



Project Report

Project Title: Cisco Packet Tracer Simulation with VLSM, Routing, NAT, ACL, and Services

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Course: Computer Networks (CNET)

Submission Deadline: 11th May 2025

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1. Introduction

This report outlines the implementation of a complex enterprise-level network in Cisco Packet Tracer based on the topology and configurations outlined in the provided scenario. The design incorporates multiple routing protocols (OSPF, EIGRP, RIP), advanced IP subnetting (VLSM), inter-protocol redistribution, DHCP, NAT/PAT, access control (ACL), and critical services such as Web, FTP, and Mail servers.

2. Network Overview

The network consists of several interconnected blocks labeled with alphabets (A to K), each configured with different routing protocols. The major components of the design are:

- **OSPF:** Area 0 (Backbone), Area 1, and Area 2.
- **EIGRP:** Blocks B and F.
- **RIP:** Legacy network routing used in specific segments.
- **Redistribution:** Between routers that connect two different routing domains.
- **DHCP:** Centralized configuration from Block D.
- **NAT/PAT:** Implemented in Router21 (Net K) and Router10 (Net F).
- **ACL:** To restrict specific host access to the web server.
- **Mail Server & FTP Server Access Control.**

3. IP Addressing Plan

- **VLSM (Variable Length Subnet Masking)** was used to conserve IP space.
- Each network and point-to-point link between routers uses appropriate subnet sizes.
- The IP plan adheres strictly to the host requirements provided in the Google Sheet.

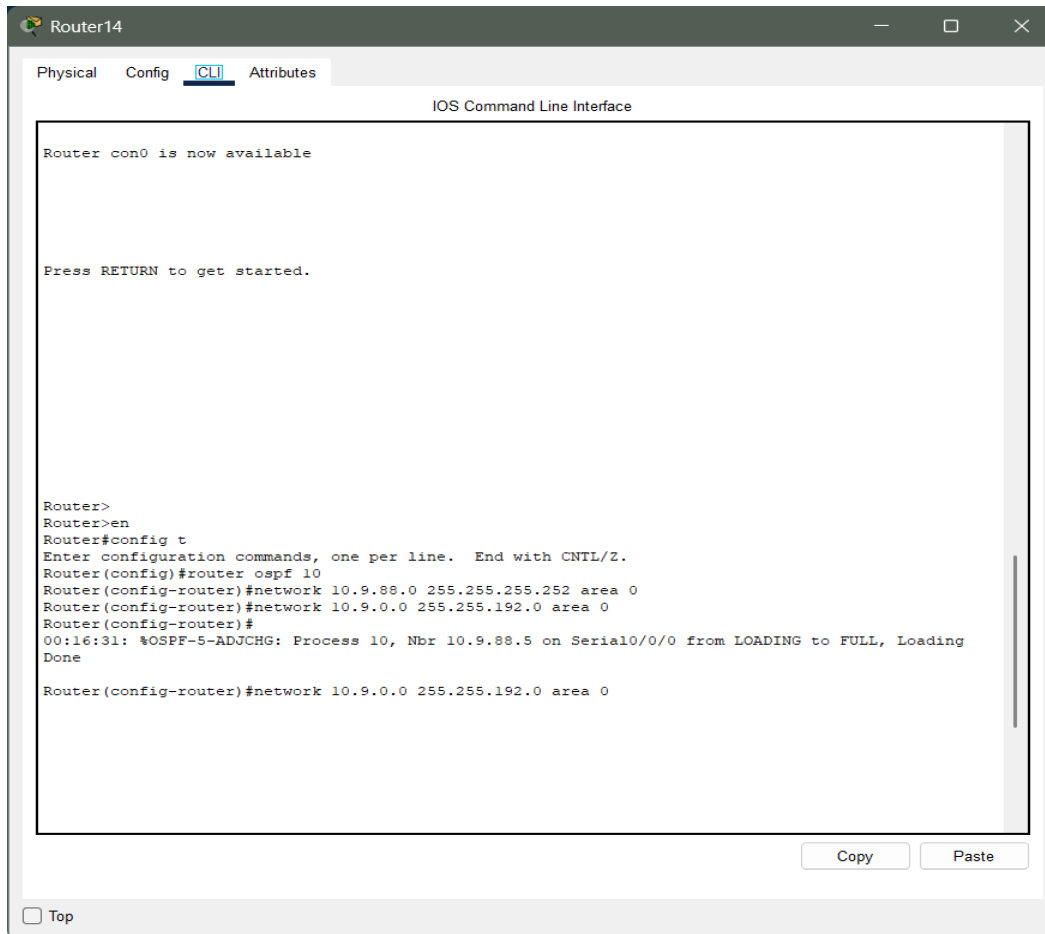
The network 10.0.0.0/24 has 254 hosts. Your subnets need 410032 hosts.								
NAME	HOSTS NEEDED	HOSTS AVAILABLE	UNUSED HOSTS	NETWORK ADDRESS	SLASH	MASK	USABLE RANGE	BROADCAST
E	93467	131070	37603	10.0.0.0	/15	255.254.0.0	10.0.0.1 - 10.1.255.254	10.1.255.255
F	67890	131070	63180	10.2.0.0	/15	255.254.0.0	10.2.0.1 - 10.3.255.254	10.3.255.255
K	60438	65534	5096	10.4.0.0	/16	255.255.0.0	10.4.0.1 - 10.4.255.254	10.4.255.255
J	49327	65534	16207	10.5.0.0	/16	255.255.0.0	10.5.0.1 - 10.5.255.254	10.5.255.255
I	38216	65534	27318	10.6.0.0	/16	255.255.0.0	10.6.0.1 - 10.6.255.254	10.6.255.255
N	33626	65534	31908	10.7.0.0	/16	255.255.0.0	10.7.0.1 - 10.7.255.254	10.7.255.255
H	27105	32766	5661	10.8.0.0	/17	255.255.128.0	10.8.0.1 - 10.8.127.254	10.8.127.255
G	16094	16382	288	10.8.128.0	/18	255.255.192.0	10.8.128.1 - 10.8.191.254	10.8.191.255
G	16094	16382	288	10.8.128.0	/18	255.255.192.0	10.8.128.1 - 10.8.191.254	10.8.191.255
C	9876	16382	6506	10.8.192.0	/18	255.255.192.0	10.8.192.1 - 10.8.255.254	10.8.255.255
L	9772	16382	6610	10.9.0.0	/18	255.255.192.0	10.9.0.1 - 10.9.63.254	10.9.63.255
M	2543	4094	1551	10.9.64.0	/20	255.255.240.0	10.9.64.1 - 10.9.79.254	10.9.79.255
A	901	1022	121	10.9.80.0	/22	255.255.252.0	10.9.80.1 - 10.9.83.254	10.9.83.255
D	456	510	54	10.9.84.0	/23	255.255.254.0	10.9.84.1 - 10.9.85.254	10.9.85.255
B	321	510	189	10.9.86.0	/23	255.255.254.0	10.9.86.1 - 10.9.87.254	10.9.87.255

