INTRODUCTION TO INFORMATION & COMMUNICATION TECHNOLOGIES.

(Classifications and History of Computers)

Lecture # 02

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Classification of Computers.
(On the Basis of size capacity and speed)

On the basis of size capacity and speed, Computers can be divided into following four classifications:

1) Super Computers.
2) Main frame Computers.
3) Mini frame Computers.
4) Micro Computers.

1-SUPER COMPUTERS.

- Leads the world in terms of processing capacity, particularly speed of calculation
- Can handle huge amount of scientific computation
- About 50,000 times faster than micro-computers
- Used primarily for engineering and scientific problem analysis as well as for computerized graphics and special effects seen in films.
- Cost as much as $20 million

1-SUPER COMPUTERS.(Conti.)

- A super computer contains a number of CPU which operate in parallel to make it faster. It also known as grand father computer.
- In areas like:
  - Defense(Missile Technology)
  - Weather forecasting
  - Scientific research
  - Drug discoveries
  - Hollywood movies

Examples of Super Computers are CRAY X1 , CRAY T90 and Control Data Cyber 205.

2-Main frame Computers

- Smaller and less powerful than supercomputer
- Can support hundreds and thousands of users
- used mainly by large organizations for critical applications, typically bulk data processing(i.e. huge storage capacity and massive processing ability)

2-Main frame Computers (Conti.)

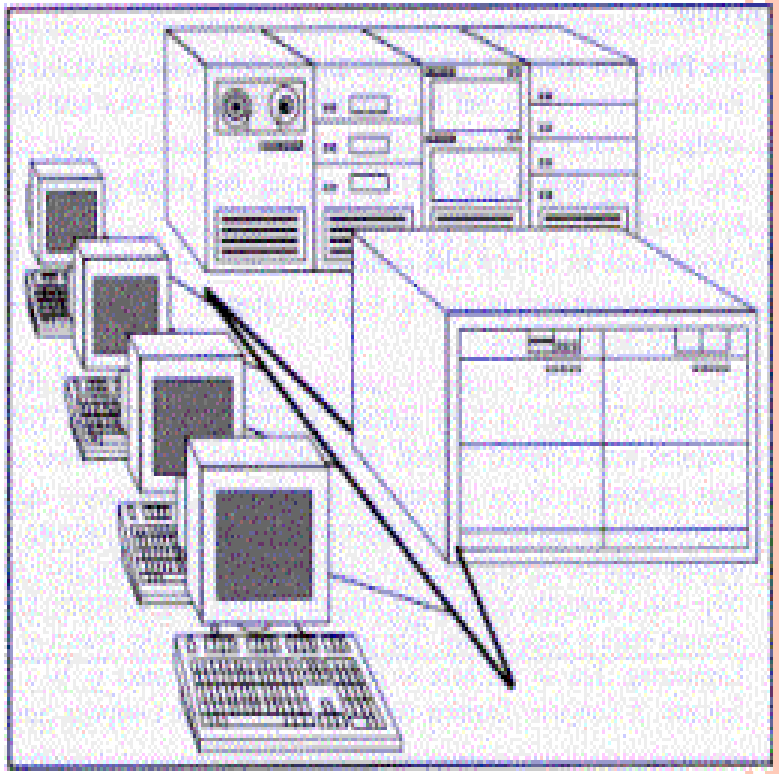
- These are large and fast computers usually housed in a controlled environment.
- Multi-user environment, have the ability to service more than 100 terminals at a time
- **TERMINALS** – are the points from which users can have access to the services of a multi-user computer.
- Terminals (which look like a microcomputer) are used to enter and retrieve data from mainframe computers.
- They can support the processing requirements of hundreds and even thousands of users.
- Are the largest, fastest and most expensive computers in commercial use today.

2-Main frame Computers. (Conti.)

- Of all types of computers, mainframe have been around the longest. ENIAC(Electronic Numerical Integrator And Calculator) and UNIVAC(Universal Automatic Computer) were mainframe computers.

3-Mini Computers.

