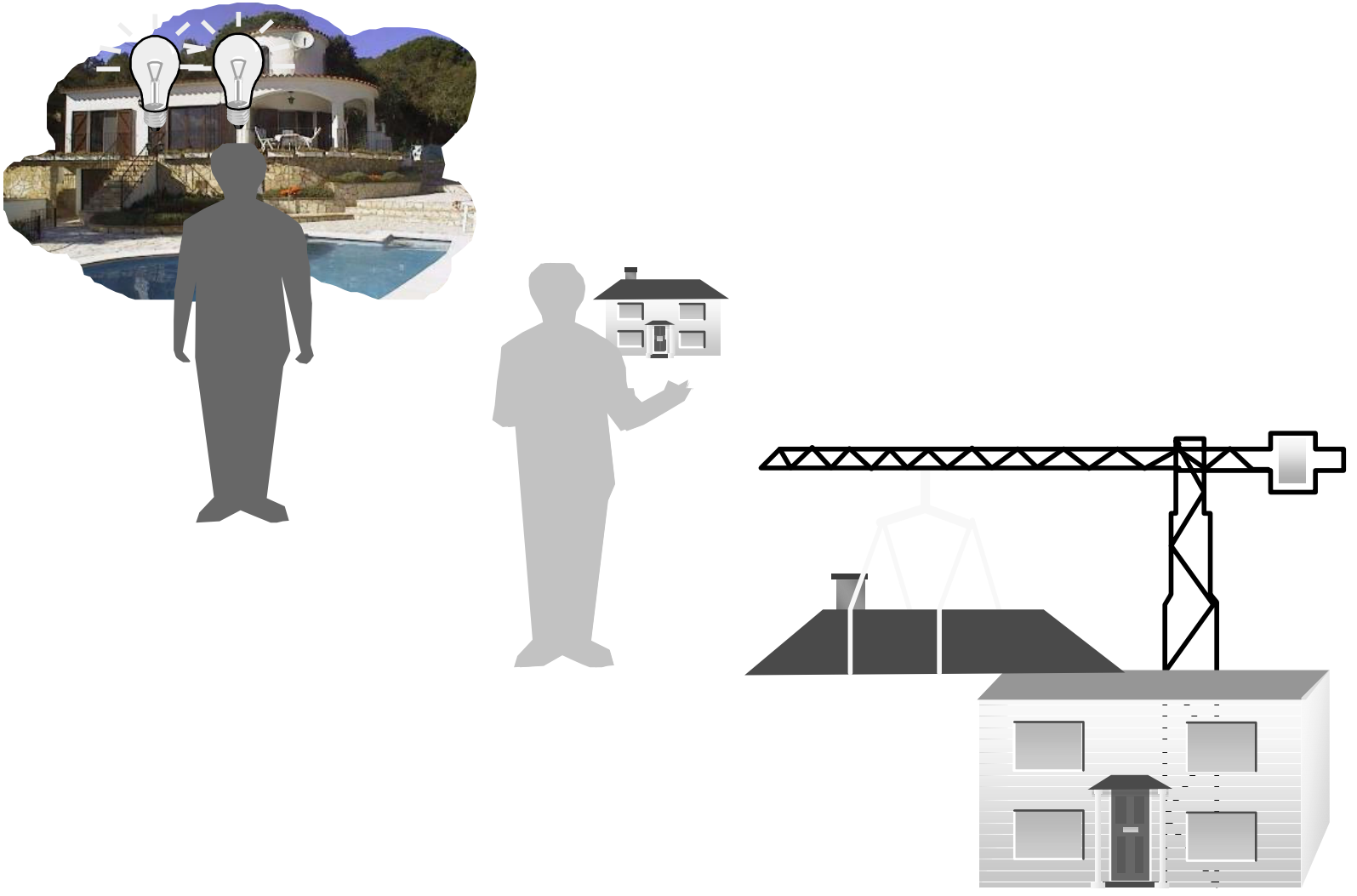
Introduction of the Key role players:

- **Entities**
- **Attributes**
- **Relationships**

Why Create a Conceptual Model?

- It describes exactly the information needs of the business
- It facilitates discussion
- It helps to prevent mistakes, misunderstanding
- It forms important “ideal system” documentation
- It forms a sound basis for physical database design
- It is a very good practice with many practitioners

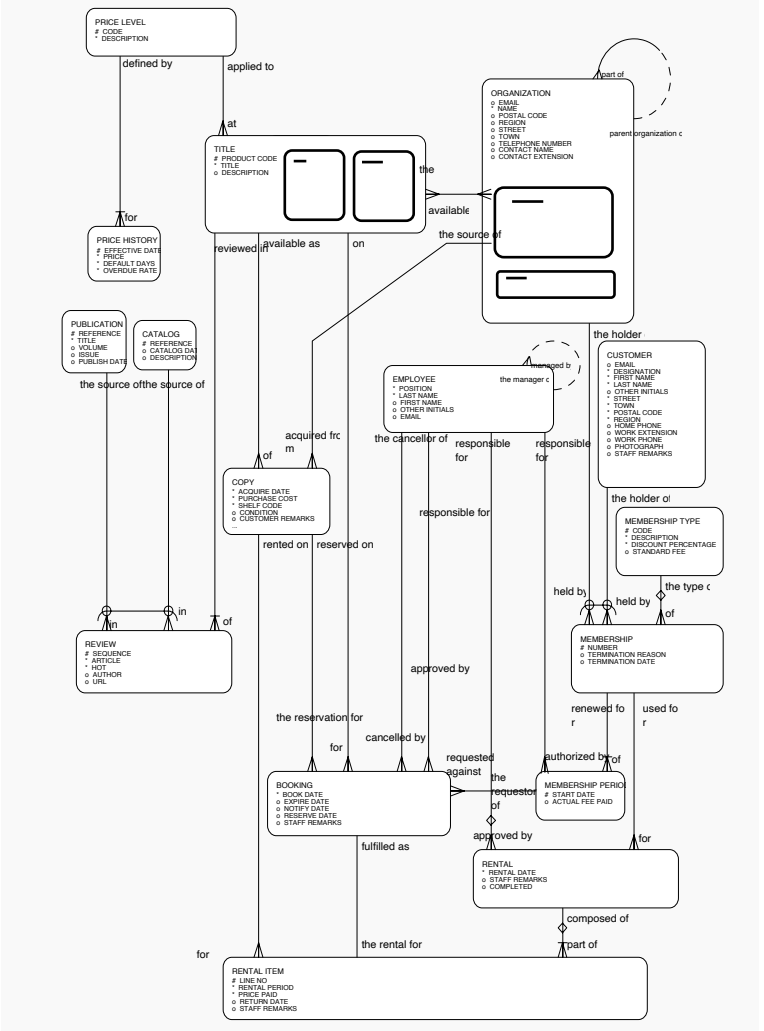
Between Dream and Reality...



Entity Relationship Modeling

- **Models business, not implementation**
- **Is a well-established technique**
- **Has a robust syntax**
- **Results in easy-to-read diagrams…**

