National University
Of Computer and Emerging Sciences

COMPUTER NETWORKS PROJECT

Hospital Network Design with DHCP, EIGRP Routing, and NAT Implementation

Submitted by:
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CS - H

Objective:

The goal of this project is to design a robust, scalable, and efficient network for a hospital environment using Cisco Packet Tracer. It features multiple networks to separate different hospital departments, with a central IT department subnet hosting a DHCP server for dynamic IP allocation. EIGRP (Enhanced Interior Gateway Routing Protocol) was used for routing between the departments, and Network Address Translation (NAT) was implemented to allow internal devices to access external networks securely. The hospital's network is designed with the following subnets:

1. **IT Department**: Contains the DHCP server.
2. **Entrance/Reception**: Network for front desk and visitor-facing services.
3. **Private Ward**: Network for patients in private rooms.
4. **General Ward**: Network for patients in general rooms.
5. **Clinic Area**: Further divided into:
    - **Operation Department**
    - **Emergency Department**
    - **General Medicine**

Technologies Used:

- **Cisco Packet Tracer**: Network simulation tool for designing and testing network topologies.
- **Routing Protocol: EIGRP**: Used for efficient routing across all hospital departments.
- **DHCP Server**: Configured within the IT department for automatic IP assignment.
- **NAT (Network Address Translation)**: Implemented on the IT department router to allow internal hosts to communicate with external networks.

Implementation Details:

Design and Approach:

- **Network Topology**: The network is divided into different subnets for the IT department, entrance/reception, private ward, general ward, and clinic area, with each having its own router.
    - The **IT department router** is connected to other department routers and hosts the **DHCP server** for dynamic IP assignment.
    - **EIGRP** routing is used to enable communication between the routers, ensuring efficient routing within the hospital network.
    - **NAT** is implemented on the IT department router to allow devices in private subnets to access the internet.

Router and Subnet Configuration:

1. **IT Department Subnet**:
    - The IT department subnet contains a **DHCP server** that dynamically assigns IP addresses to devices in the hospital network.
    - **Router Configuration**: EIGRP is used to advertise routes to other subnets and configure NAT for internet access.

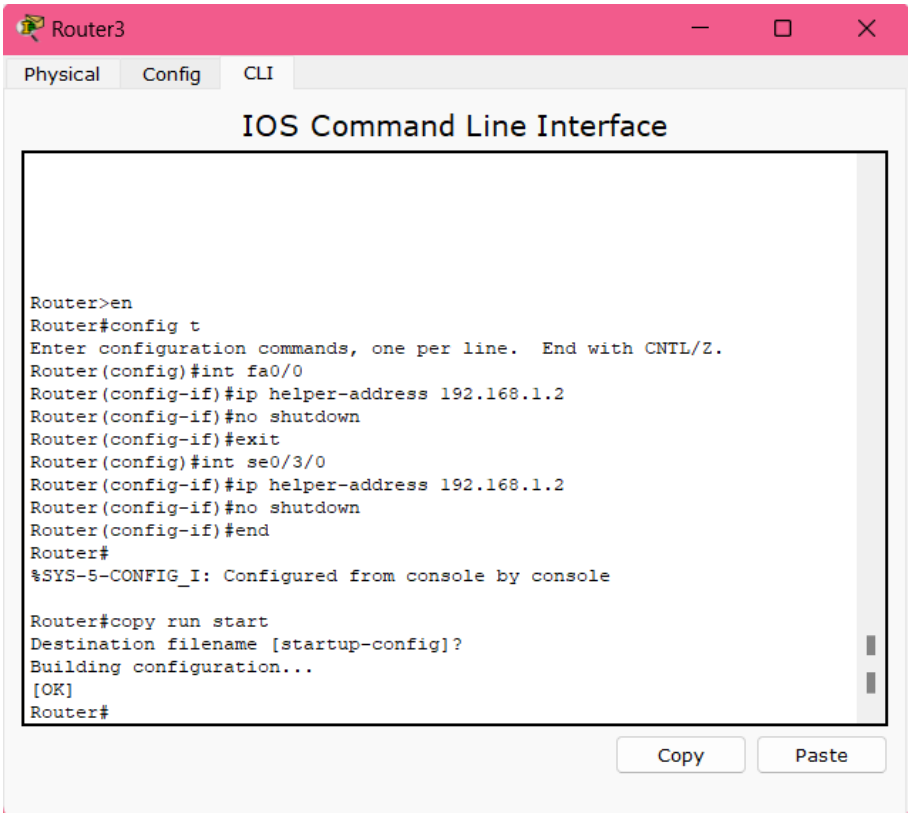
2. **EIGRP Routing Configuration:**
    - EIGRP is used between all routers to ensure that each subnet is reachable.
    - The routers within the IT department and other hospital departments exchange routing information dynamically.
3. **NAT Configuration (on IT Department Router):**
    - NAT is used to allow internal devices in private subnets to access external networks (e.g., the internet) while maintaining security.
4. **Subnetting:**
    - The network is subdivided into sub networks to optimize traffic, isolate departments, and enhance security.
    - Subnet mask 255.255.255.0 was used for each department.

