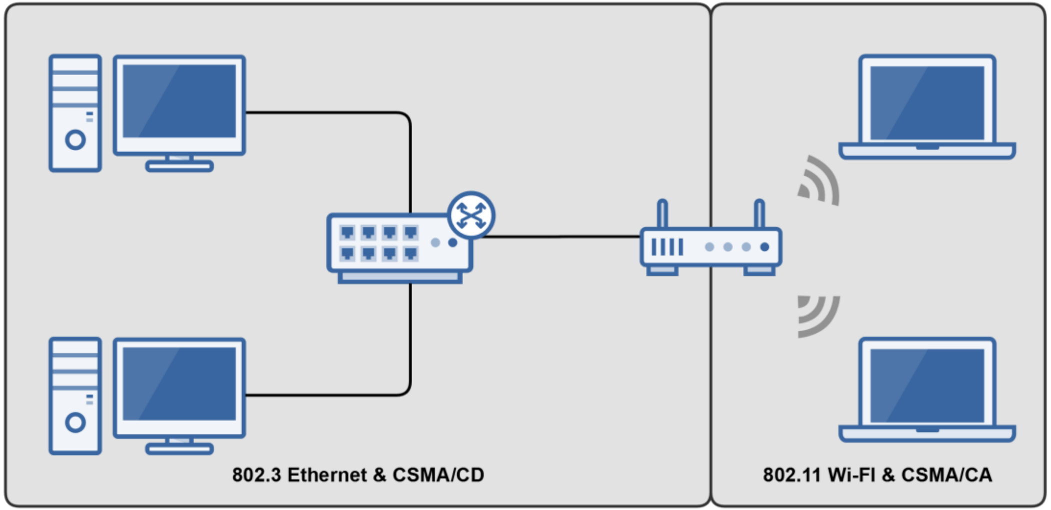
Physical vs. Logical Topologies

Physical topologies describe the placement of network devices and how they are physically connected.

Logical topologies describe how data flows throughout a network.

