

Database Design: an Introduction

CIS 3730
Designing and Managing Data

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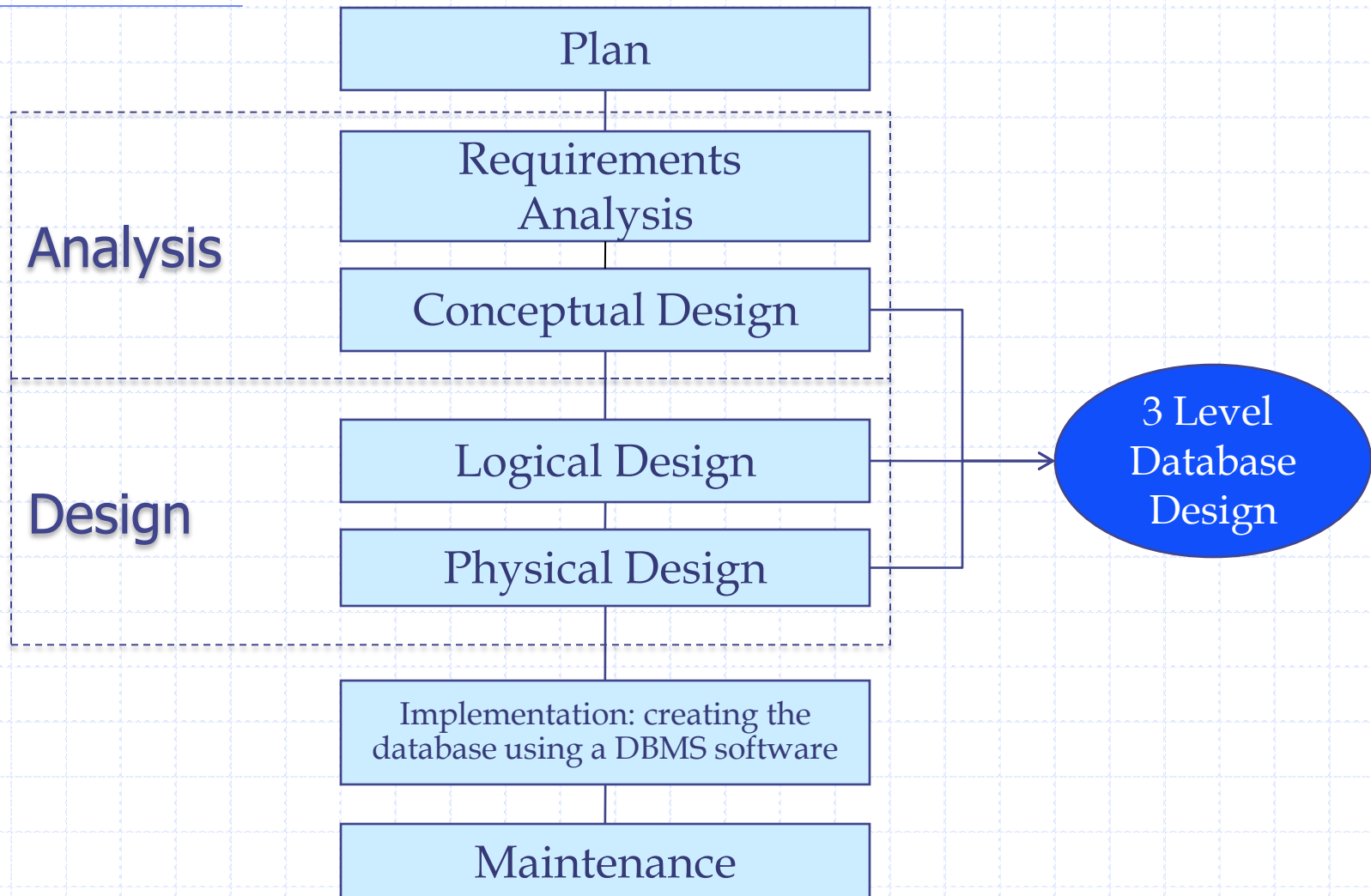
Overview

