

CHAPTER Two :History of Computing

We have all heard stories of primitive peoples counting their sheep by moving sticks or stones. Our base ten number system undoubtedly grew from the use of 10 fingers as counting objects. Together with the development of people, the need to calculate and keep track of information had become popular issue. So they soon develop a simple computing device and had a power of storing small information. However, many thousands of years elapsed before developing mechanical calculator.

Some of the calculating devises are mentioned bellow:

1. Abacus

It is one of the earliest mechanical computational devices. It was in use in the Middle East as early as 2500 BC The familiar Chinese abacus (dating approximately 1200 AD) is composed of a frame and a number of wires. The wires correspond to position of digits in a decimal number-units, tens, hundreds, and so on-and the beads represent digits. Beads above the cross bar represent 5 and those below ,1.

The abacus shows zero, if all the bead below the cross bar are at the lower frame and above are at the upper frame.

Addition of two numbers on the abacus can be performed by representing the first number and the second number without resetting the first. On any wire showing 10 or more, the two beads above the cross bar are moved back, and an extra 1 (the Cary) is added two the wire on the left. This process can be easily generalized to addition and subtraction of more than two numbers.

2. Pascal's calculator

It is the first true mechanical calculator.

In 1642, at the age of 19, the French philosopher and mathematician Blaise Pascal developed a rotating wheel calculator, the predecessor of the latter popular desktop calculator. He built largely to assist his father, who was a tax collector in the town of Rouen, Pascal's calculator has one wheel corresponding to each power of 10; each wheel has 10 position, one for each of the digits (0,..9). Although Pascal's

Development of Computers

calculator could only add and subtract, it could be used indirectly for multiplication (by successive addition) and division (by successive subtraction) as well.

3. The difference engine

It is the forerunner of the modern computer.

Charles Babbage (1792-1871), a British mathematician and engineer, is considered by many to be the real father of today's computer. He was the developer of the difference engine and designer of the analytical engine. The difference engine also based on the rotating wheels principle, was operated by means of a single crank. This device has a power of calculation and print the output without human intervention. He finally designed a significantly improved version of the difference engine (but not built) called Analytic engine. It has different key components

- ♦ **The store:** A memory wheel consisting of a set of counter wheels
- ♦ **The mill:** An arithmetic unit capable of performing the four basic arithmetic operations. It operated on pairs of mechanical registers and produced a result stored in another register, all of which were located in the store.
- ♦ **Operation cards:** These cards selected one of the four arithmetic operations by activating the mill to perform the selected function.
- ♦ **Variable cards:** These cards selected the memory locations to be used by the mill for a particular operation (a source of operand and the destination of the result).
- ♦ **Output:** was to print or a card punch device.

But finally the design halted largely due to the technology of the day is not far enough to supply the required raw materials.

4. Herman Hollerith's tabulating machine

Herman Hollerith was a statistician that in 1880 developed his machine commissioned by the U.S. Census Bureau to develop a technique for speeding up the processing of census data that took at least 8 years before. He developed his machine that uses the punched card to punch the census data and tabulated by using his machine. This machine processes the 1890 American census data within 3 years. It was really a great development. He finally began the Tabulating Machine Company, which later becomes the International Business Machine Corporation (IBM)

5. Mark I

Developed by **Howard Aiken** at Harvard university (1944) which were the one first electromechanical computer. Instruction were provided by means of punched paper tape, which combined the functions of Babbage's operation cards and variable cards. Each instruction had the format:

A1 A2 OP , where A1 and A2 are registers storing the operands and OP is the operation to be performed(e.g. +,-,x,%)

Mark I could do a single addition in 6 seconds and division in 12 seconds

6. ENIAC(Electronic Numerical Integrator And Computer)

Developed by **Eckert** and **Mauchly** at the university of Pennsylvania. This was the first electronic calculator and first general purpose digital computer. This machine was enormous, weighing 30 tones. occupying 15,000 square feet of floor space and containing over 18,000 vacuum tubes. When operating, it consumed over 140 kWh of power. It had a capability of performing 5,000 addition per second. Its memory consisted of 20 "accumulators" each capable of holding a 10 digit decimal number. Each digit was represented by a ring of 10 vacuum tubes. At any time, only one of the 10 tubes was in ON state, representing one of the 10 digits.

- ◆ ENIAC did not use internally stored programs. Programs were wired on boards similar to a telephone switch board.
- ◆ One of the major drawbacks of ENIAC was that it had to be programmed manually by setting switches and plugging and unplugging cables.

