CSC 365

Introduction to Database Systems

What is a Database?

- A **database** is a collection of interrelated information that is intended to be stored for a long period of time.

- In common usage, *database* refers to a collection of data managed by a **Database Management System DBMS**.

What core functionality should be provided by a database management system?

High Performance	Thousands of tasks per second
Large Amounts of Data	Much larger than main memory
Available	No downtime / outages
Easy to Use	Powerful operations on large amounts of data, high-level query langauge
Safe & Reliable	Maintains consistency of data, no data loss
Persistent	Data is long-lived, retained between program executions
Multi-User	Many users operating simultaneously on the same data
General Purpose	Common tools and techniques for many problem domains

Prerequisites

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- Data structures, algorithms, discrete math
  - Algebraic expressions and laws (associative, commutative, distributive)
  - Logic, sets
  - Data structures
- Software systems and programming languages
- Willingness to ask questions, share your experience and perspective

High-Level Course Outline

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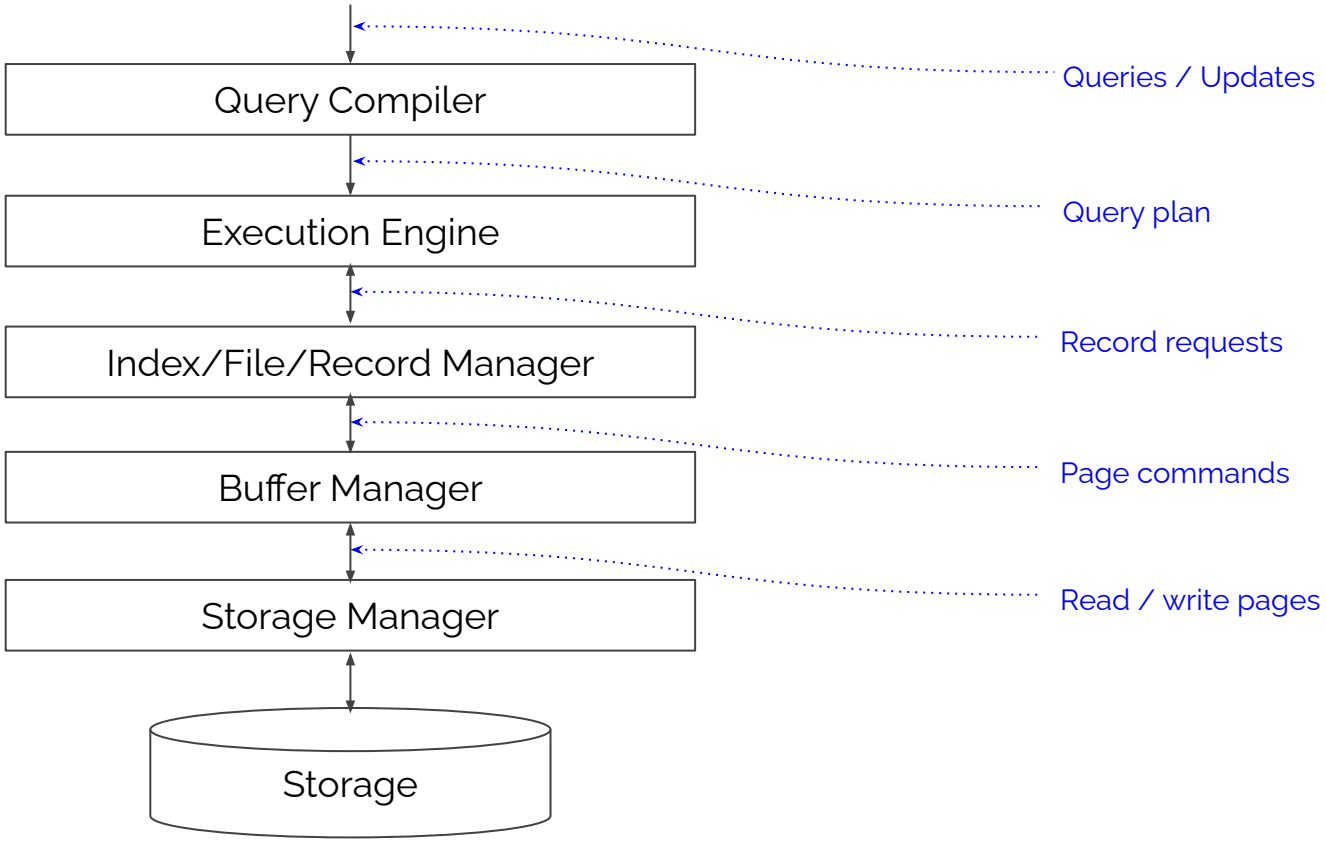
1. Introduction: Data and Data Management, Relational Data Model
2. Relational Algebra
3. Structured Query Language (SQL)
4. Java Database Connectivity (JDBC)
5. Implementation Topics:
    a. Transaction Control
    b. Query processing
    c. RDBMS architecture

