Repeated Questions (4):

1. **Explain about the Analog signals and Analog Transmissions.**
2. **Explain the following:**
    - (a) Repeaters
    - (b) World Wide Web
3. **Explain briefly OSI model with Neat diagram.**
4. **Briefly explain connection and connectionless services.**

1. **Explain about the Analog signals and Analog Transmissions.**

Analog Signals:

- Analog signals are continuous waveforms that can represent data over a continuous range.
- These signals have infinite values within a range and vary smoothly over time.
- Analog signals are used to transmit data in the form of sound, light, or radio waves.
- They are generally represented by sine waves, which are periodic and vary in amplitude, frequency, or phase.
- Analog signals are typically used in traditional broadcasting and telephone systems, where the signal is modulated to carry information.

Analog Transmissions:

- Analog transmission involves the transmission of analog signals through a transmission medium, typically over copper wires, optical fibers, or through the air via radio frequencies.
- The signals are subject to degradation such as attenuation, distortion, and noise during transmission.
- Analog transmissions are often continuous, meaning the signal does not have a discrete starting and ending point.
- Analog transmission uses methods such as amplitude modulation (AM), frequency modulation (FM), or phase modulation (PM).
- Though widely used historically, analog transmission has largely been replaced by digital transmission for better reliability and efficiency.

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2. **Explain the following:**

(a) **Repeaters**

- A repeater is a device used to extend the range of a network or communication system.
- It works by receiving a signal, amplifying it, and then retransmitting it to the next segment of the network.
- Repeaters are especially useful in long-distance communication, as they can regenerate weak signals and reduce attenuation.
- Repeaters work at the physical layer (Layer 1) of the OSI model.
- They help to maintain signal integrity in networks by overcoming the limitations of transmission medium such as cables and fiber optics.

(b) **World Wide Web (WWW)**

- The World Wide Web (WWW) is a system of interlinked hypertext documents that are accessed through the internet.

- It allows users to view and navigate information on websites using web browsers.
- The WWW is built on the HTTP (HyperText Transfer Protocol), which facilitates the transfer of web pages and content.
- The information on the WWW can include text, images, videos, and interactive content.
- The creation and development of the WWW were led by Tim Berners-Lee in 1989, revolutionizing the way people share and access information globally.

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3. **Explain briefly OSI model with Neat diagram.**

OSI Model Overview:

- The OSI (Open Systems Interconnection) model is a conceptual framework used to understand and design a network architecture in seven layers.
- Each layer serves a specific function in the communication process, from physical transmission to application-level interactions.

Layers of OSI Model:

1. **Physical Layer (Layer 1):** Deals with the transmission and reception of raw data bits over a physical medium such as cables or wireless.
2. **Data Link Layer (Layer 2):** Provides error detection and correction, and controls access to the physical medium.
3. **Network Layer (Layer 3):** Handles the routing of data packets across networks and provides logical addressing.
4. **Transport Layer (Layer 4):** Ensures reliable data transfer and manages end-to-end communication between devices.
5. **Session Layer (Layer 5):** Manages sessions and controls dialogues between devices, such as opening, closing, and maintaining sessions.
6. **Presentation Layer (Layer 6):** Ensures data is in a usable format by translating, compressing, or encrypting the data.
7. **Application Layer (Layer 7):** Provides services for applications and user interfaces for network communication, such as HTTP, FTP, and DNS.

Diagram:

```java
Application Layer (7)
Presentation Layer (6)
Session Layer (5)
Transport Layer (4)
Network Layer (3)
Data Link Layer (2)
Physical Layer (1)
```

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4. **Briefly explain connection and connectionless services.**

Connection-Oriented Service:

1. Connection-oriented service requires a dedicated path between the sender and receiver before data transmission.
2. The connection is established, maintained, and terminated during the session.
3. It ensures reliable data delivery by providing error checking, retransmissions, and sequencing.
4. Examples of connection-oriented protocols include TCP (Transmission Control Protocol).
5. Connection establishment involves handshakes, and the data is transmitted after the connection is confirmed.

Connectionless Service:

1. In connectionless services, each data packet is sent independently without establishing a dedicated connection.
2. The data packets may take different routes to reach the destination, and there is no guarantee of delivery or order.
3. Connectionless services are faster as they do not require setup time.
4. An example of a connectionless protocol is UDP (User Datagram Protocol).
5. The main advantage is simplicity and speed, but it sacrifices reliability and ordering of packets.