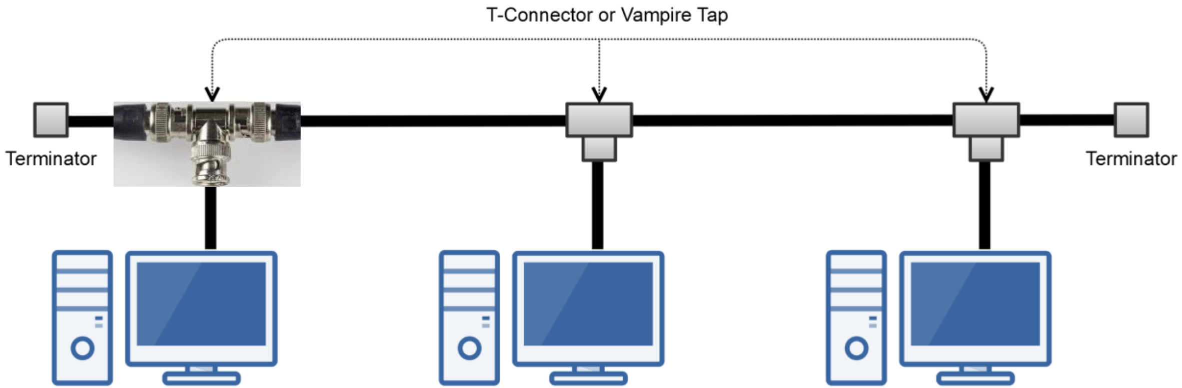


Wired Network Topologies

- Four Specific Topologies:
  - Bus
  - Ring
  - Star
  - Mesh

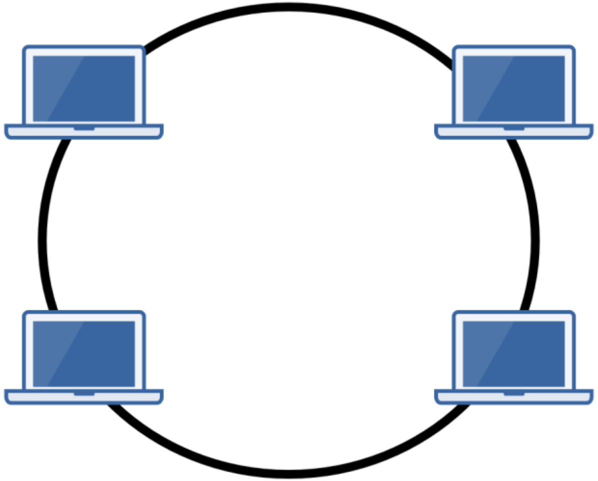
Bus Topology

- All devices are connected to a single coaxial network cable.
    - Devices are connected via a vampire tap or T-Connector.
    - Terminators are required at both ends of the cable to prevent signal bounce.
    - Antiquated technology.
- Only one end device can be active on the network at a time.
    - Data signals travel in both directions and are received by all devices on the network.
- A single break in the cable can take down the entire network.



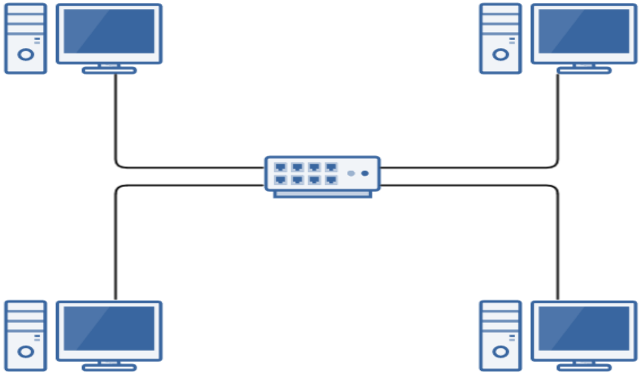
Ring Topology

- All devices are connected in a circular fashion.
- Each computer is connected to two other computers.
- Data travels from node-to-node with each computer handling data, either unidirectional or bidirectional.
- Each device (node) in the ring regenerates the signal, acting as a repeater.
- Failure of a single node can take down the entire network.
- Fiber Distributed Data Interface (FDDI) uses two counter-rotating ring topologies for redundancy.



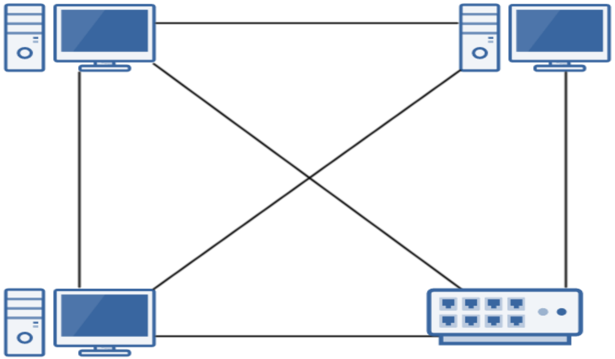
Star Topology

- All devices are connected to a central connecting device, which is usually a switch.
- Devices send data to the switch, which forwards it to the appropriate destination device.
- Popular topology in today's networks.
- Used in most large and small networks.
- Central device is a single point of failure.



Mesh Topology

- Each device is connected to every other device by separate cabling.
- Highly redundant and fault-tolerance.
- Expensive to install.
- Commonly used in Enterprise Networks & WANs.
- Two Types:
  - Partial Mesh
  - Full Mesh



Wireless Network Topologies

- Wireless networks utilize radio frequencies (RF) to communicate.
- Three Specific Topologies:
  - Ad hoc
  - Infrastructure
  - Mesh

