Repeated Questions (10):

1. **Explain the Analog and Digital Transmission.**
    - Repeated: 2 times
2. **Explain Error Control.**
    - Repeated: 2 times
3. **Discuss about Routers.**
    - Repeated: 2 times
4. **Discuss about Gateway.**
    - Repeated: 2 times
5. **Discuss Circuit Switching.**
    - Repeated: 2 times
6. **Explain about Message Switching.**
    - Repeated: 1 time
7. **Explain the TCP / IP Reference Model.**
    - Repeated: 1 time
8. **Write Short Notes on Transmission Modes.**
    - Repeated: 1 time
9. **Explain about Error Detection.**
    - Repeated: 1 time
10. **Explain the concept of FDDI in detail.**
    - Repeated: 1 time

1. Explain the Analog and Digital Transmission.

Analog Transmission:

1. **Signal Type**: Analog transmission uses continuous signals that vary in amplitude, frequency, or phase.
2. **Medium**: Typically used in older communication systems like radio, telephone lines, or television broadcasting.
3. **Quality**: Analog signals are more susceptible to noise and distortion during transmission.
4. **Bandwidth**: Analog transmission requires a broader range of frequencies and often results in lower data transfer rates.
5. **Efficiency**: Analog transmission is less efficient when compared to digital methods, particularly for error detection and correction.
6. **Applications**: Used for audio and video broadcasting and older phone systems.
7. **Conversion**: Analog data needs to be converted into electrical signals for transmission over communication lines.

Digital Transmission:

1. **Signal Type**: Digital transmission involves discrete signals, typically represented by binary (0s and 1s).
2. **Medium**: Common in modern systems like computer networks, cellular networks, and digital TVs.
3. **Quality**: Digital signals are less prone to noise and degradation, allowing for clearer communication over long distances.
4. **Bandwidth**: Digital systems use bandwidth more efficiently, allowing faster data transfer and more reliable communications.
5. **Error Detection**: Digital signals support advanced error detection and correction methods.
6. **Applications**: Used for high-speed internet, data transmission, and modern phone systems.
7. **Conversion**: Analog signals must be converted into digital format before being transmitted over digital networks.

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2. Explain Error Control.

1. **Definition**: Error control refers to the techniques used to detect and correct errors in transmitted data to ensure the accuracy of received information.
2. **Error Detection**: Involves methods like checksums, parity checks, and CRC (Cyclic Redundancy Check) to identify errors in data.
3. **Error Correction**: Involves methods like Hamming Code, where errors are not just detected but also corrected automatically.

4. **Types of Errors**: Common errors include bit errors, burst errors, and packet loss, which are corrected by retransmitting data.
5. **Automatic Repeat Request (ARQ)**: A technique that requests retransmission of data if errors are detected.
6. **Forward Error Correction (FEC)**: A method where the sender adds redundant data so the receiver can detect and correct errors without needing retransmissions.
7. **Importance**: Error control ensures the integrity of data transmission, especially in noisy or unreliable communication environments.

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3. Discuss about Routers.

1. **Definition**: Routers are network devices that forward data packets between different networks, directing them to their destination based on IP addresses.
2. **Function**: They determine the best path for data to travel from source to destination using routing tables and algorithms.
3. **Types**: Routers can be physical devices or software-based solutions that manage network traffic.
4. **Routing Tables**: Routers maintain tables with network information to decide how to forward packets based on destination addresses.
5. **Protocols**: Routers use protocols like RIP (Routing Information Protocol) and OSPF (Open Shortest Path First) to exchange routing information.
6. **NAT (Network Address Translation)**: Routers can map private IP addresses to public IP addresses to allow multiple devices to share a single public IP address.
7. **Security**: Routers can provide basic network security by filtering traffic, performing packet inspection, and blocking unwanted access.

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4. Discuss about Gateway.

1. **Definition**: A gateway is a network device that connects two different networks and allows communication between them, often performing protocol conversions.
2. **Function**: It acts as a bridge between different network architectures, such as connecting a local area network (LAN) to a wide area network (WAN) or between different communication protocols.
3. **Protocol Conversion**: Gateways can translate between different communication protocols, such as from IPX to TCP/IP or from HTTP to FTP.
4. **Security**: Gateways can also act as firewalls, providing security by controlling the flow of data between networks.

