Topic 7
Computer Networks

BY:

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Computer networks

- What is a ***computer network***??

  - A computer network is a system of interconnected computing devices connected using data transmission media

Describe the various elements that make up a network

- **Devices**

  These are used to communicate with one another (Receivers & transmitters)

- **Medium**

  This is how the devices are connected together

- **Messages**

  Information that travels over the medium

- **Rules**

  Governs how messages flow across network

Need or Rationale for computer networks

- Cutting down costs on would be shared peripheral devices
- Enhance cooperation
- Improve cooperate image
- Enhance security of data/information and devices.
- Improve/enhance communication as unnecessary staff movements are eliminated as documents get wired

Nature or forms of computer networks

Networks can be classified basing on;

- Network coverage in terms of distance
- Number of people or devices a network interconnects
- Nature of technology being used to transmit data across the network.

Hence;

- Local area networks (LAN)
- Metropolitan area network (MAN
- Wide area network (WAN)
- Personal area network (PAN)
- Home area network
- Wireless Local area network (WLAN)

1. Local area networks (LAN)

What is a Local Area Network (LAN)?

- This is a network that spans/interconnects computers within a very close or small area. For example a network interconnecting computers on an office building, or school campus.

Ice breaker 1:

- Be inspired to learn additional real practical skills (e.g. art & design, ICT, music and drama, decorations, digging, knighting, hair dressing, tailoring, and new languages – Chinese, French, Arabic, German, Luo, RR, Swahili, …….
- Maintain good/health relationships with;
  - Parents,
  - School mates
  - Church or mosque members
  - Village mates. ***Guard against those who might want to take advantage of your being good.***
- Belong, team play and network – build a community of practice. Internet, Skype, face-book, twitter, u-tube, etc. "we are smart when we listen. We're smarter when we share." Queen Rania of Jordan

LAN Models

LANs can assume any of the following designs, forms or models;

- Peer-to-peer LAN model
- Client-server LAN model
- Wireless LAN model

a. Peer-to-peer LAN Model

- This is a LAN where there is no computer that manages other computers on the network.
  - It is a network without a server.
  - It is a network where all computers on the network are peers.
  - It is not ideal for more than ten (10) connections for efficiency and effectiveness.

Advantages of Peer-to-peer LAN model

- It is cheaper to setup and manage. Why????
- It is the most ideal for homes and very small offices. Why???
- Does not require additional specialized network administration software.
- Does not require a dedicated network administrator. Why????
- Ease upgrade of programs and files.

Qn.

To what extent is the internet a peer-to-peer network???????

Disadvantages of Peer-to-peer LAN model

- It is not very secure as users connect freely without any substantial system restrictions. It is not ideal for organizations whose activities need a lot of security.
- Its efficiency and effectiveness reduces as more computing devices get connected.
- It is limited to very small organizations and homes
- In peer-to-peer, the total bandwidth of the network increases as the number of peers increase.

b. Client/Server LAN Model

- This is a network with one or a few computers assigned with a responsibility of managing other computers on the network.
- The computer with software that manages other computers on a network is ***called a server***. While the other computers being managed **are called *clients*.**
- Therefore, ***a server*** is a software that manages network traffic ***downloads*** and ***uploads***.
- ***Client-server*** networks are common in ***commercial internet cafés***

Forms of servers include;

- ***Web server:*** Manages internet users requests for web pages.
- ***File server:*** Manages data file uploads and down loads on the network.
- ***Application server:*** Manages application programs on the network.

Functions of a Server

- Administration of client computers like scheduling their activities.
- Security of files and applications.
- Managing printer Jobs.
- Data banking or backup.
- Managing data uploads and downloads.

Advantages of client-server network models

- More flexible as it can accommodate as many computers and devices as the user can afford.
- It is very secure as the ***server*** provides ***centralized control*** of resources, and the network administrators are always in charge.
- ***It eases data and software updates & scalability*** since they are usually in a centralized place in client server networks.
- It is ideal for all sorts of organizations. Small, medium or large.

Disadvantages of client-server LAN Models

- Work can be on a standstill while the server is down/spoilt.
- It is a bit expensive to setup and maintain. Why???
  - **Through services of an expensive professional administrator.**
  - **Expensive networking devices like servers.**
  - **Etc**

Disadvantages of client-server LAN Models Cont'd

- ***Congestion in Network*** **:** Too many requests from the clients may lead to congestion or overload leading to server break-down.

c. Wireless LAN (WLAN) model

- In a WLAN model computing devices are interconnected using specialized networking wireless technology using broadcast radio and cellular radio like;
  - Bluetooth
  - Infrared
- WLAN is typical of mobile communication devices.
- **Broadcast radio** distributes radio signals over long and short distances.
- **Cellular radio** is form of broadcast radio used for mobile communications
  - A **cellular telephone** is a telephone device that uses high-frequency radio waves to transmit voice and digital data messages

WLAN application areas;

- Communication between mobile devices.
- Control and security of appliances & premises (like doors, cars, gates, etc.)
- Networking of devices.

