

LEARNING THE PRINCIPLES OF NETWORK DEVICES BASED ON THE DESIGN OF AN OFFICE NETWORK IN CISCO PACKET TRACER

Do'schanov Bekzod Davronbek o'g'li

Tashkent University of Information Technologies named after Muhammad al-Khorazmi

Abdukhakimov Fayzulla Kudratulla ugli

Graduate student at Tashkent University of Information Technologies named after Muhammad al-Khwarizmi.

<https://doi.org/10.5281/zenodo.11259298>

Abstract. *In today's interconnected world, a robust and efficient office network is crucial for the smooth functioning of businesses. Whether it's sharing files, accessing the internet, or communicating with colleagues, a well-designed network infrastructure forms the backbone of modern workplaces. Cisco Packet Tracer, a simulation tool, provides an excellent platform to learn about network devices and their principles by designing and implementing an office network virtually.*

Keywords: *Computer networks, API, information, Cisco Packet Tracer, Ping, Switch, Router, CLI, LAN, VLAN, OSI model.*

ИЗУЧЕНИЕ ПРИНЦИПОВ РАБОТЫ СЕТЕВЫХ УСТРОЙСТВ НА ОСНОВЕ ПРОЕКТИРОВАНИЯ ОФИСНОЙ СЕТИ В CISCO PACKAGE TRACER.

Аннотация. *В современном взаимосвязанном мире надежная и эффективная офисная сеть имеет решающее значение для бесперебойного функционирования бизнеса. Будь то обмен файлами, доступ к Интернету или общение с коллегами, хорошо спроектированная сетевая инфраструктура составляет основу современных рабочих мест. Cisco Packet Tracer, инструмент моделирования, предоставляет отличную платформу для изучения сетевых устройств и их принципов путем виртуального проектирования и внедрения офисной сети.*

Ключевые слова: *Компьютерные сети, API, информация, Cisco Packet Tracer, Ping, Switch, Router, CLI, LAN, VLAN, модель OSI.*

Introduction

Currently, a new stage of development associated with fundamental changes in the field of telecommunications is being implemented around the world. Issues of innovative development have always been an urgent task for the field of telecommunications, which requires deep knowledge. At the same time, innovative development in the field, considering the achievements of developed countries, and the and the training of specialists are important. Implementation of innovative development in the telecommunications sector requires a systematic approach, that is, the provision of legal, technological, organizational, and qualified personnel. In modern conditions, a complex approach aimed at solving the issues of innovative development in the telecommunications sector requires knowledgeable and experienced specialists. The transition to innovative development of the industry forces new approaches to the training of specialists.

For the innovative development of the telecommunications network, it is necessary to train many specialists in network technologies, network solutions, and network integrators.

Research materials and methodology

A network is a set of computers, terminals, and other devices interconnected by communication channels that provide information exchange. Such networks that provide data exchange between computers are called computer networks. It became possible to transmit information over long distances through the network. The network provides opportunities to transfer information, organize the joint operation of computers that are used separately, and solve a problem with the help of several computers. In addition, it is possible to specialize each computer to perform a certain task and to use the resources (data, memory) of computers together, as well as to connect to the Internet network, which unites the computers of the whole world.

Examples of modern networks include local and global computer networks, corporate networks, telecommunication networks, networks of communication operators, and the network consisting of these networks, i.e., the Internet. Even though these networks are different, it is possible to point out that they have many similarities. One of them and the most important is the similarity of their structure, that is, their architecture.

In computer networks, as terminal equipment of users (computers), in telephone networks (telephones), in television or radio networks (televisions or radio receivers),. Terminal equipment of users can be connected to networks located outside of the telecommunications network.

Computers can be connected to local computer networks, and telephones can be connected to a telephone switchboard (PBX, or Private Branch Exchange) in the office.

Cisco Packet Tracer is a comprehensive network training and learning program that provides a unique combination of realistic simulation and visualization, assessment and exercise creation, competition, and collaboration in a multi-user environment. Packet Tracer's innovative features help students and teachers interact, solve problems, and learn concepts in a fun, dynamic social environment.



Figure 1. Cisco Packet Tracer.

Below are some of the benefits of Packet Tracer.

- A realistic simulation and visualization environment that complements the training equipment, including the ability to observe the internal processes hidden in real devices in real time.
- Competitions for real-time multiplayer cooperation and dynamic learning.

