Department of Electrical & Computer Engineering
AIR UNIVERSITY

PROJECT REPORT

Computer Networks

Instructor Name

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Submitted by

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Complex Engineering Problem

Implementation and Configuration of give Scenario

ABSTRACT

In this network design, the main office has a local area network (LAN) with multiple departments, each with its own VLAN which means that they are isolated from each other. A wide area network link (Serial DCE connection) connects the main office to another LAN, which is referred to as the new office. The new office has its own VLANs. Employees may exchange data and resources due to the WAN link's reliable and efficient communication between the two offices. We used a single router that is connected to both VLANs and is configured with subinterfaces for each VLAN. The router acts as the gateway for both VLANs and can route traffic between them. Lastly, the network is tested to ensure that all VLANs are isolated and inter-VLAN communication is working as intended.

Contents

1 OBJECTIVES

- Hands-on experience in designing and configuration.
- How to troubleshoot a computer network.
- Familiarization with Cisco Packet Tracer.
- Learn to Implement routing protocols.

Software Used :

- Cisco Packet Tracer

2 INTRODUCTION

2.1 Cisco Packet Tracer

The main purpose of Cisco Packet Tracer is to help students learn the principles of networking with hands-on experience as well as develop Cisco technology-specific skills. Since the protocols are implemented in a software-only method, this tool cannot replace the hardware Routers or Switches. Interestingly, this tool does not only include Cisco products but also many more networking devices. Using this tool is widely encouraged as it is part of the curriculum like CCNA and CCENT where Faculties use Packet Trace to demonstrate technical concepts and networking systems. Students complete assignments using this tool, working on their own or in teams.

2.2 Router

A router is a hardware device designed to receive, analyze and move incoming packets to another network. It may also be used to convert the packets to another network interface, drop

them, and perform other actions relating to a network. The purpose of a router is to route traffic from one network to another network.

2.2.1 WAN link

A WAN port is used to connect the router to your broadband modem.

2.3 Local area network (LAN)

LAN (Local Area Network) is a set of devices connected with each other in order to communicate with each other and is limited to certain areas such as offices or schools. Thus also called a small area network and enables the sharing of resources such as files, applications, cameras and printers. The protocol (Control of transmission) used for this Scenario is DHCP.

2.4 Virtual local area network (VLAN)

Unlike LAN, VLAN (Virtual Local Area Network) is a logical separation of the LAN where multiple LAN segments are created within a single bandwidth. It eliminates the need for installing multiple different switches for the various sub-networks of an organization.

1. **Static VLAN** In this type, VLAN is assigned to the port manually. This static configuration is said to be the most secure way of creating a VLAN as it does not change until the network administrator itself changes the configuration.

2. **Dynamic VLAN** The dynamic configuration uses intelligent software for the automatic assignment to the port of the VLAN.

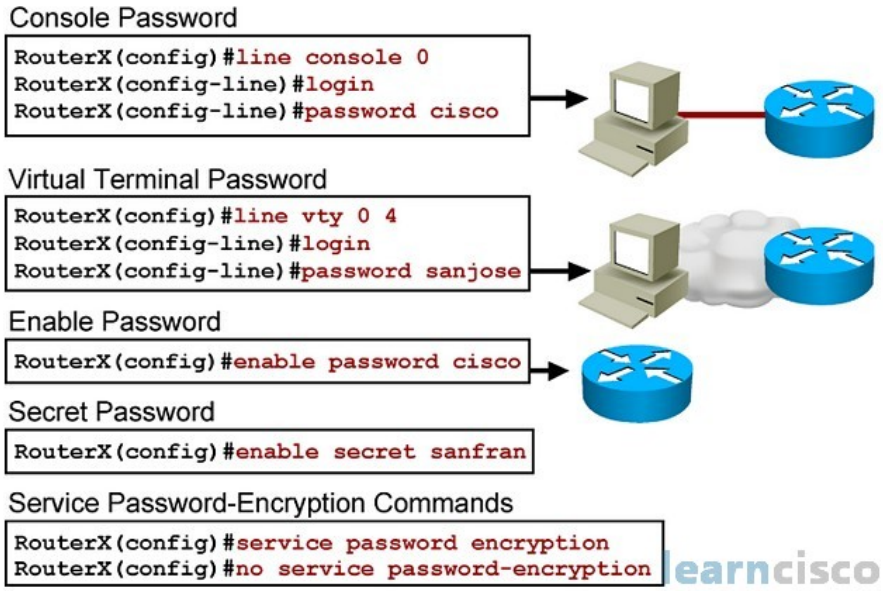
2.4.1 DHCP server

Dynamic Host Configuration Protocol (DHCP) is a client/server protocol that automatically provides an Internet Protocol (IP) host with its IP address and other related configuration information such as the subnet mask and default gateway.

- With the DCE cable, (red zigzag with clock) the side you click first will be the DCE, the second will be DTE

- With the DTE cable (red zigzag no clock) the side you click first will be DTE, the second will be DCE

Following are few security commands for the network;



2.5 DNS and Web server in System

In Cisco Packet Tracer, you can simulate the functionality of DNS (Domain Name System) and a web server using various network devices and services. Here's a basic setup to simulate DNS and a web server using Cisco Packet Tracer:

- DNS Server Setup: Drag and drop a "Server" device from the "End Devices" category onto the workspace. Double-click on the server to open its configuration. Go to the "Services" tab and select the "DNS" service. Configure the DNS server settings, such as the domain name and IP address mapping. Save the configuration and start the server.
- Web Server Setup: Drag and drop a "HTTP Server" device from the "End Devices" category onto the workspace. Double-click on the server to open its configuration. Configure the web server settings, such as the web content directory and default web page. Save the configuration and start the server.
- Client Configuration: Drag and drop a "PC" device from the "End Devices" category onto the workspace. Double-click on the PC to open its configuration. Configure the IP settings for the PC, including the DNS server's IP address. Save the configuration.
- Network Configuration: Connect the DNS server to the web server and the client using appropriate network cables. Configure IP addresses and subnet masks for all devices in the network. Ensure that the client's DNS settings point to the DNS server's IP address.
- Testing: Open a web browser on the client PC and enter the IP address or domain name associated with the web server. The web browser should establish a connection to the web server and display the default web page. You can also test the DNS functionality by entering domain names into the browser and verifying that they resolve to the correct IP addresses.

2.5.1 Use of Protocols

Following where the protocols used in the project

- HTTP
- DHCP
- RIP
- TTL
- ICMP
- DNS
- TCP

3 Procedure

Here are the steps to complete this network design in Cisco Packet Tracer:

- Open Cisco Packet Tracer and create a new project.
- Create two LANs, one for the main office and one for the new office. For the main office, create separate VLANs for each department (finance, human resources, marketing, and operations). For the new office, create a single VLAN for all departments.
- Add switches to the LANs and configure them to support VLANs. Configure the switches to isolate each department's VLAN in the main office LAN.
- Add a router to each LAN and configure them to provide inter-VLAN routing.
- Configure the WAN link between the main office and the new office with appropriate security measures, such as encryption and authentication.
- Configure a DHCP server in the main office to assign IP addresses to devices in the LAN. Configure a separate DHCP server in the new office to assign IP addresses to devices in the new office.
- Configure port forwarding on the main office router to allow access to the web server from both the main office and the new office.
- Ensure that the network design is scalable by leaving room for expansion and growth of the company.
- Test the network to ensure that devices can communicate securely and efficiently.
- These steps should help you create a network design that meets the requirements of the scenario.

4 Working Methodology

4.1 Network Architecture Design

1. Start by designing the network architecture that includes the main office LAN, new office LAN, and the WAN link.
2. Determine the number of switches, routers, and DHCP servers required based on the network requirements.
3. Plan the IP addressing scheme for each LAN and allocate IP address ranges accordingly.
4. Identify the VLANs needed and assign them to appropriate network segments.

4.2 Device Configuration

1. Open Cisco Packet Tracer and add the required devices (switches, routers, DHCP servers) to the network topology.
2. Configure the devices with appropriate IP addresses, subnet masks, and default gateways.
3. Assign VLANs to the switch ports and configure trunk links between switches to ensure VLAN connectivity.
4. Configure routing protocols (such as RIP or OSPF) on the routers to enable communication between the main office and the new office.
5. Set up DHCP servers to provide IP address allocation and configuration to devices in each LAN.

4.3 Troubleshooting

1. Use Cisco Packet Tracer's built-in tools and commands to troubleshoot any connectivity issues, VLAN isolation issues, or security problems.
2. Verify that devices in the same VLAN can communicate with each other and that devices in different VLANs are isolated.
3. Check routing tables on routers to ensure proper routing between the main office and the new office.
4. Use packet-capturing tools to analyze network traffic and identify any abnormal behavior or misconfigurations.
5. Verify that security measures such as access control lists (ACLs) and firewall rules are correctly implemented.

4.4 Network Testing

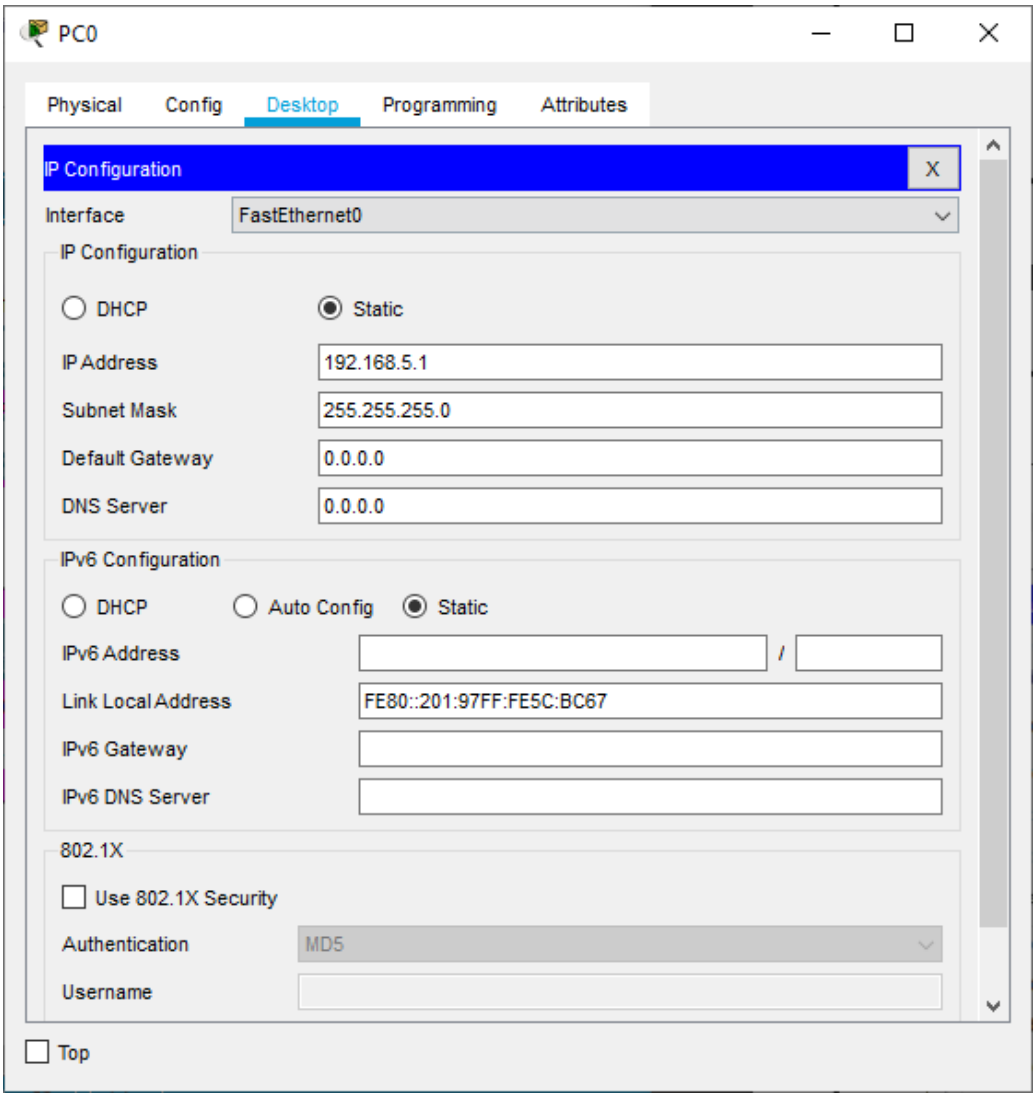
1. Simulate communication between devices in the main office and the new office to test network connectivity.
2. Verify that devices can access the web server from both offices.
3. Perform network stress tests to assess the scalability and performance of the network.
4. Monitor network traffic and performance using Cisco Packet Tracer's monitoring tools.

Throughout the process, document the network configuration, changes made and any troubleshooting steps taken. This documentation will serve as a reference for future maintenance and troubleshooting. Regularly test and monitor the network to ensure it meets the desired requirements and remains secure and efficient.

