# Routers

- Specialized network devices that connect multiple networks and facilitate communication between them

- Operate at the Internet Layer (Layer 2) of the TCP/IP Model and the Network Layer (Layer 3) of the OSI Model

- **Examples:**
  - **Hardware:** Homes and offices
  - **Software:** Running on general-purpose computers or virtual machines

- Provide critical network services:
  - Network Address Translation (NAT)
 - Dynamic Host Configuration Protocol (DHCP)
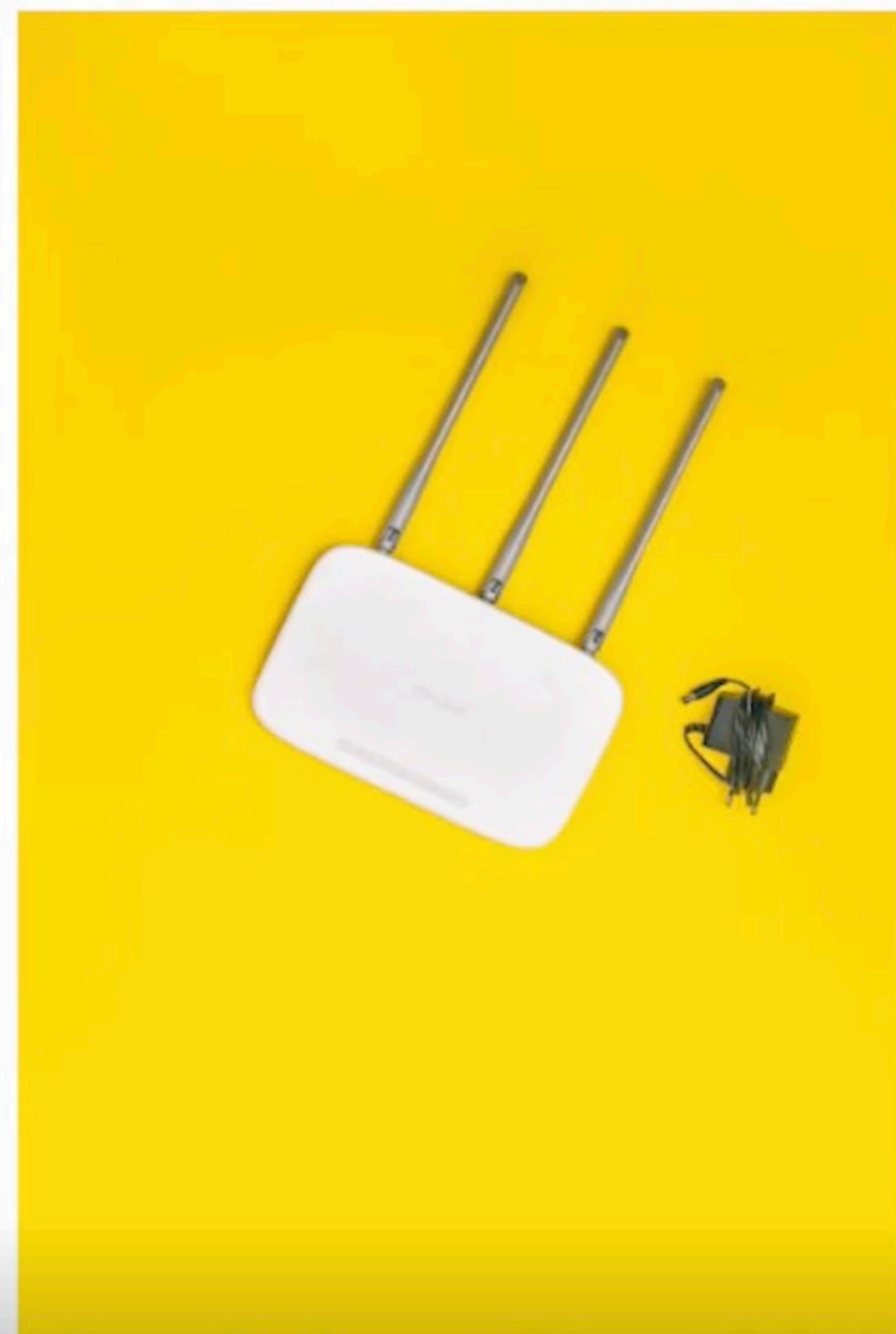
Switches

- Vital network device that operates at Layer 1 of the TCP/IP model and Layer 2 of the OSI model

