



CS3001

Computer Networks

Project Report

Final Report

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1- Project objectives

- Design and implement a complex multi-network topology using Cisco Packet Tracer.
- Implement core network services including DHCP, DNS, HTTP, FTP, SMTP.
- Use appropriate subnetting (VLSM) to efficiently assign IPs.
- Configure dynamic routing protocols (EIGRP, OSPF).
- Apply Access Control Lists (ACLs) to restrict access based on given conditions.
- Test and validate network communication across all devices and services.

2- Steps followed during implementation

a. Network Planning

To assign IP addresses efficiently, we used the VLSM (Variable Length Subnet Masking) technique. Unlike simple subnetting, which creates equal-sized subnets regardless of host requirements, VLSM allows us to allocate IP ranges based on the actual number of devices needed per segment, reducing IP wastage.

We started with a private IP address range of 192.168.1.0/24. Instead of splitting it into four equal /26 subnets (each with 64 addresses), we applied VLSM to assign:

- Subnet 1: 192.168.1.0/27 (32 addresses, suitable for medium-sized LAN)
- Subnet 2: 192.168.1.32/28 (16 addresses, used for a small switch or segment)
- Subnet 3: 192.168.1.48/29 (8 addresses, for a router and few end devices)
- Subnet 4: 192.168.1.56/30 (4 addresses, ideal for point-to-point links)

This VLSM-based planning helped meet the diverse requirements of the network segments while optimizing IP usage. so we used here vlsM because (there are too many hosts we have)

Our ip is “192.168.1.5”

And after calculation I can see this is all I have for my project

NAME	HOST S NEED ED	HOSTS AVAILA BLE	UNUS ED HOST S	NETWOR K ADDRES S	SLA SH	MASK	USABLE RANGE
BROADC AST							
F	98765	130614	32049	192.168.1. 0	/15	255.254.0. 0	192.168.1. 1 - 192.169.25 5.254
192.169.25 5.255							
G	95749	131070	34221	192.170.0. 0	/15	255.254.0. 0	192.170.0. 1 -

							192.171.25 5.254
192.171.25 5.255							
K	74527	131070	56543	192.172.0. 0	/15	255.254.0. 0	192.172.0. 1 - 192.173.25 5.254
192.173.25 5.255							
E	47876	65534	17658	192.174.0. 0	/16	255.255.0. 0	192.174.0. 1 - 192.174.25 5.254
192.174.25 5.255							
J	47801	65534	17733	192.175.0. 0	/16	255.255.0. 0	192.175.0. 1 - 192.175.25 5.254
192.175.25 5.255							
I	36790	65534	28744	192.176.0. 0	/16	255.255.0. 0	192.176.0. 1 - 192.176.25 5.254
192.176.25 5.255							
H	25689	32766	7077	192.177.0. 0	/17	255.255.12 8.0	192.177.0. 1 - 192.177.12 7.254
192.177.12 7.255							
A	9012	16382	7370	192.177.1 28.0	/18	255.255.19 2.0	192.177.12 8.1 - 192.177.19 1.254
192.177.19 1.255							
M	7256	8190	934	192.177.2 24.0	/19	255.255.22 4.0	192.177.22 4.1 - 192.177.25 5.254
192.177.25 5.255							
N	7249	8190	941	192.178.0. 0	/19	255.255.22 4.0	192.178.0. 1 -

							192.178.31 .254
192.178.31 .255							
D	5678	8190	2512	192.178.3 2.0	/19	255.255.22 4.0	192.178.32 .1 - 192.178.63 .254
192.178.63 .255							
B	1023	2046	1023	192.178.6 4.0	/21	255.255.24 8.0	192.178.64 .1 - 192.178.71 .254
192.178.71 .255							
C	1023	2046	1023	192.178.7 2.0	/21	255.255.24 8.0	192.178.72 .1 - 192.178.79 .254
192.178.79 .255							
1	4	6	2	192.178.8 0.0	/29	255.255.25 5.248	192.178.80 .1 - 192.178.80 .6
192.178.80 .7							
2	4	6	2	192.178.8 0.8	/29	255.255.25 5.248	192.178.80 .9 - 192.178.80 .14
192.178.80 .15							
3	4	6	2	192.178.8 0.16	/29	255.255.25 5.248	192.178.80 .17 - 192.178.80 .22
192.178.80 .23							
4	4	6	2	192.178.8 0.24	/29	255.255.25 5.248	192.178.80 .25 - 192.178.80 .30
192.178.80 .31							
5	4	6	2	192.178.8 0.32	/29	255.255.25 5.248	192.178.80 .33 -

