Research Facility Network System

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Department of Computer
Science

FAST – National University of Computer & Emerging Sciences

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Objective:

The objective of my project was to design and implement a research lab network system using Cisco Packet Tracer, incorporating NAT for secure communication, DHCP for auto-assigning of IP's and Routing for interconnections between routers.

Technologies Used:

1. **NAT Implementation:**
   Allow secure communication between internal lab networks and external networks by translating private IPs to a public IP.

2. **DHCP for Auto IP Assignment:**
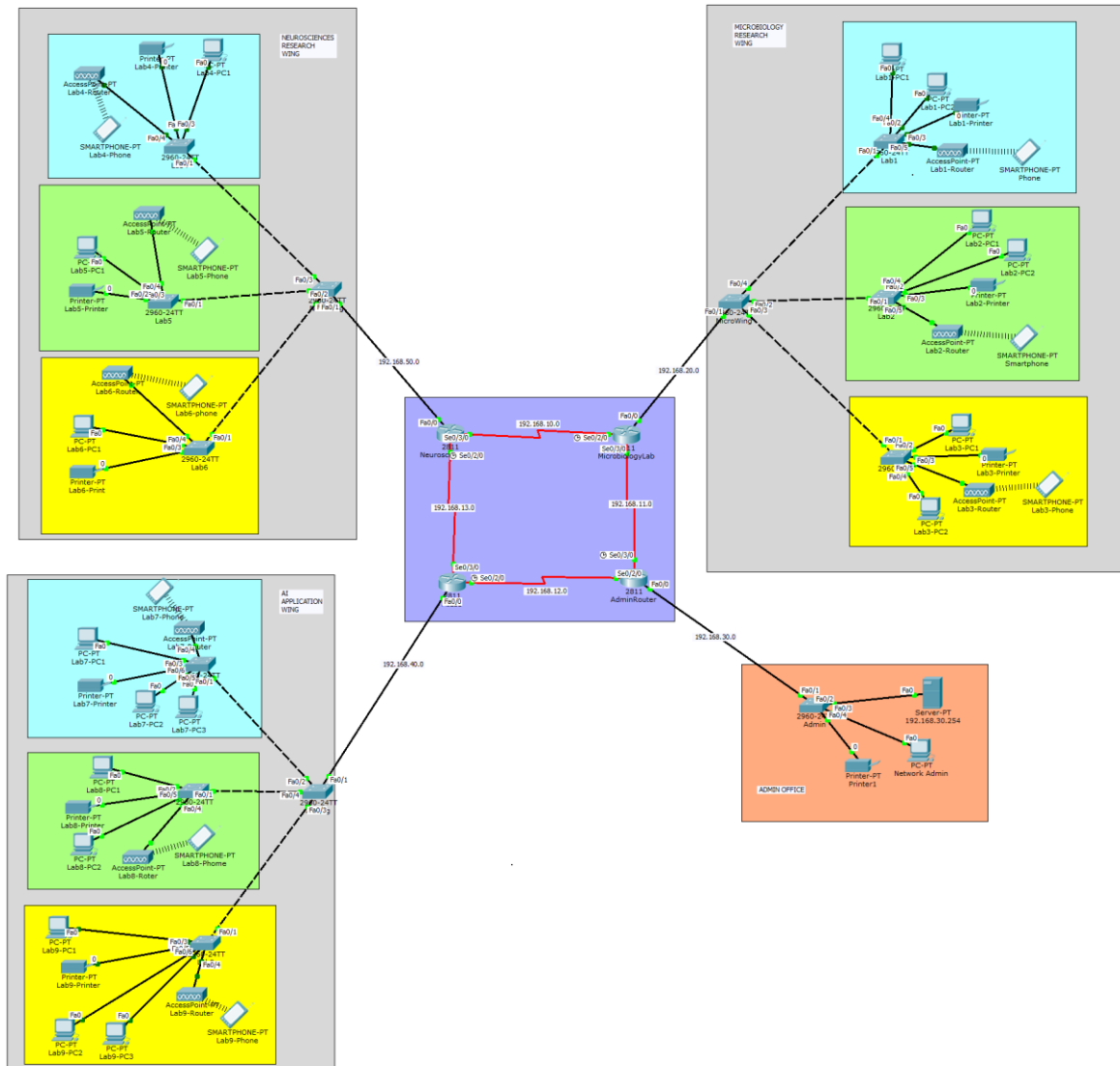   Automate IP address allocation to devices in each department, reducing manual configuration and ensuring efficient IP management.

