

SECTION 7. COMMUNICATION SYSTEMS



LEARNING OBJECTIVES

- *Learn about different ICT systems.*
- *Study the basics of networking*
- *Describe networks*
- *Learn and use phrasal verbs common in ICT*
- *Learn and use future forms*

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1. COMMUNICATION SYSTEMS

Telecommunications refers to the transmission of signals over a distance for the purpose of communication. Information is transmitted by devices such as the telephone, radio, television, satellite, or computer networks. Examples could be two people speaking on their mobile phone, a sales department sending a fax to a client, or even someone reading the teletext pages on TV. But in the modern world, telecommunications mainly means transferring information across the Internet, via modem, phone lines or wireless networks.

Because of telecommunications, people can now work at home and communicate with their office by computer and telephone. This is called teleworking.

It has been predicted that about one third of all work could eventually be performed outside the workplace. In call centres, assistance or support is given to customers using the telephone, email or online chats. They are also used for telemarketing, the process of selling goods and services over the phone.

Digital TV and radio

In recent years, TV and radio broadcasting has been revolutionized by developments in satellite and digital transmission. Digital TV Is a way of transmitting pictures by means of digital signals, in contrast to the analogue signals used by traditional TV. Digital TV offers interactive services and pay multimedia - that is, it can transmit movies and shows to TV sets or PCs on a pay-per-view basis. It is also widescreen, meaning programmes are broadcast in a native 16:9 format instead of the old 4:3 format. Digital TV provides a better quality of picture and sound and allows broadcasters to deliver more channels.

Digital Terrestrial TV is received via a set-top box, a device that decodes the signal received through the aerial. New technologies are being devised to allow you to watch TV on your mobile. For example, DMB (Digital Multimedia Broadcasting) and DVB-H (Digital Video Broadcast-Handheld) can send multimedia (radio, TV and data) to mobile devices.

Audio programs (music, news, sports, etc.) are also transmitted in a digital radio format called DAB (Digital Audio Broadcasting).

Mobile communications

Thanks to wireless connectivity, mobile phones and BlackBerrys now let you check your email, browse the Web and connect with home or company intranets, all without wires.

The use of GPS in cars and PDAs is widespread, so you can easily navigate in a foreign city or find the nearest petrol station. In the next few years, GPS chips will be incorporated into most mobile phones.

Another trend is wearable computers. Can you imagine wearing a PC on your belt and getting email on your sunglasses? Some devices are equipped with a wireless modem, a keypad and a small screen; others are activated by voice. The users of wearable technology are sometimes even called cyborgs! The term was invented by Manfred Clynes and Nathan Kline in 1960 to describe cybernetic organisms - beings that are part robot, part human.

2. Networks

A network is a number of computers linked together to allow the sharing of resources. In the simplest explanation, networking is just computers talking to each other. They do this by sending data packets using various protocols and transmission mediums such as ethernet cable or Wi-Fi connections. Computers must also know how to find other computers on the network. To put it briefly, every computer on the network needs a unique address so messages know where to go after they are sent.

Networks exist for many reasons including:

- distributed computing in a client-server or peer-to-peer networking architecture
- centralized data security and authentication
- elimination of risk of computer downtime.
- combining computers into a single domain to facilitate groupware applications and system administration tasks communication and fun!

As you may have read in books or seen in movies, security considerations play a large role when designing networks. Technology such as firewalls can both block and filter unwanted network traffic. Virtual private networks (VPNs) are used to connect remote users to office networks without jeopardizing security. VPNs use strong data encryption to hide data as it is moving between routers over the Internet.

Networking is not something you can master in a week or even a month. Hundreds of books have been written about the subject and many more hundreds will come in the future as technologies mature and evolve. If you work on networks for a living, you are called a network engineer, and you will probably take certification exams by networking companies such as Cisco.

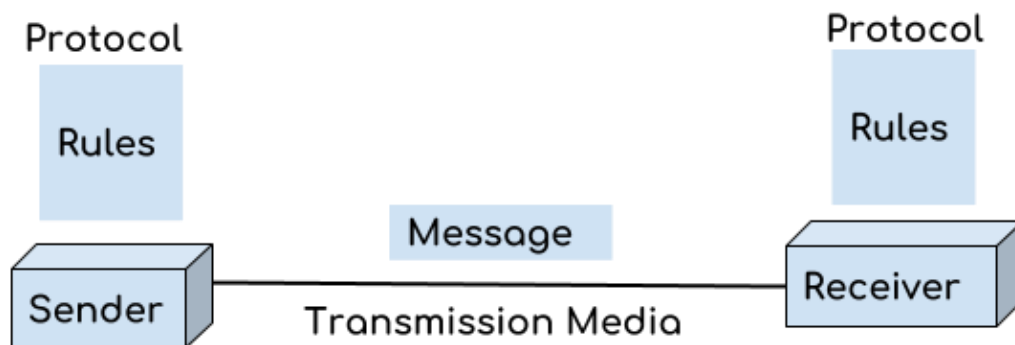
There are other kinds of networking as well which are not always between PCs and servers. An example is Bluetooth technology, which is optimized for networking between common consumer electronics such as mobile phones, mp3 players, and similar devices.

