Database Design: an Introduction

CIS 3730
Designing and Managing Data

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Fall 2010

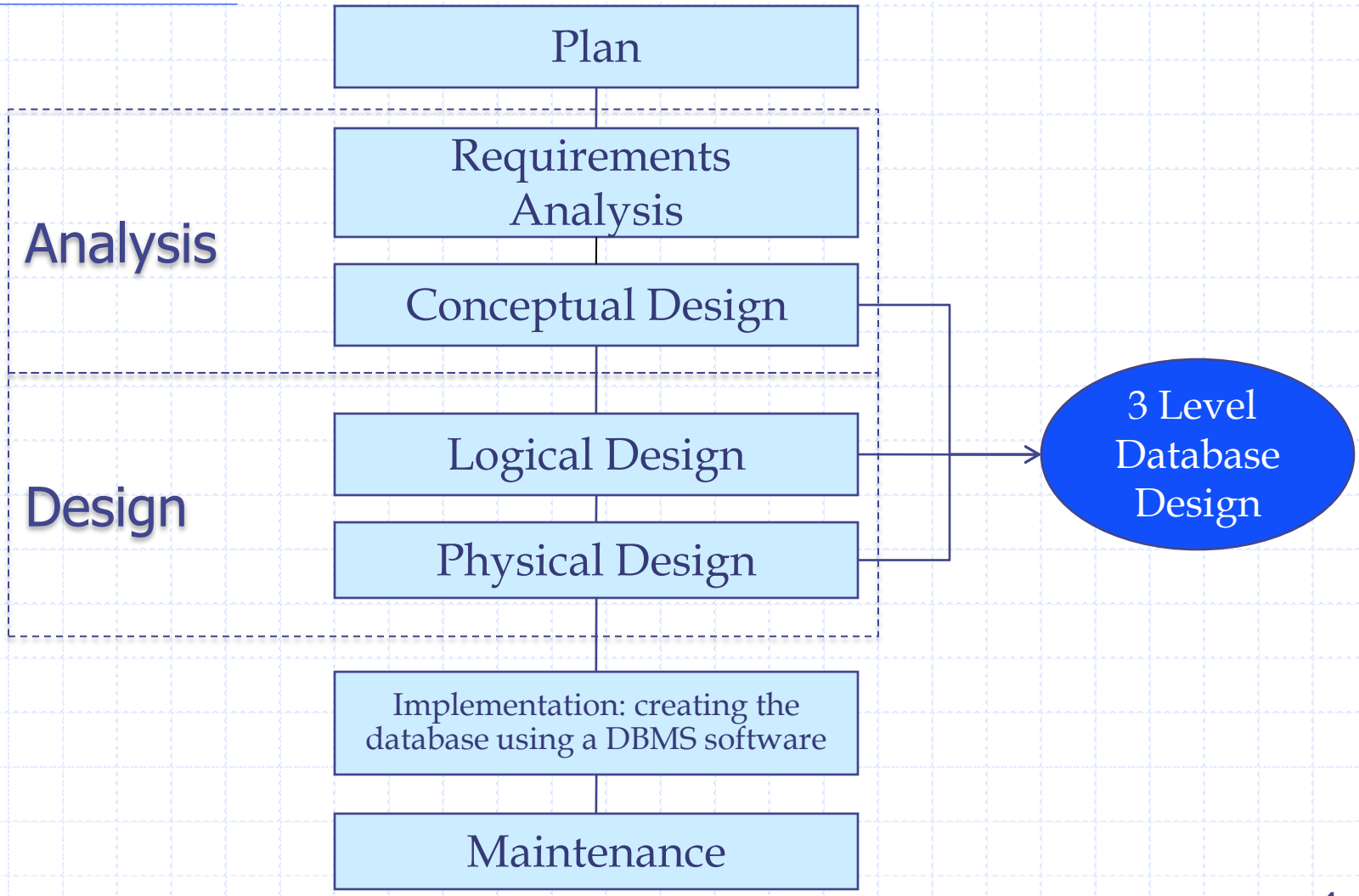
Overview

- How to design a relational database?
- What are the three data models?
- What is the general process?

