Components of a Computer System

The two principal characteristics of a computer are:

1. It responds to a specific set of instructions in a well-defined manner.
2. It can execute a prerecorded list of instructions (a program).

Modern computers are electronic and digital. The actual machinery -- wires, transistors, and circuits -- is called ***hardware***; the instructions to make it work and data are called ***software***.

All general-purpose computers require the following hardware components:

- **memory :** Enables a computer to store, at least temporarily, data and programs.
- **storage device :** Allows a computer to permanently retain large amounts of data. Common mass storage devices include disk drives and tape drives.
- **input device :** are used to put information into the computer. Examples of input devices include: keyboard, scanner, mouse, light pen
- **output device :** A monitor, printer, or other device that lets you see what the computer has accomplished.
- **central processing unit (CPU):** This is the brains of the computer, where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system. On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor.

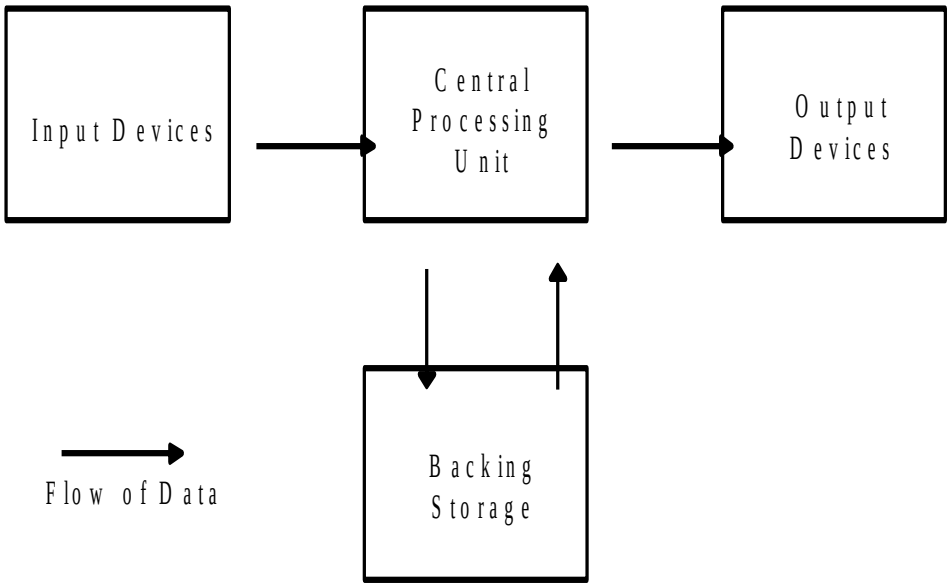

Diagram: A simple visual description of how a computer system works.

In addition to these components, many others make it possible for the basic components to work together efficiently. For example, every computer requires a bus that transmits data from one part of the computer to another.

Types of computers

Computers can be generally classified by size and power as follows, though there is considerable overlap:

- **Personal computer (PC) :** A small, single-user computer based on a microprocessor. In addition to the microprocessor, a PC has a keyboard for entering data, a monitor for displaying information, and a storage device for saving data.
- **Laptop or notebook** : A PC that is portable where all the components are built into one small unit.
- **Netbook** : Mini-laptops that are generally less than 12 inches in screen size.
- **Workstation :** A powerful, single-user computer. A workstation is like a personal computer, but it has a more powerful microprocessor and a higher-quality monitor.

- **Minicomputer :** A multi-user computer capable of supporting from 10 to hundreds of users simultaneously.
- **Mainframe :** A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.
- **Supercomputer :** An extremely fast computer that can perform hundreds of millions of instructions per second.

The Computer

What are computers?

Many people think of computers as almost human. There are computers that play music or speak and, although this task is quite simple, the circuits with which the computers themselves are made of are complex.

In fact computers do not have brains and cannot think for themselves. They are primarily machines for calculating. They are automatically controlled and can perform tasks at very high speeds. The really clever things are done by those humans who feed instructions and program them.

Although primarily calculating machines, computers can store vast amounts of information. They can be programmed to carry out logical operations such as sorting, searching and comparing data as well as using information for calculations.

How Computers Developed

Desk calculators have been in use for a very long time, and even in the days of the old navigators and astronomers there was a need for some form of instrument to carry out the long tedious calculations.

The first mechanical calculator was produced by Blasé Pascal in 1642. In 1801 a Frenchman named Jacquard invented a punched card system for controlling the threads on his weaving looms. Charles Babbage followed in 1833 with his 'Analytical Engine', which could perform calculations automatically using punched cards. This was the first digital computer. The American Hollerith System also used punched cards, but the calculating machinery was operated by electromagnetic means. It was introduced in 1889 and was generally used in a highly developed form right up to the widespread introduction of electronic computers in the 1950's.