Each router's interfaces were assigned IPs according to their connected network blocks. For inter-router links, /30 or /31 masks were used based on compatibility and requirement of exactly 2 usable Ips from 10.9.88.0-10.9.88. 94.

4. Routing Configuration

OSPF Areas

- **Area 0:** Backbone, connected to redistribution routers.



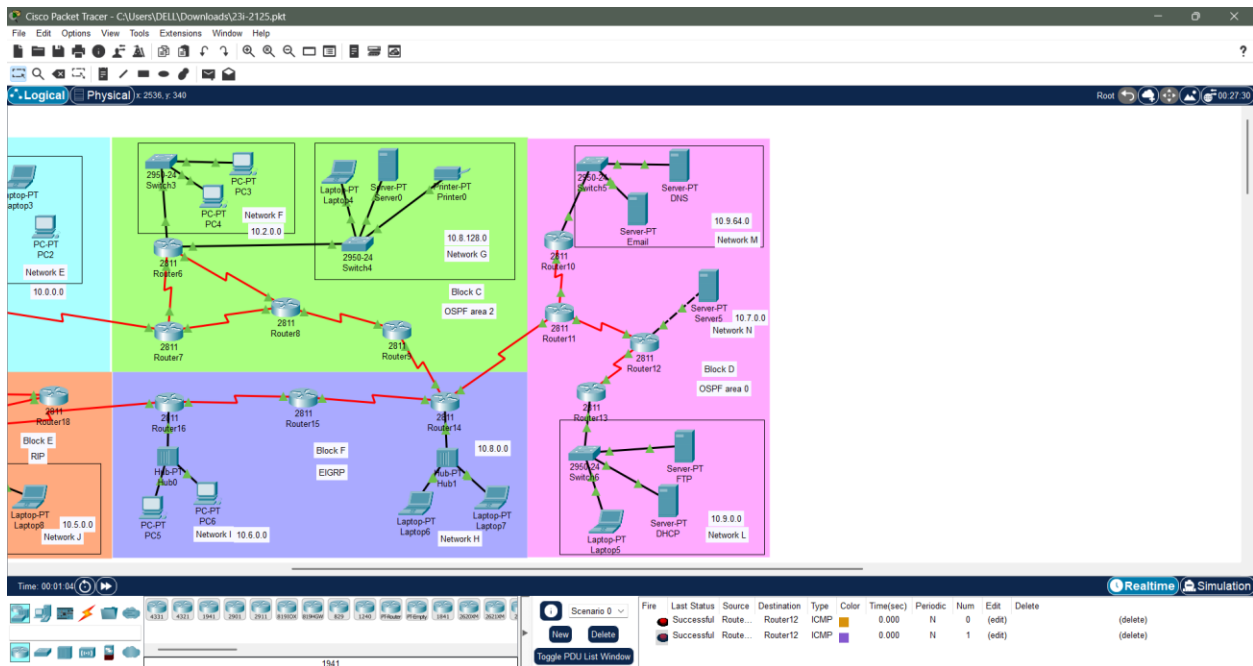
The screenshot shows a Cisco Router14 window with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the IOS Command Line Interface. The text in the CLI window is as follows:

```
Router con0 is now available

Press RETURN to get started.

Router>
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#network 10.9.88.0 255.255.255.252 area 0
Router(config-router)#network 10.9.0.0 255.255.192.0 area 0
Router(config-router)#
00:16:31: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.5 on Serial0/0/0 from LOADING to FULL, Loading
Done
Router(config-router)#network 10.9.0.0 255.255.192.0 area 0
```

At the bottom of the CLI window, there are 'Copy' and 'Paste' buttons. Below the CLI window, there is a 'Top' button with a checkbox.



