MODULE I: General Introduction

Outline history of the development of computers

A computer is an electronic device, which accepts data, performs mathematical and logical operations on the data and gives us the output in the desired format. The basic idea of computing developed in the 1200s with the invention of the abacus.

It started with Blaise Pascal's invention of the first "commercial calculator" in 1640s. Then in 1801, Joseph-Marie jacquard built a loom that weaved a pattern by reading punched holes stored on small sheets of hardwood.

The real beginning of computers began with Charles Babbage -the father of computers. In 1820, he began the quest for a programmable machine, and as a result the difference engine was developed. After 10 years he began work on the first general purpose computer called "analytical engine". Augusta Ada King was one of few people who understood engine design as well as Babbage. She is considered as the first female computer programmer. In 1854, George Boole wrote an investigation into the "laws of thoughts" and was later recognized as the father of computer science. In 1890 Herman Hollerith developed punch cards and founded tabulating machine company in 1896, which later became IBM (International Business Machine). In 1892, William Burroughs introduced a commercially successful printing calculator and in 1925Vannevar Bush founded "differential analyzer".

As years progressed, Konrad Zuse built a "mechanical calculator" in 1935 and in 1940 George Steblitz used "teletype machine". It is the first example of network. Frenetic activity and development in the same year saw John V Atanasoff and Clifford Berry developing the first "all-electronic computer".

Five generations of modern computers

First generation (1945-1956)
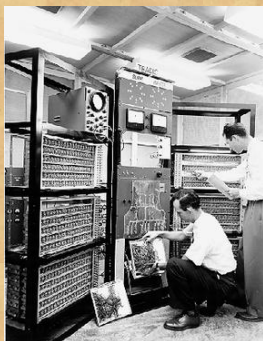
In 1941, KonradZuse developed a computer "Z3" and in 1944, Howard H Aiken produced an "all-electronic calculator". After that, John Presper Eckert and John W Mauchly developed "ENIAC" (Electronic Numerical Integrator and Computer). Later on John Von Neumann designed "EDVAC" (Electronic Discrete Variable Automatic Computer). In 1951, "UNIVAC 1 (UNIVersal Automatic Computer) was built by Remington Rand. The distinctive feature of first generation computers was the use of vacuum tubes and magnetic drums for data storage. Each computer also had a binary-coded program called a machine language.

Second generation (1956-1963)

By 1948, invention of transistors greatly changed computers development. It replaced vacuum tubes. The transistor was at work in the computer by 1956. As a result computers became smaller, faster, more reliable and more energy-efficient. Second generation computers replaced machine language with assembly language. More sophisticated high level languages such as "COBOL" (COmmon Business Oriented Language) and "FORTRAN" (FORmulaTRANslator) were formulated. New types of careers opportunities (analyst, and computer expert) sprung up and it spawned the entire software industry. It can be said that programmers began with this generation.

Third generation (1964-1971)

By the third generation, transistors were replaced by quartz. Jack Kilby developed "Integrated Circuits" (IC) in 1958. As a result computers became even smaller, as more components could be squeezed on to the chip. Operating systems (OS) were used. They allowed machines to run many different programs at once with a central program that monitored and coordinated the computer's memory.

Fourth generation (1971-present)

After "Integrated Chips"(IC), came "LSI" (Large Scale Integration) which could fit hundreds of components onto one chip. By 1980s "VLSI" (Very LSI) and later came "ULSI" (Ultra LSI). As a result size and price diminished. With improvements in power and efficiency for the 'processors (chips), reliability increased. In 1971, a more advanced "Intel 4004 chip" was developed. By 1970s, mini computers came complete with user friendly software packages. 1981, IBM introduced the "Personal Computer" (PC). This created a revolution of sorts and it continued the trend towards smaller size, working their way down from desktops to laptops, palmtops and net books. It also paved the way introduced global web of computer circuitry- the internet.

Fifth generation (present and beyond)

This generation is in its infancy. Most famous example of this generation computer is "HAL9000" from Arthur C Clarke's novel, 2001: A Space Odyssey. HAL could reason well enough to hold conversations with its human operators, use visual inputs, and learn from its own experiences. Using recent engineering advanced computers may be able to accept spoken word instructions and imitate human reasoning. The ability to translate foreign language is also a major goal of fifth generation computers.

