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Hospital Network System

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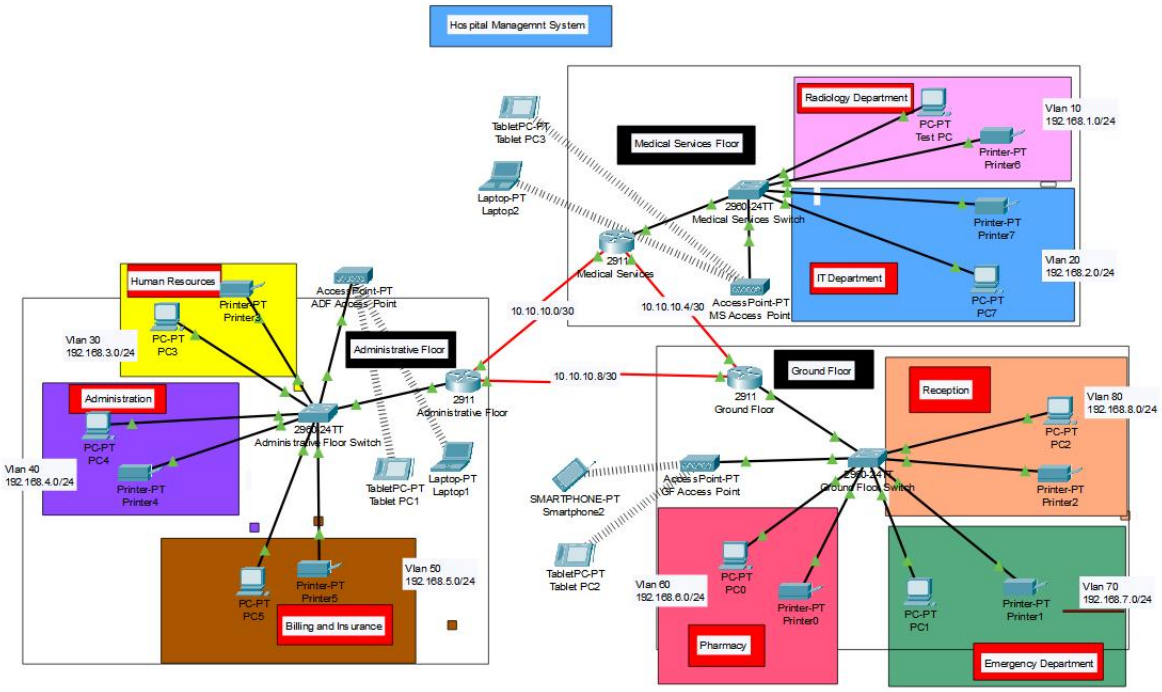
1. INTRODUCTION

This project focuses on the design and implementation of a *network for a hospital management system*. The network is designed to handle the critical operations of a hospital, including patient registration, billing, and medical services. To ensure efficiency and security, VLANs were implemented to segment departmental traffic, and inter-VLAN communication was enabled using a router.

The design emphasizes basic network configuration, **VLAN-based segmentation, IP addressing, and static routing** to ensure smooth connectivity between all hospital departments.

2. NETWORK DESIGN

2.1 Topology Diagram



2.2 Justification of Design

The network is organized into three floors, each with specific hospital departments:

- **Ground Floor:** Reception, Emergency Department, and Pharmacy
- **Administrative Floor:** Billing and Insurance, Human Resources, and Administration
- **Medical Services Floor:** IT Department and Radiology

Each floor has its own router connected to departmental VLANs. VLANs provide traffic isolation to enhance security and network efficiency. Inter-VLAN routing is implemented using a central router, allowing seamless communication between departments when needed.

3. CONFIGURATION DETAILS

3.1 VLAN Configuration

The following VLANs were configured:

- **VLAN 10 (Radiology):** Dedicated to imaging and patient report systems.
- **VLAN 20 (IT Department):** For network management and support.
- **VLAN 30 (Human Resources):** Handles HR-related communications.
- **VLAN 40 (Administration):** Segregated for management operations.
- **VLAN 50(Billing and Insurance):** Manages billing and insurance claims.
- **VLAN 60 (Pharmacy):** Isolated for pharmacy-related systems.
- **VLAN 70 (Emergency Department):** Handles emergency operations traffic.
- **VLAN 80 (Reception):** Dedicated for reception operations.

3.2 IP Addressing and Subnetting Scheme

Each VLAN was assigned a unique subnet to manage IP addresses effectively. The subnets are as follows:

- **VLAN 10 (Radiology):** 192.168.1.0/24

```
ip dhcp pool Radiology
 network 192.168.1.0 255.255.255.0
 default-router 192.168.1.1
 dns-server 192.168.1.1
```

- **VLAN 20 (IT Department):** 192.168.2.0/24

```
ip dhcp pool IT
 network 192.168.2.0 255.255.255.0
 default-router 192.168.2.1
 dns-server 192.168.2.1
!
!
```

- **VLAN 30 (Human Resources):** 192.168.3.0/24

```
ip dhcp pool Human
 network 192.168.3.0 255.255.255.0
 default-router 192.168.3.1
 dns-server 192.168.3.1
!
```