Computer Network

A computer network is a group of devices connected with each other through a transmission medium such as wires, cables etc. These devices can be computers, printers, scanners, Fax machines etc.

The purpose of having computer network is to send and receive data stored in other devices over the network. These devices are often referred as nodes.

There are **five basic components** of a computer network



Message: It is the data or information which needs to be transferred from one device to another device over a computer network.

Sender: Sender is the device that has the data and needs to send the data to other device connected to the network.

Receiver: A receiver is the device which is expecting the data from other device on the network.

Transmission media: In order to transfer data from one device to another device we need a transmission media such as wires, cables, radio waves etc.

Protocol: A protocol is a set of rules that are agreed by both sender and receiver, without a protocol two devices can be connected to each other but they cannot communicate. In order to establish a reliable communication or data sharing between two different devices we need set of rules that are called protocol. For example, http and https are the two protocols used by web browsers to get and post the data to internet, similarly smtp protocol is used by email services connected to the internet.

Advantages and disadvantages of networks

Advantages

- Sharing devices such as printers saves money.
- Site (software) licences are likely to be cheaper than buying several standalone licences.
- Files can easily be shared between users.
- Network users can communicate by email and instant messenger.
- Security is good - users cannot see other users' files unlike on stand-alone machines.
- Data is easy to backup as all the data is stored on the file server.

Disadvantages

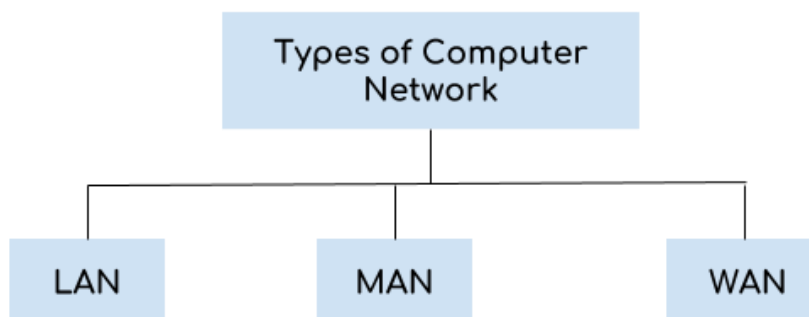
- Purchasing the network cabling and file servers can be expensive.
- Managing a large network is complicated, requires training and a network manager usually needs to be employed.
- If the file server breaks down the files on the file server become inaccessible. Email might still work if it is on a separate server. The computers can still be used but are isolated.
- Viruses can spread to other computers throughout a computer network.
- There is a danger of hacking, particularly with wide area networks. Security procedures are needed to prevent such abuse, e.g. a firewall.

Network types

Networks are classified according to different criteria:

- Geographical area: PANs (Personal Area Networks) typically include a laptop, a mobile phone and a PDA; LANS cover a building; MANS (Metropolitan Area Networks) cover a campus or a city; WANs (Wide Area Networks) cover a country or a continent.
- Architecture: in a client-server network, a computer acts as a server and stores and distributes information to the other nodes, or clients. In a peer- to-peer network, all the computers have the same capabilities — that is, share files and peripherals without requiring a separate server computer.
- Topology, or layout: in a bus network, all the computers are connected to a main cable, or bus. In a star network, all data flows through a central hub, a common connection point for the devices in the network. In a ring network, all devices are connected to one another in a continuous loop, or ring.
- Network protocol: This is the language, or set of rules, that computers use to communicate with each other. Networks use different protocols. For instance, the Internet uses TCP/IP.