- Develop and localize structured learning activities such as labs, exhibits, tests, exams, and games.
- Students can learn different concepts, conduct experiments, and test their networking knowledge.
- Students and teachers can design, build, configure, and troubleshoot complex networks using virtual hardware.
- Supports a variety of teaching and learning opportunities such as lectures, group and individual labs, homework, games, and competitions.
- Support new external application functionality using APIs to extend Cisco Packet Tracer functionality in areas such as planning, testing, gaming, usability, and communication with real hardware.

Research results

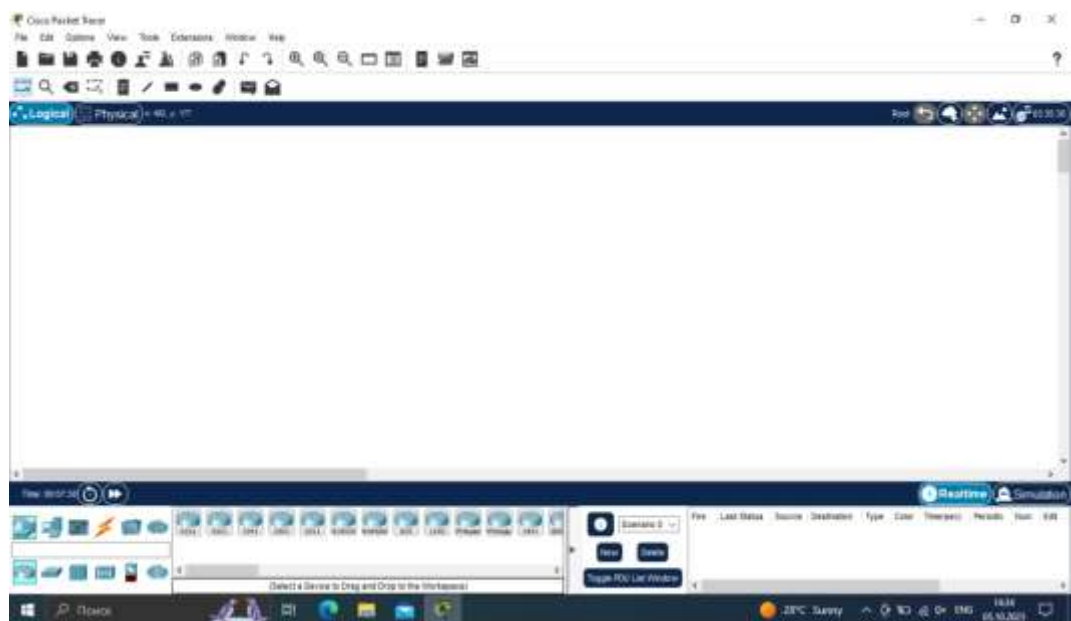


Figure 2. Application window

This research employs a mixed-methods approach, combining quantitative analysis of learning outcomes with qualitative assessment of student engagement and perceptions. Participants engage in structured activities within Cisco Packet Tracer, including designing and configuring an office network, troubleshooting network issues, and completing guided exercises.

Network devices serve various purposes in an office network, each playing a specific role in facilitating communication and data transfer. Here are some essential devices commonly found in office networks:

Switches: Acting as the traffic cops of the network, switches connect multiple devices within a local area network (LAN) and facilitate the transfer of data between them. They operate at Layer 2 (Data Link Layer) of the OSI model, using MAC addresses to forward data to the appropriate destination.

Routers: Routers operate at Layer 3 (Network Layer) of the OSI model and are responsible for directing data packets between different networks. They use IP addresses to determine the best path for data to travel, making routing decisions based on network topology and routing protocols.

Access Points (APs): In modern office environments, wireless connectivity is often a necessity. Access points provide wireless access to the network, allowing devices such as laptops, smartphones, and tablets to connect without the need for physical cables.

Cisco Packet Tracer provides a simulated environment for designing, configuring, and troubleshooting network setups. Through the device's command-line interface (CLI) or graphical user interface (GUI), users can configure various parameters, such as IP addresses, VLANs, and security settings.