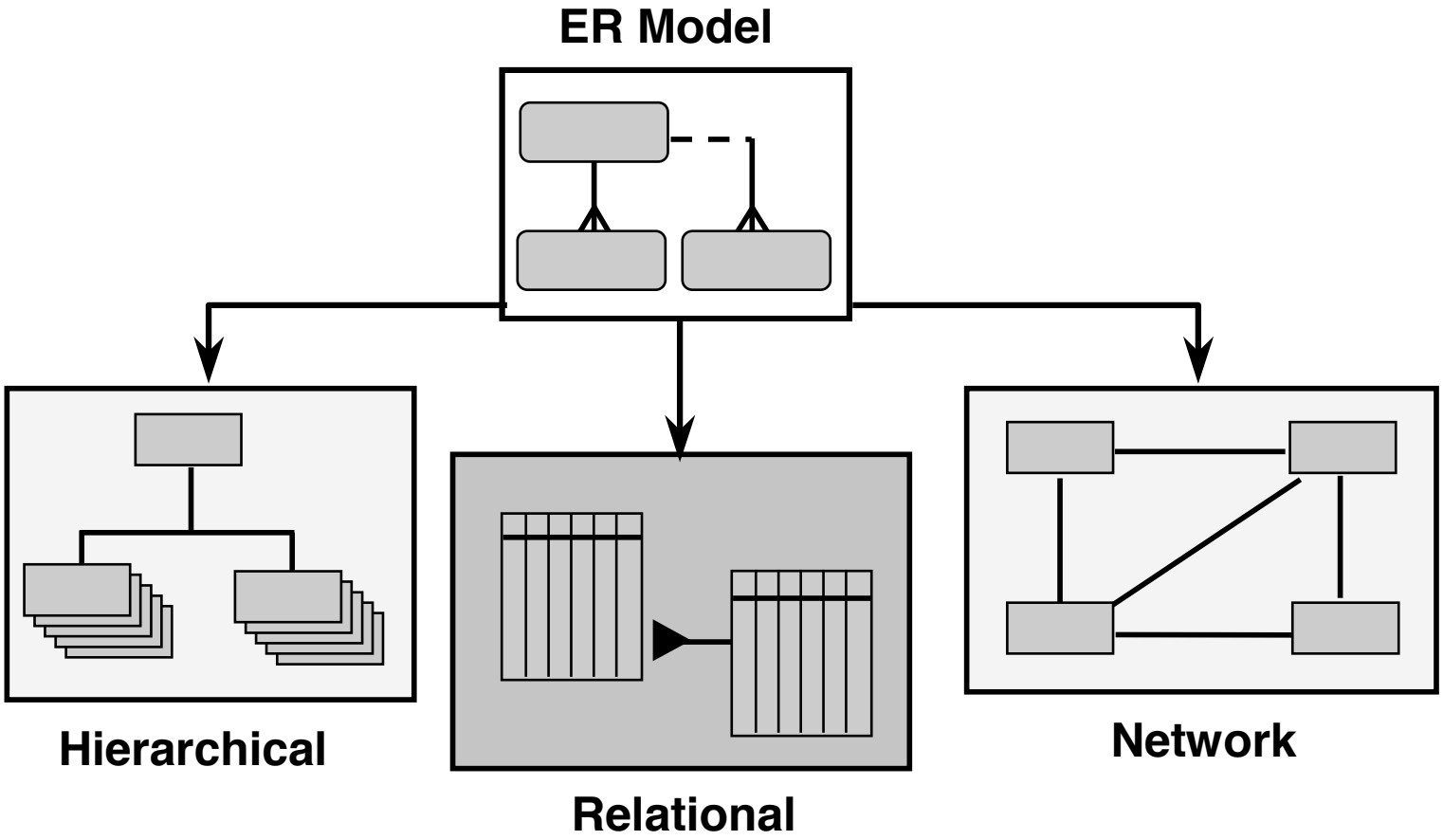
...although they may look rather complex at first sight



Goals of Entity Relationship Modeling

- Capture *all* required information
- Information appears *only* once
- Model *no* information that is derivable from other information already modeled
- Information is in a predictable, logical place

Database Types



Entity

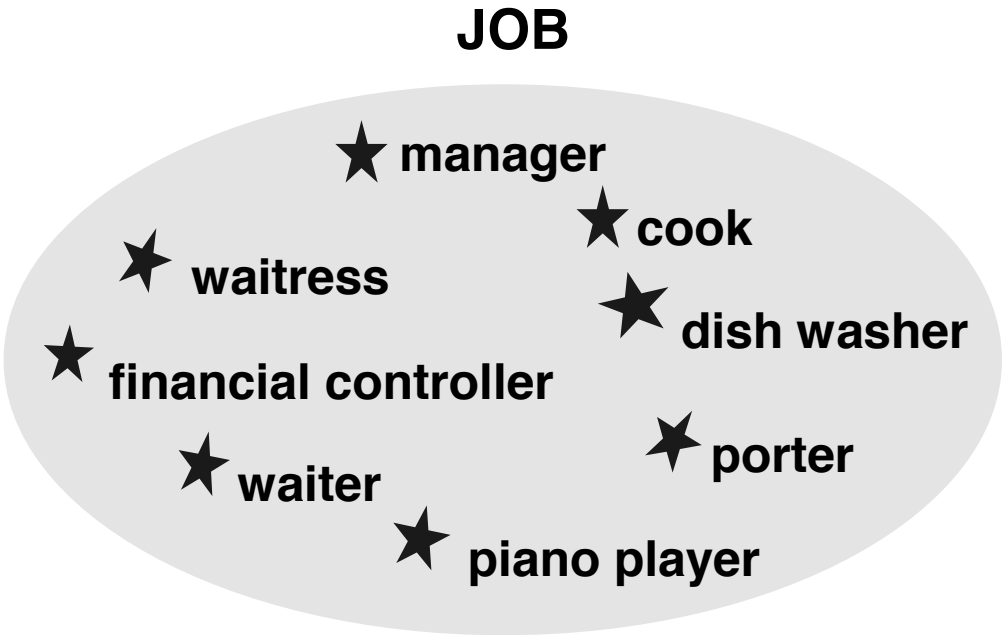
- An Entity is:
  - "Something" of significance to the business about which data must be known
  - A name for the things that you can list
  - Usually a noun
- Examples: objects, events
- Entities have instances

Entities and Instances

PERSON	Mahatma Gandhi
PRODUCT	2.5 x 35 mm copper nail
PRODUCT TYPE	nail
EMPLOYMENT CONTRACT	my previous contract
JOB	violinist
SKILL LEVEL	fluent
TICKET RESERVATION	tonight: Hamlet in the Royal
PURCHASE	the CD I bought yesterday
ELECTION	for parliament next fall
PRINTER PREFERENCE	…
DOCUMENT VERSION	...

Entities and Sets

An entity represents a set of instances that are of interest to a particular business.



Attribute

- Also represents something of significance to the business
- Is a *single valued* property detail of an entity
- Is a specific piece of information that:
  - Describes
  - Quantifies
  - Qualifies
  - Classifies
  - Specifies an entity

Attribute Examples

Entity	Attribute
EMPLOYEE	Family Name, Age, Shoe Size, Town of Residence, Email, ...
CAR	Model, Weight, Catalog Price, …
ORDER	Order Date, Ship Date, …
JOB	Title, Description, ...
TRANSACTION	Amount, Transaction Date, …
EMPLOYMENT CONTRACT	Start Date, Salary, ...

Relationships

- Also represent something of significance to the business
- Express how entities are mutually *related*
- Always exist between *two* entities (or one entity *twice*)
- Always have two perspectives
- Are named at both ends

Relationship Examples

EMPLOYEES *have* JOBS

JOBS *are held by* EMPLOYEES

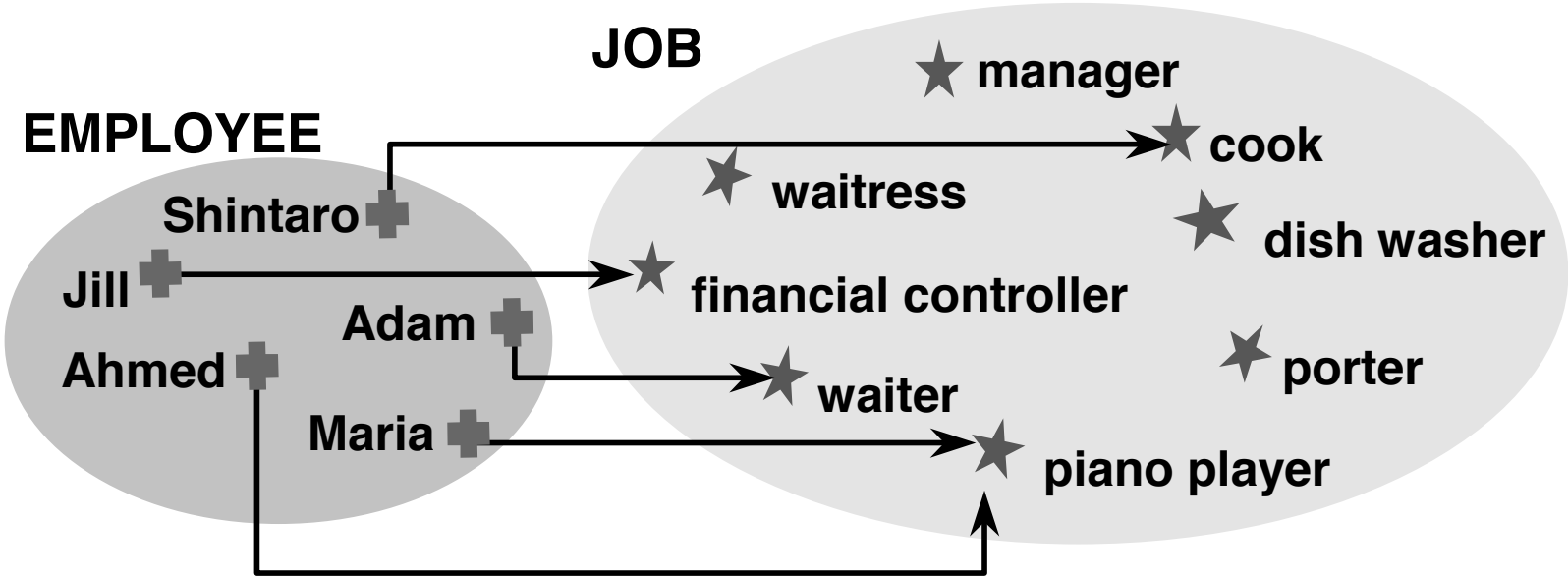
PRODUCTS *are classified by* a PRODUCT TYPE

