EE8203: DESIGN AND MANAGEMENT OF DATA NETWORKS

ASSIGNMENT 01

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REG NO : EG/2018/3304

DATE : 18/09/2023

FLOOR PLAN

<table>
<tr><td rowspan="2">MATLAB Lab</td><td colspan="3" rowspan="2">Library</td><td>Server Room 2</td><td>Lecture Room 5</td><td>Lecture Room 6</td></tr>
<tr><td>Lecture Room 7</td><td>Lecture Room 8</td></tr>
<tr><td></td><td></td><td colspan="3">Lecture Offices</td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
</table>

SECOND FLOOR

<table>
<tr><td rowspan="2">CAD Lab</td><td colspan="3" rowspan="2">Student Computer Lab</td><td>Server Room 1</td><td>Lecture Room 1</td><td>Lecture Room 2</td></tr>
<tr><td>Main Office</td><td>Lecture Room 3</td><td>Lecture Room 4</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Lecture Offices</td><td></td><td></td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
</table>

FIRST FLOOR

PLANNING IPS

The network design is as follows.

1. Students are in a separate network. **(10.4.0.0/23)**
2. The staff, teaching assistants, lecture rooms, offices, and two server rooms are in a separate network. **(10.4.2.0/23)**

The basic IP plan can be summarized as follows.

Table 1: IP Plan

Group	Network IP	Subnet Mask	Gateway IPs	Current Capacity
MATLAB Lab (Students)	10.4.0.0	255.255.255.128	10.4.0.1 10.4.0.2 10.4.0.3	123
MATLAB Lab (Teaching Assistance + Server)	10.4.2.160	255.255.255.248	10.4.2.161 10.4.2.162 10.4.2.163	3
CAD Lab - (Students)	10.4.0.128	255.255.255.128	10.4.0.129 10.4.0.130 10.4.0.131	123
CAD Lab (Teaching Assistance + Server)	10.4.2.168	255.255.255.248	10.4.2.169 10.4.2.170 10.4.2.171	3
Computer Lab (Students)	10.4.1.0	255.255.255.192	10.4.1.1 10.4.1.2 10.4.1.3	59
Computer Lab (Server)	10.4.2.176	255.255.255.248	10.4.2.177 10.4.2.178 10.4.2.179	3
Access point (Students)	10.4.1.64	255.255.255.192	10.4.1.65 10.4.1.66 10.4.1.67	59
Library (Students)	10.4.1.128	255.255.255.192	10.4.1.129 10.4.1.130 10.4.1.131	59
Library (Staff)	10.4.2.128	255.255.255.240	10.4.2.129 10.4.2.130 10.4.2.131	11
Lecture Office	10.4.2.64	255.255.255.192	10.4.2.65 10.4.2.66 10.4.2.67	59

Main Office	10.4.2.32	255.255.255.224	10.4.2.33 10.4.2.34 10.4.2.35	27
Lecture Rooms	10.4.2.0	255.255.255.224	10.4.2.1 10.4.2.2 10.4.2.3	27
Sever Farm 01	10.4.2.192	255.255.255.240	10.4.2.193 10.4.2.197 10.4.2.201 10.4.2.205	8
Server Farm 02	10.4.2.208	255.255.255.240	10.4.2.209 10.4.2.213 10.4.2.217 10.4.2.221	8

- The network is set up to easily add more computers in the future if needed. (Scalability)

NETWORK DESIGN

This network includes mainly Access layer, distribution layer and server farm.

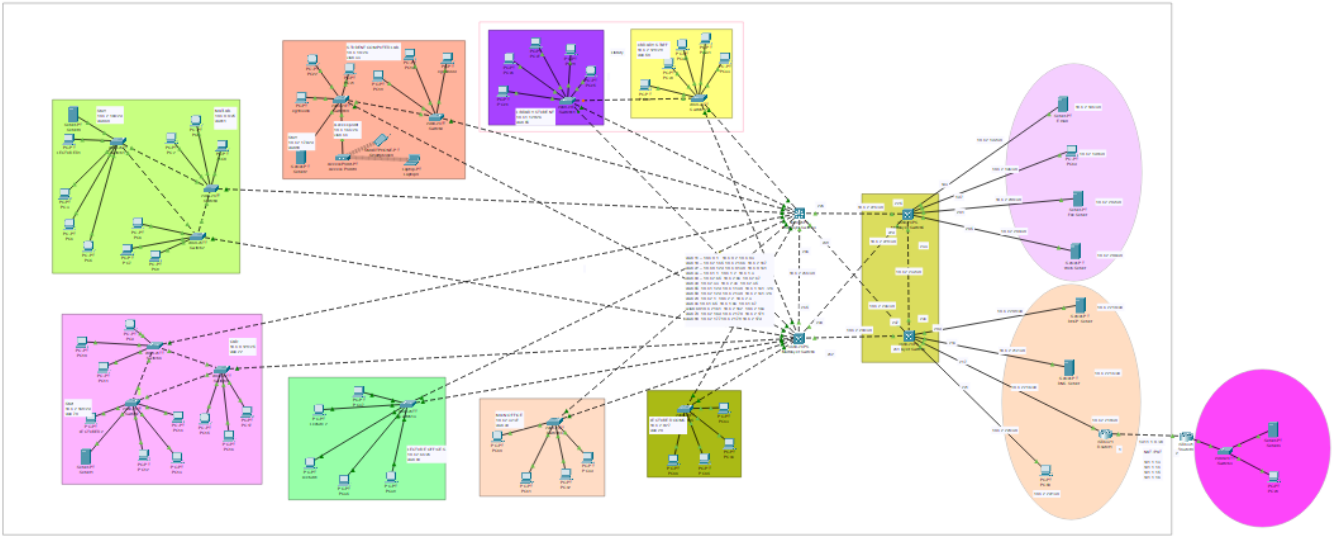

Figure 1: Complete Topology of the Network

For each and every section in the building, VLANs have been created for students as well as the teacher and staff.