5. **Types**: There are various types of gateways such as application-level gateways, protocol gateways, and transport-level gateways.
6. **Data Format Translation**: Gateways can convert data formats, ensuring compatibility between systems that use different data formats.
7. **Example**: A common example is an email gateway, which allows email exchanges between different email systems.

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5. Discuss Circuit Switching.

1. **Definition**: Circuit switching is a communication method in which a dedicated communication path is established between two devices for the duration of the communication session.
2. **Process**: Once the circuit is established, all data is transmitted through this path until the session ends.
3. **Examples**: Traditional telephone networks, where a dedicated line is set up for the entire call.
4. **Dedicated Path**: A continuous and fixed path between sender and receiver, ensuring constant bandwidth during the communication.
5. **Advantages**: Provides high-quality communication with minimal delays, as the path is reserved exclusively for the connection.
6. **Disadvantages**: Inefficient use of resources since the communication path is reserved even during idle times.
7. **Applications**: Used for voice communication, especially in older telephone networks.

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6. Explain about Message Switching.

1. **Definition**: Message switching is a network communication technique where the entire message is sent to the next node, stored temporarily, and forwarded to the next node until it reaches its destination.
2. **No Dedicated Path**: Unlike circuit switching, message switching doesn't require a dedicated path; the message is routed through various switches.
3. **Store and Forward**: Each intermediate node stores the entire message before forwarding it to the next node.
4. **Efficiency**: Suitable for applications where the message is not time-sensitive and can be delayed.
5. **Applications**: Early telegraph systems, email, and certain messaging services.
6. **Advantages**: More efficient than circuit switching for sporadic communication, as the network path is shared.

7. **Disadvantages**: Introduces delays due to storing and forwarding, and may not be ideal for real-time communication.

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7. Explain the TCP / IP Reference Model.

1. **Definition**: The TCP/IP reference model is a framework that standardizes the communication functions of a network and is used as the basis for the Internet.
2. **Layers**: It has four layers: Application, Transport, Internet, and Network Access (or Link).
3. **Application Layer**: Handles communication between end-user applications, such as HTTP for web browsing or FTP for file transfers.
4. **Transport Layer**: Provides reliable data transfer with protocols like TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).
5. **Internet Layer**: Manages addressing and routing, using IP (Internet Protocol) to direct packets to the correct destination.
6. **Network Access Layer**: Deals with the physical transmission of data, including hardware addressing and the protocols for actual data transfer.
7. **Importance**: The model provides a clear structure for how data should be transmitted across networks, ensuring standardization and interoperability.

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8. Write Short Notes on Transmission Modes.

1. **Definition**: Transmission modes define the direction of data flow between two devices in a network.
2. **Simplex Mode**: Data flows in only one direction, with no return path for feedback (e.g., TV broadcasting).
3. **Half-Duplex Mode**: Data flows in both directions, but not at the same time; devices take turns sending and receiving data (e.g., walkie-talkies).
4. **Full-Duplex Mode**: Data flows in both directions simultaneously, allowing continuous two-way communication (e.g., telephones, modern computer networks).
5. **Efficiency**: Full-duplex is the most efficient, as it allows uninterrupted communication in both directions.
6. **Usage**: Different transmission modes are selected based on the nature of the communication (e.g., simplex for one-way communication, full-duplex for two-way).
7. **Applications**: Used in various communication systems, from broadcasting to mobile networks and internet communication.

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9. Explain about Error Detection.

1. **Definition**: Error detection refers to methods used to identify errors in data during transmission over a network or communication channel.
2. **Techniques**: Common techniques include parity checks, checksums, and cyclic redundancy checks (CRC).
3. **Parity Checking**: Adds a parity bit to make the number of 1s even or odd, detecting single-bit errors.
4. **Checksums**: A sum of data values is calculated and compared at the receiver to detect discrepancies.
5. **CRC**: Uses polynomial division to create a remainder value, which is checked at the receiver to ensure data integrity.
6. **Applications**: Used in network communication, file transfers, and storage systems to maintain data integrity.
7. **Limitation**: While effective at detecting errors, error detection doesn't correct errors, requiring retransmission in some cases.

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10. Explain the concept of FDDI in detail.

