1.1: The Evolution of Database Technology

IT2306 – Database Systems I

Level I - Semester 2

Detailed Syllabus

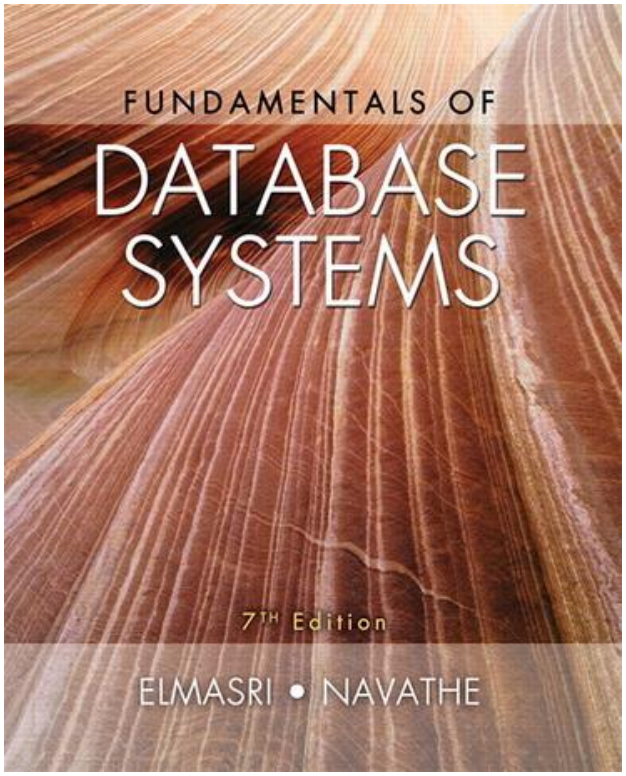
The Evolution of Database Technology

1. Data
   Information
   Database
   Database system
   Database management system
      - Data processing and data management
      - Increasing use of data as a corporate resource

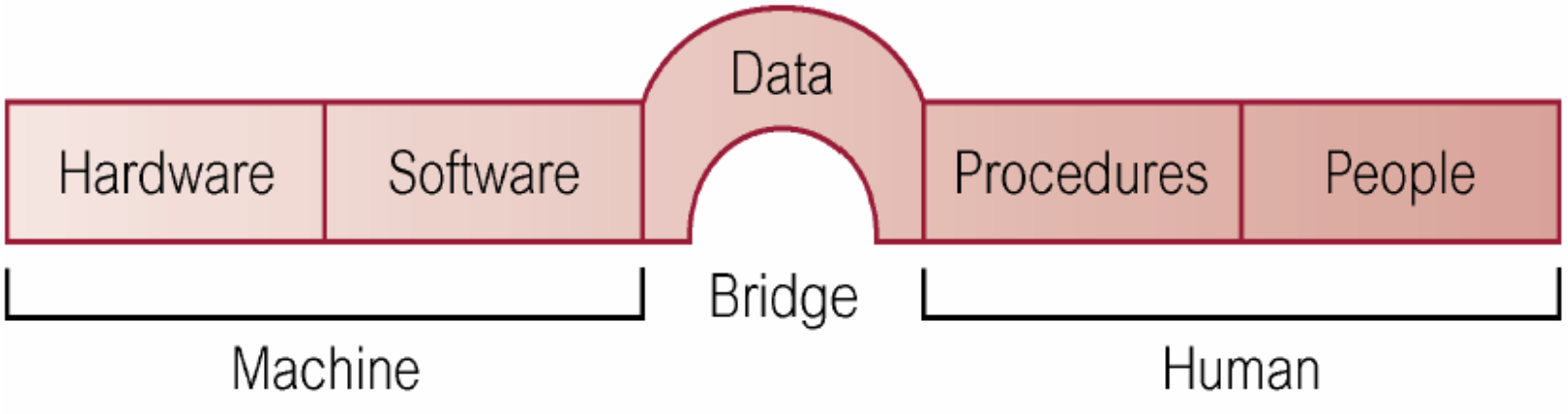
2. File oriented systems:
      - Meeting the need for random access processing
      - Limitations of Traditional File Systems
         - Data redundancy
         - Inadequate data manipulation capabilities
         - Program-data dependency
         - Data independence

Main Reference

- Fundamentals of Database Systems by R. Elmasri and S.B. Navathe, 7th edition, Addison-Wesley, 2015.



Components of Database System Environment



Components of Database System Environment

- **Hardware**

  Set of physical devices on which a database resides. Can range from a PC to a network of computers.