1. **Explain about guided and unguided Media Transmissions.**

Guided Media:

1. Guided media involves the transmission of signals through a physical medium like copper wires, fiber optic cables, or coaxial cables.
2. It provides a defined path for the signals to travel.
3. Examples include twisted pair cables, coaxial cables, and optical fibers.
4. These media are less susceptible to interference compared to unguided media.
5. Guided media is generally used for wired communication, including local area networks (LANs) and internet connections.

Unguided Media:

1. Unguided media involves the transmission of signals through the air or space, without a physical medium.
2. It relies on electromagnetic waves, which travel freely through the atmosphere.
3. Examples include radio waves, microwaves, and infrared.
4. The signals are susceptible to interference from various sources like weather and physical obstacles.
5. Unguided media is typically used for wireless communication, including Wi-Fi, Bluetooth, and satellite communication.

---

2. **Briefly explain the types of multiplexing.**

1. **Frequency Division Multiplexing (FDM):**
   - Divides the bandwidth of the communication medium into distinct frequency channels.
   - Each channel is used to transmit a different signal simultaneously.
   - Commonly used in radio and TV broadcasting.
2. **Time Division Multiplexing (TDM):**
   - Divides the time into small time slots, and each signal is transmitted in its designated slot.
   - TDM can be used for both analog and digital data.
   - It is used in digital communication systems like telephone networks.
3. **Wavelength Division Multiplexing (WDM):**
   - Similar to FDM but used in optical fiber networks.
   - Transmits multiple data streams simultaneously at different light wavelengths.
   - Maximizes the bandwidth of optical fibers.
4. **Code Division Multiplexing (CDM):**

- Each signal is encoded with a unique code, allowing multiple signals to occupy the same frequency band simultaneously.
- Common in mobile communication systems.

5. **Spatial Division Multiplexing (SDM):**
    - Transmits multiple data streams over different spatial paths.
    - It is used in advanced optical networks and MIMO (Multiple Input, Multiple Output) systems.

---

3. **Discuss about the History of Analog and Digital Network.**

1. **Analog Network History:**
    - Analog networks were the first systems for voice and data transmission.
    - Early telephone systems used analog signals for communication, which were transmitted over copper wires.
    - Analog technology relies on continuous signals, where variations in amplitude, frequency, or phase represent information.
    - Examples include AM and FM radio and early telephone systems.
2. **Digital Network History:**
    - Digital networks emerged in the mid-20th century with the development of digital signal processing and computer technologies.
    - Digital signals are discrete, representing data as binary (0s and 1s).
    - The transition from analog to digital allowed for more efficient and reliable communication, reducing noise and interference.
    - Examples include the development of the internet, digital phone systems, and fiber optic communication.

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4. **Briefly explain two guided Media with examples.**

1. **Twisted Pair Cables:**
    - Consists of pairs of insulated copper wires twisted together to reduce electromagnetic interference.
    - Widely used in telephone lines and local area networks (LANs).
    - Types include unshielded twisted pair (UTP) and shielded twisted pair (STP).
2. **Optical Fiber:**
    - Uses light to transmit data through a glass or plastic fiber.

- Provides high-speed data transfer with minimal loss and immunity to electromagnetic interference.
- Commonly used in long-distance communication, such as in the backbone of the internet and telecommunications systems.

---

5. **Discuss about Parallel and Serial Transmissions with examples.**

1. **Parallel Transmission:**
   - Involves transmitting multiple bits of data simultaneously across multiple channels.
   - Each bit is sent on a separate wire, which makes it faster than serial transmission for short distances.
   - Commonly used for data transfer between computer components, such as inside a computer between CPU and memory.
2. **Serial Transmission:**
   - Data is transmitted one bit at a time over a single channel or wire.
   - More suitable for long-distance communication, as it is less prone to errors and signal degradation.
   - Commonly used in communication protocols such as USB, RS-232, and network connections.