- Is the smallest computer designed specifically for the multi-user environment.
- This type of computer can allow several persons to use the machine at the same time.
- Can process up to millions of characters.
- Before the late 60's, most computers produced were mainframe computers and they were very expensive.
- The prohibited price of mainframes limited its buyers to only the largest companies.

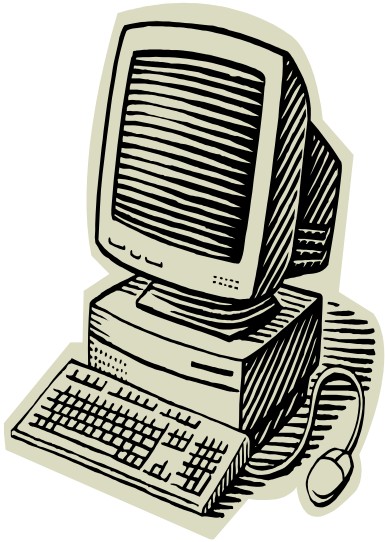


3-Mini Computers.(Conti.)

- A smaller and more affordable version of mainframe and thus what the minicomputer was born.
- Their storage capacities are smaller and they service fewer terminals as compared to mainframes.
- A computer servicing more than 100 terminals is no longer called a minicomputer.
- The major difference between the mainframe and minicomputer is in the number of terminals they can service.

4-Micro Computers.

- A personal computer; designed to meet the computer needs of an individual.
- Provides access to a wide variety of computing applications, such as word processing, photo editing, e-mail, and internet.
- The major difference between microcomputers and the larger minicomputers and mainframes is that micros are generally single-user but a multi-tasking machine.



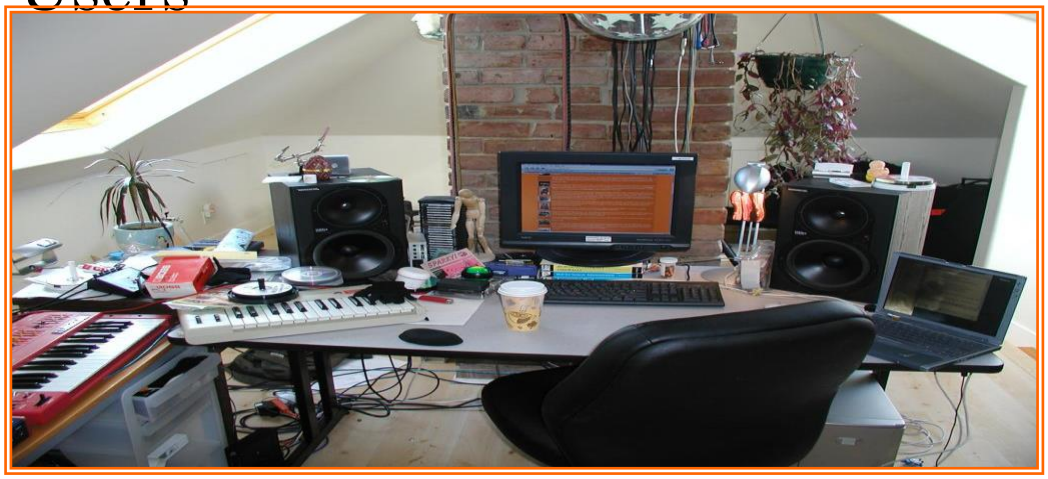
4-Micro Computers.(Conti.)

- Personal Computers (PC) occupy physically small amounts of space
- Low Power Consumption
- Example:
  - Desktop computers
  - laptop computers
  - handhelds

4-Micro Computers.(Conti.)

Workstation

- Workstations are similar like Desktop PCs but unlike desktops, they have high end processing speed for specific software
- Used for Graphic Designing, Special effects for movies, CAD applications
- Special Input and Output devices are provided to Power Users



Embedded Computers.