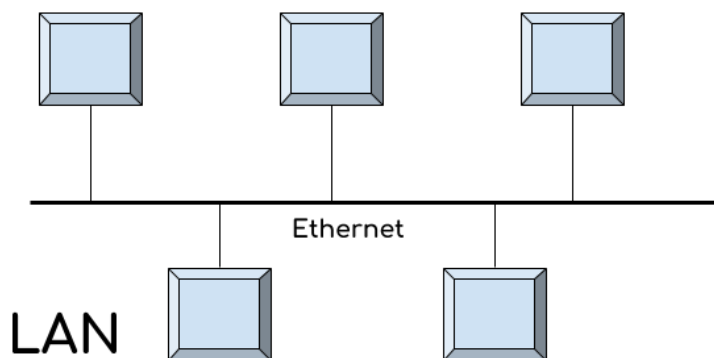
Types of geographical Computer Network



There are mainly three types of computer networks based on their size:

1. Local Area Network (LAN)
2. Metropolitan Area Network (MAN)
3. Wide area network (WAN)

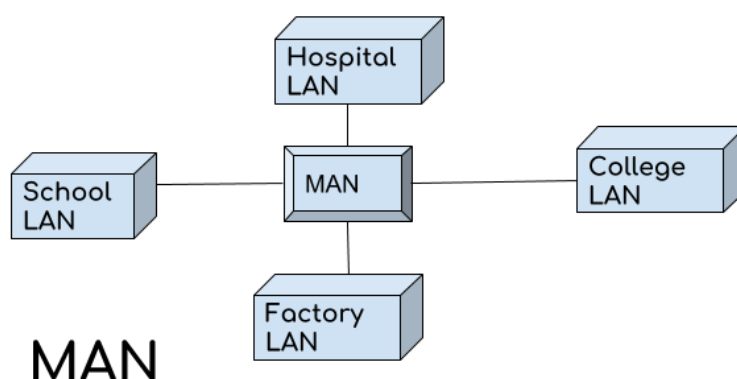
1. Local Area Network (LAN)



1. Local area network is a group of computers connected with each other in a small places such as school, hospital, apartment etc.
2. LAN is secure because there is no outside connection with the Internet. The data which is shared is safe on the local area network and can't be accessed outside.
3. LAN due to their small size are considerably faster, their speed can range anywhere from 100 to 100Mbps.
4. LANs are not limited to wire connection, there is a new evolution to the LANs that allows local area network to work on a wireless connection.

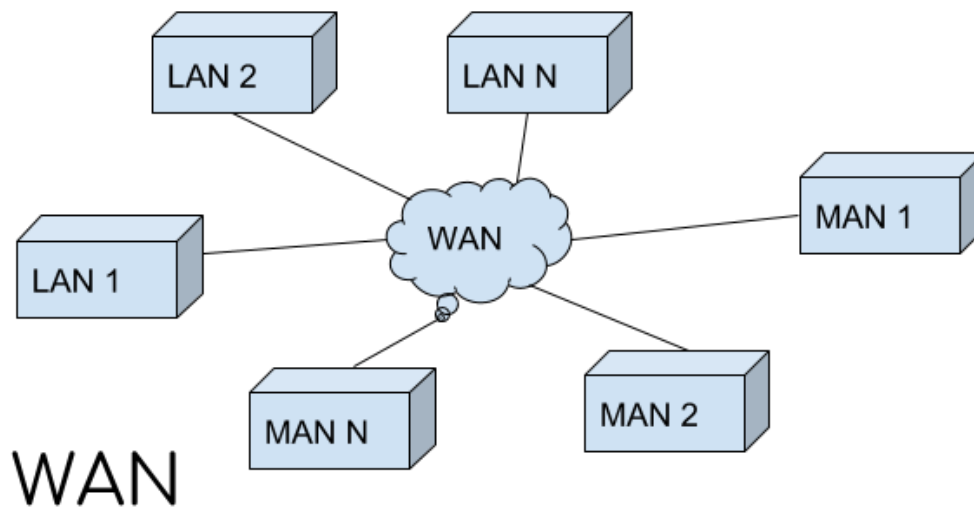
Many people today have LANs in their schools, offices, and even their homes. LANs are especially good for sharing Internet access and commonly used files and databases.

2. Metropolitan Area Network (MAN)



MAN network covers larger area by connections LANs to a larger network of computers. In Metropolitan area network various Local area networks are connected with each other through telephone lines. The size of the Metropolitan area network is larger than LANs and smaller than WANs(wide area networks), a MANs covers the larger area of a city or town.

3. Wide area network (WAN)



Wide area network provides long distance transmission of data. The size of the WAN is larger than LAN and MAN. A WAN can cover country, continent or even a whole world. Internet connection is an example of WAN. Other examples of WAN are mobile broadband connections such as 3G, 4G etc.

Advantages of WAN:

Centralized infrastructure: One of the main advantage of WAN is the that we do not need to maintain the backup and store data on local system as everything is stored online on a data centre, from where we can access the data through WAN.

