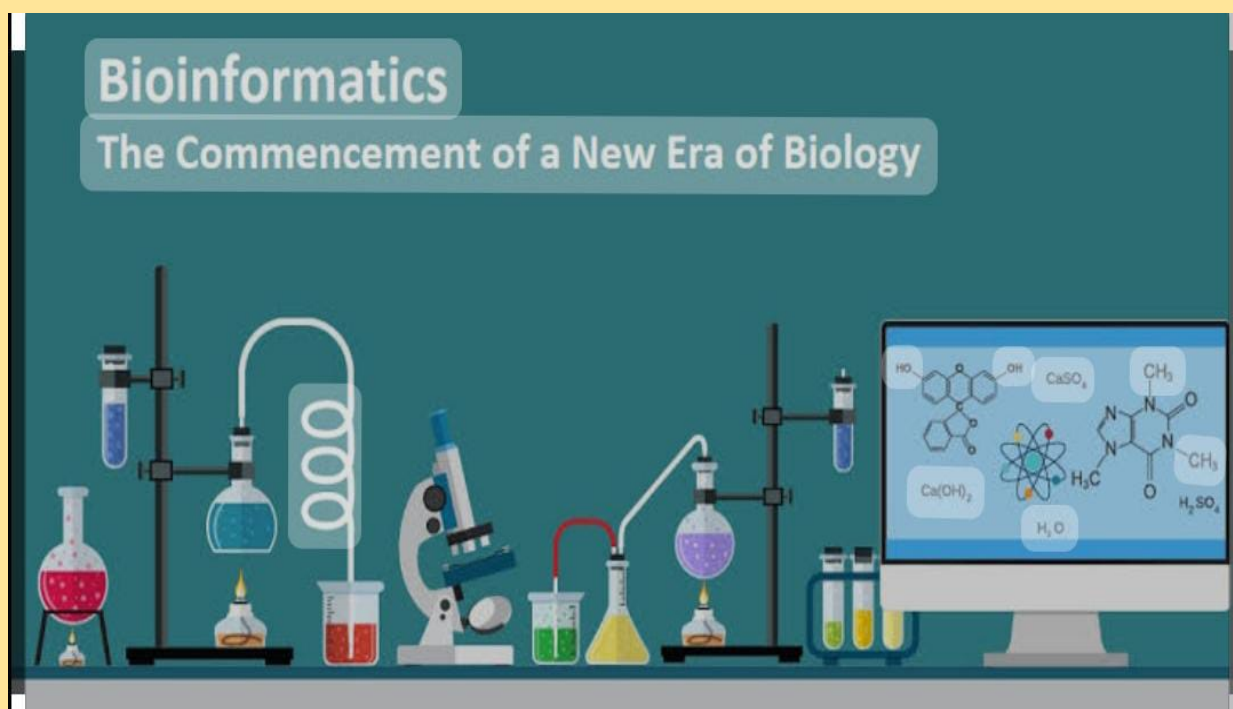


**ARULMIGU PALANI ANDAVAR ARTS COLLEGE
FOR WOMEN, PALANI**

PG DEPARTMENT OF BOTANY



LEARNING RESOURCES

BIOINFORMATICS

INTRODUCTION OF COMPUTERS

- Computers are electronic devices that can follow instructions to accept input, process the input and then produce information.
- The word computer is derived from the latin word computare which means to calculate. The computer is a programmable machine.
- It accepts input data, processes the data according to the instruction given to it and produces the required output. The output may be in the forms of numbers, graphs or images.
- Computer is known for its tremendous speed. It reduces the manual work and forms the complex task easily in a few seconds.
- They are used in a variety of fields like education, medicine, sports, engineering, rocket launching industry, banks, business, stores, etc.

COMPONENTS OF COMPUTERS

- Computer is an electronic machine for data storage and processing.

(1) Scanner: An input device that can convert the contents of a paper document into a digital image that can be stored in the computer.

(2) CPU (Central Processing Unit) or the processor: The "brain" of the computer where programs are run. It is one of the most expensive parts of the hardware. Modern CPUs can perform multiple tasks simultaneously.

(3) RAM (Random Access Memory): The computer's high-speed, short-term memory. It temporarily stores data and instructions for programs that run on the computer.

