Chapter Two

Computer System and Software Technology Development

Outline

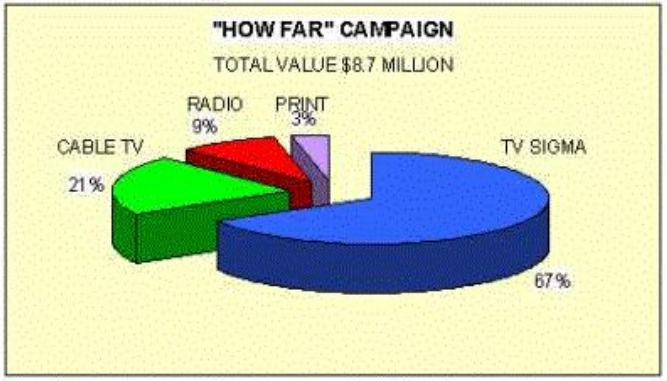
- Computers and Information Processing
- System Hardware
- Information System Software
  - Management Issues
- Software development process
- Data Resource Management
  - Solutions to managing data
- Data warehouse, Data marts and Data centers

Computers and Information Processing

- Computer is an electronic device, operating under the control of instructions stored in its own memory that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use
- Effects of using computer
  - Speed of processing & accessing of data increases -timeliness of information can be met
  - Scope of analysis widened - more data can be considered in analysis
  - Effectiveness of information system increases - because timeliness and accuracy of information is increased.
  - More comprehensive information is made available to executives - covering all aspect of the problem.

Computers and Information Processing(cont'd)

PROCESSING SYSTEM



DATA

INFORMATION

Types of Computers

- Based on processing capability of computers:
  - Supercomputers - the most powerful, fastest, largest and expensive computer.
    - Application: global weather forecasting, military defense systems, astronomy, microprocessor research and design, etc.
  - Mainframes- large, fast, and powerful computer systems
    - Application: to handle high transaction in banks, airlines, telecommunication companies, etc.
  - Minicomputers
    - Application: for scientific research, engineering analysis, and industrial process monitoring and control.
  - Microcomputers, some times called Personal Computer(PC)
- Integrated Computing
  - Along with advances in computers themselves, computing technology is being integrated into many everyday products. From automobiles to refrigerators to airplanes.
  - Example: Smart House, Self-Driving Car

Computer System

- A computer is a *system*, an interrelated combination of components that performs the basic system functions of input, processing, output, storage, and control, thus providing end users with a powerful information processing tool
- Components of computer system:
  - Hardware – physical element
  - Software – is a set of instructions that tells the hardware what to do