- An **embedded computer** is a special-purpose computer that functions as a component in a larger product

Servers

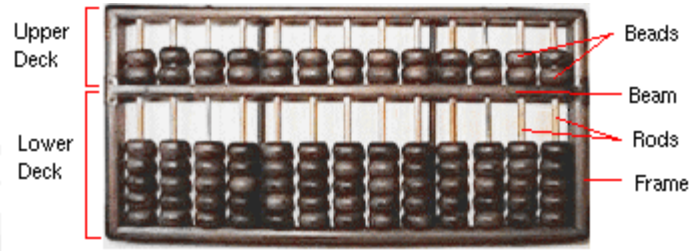
- A server is a large shared computer
  - several times the power of a workstation
  - several times the memory of a workstation
  - hardware and operating system optimised

- A server may act as one or more of functions like:
  - compute server: to run programs
  - file server: to store files centrally
  - mail server: to route mail messages
  - web server: to store web files etc
  - Print server: to print the document
  - Proxy server: to provide internet access.

Early History of Computing

Abacus

An early device to record numeric values



Blaise Pascal

Mechanical device to add, subtract, divide & multiply

Joseph Jacquard

Jacquard's Loom, the punched card

Charles Babbage

Analytical Engine

Early History of Computing

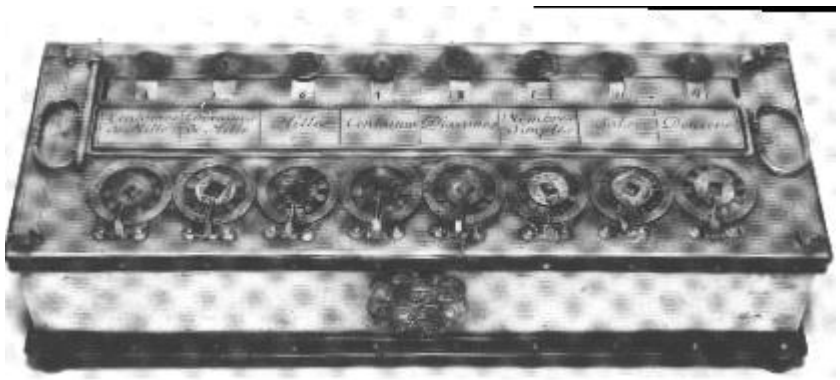
Abacus

- An early device to record numeric values
- We normally do not call it a computer, but a computing device.
- It is still used in parts of the world today.
- This distinction between a computer and a computing device will become clear as we look at other aspects of the history of computing.

source: http://www.ee.ryerson.ca:8080/~elf/abacus/intro.html

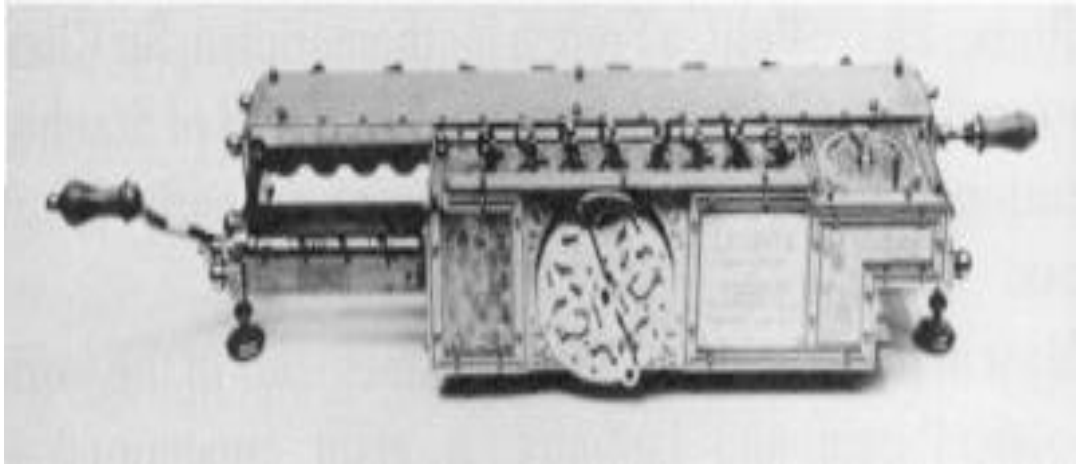
Blaise Pascal

- In 1642 Blaise Pascal, a Frenchman invented a new kind of computing device.
- It used wheels instead of beads. Each wheel had ten notches, numbered '0' to '9'. When a wheel was turned seven notches, it added 7 to the total on the machine.
- Pascal's machine, known as the Pascaline, could add up to 999999.99.
- It could also subtract.



