Module 1

COMPONENT FUNDAMENTALS

Dr. A. O. Ameen & Dr. A. O. Bajeh
ahmedameeny2k4@gmail.com  bajehamos@unilorin.edu.ng

Department of Computer Science
Faculty of Communication and Information Sciences
University of Ilorin, Ilorin, Nigeria.
Chapter Outline

- Elements of a Computer
- Types of Computer
- Computer Memory
- Input/Output Devices
- Computer Network
- Computer Troubleshooting
1: Elements of a Computer

- What is a Computer?
  an electronic device that accepts data as input, processes the data and generates results as output.

Figure 1.1: Basic Architecture of Computer
1: Elements of a Computer

- Elements of a Computer:

  A computer system can be divided into three main components: **hardware**, **software** and **humanware**.

  - Hardware: The hardware refers to the physical components and the devices which make up the visible computer.

![Figure 1.2: Computer Architecture](image-url)
1: Elements of a Computer

- Elements of a Computer:
  - Software: is basically a computer program. A program consists of a sequence of instructions required to accomplish a well-defined task
    - System Software
      - It is written by computer manufacturers
      - It directly controls and manages the underlying hardware components of the computer
      - Examples are Operating System, Language Translators, Utilities and Service Programs, Device drivers
    - Application Software
1: Elements of a Computer

- Characteristics of a Computer
  - Electronic in nature
  - Speed
  - High degree of accuracy - It is garbage-in-garbage-out (GIGO)
  - Consistency – That is, given the same set of input data, the same result will always be produced
  - Iterative - Ability to perform repetitive operations without getting bored or fatigued
  - Storage: Can store data/information on a long term basis.
2: Types of Computer

- Computer Classification:
  - By Nature of Data
  - By Size
  - By Generation
  - By Purpose
2: Types of Computer

- By Nature of Data:
  - Analogue Computer:
    measures changes in current, temperature or pressure and translates these data into electrical pulses for processing. Examples are speedometer, electric meter, water meter, thermometer, etc.

Figure 1.3: A Typical Analogue Computer
2: Types of Computer

- By Nature of Data:
  - Digital Computers:
    This operates on data representation in the form of discrete values or digits, i.e. it processes data represented in the form of 0s and 1s

![A Typical Digital Computer](image-url)
2: Types of Computer

- By Nature of Data:

  - Hybrid Computers:
    - = Analogue features + digital features.
    - They handle data in both discrete and variable quantities.
    - They are mostly found in industrial processes for data acquisition and data processing purposes.
    - Analogue-to-Digital Converter and Digital-to-Analogue Converter Modulator/Demodulator (MODEM)
2: Types of Computer

- By Size:
  - Super Computers:
    - They are extraordinarily powerful computers
    - They are the largest and fastest computer systems
    - They are used for animation purposes, meteorological, astronomical and oil exploration applications
    - Examples: Cray-1, Cyber series, Fujistu, ETA-10 system

Figure 1.5: Super Computer
2: Types of Computer

- By Size:
  - Mainframe Computers:
    - very big general-purpose computers
    - powerful Central Processing Unit (CPU) linked by cable to hundreds or thousands of terminals.
    - memory capacity more than 100 million bytes and processing power of well above 10 Million Instructions Per Second (MIPS).
  - Examples: ICL 1900 and IBM 360/370 series, IBM 704

Figure 1.6: Mainframe Computer
2: Types of Computer

- By Size:
  - Minicomputer:
    - It share the same features like the mainframe but differs in:
      - Size – It is smaller,
      - Heat – It generates lower amount of heat,
      - Instruction set – has less number of instruction set
      - Cost – It is not as expensive as mainframe
    - Examples: IBM AS/400, NCR Tower 32, DEC System’s PDP 7

Figure 1.7: Minicomputer
2: Types of Computer

By Size:

- Microcomputer:
  - It is also called Personal Computer (PC)
  - It is smaller in size compared to mini and mainframe computers.
  - It is made up of ICs and elements of computer are replaced by a single IC called “chip”.
  - It is cheaper in terms of cost compared to others.
  - Microcomputer was first developed by companies like Apple Computers and later by IBM PC in 1981.