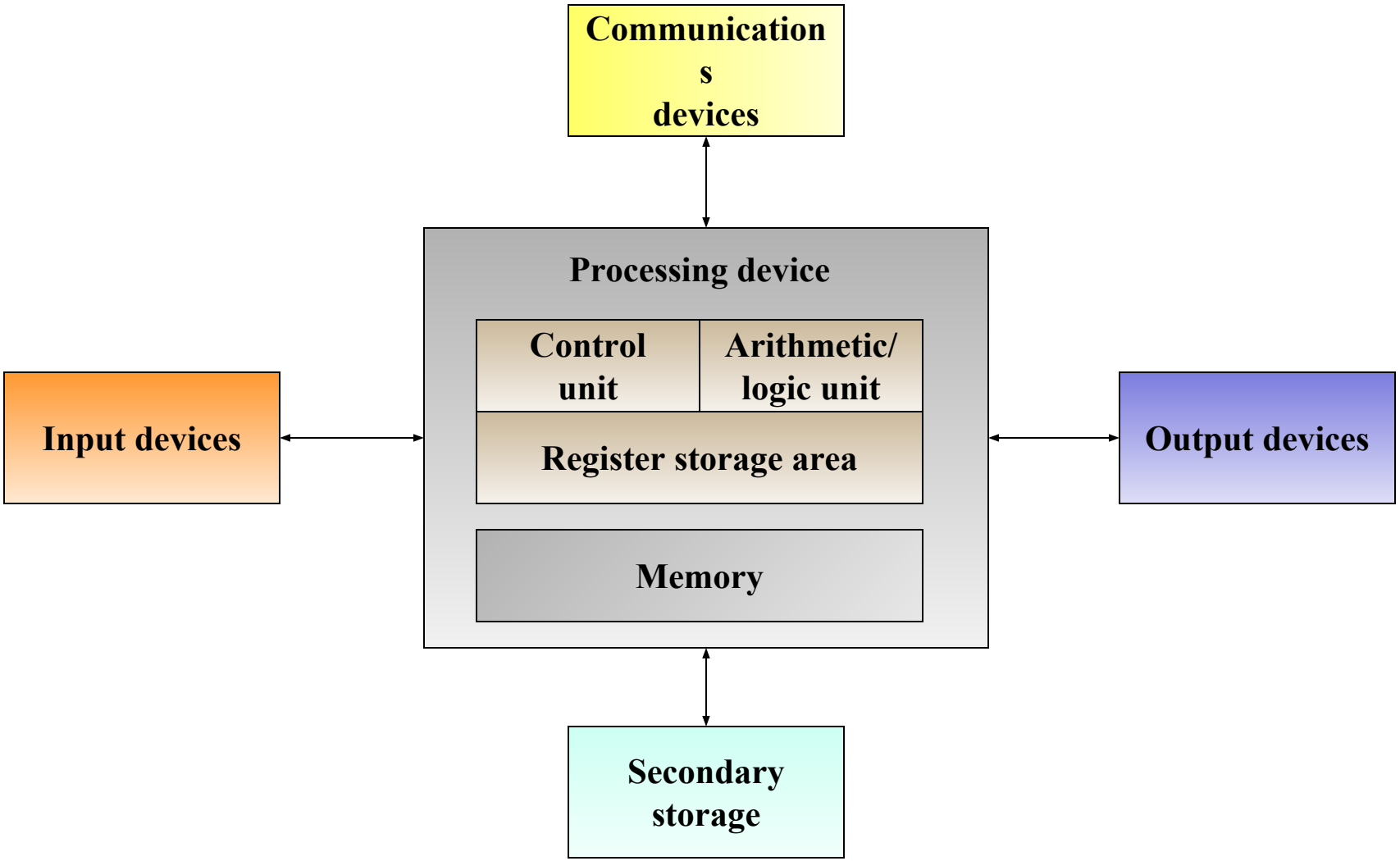
Hardware

- Any machinery that assists in the input, processing, storage, and output activities of an information system
- Hardware Components
  - Central processing unit (CPU)
    - A hardware component that performs computing functions utilizing the ALU, control unit, and registers.
      - Arithmetic/logic unit (ALU)
        - Performs mathematical calculations and makes logical comparisons
      - Control unit
        - Sequentially accesses program instructions, decodes them, coordinates flow of data in/out of ALU, registers, primary and secondary storage, and various output devices
      - Registers
        - High-speed storage areas used to temporarily hold small units of program instructions and data immediately before, during, and after execution by the CPU

Hardware(cont'd)