CAD Computer Lab

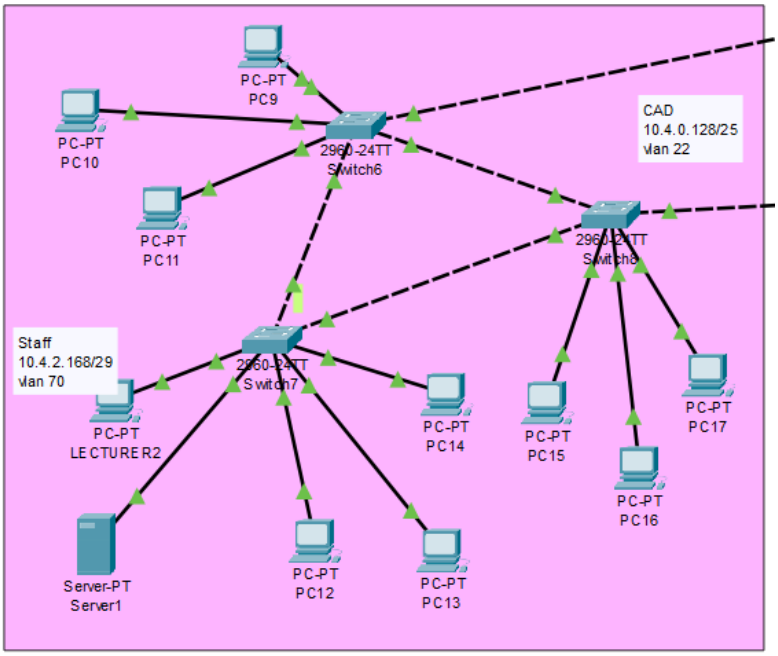

Figure 2: Network Diagram for CAD Computer Lab

MATLAB Computer Lab

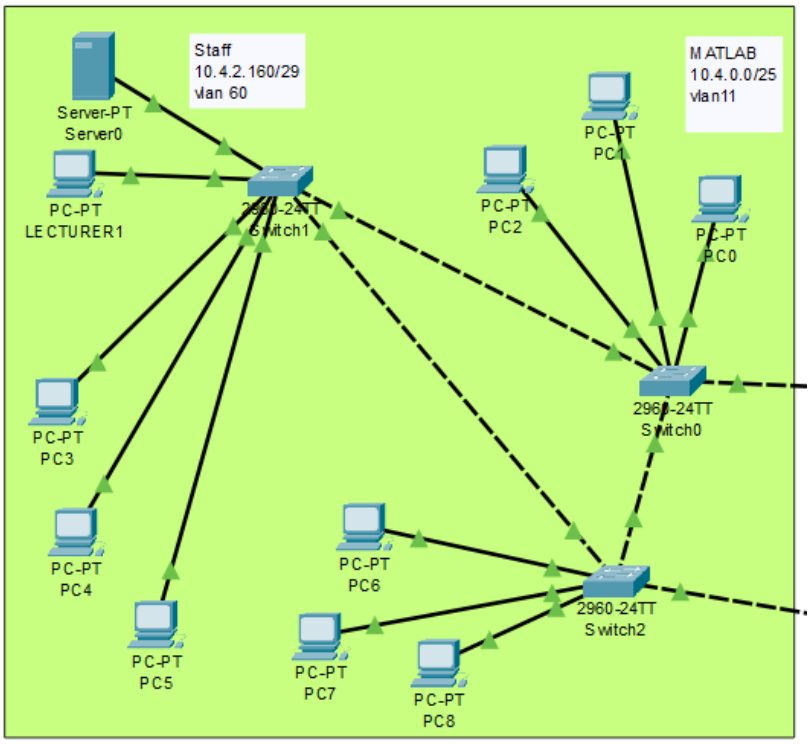

Figure 3: Network Diagram for MATLAB Computer Lab

Student Computer Lab

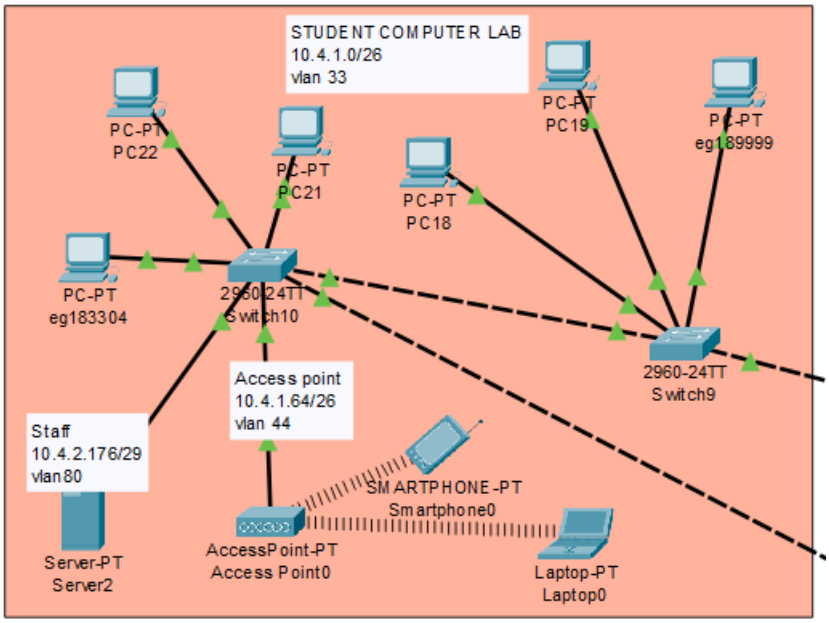

Figure 4 : Network Diagram for Student Computer Lab

Library

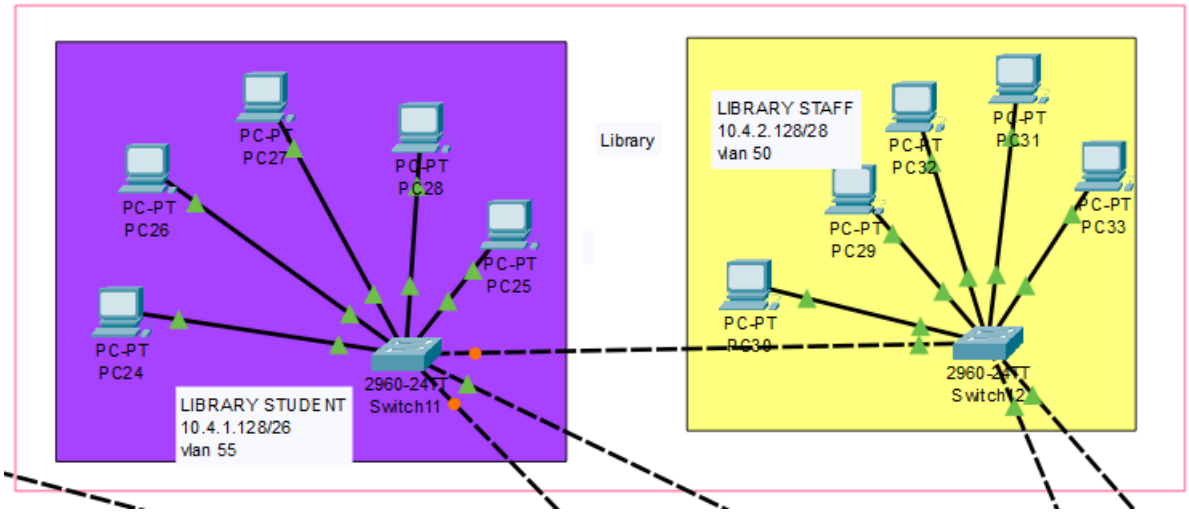

Figure 5: Network Diagram for Library

Lecture Rooms

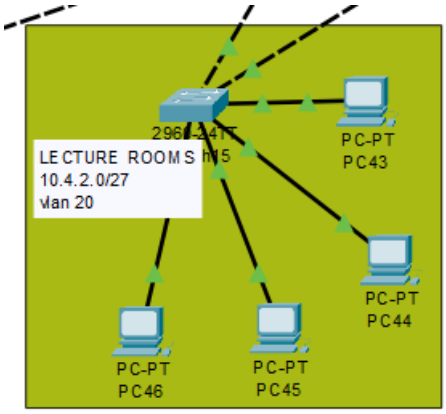

Figure 6: Network Diagram for Lecture Rooms

Lecture Offices

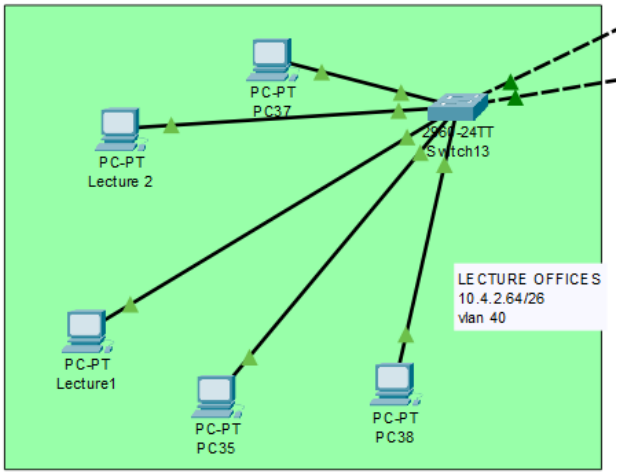

Figure 7: Network Diagram for Lecture Offices

Main Office

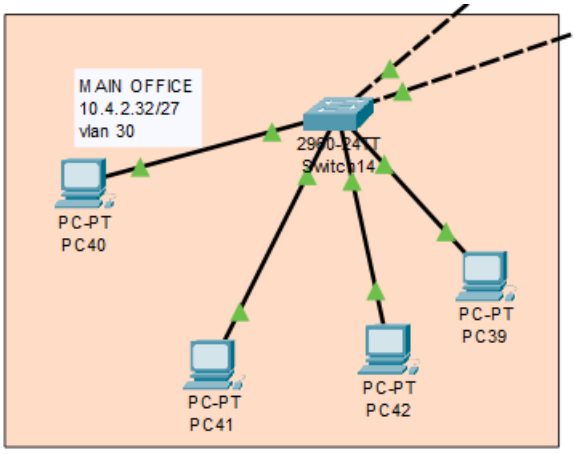

Figure 8: Network Diagram for Main Office

Server Farm

There is one server room for each floor. It is clearly illustrated in the following Figure 9.

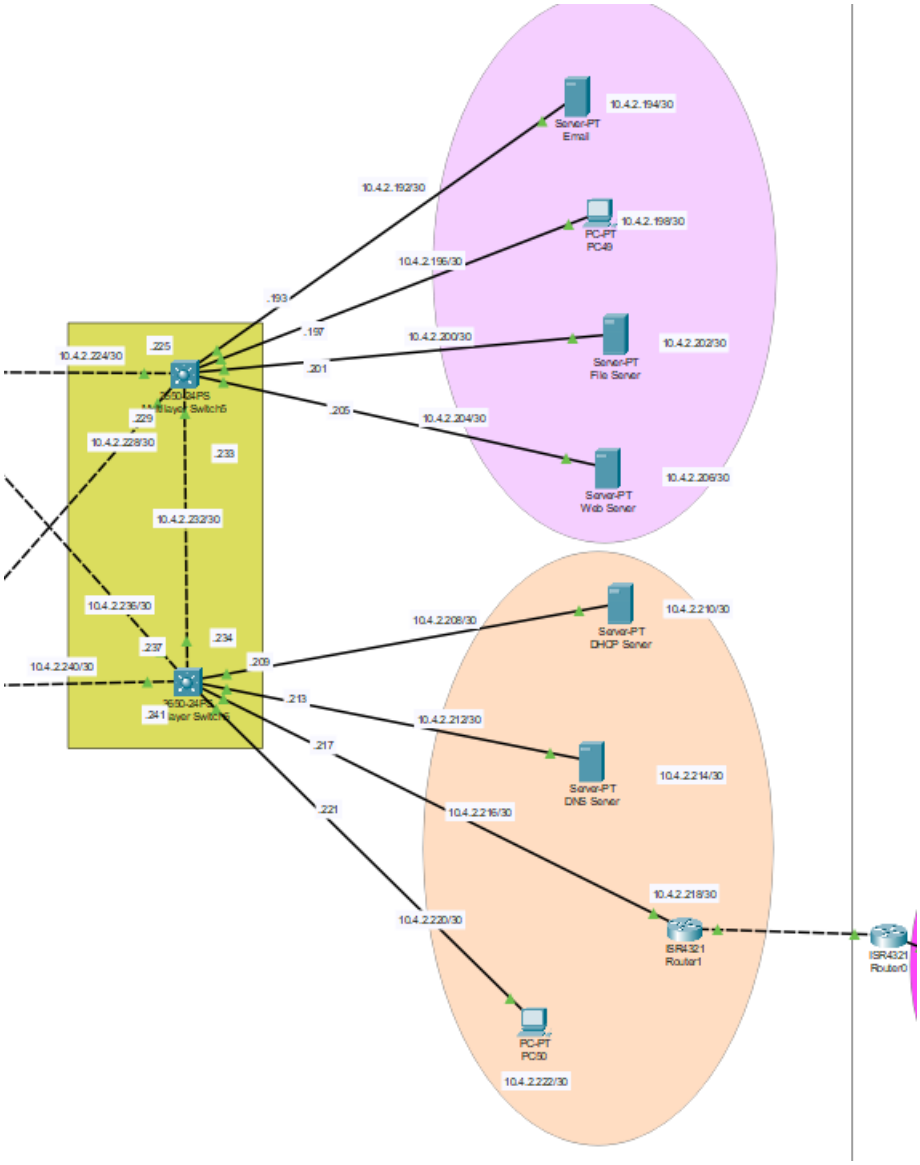

Figure 9: Network Diagram for Server Farm

1. DHCP Server

This DHCP Server in the server farm is responsible for assigning IPs for all the devices in this network. This allocation is done using the IP pools created in the DHCP server for each section of the building according to their VLANs.

