

CNND MAY 2023 Answers

Q1

a) Compare Twisted pair cable, Coaxial cable and Fiber optics cable.

Comparison of Twisted Pair, Coaxial, and Fiber Optic Cables

Feature	Twisted Pair Cable	Coaxial Cable	Fiber Optic Cable
Structure	Two insulated copper wires twisted together	Central copper core with insulation and shielding	Glass or plastic fiber core with cladding
Types	UTP (Unshielded) & STP (Shielded)	RG-6, RG-59, RG-11	Single-mode & Multi-mode
Bandwidth	Up to 10 Gbps (CAT-6)	Up to 10 Gbps	Tbps range (Very high)
Distance	100m (max)	500m – 1km	10–100 km+
Interference	High (especially UTP)	Moderate (shielding helps)	Minimal (immune to EMI)
Speed	Low to Moderate	Moderate to High	Very High
Cost	Low	Moderate	Expensive
Durability	Less durable	More durable	Very durable
Usage	LAN, telephone networks	Cable TV, broadband internet	High-speed data, long-distance communication
Advantages	Cheap, easy to install	Better shielding than twisted pair	High speed, low loss, secure
Disadvantages	Prone to interference, limited speed	Bulky, limited bandwidth	Expensive, complex installation

b) Explain Ethernet Protocol.

Ethernet is a widely used **wired networking technology** that defines how devices communicate within a **Local Area Network (LAN)**. It follows the **IEEE 802.3 standard** and uses **frames** to transmit data over physical cables such as **twisted pair, coaxial, or fiber optics**.

Ethernet Features

- Wired communication** for LAN networks.
- Uses MAC (Media Access Control) addresses** for device identification.

- Supports **various data rates** (10 Mbps to 400 Gbps).
- Operates in **half-duplex** or **full-duplex** mode.

Working of Ethernet Protocol

1. **Carrier Sense:** A device checks if the medium (cable) is free before sending data.
2. **Multiple Access:** All devices share the same medium.
3. **Collision Detection (CSMA/CD):**
 - If two devices transmit simultaneously, a **collision occurs**.
 - Both devices **stop transmitting** and **wait for a random backoff time** before retrying.

Ethernet Standards & Speeds

Standard	Speed	Cable Type	Max Distance
10BASE-T	10 Mbps	Twisted Pair	100m
100BASE-T (Fast Ethernet)	100 Mbps	Twisted Pair	100m
1000BASE-T (Gigabit Ethernet)	1 Gbps	Twisted Pair	100m
10GBASE-T	10 Gbps	Twisted Pair	100m
100GBASE-X	100 Gbps	Fiber Optic	Up to 40 km

Advantages of Ethernet

- ✓ High speed & reliability.
- ✓ Simple and cost-effective.

Disadvantages

- ✗ Prone to **collisions** in shared networks.

b) Compare lossy with lossless data compression technique.

Aspect	Lossy Compression	Lossless Compression
Definition	Reduces file size by permanently removing some data.	Reduces file size without losing any data, allowing for perfect restoration.
Data Retrieval	Original data cannot be recovered after compression.	Original data can be fully restored after decompression.
Examples of Use	Commonly used for multimedia files (images, audio, video), like MP3, JPEG, MP4.	Used for text files, software, and critical data, like ZIP, PNG, FLAC.
Quality	Slight reduction in quality due to data loss.	Retains original quality since no data is lost.
Compression Ratio	Higher compression ratios, making files much smaller.	Lower compression ratios compared to lossy methods.
Use Case	Suitable for scenarios where reduced file size is more critical than perfect quality.	Ideal for situations where data integrity is crucial, such as databases or backups.

e) How many networks and hosts are possible using ‘Class B’ IP addressing? What is subnet mask?

1. Number of Networks and Hosts in Class B IP Addressing

In Class B, the IP address range is 128.0.0.0 to 191.255.255.255.

It uses:

- 16 bits for the Network ID
- 16 bits for the Host ID

Number of Networks:

$$2^{14} = 16,384 \text{ networks}$$

(Since the first **two** bits are fixed as **10**, only 14 bits are available for network identification.)

Number of Hosts per Network:

$$2^{16} - 2 = 65,534 \text{ hosts}$$

(The subtraction of 2 accounts for the **network address** and **broadcast address**, which cannot be assigned to devices.)