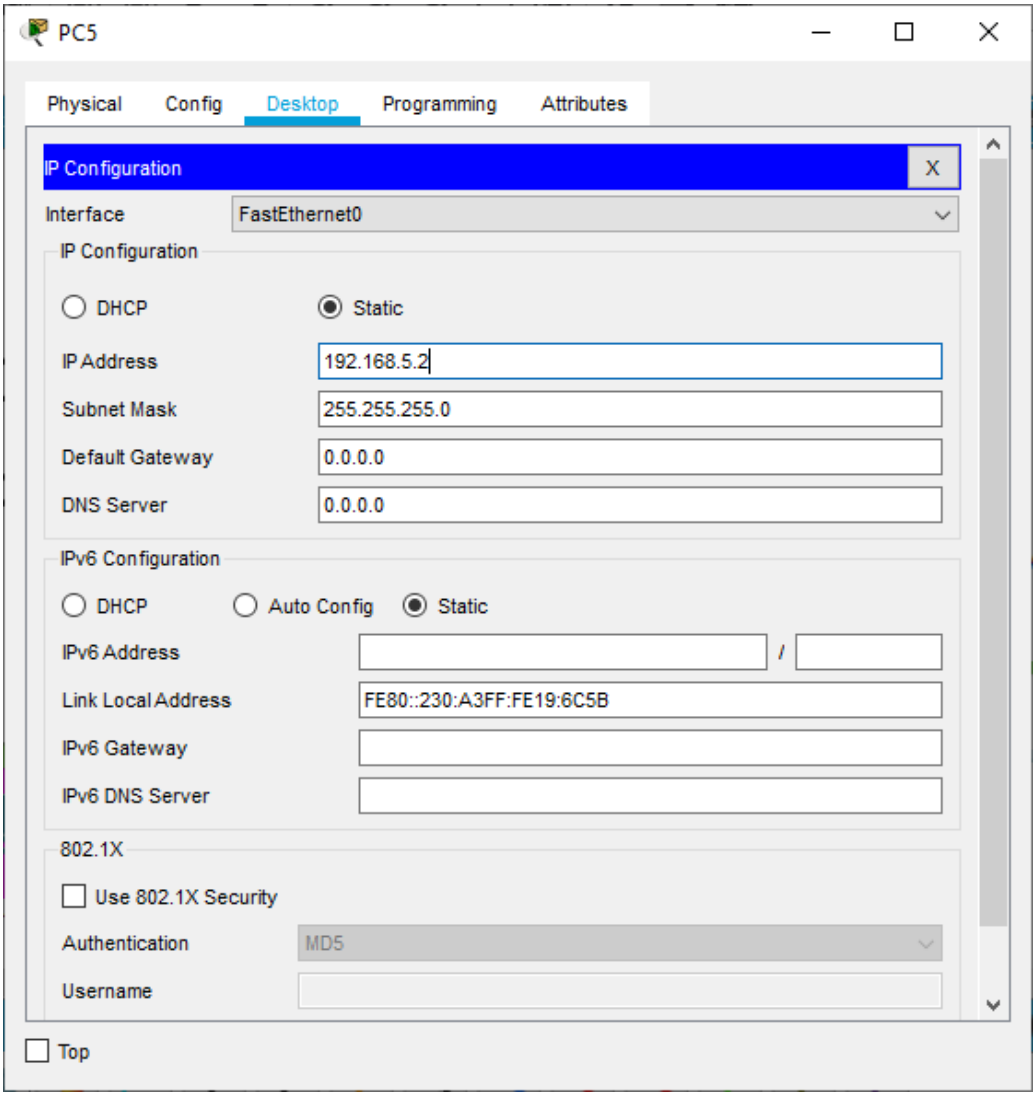
5 Results & Screen Shots

Following are the snaps for Project

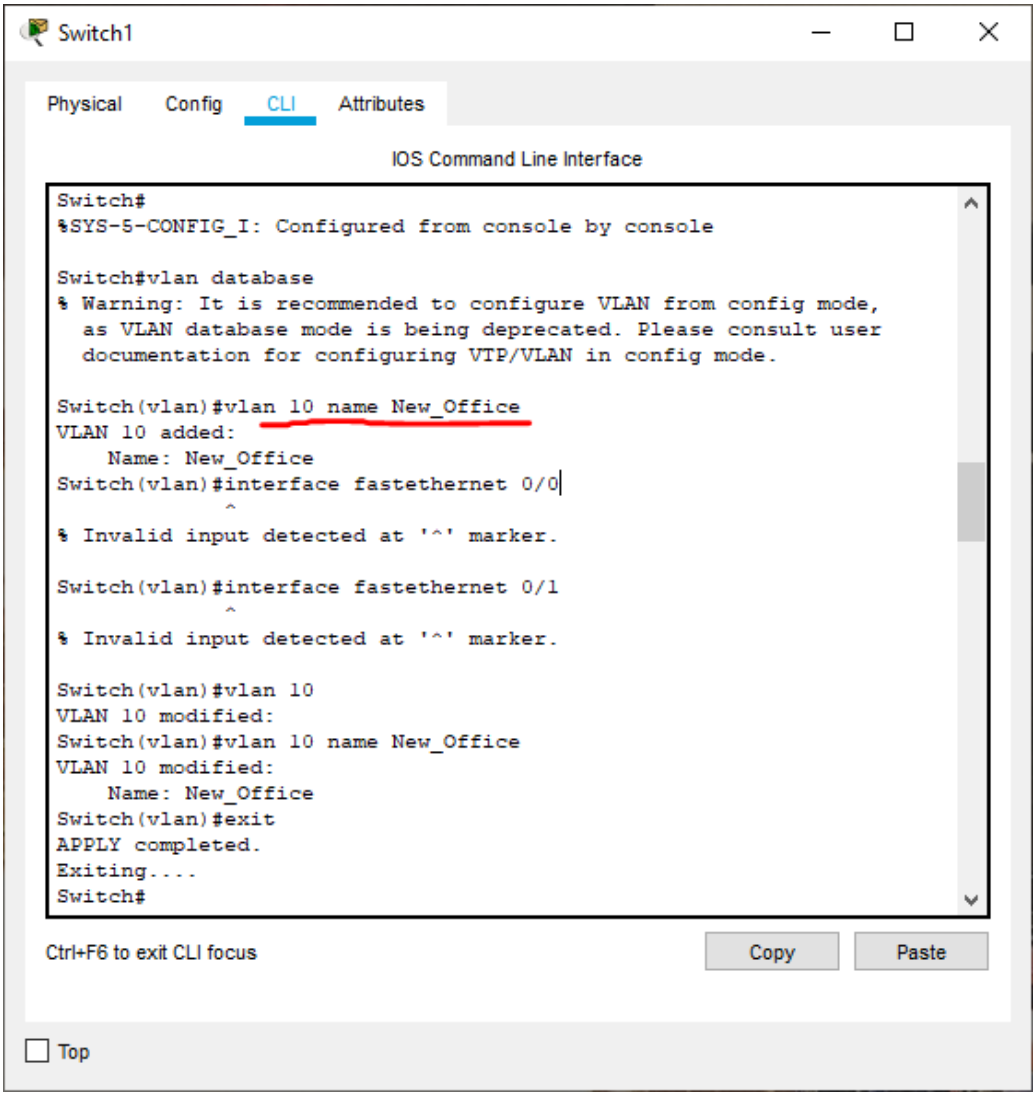
Screenshot 1



Screenshot 2



Screenshot 3



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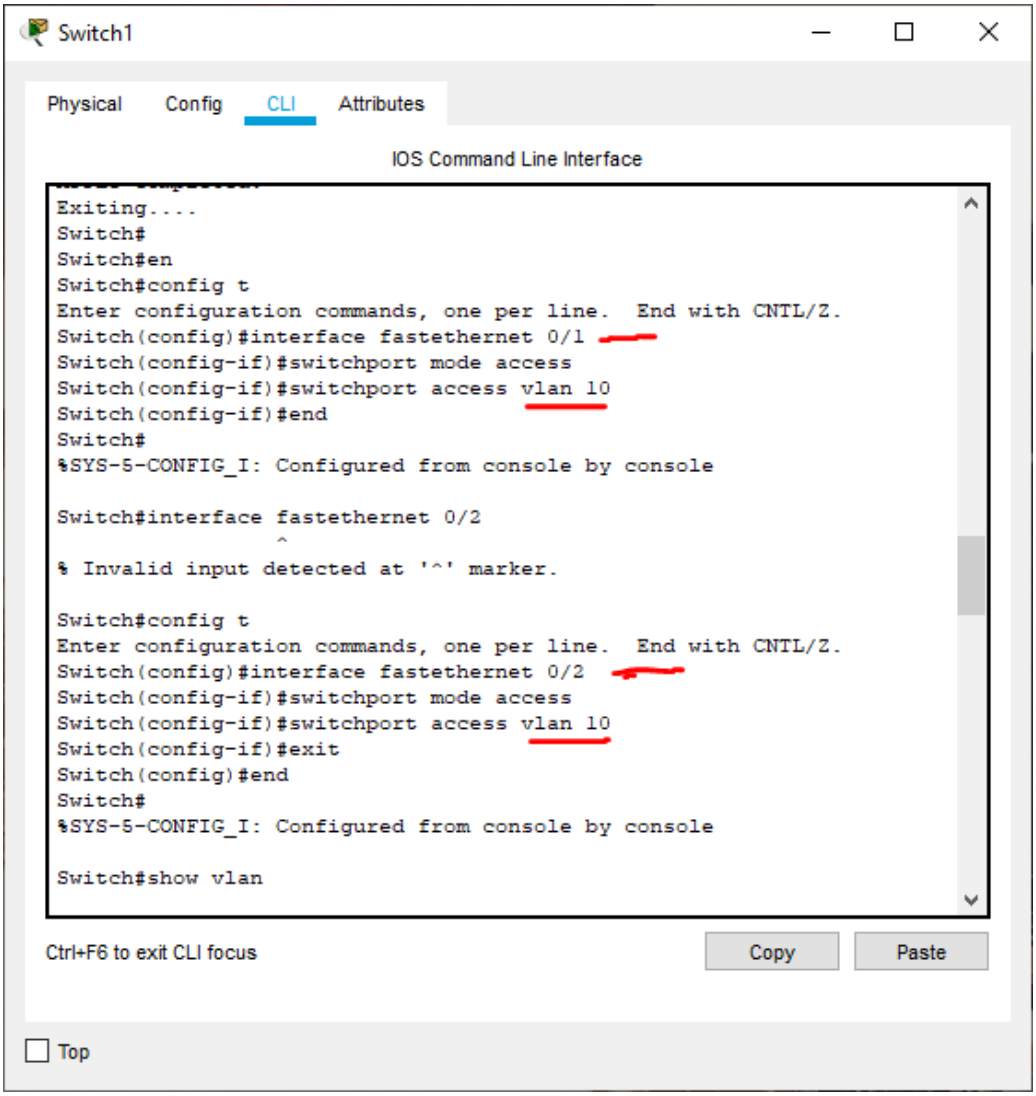

