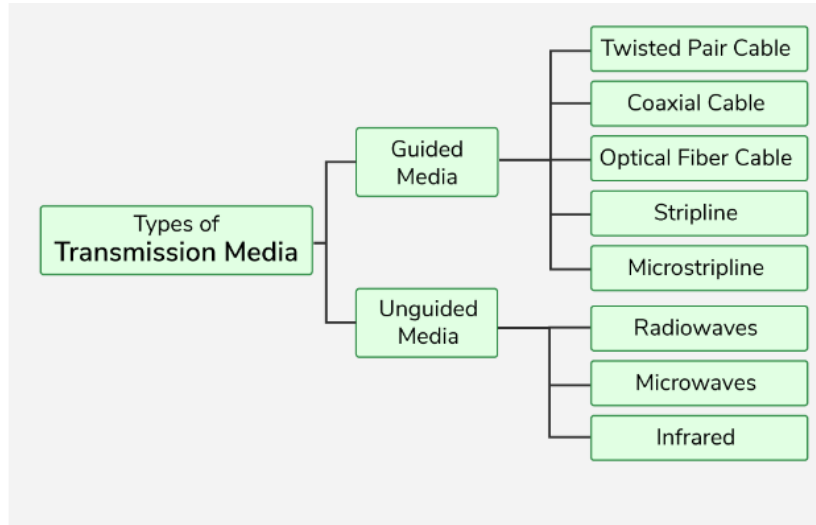


## WEEK1      Transmission media and Network devices      160122733088

AIM : To explore about transmission media.

### DESCRIPTION:

Transmission media refer to the physical pathways through which data is transmitted from one device to another within a network. These pathways can be wired or wireless. The choice of medium depends on factors like distance, speed, and interference.



### 1. Guided Media

Guided media, also known as wired or bounded transmission media, directs and confines signals within a physical path. This type of media ensures that the signals are transmitted through specific channels using physical connectors.

#### Characteristics:

- High transmission speed
- Secure data transfer
- Ideal for shorter distances

The three primary types of Guided Media include:

**Twisted Pair Cable:** This cable consists of two insulated conductor wires twisted around each other. Multiple twisted pairs are often bundled together in a protective covering, making it one of the most widely utilized transmission media.

**Types of Twisted Pair Cable:**



### Unshielded Twisted Pair

- **Unshielded Twisted Pair (UTP):**  
UTP comprises two copper wires twisted around each other without any additional shielding. This type of cable can block interference without relying on a physical shield. It is commonly used in telephone networks.

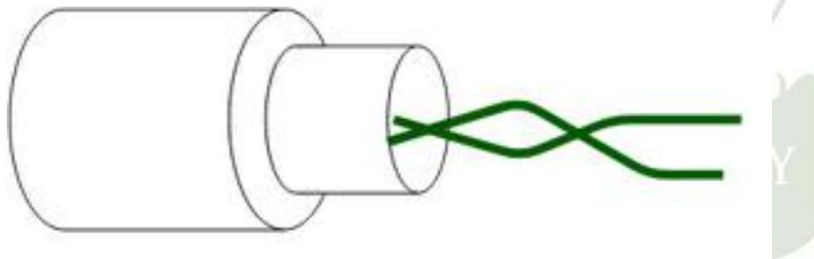
#### Advantages:

- Cost-effective
- Easy to install
- High-speed potential

#### Disadvantages:

- Vulnerable to external interference
- Lower capacity and performance compared to STP
- Limited to short-distance transmission due to signal loss

- **Shielded Twisted Pair (STP):**



### Shielded Twisted Pair

STP includes a special jacket, such as a copper braid or foil shield, to block external interference. It is used in fast Ethernet and voice/data channels.

