Hospital Network Design

Semester Project

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by

Rimsha Ayoub

Reg. No. 2022-UOK-04536

Aamna Iqbal

Reg. No. 2022-UOK-04506

Supervised by

Sir Bilal Ahmed

Faculty of Computing and Engineering

University of Kotli, Azad Jammu and Kashmir

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Abstract

This project designs a secure and efficient Hospital Network using Cisco Packet Tracer. A complete LAN setup was created with routers, switches, PCs, printers, and servers like DHCP, DNS, Email, and Web. IP addressing and routing were configured to automate device communication. Connectivity was tested using ping. The final network ensures smooth data flow, easy management, and reliable communication across all hospital departments.

1. Introduction

Hospitals need a fast and reliable network so doctors, nurses, and staff can share patient information quickly and safely. This project builds a hospital network in Packet Tracer to show how data moves between wards, labs, offices, and servers. Networking improves patient care, supports electronic records, and helps in daily hospital operations. The simulated design includes routers, switches, IP addressing, and important servers similar to a real hospital setup.

2. Objectives

- Understand how LAN communication works in hospital departments
- Assign and configure static and DHCP IP addresses
- Test full connectivity using the ping command
- Design a secure and scalable hospital network
- Implement key services such as DNS, DHCP, Email, and Web

3. Tools & Software Used

Tool : Cisco Packet Tracer

Version : 8.1 / 8.2

Purpose : Network designing and simulation

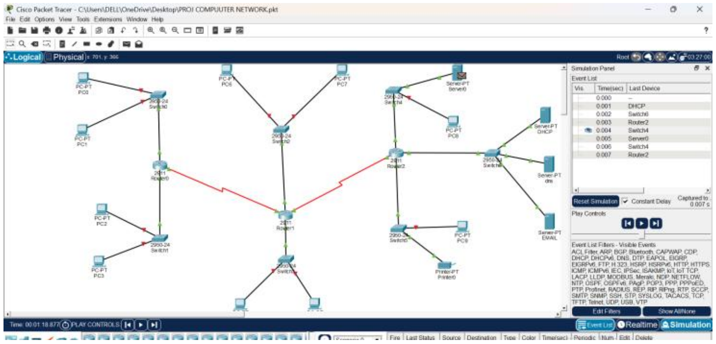
4. Tools & Software Used

In this project, Cisco was used to design and simulate the hospital network. It provides strong and secure devices such as routers and switches. Cisco Packet Tracer helped in creating, viewing, and testing the network easily. It is widely used in hospitals, schools, and companies for network planning and simulations.

5. Network Topology

The hospital network uses a **Hybrid Topology**. Each department works as a Star network connected to switches, and all switches connect to three main routers.

- **Type:** Hybrid
- Three Cisco routers (Router0, Router1, Router2) connect the main departments.
- Router1 works as the center, linking Router0 and Router2.
- Switches manage local LANs like wards, labs, and admin offices.
- Servers provide shared services across the hospital (DNS, DHCP, Email, Web).



6. Device List

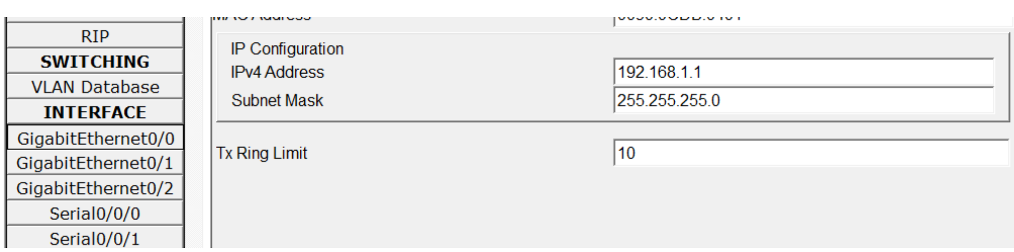
Device Name	Type	Model	Simple Purpose
Router0, Router1, Router2	Routers	2911	Connect all network segments, route data between departments, and act as gateways.
Switch0 – Switch6	Switches	2960	Connect PCs and devices inside each LAN and manage local traffic.

DHCP Server	Server	Server-PT	Gives IP addresses automatically to all devices.
DNS Server	Server	Server-PT	Converts website names into IP addresses.
Email Server	Server	Server-PT	Handles email sending and receiving in the network.
PC0 – PC9	End Devices	PC-PT	Workstations for staff to access hospital systems and services.
Printer0	End Device	Printer-PT	Shared network printer for users.