Database Management System (DBMS)

- Allows users to describe data format (database **schema**)
- Capable of storing *very large* amounts of data
- Provides answers to user information needs (**queries**)
- Offers control over data access by **multiple users**

DBMS System Components



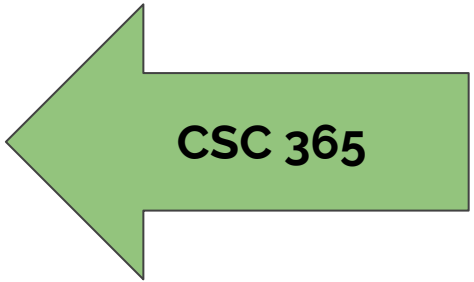
Relational Database Management Systems (RDBMS)

- Many implementations:
  - Oracle
  - Microsoft SQL Server
  - Microsoft Access
  - IBM DB2
  - MySQL
  - PostgreSQL
  - SQLite

- All based on the same fundamental concepts (relational model, SQL)
- Vendor-specific extensions

Views of Data

- **Conceptual**: captures relationships in data (CSC 366)
- **Logical**: captures the format of the data as understood by the Database Management System (DBMS)
- **Physical**: represents the exact way in which data is stored and accessed by the DBMS (CSC 468)



Networking "Hourglass" *(for context)*

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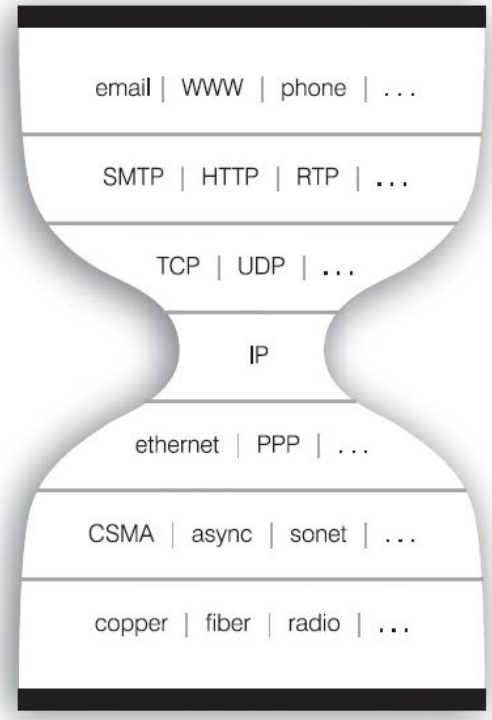

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SQL / Data Management Hourglass