1. **Definition**: FDDI (Fiber Distributed Data Interface) is a high-speed, fiber-optic-based networking standard for local area networks (LANs).
2. **Speed**: FDDI provides data transfer rates of up to 100 Mbps, suitable for high-performance applications.
3. **Topology**: It uses a dual-ring topology, where data can travel in both directions, increasing fault tolerance and reliability.
4. **Reliability**: If one ring fails, the network automatically switches to the other ring, ensuring continuous data flow.
5. **Applications**: Primarily used in backbone networks where high-speed data transfer is required.
6. **Advantages**: High-speed data transfer, reliability, and low susceptibility to electromagnetic interference due to fiber-optic cables.
7. **Limitations**: Expensive to implement, primarily due to the cost of fiber-optic cables and networking equipment.

1. Write a short note on Transmission Impairments.

1. **Definition**: Transmission impairments refer to the factors that cause degradation of the signal quality during transmission over a medium.
2. **Attenuation**: The reduction in signal strength as the signal travels through a medium, which requires amplification at regular intervals.
3. **Noise**: Unwanted electrical signals that interfere with the desired signal, causing distortion and errors in transmission.
4. **Distortion**: Occurs when different frequencies of a signal travel at different speeds, altering the signal's shape and timing.
5. **Interference**: External signals from other devices or sources can interfere with the transmission, causing data loss or corruption.
6. **Jitter**: Variations in the timing of the signal pulses, leading to potential synchronization issues in digital communication.
7. **Mitigation**: Techniques such as error correction, signal amplification, and shielding are used to reduce transmission impairments and maintain signal integrity.

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2. Describe Parallel and Serial Transmission Techniques.

1. **Parallel Transmission**: Involves transmitting multiple bits simultaneously, with each bit sent over a separate channel or wire.
2. **Speed**: Parallel transmission is faster for short distances as multiple bits can be sent at once.
3. **Applications**: Typically used in computer buses or internal connections between components, such as printers or memory.
4. **Disadvantages**: The signal may degrade over long distances due to crosstalk between wires and increased electromagnetic interference.
5. **Serial Transmission**: Involves sending bits one after another over a single communication channel.
6. **Speed**: Slower than parallel transmission but better suited for long distances as it avoids the issues of signal degradation.
7. **Applications**: Widely used in communication protocols such as USB, RS-232, and networking (e.g., Ethernet).

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3. Explain the signals of Analog and Digital.

1. **Analog Signals**: Continuous signals that vary in amplitude, frequency, or phase, representing data as continuous waves.

2. **Characteristics of Analog**: Can take any value within a range, leading to infinite precision but also more prone to noise and distortion.
3. **Digital Signals**: Discrete signals representing data as binary numbers (0s and 1s), often in the form of square waves.
4. **Characteristics of Digital**: More robust against noise and interference, but limited to discrete values, often requiring more bandwidth than analog.
5. **Advantages of Analog**: Simpler to process and capable of representing continuous phenomena like sound and light.
6. **Advantages of Digital**: Easier to store, process, and transmit with less distortion, making it ideal for modern communications.
7. **Applications**: Analog is used in older communication systems and audio/video signals, while digital dominates in computing, networking, and modern communication technologies.

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4. Explain about Message Switching.

1. **Definition**: Message switching is a technique where the entire message is sent to the next node, stored temporarily, and forwarded to the next node until it reaches the destination.
2. **Process**: The message is not sent immediately; it is first stored in the intermediate node and forwarded when the network is ready.
3. **Advantages**: Does not require a dedicated path between sender and receiver and allows more efficient use of network resources.
4. **Delay**: Because messages are stored and forwarded, this method introduces delay, making it unsuitable for real-time applications.
5. **Error Handling**: Intermediate nodes can perform error checking, ensuring message integrity before forwarding.
6. **Applications**: Early messaging systems like telegrams or postal services, and used in email systems.
7. **Limitations**: Introduces latency, and is not as efficient as packet switching for large-scale networks like the internet.

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5. Briefly Discuss Circuit Switching.

1. **Definition**: Circuit switching is a method where a dedicated communication path is established between two devices for the duration of their communication session.
2. **Process**: Once a circuit is established, all data is transmitted over this fixed path, and no other device can use this path until the session ends.

3. **Examples**: Traditional telephone networks where a dedicated phone line is established for a call.
4. **Advantages**: Provides high-quality, continuous communication, suitable for voice calls where real-time interaction is crucial.
5. **Disadvantages**: Inefficient because the path remains idle during silence or pauses in the conversation, wasting bandwidth.
6. **Applications**: Commonly used for voice communications in legacy phone systems.
7. **Limitations**: Not scalable for high-volume data transmission and is inefficient for data-based communications.