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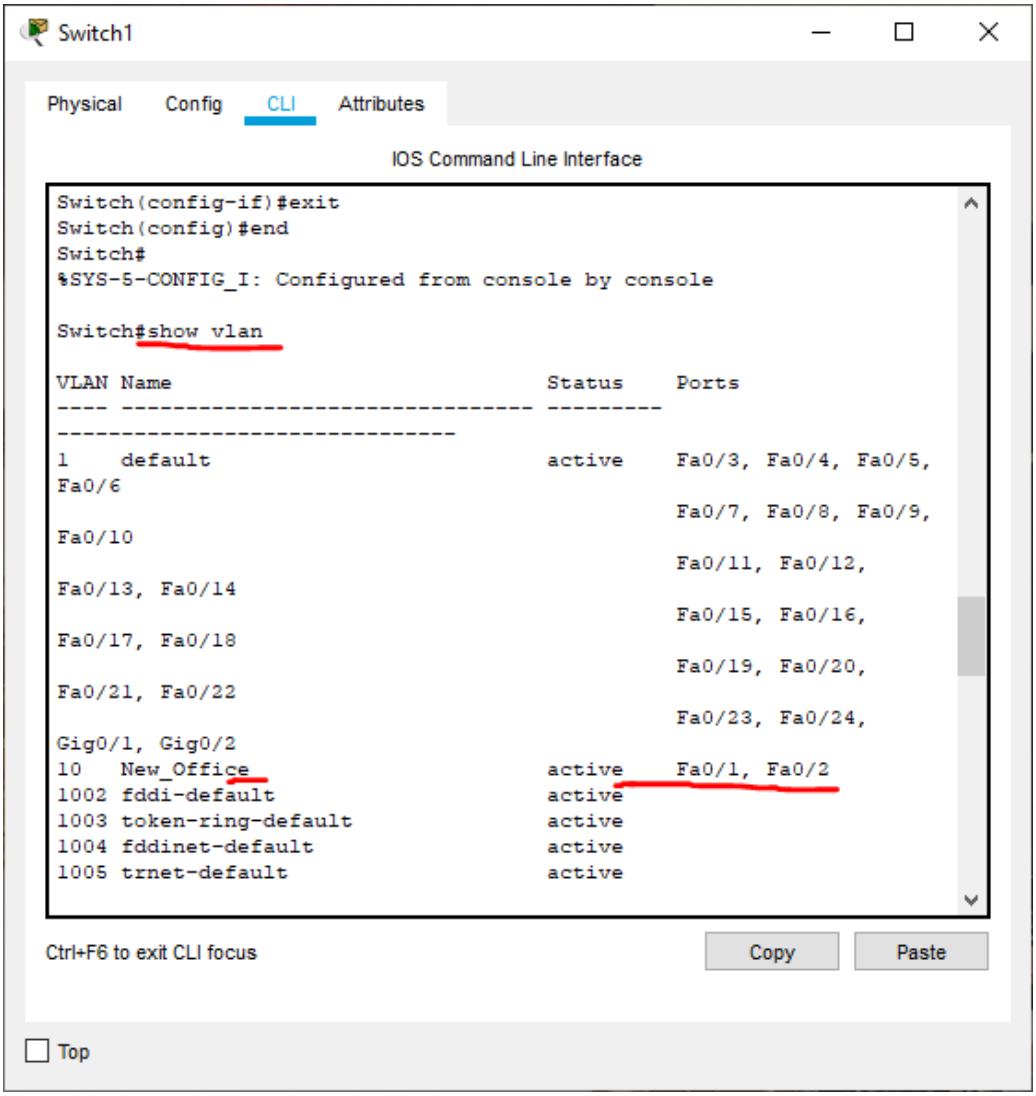
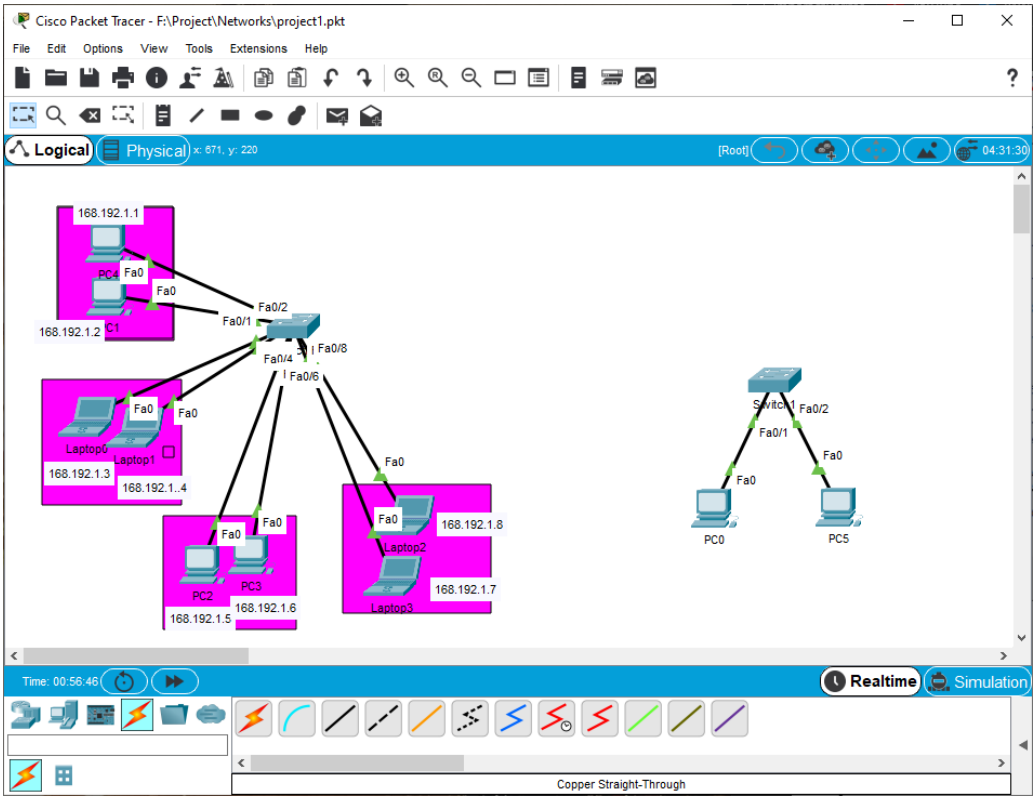


Screenshot 6



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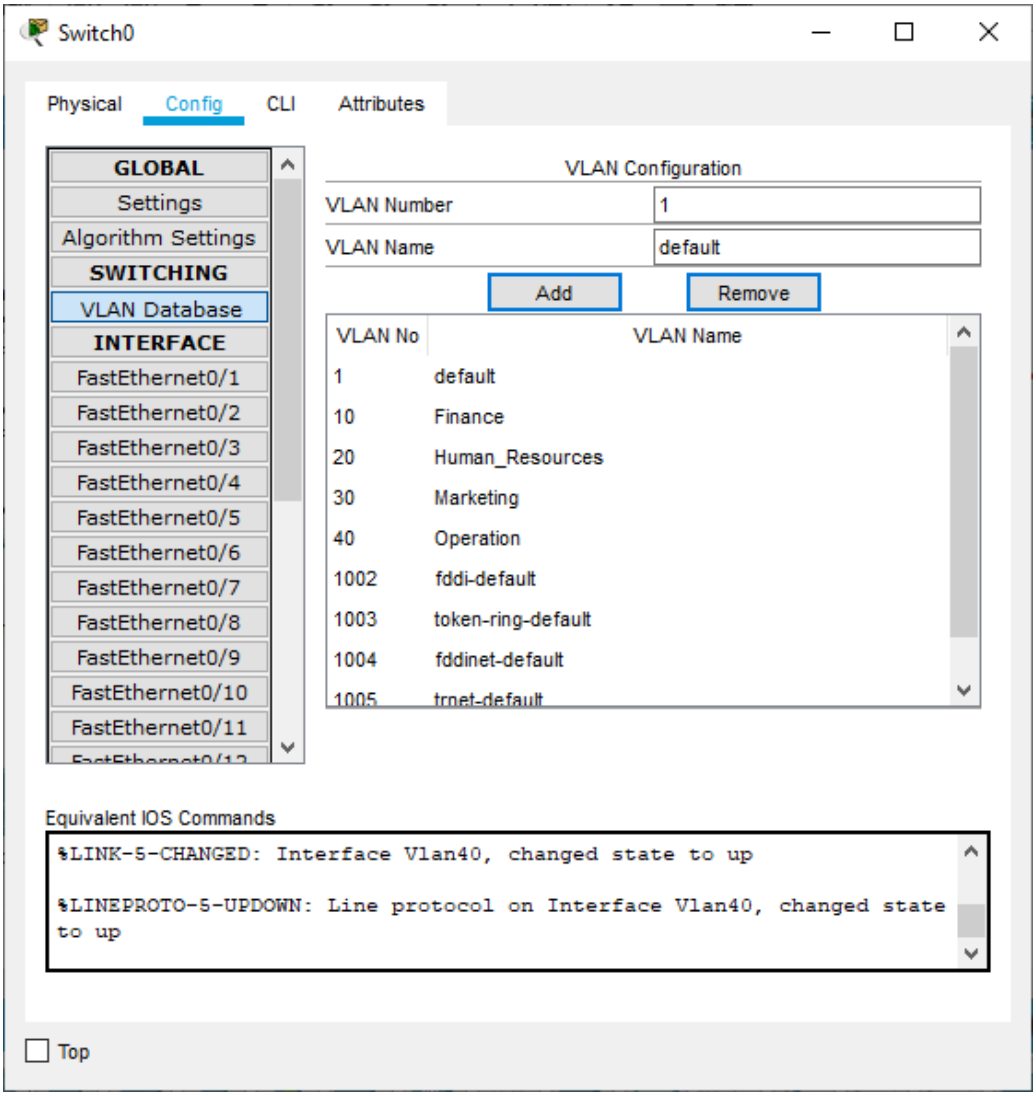
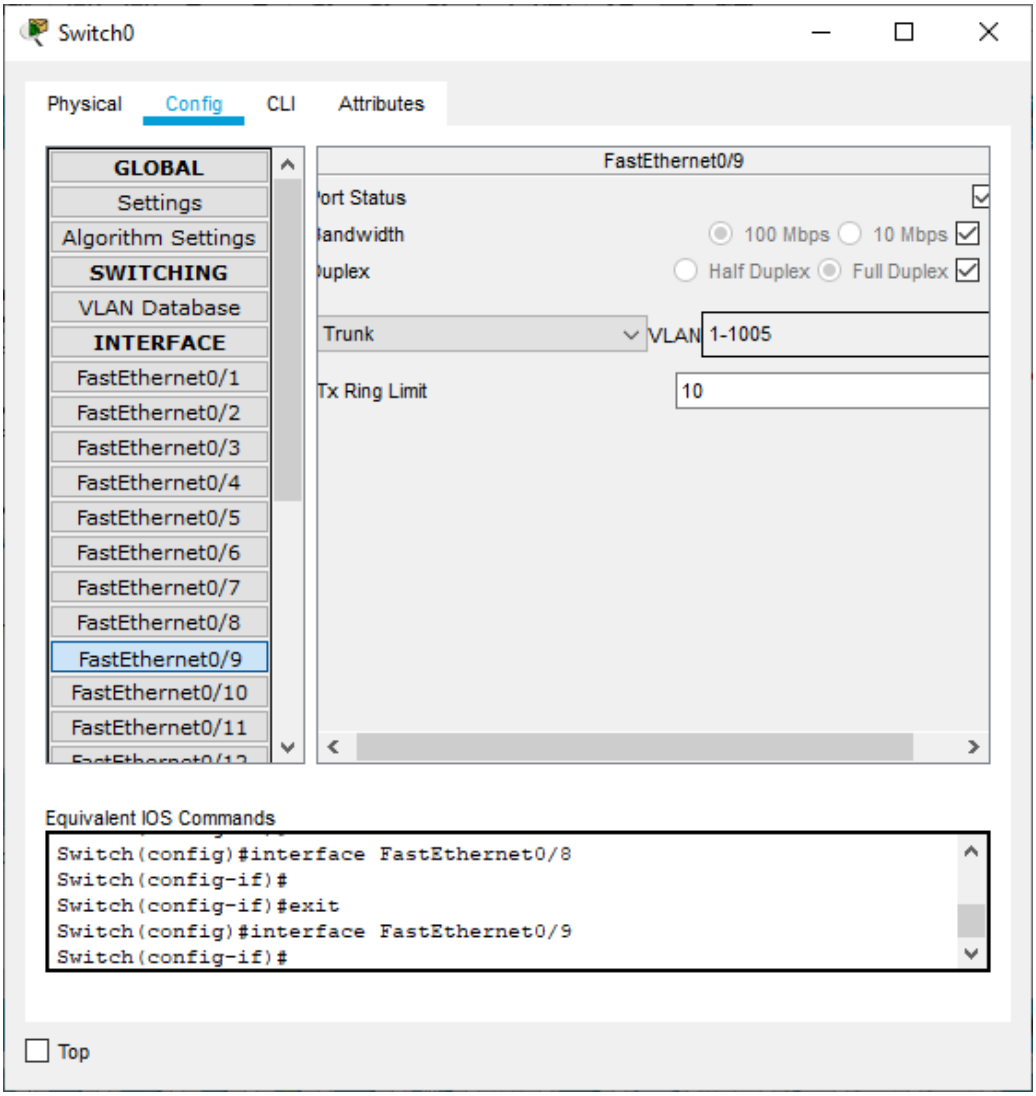


Screenshot 8



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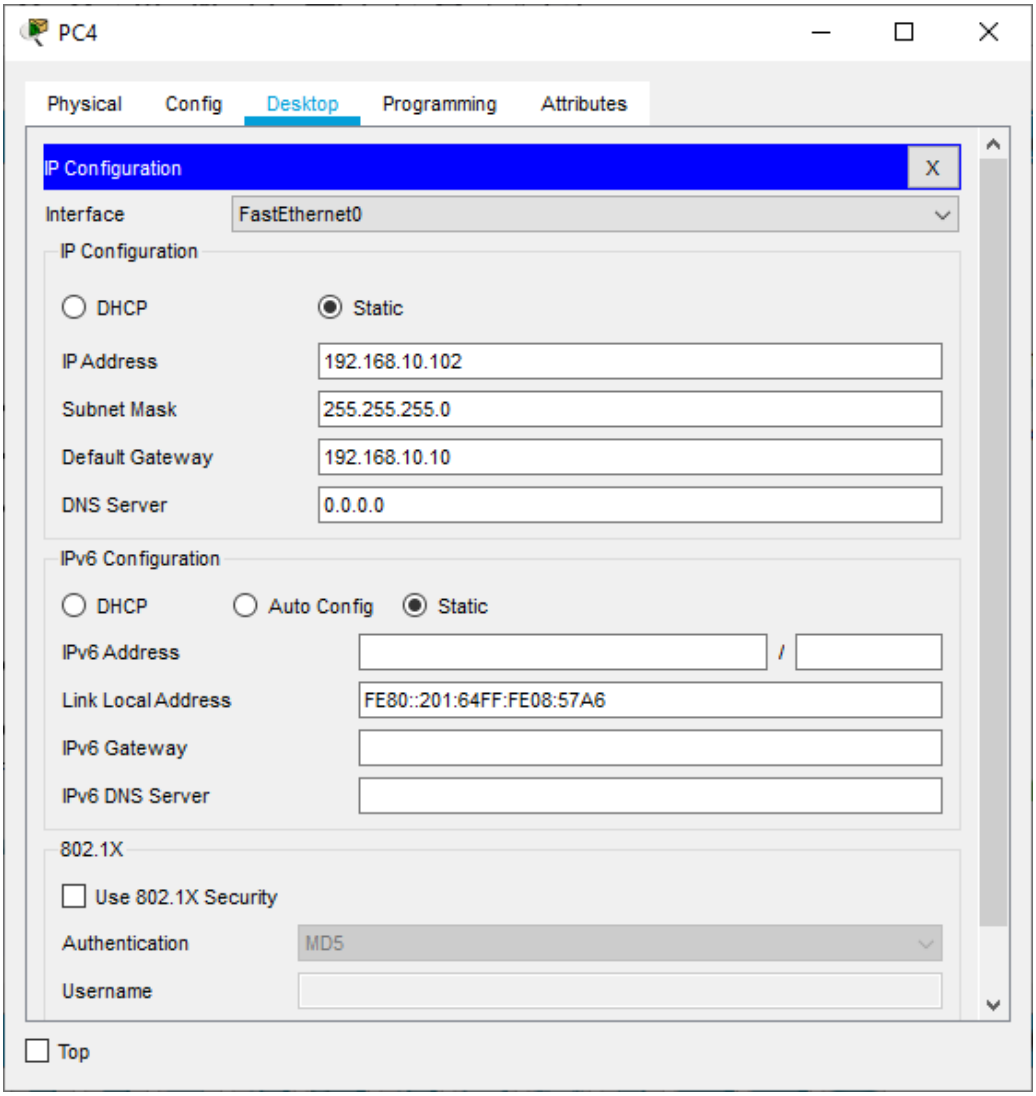