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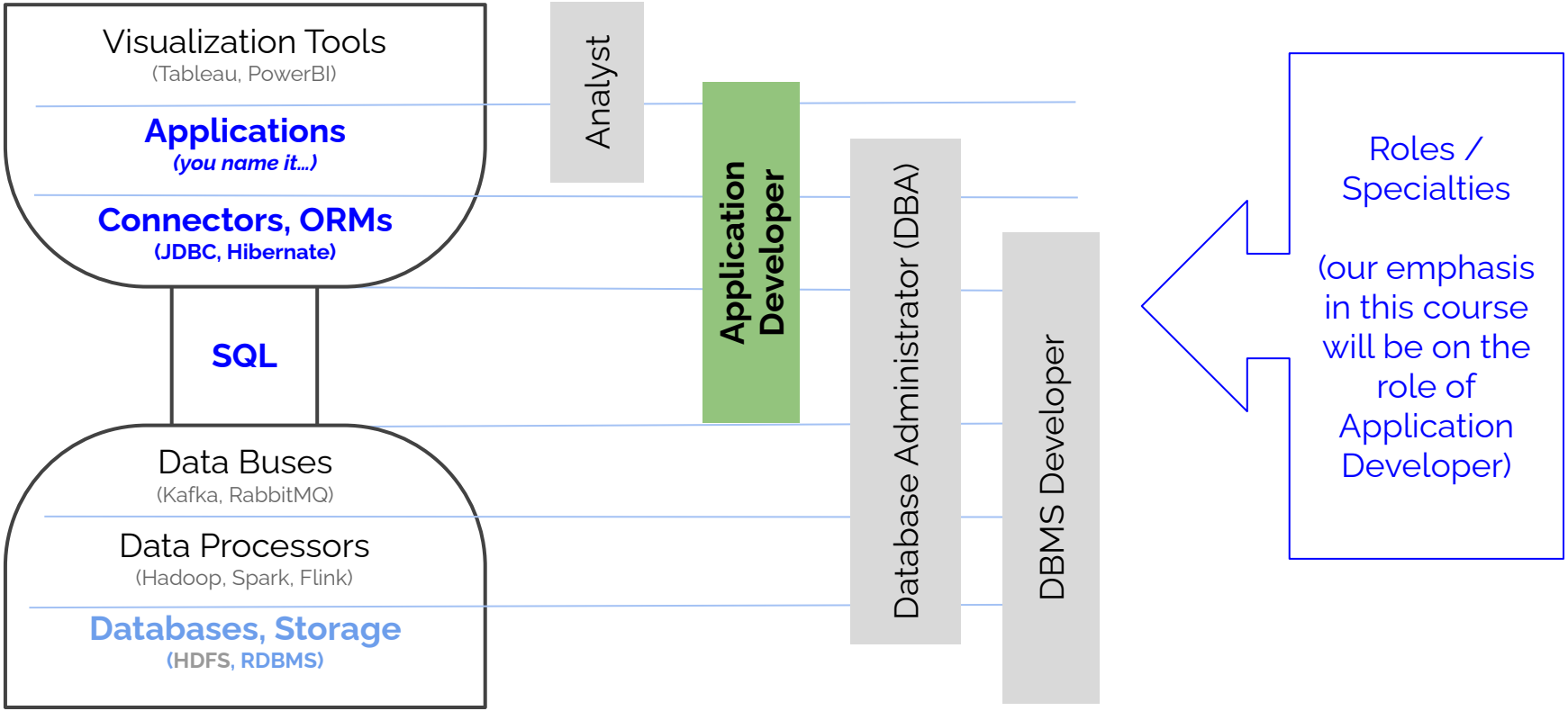
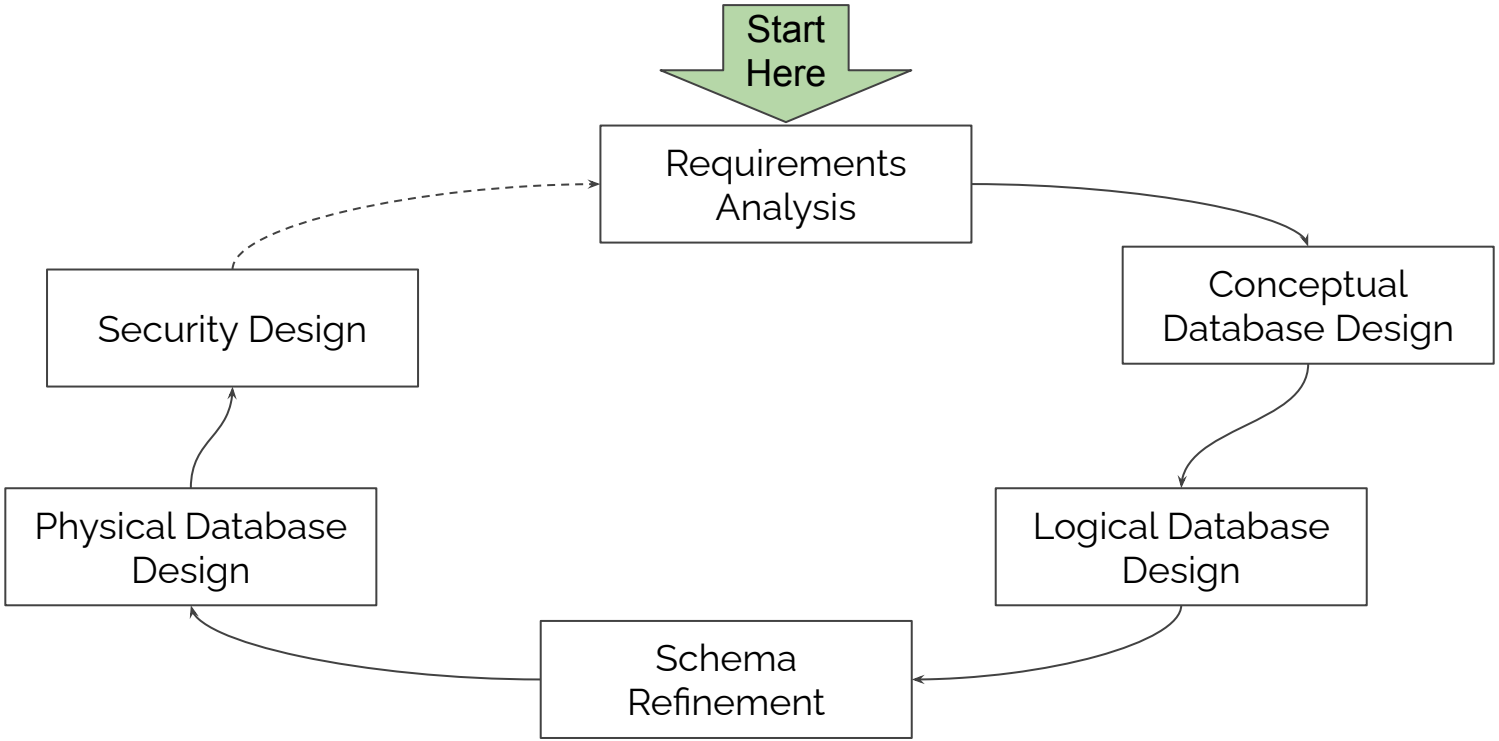


