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Faculty network system implementation using Cisco packet tracer

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ABSTRACT

In this study, the faculty network system was designed using the Cisco Packet Tracer program without the use of any physical components. The aim was to simulate the network structure of the faculty to show the engineering faculty on the campus map and enable communication between the computers within the faculty by configuring similar devices with real router, switch, and server configurations. The management of IP configurations of the devices in the network structure and the configuration of the router, switch, and servers (DNS, DHCP, FTP, HTTP, and MAIL) used in the network were implemented in the Cisco Packet Tracer environment to create a simulated network system that can be applied in real systems.

Keywords: Cisco packet tracer, network simulation, university network system

INTRODUCTION

In today's world, the steps involved in creating a network architecture have become an overlooked aspect due to increasing costs. However, design and implementation programs are extremely important for placing network resources in the appropriate position, testing and updating the network system. One of these programs is Cisco Packet Tracer. Cisco Packet Tracer is a simulation program that allows Cisco operations or applications to be performed without the use of any physical machine or tool, providing us with a network laboratory environment [1]. It serves as a design screen to explore networks. It is essential to provide network learning and practical tools for students to simulate or create and manage systems to better understand the philosophy behind networks [2]. Since protocols are implemented only in software, this program cannot replace hardware routers or switches. However, this tool includes not only Cisco hardware but also a wide range of other network devices. This program:

- Supports a multi-user system that allows many users to connect various topologies over a computer network.
- Provides visual presentation, animation, and testing and modeling of difficult and time-consuming projects.
- Has simulation, visualization, evaluation, and control capabilities for networks and peripherals.
- Has logical and physical working areas.

Logical Workspace

The logical workspace displays the logical network topology created by the user. It is used to view the connecting, placement, and clustering of virtual network devices.

Physical Workspace

In the physical workspace, we can see a physical implementation of the logical network. It also shows us how network devices such as switches, routers, and hosts are connected in a real network topology.

DHCP Server (Dynamic Host Configuration Protocol Server)

Provides automatic and centralized management for the distribution of IP addresses within a network. It creates a pool of IP addresses and leases addresses to any DHCP-enabled client when started on the network. Because IP addresses are dynamic rather than static, when an address is no longer used, it is automatically sent back to the pool for reallocation. In short, they are devices that automatically perform all the necessary configurations so that the devices on the network can communicate with each other and reach external networks, and ensure that each device has a unique IP address [3].

DNS Server (Domain Name System Server)

IP addresses are identity-like structures based on a specific protocol, consisting of number blocks, used to distinguish web sites and users on the internet [4]. Web pages on the Internet have their own unique IP addresses, and all users connected to the Internet are assigned an IP address. It's impossible for people to remember that many IP addresses. To solve this problem, the domain name system was created and the problem was eliminated with the DNS servers running in the system. The goal is to translate what a user types into a browser into a language the computer can understand and an address that they can use to find a website.

FTP Server (File Transfer Protocol Server)

It is a service structure that allows FTP users to access files on remote computers [5]. It is a standard network protocol used to transfer files between a client and server in a computer network. It also enables communication between computers on the Internet. One computer acts as a server to store information and the other acts as a client to send or request files from the server. FTP server, which provides data exchange and connection between computers at the same time, creates instant information flow.

Web Server

It is a TCP/IP based communication protocol used to present data in the network environment. Websites serve with the IP of these servers and the content on them [6]. This server presents the files on the websites to the users using the HTTP protocol, responds to each request of the users and executes them by the automatic mechanisms of the computers.

Mail Server

It is the server that establishes e-mail communication between local and remote users and provides control and management of this process. Mail Server can act as a separate machine, or any domain within a Web Server can be configured as a Mail Server. Although mail sending seems to happen very quickly, in the background there are many checks, authorizations, transfer over layers in the internet protocol, sometimes encryption and decryption, and then communication between servers. By defining the domain name, user names and passwords on this server, the e-mail service is activated within the network, allowing users to send e-mails to each other within the network [7].

The work flow diagram of the study is shown in **Figure 1**.

