Computer Science & Engineering Department

Computer Networks Lab CSEUGPC23

Project Report

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Abstract:

The aim of this project is to provide a comprehensive tutorial on how to effectively use Packet Tracer, a network simulation tool, and to teach the reader a range of essential networking skills. Specifically, the project focuses on teaching the reader how to perform IP subnetting and assignment, configure HTTP, DNS, and Email servers, set up routing algorithms on routers, configure VLANs on switches and routers, and set up ACLs. By following the step-by-step instructions provided in the tutorial, the reader will gain a comprehensive understanding of how to use Packet Tracer to build and manage networks, and will be well-equipped to apply these skills in a range of real-world scenarios.

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Theory

Introduction to Networks: The Foundation of Modern Communication

In the contemporary world, networks serve as the backbone of communication, enabling the seamless exchange of information across vast distances. The concept of networking encompasses a wide array of technologies and protocols that facilitate the connection of devices, allowing them to communicate and share resources. This interconnectedness has transformed how individuals, businesses, and governments interact, making networking a fundamental aspect of modern life.

The Importance of Networking

Networking is crucial for various reasons:

1. Global Connectivity: Networks enable people from different parts of the world to connect and communicate in real-time. This global connectivity has fostered international collaboration, cultural exchange, and the sharing of knowledge.
2. Information Access: The Internet, a product of networking, provides access to an immense repository of information. Users can retrieve data, conduct research, and engage with educational resources from anywhere, democratizing knowledge.
3. Business Operations: In the business realm, networking is essential for operations, communication, and data management. Organizations rely on networks to facilitate internal communication, manage supply chains, and engage with customers.
4. Innovation and Development: Networking has spurred innovation across various sectors, including healthcare, education, and entertainment. The ability to share ideas and collaborate remotely has accelerated technological advancements and the development of new solutions.

The Evolution of Networking

Networking has undergone a remarkable transformation since its inception, evolving from rudimentary communication methods to complex systems that underpin modern society. The journey began in the early 1960s with the development of ARPANET, a project funded by the U.S. Department of Defense. ARPANET was the first network to implement packet switching, a method that breaks data into smaller packets for efficient transmission. This innovation laid the groundwork for the development of the Internet.

In the 1970s, the introduction of the Transmission Control Protocol (TCP) and Internet Protocol (IP) by Vint Cerf and Bob Kahn marked a significant milestone. These protocols established a standardized method for data transmission across diverse networks, enabling the interconnection of multiple networks into what we now know as

the Internet. The 1980s saw the commercialization of the Internet, leading to the establishment of the Domain Name System (DNS) and the introduction of the World Wide Web by Tim Berners-Lee in 1991. This period marked the beginning of the Internet as a public resource, revolutionizing how information is shared and accessed.

The 1990s and early 2000s witnessed rapid advancements in networking technologies, including the proliferation of broadband connections, wireless networking, and the emergence of mobile communication. The introduction of Wi-Fi technology in the late 1990s allowed users to connect to the Internet without physical cables, further enhancing accessibility. The rise of social media platforms, e-commerce, and cloud computing transformed the way individuals and businesses interact, creating a more interconnected world.

Today, networking continues to evolve with the advent of technologies such as 5G, the Internet of Things (IoT), and artificial intelligence (AI). These innovations are reshaping industries, enabling smart cities, and enhancing communication in ways previously unimaginable. The future of networking promises even greater advancements, with ongoing research into quantum networking and the potential for global connectivity.

The Genesis of Networking

The genesis of networking can be traced back to the need for efficient communication. Early forms of communication, such as postal services and telegraphs, laid the foundation for more sophisticated methods. The invention of the telephone in the late 19th century revolutionized communication, allowing real-time voice transmission over long distances. However, these methods were limited in scope and speed.

The concept of networking began to take shape with the development of computer technology in the mid-20th century. As computers became more prevalent, the need for them to communicate with one another grew. The first significant step towards networking was the establishment of point-to-point connections between computers, enabling data exchange. This was followed by the creation of local area networks (LANs), which allowed multiple computers within a limited geographical area to connect and share resources.

The introduction of protocols, such as Ethernet in the 1970s, facilitated the development of LANs, enabling devices to communicate over a shared medium. This innovation was crucial in the growth of networking, as it provided a standardized method for data transmission. The subsequent development of wide area networks (WANs) allowed for the interconnection of LANs over larger distances, further expanding the reach of networking.

The 1980s marked a turning point in networking with the establishment of the Internet. The combination of TCP/IP protocols and the growing number of connected networks

created a global communication system. The Internet's open architecture allowed for the seamless integration of various technologies, fostering innovation and collaboration across different sectors.

In conclusion, the evolution of networking has been driven by the need for efficient communication and the desire to connect people and devices. From its humble beginnings to the complex systems we rely on today, networking has become the backbone of modern communication, enabling a level of connectivity that has transformed society. As we look to the future, the continued advancement of networking technologies promises to further enhance our ability to communicate and share information on a global scale.

IP assignment and subnetting

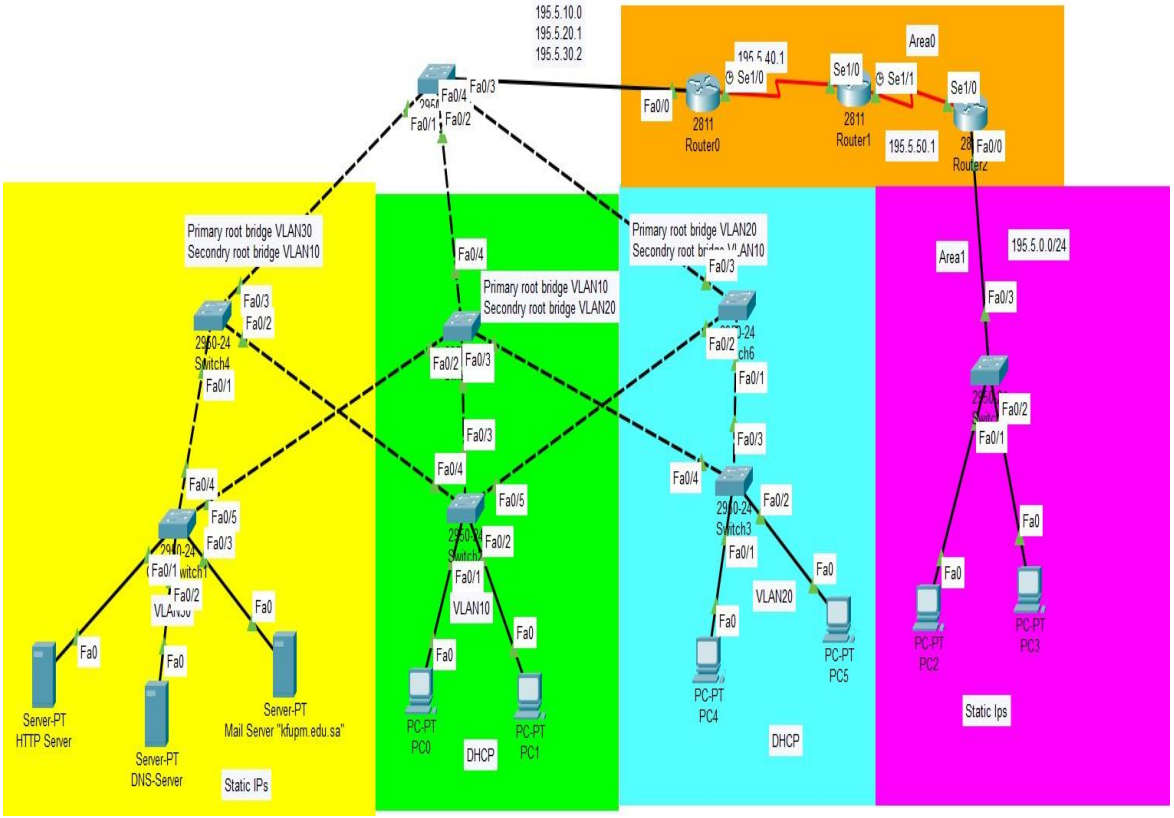
One of the student ID is 1200549,

So the IP is 195.5.0.0/24

Building the topology

This part is describing the steps for building a network topology using the Cisco Packet Tracer software. The topology includes three routers, switches, PCs, and servers, which are organized into four VLANs (virtual local area networks): a home network (Purple), two user VLANs (Green and Blue), and a server VLAN (Yellow).

We Use the IP addresses assigned in Part 0 to perform subnetting and create the network topology. We configure the interfaces of the three routers according to the instructions in the figure. We configure the switches based on the instructions in the figure. We Assign static IP addresses to PCs in the home network (Purple) using the assigned network IP. We Configure DHCP on "Router0" to assign dynamic IP addresses to PCs in VLANs 10 and 20 (Green and Blue). Assign static IP addresses to servers in VLAN 30 in the data center network (Yellow) using the assigned network IP.



Configuring servers and VLANs

the project involves configuring servers and VLANs. In this topology, three servers are used: HTTP/WEB server, DNS server, and Email server. The DNS and WEB servers are configured with the domain name www.ENCS3320.com. The HTTP server is then modified to create a website that contains information about the group members, their projects, skills, and hobbies. A link to https://www.netacad.com/courses/packet-tracer is also added. Usernames and passwords are created for all PCs in the email server. VLANs 10, 20, and 30 are created in the switches, and sub-interfaces are configured in the router. VLAN10, VLAN20, and VLAN30 are assigned to the 1st, 2nd, and 3rd sub-networks respectively, with Router0 as the gateway. The mode (access/trunk) of the switches links is then configured based on the connected devices. Understanding how to configure servers and VLANs is crucial in network design and management, as it enables network administrators to segment their network into smaller, more manageable parts and configure the various servers required for network communication and resource sharing.

Applying the routing protocols

In this section of the project, we will apply routing protocols to the network using Packet Tracer. Specifically, we will configure the following protocols on the designated routers:

- On "Router0", we will use Routing Information Protocol version 2 (RIPv2) to enable dynamic routing. RIPv2 is a simple protocol that uses hop count as the metric to determine the best path to a destination network.
- On "Router2", we will use Open Shortest Path First (OSPF), which is a more advanced routing protocol that uses a hierarchical structure and a more sophisticated algorithm to determine the best path to a destination network.
- On "Router1", we will apply the redistribution of the RIPv2 and OSPF protocols. Redistributing the routing information between RIPv2 and OSPF will enable the routers to share routing information between the two protocols and provide connectivity between the networks.

By configuring these routing protocols on the designated routers, we will be able to provide a reliable and efficient routing solution for the network.