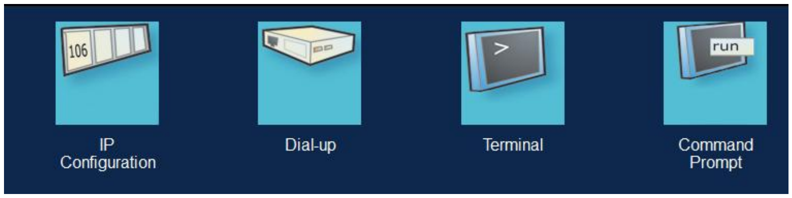
7. Implementation Steps

The following steps outline the high-level process followed to implement and configure the network topology in Cisco Packet Tracer:

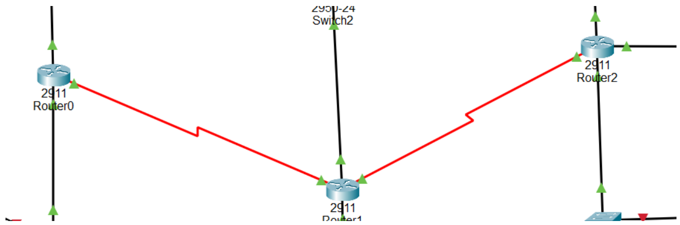
1. **Physical Layout & Cabling:** All devices were placed according to the topology map and connected using appropriate cables (Straight-through for host-to-switch/router-to-server, Crossover for switch-to-switch/router-to-router links, or Serial DTE/DCE for WAN links).
2. **IP Addressing Plan:** A clear, non-overlapping subnetting scheme was designed. Subnets were assigned to each LAN segment (connected to a switch) and the point-to-point links between the routers.



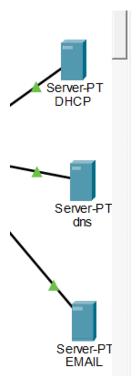
3. **Basic Device Configuration:** Hostnames, console, and VTY passwords were configured on all routers and switches for security and easy identification.



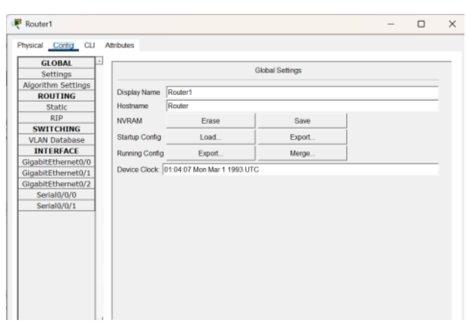
4. **Router Interface Configuration:** IP addresses were assigned to all FastEthernet and Serial interfaces on Router0, Router1, and Router2. All interfaces were activated using the no shutdown command.



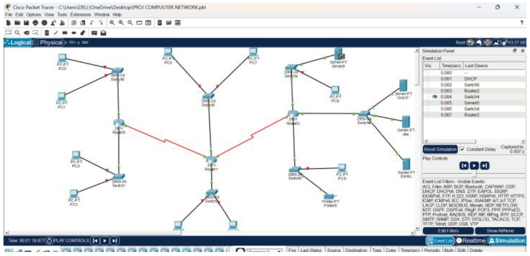
5. **Server Configuration:** The dedicated servers were configured:
   - **DHCP Server:** Configured with static IP and the DHCP service enabled to assign dynamic IPs, default gateway, and DNS server address for its respective LAN.
   - **DNS & Email Servers:** Configured with static IP addresses, and their services (DNS, SMTP, POP3) were enabled and populated.



6. **Routing Protocol Configuration:** A dynamic routing protocol (e.g., OSPF or EIGRP) was configured on Router0, Router1, and Router2 to exchange routing information, ensuring that all subnets across the entire network are reachable.



7. **End Device Configuration:** All PCs and the printer were set to use DHCP to obtain their network settings automatically, or were manually configured if required (like the servers).



8. Simulation & Testing

Ping Test:

A PC was used to ping its gateway, other PCs in the same LAN, devices in other LANs, and all servers. All ping replies were successful with low delay.

Routing Verification:

Traceroute was run from a PC to a remote server. The path showed packets moving through the switch, then the router, then the backbone routers, and finally reaching the server.

DHCP Testing:

A PC was set to obtain an IP automatically. It correctly received an IP address, subnet mask, gateway, and DNS from the DHCP server.

DNS Testing:

A service was accessed using a domain name instead of an IP address. The DNS server successfully translated the name to an IP, proving it was working properly.

9. Results & Discussion

Successes:

The network worked smoothly across all departments. All routers communicated properly, and devices could reach each other through Layer 3 routing. Core services like DHCP, DNS, and Email worked successfully, allowing devices to get IPs automatically and resolve domain names.

Challenges & Solutions:

- **Routing Issue:** Some remote networks were not reachable at first.
- **Solution:** Correct routing protocol settings were added on all routers, and WAN interfaces were properly included.
- **DHCP Issue:** PCs in another network were not receiving IP addresses.
- **Solution:** The IP helper-address command was added on the router so DHCP requests could be forwarded to the central DHCP server.

10.Conclusion

This project gave practical experience in designing and testing a complete hospital network in Cisco Packet Tracer. It highlighted the importance of proper IP addressing, using dynamic routing for smooth communication, and setting up key services like DHCP and DNS.

Future Improvements:

- **Add Security:** Use ACLs on routers to control unwanted traffic and improve security**.**
- **Use VLANs:** Create VLANs on switches to separate departments and reduce unnecessary traffic.
- **Add Redundancy:** Add another router to avoid network failure and make the backbone more reliable.

11.References