Figure 1.8: Microcomputer
2: Types of Computer

- By Generation:
  - First Generation Computers:
    - manufactured in the 1940s and last till 1950s
    - use vacuum tubes as its major components
    - programmable only in Machine Language (ML)
  - Examples:
    - UNIVAC (UNIVersal Automatic Computer)
    - ENIAC (Electronic Numerical Integrator and Calculator)
2: Types of Computer

By Generation:
- Second Generation Computers:
  - manufactured in the early 1950s and lasted until late 1950s
  - use transistors which replaced the vacuum tube in the first generation
  - reduction in size, less power consumption, generation of less heat
  - improved storage facility due to introduction of magnetic devices for storage medium
  - programmable using symbolic languages
- Examples:
  - ATLAS, IBM 1400 series
  - PDP I & II (Programmed Data Processor I & II)
2: Types of Computer

By Generation:

- Third Generation Computers:
  - manufactured in the early 1960s to the late 1960s
  - use Integrated Circuitry (IC): thousands of transistors combined into a single unit component
  - reduction in size, less power consumption, generation of less heat
  - the concept of multi-programming was introduced
  - programmable using High Level Languages
  - Examples:
    - IBM 360/370 series
    - ICL 1900 series (International Computers Limited)
    - PDP I & II (Programmed Data Processor I & II)
2: Types of Computer

By Generation:

- Fourth Generation Computers:
  - manufactured in the early 1970s
  - built with Very Large-Scale Integrated Circuitry (VLSI): over ten thousand flip-flops were placed in a single silicon chip, i.e. thousands of ICs were combined into a single chip
  - microcomputer with the introduction of microprocessors as its major component
  - reduction in size, less power consumption, generation of less heat
  - programmable using High Level Languages

Examples:
- IBM, COMPAQ 2000 series,
- Dell series,
- Toshiba
2: Types of Computer

- By Generation:
  - Fifth Generation Computers:
    - Started in the 1980s and classical researches are still going on in this generation of computers
    - The research is to build a computer system that mimics the intelligence of human expert in a knowledge domain such as medicine, law, education, criminal investigation, etc.
    - They use the concept of Artificial Intelligence
2: Types of Computer

- By Purpose:
  - Special purpose Computers:
    - developed to perform only one task
    - the program for the machine is built into the machine permanently
    - used in air traffic control system; military weapons control system, ship navigation system and industrial process controls
  - General Purpose Computers:
    - ability to handle a wide variety of programs and to solve many problems such as payroll, numerical analysis, software development for accounting, inventory system, etc.
    - It makes use of stored program for switching from one application to another
3: Computer Memory

- **Definition:**
  - A memory is the store in which data/information and instructions can be temporarily or permanently kept for processing or future use.
  - The computer memory is made up of elements called BIT (BInarydigiT).
  - Bits are organized into 8-bit addressable units called BYTES.

- **Memory Sizes:**

<table>
<thead>
<tr>
<th>Size</th>
<th>Equiv. in Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kilobyte (KB)</td>
<td>1,024 bytes</td>
</tr>
<tr>
<td>1 Megabyte (MB)</td>
<td>1,048,576 bytes</td>
</tr>
<tr>
<td>1 Gigabyte (GB)</td>
<td>1,073,741,824 bytes</td>
</tr>
<tr>
<td>1 Terabyte (TB)</td>
<td>1,099,511,627,776 bytes</td>
</tr>
<tr>
<td>1 Petabyte (PB)</td>
<td>1,125,899,069,062,426 bytes</td>
</tr>
</tbody>
</table>
3: Computer Memory

Types of Memory:

- **Primary/Main Memory**: resides inside the CPU and hold data/instruction undergoing processing.

