



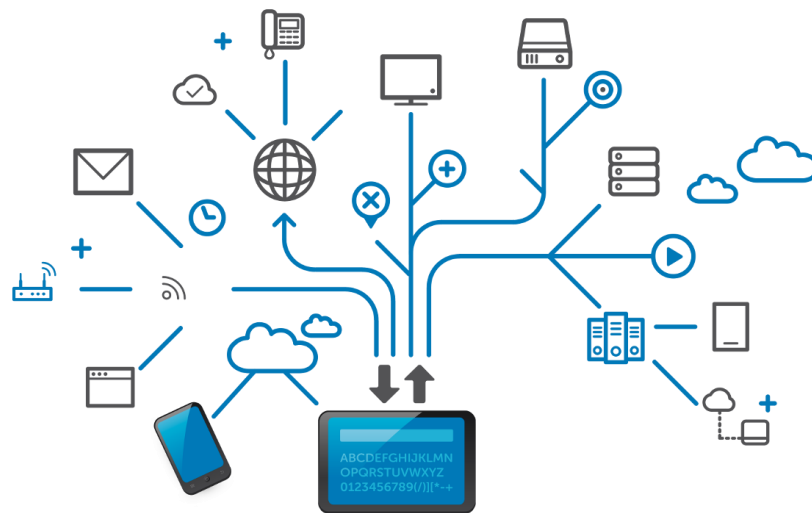
# University Network

## *IT Infrastructure Management (CIS 326)*

**2<sup>nd</sup> Semester 2022-2023**

**Date of Submission: 11. Feb.2023**

***Instructor: dr. Ruba Alsalah***



**Class: 8F4**

## GROUP (8) MEMBERS

GROUP (8) MEMBERS	
Student name	Student ID
Dai Alhussan	2210002868
Atheer Alotaibi	2210003305
Razan Almadan	2210003030
Rose Hummusni	2210002644
Raqhed Aljassim	2210003613

# Table of Contents

<b>Abstract .....</b>	<b>3</b>
<b>Introduction.....</b>	<b>3</b>
<b>Addressing Table .....</b>	<b>4</b>
<b>Our topology and setup .....</b>	<b>5</b>
<b>PCs and Laptops static configuration .....</b>	<b>6</b>
<b>Steps of Configuration a printer .....</b>	<b>7</b>
<b>Configure DHCP Server .....</b>	<b>8</b>
<b>Wireless LAN Controller &amp; lightweight Access Point Configuration .....</b>	<b>10</b>
<b>Configure RIPv2 and OSPF Routing.....</b>	<b>11</b>
<b>Default router0 configuration.....</b>	<b>14</b>
<b>VLANs Configuration .....</b>	<b>15</b>
<b>Console Cable Configuration.....</b>	<b>16</b>
<b>Check connection between all networks and VLANs.....</b>	<b>17</b>
<b>Conclusion .....</b>	<b>17</b>
<b>References.....</b>	<b>18</b>

# **Abstract**

The purpose of this project is to design and configure a network for a small educational organization. We made a well-built university network contains a several colleges connected together to benefit the students and to ease the educational process. We designed our topology specifically to meet the requirements of the university network and according to the project manual. We used many devices such as PCs, laptops, tablets, light weight access points, wireless LAN controllers and many other things, and we connected them with switches and routers using some protocols (OSPF/RIP) to build this network.

## **Introduction**

IT infrastructure is defined as the equipment (hardware), software, multiple and composite network resources services that is necessary to sustain, operate and manage an enterprise IT environment. IT infrastructure enables an organization to provide IT solutions and services to its employees, partners or clients. It is usually internal to an organization and deployed on its own premises (Techopedia, 2022).

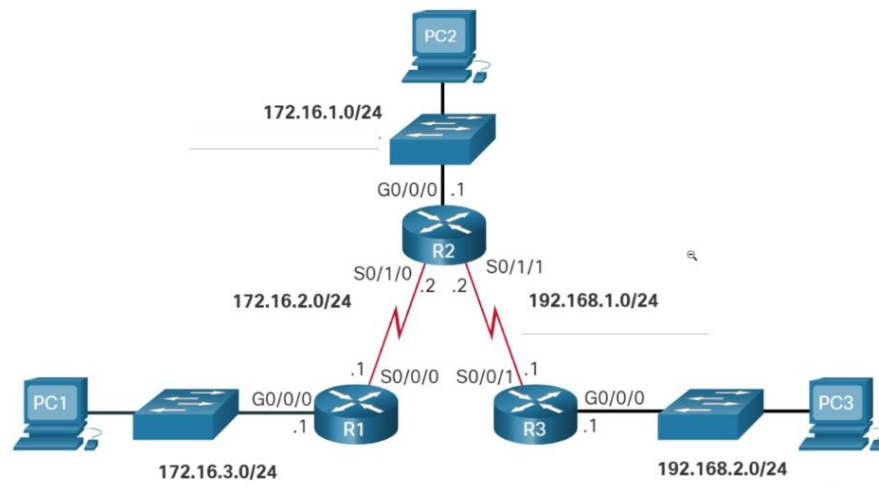
In our university network, we used three routers to enable connections between our LANs. We used four switches, and each switch has a Vlan that represents a college (nursing - Computer science - engineering) and one of the Vlans represents (Faculty/Staff). Also, we used wireless LAN controllers and lightweight access points beside the servers. The Wireless LAN Controller (WLC) acts as a central hub in the network and works together with Lightweight Access Points, and It handles the configuration of the wireless access points automatically. Also, it has a comprehensive understanding of the wireless LAN environment due to its central position. The WLC offers various services that reduce deployment costs, simplify management process, and provide multiple security layers. We also used many other devices such as PCs, laptops, tablets, and printers (Din, 2021).

