Part 4.2
Phase 1 - Purpose Definition

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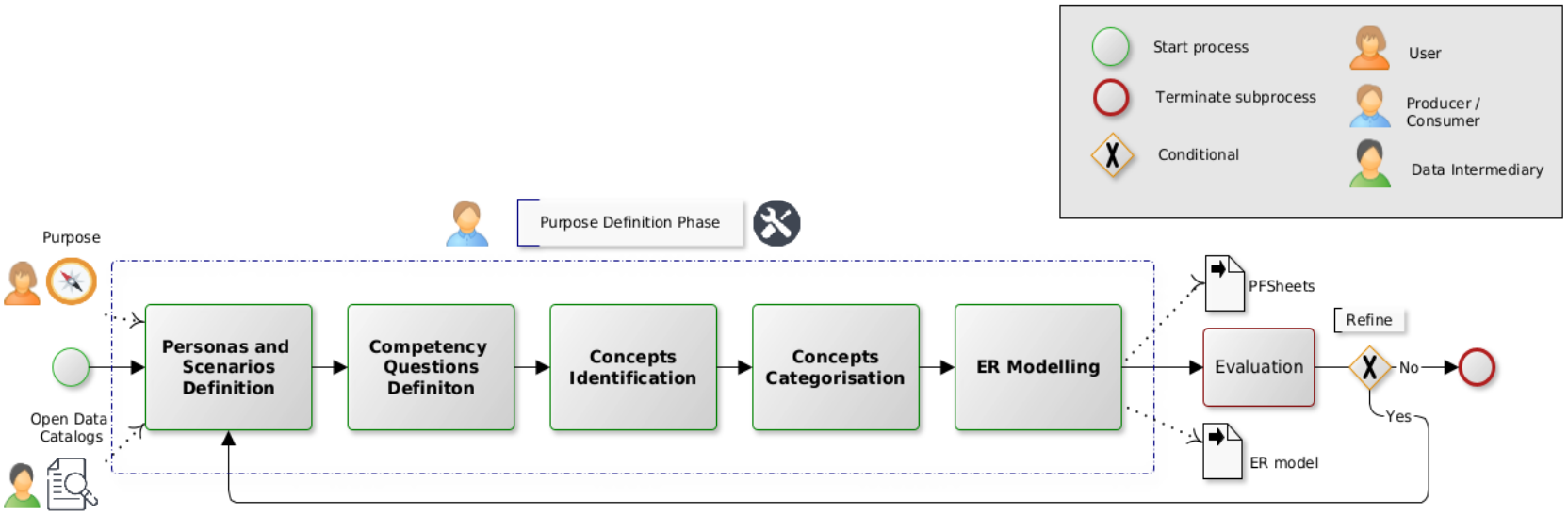


- **Input**: Purpose statement, data source list.
- **Objective**: Formalize the purpose, by extracting the functional requirements.
- **Output**: Purpose Formalization documents (PFSheets) and purpose ER model.

Phase 1 - Purpose Definition - Activities

- **Personas & Scenarios definition**: formalize the context and the actors involved in the project.
- **Competency Question definition**: state (informally) the requirements to be satisfied by the final KG.
- **Concepts Identification**: identify the information "entities" to be considered in the final KG.
- **Concept Categorization**: categorize the above entities based on their **Focus and Popularity** respect to the Purpose to be satisfied and their existing reuse.
- **ER modeling**: formalize the Purpose into an ER model.

Purpose Definition - Personas & Scenarios definition

- The goal of this activity is to **formalize the initial purpose statement** received as natural language sentence.
- Such a formalization follow an approach that aims at **extracting the specific information** from the initial Purpose.