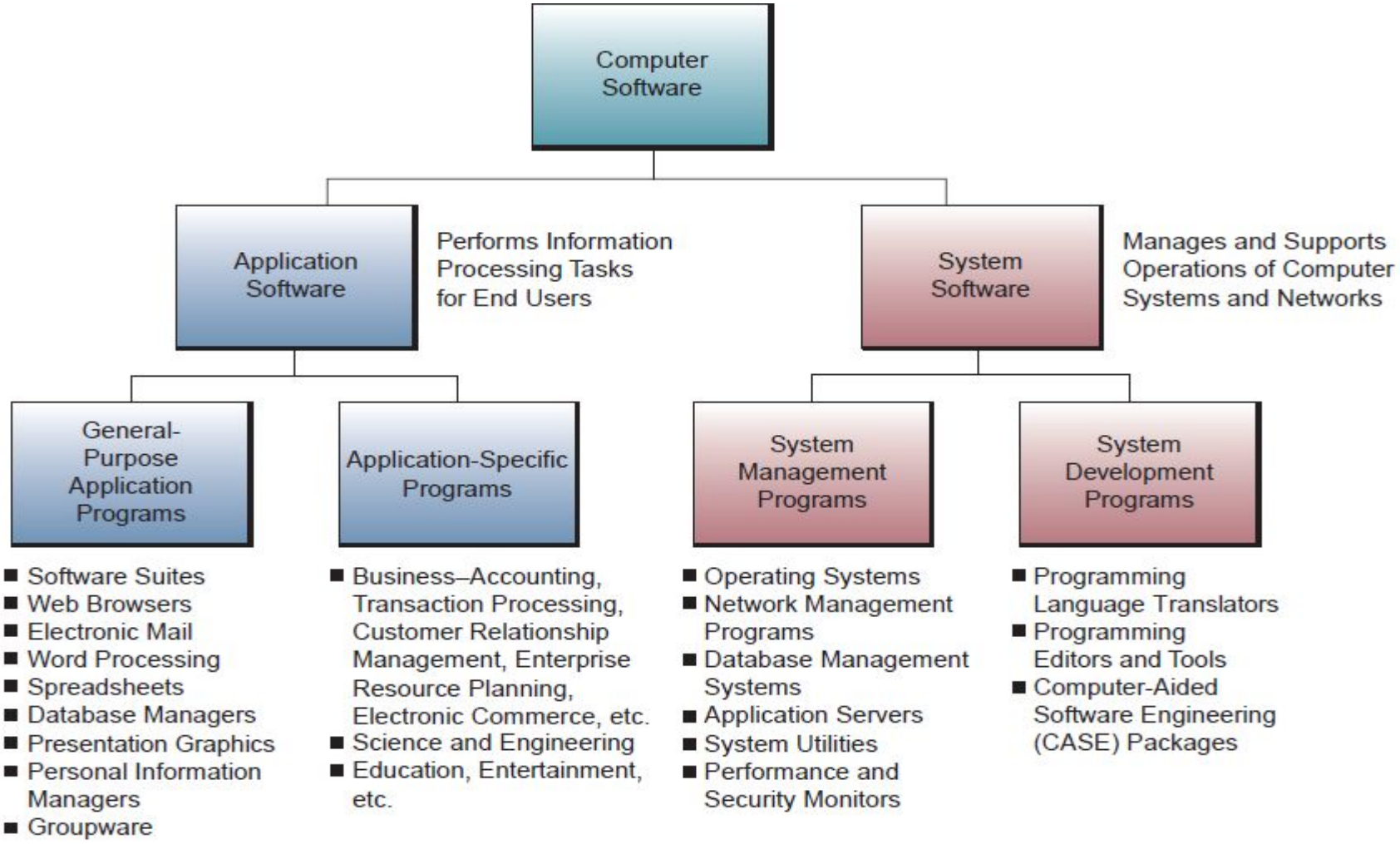
- **Primary storage**(main memory)
  - Holds program instructions and data
- **Secondary storage**
  - Store data and programs permanently. E.g. Hard disk, flash disk, magnetic tape, etc.
- **Input devices**
  - Provide data and instructions to the system and convert to machine understandable format. E.g. Keyboard, mouse, scanner, barcode reader, microphone, etc.
- **Output devices**
  - Presents the result of processing. It converts the result of the only-machine understandable form to a form understandable by human beings.
  - E.g. Monitor(soft copy output), printer(hard copy output), speaker, etc.

Hardware(cont'd)



Software

- **Two types:**
  - ✔ **Application and System software**



Software(cont'd)

1. Application Software

- subdivided into general-purpose and function-specific
  - General-purpose application programs are programs that perform common information processing jobs for end users.
    - Example: word processing, spreadsheet, database management, graphics, web browsers
  - function-specific application software packages are available to support specific applications of end users in business and other fields.
    - Example: customer relationship management, enterprise resource planning, and supply chain management, etc.

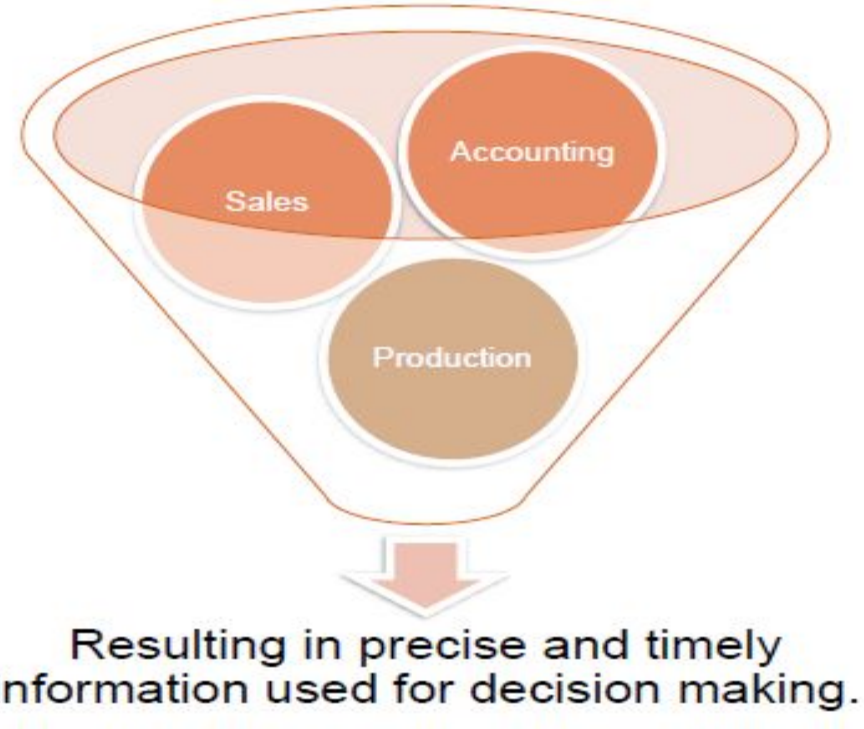
Software(cont'd)