- Maintain a MAC address table that maps the MAC addresses of connected devices to their respective physical ports

- If the switch finds a match, it forwards the packet to the appropriate port. If not, it floods the packet to all ports except the originating port. This process is known as "flooding"

- Switches come in two types:
  - Unmanaged
  - Managed
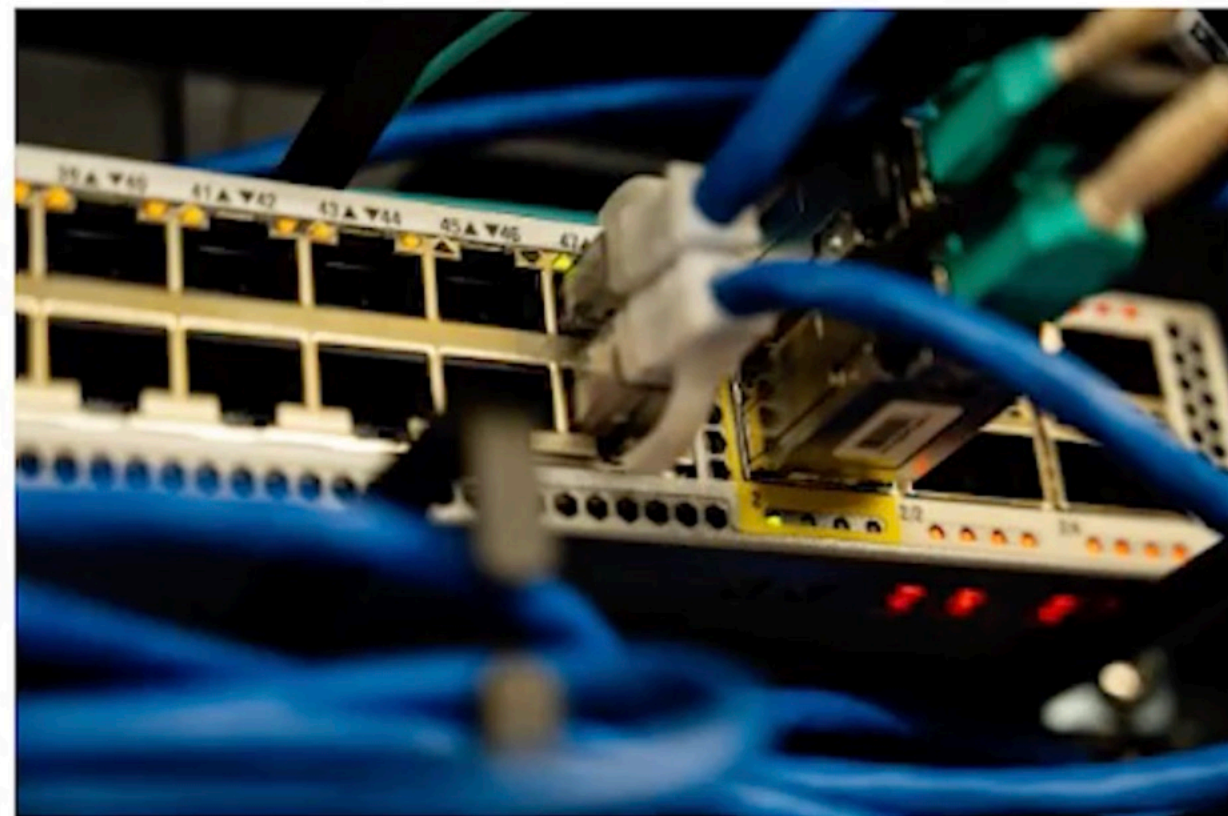
Hubs

- The most basic network devices at the Physical Layer (Layer 1) of the OSI Model

- Function as a central connection point for devices on a network and broadcast any data received to all other ports

- Can lead to network congestion and reduced performance due to indiscriminate broadcasting

