**TOPIC 11: DATA COMMUNICATION & NETWORKING**

**Definition of Data communication**

Data communication is the process of transferring data, instructions and information from one computer to another computer.

**Elements of data communication**

* A sending device
* Message
* A communication device
* A communications channel
* Protocol
* Communications software
* A receiving device

**A sending device;**

A sending device is a device that initiates an instruction to transmit data, information, or instructions.

**Message**

This is the data/content/information to be transmitted over a transmission medium.

**A communication device;**

Is a device that connects the communications channel to a sending device by converting the data, instruction or information from the sending device into signals that can be carried by a communications channel examples include a modem, repeater, switch, router, gateway etc.

**A communications channel/medium** Also known as communication links or Data links a communication channel is a medium over which Data travels/is transmitted from one computer (device) to another. It is a path over which the signals are sent either physically (cables) of wireless waves. It can be a standard telephone line

**Protocol**

This is a set of rules and procedures for exchanging information among computer device on a network.

**A receiving device;**

It is the device that accepts the transmitted signals from the sending device.

**Communications software;**

This software consists of programs that manage the transmission of data, instructions and information between the sending and receiving computers.

**Definition of data communication tools**

These are tools that enable the user to emulate and test the networks.

**Types of electronic data communication tools**

* Mobile phones
* Computers
* Internet
* Social network

**Services offered by data communication tools**

* Voicemail
* Fax
* E –mail
* Instant messaging (IM)
* Chat room
* Newsgroups (Discussion groups)
* Internet telephony
* Videoconferencing
* Telecommuting
* Groupware
* Skype

**Telecommuting**

Telecommuting is a work arrangement in which employees work away from the standard workplace of a company, but communicate with the office using some kind of communications technology

**Advantages of telecommuting**

* Reduces time and expenses for travelling to and fro work.
* Eliminated travelling during bad weather conditions
* Allows flexibility in the work schedule
* Reduces air pollution by vehicles driven to and fro work
* Employers reduce costs due to less office space and furniture required.
* Favors the disabled employees

**Disadvantages of telecommuting**

* Reduces human face – to – face interactions among the working staff
* If any device of the communications system fails, the work has to stop.
* Leisure time at home may be replaced by work.
* There is less security over the company’s information.

**Global positioning (GPS)**

It consists of one or more earth based receivers that accept and analyze signals sent by satellites in order to determine the receiver‘s geographical location.

**Uses of GPS**

* To locate a person or an object
* To find the best route between two points
* Monitor the movement of a person or object.
* Create a map
* To get weather information
* Used by cars and ships to provide directions.

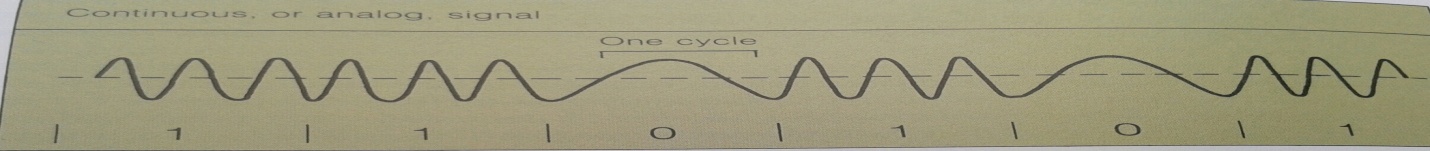
**Forms (modes) of Data transmission (Communication)**

Data transmission/digital transmission/ digital communications refer the physical transfer of data over a point-to-point or point-to-multipoint communication channels.

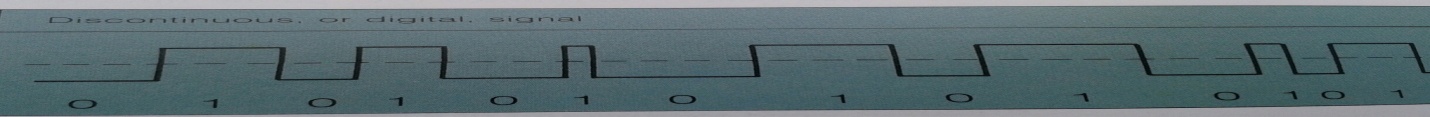
Data is transmitted over networks using signals. **A signal** isa series of electrical or radio waves which are sent to a radio or television in order to produce a sound, picture or message.

The signals used by computers to transmit data are either digital or analog

**Analog signals** are continuous signals that vary in strength. Sound is an example of an analog signal.



**Digital signals** are discrete/ discontinuous. Either there is a signal or there isn't a signal. Discrete signals are represented by on (1) and off (0) pulses.



**Modulation and Demodulation of Signal**

**Modulation** refers to the process of converting digital signals into analog form so that data can be sent over the phone line.

**Demodulation** is the process of converting the analog signals back into digital form so that they can be processed by the receiving computer.

**Examples of data transmission (Communication) forms (modes)**

**Parallel transmission**

Parallel transmission is the simultaneous transmission of the signal elements of a character or other entity of data over two or more separate paths.

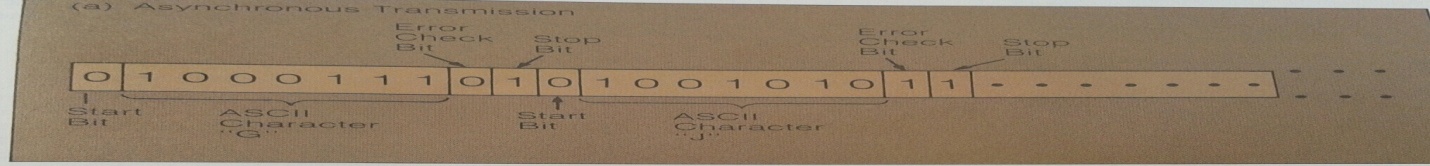
**Serial transmission**

Serial transmission is the sequential transmission of one bit of signal at a time sent over a single wire.

Serial transmission is categories into categories;

**Asynchronous Data transmission**

Transmission where each group of digital or analog signals making up the code for one character is separated and individually wrapped with a start BIT and a stop BIT and an error check BIT.



**Synchronous Data transmission**

This is the transmission where characters are sent as blocks of signals with header and trailer bytes at the beginning and end of the block.



### Direction of data transmission

###### Simplex transmission

This is a type of transmission where data flow in only one direction from the sending device to the receiving device. E.g. A communication between a mouse and a computer

###### Half duplex

This type of transmission allows data to flow in either direction from the sending device to the receiving device and back but only one direction at a time. An example is a walkie-talkie, radio calls, ATM machines, Fax machines, credit card verification systems, etc,

**Walkie-talkie** is a small radio held in the hand which is used for both sending and receiving messages

###### Full duplex

This type of transmission allowsdata to flow in both directions at the same time for instance modern telephone system; the sender can be able to talk while listening to the receiver on the other side. . E.g. Land-line and Cell telephone

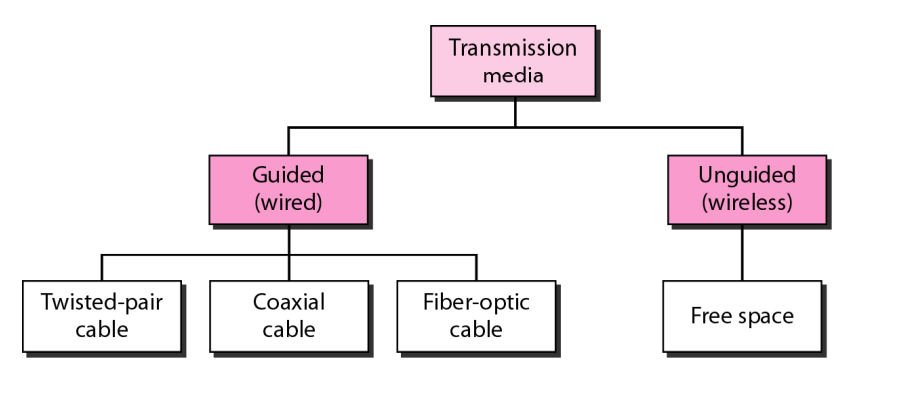
**Definition of data transmission media**

This is a communication channel or path over which the data signals are sent from the source to the destination.

**Types of data transmission media**

There are two types of transmission media;

* Physical (Guided/ bounded) transmission media
* Wireless (Unguided/Unbounded) transmission media

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**Physical (Guided/bounded) transmission media**

This is a kind of media which uses wires, cables or other tangible material to send communications signals. These include twisted pair cables, coaxial, and optical fiber cables.

**Twisted pair cable**

Twisted pair cables are types of cables in which two conductors of a single circuit are twisted together for the purposes of improving electromagnetic compatibility and to reduce electromagnetic radiation, crosstalk between neighboring pairs and rejection of external [electromagnetic interference](https://en.wikipedia.org/wiki/Electromagnetic_interference" \o "Electromagnetic interference).

**Types of twisted pair cable**

**Shielded twisted pair cable (STP)**

Shielded twisted pair cable is a type of copper telephone wiring in which each of the two copper wires that are twisted together are coated with an insulating coating that functions as a ground for the wires.

