**NETWORK ADMINISTRATION**

1. Briefly explain the three types of operating system as well as their main functions and give an example for each type.

Types of operating systems are 3 as follows:

* **Single-user, single-tasking operating systems:** This type allows only one user to run one program at a time. They are the simplest type of operating system and are often used in embedded systems and small devices.

An example of a single-user, single-tasking operating system is DOS.

* **Multi-user, single-tasking operating systems:** This type allows multiple users to run one program at a time. They are more complex than single-user, single-tasking operating systems and are often used in servers and mainframes. An example of a multi-user, single-tasking operating system is UNIX.
* **Multi-user, multitasking operating systems:** This typeallows multiple users to run multiple programs at a time. They are the most complex type of operating system and are often used in personal computers and workstations. Examples of multi-user, multitasking operating systems are Windows, macOS, and Linux.

2. Briefly list and explain the types of transmission media.

* Transmission media refers to the physical pathways through which data is transmitted from one device to another in a network

1. **Twisted Pair Cable** Twisted pair cables consist of pairs of insulated copper wires twisted together. They are widely used in Ethernet networks and come in two main categories: unshielded twisted pair (UTP) and shielded twisted pair (STP).
2. **Coaxial Cable: Explanation:** They have a central conductor surrounded by an insulating layer, a metallic shield, and an outer insulating layer. They are known for their high bandwidth and are often used for cable television and broadband internet connections.
3. **Fiber-Optic Cable:** These cables transmit data using light signals through thin strands of glass or plastic fibers. They offer extremely high bandwidth and are immune to electromagnetic interference. Fiber-optic cables are commonly used in long-distance communication and high-speed internet connections.
4. **Wireless Transmission:** uses electromagnetic waves, such as radio waves or microwaves, to transmit data without physical cables. Wireless technologies include Wi-Fi, Bluetooth, cellular networks, and satellite communication. They offer mobility and flexibility in network connections.
5. **Microwave Transmission:** This involves the use of high-frequency radio waves to transmit data over long distances. It is often used for point-to-point communication in scenarios like backhaul connections for cell towers or long-distance data links.

3. With the help of hierarchical diagram explain in detail the Seven layers of OSI Reference Model

| 7 | Application layer |
| --- | --- |
| 6 | Presentation layer |
| 5 | Session layer |
| 4 | Transport layer |
| 3 | Network layer |
| 2 | Data Link layer |
| 1 | Physical layer |

1**. Physical Layer:** is the lowest layer and deals with the physical connection between devices. It defines how data is transmitted over various physical media, such as cables or wireless signals. It specifies characteristics like voltage levels, cable types, and connectors.

Examples: Ethernet cables, fiber-optic cables, wireless radio signals.

**2. Data Link Layer:** This layer is responsible for error detection and correction in the physical layer's raw bitstream. It also manages data framing, addressing, and flow control to ensure reliable point-to-point communication between two directly connected devices.

**3. Network Layer:** The network layer manages routing and addressing to enable data packets to traverse multiple interconnected networks. It determines the best path for data to reach its destination using routing algorithms.

Examples: IP (Internet Protocol), routers.

**4. Transport Layer:** The transport layer ensures end-to-end communication by providing error detection, flow control, and data segmentation and reassembly. It manages connections and can be connection-oriented (TCP) or connectionless (UDP).

Examples: TCP (Transmission Control Protocol), UDP (User Datagram Protocol).

**5. Session Layer:** The session layer establishes, maintains, and terminates sessions (connections) between applications on different devices. It allows for synchronization and recovery in case of interruptions.

Examples: NetBIOS, RPC (Remote Procedure Call).

**6. Presentation Layer:** The presentation layer deals with data format translation, encryption, compression, and character set conversion to ensure that data sent by one device can be understood by another. It abstracts the application from the lower layers.

Examples: SSL/TLS (Secure Sockets Layer/Transport Layer Security), JPEG, ASCII.

**7. Application Layer:** This layer is the topmost layer and is responsible for providing network services directly to end-users or applications. It includes various protocols and interfaces used by software applications for network communication.

Examples: HTTP (Hypertext Transfer Protocol), FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol).

4. Briefly list and explain the types of computer networks, as well as describing the advantages and disadvantages of each of the network types.

Below I’m going to describe the types of computer networks, their advantages and also disadvantages.

1. **Wide Area Network (WAN):** This spans larger geographical areas and connects LANs in different locations, often using public or private communication links like leased lines or the internet.

**Advantages**:

* Wide coverage area for connecting remote locations.
* Centralized management and control.

**Disadvantages**:

* Slower data transfer speeds compared to LANs.
* Higher setup and operational costs.

1. **Local Area Network (LAN):** are networks that cover a small geographic area, typically within a single building or campus. They connect devices like computers and servers.