## Addressing Table

Device	Port	IP Address	Subnet Mask	Default Gateway
Router 0	GigabitEthernet 0/0	172.16.1.1	255.255.255.0	N/A
	Serial 0/1/0	172.16.2.2	255.255.255.0	
	Serial 0/1/1	192.168.1.2	255.255.255.0	
Router 1	GigabitEthernet 0/0	172.16.3.1	255.255.255.0	N/A
	Serial 0/1/0	172.15.2.1	255.255.255.0	
Router 2	GigabitEthernet 0/0	192.168.2.1	255.255.255.0	N/A
	Serial 0/1/0	192.168.1.1	255.255.255.0	
PC 0	FastEthernet0	172.16.1.4	255.255.255.0	172.16.1.1
PC 3		172.16.1.2	255.255.255.0	
PC 4		172.16.1.3	255.255.255.0	
PC 1	FastEthernet0	172.16.3.2	255.255.255.0	172.16.3.1
PC 5		172.16.3.7	255.255.255.0	
PC 7		172.16.3.9	255.255.255.0	
PC 2	FastEthernet0	192.168.2.5	255.255.255.0	192.168.2.1
Laptop0	FastEthernet0	172.16.1.6	255.255.255.0	172.16.1.1
Laptop 2	FastEthernet0	172.16.3.5	255.255.255.0	172.16.3.1
Laptop 4		172.16.3.8	255.255.255.0	
Laptop 1	FastEthernet0	192.168.2.2	255.255.255.0	192.168.2.1
Laptop 3		192.168.2.3	255.255.255.0	
Laptop 5		192.168.2.103	255.255.255.0	
WLAN3	Management	172.16.3.4	255.255.255.0	172.16.3.1
WLAN1		192.168.2.254	255.255.255.0	192.168.2.1
Server0	FastEthernet0	172.16.3.6	255.255.255.0	172.16.3.1
Server1		192.168.2.7	255.255.255.0	192.168.2.1
Printer0	FastEthernet0	172.16.1.5	255.255.255.0	172.16.1.1
Printer1		172.16.3.3	255.255.255.0	172.16.3.1

## Our topology and setup

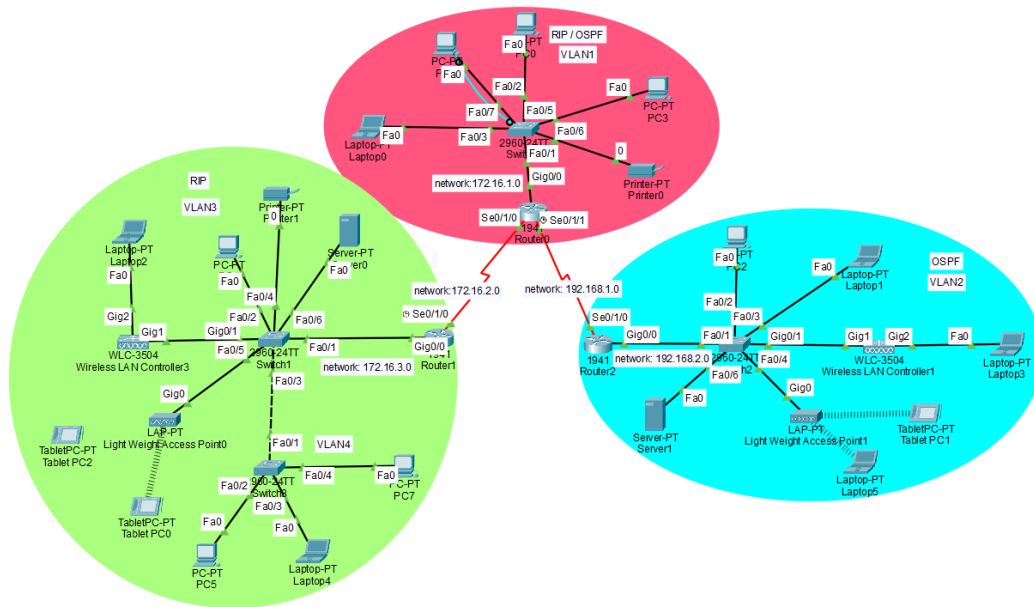
### Topology Number: 1



We used:

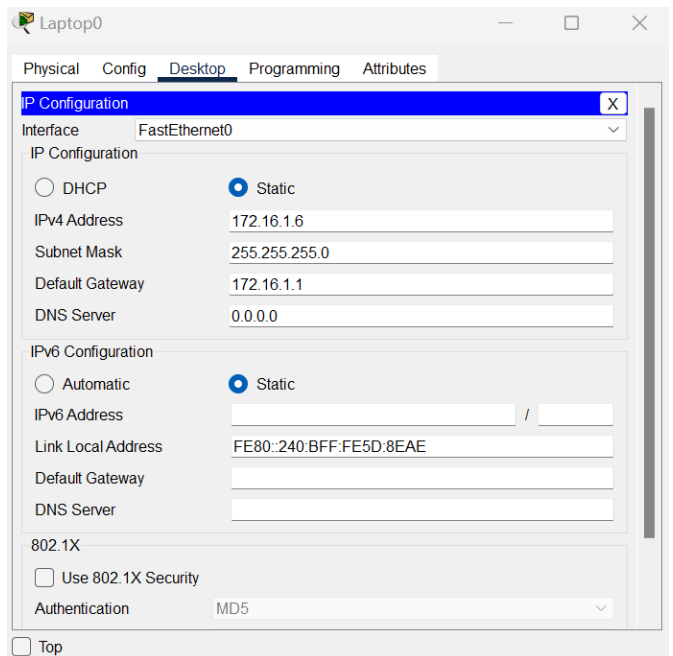
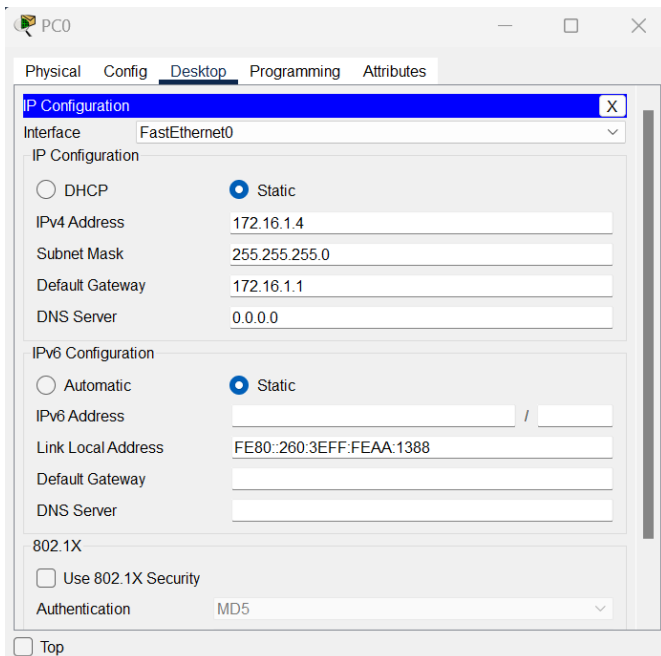
Name	Quantity
PC'S	7
Tablet	3
Laptops	6
Switches	4
Routers	3
Printer	2
Wireless LAN Controller	2
Lightweight Access Point	2
Server	2
Crossover cables	1
Straight – through cables	23
Serial cables	2
Console cables	1