WLAN Technologies & connectivity

1. What is Bluetooth???

- It is a technology that allows ***short-range*** radio waves transmission of data between ***paired Bluetooth devices***.
- Device pairing establishes a relationship for the devices to communicate.

2. What is *infrared??*

- It is a technology that allows ***close-range*** radio waves transmission of data between ***paired infrared devices***.

NB:

With changes in technology Bluetooth and infrared technologies are being enhanced to interconnect devices across cities and towns

Next

WLAN Technologies & connectivity Cont'd

3. Wi-Fi:

Refers to any network environment that allows devices to exchange and share data and other resources wirelessly conforming to the standards of the Institute of Electrical and Electronics Engineers (IEEE) – 802.11.

WLAN Technologies & connectivity Cont'd

Most of the WLAN devices use IrDA, RFID & WAP technology to communicate.

What are IrDA, RFID, and Wireless Applications Protocol (WAP)?

Radio Frequency Identification (RF

This technology uses radio signals to Communicate with a tag placed in an object

IrDA (*(Infrared Data Association)* **)**

specification allows data to be transferred wirelessly via infrared light waves

Click to view video

Wireless Applications Protocol (

This software allows wireless mobi devices to access Internet

WLAN Technologies & connectivity Cont'd

- What are Ethernet and token ring?

Ethernet: This is a technology allows computers to contend for access to network
If two computers send data at the same time, a collision occurs might occur forcing the computers resend the data again

Token ring technology controls access to network by requiring devices to pass a special signal, called token

Click to view Web Link, click Chapter 8, Click Web Link from left navigation, then click Ethernet below Chapter 8

Next

WLAN Technologies & connectivity Cont'd

- What are TCP/IP and 802.11?

TCP/IP (Transmission Control Protocol/Internet Protocol) : This is a standard or technology that allows data to be transmitted by breaking it down into small transmittable pieces (or *packets*) and loading it onto the transmission media.

NB:

Packet switching is the process of breaking down a big or huge block of data into small segments called packets for faster transmission across a network

802.11 is a family of standards for wireless LAN data transmissions

Next

Advantages of wireless networks:

- **Mobility – If one has a device that picks the network** access/connectivity can be available throughout the area covered by the network. It can be a (school, shopping mall, train/bus, airplane, etc.
- **Faster setup** - If your computer has a wireless adapter, locating a wireless network can be as simple as clicking "Connect to a Network" - in some cases, devices can be configured to connect automatically to networks within range.
- **Cost efficiency -** Setting up a wireless network can be much more cheaper than buying and installing cables.
- Wireless networks make offices look smarter than those littered with network cables.
- **Expandability** - Adding new computers to a wireless network is as easy as turning the computer on (as long as you do not exceed the maximum number of devices).

Disadvantages of wireless networks:

- **Security threats – Wireless networks can easily be hacked into. Hence need for b**eing careful. Being vigilant. Protecting your sensitive data with backups, isolate private networks, provide strong ***encryption and passwords,*** and monitor network access traffic to and from your wireless network. Data privacy on a network can be compromised through;
  - **Hacking**
  - **Cracking**
  - **Tapping/eavesdropping**
  - **Phishing**
  - **Pharming**
  - **Piracy Sabotours**
- **Signal Interference -** Because wireless networks use radio signals and similar techniques for transmission, they are susceptible to interference from lights, electronic devices or bad weather.
- **Inconsistent connections -** Wireless connections are not as stable as those done through dedicated cables. Signal strength keeps on fluctuating.

Network Intranet and Extranet

- What is an **intranet??**

An ***intranet*** is a Local Area Network that uses internet standards or protocols to relay or transmit data across the network.

An intranet is a private network but it uses internet standards like IP address to locate resources on the network

What is an **Extranet??**

An ***extranet*** is an intranet which is accessed by the company's customers, suppliers or government agencies.

