9

Database System Design

Prerequisites for This Section

- **Readings:**
  - **Required:** Connolly and Begg, sections 2.1, 9.1–9.6, 9.8–9.13, 15.1 (in third edition, sections 2.1, 9.1–9.6, 9.8–9.13, 14.1).
  - **Elective:** Connolly and Begg, sections 2.3 and 9.7

Section Objectives

In this section you will learn:

① Main roles of a database system.

② Main stages of database system development lifecycle.

③ The most commonly used fact-finding techniques.

④ Database design and application design are parallel activities.

⑤ Main phases of database design: conceptual, logical, and physical design.

Agenda

1. The Database Application Lifecycle
2. Requirements Collection and Analysis
3. Database Application System Design

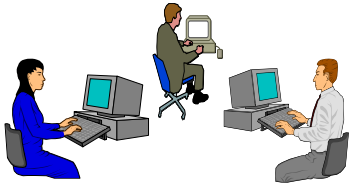
Information System (IS)

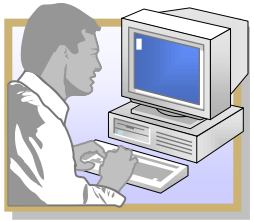
- Information system:

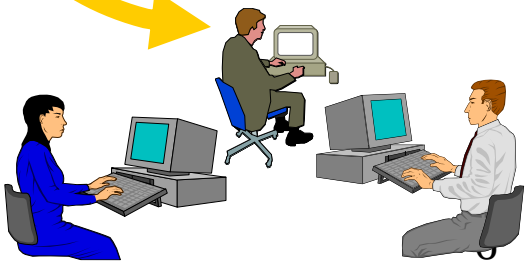
  Resources that enable collection, management, control, and dissemination of information throughout an organization.

- Database is fundamental component of the informational System (IS).

Database Application Requirement







Software Depression

- In late 1960s, led to a ‘software crisis’, now refer to as the ‘software depression’.
- Many major software project symptoms were and remain
  - late
  - over budget
  - unreliable
  - difficult to maintain
  - performed poorly
- Many requiring constant **maintenance** involving:
  - correcting faults
  - implementing new user requirements
  - modifying software to run on new or upgraded platforms

Software Depression

- **Major reasons** for failure of software projects include:

  - lack of a complete requirements specification;

  - lack of appropriate development methodology;

  - poor decomposition of design into manageable components.

- Structured approach to development was proposed called Information Systems Lifecycle (ISLC).

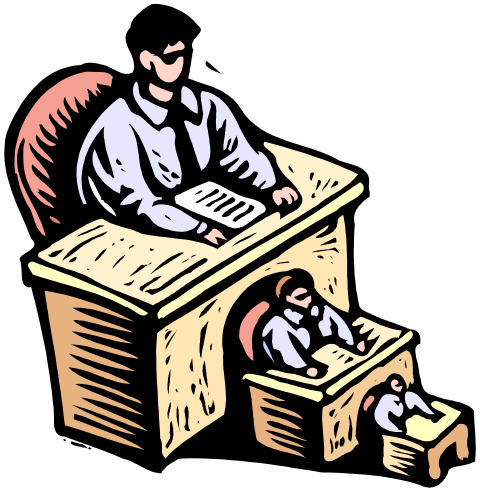
Information Systems Lifecycle (ISLC)

