Labs Networking System

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1   Project Description

This Network Scenario is about designing a topology of a network that is a LAN (Local Area Network) for a CS Department in which various computers of department are set up so that they can interact and communicate with each other by interchanging data. To design a networking scenario for a Computer Science Department which connect various labs to each other's, it puts forward communication among different departments. CS-NS is used to design a systematic and well-planned topology, satisfying all the necessities of the computer science department (i.e. client). CS-NS come up with a network with good performance.

2   Objectives

The main objective of the proposed network is to update the existing network and also enhance its capabilities and increase the flexibility of the network which will eventually provide good security.

3   Operational Details

3.1   Background of the Client

- **Organization Name:** Computer Science Department of the University of Engineering and Technology Lahore

- **Location:** Lahore

- **Line of Business:** Education

- **The name of department Labs:**

    – LAB1

    – LAB2

    – LAB3

    – LAB4

- **The number of PCs in each lab:** 50 PCs

4   Networking Requirements

4.1   Routers

- **The name of the networking hardware:** CISCO1941/K9

- **Purpose of hardware:** Models like Cisco 1941 are cost-effective and suitable for small to medium-sized networks.

- **The unit price:** PKR 25,000

- **The quantity:** 1

- **The total price:** PKR 25,000

4.2 Switches

- **The name of the networking hardware:** Cisco Catalyst 2960

- **Purpose of hardware:** Offers Fast Ethernet and Gigabit Ethernet ports. Suitable for basic connectivity needs in smaller networks. May lack some advanced features found in higher-end switches.

- **The unit price:** PKR 20,000

- **The quantity:** 1

- **The total price:** PKR 1,00,000

5 IP Addressing Scheme

For the networking of labs, we have employed a 2-bit subnetting strategy for the easy management of different labs.

Base Network: 192.168.144.0

5.1 Lab-1(1st Subnet)

- **Network Address:** 192.168.144.0

- **Broadcast Address:** 192.168.144.63

- **Host Range:** 192.168.144.1 - 192.168.144.62

- **1st Subnet Range:** 192.168.144.0 – 192.168.144.63

- **Available Addresses:** 62

5.2   Lab-2(2nd Subnet)

- **Network Address:** 192.168.144.64

- **Broadcast Address:** 192.168.144.127

- **Host Range:** 192.168.144.65 - 192.168.144.126

- **2nd Subnet Range:** 192.168.144.64 – 192.168.144.127

- **Available Addresses:** 62

5.3   Lab-3(3rd Subnet)

- **Network Address:** 192.168.144.128

- **Broadcast Address:** 192.168.144.191

- **Host Range:** 192.168.144.129 - 192.168.144.190

- **3rd Subnet Range:** 192.168.144.128 – 192.168.144.191

- **Available Addresses:** 62

5.4   Lab-4(4th Subnet)

- **Network Address:** 192.168.144.192

- **Broadcast Address:** 192.168.144.255

- **Host Range:** 192.168.144.193 - 192.168.144.254

- **4th Subnet Range:** 192.168.144.192 – 192.168.144.255

- **Available Addresses:** 62

6   IP Addressing Plan for the Project

LAB-1 (192.168.144.0)			
ID	Subnet Mask	IP Addresse	Description
1	255.255.255.192	192.168.144.1	GateWay
2	255.255.255.192	192.168.144.2	PC 1
3	255.255.255.192	192.168.144.3	PC 2
4	255.255.255.192	192.168.144.4	PC 3
5	255.255.255.192	192.168.144.5	PC 4

TABLE 1: IP Addressing Plan for CS Department Lab 1

LAB-2 (192.168.144.64)			
ID	Subnet Mask	IP Addresse	Description
1	255.255.255.192	192.168.144.65	GateWay
2	255.255.255.192	192.168.144.66	PC 1
3	255.255.255.192	192.168.144.67	PC 2
4	255.255.255.192	192.168.144.68	PC 3
5	255.255.255.192	192.168.144.69	PC 4