Types of Computers:

Analog and Hybrid (classification based on operational principle)
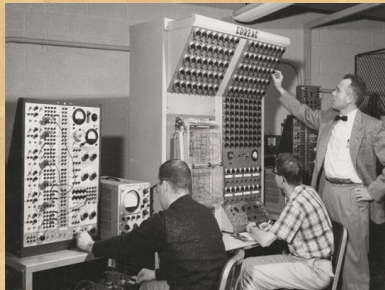
Analog Computers: It is different from a digital computer in respect that it can perform numerous mathematical operations simultaneously. It is distinct in terms of operation as it utilizes continuous variables for the purpose of mathematical computation. It utilizes mechanical, hydraulic, or electrical energy or operation.
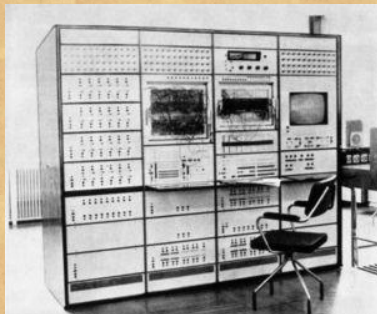
Hybrid computers: These types of computers are a combination of both Analog and Digital computers. The Digital computers are too slow and incapable of large mathematical operation. In hybrid types of computers the digital counterparts convert the analog signals to perform Robotics and Process control.

Classification of computers based on Capacity, Speed, Reliability

Computers are also categorized on the basis of physical structures and the purpose of their use. Based on capacity, speed and reliability they can be divided into three categories of computers:


The Mainframe Computer – These are computers used by large organizations like meteorological surveys and statistical institutes for performing mathematical computations. They are core computers which are used for desktop functions of over one hundred people simultaneously.

The Microcomputer – A computer with a microprocessor and its central processing unit is known as a microcomputer. They do not occupy space as much as mainframes. When supplemented with a keyboard and a mouse, microcomputers can be called as Personal Computers (PC). These computers can fit on desks or tables and are the best choices for single-user tasks. This is the type of computer meant for public use. Other than Desktop Computer the choice ranges as follows:

Personal Digital Computer

Tablet PC
Towers
Work Stations
Laptops
Hand Held Computer
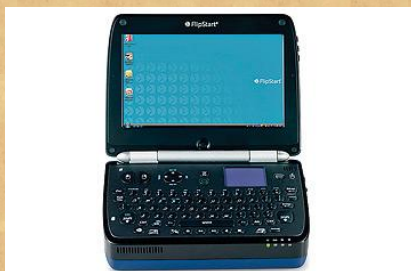
The Mini computer –Minicomputers are also called mid-range systems or workstations.. They took up the space that would be needed for a refrigerator or two and used transistor and core memory technologies. The 12-bit PDP-8 minicomputer of the Digital Equipment Corporation was the first successful minicomputer.

As Mini computers become more powerful, they are being used by business organizations. They can support the simultaneous working of up to 100 users and is usually maintained in workplaces such as front office, accounts and finance.

PC/Workstations

PC (Personal Computer) is a general-purpose computer. They are used in a variety of applications such as word-processing, database management, spreadsheet calculations and desktop publishing. Desktop Personal Computers are small, relatively inexpensive computers that are designed for individual users. These devices include a monitor, keyboard, mouse, and other peripherals.

A workstation is a microcomputer designed for technical or scientific applications, intended primarily to be used by one person at a time. They are commonly connected to a local area network and run multi-user operating systems. So it is generally a high-performance, professional-use computer.

Workstations are designed for powerful business applications that do large numbers of calculations or require high-speed graphical displays.

A workstation may be a RISC-based computer that runs under some version of Unix or Linux, the major vendors being Sun, HP, IBM and SGI. In all cases, the term implies a machine with a fast CPU and large amounts of memory and disk for the professional user rather than the consumer.

Laptops

Laptops are small and light enough to sit on a person's lap while in use. So, it can be defined as: *a portable computer that has an LCD screen, which usually weighs less than 3 kilos.* Today's laptops provide all the capabilities of most desktop computers. Following are the major features:

Keyboard:
Function keys and cursor keys are often made smaller. Usually, a touchpad or tracking device replaces the mouse.

Screen Resolution:
Laptops use high-quality LCD screens. However, the built-in display system has an external monitor for desktop use or a data projector. The laptop should have the highest resolution for the external display if you plan on connecting one.

External Display & Keyboard Connectors :
A full- size monitor and keyboard can also be connected such that both are positioned comfortably.
Built-in Pointing Device
A touchpad or pointing stick is built into the laptop. A mouse can be connected via the USB port.