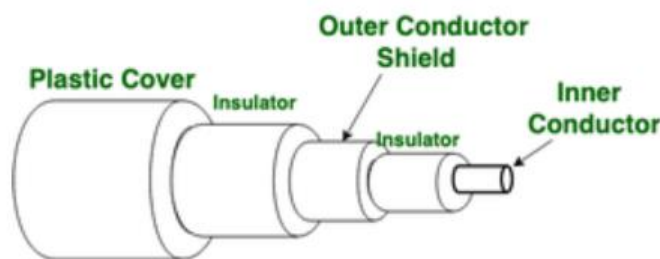
#### Advantages:

- Superior performance at higher data rates compared to UTP
- Reduces crosstalk
- Faster data transmission

- **Disadvantages:**

- More challenging to install and manufacture
- Higher cost
- Bulkier design

**Coaxial Cable:** Coaxial cables consist of a plastic outer cover, an insulation layer made of PVC or Teflon, and two parallel conductors with their own insulation. These cables transmit data in two modes: Baseband (dedicated bandwidth) and Broadband (split bandwidth). They are commonly used for cable TV and analog television networks.



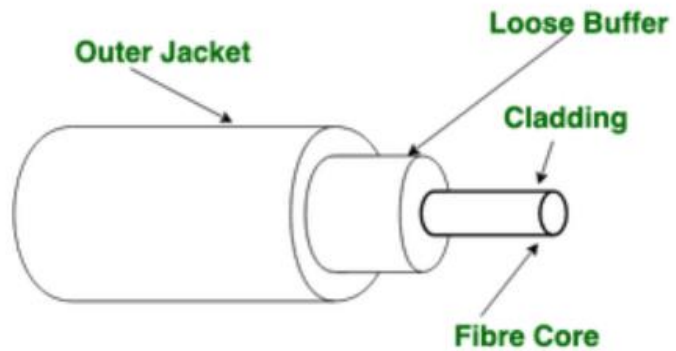
**Advantages:**

- Supports high bandwidth
- Easy to install
- Reliable and durable with better resistance to interference
- Supports multiple channels

**Disadvantages:**

- Expensive
- Requires grounding to prevent crosstalk
- Bulky design
- Vulnerable to security breaches if tampered with

**Optical Fiber Cable:** Optical fiber cables use the principle of light refraction through a core made of glass or plastic, surrounded by cladding with lower density. These cables are used for transmitting large volumes of data and can be either unidirectional or bidirectional. Wavelength Division Multiplexing (WDM) allows data to be transmitted in both directions.



#### Advantages:

- High capacity and bandwidth
- Lightweight
- Low signal attenuation
- Immune to electromagnetic interference
- Resistant to corrosive materials

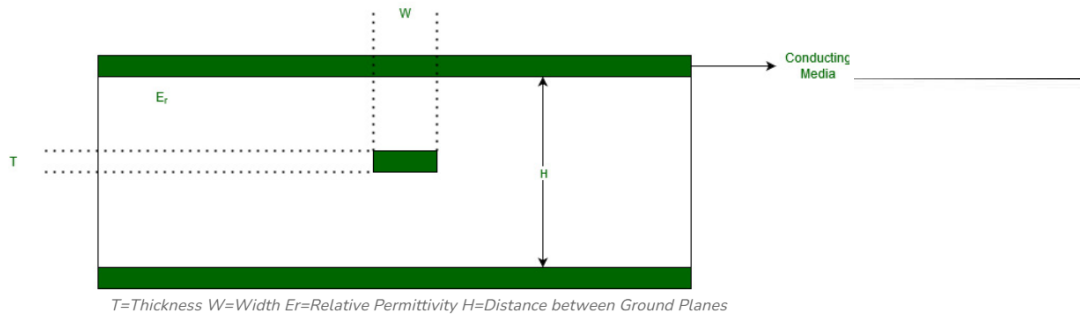
#### Disadvantages:

- Difficult to install and maintain
- Expensive
- Fragile

#### Applications:

- Medical instruments
- Data transmission in aerospace and defense
- Internet cable infrastructure
- Lighting and safety in automotive design

#### 4.Stripline and Microstripline:



- **Stripline:** A transmission line medium invented in the 1950s, where a conductor is sandwiched between two ground planes, providing electromagnetic interference (EMI) immunity.
- **Microstripline:** A variation where the conductor is separated from the ground plane by a dielectric layer.

