Topic 2:

Database Management System Architectures
What is an ‘Architecture’ of a DBMS?

**Definition: Schema**

**Definition: Architecture**
The ANSI/SPARC Architecture (1 / 4): Background

a.k.a. Three-Level Schema

- A product of the Standards Planning and Requirements Committee (SPARC) of the American National Standards Institute (ANSI)
- Never formally adopted as an ANSI or International Standards Organization (ISO) standard, but still very influential
- Created to standardize terms and concepts surrounding DBs and DBMSes

- Goals:
  - Allow for multiple views of the data to satisfy a range of users
  - Allow for a physical (disk-level) description of the database
  - Provide an abstraction layer to separate the two
The ANSI/SPARC Architecture (2 / 4): The Diagram
The ANSI/SPARC Architecture (3 / 4): The Levels

- External Level
- Conceptual Level
- Internal Level
The ANSI/SPARC Architecture (4 / 4): The Mappings

The interfaces between the levels are known as *mappings*.

- External – External Mapping

- External – Conceptual Mapping

- Conceptual – Internal Mapping
Client - Server Architectures (1 / 3): Background

- Originally: DBMSes were built with a centralized architecture.
  - All components (OS, DBMS, compilers, etc.) on one computer
One possible division of services:
Client - Server Architectures (3 / 3): Multi-Tier

Why add more tiers?

Example of a Four-Tier architecture:
Service-Oriented Architectures (1 / 3): Motivation

- SOA is a software design technique:
  - Apps are built using pre-written service modules
    - E.g., a data visualization module
  - Modules are located & accessed via a common interface
- Goal is to be flexible with the adoption of new business processes
- A web service is an interface used by service modules
  - That is, it can be a component of an SOA.
- Further details are beyond the scope of this course
Service-Oriented Architectures (2 / 3): Before/After

Service-Oriented Architectures (3 / 3): Accessing

Advertising, Finding and Using a Service:

1. Publish Service
2. Locate Service
3. Use Service
Distributed DBMSes (1 / 2): Motivation

- A single DBMS server (with its single DB) is a single point of failure

- Solution: A DBMS can be operated by several servers.
  - Each server has all, some, or none of the DB stored locally
    - (replication is permitted for performance and reliability)
  - DDBMS sites communicate to handle nearly all tasks
  - Goal: Be completely transparent to the users

- Again, details are beyond the scope of this course
Distributed DBMSes (2 / 2): Diagram
Additional DB-Related Architectures

- Web Services

  Two types:

- Data Warehouses

- Cloud Computing