

Entity-Relationship Diagrams (ERD)

Data models are tools used in analysis to describe the data requirements and assumptions in the system from a top-down perspective. They also set the stage for the design of databases later on in the SDLC.

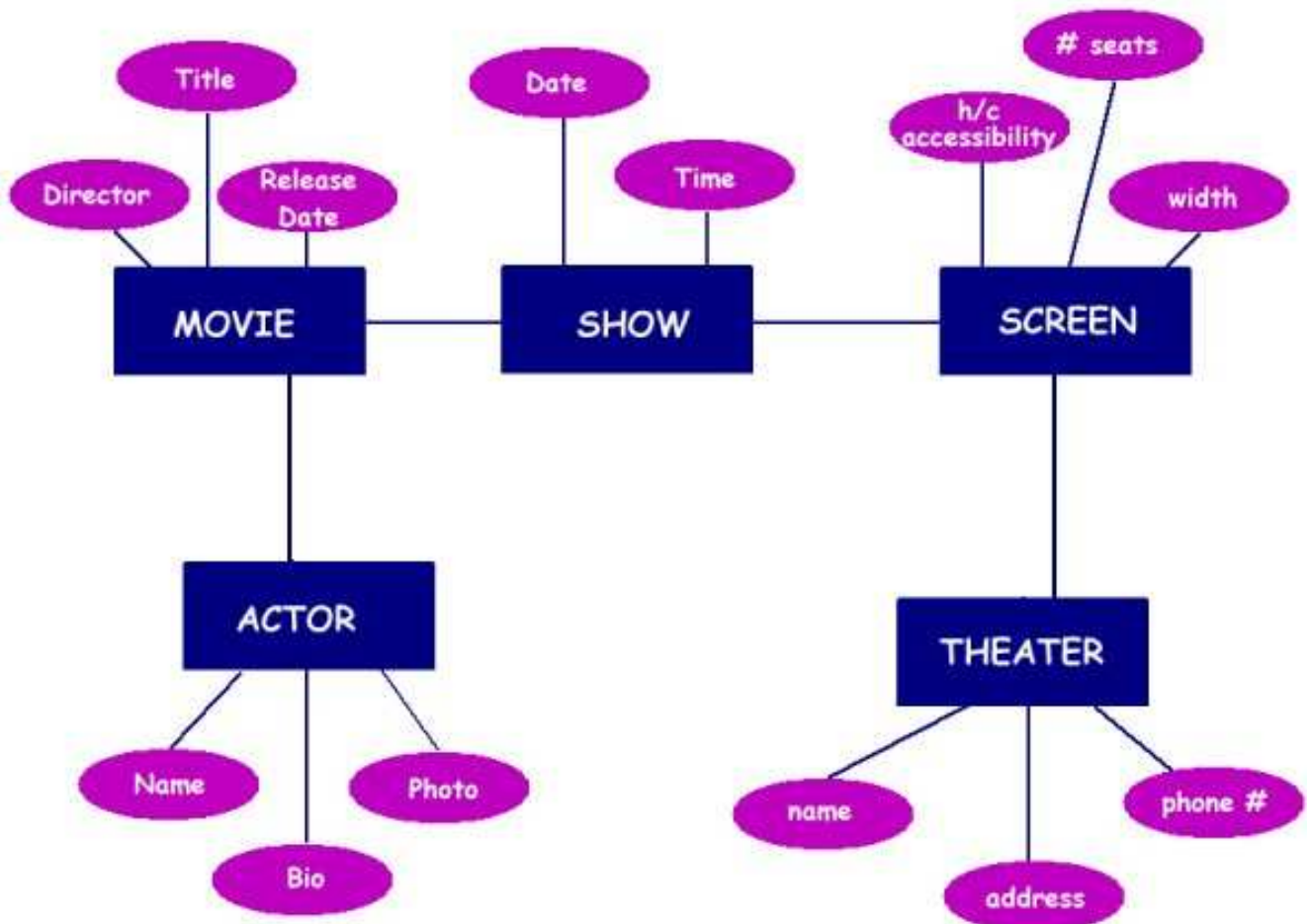
There are three basic elements in ER models:

Entities are the "things" about which we seek information.