7. The Von Neumann Machine

The task of entering and altering programs for the ENIAC was extremely tedious. **Von Neumann** was the consultant on the ENIAC project and forward the stored program concept, i.e designing the computer to get its instruction by reading them from memory alongside the data and a program could be set or altered by setting the values of a portion of a memory. Based on this concept, the first true electronic computers were developed by the name EDVAC(electronic Discrete Variable Computer) and EDSAC(Electronic Delay Storage Automatic Computer).

8. Commercial Computers

The 1950s saw the birth of computers industry with two companies, Sperry and IBM, dominating the market place. In 1947, Eckert and Mauchly develop their successful commercial computer called **UNIVAC I (Universal Automatic Computer)**.

UNIVAC was division of Remington Rand (later Sperry_Rand Corporation).

IBM also the major manufacturer of punched card processing equipment ,delivered its first electronic stored program computer, the IBM 701, in 1953.

❖ Generation of Computers

Although computer professionals do not agree on exact dates or specifics, computer developments are often categorized by generations. Actually there are four generations and major characteristics that distinguish these generations are the following;

- ◆ Dominant type of electronic circuit elements used.
- ◆ Major secondary storage media used.
- ◆ Computer language used.
- ◆ Types or characteristic of operating system used.
- ◆ Memory access time (time to store or retrieve a word or data from memory).

Computer generations are usually categorized by dramatic improvement in the hardware, typically refold or better increases in speed and reliability.

1. First generation (1950s)

- ◆ Used vacuum tubes as components for the electronic circuit.
- ◆ Punched cards were the main source of inputs, and magnetic grams were used for internal storage.
- ◆ Operate in a speed of milliseconds (thousands of a second) and could handle more than 10,000 additions each second.
- ◆ Most applications were scientific calculations.

2. Second generations (early 1960s)

- ◆ Transistors were the main circuit components. (Transistors are a solid state device made from silicon which is smaller, cheaper, faster, dissipate less energy and more reliable than vacuum tube but work in the same way with the vacuum tube.)
- ◆ Invented by Bell Labs.
- ◆ Magnetic tapes (similar with home tape cassette), used for main storage,
- ◆ Operate in microseconds (millionths of a second) with more than 200,000 additions possible each second.
- ◆ Business applications become more commonplace, with large data files stored on magnetic tape and disk. (Magnetic disk: is a circular platter constructed of metal or plastic materials coated with magnetizable substance.)
- ◆ High-level languages COBOL and FORTRAN were introduced during this period. Batch operating systems are used that permitted rapid processing of magnetic tape files.

3. Third generation (late 1960s, early 1970s)

Characterized by solid-state logic and integrated circuit (IC). (A single, self-contained transistor is called discrete component. In early 1960 electronic equipment composed of discrete components transistors, capacitors, resistors, ... They are

- ◆ manufactured separately
- ◆ Packed in their own containers and soldered (wired together) on a circuit board. So the entire manufacturing process was cumbersome and expensive. Due to these and other problems in 1958 the achievement that revolutionized electronics started the era of microelectronics: the invention of integrated circuit.
- ◆ Computer storage switched from magnetic cores to integrated circuit boards that provide modularity (expandable storage) and compatibility (interchangeable equipment)
- ◆ New input/output methods such as optical scanning and plotters.
- ◆ Software become more important with sophisticated operating systems, improved programming languages,

Development of Computers

4. Fourth generation (late 1970s,early 1989s,)

- ♦ Greatly expanded storage capabilities and improved circuitry.
- ♦ Has a large-scale integrated circuits (LSI) which has several hundred thousands transistors placed on one tiny silicon chip.
- ♦ Computer memory operates at speeds of nano seconds (billionths of a second) with large computers capable of adding 15 million numbers per second.

5. Fifth generation

The fifth generation computer is in progress. An architecture, which makes use of the changes in technology and allows a simple and natural methodology for solving problems, is being sought. These computers will have intelligent processors i.e., processors which can draw inferences. Users will also be able to interact with them in natural languages such as English, German etc. Japans are working intensively on the project for developing the 5th generation.

Generation	1 st	2 nd	3 rd	4 th	5 th
Circuit element	Vacuum tube	Transistor	IC	LSI	VLSI
SSD	Punched card	Magnetic Tape	Magnetic disk	Mass storage device	
Language	Machine & assembly	Fortran, COBOL etc	Structured language	Application oriented	
Operating system	Operator control	Batch system	Application oriented	Time sharing	
Mem. Access time	1ms	10μs	10ns	1ns	
Approx. date	1946-57	1958-64	1965-71	From 1971 above	
Examples	ENIAC, UNIVAC, UDVAC	IBM7090, 7094	IBM system	Late IBM product	

Summary of generation of computers