Privacy: We can setup the WAN in such a way that it encrypts the data that we share online that way the data is secure and minimises the risk of unauthorized access.

Increased Bandwidth: With the WAN we get to choose the bandwidth based on the need, a large organization can have larger bandwidth that can carry large amount of data faster and efficiently.

Area: A WAN can cover a large area or even a whole world though internet connection thus we can connect with the person in another country through WAN which is not possible is other type of computer networks.

Disadvantages of WAN:

Antivirus: Since our systems are connected with the large amount of systems, there is possibility that we may unknowingly download the virus that can affect our system and become threat to our privacy and may lead to data loss.

Expensive: Cost of installation is very high.

Issue resolution: Issue resolution takes time as the WAN covers large area, it is really difficult to pin point the exact location where the issues raised and causing the problem.

Interconnection of Networks:

We have read LAN, MAN and WAN above, we also talked about internet. You can say that an internet is a combination of LAN, MAN and WAN.

Computer Network Components

A computer network is build up from several components. These components together makes it possible to transfer data from one device to another and makes smooth communication between two different devices. In this guide, we will discuss the main components of a computer network.

- **Server:** Servers are computers that runs operating system and hold data that can be shared over a computer network.
- **Client:** A client is a computer that is connected to other computers in the network and can receive data sent by other computers.
- **Transmission Media:** All computers in a computer network are connected with each other through a transmission media such as wires, optical fibre cables, coaxial cables etc.
- **Network Interface card:** Each system or computer in a computer network must have a card called network interface card (NIC). The main purpose of NIC is to format the data, send the data and receive the data at the receiving node.
- **Hub:** Hub acts as a device that connects all the computer in a network to each other. Any request that comes from a client computer first received by Hub and then hub transmit this request over a network so that the correct server receives and respond to it.

- **Switch:** Switch is similar to hub however instead of broadcasting a incoming data request it uses the physical device address in the incoming request to transfer the request to correct server computer.
- **Router:** Router joins multiple computer networks to each other. For example lets say a company runs 100 computers over a local area network(LAN) and another company runs another LAN of 150 computers. These both LANs can be connected with each other through a internet connection which is provided by the router.
- **LAN cable:** A wire that is used to connect more than one computers or other devices such as printers and scanner to each other.

How do I install a wired modem router?

A modem router is a device that connects your computer or home LAN to the Internet.

Plug one end of the phone cord directly into a phone jack, and the other end into the ADSL port on the router.

Plug one end of the Ethernet cable into your computer's network port and the other end into an Ethernet port on the router.

Turn on your computer. To set up, or configure, the router, you'll need to input some parameters, for example your ISP's name and phone number.

NOTE: A router has various Ethernet ports, so you can connect various PCs to the router via Ethernet cables.

If you already have a hub or switch connecting a LAN, you only need one cable to connect the hub to the router.

How do I log on to the Internet Service Provider?

You need to type in your username and password.

Once you are online, you can get email, look for information on the Web, look up IT words in dictionaries, try out new software, and sign up for RSS feeds, newsletters, etc.

It is important that you remember to log off after using the Internet. An open line increases the risk of viruses, and hackers might break into your computer to steal confidential data.

What is wireless networking?

Wired networks are linked by Ethernet cables, phone lines and high-speed fibre optic cables. Wireless networks, however, use electromagnetic waves, such as radio waves, to transmit data. These are the main types of wireless networks:

- Satellites — for long distances
- WiMAX - for connecting Wi-Fi hotspots
- Wi-Fi - for medium-range distances
- Bluetooth - for short distances
- GSM - for mobile phones

What do I need to set up a home wireless LAN?

You'll need computers equipped with a wireless adapter or wireless card, a wireless access point (a wireless router) and a broadband internet connection.