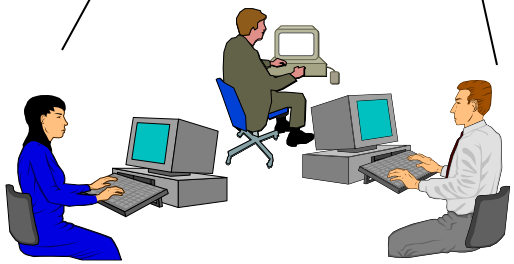
Collect requirements

Design System

Implement System

Maintain System





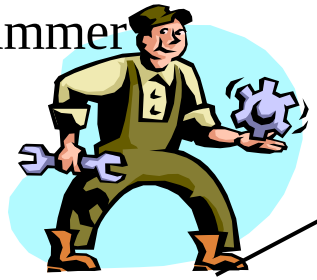
Main Roles in a Database System

User

Analyzer

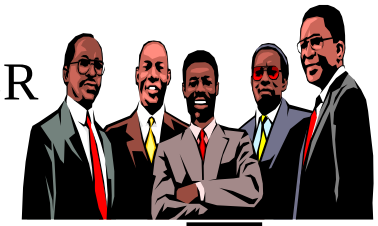
Designer

Programmer



DBA

Main Roles in a Database System

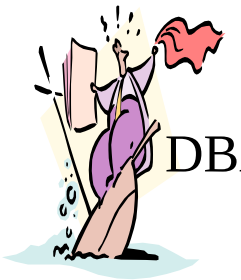


AP

AP

DBMS

DB



Database System Development Lifecycle

- Database planning
- System definition
- **Requirements collection and analysis**
- **Database design**
- DBMS selection (optional)
- **Application design**
- Prototyping (optional)
- Implementation
- Data conversion and loading
- Testing
- Operational maintenance

Agenda

1. The Database Application Lifecycle
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Fact-finding Techniques

- Are used throughout the database application lifecycle. Crucial to the early stages including:
  - database planning
  - system definition,
  - requirements collection and analysis stages.
- Several fact-finding techniques:
  - examining documentation
  - interviewing
  - observing the organization in operation
  - research
  - questionnaires

Requirements Collection and Analysis

- Information is **gathered** for each major user view including:
  - a description of data used or generated;
  - details of how data is to be used/generated;
  - any additional requirements for new database system.
- Information is **analyzed** to identify requirements to be included in new database system. Described in the requirements specification.
- Approaches to manage the requirements for a database system with multiple user views:
  - centralized approach
  - view integration approach

Agenda

1. The Database Application Lifecycle
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Database Application System Design

- Database application system design includes:
  - ① Database Design
  - ② DBMS Selection
  - ③ Application Design

① Database Design

- Process of creating a design for a database that will support the enterprise's mission statement and mission objectives for the required database system.
- Main approaches include:
  - Top-down
  - Bottom-up
  - Inside-out
  - Mixed

① Database Design

- Main purposes of data modeling include:
  - to assist in understanding the meaning (semantics) of the data;
  - to facilitate communication about the information requirements.
- Three phases of database design:
  - Conceptual database design
  - Logical database design
  - Physical database design

① DB Design -- Conceptual Database Design

- Process of constructing a model of the data used in an enterprise, independent of *all* physical considerations.
- Data model is built using the information in users' requirements specification.
- Conceptual data model is source of information for logical design phase.

①DB Design -- Logical Database Design

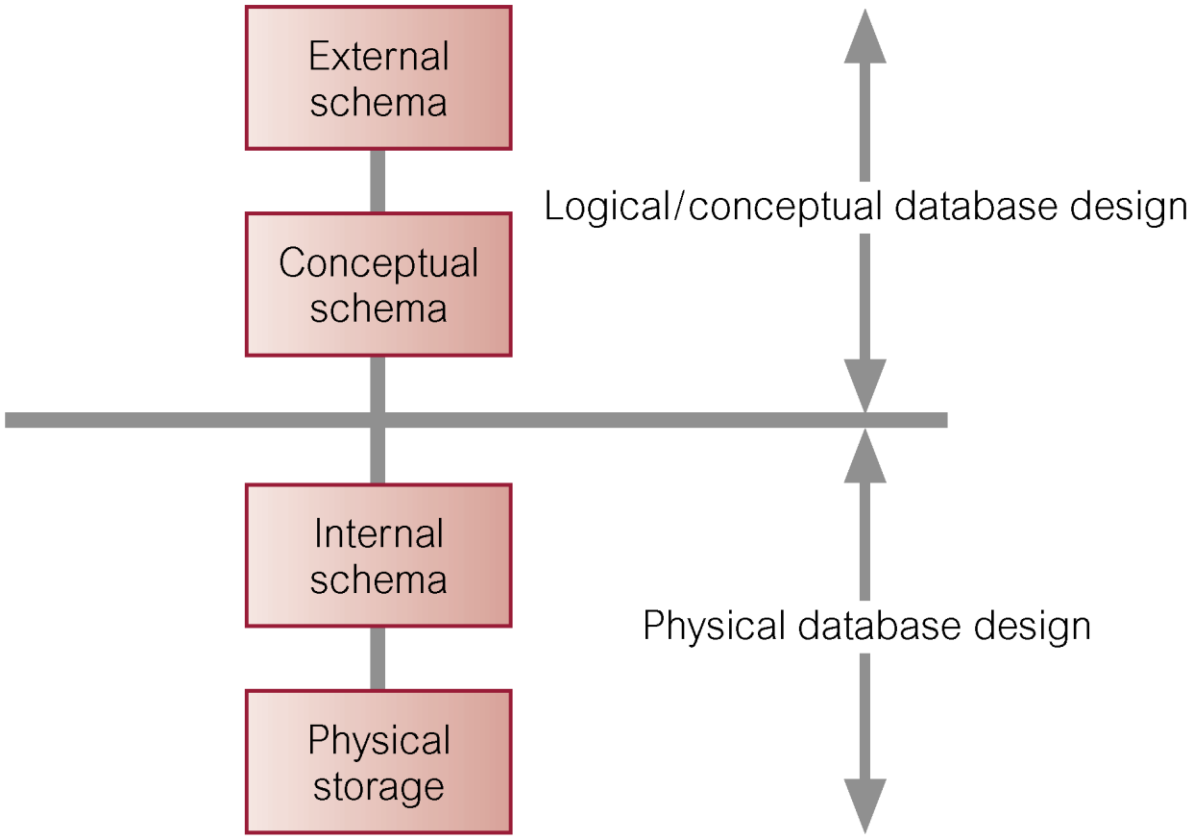
- Process of constructing a model of the data used in an enterprise based on a specific data model (e.g. relational), but independent of a particular DBMS and other physical considerations.