							192.178.80 .38
192.178.80 .39							
6	4	6	2	192.178.8 0.40	/29	255.255.25 5.248	192.178.80 .41 - 192.178.80 .46
192.178.80 .47							
7	4	6	2	192.178.8 0.48	/29	255.255.25 5.248	192.178.80 .49 - 192.178.80 .54
192.178.80 .55							
8	4	6	2	192.178.8 0.56	/29	255.255.25 5.248	192.178.80 .57 - 192.178.80 .62
192.178.80 .63							
9	4	6	2	192.178.8 0.64	/29	255.255.25 5.248	192.178.80 .65 - 192.178.80 .70
192.178.80 .71							
10	4	6	2	192.178.8 0.72	/29	255.255.25 5.248	192.178.80 .73 - 192.178.80 .78
192.178.80 .79							
11	4	6	2	192.178.8 0.80	/29	255.255.25 5.248	192.178.80 .81 - 192.178.80 .86
192.178.80 .87							
12	4	6	2	192.178.8 0.88	/29	255.255.25 5.248	192.178.80 .89 - 192.178.80 .94
192.178.80 .95							
13	4	6	2	192.178.8 0.96	/29	255.255.25 5.248	192.178.80 .97 -

							192.178.80 .102
192.178.80 .103							
14	4	6	2	192.178.8 0.104	/29	255.255.25 5.248	192.178.80 .105 - 192.178.80 .110
192.178.80 .111							
15	4	6	2	192.178.8 0.112	/29	255.255.25 5.248	192.178.80 .113 - 192.178.80 .118
192.178.80 .119							
16	4	6	2	192.178.8 0.120	/29	255.255.25 5.248	192.178.80 .121 - 192.178.80 .126
192.178.80 .127							
17	4	6	2	192.178.8 0.128	/29	255.255.25 5.248	192.178.80 .129 - 192.178.80 .134
192.178.80 .135							
18	4	6	2	192.178.8 0.136	/29	255.255.25 5.248	192.178.80 .137 - 192.178.80 .142
192.178.80 .143							
19	4	6	2	192.178.8 0.144	/29	255.255.25 5.248	192.178.80 .145 - 192.178.80 .150
192.178.80 .151							
20	4	6	2	192.178.8 0.152	/29	255.255.25 5.248	192.178.80 .153 - 192.178.80 .158
192.178.80 .159							

b. Basic Configuration

- Assigned IP addresses to all end devices, routers, and servers based on the VLSM subnetting plan.
- Accessed each router using the CLI to enable interfaces using `no shutdown` command.
- Verified IP configurations using `show ip interface brief`.
- Assigned default gateways to PCs using the desktop configuration tab in Packet Tracer.
- Connected devices using straight-through and serial cables as required.
- Performed initial connectivity tests using `ping` between directly connected devices.

c. Routing

- Configured EIGRP/OSPF on all routers.
- Verified routing tables using `show ip route`.

d. DHCP Configuration

- Configured DHCP server pools.
- Used `ip helper-address` on routers for remote DHCP clients.

e. DNS and Email Server Configuration

- Configured DNS to resolve names (e.g., mail.com).
- Configured Email server with SMTP/POP3 and created email users.

f. FTP and HTTP Configuration

- Enabled FTP and HTTP services on respective servers.
- Verified file upload/download and website accessibility.

g. ACL Implementation

- Blocked specific IPs and networks from accessing the Web Server (HTTP port 80).
- Allowed only Network G to access FTP Server.
- Used extended ACLs and applied them in correct interface directions.

3- Observations and result

- **DHCP:** All devices received IPs dynamically. IP helper worked correctly across routers.
- **DNS:** Resolved domains like `akash.com` to correct IPs.
- **Email:** Successfully sent/received mails using created accounts.

- **ACL Testing:**
 - Devices from Network A, B, and D were blocked from HTTP server as intended.
 - Only Network G could access the FTP server.
- **NAT :** Verified translation using `show ip nat translations`.
- **Routing:** Verified with `show ip route`. All destinations reachable.