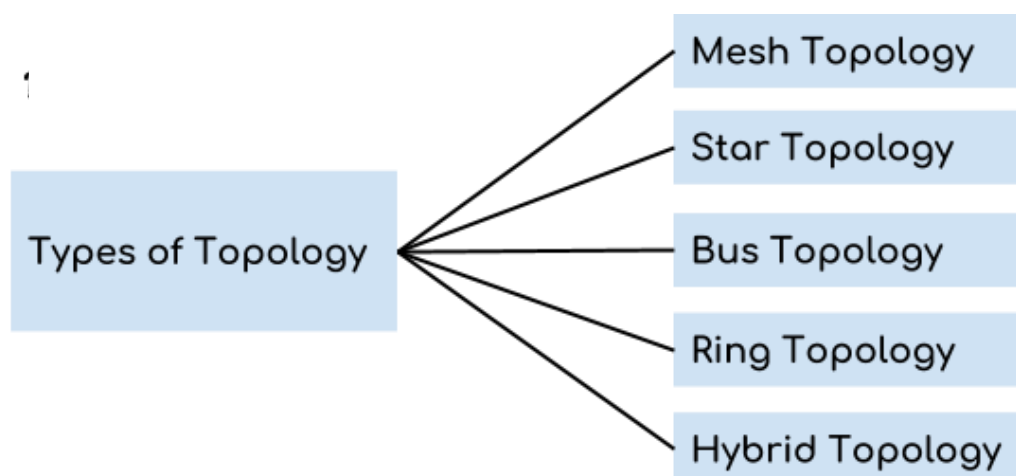
Which is better, a wired or wireless LAN?

Wired LANs are more difficult to install, but they are cheaper, faster and more reliable. Wireless networks let you move, or roam, from one access point to another, but they are less secure and subject to interference.

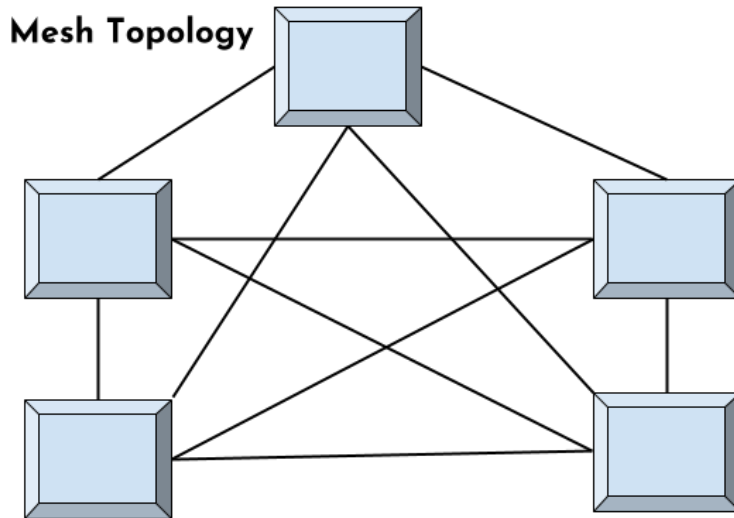
Topology

Geometric representation of how the computers are connected to each other is known as topology. There are five types of topology – Mesh, Star, Bus, Ring and Hybrid.

There are five types of topology in computer networks:



Mesh Topology



In mesh topology each device is connected to every other device on the network through a dedicated point-to-point link. When we say dedicated it means that the link only carries data for the two connected devices only. Let's say we have n devices in the network then each device must be connected with $(n-1)$ devices of the network. Number of links in a mesh topology of n devices would be $n(n-1)/2$.

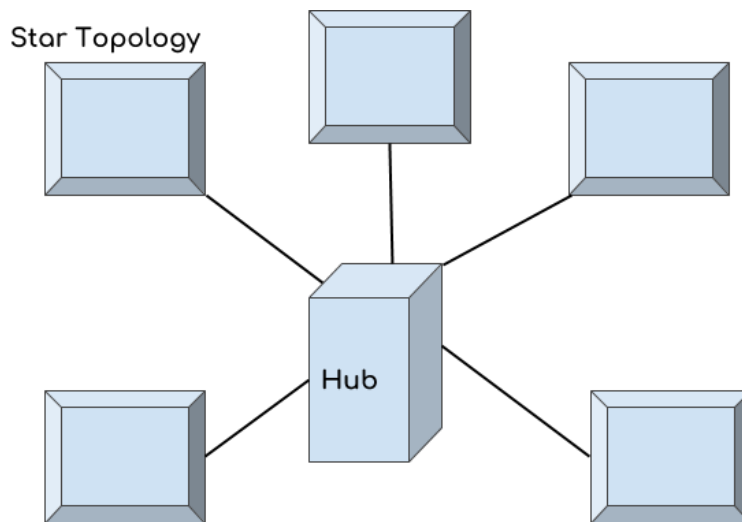
Advantages of Mesh topology

1. No data traffic issues as there is a dedicated link between two devices which means the link is only available for those two devices.
2. Mesh topology is reliable and robust as failure of one link doesn't affect other links and the communication between other devices on the network.
3. Mesh topology is secure because there is a point to point link thus unauthorized access is not possible.
4. Fault detection is easy.