## 2. Unguided Media

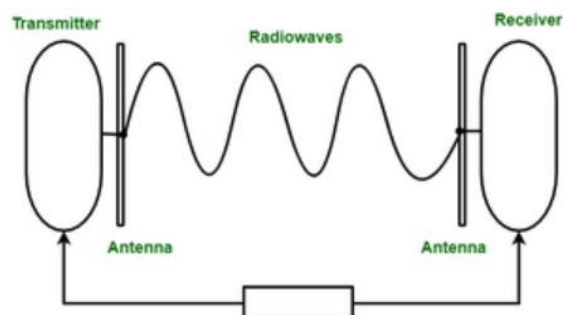
Unguided media, also known as wireless or unbounded transmission media, does not require a physical medium for transmitting electromagnetic signals.

### Characteristics:

- Signal broadcast through the air
- Less secure compared to guided media
- Suitable for long-distance communication

### Types of Signals in Unguided Media:

#### 1. Radio Waves:

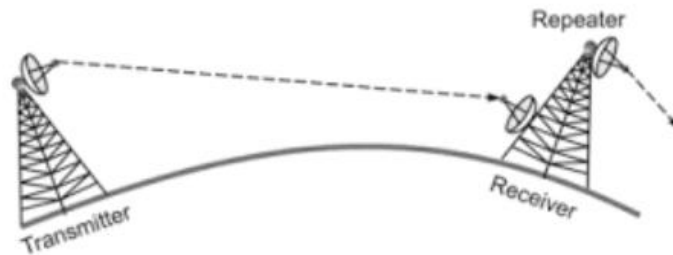


These waves are easy to generate and can penetrate buildings. The sending and receiving antennas do not need to be aligned. The frequency range is from 3

KHz to 1 GHz. Radio waves are used in AM and FM radio broadcasts and \_\_\_\_\_ cordless phones.

- **Further Divisions:** Terrestrial and Satellite Radio Waves

## 2. Microwaves:



**Fig: Microwave Transmission**

*Microwave Transmission*

Microwaves require line-of-sight transmission, meaning the antennas must be properly aligned. The distance the signal can travel is proportional to the height of the antenna. The frequency range is from 1 GHz to 300 GHz. Microwaves are primarily used for mobile phone communication and television distribution.

## 3. Infrared waves

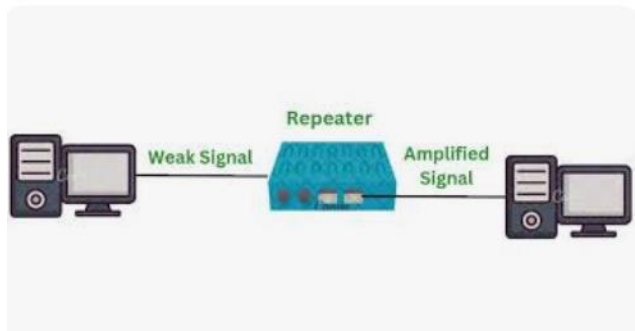
Infrared waves are used for very short distance communication. They cannot penetrate through obstacles. This prevents interference between systems. Frequency Range: 300GHz – 400THz. It is used in TV remotes, wireless mouse, keyboard, printer, etc.

AIM : To explore about networking devices.

#### DESCRIPTION:

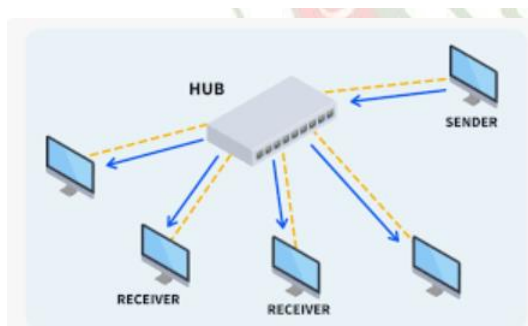
Network devices, also known as networking hardware, are physical devices that allow hardware on a computer network to communicate and interact with one another. For example Repeater, Hub, Bridge, Switch, Routers, Gateway, Brouter, and NIC, etc.