**Unshielded twisted pair cable (UTP)**

Unshielded Twisted Pair able is a pair of wires without a metal wrapper for shielding noise that are twisted around each other to minimize interference.

**Advantages of twisted pair cables**

* They are relatively cheap to use because its cost per unit length is low.
* They are convenient to use because they are small in size.
* They are easy to install because of their flexibility.
* TP is easy to terminate
* It is inexpensive and easy to install.

**The Disadvantages of twisted pair cables**

* Used over a short distance, usually less than 100 meters
* Twisted pair’s susceptibility (prone) to the electromagnetic interference which leads to signal loss
* They are easily damaged. Especial the UTP
* They are low frequency cables.

**Coaxial cable;**

This is an electrical single copper wire surrounded by three insulating layers i.e. an insulating material, a braided metal and a plastic outer coating used for connectivity over long distances.

**Advantages of coaxial cables**

* It has a high bandwidth capacity
* It can be used for long distances between 300-600 meters
* It is very effective at carrying many analog signals
* It is resistance to signal interference because of its protection shield

**Disadvantages of coaxial cables**

* It is not flexible
* It is quite bulky and sometimes difficult to install
* It is more expensive that twisted pair cables
* It has high installation cost
* It is prone to lightening strikes which can damage the cables.

**Fiber – optic cable;**

A fiber optic cable is a cable that contains hundreds of tiny threads covered by insulated glass coated in plastic that use pulses of light to transmit data or signals.

**Advantages of fiber optic cables over wired cables**

* Carry more signals that wired cables.
* They transmit data faster.
* They are less susceptible to noise from other devices
* Has a better security for signals during transmission
* They are small in size and lighter that wired cables.

**Disadvantages of fiber optic cables over wired cables**

* They are more expensive
* They are difficult to install and modify
* They are delicate.
* It is difficult o add additional nodes on the network
* It is very complex to configure

**Wireless (unguided) transmission media**

This is a kind of media that sends communications signals without wires between communications devices. They use microwaves to transmit signal. They are used when it is inconvenient, impractical, or impossible to install cables.

**Categories of wireless transmission mediabop**

* Microwaves
* Satellite
* Infrared (IR)
* Broadcast radio

**Broadcast radio**

Radio broadcast is a wireless transmission medium that uses radio waves through the air to send transmissions over long distances to a large audience who will listen to the transmission through a radio. Radio broadcast can be expanded by examining radio waves, radio transmitters and receivers.

**Advantages of Broadcast Radio**

1. Radio covers huge population with a single message.
2. Radio can be enjoyed anywhere be it at home, in office or while driving car.
3. It is less expensive
4. Radio broadcast is use for advertisement
5. Important information or news can be easily spread on radio.
6. It utilizes modulation schemes such as AM and FM to leverage advantages of both of them.
7. It trains audience to be good listeners.

### Disadvantages of broadcast radio

1. It favours only audio medium for communication.
2. It does not favor deaf people
3. It is greatlyaffected by bad weather

**Microwaves**

These are high-frequency radio waves that are sent through the atmosphere and space. They provide a high speed signal transmission by receiving signals amplifies it and transmits it to the receiving devices or retransmits it to the next microwave transmission tower.

**Advantages of microwaves**

### It is difficult to implement lumped components such as resistors, inductors and capacitors at microwave frequencies.

### Microwave communication is limited to line of sight mode only.

### Antennas required are much smaller in size hence low losses of signals

* They havehigh frequencies which allows broadband width and high data flow

**Disadvantages of microwaves**

### It is difficult to propagate because frequencies travel only in straight line path.

### Microwave transmission towers are complex and expensive to construction.

* Microwave systems do not pass through solid objects.
* Microwave is also degraded by heavy wind turbines and moisture in the atmosphere.

**Satellite;** Satellites are communication devices stationed in space and use microwave radio as their telecommunications medium to communicate with the earth based communication facilities.

**Applications of satellites**

They are used in applications such as;

* Air navigation,
* Weather forecasting,
* Video conferencing,
* Paging,
* Global positioning systems,
* Internet connections etc

**Advantages of satellites**

* They receive and broadcast data/signals over larger geographical regions.
* They sent a lot of data/ signals simultaneously.
* They allow high quality broadband communication across continents
* Satellite communication has high bandwidth.
* They are cheaper over long distances.
* They allow earth Station to be removed from a location and reinstalled somewhere else.
* Satellite communications allow users to have control over their own network.

**Disadvantages of satellites**

* It takes long and time consuming to propagate satellite tower
* The time delayed in propagation reduces the efficiency of data transmission.
* The initial cost is very expensive and costly
* They are subjected to interference by phenomenon
* The infrastructure needed to access satellite communications is also expensive.

**Infrared (IR)**

Is a wireless transmission media that transmits signals across relatively short distances to transmit data between personal devices using infrared light waves for instance a computer and a cell phone.

### Advantages of IrDA (Infrared)

* The devices are very cheap.
* The devices are compact, lightweight and consume low power.
* The technology based devices are easy to use.
* There is no interfering from RF waves.
* They are more secure compare to RF technologies.

### Disadvantages of IrDA (Infrared)

* The area for data transfer is very less.
* They are used for very short distance applications only.
* Due to line of sight communication is blocked by obstacles.
* They allow only one device at a time
* They require both transmitter and receiver to be in line of sight.
* Devices cannot move around while transmission is in progress.

**Terminologies useful used in data transmission**

**Baseband transmission media** is the kind of media that can only transmit one signal at a time.

**Broadband transmission media** is the kind of transmission media that can transmit multiple signals simultaneously.

**Latency** is the time it takes a signal to travel from one location to another on a network.

**Attenuation** is the process by which signals undergo reduction in its strength as it travels over long distances.

**Throughput** refers to the amount of data to be transferred from one location to another in a given amount of time.

**Bandwidth** is the difference between high frequency and low frequency

**Crosstalk** is a signal transmission issue that causes a disruption in another circuit or channel.

**Advantages of using wireless technologies**

* Wireless technologies overcome inconvenience of using too many wires for communication.
* Wireless technology makes it easy to set up temporary network installations
* Wireless increase flexibility and mobility at the work place because works can sit anywhere with their computers without being limited by the extent of cable connections.
* Fast data transfer rates are possible where there are no environmental obstacles
* Wireless technology is appropriate to use in places where cabling is practically impossible.

**Disadvantages of using wireless technologies**

* They are slower than LANs using cabling
* They are prone to electrical interference from light and radio
* They are subjected to obstruction especially walls
* Wireless access point and Wi-Fi technology in general have limited range that is signal strength decrease as the range increase.
* Poor security of data on a wireless network, outsider can easily log on an unsecured wireless network.

**Factors to consider when choosing a communication/transmission media**

* Speed of data transmission
* Cost of transmission media
* Installation cost
* Data security
* Country/company policy
* Availability of the communication media in the market
* Size of the network

**Computer networking**

A Computer network is the interconnection of two or more computers and other related devices for purposes of sharing information and resources.

**Purpose of computer networking**

* To allow users to share information,
* To enable sharing of software’s
* To allow the users to share resources such as printers, modems, storage devices etc
* To enable communication between computers users through tools like e-mail.
* To enable data communication I.e. transmission of electronic content over a given medium
* To ensure security of data by putting in place administrative controls over the network
* To share databases

**Basic requirements for setting up a computer network**

1. Computers/clients/workstations
2. Network hardware devices
3. Transmission or communication media/channels
4. Network software
5. Server
6. **Computers/clients/workstations**

These are other computer on the network except the server that sends request and receive responses from the server

**2. Network hardware devices**

These are devices that handle the movement of data in a computer network.

* Modems
* Router
* Hub
* Switch
* Gateway
* Bridge
* Repeaters
* Network interface cards
* **A modem**

The word "**modem**" is a contraction of the words modulator and demodulator i.e. Modulation and Demodulation.

**Modulation i**s the process of converting digital signals into analog signals while **Demodulation** is the process of converting analog signals into digital signals.

Therefore **a modem** is a communication device that converts between analog and digital signals.

* **Router**

A router is an intelligent communication device that sends communications traffic to the appropriate network using the fastest available path

* **Hub/concentrator**

A hub is a device that connects multiple devices to the network and its function is to send and receive signals along the network between the devices connected to it by broadcasting the data to all the devices/computers.

* **Switch**

A switch is a high-speed device that maintains a bridging table, keeping track of which hardware addresses are located on which network segment.

* **Gateway**

A gateway is a communication device that consist of a combination of hardware and software that connects networks that use different protocols technologies by performing the required protocol conversions

* **Bridge**

A bridge is a device that links two local area networks that use the same address method or protocol.

* **Repeater**

A repeater is a communication device that accepts a signal from a transmission medium, amplifies it, and retransmits it over the medium in order to overcome attenuation.

**N.B Attenuation** is the process by which signals undergo reduction in its strength as it travels over long distances.

* **Network interface cards (NIC) or LAN Adapter**

A network interface card is an electronic communication device or an expansion card that enables other devices on a computer to connect to a network.

