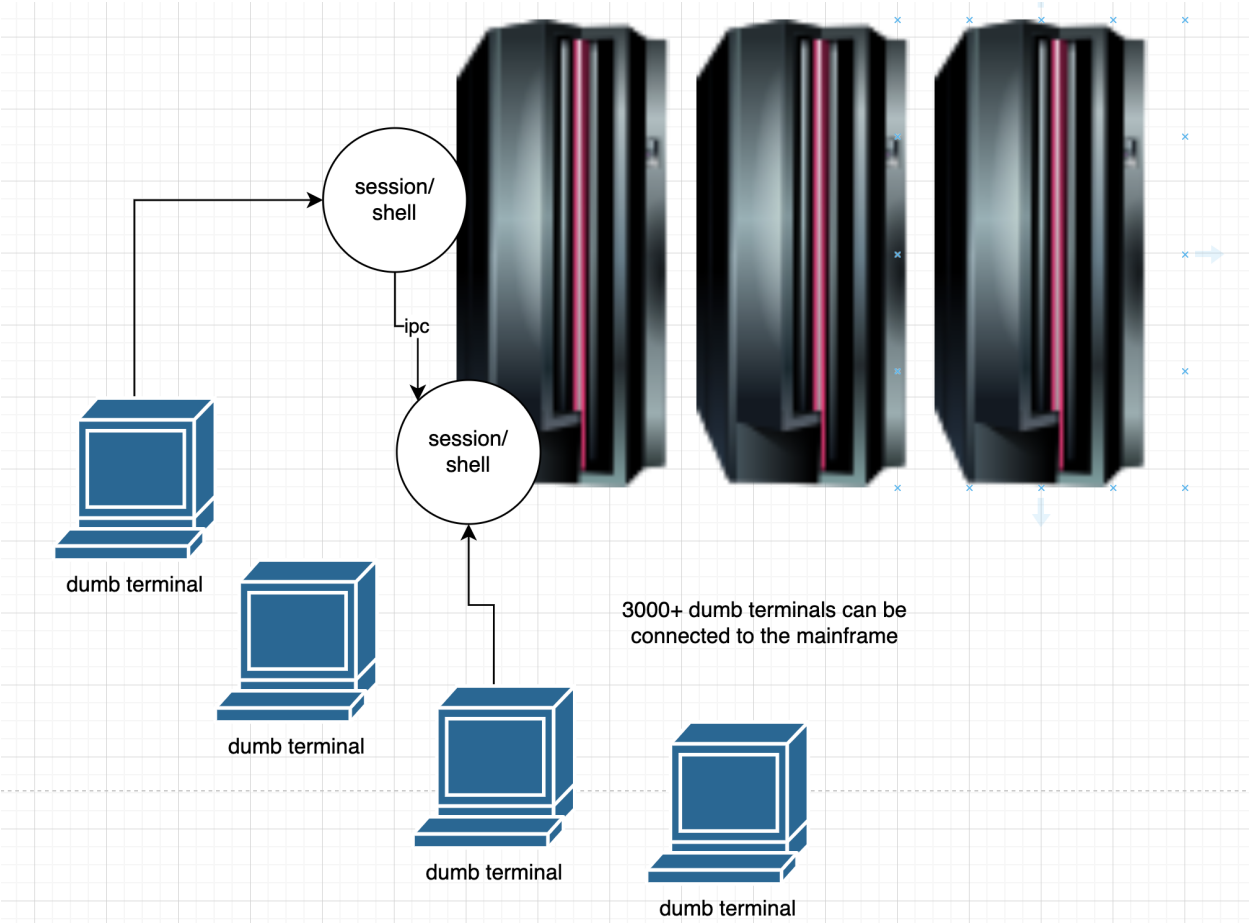
Network fundamentals

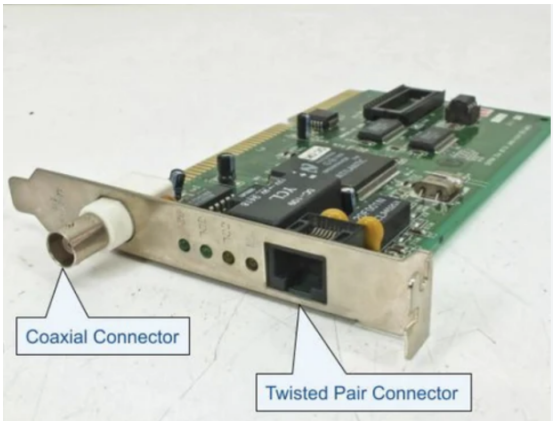


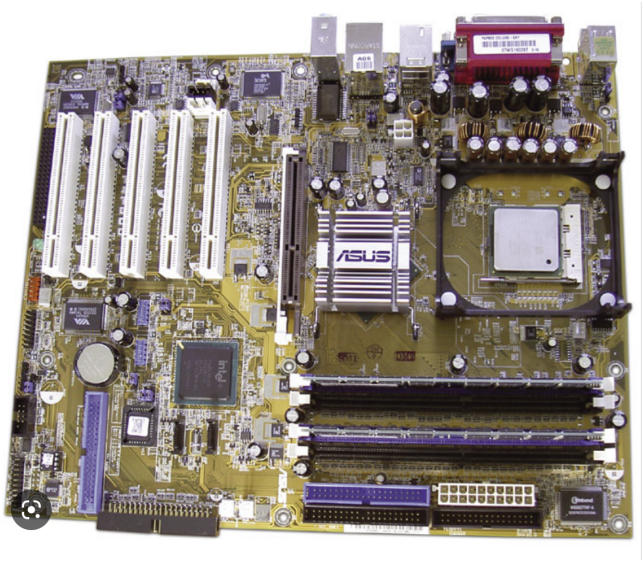
Components involved in computer network

1. NIC (network interface card)
2. Hub
3. Switch/ bridge
4. Modem
5. Router
6. Cables
7. Connectors
    a. T junction
    b. Caps

Network interface cards

- Hardware device to be installed on a motherboard of a PC
- Allows a network cable to be connected to your PC
- Most modern computer's motherboard already has an integrated NIC
- It has a socket for a network cable called RJ45
- In most modern laptops, we don't have this at all, instead we depend on wireless network interface card

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Hub

- As the name suggests, it is the central piece of equipment in a computer network