Disadvantages of Mesh topology

1. Amount of wires required to connect each system is tedious and headache.
2. Since each device needs to be connected with other devices, number of I/O ports required must be huge.
3. Scalability issues because a device cannot be connected with large number of devices with a dedicated point to point link.

Star Topology



In star topology each device in the network is connected to a central device called hub. Unlike Mesh topology, star topology doesn't allow direct communication between devices, a device must have to communicate through hub. If one device wants to send data to other device, it has to first send the data to hub and then the hub transmit that data to the designated device.

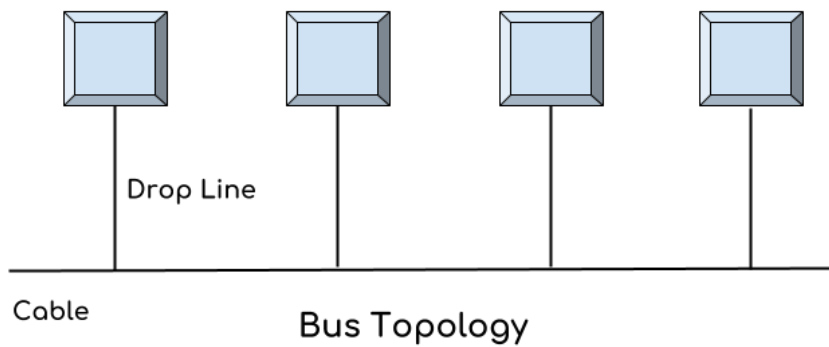
Advantages of Star topology

1. Less expensive because each device only need one I/O port and needs to be connected with hub with one link.
2. Easier to install
3. Less amount of cables required because each device needs to be connected with the hub only.
4. Robust, if one link fails, other links will work just fine.
5. Easy fault detection because the link can be easily identified.

Disadvantages of Star topology

1. If hub goes down everything goes down, none of the devices can work without hub.
2. Hub requires more resources and regular maintenance because it is the central system of star topology.

Bus Topology



In bus topology there is a main cable and all the devices are connected to this main cable through drop lines. There is a device called tap that connects the drop line to the main cable. Since all the data is transmitted over the main cable, there is a limit of drop lines and the distance a main cable can have.

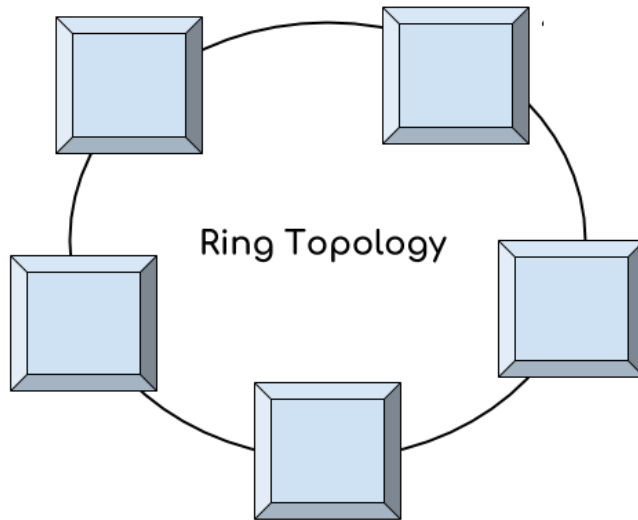
Advantages of bus topology

1. Easy installation, each cable needs to be connected with backbone cable.
2. Less cables required than Mesh and star topology

Disadvantages of bus topology

1. Difficulty in fault detection.
2. Not scalable as there is a limit of how many nodes you can connect with backbone cable.

Ring Topology



In ring topology each device is connected with the two devices on either side of it. There are two dedicated point to point links a device has with the devices on the either side of it. This structure forms a ring thus it is known as ring topology. If a device wants to send data to another device then it sends the data in one direction, each device in ring topology has a repeater, if the received data is intended for other device then repeater forwards this data until the intended device receives it.