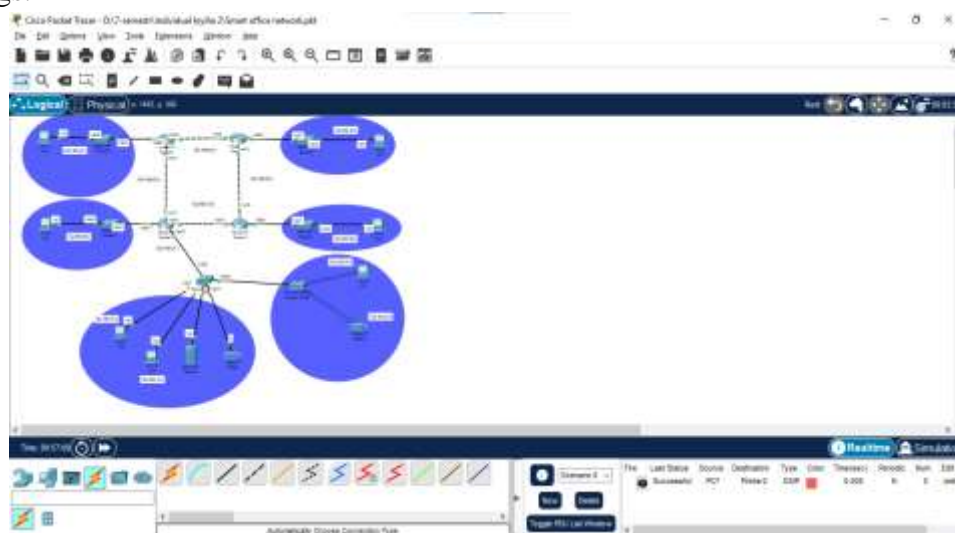


Figure 3. Cisco Packet Tracer office network.

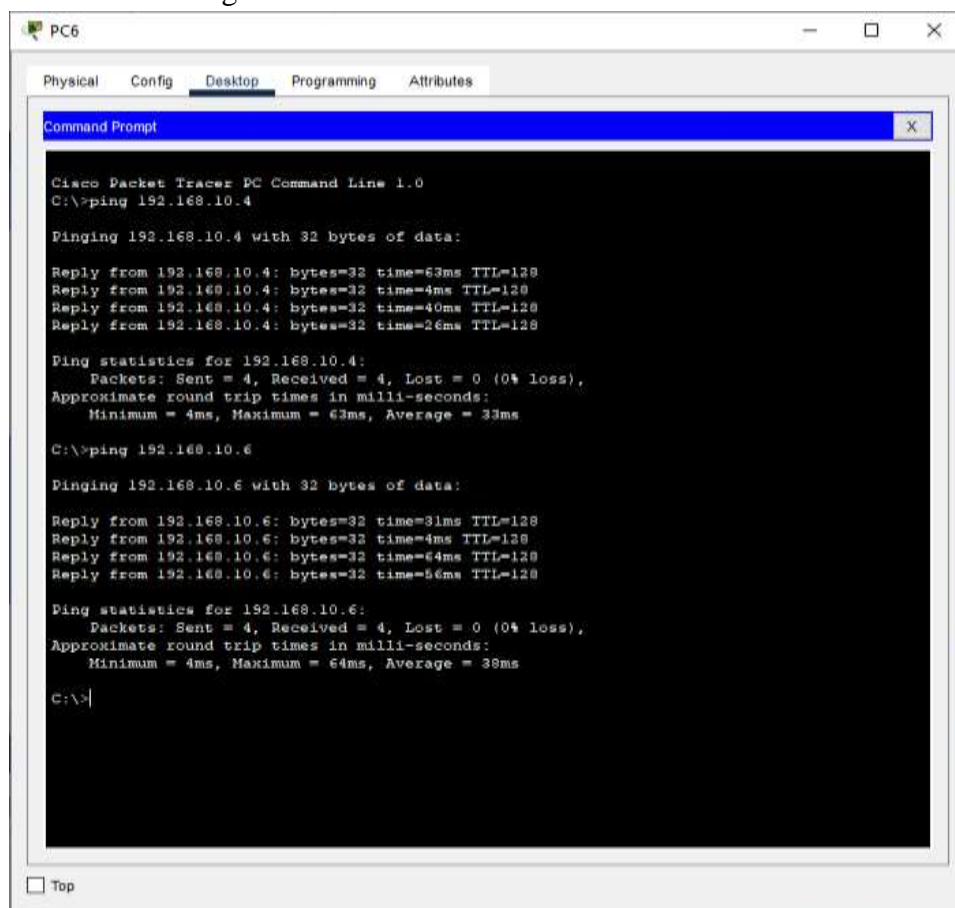
The image shows a PC6 window with a Command Prompt. The prompt is running two ping commands. The first command is 'ping 192.168.10.4' and the second is 'ping 192.168.10.6'. Both commands show successful results with 4 packets sent and 4 received, 0% loss, and approximate round trip times in milliseconds. The output for the first ping is: 'Pinging 192.168.10.4 with 32 bytes of data: Reply from 192.168.10.4: bytes=32 time=63ms TTL=128 Reply from 192.168.10.4: bytes=32 time=4ms TTL=128 Reply from 192.168.10.4: bytes=32 time=40ms TTL=128 Reply from 192.168.10.4: bytes=32 time=26ms TTL=128 Ping statistics for 192.168.10.4: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 4ms, Maximum = 63ms, Average = 33ms'. The output for the second ping is: 'Pinging 192.168.10.6 with 32 bytes of data: Reply from 192.168.10.6: bytes=32 time=31ms TTL=128 Reply from 192.168.10.6: bytes=32 time=4ms TTL=128 Reply from 192.168.10.6: bytes=32 time=64ms TTL=128 Reply from 192.168.10.6: bytes=32 time=56ms TTL=128 Ping statistics for 192.168.10.6: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 4ms, Maximum = 64ms, Average = 38ms'. The prompt is currently at 'C:\>'.