Next

2. Metropolitan area network (MAN)

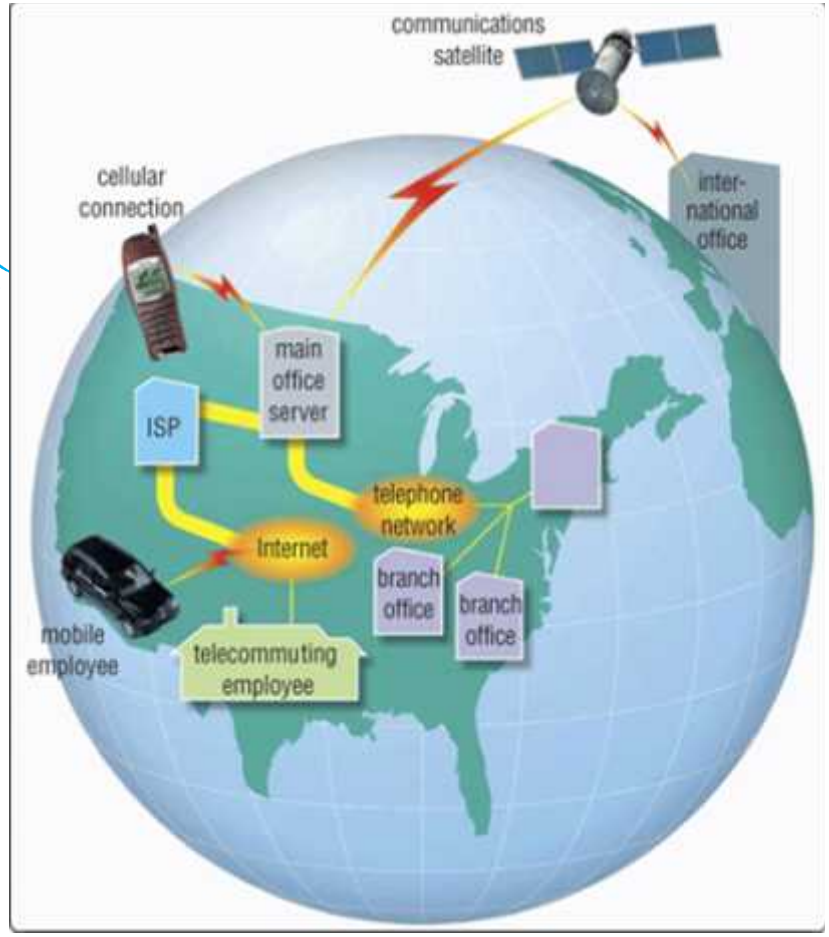
- This is a network that spans or interconnects computers in a city, town, or urban area.
- MANs usually cover a single geographical area like a district, municipality, region or state.

3. Wide area network

- What is a Wide Area Network (WAN)?

- **A WAN is a network that spans or interconnects computers and local area networks (LANs) across large geographical areas using many types of media**

- **Internet is the world's largest WAN**



p. 290 Fig. 8-8

Next

4. Home/Personal Network (PAN)

- What is a home network?
  - **A network of multiple computers connected at a very personal level**
  - **PANs usually** interconnect a couple of ***people*** within some close range.

Next

Advantages of networking

- **Down sizing and reduced operational cost through**;
  - Sharing devices like printers saving money on individual computers.
  - Cheaper network software licenses than computer licenses for standalone computers.
- **It promotes cooperation** amongst workers through sharing of files, and devices. Therefore, devices are ours NOT mine or yours.
- **Better and improves communication and collaboration** which in turn fastens decision making.
- **It eliminates unnecessary time wasting** through unnecessary staff movements plus troubleshooting and installation of software on several stand alone computers.
- **It connects persons to the outside world** and can keep organizations well updated with happenings in the outside world.
- **Networking improves device, data and software security** through administrative server software on networks.

Advantages of networking

- Flexibility in file access as users can log-on to a computer from anywhere on a network to access files.
- **Networking improves data management and consistence**. With computer networks data backups, storage, retrieval, & updates are easy with centralized servers. Necessary changes can easily be made.
- **Networks have promoted research** as a lot of information is available on computer networks. They even ease access to common databanks.
- Increased storage capacity as files can be dropped on any computer on the network for storage.

NB:

- What is a **wireless access point or Hot spot**?

This is a central communications device that allows computers and devices to transfer data wirelessly among themselves or to wired network

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Next

Ice Breaker 2:

- The wind of opportunity is blowing your door back open.
- Fill your self-esteem basket so high that come rain or sunshine, nothing blows it.
- Be good ambassadors. We shall be the proudest and happiest when you succeed here and in life.

"Five stages of wisdom: Silence, Reflection, Imitation, Experience, and Sharing."

Solomon Ibn Gabirol

Disadvantages of networking

- ***High initial installation and maintenance costs*** for cabling, other networking devices and software.
- There is a ***risk of organisation work getting to a standstill*** in cases of network break down.
- **Viruses transmission:** Networks are one of the major platforms for virus transmission.
- **Risk of information tapping & hacking:** Lots of security measures and vigilance are required to protect data kept on computer networks.