### 1. Repeater



A repeater operates at the physical layer, amplifying or regenerating signals to extend their transmission distance across a network. When signals weaken or become corrupted, the repeater regenerates the signal bit by bit, restoring its original strength. It's a basic 2-port device used in star topology connectors.

### 2. Hub



A hub is essentially a multi-port repeater, connecting multiple devices in a network. Unlike switches, hubs cannot filter data, so data packets are sent to all connected devices, keeping the collision domain the same for all hosts. Hubs lack intelligence for determining the best path for data, leading to inefficiencies.

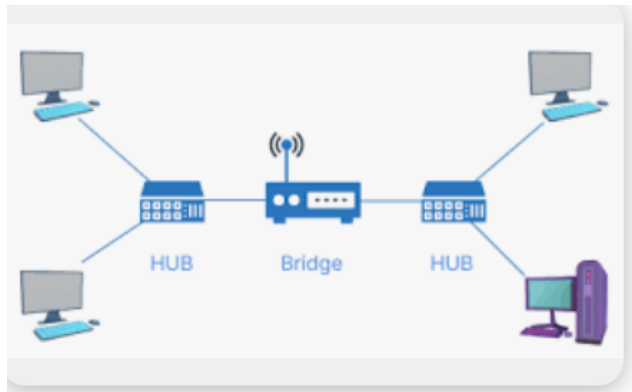
#### Types of Hubs:

- **Active Hub:** Has its own power supply, boosts, and relays signals, acting as both a repeater and wiring center, extending the network.



- **Passive Hub:** Relays signals without boosting, collecting wiring from nodes and power from an active hub.
- **Intelligent Hub:** Functions like an active hub with remote management capabilities and flexible data rates. It allows administrators to monitor and configure traffic.

### 3. Bridge

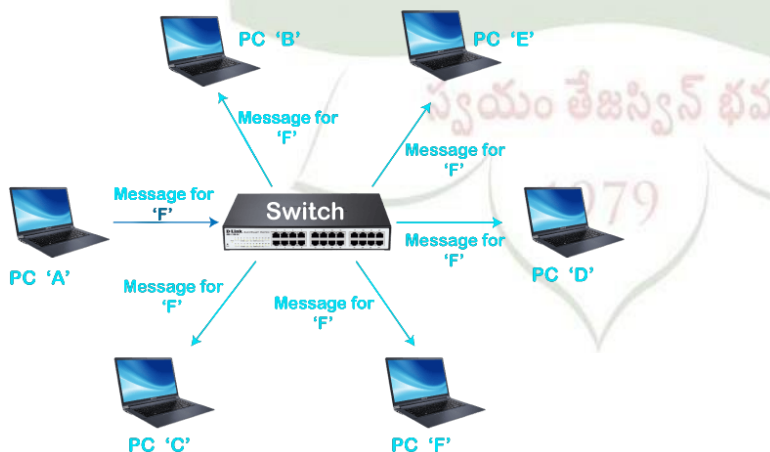


A bridge operates at the data link layer and serves as a repeater with additional filtering capabilities based on MAC addresses. It connects two LANs using the same protocol and has a single input and output port.

#### Types of Bridges:

- **Transparent Bridges:** Operate without the stations being aware of the bridge, requiring no reconfiguration. They use bridge forwarding and learning.
- **Source Routing Bridges:** The source station determines the route for the data frame, using a discovery frame to identify the path.