Gottfried Leibnitz

- Leibnitz improved on Pascal's adding machine so that it could also perform multiplication, division and calculate square roots.



Joseph Jacquard

- In the late 1700s in France, Joseph Jacquard invented a way to control the pattern on a weaving loom to make fabric.
- He used ***punched cards*** to allow only some rods to bring the thread into the loom on each shuttle pass.
- Jacquard punched pattern holes into paper cards.
- Instead of a person making every change in a pattern, the machine made the changes all by itself.
- Jacquard's machine didn't count anything. So it wasn't a computer or even a computing device. His ideas, however, led to many other computing inventions later.

Charles Babbage's Difference Engine

- Babbage is known as the father of modern computing because he was the first person to design a general purpose computing device.
- In 1822, Babbage began to design and build a small working model of an automatic mechanical calculating machine, which he called a "difference engine".
- Example: It could find the first 30 prime numbers in two and a half minutes.

Placed In the Science Museum, London

- Babbage continued work to produce a full scale working Difference Engine for 10 years, but in 1833 he lost interest because he had a "better idea"--the construction of what today would be described as a general-purpose, fully program-controlled, automatic mechanical digital computer.

- Babbage called his machine an "***analytical engine***".

- He designed, but was unable to build, this Analytical Engine (1856) which had many of the characteristics of today's computers:

  an input device – punched card reader

  an output device – a typewriter

  memory – rods which when rotated into position "stored" a number

  control unit – punched cards with instructions encoded as with the Jacquard loom

SOME CALL BABBAGE'S ANALYTIC ENGINE THE FIRST COMPUTER, BUT, AS IT WAS NOT BUILT BY HIM, MOST PEOPLE PLACE THAT HONOR ELSEWHERE.

- Babbage's analytical engine contained all the basic elements of an automatic computer--storage, working memory, a system for moving between the two, an input device and an output device.
- But Babbage lacked funding to build the machine so Babbage's computer was never completed.

Generations of Electronic Computers.

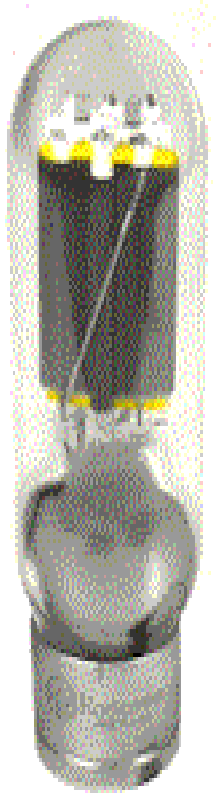
- First Generation Computers (1940-1956)
- Second Generation Computers (1956-1963)
- Third Generation Computers (1964-1971)
- Fourth Generation Computers (1971-Present)
- Fifth Generation Computers(Present and Beyond)

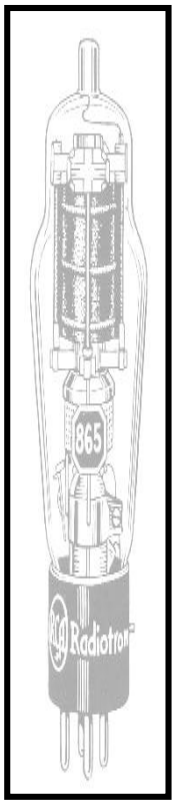
First Generation Computers (1940-1956)

- The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions.
- First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.
- The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.

First Generation Hardware (1940-1956)
Vacuum Tubes

- **Vacuum tubes** are glass tubes with circuits inside. it has no air inside of them, which protects the circuitry.





- **Magnetic Drum**
  Memory device that rotated under a read/write head

- **Card Readers → Magnetic Tape Drives**
  Sequential auxiliary storage devices

Second Generation Computers (1956-1963)

- Transistors replaced vacuum tubes in the second generation of computers. The transistor was invented in 1948 but did not see widespread use in computers until the late 1950s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.
- Second-generation computers moved from *cryptic binary machine language* to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.
- The first computers of this generation were developed for the atomic energy industry.

