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HISTORY AND USE OF COMPUTERS

Rohith Udalagama

General Business Systems Division, Data Management Systems Ltd., 159, Dharmapala Mawatha, Colombo 7.

TYPES OF COMPUTERS

The term computer could be used to describe several types of equipment which are frequently used.

These computers could be broadly classified into the following three categories;

1. ANALOG COMPUTERS
2. DIGITAL COMPUTERS
3. HYBRID COMPUTERS

1. ANALOG COMPUTERS

The term 'ANALOG COMPUTER' is used to describe instruments or equipment which are used to measure physical magnitudes. An example of these Analog computers would be:

a) Speedometer
b) Slide Rules, etc.

2. DIGITAL COMPUTERS

Digital computers do not measure physical magnitude but operate directly on discrete numbers which are expressed as digits or decimal numbering systems.

Since digital computers do not operate by measuring physical magnitudes, these computers are used on a wide variety of functions from Information Processing to Scientific Analysis, Engineering, Calculation and numerous other Applications.

Today when the term Computer is used more often than not it refers to a Digital Computer System.

The modern computer is a piece of STATE-OF-THE-ART electronic equipment which is capable of storing and executing a pre-defined sequence of instructions which is known as a program. This enables the equipment to automatically carry out a series of operations to complete a given task.

This capability of stored program concept is the cornerstone of the modern day Computers.

3. HYBRID COMPUTERS

Hybrid computers are not a special type of computer but special devices which incorporate both Digital computers and Analog computers and is used for specific applications such as various process control applications.

THE EVOLUTION OF COMPUTERS

Although the concept of the stored program's are vital to modern computers the earliest invention of computers were mainly mechanical.

Since very ancient times, man invented various methods and means to make calculations faster and less tedious.

In pre-historical times, man may have calculated by counting his fingers, by collecting twigs or pebbles, by marking caves, etc.

The first device invented purely for the purpose of calculation was the ABACUS which dates back to around 10,000 years ago.

The ABACUS which resembles a child's counting frame is in use even today, in some Asian countries.

The first real calculating aid was invented in the 17th century was by a Scottish mathematician named John Napier.

This invention which is referred to as the "Napier's Bones" consisted of a set of rods engraved with multiples of integers which simplified multiplication to reading off sets of numbers and adding them.

Napier also developed LOGARITHAMS which simplified/reduced multiplication and division to addition and subtraction.

The first machine capable of adding and subtracting was constructed by the 19 year old BLAISE PASCAL in the mid 17th century. While in the 1670s LEIBNIZ invented a machine capable of multiplication.

The concept of the Digital Computer was first defined in the early 18th century by CHARLES BABBAGE who attempted to construct a complex computer. Although he developed the blue print for a digital computer, technology at that time did not permit them to actually manufacture a digital computer system.

The next major innovation was in 1880 when Dr. HERMAN HOLLERITH invented an electro-mechanical machine which used punched cards for the tabulation of Census data in the U.S.A.

This invention heralded the advent of electro-mechanical Data Processing.

In 1944, a Machine named HARVARD Mark-1 was built using the original concepts of Charles Babbage.

The HARVARD Mark-1 was an electro-mechanical device which enabled arithmetic operations to be done in around 5 seconds.

The limitations of the Electro-Mechanical Computers were overcome in 1946 when the first Electronic Computer named ENIAC was built by the University of Pennsylvania for the US Army.

The ENIAC used vacuum tubes or thermonic valves which enabled calculations to be carried out in milliseconds.

The first computer to operate with internally stored programs was the EDSAN in 1949 while the first commercial computer was the UNIVERSAL AUTOMATIC computer introduced in 1951.

The computers which used the thermonic valve technology are known as first generation computers. These computers were not widely used due to the high power consumption and low reliability.

In the late 1950s and early 1960s the second generation of computers came into the market which reduced the time taken to carry out calculations to the micro-second range from the millisecond range.

These second generation computers were more reliable due to the use of TRANSISTORS while they also had lower power consumption.

In the mid 1960s the third generation of computers were introduced which used integrated circuits which once again helped to reduce the time taken for calculation from micro-seconds to nanoseconds and increased the reliability of the systems and reduced the power consumption and cost.

The present generation of computers which is called the 4th generation of computers, use large scale integrated circuits which enable faster processing and lower cost.