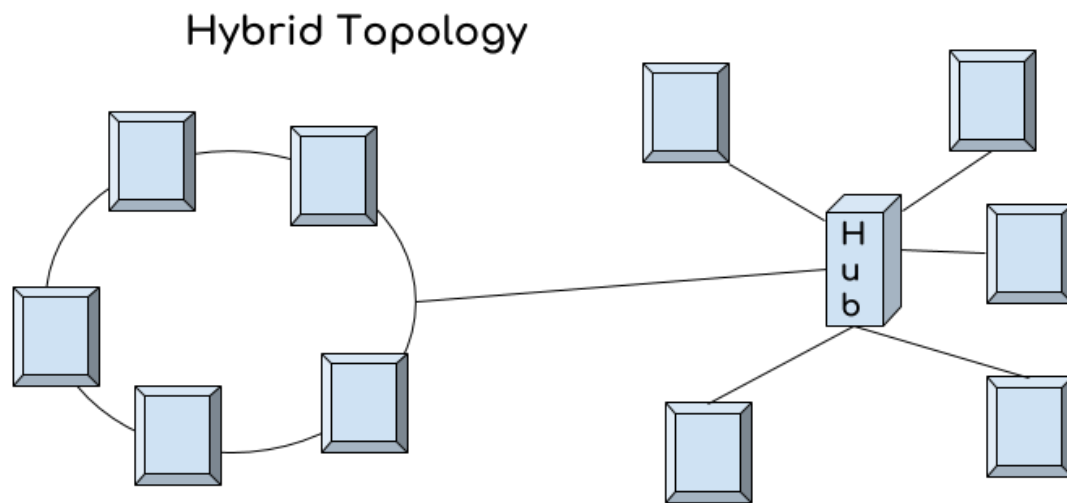
Advantages of Ring Topology

1. Easy to install.
2. Managing is easier as to add or remove a device from the topology only two links are required to be changed.

Disadvantages of Ring Topology

1. A link failure can fail the entire network as the signal will not travel forward due to failure.
2. Data traffic issues, since all the data is circulating in a ring.

Hybrid topology



A combination of two or more topology is known as hybrid topology. For example a combination of star and mesh topology is known as hybrid topology.

Advantages of Hybrid topology

1. We can choose the topology based on the requirement for example, scalability is our concern then we can use star topology instead of bus technology.
2. Scalable as we can further connect other computer networks with the existing networks with different topologies.

Disadvantages of Hybrid topology

1. Fault detection is difficult.
2. Installation is difficult.
3. Design is complex so maintenance is high thus expensive.

3. GRAMMAR

The passive

We form the passive with the verb be + the past participle of the main verb. When we mention the agent, we use by.

The passive is often used in technical writing to give an objective tone.

- Present simple passive
 - Information is transmitted by devices such as the telephone, radio, TV or ...
- Present continuous passive
 - New technologies are being devised to allow you to watch TV on your mobile.
- Past simple passive
 - The term cyborg was invented by M Clynes and NKline in 1960.
- Past continuous passive
 - My TV was being repaired. so I couldn't watch the match.
- Present perfect passive
 - It has been predicted that about one third of all work could eventually be performed outside the workplace
- Past perfect passive
 - The system had been infected by a virus.
- Future simple passive
 - In the next few years, GPS chips will also be Incorporated into most mobile phones.
- Modal verbs in the passive
 - It has been predicted that about one-third of all work could eventually be performed outside the workplace.

Phrasal verbs

The meaning of some verbs with particle (often called phrasal verbs) can be easily understood from its two parts.

- *Look at the photos.*
- *A network consists of two or more ...*
- *Separate networks are linked over a public network, the Internet.*

However, many phrasal verbs have an idiomatic meaning, not predictable from the meaning of its parts.

- *Carry (= transport); carry out (= execute)*
- *Computers carry out the programs ...*

Certain particles have similar meanings, regardless of the verb (on/off, in/out, etc.).

- *turn on / switch on (start the operation of something)*
- *turn off / switch off (stop the operation of something)*

Other common phrasal verbs in computing include:

- plug into (= connect)
 - *Plug one end of the phone cord into the phone jack.*
- set up (= establish)
 - *What do I need to set up a wireless LAN?*
- sign up (= register, enrol in a service)
 - *Once connected, you can sign up for RSS feeds, newsletters, etc.*
- try out (= test or use experimentally)
 - *You can try out new software on their site.*
- find out (= learn, discover)
 - *Search the Web to find out more information about WiMAX.*
- take up (= occupy)
 - *Fibre optic cables take up less space than copper cables.*
- make up (= constitute, form)
 - *Several LANs connected together make up a WAN.*
- fill in (= write the necessary information)
 - *You need to fill in this online form,*

When the verb has a preposition associated with it, the preposition must precede the object:

- *You can look for information on the Web. (not: look information for)*
- *Hackers might break into your PC. (not: break your PC into)*

When the particle is an adverb, it can precede or follow the direct object:

- *You need to type in your username /... type your username in.*
- *You can look up words in a dictionary /... look words up in a dictionary.*
- *Turn on the computer. / Turn the computer on.*

If the direct object is a pronoun, the particle must follow it

- *You need to type it in. (not: type in it)*

Future

When we **know about the future**, we normally use the **present tense**.