Second Generation Hardware (1956-1963)

Transistor

Replaced vacuum tube, fast, small, durable, cheap

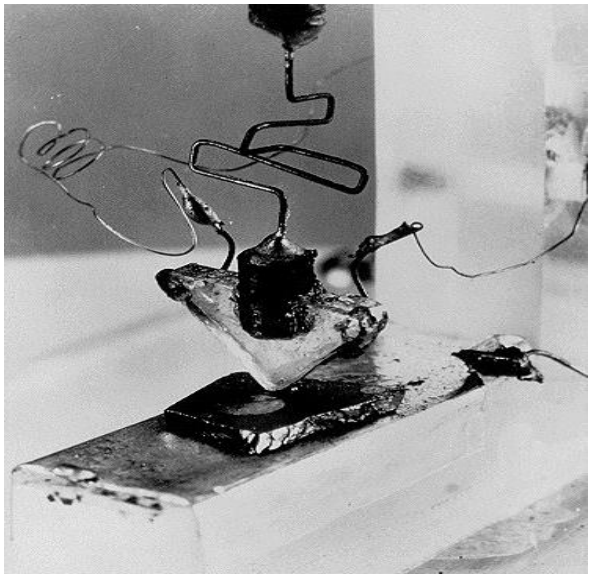
Magnetic Cores

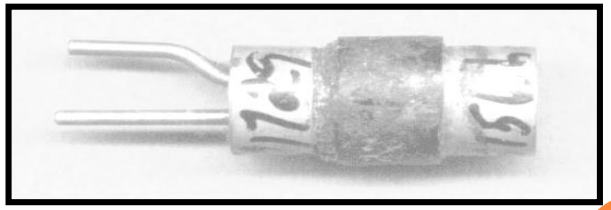
Replaced magnetic drums, information available instantly

Magnetic Disks

Replaced magnetic tape, data can be accessed directly

First Transistor





Third Generation Computers (1964-1971)

- The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.
- Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

Third Generation Hardware (1964-1971)

Integrated Circuits

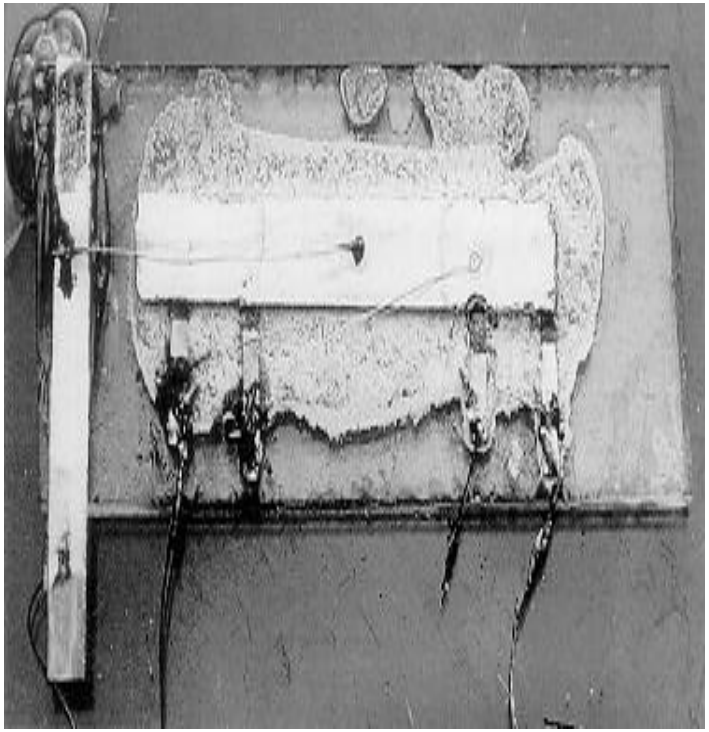
- Integrated Circuits are transistors, resistors, and capacitors integrated together into a single “chip”
- Replaced circuit boards, smaller, cheaper, faster, more reliable

Transistors

Now used for memory construction

Terminal

An input/output device with a keyboard and screen



Fourth Generation Computers (1971-Present)

- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip.
- In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.
- As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

Fourth Generation Hardware (1971-?)