**3. Transmission or communication (Network) media/channels**

Transmission or communication (Network) media/channelsis also known as communication links or Data links. It is a medium over which Data travels/ transmitted from one computer (device) to another.

**4. Network software**

Network software’s are Communication programs that are used in combination with network devices to enable transmission of data between network terminals E.g.Network operating system (NOS) and Network protocols.

**Network protocols**

A protocol is a set of rules and procedure (standard) for connection and data transfer between devices on a network. Protocols control all aspects of data exchange, which include the following:

**Functions of protocol in a communications network**

* Identifying each device in the communication path
* Securing the attention of the other device
* Verifying correct receipt of the transmitted message
* Determining that a message requires retransmission if it is incomplete or has errors.
* Performing recovery when errors occur

**Commonly used protocols**

* TCP/IP-transmission control protocol/Internet protocol.
* HTTP- Hypertext transfer protocol
* FTP- file transfer protocol.
* POP- post office protocol
* SMTP-Simple mail transfer protocol
* Telnet (Telecommunication Network) for Remote access between computers
* IMAP; Internet Message Access Protocol.

**5. Server**

A server is a computer that runs software that enables it to serve specific requests from other computers (clients).

**Implications of using computer networks**

**Positive implications (advantages)**

* It facilitates easy communication for instance through electronic mail.
* Allow users to log on and access their work from any workstation on the network
* It provides rapid method of sharing files instead of using movable disks.
* Computer networks enable workgroup computing
* It allows software to be upgraded easily on the network since it is done at ago on the server.
* It enable online learning and collaborative research
* It allows sharing of data and information stored on any other computer on the network.

**Negative implications (disadvantages)**

* Initial costs of installing a network are expensive.
* Networks require a network Administrator for Proper maintenance hence leading to additional cost.
* The entire networker fails if the server crashes.
* There is increased risk of data compromise, since many users will be using the system to access the same documents.
* There is a greater risk from viruses spread.

**Different types of computer network**

Communication networks can be grouped into the following categories based on the geographical locations of its computer terminals;

* LOCAL AREA networks (LANs)
* Metropolitan area networks (MAN)
* WIDE AREA networks (WANs)

**Local Area Network (LAN)**

A local area network is a network that connects computers and other devices within a small geographical area such as a room or a building, home a school or a computer laboratory.

**Categories of local Area Networks (Network Models or architectures)**

* Peer-to-peer networks
* Clients-server networks

**Peer to peer Configurations**

This is an interconnected group of equal computers where there is no hierarchy among them, each computer acts as both a client and a server to others on the network.

**Characteristics of peer to peer network**

* All computers have access to resources equally.
* Each computer stores files on its own storage devices.
* Each computer has its own network operating system and application software.
* Peer-to-peer connects less than 10 computers together.
* It is suitable for home and small scale business users

**Advantages of peer to peer network**

* It is very simple/easy to setup
* It is less expensive to maintain
* It does not require a dedicated network administrator.

###### Disadvantages of peer to peer network

* It is not easy to administer
* Each user must be trained to perform administrative tasks
* It doesn‘t allow remote installation of software
* It lacks security due to absence of a server.
* It’s not appropriate for big networks.

**Clients-server networks**

This is a type of local area network that consists of a central computer (the server) on which other computers (clients) are connected. The central computer providing services to client computers

**Network server**

A server (Network server) is a computer on a network that controls and manages the network resources, making them available to its clients (computers connected to it).

**Client Computer**

Client computer is one that is connected to the Network server in order to receive services from the server.

**Advantages of Client-server network**

* It offers a reliable centralized storage and sharing of files.
* It ensures high security of the network through access controls installed on the server.
* It is easy to monitor the network performance on the server
* It is easy to solve network problems.
* It’s cheap to install software because it is done on the server.

**Disadvantages of client-server network**

* It’s expensive to setup.
* It require extra expenses of buying a server computer
* It require extra expenses to hire a network administrator
* In case the server fails to work, the whole network comes to a standstill

**Metropolitan Area Networks (MAN)**

A metropolitan Area network is a computer network that connects two or more local area networks together which are geographically separated but in the same city. Routers, switches and hubs are the hardware devices used to create metropolitan Area network.

**Wide Area Networks (WANs)**

A wide area network is a network that connects two or more local area networks together over a large geographical distance such as across districts, cities or regions.

**Network topology**

Topology is a way of laying out network. There are two categories of topologies that is, physical topology and logical topology. The physical topology is the physical arrangement of cables, computers, and other peripheral devices in relation to each other on a network and Logical topology is the method used to pass information between workstations on a network.

**Types of physical network topologies**

* Bus network topology
* Ring network topology
* Star network topology
* Mesh network topology

**Bus topology or linear bus topology**

Bus network topology is one that consists of a main, central cable known as the backbone with a terminator at each end of it where all devices on the network are connected to the main/central cable.

**Advantages of Bus topology**

* It is less expensive than a star topology.
* It is good for smaller networks.
* It is easy to add new workstations on the network.
* Requires less cable length than a star topology.

**Disadvantages of Bus network**

* It is Limited in size and speed
* The Entire network shuts down if there is a break in the main cable.
* Difficult to troubleshoot.
* It is less secure since all data is transmitted down one main cable.
* Transmission slows down as more work stations are added.

**Ring topology**

This is a topology where all devices on the network are connected to one another in the shape of a closed ring or a loop to form a ring. Data travels in form of a packet from one device to another device around the entire ring in only one direction until it reaches its final destination.

**Advantages of ring topology**

* It is a Very orderly network.
* It is Cheaper to install than star network.
* High speed can be achieved as each workstation can boast the signal.

**Disadvantages of a Ring network**

* One malfunctioning workstationcan create problems for the entire network
* Removing, additions and changes of devices affect the entire network.
* Network adapter cards are expensive.

**Star topology**

A star topology is a type of topology designed where computers and other devices are connected directly to a central network hub or switch thus forming star.

**Advantages of Star topology**

* It is suited for large networks
* It is easy to expand the network without any negative effects
* If one cable or station fails, the entire network is not affected
* It is easy to install, maintain and troubleshoot.
* No disruptions to the network when connecting or removing devices.

**Disadvantages of Star topology**

* Breakdown of the Hub becomes a single point of network failure
* It’s expensive to set up due to increased cabling costs and the need for a hub.
* If the cable fails the workstation cannot receive data via any other route.
* Requires more cable length than a bus topology.
* If the hub or switch fails, nodes attached are disabled.

**Mesh topology**

This is a network where each device has its own connections to all other devices on the network. It provides each device with a point-to-point connection to every other device in the network.

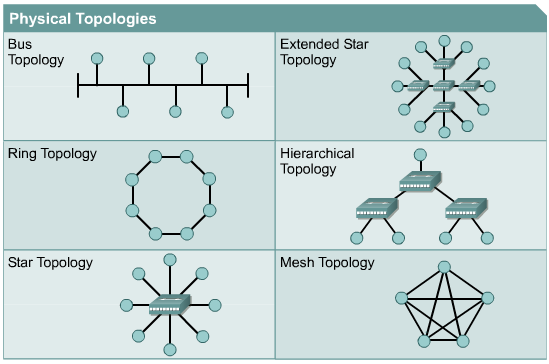
**Advantages of Mesh topology**

* A mesh topology provides much protection from interruption of service because of possible routes through the network.
* Mesh networks provide redundancy.

**Disadvantages Mesh topology**

* Much cabling is needed hence expensive
* Not easy to troubleshoot in case of failure
* Not easy to install.
* It is the most expensive and difficult to maintain topology.
* The damage of at least one cable or device may damage the network.

**Summary of physical types of topologies**



**Logical topology (Media Access Method)**

Logical topology is how computing devices access the network and send data over the network. The logical topology of a network determines how the devices communicate across the medium.

There are four commonly used media access methods:

1. Ethernet,
2. Token Ring,
3. Packet switching
4. Circuit switching

**Ethernet**

Ethernet is a type of local area network technology that uses coaxial cable or special grades of twisted pair wires. Ethernet is also used in wireless LANs.

**Token Ring**

A network topology developed by IBM in which computers access the network through token-passing.

A Token is a special packet that contains data and acts as a messenger/carrier between each computer and device on a ring topology.

**Packet switching**

This is a data transmission technique which involves transmitting and routing of messages by dividing the electronic message/data into packet segments and sending them rapidly and sequentially over a network channel which are then reassembled into the original message at their destination.

**Circuit switching**

Circuit switching is a method of communicating in which a dedicated communications path referred to as a circuit or channel is established between two devices through one or more intermediate switching nodes before communication between the devices takes place.