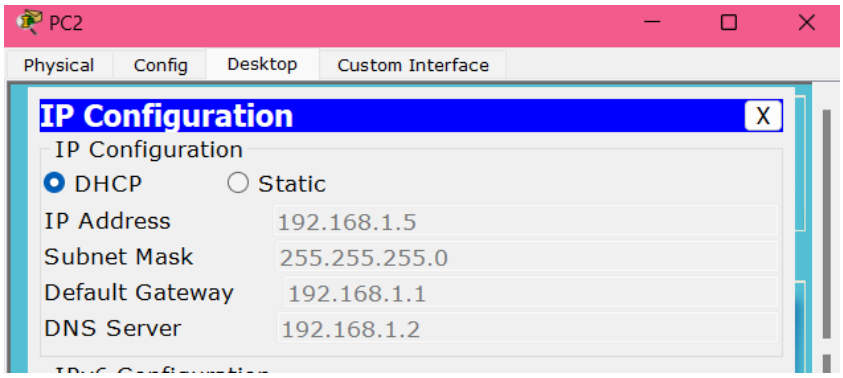
Results and Testing:

Network Testing:

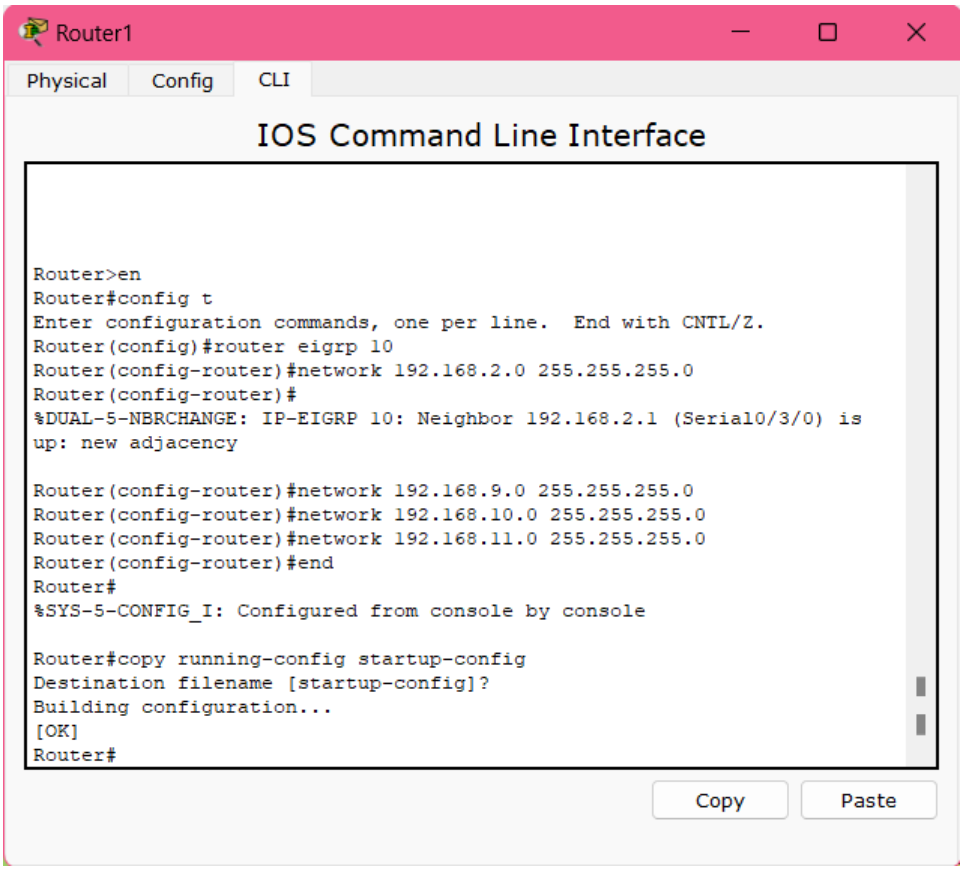
1. **Connectivity Test**:
   Sending packets from one department to another.
2. **DHCP Functionality Test**:
   Devices in the private ward and general ward were verified to automatically receive IP addresses from the DHCP server in the IT department.
3. **NAT Functionality Test**:
   Devices in internal subnets (e.g., private ward, clinic area) were tested to ensure they could access the internet using NAT.