Power

Collision
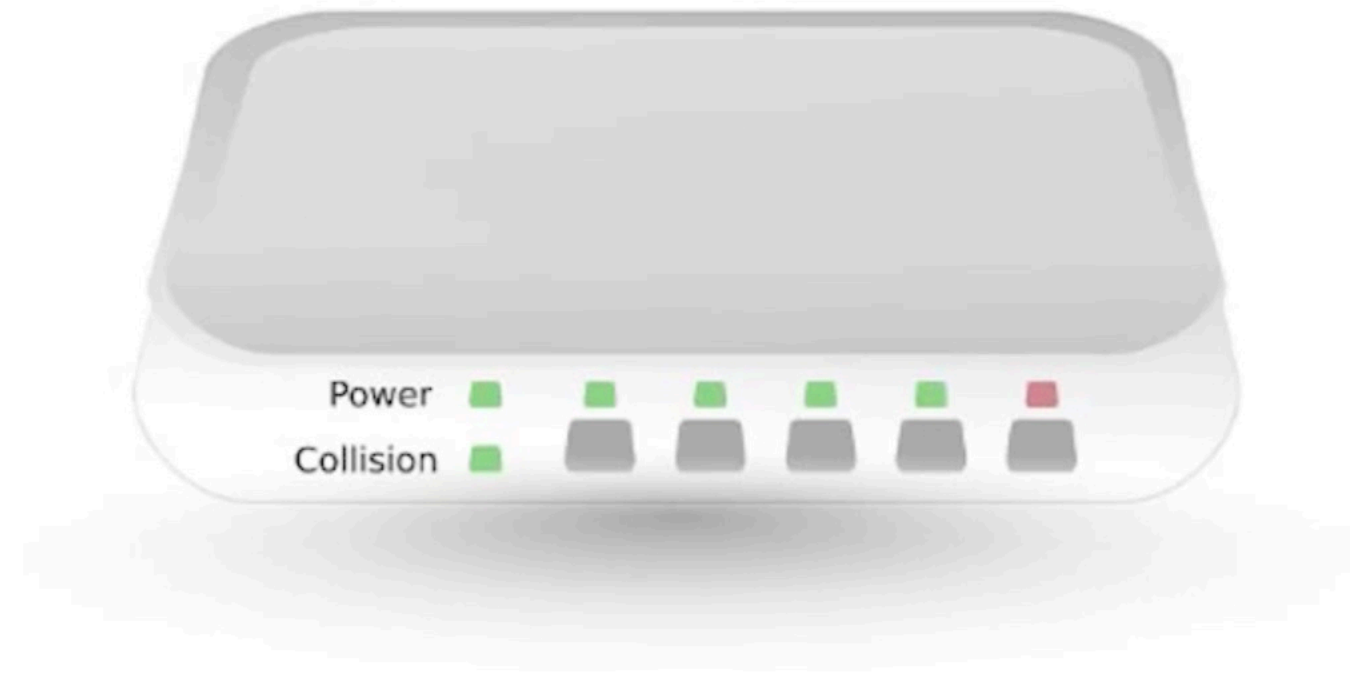
Network Interface Cards (NICs)

- Hardware components that enable devices to connect to a network at the Physical and Data Link Layers (Layer 1 and 2) of the OSI Model

- Convert digital data into electrical signals for transmission over the network medium and vice versa

- They are assigned a unique MAC address to identify the device on the network

- Come in various form factors and support different network standards and speeds, such as Ethernet, Wi-Fi, and Bluetooth

Introduction to Cables and Connectors

- Physical components that connect devices on a network, allowing them to transmit and receive data

- Several types of cables and connectors used in networking, each with its characteristics, advantages, and limitations

- Let's take a closer look at the two most common types: Ethernet and fiber optic cables

Cables and Connectors: Ethernet Cables

- Most widely used type of cable in wired networks

- Twisted pairs of copper wires encased in a protective sheath

- Come in various categories, such as Cat5e, Cat6, and Cat7, each supporting different data transmission speeds and distances

- RJ-45 connectors are the most common connectors used with Ethernet cables

Cables and Connectors: Fiber Optic Cables

- Use light to transmit data over long distances with minimal signal loss and interference

- Consist of thin strands of glass or plastic, called optical fibers, encased in a protective sheath

- Offer higher bandwidth, longer transmission distances, and immunity to electromagnetic interference