(4) Expansion Cards: Circuit boards that can be inserted to add functionality to a computer system (for example: network, sound, or video cards).

(5) Power Supply: Converts electricity from the wall into the form that the other computer components use.

(6) Optical Drive: An input/output device that reads data from and writes data to CDs and DVDs.

(7) Hard Drive: An input/output device that serves as the long-term storage memory of the computer. There are two primary kinds: mechanical drives that use a mechanical arm to read and write data on a rotating disk, and "solid state" drives that have no moving parts.

(8) Motherboard: A circuit board that holds and connects various components of the computer and allows their communication.

(9) Speaker: An input/output device that outputs sound from the computer.

(10) Monitor: An input/output device that displays information visually. Generally, monitors are output devices where the computer visually displays information. Touch screens combine the functions of output and input.

(11) Keyboard: An input device on which the user can type to communicate with the computer.

(12) Mouse: An input device that allows the user to interact with visual objects displayed on the monitor.

(13) External Hard Drive: An input/output device that serves as an extra hard drive used for additional or backup storage.

(14) Printer: An output device that can transfer digital data onto paper.

Input Devices

- Any peripheral (piece of computer hardware equipment) used to provide and control signals to a computer.

- Allows the user to put data into the computer.

- Without any input devices, a computer would only be a display device and not allow users to interact with it.

Input Device

- Keyboard

- Mouse
- Touch screen
- Graphic tablet
- Microphone
- Scanner

1. Keyboard

- One of the primary input devices used with a computer.
- The **keyboard** looks very similar to the keyboards of electric typewriters, with some additional keys.
- Keyboards allow a computer user to input letters, numbers, and other symbols into a computer
- Uses an arrangement of buttons or keys.
- Requires pressing and holding several keys simultaneously or in sequence.

Key Types

Key Type	Example
Alphanumeric	A-Z, 0-9
Punctuation	. , ! “ ?
Modifiers	Shift, Space Bar, Enter, Ctrl, Alt
Navigation	Arrows, Home, Page Up
System Command	PrtScn, Esc, F1, Start

Key Types

1. Function keys

- The Function keys or F1 through F12 keys are used in programs as shortcut keys to performed frequently performed tasks.
- For example, the F1 key is the key to open the online help for most programs.

2. Control Keys

- The Control keys are what give you additional control of a document.

3. Keypad

•Although not available on all computer keyboards, especially laptops; the keypad gives the user a quick access to numbers and math functions such as plus, divide, times, and subtract.

4. Arrow keys

•The arrow keys are four directional arrow keys that allow the user to move their cursor and position on a page.

Keyboard Shortcut Keys

Shortcut Keys	Description
Alt + F	File menu options in current program.
Alt + E	Edit options in current program
F1	Universal Help in almost every Windows program.
Ctrl + A	Select all text.
Ctrl + X	Cut selected item.
Shift + Del	Cut selected item.
Ctrl + C	Copy selected item.
Ctrl + Ins	Copy selected item
Ctrl + V	Paste
Shift + Ins	Paste
Ctrl + P	Print the current page or document.
Home	Goes to beginning of current line.
Ctrl + Home	Goes to beginning of document.
End	Goes to end of current line.
Ctrl + End	Goes to end of document.
Shift + Home	Highlights from current position to beginning of line.
Shift + End	Highlights from current position to end of line.
Ctrl + Left arrow	Moves one word to the left at a time.
Ctrl + Right arrow	Moves one word to the right at a

time.

2. Mouse

- A device that controls the movement of the cursor or pointer on a display screen.
- The mouse is important for graphical user interfaces because user can simply point to options and objects and click a mouse button.

Type of Mouse

•**Mechanical:** It has a rubber or metal ball on its underside that can roll in all directions.

•**Optical:** Uses a laser to detect the mouse's movement.

Trackball

- A trackball is a mouse lying on its back.
- To move the pointer, you rotate the ball with your thumb, your fingers, or the palm of your hand
- It does not require much space to use it

3. Touchpad

- A small, touch-sensitive pad used as a pointing device on some portable computers.
- By moving a finger or other object along the pad, you can move the pointer on the display screen.

4. Graphic Tablet

• A graphics tablet (or digitizer, digitizing tablet, graphics pad, drawing tablet) is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper.