## The topology set up:



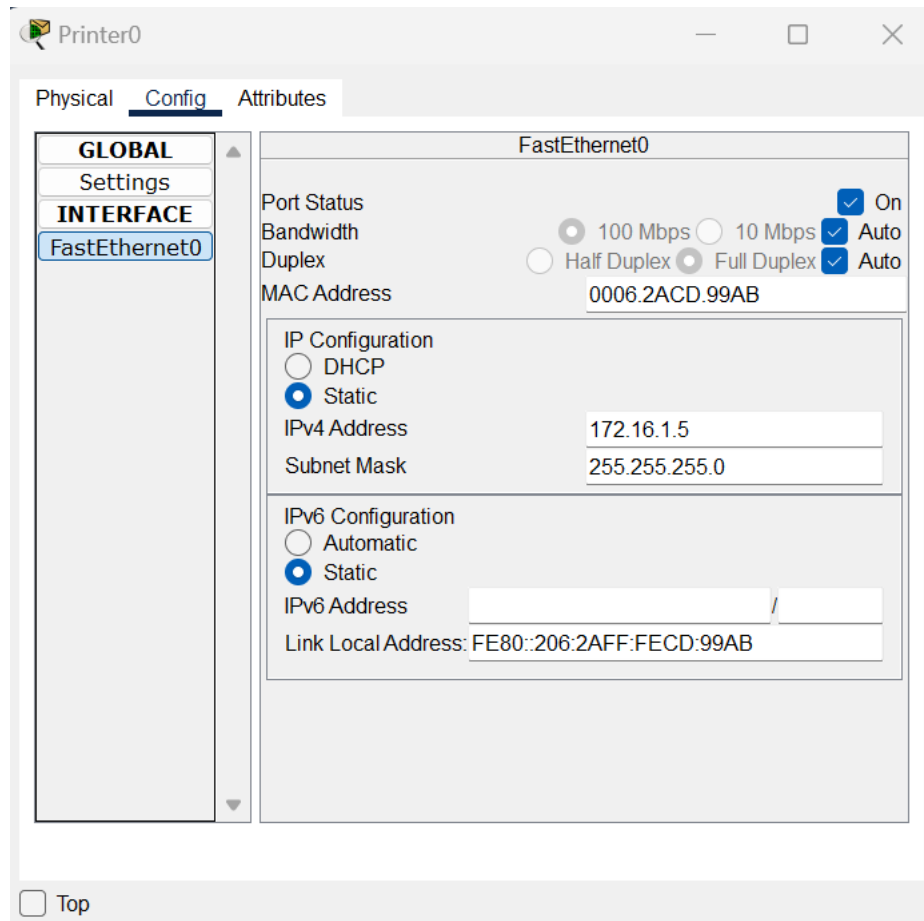
## PCs and Laptops static configuration

- 1- Go to the PC or the Laptop and click on desktop.
- 2- Click on IP configuration and enter the IP address.



## Steps of Configuration a printer

- 1- Assign the IP address and subnet mask.
- 2- Assign the default gateway.



# Configure DHCP Server

- 1- Go to the server and click on desktop then click on IP configuration to set the IP address, subnet mask, and default gateway.

The screenshot shows the 'IP Configuration' window in the 'Server0' interface. The 'Desktop' tab is selected. The 'IP Configuration' section has two sub-sections: 'IP Configuration' and 'IPv6 Configuration'. In the 'IP Configuration' section, the 'Static' radio button is selected. The fields are: IPv4 Address: 172.16.3.6, Subnet Mask: 255.255.255.0, Default Gateway: 172.16.3.1, and DNS Server: 0.0.0.0. In the 'IPv6 Configuration' section, the 'Static' radio button is selected. The fields are: IPv6 Address: (empty), Link Local Address: FE80::2D0:FFFF:FEB7:2309, Default Gateway: (empty), and DNS Server: (empty). Below these sections is the '802.1X' section with a 'Use 802.1X Security' checkbox (unchecked), an 'Authentication' dropdown menu set to 'MD5', and a 'Username' field (empty). A 'Top' button is at the bottom left.

