Computer networks

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Computer networks

A network is a group of two or more computer systems linked together to exchange data and share resources, including expensive peripherals such as high-performance laser printers. Network allowed people and organizations to communicate and collab in ways that weren't possible before.

Business networks are often labeled based on the size of the geographical region that network spans.

The advantages of computer networks

1- **Reduce hardware**: with networks users can share expensive equipments which reduce coasts on the user. A network can share a high-capacity printer, storage devices, and a common connection to the internet.

2- **Application sharing**: networks allow users to share software. Networks versions of applications installed on a file server can be used by more than one user at a time.

3- **Sharing information resources:** organizations can use networks to create common pools of data that employees can access.

The advantages of computer networks

4- **centralized data management**: data stored on a network can be accessed by multiple users. Organizations can ensure the security and integrity of the data on the networks with security software and password protection. Centralized storage also makes it easier to maintain consistent backup procedures and develop disaster recovery strategies.

5- **connecting people:** networks create powerful new ways for people to work together like work. workers can use groupware applications to create a shared calendar for scheduling purposes. Team members can instantly see who's available at a given day and time.

The disadvantages of networks

1- **loss of autonomy:** when you become a part of a network, you become a part of a community of users which means that sometimes you have to give up personal freedom for the good of the group.

2- **lack of privacy**: network membership can threaten your privacy. Network administrators can access your files and may monitor your network and internet activities.

The disadvantages of networks

3- **security threats**: some personal and corporate information is stored on a network server it is possible that others may gain unauthorized access to files, username and even passwords.

4- **loss of productivity:** as powerful as networks are they can still fail. Access to resources is sometimes restricted or unavailable because of viruses, hacking, sabotage or a simple breakdown.

Local area network (LAN)

uses cables, radio waves, or infrared signals to link computers or peripherals, such as printers, within a small geographic area, such as a building or a group of buildings. LANs are typically owned and managed by a single person or an organization.
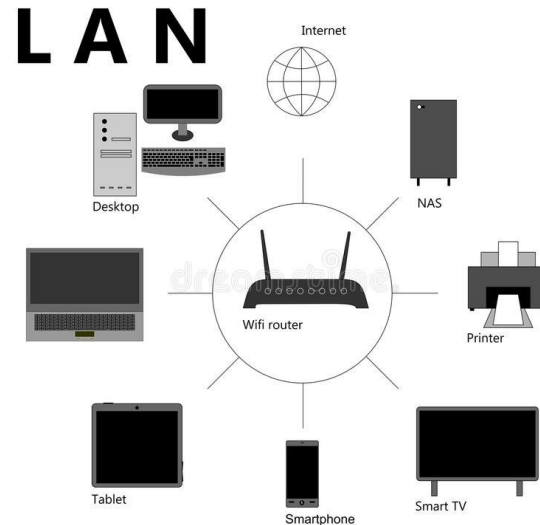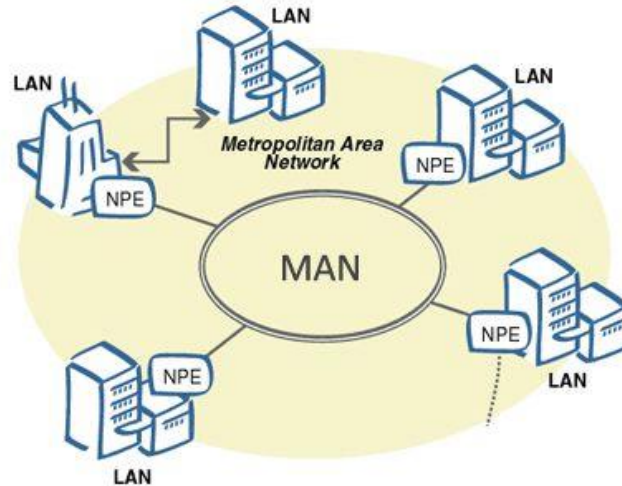
Wide area network (WAN)