5. Microphone

• A **microphone** is a hardware peripheral that allows computer users to input audio into their computers.

6. Scanner

1. Fingerprint Scanner

- A **fingerprint scanner** or **fingerprint reader** is a hardware device that verifies a user or enters password information by scanning their finger.

2. Barcode Reader

- A **barcode reader** or **scanner** is a hardware device capable of reading a barcode and printing out the details of the product or logging that production to a database.

Output Devices

- Any peripheral that receives or displays output from a computer.
- Computer hardware equipment used to communicate the results of data processing carried out by a computer to the outside world.

- Monitor
- Printer
- Speakers
- Projector

1. Monitor

- The device which displays computer output.
- The monitor displays the video and graphics information generated by the computer through the video card.
- Monitors are very similar to televisions but usually display information at a much higher resolution.

a) Monochrome Monitor

- A **monochrome monitor** is a type of CRT computer display which was very common in the early days of computing, from the 1960s through the 1980s, before color monitors became popular.

- They are still widely used in applications such as computerized cash register systems

- Monochrome monitors actually display two colors, one for the background and one for the foreground.

- The colors can be black and white, green and black, or amber and black.

b) Color Monitor

- Color monitors can display anywhere from 16 to over 1 million different colors.

- Color monitors are sometimes called RGB monitors because they accept three separate signals --red, green, and blue.

Types of Monitor

- Cathode Ray Tube (CRT)
- Liquid Crystal Display (LCD)
- Light-emitting Diode (LED)

1. Cathode Ray Tube (CRT)

- Large
- Heavy
- Produce heat
- Not expensive

2. Liquid Crystal Display (LCD)

- Less space
- Lighter
- Low power consumption
- Expensive
- Limited viewing angle

3. Light-emitting Diode (LED)

- Less space
- Lighter
- Very expensive
- Provide higher contrast and better viewing angles than LCD monitor

Monitor Features

Screen Size

Aspect Ratio

Display Resolution

Display Resolution

Refresh Rate

Color Depth

2. Printer

•Printer is an external hardware device responsible for taking computer data and generating a hard copy of that data.

•Printers are one of the most used peripherals on computers and are commonly used to print text, images, and photos.

Types of Printer

Printers can be categorized into:

- Impact Printer
- Non-Impact Printer

Impact Printer

•It strikes paper and ribbon together to form a character, like a typewriter.

Advantages

- Less expensive
- Can make multiple copies with multipart paper

Disadvantages

- Noisy
- Print quality lower in some types
- Poor graphics or none at all
- Slow

Non-Impact Printer

•It uses ink spray, toner powder or inkless

Advantages

- Quiet
- Can handle graphics and often a wider variety of fonts than impact printers
- Fast

Disadvantages

- More expensive
- Occupies a lot of space
- The cost of maintaining it is high

3. Speakers

•A hardware device connected to a computer's sound card that outputs sounds generated by the computer.

•Speakers can be used for various sounds meant to alert the user, as well as music and spoken text

Headphones

- Headphones give sound output from the computer.

- They are similar to speakers, except they are worn on the ears so only one person can hear the output at a time.

4. Projector

- An output device that can take the display of a computer screen and project a large version of it onto a flat surface.

- Projectors are often used in meetings and presentations so that everyone in the room can view the presentation.

Types of projector

- Cathode Ray Tube (CRT) projector

- Liquid Crystal Display (LCD) projector

- Digital Light Processing (DLP) projector

1. Cathode Ray Tube (CRT) projector

- In the early days of projectors, CRT projectors were commonly used.

- They utilized three tubes, one for each of the primary colors.

- Due to their large size, low light output and the frequent need to converge and align the images projected from each of the three tubes, they are no longer commonly used.

- Long service life; CRT tubes maintain good brightness to 10,000 hours.

- CRT projectors are both considerably larger and heavier than comparable LCD and DLP projectors.

- CRT projectors require far more time to set up and adjust than LCD and DLP based projectors.

2. Liquid Crystal Display (LCD) projector

- LCD projectors work by utilizing polarized mirrors that pass and reflect only certain colors of light.

- This causes each channel of red, green and blue to be separated and later re-converged via a prism after passing through an LCD panel that controls the intensity and saturation of each color.