IS Development Life Cycle

- Planning
- Analysis
- Design
- Building
- Testing
- Deployment
- Maintenance

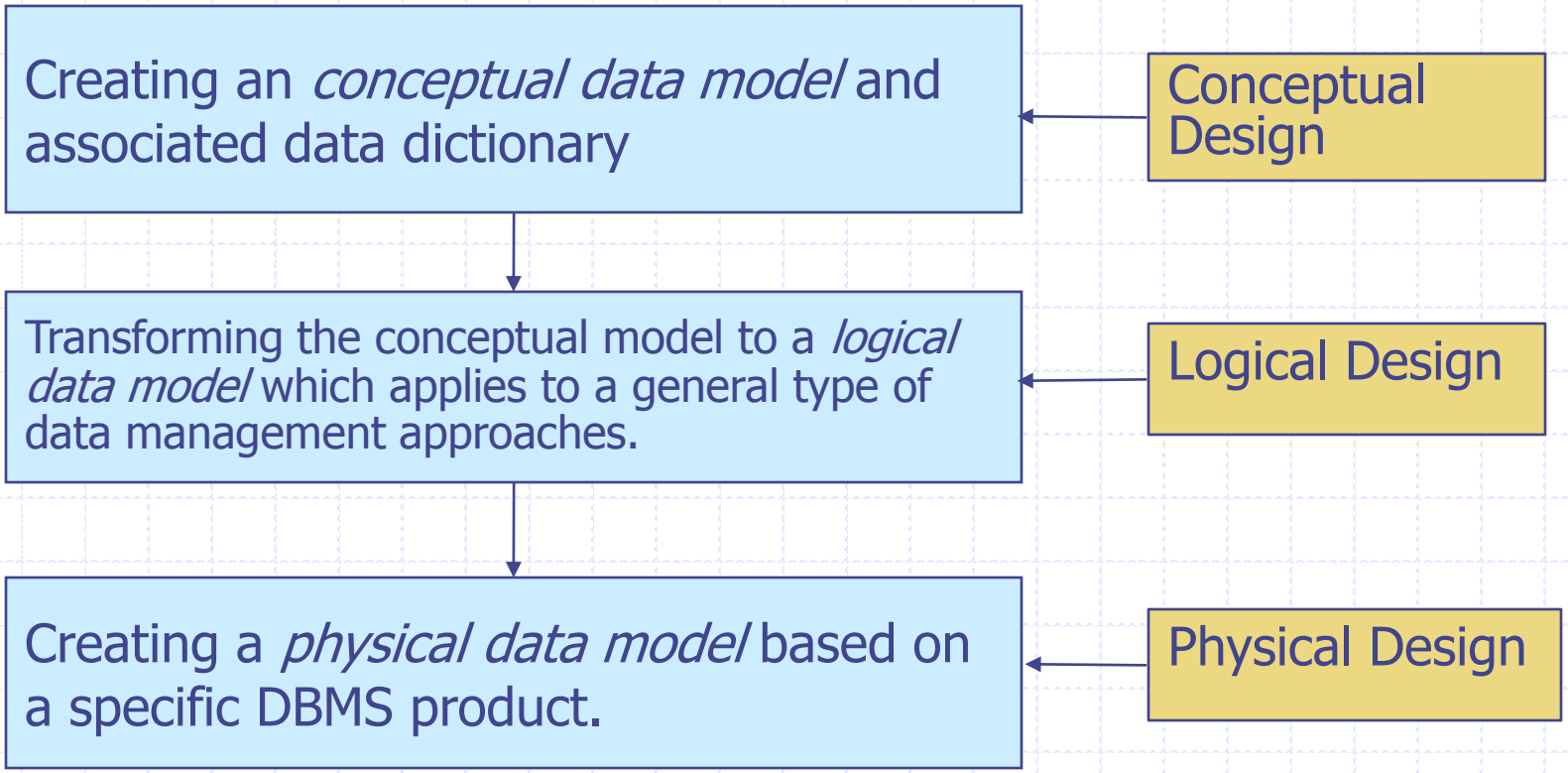
Database Development



Requirement Analysis

- Requirements describe what a system should be or do
  - Functional vs. non-functional requirements
  - Process vs. data requirements
- Issues in requirements engineering
  - How to obtain requirements?
  - How to record/represent requirements?