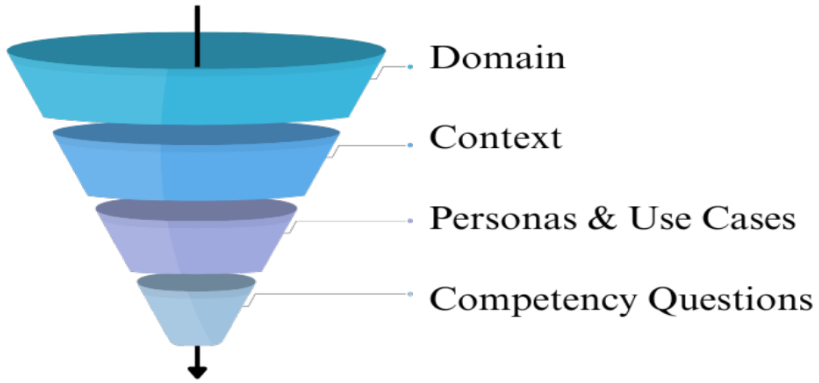


Figure 4: Funnel approach on the Purpose

Purpose Definition - Personas & Scenarios definition

- **Domain of interest**: It refers to the area of knowledge or field of study of interest [35]. Examples are the domains capturing knowledge about daily lives, such as music, tourism, and health, or geographical domains, like Trentino autonomous province.

- **Context**: The second level refers to the context description. The first prescriptive definition of Context referred to it as a location, identities of nearby people and objects, and changes to those objects [36]. More in details the context is defined over three main dimensions:

  - **Geographical boundaries**: Aspects that geographically constrain the problem.
  - **Temporal boundaries**: Aspects that constrain the problem in time.
  - **Domain boundaries**: Domain specific aspect constraining the problem.

[35] Fausto Giunchiglia and Biswanath Dutta, Dera: A faceted knowledge organization framework, 2011.

[36] Bill N Schilit and Marvin M Theimer, Disseminating active map information to mobile hosts, IEEE Network 8 (1994), no. 5, 22–32.

Purpose Definition - Personas & Scenarios definition

- **Personas & Scenarios**: user-centered subsets triggered by various subjects, *Personas*, and their real-world perceptions, called Use Cases or *Scenarios*. Personas generation is a widely heralded technique that provides semi-fictional subjects characterising the perception and needs of larger groups of end-users. Moreover, Use Cases are an essential complement to personas, ensuring a complete and good representation of end-users.

Purpose Definition - Competency Question definition

- The second activity add one more step in the formalization of the initial purpose, by **extracting the KG functional requirements**, from the output of the previous activity, shaping them as **Competency Questions (CQs)**.
- **Competency Questions**: a list of natural language questions. Each question defines a need (or query to the KG) that should be satisfied by the final KG. Each query refers to a Persona into a specific Scenario.
- **NOTE**: it is important to notice how the definition of CQs is crucial for the design of the final KG.
  - A **poor, set of CQs doesn't provide enough information** regarding which (information) entities needs to be modeled in the KG.
  - A set of CQs with **low heterogeneity, does not represent precisely all the possible (information) details** that the KG should be able to support.

Phase 1 - Purpose Definition - Example

- Here an example of Purpose definition phase applied to a concrete iTelos project.
- Let's check how the above activities have been implemented.