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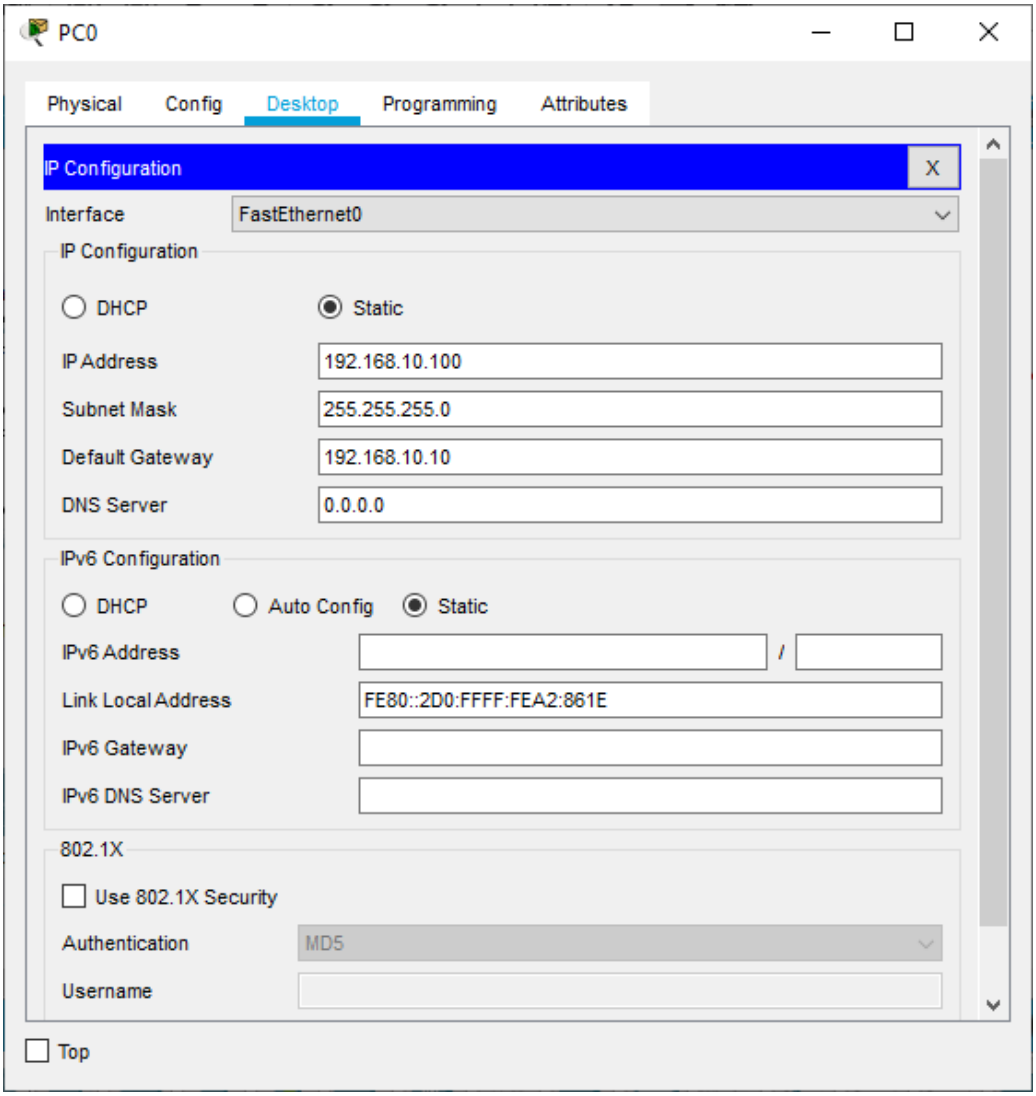

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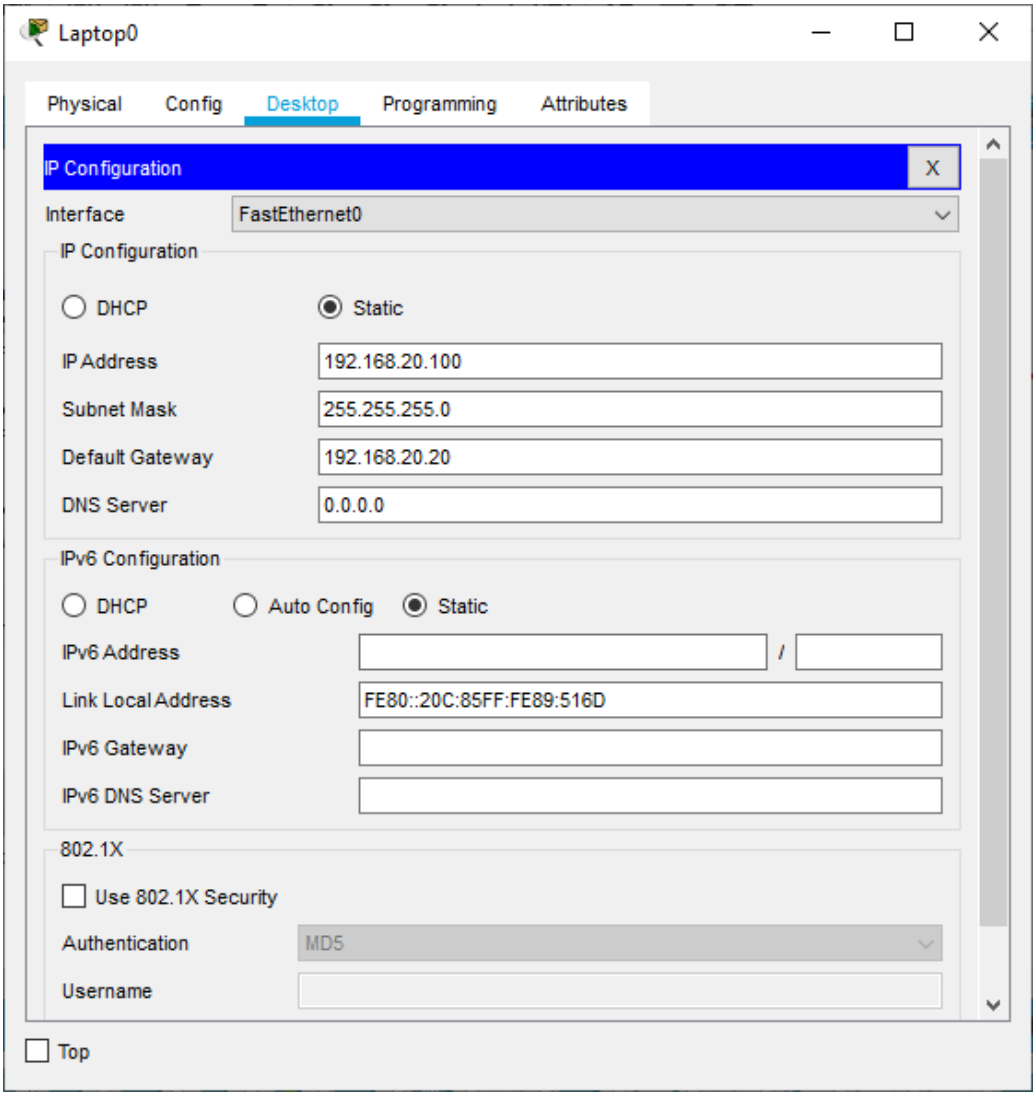

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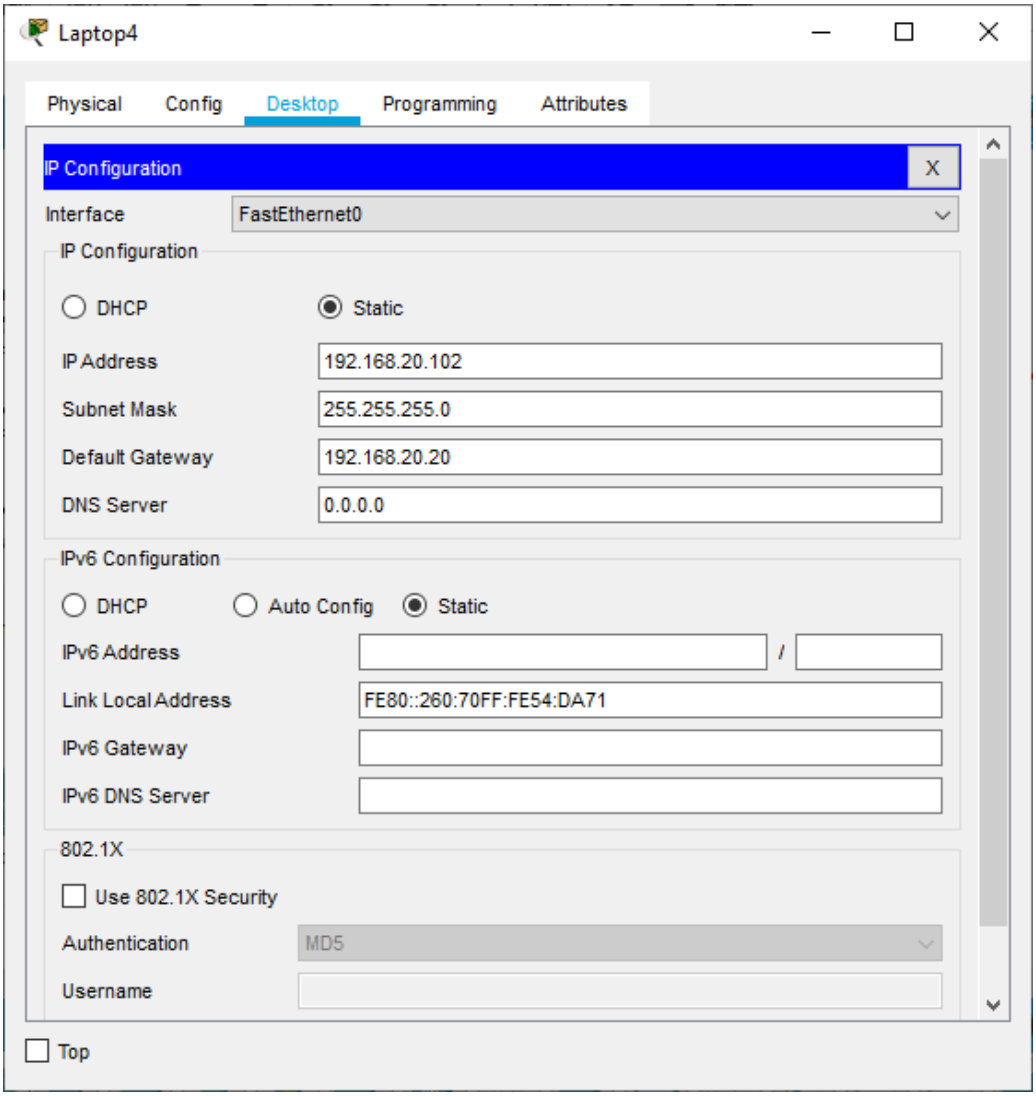