2. System Software

- System Software enables the application software to interact with the computer hardware.
- Operating Systems are programs that coordinate computer resources, provide an interface between users and the computer; and run applications. E.g. Windows 10, Linux, etc.
- Utilities perform specific tasks related to managing computer resources. E.g. Antivirus
- Device drivers are specialized programs designed to allow particular input or output devices to communicate with the rest of the computer system

Information System Software

- Enterprise Resource Planning(ERP)
  - ERP (sometimes just called enterprise software) - collects data from different firm functions and stores data in single central data repository to be shared among firm
  - Some of the more well-known ERP systems include those from SAP, Oracle, and Microsoft.



- **Benefits:**
  - **Integration**
  - **Mobility**
  - **Flexibility**
  - **Productive**
  - **Collaborate**
  - **Secure**

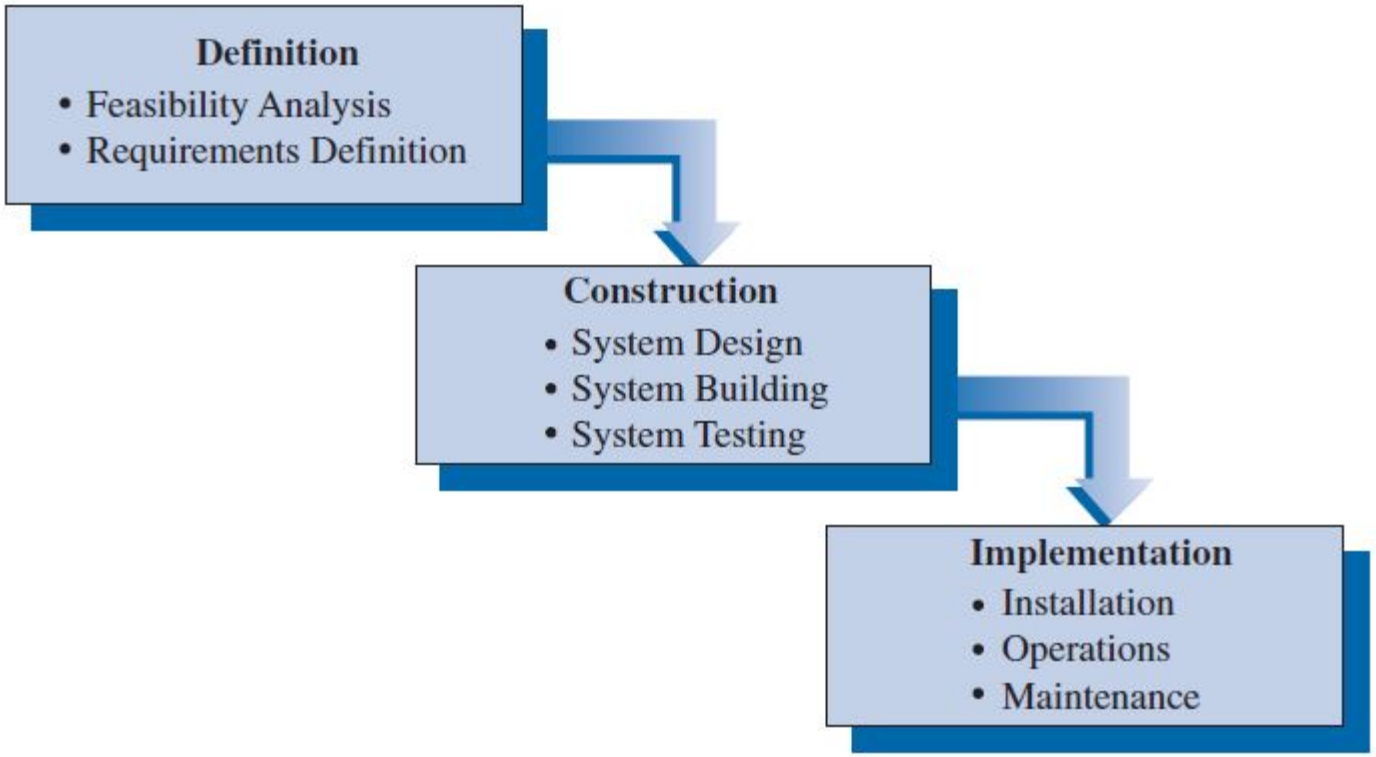
Information System Software(cont'd)