**Summary Chart:**

|  |  |  |
| --- | --- | --- |
| **Physical Topology** | **Common Cable** | **Common Protocol** |
| **Linear Bus** | **Twisted pair, Coaxial & fiber** | **Ethernet** |
| **Star** | **Twisted pair & Fiber** | **Ethernet** |
| **Star-Wired Ring** | **Twisted pair** | **Token Ring** |
| **Tree** | **Twisted pair, Coaxial & fiber** | **Ethernet** |

**Factors to consider when choosing a network topology**

* Cost of installation.
* Number of computers and other devices to connect/size of the organization
* The architecture of the building to be used
* The purpose of the network
* Distance of connectivity
* Safety provisions of the network
* Personnel provisions/technicalities involved
* Ease in accessing the network
* Length of cable needed.
* Cable type to use that is the most common cable in schools is unshielded twisted pair.

**Factors that affects the rate of transmission on a network**

**Frequency and bandwidth of the medium that is to say** he higher the frequency, the wider the bandwidth, the more data will be sent over a medium and vice versa.

**NB; Bandwidth**; is the difference between the highest frequency and the lowest frequency.

**Line configurations** data moves faster in a point – to point than in a multipoint.

**Serial and parallel transmission;** data transmission is faster in parallel transmission than in serial.

**Direction of transmission**

This can be simplex, half duplex or full duplex therefore data travels faster in simplex than in any others transmission.

**Transmission mode**

This can be either asynchronous or synchronous. In asynchronous transmission, data is sent one byte (character) at a time. In synchronous transmission, large quantities of data are transmitted at ago at regular intervals therefore data travel faster in asynchronous transmission than in synchronous transmission

**Network topology**

There may be data collisions in a bus topology hence slowing down the network. A star and ring topology has fewer collisions and usually runs faster.

**Capacity of hardware in the network**

The speeds of hubs, switches and NICs will greatly determine the speed of the network.

**The server**

The amount of RAM installed in the server and the speed of the hard disk greatly affects the speed of the network.

**Qn .Differentiate between standalone computers and networked computers**

A standalone computers are computers that are not connected to a network and is capable of performing the operations in the information processing cycle meanwhile Networked computers are computers designed specifically to connect to a network especially the internet.

**TOPIC 11: INTERNET AND WORLD WIDE WEB**

**Definition of internet**

**Internet** is an International/global interconnection of computer networks.It is described as a network of networks; it is a global network where all LANs (both big and small) worldwide are interlinked.

**Characteristics of internet**

* It is made up of numerous networks worldwide.
* There is No organization that has a direct control over the Internet.
* It is dynamic; ever changing.
* It offers very many services
* The Internet size and technology is growing at a very faster rate.

**Advantages of using internet**

* The biggest benefit offer by internet is that it is a source of all valuable information
* It offers a speedy communication through the use of e-mail
* Internet has facilitated social networking that is the sharing of information to people across the world such watsap, face book etc.
* As far as learning is concern, internet has now become a part of education in the sense that online studies, e-library, uploading educational information’s, and research can easily be carried out using internet.
* All business deals can be carried in the internet like transaction of money that is e-money, online reservations, online ticket booking for movie, online shopping, advertising for goods and services.

**Disadvantages of using internet**

* Internet leads to the loss of information that is information crucial to us or any important files can be easily taken by the hackers.
* Internet offers high possibility for the fraudulent people to easily access personal details such as names, address, credit card number etc.
* Networked computers connected to internet are susceptible to virus attack
* Internet allows any body to access and download unnecessary materials and pornographic photos and films hence leading to moral degeneration in the society
* Internet had led to social disconnection in the society by reducing face to face interaction for example the use of social media such as face book, what sap, twitter etc.
* Internet has also led to the distribution of unwanted bulky e-mails (spamming)

**Uses of internet as a learning tool**

* Used to search for information using search engines and directories
* Internet services like E-mail system can use in collaborative learning.
* Enables distance learning for those who are unable to attend collage/school physically.
* Internet has offer discussions over educational chat rooms.
* It has enables downloads of relevant documents.
* Using computer assisted assessments (CAA) for online exams.
* It enables the use of electronic libraries and textbooks.
* It has led to development of skills of research and communication by the students and teachers.
* Assignment are received, done and sent across the network by the students.
* Internet has enabled video conferencing to share views and ideas among students and teachers.

**Advantages of internet in schools**

* A lot of information is obtained which is not available in a single textbook.
* Updated or current information is obtained since internet is dynamic.
* Learning is fun and easy as internet is exciting due to the multimedia content used.
* It offers different sources of information hence a variety of opinions on a topic.
* It is a quick way of getting information where internet connection is good.
* Related topics are easily accessible through hyperlinks.
* Students are able to attend virtual classes.
* Different skills such as typing, use of web browsers, problem solving, E-mail are developed through the use of the Internet.
* Instant or timely communication is done by use of the E-mail system.

**Disadvantages of the Internet in schools**

* Since there in no Information control over the Internet, all sorts of bad information’s are accessed by students
* There is no privacy of information and information piracy is common.
* A lot of indecent materials are published on the Internet.
* Internet is not readily available to most people.
* It is expensive to access drains school resources.
* Time is lost where Internet speed is low due to poor links, hardware and congestion.
* Time wasting occurs when students easily stray into non-essential materials.
* Computer viruses can easily spread over the Internet.
* Difficult to obtain information relevant to a particular level of a student.
* It is possible to obtain contradictory information.
* Many students and teachers do not have adequate skills of accessing the Internet.

**Internet protocols**

The Internet Protocol (IP) is a method or a standard set of rules for sending and receiving data from one computer to another on the internet.

**Qn. Differentiate between Network protocols and internets protocols.**

A Network protocol is a set of rules and procedure (standard) for connection and data transfer between devices on a network meanwhile Internet Protocol (IP) is a method or a standard set of rules for sending and receiving data from one computer to another on the internet

**Examples of internet protocols**

* Transmission communication protocol/internet protocol (TCP/IP)
* Hypertext transfer protocol (HTTP)
* File transfer protocol (FTP)

**Basic requirements for internet connection**

* Host computer
* Communication hardware such as Modem and router.
* Communication Software such as a Web browser and internet protocols
* Communication media such as VSAT, wireless antenna or telephone line.
* Internet Service provider (ISP)

**Internet service providers**

Internet service provider (ISP) is a company that provides connection and services for accessing and using the Internet at a monthly subscription fee.

**Examples of internet service providers in Uganda**

* Airtel Uganda limited
* Mtn Uganda limited
* Africel Uganda limited
* Uganda telecom limited (UTL)
* Roke Uganda limited
* Infocom Uganda limited etc

**Services offered by internet service providers**

* They offer internet access and internet connectivity
* They do system analysis and consultancy
* They provide network servicing and maintenance
* They Provide network security
* They provide other services like website hosting
* They facilitate domain name registration
* They provide electronic mail services
* They facilitate video conferencing

**Factors to consider when choosing an internet service provider (ISP)**

* Setup costs
* Experience for both ISP and client.
* Auxiliary/additional services offered by the ISP e.g. E – Mail/telephone SMS facility.
* Availability of online help.
* Compatibility of ISP software with yours e.g. windows Vs Linux Vs Wang.
* Efficiency/Effectiveness of ISP devices e.g. speeds of ISP modem, Bandwidth etc.
* Available technology.
* Technical support.
* The fee charged for the services. What is the monthly fee for the service?
* Coverage. Does the ISP coverage reach your location or not?

**Factors that determines the internet access speed**

* The amount of bandwidth allocated by ISP.
* Connection technologies used
* The volume of traffic. The more the number of people logged on the internet the slower the internet speed.
* Adapter or modem speed used.
* The processing speed and amount of RAM of the host computer
* Type of data/files being downloaded or uploaded.
* The age of computer set, whether clone or new

**Services offered by internet communication**

* E-mail
* World wide web (WWW)
* Chat rooms
* Mailing lists
* Instant messaging (IM)
* Internet Relay chat (IRC)
* News group
* Message board (Internet forum)
* Voice over internet protocol (VoIP)
* Usenet
* Video conferencing
* Internet telephony
* Telnet
* Electronic commerce (e-commerce)
* Social network
* Internet banking (e-banking)
* Search Engine (Web Search)
* Wikis and blogs
* Discussion boards
* Portals.
* Podcasts.
* E- Libraries
* Electronic waste (e-waste)
* **Chat rooms**

A chat room is an online service that permits users to chat (converse) with each other through the internet, traditionally in plain text only by typing lines of text in the computer.

* **Mailing lists**

Is a collection of names and addresses used by an individual or an organization to send material to multiple recipients. Mailing lists are generally used as a means to share content, news and any product- or service-related information with subscribers that is when a message is sent to a mailing list, every person in the list will receive a copy of the message.

* **Instant messaging (IM)ï**

Instant messaging (IM) technology is a type of online chat that offers real-time text transmission over the Internet between two parties, when each user chooses to complete a thought and select "send".

* **Internet Relay chat (IRC)**

Internet Relay Chat (IRC) is a text based communication system that allow people to chat with one another on the [Internet](https://simple.wikipedia.org/wiki/Internet" \o "Internet) within the chart room. It allows people within the same chart room to send and receive instant message

* **News group**

A newsgroup also called a discussion group is an online discussion forum accessible through [Usenet](https://techterms.com/definition/usenet) about a particular subject.To participate in a discussion, a user sends a message to the news group and other users in the news group read and reply to the message.