- **Area 1 & Area 2:** Contain multiple networks and hosts, each configured with network statements matching assigned ranges.

AREA 1:

AREA 2:

```

Router2
Physical Config CLI Attributes
IOS Command Line Interface

Router(config-if)#

Router con0 is now available.

Press RETURN to get started.

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#network 10.9.88.48 255.255.255.252 area 1
Router(config-router)#
00:51:06: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.57 on Serial0/0/0 from LOADING to FULL, Loading Done
Router(config-router)#network 10.9.86.0 255.255.254.0 area 1
Router(config-router)#network 10.8.192.0 255.255.192.0 area 1
Router(config-router)#
Copy Paste

```

```

Router9
Physical Config CLI Attributes
IOS Command Line Interface

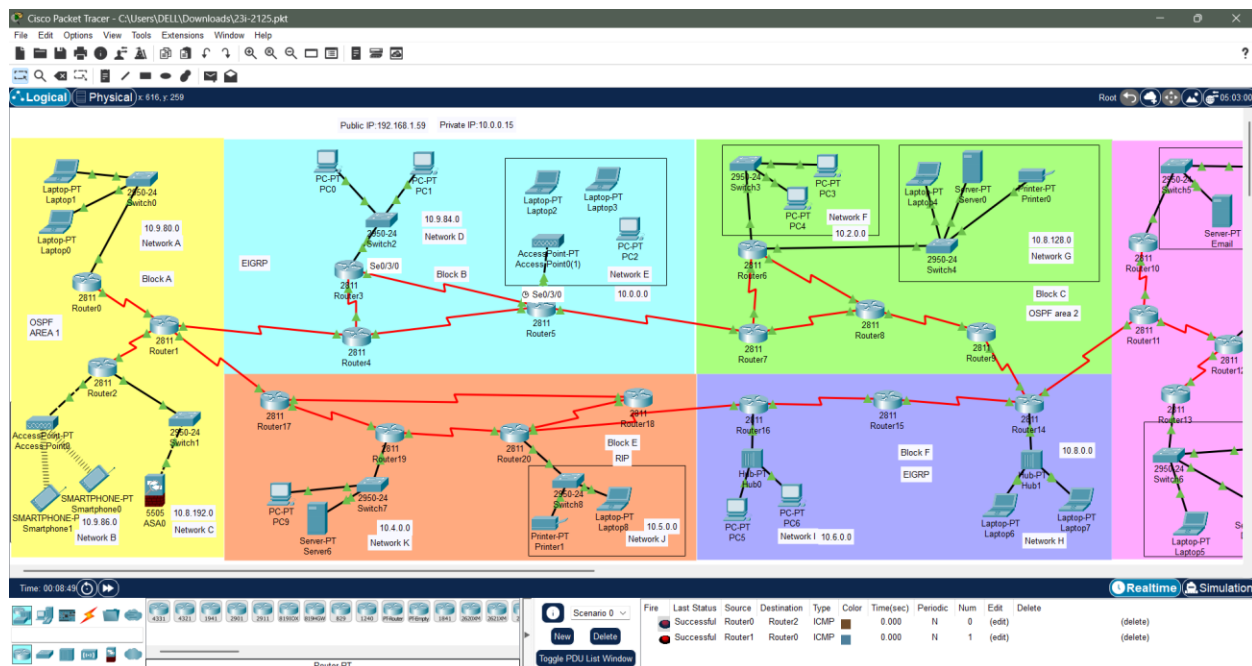
Router(config-if)#

Router con0 is now available.

Press RETURN to get started.

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#network 10.9.88.88 255.255.255.252 area 2
Router(config-router)#
00:54:36: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.93 on Serial0/1/0 from LOADING to FULL, Loading Done
Router(config-router)#network 10.9.88.84 255.255.255.252 area 2
Router(config-router)#network 10.9.88.80 255.255.255.252 area 2
Router(config-router)#
Copy Paste

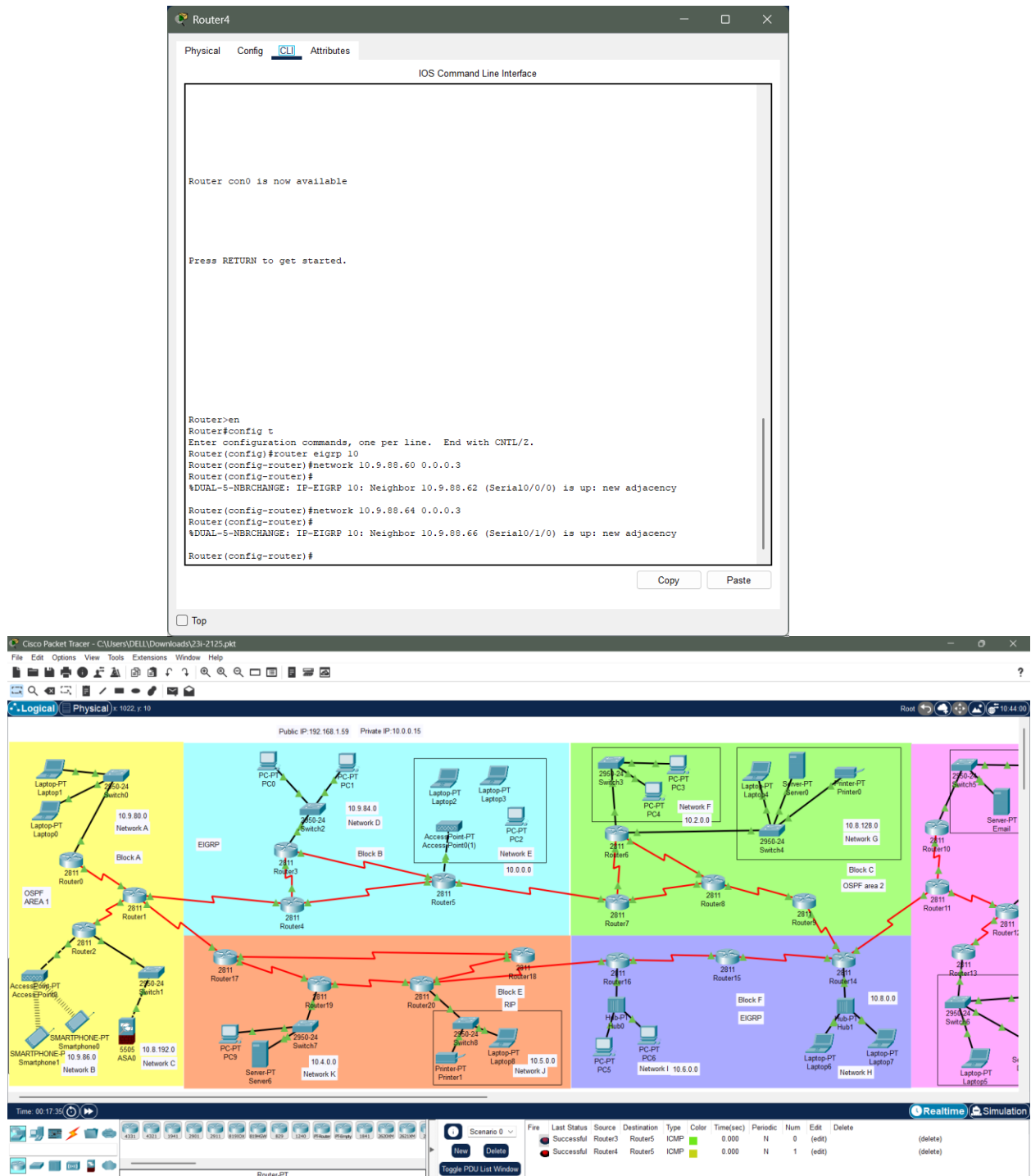
```