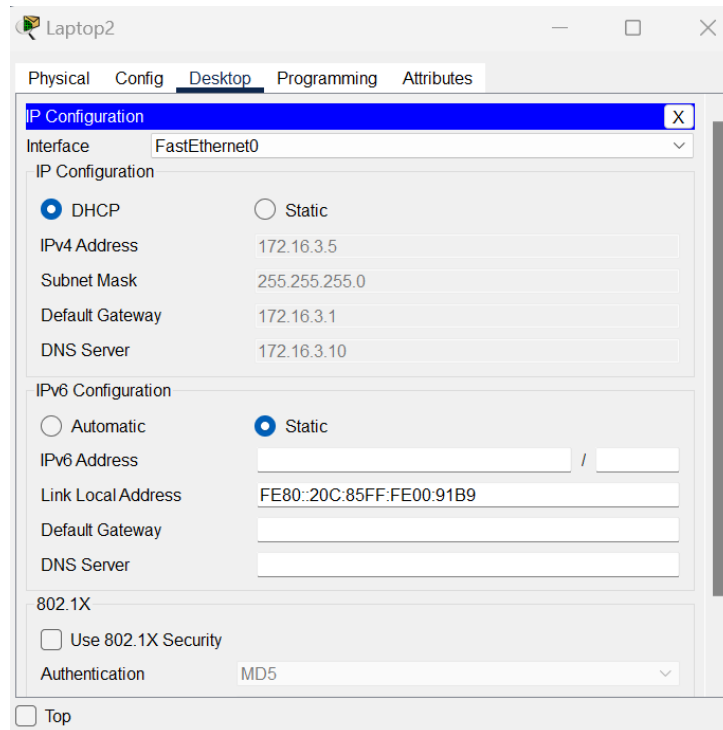
- 2- Go to the services, choose DHCP, turn it on and set the network information needed for DHCP for sending the IP addresses for the DHCP devices then click on add.

The screenshot shows the 'Services' window in the 'Server0' interface. The 'Services' tab is selected. On the left, a list of services is shown: HTTP, DHCP (selected), DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. The main area is titled 'DHCP'. It has a dropdown menu for 'Interface' set to 'FastEthernet0' and a 'Service' section with 'On' selected and 'Off' unselected. The fields are: Pool Name: serverPool, Default Gateway: 172.16.3.1, DNS Server: 172.16.3.10, Start IP Addr: 172.16.3.0, Subnet Mask: 255.255.255.0, Maximum Number of Users: 156, TFTP Server: 0.0.0.0, and WLC Address: 172.16.3.4. Below these fields are 'Add', 'Save', and 'Remove' buttons. At the bottom, there is a table with columns: Pool Name, Default Gateway, DNS Server, Start IP Address, Subnet Mask, Max User, TFTP Server, and WLC Address. The table contains one row: serverPool, 172.16.3.1, 172.16.3.10, 172.16.3.0, 255.255.255.0, 156, 0.0.0.0, 172.16.3.4. A 'Top' button is at the bottom left.

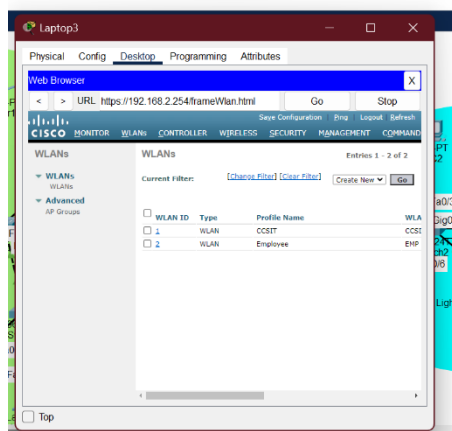
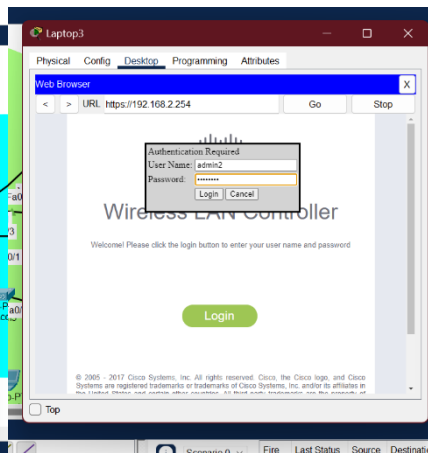
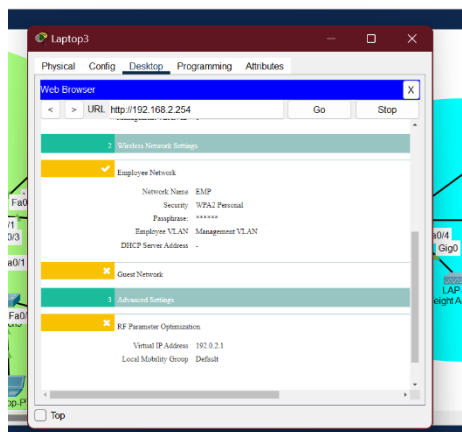
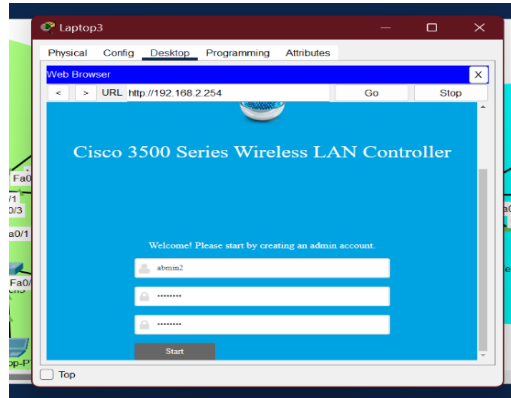
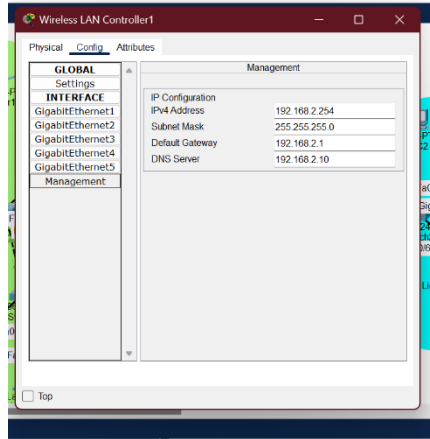
Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool	172.16.3.1	172.16.3.10	172.16.3.0	255.255.255.0	156	0.0.0.0	172.16.3.4



- 3- Go to the laptop using same steps mentioned before for configuring the laptop, but this time we click on DHCP.