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6. Explain: ATM Topology.

1. **Definition**: ATM (Asynchronous Transfer Mode) is a high-speed networking technology that uses fixed-size packets called cells to transfer data.
2. **Topology**: ATM can operate in various topologies, including star and mesh, depending on the network's design.
3. **Efficiency**: ATM allows for the simultaneous transmission of voice, video, and data over a single network, making it highly versatile.
4. **Cell Structure**: Each ATM cell is 53 bytes, consisting of a 5-byte header and a 48-byte payload, ensuring predictable transmission times.
5. **Connection Types**: ATM supports both connection-oriented and connectionless communication, making it flexible for various network types.
6. **Advantages**: Provides quality of service (QoS) and is scalable for both LAN and WAN applications.
7. **Applications**: Used in high-speed internet backbones, telecommunications, and multimedia services.

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7. Discuss about Routers.

1. **Definition**: A router is a networking device that forwards data packets between different networks, typically using IP addresses to determine the best route.
2. **Functionality**: Routers maintain routing tables and use algorithms to find the most efficient path for data transmission across networks.
3. **Types**: Routers can be hardware-based (dedicated devices) or software-based (virtual routers).
4. **Protocols**: Routers use routing protocols such as RIP (Routing Information Protocol), OSPF (Open Shortest Path First), and BGP (Border Gateway Protocol) to share network routing information.

5. **Security**: Routers can provide network security by filtering incoming and outgoing data and blocking malicious traffic.
6. **Applications**: Commonly used in enterprise networks, home networks, and the internet to connect different subnets and networks.
7. **Advanced Features**: Modern routers can offer additional features like NAT (Network Address Translation), VPN support, and Quality of Service (QoS).

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8. Discuss about Gateway.

1. **Definition**: A gateway is a device that connects two different networks, often using different protocols, and allows them to communicate.
2. **Function**: It translates communication protocols, data formats, and even network types, enabling interoperability between different systems.
3. **Protocol Conversion**: Gateways can convert between different communication protocols, such as from IPX to TCP/IP or from HTTP to FTP.
4. **Security**: They can act as firewalls, controlling data traffic and providing security between networks.
5. **Types**: There are various types of gateways like application-level gateways, protocol gateways, and transport-level gateways.
6. **Applications**: Commonly used in communication between different systems, such as connecting a local area network (LAN) to the internet.
7. **Example**: An email gateway that allows email exchanges between different email systems, such as SMTP and POP3.

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9. Explain briefly the wireless transmission.

1. **Definition**: Wireless transmission involves sending data without using physical cables, using electromagnetic waves through air or space.
2. **Medium**: It uses different frequencies of electromagnetic spectrum, such as radio waves, microwaves, and infrared light.
3. **Types**: Includes technologies like Wi-Fi, Bluetooth, cellular networks, and satellite communication.
4. **Advantages**: Provides mobility, convenience, and flexibility, allowing devices to connect to the network from virtually anywhere.
5. **Limitations**: Susceptible to interference, signal degradation, and security risks like unauthorized access.

6. **Bandwidth**: Wireless systems typically have lower bandwidth and slower speeds compared to wired systems.
7. **Applications**: Used in mobile communication, internet access, GPS, and wireless networking.

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10. Compare and contrast Analog and Digital Signals.

1. **Analog Signals**: Continuous signals that vary in amplitude, frequency, or phase to represent information.
2. **Digital Signals**: Discrete signals, typically in the form of binary (0s and 1s), representing data as individual bits.
3. **Noise Resistance**: Digital signals are more resilient to noise and interference compared to analog signals, which are more prone to distortion.
4. **Transmission**: Analog signals can carry continuous data, while digital signals carry data in discrete units, often requiring more bandwidth.
5. **Quality**: Digital signals maintain signal quality over long distances without degradation, unlike analog signals which lose clarity over long distances.
6. **Conversion**: Analog signals can be converted to digital using techniques like ADC (Analog-to-Digital Conversion) for processing in digital systems.
7. **Applications**: Analog is used in audio and video signals, while digital dominates in computing, networking, and modern communication technologies.

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11. Discuss about Multiplexing.