- **Software**
  - Database management system(DBMS)
  - Operating system
  - Application programs
  - User Interface
- **Data**
  - Used by the organization and a description of this data called the schema.

Components of Database System Environment

- **Data**
  - A representation of facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing by human beings or by automatic means.

  - Raw data which is unprocessed

    Text, colours, symbols, shapes, graphics, images, temperatures, sound, video or other facts and figures are data suitable for processing.

E.g. Person or Employee or Customer

–*name, address, phone, date of birth, designation, department, salary,*

–*employee no, photograph*

Components of Database System Environment

- **Procedures**
  - Instructions and rules that should be applied to the design and use of the database

- **People**
  - Two different types of people (end-users and practitioners) are concerned with the database.
    - End-Users
      - are the 'clients' of the database, who need information from the database to carry out their duties.
      - e.g. Executives, managers, staff, clerical personnel
    - Practitioners
      - people responsible for the database system and its associated application software.
      - e.g. Data and Database administrators, Database designers, Application developers.

Information

- Knowledge derived from data.
- Processed or organized or summarized data.
- Eg:-
  - Process Date of Birth->Age
  - Process Salary (all) ->Highest paid employee
  - Process all -> No of employees
  - Process all -> Employees working for

Why use a Database?

- Many people collect things
  - –How about you?
- If you collect any thing, you probably are familiar with some of the problems of managing a collection
  - –e.g. stamps, photos, paper cuttings
- One way to keep track of a collection is to create a database

Why Database Technology?

- The need to manipulate large collection of data for frequent used data queries and reports.

  E.g. Collection of information on library books
  Queries:

  - –List of books written by a particular author
  - –List of books about a particular subject
  - –Borrowing a book
  - –Reserving a book for borrowing

Examples of Database Applications

- Purchases from the supermarket
- Purchases using your credit card
- Booking a holiday at the travel agents
- Using the Internet
- Studying at university

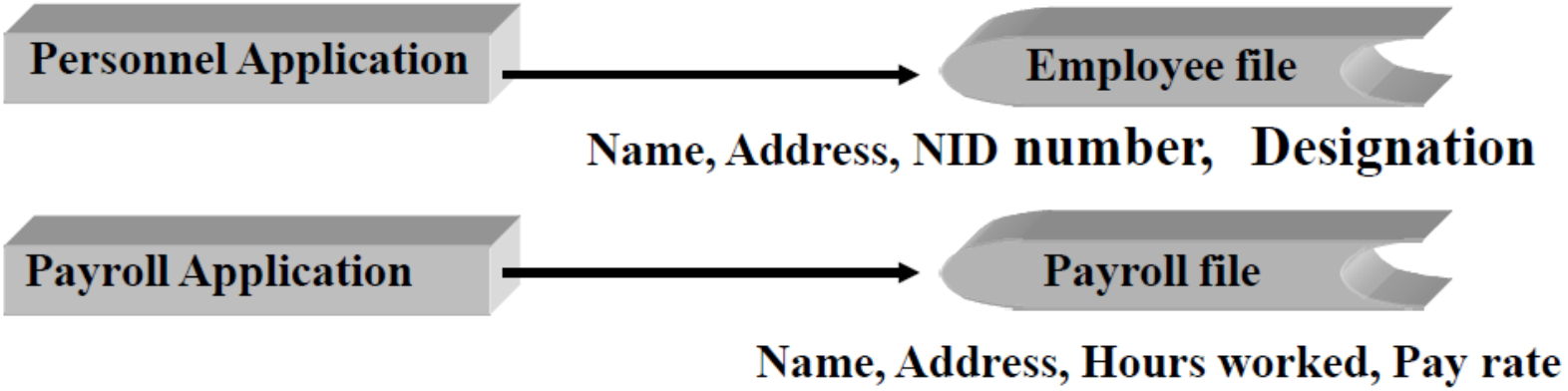
Manual Systems –Information on library books

- Before and during most of last century, libraries used card catalogues stored in drawers of special cabinets
  - cards with typed book information