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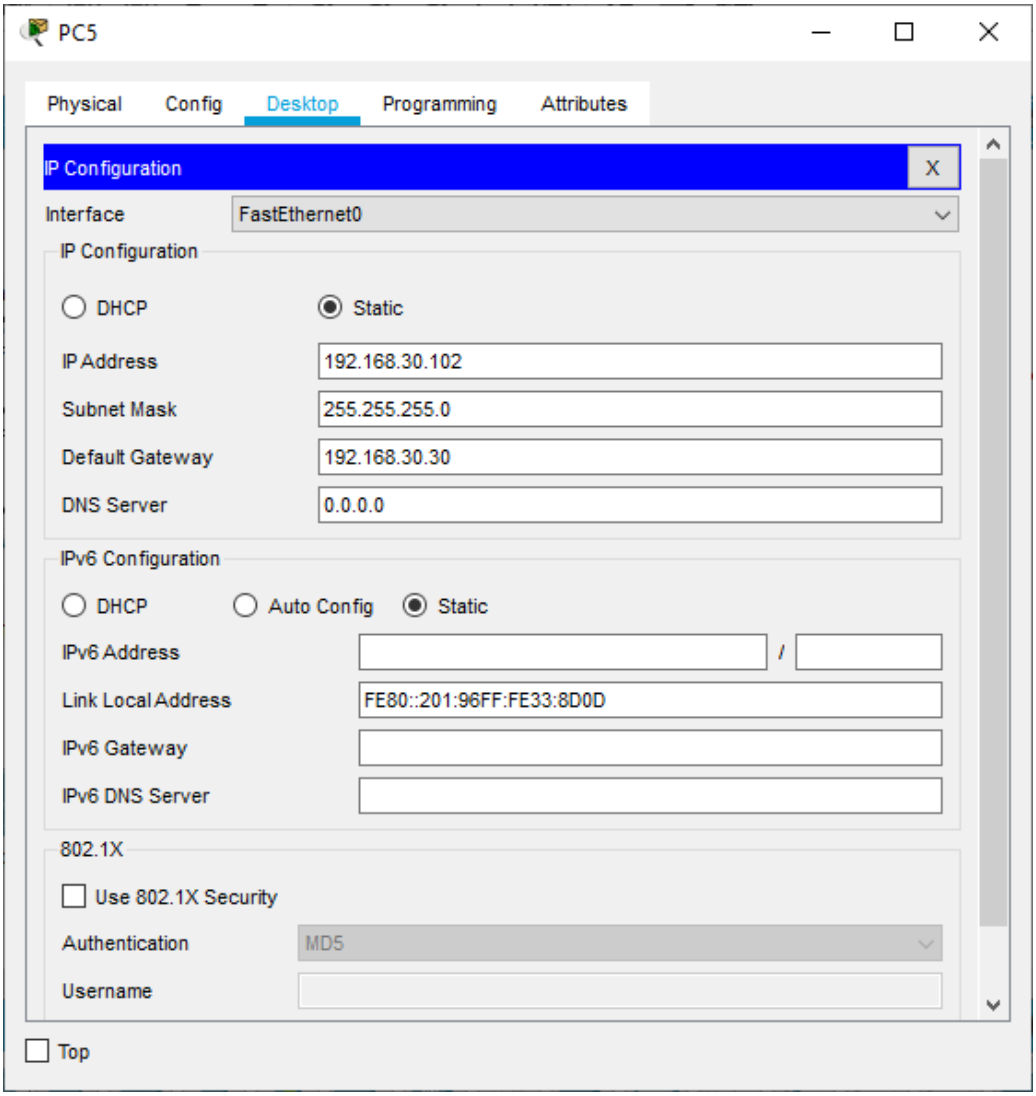
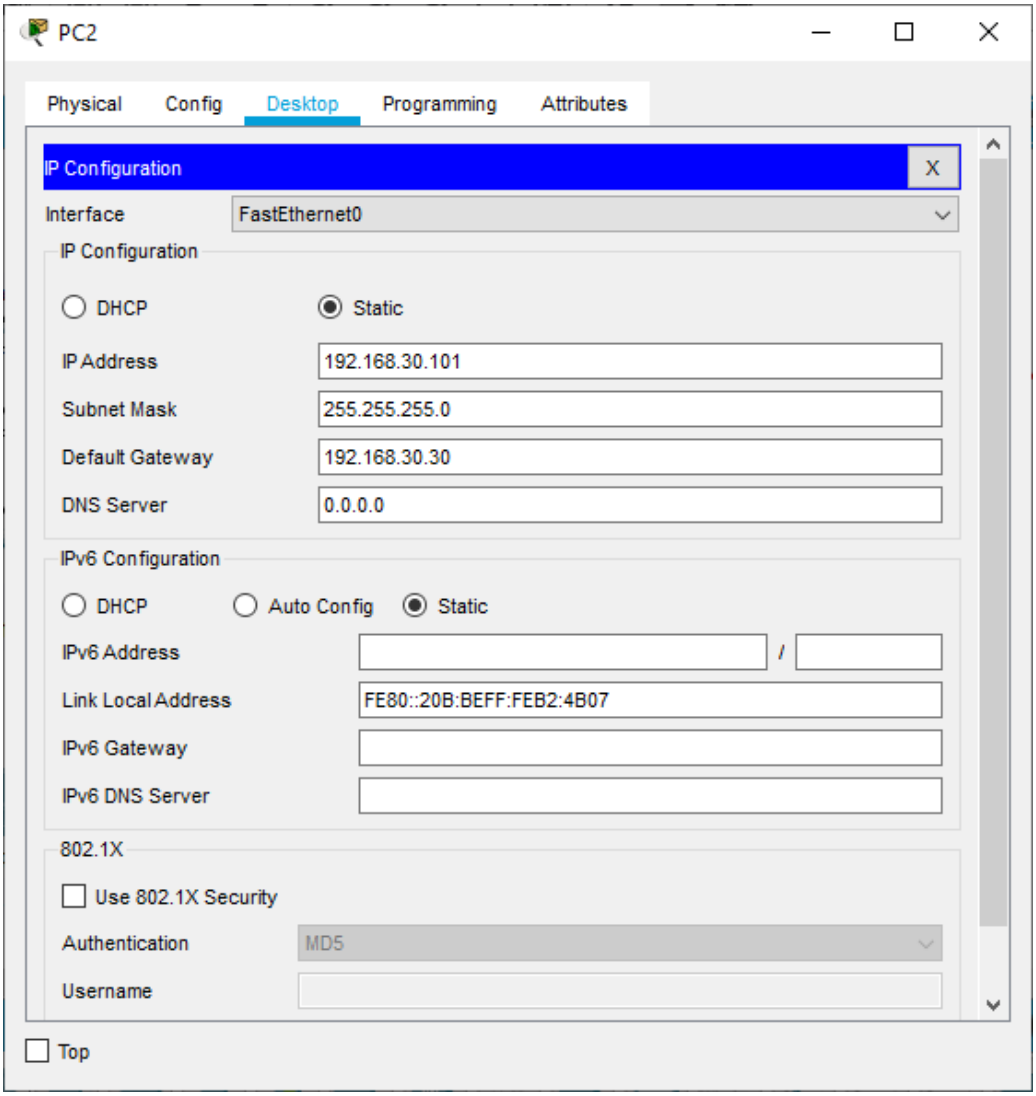


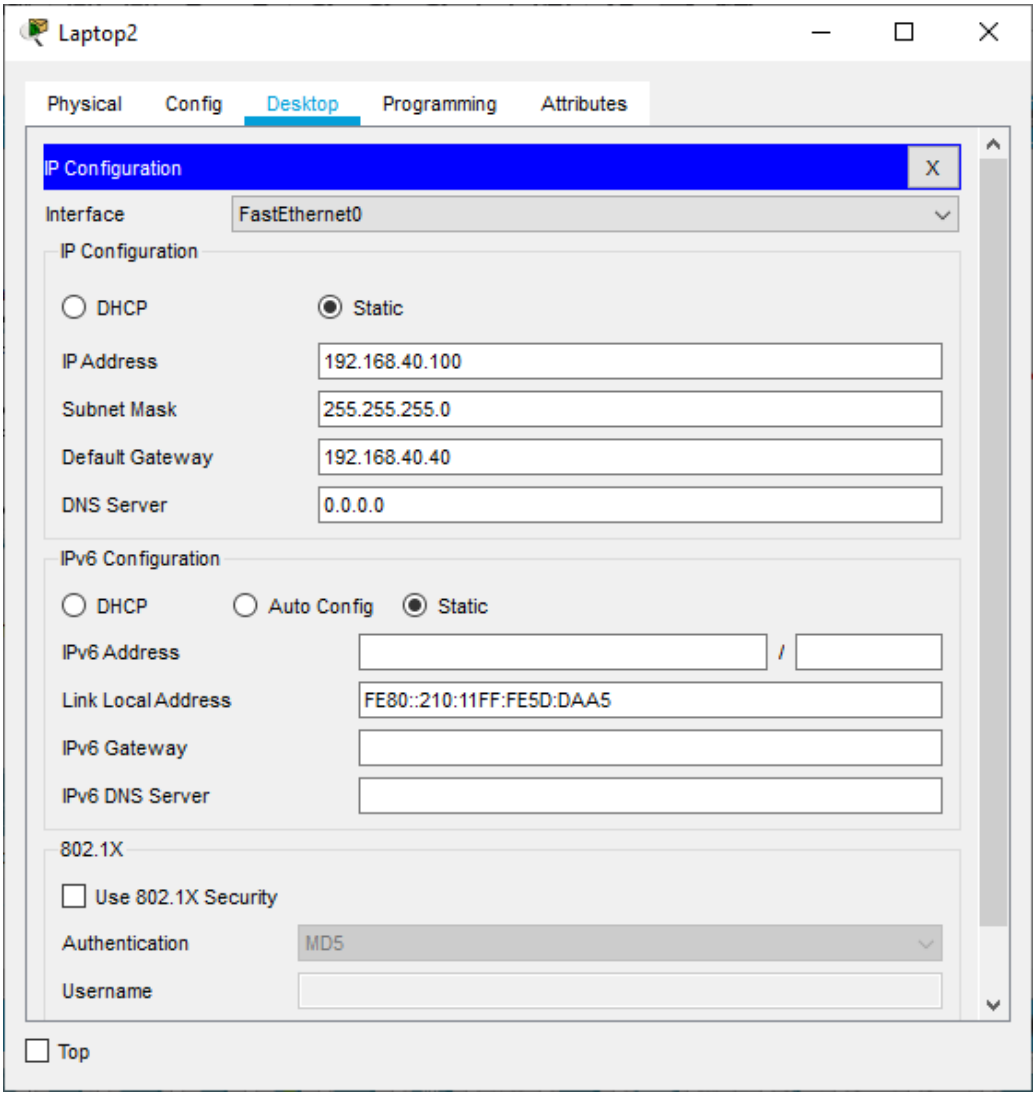
Same Process works for Player 2 also where he can roll the dice for a maximum of 3 times. If he gets 3 '6' in a row then the position is not affected else the token moves till the desired step.

Screenshot 14



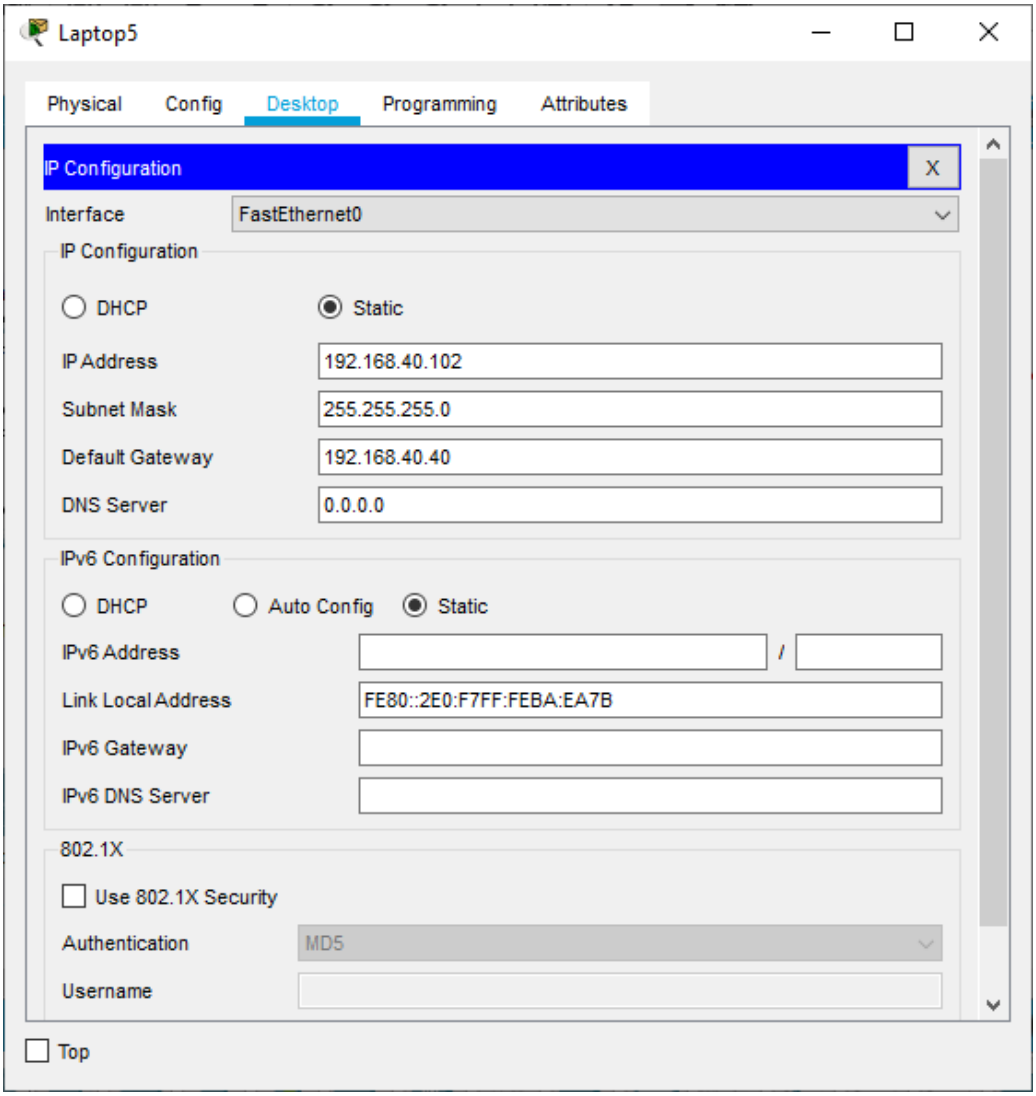
Here is another test case where users is bitten by a snake and the token slides down till 3. Now he will make move from 3.

Screenshot 15



This output shows that when the user gets a six for the first time. It will be used as a pass to make all future moves valid. He is given a second chance to roll the dice again and he gots a 3. Since 3 is the first valid move thus token moves only three steps forward.