- Customer Relationship Management(CRM)
  - Provide information to coordinate all of the business processes that deal with customers in sales, marketing, and service to optimize revenue, customer satisfaction, and customer retention.
  - E.g. Salesforce.
- Supply Chain Management(SCM)
  - manages the interconnection between an organization's suppliers, its manufacturing facilities, and the distributors of its products, as well as the inventory of the products in their various stages of development.

Information System Software(cont'd)

- Cloud service
  - Cloud refers to applications, services, and data storage on the Internet. E.g. Google Drive's application, Salesforce, etc.
  - Advantages:
    - No software to install or upgrades to maintain.
    - Available from any computer that has access to the Internet.
    - Can scale to a large number of users easily.
    - New applications can be up and running very quickly.
    - Your information is not lost if your hard disk crashes or your laptop is stolen.
    - You are not limited by the available memory or disk space on your computer.
  - Disadvantages:
    - Your information is stored on someone else's computer – how safe is it?
    - You must have Internet access to use it.
    - You are relying on a third-party to provide these services

IS Development Process



IS Development Process(cont'd)

- The Definition phase is critical: It justifies the systems development work and defines precisely what the system must do in sufficient detail for IS specialists to build the right system.
  - Feasibility study: *economic*, *operational*, and *technical*
- In the Construction phase, the IS specialists produce a working system according to the specifications set forth in the earlier phase.
- In the Implementation phase, the new system is installed, becomes operational within the organization, and is maintained (modified) as needed so that it continues to reflect the changing needs of the organization.

Management Issues

- Dealing with platform and infrastructure change
  - Firms require new policies and procedures for managing new platforms
- Management and governance
  - Each organization will need to arrive at answers based on its own needs for the following questions:
    - who will control and manage the firm's IT infrastructure?
    - should IT infrastructure be centrally controlled and managed? or should it be by departments and divisions?
    - What is the relationship between central information systems management and business unit information systems management?
    - How will infrastructure costs be allocated among business units?

Management Issues(cont'd)

- Making wise infrastructure investments
  - How much should the firm spend on infrastructure?
  - Should purchase or rent(cloud) IT infrastructure?
  - The actual cost of owning technology resources includes:
    - original cost of acquiring and installing hardware and software
    - ongoing administration costs for:
      - hardware and software upgrades,
      - maintenance,
      - technical support,
      - training, and
      - utility and real estate costs for running and housing the technology
    - **Total cost of ownership (TCO)** model can be used to analyze these direct and indirect costs
    - Hardware and software acquisition costs only about 20 percent of TCO, so managers must pay close attention to administration costs

TOC cost components

INFRASTRUCTURE COMPONENT	COST COMPONENTS
Hardware acquisition	Purchase price of computer hardware equipment, including computers, terminals, storage, and printers
Software acquisition	Purchase or license of software for each user
Installation	Cost to install computers and software
Training	Cost to provide training for information systems specialists and end users
Support	Cost to provide ongoing technical support, help desks, and so forth
Maintenance	Cost to upgrade the hardware and software
Infrastructure	Cost to acquire, maintain, and support related infrastructure, such as networks and specialized equipment (including storage backup units)
Downtime	Cost of lost productivity if hardware or software failures cause the system to be unavailable for processing and user tasks
Space and energy	Real estate and utility costs for housing and providing power for the technology