Database Design Process



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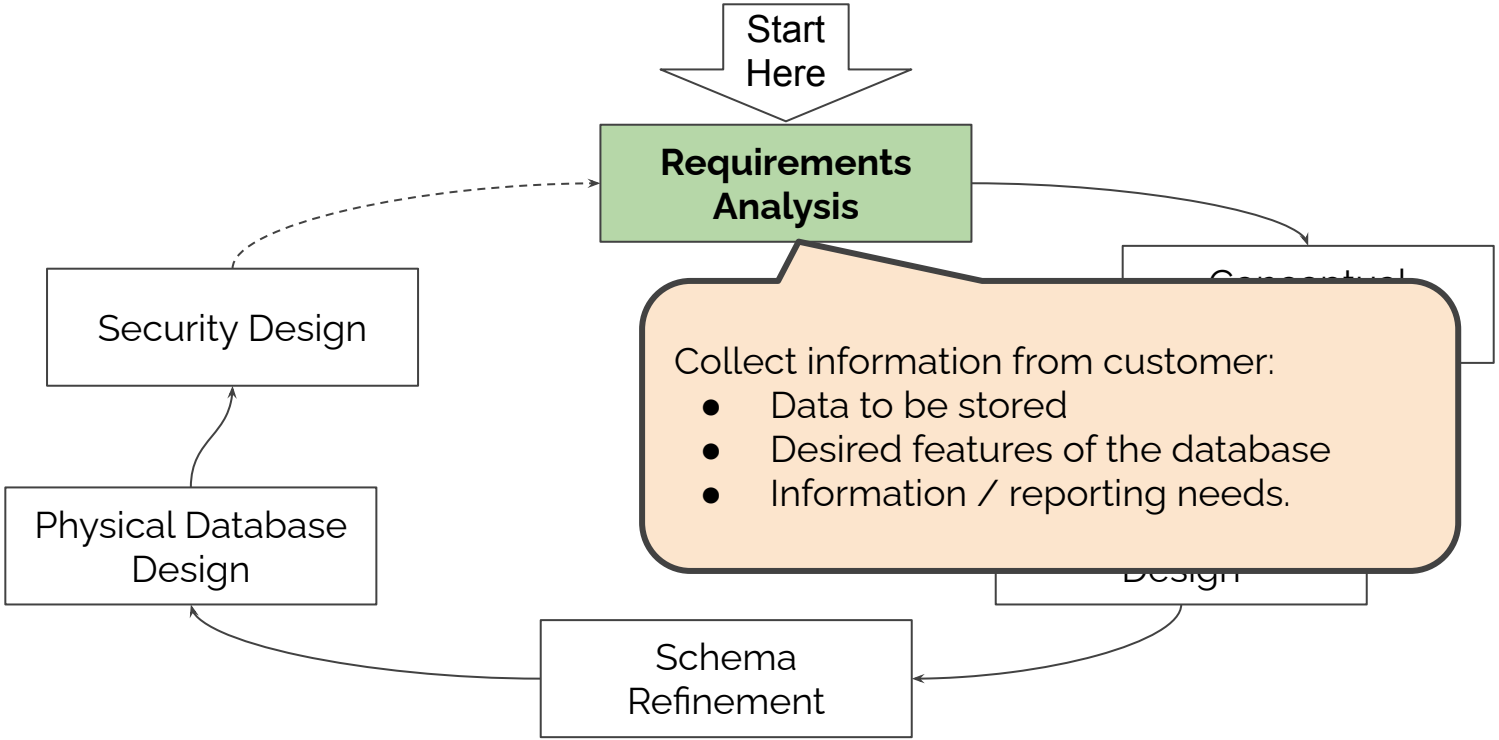