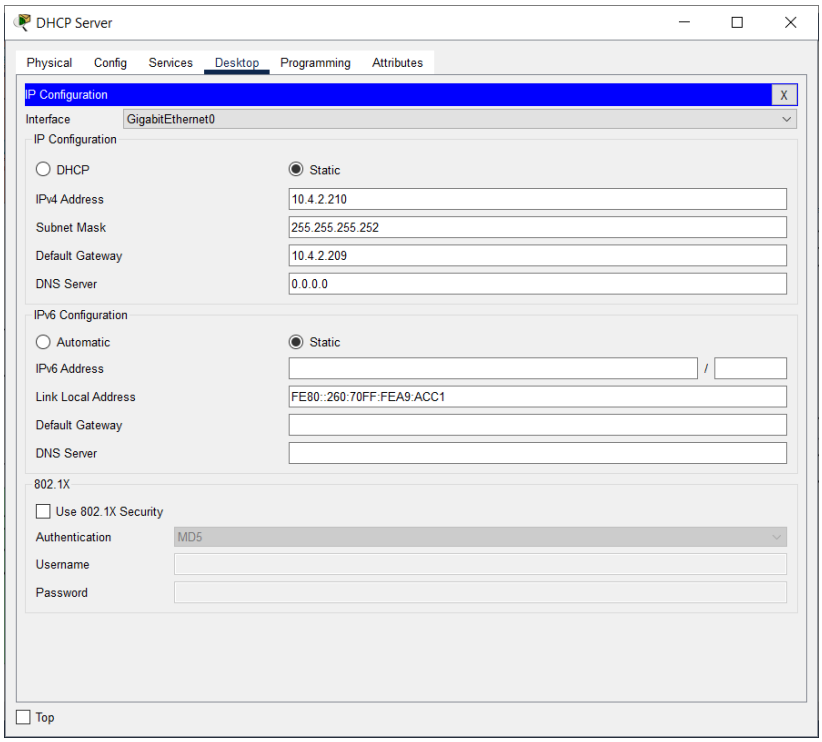

Figure 10: IP Configuration of DHCP Server

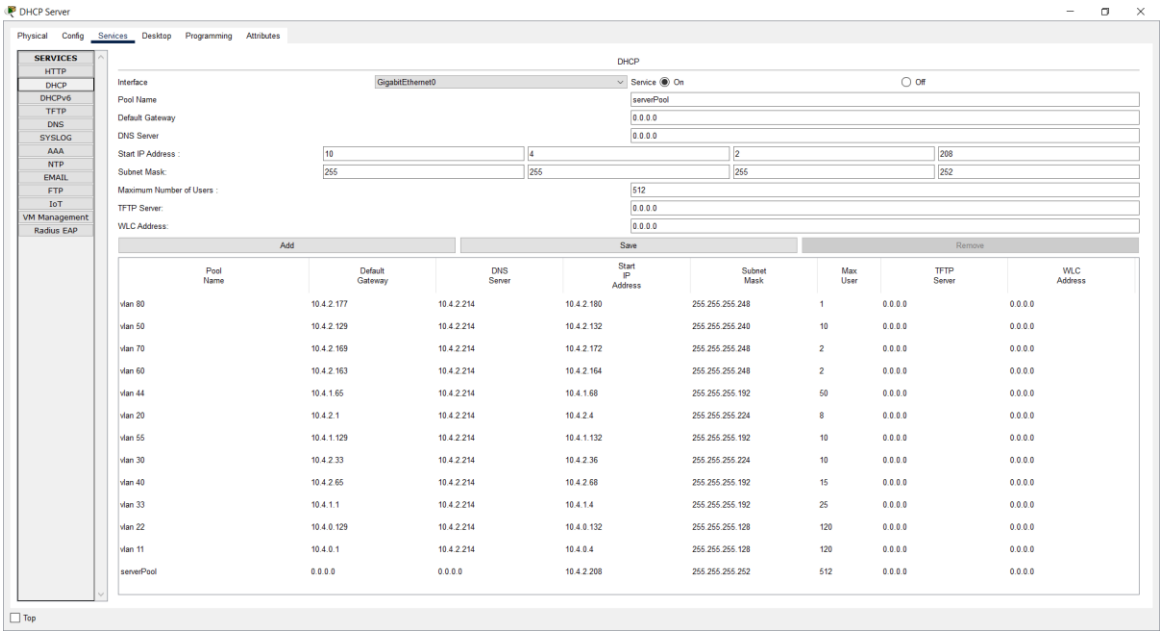

Figure 11: IP Pools in the DHCP Server

2. DNS Server

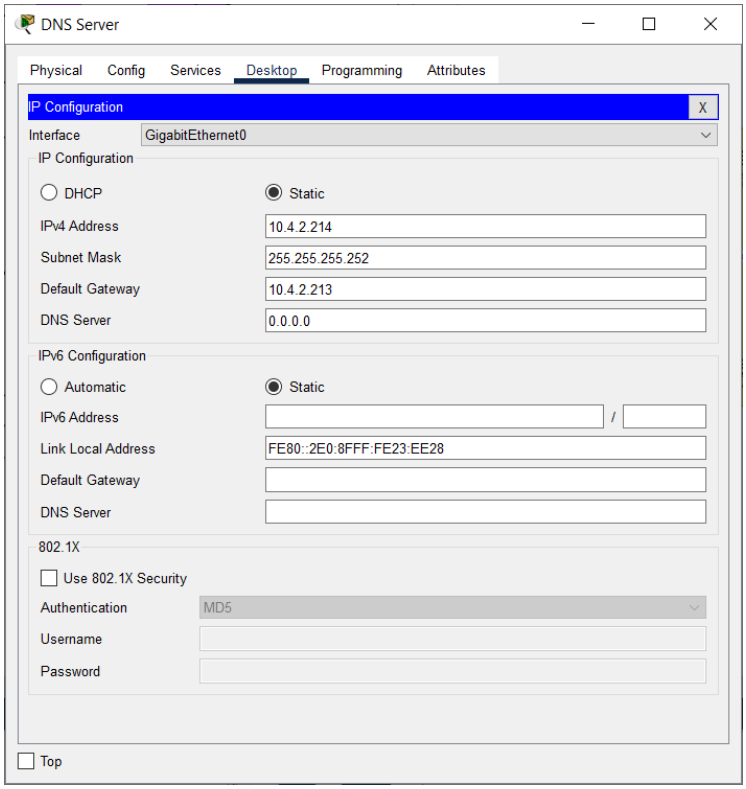

Figure 12: IP Configuration for the DNS Server

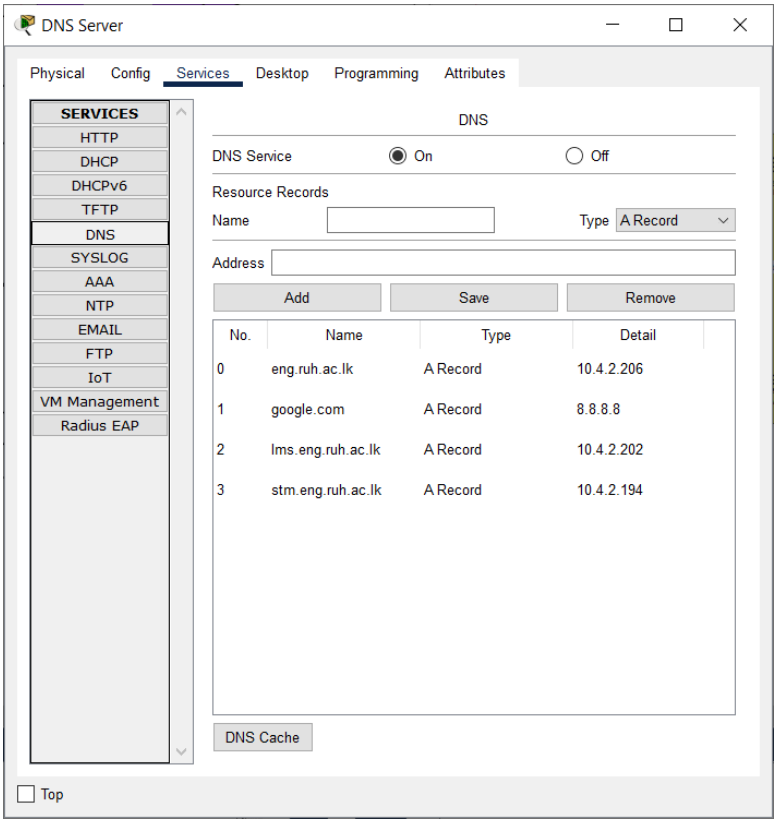

Figure 13: DNS Configurations

3. Email Server

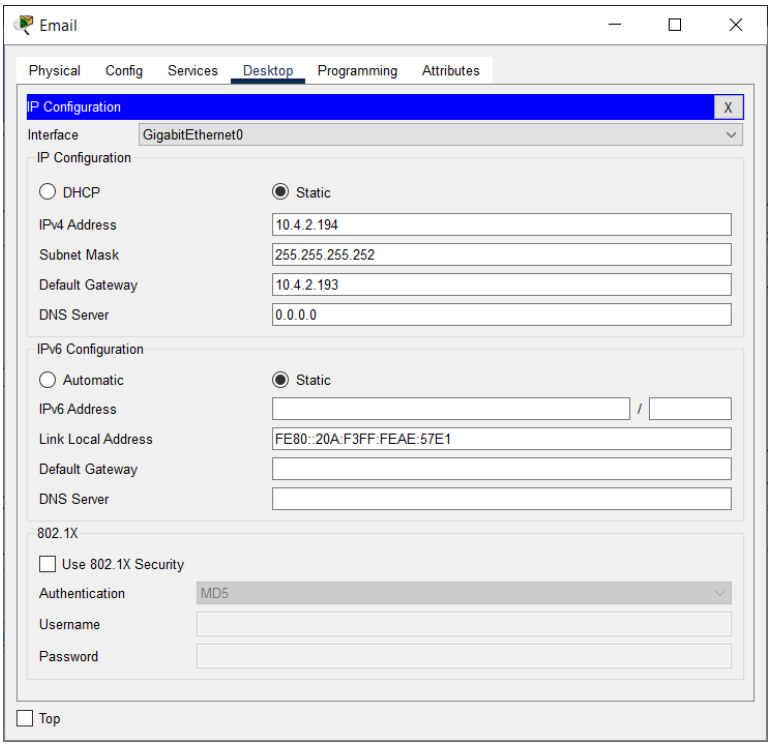

Figure 14: IP Configurations of the Email Server

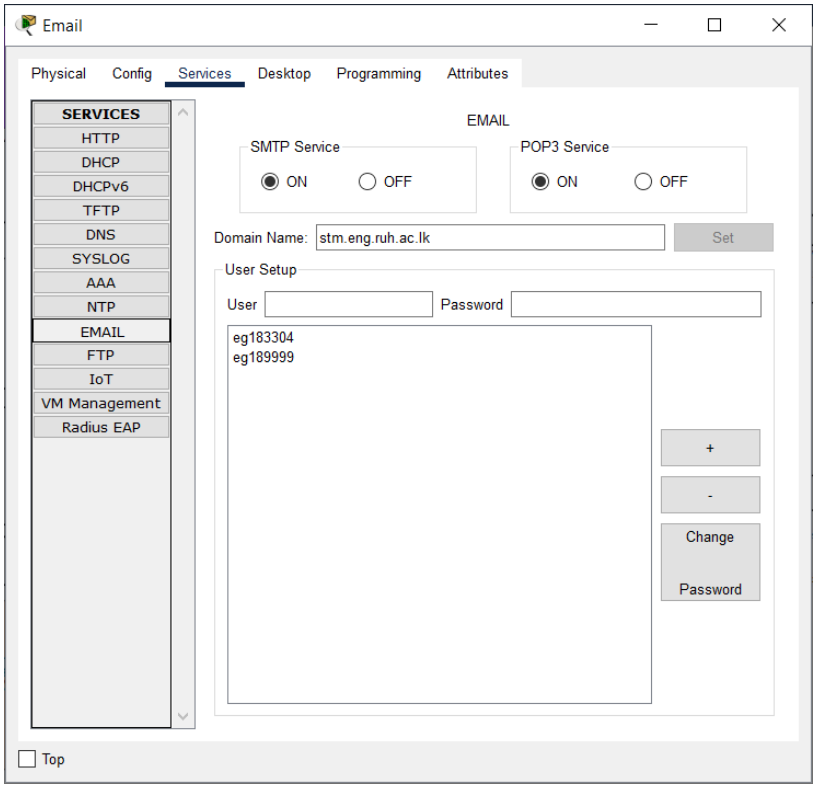