Purpose Definition - Concepts Identification

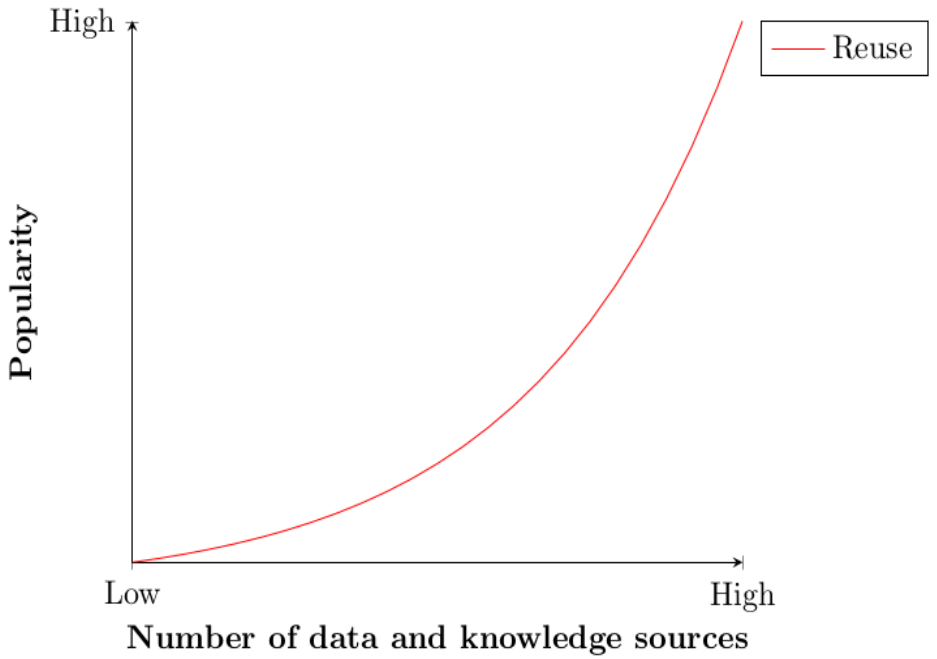
- Having the CQs listed down, the next activity aims at **extracting the concepts identifying the information entities** (and their properties) to be modeled in the KG.
- To this end a dedicated spreadsheet is adopted, called Purpose Formalization sheet (PFsheet).
- By following the **Middle-out approach**, this activity has to be done considering both the purpose (knowledge layer) and the data sources available (Data layer)

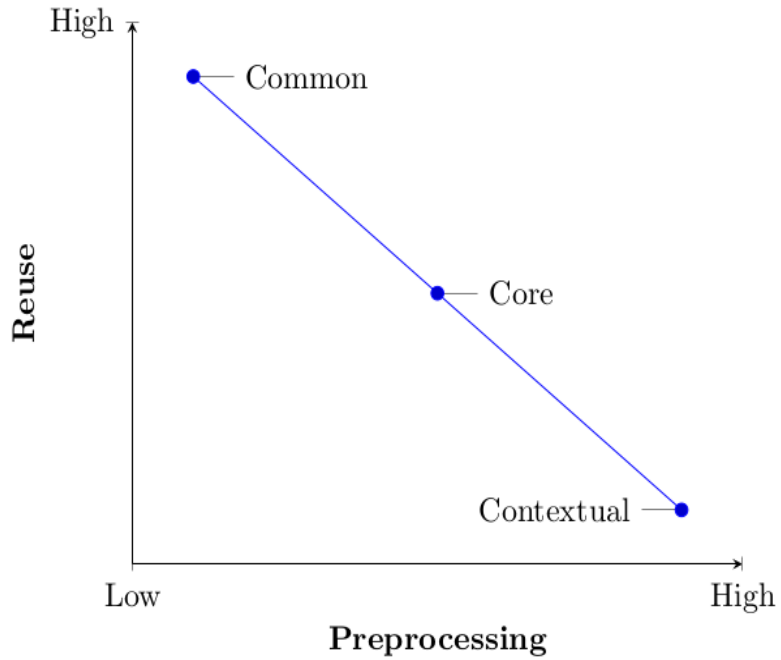
A	B	C	D	E	F	G
Scenarios	**Personas**	**Competency Questions**	**Entities**	**Properties**	**Focus**	**Popularity**
1	2	2,3	Car	color, number_of_wheels, plag	Core	Common
1	1	4	Pharmacy	address, name	Contextaual	Core
...	...	...	...	...	...	...