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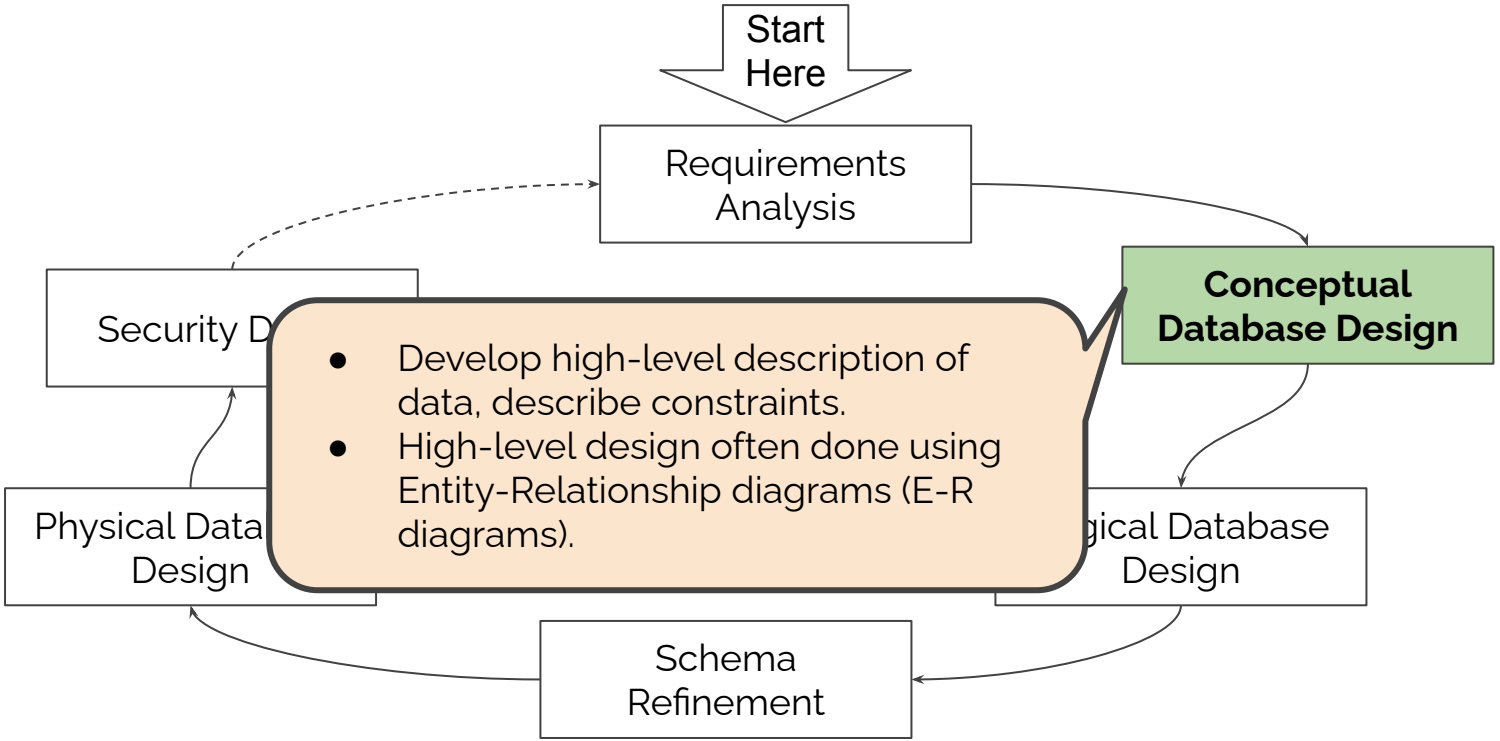