Figure 15: Email Client Configurations of the Email Server

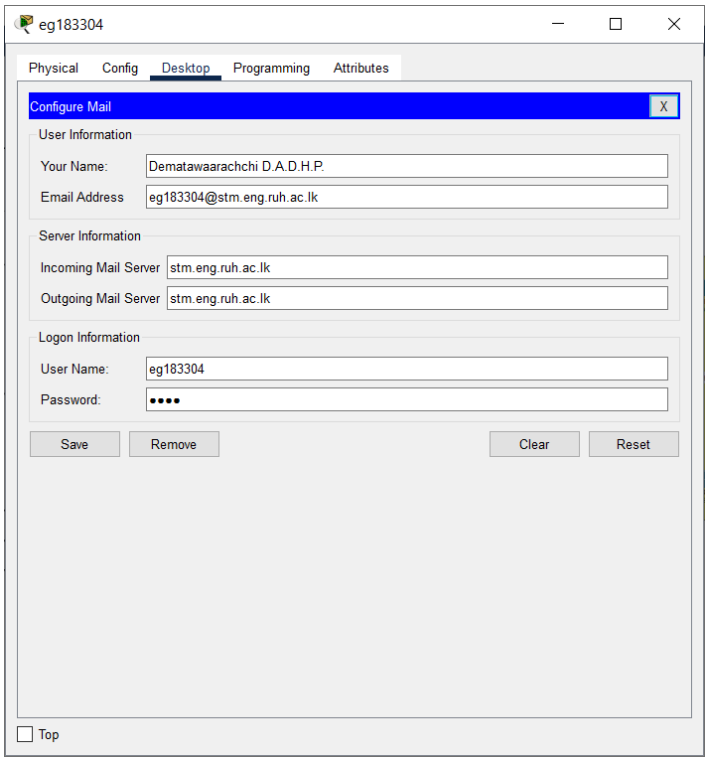

Figure 16: Email Client Configuration of User Device

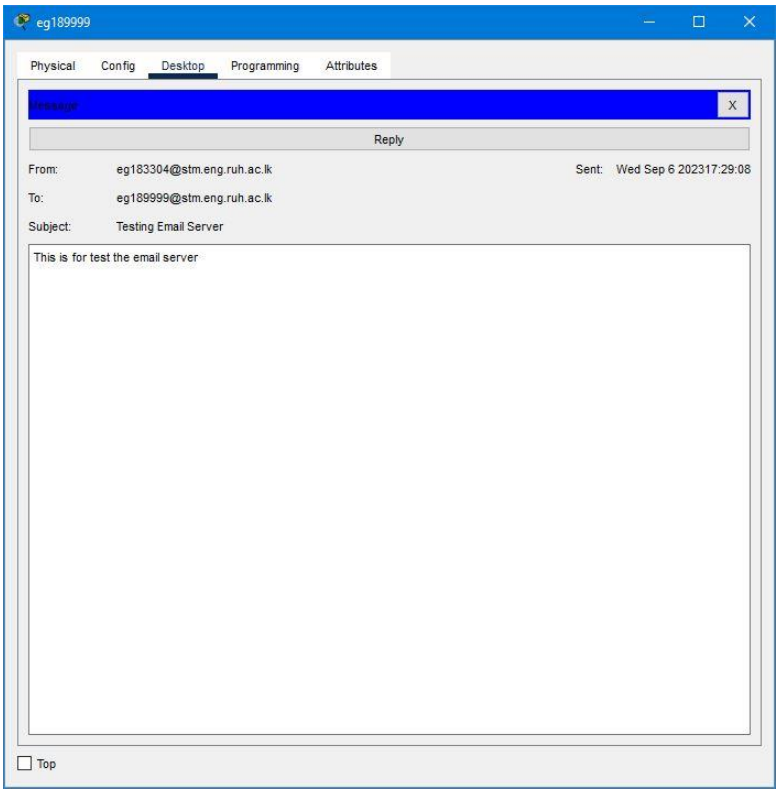

Figure 17: Email Service Testing

4. File Server

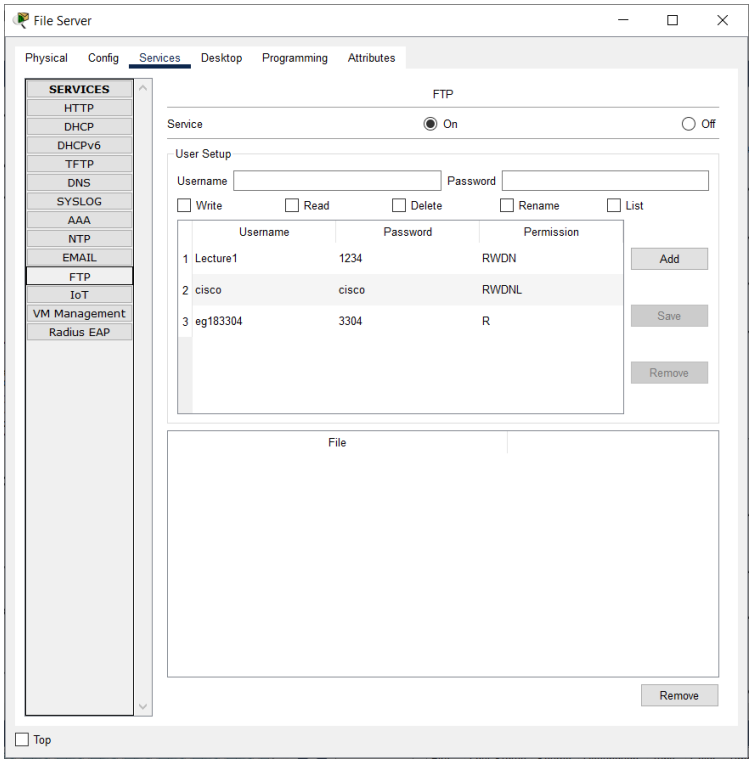

Figure 18: Client Configuration with Different Privileges in File Server

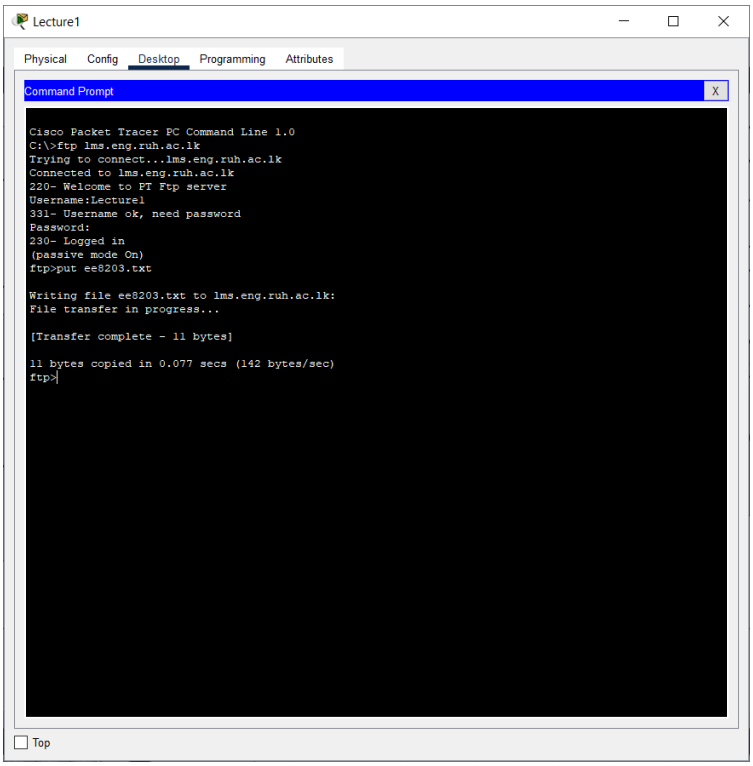

Figure 19: Lecturer uploads a File to Server

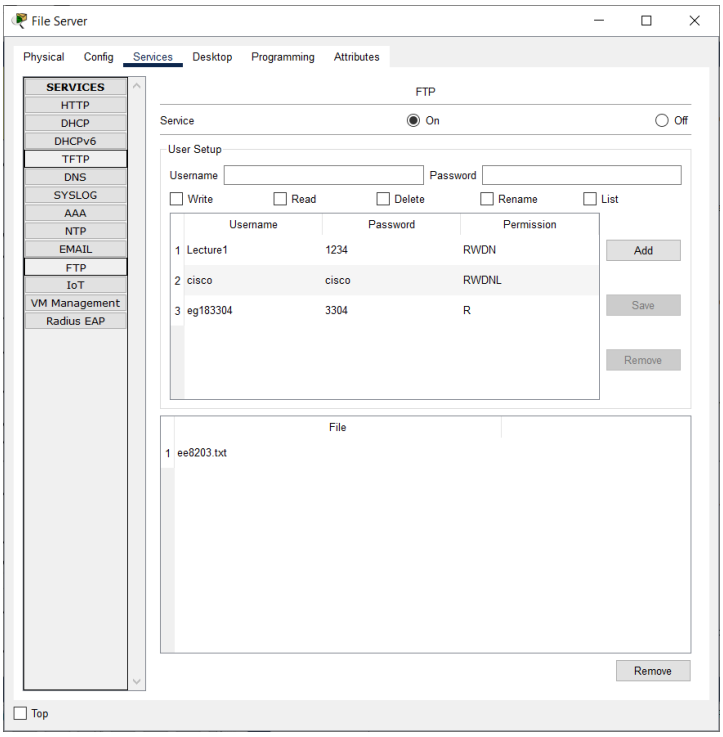

Figure 20: Verifying the File is Uploaded to the Server