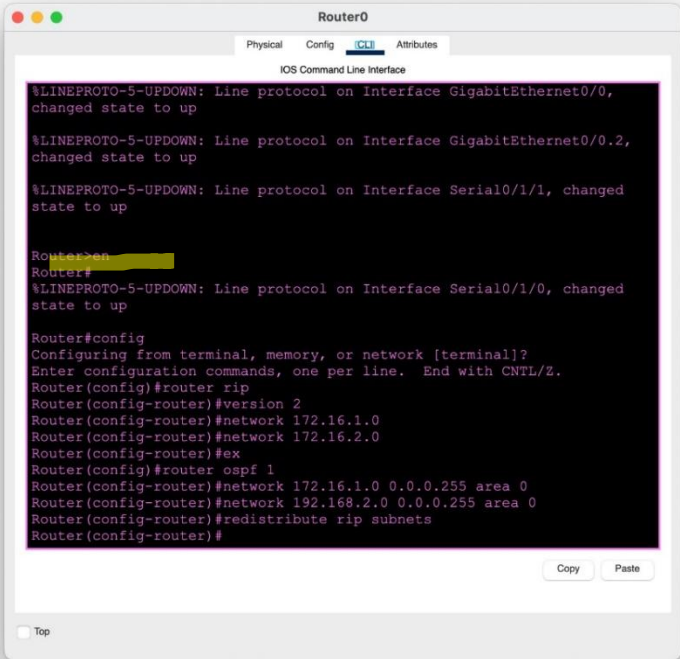
# Wireless LAN Controller & lightweight Access Point Configuration



# Configure RIPv2 and OSPF Routing

## - Router0 RIPv2 and OSPF Routing:

We configure RIP protocol router, and we used show ip protocols & show ip route commands.



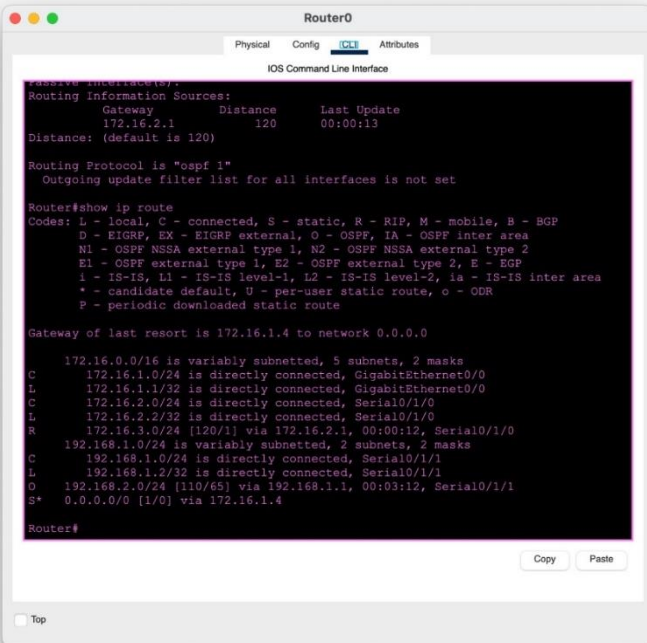
```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2,
changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed
state to up

Router>
Router#
Router#config
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 172.16.1.0
Router(config-router)#network 172.16.2.0
Router(config-router)#ex
Router(config-router)#router ospf 1
Router(config-router)#network 172.16.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#redistribute rip subnets
Router(config-router)#
```



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router#show ip route
Routing Information Sources:
  Gateway         Distance      Last Update
  172.16.2.1       120           00:00:13
Distance: (default is 120)

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set

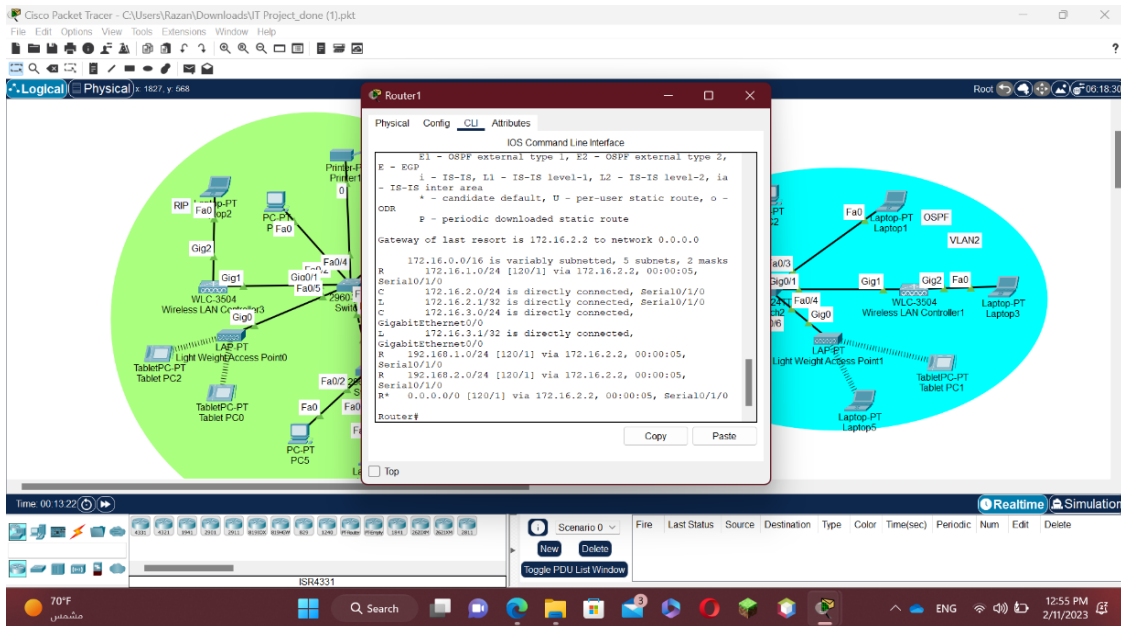
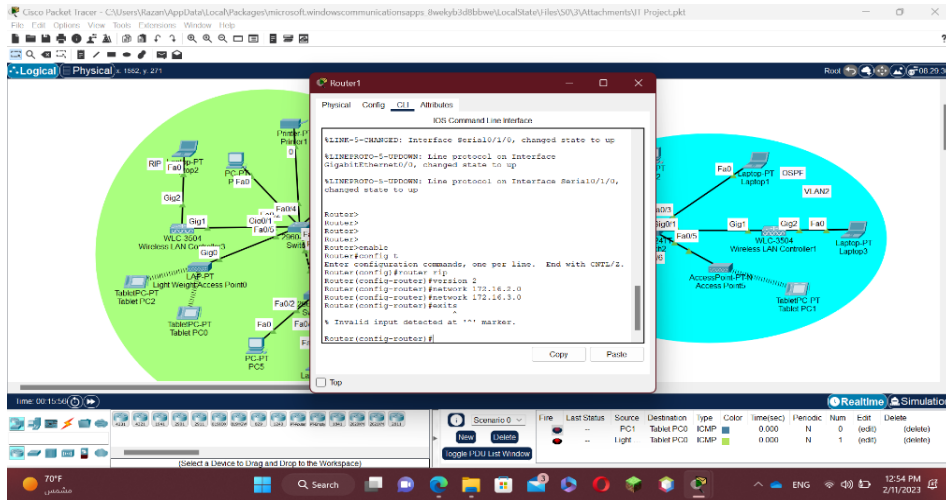
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       I - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 172.16.1.4 to network 0.0.0.0