- Two primary types of fiber optic connectors: SC and LC connectors
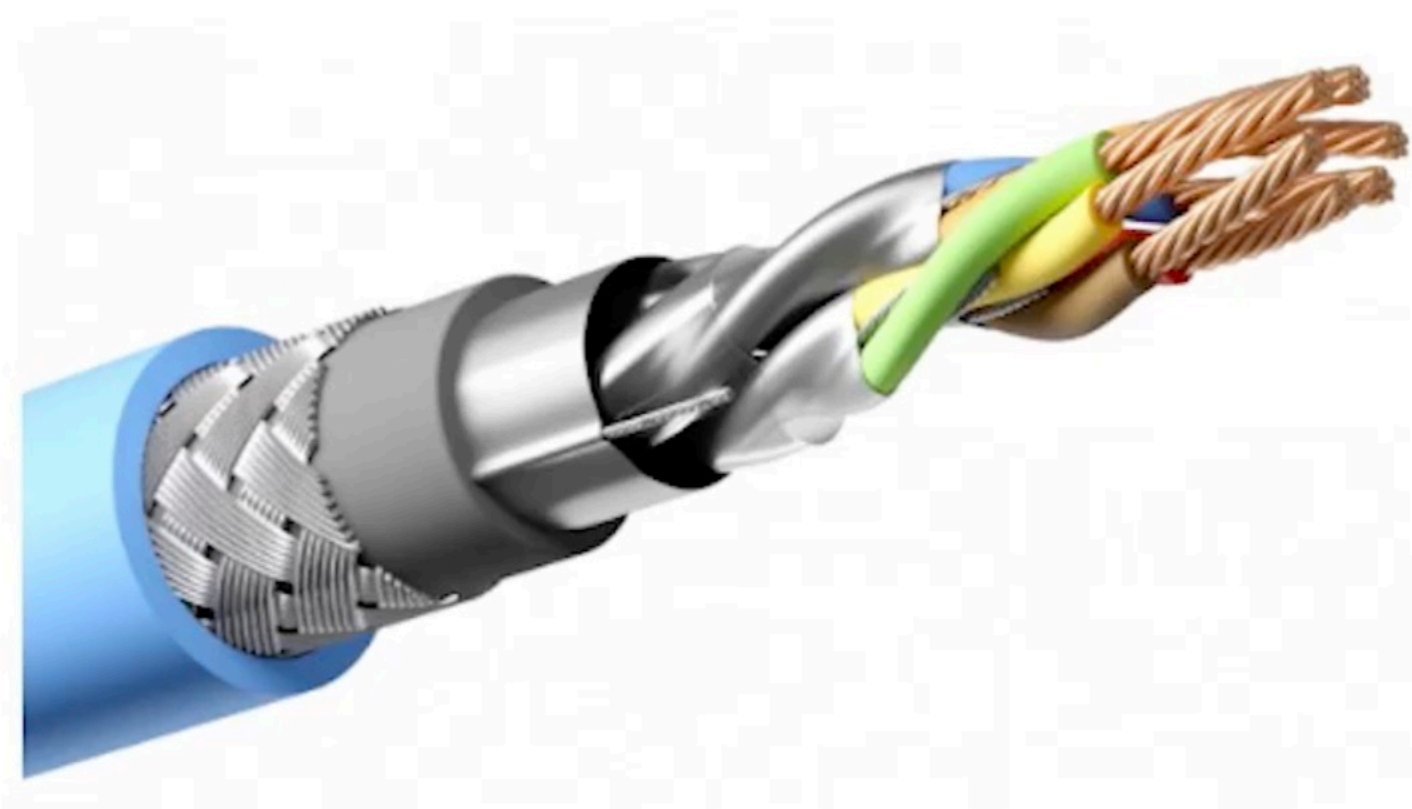
Functions & Differences Between The Network Devices

- **Routers:**
    - Connect multiple networks and route data packets between them
    - Provide essential network services such as NAT and DHCP
    - Operate at the Internet Layer (Layer 2) of the TCP/IP Model and the Network Layer (Layer 3) of the OSI Model

- **Switches:**
    - Direct and forward data packets between devices on the same LAN
    - Use MAC addresses to make forwarding decisions
    - Operate at the Network Interface Layer (Layer 1) of the TCP/IP Model and the Data Link Layer (Layer 2) of the OSI Model

Functions & Differences Between The Network Devices (Cont.)

- **Hubs:**
  - Broadcast data packets to all connected devices
  - Operate at the Physical Layer (Layer 1) of the OSI Model
  - Less efficient and intelligent than switches

- **Network Interface Cards (NICs):**
  - Enable devices to connect to a network
  - Responsible for converting digital data into electrical signals and vice versa
  - Operate at both the Physical Layer (Layer 1) and the Data Link Layer (Layer 2) of the OSI Model

Functions & Differences Between The Network Devices (Cont.)

Cables and Connectors

- **Ethernet Cables:** Ethernet cables are the most common type used in wired networks.

- **Fiber Optic Cables:** Fiber optic cables offer higher bandwidth and longer transmission distances.

Understanding the functions and differences of network devices is essential for building and managing efficient, reliable networks. Consider the appropriate devices and components for performance optimization and congestion reduction.