---

6. **Explain the different types of Multiplexing.**

1. **Frequency Division Multiplexing (FDM):**
   - Divides the total available bandwidth into smaller sub-channels, each transmitting a different signal at different frequencies.
   - Typically used in analog communication systems like radio and TV broadcasts.
2. **Time Division Multiplexing (TDM):**
   - Divides time into small slots, and each signal is transmitted in its designated time slot.
   - Commonly used in digital communication systems such as telephone networks.
3. **Wavelength Division Multiplexing (WDM):**
   - Used in fiber-optic networks, where different light wavelengths are used to transmit multiple signals simultaneously over a single fiber.
   - Maximizes the bandwidth of optical fibers.
4. **Code Division Multiplexing (CDM):**
   - Each signal is assigned a unique code, and multiple signals are transmitted simultaneously over the same frequency band.

- Used in mobile communication systems.

5. **Space Division Multiplexing (SDM):**
   - Uses multiple physical channels or paths to transmit different signals simultaneously.
   - Used in advanced wireless systems like MIMO (Multiple Input, Multiple Output).

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7. **Explain the ATM cells and their Transmissions.**

1. **ATM Cells:**
   - ATM (Asynchronous Transfer Mode) is a cell-based switching technology used in wide area networks (WANs).
   - The data is transmitted in fixed-length cells, typically 53 bytes in size (48 bytes for data and 5 bytes for header).
   - The fixed size allows for fast switching and reduces processing delay.
2. **ATM Transmission:**
   - ATM uses a connection-oriented service, ensuring that data is transmitted in a predefined path from sender to receiver.
   - It supports both voice and data communication by using different traffic classes (e.g., constant bit rate, variable bit rate).
   - ATM is capable of transporting a variety of data types like voice, video, and data in real-time, making it suitable for multimedia services.

---

8. **Explain the architecture of OSI model with a neat diagram.**

OSI Model Overview:

- The OSI (Open Systems Interconnection) model is a conceptual framework used to understand network communication in seven layers.
- Each layer performs a specific function, and the layers work together to facilitate data communication between devices.

OSI Layers:

1. **Physical Layer (Layer 1):** Handles the transmission of raw bitstreams over a physical medium.
2. **Data Link Layer (Layer 2):** Provides error correction, data framing, and access control.
3. **Network Layer (Layer 3):** Manages routing and logical addressing (e.g., IP addressing).
4. **Transport Layer (Layer 4):** Ensures reliable data transfer between devices (e.g., TCP).
5. **Session Layer (Layer 5):** Manages sessions or connections between devices.
6. **Presentation Layer (Layer 6):** Translates data formats and encrypts/decrypts information.

7. **Application Layer (Layer 7):** Provides network services to applications and users (e.g., HTTP, FTP).

Diagram:

java Copy code

```
Application Layer (7)
Presentation Layer (6)
Session Layer (5)
Transport Layer (4)
Network Layer (3)
Data Link Layer (2)
Physical Layer (1)
```

9. **Discuss about Asynchronous Transmission in detail.**

1. **Definition:**
   - Asynchronous transmission is a method where data is sent one byte or character at a time, without needing a clock signal to synchronize the transmission.
   - It is used for irregular data transfers, typically in situations where the timing of data transfer is unpredictable.
2. **Start and Stop Bits:**
   - Each data byte is framed with a start bit at the beginning and a stop bit at the end. These bits signal the start and end of the data frame.
   - Start and stop bits help the receiver identify the boundaries of the data being sent.
3. **Data Transfer:**
   - In asynchronous transmission, data is sent in small, discrete chunks (usually one byte) and is separated by gaps in transmission.
   - This allows devices to send data when they are ready without the need for constant synchronization.
4. **Example:**
   - Common in RS-232 serial communication, where data is sent character by character, such as in keyboard and mouse inputs.
5. **Advantages:**
   - Simple and cost-effective since no clock synchronization is required.
   - It can work over short distances and is suitable for low-speed data transmission.

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10. **Explain briefly:**

(a) **Circuit Switching** (b) **SMDS** (c) **Multiplexing Application**

(a) Circuit Switching:

1. Circuit switching is a method of communication where a dedicated communication path is established between two devices for the duration of the conversation.
2. The most common example is the traditional telephone system, where a continuous connection is maintained until the call ends.
3. It ensures a constant bandwidth, providing reliable communication with minimal delay.
4. However, it is inefficient for bursty traffic since the circuit is reserved for the entire duration of the call, even during idle times.
5. It is used in systems requiring continuous transmission of data, like voice communication.