3. Digital Light Processing (DLP) projector

- DLP projectors can be classified as one-chip or three-chip.
- One-chip DLP projectors can produce more than 16 million colors while three-chip models can produce more than 35 trillion colors.
- This allows DLP projectors to reproduce more natural and lifelike images.

Storage Devices

- A **storage device** is used in the computers to store the data.
- Provides one of the core functions of the modern computer.

Types of Storage

There are four types of storage:

- Primary Storage
- Secondary Storage
- Tertiary Storage
- Off-line Storage

1. Primary Storage

- Also known as **main memory**.
- Main memory is directly or indirectly connected to the central processing unit via a memory bus.
- The CPU continuously reads instructions stored there and executes them as required.
- Example:
 - RAM
 - ROM
 - Cache

RAM

- It is called Random Access Memory because any of the data in RAM can be accessed just as fast as any of the other data.

- There are two types of RAM:

- DRAM (Dynamic Random Access Memory)

- SRAM (Static Random Access Memory)

RAM

Static RAM

- Faster
- More expensive
- More power consumption
- does not need to be refreshed

Dynamic RAM

- Slower
- Less expensive
- Less power consumption
- needs to be refreshed thousands of times per second

ROM

- This memory is used as the computer begins to boot up.

- Small programs called firmware are often stored in ROM chips on hardware devices (like a BIOS chip), and they contain instructions the computer can use in performing some of the most basic operations required to operate hardware devices.

- ROM memory cannot be easily or quickly overwritten or modified.

Cache

Cache

It is a high-speed access area that can be either is served section of main memory or a storage device.

- Most computers to day come with L3 cache or L2 cache, while older computers included only L1 cache.

2. Secondary Storage

- It is not directly accessible by the CPU.
- Computer usually uses its input/output channels to access secondary storage and transfers the desired data using intermediate area in primary storage.
- Example:
 - Hard disk

Hard Disk

- The hard disk drive is the main, and usually largest, data storage device in a computer.
- It can store anywhere from 160 giga bytes to 2 tetra bytes.
- Hard disk speed is the speed at which content can be read and written on a hard disk.
- A hard disk unit comes with a set rotation speed varying from 4500 to 7200 rpm.
- Disk access time is measured in milli seconds.

3. Tertiary Storage

- Typically it involves a robotic mechanism which will mount (insert) and dismount removable mass storage media into a storage device.
- It is a comprehensive computer storage system that is usually very slow, so it is usually used to archive at that is not accessed frequently.
- This is primarily useful for extra ordinarily larged at a stores, accessed without human operators.Examples:
 - Magnetic Tape–Optical Disc

i) Magnetic Tape

- A magnetically coated strip of plastic on which data can be coded.
- Tapes for computers are similar to tapes used to store music.
- Tape is much less expensive than other storage mediums but commonly a much slower solution that is commonly used for backup.

ii) Optical Disc

- **Optical disc** is any storage media that holds content in digital format and is read using a laser assembly is considered optical media.

- The most common types of optical media are

- Blu-ray (BD)

- Compact Disc (CD)

- Digital Versatile Disc (DVD)

4. Off-line Storage

- Also known as **disconnected storage**.

- Is computer data storage on a medium or a device that is not under the control of a processing unit.

- It must be inserted or connected by a human operator before a computer can access it again.

- Also known as **disconnected or removable storage**.

- Is computer data storage on a medium or a device that is not under the control of a processing unit.

- It must be inserted or connected by a human operator before a computer can access it again.

Examples:

- Floppy Disk–USB Flash drive

- Zip diskette–Memory card

USB Flash Drive

- A small, portable flash memory card that plugs into a computer's USB port and functions as a portable hard drive.

- Flash drives are available in sizes such as 256MB, 512MB, 1GB, 5GB, and 16GB and are an easy way to transfer and store information.

Memory Card

- An electronic flash memory storage disk commonly used in consumer electronic devices such as digital cameras, MP3 players, mobile phones, and other small portable devices.