PRODUCT TYPE *is a classification for* a PRODUCT

PEOPLE *make* TICKET RESERVATIONS

TICKET RESERVATIONS *are made by* PEOPLE

Employees have Jobs

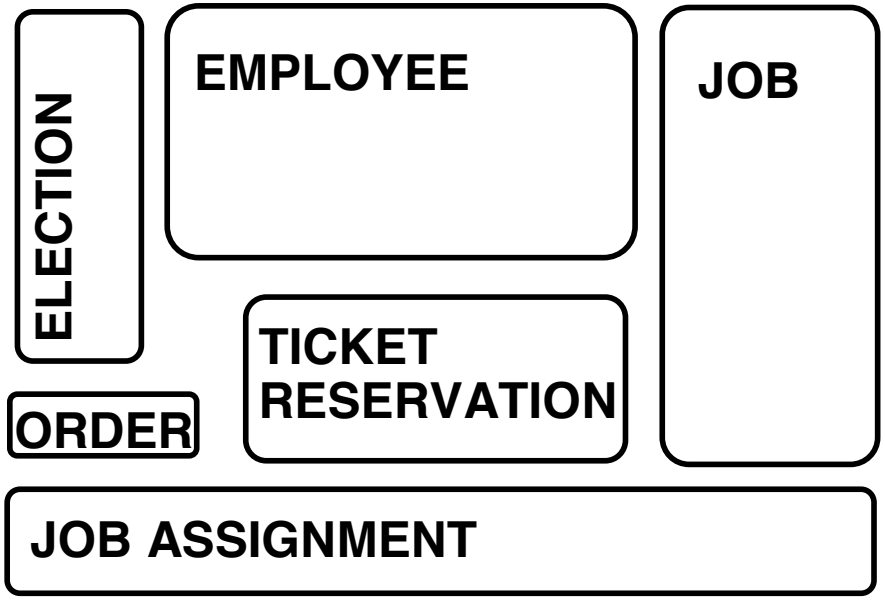


Numerical observation:

- ***All*** **EMPLOYEES have a JOB**
- **No EMPLOYEE has *more than one* JOB**
- ***Not all*** **JOBS are held by an EMPLOYEE**
- **Some JOBS are held by *more than one* EMPLOYEE**

Entity Representation in Diagram

- Drawn as a “softbox”
- Name singular
- Name inside
- Neither size, nor position has a special meaning



During design, entities usually lead to tables.

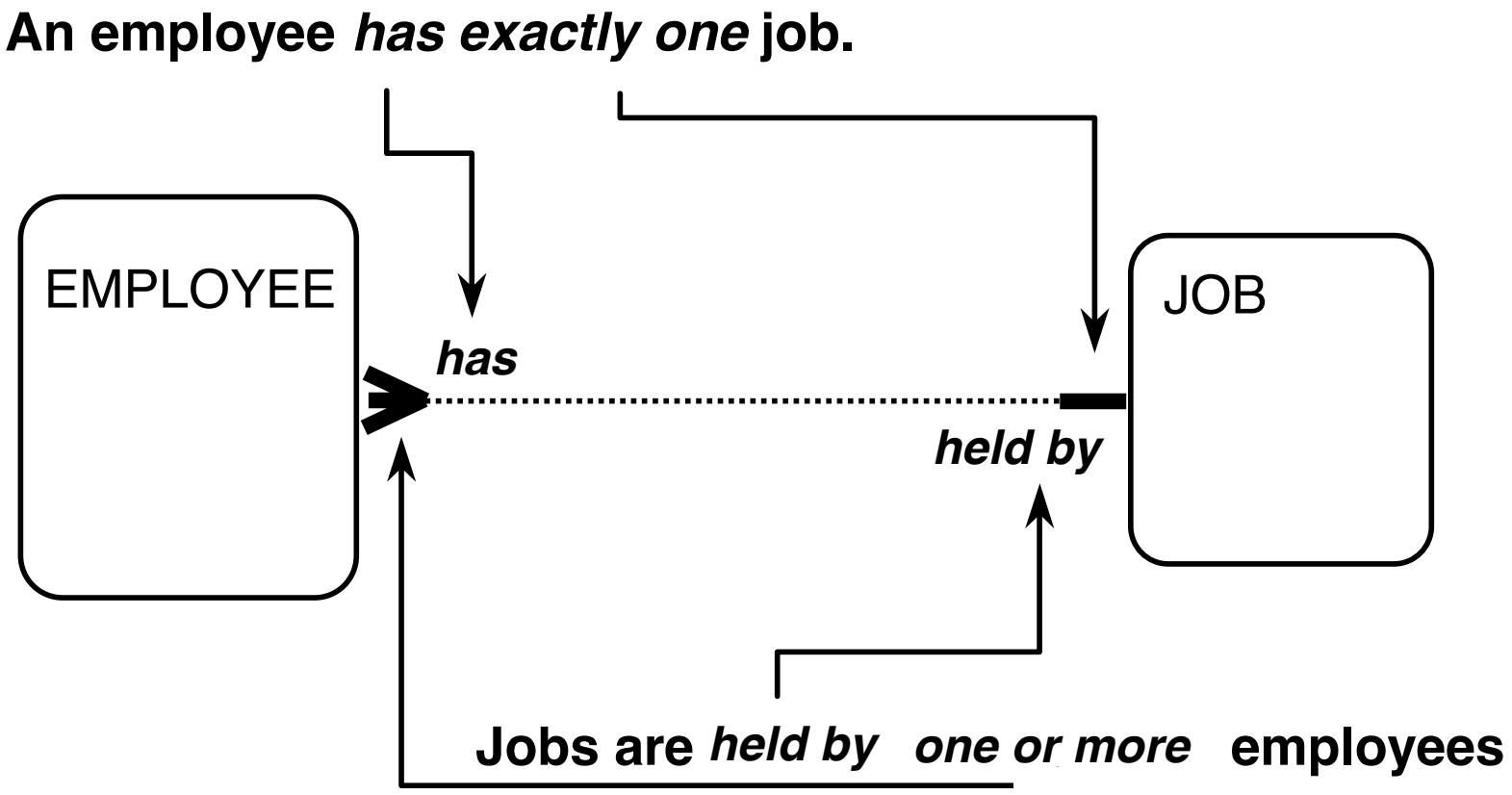
Attributes in Diagrams

Mandatory attribute, that is, known *and* available for every instance.

Optional attribute, that is, unknown *or* unimportant to know for some instances.