How Networks Impact Daily Life

- They describe the foundation, characteristics and purpose of popular communication media such as, IM, Wikis , Blogs, Podcasting, and Collaboration Tools
  - Instant messaging (IM)

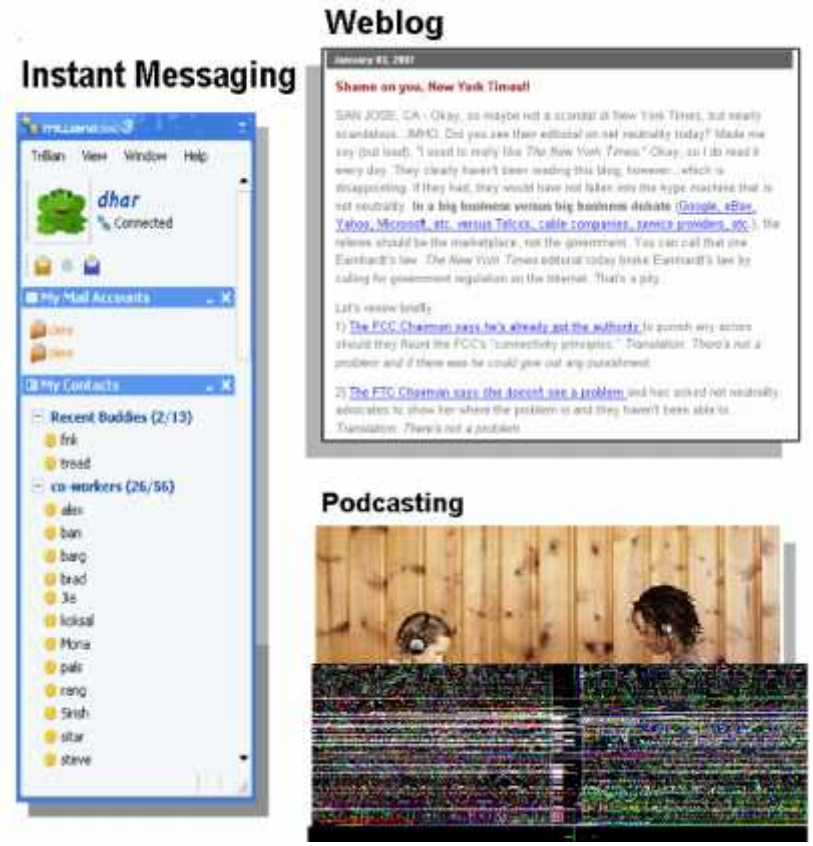
Real time communication between 2 or more people based on typed text.

  - Weblogs (Blogs)

Web pages created & maintained by an individual

  - Podcasting

Website that contains audio files for downloading.



How Networks Impact Daily Life Cont'd

Wikis

- Wikis are web pages that groups of people can edit and view together.
  - Whereas a blog is more of an individual, personal journal, a wiki is a group creation.

Characteristics/parameters of a good computer network

- Speed
- **Consistence/reliability parameter**. This describes the predictability of the network.
- **Security parameter**. This describes the ease with which strangers can access network information. Also looks at network susceptibility to network spasms, hackers and crackers.
- **Coverage parameter**. A good network must be able to reach all its intended spots with ease.
- **Recovery parameter**. This defines the easy for restoring the network to its operational level following some failure.
- Performance. This is measured in terms of network throughput and response time.
- **Expandability /Flexibility**. This defines networks ability to grow or change with minimal disturbances to the users and applications. Also defines networkers ability to run different applications and platforms.

NETWORK TOPOLOGIES

By Matovu K. David

Network Topologies

Network Topology refers to the physical layout of a network. It is the way how different ***nodes*** in a network are connected to each other and how they communicate.