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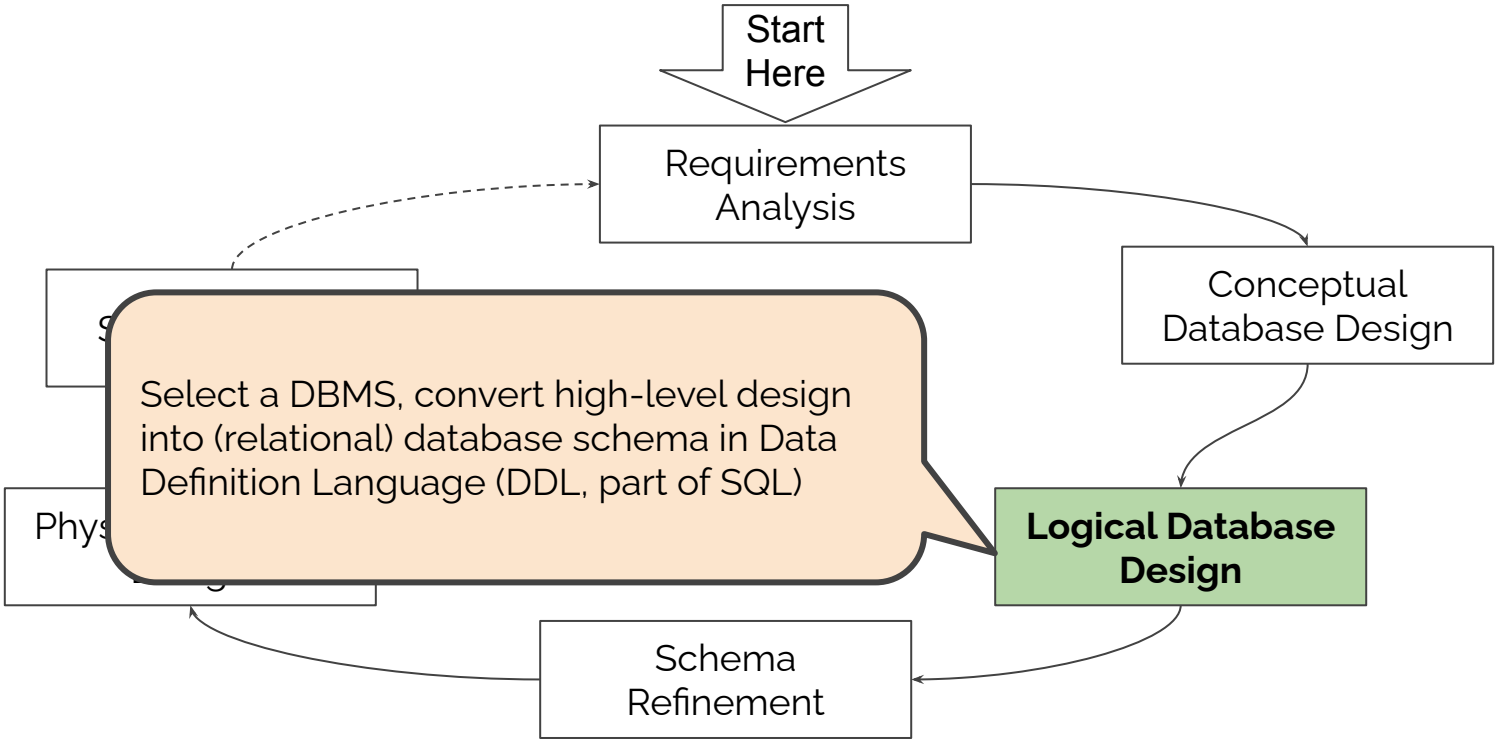

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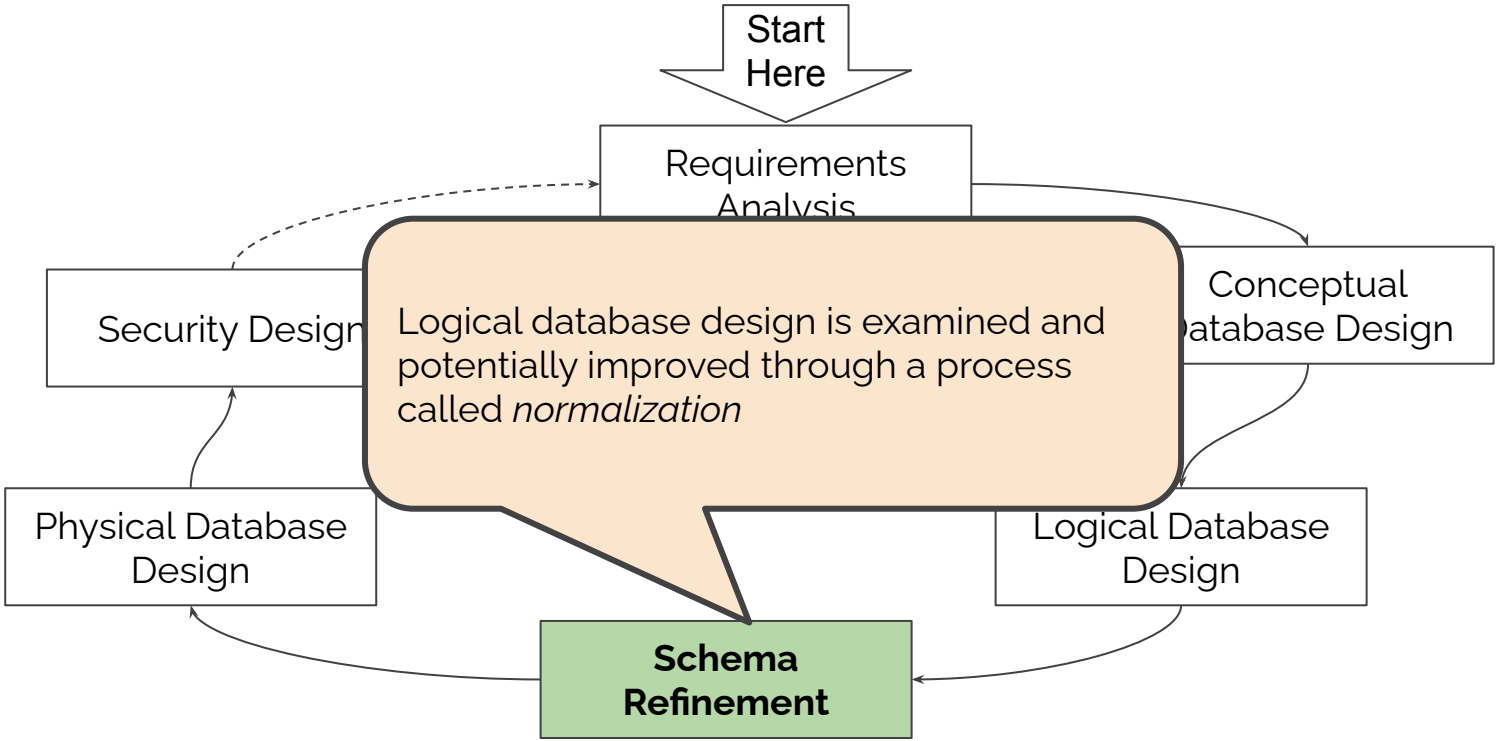