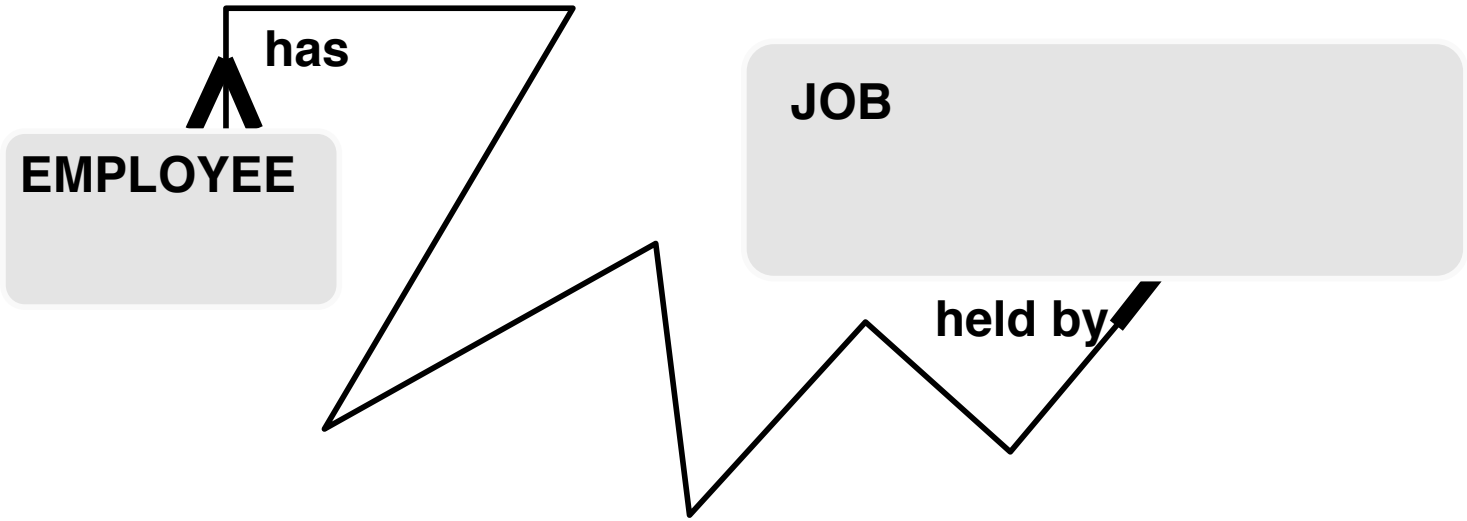
During design, attributes lead to columns.

Relationship in Diagrams



During design, relationships lead to foreign keys.

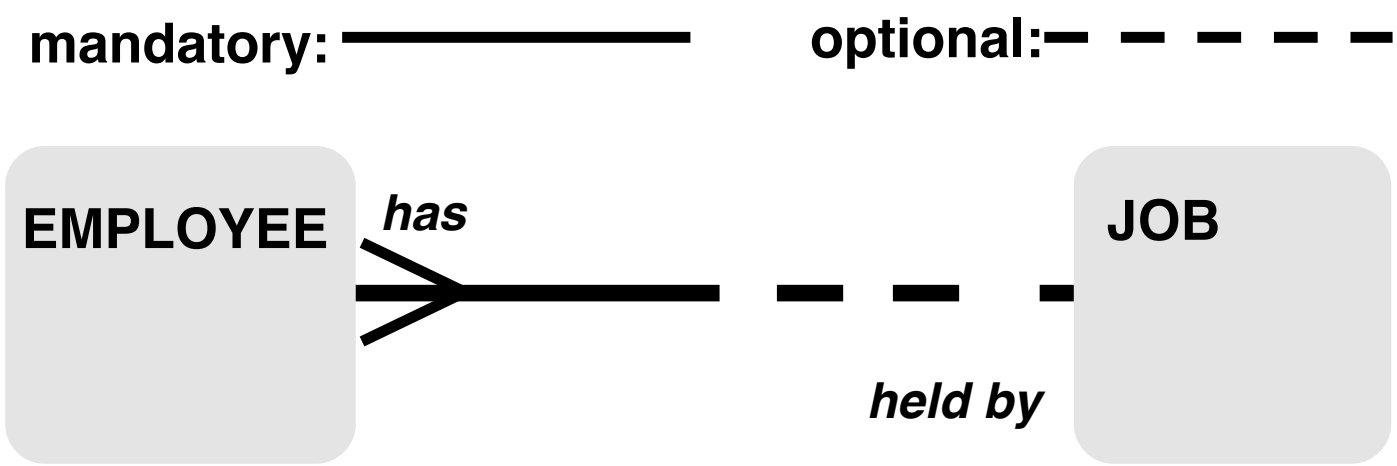
Diagrams Are To Communicate



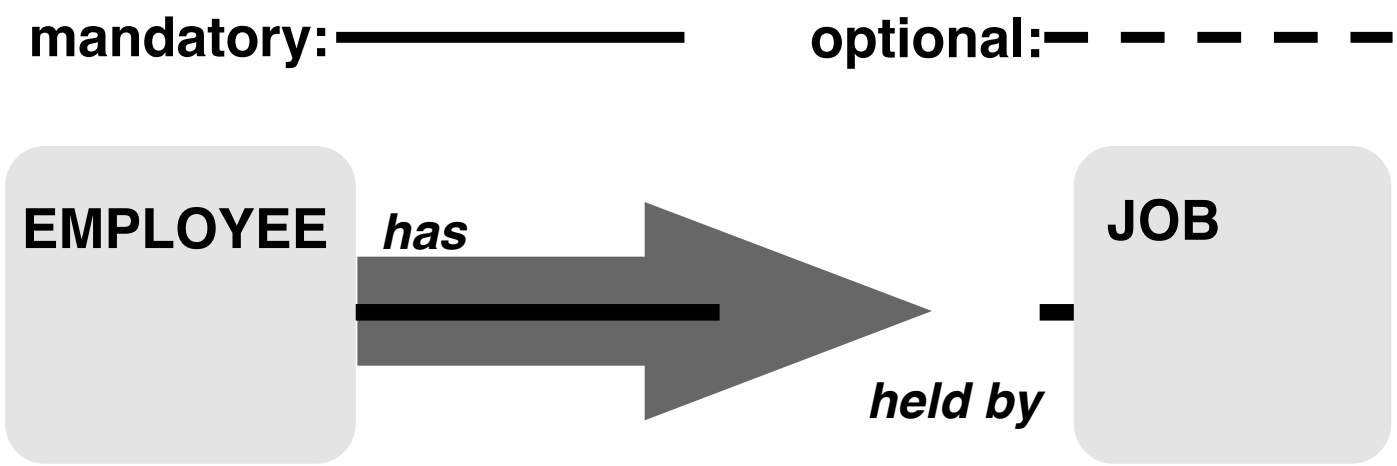
Characteristics Of The Relationship Line