Purpose Definition - Concept Categorization

- In the above figure, the PFsheet shows in the last two columns a categorization over:
  - the **Focus**, which defines how much an entity is "important" respect to the main purpose;
  - the **Popularity**, which defines how much an entity is **reused** in already existing data (considering the input information sources).
- Both Focus and Popularity, for each entity, can have three value:
  - **Common**: (Focus) general entities for the purpose considered. (Popularity) the entity is largely available in existing resources.
  - **Core**: (Focus) specific entities for the purpose considered. (Popularity) the entity is available in existing resources but not so common.
  - **Contextual**: (Focus) very specific entities for the purpose considered. (Popularity) the entity is not available in existing resources.
- By following the **Middle-out approach**, this activity has to be done considering both the purpose (knowledge layer) and the data sources available (Data layer)

Purpose Definition - Concept Categorization





Purpose Definition - ER modeling

- The next activity, in the first iTelos phase, aims at producing a **formal representation of the initial purpose**, shaped as ER model.
  - the **ER model** is the first (graphical) version of the final KG structure (or knowledge layer).

ER Model - Definition

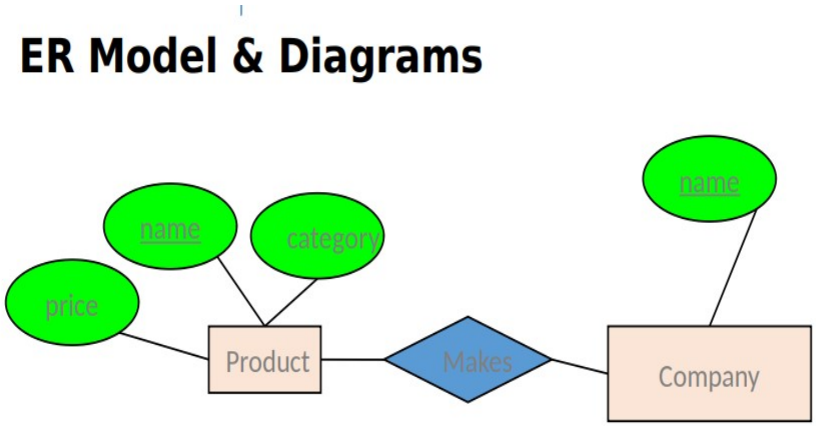
- An **Entity–Relationship (ER) Model** describes interrelated things of interest in a specific domain of knowledge.
- It is composed of **classes** / **entity types** (etypes) (which classify the things of interest, i.e. **entities**) and specifies **relationships** that can exist between entities (instances of those entity types).
- The ER model is, thus, an **abstract data model** that defines a data or information structure which can be implemented in a data/knowledge base.
- It is usually drawn in a graphical form as **boxes (classes)** that are connected by **lines (relationships)** which express the associations and dependencies between entities.
- An ER model is the **informal foundation** for the specification of domain-specific teleologies.

ER Model - Notations

Following are the main components and its symbols in ER Diagrams:

- **Rectangles**: This Entity Relationship Diagram symbol represents entity types.
- **Ellipses** : This symbol represents attributes.
- **Diamonds**: This symbol represents relationship types.
- **Lines**: It links attributes to entity types and entity types with other relationship types.
- **Identifying attributes** are underlined.