Screenshot 16



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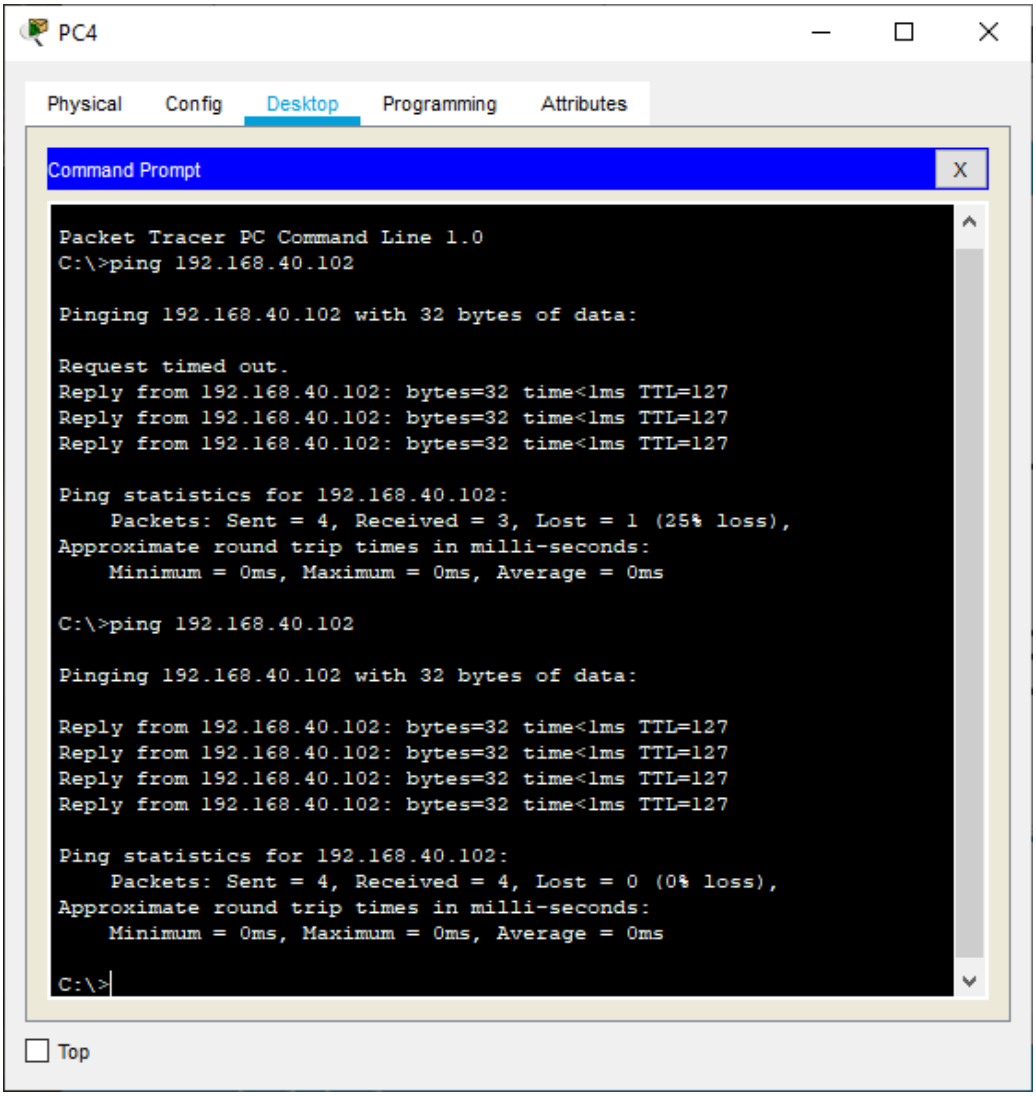
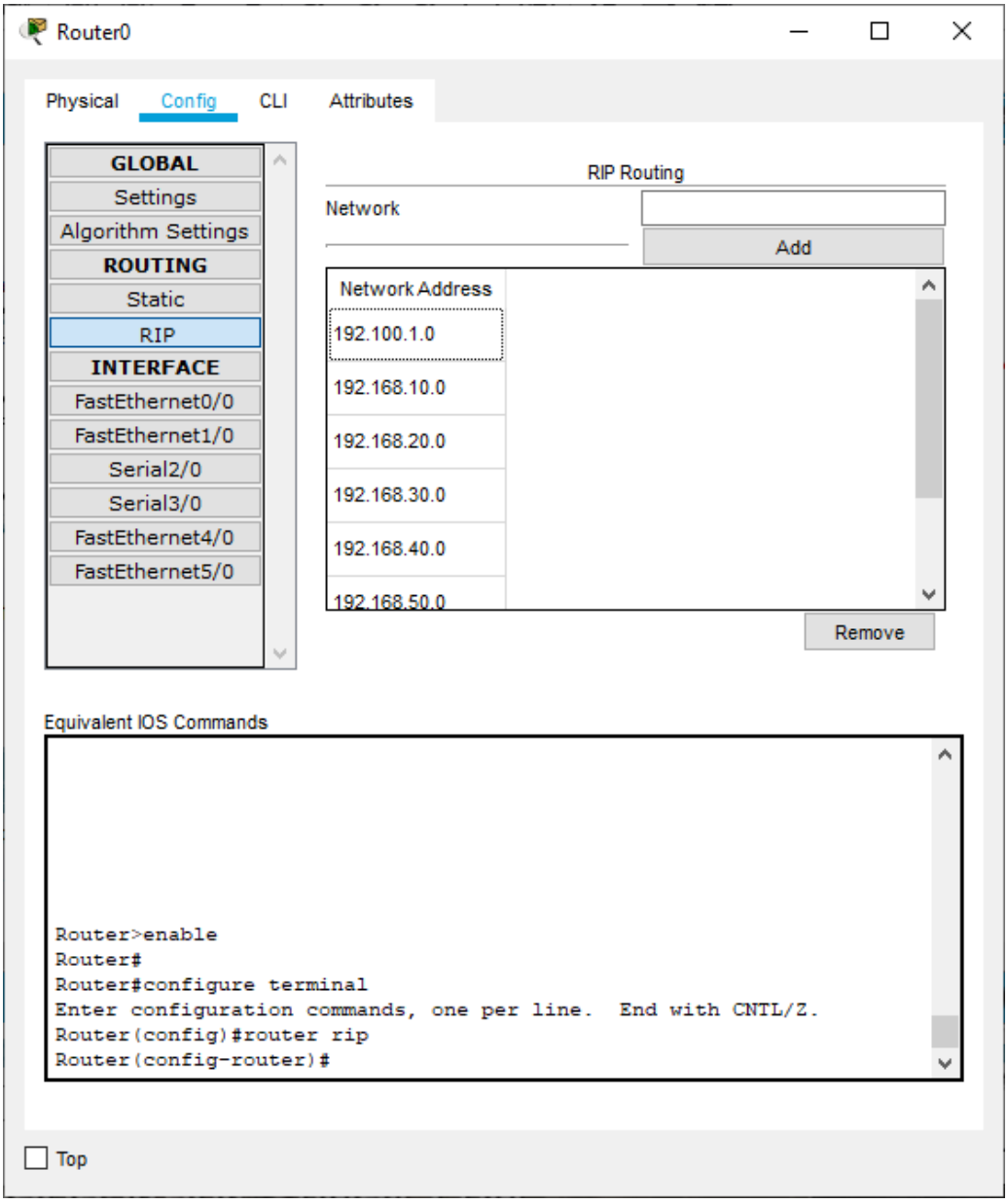


Screenshot 18



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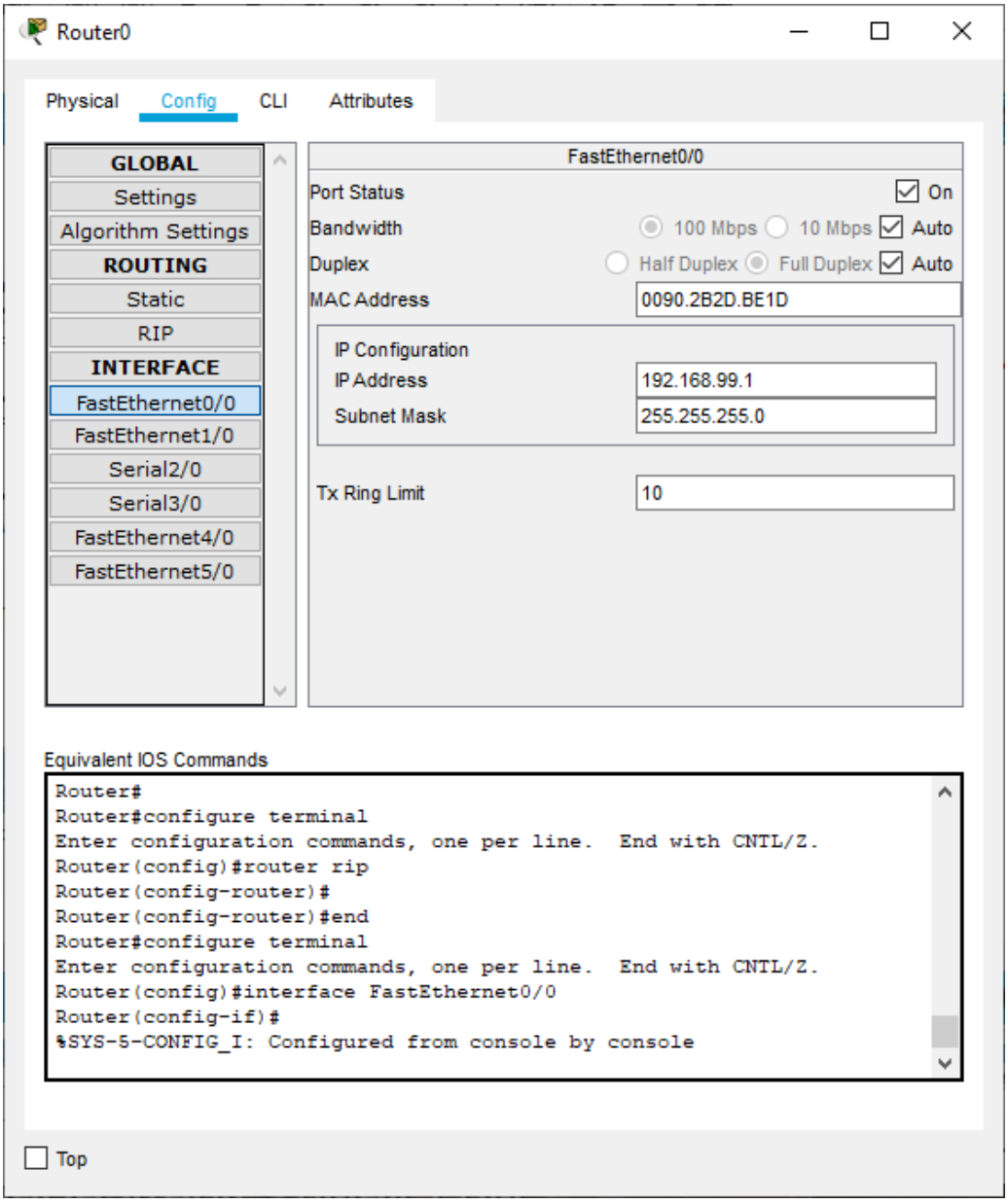

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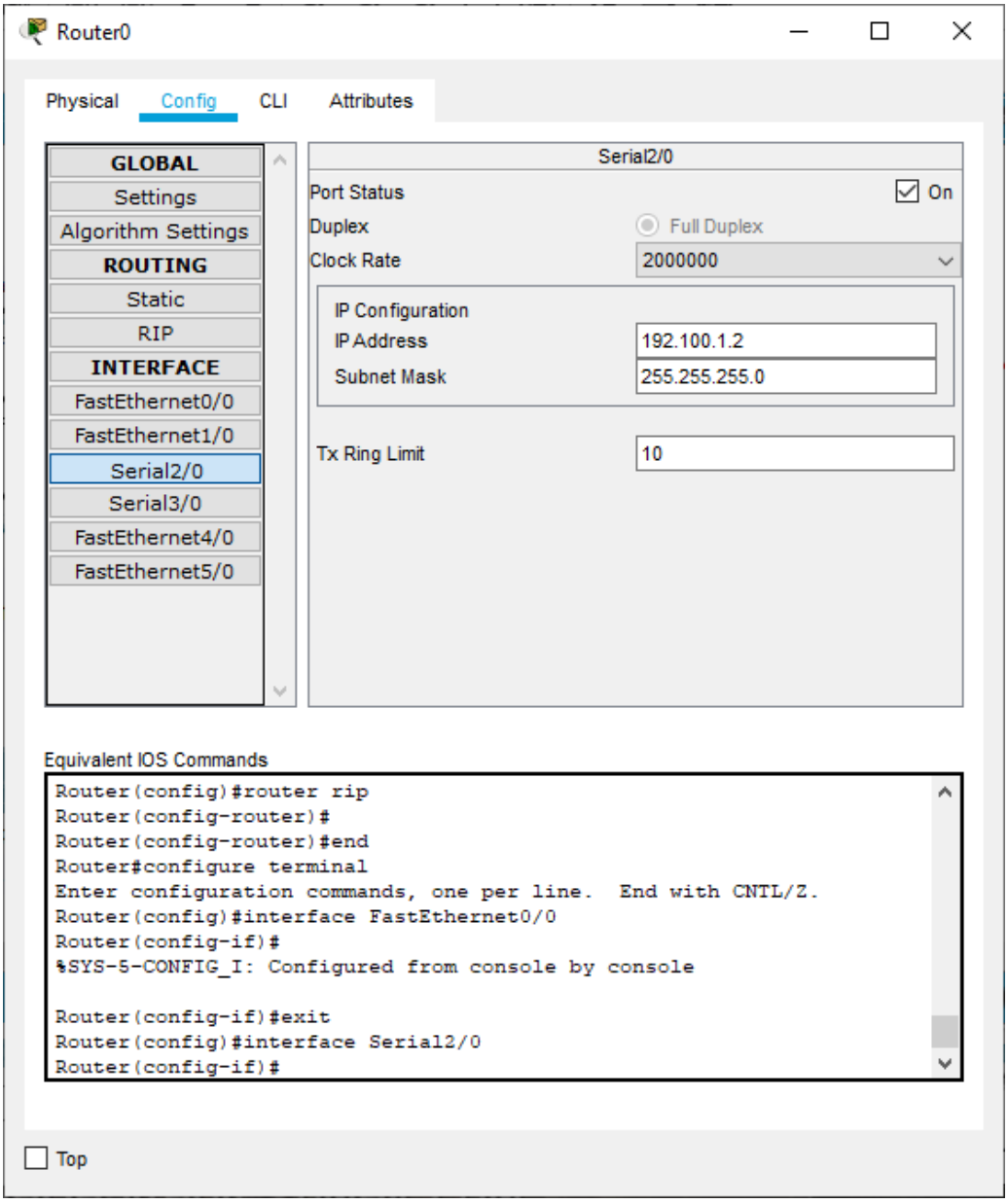