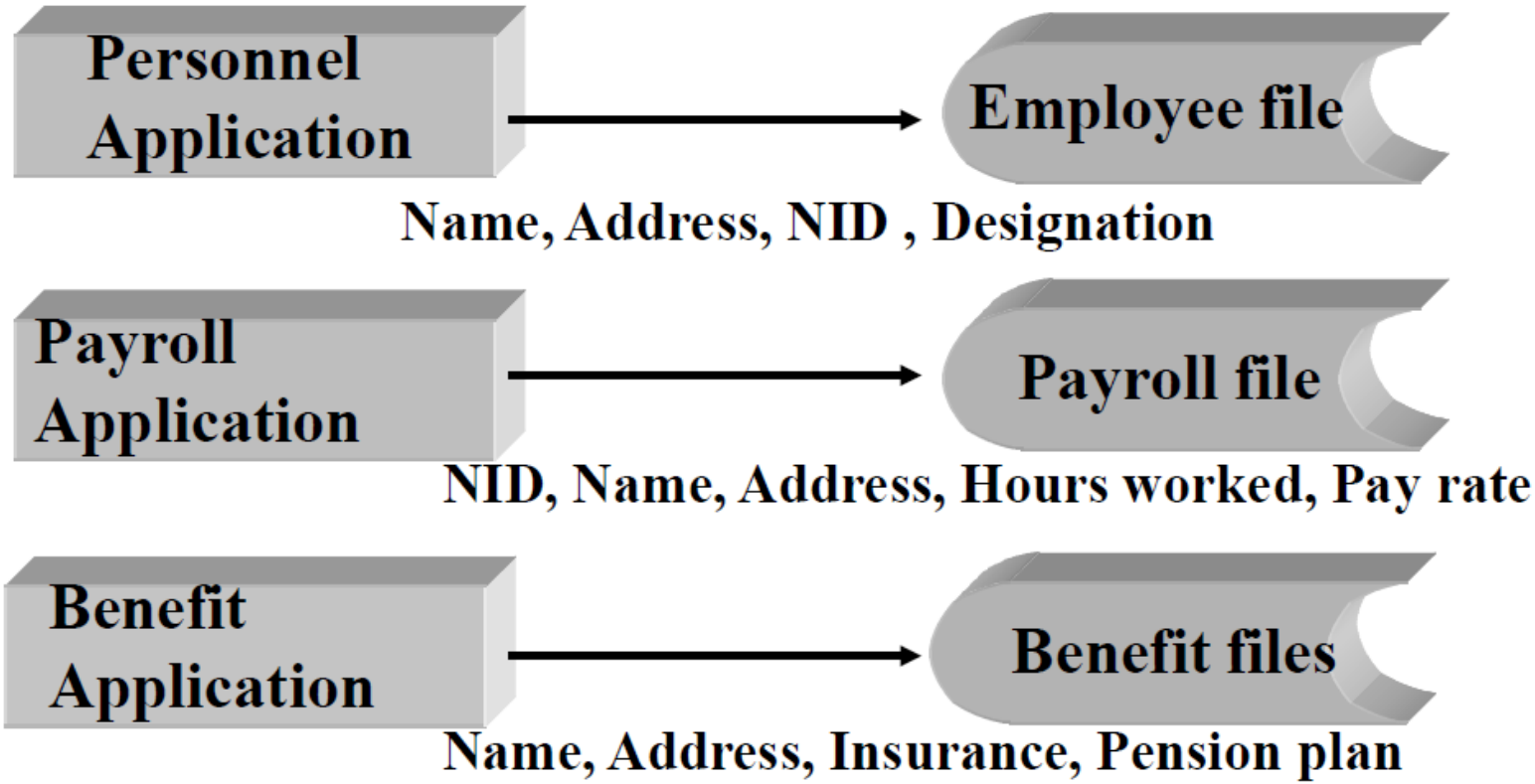
    e.g. the title index has one card for every book in the library

File-Based Systems

- Collection of application programs that perform services for the end users (e.g. reports).
- Each program defines and manages its own data.



Data Redundancy



Limitations of File-Based Approach

- **Separation and isolation of data**
  - Each program maintains its own set of data.
  - Users of one program may be unaware of potentially useful data held by other programs.

- **Duplication of data**
  - Same data is held by different programs.
  - Wasted space and potentially different values and/or different formats for the same item.

Limitations of File-Based Approach

- **Data dependence**
  - File structure is defined in the program code.
- **Incompatible file formats**
  - Programs are written in different languages, and so cannot easily access each other's files.
- **Fixed Queries/Proliferation of application programs**
  - Programs are written to satisfy particular functions.
  - Any new requirement needs a new program.

Database Approach

- **Arose because:**
  - Definition of data was embedded in application programs, rather than being stored separately and independently.
  - No control over access and manipulation of data beyond that imposed by application programs.
- **Result:**
  - The database and Database Management System (DBMS).