Attributes are the data we collect about the entities.

Relationships provide the structure needed to draw information from multiple entities.

Generally, ERD's look like this:



adapted from another professor.

Developing an ERD

Developing an ERD requires an understanding of the system and its components. Before discussing the procedure, let's look at a narrative created by Professor Harman.

Consider a hospital:

Patients are **treated** in a single **ward** by the **doctors** assigned to them. Usually each patient will be **assigned** a single doctor, but in rare cases they will have two.

Healthcare assistants also **attend** to the patients, a number of these are **associated** with each ward.

Initially the system will be concerned solely with drug treatment. Each patient is required **to take** a variety of **drugs** a certain number of times per day and for varying lengths of time.

The system must **record** details concerning patient treatment and **staff payment**. Some staff are **paid** part time and doctors and care assistants work varying amounts of overtime at varying rates (subject to grade).

The system will also need to **track** what treatments are required for which patients and when and it should be capable of calculating the cost of **treatment** per week for each patient (though it is currently unclear to what use this information will be put).

How do we start an ERD?

1. Define Entities: these are usually nouns used in descriptions of the system, in the discussion of business rules, or in documentation; identified in the narrative (see **highlighted** items above).
2. Define Relationships: these are usually verbs used in descriptions of the system or in discussion of the business rules (entity _____ entity); identified in the narrative (see **highlighted** items above).
3. Add attributes to the relations; these are determined by the queries, and may also suggest new entities, e.g. grade; or they may suggest the need for keys or identifiers.

What questions can we ask?

- a. Which doctors work in which wards?
- b. How much will be spent in a ward in a given week?
- c. How much will a patient cost to treat?
- d. How much does a doctor cost per week?
- e. Which assistants can a patient expect to see?
- f. Which drugs are being used?

4. Add cardinality to the relations

Many-to-Many must be resolved to two one-to-manys with an additional

entity

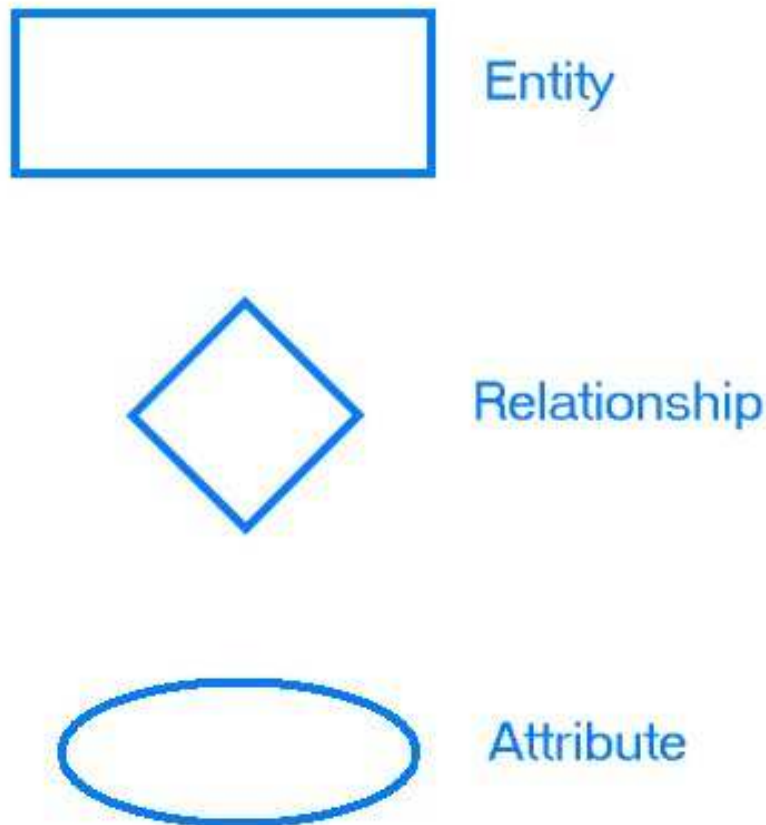
Usually automatically happens

Sometimes involves introduction of a link entity (which will be all foreign key) Examples: Patient-Drug

5. This flexibility allows us to consider a variety of questions such as:

- a. Which beds are free?
- b. Which assistants work for Dr. X?
- c. What is the least expensive prescription?
- d. How many doctors are there in the hospital?
- e. Which patients are family related?