uses long-distance transmission media to link computers separated by a few miles or even thousands of miles. A WAN is a geographically dispersed collection of LANs. The Internet is the largest WAN; it connects millions of LANs all over the globe. Unlike a LAN, a WAN is not owned by a single organization. Instead, it has a collective ownership or management, like the Internet.
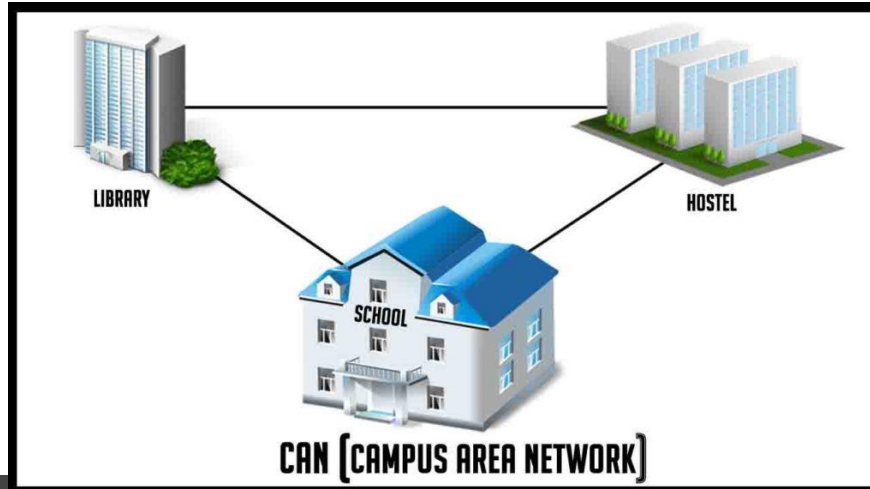

Wide area network (WAN)

Metropolitan area network (MAN)

is a network designed for a city or town. It is usually larger than a LAN but smaller than a WAN. A MAN is owned by a single government or organization. A MAN include a network used to connect firehouses across a region or county and the network that supports a site.

A campus area network (CAN)

A CAN includes several LANs that are housed in many locations on a college or business campus. Most of the time a CAM is smaller than a WAN, CANs use devices such as switches, hubs, and routers to interconnect.

A home area network (HAN)

HAN is a personal and specific use of network technology that provides connectivity between users and devices located in or near one residence. It allows users who are at that location to quickly and conveniently share files and resources by using network connections between computers and peripheral devices.


HAN Wiring Diagram
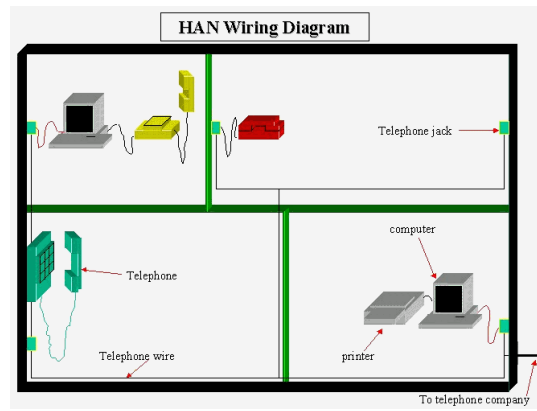
Personal area network (PAN)

PAN is a network created among an individual's own personal devices, usually within a range of 32 feet. Such networks involve wireless technology.
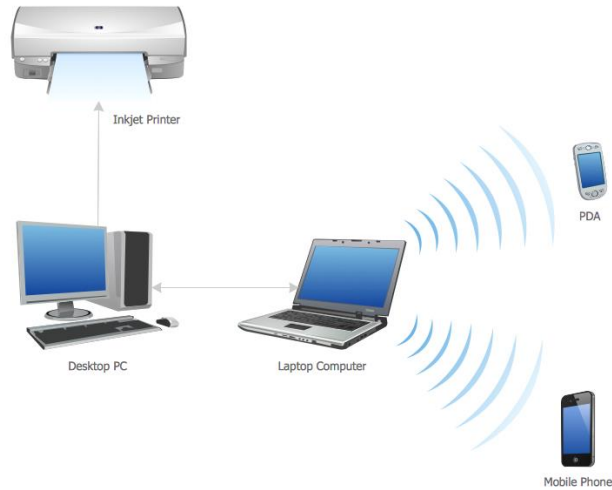
Peer to peer networks