Database

- **Shared collection of logically related data (and a description of this data), designed to meet the information needs of an organization.**

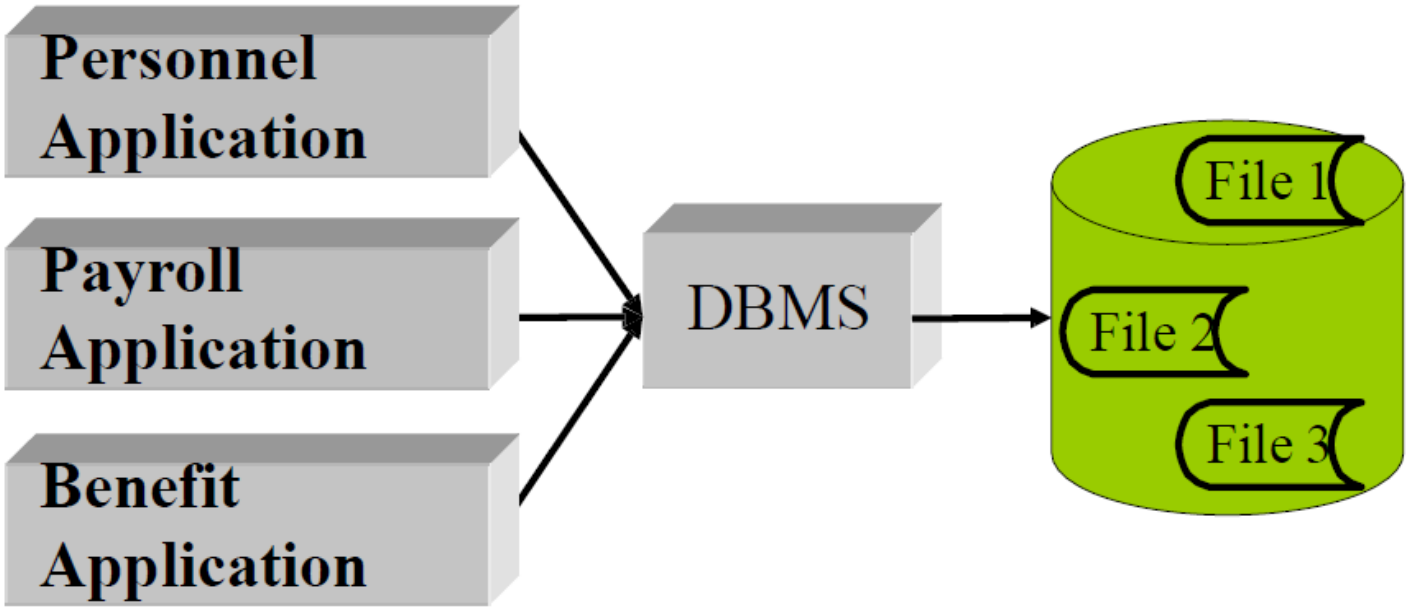
- System catalog or data dictionary provides description of data (metadata) to enable program–data independence.

- Logically related data comprises entities, attributes, and relationships of an organization's information.

Database Management System (DBMS)

- **A software system that enables users to define, create, and maintain the database and that provides *controlled access* to this database.**

