NWD1781

Group project

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INTRODUCTION

In today's fast-paced digital world, the demand for secure and efficient communication systems within educational institutions is more critical than ever. This project focuses on designing a reliable and cost-effective network solution for **Belgium Campus**. The goal is to enable smooth communication between classrooms, secure access to a centralized server, and ensure a high-speed internet connection for both faculty and students.

Our proposal presents a tailored network design for Belgium Campus, which consists of three classrooms. Each classroom is equipped with one lecturer PC and ten student PCs. **Using Cisco Packet Tracer**, we have crafted a network topology that facilitates efficient file sharing, dynamic IP management, and centralized server access, all while balancing performance and budget considerations.

This report outlines the selection of hardware, IP addressing strategies, and network configuration details, each chosen to maximize functionality and meet the needs of the campus. The overall objective is to create a scalable, secure, and easily manageable network infrastructure that guarantees seamless connectivity and resource access across all devices.

HARDWARE AND NETWORK BREAKDOWN/SELECTION

To design a network that meets the performance and communication needs of a campus environment, we have carefully selected hardware components and networking devices based on their reliability, cost-effectiveness, and scalability. The following is a breakdown of the selected equipment and the rationale behind each choice:

1. **Network Topology**

We have implemented a **star topology**, which connects all devices to a central switch. This topology offers several advantages, including ease of troubleshooting, simplicity in adding new devices, and minimized network collisions.

2. **Router**
   Model- Cisco 1841 Integrated Services Router
   Explanation- This router was selected due to its strong performance capabilities, comprehensive security features, and compatibility with various interfaces. It provides secure, high-speed internet access across the network and can manage substantial data traffic, which is crucial for maintaining continuous access to shared resources like the server.

3. **Switches**
   Model- Cisco Catalyst 2960 Series Switches
   Explanation-These switches offer quick Ethernet connectivity for all devices in the classroom. They are selected for their scalability and energy efficiency, allowing them to accommodate many PCs while keeping latency low. Additionally, these switches support VLAN configuration, enabling traffic segmentation for security and performance.

Model- Cisco 3560(the main switch)

Explanation- The Cisco 3560 series provides high-performance switching capabilities, ensuring low latency and fast data transfer rates, which is essential for handling multiple devices in a classroom environment.

4. **Servers**

Model: Dell PowerEdge R440 Rack Server

Explanation- This server functions as the central point for sharing resources and data storage. The Dell PowerEdge is well-known for its dependable performance, efficiency and ability to support virtualization, making it ideal for the campus setting. It is capable It is capable of handling multiple requests from both the students and lecturers PCs, always ensuring consistent access to data

5. **Wireless Access Point**

Model: Cisco Aironet 1850 Series

Explanation: To enable wireless internet access for both students and staff, wireless network access points have been integrated into the network. These devices provide high-speed wireless connectivity and are designed to support a large number of users at the same time, which is essential in a campus environment where many users rely on wireless connections

6. **PCs:**

Model: Dell OptiPlex 3070

Explanation: Dell OptiPlex have been installed in every classroom for both students and lecturers. These computers were chosen for their reliability, affordability and excellent performance with everyday applications. The OptiPlex series also comes with built-in Ethernet ports, making them ideal for both wired and wireless networks

7. **Cabling**

Type: Cat6 Ethernet Cables

Explanation: To connect the PCs, switches and routers, Cat6 cables were selected. These cables have the ability to support gigabit Ethernet speeds, ensuring the network runs efficiently with low latency. Additionally, Cat6 cables are cost-effective and easily sourced solution, making them an efficient and practical option for this network design.

8. **Firewall**

Model: Cisco ASA 5506-X

Explanation: For enhanced network security, the Cisco ASA firewall was selected. This device safeguards the network from external threats while ensuring that internal communication and

internet access remain secure. The ASA series is known for providing robust security features without affecting the overall network performance.

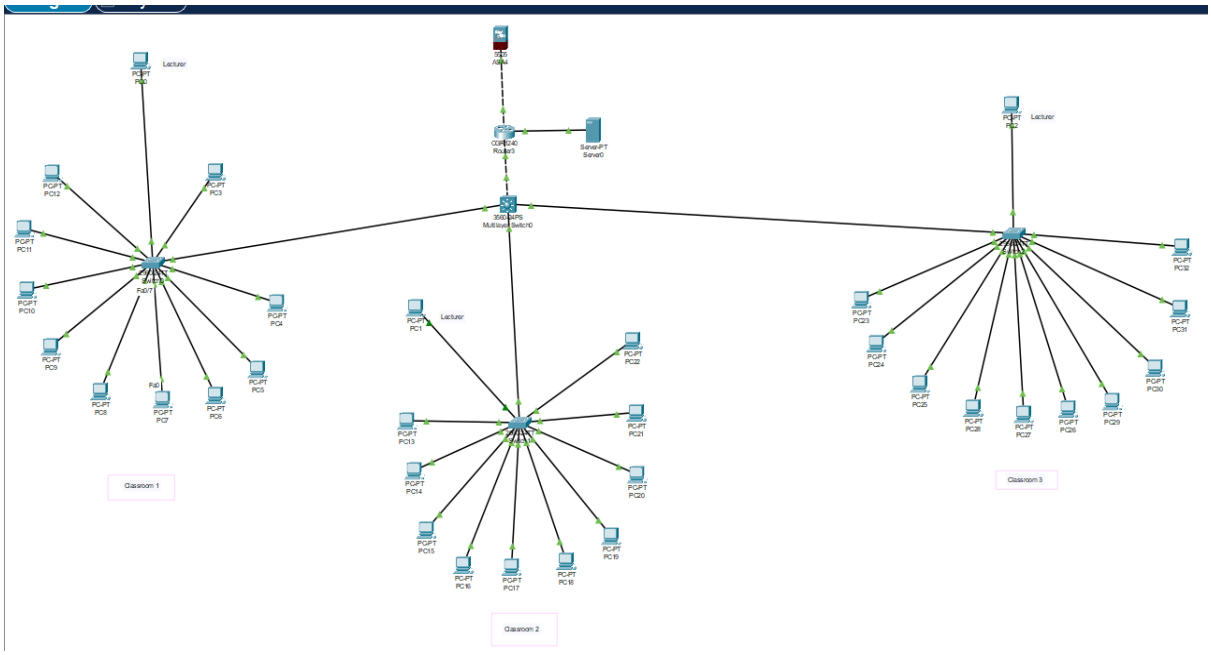
Network Topology Overview:

The campus network is based on a star topology, with a central router and switches interconnecting all classroom devices to the primary server and the internet connection. This configuration enhances reliable communication and allows for easy scalability and troubleshooting.

1)Classroom Design.

- The network consists of 10 student PCs and 1 Lecturer PC connected via a 2930 switch. Each PC is connected to a switch using Ethernet cables, ensuring local communication within the classroom.
- The is only one server which is connected to the router to help managing applications, data storage, and resource sharing and therefore allows centralized access for managing files, applications, and updates for all classroom PCs.
- There is a firewall, that helps with filtering traffic and securing the network.

Network Topology Diagram in Cisco Packet Tracer



TCP/IP Address Configuration, address allocation and DHCP Design and scope

Each classroom is assigned with its own subnet, with static IPs for important devices and dynamics IPs (DHCP) for student PCs. This approach ensures that communication is efficient and important resources are easily accessible.

1. Classroom 1 Subnet: 192.168.
   Lecturer PC: DHCP- 192.168.1.35
   Student PCs: DHCP Range- 192.168.1.3 - 192.168.1.12
2. Classroom 2 Subnet: 192.168.
   Lecturer PC: DHCP- 192.168.1.34
   Student PCs: DHCP- 192.168.1.13 - 192.168.1.22
3. Classroom 3 Subnet: 192.168.
   Lecturer PC: DHCP- 192.168.1.33
   Student PCs: DHCP Range- 192.168.1.23 – 192.168.1.32
4. Server
   TCP/IP Static: 192.168.1.1

Network Solution Explanation

The network plan for Belgium Campus involves setting up a Local Area Network (LAN) that links three classrooms, each containing ten student computers and one lecturer computer, to a main server and high-speed internet. This setup makes it simpler for both students and teachers to connect and share files, improving classroom collaboration. The server serves as a central storage and management hub, allowing the sharing of files, programs, and internet access. By providing high-speed internet throughout the network, students and teachers can access online resources.

The network is arranged in a star topology, where each computer and device in the classrooms connects to a central network switch. This design is chosen because it is relatively easy to manage and expand. If one device has a poor connection and stops working, the other devices and computers remain unaffected. The central switch is connected to a router that provides internet access.

Cost effectiveness:

When establishing a network, particularly for an educational institution like Belgium Campus, prioritizing cost-effectiveness is crucial. Adopting a centralized network design helps minimize the operational expenses related to maintenance and troubleshooting. By using the 2930 switches in each classroom, we can establish

connections effectively between the lecturer PC and student PCs without the use of excessive equipment. These switches function as traffic managers, facilitating quick and efficient communication among devices within a single classroom.

Security:

The security plan for the network design aims to protect internal resources while ensuring smooth communication and data transfer. To secure the campus network, a firewall will be set up at the router to manage incoming and outgoing traffic, blocking unauthorized access from outside sources. Access Control Lists (ACLs) will be used to limit access to sensitive parts of the network, allowing only approved devices and users to interact with important components like the server. Also, user authentication methods, such as username and password, will be required to control access to shared resources, ensuring that only authorized people can access or change crucial files. Keeping network devices and software up to date will be a top priority to guard against known security issues. These security measures together help reduce risks and maintain the network's integrity.

File sharing and communication:

File sharing and communication within the network will be managed through a central server that both students and lecturers can access. This server will have shared folders where lecturers can upload course materials and students can submit assignments, making collaboration easy. To ensure fast and secure file transfers, protocols like FTP (File Transfer Protocol) or SMB (Server Message Block) will be used. These protocols will help devices communicate and exchange data reliably, ensuring that file transfers are quick and safe. The network will be set up to allow smooth communication between student computers and the lecturer's computer, enabling file sharing during classes and encouraging interactive learning.

Conclusion:

In summary, the network design for the Belgium Campus project effectively prioritizes Cost-Effectiveness, Scalability, Reliability, and Ease of Management. By leveraging thoughtful hardware choices, modular architecture, and centralized management practices, the network will not only meet current needs but also be well-positioned to adapt to future demands, ensuring a robust and efficient educational environment. This comprehensive approach creates a reliable foundation for supporting the campus's mission and enhances the overall learning experience for students and faculty alike.