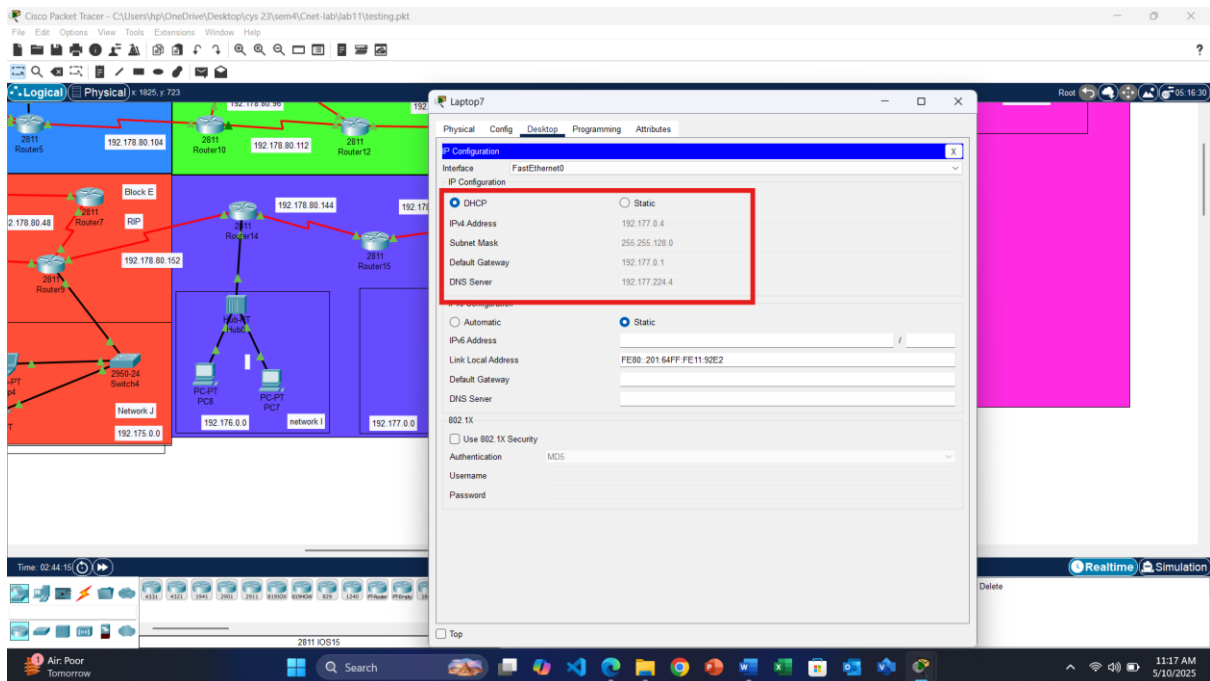
4- Screenshots test results and verification

The following screenshots provide validation for each part of the network implementation and configuration:

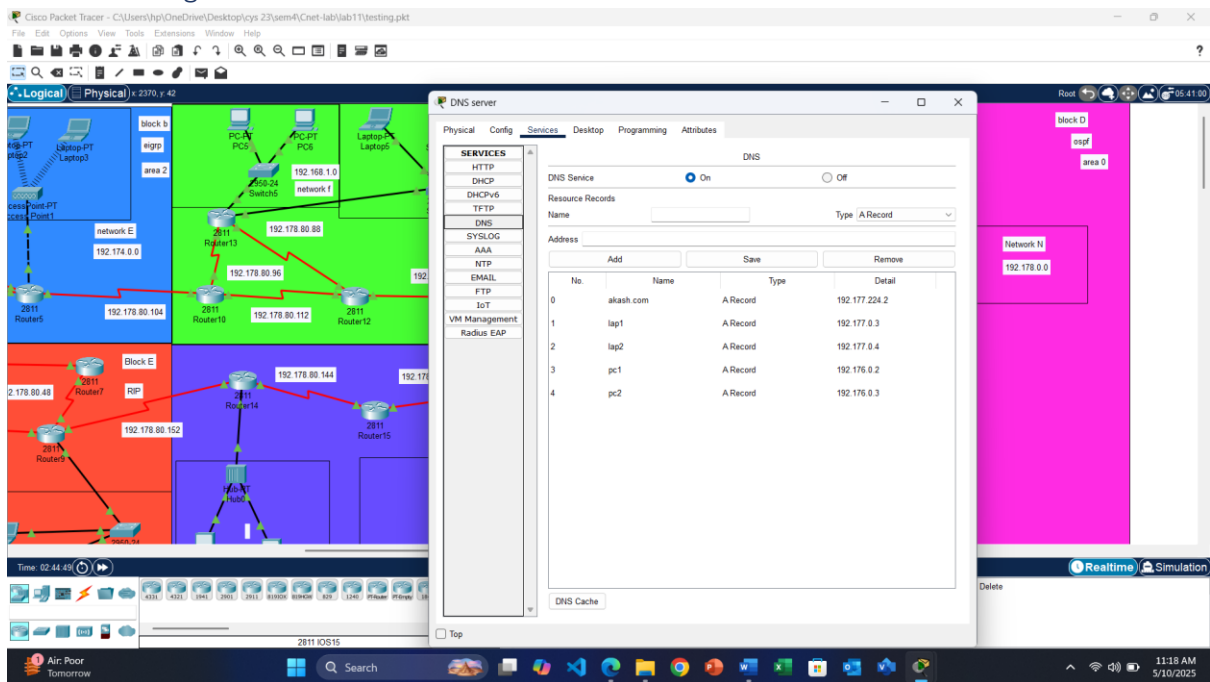
5.1 DHCP Configuration

The screenshot displays a Cisco Packet Tracer environment. On the left, a network topology is visible with various devices including routers (2811), switches (2950-24), and PCs. Networks are color-coded: Network E (blue), Network F (green), Network G (red), Network H (purple), Network I (orange), Network J (pink), Network K (light blue), Network L (light green), and Network M (light purple). On the right, the DHCP server configuration window is open, showing the configuration for the FastEthernet0/24 interface. The configuration includes a pool name 'samePool', a default gateway of 0.0.0.0, and a DNS server of 0.0.0.0. The IP address range is 192.177.0.0 to 192.177.255.255 with a subnet mask of 255.255.0.0. The maximum number of users is set to 512. The TFTP server and WLC address are both set to 0.0.0.0. Below the configuration fields, a table lists the DHCP pools and their associated parameters.