Testing the connectivity

To ensure the network is properly configured and connected, various tests were conducted on the topology. First, the connectivity between all PCs was tested using the ping and tracert commands. Snapshots of the results were taken for all PC pairs to verify successful communication.

Next, the website www.ENCS3320.com was accessed from all PCs to test connectivity to the HTTP/WEB server. Snapshots were taken for all cases to confirm successful access.

Email functionality was also tested by sending emails from one PC to other PCs using the Email server configured earlier. Snapshots were taken at the receiving PCs to verify the successful receipt of emails.

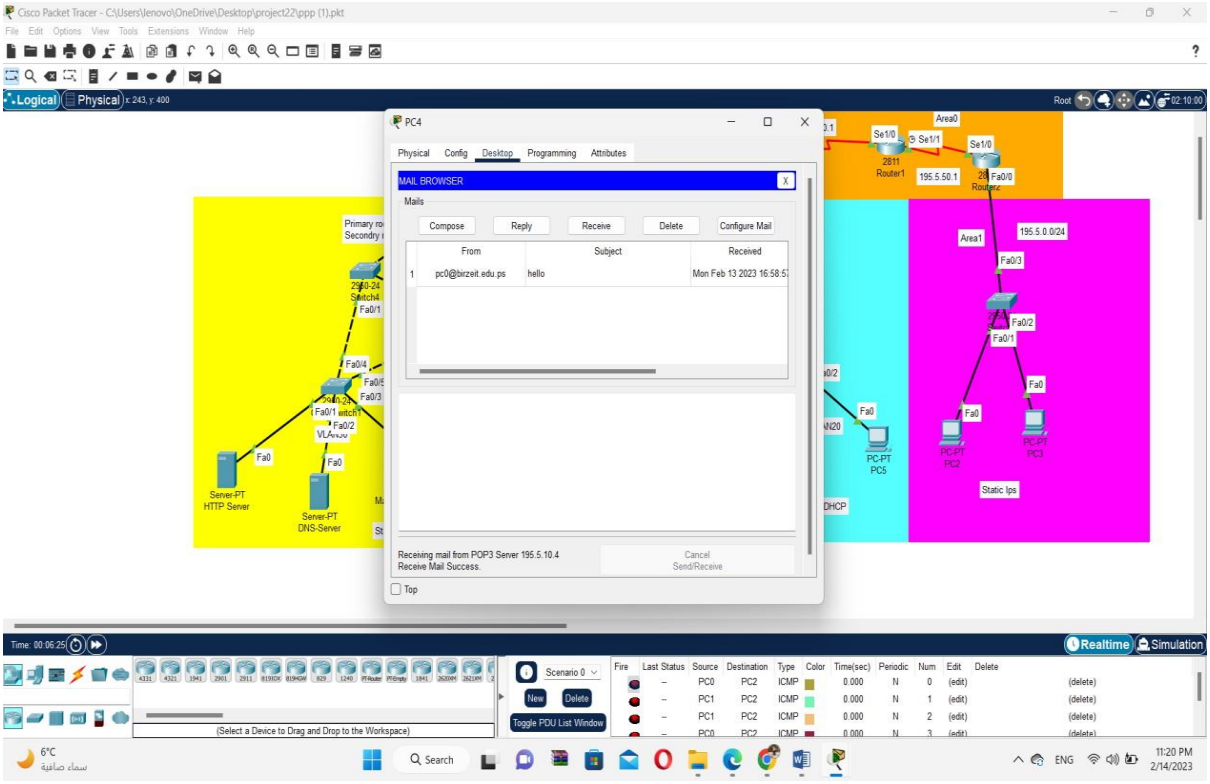
All the results of the tests were recorded in the report with detailed explanations, accompanied by the corresponding snapshots. This ensured that the objectives of the project were met and that the network topology was fully functional

Procedure:

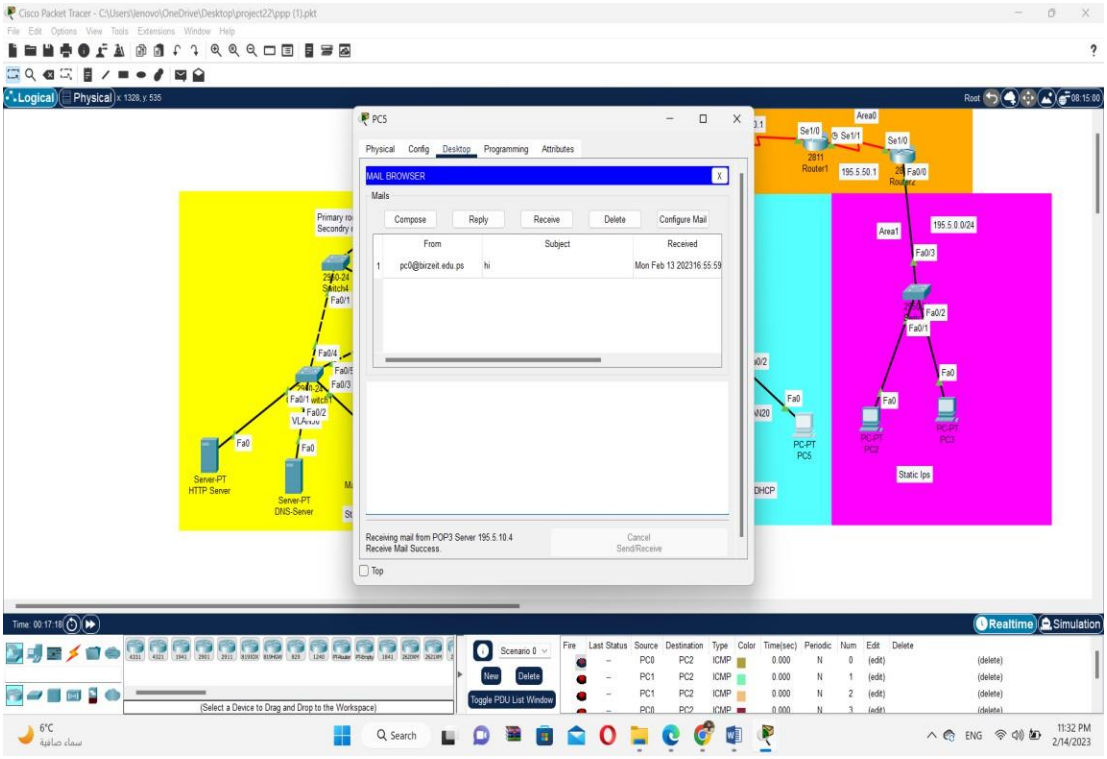
Testing the connectivity:

Sending Emails to PCs:

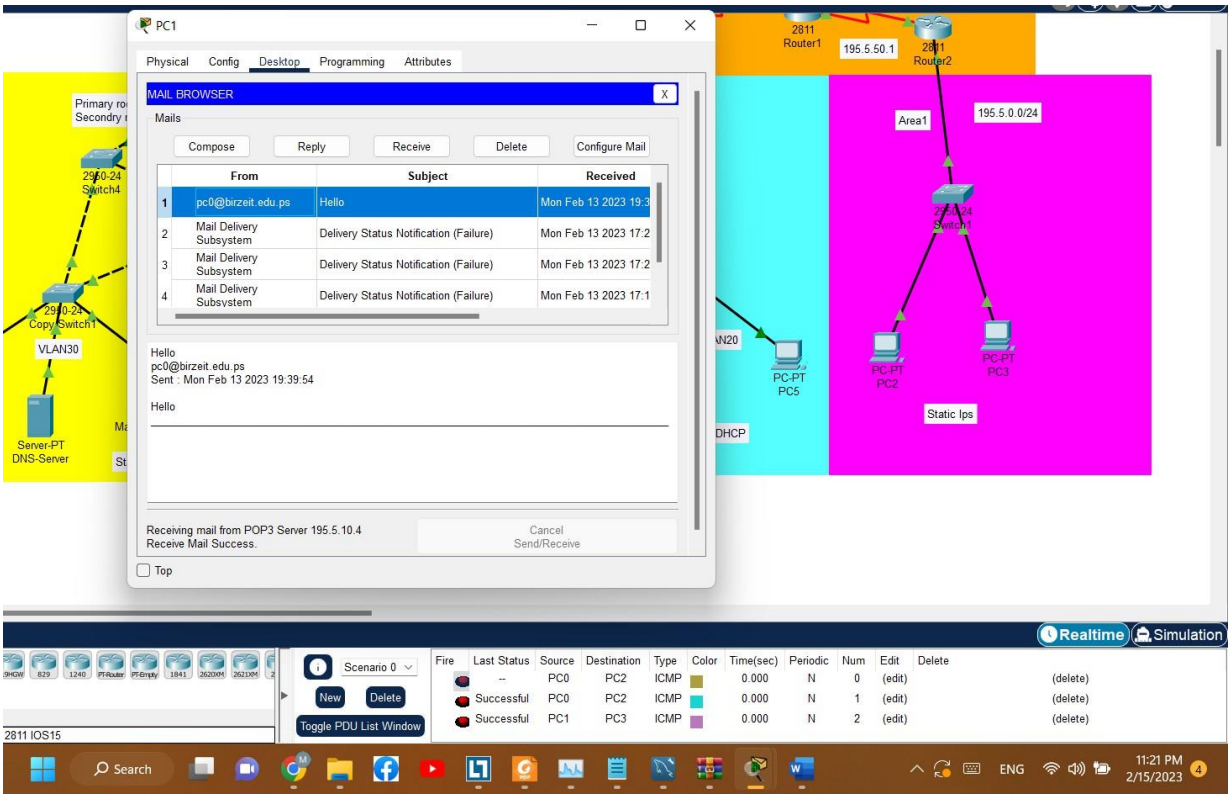
Send email from PC0 to PC4



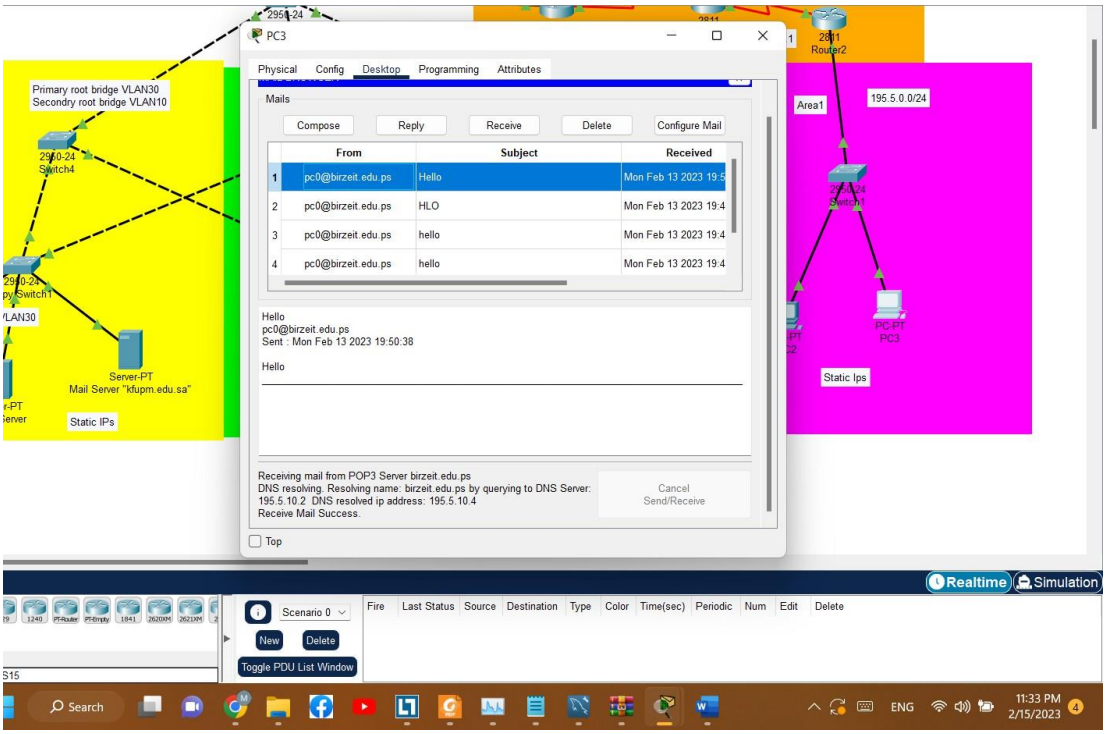
Send email PC0 to PC5:



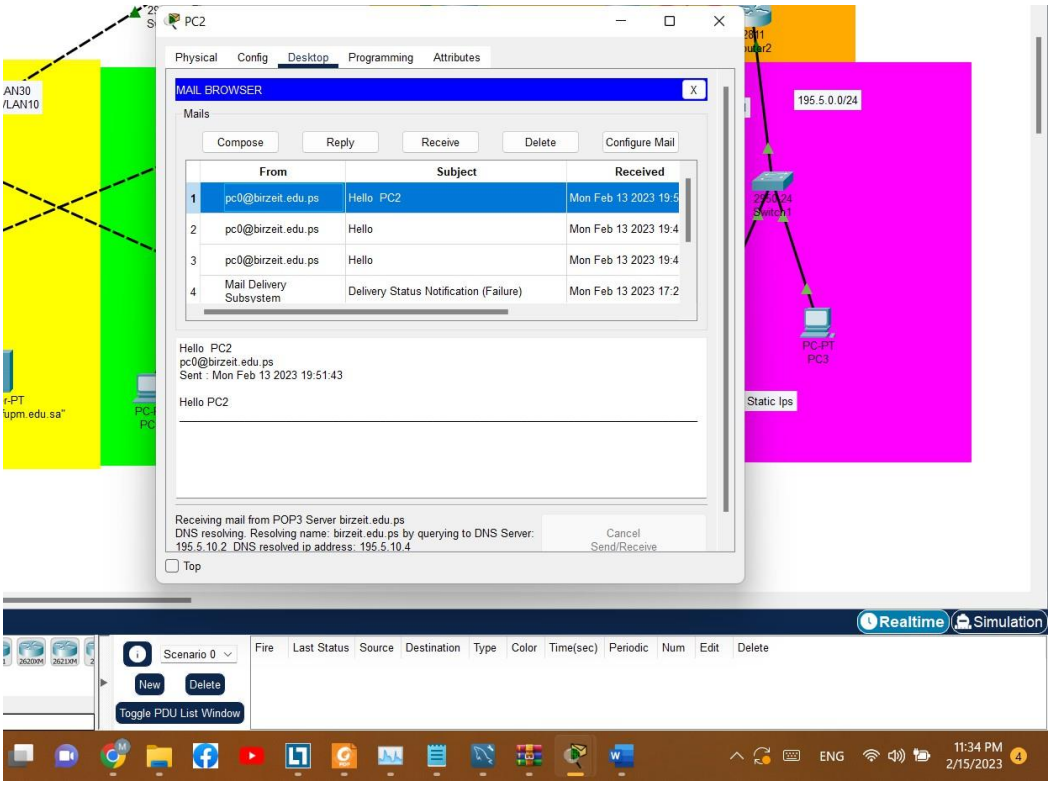
Send Email from PC0 to PC1:



Send Email from PC0 to PC3:

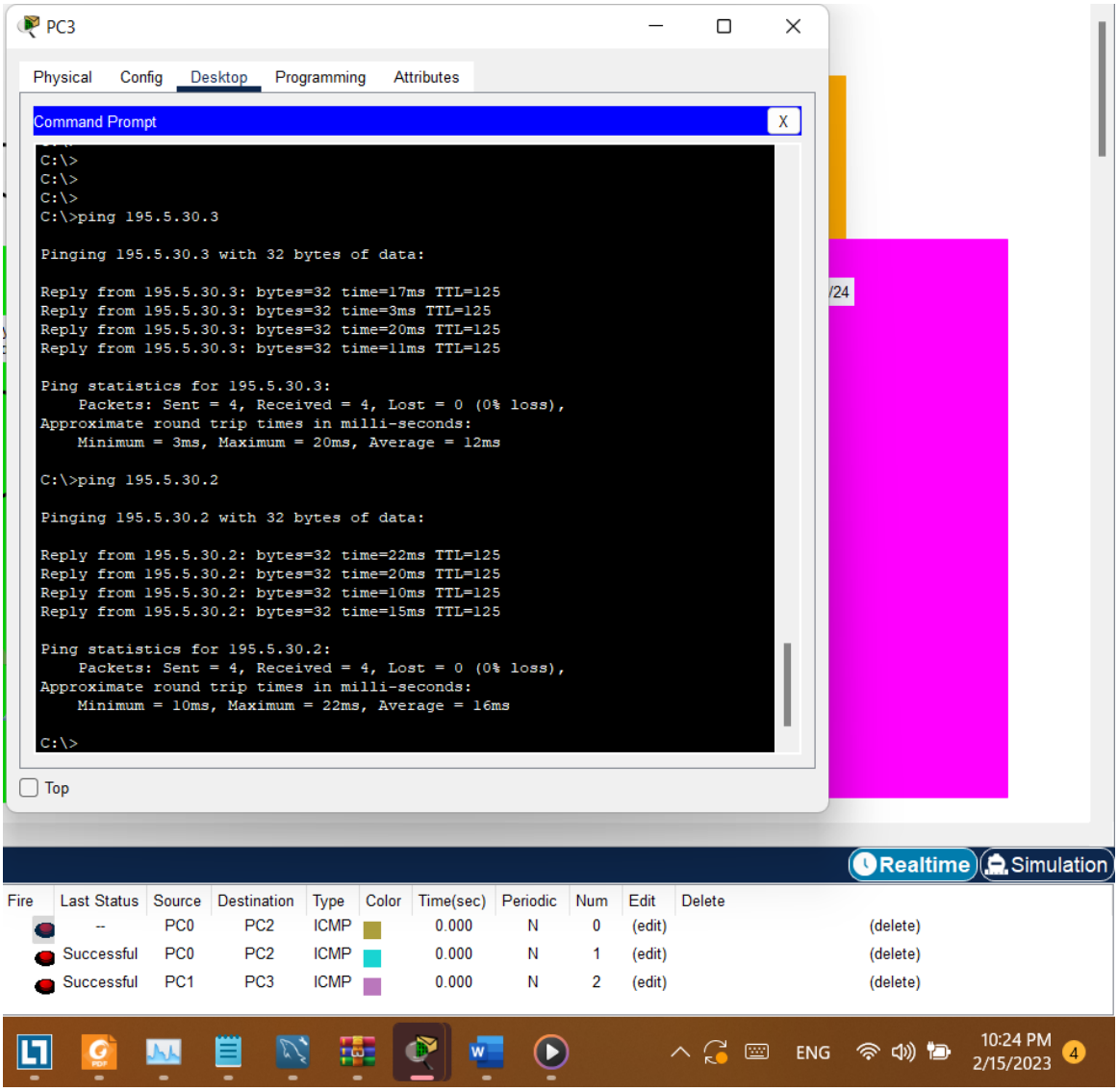


Send Email from PC0 to PC2:



Ping Between PCs:

Ping from PC3 to PC1 and PC0:



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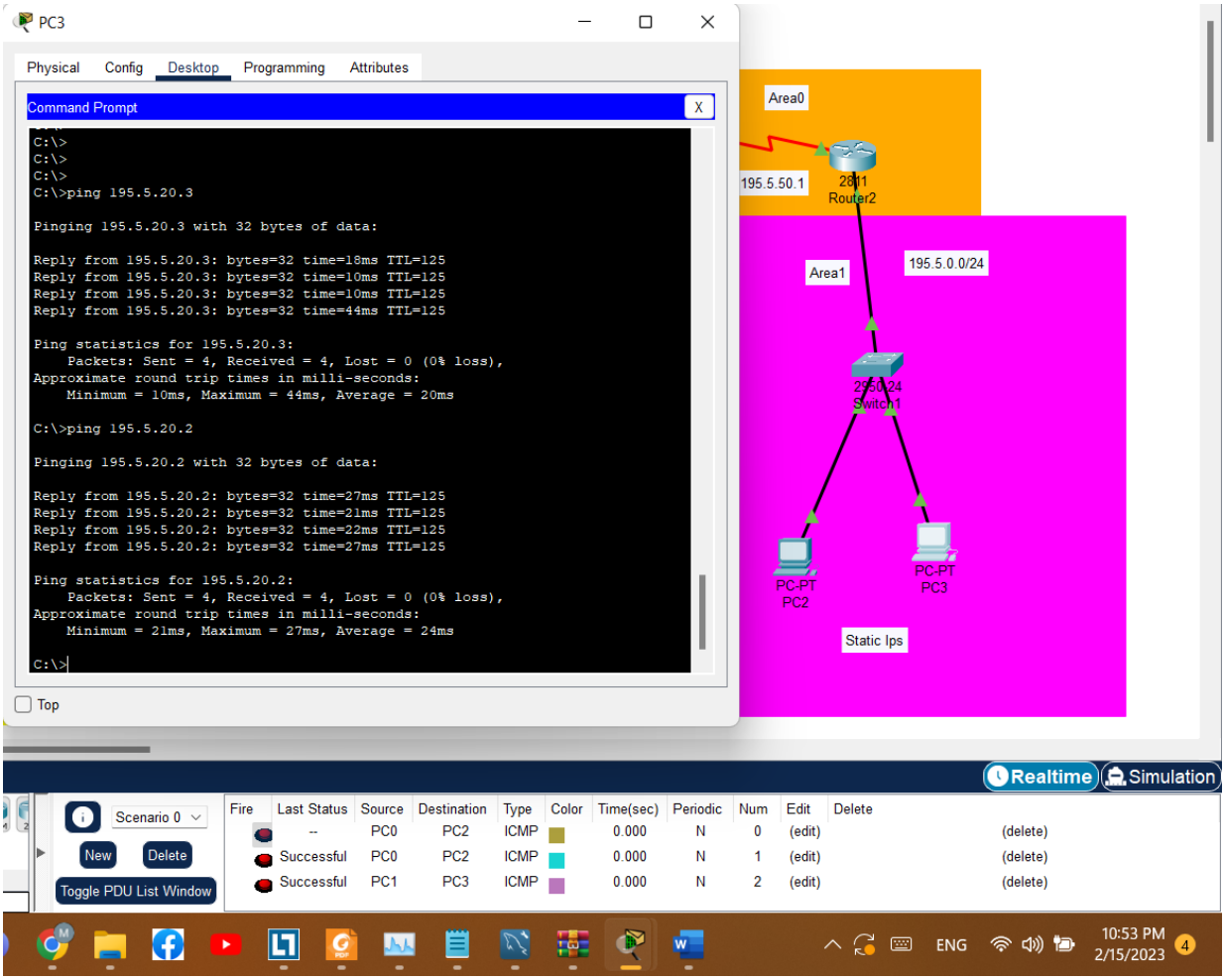
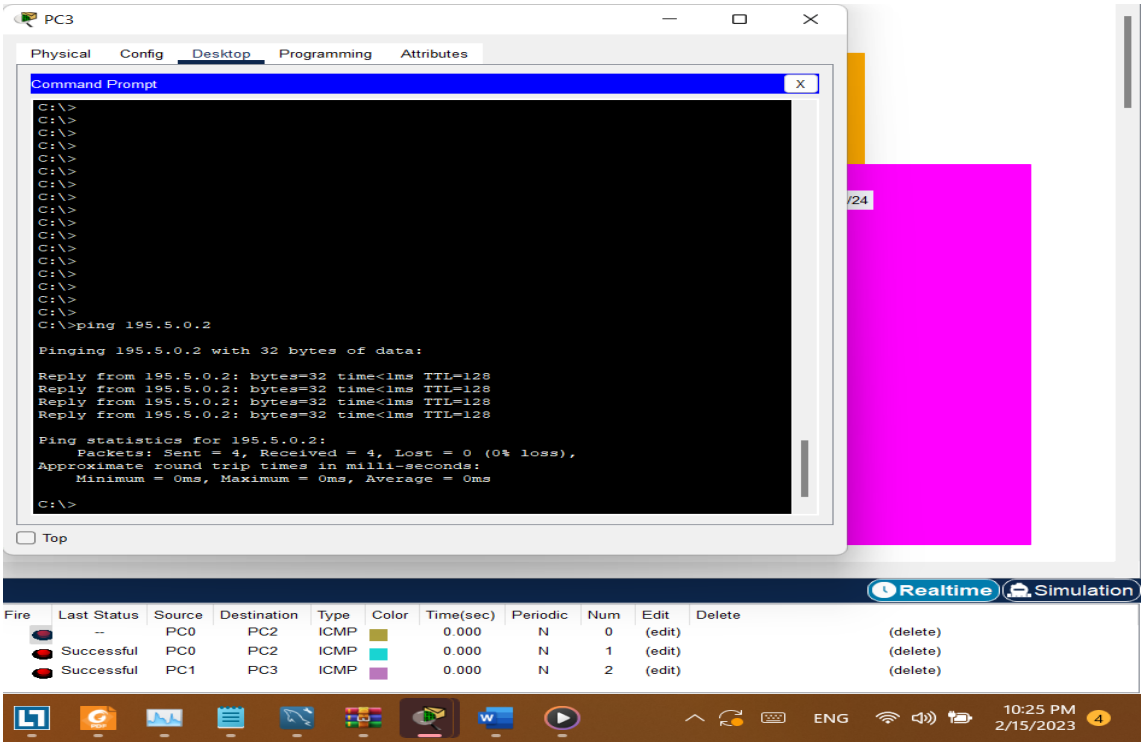
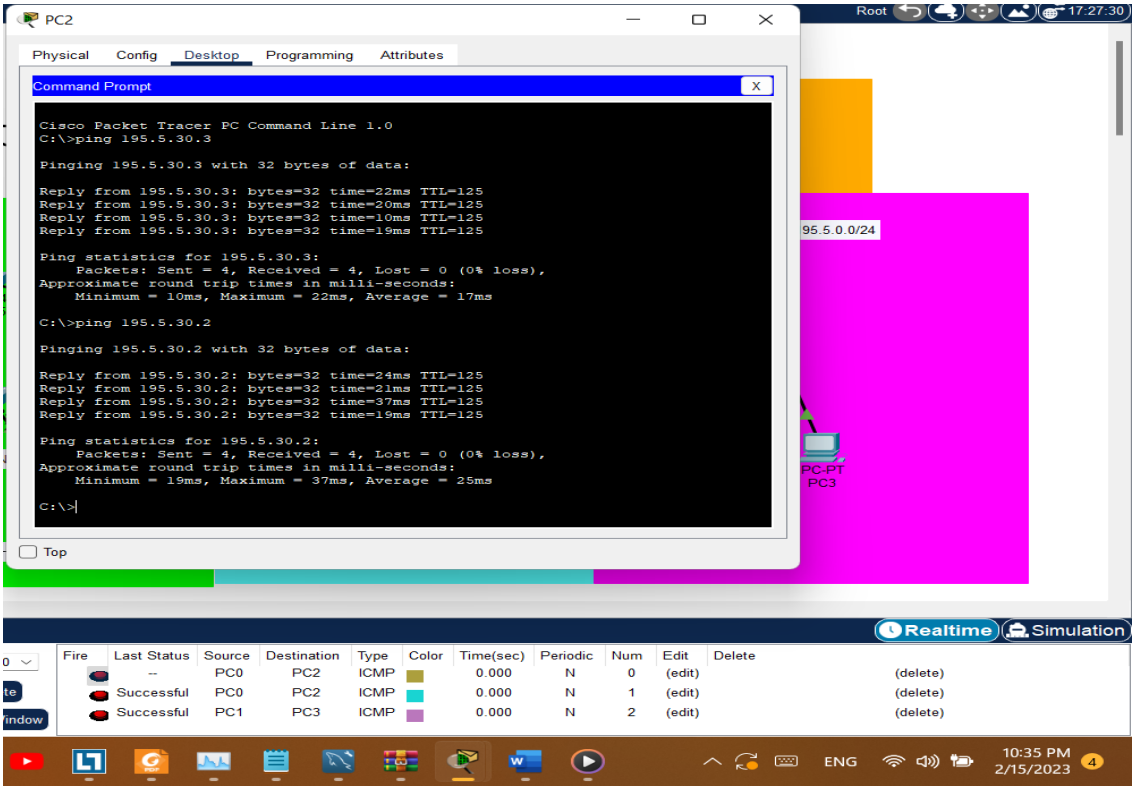


Ping from PC3 to PC2:



Ping from PC2 to PC0 and PC1:



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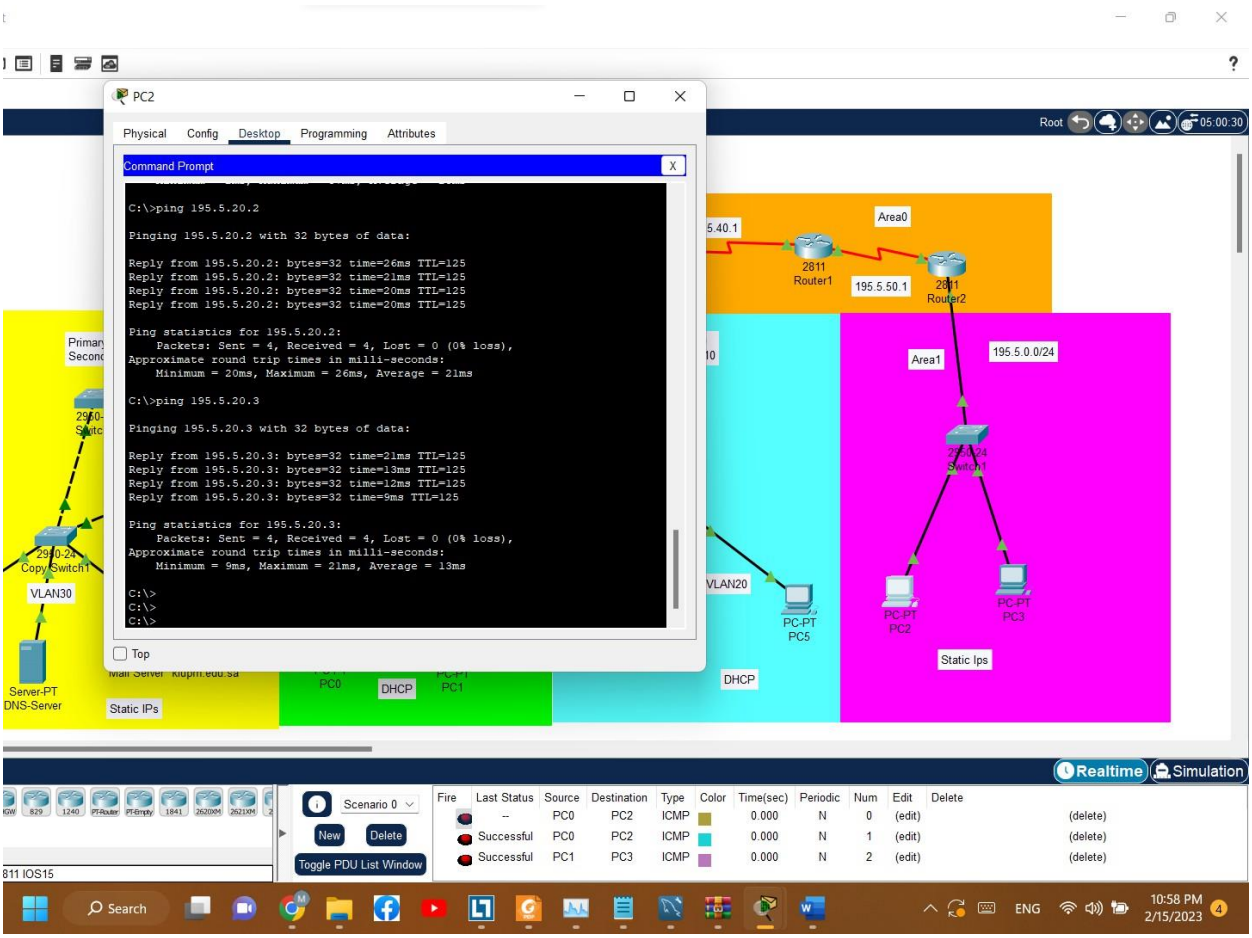
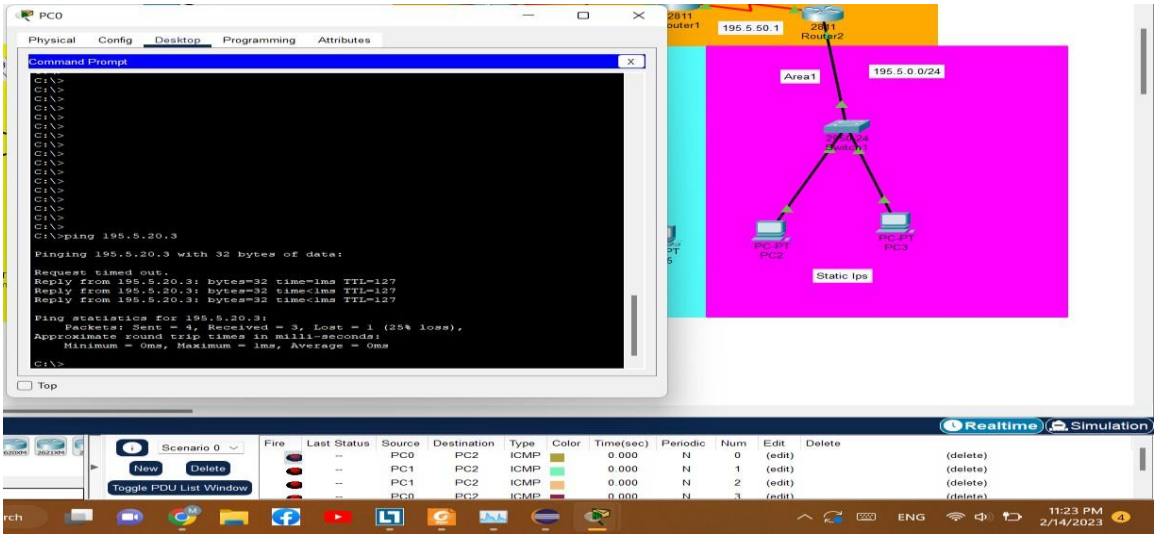
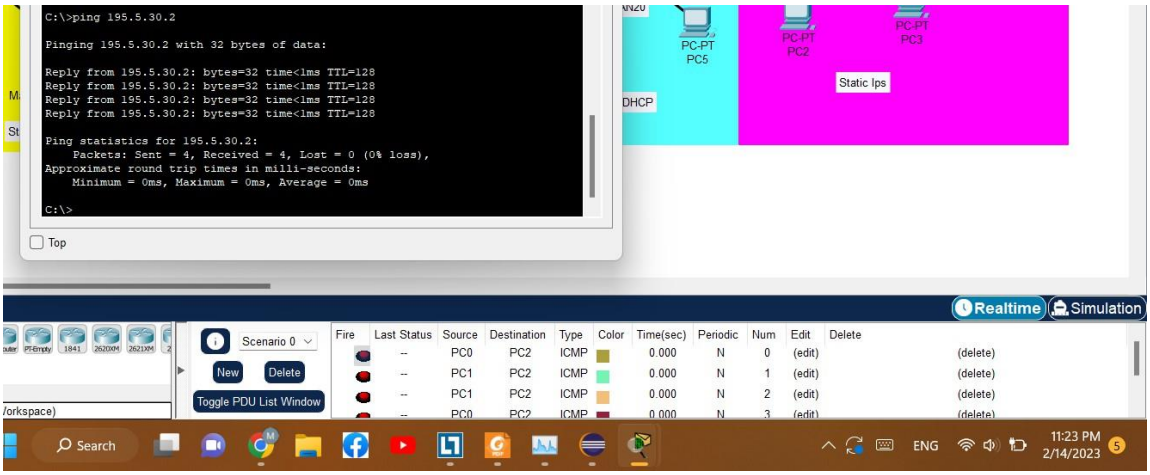
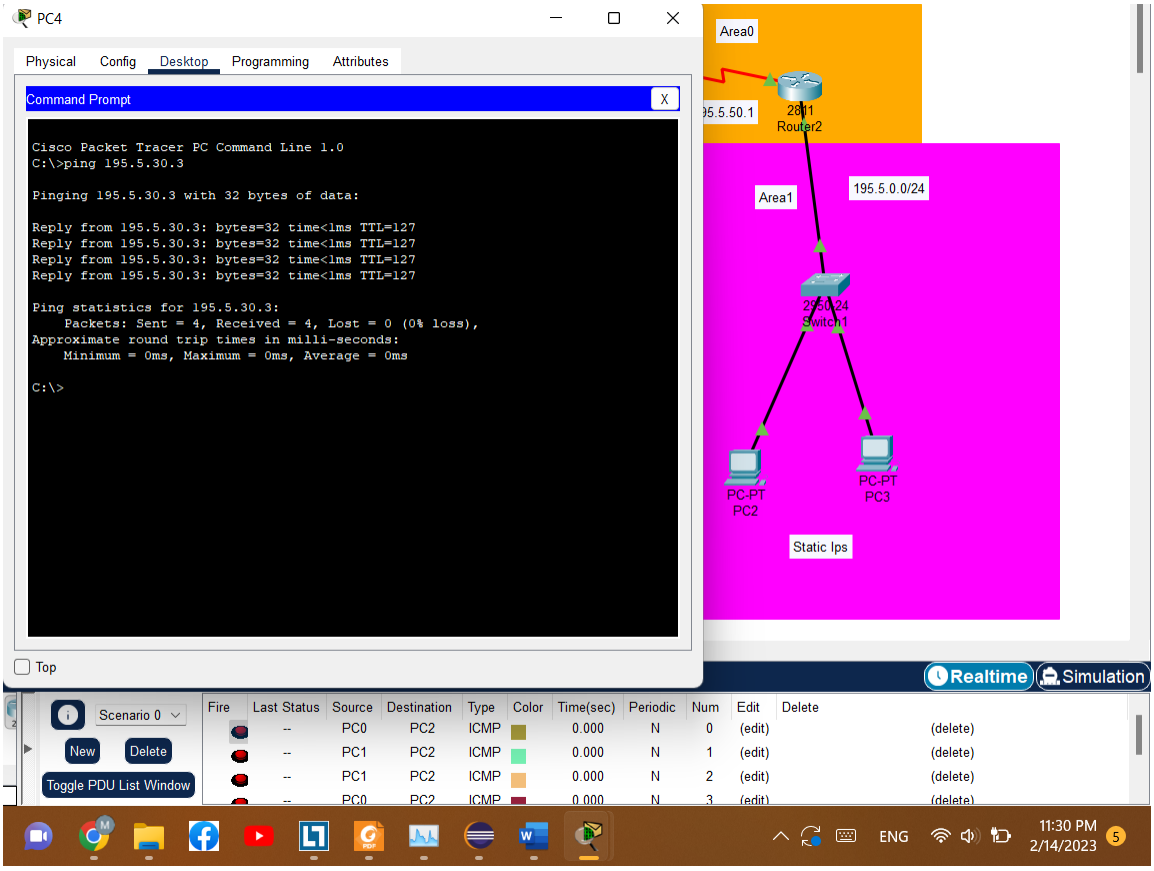