 **Final Answer:**

- 16,384 networks
- 65,534 hosts per network

2. What is a Subnet Mask?

A **subnet mask** is a 32-bit number used to divide an IP address into network and host portions. It helps in identifying the network to which an IP address belongs.

Default Subnet Mask for Class B:

255.255.0.0 (or in CIDR notation: /16)

This means:

- First 16 bits represent the Network ID (255.255).
- Last 16 bits represent the Host ID (0.0).

Example:

For IP 172.16.5.10, with a **subnet mask** of 255.255.0.0, the:

- Network ID = 172.16.0.0
- Host ID = 5.10

Q2

b) Explain the difference between static and dynamic routing. Explain distance vector routing.

Aspect	Static Routing	Dynamic Routing
Route Setup	Routes are manually configured by the network administrator.	Routes are automatically learned and updated using routing protocols.
Flexibility	Less flexible; changes require manual intervention.	Highly flexible; adapts to network changes automatically.
Complexity	Simple to configure and manage.	More complex due to routing protocol operations.
Scalability	Suitable for small networks with fewer route changes.	Ideal for large networks with frequent route changes.
Overhead	Minimal processing overhead.	Requires processing power and bandwidth for protocol operation.
Example	Small office networks, static routes for VPNs.	Internet routing, dynamic protocols like RIP, OSPF, and BGP.

Q4

a) Draw and explain guided and unguided transmission media.

Transmission Media in Communication

Transmission media are the physical pathways used to transmit data between devices in a network. They are classified into **guided** and **unguided** media.

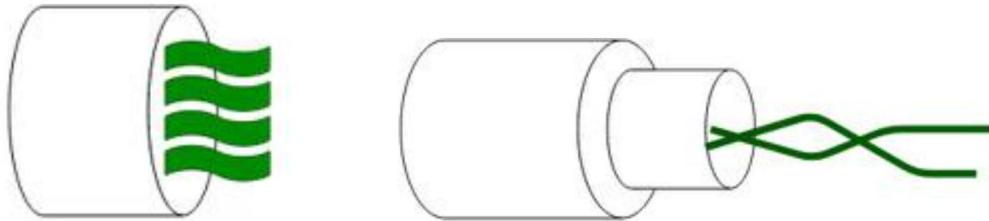
1. Guided Transmission Media

Guided media use a physical medium (cables) to transmit signals. The signal is confined within the medium, reducing interference and improving reliability.

Types of Guided Media:

- **Twisted Pair Cable:** Two insulated copper wires twisted together to reduce electromagnetic interference. Used in telephone lines and LANs.

- **Coaxial Cable:** Consists of a central conductor, insulating layer, metal shield, and outer cover. Used in cable TV and broadband.
- **Fiber Optic Cable:** Uses light signals to transmit data through glass or plastic fibers. Offers high speed, large bandwidth, and low signal loss.



Unshielded Twisted Pair

Unshielded Twisted Pair

Shielded Twisted Pair

Shielded Twisted Pair

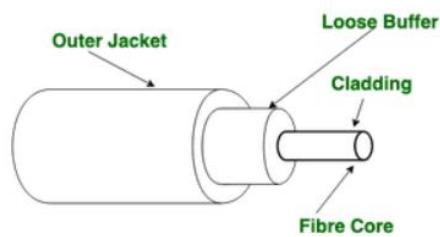
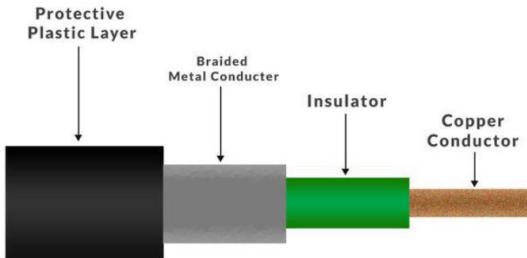


Figure of Optical Fibre Cable

2. Unguided Transmission Media

Unguided media, also known as wireless media, transmit signals through the air or space without a physical medium. They rely on electromagnetic waves.

Types of Unguided Media:

- **Radio Waves:** Used for AM/FM radio, TV broadcasting, and Wi-Fi. Can travel long distances and penetrate obstacles.
- **Microwaves:** Used in satellite communication and mobile networks. Require line-of-sight communication.
- **Infrared (IR):** Used in remote controls and short-range communication. Cannot pass through obstacles.

