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Healthcare Network Simulation

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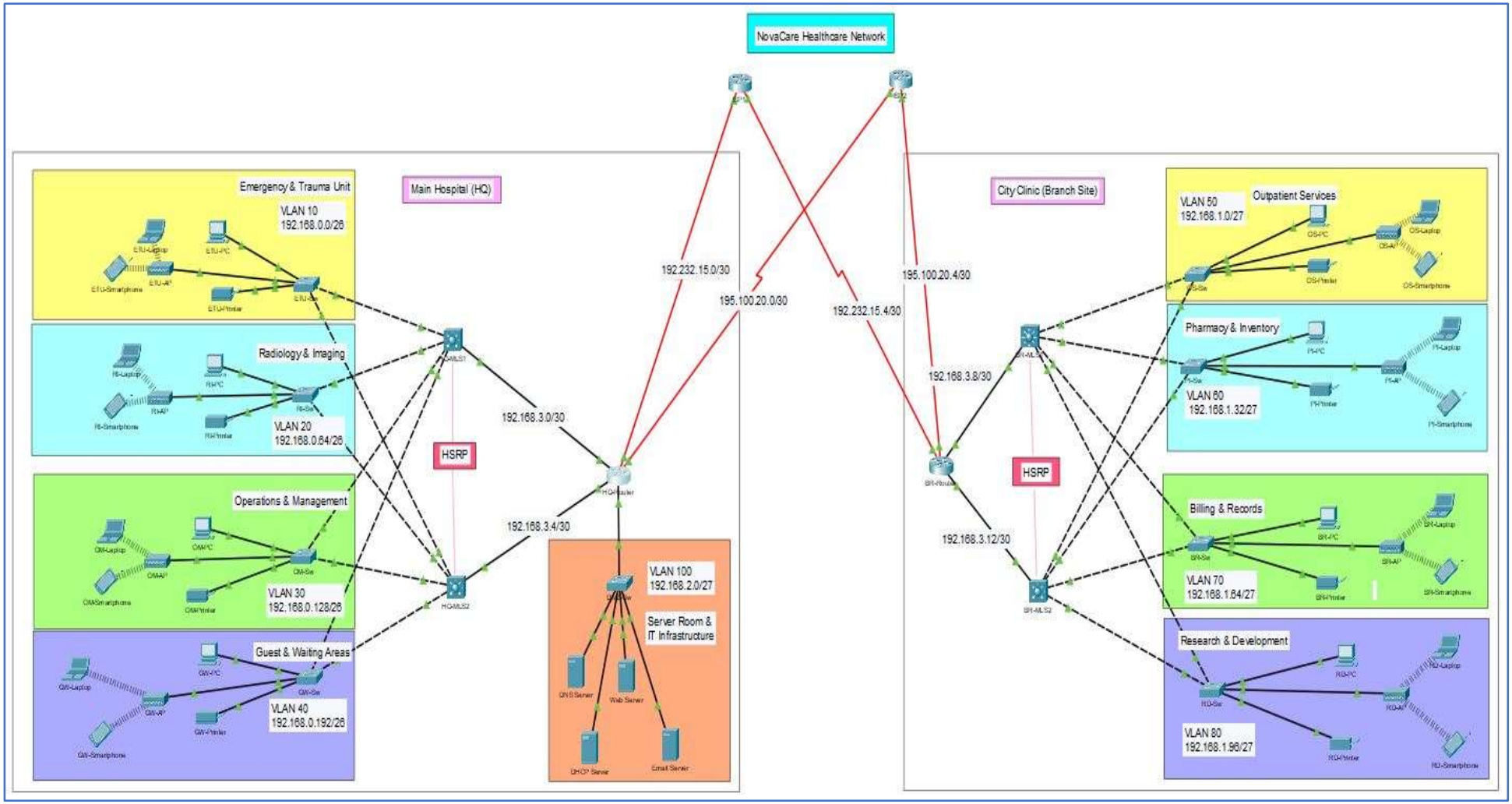
Network Topology Diagram



NovaCare Healthcare Network Infrastructure Project

Client: NovaCare Medical Group

Locations: Main Hospital (HQ) & City Clinic (Branch Site)

1. Objective:

Deploy a new, resilient network infrastructure connecting two healthcare facilities, ensuring secure communication, optimized performance, and departmental segmentation.

2. Background

NovaCare Medical Group is expanding operations by establishing a new City Clinic. This expansion requires a comprehensive, fault-tolerant network infrastructure, securely linked to the Main Hospital. The goal is to support uninterrupted collaboration between healthcare professionals, allowing them to share medical records, access clinical systems, and coordinate patient care—regardless of hardware failure or site outages.