3. **RIP Routing for Inter-Department Connectivity:**
   Enable seamless communication between labs using Routing Information Protocol (RIP) for dynamic routing.

Results and Testing:

Overall Topology:

DHCP Pools:

192.168.30.254 — ▢ ✕

| Physical | Config | Services | Desktop | Custom Interface |

SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP

DHCP

| Interface | FastEthernet0 ▼ | Service | ⦿ On | ◯ Off |

Pool Name	serverPool
Default Gateway	192.168.30.1
DNS Server	192.168.30.4

| Start IP Address : | | 192 | 168 | 30 | 10 |
| Subnet Mask: | | 255 | 255 | 255 | 0 |

Maximum number of Users :	50
TFTP Server:	0.0.0.0

| Add | Save | Remove |

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server
network50	192.168.50.1	192.168.30.4	192.168.50.10	255.255.255.0	50	0.0.0.0
network40	192.168.40.1	192.168.30.4	192.168.40.10	255.255.255.0	50	0.0.0.0
serverPool	192.168.30.1	192.168.30.4	192.168.30.10	255.255.255.0	50	0.0.0.0
network20	192.168.20.1	192.168.30.4	192.168.20.10	255.255.255.0	50	0.0.0.0

Lab2-PC1 — □ ✕

Physical   Config   **Desktop**   Custom Interface

IP Configuration ✕

IP Configuration

◉ DHCP   ○ Static   DHCP request successful.

IP Address   192.168.20.21

Subnet Mask   255.255.255.0

Default Gateway   192.168.20.1

DNS Server   192.168.30.4

IPv6 Configuration

○ DHCP   ○ Auto Config   ◉ Static

IPv6 Address   /

Link Local Address   FE80::20C:CFFF:FEC6:C395

IPv6 Gateway

IPv6 DNS Server

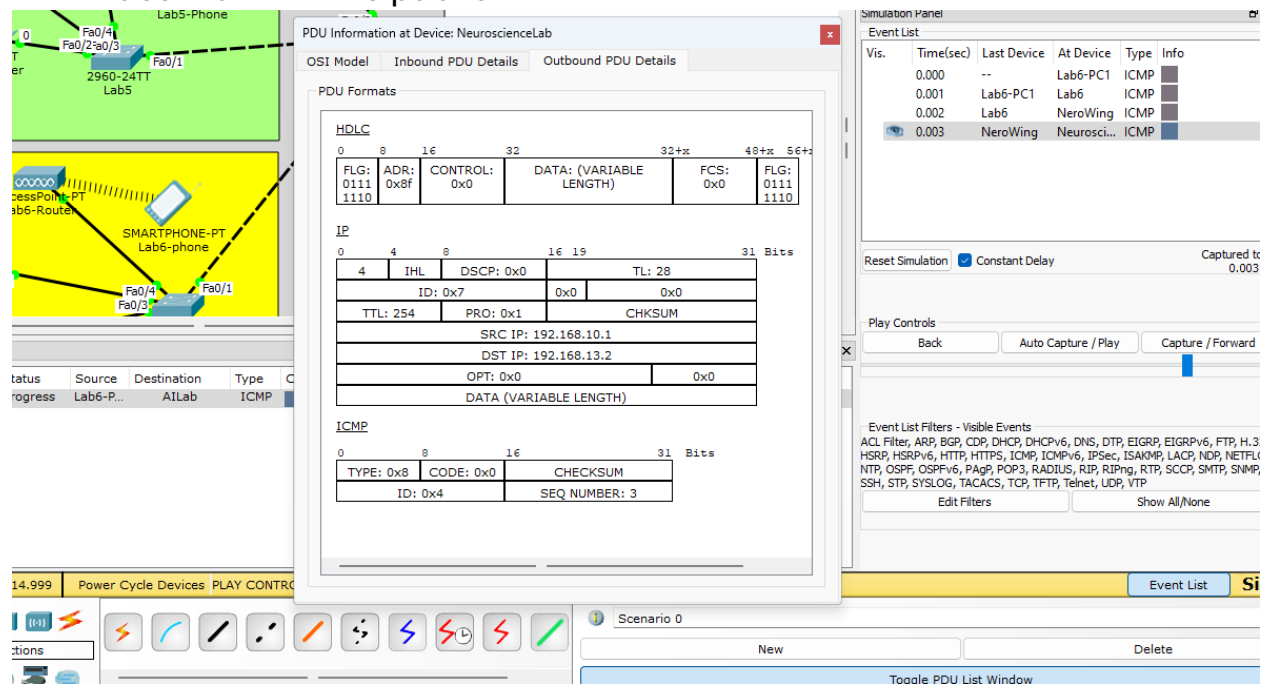RIP Routing:

NAT Configuration:
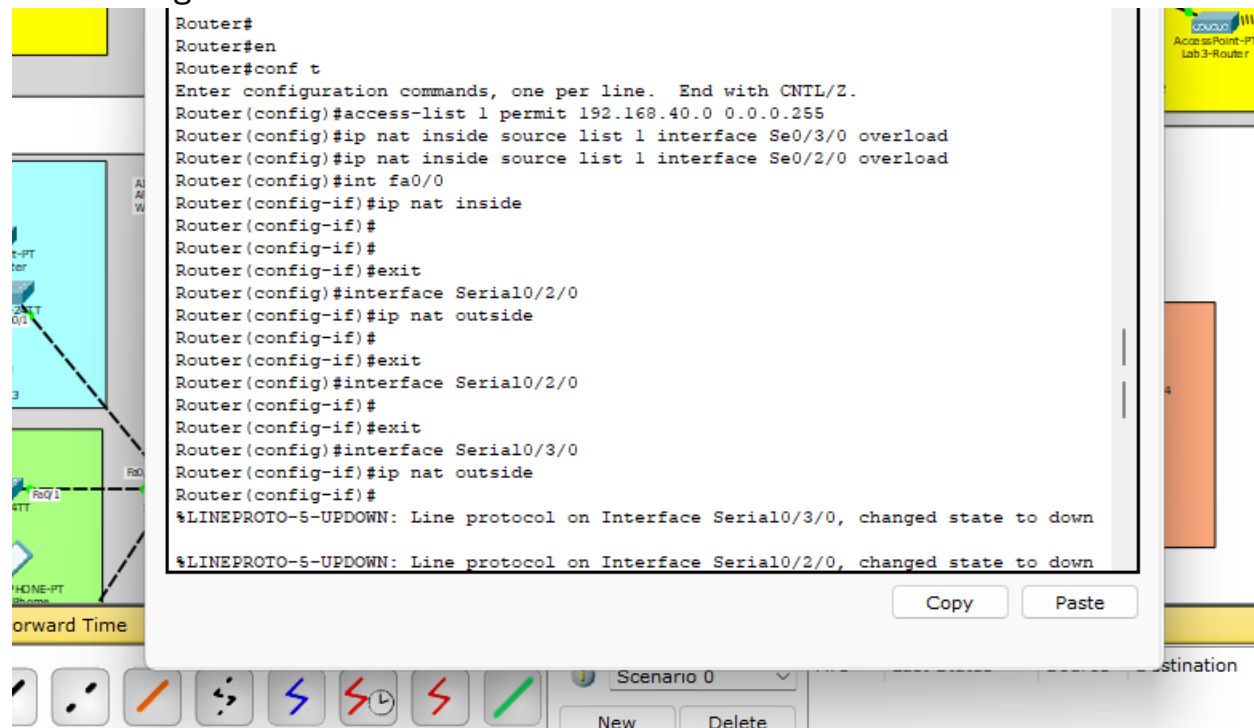
```
Router#
Router#en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#access-list 1 permit 192.168.40.0 0.0.0.255
Router(config)#ip nat inside source list 1 interface Se0/3/0 overload
Router(config)#ip nat inside source list 1 interface Se0/2/0 overload
Router(config)#int fa0/0
Router(config-if)#ip nat inside
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/2/0
Router(config-if)#ip nat outside
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/3/0
Router(config-if)#ip nat outside
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to down
```

Copy   Paste

If we send a packet from Lab6-PC, whose IP address is 192.168.50.12, but NAT hides that with the public IP:

PDU Information at Device: NeuroscienceLab

OSI Model | Inbound PDU Details | Outbound PDU Details

PDU Formats

HDLC

0	8	16	32	32+x	48+x 56+x
FLG: 0111 1110	ADR: 0x8f	CONTROL: 0x0	DATA: (VARIABLE LENGTH)	FCS: 0x0	FLG: 0111 1110

IP

0	4	8	16 19	31 Bits
4	IHL	DSCP: 0x0		TL: 28
	ID: 0x7		0x0	0x0
TTL: 254		PRO: 0x1	CHKSUM	
	SRC IP: 192.168.10.1			
	DST IP: 192.168.13.2			
	OPT: 0x0		0x0	
	DATA (VARIABLE LENGTH)			