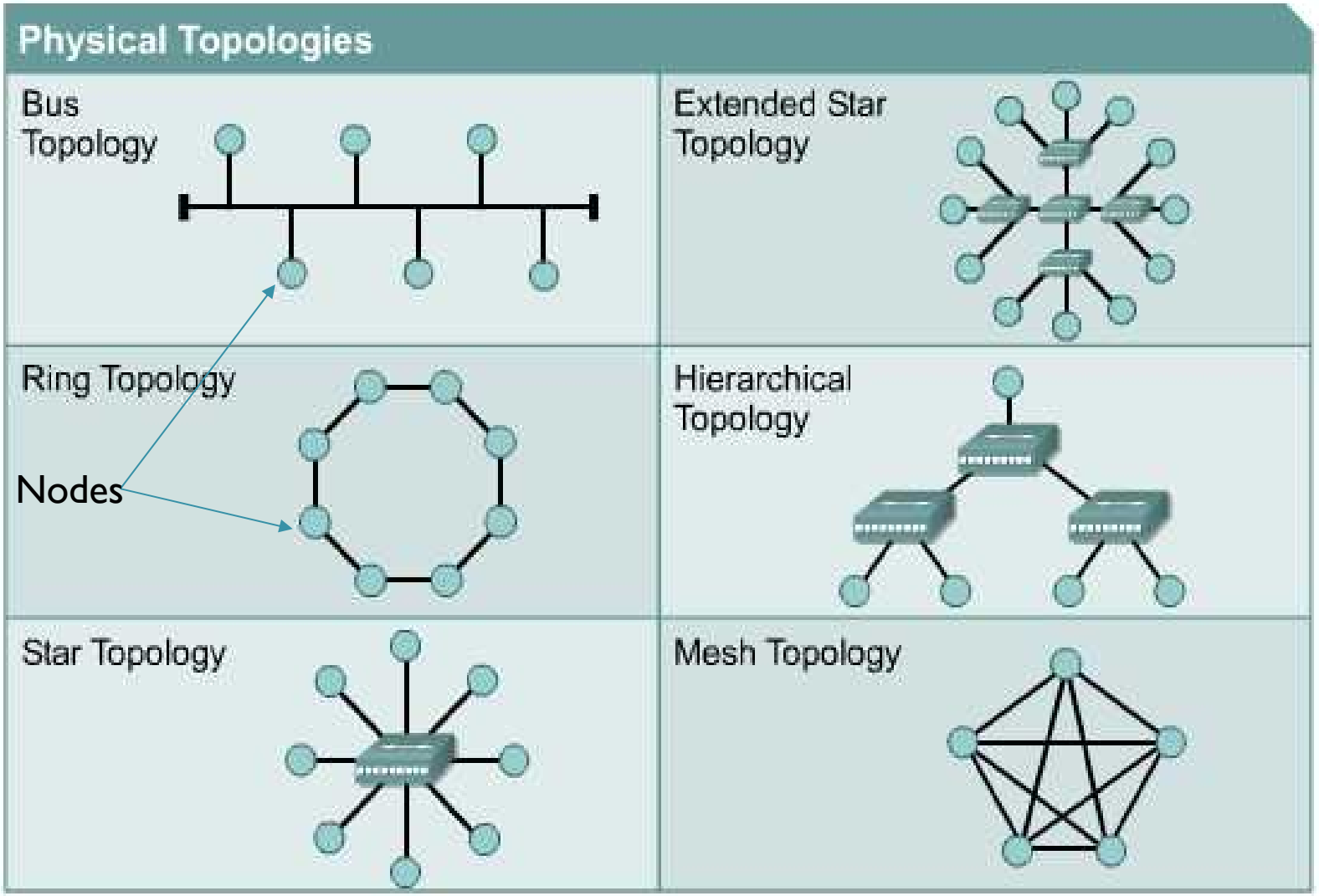
A node is any device connected to a network, including the server, computers, telephones, and other devices.

Technically topology has got two parts. That is;

1. One component of the topology is the ***Physical topology***, which is the actual physical layout of the wires/cables or media interconnecting the networked devices.

2. The other component of the topology is the ***Logical topology***, which defines how the media is accessed by the hosts for sending data.