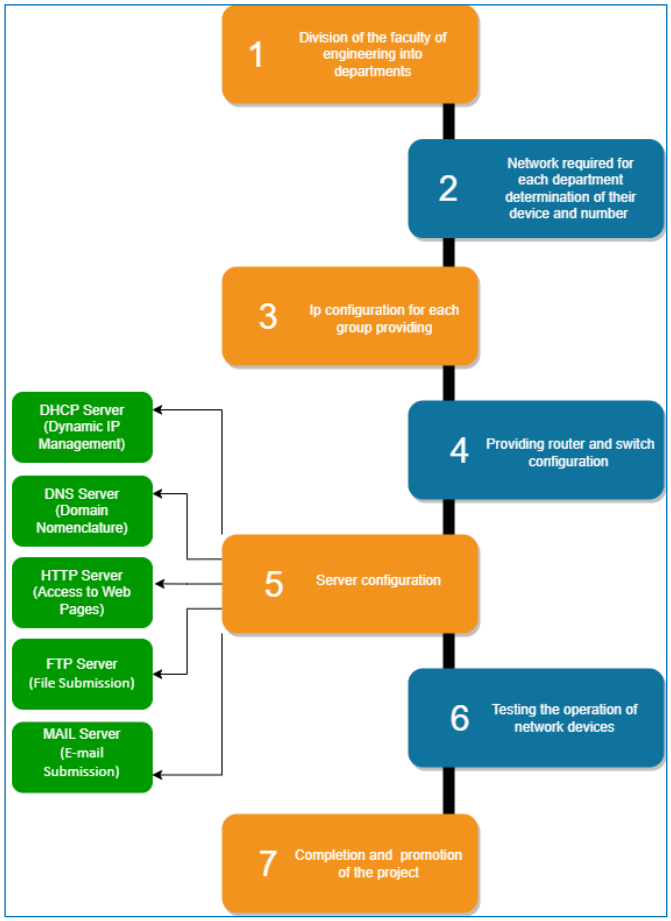

Figure 1. Workflow diagram of the proposed system.

METHODS

Network Components

In the designed simulation, DSL modem, router, switches, access points, servers, IP phone, computers and printers were used on the Cisco Packet Tracer program. The number and types of servers are variable according to the needs, and the design was carried out using base servers in this structure [8].

Network Configuration

In the study, a real network topology was designed, all configurations were realized and a local area network (LAN) is created. LANs provide computer users with many conveniences such as shared access to devices and applications, file sharing among connected users, and communication between users [9].

In **Figure 2**, the design of the overall network topology is given.

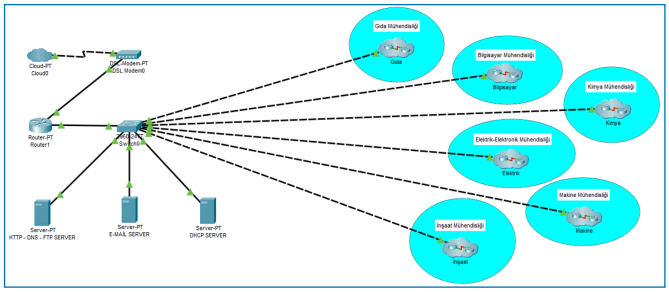

Figure 2. Designed network topology.

IP Configuration

In growing network topologies, dynamic IP distribution is made to clients using a DHCP Server, as manually configuring TCP/IP settings of network devices would be a waste of time.

Figure 3 shows a computer with a static IP assignment.

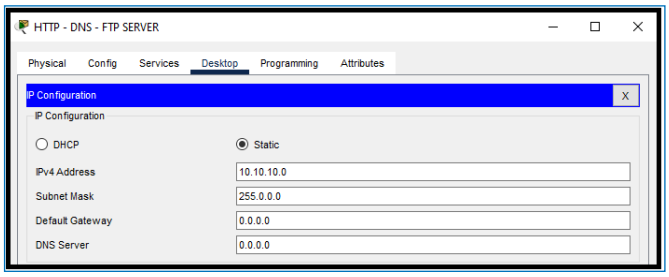

Figure 3. Static IP assigned computer.

Router Configuration

As a result of the physical connections between the devices, the devices are only physically connected to each other, but this is not enough for the devices to communicate with each other because the interface configurations of the devices must also be made [10].

The router configuration is shown in **Figure 4**.

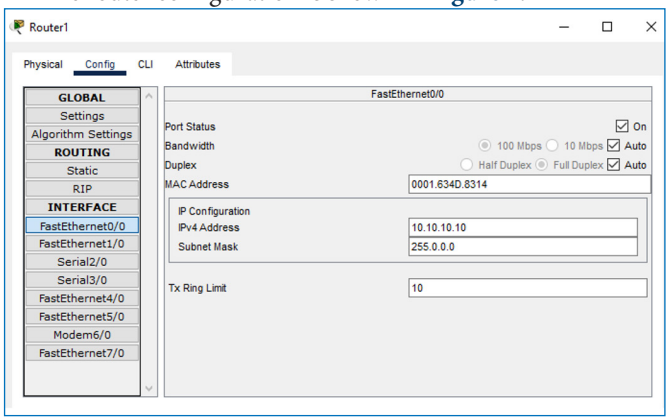

Figure 4. Router configuration.