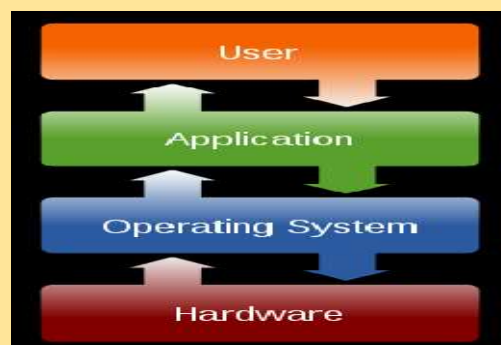
- Memory cards are usually read by connecting the device containing the card to your computer, or by using a USB card reader.

Storage Device Features

- Volatility
- Accessibility
- Mutability
- Addressability

Operating Systems

- The operating system is the most important program that runs on a computer.
- Operating system is an interface between computer and user.
- It is responsible for the management and coordination of activities and the sharing of their sources of the computer.



Types of Operating System

- Real-time
- Multi-usersvs.Single-user
- Multi-taskingvs.Single-tasking
- Distributed

- Embedded

1. Real-Time

- A real-time operating system is a multi tasking operating system that aims at executing real-time applications.
- Responds to input instantly.

2. Multi-user vs. Single user

- A multi-user operating system allows multiple users to access a computer system concurrently.
- Time-sharing system can be classified as multi-user systems as they enable a multiple user access to a computer through the sharing of time.
- Single-user operating systems, as opposed to a multi-user operating system, are usable by a single user at a time.

3. Multi-tasking vs. Single-tasking

- When a single program is allowed to run at a time ,the system is grouped under a single-tasking system
- While in case the operating system allows the execution of multiple tasks at one time, it is classified as a multi-tasking operating system.

4. Distributed

- A distributed operating system manages a group of independent computer sand makes them appear to be a single computer.
- The development of networked computers that could be linked and communicate with each other, gave rise to distributed computing.

5. Embedded

- Embedded operating systems are designed to be used in embedded computer systems.
- They are designed to operate on small machines like PDAs with less autonomy.
- They are able to operate with a limited number of resources.

Major Functions of Operating System

- Operating system loads itself in the computer memory.
- It transfers the programs in and out of memory.

- It acts as an interface between the user and the computer hardware.
- It organizes the use of memory between the programs.
- It organizes programming time between the programs and the user.
- It maintains security and access rights of users.
- It allows the user for saving files to the hard disk. It also allows changing or manipulating the files easily.
- It determines and manages the order of the tasks to be executed in the computer system.
- It controls the hard disk and the external device connected to the computer system (printers, scanners, etc.).
- It provides a software platform on top of which other programs can run.
- It controls all application software.
- It interprets the commands and instructions executed by the user.
- It deals with errors and user instructions.
- It issues simple error messages.

Examples of Operating System

•MS-DOS•Linux

•Windows•Solaris

•Mac OS•Android

1. Microsoft DOS

- DOS stands for **Disk Operating System**.
- Developed by Microsoft Inc.
- Using command line interface.
- It does not support multiple users and multitasking.
- First version: MS-DOS 1.0 (1981)
- Final version: MS-DOS 7.0 (1995)

```
Microsoft(R) Windows DOS
(C) Copyright Microsoft Corp 1990-2001.

C:\>mem

655360 bytes total conventional memory
655360 bytes available to MS-DOS
578352 largest executable program size

4194304 bytes total EMS memory
4194304 bytes free EMS memory

19922944 bytes total contiguous extended memory
0 bytes available contiguous extended memory
15580160 bytes available XMS memory
MS-DOS resident in High Memory Area

C:\>
```

Windows

- Produced by Microsoft, Inc.
- Using graphical user interface.
- Support multi tasking and multiuser.
- First version: Windows 1.0 (1985)



- Latest version: Windows 8

Linux

- A freely-distributable open source operating system that runs on a number of hardware platforms.
- Linux has become an extremely popular alternative to proprietary operating systems.
- First version: Linux (1992)
- Latest version: Linux 3.9.6



Generations of Programming Language

- The **first generation languages**, or 1GL, are low-level languages that are machine language.
- The **second generation languages**, or 2 GL, are also low-level languages that generally consist of assembly languages.
- The **third generation languages**, or 3 GL, are high-level languages such as C. The **fourth generation languages**, or 4 GL, are languages that consist of statements similar to statement sina human language. Fourth generation languages are commonly used in database programming and scripts.
- The **fifth generation languages**, or 5GL, are programming languages that contain visual tools to help develop a program. A good example of a fifth generation language is Visual Basic.