ER Model - A Simple Example



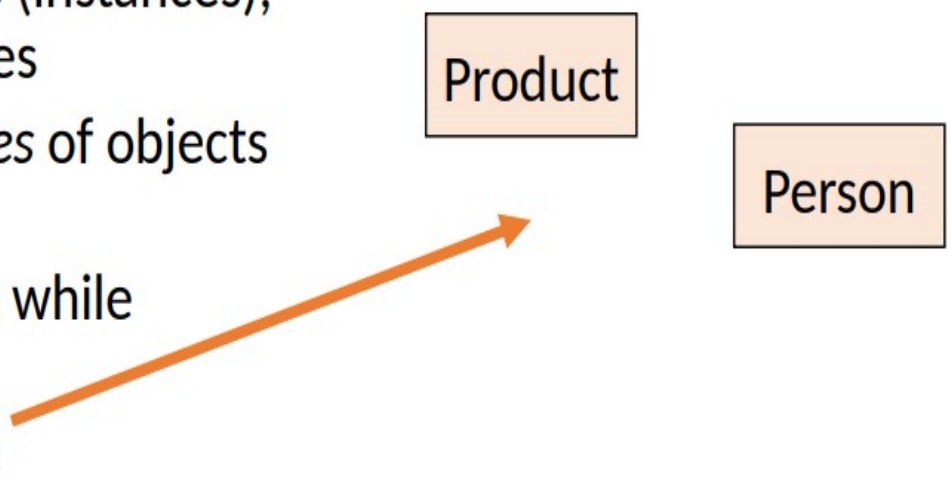
ER is a *visual syntax* for DB design which is ***precise enough*** for technical points, but ***abstracted enough*** for non-technical people.

Reference: M. Hahsler. DS1300: The ER Model.

ER Model - Entities and Entity Types

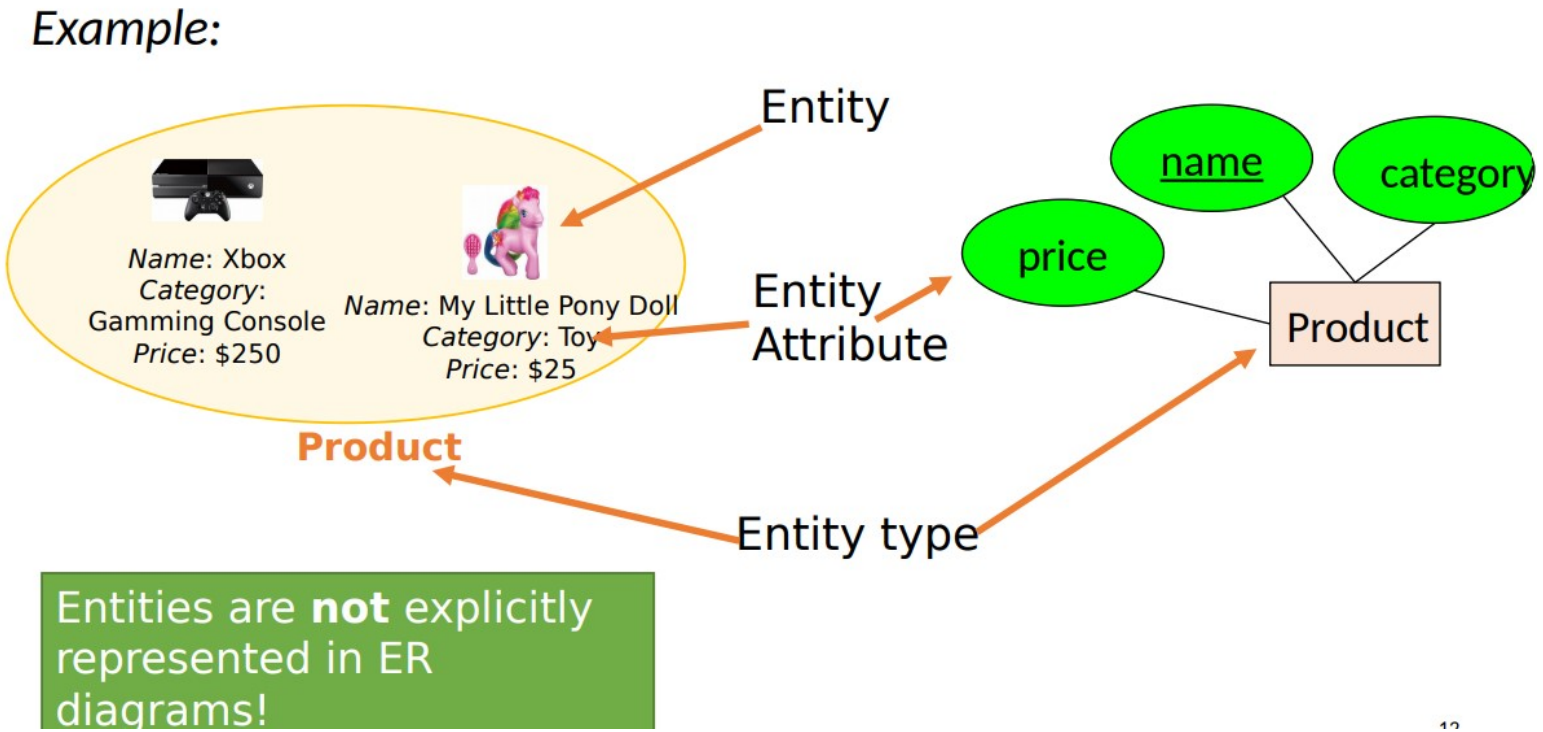
- **Entities** & **entity types** are the primitive units of the ER model