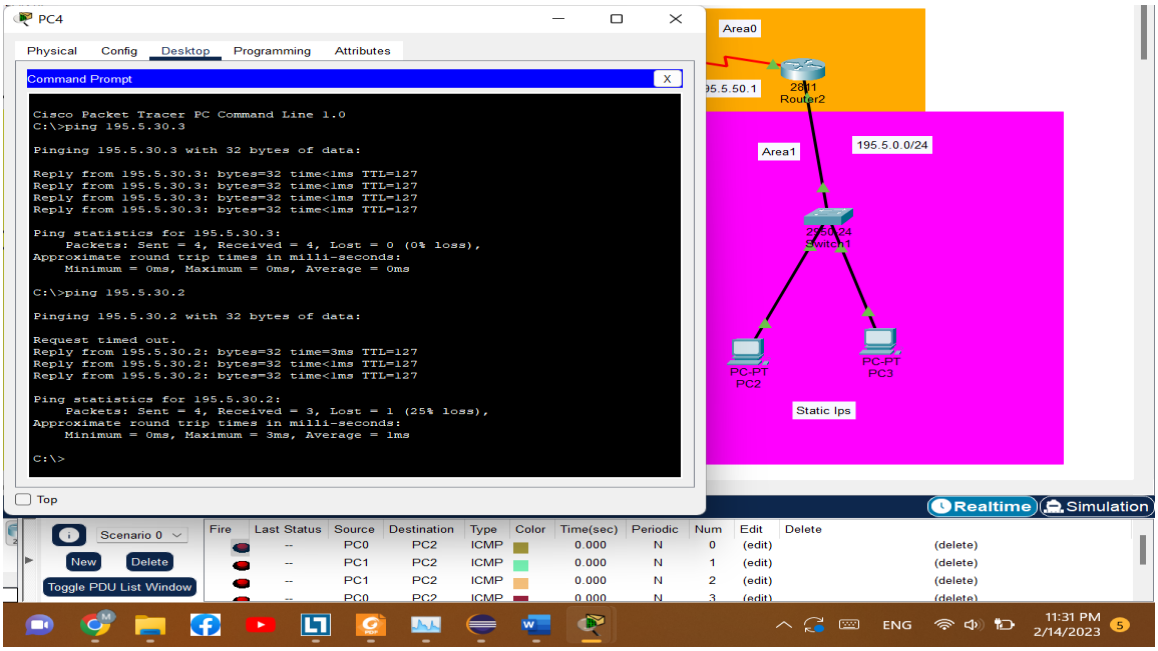
Ping from PC0 to PC4 and PC5



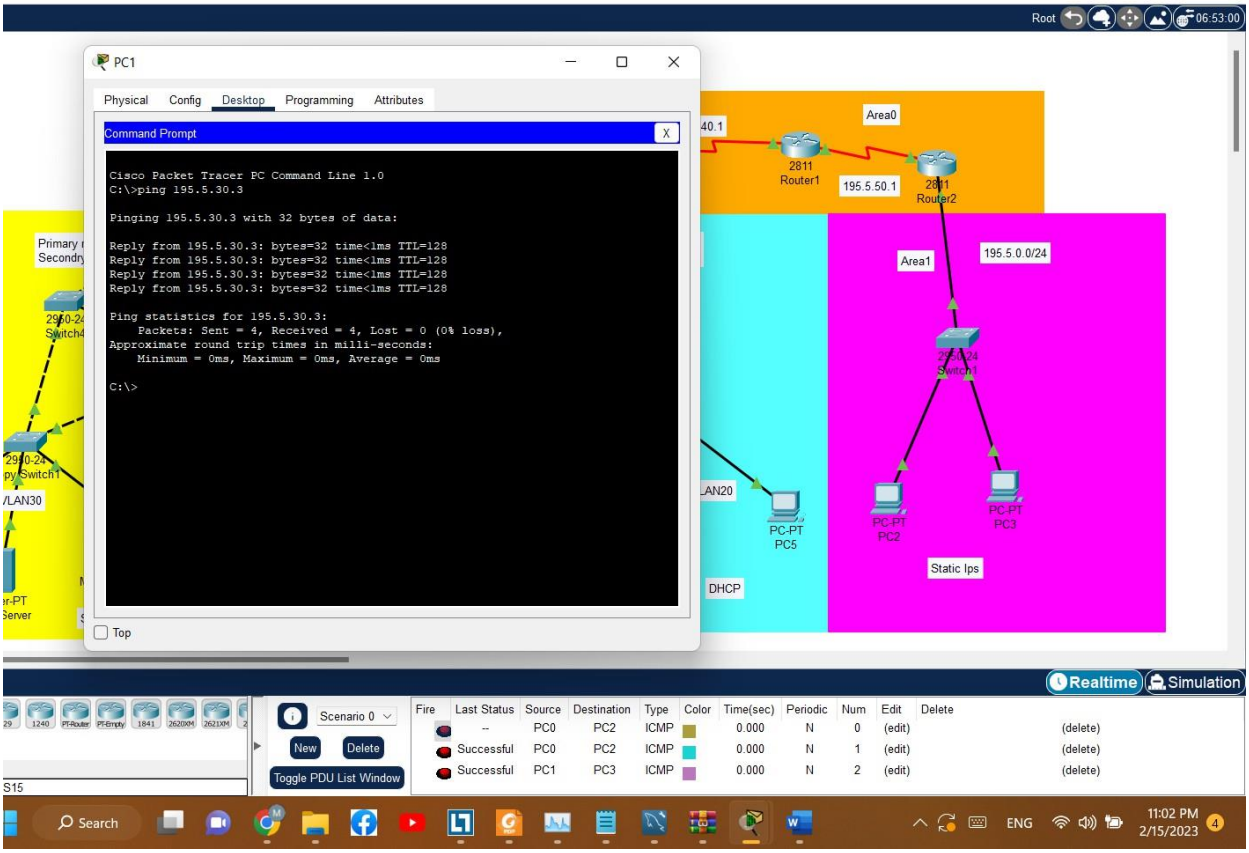


Ping From PC4 to PC1 and PC0

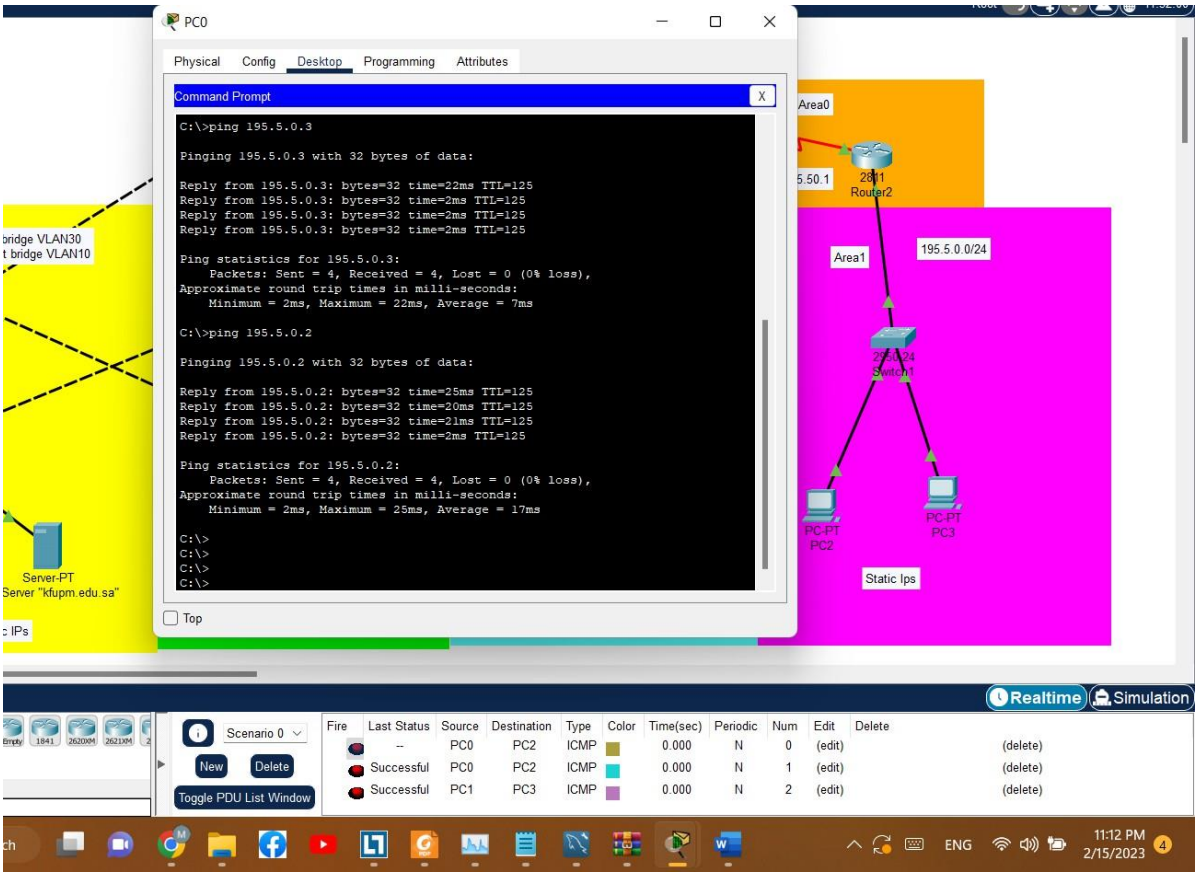




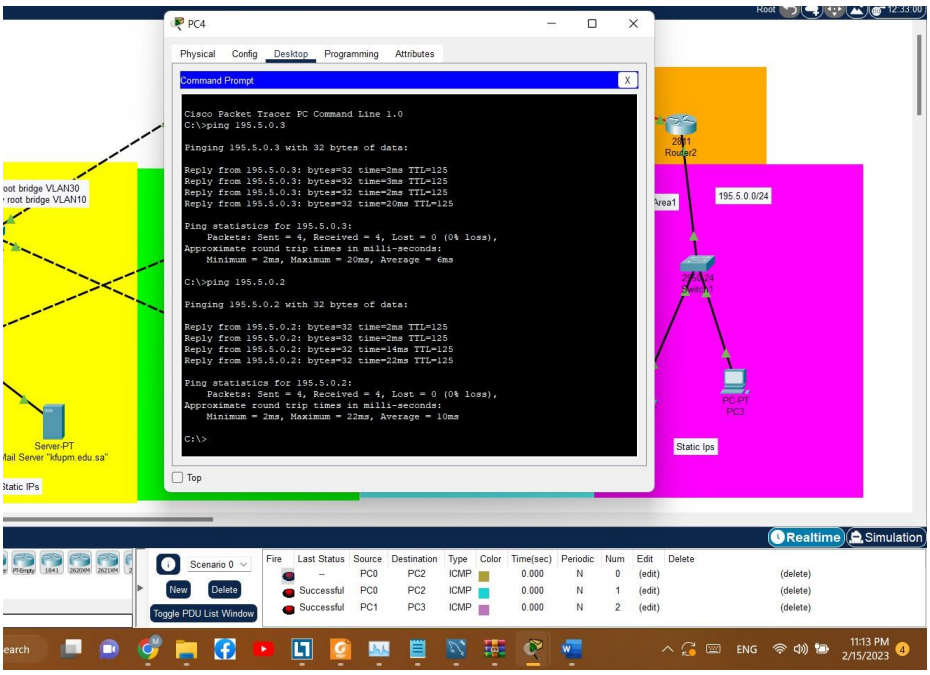
Ping From PC1 to PC0:



Ping from PC0 to PC2 and PC3:

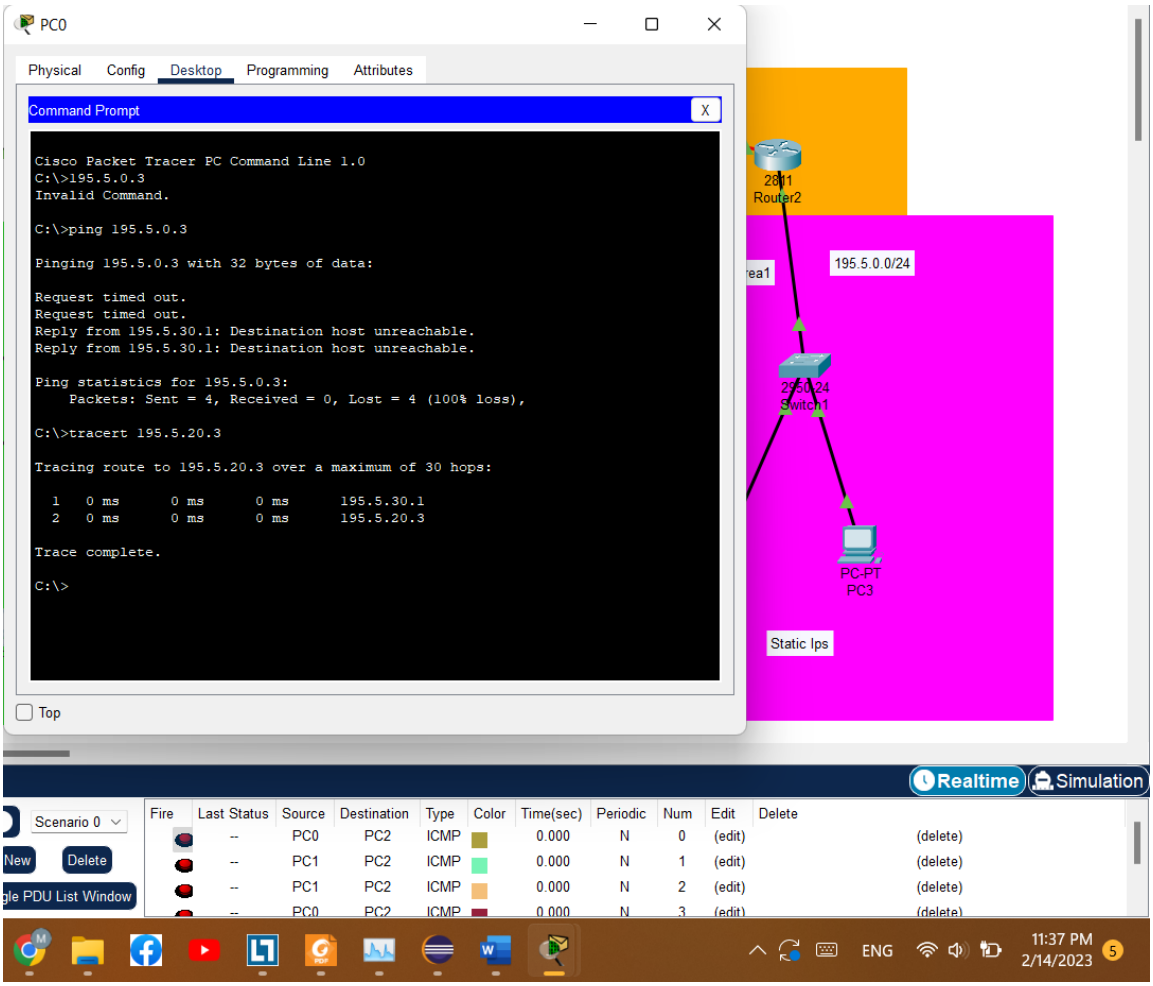


Ping from PC4 to PC2 and PC3:

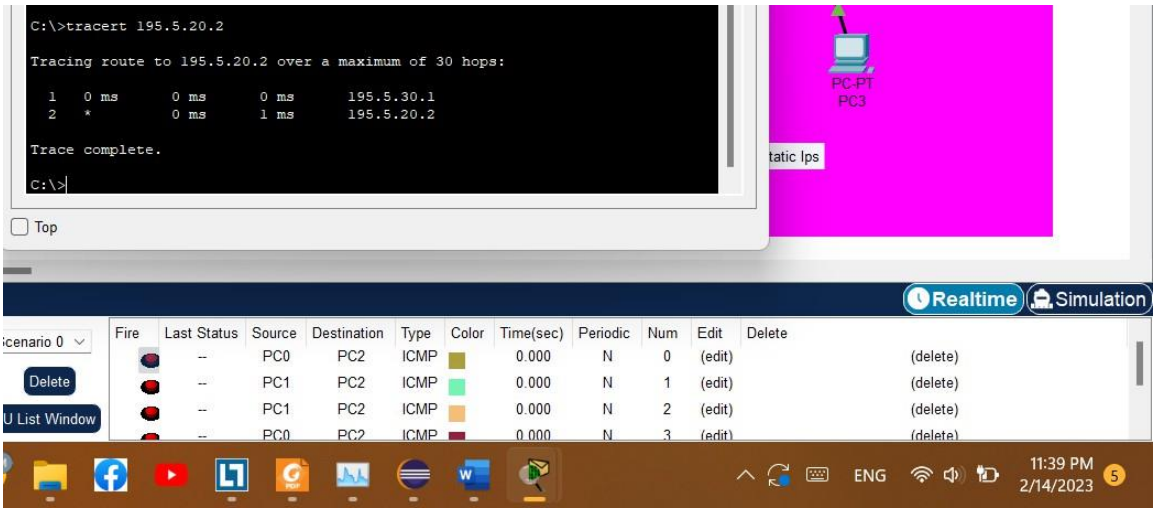


TraceRt between PCs:

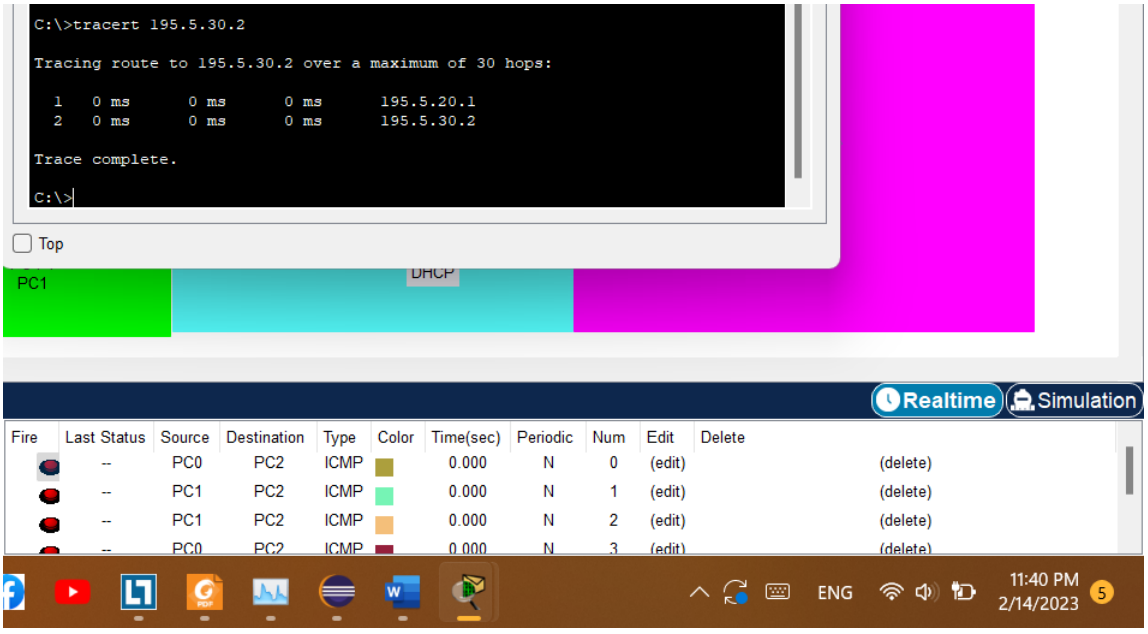
From PC0 to PC4:



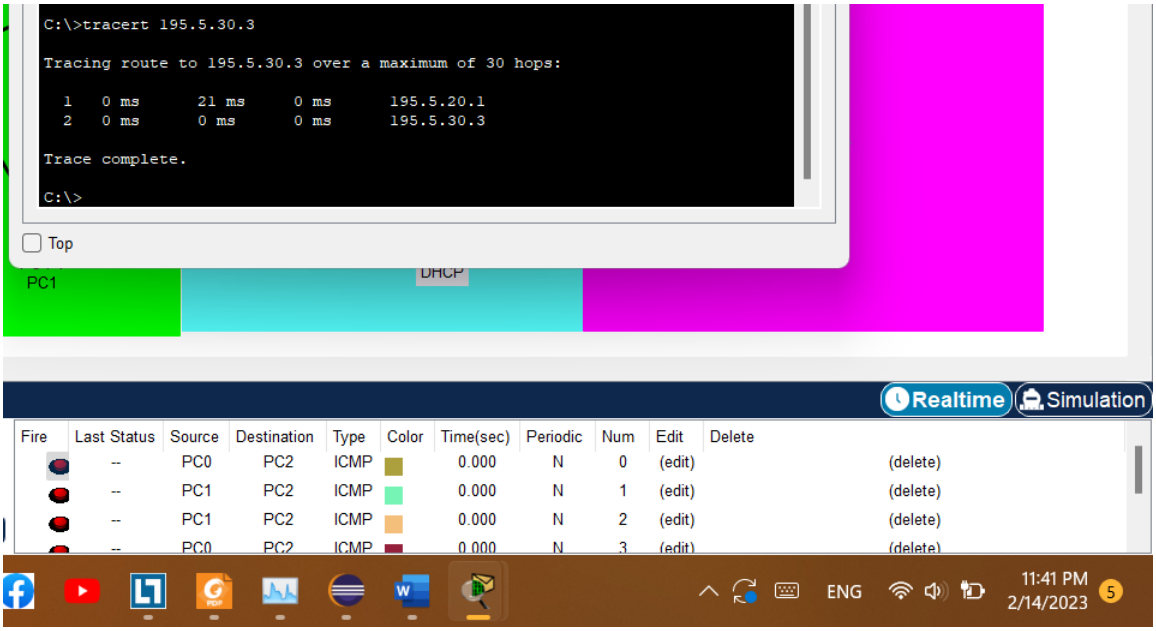
From PC0 to PC5



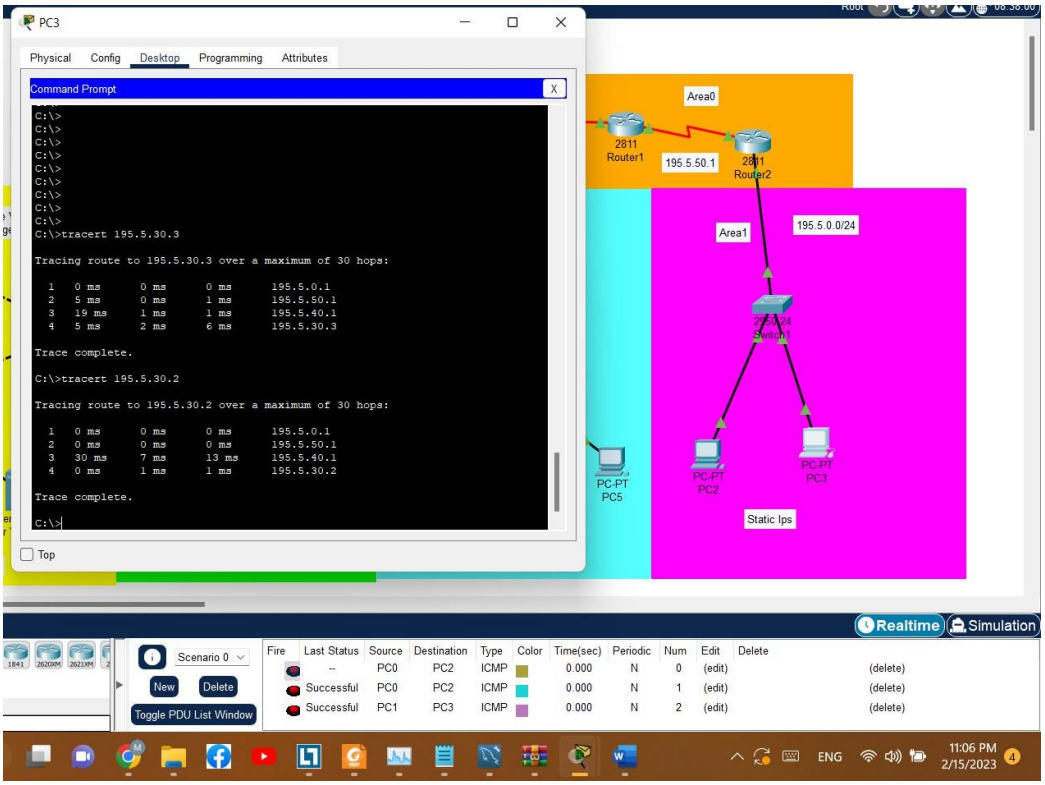
From PC4 to PC1



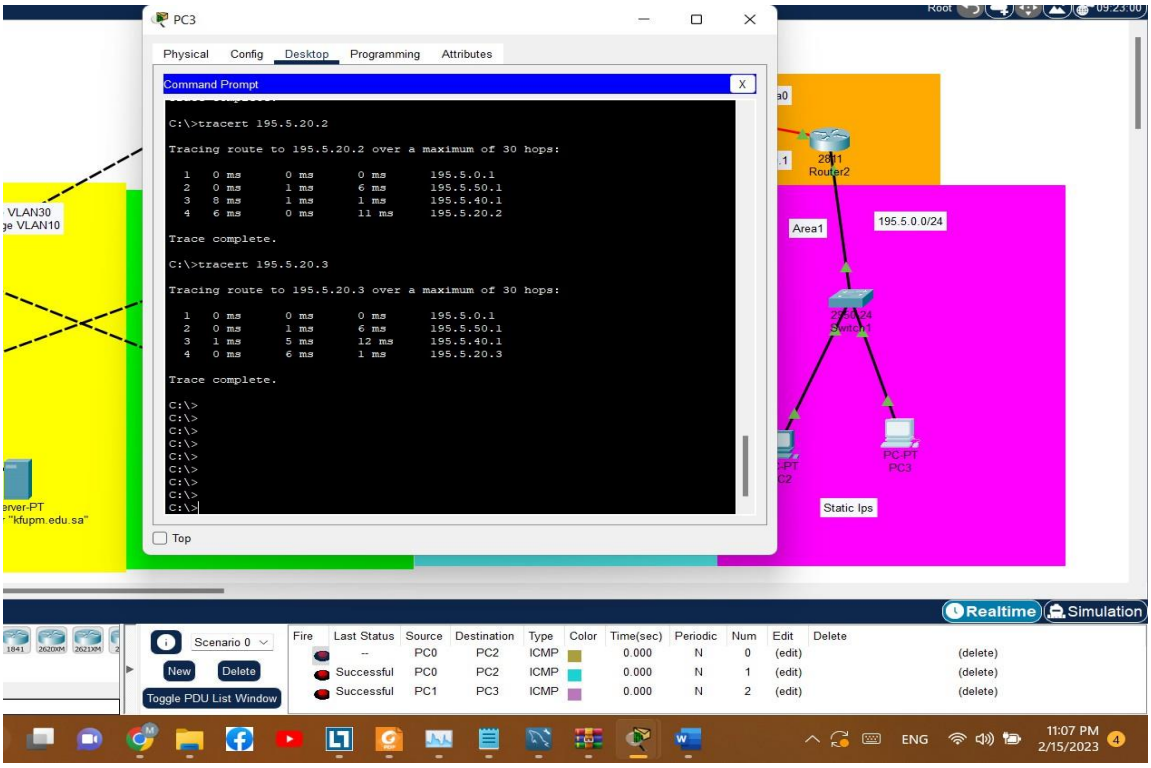
From PC4 to PC0:



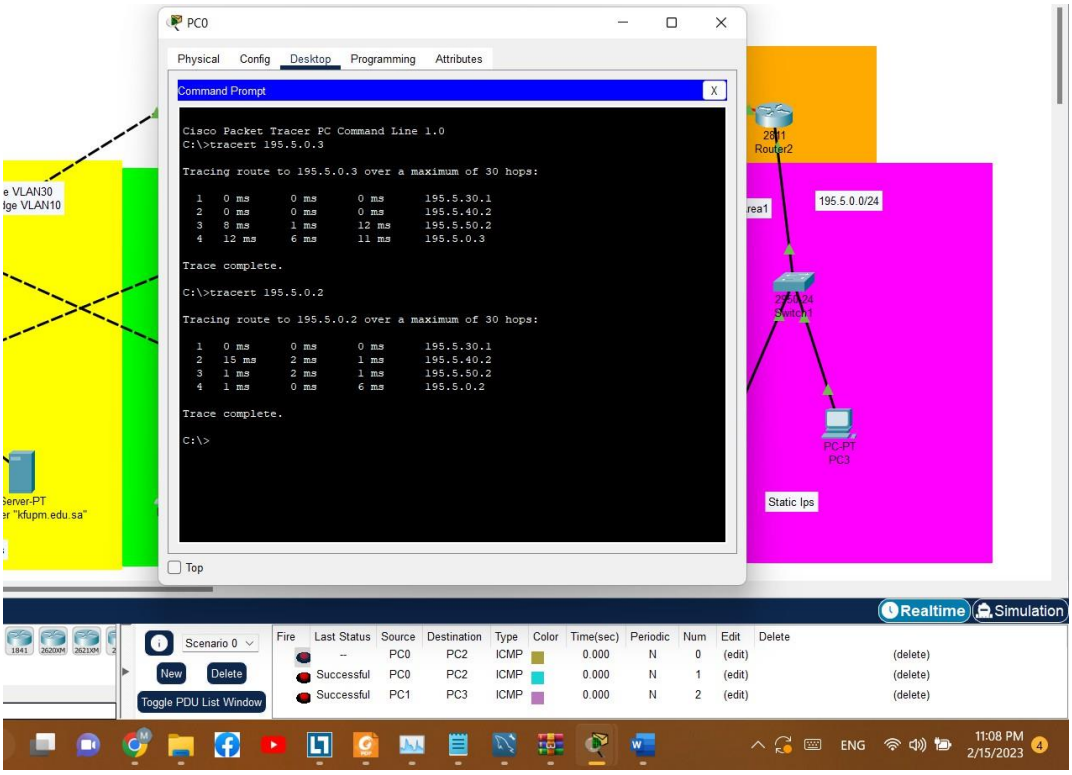
From PC3 to PC0 and PC1:



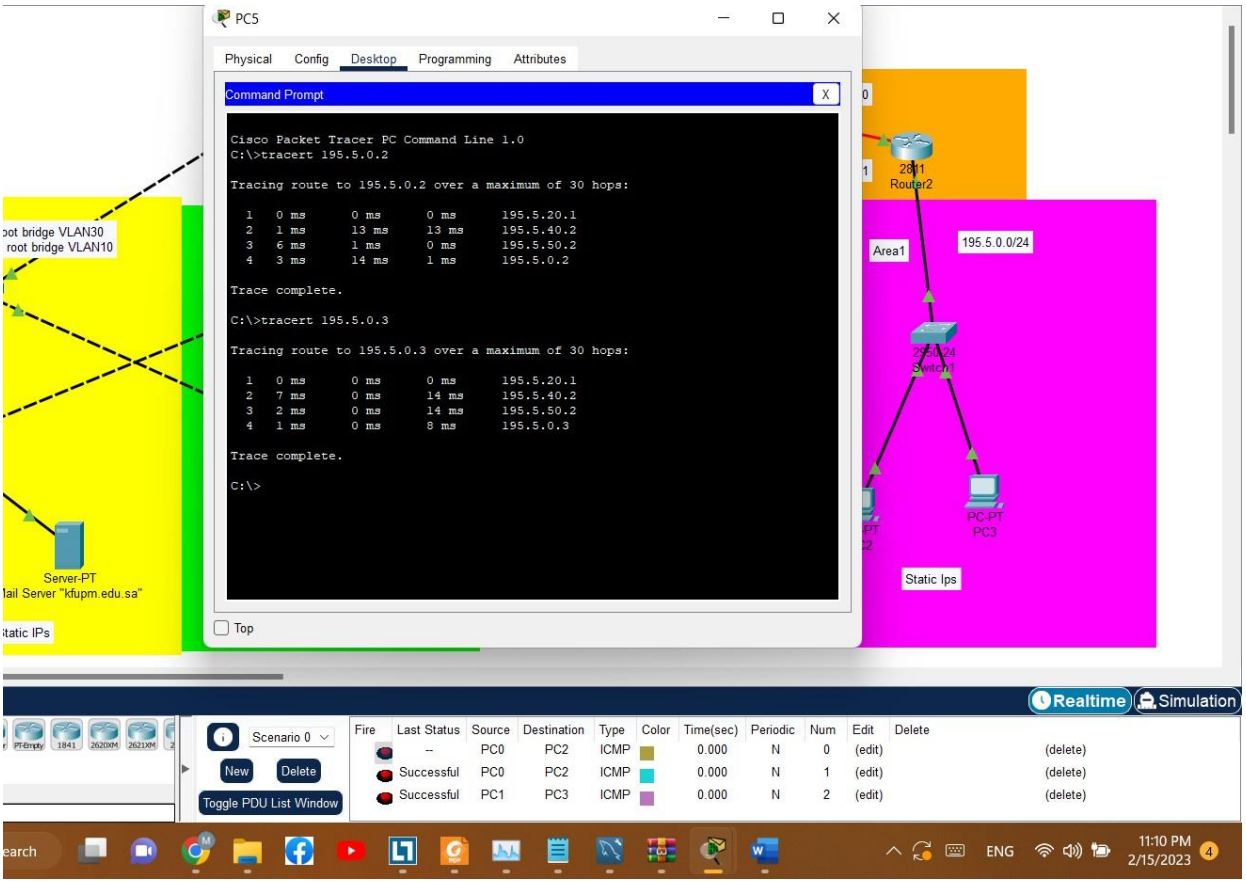
From PC3 to PC4 and PC5:



From PC0 to PC2 and PC3:



From PC5 to PC2 and PC3:



Conclusion:

Through this project, we learned a great deal about computer networking and gained practical skills that can be applied to real-world scenarios. I started by learning how to use Packet Tracer, a powerful network simulation tool used for creating, configuring, and troubleshooting virtual networks. I then delved into the fundamental concepts of IP subnetting and assignment, which enabled me to assign IP addresses to network devices. Next, I learned how to configure HTTP, DNS, and email servers, essential services used for communication and information sharing in a network. Moving on, I explored the basics of routing algorithms and learned how to configure them on routers to enable dynamic routing. I then set up VLANs on switches and routers to segment a network into smaller, more manageable parts, and set up Access Control Lists (ACLs) to control network traffic and restrict access to network resources. By achieving these objectives, I gained a deeper understanding of computer networking and acquired practical skills that will undoubtedly be useful in my future endeavors in this exciting and rapidly-evolving field.