on a P2P network there's no file server, but each computer user decides which, if any, files will be accessible to other users on the network. Users also might choose to share entire directories, entire disks, and even peripherals, such as printers and scanners. These networks are usually used for home networks or small businesses.
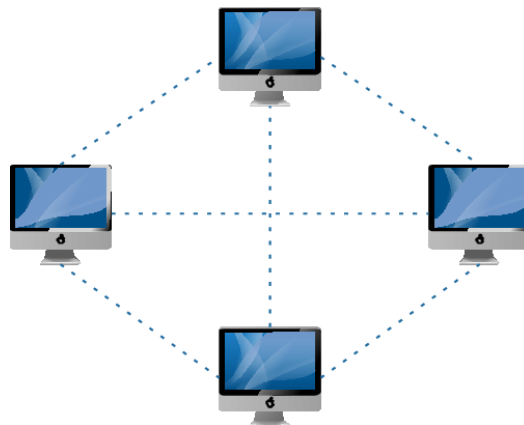
Client/ server network

includes one or more servers as well as clients. Some common servers on a client/server network include those that provide e-mail, file storage, and database storage, and facilitate communication with other networks, including the Internet.

client can be any type of computer PC, Mac, desktop, notebook, or even a handheld device that is connected to a network and contains the software that allows it to send requests to a server.

It can connect via modem, dedicated physical connection, or wireless connection.
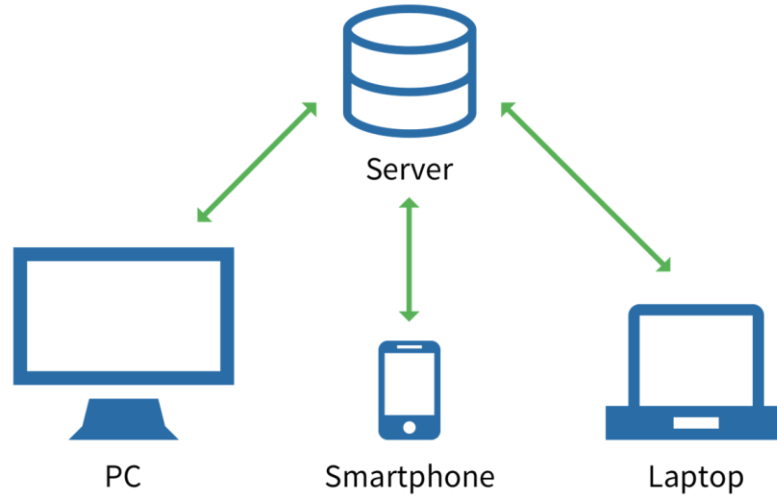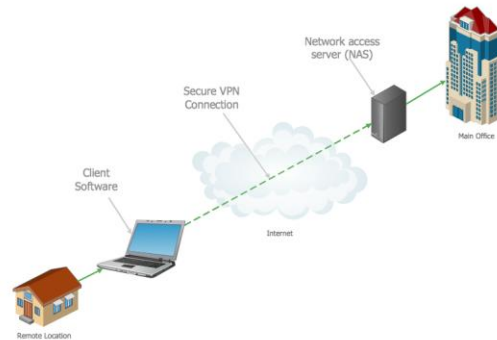
Private local area network

a password-protected network controlled by the company and accessed only by employees. A VPN operates as a private network over a public network, usually the Internet, making data accessible to authorized users in remote locations through the use of secure, encrypted connections and special software.

LAN topologies

A network topology is the physical layout of a LAN. there's three main LAN topologies which are bus topology, star topology and a ring topology.