Switch Configuration

Each switch is configured with a password. Username and password are assigned. Password must be entered to access/modify the IOS command line interface [11].

Figure 5 shows the commands used in the CLI console where the switch is configured.

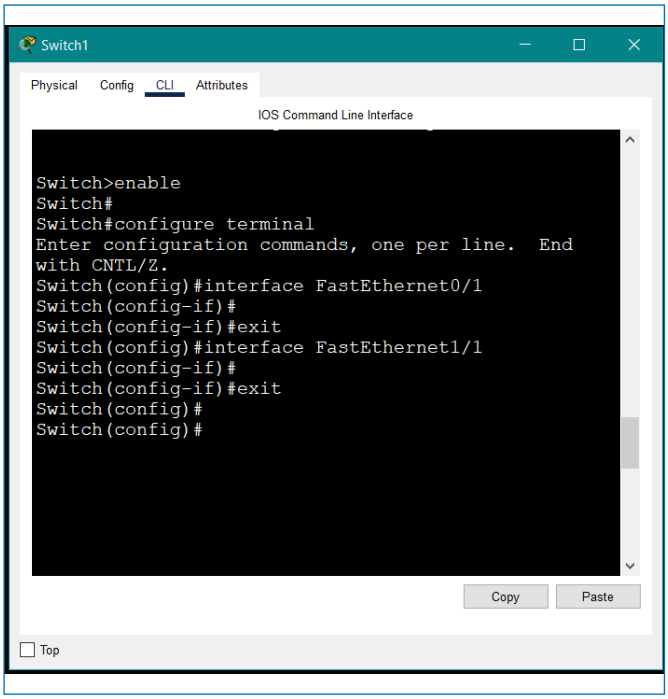

Figure 5. Switch configuration.

Server Configurations

It is shown in **Figure 6** that the e-mail addresses are defined and in **Figure 7**, the mail is successfully transmitted from one user to another with the Mail Server connection.

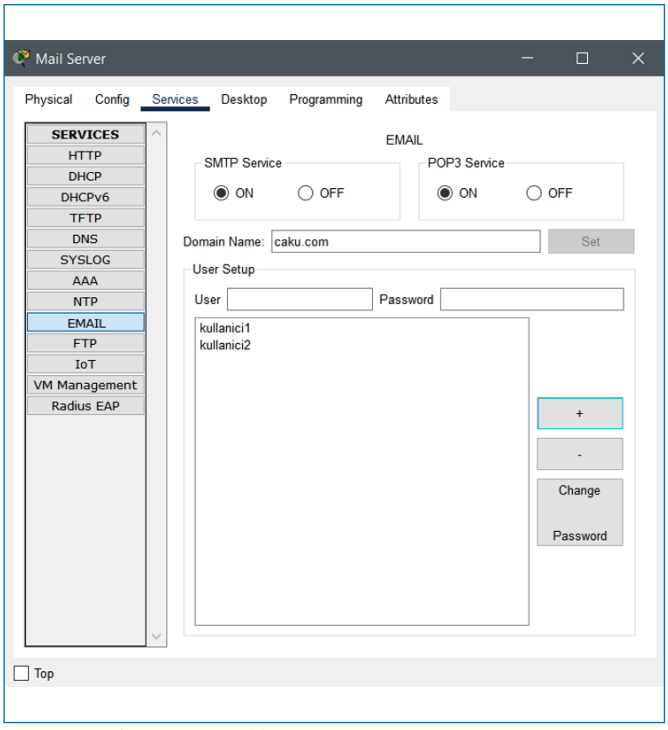

Figure 6. Defining e-mail addresses.

We configured it with a DHCP server to provide IP addresses to PCs [12].

In **Figure 8**, it is shown that the IP distribution takes place statically by configuring the DHCP Server.