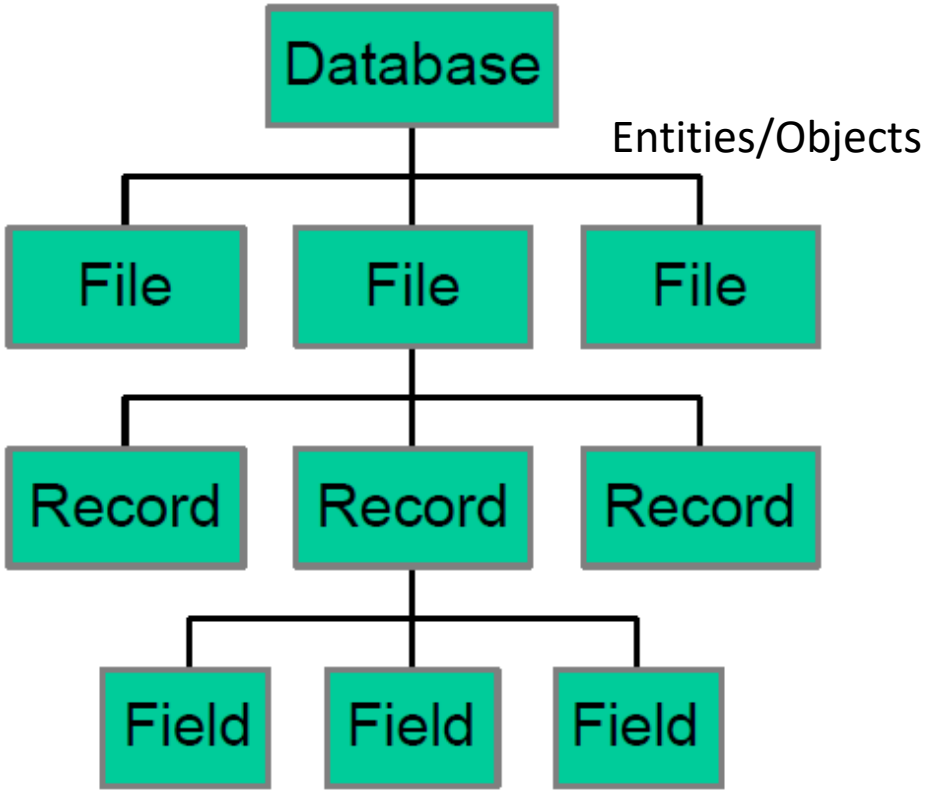
Database Approach



e.g. Integrated human resources database

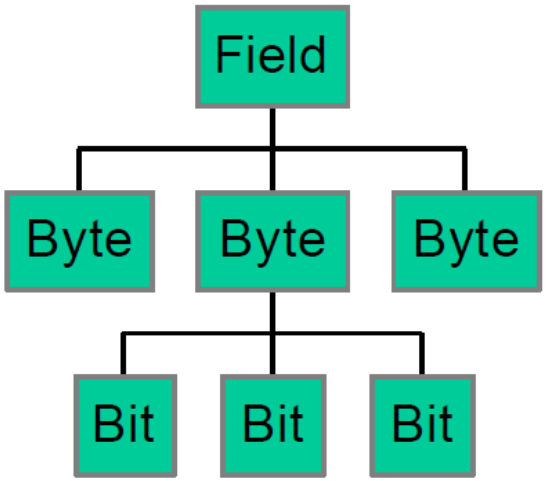
- Employees: *Name, Address, NIC number, Designation*
- Payroll: *Hours worked, Pay rate*
- Benefit: *Insurance, Pension plan*

Data Hierarchy



Entities/Objects

Attributes



Data Hierarchy

Employee (Empno, Name, Designation, Salary, Depart)

1	*De Silva*	*Manager*	*50000*	*Personnel*
2	*Perera*	*Secretary*	*15000*	*Personnel*
3	*Dias*	*Salesman*	*25000*	*Sales*

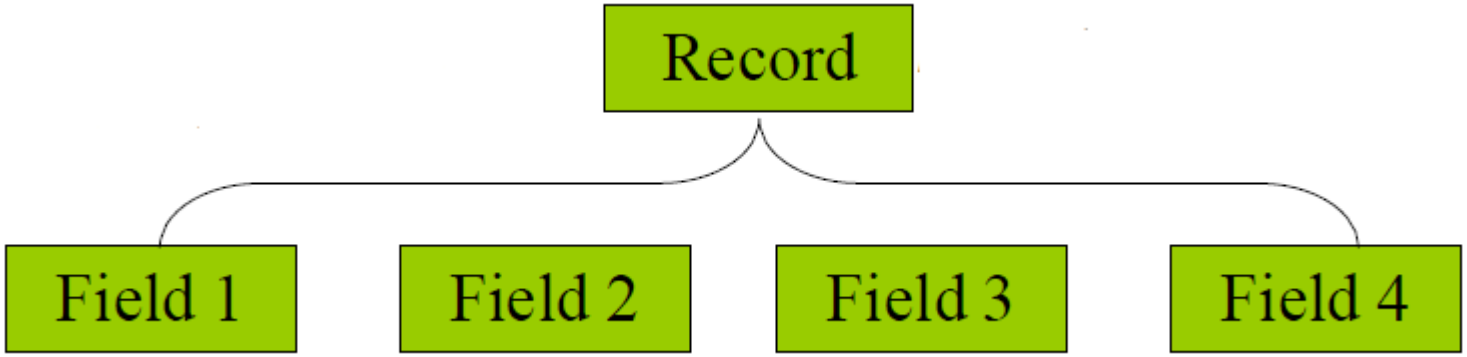
Department (Depart, Manager, Dept Addr, DeptPhone)

Personnel	*DeSilva*	*Colombo*	*589123*
Sales	*Alwis*	*Kandy*	*987275*
.....	.....		

Data Hierarchy

(Empno, name, designation, salary, department)

2 Perera Secretary 15000 Personnel



Byte

- A single character (letter, number, symbol) is represented using a group ofbits,E.g.10101010 letter J in ASCII

Bit

- The smallest unit of data, E.g. 0 or1