1. We use the **present simple** for something **scheduled**:

*We **have** a lesson next Monday.*

*The train **arrives** at 6.30 in the morning.*

*The holidays **start** next week.*

It's my birthday tomorrow.

2. We can use the **present continuous** for **plans or arrangements**:

*I'm **playing** football tomorrow.*

*They **are coming** to see us tomorrow.*

*We're **having** a party at Christmas.*

3. We use **will**:

- when we express beliefs about the future:

*It **will be** a nice day tomorrow.*

*I think Brazil **will win** the World Cup.*

*I'm sure you **will enjoy** the film.*

- to mean **want to** or **be willing to**:

*I hope you **will come** to my party.*

*George says he **will help** us.*

- to **make offers and promises** :

I'll see you tomorrow.

*We'll **send** you an email.*

- to talk about offers and promises:

*Tim **will be** at the meeting.*

*Mary **will help** with the cooking.*

4. We use **be going to**:

- to talk about **plans or intentions**:

*I'm **going to drive** to work today.*

*They **are going to move** to Manchester.*

- to make **predictions** based on **evidence** we can see:

*Be careful! **You are going to fall.** (= I can see that you might fall.)*

*Look at those black clouds. I think **it's going to rain.** (= I can see that it will rain.)*

5. We use **will be with an -ing form** for something happening before and after **a specific time in the future**:

*I'll **be working at eight o'clock.** Can you come later?*

*They'll **be waiting** for you **when you arrive.***

6. We can use **will be with an -ing form** instead of the present continuous or **be going to** when we are talking about **plans, arrangements and intentions**:

*They'll **be coming** to see us next week.*

*I'll **be driving** to work tomorrow.*

7. We often use **verbs like would like, plan, want, mean, hope, expect** to talk about the future:

*What are you going to do next year? I'd **like to go** to university.*

*We **plan to go** to France for our holidays.*

*George **wants to buy** a new car.*

8. We use **modals may, might and could** when we are **not sure** about the future:

*I **might stay** at home tonight or I **might go** to the cinema.*

*We **could see** Mary at the meeting. She sometimes goes.*

9. We can use **should** if we think there's a **good chance** of something happening:

*We **should be** home in time for tea.*

*The game **should be** over by eight o'clock.*

The future in time clauses and if-clauses

In time clauses with words like when, after, until we often use **present tense forms** to talk about the future:

*I'll come home **when I finish** work.*

*You must wait here **until your father comes**.*

*They are coming **after they have had** dinner.*

In clauses with if we often use **present tense forms** to talk about the future:

*We won't be able to go out **if it is raining**.*

***If Barcelona lose** tomorrow, they will be champions.*

Be careful!

We do **not** normally use will in time clauses and if-clauses:

*I'll come home when I **finish** work. (NOT will finish work)*

*We won't be able to go out if it **rains**. (NOT will rain)*

but we can use will if it means want to or be willing to:

*I will be very happy if you **will come** to my party.*

*We should finish the job early if George **will help** us.*

4. SELF-ASSESSMENT

- 1) What does a computer network allow computers to share?
 - a) Electricity
 - b) Resources
 - c) Mice
- 2) What does LAN stand for?
 - a) Logical Analogue Network
 - b) Laser Assisted Network
 - c) Local Area Network
- 3) To log onto a network, what do you usually need?
 - a) A user ID and password
 - b) A fast connection
 - c) Specialist software
- 4) Which of the following statements about a network is FALSE?
 - a) Resources such as printers can be shared
 - b) Viruses can spread to other computers throughout a computer network
 - c) Files cannot be shared between users
- 5) Which of these statements is TRUE about a LAN?
 - a) A LAN connects computers in a small area such as an office
 - b) A modem is needed to connect a computer to a LAN
 - c) A LAN consists of only one computer
- 6) What is a server in a computer network?
 - a) Someone who manages the network
 - b) The name for a large number of computer cables
 - c) A powerful computer that provides a service, such as centralised file storage

- 7) Which of the following networks is LEAST likely to be a WAN?
 - a) The Internet
 - b) A school network
 - c) A network of bank cash dispensers
- 8) Which type of network needs 'terminators' to function correctly?
 - a) Bus
 - b) Ring
 - c) Star
- 9) Which type of network needs a 'hub' or 'switch'?
 - a) Star
 - b) Ring
 - c) Bus
- 10) What is a data collision?
 - a) When two devices on a network transmit data at the same time
 - b) When one device on a network transmits data
 - c) When two devices on a network transmit at separate times

ANSWERS

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