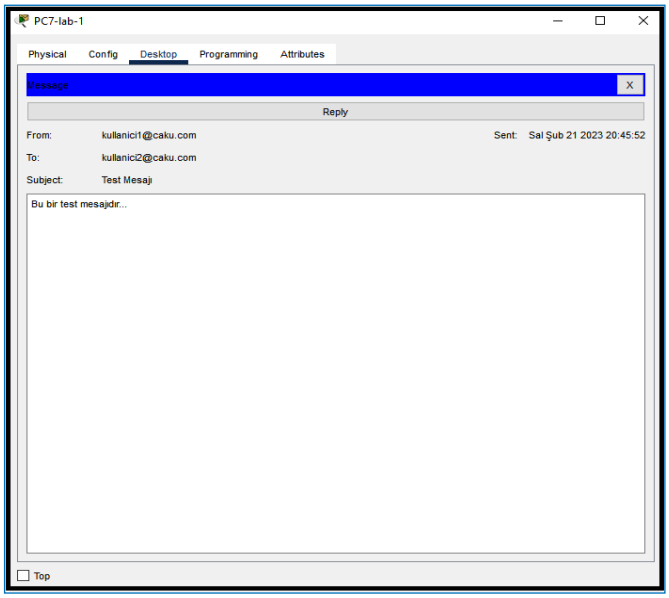

Figure 7. Mail Server connection.

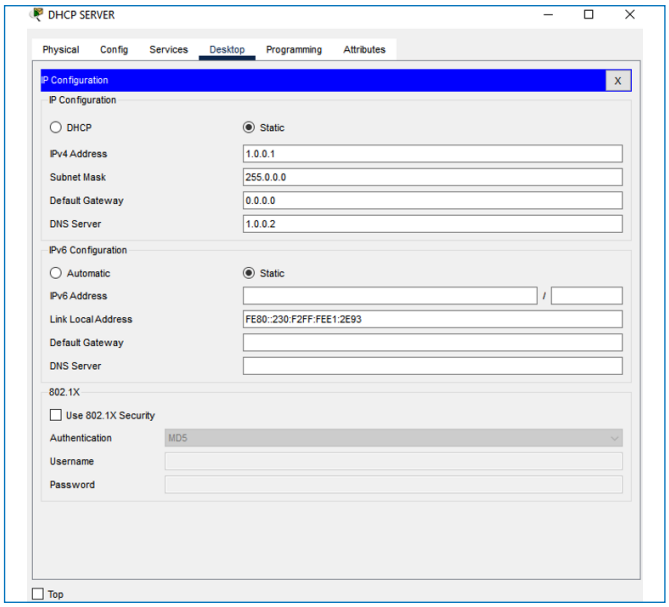

Figure 8. DHCP Server pools.

In **Figure 9**, it is shown that connection to a website can be provided by configuring the Web Server.

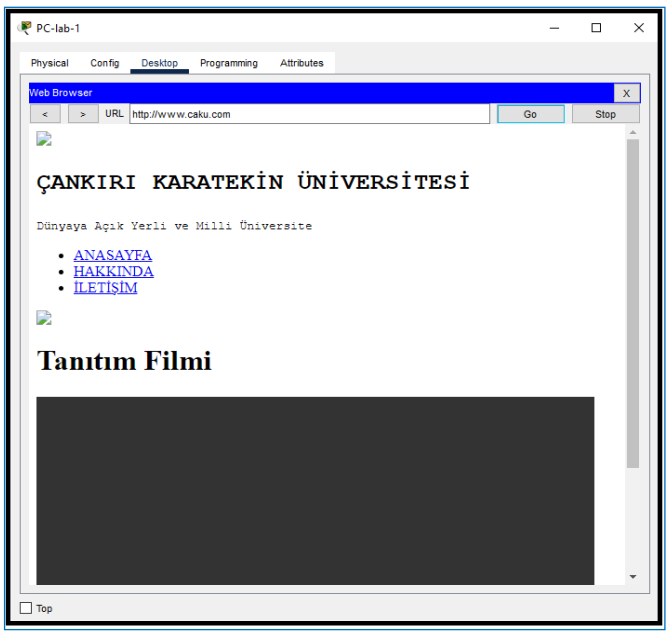

Figure 9. Web Server connection.

The command prompt in **Figure 10** shows the configuration of the FTP server and the file transfer process.