Bus topology: all nodes are connected to a common cable. At the ends of the bus, special connectors called terminators signify the end of the circuit. only one node can transmit at a time. limitations of a bus topology include length restrictions and practical limits as to the number of nodes attached. On the plus side, bus networks are simple and reliable.The bus topology is used in a small environment.

LAN topologies

Star topology: solves the expansion problems of the bus topology with a central wiring device, which can be a hub, switch, or computer. Star networks also use contention management to deal with collisions. The star topology is used in office buildings, computer labs, and WANs.The disadvantage of a star topology is that the loss of the hub, switch, or central computer which can bring a network down.

Ring topology: the nodes are attached in a circular wiring arrangement. A special unit of data called a token travels around the ring. A node can transmit only when it possesses the token. It's used in company or on one floor of a multi-floor office building.

BUS TOPOLOGY

TREMINATOR   BACK BONE CABLE   NODE   T CONNECTOR

STAR TOPOLOGY

HUB   NODE   LINK

Ring Topology
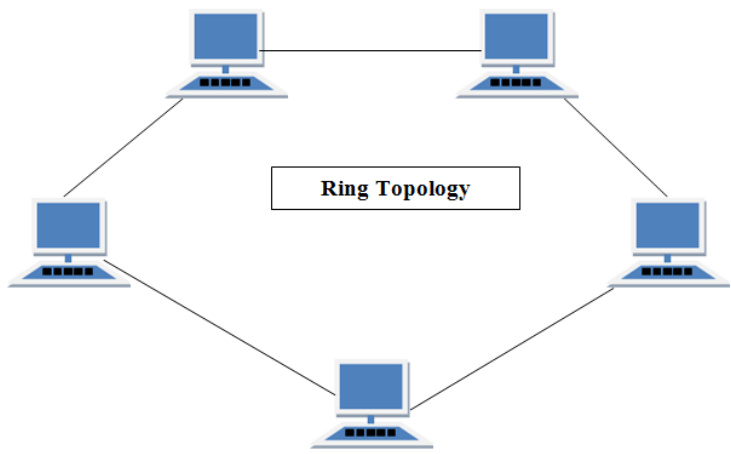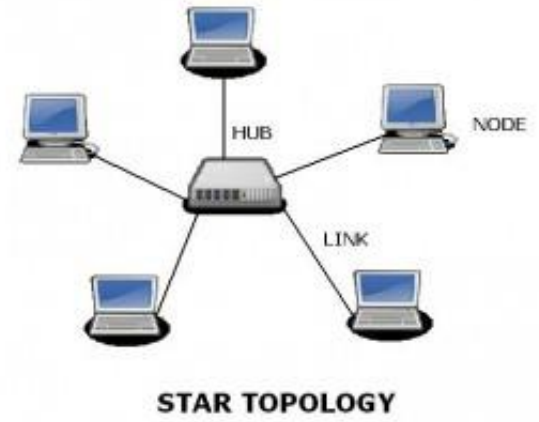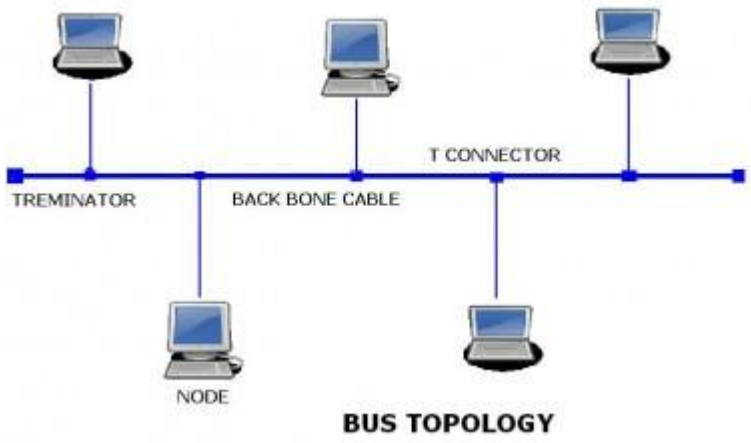
The components of LAN and WAN

LAN and WAN mostly share the same basic components. These are some of LAN's components:

Switches: a switch contains software that inspects the source and target of a data package and attempts to deliver it to that destination.