There are three types of programming language:

- Machine language (Low-level language)**
- Assembly language (Low-level language)**
- High-level language**

Machine language (Low-level language)

- Low-level languages are closer to the language used by a computer, while high-level languages are closer to human languages.
- Machine language is a collection of binary digits or bits that the computer read sand interprets.
- Machine languages are the only languages understood by computers.
- While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of numbers.

Machine Language

169 1 160 0 153 0 128 153 0 129 153 130 153 0 131 200 208 241 96

Example:

- Let us say that an electric tooth brush has a processor and main memory.
- The process or can rotate the bristles left and right, and can check the on/off switch.

- The machine instructions are one byte long, and correspond to the following machine operations

High Level Language

- High-level** languages allow us to write computer code using instructions resembling everyday spoken language (for example: **print, if, while**) which are then **translated** into machine language to be executed.

- Programs written in a **high-level** language need to be translated into **machine language** before they can be executed.

- Some programming languages use a **compiler** to perform this translation and others use an **interpreter**.

Examples of High-level Language:

- ADA
- JAV
- C•BASIC
- C++

High level language

```
5 FOR I=1 TO 1000: PRINT "A";: NEXT I
```

Data Communication

Data Communication is a process of exchanging data or information

In case of computer networks this exchange is done between two devices over a transmission medium.

Components of Data Communication

A Data Communication system has five components as shown in the diagram below:

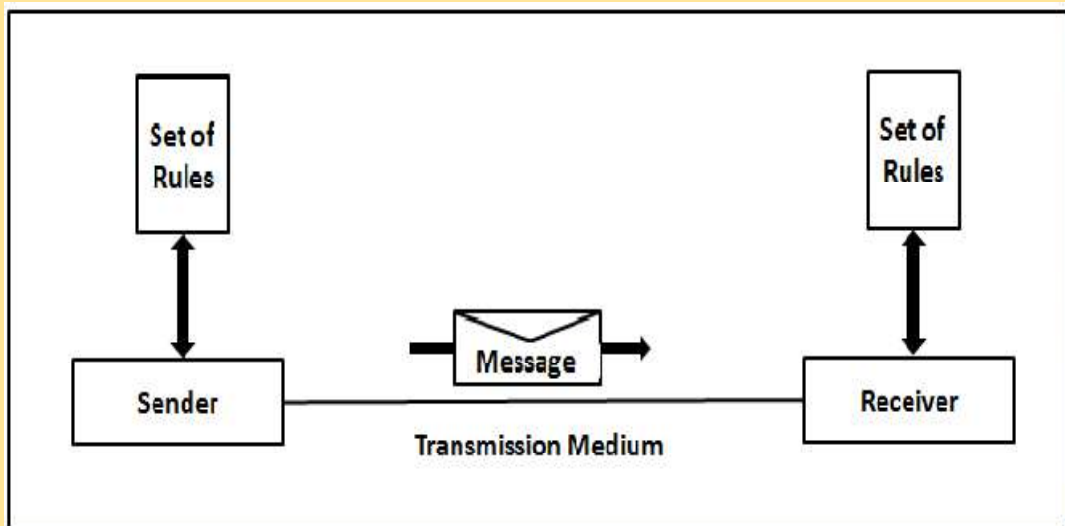


Fig. Components of a Data Communication System

1. Message

Message is the information to be communicated by the sender to the receiver.

2. Sender

The sender is any device that is capable of sending the data (message).

3. Receiver

The receiver is a device that the sender wants to communicate the data (message).

4. Transmission Medium

It is the path by which the message travels from sender to receiver. It can be wired or wireless and many subtypes in both.

5. Protocol

It is an agreed upon set or rules used by the sender and receiver to communicate data.

A protocol is a set of rules that governs data communication.

A Protocol is a necessity in data communications without which the communicating entities are like two persons trying to talk to each other in a different language without know the other language.

The Internet

- A global network connecting millions of computers
- More than 100 countries are linked into exchanges of data, news and opinions.
- The Internet links are computer networks all over the world so that users can share resources and communicate with each other.