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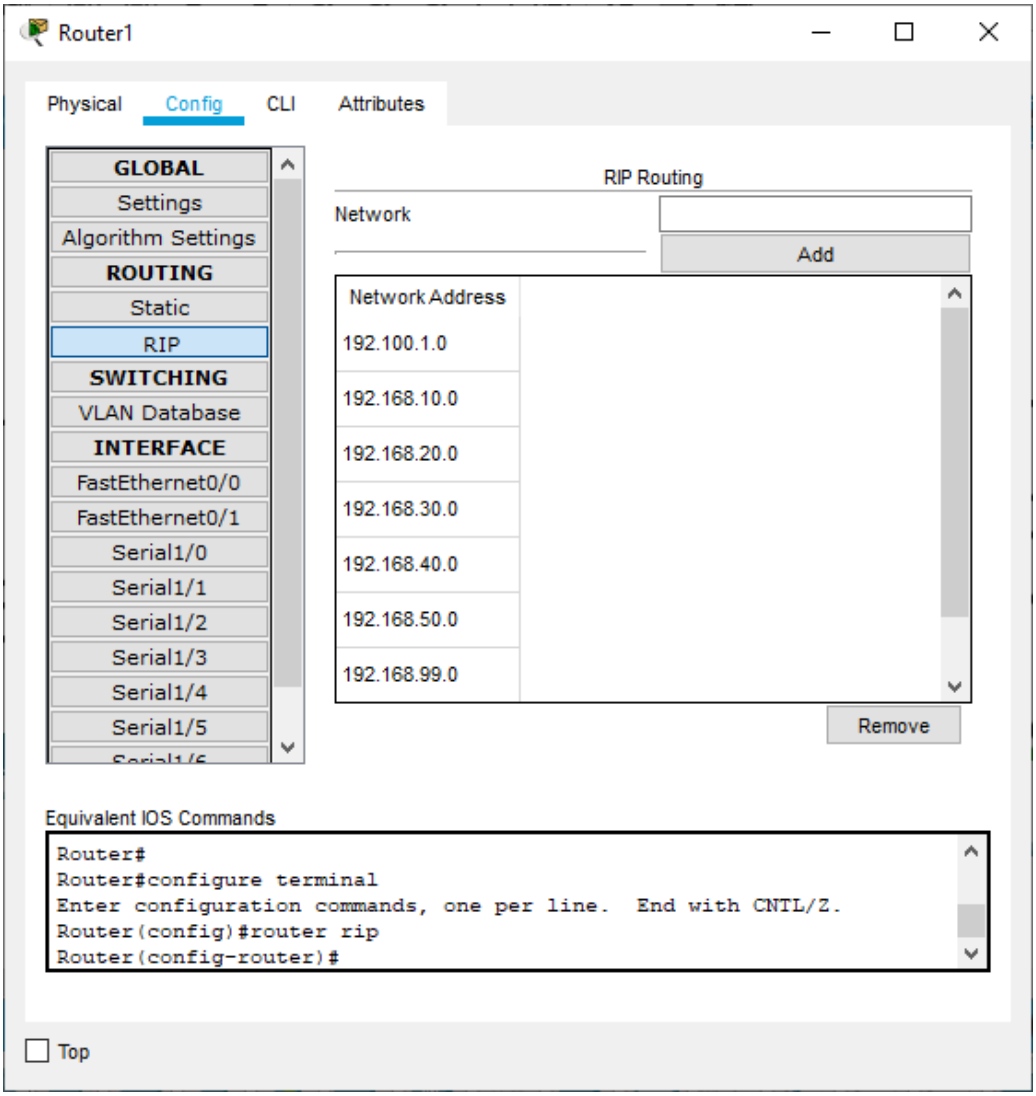

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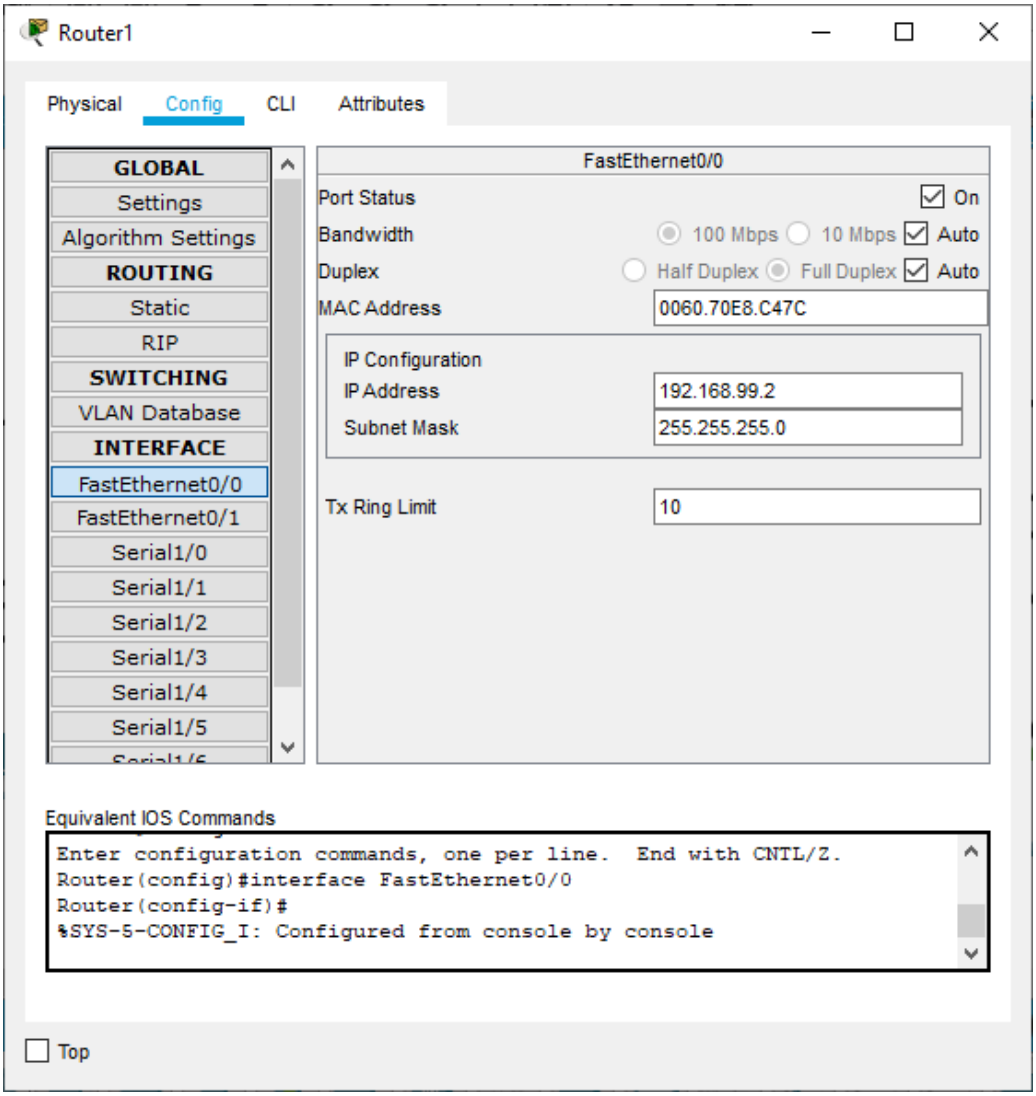

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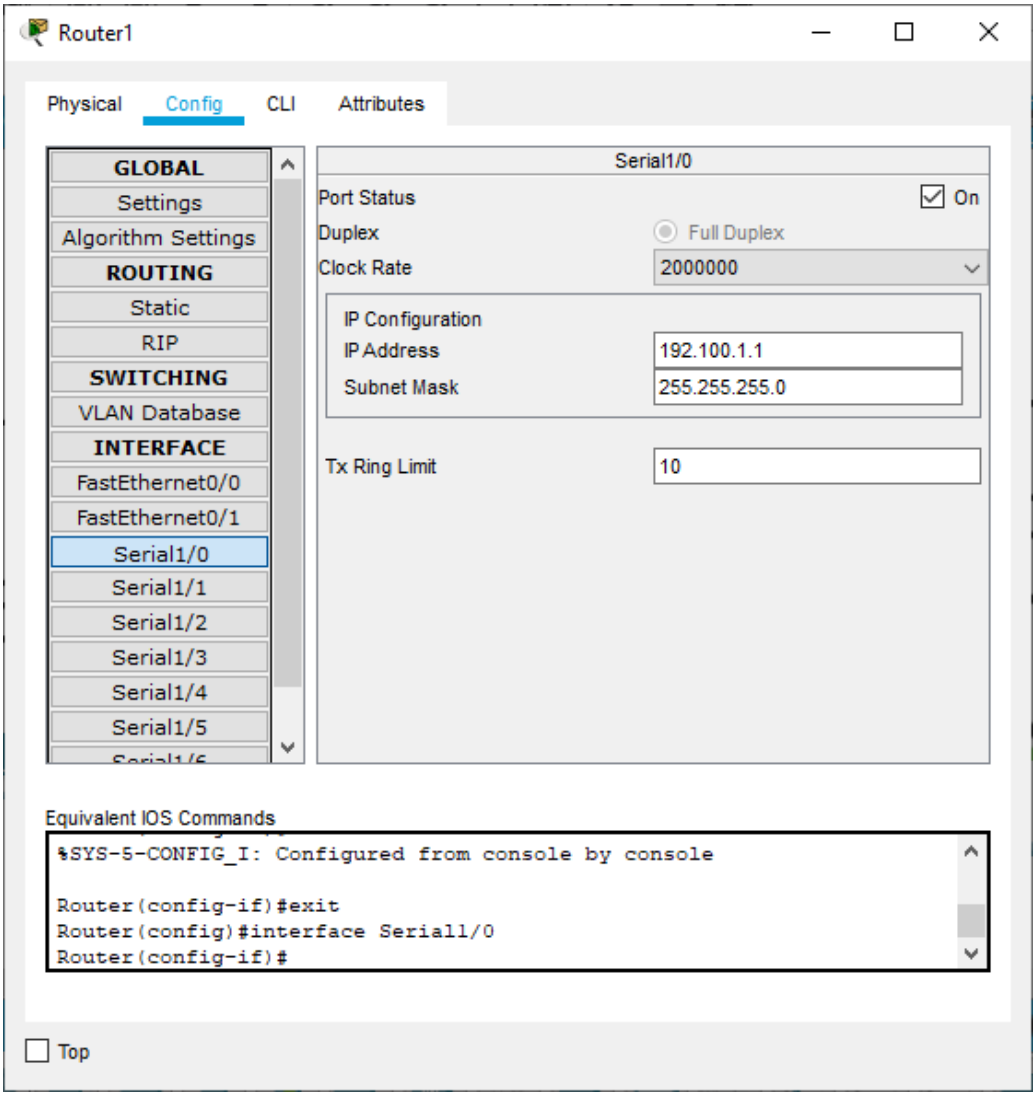