- All OSPF routers used router-id for unique identification and seamless adjacency.

EIGRP Configuration

- **Autonomous System 10** used.
- Included passive interfaces for unnecessary links.
- no auto-summary used for precise routing.

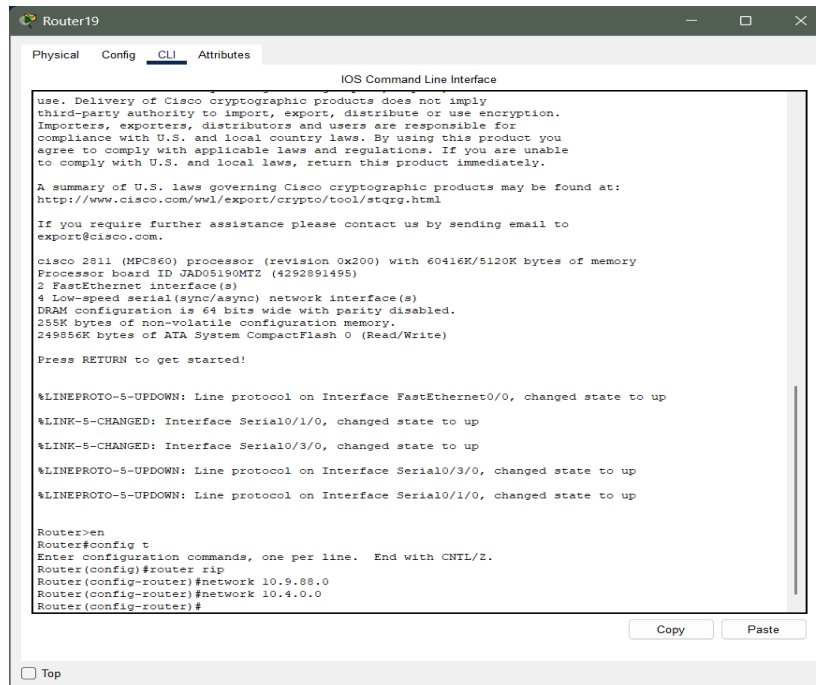


RIP

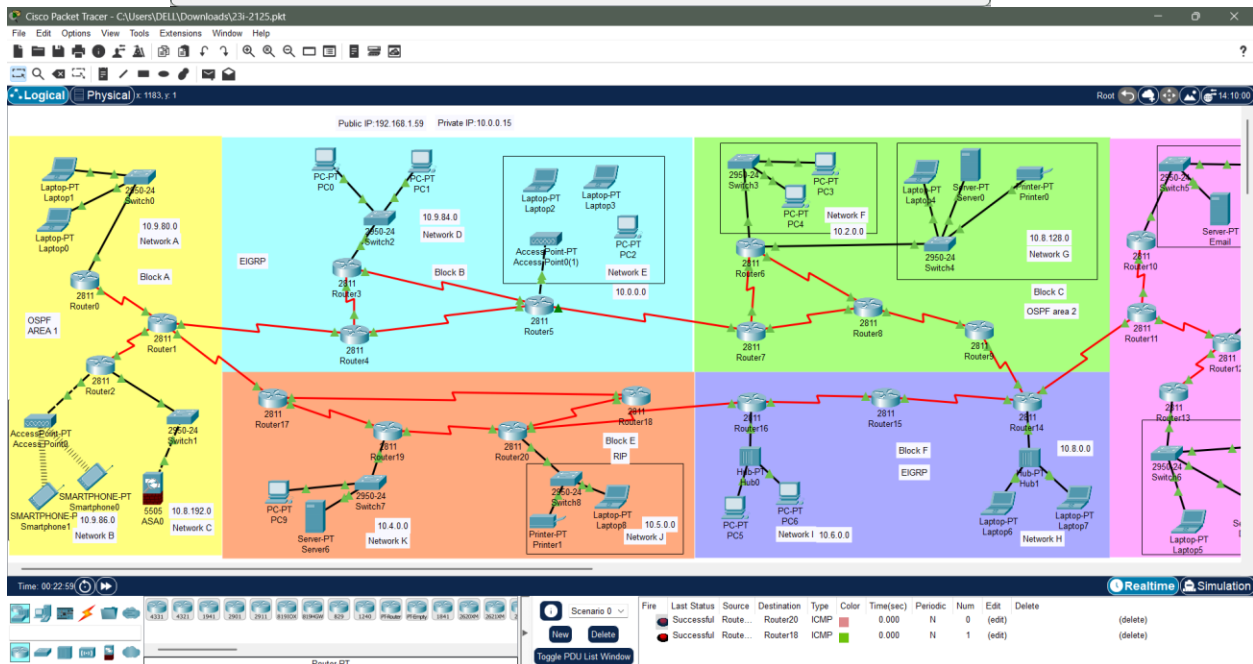
- Implemented RIP v2 using:

version 2

no auto-summary



- Specific networks advertised according to project topology.



5. Redistribution

Redistribution was configured on routers that connected different routes. For example:

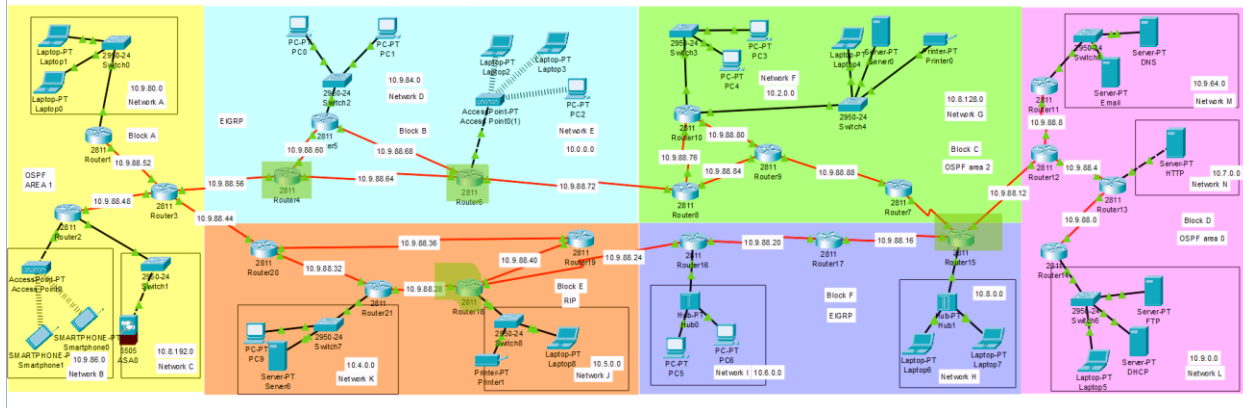
- Between **OSPF** and **EIGRP**
- Between **OSPF** and **RIP**

Each redistribution point included appropriate route-maps and metric values to avoid routing loops and ensure proper convergence.

Commands used:

```
router ospf 10  
redistribute eigrp 10 metric 100 subnets  
redistribute rip metric 200 subnets  
  
router eigrp 10  
redistribute ospf 10 metric 1000 10 255 1 1500  
redistribute rip metric 1000 10 255 1 1500  
  
router rip  
version 2  
redistribute ospf 10 metric 1  
redistribute eigrp 10 metric 1
```

COMMANDS WERE USED ACCORDING TO THE ROUTER CONFIGURATION



The picture highlighted the routers on which redistribution is done.

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 10
Router(config-router)#network 10.9.88.56 255.255.255.252 area 1
Router(config-router)#
00:29:09: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.65 on Serial0/2/0 from LOADING to FULL, Loading Done

Router(config-router)#router ospf 10
Router(config-router)#network 10.9.88.44 255.255.255.252 area 1
Router(config-router)#
00:31:15: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.45 on Serial0/3/0 from LOADING to FULL, Loading Done
```

Result:

```
10.0.0.0/8 is variably subnetted, 42 subnets, 9 masks
O E2 10.0.0.0/15 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.2.0.0/15 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.4.0.0/16 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.5.0.0/16 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.6.0.0/16 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.7.0.0/16 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.8.0.0/17 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.8.128.0/18 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O 10.8.192.0/18 [110/65] via 10.9.88.50, 00:32:17, Serial0/0/0
O E2 10.9.0.0/18 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.64.0/20 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O 10.9.80.0/22 [110/65] via 10.9.88.54, 00:32:17, Serial0/1/0
O E2 10.9.84.0/23 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O 10.9.86.0/23 [110/65] via 10.9.88.50, 00:32:17, Serial0/0/0
O E2 10.9.88.0/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.4/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.8/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.12/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.16/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.20/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.24/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.28/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.32/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.36/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.40/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
C 10.9.88.44/30 is directly connected, Serial0/3/0
L 10.9.88.46/32 is directly connected, Serial0/3/0
C 10.9.88.48/30 is directly connected, Serial0/0/0
L 10.9.88.49/32 is directly connected, Serial0/0/0
C 10.9.88.52/30 is directly connected, Serial0/1/0
L 10.9.88.53/32 is directly connected, Serial0/1/0
C 10.9.88.56/30 is directly connected, Serial0/2/0
L 10.9.88.57/32 is directly connected, Serial0/2/0
O E2 10.9.88.60/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.64/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.68/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.72/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.76/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.80/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.84/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.88/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
O E2 10.9.88.92/30 [110/100] via 10.9.88.58, 00:02:51, Serial0/2/0
```

6. DHCP Implementation

- A central **DHCP Server in Block D** was configured to handle IP address assignments.
- Routers used ip helper-address to forward DHCP broadcasts to the DHCP server.

Each network's DHCP pool was configured with:

- Default gateway
- DNS server
- Address range and subnet mask
- Lease time

DHCP Configuration Interface

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP Configuration:

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: serverPool

Default Gateway: 0.0.0.0

DNS Server: 0.0.0.0

Start IP Address: 0.0.0.0

Subnet Mask: 0.0.0.0

Maximum Number of Users: 512

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
Network B	10.9.86.1	0.0.0.0	10.9.86.1	255.255.2...	321	0.0.0.0	0.0.0.0
Network D	10.9.84.1	0.0.0.0	10.9.84.1	255.255.2...	456	0.0.0.0	0.0.0.0
Network A	10.9.80.1	0.0.0.0	10.9.80.1	255.255.2...	901	0.0.0.0	0.0.0.0
Network M	10.9.64.1	0.0.0.0	10.9.64.1	255.255.2...	2543	0.0.0.0	0.0.0.0
Network L	10.9.0.1	0.0.0.0	10.9.0.1	255.255.1...	9772	0.0.0.0	0.0.0.0
Network C	10.8.192.1	0.0.0.0	10.8.192.1	255.255.1...	9876	0.0.0.0	0.0.0.0
Network G	10.8.128.1	0.0.0.0	10.8.128.1	255.255.1...	16094	0.0.0.0	0.0.0.0
Network H	10.8.0.1	0.0.0.0	10.8.0.1	255.255.1...	27105	0.0.0.0	0.0.0.0
Network N	10.7.0.1	0.0.0.0	10.7.0.1	255.255.0.0	32626	0.0.0.0	0.0.0.0

☐ Top

7. NAT & PAT

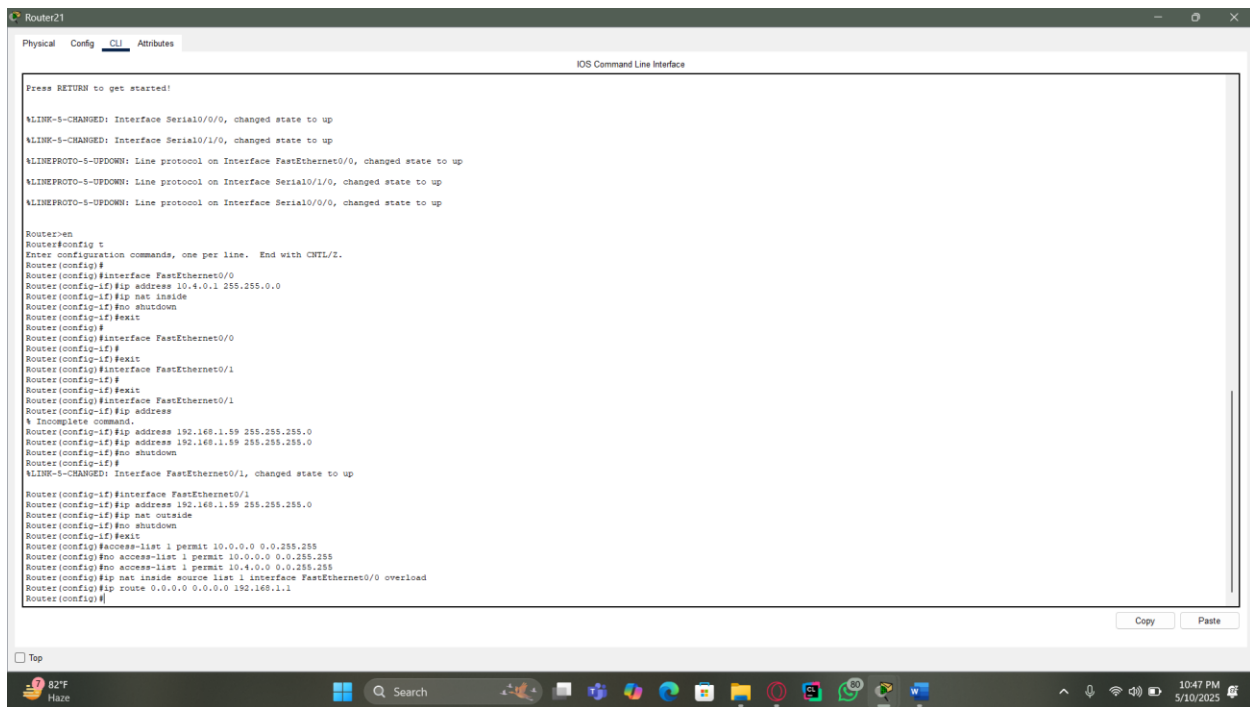
NAT and PAT were implemented on:

- **Router21 (Network K)**
- **Router10 (Network F)**

Static NAT and overload PAT configuration:

ip nat inside source list 1 interface Serial0/0/1 overload

Public IPs from the Google Sheet were used for NAT translations.