### 4. Switch



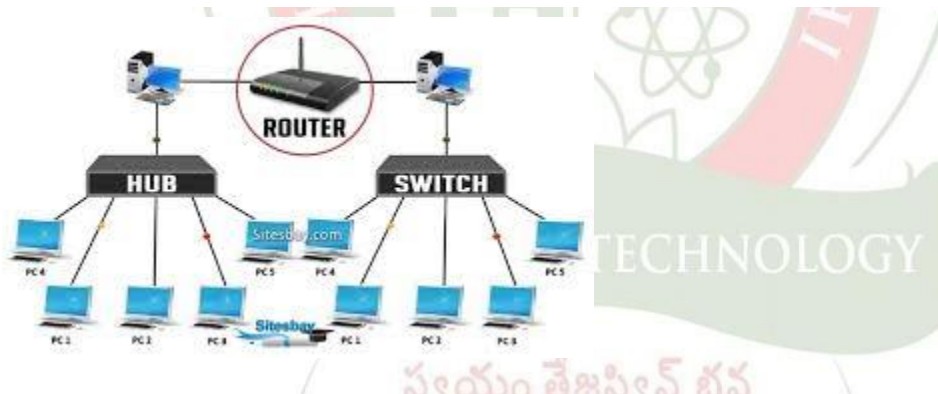


A switch is a multiport bridge with a buffer, enhancing efficiency and performance by reducing traffic. Operating at the data link layer, it performs error-checking before forwarding data, ensuring only error-free packets are sent to the correct port, dividing the collision domain but maintaining the same broadcast domain.

### Types of Switches:

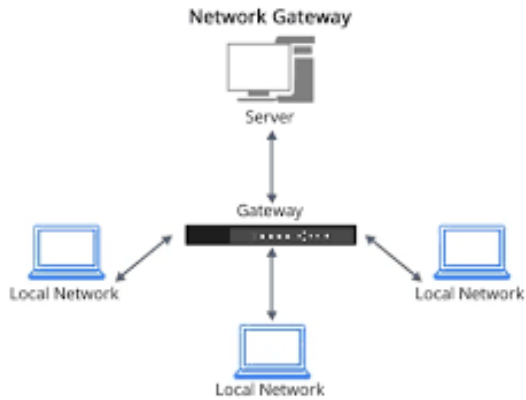
- **Unmanaged:** Simple plug-and-play with no advanced configuration.
- **Managed:** Offers advanced settings like VLANs and QoS for larger networks.
- **Smart:** Similar to managed switches but easier to set up, suitable for small to medium networks.
- **Layer 2:** Operates at the Data Link layer, forwarding data within the same network segment.
- **Layer 3:** Functions at the Network layer, routing data between network segments.
- **PoE:** Provides power over Ethernet to network devices.
- **Gigabit:** Supports high-speed Gigabit Ethernet.
- **Rack-mounted:** Designed for data centers, mounted in server racks.
- **Desktop:** Smaller switches for desktop or small office use.
- **Modular:** Allows easy expansion and customization for large networks.

### 5. Router



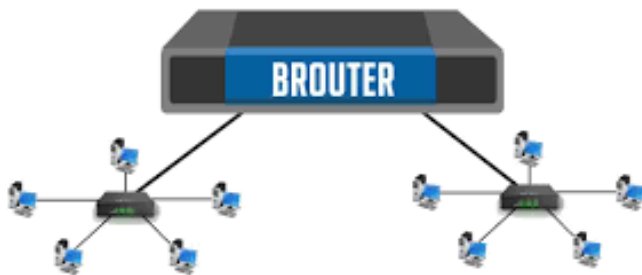
A router, operating at the network layer, routes data packets based on IP addresses, connecting LANs and WANs. It uses a dynamically updating routing table to make routing decisions, dividing broadcast domains.

### 6. Gateway



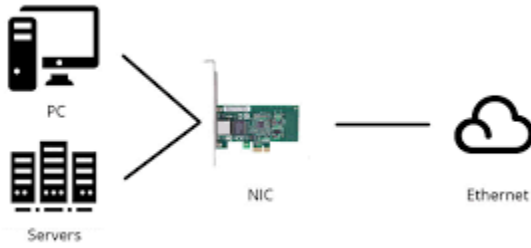
A gateway connects two networks using different protocols, acting as a translator that interprets and transfers data between them. Known as protocol converters, gateways can operate at any network layer and are more complex than switches or routers.

## 7. Router



A router, or bridging router, combines the functions of both a bridge and a router. It can operate at either the data link layer or the network layer, routing packets across networks or filtering traffic within a local area network.

## 8. NIC



A Network Interface Card (NIC) is a network adapter installed in a computer to connect it to a network. It operates at both the physical and data link layers, providing a unique ID for the computer and connecting it to a network via a cable.