HOW THE DIGITAL COMPUTER FUNCTIONS

When we try to examine the functioning of Digital Computers we have to have an understanding of how the Digital Computer operates.

All Digital computers function by using the BINARY numbering system. The binary system uses Zero's and One's to represent any character.

It is by the use of binary that a Digital Computer could use electrical impulses to represent information. In a Digital Computer all information is stored by switching electronic components "on or off" at pre-determined sequences enabling the representation of characters and numbers internally in a computer system.

The on and off status of electricity in a computer is represented by a series of Zeros (0) or Ones (1).

Each of these zeros or ones is called a BIT in computer jargon. Each character represented in a computer system is called a BYTE and every byte is made up by using upto 8 bits. By changing the sequence of the zeros and ones, in a 8 bit sequence different characters could be represented in a computer system.

When we need to measure the ability of a computer system to store information we use the term kilobyte which is 1024 bytes. We use the term Megabyte to measure larger Volume storage requirements. A Megabyte is 1000 kilobytes.

THE COMPONENTS OF A COMPUTER SYSTEM

The computer system itself is only a piece of equipment which requires 3 essential components for successful operations.

These are:

(a) THE COMPUTER HARDWARE
(b) THE SOFTWARE (OR PROGRAMS)
(c) THE LIVEWARE (OR PEOPLE)

THE COMPUTER HARDWARE

All the physical components of the computer are together known as the computer hardware.

In any workable computer configuration, the computer hardware consists of a minimum of four components.

These four components are:

(a) INPUT EQUIPMENT
(b) OUTPUT EQUIPMENT
(c) PROCESSING EQUIPMENT
(d) STORAGE EQUIPMENT

INPUT EQUIPMENT

Since any information which is to be processed by the computer system requires to be entered into the Computer Input Equipment, it is essential for the operation of the computer.

Upto the second generation of computers the most widely used mode of inputting information to the computer system was through the use of Punch Cards.

However, the Punch Card input system was inefficient as it required a two step operation.

The major disadvantage of this mode of operation was that since the information entered onto the card was stored on the card by the perforation of the card, it was not possible to easily decipher the information on the card which made it necessary to verify the information input to card through other methods.

The first step of Card punching or the initial inputting of information was called DATA ENTRY.

The second stage, called the verification stage involved the re-keying of the information input at the data entry stage. If there was a discrepancy in the information stored on the card and the information typed at the verification stage, an error sign was shown by the card verifying equipment.

Once all the information that required to be input into the computer system was recorded on punch cards these cards were collected and were fed into another piece of equipment known as a card reader which was connected to the CENTRAL PROCESSING UNIT of the computer.

The punch card method of inputting information into the system was acceptable for the inputting of data or data entry in a batch environment where information was entered into the computer system in batches at pre-determined periods.

However as computers became cheaper and the need to use computers become more important, this method of inputting information into the computer system became a constraint to the development and widespread use of computers.

This problem was a major constraint in operations where users of computers required information to be input into the computer system as and when transactions occurred. This type of data entry is known as "on-line" data entry.

The advantage of "on-line" data entry is that a transaction which occured first could be processed and results obtained before any subsequent transaction took place.

This type of processing which is known as "on-line processing" ensured more uptodate information to be available.

At present the most widely used input equipment is the Interactive Terminal from which data could be entered on-line into the computer system.

The interactive terminal consists of two components:

(a) A keyboard - which includes full typewriter like keyboard for the entering of alpha-numeric information, a numeric keypad similar to a calculator keyboard for the fast inputting of numeric only data, a set of editing keys which are used for editing information entered into the system and a set of special function keys which could be programmed to carry out a sequence of operations at the press of one key.

(b) The display — Which is a TV like monitor is used to display information entered through the keyboard or to display responses from the computer system.

The major advantage of the interactive terminal is that since the display unit has the ability to display information input from the keyboard, the data entry and verification stages could be combined as information entered to the keyboard could be visually verified.

At present several types of interactive terminals are available. These could be broadly grouped into two categories:

(a) Dumb Terminals - Which function by using the electronic components in the central processing unit.

(b) Intelligent Workstations - Intelligent workstations incorporate electronic components in the workstation itself enabling many of the functions such as character generation to be carried out in the workstation itself. These intelligent workstations also have a buffer where any information input to the keyboard is first stored before transfer to other locations of the computer sytem.