1. **Definition**: Multiplexing is the technique of combining multiple signals into one signal over a shared medium, optimizing resource use.
2. **Types of Multiplexing**: Includes Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), and Code Division Multiplexing (CDM).
3. **Efficiency**: Multiplexing allows multiple users or applications to share a common channel, improving bandwidth utilization.
4. **Time Division Multiplexing**: TDM divides the channel into time slots, with each user transmitting in its designated time.
5. **Frequency Division Multiplexing**: FDM divides the channel into different frequency bands for simultaneous transmission by multiple users.
6. **Applications**: Used in communication systems like telephone networks, satellite communications, and cable TV services.
7. **Advantages**: Efficient use of available bandwidth, reducing the need for additional channels or infrastructure.

12. Discuss about ISDN Layers.

1. **Definition**: ISDN (Integrated Services Digital Network) is a set of communication standards designed to provide digital transmission of voice, video, and data over traditional telephone networks.
2. **Layers of ISDN**: Includes the Physical Layer, Data Link Layer, and Network Layer.
3. **Physical Layer**: Defines the electrical and mechanical characteristics of the ISDN interface, such as cable types and connectors.
4. **Data Link Layer**: Responsible for error detection and correction, ensuring reliable communication over the network.
5. **Network Layer**: Manages the routing of data between devices, supporting various network services like circuit-switched and packet-switched communication.
6. **Applications**: Used in telephony, video conferencing, and Internet access, providing faster, more reliable digital communication.
7. **Benefits**: ISDN enables faster communication speeds compared to traditional analog systems, with higher reliability and better quality.

13. Explain about Routing Algorithm.

1. **Definition**: A routing algorithm is a set of rules used to determine the optimal path for data to travel across a network from source to destination.
2. **Types**: Common types of routing algorithms include Distance Vector Routing, Link State Routing, and Path Vector Routing.
3. **Distance Vector**: Routers send their routing tables to neighbors to update each other with the shortest path information. Examples include RIP (Routing Information Protocol).
4. **Link State**: Each router independently discovers the network's topology and uses this information to construct a routing table. OSPF (Open Shortest Path First) is an example.
5. **Path Vector**: Used for inter-domain routing, where each router tracks the paths to reach a particular destination. BGP (Border Gateway Protocol) is an example.
6. **Metric**: Routing algorithms use metrics like distance, bandwidth, or hops to select the optimal route. Some algorithms also account for delays or load on the network.
7. **Application**: Routing algorithms are essential for efficient network traffic management in internet routing, internal enterprise networks, and large-scale WANs.

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14. Discuss about different categories of Network Topology.

1. **Bus Topology**: All devices are connected to a central cable or bus. It's cost-effective but can suffer from performance degradation as more devices are added.
2. **Ring Topology**: Each device is connected to two other devices, forming a closed loop. Data travels in one direction, which can lead to delays or failure if a node is down.
3. **Star Topology**: All devices are connected to a central hub or switch. It is easy to set up and manage, but the hub represents a single point of failure.
4. **Mesh Topology**: Every device is connected to every other device. It provides high reliability and fault tolerance but can be complex and expensive to implement.
5. **Tree Topology**: A hybrid of bus and star topologies. Devices are arranged in a hierarchical structure, allowing for scalability but increasing cabling requirements.
6. **Hybrid Topology**: A combination of two or more topologies to benefit from the advantages of each. It's flexible but can be difficult to manage.
7. **Applications**: Different topologies are chosen based on cost, scale, fault tolerance, and required performance for the network.

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15. What are the responsibilities of the Transport Layer? Explain briefly.

1. **Definition**: The Transport Layer (Layer 4 of the OSI model) ensures reliable data transfer between two hosts on different networks.
2. **Segmentation and Reassembly**: It breaks large messages into smaller segments, ensuring they are reassembled correctly at the destination.
3. **Flow Control**: The transport layer controls the rate of data transmission to prevent congestion or buffer overflow at the receiving end.
4. **Error Control**: It detects errors in data transmission and ensures that corrupted data is retransmitted.
5. **Connection Management**: Provides end-to-end communication services by establishing, maintaining, and terminating connections. It supports both connection-oriented (TCP) and connectionless (UDP) communication.
6. **Reliability**: Ensures that the data is delivered accurately and in sequence, with mechanisms like acknowledgment and retransmission.
7. **Applications**: Protocols such as TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) are used for reliable and unreliable data transfer, respectively.

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16. Discuss briefly on FDDI.