mandatory:  **optional:** 

Two Perspectives

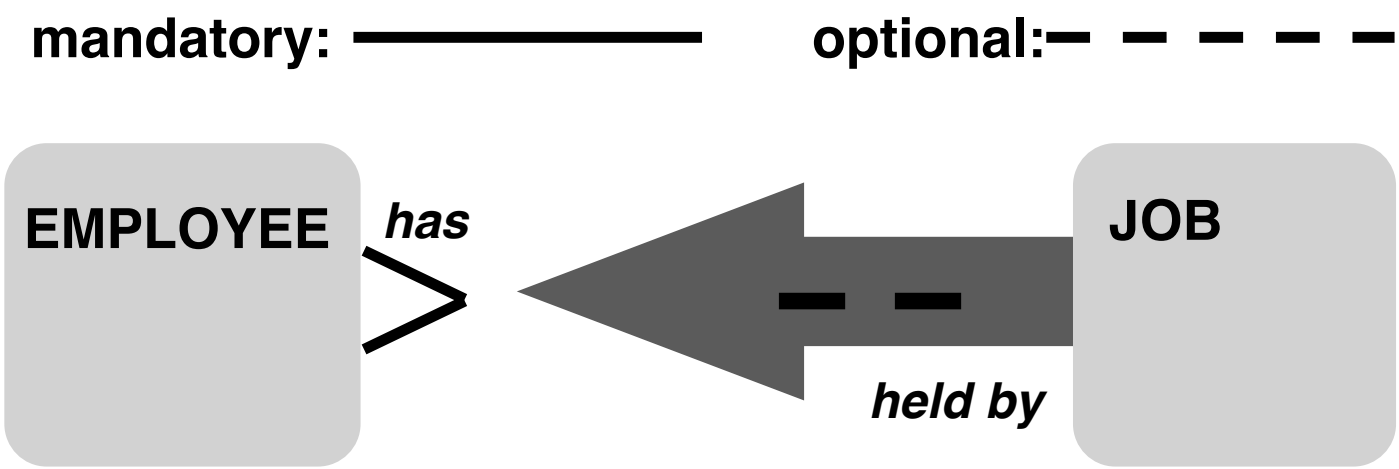


One Way



Every EMPLOYEE *has* exactly one JOB

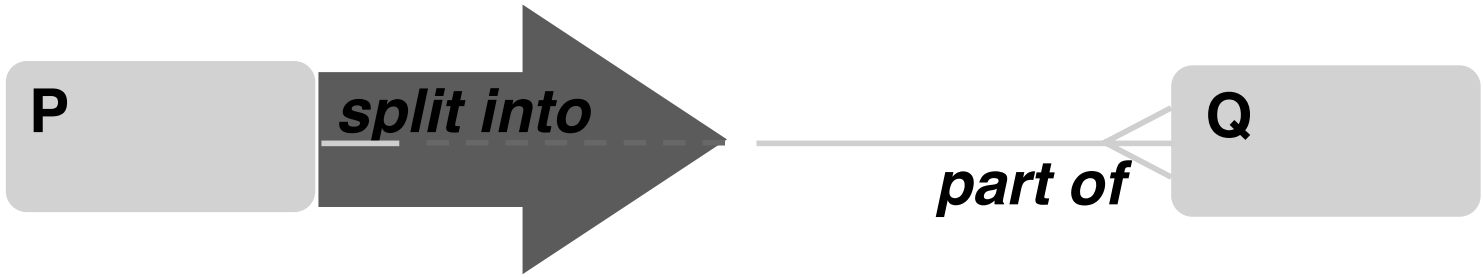
The Other Way



A JOB may be *held by* one or more EMPLOYEES

Reading a Relationship End

Reading a Relationship End



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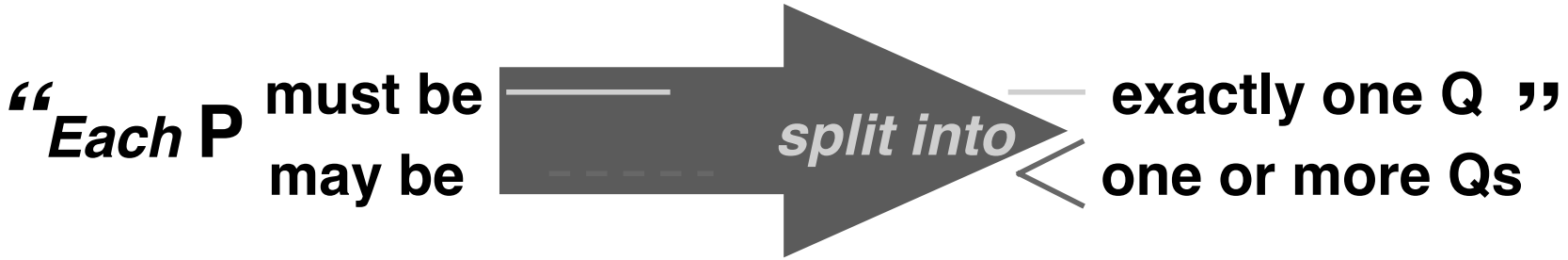

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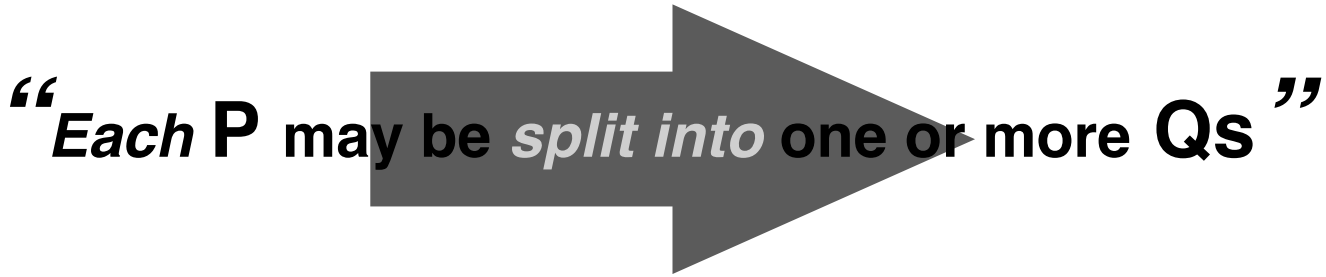

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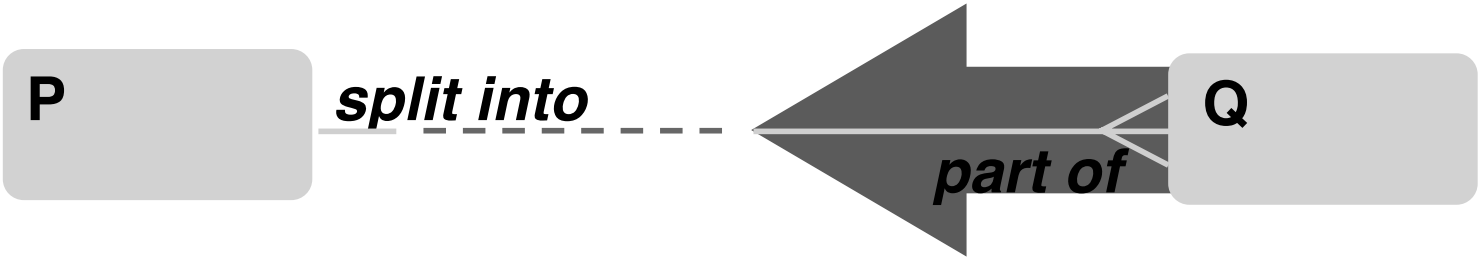

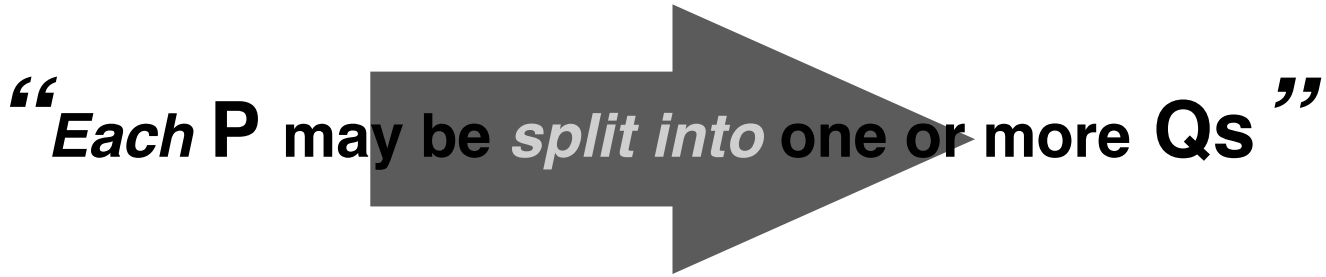

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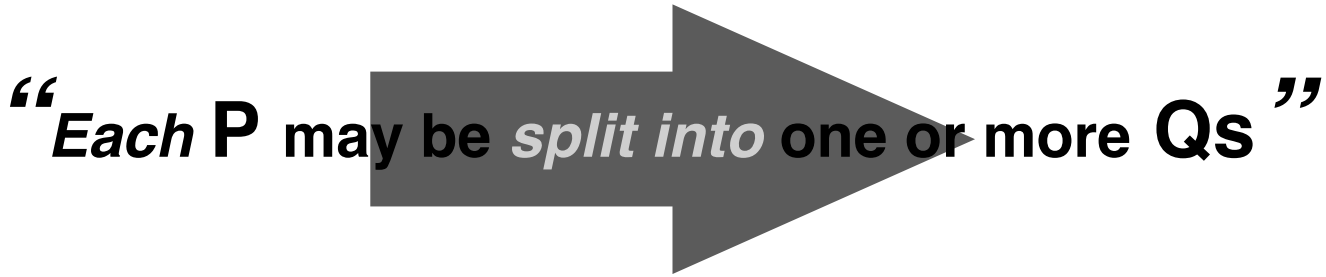
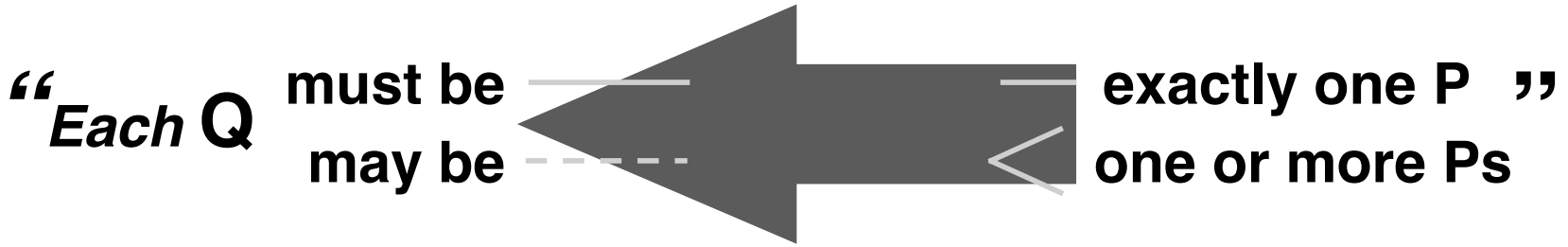