- Has multiple (5 to 8) rj45 sockets, using which you may connect multiple computers and printers, making it a computer network
- When a computer wants to send a message to another computer, this acts like a receiver of the message, which then broadcasts the message to all the computers. The one which is the intended recipient, will only receive the message.

Switch

- similar to a hub, but with much better performance and more number of connection possibilities
- Unlike the hub, it does not broadcast the message to all the computers, but forwards the message to the intended recipient directly

Modem (Modulator + Demodulator)

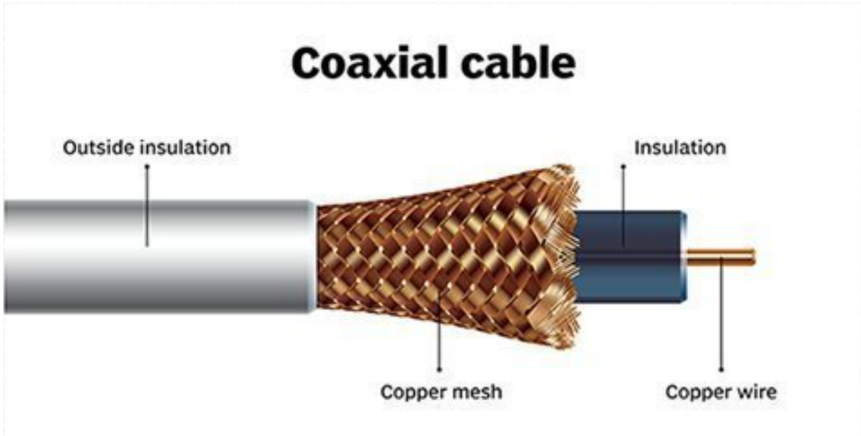
- A device that was used for getting an external internet connection via the telephone line
- Used AM/FM band to carry the internet signals
- Special software was used on the PC to switch ON/OFF the internet connection.