In addition to the interactive terminal several other type of equipment too could act as input equipment. These include;

(a) PAPER TAPE READERS
(b) MAGNETIC TAPE DRIVE
(c) DISK DRIVE
(d) DISKETTE DRIVE
(e) OPTICAL CHARACTER READER
(f) MAGNETIC INK CHARACTER READER
(g) OPTICAL MARK READER
(h) CARD READERS

THE PROCESSING EQUIPMENT

Since the objective of inputting the information into the computer equipment is to process the information, each computer system is equipped with a processing unit.

This processing unit is known commonly as the CENTRAL PROCESSING UNIT or CPU.

The Central Processing Unit consists of several components such as:

(a) MAIN MEMORY - Where information which requires to be processed is stored. The capacity of the main memory is normally measured in kilobytes.

(b) THE ARITHMETIC LOGIC UNIT - Where the actual processing of information takes place.

(c) CONTROL UNIT - Which controls the activities of the other components of the central processing unit.

The three components indicated above are the major components which are found in any central processing unit.

In addition to these components all central processing units incorporate other types of registers for the temporary storing of information.

OUTPUT EQUIPMENT

Once the information is processed, the results generated by the computer system could be displayed or printed using output equipment available on the computer system.

The most commonly used hard copy output equipment are PRINTERS.

Depending on the type of work, volume and quality of output required different types of printers could be used. These printers include:

A) MATRIX PRINTERS- For medium speed, draft quality output

B) DAISY WHEEL PRINTERS - For high quality output

C) BAND PRINTERS - For high volume output

D) LASER PRINTERS - For high quality, high volume output.

In addition to printing the output information, it is also possible optionally to only display the information.

When the output information needs only to be displayed, the display unit in the workstation is used for this purpose.

In addition to printers and display units other peripherals too could act as output equipment. These include:

(a) TAPE DRIVE
(b) DISKETTE DRIVE
(c) DISK DRIVE

STORAGE EQUIPMENT

Any information stored in the main memory of the central processing unit will be erased from the system if the power supply to the computer is curtailed. However, the information which is input to the computer system at times requires to be stored in the computer system for subsequent processing, for reference purposes, etc.

Since it is not practical to input the same information each time it is required for processing or references, computers are equipped with secondary storage media.

This secondary storage is also known as BACK-UP storage because any information stored on this secondary storage is retained in the computer system even when power to the computer system is cut off.

In the early computers, the only available back-up storage was magnetic tape media.

The disadvantage of using magnetic tape media for secondary storage is that, since the information stored on tapes could only be accessed serially, the time taken to access any information which was stored at the end of a tape was very long.

To overcome this disadvantage in tape storage of being only able to access information serially, the MAGNETIC DISK DRIVES were invented which enabled RANDOM ACCESS of information stored.

The major advantage of Random Access is that any information stored on the disk could be accessed without any consideration given to the actual physical location of the information. Random access speeded up the retrieval of the information from back-up storage.

SOFTWARE

Now that we have looked at the computer hardware in detail we will now examine the second essential component in a computer system.

This component is the software or the set of programs which are essential to make the computer carry out the functions required by the computer users.

The SOFTWARE on a computer system could be divided into two broad categories;

1. SYSTEM SOFTWARE
2. APPLICATION SOFTWARE

1. SYSTEM SOFTWARE

The system software is a name given to the software packages or set of programs supplied by the manufacturer of the computer hardware which enables certain functions on the computer system to be carried out automatically.

The system software supplied by the manufacturer could be broadly divided into the following categories;

(a) Operating System
(b) Utilities
(c) Compilers or Interpreters

OPERATING SYSTEM

The operating system is a program supplied by the manufacturer which carries out the following functions:

A) MEMORY MANAGEMENT

When the computer system is being used by several users concurrently it is necessary for the main memory in the CPU to be allocated such that all users of the computer system will have access to the main memory.

The most commonly used memory management techniques are as follows;

* PARTITION MEMORY - Is a suitable Memory Management Techniques for computers which are used in an "online" environment.

* SWAPPING MEMORY - Is suitable for computer systems which are used mainly in batch environment.

* VIRTUAL MEMORY - Is the most sophisticated memory management system currently available and is ideal for use in both the BATCH and INTERACTIVE environments.