* **Internet forum (Message board)**

An Internet forum, or message board, is an [online](https://en.wikipedia.org/wiki/Online" \o "Online) discussion site where people can hold conversations in the form of posted messages. They differ from [chat rooms](https://en.wikipedia.org/wiki/Chat_rooms" \o "Chat rooms) in that messages are often longer than one line of text, and are at least temporarily archived.

* **Voice over internet protocol (VoIP) or Internet telephony**. This is a web based telephone service that allows a user to talk to others for just a cost of the internet connection.
* **Usenet**

Usenet is a collection of newsgroups where the users can post messages and these posted messages are distributed via Usenet servers.

* **Video conferencing**

Video conferencing is a mean of conducting a session/conference/discussion using a set of telecommunication technologies between two or more participants at different geographical locations by using [computer](https://www.webopedia.com/TERM/C/computer.html)[networks](https://www.webopedia.com/TERM/N/network.html) to transmit audio and [video](https://www.webopedia.com/TERM/V/video.html)[data](https://www.webopedia.com/TERM/D/data.html).

* **Electronic commerce (e-commerce)**

**E**-**commerce** (electronic **commerce** or EC) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the internet. These business transactions occur either as business-to-business, business-to-consumer, consumer-to-consumer or consumer-to-business.

**Business – to - Consumer (B2C)**

This is a business transaction model that applies to any business that sells its products or services to consumers over the internet.

###### Consumer – to Consumer (C2C)

This is a model that applies to sites primarily offering goods and services that assist consumers interacting with each other over the Internet.

###### Business – to – Business (B2B)

Is the e – commerce which consists of businesses buying from and selling to each other over the internet.

###### Consumer – to – Business (C2B)

This transaction applies to any consumer that sells a product or service to a business over the internet.

**Examples of transactions conducted online**

* Online shopping
* Online banking

###### Advantages of e – commerce

* It operates 24 hours a day hence transactions can be conducted at any time.
* Information about a product can be changed and be available quickly (i.e. it is easy to update)
* It gives immediate feedback
* Allows manufacturers to buy and sell directly hence avoiding the cost of middlemen.
* Customers can easily compare prices.
* It allows business to gather customer information, analyze it and react appropriately.
* Businesses have access to millions of people with internet connections.
* It widens the market easily.
* Distribution costs for information is reduced or completely eliminated
* **Social network**

This is a dedicated website which enables users to post comments, and communicate with each to share their interests, ideas, stories, photos, music, and videos with other registered users via interment by using social media such as face book, Twitter, Instagram, what sap etc.

* **Search Engine (Web Search).**

Search engine is a service that allows Internet users to search for content via the World Wide Web (WWW). A user enters keywords or key phrases into a search engine and receives a list of Web content results in the form of websites, images, videos or other online data.

* **Wikis and blogs**

**A wiki** is a website that allows multiple users to create, modify and organize web page content in a collaborative manner via their web browsers. Wiki documents can be modified by anyone with access to the website, examples of a wiki is the Wikipedia free online encyclopedia.

**A blog** is a website where users post journal-like entries that are displayed in reverse chronological order, with the most recent posting at the top of the page.

* **Portals.**

A Web portal is a specially designed [website](https://en.wikipedia.org/wiki/Website" \o "Website) that brings information from diverse sources, like emails, online forums and search engines, together in a uniform way.

* **Electronic waste (e-waste)**

Electronic waste is a term abbreviated as "E-Waste” refers to the disposal of broken or obsolete electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of re-use such as televisions, stereos, copiers and fax machines.

**Netiquette**

Netiquette is defined as a set of rules for acceptable online behavior. Similarly, online ethics focuses on the acceptable use of online resources in an online social environment.

**Rules of netiquette**

* Keep messages brief. Use proper grammar, spelling and punctuation.
* Be careful when using sarcasm and humor as it might be misinterpreted.
* Be polite. Avoid offensive language.
* Read the message before you send it.
* Use meaningful subject lines
* Avoid sending or posting flames, which are abusive or insulting messages.
* Avoid sending spam, which is the internet‘s version of junk mail.
* Do not use all capital letters which is equivalent to SHOUTING!
* Read the FAQ (Frequently Asked Questions), if one exists. Many news groups and web pages have a FAQ.
* Do not assume material is accurate or up-to-date. Be forgiving of other’s mistakes.
* Never read someone’s-mails.

**Differentiate between internet, intranet and extranet**

**Internet**

Internet is a worldwide collection of networks linked together. It is the largest Wide Area network in the World.

**Intranet**

Intranet is a private internal network of an organization whose resources are accessed by only people within that organization.

**Extranet**

Extranet is a private network owned by a single organization but has limited connections to the network of one or more other organizations. It is an intranet that extends to authorize users outside the company. Organizations allow customers and suppliers to access their intranets.

**Differences between an Intranet and Internet**

* Intranet is private while Internet is public.
* Intranet has geographical boundaries while internet has no boundaries.
* Intranet only shares company information while Internet has all sorts of information
* Intranet is single source information while Internet is multisource information.
* Intranet is controlled by an organization while there is no control over the Internet.

**Electronic mail (e-mail)**

Electronic Mail is a method of exchanging messages between people using electronic devices. In order for any two users to receive or exchange E-mail messages online, they must have E- mail addresses.

**E-mail address** is a set of characters such as letters, number, symbols etc that are required to send and receive emails

###### Parts of an email address

###### Email address consist of four parts;

###### Usrname

###### @

###### Domaun name

###### Top level domain

###### Consider this example: tobbyecat@gmail.com

###### Username: tobbyecat

###### @: at (The one that separate the user name and the domain name)

###### Domain name: gmail

###### Top level domain: .com

**Username**:

A username is a name that uniquely identifies someone account on the email server that handles the email.

###### @:

###### It separates username or account name from the name of the mail server.

**Domain name:**

It consists of Email server name (gmail) that comes after the @ symbol in an email address

**A top level domain:**

A top level domain refers to the last segment of a **domain** name, or the part that follows immediately after the "dot" symbol. Itusually a three letter extension which shows the type of a particular organization.

**Examples of top level domain names**

|  |  |
| --- | --- |
| **Top-level domain name** | **Purpose of host** |
| **.com** | a business or commercial enterprise (trying to make money) |
| **.ac** | an academic institution or a university |
| **.edu** | host is an educational institution |
| **.org** | a non-commercial organization |
| **.mil** | Military |
| **.net** | for network(ISP) |
| **.gov** | Government |

|  |  |
| --- | --- |
| **Country-codes** | **Country** |
| .ca | Canada |
| .au | Australia |
| .nz | New Zealand |
| .ug | Uganda |
| .uk | United Kingdom |
| .za | South Africa |

###### Email message

An email message is a text, typically brief and informal, that is sent or received over a computer network including attachments (such as image files and spreadsheets).

**Email message comprises of the 3 parts, these are:-**

1. Message Header
2. Message Body
3. Message Envelope

**Message Headers**

The message headers contain information concerning the sender and recipients. Generally, headers contain the following information:

**From:** Contains the E-mail address and the actual name of the sender of the e-mail message.

**To:** Contains the E-mail address and the actual name of the recipient of the e-mail message

**Date:** Contains the date and time when the E-mail message is sent.

Cc: Carbon Copy

Contains another E-mail address (es) of recipients to whom the same copy of the E- mail message is being sent.

The recipients of such an E-mail are able to view the e-mail addresses of all the other recipients who have received the same mail.

Bcc: Blind Carbon Copy

Contains another E-mail address (es) of recipients to whom the same copy of the E- mail message is being sent.

But the recipients of such an E-mail are not able to view the e-mail addresses of all the other recipients who have received the same mail.

**Subject:** Contains the main theme/topic/content of the mail message.

**Message Body**

The email body is the main part of an email message. It contains the message's text, images and other data (such as attachments)

**Message Envelope**

When email is handed over from the sending computer to the receiving computer the sending computer declares a sender address (the “envelope-from", which is the address that bounce messages will go to if delivery fails at a later stage) and one or more recipient addresses ("envelope-to").

**Notice:** For one to create email address and access to e-mail via the Web, he or she is required to enter a username and a password.

**A username** is a name that uniquely identifies someone account on the email server that handles the email.

**A password** is a private combination of characters associated with the user name that allows access to certain computer resources or to a network. The password helps ensure that unauthorized users do not access the computer.

###### Characteristics of a good password

* Should be easy to remember but not too obvious.
* Should be longer, at least eight characters.
* Should have a combination of mixed case letters and digits.
* Should be easy to type without looking at the keyboard.

**Avoid the followings with a password**

* Using **your name**, birthday, ID card number or telephone number.
* A password of all digits or all the same letter.

