Unit 4:
Relational Databases

4.1. Database Design Fundamentals

4.2. Conceptual Design

4.3. Logical Design

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Unit 4.1 DB Design Fundamentals

1. Introduction

2. Methodology

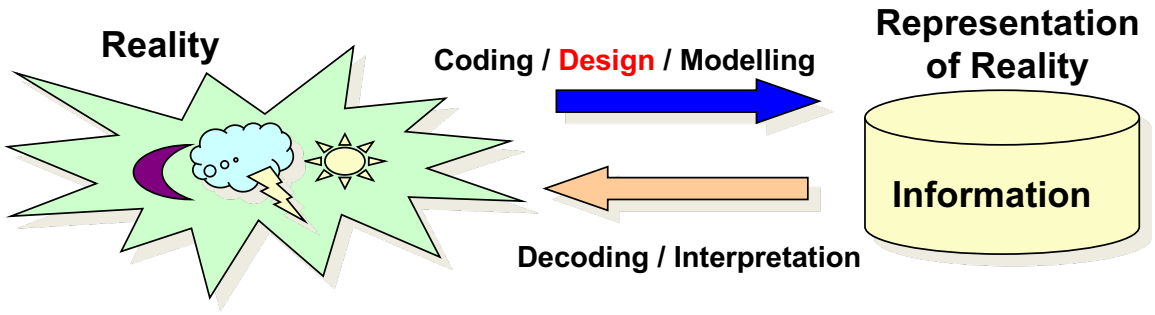
3. Data models

4. Database Design

5. Example

1. Introduction

In this unit we will present a methodology for the design of relational databases



We will focus on:

- Methodology issues: Strategies and recommendations to address the design problem.
- Modelling languages issues: Presentation of an appropriate (graphical) language to represent the sistem (data model).

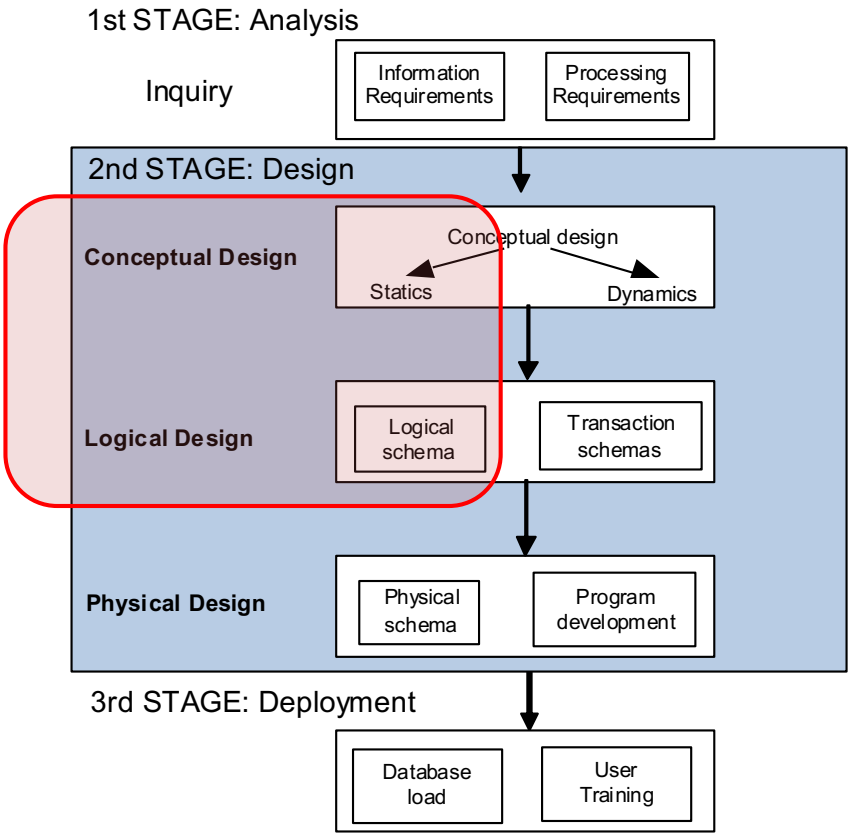
UD 4.1 DB Design Fundamentals

2. Methodology

A methodology is a set of standard procedures, techniques and documentation for the development of a product (a database in our case).