(b) **SMDS (Switched Multimegabit Data Service):**

1. SMDS is a high-speed, wide-area networking service developed by AT&T, designed to provide packet-switched data transmission.
2. It supports data rates from 1.5 Mbps to 45 Mbps and was intended for connecting LANs over large distances.
3. SMDS is a connectionless service that uses asynchronous transfer mode (ATM) for data transfer.
4. It is commonly used for applications such as video conferencing, multimedia, and real-time data transmission.
5. SMDS is typically used for transmitting bursty data and handling large amounts of traffic efficiently.

(c) **Multiplexing Application:**

1. Multiplexing enables the simultaneous transmission of multiple signals over a single communication channel.
2. It is used to maximize the efficiency of communication channels by sharing resources among multiple users.
3. Applications include broadband services, where multiple data streams (voice, video, and internet) are combined on a single fiber-optic link using WDM.
4. Multiplexing is essential in cellular networks to handle large volumes of calls and data traffic.
5. It is also used in television broadcasting, where multiple channels are transmitted over a single frequency band using FDM.

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11. Explain the Architecture of ATM network with a neat diagram.

1. **ATM (Asynchronous Transfer Mode) Network:**
   - ATM is a high-speed, cell-based switching technology used for transmitting data, voice, and video across networks.
   - The network is designed to support real-time communication and quality of service (QoS).
2. **ATM Architecture Components:**
   - **User Network Interface (UNI):** This is the interface between the user equipment (e.g., computer, telephone) and the ATM network.
   - **ATM Switches:** These switches route the ATM cells (fixed-size packets) from one network node to another.
   - **Network Interface:** This connects the ATM switches together, typically using fiber-optic links for high-speed data transfer.
3. **Cell Structure:**
   - ATM data is transmitted in fixed-length cells, each with 53 bytes (48 bytes for data, 5 bytes for header information).
   - This ensures fast switching and minimal latency in the network.

4. **Connection Types:**
    - ATM supports both connection-oriented (virtual circuit) and connectionless (datagram) communication methods.
5. **QoS in ATM:**
    - ATM provides different traffic types to handle real-time data (like video calls) and non-real-time data (like email), ensuring that each type receives the appropriate level of service.

Diagram:

sql

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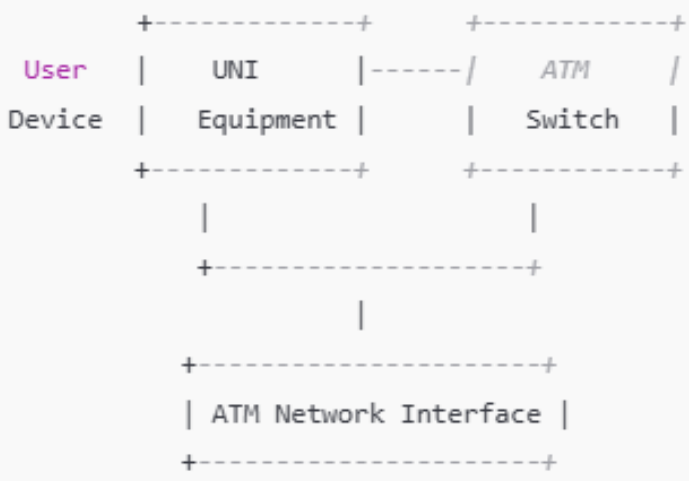

12. **Discuss in detail connection-oriented and connectionless services.**

1. **Connection-Oriented Service:**
    - In connection-oriented communication, a dedicated communication path is established between the sender and receiver before the data transfer begins.
    - The path remains open for the duration of the communication, ensuring continuous and reliable delivery of data.
    - Examples include TCP (Transmission Control Protocol) and telephone systems.
    - It guarantees that data will arrive in order and without errors by using acknowledgment and retransmission.
    - Suitable for applications requiring reliability and sequence, like file transfers or voice calls.
2. **Connectionless Service:**
    - In connectionless communication, there is no need to establish a dedicated path between sender and receiver before transmitting data.
    - Data packets are sent independently, and each packet may take a different path through the network.
    - Examples include UDP (User Datagram Protocol) and IP (Internet Protocol).
    - While it is faster and more efficient for bursty data, it does not guarantee delivery, order, or error-free transmission.
    - Suitable for applications like streaming and gaming, where occasional data loss or out-of-order packets are acceptable.