172.16.0.0/16 is variably subnetted, 5 subnets, 2 masks
C    172.16.1.0/24 is directly connected, GigabitEthernet0/0
L    172.16.1.1/32 is directly connected, GigabitEthernet0/0
C    172.16.2.0/24 is directly connected, Serial0/1/0
L    172.16.2.2/32 is directly connected, Serial0/1/0
R    172.16.3.0/24 [120/1] via 172.16.2.1, 00:00:12, Serial0/1/0
R    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, Serial0/1/1
L    192.168.1.2/32 is directly connected, Serial0/1/1
O    192.168.2.0/24 [110/65] via 192.168.1.1, 00:03:12, Serial0/1/1
S*   0.0.0.0/0 [1/0] via 172.16.1.4

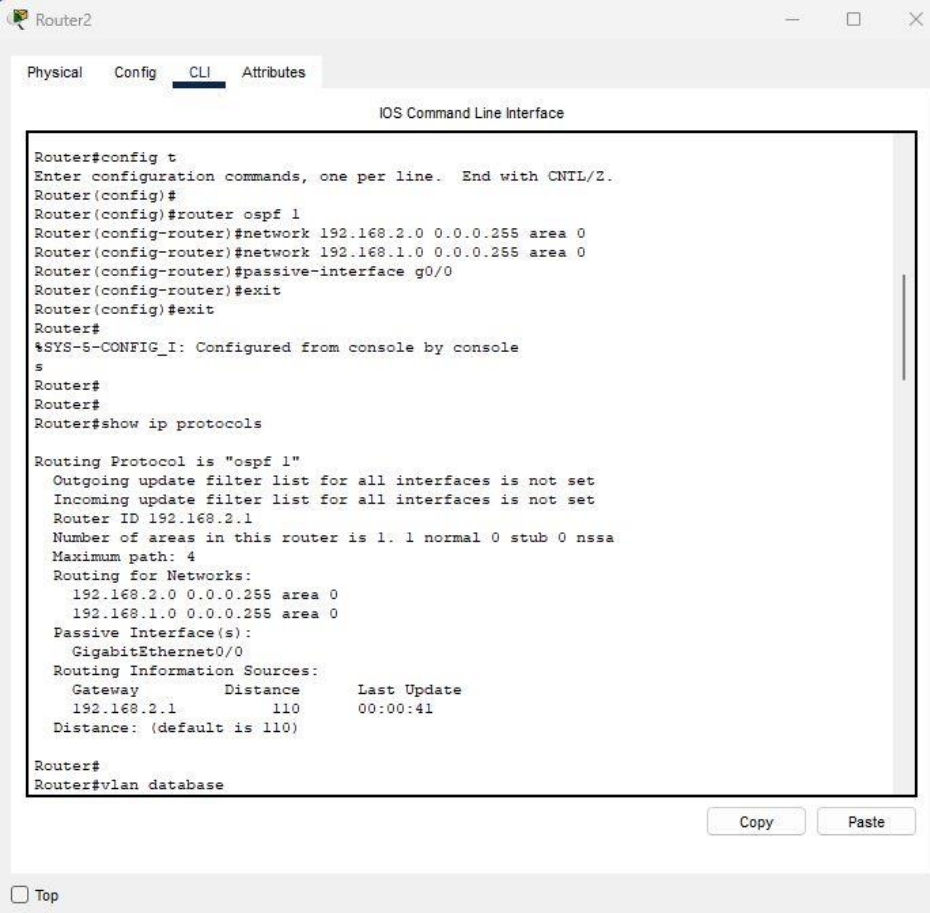
Router#
```

## Router1 RIPv2 routing:



## - Router2 OSPF routing:

We configure OSPF router, and we used show ip protocols command.



The screenshot shows a Packet Tracer console window for Router2. The window has tabs for Physical, Config, CLI, and Attributes, with the CLI tab selected. The title bar says "Router2". The main area is titled "IOS Command Line Interface" and contains the following text:

```
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#passive-interface g0/0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
s
Router#
Router#
Router#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.2.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.2.0 0.0.0.255 area 0
    192.168.1.0 0.0.0.255 area 0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.2.1         110          00:00:41
  Distance: (default is 110)