DHCP:



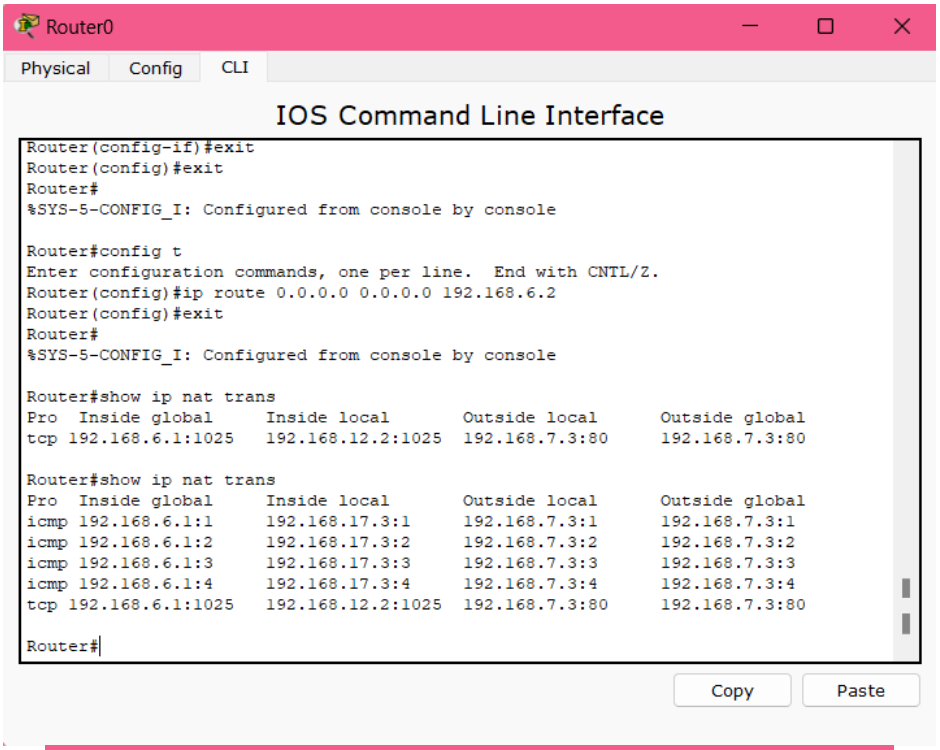


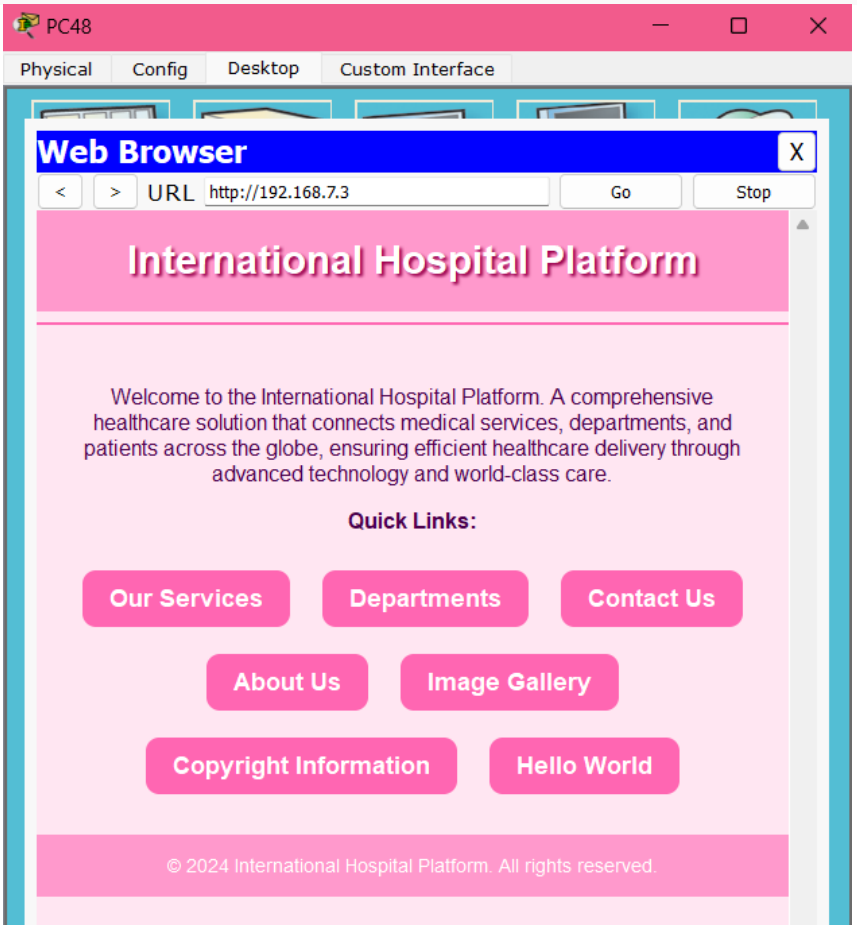
EIGRP:



Fire	Last Status	Source	Destination	Type	Color	Time(se	Periodic	Num	Edit	Delete
	Successful	Route...	Router6	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Route...	Server0	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Route...	Router2	ICMP		0.000	N	2	(edit)	(delete)

NAT:


Router0
Physical
Config
CLI
IOS Command Line Interface
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.6.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#show ip nat trans
Pro Inside global Inside local Outside local Outside global
tcp 192.168.6.1:1025 192.168.12.2:1025 192.168.7.3:80 192.168.7.3:80
Router#show ip nat trans
Pro Inside global Inside local Outside local Outside global
icmp 192.168.6.1:1 192.168.17.3:1 192.168.7.3:1 192.168.7.3:1
icmp 192.168.6.1:2 192.168.17.3:2 192.168.7.3:2 192.168.7.3:2
icmp 192.168.6.1:3 192.168.17.3:3 192.168.7.3:3 192.168.7.3:3
icmp 192.168.6.1:4 192.168.17.3:4 192.168.7.3:4 192.168.7.3:4
tcp 192.168.6.1:1025 192.168.12.2:1025 192.168.7.3:80 192.168.7.3:80
Router#
Copy
Paste