- **VLAN 40 (Administration):** 192.168.4.0/24

```
ip dhcp pool Administration
 network 192.168.4.0 255.255.255.0
 default-router 192.168.4.1
 dns-server 192.168.4.1
```

- **VLAN 50 (Billing and Insurance):** 192.168.5.0/24

```
ip dhcp pool Billing
 network 192.168.5.0 255.255.255.0
 default-router 192.168.5.1
 dns-server 192.168.5.1
```

- **VLAN 60 (Pharmacy):** 192.168.6.0/24

```
ip dhcp pool Pharmacy
 network 192.168.6.0 255.255.255.0
 default-router 192.168.6.1
 dns-server 192.168.6.1
```

- **VLAN 70 (Emergency Department):** 192.168.7.0/24

```
ip dhcp pool Emergency
 network 192.168.7.0 255.255.255.0
 default-router 192.168.7.1
 dns-server 192.168.7.1
```

- **VLAN 80 (Reception):** 192.168.8.0/24

```
ip dhcp pool Reception
 network 192.168.8.0 255.255.255.0
 default-router 192.168.8.1
 dns-server 192.168.8.1
```

3.3 Security Measures

- Access Control Lists (ACLs): Applied to restrict inter-departmental communication and unauthorized access to sensitive data.

```
[Connection to 192.168.6.1 closed by foreign host]
C:\>ssh -l getch 192.168.4.1

Password:



AFRouter>exit
```

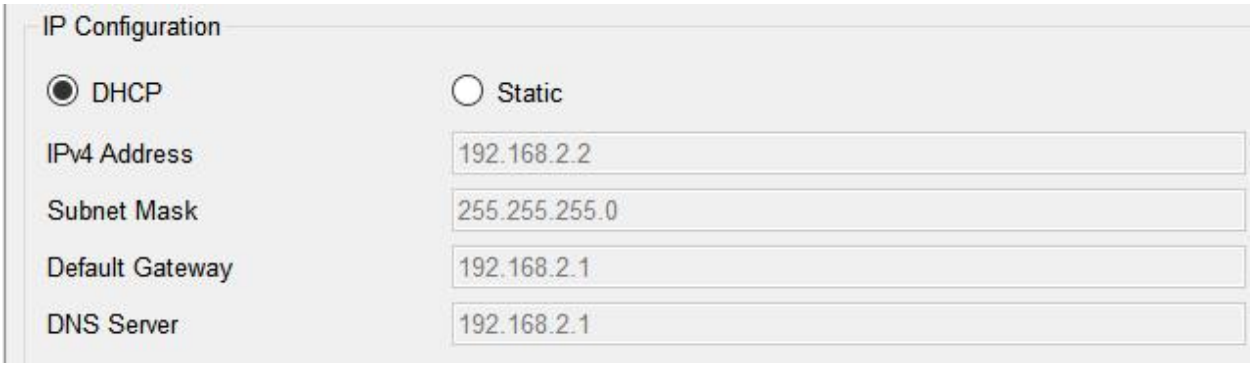
- VLAN Isolation: Ensures departmental traffic is segregated to maintain security and efficiency.

```
[Connection to 192.168.4.1 closed by foreign host]
C:\>ssh -l getch 192.168.6.1

Password:



GFRouter>exit

[Connection to 192.168.6.1 closed by foreign host]
```

4. ROUTING OPTIMIZATION

4.1 Static Routing Overview

Static routing was used to enable inter-VLAN communication between departments on different floors. Each router was configured with static routes to direct traffic between connected subnets efficiently. This approach ensures predictable and secure data flow across the network.



5. TESTING AND VALIDATION

5.1 Connectivity Validation

Network connectivity was tested using ping commands to verify successful communication between VLANs. Each department was able to connect to other necessary departments, ensuring inter-VLAN routing worked as intended.

- **Pinging from 192.168.2.2 to 192.168.4.2**

```
C:\>ping 192.168.4.2

Pinging 192.168.4.2 with 32 bytes of data:

Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.4.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

- **Pinging from 192.168.4.2 to 192.168.8.2**

```
C:\>ping 192.168.8.2

Pinging 192.168.8.2 with 32 bytes of data:

Reply from 192.168.8.2: bytes=32 time=2ms TTL=126
Reply from 192.168.8.2: bytes=32 time=1ms TTL=126
Reply from 192.168.8.2: bytes=32 time=1ms TTL=126
Reply from 192.168.8.2: bytes=32 time=10ms TTL=126

Ping statistics for 192.168.8.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 3ms
```

5.2 Packet Flow Analysis using Wireshark

Wireshark was used to monitor network traffic and validate the implementation of VLAN isolation and inter-VLAN routing. The analysis confirmed that traffic within each VLAN remained isolated and only authorized communication occurred between VLANs.

6. CONCLUSION

The hospital management system network was successfully designed and implemented. By utilizing VLANs and static routing, the network ensures secure and efficient communication between hospital departments. This design supports the hospital's operational requirements and provides a foundation for potential future enhancements, such as dynamic routing protocols or additional network services.