Reading a Relationship End

"*Each* P may be *split into* one or more Qs"

"*Each* Q must be *part of* exactly one P"

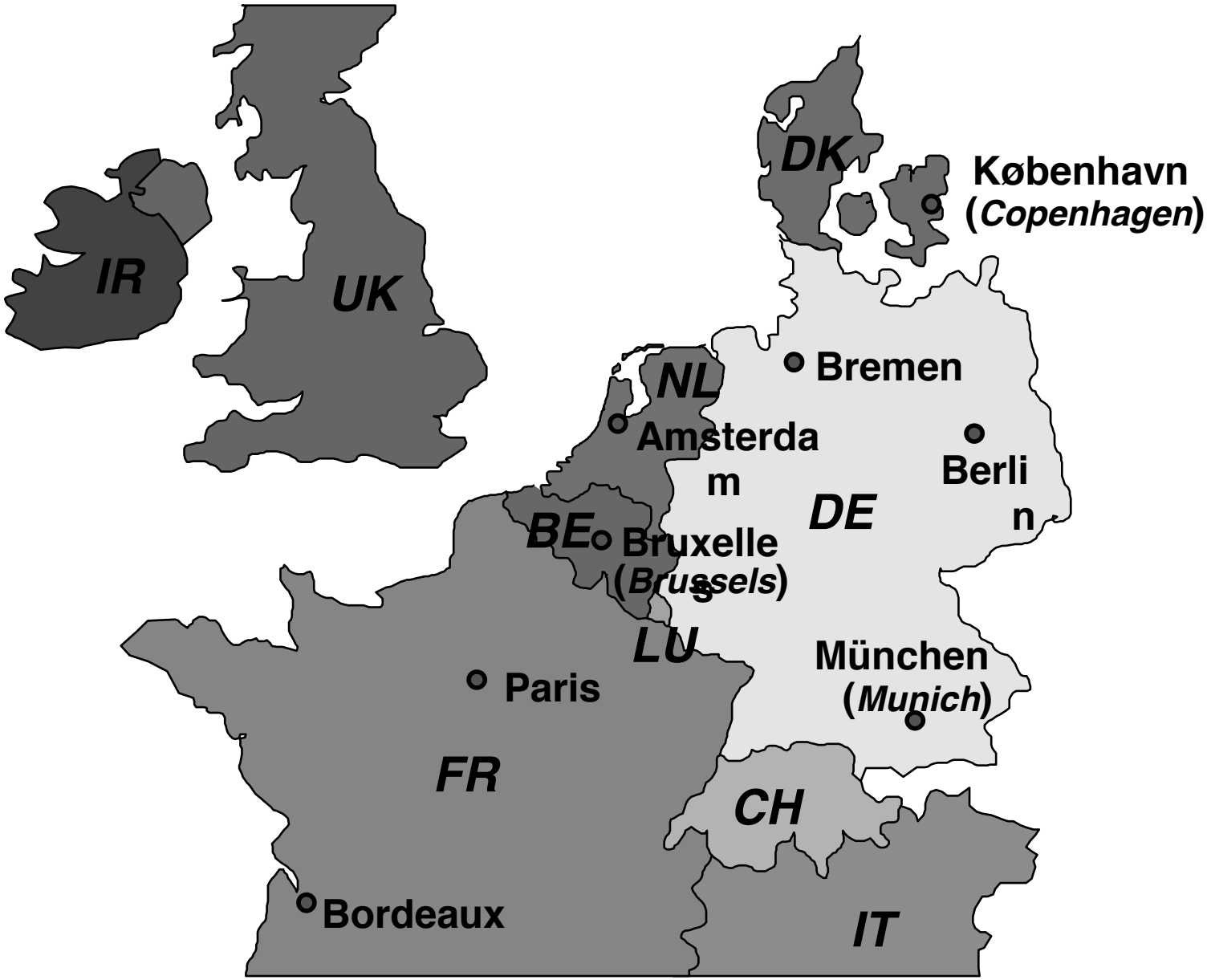
Functions Drive Data

- Business functions are always present.
  - Explicit
  - Assumed
- Business functions need data.
- An entity, attribute, or relationship may be modeled because:
  - It is used by a business function.
  - The business need may arise in the near future.

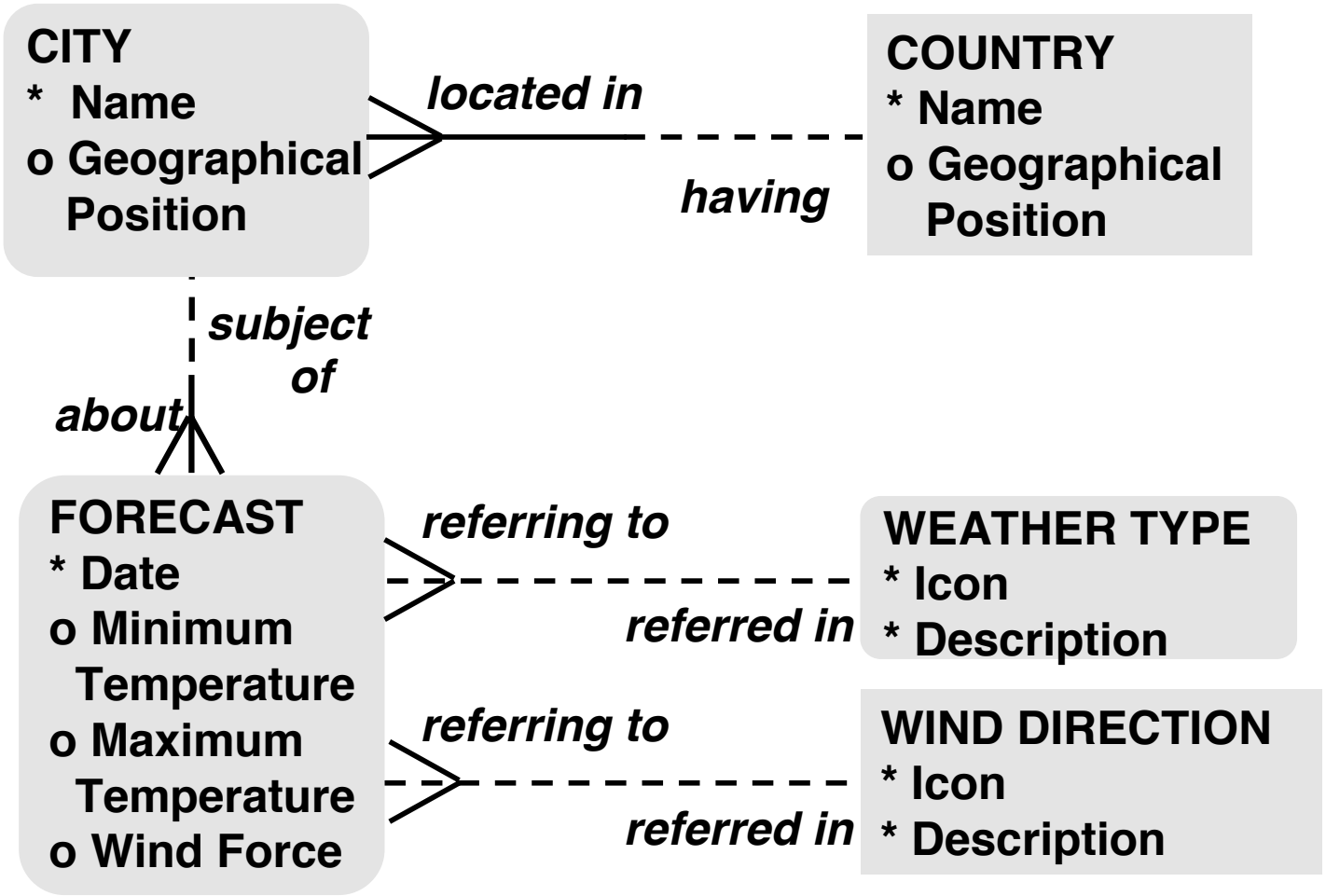
Weather Forecast

January 26

København		1/-5	→ 3
Bremen		0/-3	↙ 4
Berlin		3/-1	← 3
München		5/-3	← 3
Amsterdam		8/3	↗ 4
Bruxelles		4/0	→ 2
Paris		4/1	→ 3
Bordeaux		7/2	↗ 3