Router

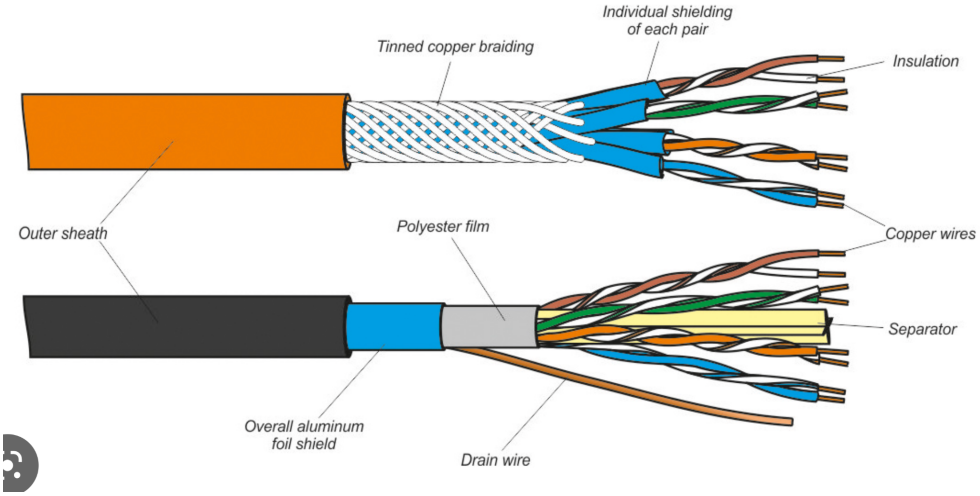
- Replacement for Modem
- Use this for a local network of computers or receiving internet connection from an external source.
- Mostly every home network has one.
- Different types of connection media are available
    - Regular high speed internet cable
    - Optic fiber cable

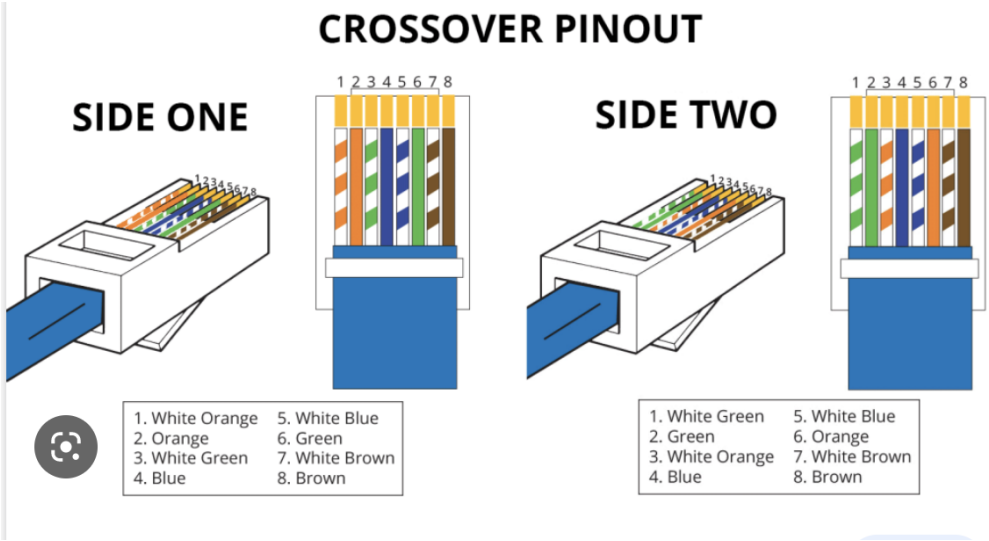
Cables

- One of the most important components of a computer network
- Primary medium of transmission
- Specialized cables are used
    - Coaxial cable
    - Twisted pair cable
    - Fiber optic cable