- Conceptual data model is refined and mapped onto a logical data model.

① DB Design -- Physical Database Design

- Process of producing a description of the database implementation on secondary storage.
- Describes base relations, file organizations, and indexes used to achieve efficient access to data. Also describes any associated integrity constraints and security measures.
- Tailored to a specific DBMS system.

① Three-Level ANSI-SPARC Architecture and Phases of Database Design



②DBMS Selection

- Selection of an appropriate DBMS to support the database system.
- Main steps to selecting a DBMS:
  - define Terms of Reference of study;
  - shortlist two or three products;
  - evaluate products;
  - recommend selection and produce report.

③Application Design

- Design of user interface and application programs that use and process the database.

- Includes two important activities:
  - user interface design;
  - transaction design.
- Database design and application design are parallel activities.

③Application Design - Transactions

- Transaction is an action, or series of actions, carried out by a single user or application program, which accesses or changes content of the database.
- Three main types of transactions: retrieval, update, and mixed.
- Should define and document the high-level characteristics of the transactions required such as importance to the users, and expected rate of usage.

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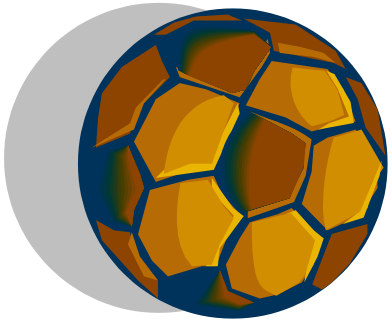
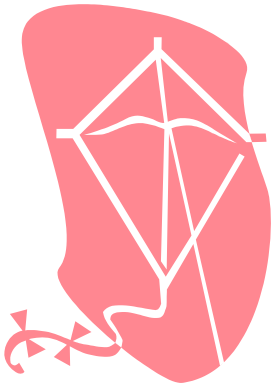
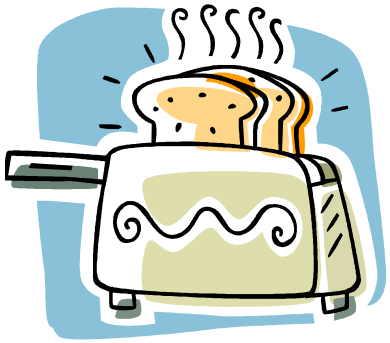
Questions?

Assignments







Prerequisites for Next Section

- **Readings:**
  - **Required:** Connolly and Begg, sections 11.1–11.6
  - **Optional:** Connolly and Begg, section 11.7

- **Assessments**
  - Multiple-Choice Quiz 5