Large-scale Integration

Great advances in chip technology

PCs, the Commercial Market, Workstations

Personal Computers and Workstations emerge

New companies emerge: Apple, Sun, Dell …

Laptops

Everyone has his/her own portable computer

Parallel Computing

Computers rely on interconnected central processing and/or memory units that increase processing speed

Networking

Ethernet connects small computers to share resources

File servers connect PCs in the late 1980s

ARPANET and LANs → Internet

(4TH GENERATION – 1971-PRESENT) WHAT IS A MICROCHIP?

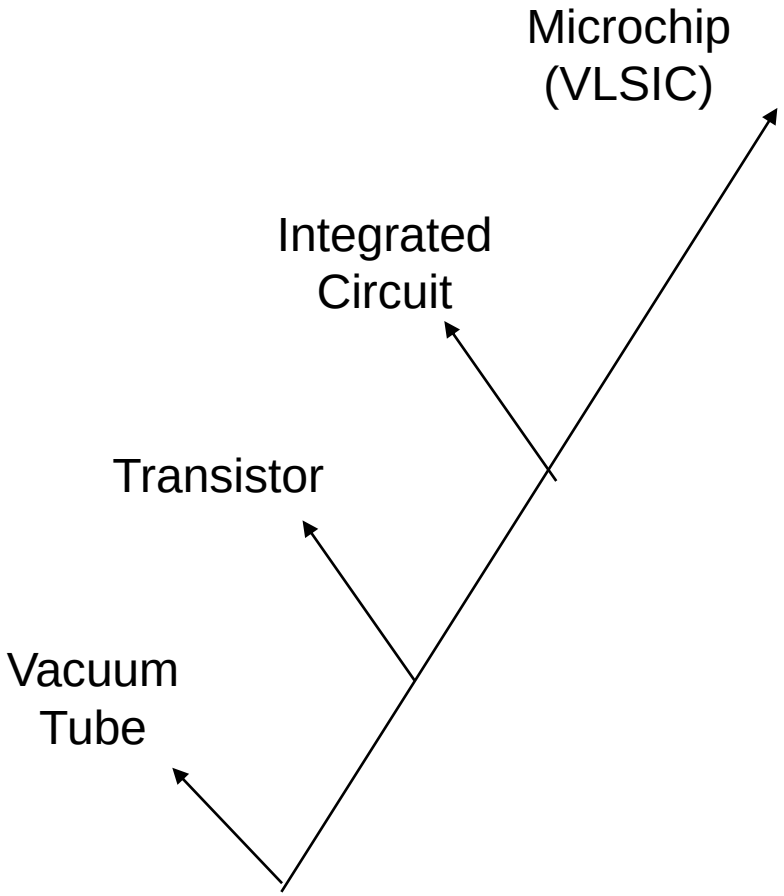
- Very Large Scale Integrated Circuit (VLSIC)
  - Transistors, resistors, and capacitors
- 4004 had 2,250 transistors
- Pentium IV has 42 MILLION transistors
  - Each transistor 0.13 microns (10^{-6} meters)
- Getting smaller and smaller, but we are still using microchip technology

Fifth Generation Computers (Present and Beyond)

- Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

Summary /Evolution of Generations of Electronic Computers

	First Generation	Second Gen.	Third Gen.	Fourth Gen.
Technology	Vacuum Tubes	Transistors	Integrated Circuits (multiple transistors)	Microchips (millions of transistors)
Size	Filled Whole Buildings	Filled half a room	Smaller	Tiny - Palm Pilot is as powerful as old building sized computer



First Generation Software (1941-1956)

Machine Language

Computer programs written in binary (1s and 0s)