Weather Forecast, a Solution



Graphical Elements of ER Diagram

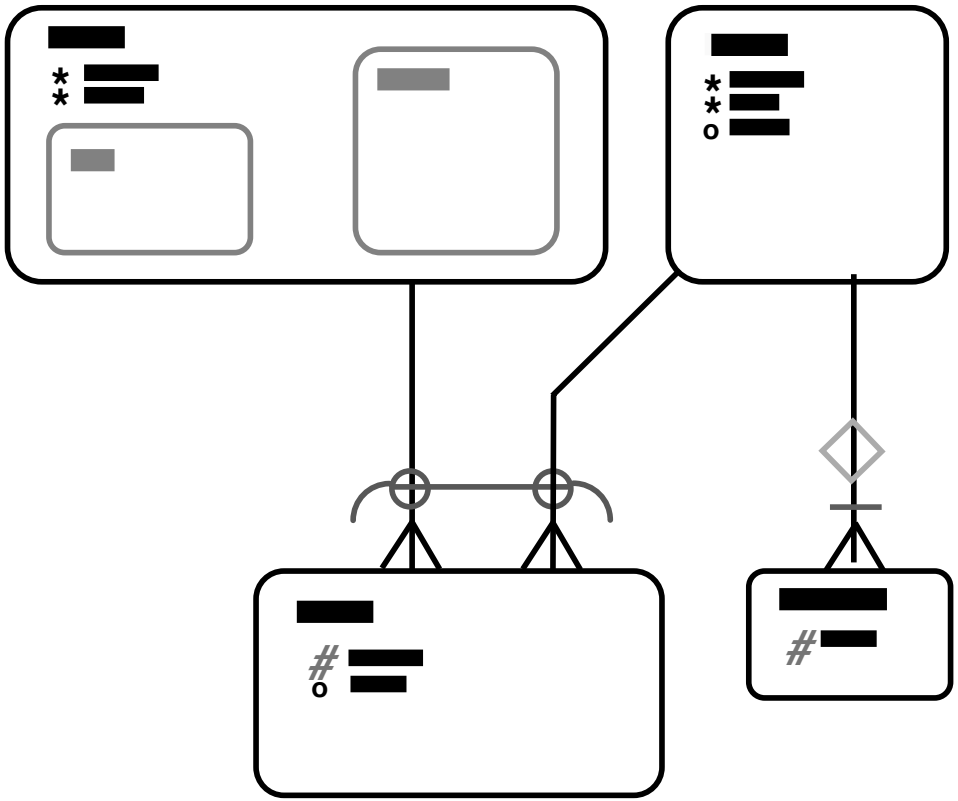
- ☑ Entity
- ☑ Attribute
- ☑ Relationship

Subtype

Unique identifier

Arc

Nontransferability



Summary

- ER Modeling models information conceptually
- Based on functional business needs
- “What”, not “How”
- Diagrams provide easy means of communication
- Detailed, but not too much

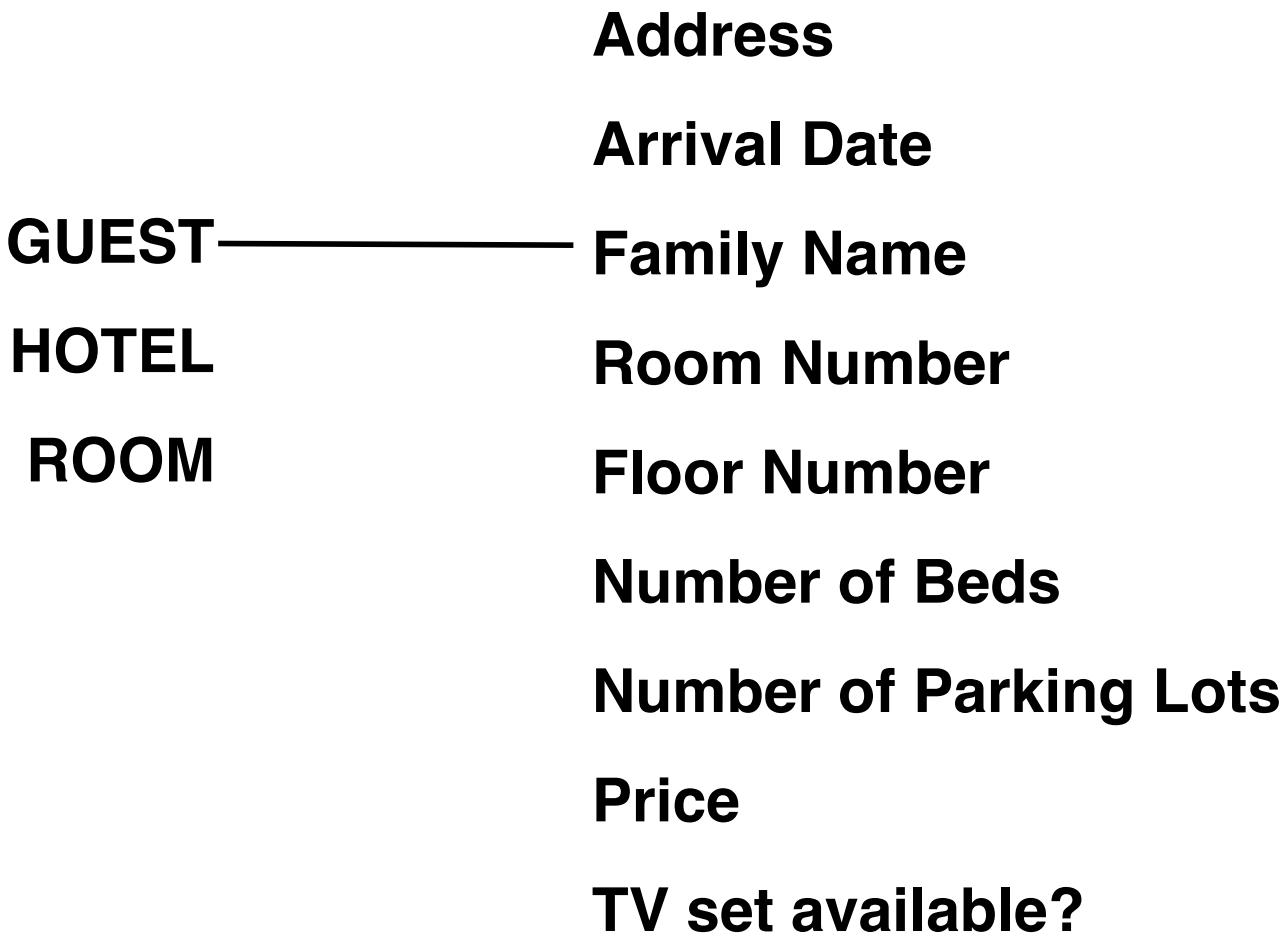
Practices

- Instance or Entity
- Guest
- Reading
- Hotel
- Recipe

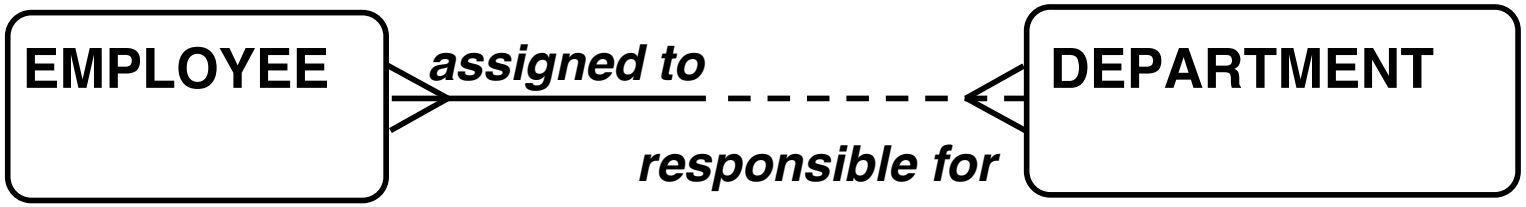
Practice: Instance or Entity?