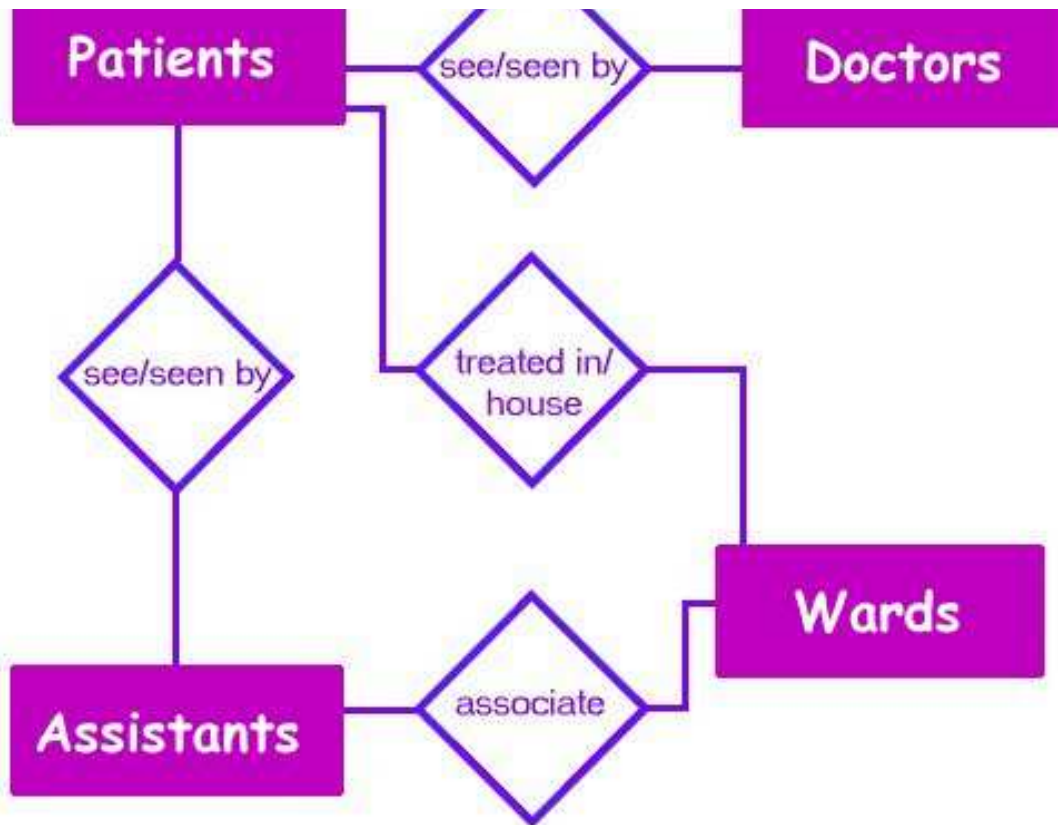
6. Represent that information with symbols. Generally E-R Diagrams require the use of the following symbols:

**Reading an ERD**

It takes some practice reading an ERD, but they can be used with clients to discuss business rules.

These allow us to represent the information from above such as the E-R Diagram below:





ERD brings out issues:

Many-to-Manys

Ambiguities

Entities and their relationships

What data needs to be stored

The Degree of a relationship

Now, think about a university in terms of an ERD. What entities, relationships and attributes might you consider? Look at this simplified view. There is also an example of a simplified view of an airline on that page.

You can investigate more about ERDs by viewing these sources available on the Internet:

[E-R Diagrams, Tables and their Meaning](#)

[Entity-Relationship Diagrams](#)

[Entity-Relationship Diagrams](#)

[Entity-Relationship Diagrams](#)

[4.1 Lecture: Entity Relationship Analysis](#)

[Five Entities related to Agent](#)

[Crosswalk Exercise - ALMRS Customer with the Standard](#)

[Guidelines](#)

[Domain Analysis](#)

[ERDIAG](#)

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