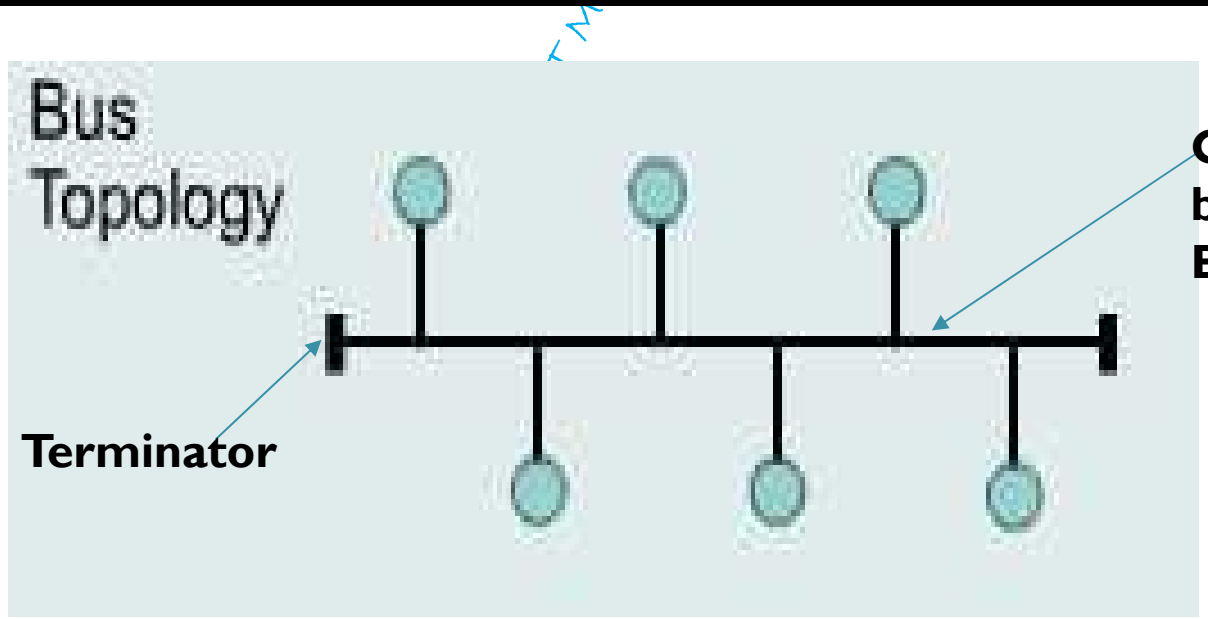
Physical Topologies



Bus Topology

A bus topology uses a single backbone cable that is terminated at both ends.

All the hosts connect directly to this backbone.



Advantages of Bus

- Easy to extend and implement.
- Less expensive than star topology due to less footage cable at no network hubs.
- Cost effective as only a single backbone cable is used
- Cable faults are easily identified
- Weight reduction due less wiring within the backbone

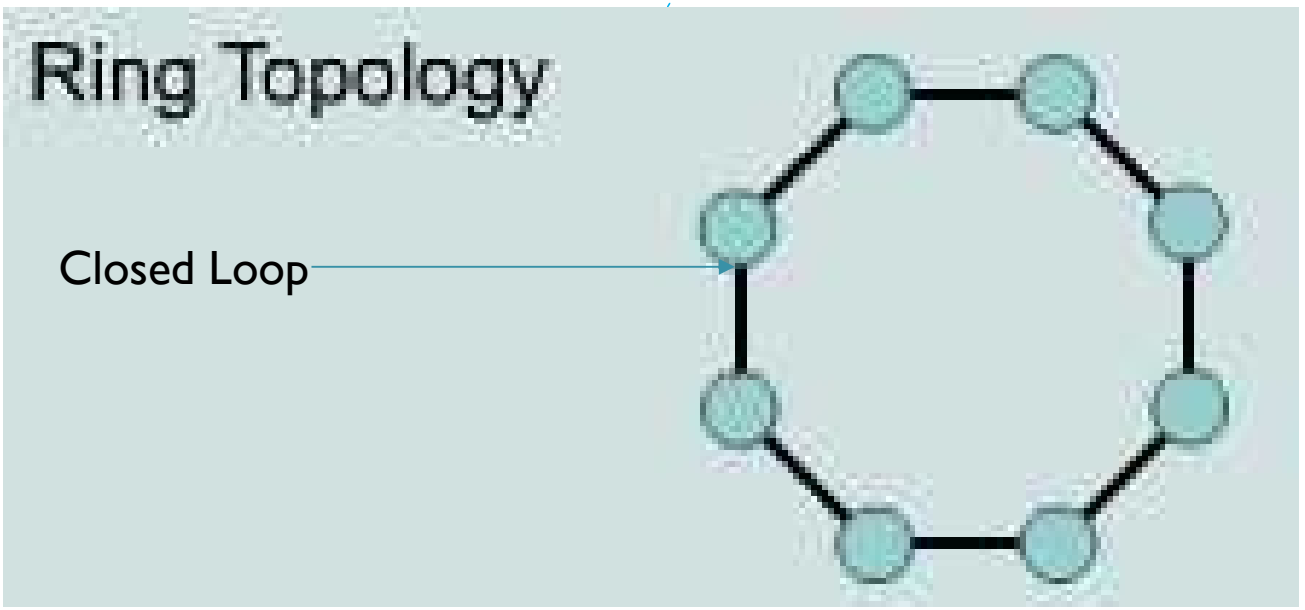
Disadvantages of Bus topology

- If there is a fault on the network (backbone), the entire network goes down.
- Its difficult to troubleshoots