```
Router21
Physical Config CLI Attributes
IOS Command Line Interface

Press RETURN to get started!

%LINK-3-CHANGED: Interface Serial0/0/0, changed state to up
%LINK-3-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 10.4.0.1 255.255.0.0
Router(config-if)#ip nat inside
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#ip address
% Incomplete command.
Router(config-if)#ip address 192.168.1.59 255.255.255.0
Router(config-if)#ip address 192.168.1.59 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-3-CHANGED: Interface FastEthernet0/1, changed state to up
Router(config-if)#interface FastEthernet0/1
Router(config-if)#ip address 192.168.1.59 255.255.255.0
Router(config-if)#ip nat outside
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#access-list 1 permit 10.0.0.0 0.0.255.255
Router(config)#no access-list 1 permit 10.0.0.0 0.0.255.255
Router(config)#no access-list 1 permit 10.4.0.0 0.0.255.255
Router(config)#ip nat inside source list 1 interface FastEthernet0/0 overload
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.1.1
Router(config)#
```


WEB:

 Router13

Physical Config CLI Attributes

IOS Command Line Interface

```
cisco 2811 (MPC860) processor (revision 0x200) with 60416K/5120K bytes of memory
Processor board ID JAD05190MTZ (4292891495)
2 FastEthernet interface(s)
4 Low-speed serial(sync/async) network interface(s)
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

00:00:10: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.13 on Serial0/1/0 from LOADING to FULL,
Done

00:00:10: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.1 on Serial0/0/0 from LOADING to FULL,
Done

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip access-list extended BLOCK_WEB
Router(config-ext-nacl)# deny tcp host 10.9.80.10 host 192.168.100.10 eq 80
Router(config-ext-nacl)#deny tcp host 10.0.0.55 host 192.168.100.10 eq 80
Router(config-ext-nacl)#deny tcp host 10.9.86.44 host 192.168.100.10 eq 80
Router(config-ext-nacl)#deny tcp 10.9.84.0 0.0.0.255 host 192.168.100.10 eq 80
Router(config-ext-nacl)#permit ip any any
Router(config-ext-nacl)#exit
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#ip access-group BLOCK_WEB in
Router(config-if)#
```

Conv

Router13

Physical Config CLI Attributes

IOS Command Line Interface

```
!  
router ospf 10  
  log-adjacency-changes  
  network 10.9.88.0 0.0.0.3 area 0  
  network 10.9.88.4 0.0.0.3 area 0  
  network 10.7.0.0 0.0.255.255 area 0  
!  
router rip  
!  
ip classless  
!  
ip flow-export version 9  
!  
!  
ip access-list extended BLOCK_WEB  
  deny tcp host 10.9.80.10 host 192.168.100.10 eq www  
  deny tcp host 10.0.0.55 host 192.168.100.10 eq www  
  deny tcp host 10.9.86.44 host 192.168.100.10 eq www  
  deny tcp 10.9.84.0 0.0.0.255 host 192.168.100.10 eq www  
  permit ip any any  
!  
!  
!
```

Mail:

Router11

Physical Config CLI Attributes

IOS Command Line Interface

```
If you require further assistance please contact us by sending email to  
export@cisco.com.  
  
cisco 2811 (MPC860) processor (revision 0x200) with 60416K/5120K bytes of memory  
Processor board ID JAD05190MTZ (4292891495)  
2 FastEthernet interface(s)  
4 Low-speed serial(sync/async) network interface(s)  
DRAM configuration is 64 bits wide with parity disabled.  
255K bytes of non-volatile configuration memory.  
249856K bytes of ATA System CompactFlash 0 (Read/Write)  
  
Press RETURN to get started!  
  
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up  
  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up  
  
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up  
  
00:00:10: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.13 on Serial0/0/0 from LOADING to FULL, Loading  
Done  
  
Router>en  
Router#config t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#ip access-list extended MAIL_ACCESS  
Router(config-ext-nacl)#permit tcp 10.8.0.0 0.0.255.255 host 10.9.84.100 eq 25  
Router(config-ext-nacl)#permit tcp 10.8.192.0 0.0.63.255 host 10.9.84.100 eq 25  
Router(config-ext-nacl)#permit tcp host 10.9.84.100 10.8.0.0 0.0.255.255 eq 25  
Router(config-ext-nacl)#permit tcp host 10.9.84.100 10.8.192.0 0.0.63.255 eq 25  
Router(config-ext-nacl)# deny ip any any  
Router(config-ext-nacl)#  
Router(config-ext-nacl)#end  
Router#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface FastEthernet0/0  
Router(config-if)#  
%SYS-5-CONFIG_I: Configured from console by console  
ip access-group MAIL_ACCESS in  
Router(config-if)#
```


Router11

Physical Config CLI Attributes

IOS Command Line Interface