Router#
Router#vlan database
```

At the bottom right of the console window, there are "Copy" and "Paste" buttons. At the bottom left, there is a "Top" button.

Router>

Physical Config CLI Attributes

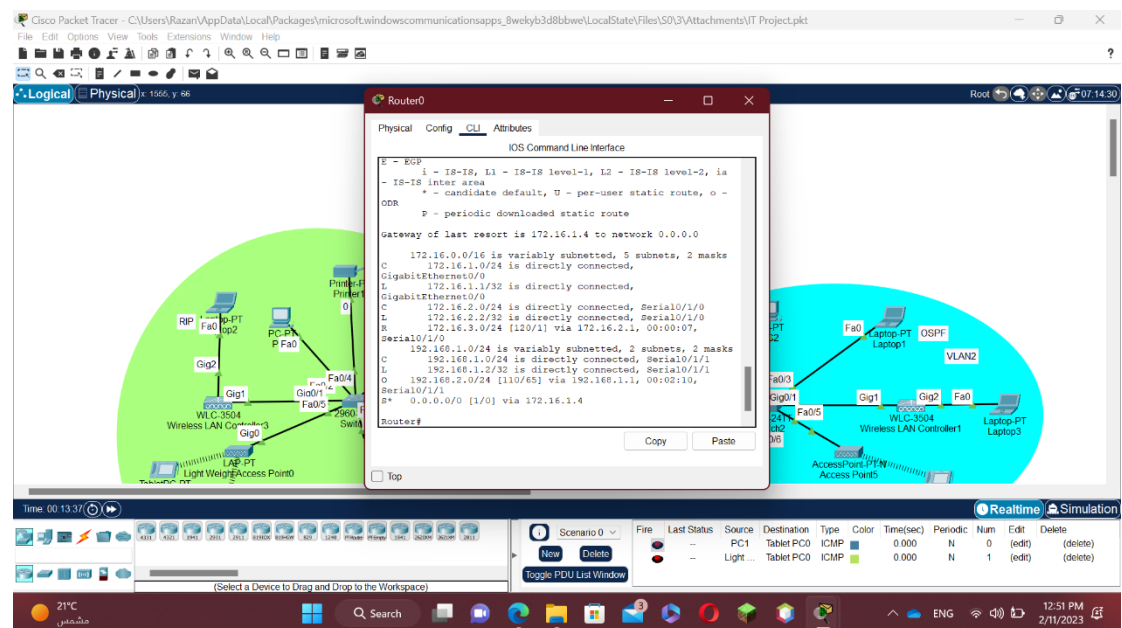
IOS Command Line Interface

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#ip route 0.0.0.0 0.0.0.0 172.16.1.4
Router(config)#Router #ip
Router(config-router)#default-information originate
Router(config-router)#
```

Copy

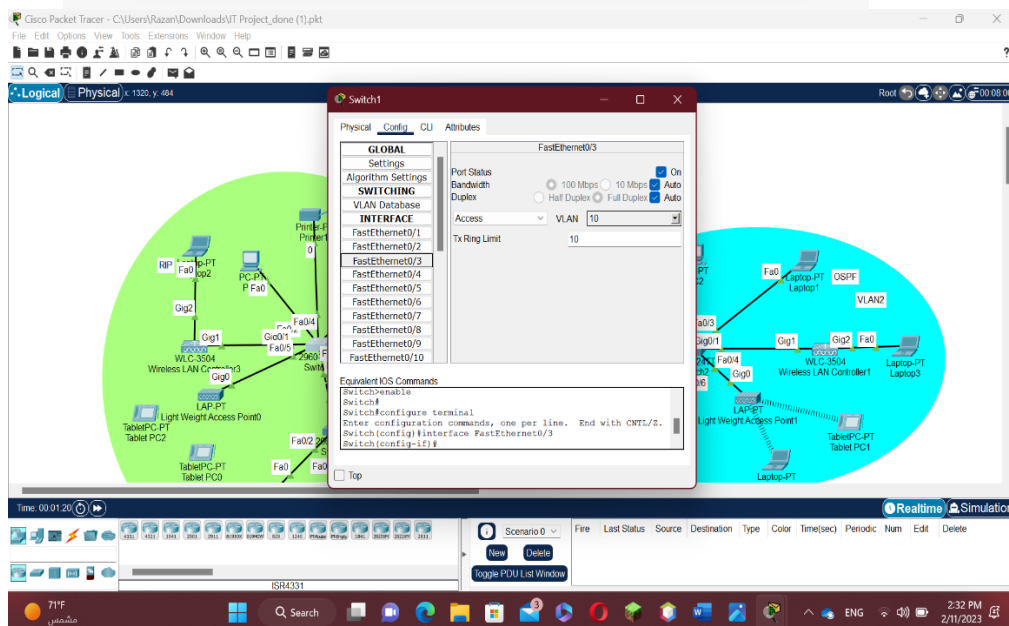
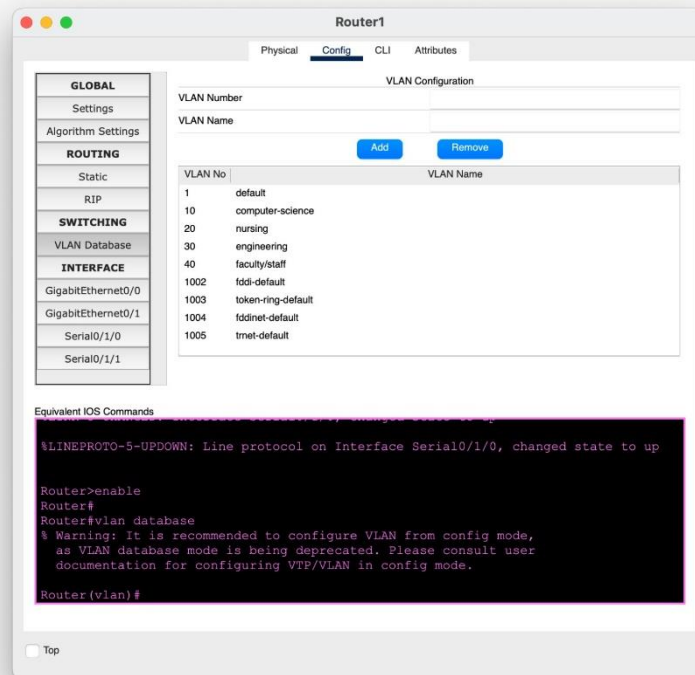
Paste