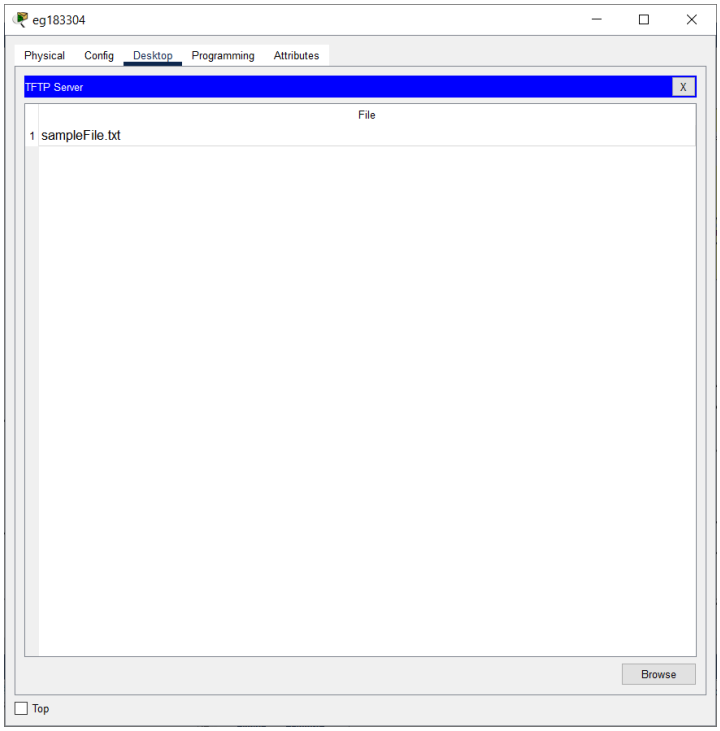

Figure 21: Student PC before Downloading the File

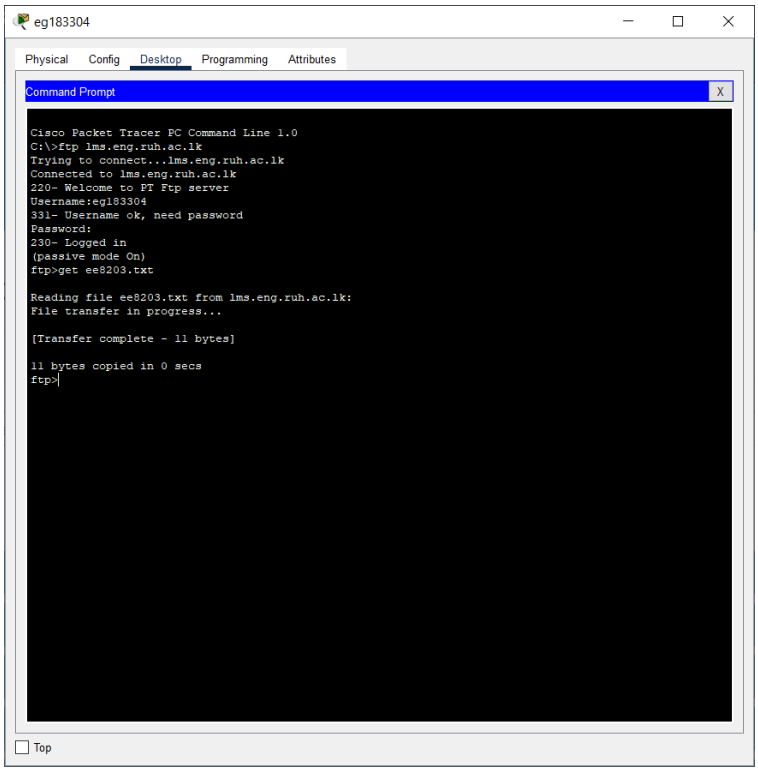

Figure 22: Student downloads the File from the Server

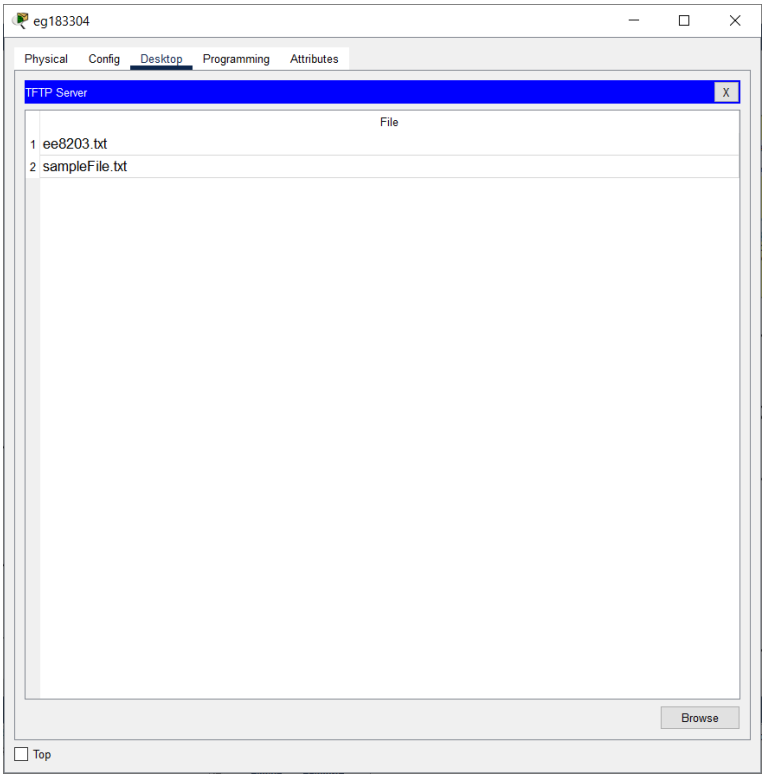

Figure 23: Student's PC After Downloading the File

5. Web Server

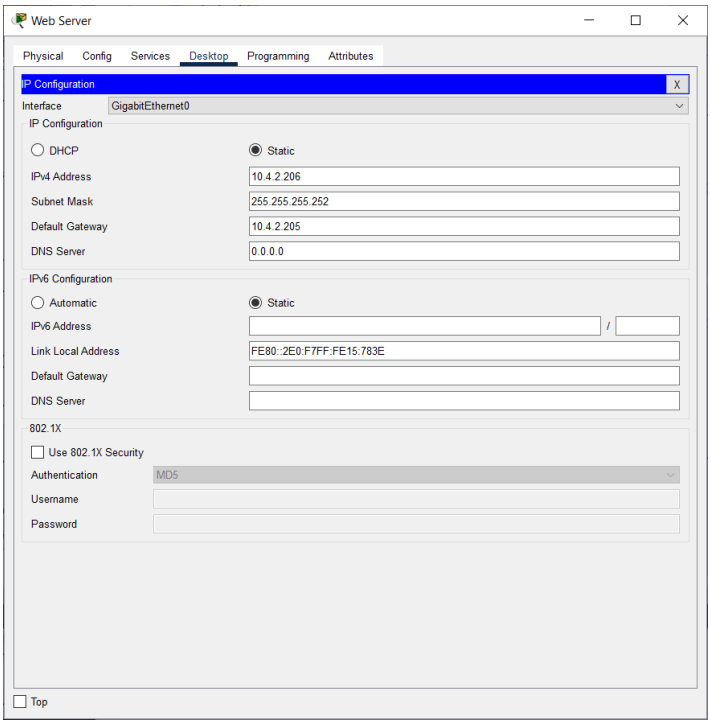

Figure 24: IP Configuration of the Web Server

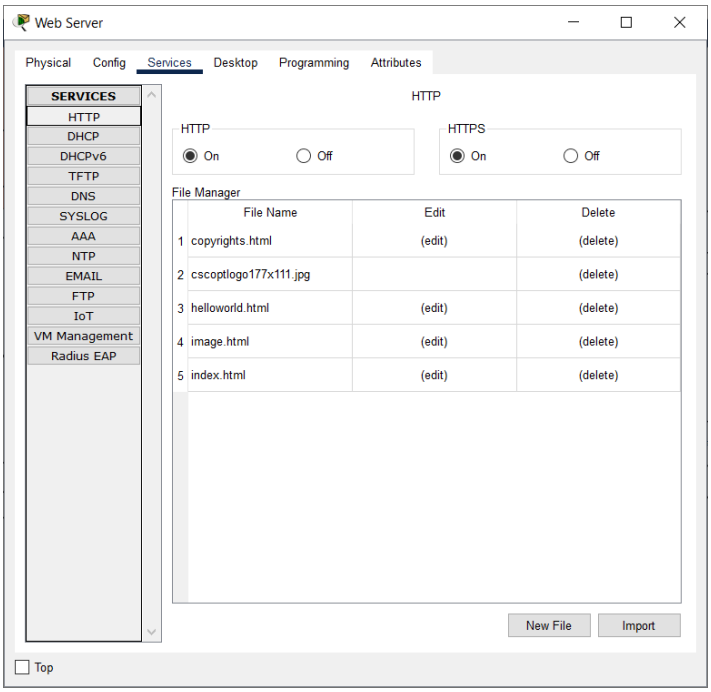

Figure 25: Files in Web Server

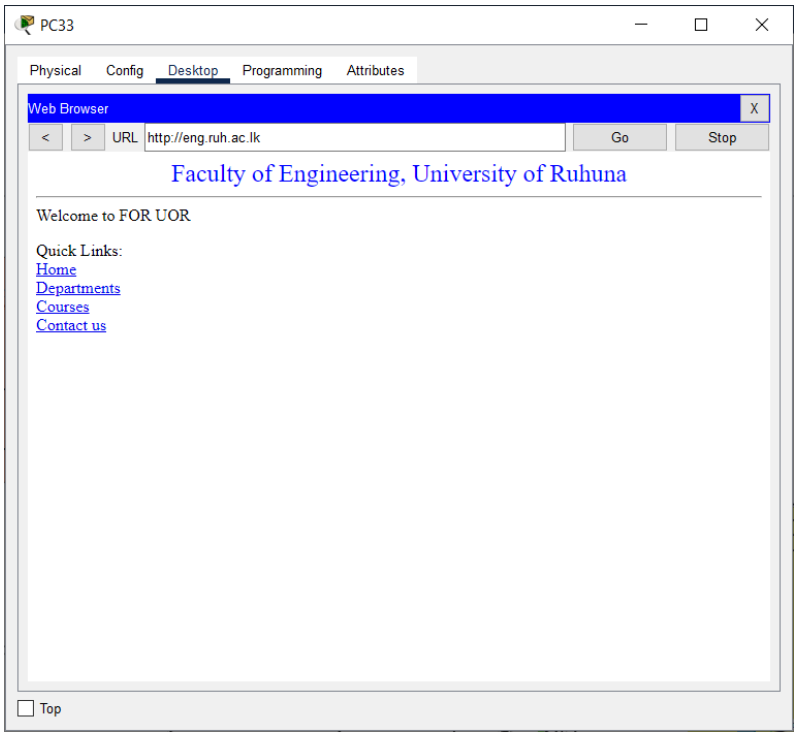