Router: a complex software, that is used to connect two or more networks.they also have the capability to inspect the source and target of a data package and determine the best path to route data.

Hub: inexpensive device that joins multiple computers together in a single network.

LAN components

Node: A node can be any computer, peripheral device, or communication device.

Server: a computer or device with software that manages network resources like files, e-mails, printers, and databases.

Wireless access point (WAP): is a node on a network that acts as a receiver and transmitter of wireless radio signals between other nodes on a network.

Network interface card (NIC): It provides the electronic components to make the connection between a computer and a network.

LAN components

USB wireless network adapter: a communication device that plugs into a USB port and usually provides an intuitive graphical user interface (GUI) for easy configuration.

USB dongle: a device that is inserted into a USB port and adds additional features to the base system.

Wireless PC card adapter: provides wireless capability and LED lights that indicate whether the computer is connected.

Special components WAN

a point of presence and backbones.

A point of presence is a wired or wireless WAN network connection point that allows users to access the WAN. To provide availability to it users, WANs have a POP in as many towns and cities as needed. However, in many rural areas, POPs may still not be available.

Backbones:the high-capacity transmission lines that carry WAN traffic. A variety of physical media are used for backbone services, including microwave relays, satellites, and dedicated telephone lines.

Circuit switching and packet switching

Circuit switching: there is a direct connection between the communicating devices. Data is sent over a physical end-to-end circuit between the sending and receiving computers. Circuit switching works best when avoiding delivery delays is essential. high-speed electronic switches handle the job of establishing and maintaining the connection.

Packet switching: The sending computer's outgoing message is divided into packets. Each packet is numbered and addressed to the destination computer. The packets then travel to a router, which examines each packet it detects. On the receiving computer, protocols put the packets in the correct order and decode the message they contain.

Strength and weakness of packet switching

Packet switching is more efficient and less expensive than circuit switching packet-switching networks are more and can function even if portions of the network aren't working.

When a router examines a packet, it delays the packet's progress by a tiny fraction of a second. In a huge packet-switching network (the Internet)a given packet may be examined by many routers, which introduces a noticeable delay called latency.

Strength and weakness of circuit switching

A circuit switching is the best for voice and real time data because it creates an end-to-end circuit.

 circuit switching is not as efficient or reliable as packet switching, it is also more expensive.

Network protocols

Protocols (standards or rules) that enable network-connected devices to communicate with each other. Protocols may be implemented by hardware, software, or a combination of the two.

Protocols are fixed, formalized exchanges that specify how two dissimilar network components can establish a communication. All of the communications devices in a network conform to different protocols.
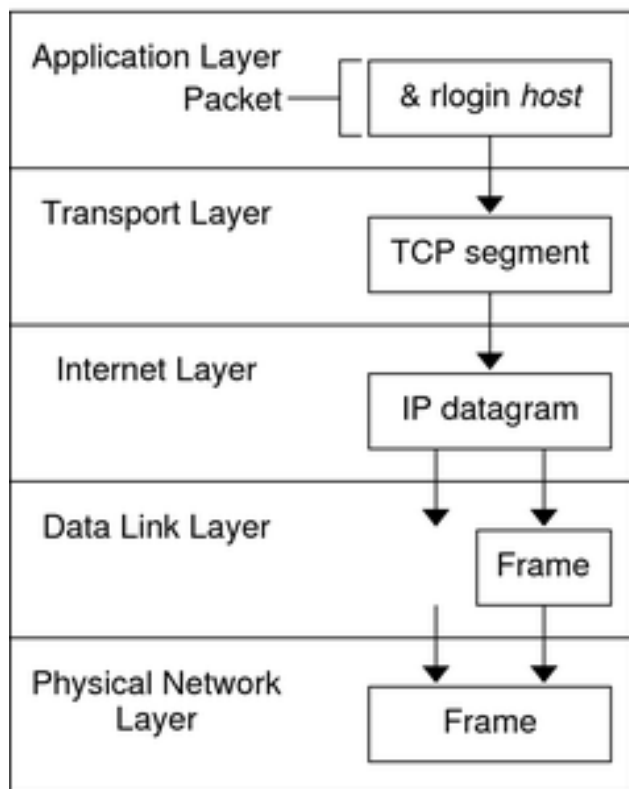
Network protocols

Messages go through the layers of protocol stack.