3 Level Database Design



Data Model

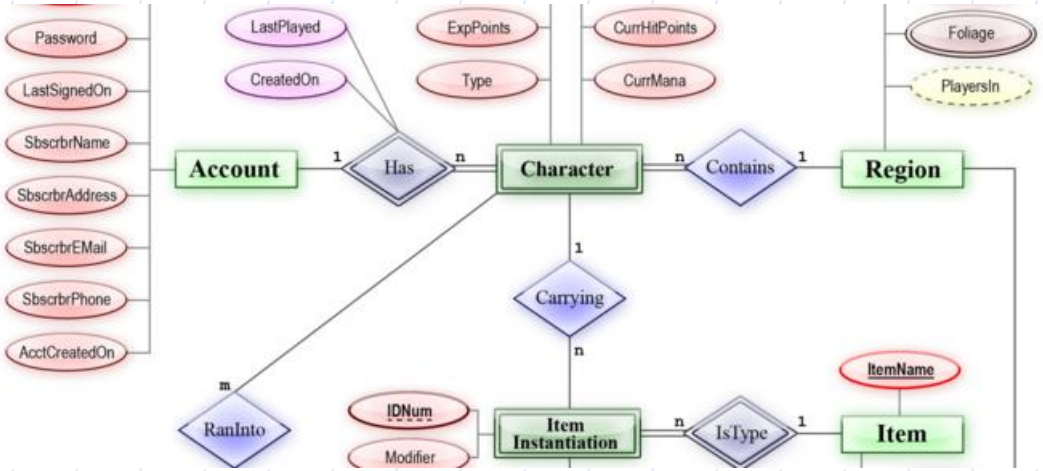
- A model is a general and abstract representation of something more complicated and detailed
  - Process model
  - Data model
  - UML model
- A data model is a general and abstract representation of the structure of data
  - Conceptual
  - Logical
  - Physical

Conceptual Modeling/Design

- Conceptual data model
  - A high level representation of the reality based on human understanding
  - It is abstract, simple, yet meaningful
  - Not tied to any computing technologies
- Examples
  - Entity Relationship Diagram (ERD)
  - Semantic data model
  - Concept diagram
  - Data structure diagram

Entity Relationship Diagram (ERD)

- ERD is a conceptual model used to represent the reality
  - A dominant method used in relational database design

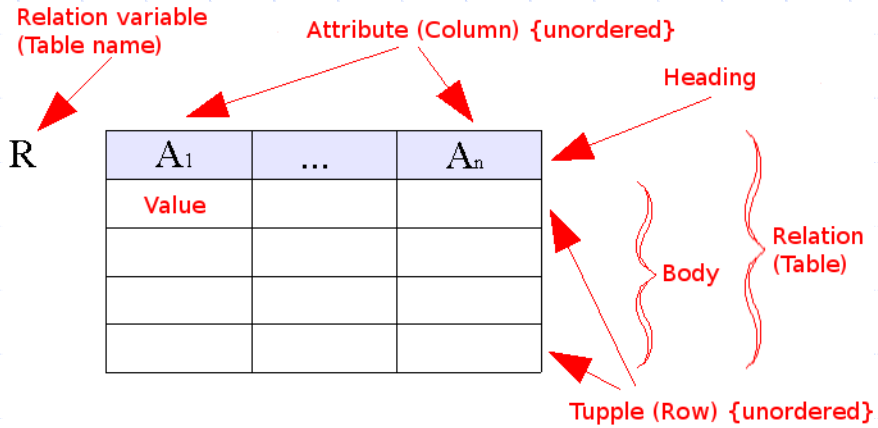


Logical Modeling/Design

- Logical data model
  - A specific data structure that organizes data following specific rules (logics); for example, mathematical or computing rules
  - It is more detailed, structured, actionable and has specific rules
  - Yet it is implementation (product) independent
- Examples
  - Relational data model
  - Object-oriented data model
  - Hierarchical data model (XML)