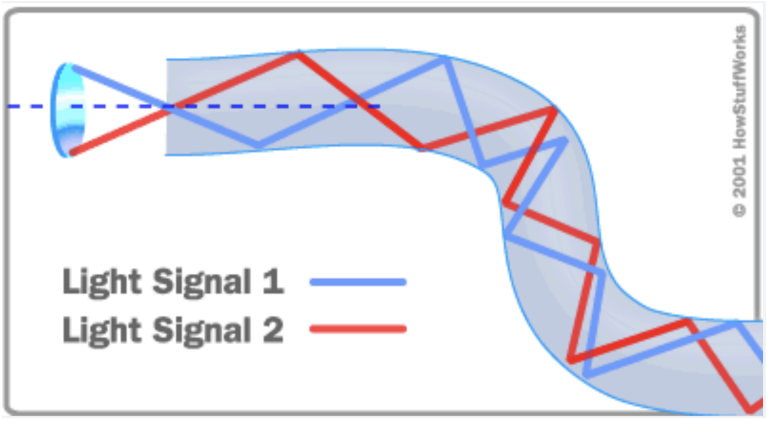


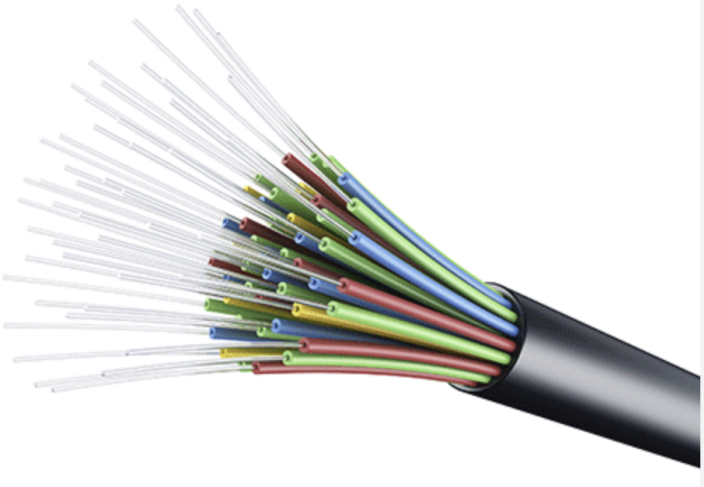
Twisted pair cable





Optic fiber working principle





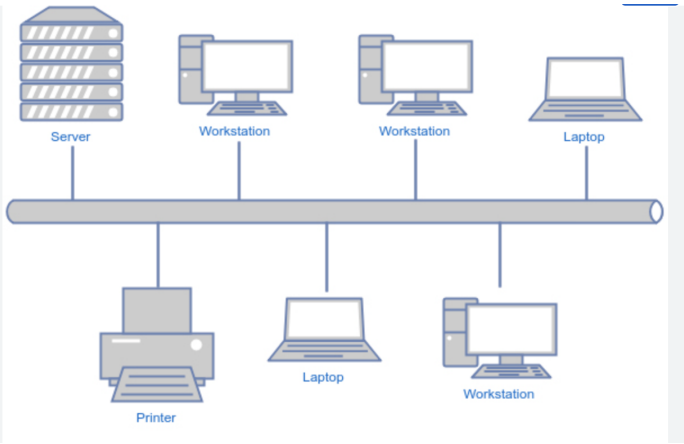
How does the internet work?
https://www.youtube.com/watch?v=TNQsmPf24go