Database Design Process

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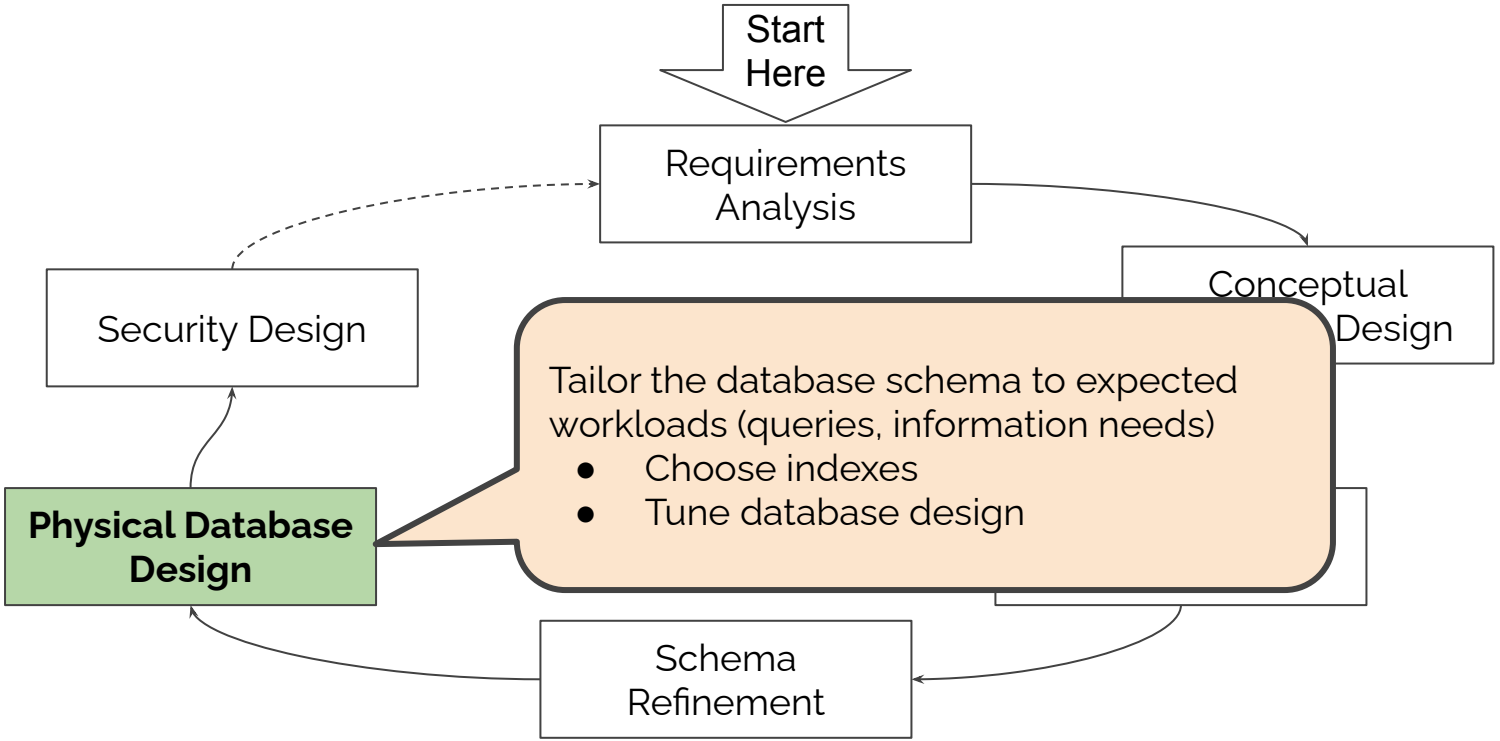

