CSE320

Section – 15

Assignment – 1

Name: Ahtesham Ibne Mostafa

ID: 21201342

1.

Hubs: A hub is essentially a multi-port repeater that operates at the physical layer of the network (Layer 1). Regardless of the destination, a signal that enters one port is transmitted to all other ports. This implies that even if a device is not meant for it, all linked devices receive the data. Although hubs are frequently used in tiny home networks, they are old and ineffective because of their poor intelligence and performance.

Switches: A switch is a sophisticated networking device that works at the network's data link layer (Layer 2). It is intended to establish specialized communication channels between networked device. A table called a MAC address table that maps connected devices' MAC addresses to the appropriate switch ports is kept up to date by switches. This improves network performance and efficiency by enabling the switch to intelligently forward incoming data packets only to the proper destination port. It is widely accepted that switches are necessary for local area network (LAN) communication in both small and big networks.

Routers: A router is a highly developed networking device that works at the network's third tier, the network's network layer. Routers are in charge of tying various networks together. To choose the optimum route for data packets to take across various networks, they use routing protocols. In order to make informed decisions about where to forward data, routers keep routing tables that contain details about available network paths. In addition, routers perform other tasks including NAT (network address translation), firewall security, and QoS control. In order to connect networks, routers are widely used in homes, offices, and online.

Differences between hubs, switches and routers :

|  |  |  |
| --- | --- | --- |
| Hubs | Switches | Routers |
| Hubs are multi-port repeaters that broadcast incoming signals to all connected devices, regardless of the destination. They operate at the physical layer and lack intelligence. | Switches create dedicated communication paths between devices by using MAC address tables. They forward data packets only to the appropriate destination port, enhancing network efficiency. Switches operate at the data link layer. | Routers connect multiple networks together. They use routing protocols and maintain routing tables to determine the best path for data packets across networks. Routers operate at the network layer. |
| Hubs simply repeat signals without any filtering or decision-making. They offer no control over network traffic and can lead to collisions and performance issues. | Switches intelligently forward data based on MAC addresses. They create separate collision domains for each port, allowing simultaneous communication between multiple devices. | Routers examine network layer addresses (such as IP addresses) to make routing decisions. They direct data packets to the appropriate network based on destination addresses. |
| Hubs usually have a limited number of ports (e.g., 4, 8, or 16 ports) and can connect multiple devices in a network. | Switches typically offer more ports (e.g., 24 or 48 ports) and allow simultaneous communication between devices connected to different ports. | Routers connect networks together, allowing communication between devices on different networks. They often have multiple ports for connecting to various networks. |
| Hubs are commonly used in small home networks or as temporary solutions due to their simplicity and low cost. | Switches are widely used in both small and large networks, including local area networks (LANs) and data centers. | Routers are essential for interconnecting networks, including home networks, business networks, and the internet. |
| Hubs have no additional features beyond signal repetition. | Switches may offer advanced features such as VLAN support, port mirroring, link aggregation, and quality of service (QoS) management. | Routers provide additional functions like network address translation (NAT), firewall protection, virtual private network (VPN) support, and more. |

2. Based on the given requirements, a suitable network topology for the university scenario would be a combination of three separate departmental LANs connected to a central management network using a star topology.

Department A LAN:

Topology: Star topology

Devices: 5 devices initially, scalable for future expansion

Logic: The star topology allows for easy management and scalability. Each device in the department connects directly to a central switch or hub, enabling efficient communication within the department.

Department B LAN:

Topology: Star topology

Devices: 5 devices initially, scalable for future expansion

Logic: Similar to Department A, a star topology provides centralized management and scalability. It allows for easy addition of new devices to the department's network without affecting other departments.

Department C LAN:

Topology: Star topology

Devices: 5 devices initially, scalable for future expansion

Logic: Again, a star topology is chosen for Department C to ensure independent network management and scalability. This topology simplifies troubleshooting and allows for future growth by adding more devices as needed.

Central Management Network:

Topology: Star topology

Logic: The central management network connects all the departmental LANs together and serves as the backbone of the university's network infrastructure. By using a star topology, the central management network provides a centralized hub or switch that connects to the individual departmental LANs, facilitating communication and coordination between the departments.

The star topology is selected for each departmental LAN because it offers the following advantages:

Centralized management: The central switch or hub in each department enables easy monitoring, configuration, and troubleshooting of devices within that department.

Scalability: The star topology allows for easy expansion of the network by adding more devices to each department without affecting other departments. This scalability aligns with the requirement to accommodate an increasing number of devices in each department.

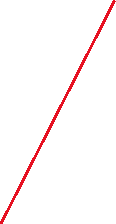
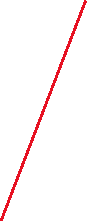
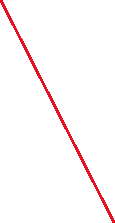
Fault isolation: In case of a device or cable failure in one department, the star topology ensures that the issue is isolated and does not affect the other departments' networks.

Simplicity: The star topology is straightforward to implement and understand, making it an ideal choice for a university environment where network administrators might have varying levels of expertise.

Overall, the combination of departmental LANs using star topologies, connected to a central management network, provides an efficient and scalable solution that meets the requirements of the university scenario.

Design :

|  |  |  |  |
| --- | --- | --- | --- |
| Central Management Network   |  |  |  | | --- | --- | --- | |  |  |  |   Switch |



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Department A   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |   Switch |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Department B   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |   Switch |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Department c   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |   Switch |



|  |
| --- |
| Device3 |

|  |
| --- |
| Device5 |

|  |
| --- |
| Device1 |

|  |
| --- |
| Device3 |

|  |
| --- |
| Device5 |

|  |
| --- |
| Device1 |

|  |
| --- |
| Device3 |

|  |
| --- |
| Device5 |

|  |
| --- |
| Device1 |

|  |
| --- |
| Device2 |

|  |
| --- |
| Device2 |

|  |
| --- |
| Device4 |

|  |
| --- |
| Device2 |

|  |
| --- |
| Device4 |

|  |
| --- |
| Device4 |