A methodology is supported by:

- Techniques: how to deal with each of the steps and activities in the methodology
- Models: Way to represent or think abstractly about the reality, the problem or the solution.
- CASE tools: (optionally) software tools to automate or assist on the development of techniques and models.

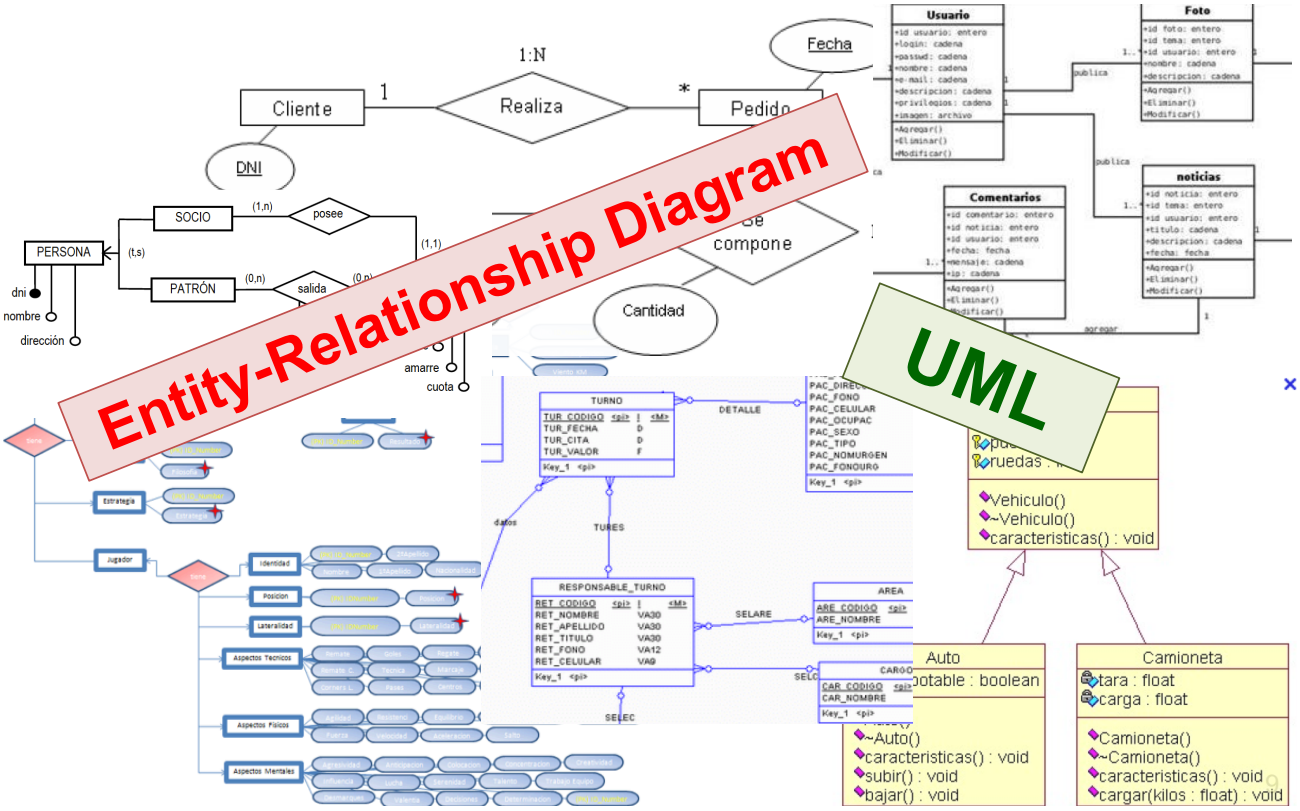


3. Data models

A **data model** is a way in which static and dynamic properties of reality (entities, relationships,…) are represented.