- ◆ 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

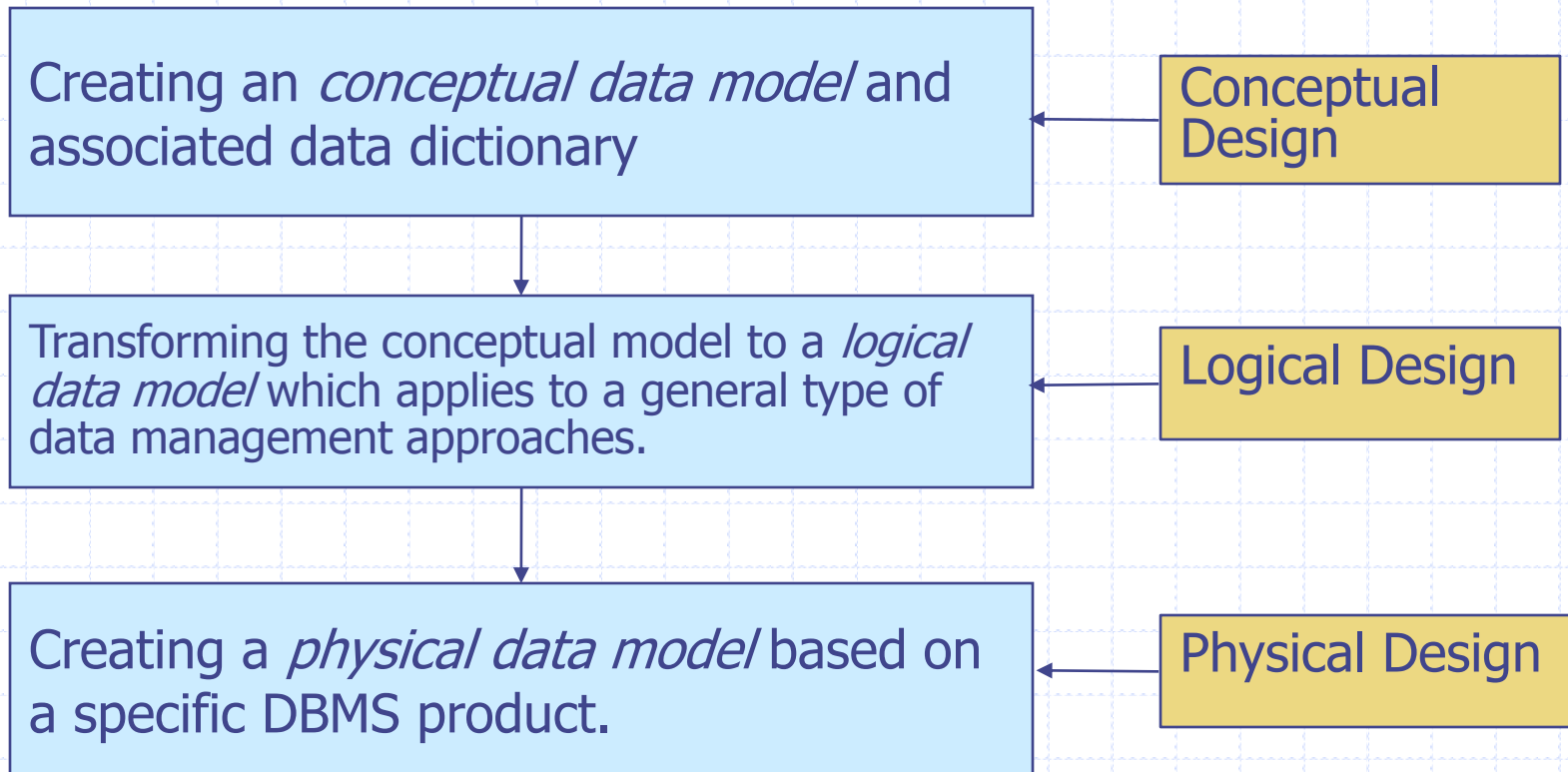


Requirement Analysis

- ◆ 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

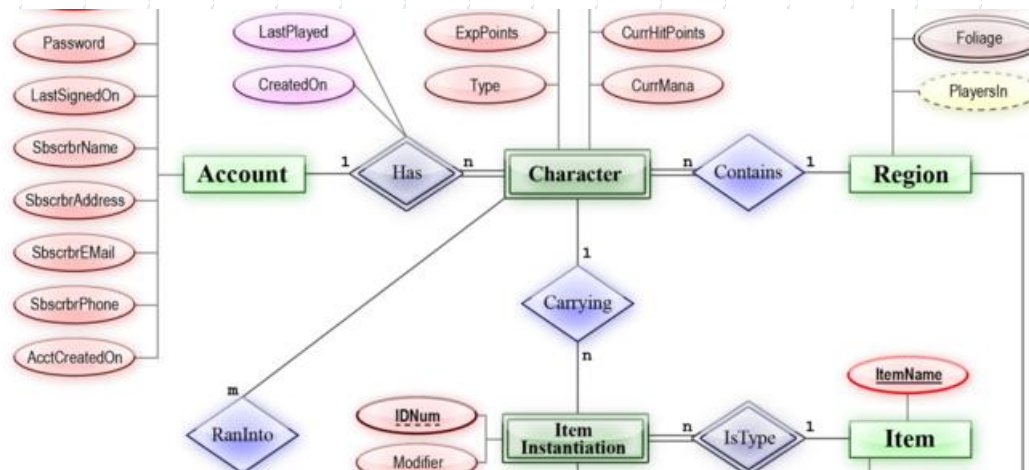
- A high level representation of the reality based on human understanding
- It is abstract, simple, yet meaningful
- Not tied to any computing technologies