Ring Topology

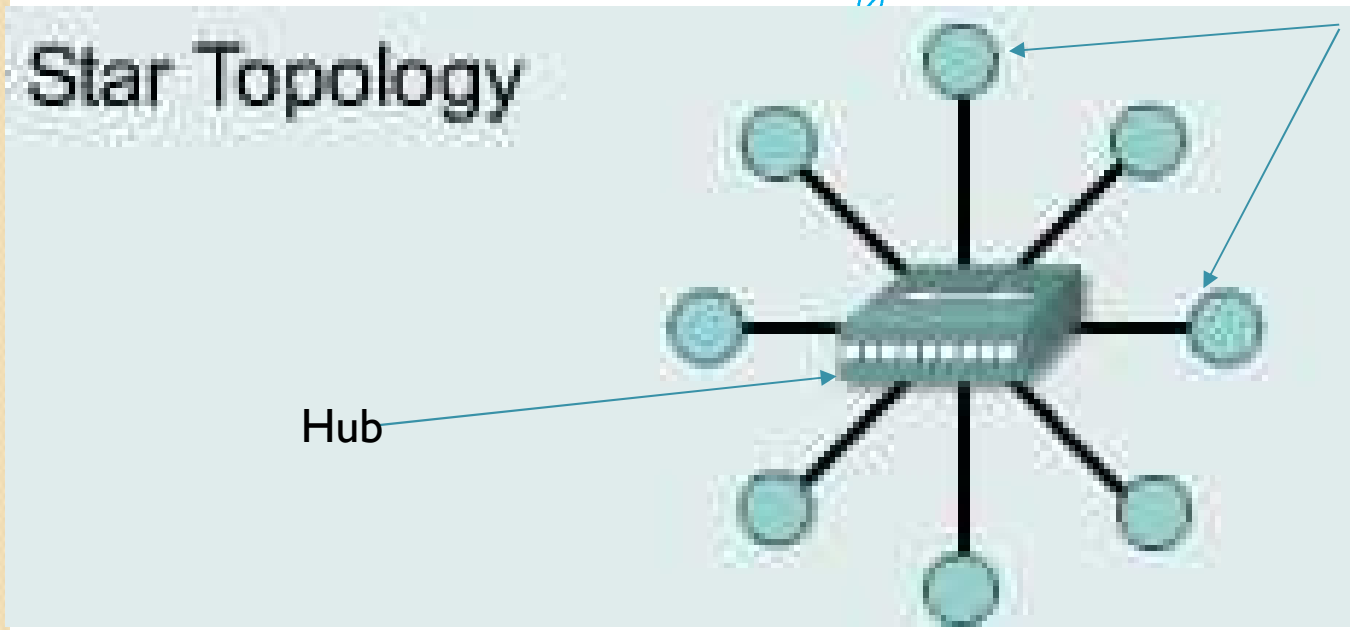
A **ring network topology** links all nodes together in a circular chain forming a closed loop. One host connects to the next and the last host to the first.

This creates a physical ring of cable.



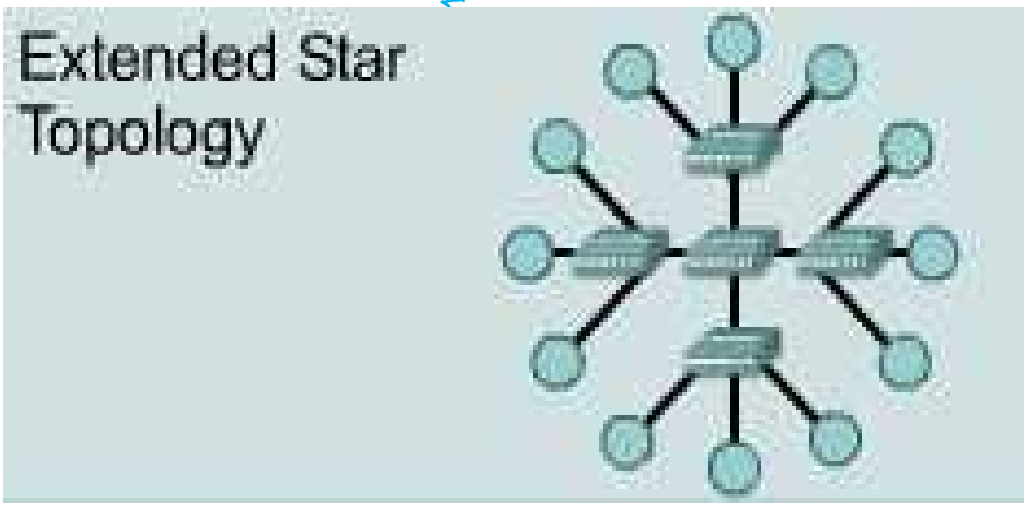
Star Topology

A star topology connects all cables to a central point of concentration. The central point of concentration is the hub.