Example: The relational data model

There are many models, many notations,…



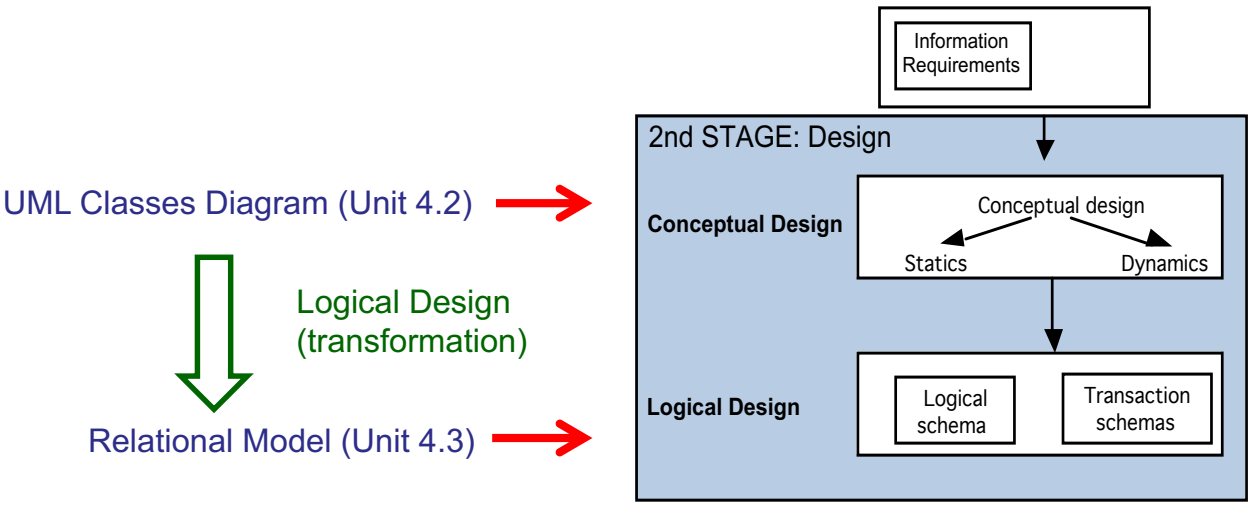
We are going to use a conceptual data model that:

- incorporates notions from the Entity-Relationship Model using UML
- is more abstract , expressive, and system-independent than the classical relational model
- is essentially graphical (based on UML)