---

13. **Explain about different categories of computer Network.**

1. **Local Area Network (LAN):**
    - A LAN is a network confined to a small geographical area, such as a home, office, or campus.
    - It typically uses Ethernet cables or Wi-Fi to connect devices within the same building or nearby area.
    - LANs are cost-effective and allow for high-speed data transfer.
2. **Wide Area Network (WAN):**
    - WAN covers a large geographical area, connecting multiple LANs across cities, countries, or even continents.
    - It often uses leased lines, satellite links, or the internet to connect remote locations.
    - WANs provide long-distance communication but may be slower and more costly.
3. **Metropolitan Area Network (MAN):**
    - A MAN covers a larger area than a LAN but is smaller than a WAN, typically spanning a city or large campus.

- It is used to connect LANs within a metropolitan area and is usually owned and managed by a single entity.
- Fiber-optic cables and wireless technologies are commonly used for MAN connections.

4. **Personal Area Network (PAN):**
   - PAN is a small network that connects devices like smartphones, tablets, and laptops within a very short range (e.g., Bluetooth or infrared).
   - It is typically used for personal communication, such as file sharing or connecting peripheral devices.
5. **Wireless Local Area Network (WLAN):**
   - A WLAN is a LAN that uses wireless communication (Wi-Fi) instead of wired connections.
   - It allows devices to connect without the need for physical cables, providing mobility and convenience.

---

14. Describe in detail about unguided media with suitable Examples.

1. **Definition of Unguided Media:**
   - Unguided media, also known as wireless media, uses electromagnetic waves to transmit data through the air or space without the use of physical conductors like wires or cables.
   - It relies on natural resources, such as radio waves, microwaves, or infrared signals.
2. **Types of Unguided Media:**
   - **Radio Waves:** Used for long-range communication like AM/FM radio, TV broadcasting, and mobile communication.
   - **Microwaves:** Used for point-to-point communication, such as satellite links and microwave towers.
   - **Infrared:** Used for short-range communication, like remote controls, infrared communication between devices, and certain wireless devices.
   - **Visible Light:** Optical communication systems, such as free-space optical communication (FSO), use visible light for transmitting data.
3. **Applications:**
   - Unguided media is commonly used for wireless communication technologies like Wi-Fi, Bluetooth, and mobile data networks.
   - It enables communication in environments where laying physical cables is impractical, such as outdoor or remote locations.
4. **Advantages:**
   - Flexibility and mobility, as users can connect without needing physical infrastructure.
   - Can cover large areas, especially in rural or hard-to-reach regions.
5. **Disadvantages:**

- More susceptible to interference from environmental factors such as weather, physical obstructions, and electromagnetic noise.

15. **Briefly explain the following:**

(a) **Token Bus**
(b) **Token Ring**

(a) Token Bus:

1. **Definition:** Token Bus is a network protocol used for data transmission in bus topology. It employs a special token that circulates around the network, and the device holding the token can send data.
2. **Data Transmission:** In Token Bus, the token travels along the bus, and only the device with the token is allowed to transmit data.
3. **Bus Topology:** Devices are connected to a shared communication medium (the bus), and the token moves along this shared channel.
4. **Collision-Free:** The token ensures that only one device transmits at a time, preventing data collisions.
5. **Usage:** Token Bus is mainly used in industrial control systems and small networks, where the need for a centralized control mechanism is essential.

(b) Token Ring:

1. **Definition:** Token Ring is a network protocol used in ring topology, where the devices are connected in a circular fashion, and the token circulates around the ring.
2. **Data Transmission:** Similar to Token Bus, only the device holding the token can transmit data, ensuring no collisions occur.
3. **Ring Topology:** The network forms a closed loop, and the token moves from one device to the next in the circle, granting permission for data transmission.
4. **Fair Access:** Token Ring ensures fair access to the network since each device gets a chance to transmit once it holds the token.
5. **Usage:** It was historically popular in LANs, especially in office environments, though it has largely been replaced by Ethernet.