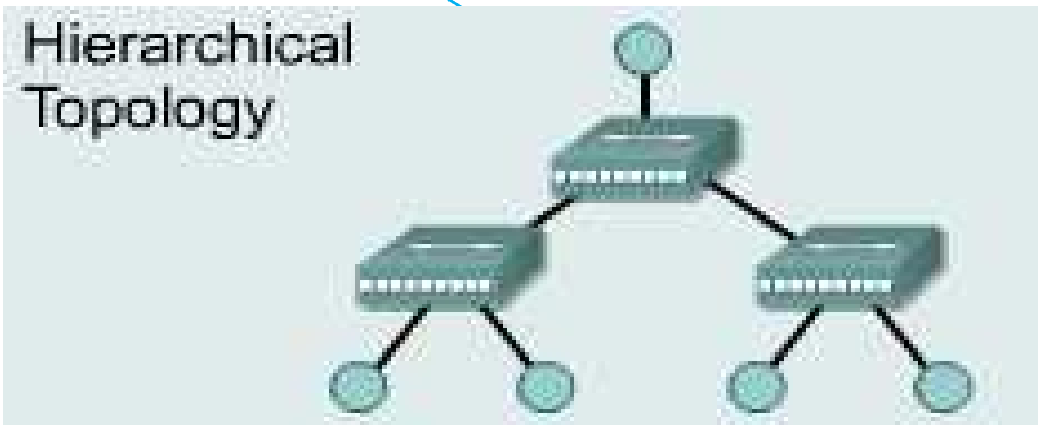
Extended Star Topology

An extended star topology links individual stars together by connecting the hubs and/or switches. This topology can extend the scope and coverage of the network.



Hierarchical Topology

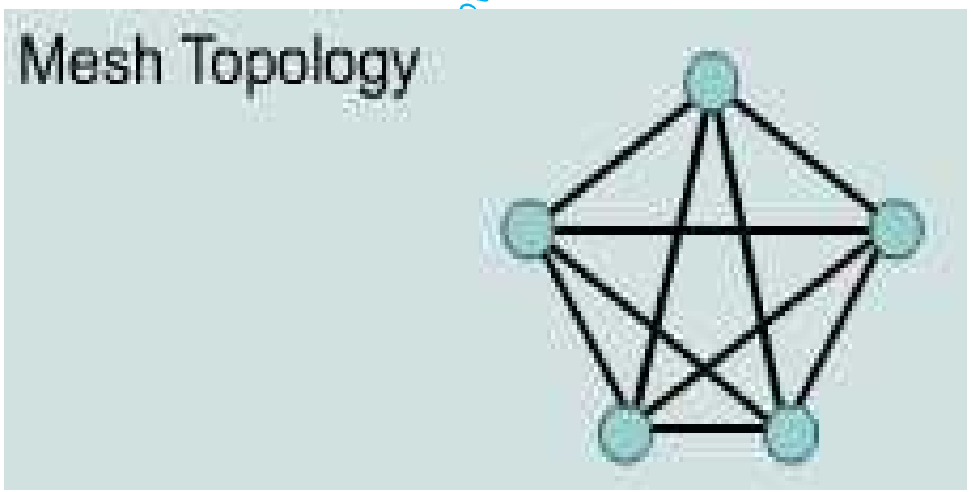
A hierarchical topology is similar to an extended star.



Mesh Topology

A ***Mesh topology*** is one where each computer or node on the network has got its own direct line the every node on the network.

It is implemented to provide as much protection as possible from interruption of service.
Each host has its own connections to all other hosts. Although the Internet has multiple paths to any one location, it does not adopt the full mesh topology.



Revision Exercise - 1

State Advantages and Disadvantages of:

a. Mesh Topology
b. Hierarchical Topology
c. Extended Star Topology
d. Star Topology
e. Ring Topology
f. Bus Topology

Revision exercise - I

1. **What is the difference between;**
   a) Computer communication and computer network
   b) Intranet and extranet technology
   c) Email and the internet
   d) Internet and world wide web (WWW)
2. **Briefly describe;**
   a) Four forms or types of networks
   b) The three LAN models
3. **State four components of an e-mail message window**
4. **Give three limitations of using e-mails as means of communication**
5. **Explain the following fields used in e-mail accounts:**
   a) CC
   b) BCC
   c) Compose
   d) Drafts
   e) starred
6. **State three netiquette guidelines for electronic mail users**

Revision exercise - I

7. Who is an Internet Service Provider (ISP)
8. Give four examples of ISPs in Uganda.
9. Give five services provided by ISP's in Uganda
10. State five services provided on the internet.
11. State five factors that affect data transmission speeds across networks.
12. Explain the nature of crimes committed by some internet users
13. State how crimes committed by internet users can be averted.
14. Distinguish between the following;
    a) Domain name and an IP address
    b) Analogue from digital signals
    c) Modulation from demodulation
    d) Serial transmission from parallel transmission
    e) Physical from wireless transmission media
15. Give any three factors to consider when choosing transmission media

Revision exercise - I

16. State four elements of a data transmission model
17. What is data transmission media?
18. With the help of examples give the difference between guided and unguided data transmission media.
19. Outline the advantages and disadvantages of <u>Guided transmission media:</u>
20. State the functions of the following protocols;
    a) TCP
    b) UDP
    c) SMTP
21. Explain the following terms as related to world wide web
    a) Web browser
    b) Search engines
    c) Web server
    d) Home page
    e) Marquee
22. Give three examples of web authoring software