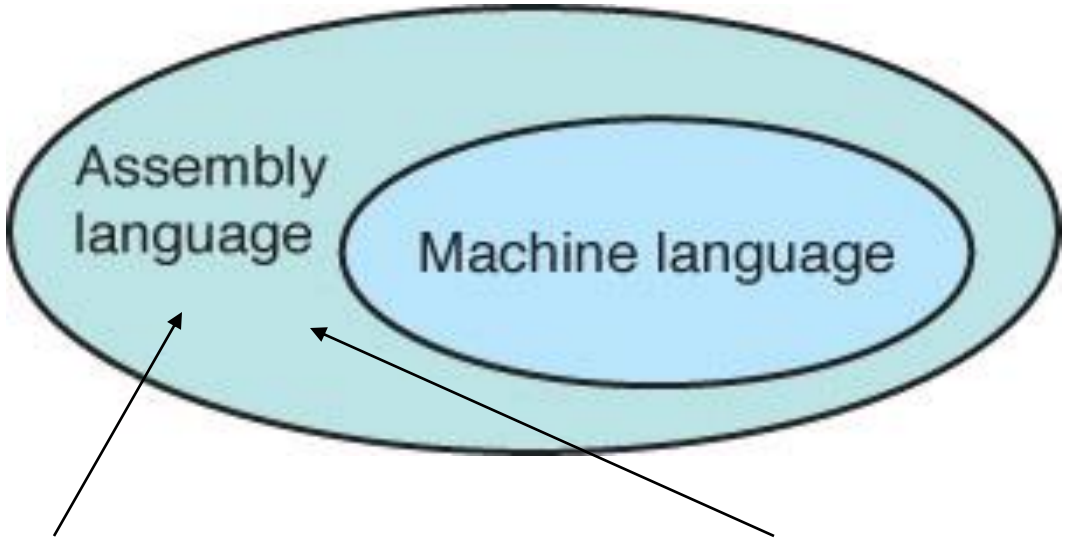
Assembly Languages and Translators

Programs written using mnemonics(designed to add memory), which were translated into machine language

Programmer Changes

Programmers divide into two groups: application programmers and systems programmers

First Generation Software (1941-1956) Assembly/Machine



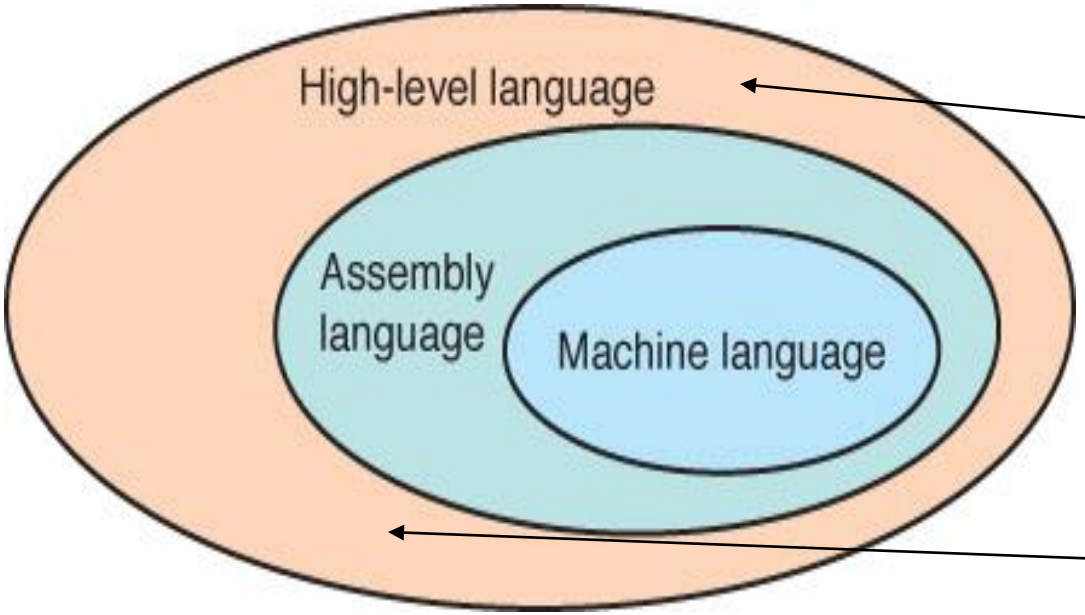
Systems programmers *write* the assembler (translator)

Applications programmers *use* assembly language to solve problems

Second Generation Software (1956-63)