Figure 26: Verifying the Web Server is Running Accurately

6. WAN Link

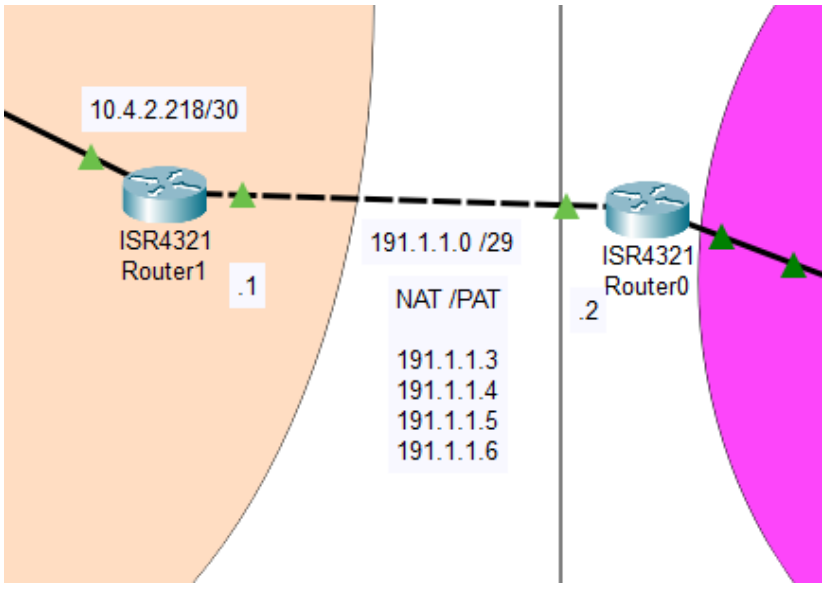

Figure 27: WAN Configuration of the Building

To translate local Ips to public Ips , NAT/PAT is used from 191.1.1.3 to 191.1.1.6 Ip range.

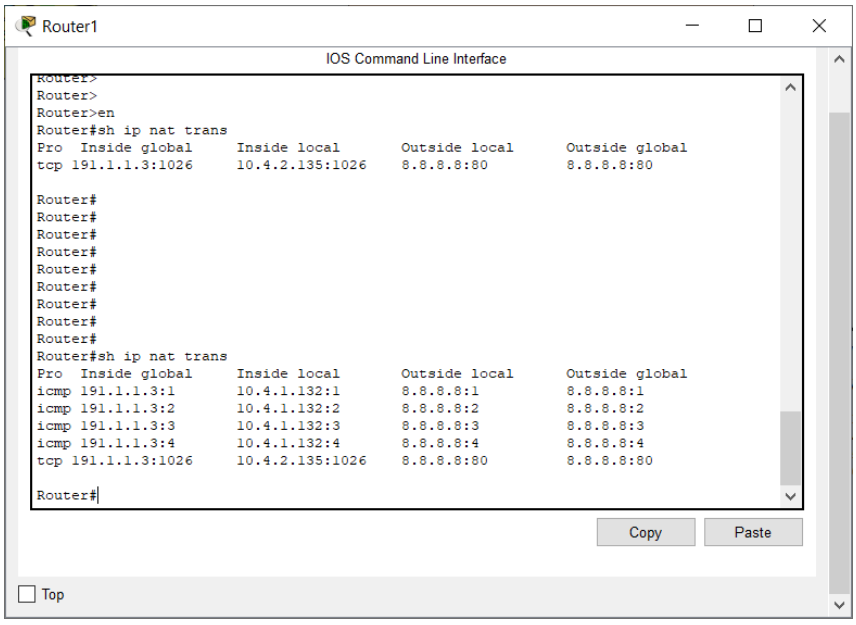

Figure 28: Verifying NAT/PAT Translation

7. Access Lists

Students in the computer lab cannot access the internet. Therefore, a standard access list is created in the multilayer switch to deny the access for internet to those students.