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
NetworkG	192.170.0.1	0.0.0.0	192.170.0.2	255.254.0.0	10	0.0.0.0	0.0.0.0
NetworkF	192.168.1.1	0.0.0.0	192.168.1.1	255.254.0.0	10	0.0.0.0	0.0.0.0
NetworkI	192.176.0.1	192.177.2...	192.176.0.2	255.255.0.0	10	0.0.0.0	0.0.0.0
NetworkH	192.177.0.1	192.177.2...	192.177.0.2	255.255.1...	10	0.0.0.0	0.0.0.0
NetworkJ	192.175.0.1	0.0.0.0	192.175.0.2	255.255.0.0	10	0.0.0.0	0.0.0.0
NetworkK	192.172.0.1	0.0.0.0	192.172.0.2	255.254.0.0	10	0.0.0.0	0.0.0.0
NetworkE	192.174.0.1	0.0.0.0	192.174.0.2	255.255.0.0	10	0.0.0.0	0.0.0.0
NetworkD	192.178.32.1	0.0.0.0	192.178.32.2	255.255.2...	10	0.0.0.0	0.0.0.0
NetworkA	192.177.1	0.0.0.0	192.177.1	255.255.1	10	0.0.0.0	0.0.0.0

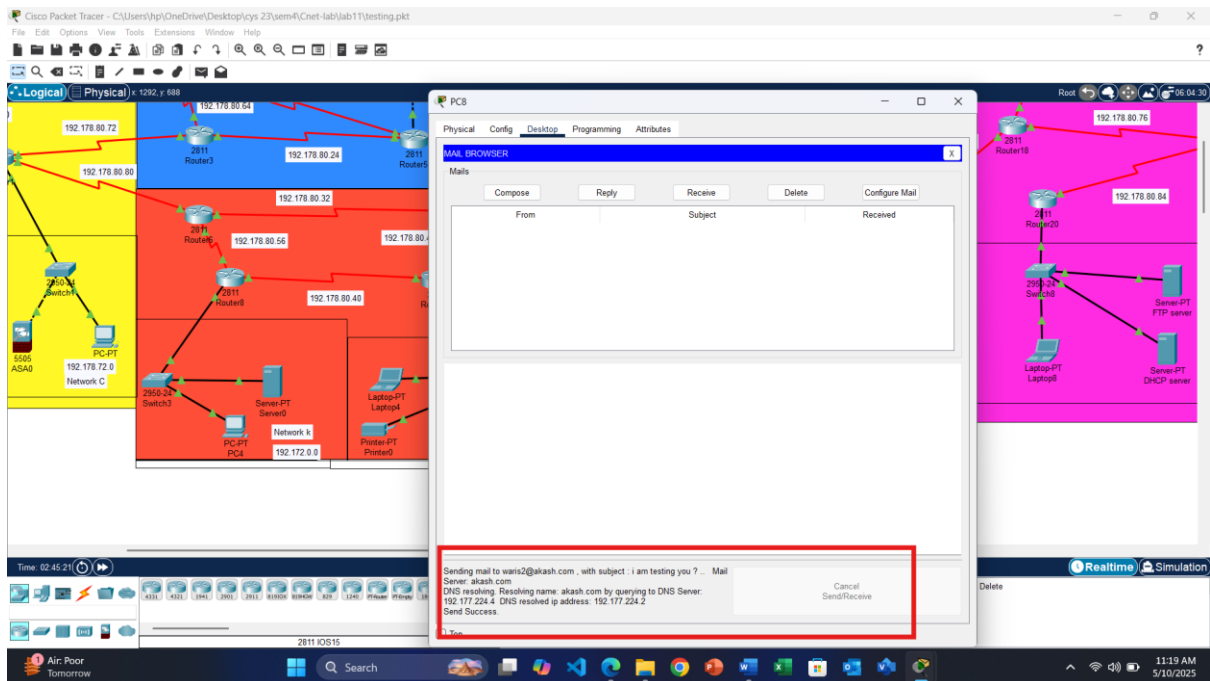


5.2 DNS Configuration

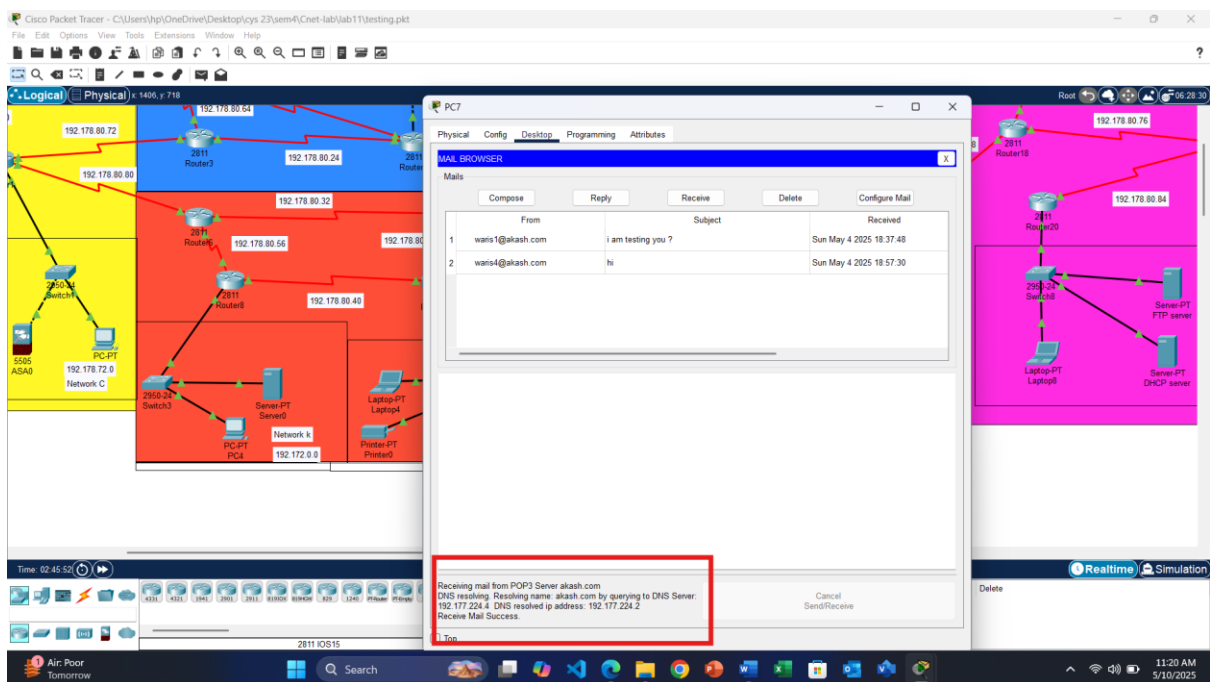


5.3 Email Functionality

Sending side :

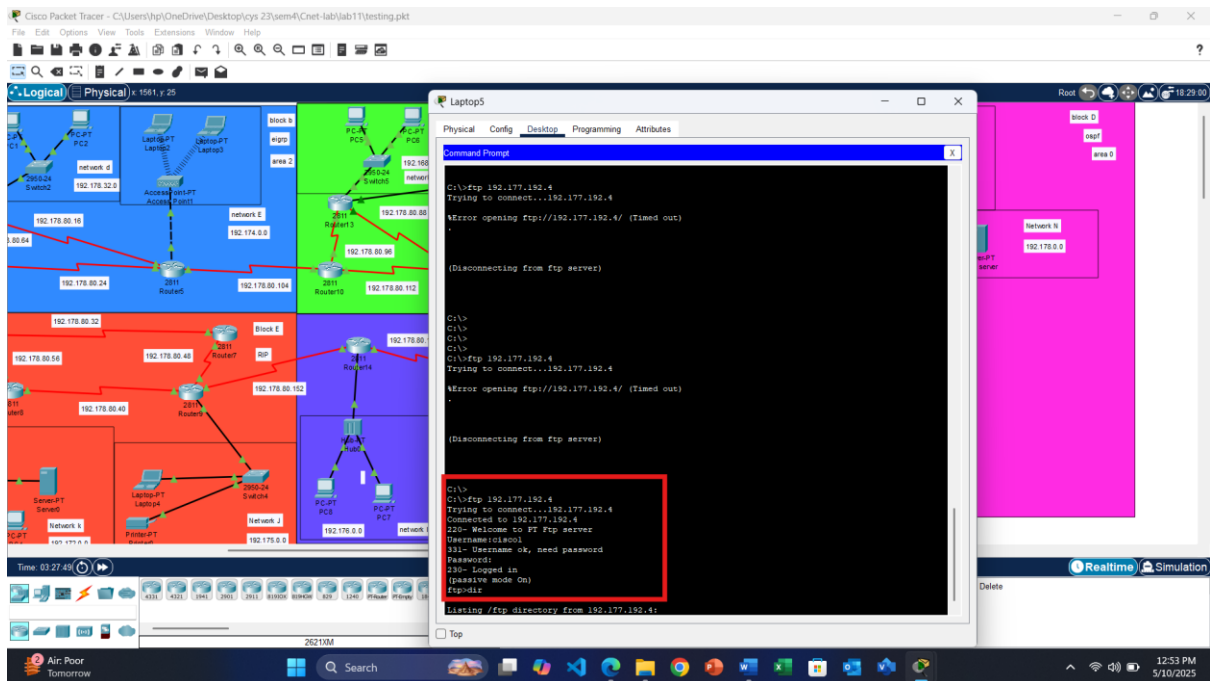


Receive side:

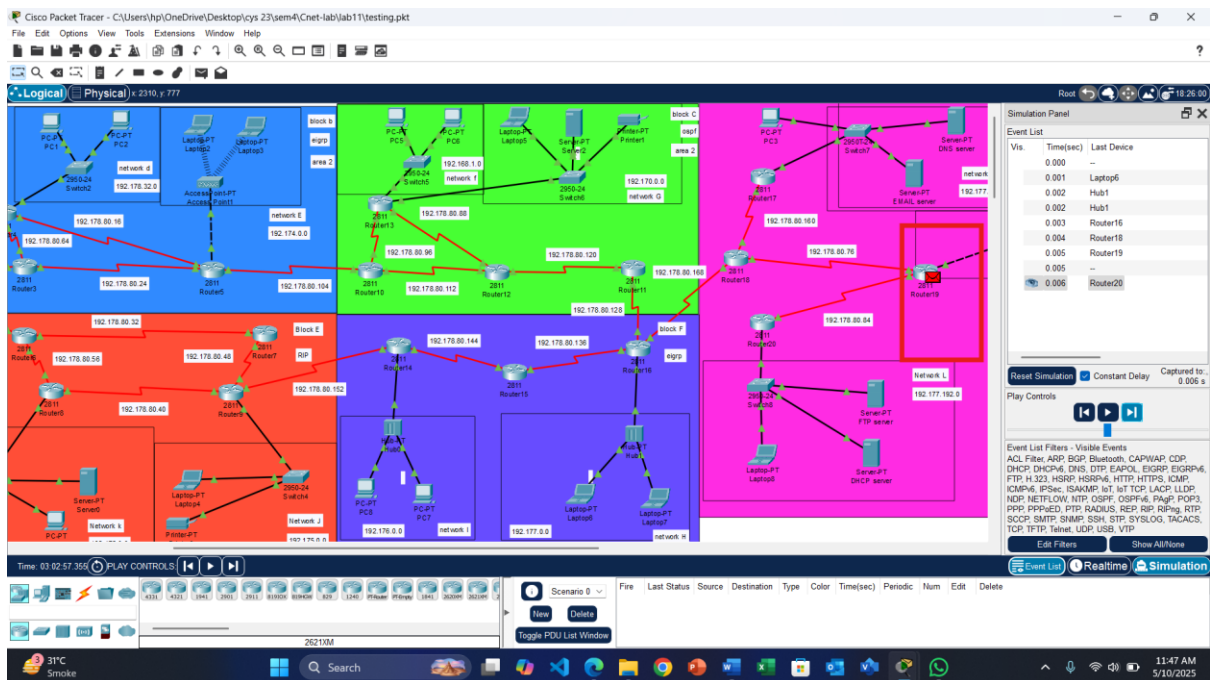


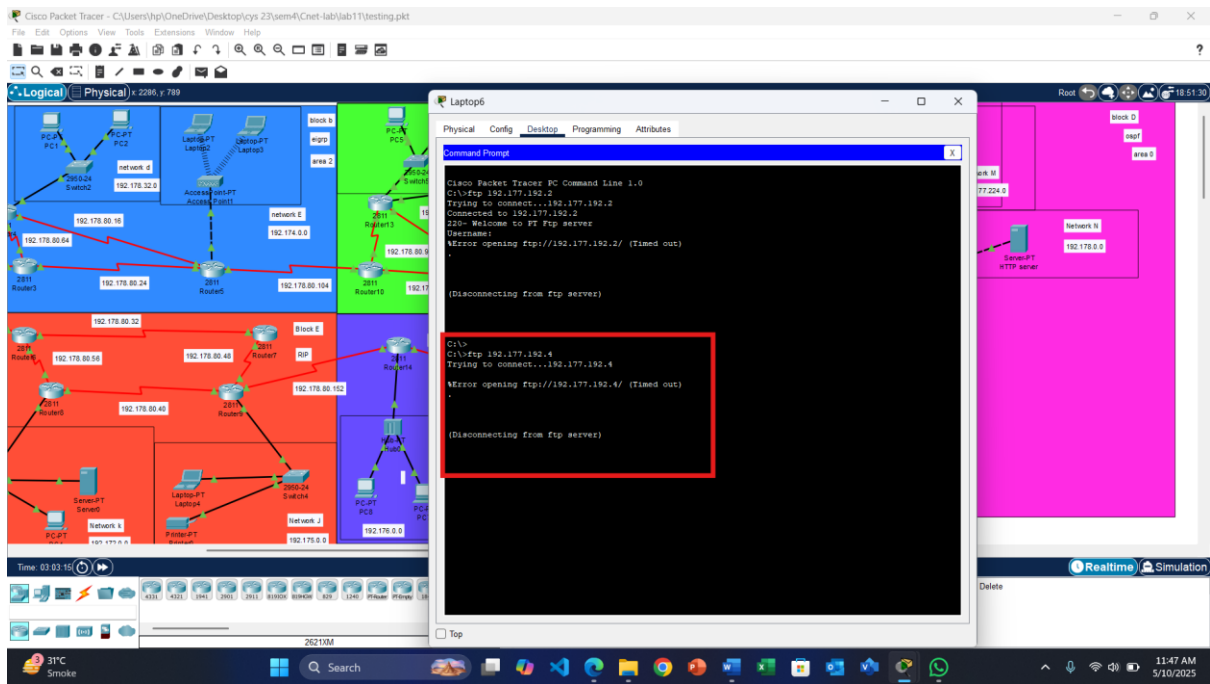
5.4 FTP Access Control

Network G which have access:



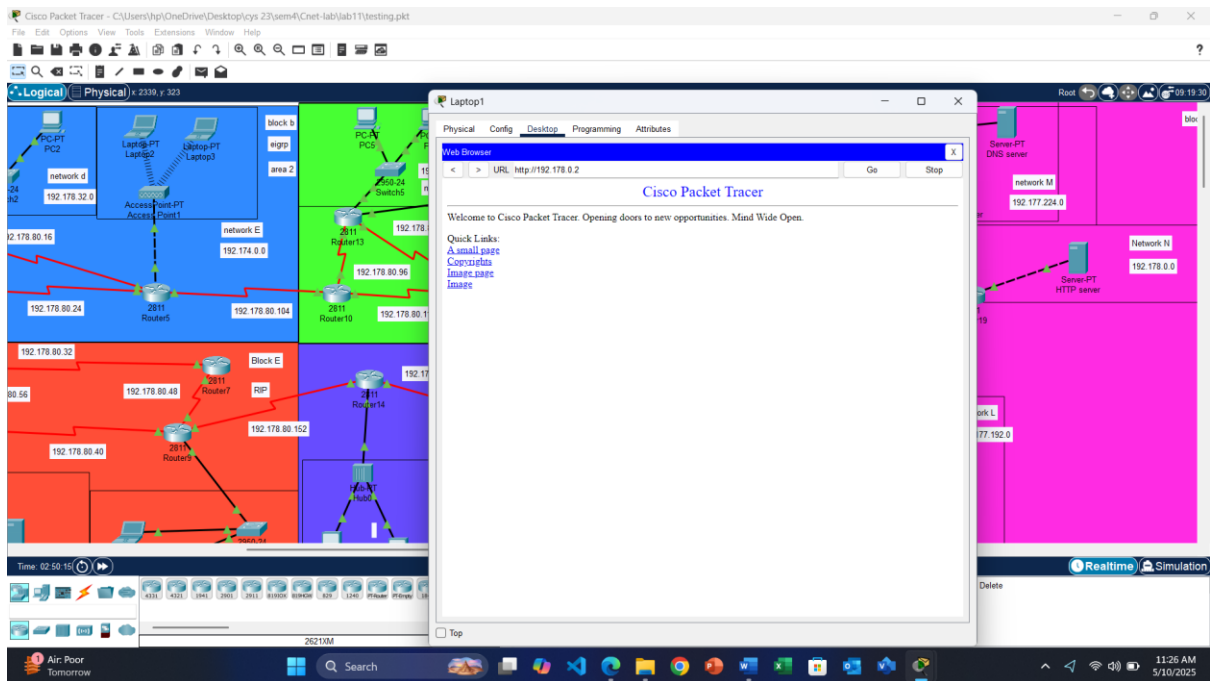
And all other which don't have access



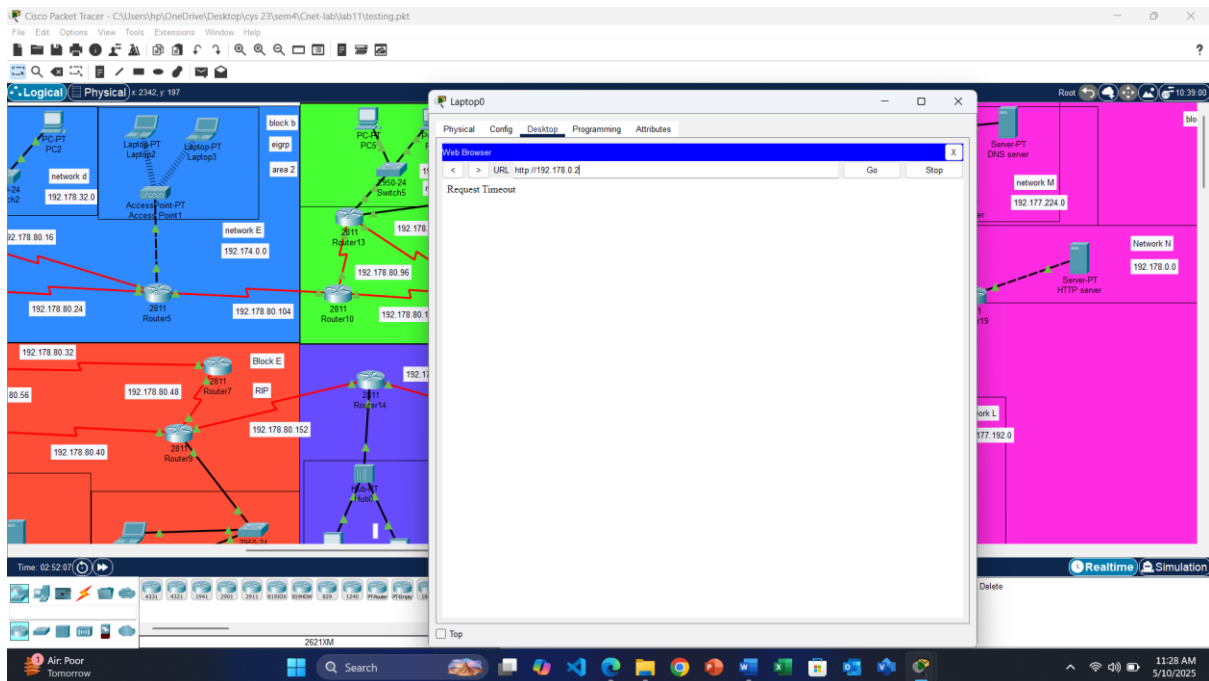


5.5 HTTP ACL Blocking

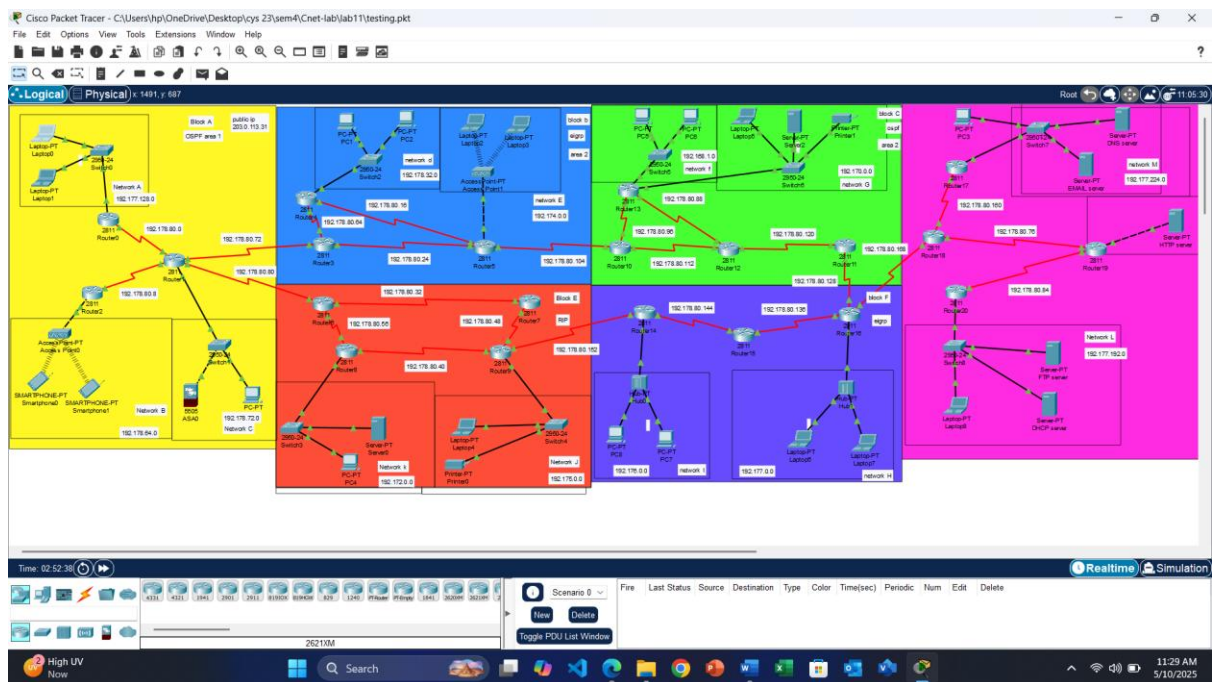
From allowed device:



FROM BLOCKED DEVICE:



5.6 Network Topology Overview



5- Conclusion

This project simulated a realistic multi-service enterprise network using Cisco Packet Tracer. Through proper subnetting, routing, ACLs, and service configurations, all project objectives were met. The challenges faced, especially with DHCP relay and ACL orders, helped in deepening practical understanding of network security and routing logic.