###### Safeguarding your password

* Do not share your password with others
* Do not write down your password
* Change your password frequently

###### Advantages of email

* It is very quick to communicate quickly with anyone on the Internet.
* It is a cheap means of transferring files.
* Other computer files can be attached to the email.
* Records and copies are kept automatically online.
* Can be picked up anywhere in the world.
* Can be sent at any time to its destination (it works24-7)
* You can deal with your email at a convenient time.
* You can send letters, notes, files, data, or reports all using the same techniques**.**

###### Disadvantages of an email

* + A computer and other hardware such as a modem are required hence expensive
  + It is not secure
  + It is easy to get on junk (useless) mail lists.
  + Some email systems can send or receive text files only.
  + It's possible to forge email.
  + It's difficult to express emotion using email.
  + In case of any error in the address, email cannot be delivered.
  + Email consumes a lot of time hence promoting laziness
  + Parcels cannot be delivered via email which limit its usability

**World Wide Web (www)**

The World Wide Web (abbreviated WWW or the Web) is an information space where documents and other web resources are identified by Uniform Resource Locators (URLs), interlinked by hypertext links, and can be accessed via the Internet. It is where all the Web pages, pictures, videos and other online content can be accessed via a Web browser.

**Common terms used in World Wide Web**

* Web page
* Web server
* Web master
* Hyperlinks
* Web publishing software
* Domain name
* Uniform Resource Locator (URL)
* Web browser
* Search engine
* Website

**A webpage**

A web page is an electronic document or files of information stored on the web /website that contain text, animations, audio, and video hyperlinks to other documents.

**A web server**

A web server is a computer that keeps and delivers web pages requested by users.

**A webmaster**

A web master is an individual person responsible for creating, managing and developing web pages and maintaining a website.

**Hyper links**

These are built-in links to other related documents, allowing users to quickly navigate from one document to another when clicked

###### Homepage

Home page is the first page (starting page) or the table of contents of a website. It is the software

**Web publishing software**

Web publishing software is specially designed software designed for creating web pages that contain text and multimedia elements. **Examples include**: Microsoft FrontPage, Macromedia Dreamweaver, Adobe Go Live, Adobe Page mill etc.

**Domain name**

A domain name is the address where Internet users can access a website. A domain name is used for finding and identifying computers on the Internet. A domain name can be any combination of letters and numbers, and it can be used in combination of the various domain name extensions, such as .com, .net and more.  **An example; www.bbc.co.uk**

**Name resolution**

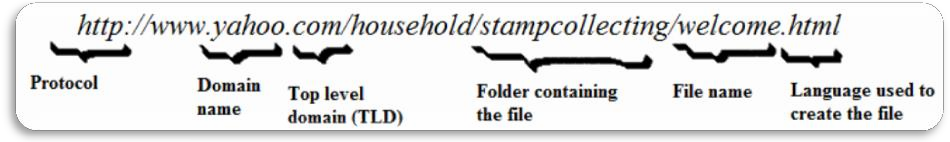
Name resolution is a technique that allows names to represent network addresses is called.

**Domain name system (DNS)**

Domain Name System (DNS) is a system on a computer that maps text names to IP addresses automatically. For example **[www.bbc.co.uk](http://www.bbc.co.uk)**

**Uniform resource locator (URL)**

**U**niform **R**esource **L**ocator and is defined as the global[address](https://www.webopedia.com/TERM/A/address.html) of [documents](https://www.webopedia.com/TERM/D/document.html) and other [resources](https://www.webopedia.com/TERM/R/resource.html) on the [World Wide Web](https://www.webopedia.com/TERM/W/World_Wide_Web.html).

Example: <http://www.yahoo.com/household/stampcollecting/welcome.html>

**Definition of a web browser (web Client)**

This is the software program used to access and view web pages.A Web browser is communication software designed to allow the user to access and view web pages (HTML documents) on the Internet’s World Wide Web.

**A browser** is a software application for retrieving, presenting and traversing information resources on the World Wide Web.

**Types of web browsers**

* Opera
* Google Chrome
* Mozilla Firefox
* Microsoft Internet Explorer
* Safari
* Netscape
* Sea Monkey
* Camino
* iCab
* Mozilla Suite
* Sunrise

**Functions of a web browser**

* To request for web pages from a web server when the user type in the uniform resource locator.
* The web browser helps the user to access information from the web server using the HTTP protocol over a network to communicate with the web server.
* It displays web pages on the screen.
* It is used for steaming video content over the internet.
* Displays multimedia content.

**The followings can be done using web browsers**

* View hundreds of millions of Webpages.
* Use mail clients to Send and receive e-mail.
* Download games, music and computer software.
* Chat
* Shop on line
* See and hear recorded broadcasts
* Participate in virtual conferences

**Search engines**

A search engine is software that allows one to search for web pages on the WWW by typing in a search query relating to the topic that one is searching for. A user enters keywords or key phrases into a search engine and receives a list of Web content results in the form of websites, images, videos or other online data.

**Different types of search engines**

**How search engines work**

* + 1. Type the key words in the search query in the search text box and presses ok button.
    2. The search engine will invoke a program that queries its database by collecting all the web pages it has access to.
    3. The results are returned to the user as a number of possible URL's ranked in priority, the top URLs are the ones with most occurrences of the query words or phrases used.

###### A website

A web site is a collection of web pages where information of a particular organization or company is stored.

**Basic types of websites**

* News websites
* Informational websites
* Online Business / marketing websites
* Wikis
* Online social networks
* Rating website
* Educational websites
* E- Commerce website
* Mobile device websites
* Blogs
* Personal websites
* Photo sharing websites

**Why people visit a web site**

1. To find information they need
2. To buy something online
3. To get various multimedia elements for entrainment
4. To be part of the community through social media
5. To complete a task

**Characteristics of a good web site**

* A web site must be supported by a reputable institution without bias in the information
* A website should be written at an appropriate level
* It should list the author and the appropriate credentials
* It should be well organized and the links should work well
* The information on the web page should be current
* The pages at the web site should download quickly and be visually pleasing and easy to navigate
* It should contain little advertising and be free of preconceptions

**Functions of a web site**

1. It acts as a source of information. It can be used in research to get information on the internet about advertisements, entertainment, etc.
2. It helps users or a particular organization to share knowledge and information over the internet
3. It provides motivations to the users of an organization
4. It encourages pride of ownership
5. It enhances communication and collaboration
6. It helps in storing important information for an organization.
7. It helps organizations in easy and quick advertisement of their products.
8. It enables organizations to upload and download information to and from the internet respectively.
9. It helps organizations to easily maintain and update the information about them quickly

**Importance of a web site to a school**

1. It is used for communication purposes. The school can reach out to a wider audience worldwide, for example, in school recruitment.
2. Used for mobilization of resources. The website can be used for resource mobilization as it can reach out to a wide supporting audience.
3. For advertising purposes. The website can provide general information about the school.
4. The website can provide a forum for discussion of issues concerning the school using blogs.
5. It can be used for teaching and learning in the following ways:

* The website can provide subject content notes to students.
* The website can present an opportunity for developing web designing technology skills for students directly involved.
* The school community can collaborate with other students worldwide for project based learning.

1. The website can provide a forum for students and teachers to collaborate with others elsewhere.
2. The site can provide a forum for parents and alumni feedback.
3. It can work as a depository (store) where student’s achievement data is posted for easy access by the stakeholders.
4. It can help teachers to collaborate with other teachers worldwide.
5. The site can be used to publish students and teachers work.

**Limitations of a web site to a school**

1. Websites are expensive to be constructed. Therefore, some institutions may not be in position to come up with one.
2. They require a lot of maintenance and update hence becoming expensive and time consuming.
3. They limit customers from directly interfacing with the business men. This makes customers to sometimes be cheated.
4. Very many people and organizations are creating websites with a lot of information which is not legitimate and some organizations lay the public through the websites.

A **rating site** is a [website](https://en.wikipedia.org/wiki/Website" \o "Website) designed for [users](https://en.wikipedia.org/wiki/User_(computing)" \o "User (computing)) to vote on or rate people, [content](https://en.wikipedia.org/wiki/Web_content" \o "Web content), or other things. Rating sites are typically organized around attributes such as physical appearance, body parts, voice, personality, etc.

**TOPIC 13: System Security, privacy and ICT Ethical Issues and Emerging Technologies**

**Computer security system**

Computer system security is the ability of a computer system to protect information and system resources with regards to confidentiality and integrity

**Forms of computer security system**

There are two forms or categories of computer security systems;

1. Physical security
2. Data security

In order to protect the physical equipment, the following physical security access control measures must be put in place;

* Use physical access controls such as locked doors and windows.
* Use cables to lock the equipment to desk, cabinet or floor.
* Install alarm systems to warn you in case of any intrusion
* Use passwords, and biometric devices.
* Install surveillance cameras to help you in easy monitoring of the hardware
* Putting up strong burglar poof doors and windows to avoid thieves
* Ensure that fire extinguisher is fixed in the computer lab in case of any emergency fire outbreak
* Consider installing a security alarm at a strategic point in case of a breakage.
* Do not welcome strangers into the computer room.
* Employing security guards to the entrance of the facilities

**Data security**

For data protection to be ensured the user must employ both hardware and software based security mechanisms such as;

* Keep a copy of your data off site in case of any firebreak.
* Make regular backups of critical data. A backup: is a duplicate of a file, program or disk that can be used if the original is lost, damaged or destroyed
* Protect data files by using password mechanism
* Install intrusion detection software to provide extra protection against hackers and other intruders.
* Use data masking. Data masking is the process of obscuring a specific data within a database table to ensure that data is maintain and sensitive information is not exposed to unauthorized user.
* Install reliable antivirus programs on your computer system and update it regularly.
* Use encryption mechanism. Encryption is the process of transforming plain text or data into cipher (unreadable) text that cannot be read by anyone other than the sender and the receiver. It is a process of covering readable data into unreadable characters to prevent unauthorized access.
* Install a firewall-The key defense against Internet attackers is an Internet firewall.
* Avoid e-mail Attachments from Unknown Sources.
* Avoid booting computers from infected floppies.
* Avoid downloading programs from unknown/unlicensed sources.

