Entity-Relationship Model – Part 1

Database Design Process

IT Projects[1]

	2011	2012	2013	2014	2015
SUCCESSFUL	29%	27%	31%	28%	29%
CHALLENGED	49%	56%	50%	55%	52%
FAILED	22%	17%	19%	17%	19%

[1] CHAOS report by Standish Group, 2015

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- There can be many reasons, including:
  - Customers were not sure about what they wanted,
  - Requirements were not properly documented,
  - Improper development methodology was used,
  - Resources were not sufficient,
  - There were communication issues,
  - . . .

[1] CHAOS report by Standish Group, 2015
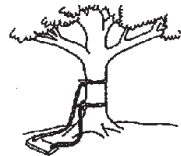
The Tyre Swing Project

As proposed by
the project sponsor
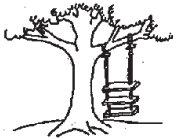
As specified in the
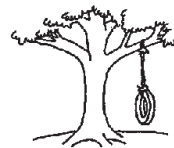project request

As designed by the
senior analyst

As produced by
the programmers

As installed at the
user's site

What the user
wanted

Database Design – Four Phases

- The database design process has **four phases**:

  1. **Requirements Collection and Analysis**

  2. **Conceptual Design**

  3. **Logical Design**

  4. **Physical Design**

Phase 1: Requirements Collection and Analysis

- **Requirements collection and analysis** is the process of collecting and analyzing data requirements of the organization so as to provide database solutions that fulfill business needs of the organization.

- Compilation of data requirements includes:

    - a description of data used or generated;

    - details of how data is to be used/generated;

    - any additional requirements for new database system;

    - . . .

Phase 2: Conceptual Design

- **Conceptual design** is the process of constructing a conceptual data model that is

  - modeled at a high-level of abstraction;

  - sufficiently simple and often graphical;

  - used to communicate the requirements of a database with nontechnical users.

- A conceptual data model is built using the information in users' requirements specification.

  Note: The conceptual design is based on **the entity-relationship model** in this course.

Phase 3: Logical Design

- **Logical design** is the process of constructing a logical data model (e.g. relational or object-oriented).

- A conceptual data model is translated onto a logical data model, which can be further refined (e.g., normalisation) to meet the data requirements. For example,

    - **From:** An ER model

    - **To:** Relations with their primary and foreign keys, which facilitates SQL to deal with retrieving, updating and deletion.

    Note: The logical design is based on **the relational data model** in this course.

Phase 4: Physical Design

- **Physical design** is the process of implementing the logical data model in a specific database management system (DBMS).

- Assume that the logical data model is the relational data model. Then the physical design is to create relations in a DBMS that involves:

    - Selecting the files in which to store the relations.
    - Deciding which indexes should be used to achieve efficient access.
    - Describing the integrity constraints and security measures.
    - ...

- The decisions made during the physical design phrase affect the performance and accessibility of the database.

    Note: Details of this topic are out of the scope of our course.

Database Design Process