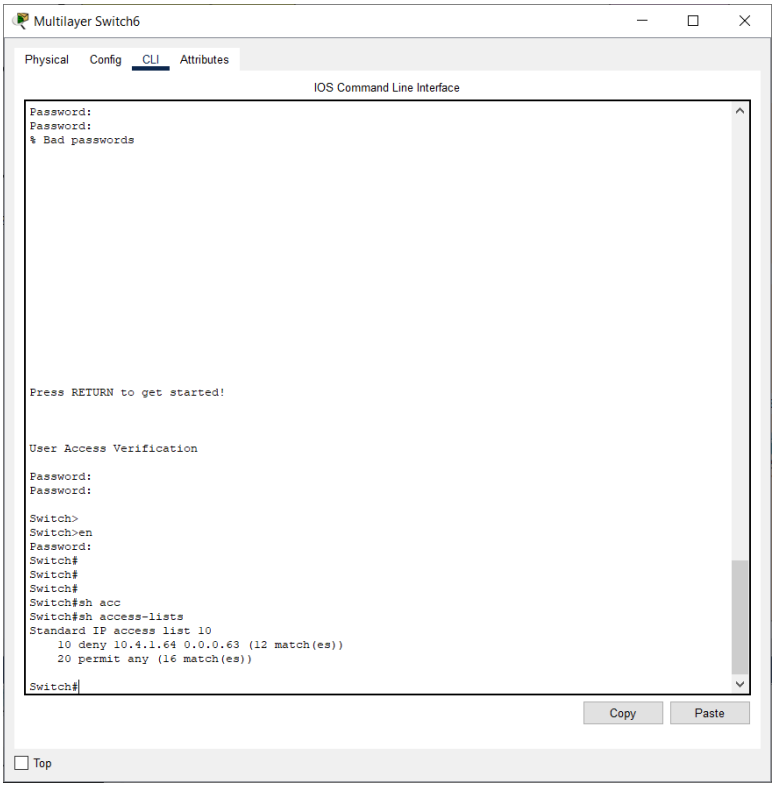

Figure 29: Configured Standard Access Lists

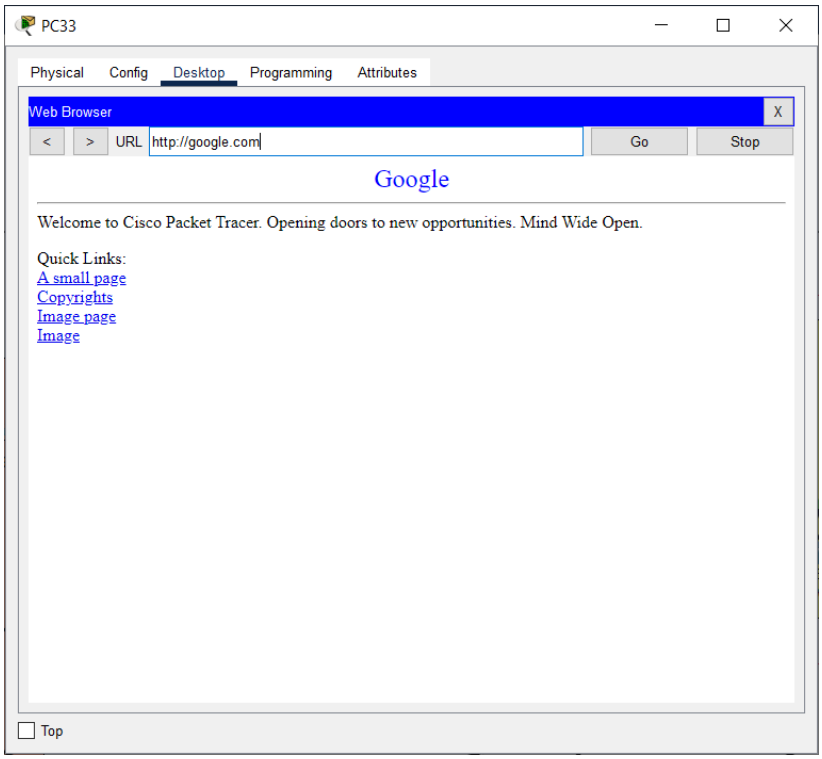

Figure 30: Verifying Access for Allowed Users

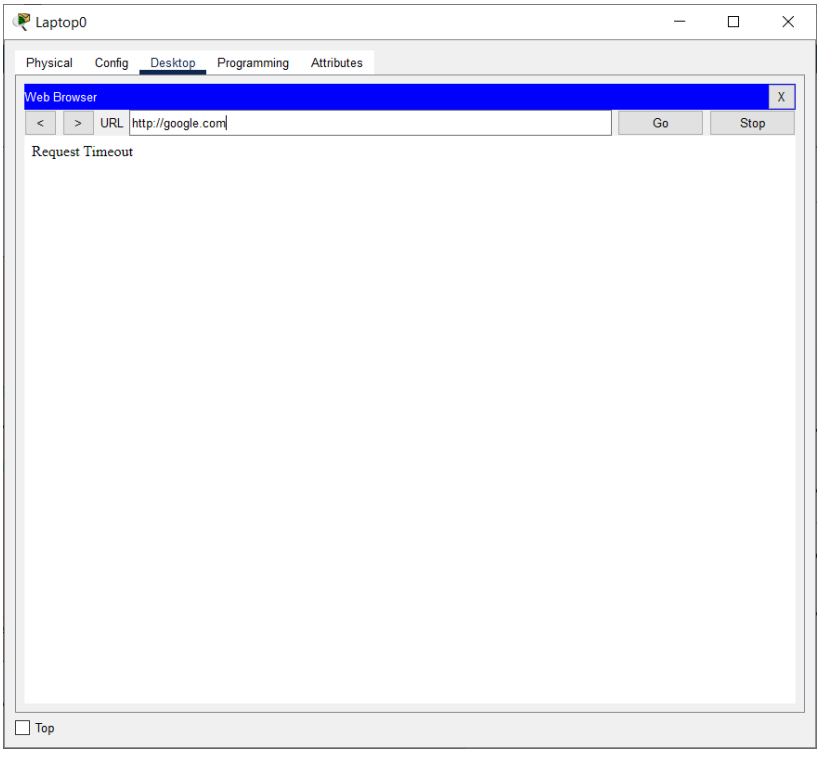

Figure 31: Verifying the Access Denied Users

Access Point

The WLAN users in the computer lab obtain the IP s from the DHCP server.

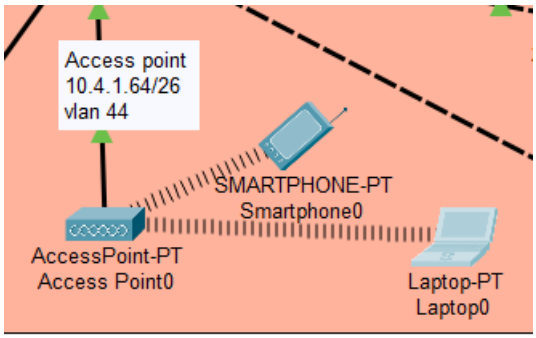

Figure 32: Network Diagram of the Access Point

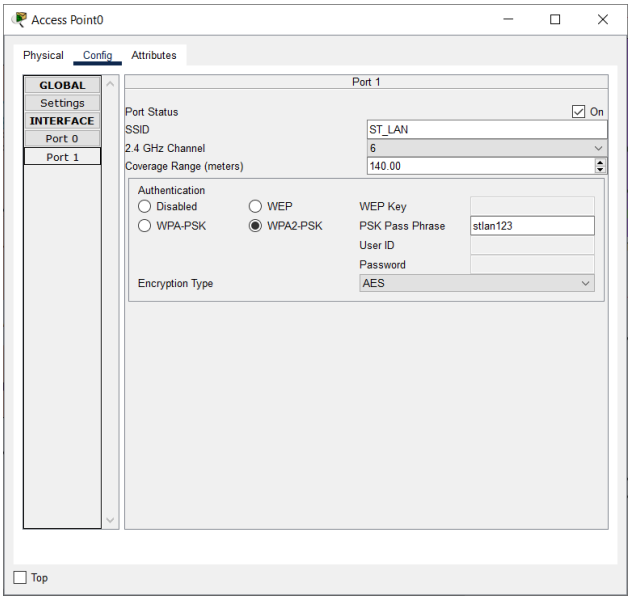

Figure 33: Access Point Configuration

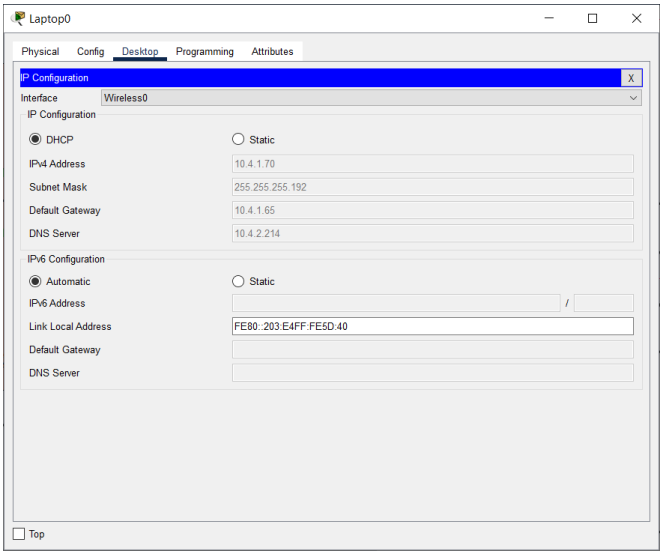

Figure 34: Verifying the IP Allocation of WLAN Users from DHCP Server

Redundancy Implementations

According to Figure 35, it can be observed that redundant paths have been established between switches in the access layer to ensure reliable communication between each other. In this case, full mesh topology has been established between switches. Also, two links are implemented between the access layer and the distribution layer in each section. According to the Figure 36, in the distribution layer it has been implemented full mesh topology between the multilayer switches. Another special case is, for each floor there is an active multilayer switch and a standby multilayer switch. Active one is the switch located in the same floor and standby multilayer switch for each floor is the one located on the other floor. This is implemented using HSRP protocol.

