**Document 5**

**Project Name:** Hospital Network Design

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**First problem.**

One potential problem that might be faced before the implementation of the project is related to the dynamic IP addressing requirement. The hospital aims to provide dynamic IP addressing to all employees from a central server. While dynamic IP addressing offers flexibility and efficient use of IP resources, there are potential challenges associated with its implementation:

**Problem**: IP Address Exhaustion and Scalability

The hospital has around 150 practitioners, and each floor in the main block has at least one computer. Additionally, the wards have 10 computers on the ground floor. As the hospital expands or if more devices are added to the network, there is a risk of exhausting the available IP address pool.

**Solution:**

1. Subnetting and Address Allocation: To logically split the network into smaller subnets, use subnetting. Assign distinct subnets to various hospital areas, such each ward and floor of the main building. This keeps IP addresses from running out in a single pool and aids in effective IP address management.

1. Planning IP Address Ranges: Give great thought to future expansions when arranging the IP address ranges. Give IP addresses according to the number of devices in use today, with space for expansion. As the hospital network develops, check, and change IP address assignments on a regular basis.

1. Use DHCP Lease Management: To effectively recover and reuse IP addresses, set the proper DHCP lease times. In densely populated locations, shorter lease periods for dynamic IP addresses can aid in IP address pool optimization.

1. Monitoring & Auditing: Use monitoring software to monitor IP address utilization. Audit the DHCP logs on a regular basis to look for any anomalies or unusual address usage trends.

1. Communication and Documentation: Keep thorough records of IP address distributions and notify the IT staff of any alterations or additions. This makes sure that everyone concerned is informed about the use of IP address space and any modifications that have been made.

By addressing the IP address exhaustion and scalability concerns through these solutions, the hospital can ensure a smooth and sustainable implementation of dynamic IP addressing for its employees, accommodating both current and future network requirements.

**Second problem.**

**Problem**: Network Performance Bottlenecks.

After implementing the system, a potential challenge could be the emergence of network performance bottlenecks. As the hospital expands and the number of connected devices increases, there might be a strain on the network infrastructure, leading to slow data transfer, delays in accessing the hospital management software, and overall degraded user experience.

**Solution**:

1. Analysis and Monitoring of Traffic:
   * Use network traffic analysis tools to pinpoint devices or programs that consume a lot of bandwidth and are creating bottlenecks.
   * Maintain a regular eye on network performance to quickly identify and resolve any irregularities.
2. Implementing Quality of Service (QoS):
   * Use QoS settings to prioritize important apps, like the hospital administration software.
   * Make sure that during times of high network traffic, vital services are given precedence to avoid performance deterioration.
3. Upgrade your network's hardware:
   * Examine the current networking equipment's capabilities and, if necessary, replace the routers, switches, and other infrastructure parts.
   * Gigabit or 10-gigabit connections should be implemented to effectively manage growing data loads.
4. Load Balancing:
   * Implement load balancing techniques to reduce congestion on certain nodes and evenly distribute network traffic among servers.
   * When distributing requests to the server hosting the hospital administration software, load balancing can be quite helpful.
5. Optimize Wireless Networks:
   * If applicable, arrange access points strategically and make sure there is enough coverage to maximize Wi-Fi networks.
   * Use the most recent Wi-Fi standards to minimize interference and increase data transfer speeds.
6. Regular Network Audits:
   * To find and remove redundant or needless network configurations, conduct routine network audits.
   * Eliminate any unneeded hardware or services that could be causing network congestion.

1. Scaling Resources Proactively:
   * Plan for future expansion by aggressively scaling resources.
   * This could entail monitoring network demands on a regular basis and allocating resources appropriately.

1. Employee Education:
   * Provide training to staff members on how to reduce superfluous bandwidth use, such as steering clear of big file downloads at busy times.

1. Redundancy and Failover techniques:
   * To guarantee uninterrupted network functioning in the event of hardware problems, implement redundancy and failover techniques.
   * Moreover, redundancy can enhance network performance by offering different routes for data transfer.

By addressing these solutions, the hospital can mitigate network performance bottlenecks, ensuring a stable and responsive network even as the organization continues to grow and evolve. Regular monitoring and proactive adjustments are key to maintaining optimal performance in a dynamic healthcare environment.