# Networking

Network Topologies

Network Topologies

- A **network topology** is a map of a physical network
    - These maps contain all the devices on the network and how they are connected
    - These maps are a visual tool to see how data moves on the network
   - Different shapes = different names

Mesh

- A **mesh** network is when every device is connected to every other device
    - There are a lot of connections for each device on the network and would require a lot of cable for each machine to be connected to every other
    - A mess network becomes more difficult when additional devices are connected to the network


MESH
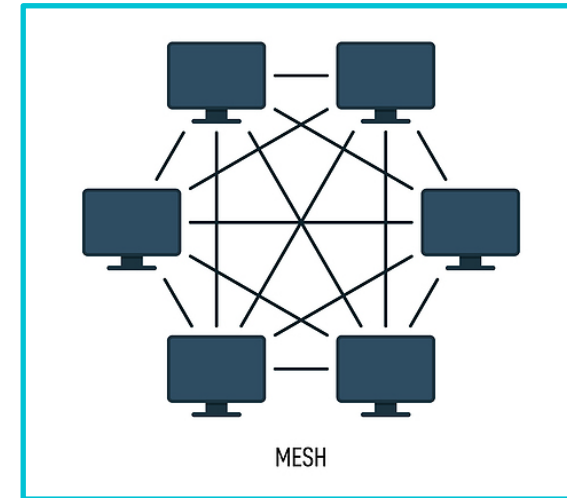
Star/hub-and-spoke

- A **star** network (also known as **hub-and-spoke**) is when all the devices are connected to one central device
  - Typical, this central device is an access point, hub, switch, etc.
  - Single Point of Failure
    - When the central device fails, this means all the other devices lose network connectivity


STAR
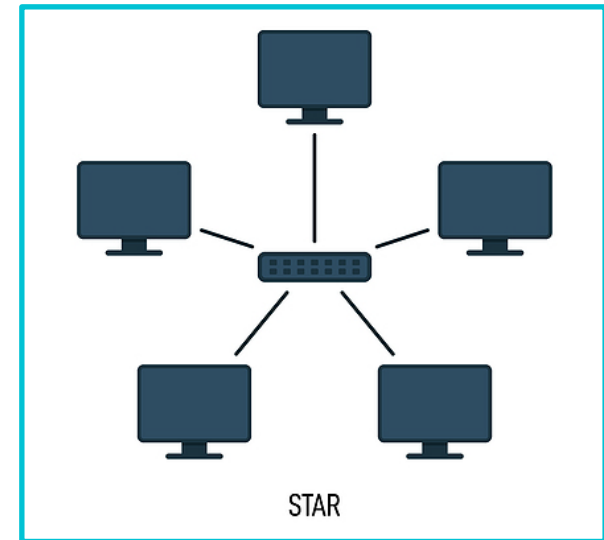
Bus

- **Bus** topology is a type of network topology in which all devices in the network are connected by one central RJ-45 network cable or coaxial cable
    - Single Point of Failure
        - If this central cable fails, the entire network goes down, but requires a lot less cable than other types of topologies
    - Hard to move
        - Built for the specific space
   - One cable means this cannot support a large network

BUS
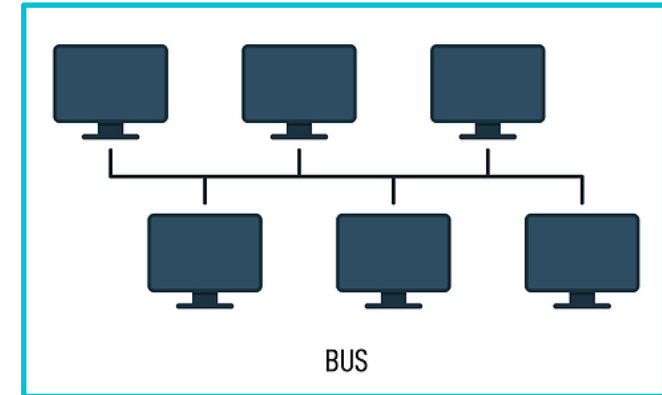
Ring

- In a ring topology, all the devices are connected in a "circle" with each device connected to two other devices
  - The ring must be broken to add a new device, taking down the entire network to add a device
  - Ring topologies are very uncommon
  - If any break appears, the network will shut down
    - Dual rings allow users to continue to transmit packets while the break is fixed
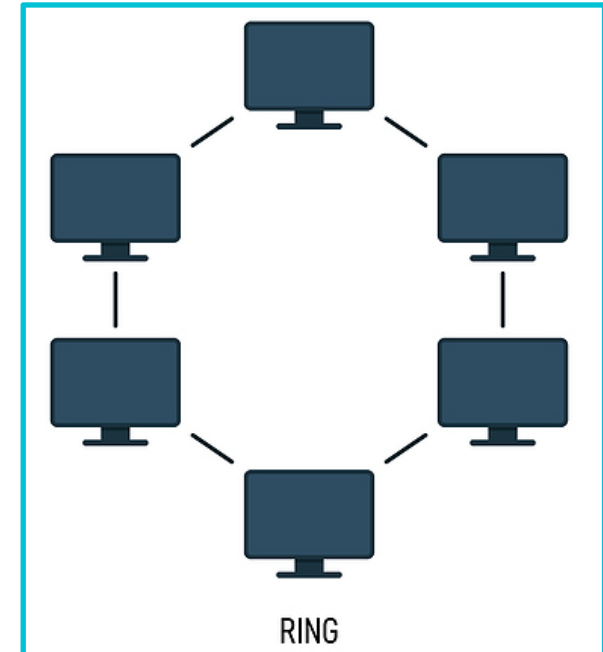
RING