◆ 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

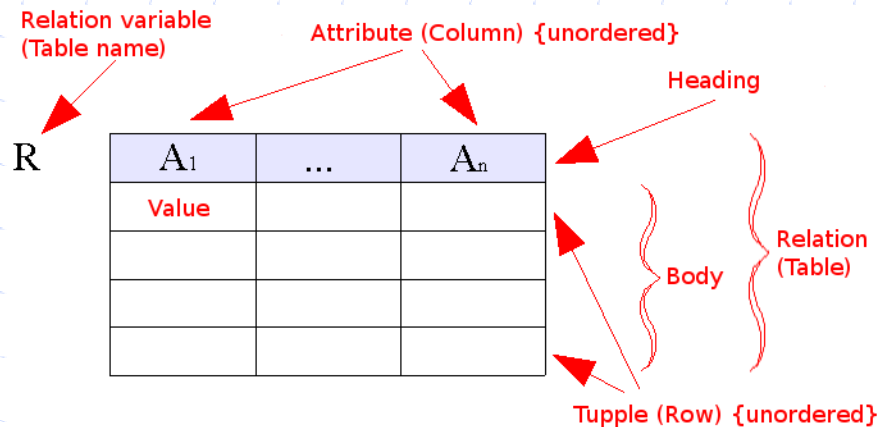
- A specific data structure that organizes data following specific rules (logics); for example, mathematical or computing rules
- It is more detailed, structured, actionable and has specific rules
- Yet it is implementation (product) independent

◆ 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

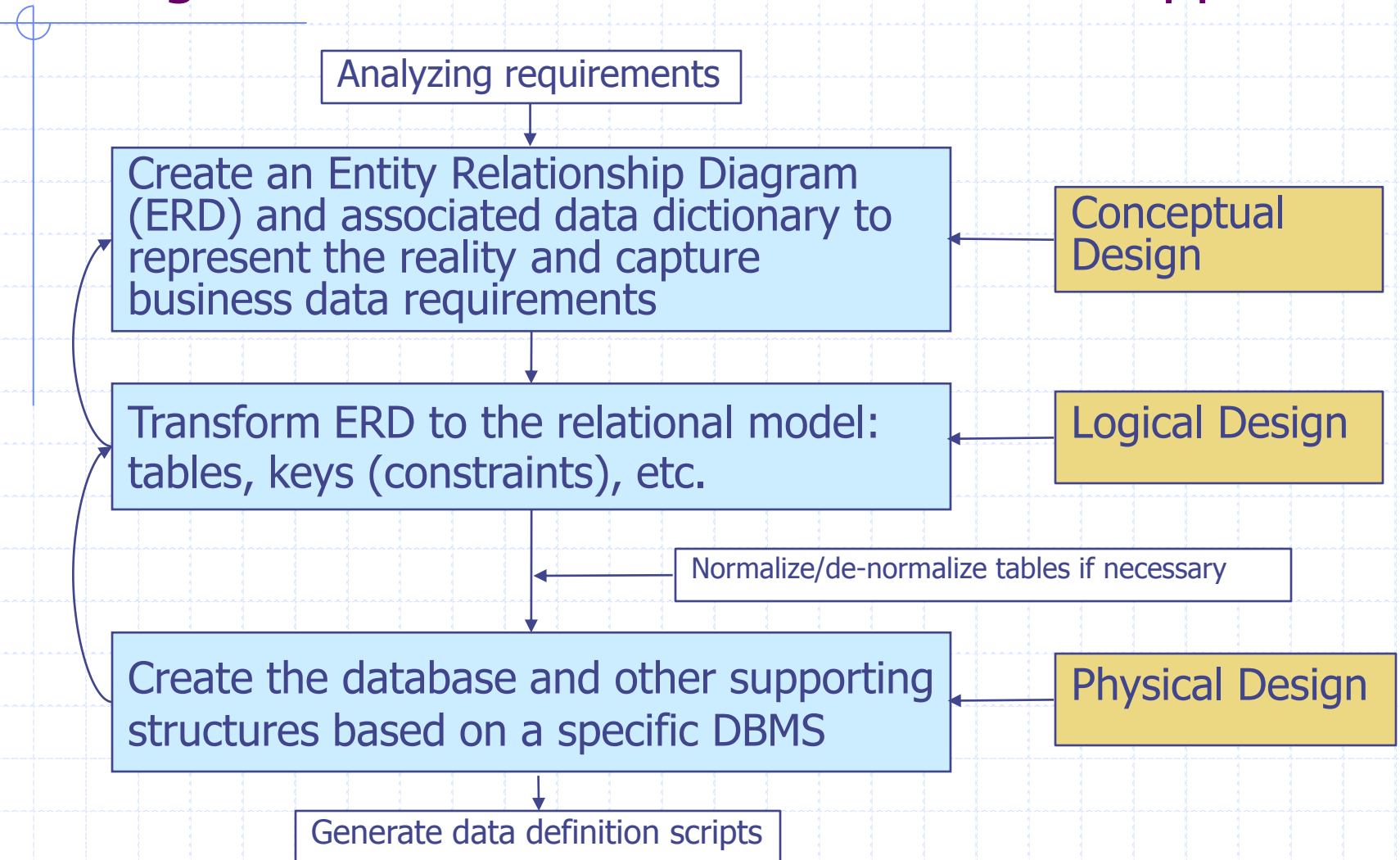
◆ Physical data model

- 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