Network layers each network layer has a function that can be isolated and treated separately from other layers.
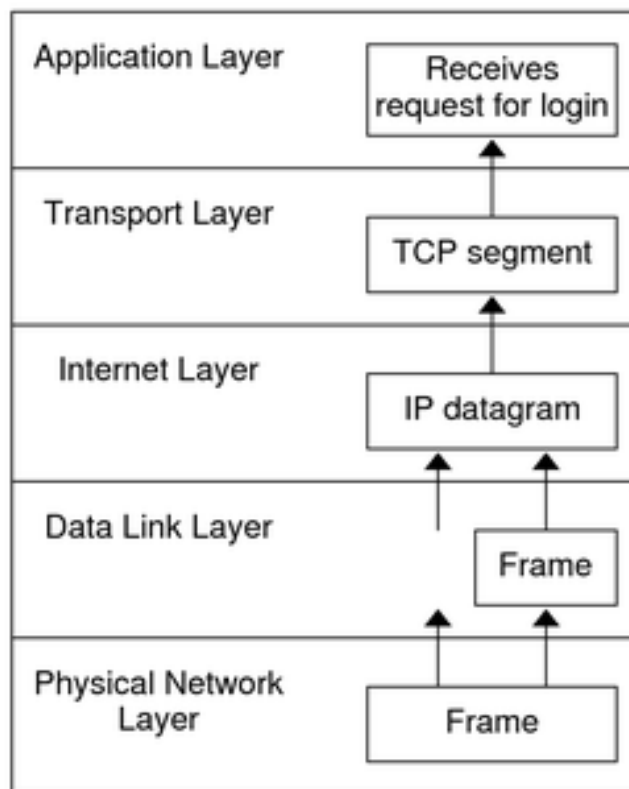
A network message starts at the top of a stack of layers and moves down through the various layers until it reaches the bottom.The layers are arranged vertically.

The received message goes up the protocol stack. First, the network's data envelope is opened, and the data is translated until it can be used by the receiving application.

Sending Host

Application Layer
Packet — & rlogin *host*

Transport Layer
TCP segment

Internet Layer
IP datagram

Data Link Layer
Frame

Physical Network Layer
Frame

Receiving Host

Application Layer
Receives request for login

Transport Layer
TCP segment

Internet Layer
IP datagram

Data Link Layer
Frame

Physical Network Layer
Frame

Network media

Wired and wireless LAN protocols

The most used LAN protocol for wired networks is Ethernet. It uses a protocol called carrier sense multiple access/collision detection, or CSMA/CD.

Using the CSMA/CD protocol, a computer looks for an opportunity to place a data unit of a fixed size, called a packet, onto the network and then sends it on its way.

The most popular version are Ethernet star networks that use switches and twisted-pair wire.

10Base-T (10 Mbps), Fast Ethernet and Gigabit Ethernet. They prevent data bottlenecks.

Wired and wireless LAN protocols

The most commonly used wireless protocol is 802.11g is very fast.

other wireless protocols are 802.11nd improves speed and range and operates on both frequencies.

 80211r speeds up the handoff of data between access points or cells in a wireless LAN to less than 50 ms (milliseconds), greatly improving VoIP or Internetbased telephony.

802.15

Wired and wireless LAN protocols

802.15 Used for Bluetooth technology, it has a very short range.

802.16 provides high-speed wireless Internet access over long distances.

802.20 multi-megabyte mobile data and voice system, can be used in moving vehicles.

Wired & Wireless Networking

Wired Network

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Reference: computers are your future by Catherine LaBerta.