☐ Top

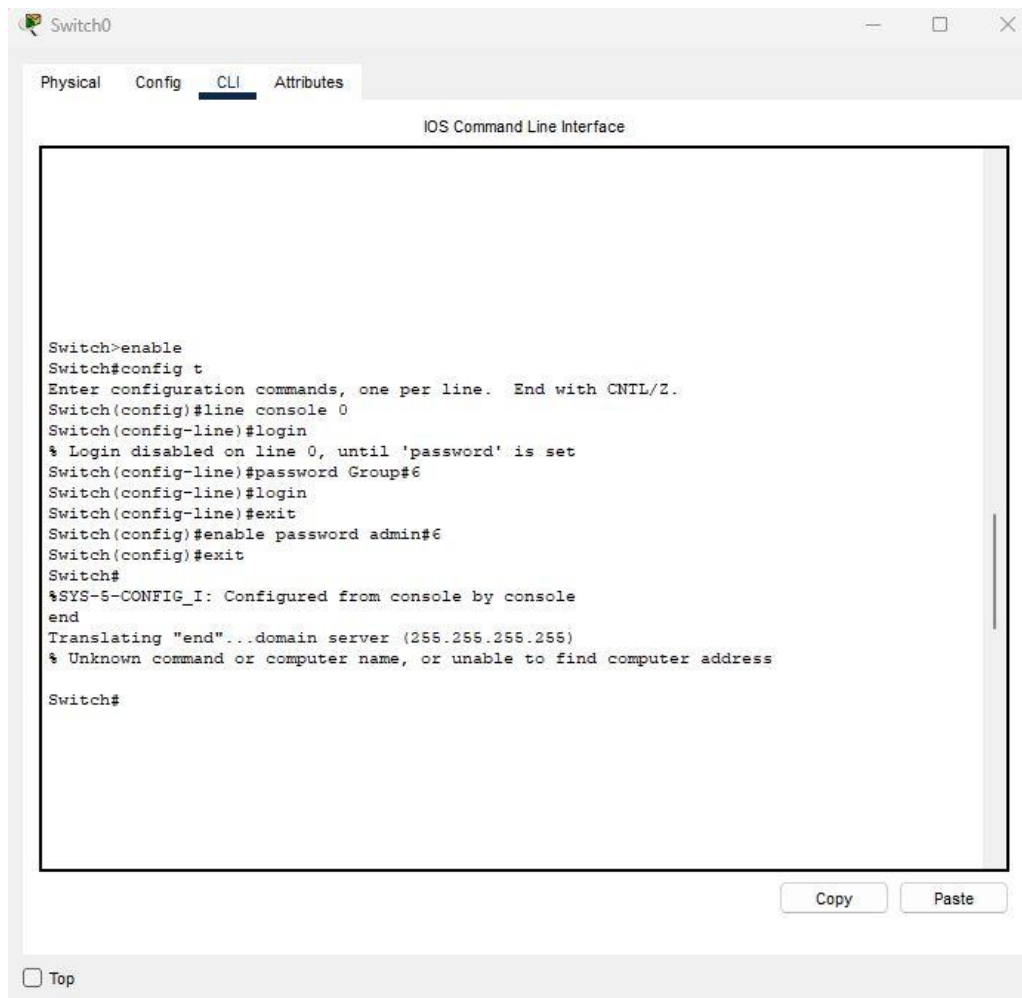


# VLANs Configuration

- We configured 4 VLANs: nursing – computer science – engineering – faculty/Staff, then we use VLAN brief command.



# Console Cable Configuration



The screenshot shows a window titled "Switch0" with tabs for "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal text shows the following sequence of commands and responses:

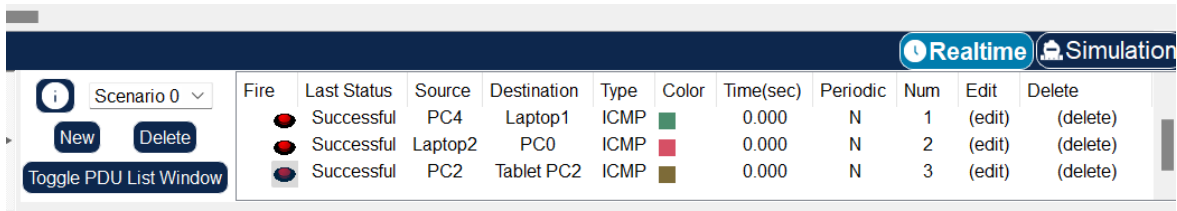
```
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#line console 0
Switch(config-line)#login
% Login disabled on line 0, until 'password' is set
Switch(config-line)#password Group#6
Switch(config-line)#login
Switch(config-line)#exit
Switch(config)#enable password admin#6
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
end
Translating "end"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Switch#
```

At the bottom right of the terminal area are "Copy" and "Paste" buttons. At the bottom left of the window is a "Top" button with a small square icon next to it.



# Check connection between all networks and VLANs.



The screenshot shows a network simulation interface. At the top, there are two tabs: 'Realtime' (active) and 'Simulation'. Below the tabs, on the left, is a control panel with a 'Scenario 0' dropdown, 'New' and 'Delete' buttons, and a 'Toggle PDU List Window' button. The main area displays a table of fire events.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC4	Laptop1	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop2	PC0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC2	Tablet PC2	ICMP		0.000	N	3	(edit)	(delete)

## Conclusion

Finally, after we create, set up and configure the VLAN network including switches, routers, and so many other devices. Also configuring the OSPF and RIPv2 in routers, now the whole university building can communicate with each other directly. So, a connection test will work between any two sites even from deferent VLAN, and we will finally acquire the wanted result and goals.

## References

- ❖ Techopedia. (2022, April 25). *IT Infrastructure*. Techopedia.com.  
<https://www.techopedia.com/definition/29199/it-infrastructure>
- ❖ Din, A. (2021, April 13). What Is WLC in Networking and Why Is It Important?  
Heimdal Security Blog. <https://heimdalsecurity.com/blog/what-is-wlc-in-networking/>