Hybrid

- A **hybrid** topology is when two or more topologies are combined
  - In the image, a ring and bus topology have been used to form the network
  - Hybrid topologies can become difficult to design and maintain but can help personalize a network for specific needs

HYBRID
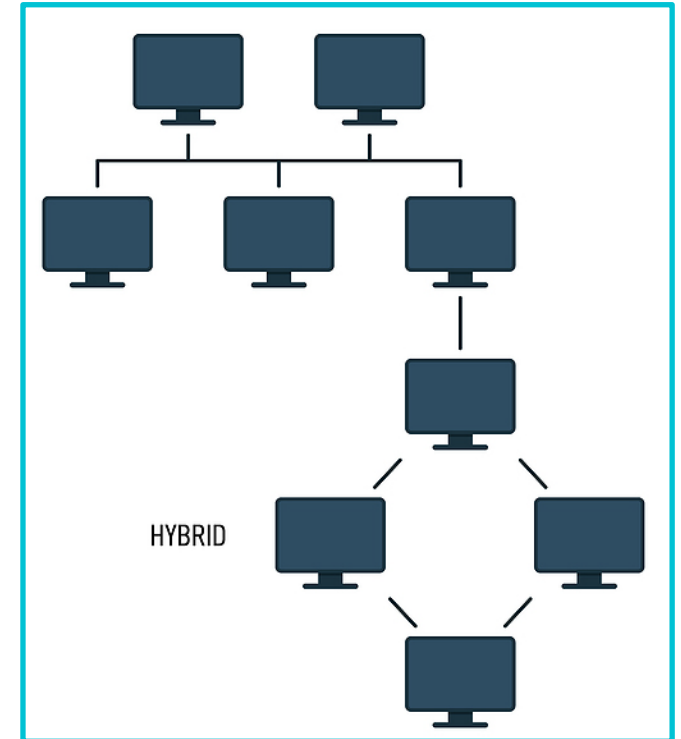
Peer-to-Peer and Client-Server Networks

- A **client-server** network is when a single server controls the network for all the devices
  - Server controls all the usernames, passwords, and rights for the network
  - Gmail is an example
- In a **peer-to-peer** network all the machines are the client and the server
  - Each machine controls their own usernames, passwords, and rights to their machine
  - iPhone is an example

WANs and LANs

- A **local area network (LAN)** covers a small area, with all the computers connected via cables, wireless signals, or a combination of the two
  - LANs typically cover one building or a small group of nearby buildings
  - Home and small office networks are usually LANs
- A **wide area network (WAN)** covers a large area, typically composed of two or more LANs connected
  - All the schools in a district may have a unique LAN per school but could be linked together to form a WAN

MANs, WLANs, and CANs

- A centralized/location specific WAN can be called a **metropolitan area network (MAN)**
  - Specific to an area where cables can be placed to transfer data quickly between locations within the MAN
- A **wireless local area network** is a LAN that allows their users to move around while still being connected to the network wirelessly
  - Many homes have a wireless LAN where people living in the house can move from room to room and still be on the same network wirelessly
- A **campus area network (CAN)** is a network usually on a corporation's campus or a school/university campus
  - High mobility, same network
  - Both ethernet and wireless connectivity

PANs, SANs, and SDWANs

- A **personal area network (PAN)** is a close proximity network that is usually specific to a certain room
  - An office where the computer is connected to a printer and a speaker located in the room
  - A conference room where users can connect to a speaker, microphone, projector, or anything else in the room
- A **storage area network (SAN)** is designed to be used with large storage centers for data
  - Large data servers
- A completely virtual network is a **software-defined wide area network (SDWAN)**
  - Uses software to connect devices
  - Popular services include Amazon Web Services (AWS) and Microsoft Azure

MPLS and mGRE

- **Multiprotocol Label Switching (MPLS)** contains label information that is read and then re-routed to a destination based off this information
  - Labels are read and the data is transferred, rather than a wire transferring the data
- **Multipoint generic routing encapsulation (mGRE)** is when a network will create VPNs between devices when they are communicating
  - VPN is created when two offices communicate and is shut down after communications are complete