1. **Definition**: FDDI (Fiber Distributed Data Interface) is a high-speed networking standard that uses fiber optic cables to transmit data.
2. **Speed**: FDDI supports data transmission speeds of up to 100 Mbps, making it suitable for high-performance networks.
3. **Topology**: It uses a dual ring topology, ensuring redundancy in the event of a failure in one of the rings. Data travels in both directions around the ring for reliability.
4. **Medium**: FDDI primarily uses optical fiber, which provides greater bandwidth and is less susceptible to electromagnetic interference.
5. **Fault Tolerance**: In case of a ring failure, the secondary ring allows data to be rerouted, making FDDI highly fault-tolerant.
6. **Distance**: FDDI is designed for long-distance transmission, with distances of up to 200 kilometers possible using single-mode fiber.
7. **Applications**: It is used in local area networks (LANs) and wide area networks (WANs) where high-speed data transfer and reliability are crucial.

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17. Explain about X.25 Layers with suitable Examples.

1. **Definition**: X.25 is a standard for packet-switched data communication that defines how data is transmitted over a network, especially in wide area networks (WANs).

2. **Layers**: X.25 uses a 3-layer model: the physical layer, the data link layer, and the packet layer.
3. **Physical Layer**: Specifies the electrical, mechanical, and procedural characteristics of the physical medium used for transmission.
4. **Data Link Layer**: Ensures reliable data transmission by framing data into packets and providing error control and flow management.
5. **Packet Layer**: Provides the network-level functionality for routing packets between devices, ensuring correct addressing and handling congestion.
6. **Flow Control**: X.25 uses window-based flow control to manage the rate at which data is sent, avoiding congestion on the network.
7. **Applications**: X.25 is commonly used in legacy telecommunication networks, including public data networks, and is suited for applications requiring error correction and reliable communication.

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18. Write short notes on: WWW.

1. **Definition**: The World Wide Web (WWW) is a system of interlinked hypertext documents accessed via the internet, allowing users to navigate using a web browser.
2. **Protocols**: The WWW operates on protocols like HTTP (Hypertext Transfer Protocol) and HTTPS (secure HTTP), which allow web browsers to retrieve and display web pages.
3. **Content**: WWW allows access to multimedia content, such as text, images, audio, and video, hosted on web servers across the internet.
4. **URL**: Each document on the WWW is identified by a Uniform Resource Locator (URL), which provides the address for the document.
5. **HTML**: Web content is primarily structured using HTML (Hypertext Markup Language), which defines the layout and content of a web page.
6. **Browsers**: Web browsers like Google Chrome, Mozilla Firefox, and Microsoft Edge are used to access and view websites on the WWW.
7. **Applications**: The WWW is used for a wide range of purposes, including browsing, online shopping, social media, information sharing, and education.

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19. Explain the following:

(a) TCP/IP Network

1. **Definition**: TCP/IP (Transmission Control Protocol/Internet Protocol) is a suite of communication protocols used to interconnect network devices on the internet and other networks.

2. **Layers**: It is a four-layer model consisting of the Application Layer, Transport Layer, Internet Layer, and Network Access Layer.
3. **Functionality**: TCP ensures reliable data transmission with acknowledgment and retransmission, while IP handles the routing and addressing of data packets.
4. **Protocol Support**: TCP/IP supports many protocols, including HTTP, FTP, SMTP, and DNS, enabling the internet's diverse services.
5. **Interoperability**: It enables devices from different manufacturers to communicate, making it the foundation for the internet.
6. **Routing**: IP handles packet routing across networks using routing tables, while TCP ensures that packets arrive in order and without errors.
7. **Applications**: Used across a wide variety of systems, from home networks to global internet infrastructure.

(b) Repeaters

1. **Definition**: A repeater is a device used to amplify or regenerate signals in a network to extend the range of communication.
2. **Functionality**: Repeaters receive weak or degraded signals, amplify them, and retransmit them, allowing the signal to travel further without degradation.
3. **Signal Quality**: They help restore signal strength, ensuring that data can travel over longer distances without errors or loss.
4. **Types**: Analog repeaters amplify the signal, while digital repeaters regenerate the signal and retransmit it to maintain integrity.
5. **Applications**: Used in long-distance communication systems, including telephone networks, wireless networks, and satellite communication.
6. **Bandwidth**: Repeaters typically operate at a specific bandwidth, ensuring that signals within that range can be extended.
7. **Limitations**: While repeaters help extend range, they can also amplify noise, so the network design needs to ensure signal clarity at the input.