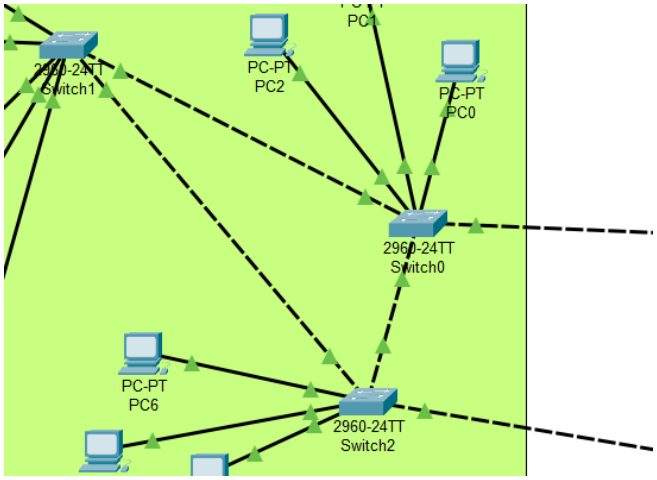

Figure 35: Redundancy in Access Layer

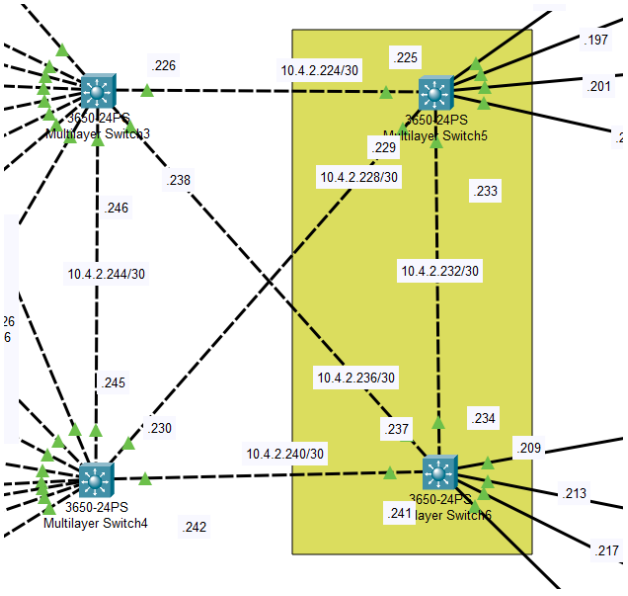

Figure 36: Redundancy in Distribution Layer

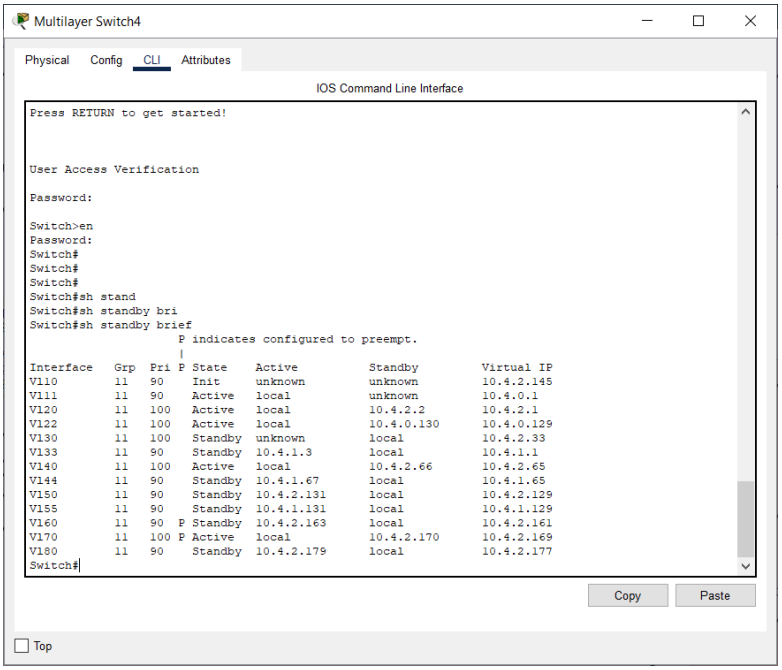

Figure 37: Implemeted HSRP Protocol

Security Implementations

For security purposes it has been added a console password and a telnet password to the switches, multilayer switches, and the routers in the entire network. Also, it has been added the enable secret password. Also, the passwords are encrypted for more security.

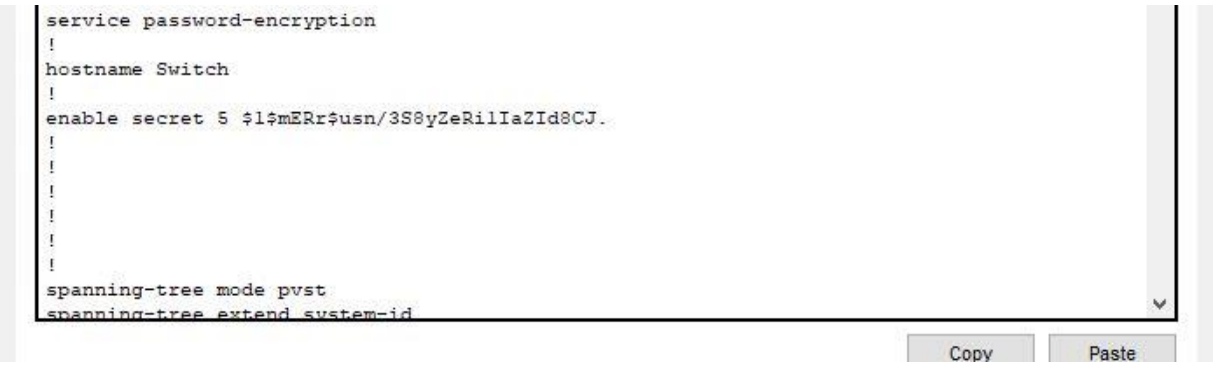

Figure 38: Enabled Secret Password in Switches

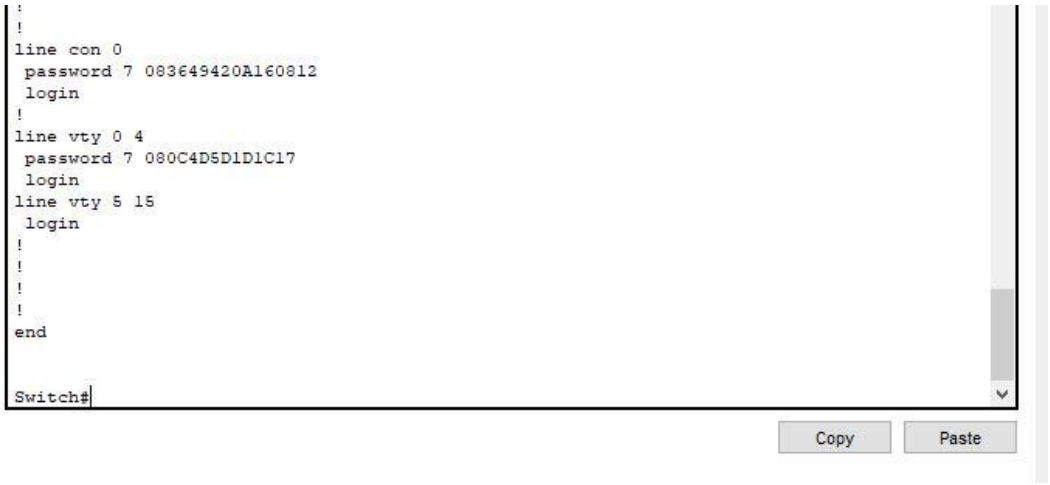

Figure 39: Added Console and Telnet Passwords in Switch

Figure 40: User Access Verification

Cable Implementations

Table 2: Cable Usage with the Network

Location	Cable Type	Speed/Model
PC - Switch	Copper (Twisted Pair) Straight through	Fast Ethernet
Switches – Switches	Copper (Twisted Pair) Cross over	Fast Ethernet
Switches – Multilayer switches	Copper (Twisted Pair) Cross over	Gigabit Ethernet
Multilayer switches – Multilayer switches	Copper (Twisted Pair) Cross over	Gigabit Ethernet
Multilayer switches – Servers (Within Server Farm)	Copper (Twisted Pair) Straight through	Gigabit Ethernet
Multilayer switches – Router	Copper (Twisted Pair) Straight through	Gigabit Ethernet
Router – Router	Copper (Twisted Pair) Cross over	Gigabit Ethernet