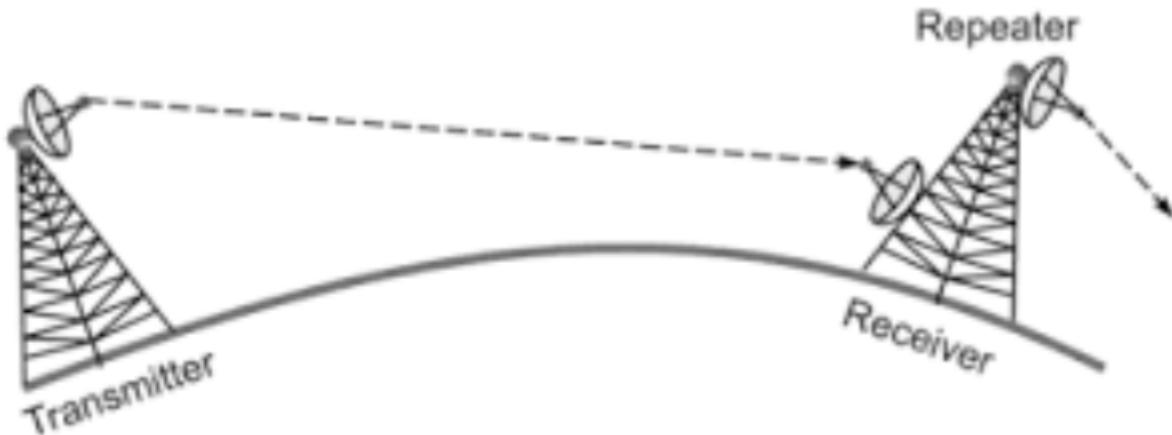
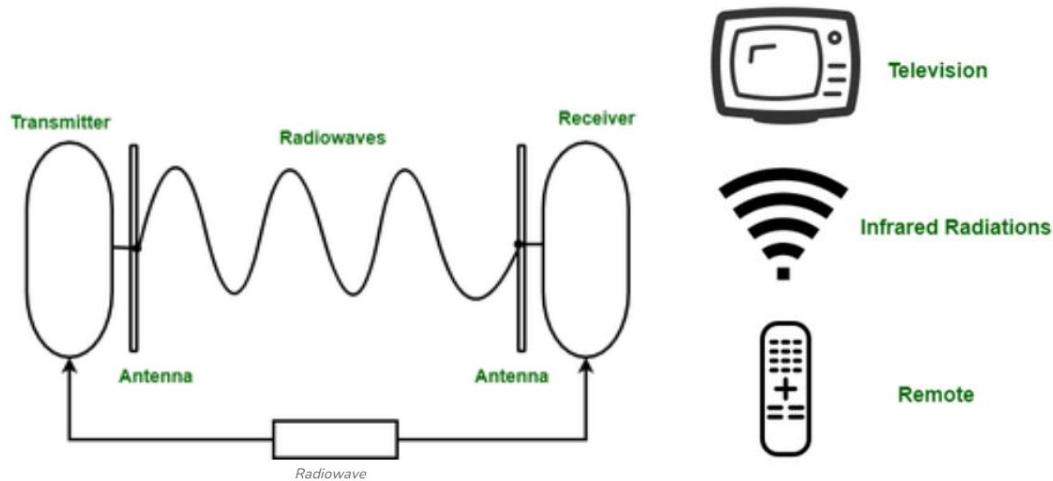


Fig: Microwave Transmission

b) Explain Go-Back-N protocol.

Go-Back-N Protocol

Go-Back-N (GBN) is an ARQ (Automatic Repeat reQuest) protocol used for reliable data transmission in **sliding window flow control**. It ensures that packets are delivered in order without errors or loss.

How It Works

1. Sliding Window Mechanism:

- The sender can transmit up to **N frames (window size)** before waiting for an acknowledgment (ACK).