Ad hoc

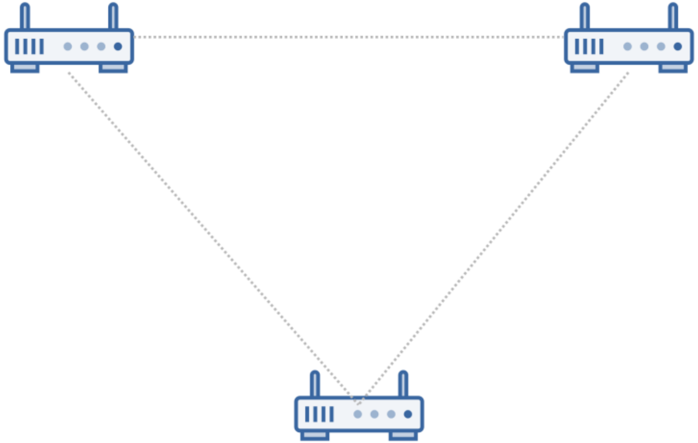
- Peer-to-peer (P2P) wireless network where no wireless access point (WAP) infrastructure exits.
- The devices communicate directly with one another.
- Personal area networks (PANs) are a common example of Ad hoc wireless networks.

Infrastructure

- Wireless network that uses a wireless access point (WAP) as its central connecting device.
- Infrastructure wireless networks (WLANs) are commonly used in homes and small offices.

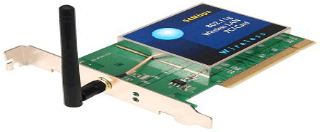
Mesh

- Just like a wired mesh design, wireless mesh networks utilize several wireless access points (nodes) to create a robust wireless network that is:
  - Scalable
  - Self-Healing
  - Reliable (redundancy)
- Common in larger homes and businesses.



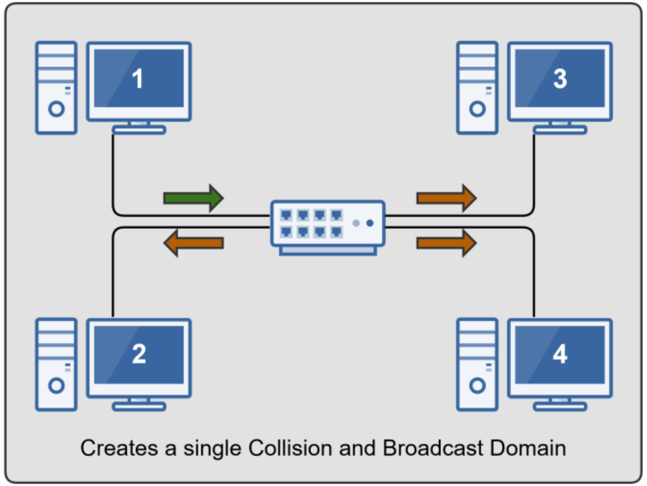
Network Interface Card (NIC)

- The network adapter installed on your network device.
- Provides the physical and electrical, light or radio frequency connections to the network media.
- It can either be an expansion card, USB devices or built directly into the motherboard.



Hubs

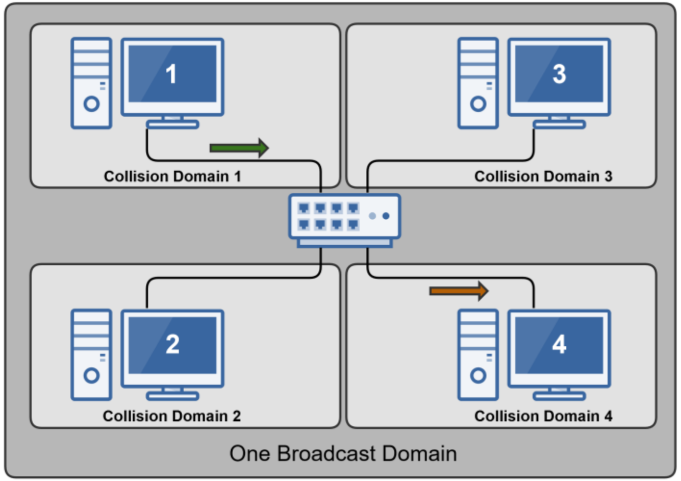
- Used to Connect Devices Together Within a Network
- Used in Early Networks; Replaced by Switches
- “Multi-Port Repeater”
    - Traffic goes in one port and is repeated (broadcasted) out every other port
    - OSI Layer 1 Device
    - Dumb Network Device
    - Causes increased network collision errors
- Much Less Efficient than a Switch
- Legacy Equipment No Longer Used