Reasons for the growth in computer usage

The name computer covers many types of installation. Early electronic computers were developed around thermionic valves and gave off a large amount of heat. Later transistors were used giving a great reduction in size. Continued miniaturisation of components allowed smaller and smaller computers to be made, but also allowed the power of the computer to be increased. Nowadays we are using even smaller computers (microcomputers) in everyday life, although some of the desktop computers are more powerful than the larger computers used only ten years ago.

The Space Program probably did much to stimulate the growth in computers. During the space flight, there are many tasks and calculations to be performed and in order to take computers onboard the space capsules the computers had to become smaller and more powerful. This development led to them being used in many different applications.

The main reasons for the growth in computer usage are summarised in the next sections.

COST

Computers are becoming cheaper and the demand for their usage is increasing.

ACCURACY

Extreme accuracy and consistency can be relied on.

RELIABILITY

Cycles that repeat themselves are ideally suited to computers. Once programmed computers will happily repeat a sequence of tasks over and over.

SPEED

Computers can work extremely fast - capable of one million processes per second. Combined with their ability to access records, this speed enables them to respond very quickly.

VERSATILITY

There seems to be no end to the possible uses of computers. Most professions use them in some capacity or another.

VOLUME

Computers can handle large amounts of data.

COMPLEXITY

Computers can perform complex calculations. Applications can be programmed.

Applications Of Computers

Data Processing

Data Processing involves the gathering and manipulation of data. For instance, the payroll which has to be prepared every week and the names and wages of all the employees printed on their individual payslips. Records of all the employees have to be maintained and continually brought up to date as some people leave and others employed.

Machine Control

Computers are increasingly being used to control industrial machines e.g. lathes, milling machines and robotic devices. Once the computer has been programmed, it can repeat a series of operations indefinitely. Apart from relieving the operator from dirty and routine operations, the computer also has the advantage of being more accurate, more reliable, faster and more cost effective than the equivalent manual alternative.

Traffic Lights

Computer controlled traffic lights are now used in many town centres. A typical system will employ one central computer which is linked to a number of traffic lights with sensors installed from which the computer can assess the rate of flow of traffic on the roads. The computer can then synchronise the traffic lights to take into account where the heaviest flow of traffic will be. This system can be flexible to suit emergency situations and can be reprogrammed.

At Home

Many homes now have personal computers. In many cases they are used for leisure to play games although they can be used for more serious purposes. Although they are small, they are very powerful. It is now possible to have your own computer and pay your bills by linking into the bank's computer system. Another use is in the control of household items e.g. washing machines, programmable video recorders, intruder alarms and in many toys. Some of these applications require small dedicated 'chips' where the computer is built into one integrated circuit which would fit into a matchbox.

In Cars

This is another example of the single 'chip' dedicated computer. Typical applications include metering the fuel to the engine, monitoring brake wear, oil pressure, water temperature, etc.. In some cars the conventional engine running conditions are monitored and adjustments made by the computer system to give ideal engine conditions - called electronic engine management. In some cars it is now possible to switch the engine performance between sports and economy modes.

6 Common Users Of Computers

Users can be divided into six main categories:

1. Education
2. Industry
3. Science / Engineering
4. Government
5. Commerce
6. Public Service

The uses that are made of computers include:

EDUCATION

- Computer Aided Learning (CAL)
- Computer Assisted Instruction (CAI)
- Programming
- Administration
- Salaries
- Timetabling
- Student Records
- Simulation
- Careers Guidance

INDUSTRY

- Computer Aided Design (CAD)
- Computer Aided Draughting (CAD)
- Computer Assisted Manufacture (CAM)
- Robotics - Automated Assembly, etc..
- Stock Control
- Process Control
- Salaries
- Simulation

SCIENCE / ENGINEERING

- Solving complex equations
- Experimental monitoring
- Weather Forecasting
- Space flight planning and control
- Design of space vehicles
- Data Logging
- Circuit Design and Emulation

GOVERNMENT

- National and local law and order
- Criminal Record Storage
- Wanted and Missing persons
- Stolen Property Lists
- Accident Details
- Vehicle Owner Details
- Fingerprint Records
- Crime Analysis
- Personal Records of Police Officers etc..
- Library users, library loans and library stock
- Hospital administration and patient records

COMMERCE

- Banking
- Cheque Handling
- Customer Accounts
- Printing Statements
- Calculation of Interest Charges
- Cash Dispensing
- World-wide Financial Market Linking
- Insurance Claim Records
- Insurance Policy Issue
- Calculation of Policy Costs
- Policy Holder Records
- Schedules
- Renewal Notices
- Building Societies
- Investment Accounts
- Calculation of Interest Rates
- Mortgage Policies
- Stock broking

- Calculation of Shares Prices
- Calculation of Commission Due on Deals
- Printing Contract Notes
- On-line Financial Services

PUBLIC SERVICE

- Transport Ticket Supplies
- Route Planning
- Timetabling
- Satellite Communications
- Phone Links
- Teletext (Ceefax etc..)
- Viewdata (Prestel)