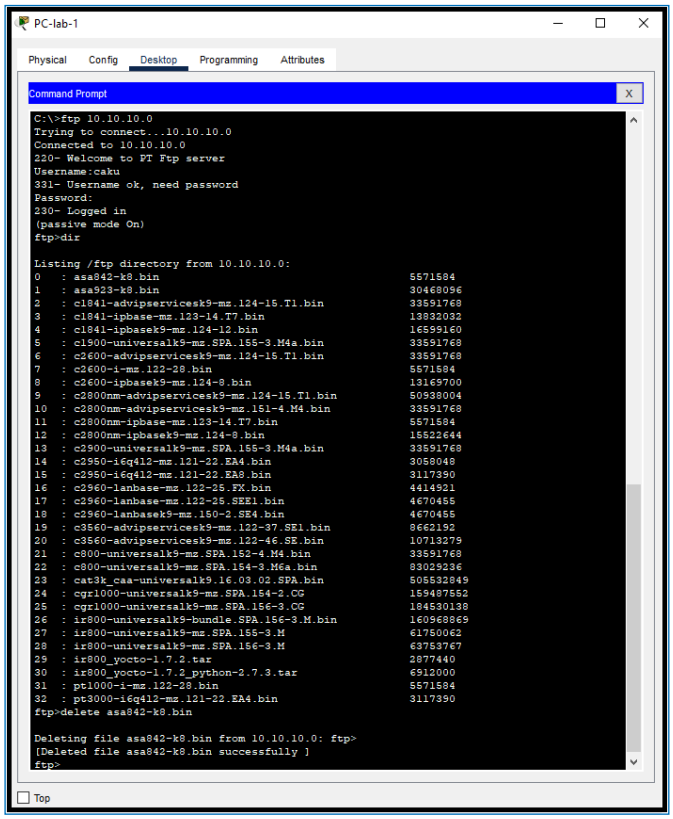

Figure 10. FTP Server connection.

DNS Server configuration is shown in **Figure 11**.

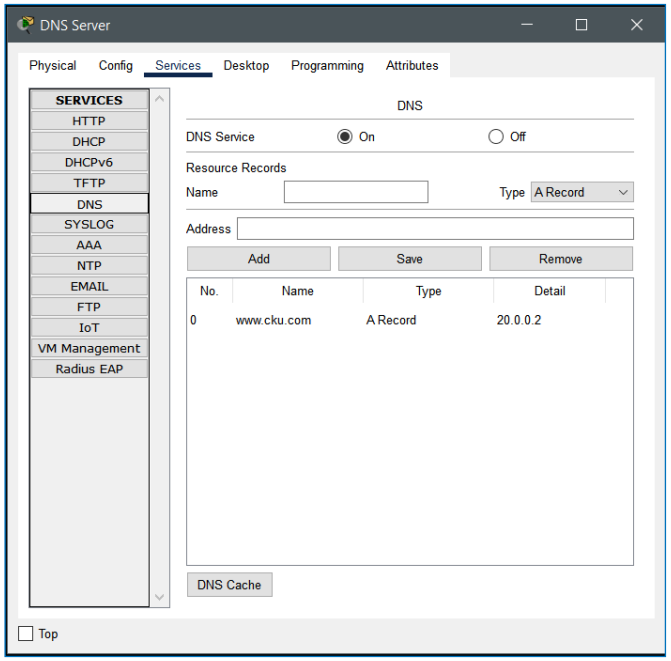

Figure 11. DNS Server configuration.

RESULTS AND DISCUSSION

This study involved designing a local area network that includes routers, switches, IP phones, access points, modems, and necessary servers. Cisco Packet Tracer program was used during the project and device configurations were identical to those of real routers and switches. VLANs were defined and configured on the necessary devices. A DHCP server was defined for computers, and IP addresses were observed to be assigned to them. A DHCP pool was created for IP phones. Configurations were made on the routers, and it was observed that the networks communicated with each other. A DNS server was defined and distributed to computers via DHCP pools. An HTTP server was defined and accessibility was observed. Access lists were defined to determine which networks could be accessed and which ones could not, and which devices could access which devices were also determined. An FTP server was defined, and it was observed that file sharing was possible between computers. A mail server was set up by defining domain names, usernames, and passwords, and it was observed that users were able to send emails to each other within the network. In the simulation results, it was seen that a packet can travel smoothly between the source and destination. Configurations were completed flawlessly within the determined rules, and a local area network was created.

CONCLUSION

This study was conducted using the Cisco Packet Tracer application, and therefore did not incur any costs. This application enabled testing of both servers and network devices. The study can be further developed and applied to all faculties of the university, and even to other universities. The number of network devices that can be used in reality cannot be replicated in the study, and physical conditions are not present. As the application eliminates physical conditions, it cannot fully reflect reality..

ETHICAL DECLARATIONS

Referee Evaluation Process: Externally peer-reviewed.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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