Creates a single Collision and Broadcast Domain

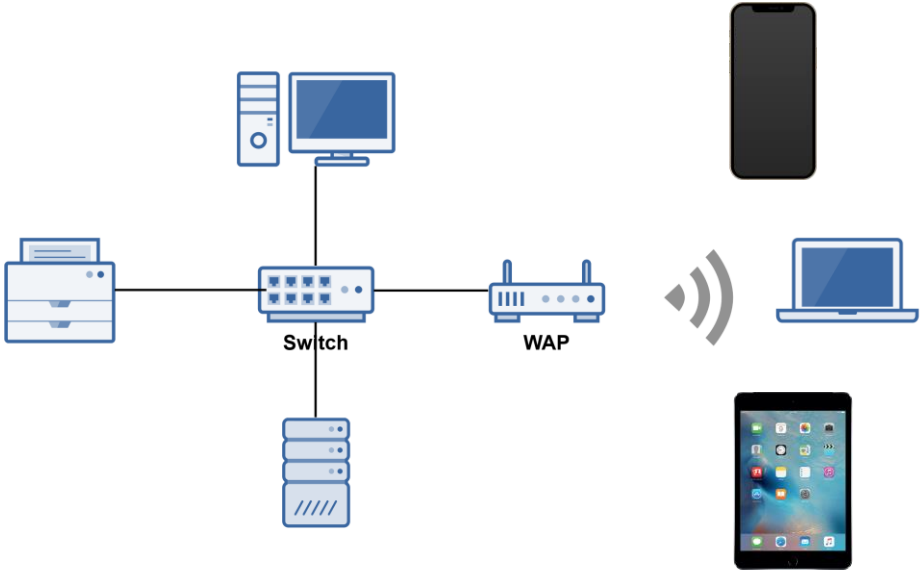
Switches

- Connects Devices Together Just Like a Hub
- Intelligent Network Device (OSI Layer 2)
- Memorizes the **MAC Address** of Each Device Connected to It via a **MAC Address Table,** sometimes called a **Content Addressable Memory (CAM) Table**
- Pays attention to *Source* and *Destination* **MAC addresses** during Communication Process
- Use Application-Specific Integrated Circuitry (**ASIC**), which makes them Extremely Fast
- Breaks up Collision Domains
    - Traffic Goes in One Port and Is Repeated out to Only Destination Port
    - Designed for High Bandwidth
    - Standard in Today's Network Infrastructure



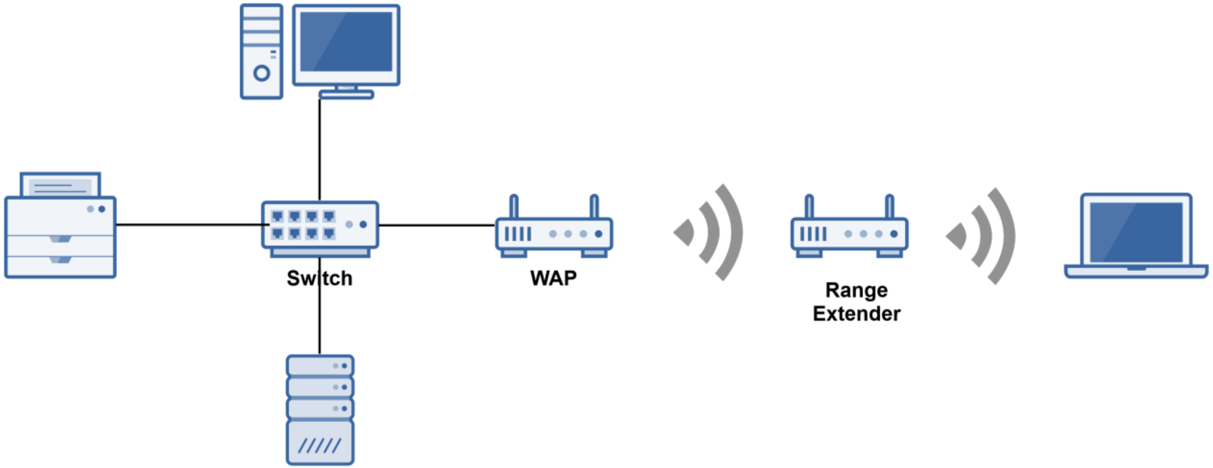
Wireless Access Point (WAP)