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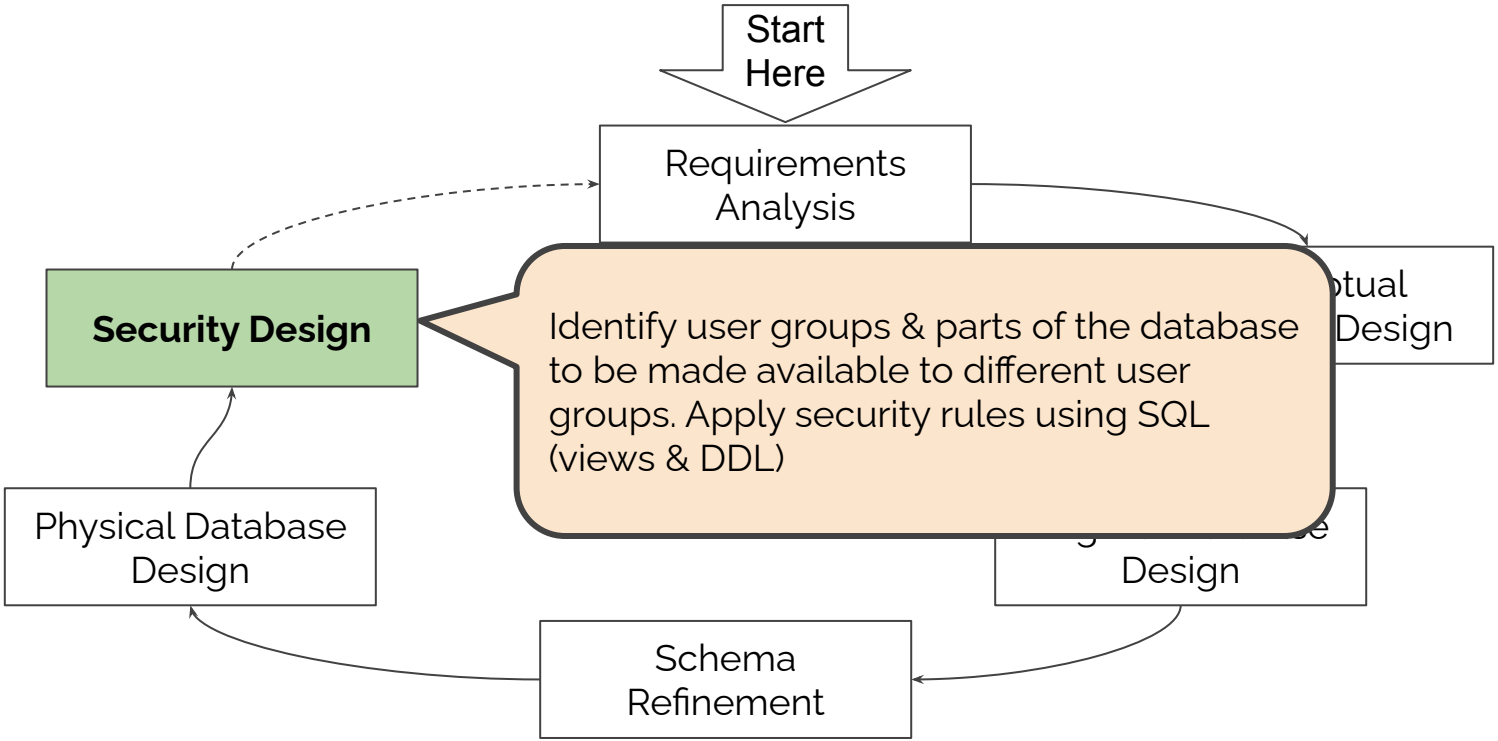

Syllabus / Schedule Overview

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- Communication
  - I strongly encourage the use of Canvas forums for general-interest questions
- Textbook is *optional*
- Homework & Labs
- Quizzes & Exams
  - Weekly Quizzes
  - Comprehensive Final Exam