3. Project Scope

3.1. Network Setup & Departmental Segmentation

Main Hospital (HQ) Departments:

- Emergency & Trauma Unit – High-priority network access.
- Radiology & Imaging – Secure storage and transfer of medical scans.
- Operations & Management – Administrative network segment.
- Guest & Waiting Areas – Public Wi-Fi segment.
- Server Room & IT Infrastructure – Hosts critical services.

City Clinic (Branch Site) Departments:

- Outpatient Services – Consultation and treatment areas.
- Pharmacy & Inventory – Medication management system access.
- Billing & Records – Financial transactions and patient records.
- Research & Development – Medical data analytics and studies.

3.2. Server Infrastructure at Main Hospital

- DNS Server – Manages domain resolution for both sites.
- DHCP Server – Handles dynamic IP allocation across departments.
- Web Server – Hosts internal applications like scheduling and reports.
- Email Server – Manages hospital-wide staff communication.

3.3. High Availability via HSRP

To ensure gateway redundancy and optimized resource utilization, Hot Standby Router Protocol (HSRP) is implemented on paired multilayer switches at both HQ (HQ-MLS1 & HQ-MLS2) and the branch site (BR-MLS1 & BR-MLS2).

At each site:

- MLS-1 holds higher HSRP priority for two VLANs
- MLS-2 holds higher HSRP priority for the remaining two VLANs

This strategy provides not only failover protection, but also distributes active gateway responsibilities, promoting load balancing and efficient usage of both switches.

Example for VLAN 40 (Guest & Waiting Area):

HQ-MLS1

```
interface vlan 40
 ip address 192.168.0.194 255.255.255.192
 ip helper-address 192.168.2.3
 standby version 2
 standby 40 ip 192.168.0.193
 standby 40 priority 100
 standby 40 preempt
```

HQ-MLS2

```
interface vlan 40
 ip address 192.168.0.195 255.255.255.192
```

ip helper-address 192.168.2.3

standby version 2

standby 40 ip 192.168.0.193

standby 40 priority 110

standby 40 preempt

4. IP Addressing and Subnetting

4.1 VLAN Allocation Table

VLAN ID	Department	Subnet
10	Emergency & Trauma Unit	192.168.0.0/26
20	Radiology & Imaging	192.168.0.64/26
30	Operations & Management	192.168.0.128/26
40	Guest & Waiting Area	192.168.0.192/26
50	Outpatient Services	192.168.1.0/27
60	Pharmacy & Inventory	192.168.1.32/27
70	Billing & Records	192.168.1.64/27
80	Research & Development	192.168.1.96/27
100	DMZ (External Services)	192.168.2.0/27

5. Inter-Site & ISP Networks

Redundant routed links connect the Main Hospital and City Clinic through dual ISP circuits. OSPF is used internally at each site to distribute departmental routes. Static default routes are configured at the edge routers (HQ-Router and BR-Router) to manage external and inter-site traffic flow.

- On HQ-Router, a default route points to ISP1 as the primary path, with ISP2 as the lower-priority backup.

- On BR-Router, the default route favors ISP2, with ISP1 serving as the backup.

This asymmetric preference enhances redundancy by distributing outbound traffic across ISPs and supporting failover if one link fails.

5.1 Interconnectivity Links Table

Link	Subnet
ISP1 ↔ HQ-Router	192.168.15.0/30
ISP1 ↔ BR-Router	192.168.15.4/30
ISP2 ↔ HQ-Router	195.100.20.0/30
ISP2 ↔ BR-Router	195.100.20.4/30

6. Topology Overview

- Each department has an access layer switch, connected to:
  - A PC, a printer, and an Access Point (AP).
  - A laptop and a smartphone connected to each AP.
- Devices naming convention:
  - Example: ETU-SW, ETU-PC, ETU-Printer, ETU-AP, ETU-Laptop, ETU-Smartphone (for Emergency & Trauma Unit).
  - Similar naming for all other departments.
- HQ Infrastructure:
  - HQ-MLS1 & HQ-MLS2 connect to the HQ-Router and departmental access switches.
- City Clinic Infrastructure:
  - BR-MLS1 & BR-MLS2 connect to the BR-Router and departmental access switches.

7. Key Features of This Scenario

- Uses HSRP and OSPF for high availability and inter-site redundancy.
- Departmental segmentation improves security and performance.
- Centralized servers deliver DHCP, DNS, web, and email services.
- Scalable topology with VLANs, trunking, and standardized device structure.
- Supports critical healthcare applications and mobile client access.

8. Outcome

After deployment, NovaCare Medical Group benefits from a resilient, secure, and efficient multi-site network. Doctors, nurses, and administrative staff collaborate seamlessly across both sites, improving care coordination and operational responsiveness, without service disruption due to hardware or link failures.

9. Final Notes

This network enhances **data integrity, uptime, and performance**, empowering NovaCare Medical Group to expand services confidently with a strong digital backbone.