- A wireless access point (WAP) is a bridge that extends the wired network to the wireless network.
- Just like a switch, it's a Data Link Layer 2 device.
- **Note**: A WAP is not a router.



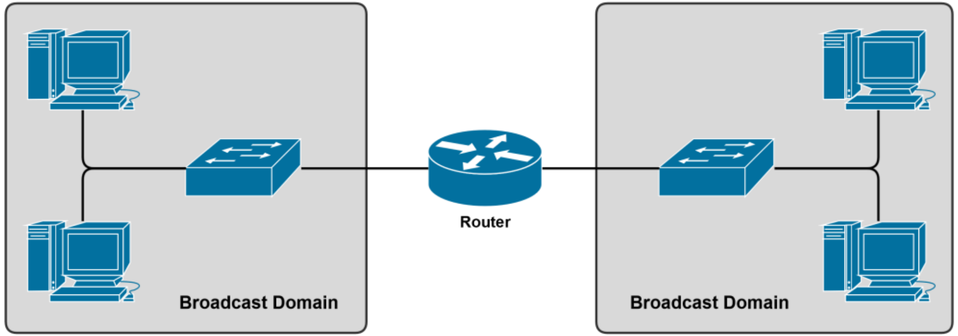
Wireless Ranger Extender

- Extends the range of a wireless network by acting as a wireless repeater.
- Rebroadcasts radio frequencies from the wireless network it is associated with



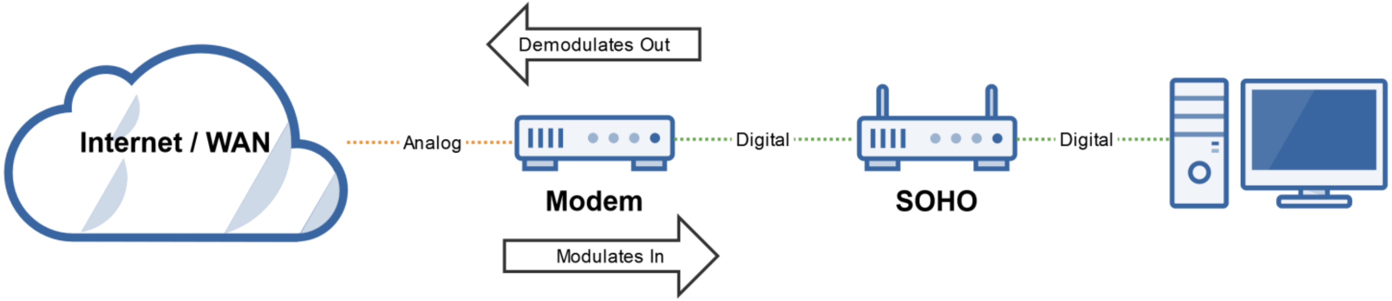
Routers

- Used to Connect Different Networks Together
- Routes Traffic Between Networks using **IP Addresses**
- Uses Intelligent Decisions (Routing Protocols) to Find the Best Way to Get a Packet of Information from One Network to Another.
- Break Up Broadcast Domains
- **OSI Layer 3 Device**
    - Layer 3 = Router
    - Layer 2 = Switch
    - Layer 1 = Hub