---

16. **Explain about ISDN Layers with Necessary Examples.**

1. **Definition of ISDN:**
   - ISDN (Integrated Services Digital Network) is a set of communication standards used to transmit voice, video, and data over digital telephone lines.
   - It aims to integrate various services into a single communication network, offering higher data rates and quality than traditional analog systems.
2. **ISDN Layers:**
   - **Layer 1 (Physical Layer):** Deals with the physical connection, defining the electrical characteristics and signaling methods for transmission. Example: The ISDN Basic Rate

Interface (BRI) physical layer uses twisted pair cables.

- **Layer 2 (Data Link Layer):** Responsible for establishing, maintaining, and terminating logical links between devices. It uses protocols like LAPD (Link Access Procedure for Digital) to manage data transmission.
- **Layer 3 (Network Layer):** Handles addressing, routing, and the establishment of virtual circuits. In ISDN, this layer includes protocols such as the Q.931 signaling standard for call setup and teardown.

3. **Examples:**
   - **Basic Rate Interface (BRI):** Provides two 64 kbps B-channels for data or voice and one 16 kbps D-channel for signaling.
   - **Primary Rate Interface (PRI):** Provides 23 B-channels (in North America) for voice or data and one D-channel, offering a total of 1.544 Mbps bandwidth.
4. **Advantages of ISDN:**
   - ISDN offers digital transmission quality and allows for multiple services (voice, video, data) to share the same line, making it more efficient than analog systems.
   - ISDN supports faster connection speeds, lower latency, and more reliable transmission, making it suitable for video conferencing and high-quality voice communication.
5. **Use Cases:**
   - Used in applications like telemedicine, remote offices, and video conferencing, where higher quality and faster speeds are needed compared to traditional phone lines.

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17. **Write short notes on:**

(a) **Bridges**
(b) **ATM Protocol**

(a) Bridges:

1. **Definition:** A bridge is a networking device that connects two or more network segments and filters traffic based on MAC addresses to reduce network collisions and improve performance.
2. **Operation:** It operates at the Data Link layer (Layer 2) and makes forwarding decisions based on MAC addresses. It checks the destination address of each frame and either forwards it or drops it.
3. **Types of Bridges:** There are two main types:
   - **Transparent Bridges:** Automatically learn the MAC addresses of devices on each side and filter traffic accordingly.
   - **Source Routing Bridges:** Used in Token Ring networks, where the source device determines the path the data should take.
4. **Use Cases:** Bridges are used to extend LANs, connect different types of networks, and reduce network traffic by segmenting large networks.

5. **Advantages:** Improves performance by dividing large networks into smaller segments, reducing traffic in each segment.

(b) **ATM Protocol:**

1. **Definition:** ATM (Asynchronous Transfer Mode) is a high-speed networking protocol designed to handle voice, video, and data transmission.
2. **Cell Structure:** ATM uses fixed-size cells (53 bytes) to ensure low-latency communication and efficient handling of real-time traffic. The 53-byte cell is composed of 48 bytes of data and 5 bytes of header information.
3. **Traffic Types:** ATM supports multiple traffic types, including constant bit rate (CBR), variable bit rate (VBR), and available bit rate (ABR) to cater to different applications.
4. **Quality of Service (QoS):** ATM is designed to provide various QoS levels, ensuring that time-sensitive data like voice and video gets prioritized over other data.
5. **Use Cases:** ATM is commonly used in backbone networks, broadband connections, and mobile communication networks, where high throughput and low latency are required.

---

18. **Explain about the data communication process.**

1. **Definition:**
   - Data communication is the process of transmitting data between devices or systems over a communication medium, such as cables, fiber optics, or wireless signals.
2. **Basic Components:**
   - **Sender:** The device that initiates the data transfer (e.g., computer, smartphone).
   - **Receiver:** The device that receives the transmitted data (e.g., printer, server).
   - **Transmission Medium:** The physical path through which data travels, such as copper wires, fiber optic cables, or wireless radio waves.
   - **Message:** The actual data being transmitted, which can be text, images, voice, or video.
3. **Transmission Process:**
   - **Encoding:** The sender converts the data into a signal suitable for transmission over the medium. This could be in the form of electrical pulses, light, or radio waves.
   - **Transmission:** The signal is sent through the medium, typically in the form of bits (0s and 1s).
   - **Decoding:** The receiver interprets the signal, converting it back into data that can be understood by the device.
   - **Error Detection and Correction:** During transmission, data may be corrupted due to noise or interference. Techniques like checksums or parity bits are used to detect and correct errors.
4. **Modes of Communication:**
   - **Simplex:** Data flows in only one direction (e.g., keyboard to computer).