Concept	E/A/I?	Example Instance or Entity
PRESIDENT		
ELLA FITZGERALD		
DOG		
ANIMAL		
HEIGHT		
	E	CAR
	A	CAR
	I	CAR

Practice: Guest



Practice: Reading

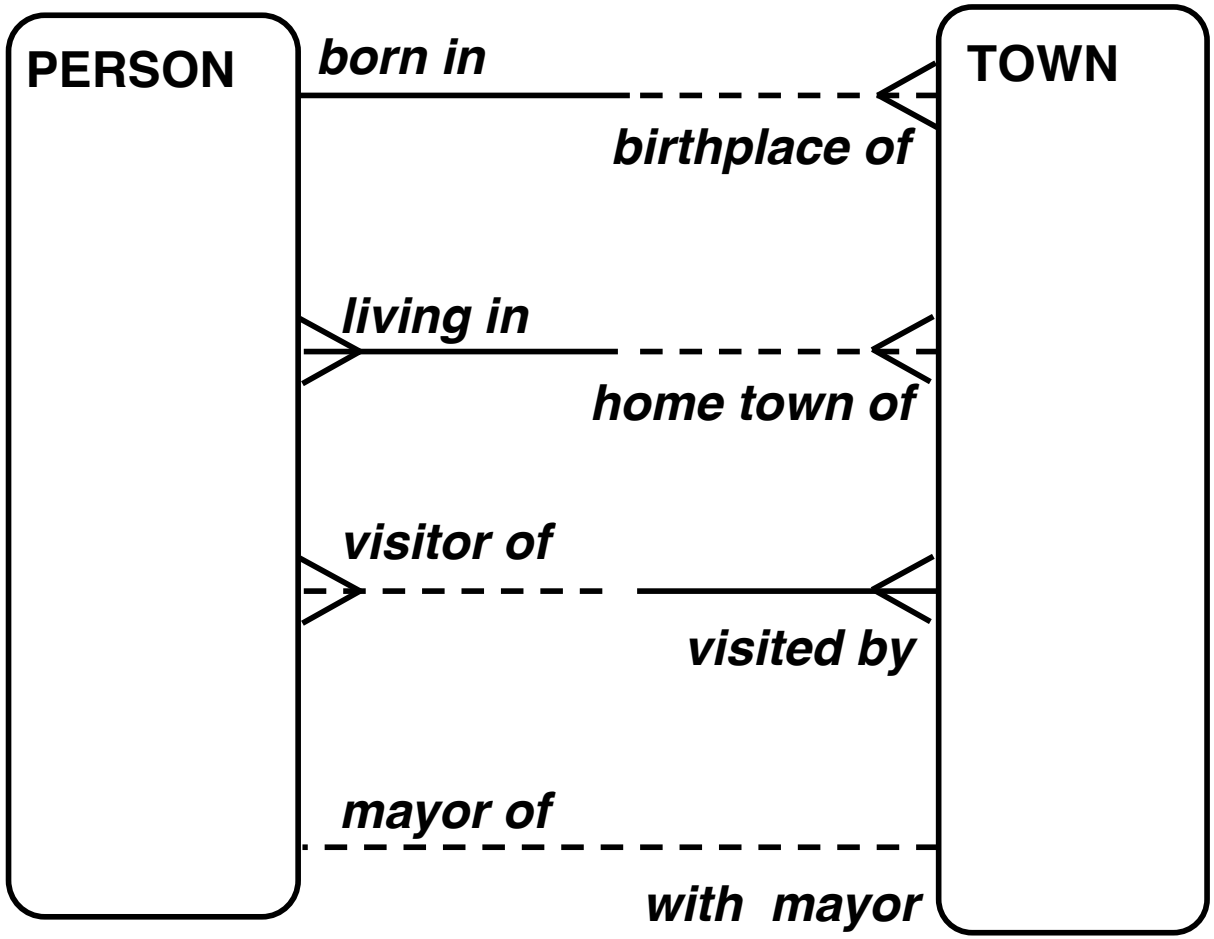


A Each EMPLOYEE may be assigned to one or more DEPARTMENTS
Each DEPARTMENT must be responsible for one or more EMPLOYEES

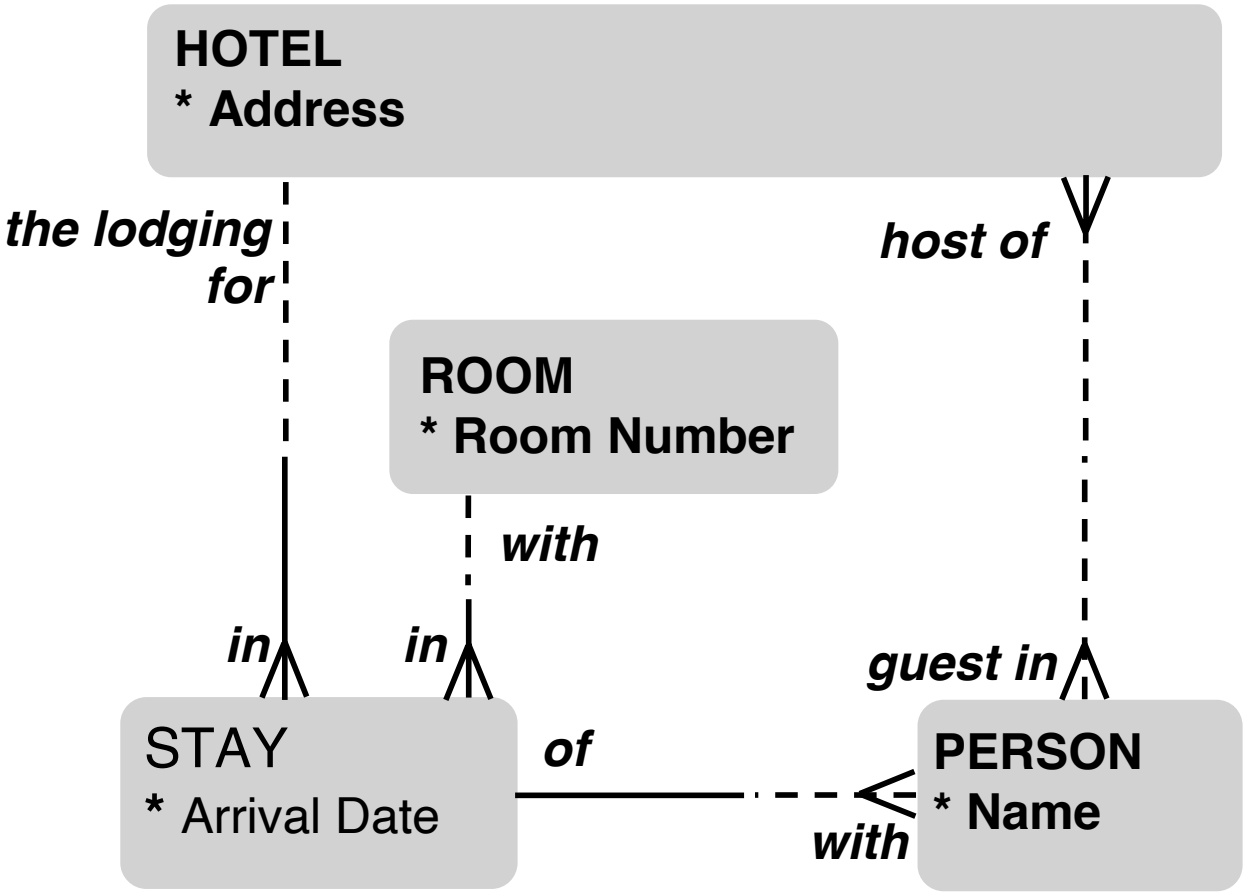
B Each EMPLOYEE must be assigned to one or more DEPARTMENTS
Each DEPARTMENT may be responsible for one or more EMPLOYEES

C Each EMPLOYEE must be assigned to exactly one DEPARTMENT
Each DEPARTMENT may be responsible for exactly one EMPLOYEE

Practice: Read and Comment



Practice: Hotel



Soups	**Açorda alentejana** bread soup from Portugal
vegetarian 15 min easy	For 4 persons: 1 onion 4 cloves of garlic 1 red pepper 1 liter of vegetable broth 4 tablespoons of olive oil 4 fresh eggs 1 handful of parsley or coriander salt, pepper 9-12 slices of (old) bread
Preparation	Cut the onion into small pieces and fry together with the garlic. Wash the red pepper, cut it in half, remove the seeds and fry it for at least 15.