TABLE 2: IP Addressing Plan for CS Department Lab 2

LAB-3 (192.168.144.128)			
ID	Subnet Mask	IP Addresse	Description
1	255.255.255.192	192.168.144.129	GateWay
2	255.255.255.192	192.168.144.130	PC 1
3	255.255.255.192	192.168.144.131	PC 2
4	255.255.255.192	192.168.144.132	PC 3
5	255.255.255.192	192.168.144.133	PC 4

TABLE 3: IP Addressing Plan for CS Department Lab 3

LAB-4 (192.168.144.192)			
ID	Subnet Mask	IP Addresse	Description
1	255.255.255.192	192.168.144.193	GateWay
2	255.255.255.192	192.168.144.194	PC 1
3	255.255.255.192	192.168.144.195	PC 2
4	255.255.255.192	192.168.144.196	PC 3
5	255.255.255.192	192.168.144.197	PC 4

TABLE 4: IP Addressing Plan for CS Department Lab 4

7   Configure VLANs

- Open Switch CLI

- Run: `config terminal`

7.1   VLAN 10 for Subnet 1

- `int fa0/2`

- `switchport mode access`

- `switchport access vlan 10`

7.2   VLAN 20 for Subnet 2

- `int fa0/3`

- `switchport mode access`

- `switchport access vlan 20`

7.3   VLAN 30 for Subnet 3

- `int fa0/4`

- `switchport mode access`

- `switchport access vlan 30`

7.4   VLAN 40 for Subnet 4

- `int fa0/5`

- `switchport mode access`

- `switchport access vlan 40`

8   Configure DHCP Server

- Go to the router

- Router: `CS Department`

8.1   DHCP for Subnet 1

- `ip dhcp pool Lab1`

- `network 192.168.144.0 255.255.255.192`

- `default-router 192.168.144.1`

8.2   DHCP for Subnet 2

- `ip dhcp pool Lab2`

- `network 192.168.144.64 255.255.255.192`

- `default-router 192.168.144.65`

8.3   DHCP for Subnet 3

- `ip dhcp pool Lab3`

- `network 192.168.144.128 255.255.255.192`

- `default-router 192.168.144.129`

8.4   DHCP for Subnet 4

- `ip dhcp pool Lab4`

- `network 192.168.144.192 255.255.255.192`

- `default-router 192.168.144.129`

9   Project Features

9.1   2-bit subnetting:

The network design incorporates 2-bit subnetting, providing a structured and efficient method for organizing IP addresses within the Computer Science Department.

9.2   Scalable:

The 2-bit subnetting scheme ensures scalability, allowing for easy expansion as the department's computing needs evolve over time.

9.3   DHCP:

Dynamic Host Configuration Protocol (DHCP) is utilized to automate the assignment of IP addresses, streamlining the configuration process and enhancing network connectivity.
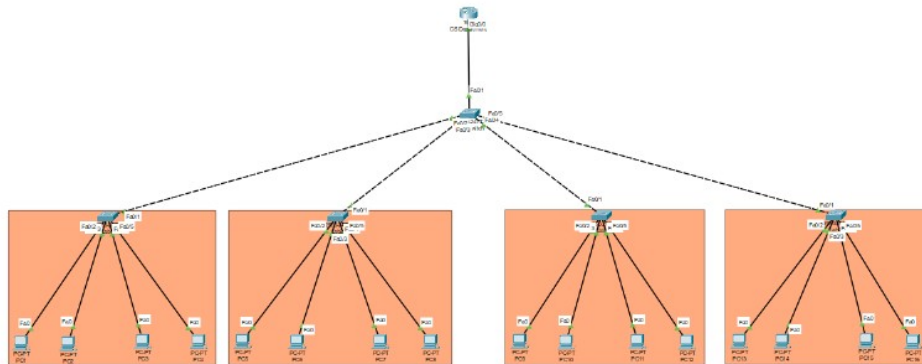
10   Network Design

FIGURE 1: The prototype of the network is implemented on cisco packet tracer