B) SECURITY - Curtails unauthorized access to information stored in the computer system.

C) PRIORITY MANAGEMENT

D) QUEUE MANAGEMENT

E) PRINT SPOOLING, ETC., ETC.

THE UTILITIES

Utilities are programs which are supplied by the manufacturer of the hardware, to carry out frequently needed functions such as:

* SORT/MERGE

* COPY/VERIFY

* BACKUP ETC.,

* The Programming Aids are utilities which help speed up program development.

COMPILERS AND INTERPRETERS

Since computers operate by using binary or zeros and ones, all information which requires to be processed by the computer must finally be represented internally in the computer system in zeros and ones before processing could take place.

Therefore, all computer programs ultimately have to be represented in the binary code or the machine code.

In the first generation computers all programming had to be done in machine code or binary.

The disadvantage of using machine code or binary is that since the program will have to be in zeros and ones, the time taken to develop the program was very lengthy. This problem was further compounded by each manufacturer having a different machine code or binary language.

The use of the machine code was considered to be the first generation of programmers' languages.

To avoid some of the problems associated with using machine code, manufacturers later developed second generation programming languages which use symbols in place of binary code.

The second generation programming languages were understood more easily by computer personnel and enabled manufacturers to standardize on computer languages.

However, even these second generation programming lanugages were time-consuming to learn and use.

As the use of computers became more wide-spread, third generation programming languages were evolved.

These third generation languages are less time consuming to learn and easy to use as they resemble English language more closely.

Examples of these third generation languages are BASIC, COBOL, FORTRAN, etc.

The compiler or interpreter is a SOFTWARE PROGRAM supplied by the manufacturer to convert programs developed using the third generation programming languages to the machine code of the computer.

The initial program developed in a third generation programming language is known as the "SOURCE PROGRAM" while the program after it is compiled is known as the "OBJECT PROGRAM".

When any application program is executed on a computer system only THE object version of the program is used.

APPLICATION SOFTWARE

In addition to the System software which is supplied by the computer manufacturer, another

set of programs are essential to make the computer carry out the functions which are required to obtain the results desired by the users.

All such programs developed to computerise specific functions are called Application Software.

Some Examples of Application Software are programs developed to handle the following functions:

* PAYROLL
* ACCOUNTING FUNCTIONS
* INVENTORY CONTROL
* CURRENT ACCOUNT BANKING
* TEA AUCTION DOCUMENTATION & BLENDING, ETC.

LIVE WARE

The third and final component essential for the functioning of a computer system is the "LIVEWARE" or the people involved in operating and using the computer system.

The LIVEWARE in the computer environment could be categorised into two types:

A) THE COMPUTER PERSONNEL

B) THE COMPUTER USERS

THE COMPUTER PERSONNEL

The computer personnel are the people involved in the day-to-day operations of the computer system such as:

(a) DATA PROCESSING/INFORMATION PROCESSING MANAGER

(b) SYSTEM ANALYST

(c) PROGRAMMERS

(d) DATA ENTRY OPERATORS, ETC.

THE COMPUTER USERS

The computer users are people who give input information to the computer personnel and use the information/results obtained from the computer system.

In today's computer environment, the distinction between these two different types of users is being reduced as in an on-line computer environment, the computer users themselves would input data into the computer system and directly obtain results from the computer system.

THE USE OF COMPUTER SYSTEMS

Now that we have examined in detail the various components essential to the successful use of computers, we will briefly examine their varied uses.

Although computers were initially invented to handle large scale number crunching and data processing functions with the advent of technology, present day computers are able to support several other technologies in addition to Data Processing.

These include:

* WORD PROCESSING - To process information in the form of written words.
* IMAGE PROCESSING - To process information in the form of pictures and graphics.
* AUDIO PROCESSING - For the processing of information in the form of spoken words and optimise the use of telephone systems, etc.
* COMMUNICATIONS & NETWORKING - Which will enable different computers in physically separate locations or used to process different types of application to be inter-connected for the interchange of information.

Today, computers are available which supports all the above types of processing on one system.

Due to these powerful features, and frequent reduction in prices, computers are in use in varied types of application in Business, Education, Scientific, and numerous other areas.

The potential uses of computers are restricted only to the imagination of users.