```
interface Vlan1
  no ip address
  shutdown
!
router ospf 10
  log-adjacency-changes
  network 10.9.88.8 0.0.0.3 area 0
  network 10.9.64.0 0.0.15.255 area 0
!
ip classless
!
ip flow-export version 9
!
!
ip access-list extended MAIL_ACCESS
  permit tcp 10.8.0.0 0.0.255.255 host 10.9.84.100 eq smtp
  permit tcp 10.8.192.0 0.0.63.255 host 10.9.84.100 eq smtp
  permit tcp host 10.9.84.100 10.8.0.0 0.0.255.255 eq smtp
  permit tcp host 10.9.84.100 10.8.192.0 0.0.63.255 eq smtp
  deny ip any any
!
```

FTP:

Router14

Physical Config CLI Attributes

IOS Command Line Interface

```
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco 2811 (MPC860) processor (revision 0x200) with 60416K/5120K bytes of memory
Processor board ID JAD05190MTZ (4292891495)
2 FastEthernet interface(s)
4 Low-speed serial(sync/async) network interface(s)
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

00:00:10: %OSPF-5-ADJCHG: Process 10, Nbr 10.9.88.5 on Serial0/0/0 from LOADING to FULL, Loading
Done

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip access-list extended FTP_UPLOAD
Router(config-ext-nacl)# permit tcp 10.8.128.0 0.0.0.255 host 192.168.100.20 eq 21
Router(config-ext-nacl)#permit tcp host 192.168.100.20 eq 20 10.8.128.0 0.0.0.255
Router(config-ext-nacl)#deny ip any any
Router(config-ext-nacl)#interface GigabitEthernet0/0
%Invalid interface type and number
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#ip access-group FTP_UPLOAD in
Router(config-if)#
```

Router14

Physical Config CLI Attributes

IOS Command Line Interface

```
router ospf 10
log-adjacency-changes
network 10.9.88.0 0.0.0.3 area 0
network 10.9.0.0 0.0.63.255 area 0
!
ip classless
!
ip flow-export version 9
!
!
ip access-list extended FTP_UPLOAD
permit tcp 10.8.128.0 0.0.0.255 host 192.168.100.20 eq ftp
permit tcp host 192.168.100.20 eq 20 10.8.128.0 0.0.0.255
deny ip any any
!
```

9. Services Configuration

Mail Server (Block D)

- SMTP and POP3 configured.
- Only Networks H and I permitted for email communication.

Email

Physical Config Services Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL**
- FTP
- IoT
- VM Management
- Radius EAP

EMAIL

SMTP Service ☒ ON ☐ OFF

POP3 Service ☒ ON ☐ OFF

Domain Name:

User Setup

User Password

am1
am2

☐ Top

FTP Server

- Located as per topology.
- Only hosts in **Network G** were permitted to access and upload files.
- Configuration included:
 - FTP usernames and passwords
 - Write permissions
 - ACL to restrict access from other networks

The screenshot shows the configuration utility for an FTP server. The interface has a sidebar on the left with a list of services: HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, **FTP**, IoT, VM Management, and Radius EAP. The main area is titled 'FTP' and has a 'Service' toggle set to 'On'. Below this is a 'User Setup' section with input fields for 'Username' and 'Password', and checkboxes for 'Write', 'Read', 'Delete', 'Rename', and 'List'. A table below these fields lists the configured users. At the bottom, there is a 'File' section showing a list of files stored on the server.

	Username	Password	Permission
1	Ammar	1234	RWDNL

	File
1	asa842-k8.bin
2	asa923-k8.bin
3	c1841-advipservicesk9-mz.124-15.T1.bin
4	c1841-ipbase-mz.123-14.T7.bin
5	c1841-ipbasek9-mz.124-12.bin
6	c1900-universalk9-mz.SPA.155-3.M4a.bin
7	c2600-advipservicesk9-mz.124-15.T1.bin

10. Validation & Testing

All services were tested for functionality:

- **Ping tests** across inter-domain routers and to DHCP clients confirmed correct routing and addressing.
- **Web server:**
 - Accessible to all except denied clients (validated via browser simulation).
- **FTP:**
 - Accessed and uploaded by Network G hosts.
- **Mail server:**
 - Email exchange successful between H and I users.
- **DHCP:**
 - Every client auto-assigned correct IP and gateway.
- **NAT:**
 - Verified using show ip nat translations.

11. Challenges & Resolutions

Issue: DHCP clients not receiving IPs in remote networks

Fix: Added ip helper-address on router interfaces.

Issue: ACL blocked unintended traffic

Fix: Carefully structured ACLs with specific deny and permit statements in correct order.

Issue: Redistribution loops

Fix: Used route-map with tag filtering and manual metric tuning.

12. Conclusion

This project successfully demonstrates advanced network design and configuration using Cisco Packet Tracer. It integrates real-world networking scenarios such as routing protocol redistribution, NAT, DHCP centralization, ACL-based access control, and secure service segmentation (Mail, FTP, Web). The entire network is functional, scalable, and secure — showcasing a solid grasp of network engineering principles and Cisco technologies.