**Internet and network attack (hardware and software threats)**

Below are the most common and most damaging forms of security threats to network and Internet users and site operators:

* Malware
* Unwanted programs,
* Phishing and identity theft,
* Hacking and cyber vandalism
* Credit card fraud/theft,
* Spoofing (pharming)
* Denial of Service
* Sniffing, insider attacks,

**Defense against internet and network attacks**

* Use a firewall;this is a software program that monitors all incoming and outgoing network traffic and allows only the connections that are known and trusted.
* Use antivirus software and keep it up-to-date
* Don’t open unknown email attachments
* Make regular backups of important data
* Route information through a proxy server

Proxy servers are software servers that handle all communications originating from or being sent to the Internet, acting as a spokesperson or bodyguard for the organization.

* Install intrusion detection software;
* Encryption all important files

Encryption involves converting data into a form that cannot be easily understood by others.

* Use Biometric devices.
* Avoid booting computers from infected floppies.
* Avoid downloading programs from unknown/unlicensed sources.

**Malware**

Malware is software designed to infiltrate or damage a computer system without the owner's informed consent. Malware is a general term used by computer professionals to mean a variety of forms of hostile, intrusive, or annoying software/code. Examples of malware and malicious attacks include;

**Time bomb**

It is a program code that is activated when it detects a certain condition or event. These events can be famous days like Valentine, Fools day.etc.

Droppers

These are programs that have been written to perform useful tasks like compressing files, previewing video clips, etc. and in the process of performing those tasks; they introduce viruses in the system.

###### Bugs:

A bug is unintentional fault in a program that is normally misinterpreted as a real virus. Moat complex software in computer systems normally contains bugs. Minor bugs normally cause simple inconveniences while major bugs can cause loss of data

Adware

It is a program that displays an online advertisement in a banner or pop-up window on Web pages, email, or other Internet services.

Browser parasite

It is a program that can monitor and change the settings of a user‘s browser.

Spyware

It is a program placed on a computer without the user's knowledge that secretly collects information about the user e.g. email address, instant messages, etc.

Worms

A worm is a computer program that sits in the computer‘s memory, rewrites itself continuously into the memory until the system runs out of memory and crushes.

Trojan horse

It is a small program code hidden within legitimate software that continue to operate as legitimate software until at such a time that they are activated to cause trouble

Bots

Are a type of malicious code that can be covertly (secretly) installed on your computer when attached to the Internet.

**Computer virus**

A computer virus is a computer program that can copy itself and infect a computer without permission or knowledge of the user.

**Examples of computer viruses;**

* Multipartite Viruses
* Direct Action Viruses
* Boot Virus
* Directory Virus
* Macro Virus
* Polymorphic Virus
* File Infectors
* Network Virus

**Sources of computer virus**

1. Fake games
2. Through use of contaminated diskettes on several computers.
3. Through using pirated software.
4. Through using freeware and shareware from the internet.
5. Through software updates most especially over the internet or other networks.
6. Through sharing of data in a network.

**How computer viruses spread**

* Booting a PC from an infected medium such as a floppy.
* Executing an infected program.
* Opening an infected file.
* Viruses often travel via e-mail attachments.
* Via networking connection.
* Via file down loading: downloading of files from the internet can spread viruses to your computer.

**Symptoms of computer virus**

* The computer runs slower than usual.
* The computer stops responding, or it locks up frequently.
* The computer restarts on its own.
* Applications on the computer do not work correctly.
* Disks or disk drives are inaccessible.
* Strange error messages appears on the screen
* Strange sounds or music plays from the speakers unexpectedly.
* It shuts down unexpectedly or crashes frequently.
* It experiences memory problems or runs out of disc space.

**Effects of computer virus**

1. They take up computer memory used by legitimate programs.
2. They can result in system crashes and data loss.
3. They can prevent a computer from booting.
4. The computer may freeze
5. Files on the computer become corrupted
6. Failure to do print jobs
7. Computers may fail to save or accessing a file to save
8. A computer gives un usual sound
9. It becomes very slow in operation
10. Files go on missing/ cannot be seen
11. Expected files increase in size
12. The computer take time to respond to instructions

**How to control computer virus**

* Do not use media like diskettes, backup tapes, CDs from unknown sources.
* Scan all foreign media for viruses.

###### Install antivirus software;

###### Ensure that the anti – virus software is up to date;

###### Employ a firewall to protect networks;

###### Filter all email traffic

###### Scan internet downloads;

* Make regular backups of critical data.

**Computer crime**

Computer crimes are criminal activities which involve the use of information technology to gain an illegal or unauthorized access to a computer system with the intent of damaging, deleting, or altering computer data.

**Different forms (types) of computer crimes**

**Hacking** refers to unauthorized intrusion into a computer or a network. The person engaged in hacking activities is known as a hacker.

**Child pornography** - Making or distributing child pornography.

**[Cracking](https://www.computerhope.com/jargon/c/cracker.htm)** - Breaking or deciphering codes that are being used to protect data.

**Cyber terrorism** - Hacking, threats, and blackmailing towards a business or person.

**[Cyber bully or Cyber stalking](https://www.computerhope.com/jargon/c/cyberbul.htm)** - Harassing others online.

**[Creating Malware](https://www.computerhope.com/jargon/m/malware.htm)** - Writing, creating, or distributing malware (e.g., [viruses](https://www.computerhope.com/jargon/v/virus.htm) and spyware.)

**[Denial of Service attack](https://www.computerhope.com/jargon/d/dos.htm)** - Overloading a system with so many requests it cannot serve normal requests.

**Espionage** - Spying on a person or business.

**[Fraud](https://www.computerhope.com/jargon/c/computer-fraud.htm)** - Manipulating data, e.g., changing banking records to transfer money to an account.

**[Harvesting](https://www.computerhope.com/jargon/h/harvest.htm)** - Collect account or other account related information on other people.

**[Identity theft](https://www.computerhope.com/jargon/i/identhef.htm)** - Pretending to be someone you are not.

**Intellectual property theft** - Stealing practical or conceptual information developed by another person or company.

**[Phishing](https://www.computerhope.com/jargon/p/phishing.htm)** - Deceiving individuals to gain private or personal information about that person.

**[Salami slicing](https://www.computerhope.com/jargon/s/salami-slicing.htm)** - Stealing tiny amounts of money from each transaction.

**[Scam](https://www.computerhope.com/jargon/s/scam.htm)** - Tricking a person into believing something that is not true.

**[Spamming](https://www.computerhope.com/jargon/s/spam.htm)** - Distributed unsolicited e-mail to dozens or hundreds of different addresses.

**[Spoofing](https://www.computerhope.com/jargon/s/spoof.htm)** - Deceiving a system into thinking you are someone you really are not.

**[Unauthorized access](https://www.computerhope.com/jargon/u/unauacce.htm)** - Gaining access to systems you have no permission to access.

**Wiretapping** - Connecting a device to a phone line to listen to conversations.

**Sniffing:** The act of intercepting internet protocol packets while getting transferred on a network

**Eavesdropping:** The act of secretly listening to the private conversation of others without their consent

**Ethical issues in ICT**

Ethics is a set of moral principles that govern the behavior of a group or individual. Therefore, computer ethics is set of moral principles that regulate the use of computers. Some common issues of computer ethics include intellectual property rights (such as copyrighted electronic content), privacy concerns, and how computers affect society.

**Common ethical issues in ICT**

**Label issue**: Libel is the publication of a false statement that injuries one’s business or personal reputation.

**Plagiarism**: Plagiarism means using someone intellectual property such as ideas and written works and claim that ideas is yours

**Software piracy**: Software piracy refers to the act of installing a copy of software into your computer without authorization.

**Misuse**: Misuse is the use of the harmful acts such as hacking, spamming, cracking etc.

**Copyright infringement**: copyright infringement refers to the act of copying intellectual property without the written permission from the copyright owner.

**The rights owned by the owner of the copyright are:**

* The right to modify the work to create a new work
* The right to distribute the work to the public by sale
* The right to display a copy of the work directly to the public by posting it on the internet, or hanging it on public places.

**IT Codes of conduct**

Codes of conduct are written guidelines that help to determine whether a specific action is ethical or unethical.