High-level Languages

English-like statements made programming easier:
Fortran, COBOL, Lisp



Systems programmers *write* translators for high-level languages

Application programmers *use* high-level languages to solve problems

Third Generation Software (1964-71)

Systems Software

Utility programs

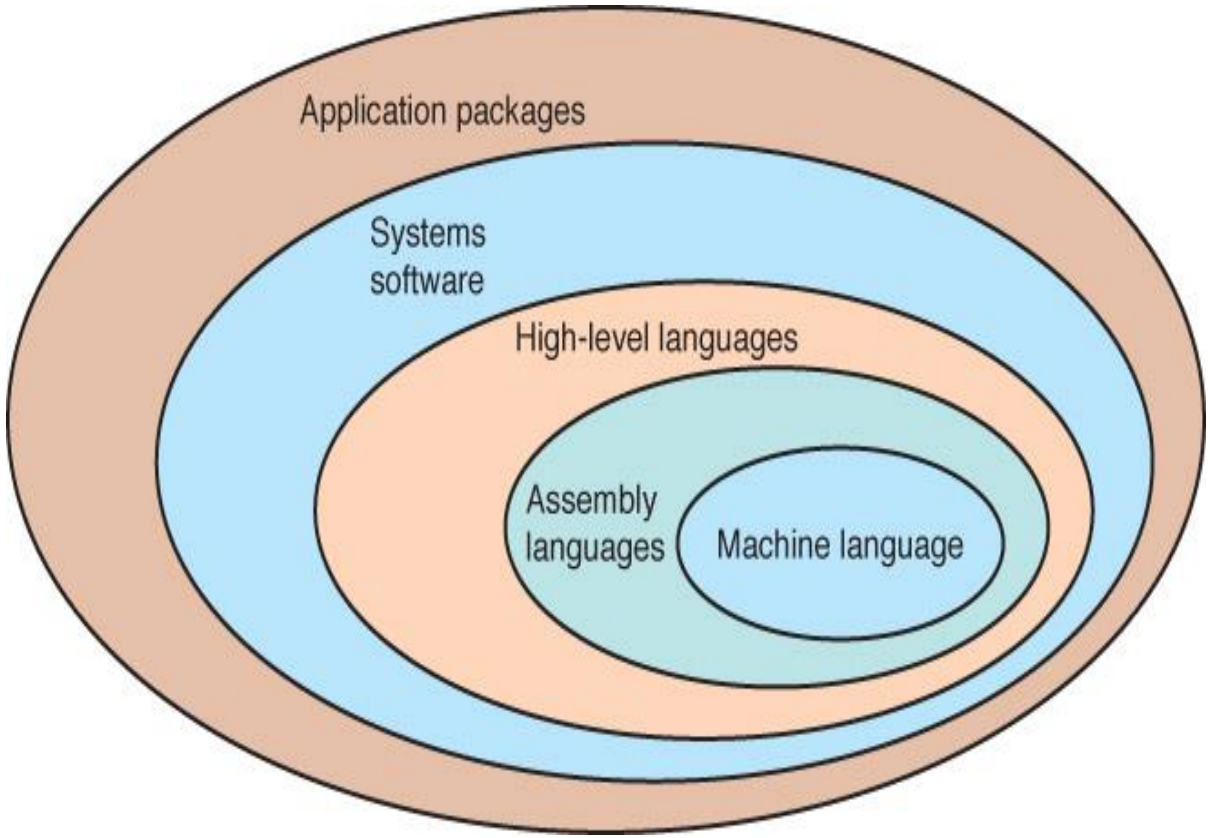
Language translators

Operating system, which decides which programs to run and when

Separation between Users and Hardware

Computer programmers write programs to be used by general public (i.e., nonprogrammers)

Third Generation Software (1964-1971)



Fourth Generation Software (1971-1989)

Structured Programming

Pascal
C
C++

New Application Software for Users

Spreadsheets
Word processors
Database management systems

Fifth Generation Software (1990- present)

Microsoft

Windows operating system and other Microsoft application programs dominate the market

Object-Oriented Design

Based on a hierarchy of data objects (i.e. Java, C# etc.)

World Wide Web

Allows easy global communication through the Internet