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Assignment 3

Question 1: IPv4 Plan for Riphah International University

1. Organization Overview

Riphah International University has 5 main departments:

- Administration (50 hosts)
- Faculty of Engineering (120 hosts)
- Faculty of Sciences (80 hosts)
- Library (30 hosts)
- Computer Labs (100 hosts)

2. Network Topology

The network will use a hierarchical design with:

- Core router connecting to the internet
- Distribution switches for each department
- Access switches for end devices
- Wireless access points for mobile devices

3. Subnet Planning (Using 192.168.0.0/16)

Subnet	Subnet Mask	Network ID	First Host IP	Last Host IP	Broadcast IP	Host Range	
Administration Department	192.168.1.0	255.255.255.192	192.168.1.0	192.168.1.1	192.168.1.62	192.168.1.63	192.168.1.1 - 192.168.1.62
Faculty of Engineering	192.168.2.0	255.255.255.128	192.168.2.0	192.168.2.1	192.168.2.126	192.168.2.127	192.168.2.1 - 192.168.2.126
Faculty of Sciences	192.168.3.0	255.255.255.128	192.168.3.0	192.168.3.1	192.168.3.126	192.168.3.127	192.168.3.1 - 192.168.3.126
Library	192.168.4.0	255.255.255.224	192.168.4.0	192.168.4.1	192.168.4.30	192.168.4.31	192.168.4.1 - 192.168.4.30
Computer Labs	192.168.5.0	255.255.255.128	192.168.5.0	192.168.5.1	192.168.5.126	192.168.5.127	192.168.5.1 - 192.168.5.126

4. Hardware Plan

Hardware devices	Cable	Port	Network ID/connection
Core Router	Fiber	6	ISP + 5 distribution switches
Distribution Switch 1	Cat6	24	192.168.1.0/26 (Admin)
Distribution Switch 2	Cat6	48	192.168.2.0/25 (Engineering)
Distribution Switch 3	Cat6	48	192.168.3.0/25 (Sciences)
Distribution Switch 4	Cat6	24	192.168.4.0/27 (Library)
Distribution Switch 5	Cat6	48	192.168.5.0/25 (Computer Labs)
Access Points	Cat6	N/A	Each department's subnet
Printers	Cat6	N/A	Each department's subnet

Question 2: OSI Model and Protocol Layering

2(a) OSI Model Explanation and Security Layer

OSI Model Layers and Functions:

1. **Physical Layer (Layer 1):**
   - Physical connections and raw bit transmission
   - Electrical/mechanical specifications
   - Hardware: Cables, connectors, hubs

2. **Data Link Layer (Layer 2):**
   - Node-to-node communication
   - Error detection/correction (CRC)
   - MAC addressing, switching
   - Protocols: Ethernet, PPP

3. **Network Layer (Layer 3):**
   - Logical addressing (IP addresses)
   - Routing packets across networks

- Protocols: IP, ICMP, ARP

4. **Transport Layer (Layer 4):**
   - End-to-end communication
   - Flow control, error recovery
   - Protocols: TCP (reliable), UDP (unreliable)

5. **Session Layer (Layer 5):**
   - Establishes, manages, terminates sessions
   - Synchronization points in data stream

6. **Presentation Layer (Layer 6):**
   - Data translation, encryption/decryption
   - Data compression, formatting

7. **Application Layer (Layer 7):**
   - Interface for user applications
   - Protocols: HTTP, FTP, SMTP, DNS

Security Layer Addition:
For application layer encryption/decryption, we don't add a new TCP/IP layer. This functionality belongs to the Presentation Layer in OSI, which in TCP/IP is part of the Application Layer. Encryption details would be added to application layer headers.

Updated TCP/IP Layers with Security:
1. Application Layer (with encryption)
2. Transport Layer
3. Network Layer
4. Data Link Layer
5. Physical Layer

2(b) Protocol Layering in Air Travel

Round-Trip Protocol Layers:

1. **Baggage Layer:**
   - Departure: Check-in baggage
   - Arrival: Baggage claim
   - Return: Check-in baggage
   - Home: Baggage claim

2. **Boarding Layer:**
   - Departure: Boarding pass check, security
   - Arrival: Deboarding
   - Return: Boarding pass check, security
   - Home: Deboarding

3. **Transport Layer:**
   - Departure: Take off
   - Arrival: Landing
   - Return: Take off
   - Home: Landing

4. **Routing Layer:**
   - Flight path determination
   - Air traffic control communication
   - Navigation between airports

5. **Physical Layer:**
   - Aircraft operation
   - Runway usage
   - Fuel management