PC48
Physical
Config
Desktop
Custom Interface
Web Browser
X
URL
http://192.168.7.3
Go
Stop
International Hospital Platform
Welcome to the International Hospital Platform. A comprehensive healthcare solution that connects medical services, departments, and patients across the globe, ensuring efficient healthcare delivery through advanced technology and world-class care.
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Hello World
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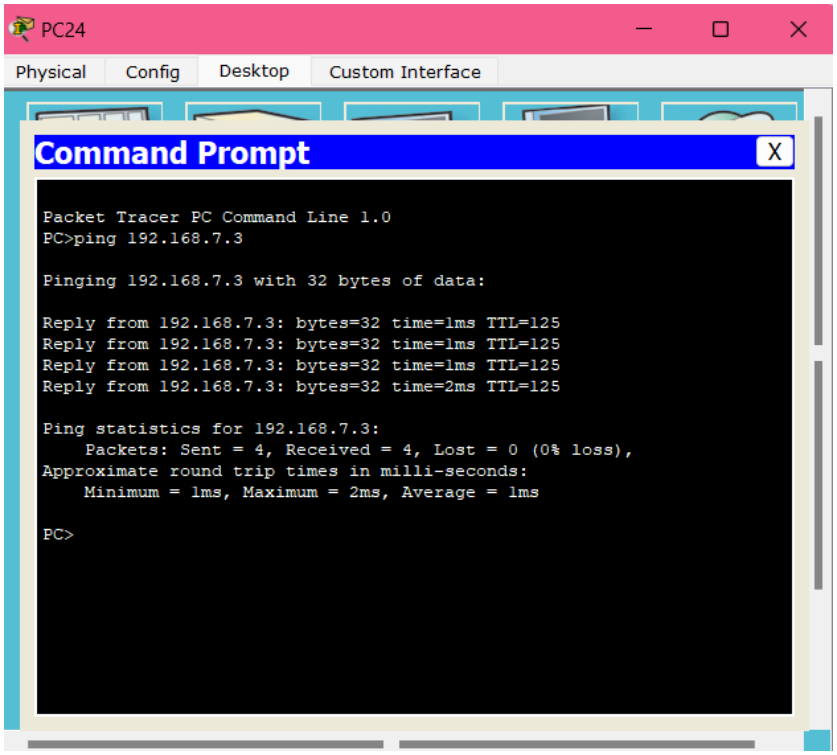
PC24
Physical
Config
Desktop
Custom Interface
Command Prompt
X
Packet Tracer PC Command Line 1.0
PC>ping 192.168.7.3
Pinging 192.168.7.3 with 32 bytes of data:
Reply from 192.168.7.3: bytes=32 time=1ms TTL=125
Reply from 192.168.7.3: bytes=32 time=1ms TTL=125
Reply from 192.168.7.3: bytes=32 time=1ms TTL=125
Reply from 192.168.7.3: bytes=32 time=2ms TTL=125
Ping statistics for 192.168.7.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 2ms, Average = 1ms
PC>

Challenges and Learnings:

1. **Routing Complexity**:
   Implementing EIGRP and ensuring proper route advertisement between multiple routers presented some challenges. Debugging the routing tables and ensuring that all routers had proper EIGRP configurations was crucial.
2. **NAT Configuration**:
   Setting up NAT required careful attention to the interface configuration and access control lists (ACLs). Testing the translation from private IP addresses to public IP addresses was vital to ensure internet access.

Learnings:

- Gaining a deeper understanding of EIGRP and how it dynamically updates routing tables.
- Practical experience with configuring DHCP and NAT in a real-world scenario.

Conclusion:

This project successfully demonstrates the design and implementation of a hospital network with multiple sub networks, routers, and a DHCP server. By using EIGRP for routing, NAT for internet access, and subnetting for security and network organization, the network can handle the specific requirements of different hospital departments while providing robust connectivity.

Future Recommendations:

- Explore the use of ACLs for enhanced security, restricting access between departments.
- Consider the scalability of the network design, especially if additional departments or services need to be added in the future.
- Consider the number of hosts required in each subnet and do VLSM.