- The receiver **only accepts frames in order and discards out-of-order frames.**

2. Acknowledgment (ACK) Handling:

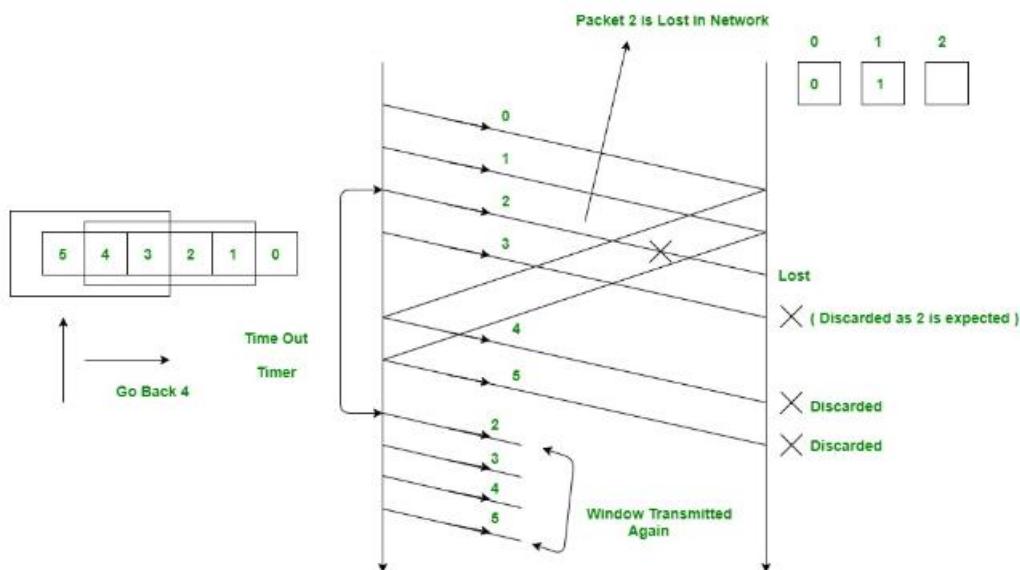
- The receiver sends an **ACK for the last correctly received frame**.
 - ACK is **cumulative**, meaning it acknowledges all previous frames.

3. Error Handling (Retransmission):

- If a frame is lost or corrupted, the receiver **stops accepting new frames**.
 - The sender **goes back** and retransmits all frames starting from the **lost frame**.

Example Scenario (Window Size = 4)

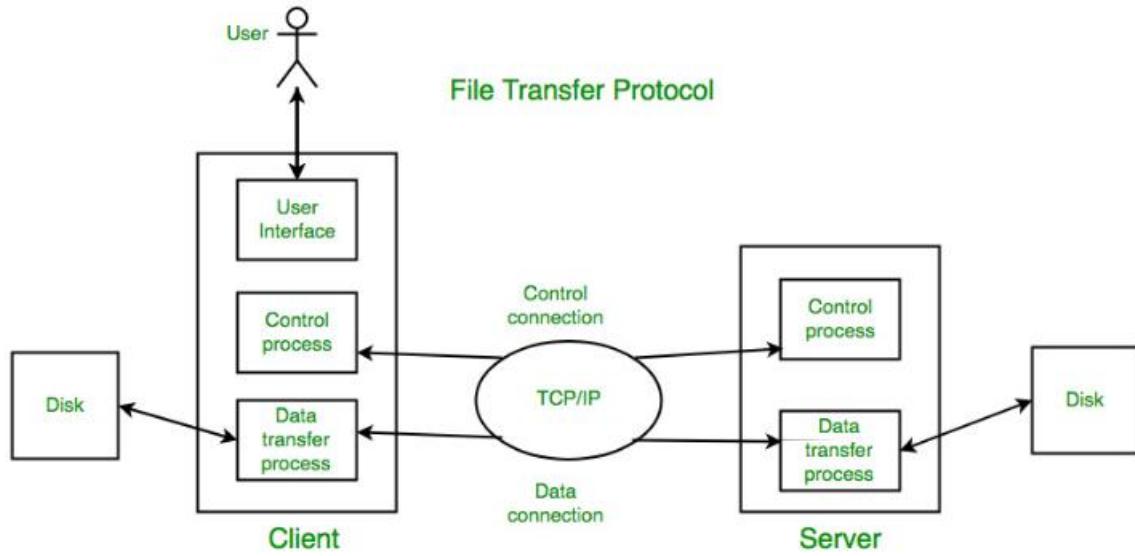
1. Sender transmits **Frames 1, 2, 3, and 4**.
 2. Receiver correctly receives **Frames 1, 2, and 4**, but Frame **3 is lost**.
 3. Receiver sends **ACK 2** (last correctly received frame).
 4. Sender **goes back** and retransmits **Frames 3 and 4**.