UD 4.1 DB Design Fundamentals

1. Introduction
2. Methodology
3. Data models
4. **Database Design**
5. Example

4. Databases Design



1. Analysis stage: information requirements

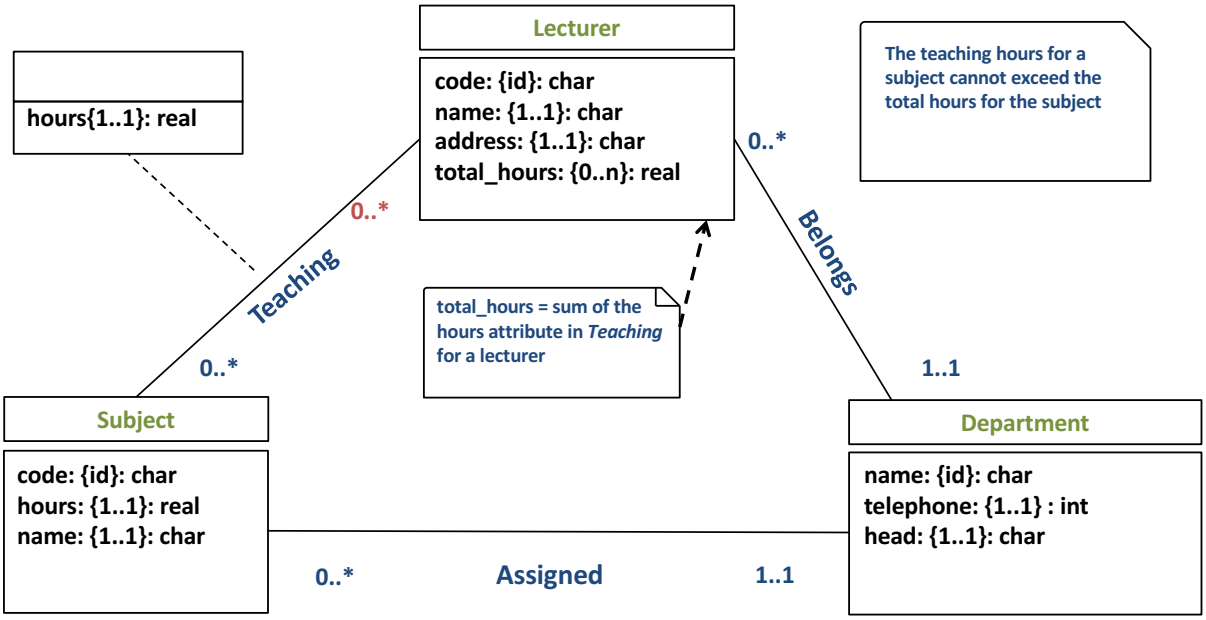
Lecturer:
- code, name and address
- department where the lecturer belongs to
- subjects s/he teaches, and how many hours each
- total number of teaching hours s/he is assigned

Department:
- name, head and telephone.

Subject:
- code and name of the subject,
- total number of hours in the degree syllabus
- department which is assigned to.

INTEGRITY CONSTRAINTS:
- A lecturer must belong to one and only one department.
- A subject must be assigned to one and only one department.
- There can't be two departments with the same name.
- There can't be two lecturers with the same code.
- There can't be two subjects with the same code.
- The number of taught hours for a subject cannot exceed the total number of hours for the subject in the degree syllabus.
- A lecturer cannot teach more than 12 hours in one subject.
- A subject cannot have more than 24 hours.

2a. Design stage: Conceptual Design (static)



UML Classes Diagram

2a. Design stage: Conceptual Design (dynamic)

Transaction *Inserta_lecturer*
- Insert into Lecturer
- Insert into Belongs

Transaction *Insert_subject*
- Insert into Subject
- Insert into Assigned

Transaction *Insertar_departament*
- Insert into Departamen

…

Transaction description

2b. Design stage: Logical Design (static)

Department (name: char(50), head: char(50), telephone: char(8))
PK: {name}

Lecturer (code: char(9), name: char(50), address: char(50), dname: char(50))
PK: {code}
FK: {dname} → Department
NNV: {name, address, dname}

Subject (code: char(5), name: char(50), hours: number, dname: char(50))
PK: {code}
FK: {dname} → Department
NNV: {name, hours, dname}

Teaching (lcode: char(9), scode: char(5), hours: number)
PK: {lcode, scode}
FK: {lcode} → Lecturer
FK: {scode} → Subject
NNV: {hours}

(*) The attribute total_hours is not included and will be calculated every time it is needed.

(**) The number of taught hours for a subject cannot exceed the total number of hours for the subject in the degree syllabus.

2b. Design stage: Logical Design (dynamic)

TRANSACTION Insert_lecturer (code: char(9), name: char(50), address: char(50), dname: char(50))
INSERT INTO Lecturer **VALUES** (code, name, address, dname)

TRANSACTION Insert_subject (code: char(5), name: char(50), hours: number, dname: char(50))
INSERT INTO Subject **VALUES** (code, name, hours, dname)

TRANSACTION Insert_departament (name: char(50), head: char(50), telephone: char(8))
INSERT INTO Department **VALUES** (name, head, telephone)

2c. Design stage: Physical design

Lecturer:

File indexed by *code;* index on *name*

Subject:

File indexed by *code;* index on *name*

Department:

Sequential file; index on *name*

Teaching:

File indexed by *scode;* index on *lcode*