**IT ethical codes of conduct**

* Don’t use a computer to harm other people.
* Don’t interfere with other people’s computer works
* Do not open people’s computer files without their permission
* Do not use a computer for stealing
* Do not use a computer to bear false witness
* Do not copy or use proprietary software for which you have not paid
* Do not use other people’s computer resources without their authorization
* Do not use other people’s intellectual property output
* Always use computer in a way that ensure consideration and respect for other people
* Think about the consequences of the program you are designing.

**Unethical IT codes of conduct**

* Modifying people’s information on the internet without authorization
* Selling someone information to other parties without the owner’s permission
* Using someone information or resources without authorization
* Stealing of computer software
* Sending or posting flames which are so abusive or insulting messages
* Invasion of privacy
* Using capital letters which is equivalent to shouting

**Definition of information accuracy**

**Information Accuracy** refers to the correctness of the output information**.**

**Definition of intellectual property rights**

Intellectual property is a category of property that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, and trademarks.

**A right** that is had by a person or by a company to have exclusive rights to use its own plans, ideas, or other intangible assets without the worry of competition, at least for a specific period of time.

## Types of intellectual property

## [Copyright](http://www.wipo.int/copyright/en/)

Copyright is a legal term used to describe the rights that creators have over their literary and artistic works. Works covered by copyright range from books, music, paintings, sculpture and films, to computer programs, databases, advertisements, maps and technical drawings.

## [Patents](http://www.wipo.int/patents/en/)

A patent is an exclusive right granted for an invention. Generally speaking, a patent provides the patent owner with the right to decide how - or whether - the invention can be used by others.

## [Trademarks](http://www.wipo.int/trademarks/en/)

A trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises.

**Definition of information privacy**

**Privacy** is the moral right of individuals to be left alone, free from surveillance or interference from other individuals or organizations, including the state.

**Information Privacy** refers to the right individuals, companies or organizations have to deny or restrict the collection and use of information about them.

A **cookie** is a small text file that a Web server stores on your computer that allows a site to track the actions of its visitors. A cookie resides on an individual’s hard drive, but does not interact with other information store on the system.

**Meaning of Emerging technologies**

**Emerging technologies** are technologies that are perceived as capable of changing the status quo. These technologies are generally new but include older technologies that are still controversial. Prediction suggest that with the rapid advancement in information and communication technology more new technologies and computer related devices are emerging up which will bring a lot of impacts in all aspects of life.

**Lists of Emerging technologies**

**Artificial intelligence**

Artificial Intelligence is a group of related technologies that attempt to develop machines to emulate human like qualities such as learning, reasoning, communicating, seeing and hearing.

**Digital Forensics**

Digital forensics also known as digital forensic science is a branch of [forensic science](https://en.wikipedia.org/wiki/Forensic_science" \o "Forensic science) encompassing the recovery and investigation of material found in digital devices, often in relation to [computer crime](https://en.wikipedia.org/wiki/Computer_crime" \o "Computer crime).

* [Internet of Things](https://www.zdnet.com/article/iot-helping-offshore-driller-gain-efficiencies/)
* Machine learning
* Robotic surgery
* Smart building
* Smart robot
* Virtual personal assistants
* Cloud computing
* Mobile computing

**Advantages of Emerging technologies**

* Easy Access to Information
* Encourages Innovation and Creativity
* Improved Communication
* Improved Housing and Lifestyle
* Improved Entertainment
* Efficiency and Productivity
* Convenience in Education
* Social Networking

**Disadvantages of Emerging technologies**

* Increased Loneliness
* Job Loss
* **Excessive dependency:**
* World Destruction/Advanced Weapons
* **High Maintenance costs**

**Digital Forensics**

Digital forensics also known as digital forensic science is a branch of [forensic science](https://en.wikipedia.org/wiki/Forensic_science" \o "Forensic science) encompassing the recovery and investigation of materials found in digital devices, often in relation to [computer crime](https://en.wikipedia.org/wiki/Computer_crime" \o "Computer crime).



**Figure:** A portable Tableau write-blocker

**Branches of Digital Forensics**

**Computer forensics**

Computer forensic is a branch of forensic related to the identification, preservation, collection, analysis and reporting on evidence found on computers, laptops and storage media in support of investigations and legal proceedings.

Mobile device forensics

It is a branch of digital forensics relating to recovery of digital evidence or data from mobile devices such as mobile phones, smart phones, SIM cards, PDAs, GPS devices, tablets and game consoles.

Network forensics

It is a branch of forensic concerned with the monitoring and analysis of computer network traffic from both LAN and WAN/internet, for the purposes of gathering information, collection of evidence and detection of intrusion in a network.

Database forensics

It is a branch of digital forensics relating to the forensic study of databases and their metadata. Investigations use database contents, log files and in-RAM data to recover relevant information.

**Advantages of Digital forensics**

* Digital forensics helps in recovery and investigation of materials found in digital devices
* It assists in securing confidential information that has been accessed by hackers.
* Digital forensic devices minimizes the cost and the time of investigations
* It reduces the cost of regulatory or legal requirements for disclosure of data
* Digital forensic blocks the opportunity for malicious insiders to cover their tracks

**Disadvantages of Digital forensics**

* The privacy of the client may be compromised in some cases.
* It is also possible that some sensitive data or information to the client may be lost in order to find the evidence.
* There are also chances of introduction of some malicious programs such as viruses or worms in the computer system that may corrupt the data at a later stage of time.
* It is also possible that the hardware of the device system is damaged physically.
* Data may be corrupted / modified in the process as they try to retrieve for lost or hidden data.

**Careers in ICT industry**

This refers to the job titles or professions related to information communication (ICT). The high growth rate in ICT industry has resulted into many new kinds of jobs and careers.

**Different careers offered by ICT industries**

These careers include;

Computer operators

**Responsibilities**

* Entering data into the computer for processing
* Keeping up-to-date records of all information processing activities

Computer technician

Is a person responsible for the maintenance, upgrading and repairing of computers and related devices

###### Responsibilities

* Troubleshooting computer hardware and software related problems
* Assembling and upgrading computers and their components
* Ensuring that all computer related accessories such as printers, modems, storage media and devices are in a good working condition.

Systems analyst

This is a person who is responsible for analyzing a company‘s needs or problems, then designs and develops a computer based information system to help prevent the problem.

###### Responsibilities

* Reviewing the current manual or redundant information system and making recommendations on how to replace it with a more efficient one.
* Working with programmers to construct and test the system.
* Coordinating training for users on how to use the new system

Computer programmer

**Responsibilities**

* Writing application programs or system programs.
* Customizing commercial application package to suite the organization needs.
* Testing, debugging, installing and maintaining programs developed or customized for the organization.

Software developer (engineer)

Software developer is a person who is skilled in software development and technical operation of computer hardware.

###### Responsibilities

* Developing system and application software
* Developing user and technical documentations for the new software.
* Maintaining and updating the software to meet day to day requirements while overcoming challenges.

Computer engineer

Computer engineer is a technical person with skills and knowledge of designing and developing computer components such as storage devices, motherboards, and other electronic components.

**Responsibilities**

* Determine the electrical power requirement of each computer component.
* Re – engineer computer components to enhance its functionality and efficiency.
* Design and develop engineering and manufacturing computer controlled devices such as robots.

Information systems manager

**Responsibilities**

* He controls, plans, staffs, schedules and monitors all the activities of the ICT department in the organization.
* Test the impact that an alternative course of action might have on the business.
* Ensures that all tasks in the IT department are done correctly and on time in order to support business planning, control and decision making process.
* Prepares budgets for the ICT department.
* Keeps the department‘s inventory records up-to-date.
* Managing the human resource within the ICT department.

Database administrators (DBA)

**Responsibilities**

* Designing and developing database applications for the organization.
* Setting up security measures needed to control access to data and information.
* Keeping the database up-to-date by adding new records, modifying or deleting un necessary records.

Computer trainer/Instructor/Teacher

Due to the dynamic nature of computers and information technology, there is a high demand for qualified ICT trainers.

###### Responsibilities

* Training people on how to use a computer and various application programs.
* Developing training reference materials
* Guiding learners on how to acquire knowledge through carrying out research.
* Advising the learners on the best career opportunities in the broad field of ICT.
* Preparing learners for ICT examinations.

Website administrator /Webmaster

**Responsibilities**

* Developing and testing websites
* Maintaining, updating and modifying information on the websites to meet new demands by the users.
* Monitoring the access and use of internet connection by enforcing security measures.
* Downloading information needed by an organization or institution from the internet websites.

Computer graphics designer

This is a professional responsible who designs and creates either graphics or 3D animations for software programs, games, movies by people. This person must have a good understanding of graphic software’s such as Adobe Photoshop, Adobe Illustrator, etc.

**Network administrator**

**Responsibilities**

* This is a professional person responsible for designing, setting up and maintaining a network
* Monitoring the network resources
* Troubleshooting network related problems

Secretary

A secretary is a person who uses computers to keep all the necessary information instead of keeping paper files