Q6. Write a Short Note on

a) FTP

File Transfer Protocol (FTP) is a standard network protocol used to transfer files between a client and a server over a TCP/IP network, such as the internet. It enables users to upload, download, and manage files on remote servers efficiently.



Key Features

1. Two Connections:

- FTP uses two separate connections: a control connection (port 21) for commands and a data connection (port 20) for transferring files.

2. Authentication:

- Supports user authentication with usernames and passwords.

3. File Management:

- Allows operations like uploading, downloading, deleting, and renaming files on servers.

Applications

- **Web Development:** Uploading website files to hosting servers.
- **Backup Systems:** Transferring large files between systems.
- **File Sharing:** Sharing files over a network efficiently.

c) VPN

Definition:

A **VPN (Virtual Private Network)** is a secure communication method that allows users to send and receive data over a **public network (like the Internet)** as if they were directly connected to a **private network**.

Key Features:

- **Encrypts** data to ensure privacy and security
- **Hides IP address** to maintain user anonymity
- Allows **remote access** to private networks (e.g., for employees working from home)

How it Works:

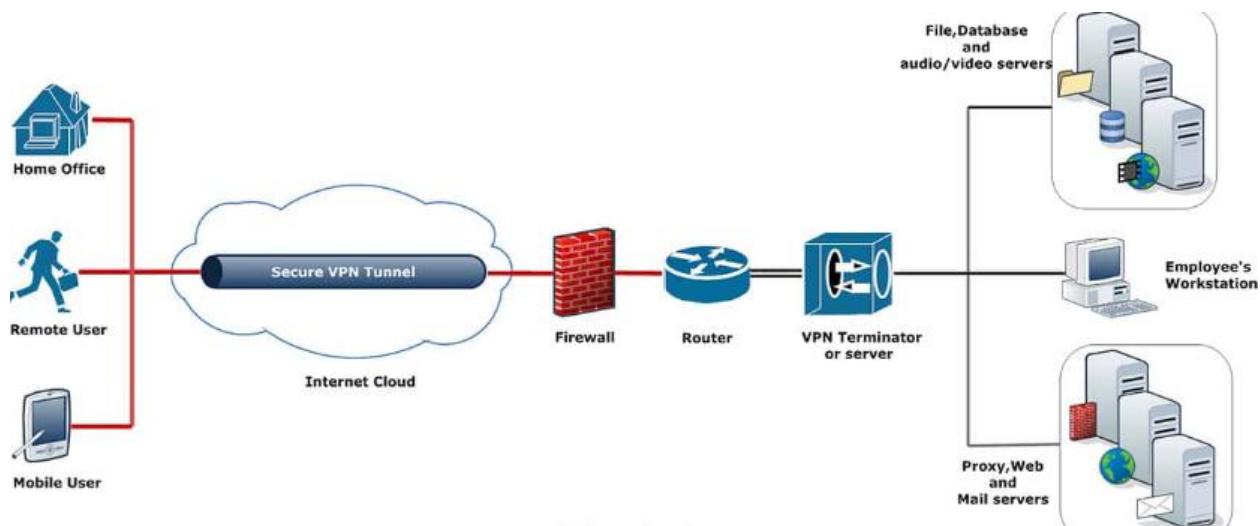
- Creates a **virtual tunnel** between the user's device and the VPN server.
- All data passing through this tunnel is **encrypted**, making it unreadable to hackers or ISPs.

Uses of VPN:

- Secure browsing on public Wi-Fi
- Accessing region-restricted content
- Protecting sensitive business data over the internet

Types of VPN:

- **Remote Access VPN:** For individuals connecting to a private network
- **Site-to-Site VPN:** For connecting entire networks across locations



e) HTTP

HyperText Transfer Protocol (HTTP) is a foundational protocol used on the World Wide Web for transferring hypertext documents, such as HTML files. It follows a client-server communication model where web browsers (clients) request resources from web servers.



Key Features

1. **Request-Response Model:**
 - o The client sends an HTTP request, and the server responds with the requested resource or an error message.
2. **Stateless Protocol:**
 - o Each request is independent; the protocol does not retain any memory of previous interactions.
3. **Port:**
 - o HTTP operates on port 80 by default.

Applications

- HTTP is used to access websites, transfer web content, and retrieve resources like images, videos, and APIs.
- Plays a crucial role in web browsing and online communication.