Relational Model

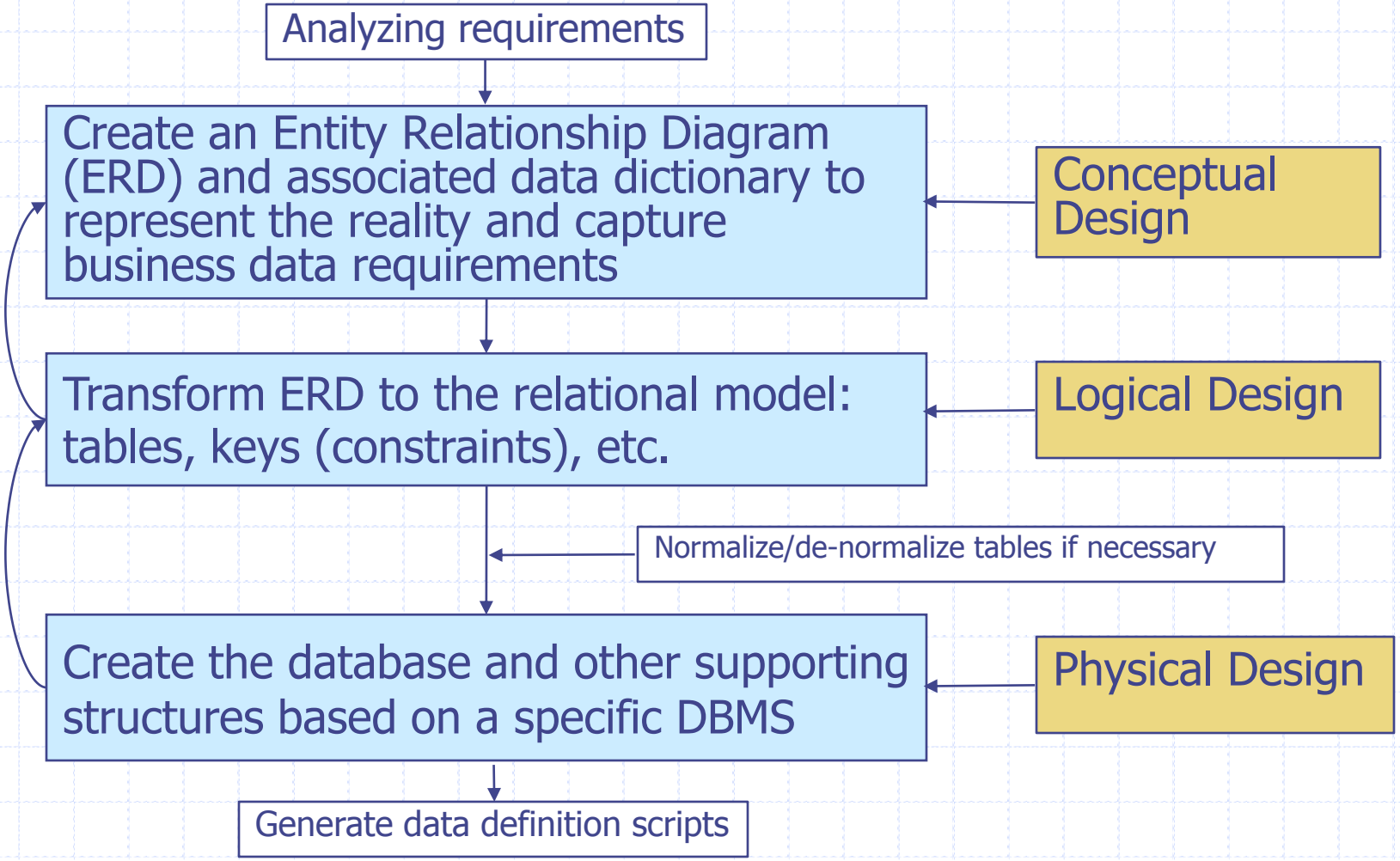
- Relational model is a type of logical model
  - In this phase, conceptual models (high level abstractions) are transformed into relational models using relational concepts (tables, keys, etc.)



Physical Modeling/Design

- Physical data model
  - Based on a specific implementation (a software product), which implements the corresponding logical data model and adds more operational details
- In database design
  - More details are added to relational models that directly support the creation of the database in a certain database product
  - DBMS product specific: data types, storage methods, DBMS capability, proprietary functions and rules, etc.
  - Including lower level details and other DBMS structure, such as index, partition, cluster, storage, etc.

A Practical Process for Relational Database Design based on the Three-Data Model Approach



Summary

- Key concepts
  - Three data models and examples
    - Conceptual, logical, physical
    - ERD
    - Relational model
  - Three-level database design method
    - Conceptual design
    - Logical design
    - Physical design

More Readings

- The database development life cycle
  - http://openlearn.open.ac.uk/mod/oucontent/view.php?id=399373
- Data modeling 101
  - http://www.agiledata.org/essays/dataModeling101.html
- Data model
  - http://en.wikipedia.org/wiki/Data_model