**Advantages**:

* High data transfer speeds.
* Low latency and minimal network congestion.
* Easier management and administration.

**Disadvantages**:

* Limited geographical coverage.
* Can be expensive to set up and maintain in large organizations

1. **Metropolitan Area Network (MAN):** MANs are intermediate in size between LANs and WANs, covering a city or a large campus. They provide high-speed connections between LANs.

**Advantages**:

* Faster than WANs within a city or metropolitan area.
* Suitable for organizations with multiple locations in the same city.

**Disadvantages**:

* Limited to a specific geographic area.
* Costlier to set up and manage than a single LAN.

1. **Wireless Local Area Network** (WLAN): WLANs use wireless technologies like Wi-Fi to connect devices within a limited area, such as a home, office, or public hotspot. **Advantages**:

* Mobility and flexibility for device connectivity.
* Cost-effective and easy to set up.

**Disadvantages**:

* Limited coverage area compared to wired networks.
* Susceptible to interference and security risks.

**5)**  any four network topologies as well as describing their advantages and disadvantages.?

* **Star Topology**:

**Advantages**: Centralized management, easy scalability, isolated failures, high reliability. **Disadvantages**: Single point of failure (central hub), cost of hub/switch, cable length limits.

* **Bus Topology**:

**Advantages**: Simplicity: Easy to install and requires minimal cabling. Cost-Effective: Requires less cable than some other topologies. Scalability: It's relatively simple to add or remove devices.

**Disadvantages:** Single Point of Failure: If the main cable or connector fails, the entire network can go down. Limited Cable Length: The length of the bus is limited, which can restrict the size of the network. Performance: As more devices are added, network performance can degrade.

* **Ring Topology:**

**Advantages:** No collisions, deterministic, fair access, easy scalability.

**Disadvantages:** Single point of failure (device/connection), latency with more devices, complexity.

**6)** Convert the following **IP address 128.21.41.3** written in dotted-decimal notation in binary

notation.

* 128.21.41.3 = 10000000.00010101.01000011.00000011

The first octet (128) is 10000000 in binary.

The second octet (21) is 00010101 in binary.

The third octet (41) is 01000011 in binary.

The fourth octet (3) is 00000011 in binary.

***7)*** Change the following IP address from binary notation to dotted-decimal notation:

***01101111 00111000 00101101 01001110?***

01101111 00111000 00101101 01001110 = 192.168.21.14

The first octet (192) is 01101111 in binary. The second octet (168) is 00111000 in binary. The third octet (21) is 00101101 in binary. The fourth octet (14) is 01001110 in binary.

**8)** You have the following address: 192.16.5.133 /29.

How many total bits are being used to identify the network, and how many total bits

identify the host?

The /29 in the IP address 192.16.5.133 /29 means that the last 3 bits are used to identify the host, and the first 29 bits are used to identify the network bits.

there are 29 total bits being used to identify the network, and there are 3 total bits being used to identify the host.

The subnet mask for the IP address 192.16.5.133 /29 is 255.255.255.248

***9)*** What is the full subnet mask for address 172.16.5.10 /28?

The full subnet mask for the address **172.16.5.10 /28 is 255.255.255.240**

**10)** Given the following IP address 10.245.131.0 and a subnet mask of 255.255.224.0 (/19)

determine the following:

a. Class of the IP:

* The first octet of an IP address determines its class. The IP address 10.245.131.0 has a first octet of 10, which is a Class A IP address.

b. Default subnet mask

* The default subnet mask for a Class A IP address is 255.0.0.0.

c. Network Address

* Network address = 10.245.131.0 AND 255.255.224.0 = 10.245.128.0 by (Using ANDing)
* So, the network address is 10.245.128.0

**11)** Given the following IP address 172.16.189.5 a subnet mask of 255.255.254.0/23 determine

the following:

i. Class of the IP:

* The first octet of an IP address determines its class. The IP address 172.16.189.5 has a first octet of 172, which is a Class B IP address.

ii. Default subnet mask:

* The first octet of an IP address determines its class. The IP address 172.16.189.5 has a first octet of 172, which is a Class B IP address.

iii. Network Address:

* Network address = 172.16.189.5 AND 255.255.254.0 = 172.16.188.0
* So, the network address is 172.16.188.0.

**12)** Assuming that you are expert in Network Administration, and you are hired to help ABC

Company to do subnetting of the following IP address 192.168.1.0 /26 in order to fulfill

its network requirements. You are required to do the following:

a) What is the subnet mask for the above given address?

b) How many subnets does the subnet mask you found in question a above

provide?

c) What is the block size for the subnet mask you found in question above ?

d) What are the total subnets?

e) How many valid (usable) hosts are available per subnet?

f) What is the network address of each subnet? Justify your answer.

g) What is the broadcast address of each subnet? Justify your answer.