ICMP

0	8	16	31 Bits
TYPE: 0x8	CODE: 0x0	CHECKSUM	
	ID: 0x4	SEQ NUMBER: 3	

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.000	--	Lab6-PC1	ICMP	
	0.001	Lab6-PC1	Lab6	ICMP	
	0.002	Lab6	NeroWing	ICMP	
	0.003	NeroWing	Neurosci...	ICMP	

Reset Simulation   ☑ Constant Delay

Captured to 0.003

Play Controls
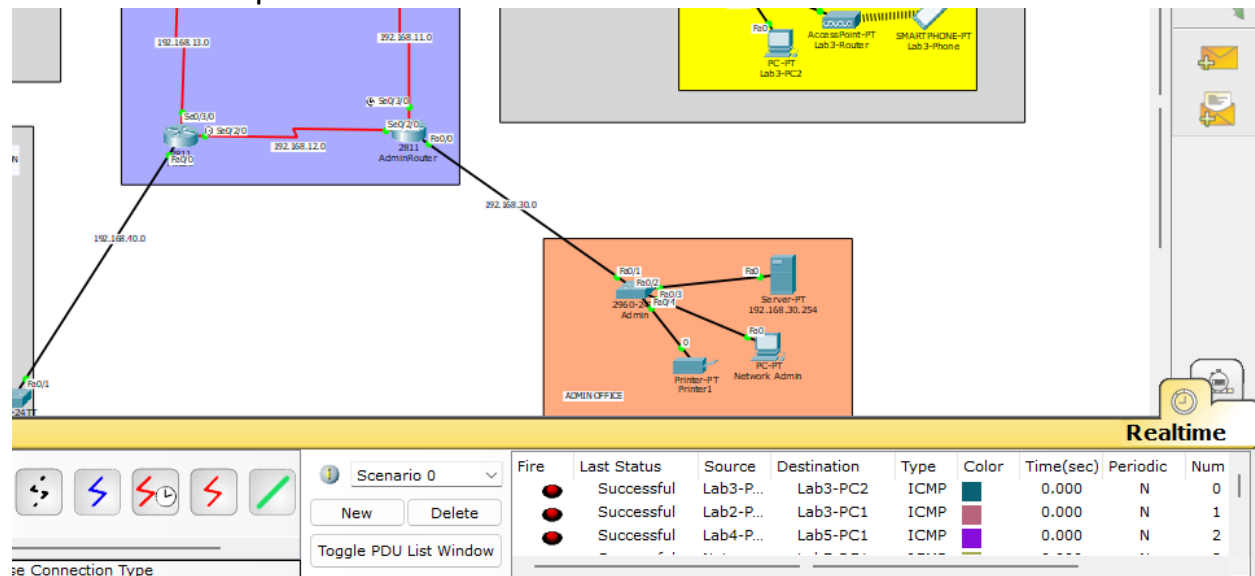
Back   Auto Capture / Play   Capture / Forward

Event List Filters - Visible Events
ACL Filter, ARP, BGP, CDP, DHCP, DHCPv6, DNS, DTP, EIGRP, EIGRPv6, FTP, H.3
HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, LACP, NDP, NETFL
NTP, OSPF, OSPFv6, PAgP, POP3, RADIUS, RIP, RIPng, RTP, SCCP, SMTP, SNMP,
SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, VTP

Edit Filters   Show All/None

14.999   Power Cycle Devices   PLAY CONTR...

atus	Source	Destination	Type
rogress	Lab6-P...	AILab	ICMP

Scenario 0

New   Delete

Toggle PDU List Window

Some success packets sent:

Challenges and Learnings:

I struggled with configuring NAT due to confusion between public and private IPs, which helped me understand their roles in networking. Setting up DHCP was also a learning experience, as I initially faced issues understanding how it dynamically assigns IPs. These challenges improved my networking knowledge.

Conclusion:

This project provided valuable hands-on experience in networking concepts such as DHCP, RIP routing, and NAT. Despite initial challenges, I gained a deeper understanding of IP management and dynamic configuration. The project demonstrated how different departments in a research lab can be interconnected, also making sure that in future if the network is expanded, its dynamic nature will make it much easier!