Data Resource Management

- The data resource consists of the facts and information an organization gathers while conducting business and in order to conduct business at all levels of the organization.
- Data is an organization's informational asset.
  - Data can be an asset only if they are available and understood when needed and purged when no longer useful
- Difficulties with managing data
  - Amount of data is increasing- every 18 months data of an organization becomes double.
  - Data is scattered throughout the organization
  - Data quality and security

Data Resource Management(cont'd)

- Data management helps companies improve productivity by ensuring that people can find what they need without having to conduct a long and difficult search.
- Goal to transform raw data into usable corporate information of the highest quality.
  - Managers make decisions and service customers based on the data available to them.
  - Managers need rapid access to correct, comprehensive, and consistent data

Solutions to managing data

- Manual Approach
- File Management
- Database Management Systems (DBMS)

Manual Approach

- Typing the data on paper and put in a file cabinet
- Works well if the number of items to be stored is small.
- **Limitations**
  - Prone to error
  - Difficult to update, retrieve, integrate
  - You have the data but it is difficult to compile the information
  - Limited to small size information
  - Cross referencing is difficult
- Two computerized approaches evolved to overcome this limitations
  - File based approach → decentralised
  - Database approach→ centralised

File-Based Approach

- A collection of application programs that perform services for the end-users. Each program defines and manages its own data.
- This approach is to develop a program or a number of programs for each different application.
- File based systems were an early attempt to computerize the manual filing system.

File-Based Approach(cont'd)

- **Limitations**
  - Data Redundancy (Duplication of data)
    - Same data is held by different programs
    - Wasted space
  - Separation or 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.
  - Data Inconsistency and confusion
  - E.g. Consider an organization:
    - Personnel Department stores details relating to each member.
    - Payroll Department stores salaries of each staff

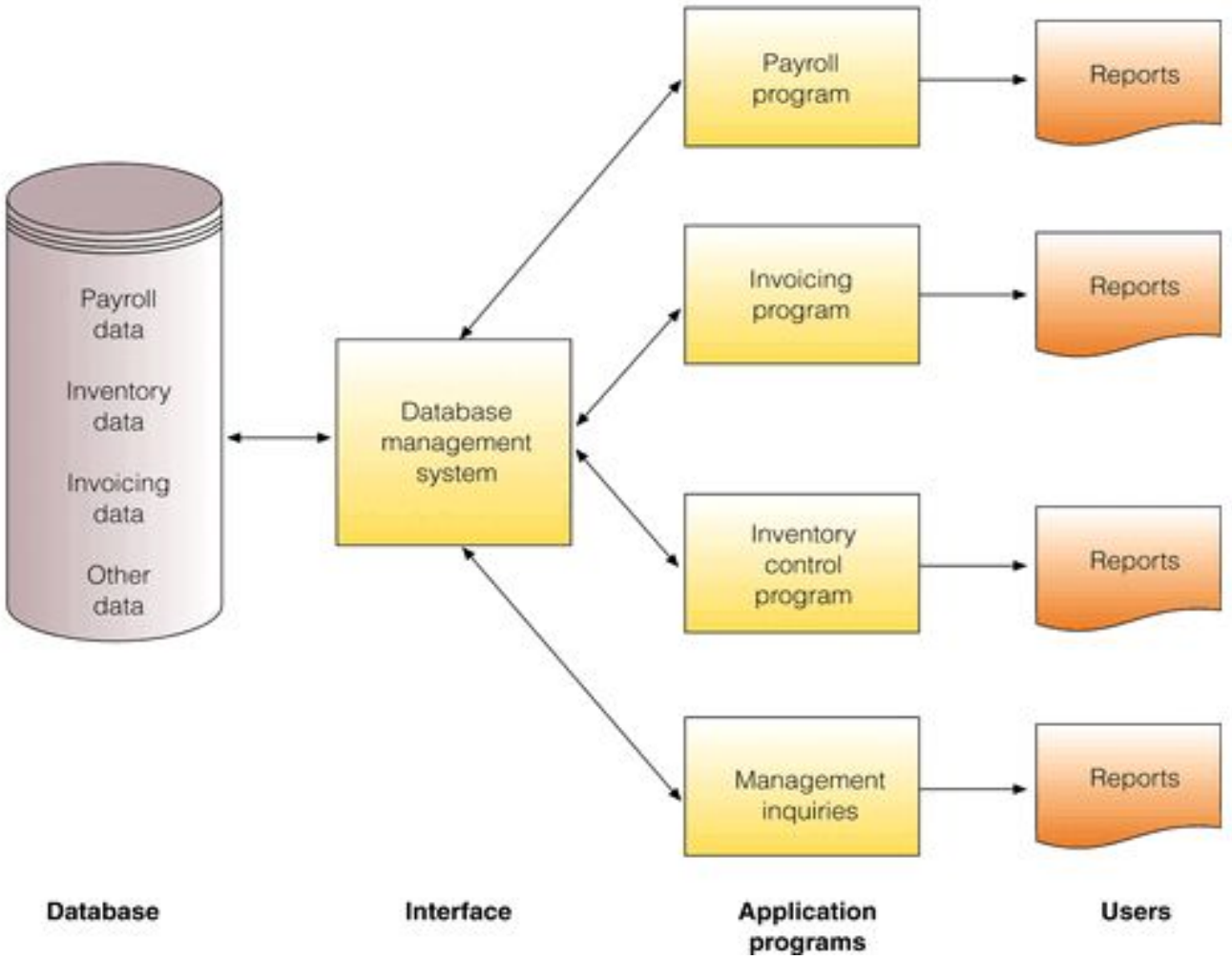
File-Based Approach(cont'd)