- A computer network can be defined as a collection of nodes. A node can be any device capable of transmitting or receiving data. The communicating nodes have to be connected by communication links.

- A Compute network should ensure

 - Reliability** of the data communication process, should computer

 - Security** of the data

 - Performance** by achieving higher throughput and smaller delay times

Types of Computer Network

Networks are categorized on the basis of their size. The three basic categories of computer networks are:

Local Area Network (LAN)

- A LAN connects network devices over a relatively short distance.

- A networked office building, school, or home usually contains a single LAN, though sometimes one building will contain a few small LANs (perhaps one per room), and occasionally a LAN will span a group of nearby buildings.

Wide Area Network (WAN)

- WAN covers a large geographic area such as country, continent or even whole of the world.

- A WAN is a geographically-dispersed collection of LANs.

- Most WANs (like the Internet) are not owned by any one organization but rather exist under collective or distributed ownership and management.

Internet Access

- To gain access to the internet, the user has to register to any Internet Service Provider (ISP).

- Types of Internet connection:

 - Dial-up

 - Integrated services digital network

–A symmetric Digital Subscriber Line

–Wireless Internet Connections

–Internet over Satellite

Internet Usages

- Communication
- Send and receive emails
- Download files
- Post your opinion to a news group
- Chatting
- Surf the World Wide Web
- Business
- Shopping
- Entertainment

Internet Applications

- An Internet application is an interactive, compiled application that can be accessed through a corporate or through the Internet.
- Internet applications can perform complex business processes on either the client or the server.
- The application uses the Internet protocol to receive requests from a client, typically a Web browser, process associated code, and return data to the browser.
 - The World-Wide Web (WWW)
 - Electronic Mail (E-Mail)
 - File Transfer Protocol (FTP)
 - Search Engine

- Chatting
- Video Conferencing
- E-Commerce

World Wide Web (WWW)

- The **World Wide Web** is a system of inter linked hyper text documents accessed via the Internet
- With a web browser, one can view web pages that may contain text, images, videos, and other multimedia and navigate between them via hyperlinks
- It use a protocol called HTTP–Hyper text Transfer Protocol
- HTTP defines the messages are formatted and transmitted, and what actions Web server sand browsers should take in response to various commands.
- A **Uniform Resource Locator**, or URL is the address of a document it'll find on the WWW.

- The elements in a URL:

Protocol://server's address/filename

- Example:

<http://www.google.com/index.html>

Types of website:

- Static

A static website is one that has web pages stored on the server in the format that is sent to a client web browser. It is primarily coded in hyper text Markup Language (HTML)

- Dynamic

A dynamic website is one that changes or customizes itself frequently and automatically, based on certain criteria.

Electronic Mail (Email)

- The transmission of messages over communications networks.
- It is a fast and efficient way to communicate with friends or colleagues.
- It can communicate with one person at a time or thousands; it can receive and send files and other information.

- Basic email functions:
 - send and receive mail messages
 - save the messages in a file
 - print mail messages
 - reply to mail messages
 - attach a file to a mail message
- Email address
 - Someone @ mail server
- The email address has three parts:
 - a user name
 - an "at" sign (@)
 - the address of the user's mail server

- Example

Harris@ftms.edu.my

Email advantages

Productivity tools: Email is usually packaged with a calendar, address book, instant messaging, and more for convenience and productivity.

Access to web services: If want to sign up for an account like Face book or order products from services like Amazon, you will need an email address so you can be safely identified and contacted.

Easy mail management: Email service providers have tools that allow filing, labeling, prioritizing, finding, group, and filtering the emails for easy management. It can even easily control spam, or junk email.

Privacy: The email is delivered to the own personal and private account with a password required to access and view emails.

Communication with multiple people: It can send an email to multiple people at once, giving you the option to include as few as or as many people as you want in a conversation.

Accessible anywhere at any time: Don't have to be at home to get their mail. It can access it from any computer or mobile device that has an Internet connection.

File Transfer Protocol (FTP)

- The protocol for exchanging files over the Internet.
- Used for moving files between two hosts on a TCP/ IP network.
- FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.

To do FTP, a user invokes one of two commands:

- **get** – the command for transferring a file from another server to their own computer.
- **put** – the command for moving a file from their computer to another one.