- **Half-Duplex:** Data can flow in both directions but not simultaneously (e.g., walkie-talkies).
- **Full-Duplex:** Data flows in both directions simultaneously (e.g., telephones).

5. **Protocols:**
    - The data communication process is governed by protocols like TCP/IP, which define the rules for sending and receiving data, ensuring that the data is transmitted correctly and reliably.

---

19. **Elucidate the frequency divisions multiplexing.**

1. **Definition:**
    - Frequency Division Multiplexing (FDM) is a technique used to divide the total bandwidth of a communication channel into smaller, non-overlapping frequency bands.
2. **Process:**
    - FDM assigns a separate frequency band to each signal or data stream being transmitted simultaneously over a single medium, allowing multiple signals to be transmitted at the same time without interference.
    - Each signal is modulated to a different carrier frequency, and the signals are transmitted concurrently over the shared medium.
3. **Example:**
    - Radio broadcasting is an example of FDM, where different radio stations transmit at different frequencies, allowing multiple stations to be received simultaneously without interference.
4. **Advantages:**
    - Efficient use of the available bandwidth, as multiple signals can be sent simultaneously without interference.
    - Suitable for continuous transmission of analog signals like voice and video.
5. **Disadvantages:**
    - Requires a large bandwidth, which may not be available in some communication channels.
    - More prone to noise and interference, especially if the channels are not well separated.

---

20. **Briefly explain the routing algorithm with examples.**

1. **Definition:**
    - A routing algorithm determines the best path for data to travel from the source to the destination in a network. The algorithm is responsible for selecting the most efficient route, based on certain metrics like distance, cost, or network traffic.

2. **Types of Routing Algorithms:**
    - **Distance Vector Routing:** In this algorithm, each router maintains a table of distances to reach various destinations. Example: RIP (Routing Information Protocol).
    - **Link-State Routing:** Each router maintains a map of the network, updating its table based on information from all routers in the network. Example: OSPF (Open Shortest Path First).
3. **Routing Metrics:**
    - Metrics used by routing algorithms include hop count (number of routers between source and destination), delay, bandwidth, and cost.
    - These metrics help determine the most efficient route for data to travel.
4. **Example of Distance Vector:**
    - In RIP, routers share their routing tables with neighboring routers, and the best path is selected based on the least number of hops.
5. **Example of Link-State:**
    - In OSPF, routers periodically broadcast information about their directly connected links, and each router builds a map of the entire network to calculate the best path.

---

21. Explain about OSI model with a neat diagram.

1. **Definition:**
    - The OSI (Open Systems Interconnection) model is a conceptual framework used to understand network interactions in seven distinct layers, from physical transmission to application.
2. **Layers of OSI Model:**
    - **Layer 1 - Physical Layer:** Deals with the physical transmission of raw data bits over a communication medium (e.g., cables, radio waves).
    - **Layer 2 - Data Link Layer:** Provides error-free transfer of data frames between devices on the same network (e.g., Ethernet, Wi-Fi).
    - **Layer 3 - Network Layer:** Handles logical addressing and routing to ensure data packets reach the destination (e.g., IP).
    - **Layer 4 - Transport Layer:** Ensures end-to-end communication and error recovery (e.g., TCP, UDP).
    - **Layer 5 - Session Layer:** Manages sessions and controls the dialogues between applications (e.g., NetBIOS).
    - **Layer 6 - Presentation Layer:** Translates data between the application and transport layers, including encryption and data compression.
    - **Layer 7 - Application Layer:** The layer closest to the user, providing network services directly to applications (e.g., HTTP, FTP).

Diagram:

lua

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```
+---------------------------+
|   Application Layer (7)   |
+---------------------------+
|   Presentation Layer (6)  |
+---------------------------+
|   Session Layer (5)       |
+---------------------------+
|   Transport Layer (4)     |
+---------------------------+
|   Network Layer (3)       |
+---------------------------+
|   Data Link Layer (2)     |
+---------------------------+
|   Physical Layer (1)      |
+---------------------------+
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