- Consider the duplication of data between the payroll and personnel departments . If an employee moves house and the change of address is communicated only to personnel and not to payroll, the person's pay slip will be sent to the wrong address.
- A more serious problem occurs if an employee is promoted to a more senior position with an associated increase in salary. Again, the change is notified to personnel but the change does not filter through payroll. And the employee may be getting the wrong salary.

Database Approach

- A Database is shared collection of logically related data (and a description of this data), designed to meet the information needs of an organization.
  - Shared collection- can be used simultaneously by many departments and users
  - Logically related data comprises entities, attributes, and relationships of an organization's information.
  - System catalog (data dictionary or metadata) provides the description of the data.
    - Example: Student data base, Inventory database, hotel reservation data base, online book data base, etc

The Database Approach to Data Management



Advantages

- Data can be shared
  - two or more users can access and use same data instead of storing data in redundant manner for each user.
- Improved accessibility of data
  - by using structured query languages, the users can easily access data **without programming experience**.
- Redundancy can be reduced
  - isolated data is integrated in database to decrease the redundant data stored at different applications.
- Quality data can be maintained
  - the different integrity constraints in the database approach will maintain the quality leading to better decision making

Advantages(cont'd)

- Transaction support can be provided
  - basic demands of any transaction support systems are implanted in a full scale DBMS.
- Improved decision support
  - the database will provide information useful for decision making.
- Centralized information control
  - Since relevant data in the organization will be stored at one repository, it can be controlled and managed at the central level.

Managing Data Resources

- To make sure that the data for your business remain accurate, reliable, and readily available to those who need it, your business will need special policies and procedures for data management
- Establishing an information policy
  - specifies the organization's rules for sharing, disseminating, acquiring, standardizing, classifying, and inventorying information.
    - which users and organizational units can share information, where information can be distributed, and who is responsible for updating and maintaining the information.
    - Example: only human resource department would have the right to change employee's salary.
- Ensuring data quality

Who Manages Data?

- Managed assets - finance, personnel, equipment, and facilities. Today, data must be added to this list of managed assets
- Who manages data?
  - Business manager - manages organizational data
  - Database administrator - provides overall organizational leadership in the data management function
  - Chief knowledge officer(for some organizations) - knowledge management functions.

Data Warehouses, Data Marts, and Data Centers

- A data warehouse is a subject-oriented(such as customer, product, sales), integrated(multiple, heterogeneous data sources), time-variant, and nonvolatile(a physically separate store of data transformed from the operational environment) collection of data in support of management's decision-making process.—W. H. Inmon
- Is a database that is maintained separately from the organization's operational database for the purpose of decision support.
- It is a repository of multiple heterogeneous data sources organized under a unified schema at a single site in order to facilitate management decision making
- Data warehousing:
  - The process of constructing and using data warehouses

Data warehouse

- Data warehousing is most appropriate when
  - Large amount of data to be accessed
  - The operational data is stored in different systems
  - Large number of users (AT&T)
  - Extensive end-user computing

Data marts

- A data mart is a small warehouse designed for a department
- Contains a subset of the organization-wide data that is of value to a small group of users, e.g., marketing or customer service.

Data Center

- An organizational unit that uses centralized computing resources to perform information processing activities for an organization. Also known as a computer center.

Thank you !!!!