Design and Simulation of a Hospital Management Network Using Cisco Packet Tracer

Aditya R Pai, Dheeraj M, Hisham Hassan Konadath, Jayasoorya S, Sanchana P Thomas
Dept. of Electronics and Communication Eng.,
Amrita Vishwa Vidyapeetham, Amritapuri, Kollam, Kerala, India

***Abstract*—The current paper summarizes the analysis and development of a virtual hospital network in Cisco Packet Tracer. The healthcare network links different departments including IT, Clinical, Reception, General Ward, Private Ward, and a Guest Lobby with the help of routers, switches, and wireless access points. The different departments share a static IP routing that is in a separate subnet. The simulation confirms inter-department communication, server access, and wireless guest access to his or her place.**

***Index Terms*—Computer Networking, Cisco Packet Tracer, Subnetting, Static Routing, Hospital LAN Design, Wireless Access, Access Control.**

I. Introduction

Real time exchange of information between administrative offices, admission desks and diagnostic laboratories is a must in the modern day hospitals which require effective and secure communication infrastructure. This project makes use of Cisco Packet Tracer where a scalable and secure network of a hospital is simulated and addresses the aspect of inter-router communication, segregation among departments, and access of servers by multiple subnets. The hospital environment needs accessibility, dependability, and segregation of the services to facilitate better workflow and security.

II. Objectives

- Plan a modular hospital LAN and then segment LAN based on department.
- The installation of static IP between the routers to allow communication across departments must be done.
- Install centralized servers of DNS, FTP, and HTTP.
- Introduce wireless guest network which is not interconnected with the internal common hospital network.
- Test the network performance with tests based on ICMP as well as tests based on services.

III. Methodology

A. Network Topology Design

The network topology is designed to reflect the actual departmental structure of a hospital. The network is divided into six logical areas:

1) **IT Department** (192.168.1.0/24): Contains servers and IT staff PCs.
2) **Clinical Area** (192.168.2.0/24): Includes diagnostic equipment and consulting room PCs.
3) **Reception Area** (192.168.3.0/24): Houses the front desk and patient record access systems.
4) **General Ward** (192.168.4.0/24): Provides staff PCs for managing patient information.
5) **Private Ward** (192.168.5.0/24): Handles high-security patient records.
6) **Guest Lobby** (10.0.0.0/24): Allows wireless access for visitors, isolated from internal systems.

Each department is connected via a switch to a dedicated router interface. Routers are interconnected using serial DCE cables on point-to-point subnets such as 192.168.6.0/30, 192.168.7.0/30, and 192.168.9.0/30. This design ensures modularity, security, and scalability.

B. Device and IP Configuration

Each department's router interface is assigned an IP address and subnet mask relevant to its network segment. PCs and servers are manually configured with static IPs, default gateways, and DNS entries. The wireless router provides DHCP service to guest devices in the lobby.

```
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
no shutdown
interface Serial2/0
ip address 192.168.6.1 255.255.255.252
clock rate 64000
no shutdown
ip route 192.168.2.0 255.255.255.0 192.168.6.2
ip route 192.168.3.0 255.255.255.0 192.168.6.2
```

C. Server Deployment

The DNS server provides name resolution for internal services. HTTP servers host the hospital portal, and FTP servers are used to share records between departments. These are hosted in the IT and Reception departments and are reachable from all subnets.

D. Wireless Access Configuration

The WRT300N wireless router is connected to the IT router and configured with DHCP. It issues addresses in the 10.0.0.0/24 range. Wireless clients, including smartphones and tablets, can access internet-facing services but are restricted from accessing internal hospital networks.

E. Routing Configuration

Static routing is implemented on all routers. Each router includes route entries for all other subnets with the next-hop IP pointing to the neighboring router's interface. This ensures deterministic packet forwarding and minimizes routing overhead.

F. Testing and Validation

Ping tests (ICMP) are conducted between PCs in different departments to confirm connectivity. HTTP and FTP access tests are run from various PCs to verify server reachability. Wireless clients are validated using web browsing and DHCP lease checks.

IV. Results

Simulation results demonstrate that:

- Communication is effective and possible among all departments.
- IT and Reception servers can be accessed by any subnet.
- The wireless clients are given dynamic IP addresses and have a secure access to web services.
- Interdepartmental communication is made sound through static routing.

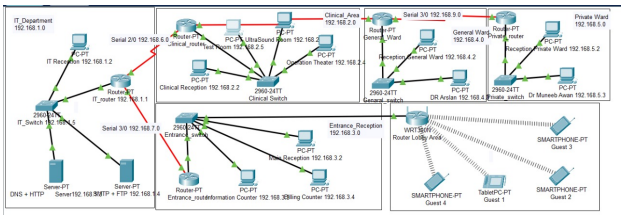

Fig. 1. Logical Topology of the Hospital Network

V. Conclusion

The network of the hospital management was simulated successfully in Cisco Packet Tracer, which showed adequate inter-departmental communication, central access of the server, as well as safe wireless access given to the guests. The project supports important networking principles of subnetting, use of static routes, IP addressing and deployment of services on a controlled network environment. In the future, it may be possible to combine VLANs, OSPF routing, and firewall services to make it perform better and be more secure.

References

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