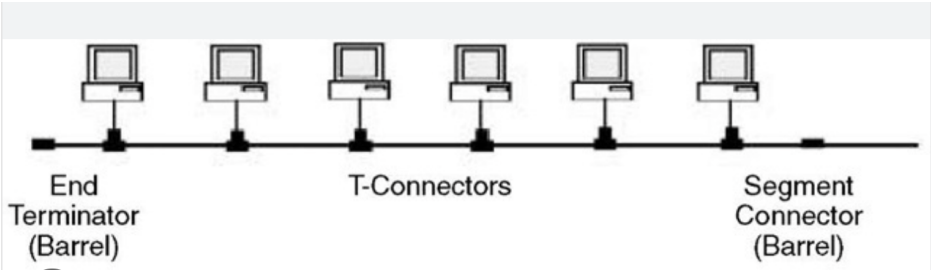
Network topologies

- Defines the structure or architecture of the network
- How to put all the components together so that a network exists
- Based on the geometric representation of all the nodes (computers and other devices like printers)
    - Bus
    - Ring
    - Star
    - Tree
    - Mesh
    - Hybrid

Bus topology

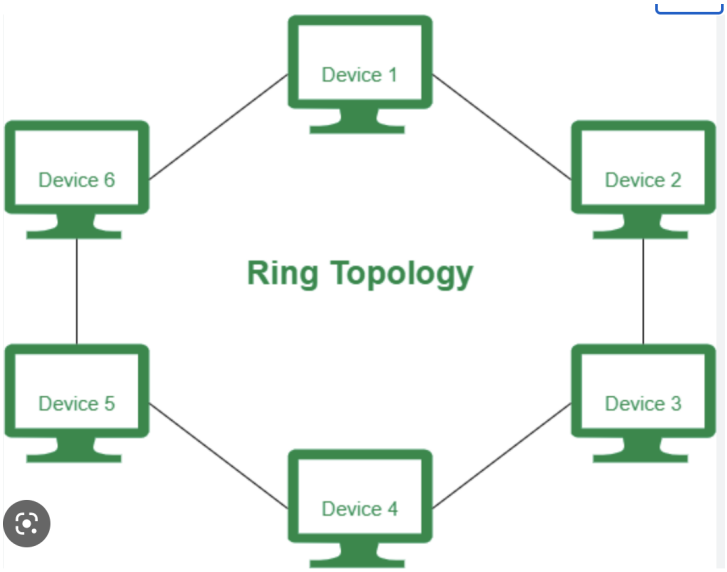
- Uses coaxial cable with T-Connectors, barrels and Terminators
- No computer is designated as server
- You can share files with each other
- Advantages:
    - Low cost
        - no hub/switch required
        - coaxial cable is less expensive than twisted pair cable, which also require RJ45 plugs, crimping tool, sockets etc
    - Simple to use/ setup/ install
    - Failure in one node will not impact other nodes
- Disadvantages:
    - Limited for small number of nodes
    - Extensive cabling may disrupt the entire network
    - Troubleshooting is difficult
    - Low performance
    - signal interference is high due to close proximity of other cables and EMF
    - Attenuation - loss of signal due to the length of the cable





Ring topology

- Similar to bus topology, except that there are no terminators, and the two endpoints are connected to each other, forming a circle
- Advantages:
    - all of that of bus topology
    - many hardware/software tools for network monitoring is available
    - reliable
- Disadvantages
    - all of that of bus topology



Star topology

- Uses twisted pair cable along with a hub or a switch (or a router today)
- Hub is the central piece of hardware that connects all the nodes
- Advantages:
    - Better performance than that of bus/ ring topology
        - just by using the twisted pair cable alone
    - More control over the network (betters software)
    - Limited failure (due to the cabling efficiency)
    - Adding/ removing nodes to the network does not affect other nodes
    - Data speed up to 100 Mbps
- Disadvantages:
    - Single point of failure (hub)
    - Cost is high
        - cable
        - sockets/ plugs/ tools
        - hub/ switch