  - Entities are the individual objects (instances), which are members of entity types
  - Entity type are the *classes* or *types* of objects in our model
  - Example: Person is an entity type while Michael is an entity.
  - *We **use entity types** in ER models*



Reference: M. Hahsler. DS1300: The ER Model.

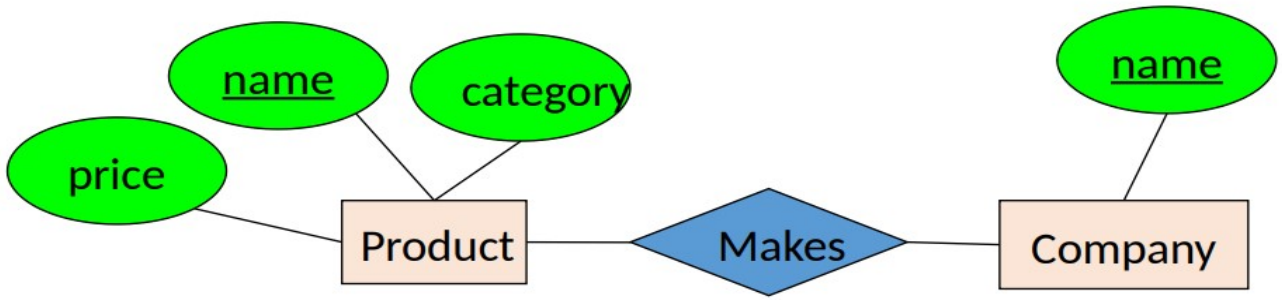
ER Model - Entities vs. Entity Types



Reference: M. Hahsler. DS1300: The ER Model.