Figure 4. Check data exchange using the ping command

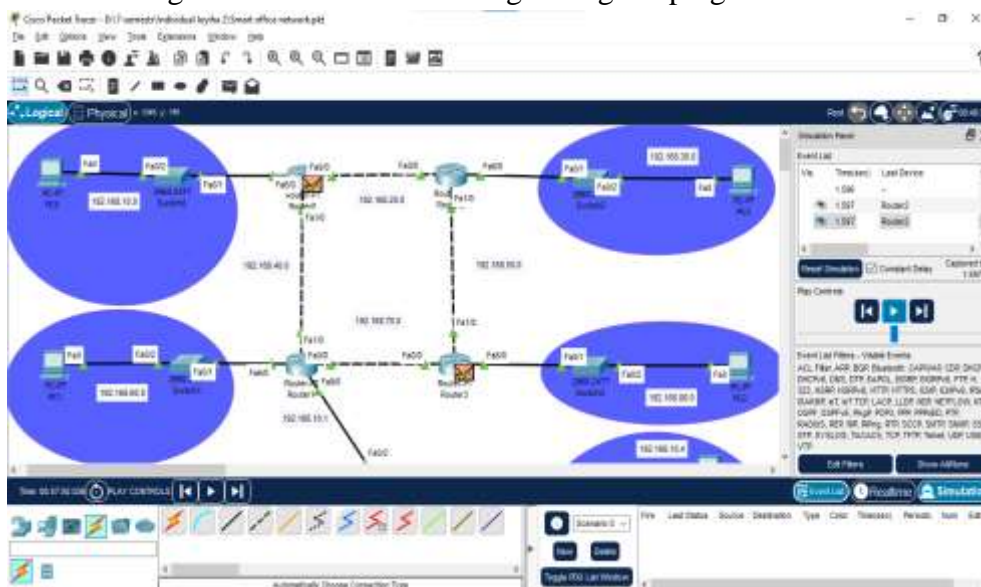


Figure 4. Check data exchange in simulation mode

Conclusion

Understanding the principles of network devices is essential for anyone aspiring to work in the field of networking or IT. Cisco Packet Tracer offers a hands-on approach to learning, allowing users to experiment with different configurations and troubleshoot network issues in a safe, simulated environment. By designing an office network in Packet Tracer, learners can gain valuable experience that prepares them for real-world networking challenges. Whether you're a student, an aspiring IT professional, or a seasoned network engineer looking to enhance your skills, Cisco Packet Tracer provides an invaluable platform for exploring the fascinating world of network devices and their principles. So, roll up your sleeves, dive into the simulation, and embark on your journey to mastering office network design.

REFERENCES

1. Олифер В.Г., Олифер Н.А. Компьютерные сети. Принципы, технологии, протоколы. Учебник. - СПб. Питер. 2016 г.
2. Musaev M.M. "Kompyuter tizimlari va tarmoqlari". Toshkent.: "Aloqachi" nashriyoti, 2013 yil. 394 bet. – Oliy o'quv yurtlari uchun qo'llanma.
3. Велихов А.В. и др. Компьютерные сети. Учебное пособие по администрированию локальных и объединенных сетей. 3-е изд. доп. и исп. - М.: Нов. Изд. дом. 2005 г.304 с.
4. Бройдо В.Л. "Вычислительные системы, сети и телекоммуникации" - СПб.:Питер. 2003.