- **Secondary/Auxiliary Memory**: is an external memory used to store data/information permanently for future use.

Figure 1.9: Main Memory or RAM.

Figure 1.10: Auxiliary Memory
3: Computer Memory

- Types of Memory:

- **Cache Memory** (pronounced as **Kash**):
  - is the memory that serves as a buffer between the primary memory between the CPU and main memory.
  - Data/information and instruction frequently used in the CPU are kept in the cache for faster access
4: Input and Output Devices

- **Input Devices:**
  - Data and instructions are fed into the computer through input devices.
  - The input device translates data and instruction into the form the computer can process.
  - Examples:

- **Keyboard**
- **Mouse**
- **Bluetooth**
- **Scanner**
- **Web cam**
- **Joy stick**
- **Touch pad**
- **Light pen**
- **Bar code Reader**
- **MCR**

*Figure 1.11: Input Devices*
4: Input and Output Devices

- **Output Devices:**
  - Information are received from the computer through the output devices.
  - The output device translates information into the form users can understand.
  - **Examples:**
    - Monitor (VDU)
    - Printer
    - Graph Plotter
    - Speaker
    - Projector

*Figure 1.12: Output devices*
5: Computer Network

Definition:

- A computer network is a system of computers interconnected to share data and resources with one another.

Figure 1.13: A Computer Network
Types of Computer Network:

- **Local Area Network (LAN):**
  - It is a network that interconnects computers within a limited area and has its equipment locally managed.
  - The limited area covered by a LAN could be a residence, school, laboratory, university campus or office building.

- **Metropolitan Area Network (MAN):**
  - It is a network that connects computers in a geographical area larger than that covered by LAN such as a city.

- **Wide Area Network (WAN):**
  - It is a network that extends over a large geographical distance. The area covered is wider than that of MAN.
5: Computer Network

- Hardware Components of Computer Network:

  - Network Cable
  - Distributor
  - External Network Card
  - Internal Network Card
  - Router

Figure 1.14: Computer Network Equipment
5: Computer Network

Benefits of Computer Network:

- Share files stored in one location (network) by multiple users
- Shares devices such as printers or access the internet
- Company information is organized in one central area for storage, maintenance and backup
6: Computer Troubleshooting

Definition:

- Computer troubleshooting is the act of identifying and correcting faults in a computer system.

- It involves a step-by-step logical and systematic search for the sources of faults or problems in order to fix them and make the computer work properly as expected.

- The steps taken for troubleshooting are determined by the type of problem or fault in the computer. The following are some common problems and the troubleshooting steps for fixing them
6: Computer Troubleshooting

Examples:

1. **Problem: Power button will not start computer**

   - **Step 1:**
     - Begin by checking the power cord to confirm that it is plugged securely into the back of the computer case and the power outlet.

   - **Step 2:**
     - If it is plugged into an outlet, make sure it is a working outlet. To check your outlet, you can plug in another electrical device such as a lamp.

   - **Step 3:**
     - If the computer is plugged into a surge protector, verify that it is turned on. You may have to reset the surge protector by turning it off and then back on. You can also plug a lamp or other device into the surge protector to verify that it is working properly.
6: Computer Troubleshooting

Examples:

2. **Problem: The computer is frozen**
   - **Step 1 (Windows OS only):**
     - Restart Windows Explorer- press and hold Ctrl+Alt+Delete on your keyboard to open the Task Manager.
     - Next, locate and select Windows Explorer from the Processes tab and click Restart.
   - **Step 2 (Mac OS only):**
     - Restart Finder- press and hold Command+Option+Esc on your keyboard to open the Force Quit Applications dialog box.
     - Next, locate and select Finder, then click Relaunch.
   - **Step 3:**
     - Press and hold the Power button
   - **Step 4:**
     - If the computer still refuses to shut down, you can unplug the power cable from the electrical outlet.