ER Model - Relationships

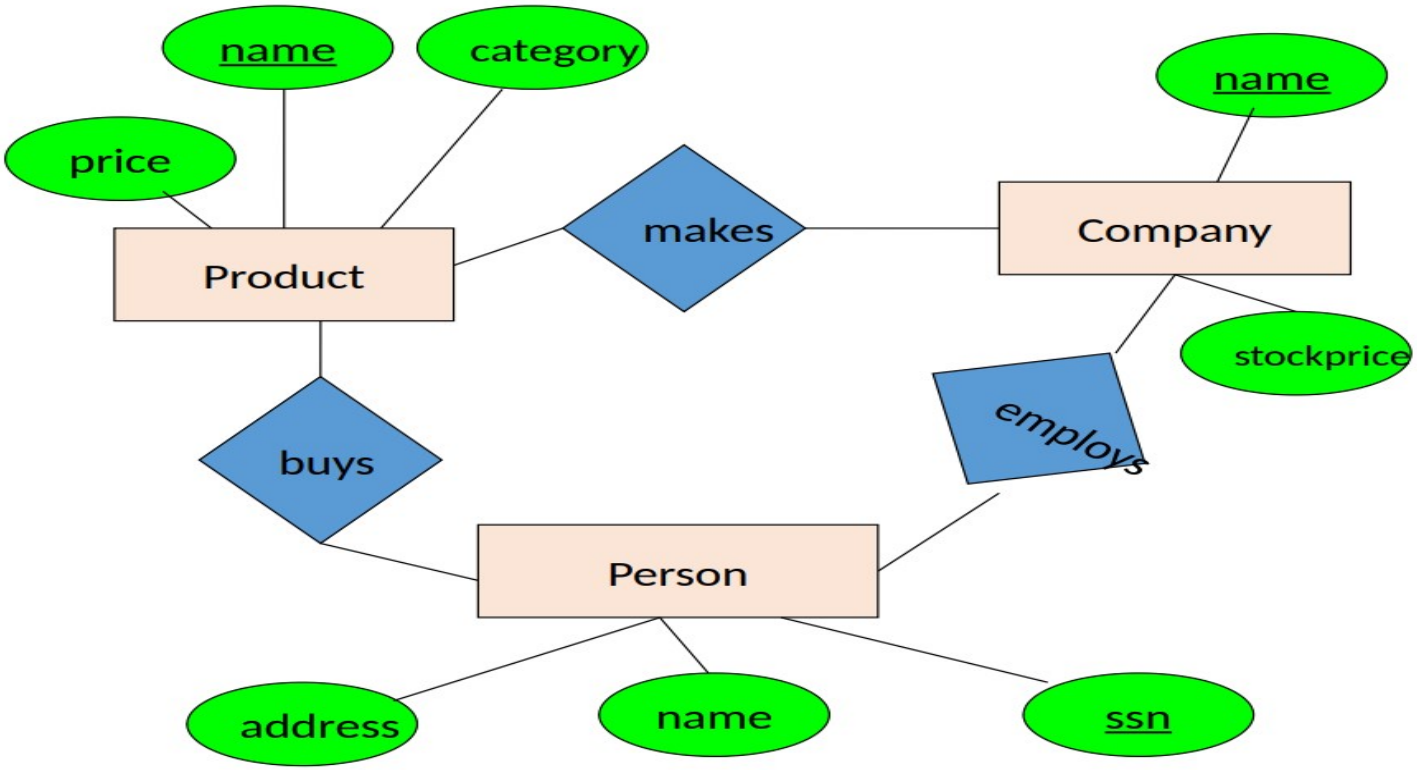
- A **relationship type** is between two entity types



How to read a relationship in both directions:
1. A product is made by a company
2. A company makes a product

Reference: M. Hahsler. DS1300: The ER Model.

ER Model - Example



Reference: M. Hahsler. DS1300: The ER Model.

Phase 1 - Purpose Definition - Example

- Here an example of Purpose definition phase applied to a concrete iTelos project.
- Let's check how the above last activities have been implemented.

Phase 1 - Purpose Definition - Tools, templates & output

- What we need to implement the Purpose Definition phase?
- **Tools**:
  - **Document Writer**: to write the project report with Domain, Context, Personas, Scenarios and CQs.
  - **Spreadsheet editor**: to fill the PFsheet for Concept Identification and Categorisation activities.
  - **yEd**: to model the ER (ot any other diagram editor).
- **Templates**:
  - Project Report Template
  - PFsheet template

Phase 1 - Purpose Definition - Producer & Consumer

- As already discussed, the methodology can be applied both as a data producer and consumer.
  - **What is the difference in this phase?**
- **The producer** aims at creating resources, thus it's purpose is to enhance the availability of such resources, in one (or more) specific domain and contexts.
  - Notice how such resources will be applied fo specific purposes, even if the producer did not consider them (or they have been considered in a more generic way) during the resource production.
- **The consumer** already has a specific purpose to satisfy, thus all the activities are leaded by such purpose.
- **NOTE**: The formalization of the purpose (general or specific) in the first phase of iTelos, is crucial to define the output of the project, both on producer and consumer side.