Expansion :
Modern laptop computers have PC Card slots and USB ports, making them very flexible to expand into a full-featured desktop.

Batteries :
Extended life batteries add weight, whereas flat auxiliary batteries can be plugged into the laptop. The rechargeable battery (if present) is charged from an AC adapter and stores enough energy to run the laptop for three to five hours, depending on the power management of the computer.

Multimedia :
All laptops today have built-in speakers and may include a camera for video phoning. They generally have a CD or DVD drive with read/write facilities.
Laptops have evolved over the period into sleek, slim, and colourful as well as an affordable gadget. It's a style statement more than a mobile computer

Palmtops or net books

Palmtops are small hand-held computers that fit (literally) in the palm of your hand. Palmtops have limited functions such as phone books and calendars with an operating system that contains a word processor and a spreadsheet. They are battery powered. They do not have disk drives. They PCMCIA slots in which you can insert disk drives, modems, memory, and other devices. The most important feature is that a lot of data can be stored in it.

Palmtops are being rechristened as Net books. A net book is a small, light and portable computer, which is neither too big to carry around nor too small to function efficiently. The primary purpose was to surf the internet, chat and email friends. Nowadays more powerful processors are making net books very powerful.

Net books have small keyboards, small yet clear screens, more storage capacity than expected of it (hard drives and USB storages) and runs on battery. Net books are ideal for students while taking lectures. Students can take notes, type them, save and categorize and even work on projects. It is also convenient to use while in airports, on planes, or anywhere and they are popular among writers and businesspeople. On the top of all, they are easy on the budget.

Mobile devices:

Any computer- based device that is mobile or portable that cater to our conveniences and needs, can be called a mobile device. Many types of mobile computers have been introduced since the 1990s, some of which are listed below:

A **pager** is a simple personal telecommunication device for short messages. It can only receive a message consisting of a phone number that the user is then expected to call. Two-way pagers have the ability to send and receive email, numeric pages, and SMS messages. They continue to work in times of emergency or disaster as they do not suffer from network overload. For this reason, they are still very popular with emergency service personnel, medical personnel, and information technology support staff.

A **mobile phone** (also called mobile, cell phone or hand phone) is an electronic device used for two-way radio telecommunications over a network of base stations known as cell sites. A mobile phone allows its user to make and receive telephone calls to and from the public telephone network. A key feature of the cellular network is that it enables seamless telephone calls even when the user is moving around. It uses a rechargeable battery. Smart phones, like the iPhone, and Blackberry are full-featured cell phone- computers with built-in GPS, compass and camera, Web access, streaming video, a touch screen, multiple gigabytes of memory and tons of applications. The iPhone is a line of Internet and multimedia-enabled smart phones. The iPhone functions as a camera phone (also including text messaging and visual voice mail) and a portable media player (equivalent to a video iPod). It is also an Internet client (with e-mail, web browsing, and Wi-Fi connectivity). The device also has multi-touch screen, including a virtual keyboard rather than a physical one and diverse functionalities, including games, reference, GPS navigation, social networking, and advertising for television shows, films, and celebrities.

A **tablet computer** is a computer contained entirely in a flat touch screen. It uses the screen as an input device, using a stylus, digital pen, or fingertip instead of a keyboard or mouse. Tablet PCs use the pen with hand writing and voice recognition functionality. While tablet computers run on an operating system dedicated to the device rather than a Microsoft Windows, or Linux. Sometimes they need to be connected to a traditional PC for back up or software upgrade. Tablet computers are specialized for internet use and general purposes. Prominent among tablets is the ubiquitous ipad.

A **carputer** is a computer that can be installed and run in cars. It has an LCD touch screen that allows users to enjoy features such as a GPS direction system, personal mp3 music libraries, radio (AM, FM,), voice recognition, and web browsing. They ensure safe driving too.

Wearable **computers** are just portable but wearable. This health monitoring systems, and technologies. Wearable for applications that require while the user's hands, voice, are actively engaged with the There is a constant interaction and user. It is not necessary to computers that are not technology is used in, information computers are useful computational support eyes, arms or attention physical environment. between the computer stop what you are doing to use the device. It can therefore be an extension of the user's mind and/or body. Both general and special purposes are envisioned. Nintendo Wii is a type of wearable computer.

Notebooks:

Laptop computers began to be called notebooks when they reached a relatively small size in the 1990s. Notebooks have the capacity of a computer that has word processing, spreadsheets, database management and desk top publishing capabilities. Notebooks are also capable of Internet chat, text and managing digital photos. It is also portable.