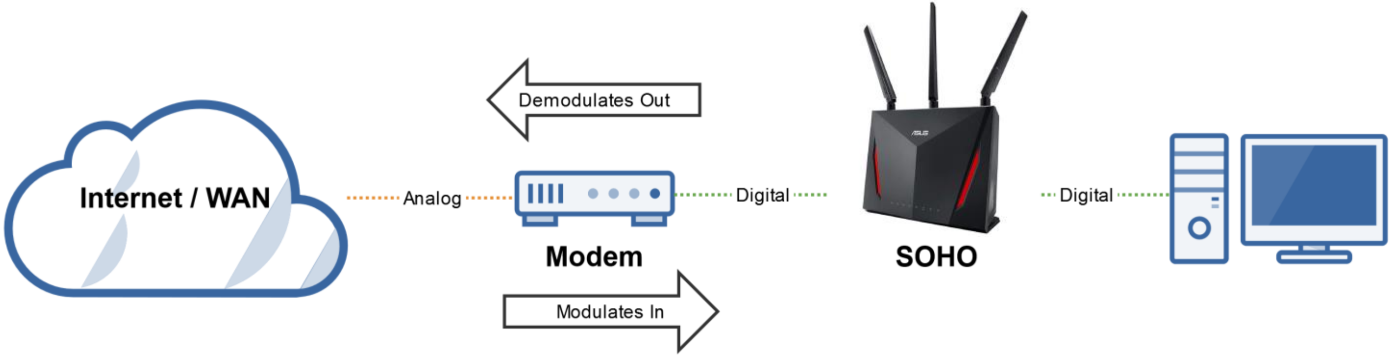
Modems (Modulators/Demodulators)

- Modems modulate one signal to another, such as analog to digital.
- For example, modulating a telephone analog signal into a digital signal that a router can understand.



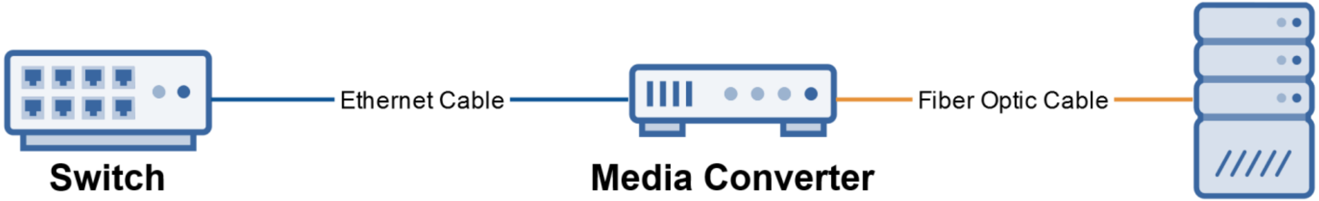
Small Office Home Office (SOHO) Device

- All-In-One Wireless Router with Expanded Capabilities:
  - Router, Wireless Access Point, Firewall, Switch, DHCP Server, NAT Device, File Server, etc.



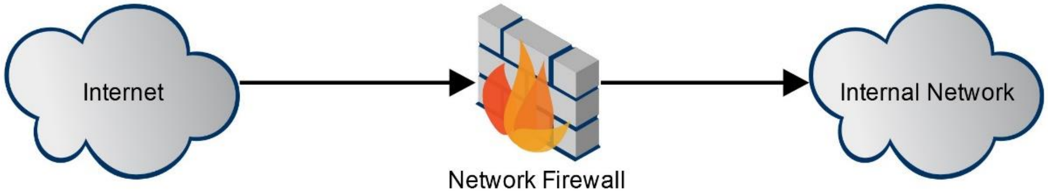
Media Converters

- Like its name implies, it converts one media type to another.
- **Layer 1 Device**: Performs physical layer signal conversion.
- Ethernet to fiber optic media converters are commonly used.



Firewalls

- Firewalls are the foundation of a defense-in-depth network security strategy.
- They protect your network from malicious activity on the Internet.
- Prevent unwanted network traffic on different networks from accessing your network.
- Firewalls do this by filtering data packets that go through them.
- They can be a standalone network device or software on a computer system, meaning **network-based** (**hardware**) or **host-based** (**software**).


Internet
Network Firewall
Internal Network