Mainframes:

A mainframe (also known as big iron) is a high-performance computer used for large-scale computing purposes that offers greater availability and security. Mainframes acquired their name in part because of their substantial size, and because of requirements for specialized heating, ventilation, air conditioning and electrical power. The term originally referred to the large cabinets that housed the central processing unit and main memory of early computers. Later the term was used to distinguish high-end commercial machines from less powerful units.

Mainframes are powerful computers used mainly by large organizations for critical applications, such as census, industry and consumer statistics, enterprise resource planning, and financial transaction processing.

Some of its most distinct features are reliability, availability, and serviceability (or "RAS") Mainframes have always been important factors in data processing.

USES

If you ever used an automated teller machine (ATM) to interact with your bank account, you used a mainframe.

In banking, finance, health care, insurance and a multitude of other public and private enterprises, the mainframe computer continues to be the foundation of modern business.
No other computer architecture can claim as much continuous, evolutionary improvement, while maintaining compatibility with previous releases.
Because of these design strengths, the mainframe is often used by IT organizations to host the most important, mission-critical applications. These applications typically include customer order processing, financial transactions, production and inventory control, payroll, as well as many other types of work.

These machines often run for years without interruption, with repairs and hardware upgrades taking place during normal operation.

One common impression of a mainframe's user interface is the 80x24-character "green screen" terminal, named for the old cathode ray tube (CRT) monitors from years ago that glowed green. In reality, mainframe interfaces today look much the same as personal computers.

Business applications accessed through a web browser rely on the mainframes to:

- Perform large-scale transaction processing (thousands of transactions per second)
- Support thousands of users and application programs concurrently accessing numerous resources
- Manage terabytes of information in databases and handle large-bandwidth communication

Modern mainframe computers have abilities defined by high reliability and security, extensive input-output facilities, strict backward compatibility with older software, and high utilization rates to support massive throughput. Thus mainframe computers perform crucial functions behind the scene.

Supercomputers:

A supercomputer performs at an unbelievable rate of speed which is far above that of other computers. They are at the front line for their speed of calculation. They have great processing power and multiple processors such that they are incredibly fast, sophisticated and powerful. In the fast changing world of computing, today's supercomputer will be tomorrow's computer. Supercomputers were introduced in the 1960s, designed primarily by Seymour Cray at Control Data Corporation(CDC). Today, supercomputers are produced by "traditional" companies such as Cray, IBM and Hewlett-Packard. The Cray's Jaguar is the fastest supercomputer in the world.

Supercomputers are used for highly calculation-intensive tasks such as problems involving quantum physics, weather forecasting, climate research, molecular modelling, physical simulations (such as simulation of airplanes in wind tunnels, simulation of the detonation of nuclear weapons, and research into nuclear fusion).

Scientific organizations like NASA have supercomputers the size of rooms for the purpose of performing calculation; derive complex formulas, and performing other tasks which require a large amount of computer power.

Some supercomputers have also been designed for very specific functions like cracking codes and playing chess. Deep Blue is a famous chess-playing supercomputer.
Even supercomputers have their own issues….

Supercomputers get extremely hot as they run, requiring complex cooling systems to ensure that no part of the computer fails. It takes advantage of extremely cold liquids. Also, another issue is the speed at which information can be transferred to a storage device, as that will limit the supercomputer's performance.

Significance of IT and the Internet:

Information technology has a significant role in almost all areas of our lives. IT is a main component in business, hotels, colleges and our homes.

- Almost everyone use email as an important mode of communication.

- Internet allows us to hold conversations in real-time (eg:-Skype, Google talk)

- Surveys and research can be conducted

- Word processors, Power Point, Photoshop use software

- games, modelling and simulation, networking

- digital imaging and photography

- audio and video applications,

- electronic commerce applications

- search engines

The growth and diversity of applications greatly increase the utility of IT, leading to its further expansion in all walks of life.

The Internet is named after the Internet Protocol, the standard communications protocol used by every computer on the Internet. The Internet has a powerful ability to find, manage, and share information. Information is available to so many people at such little cost. Knowing how to get the most out of the Internet can help you as much as knowing how to read. The Internet has become an integral part of our lives, with such powerful capabilities. The making of the Internet is attributed to 3 individuals – Vannevar Bush, Norbert Wiener and Marshall McLuhan at the 1956 Dartmouth Artificial Intelligence Conference. Here, the idea of a global village interconnected by an electronic nervous system part of our popular culture was conceptualized.