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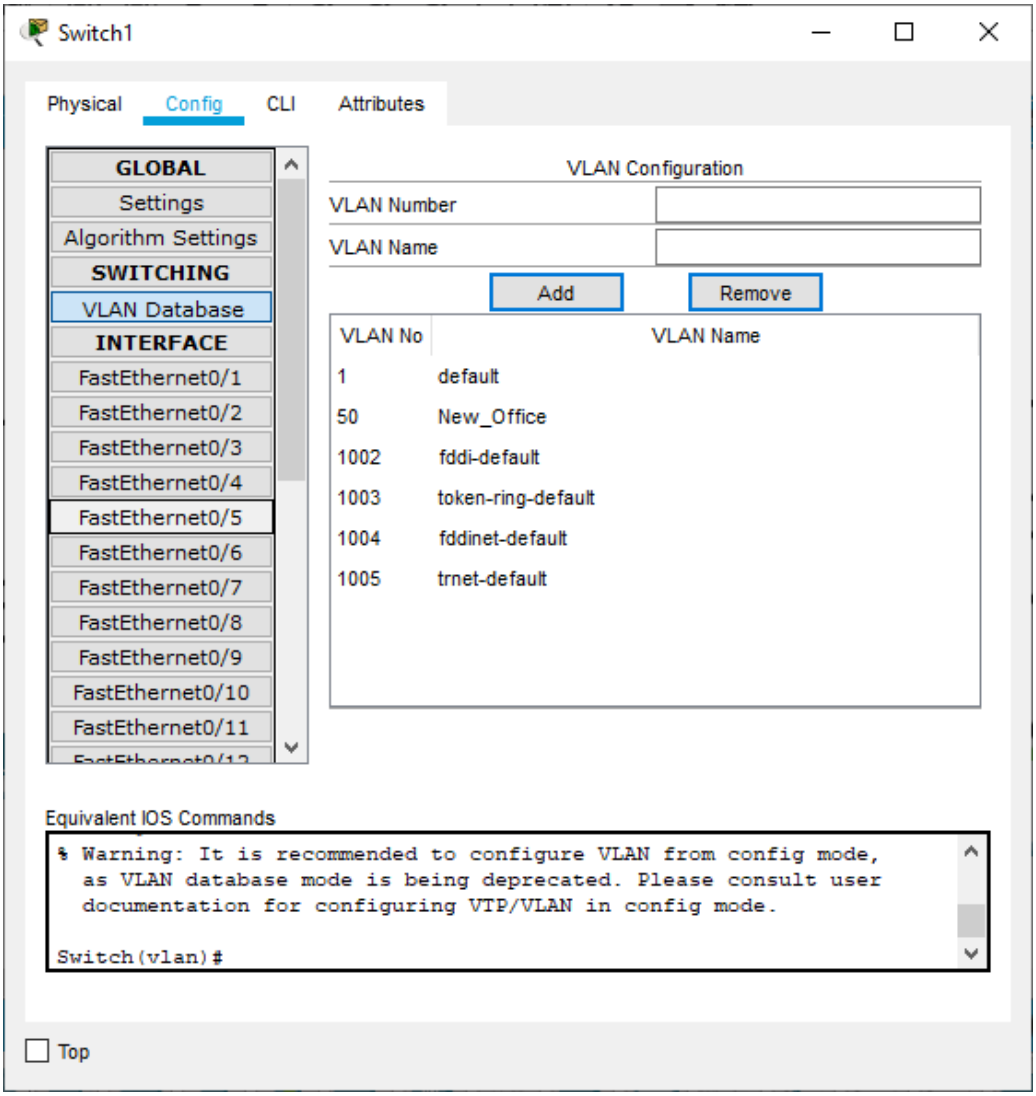

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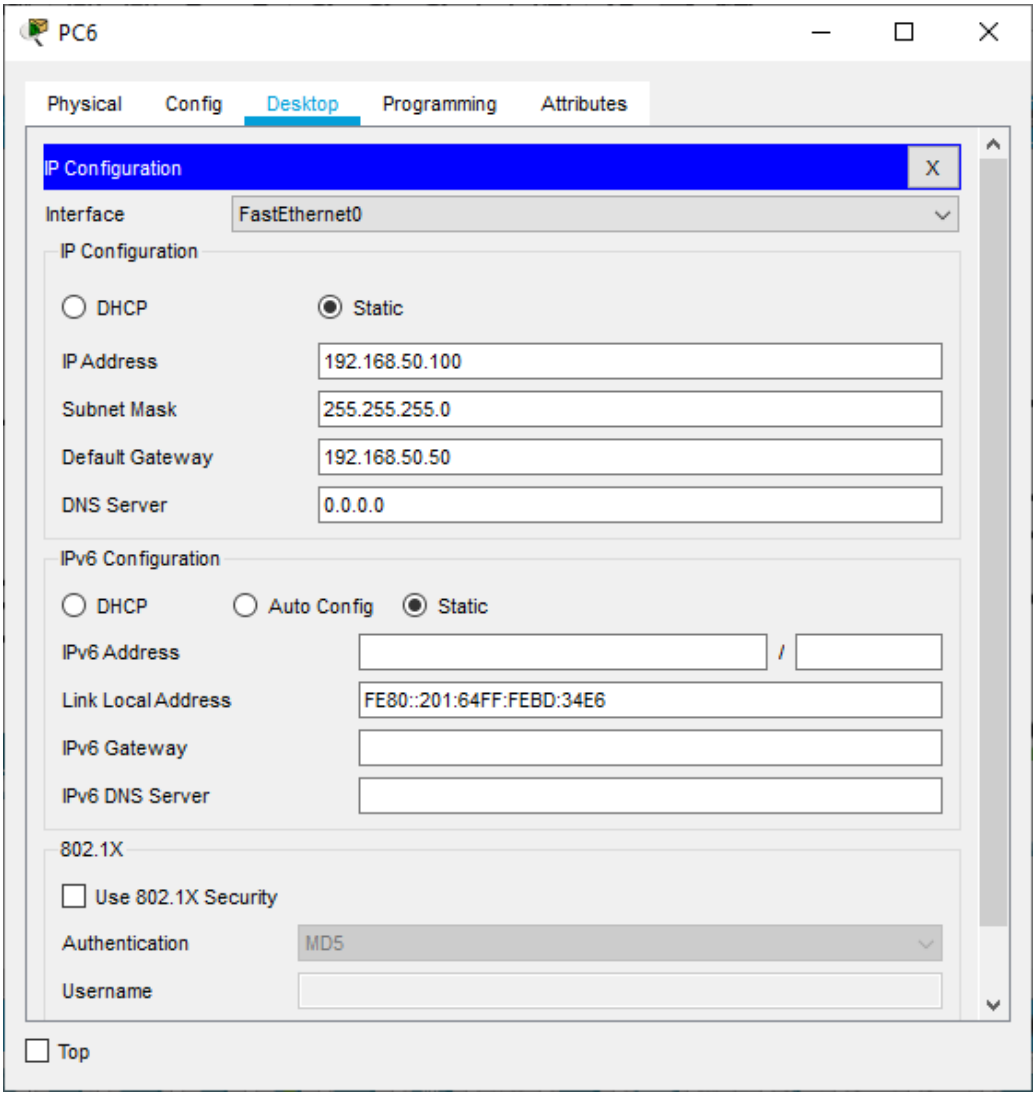

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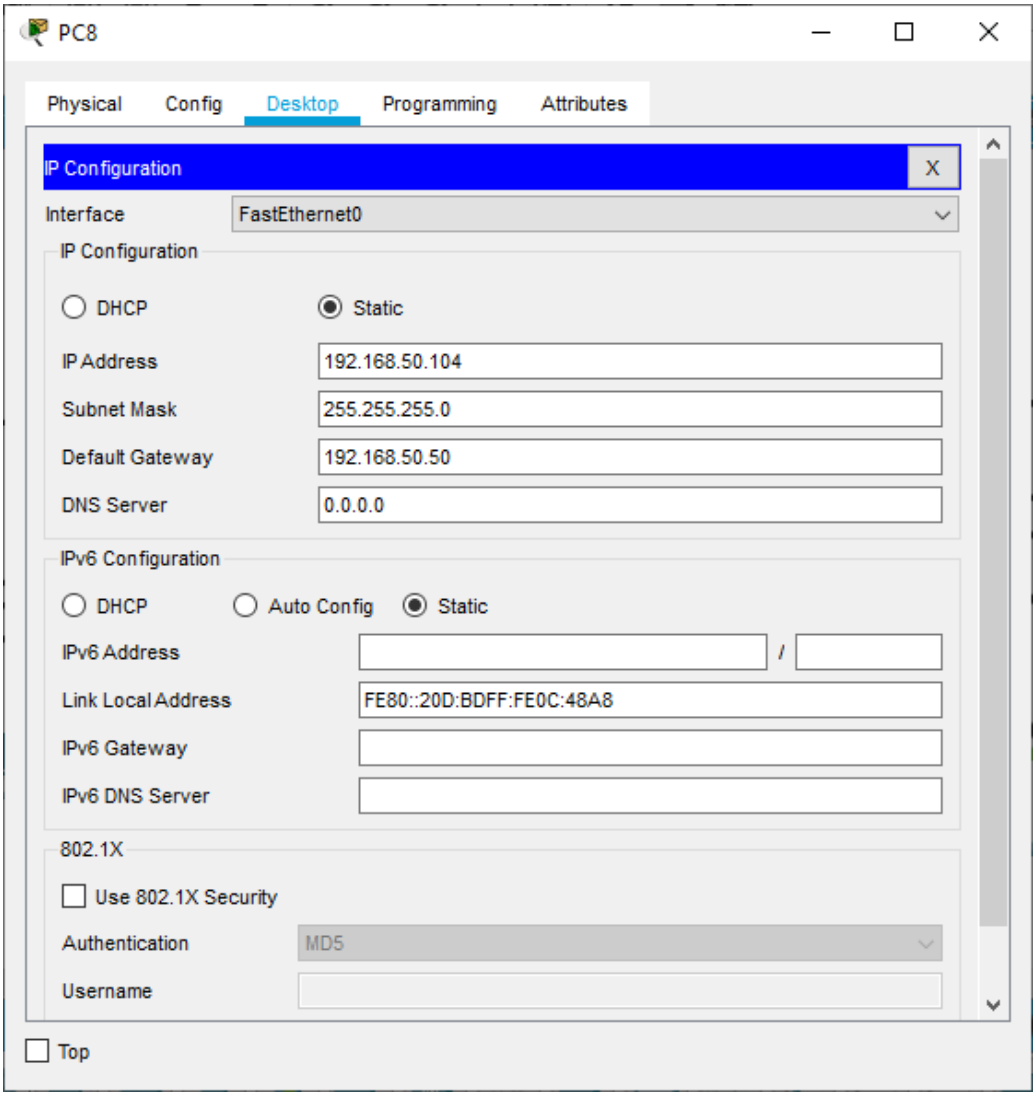

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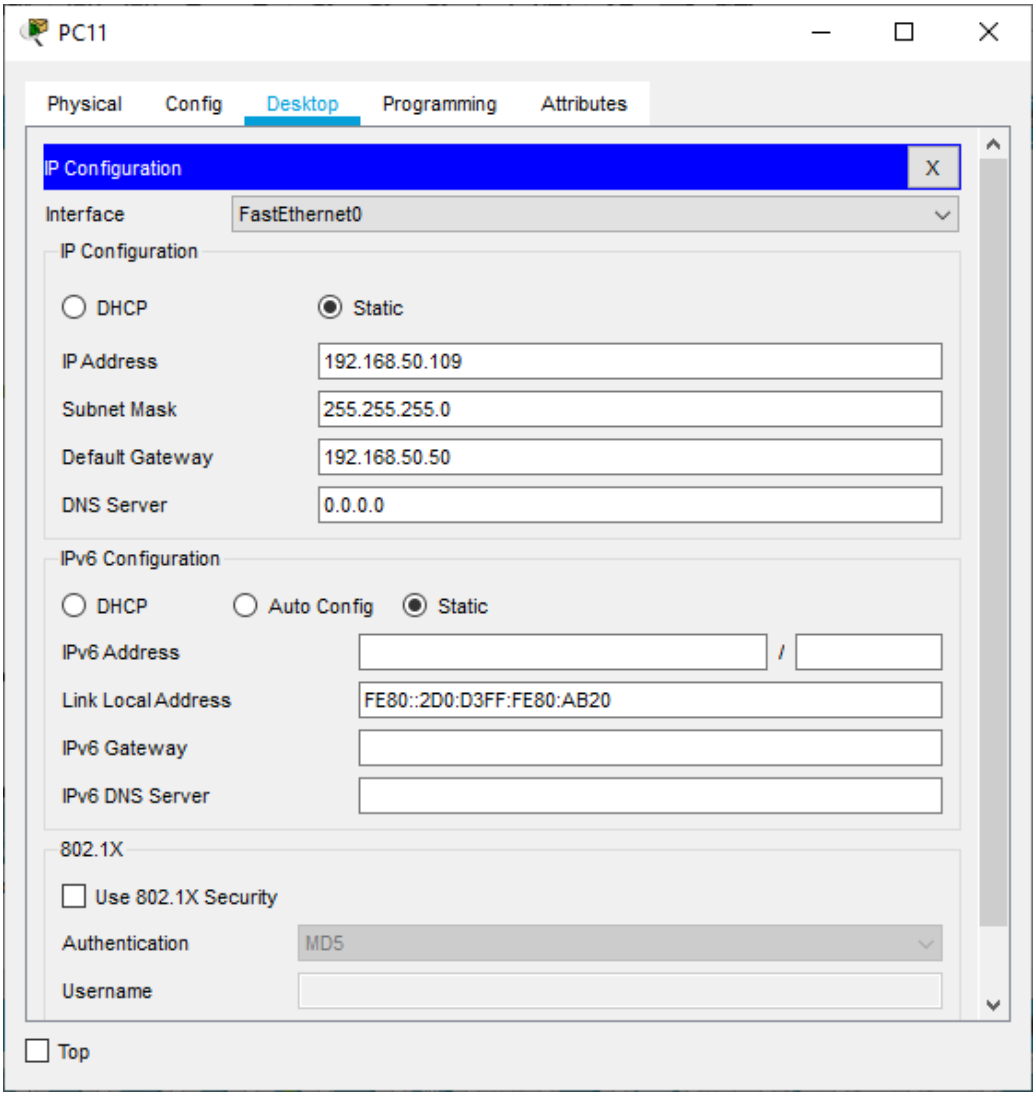

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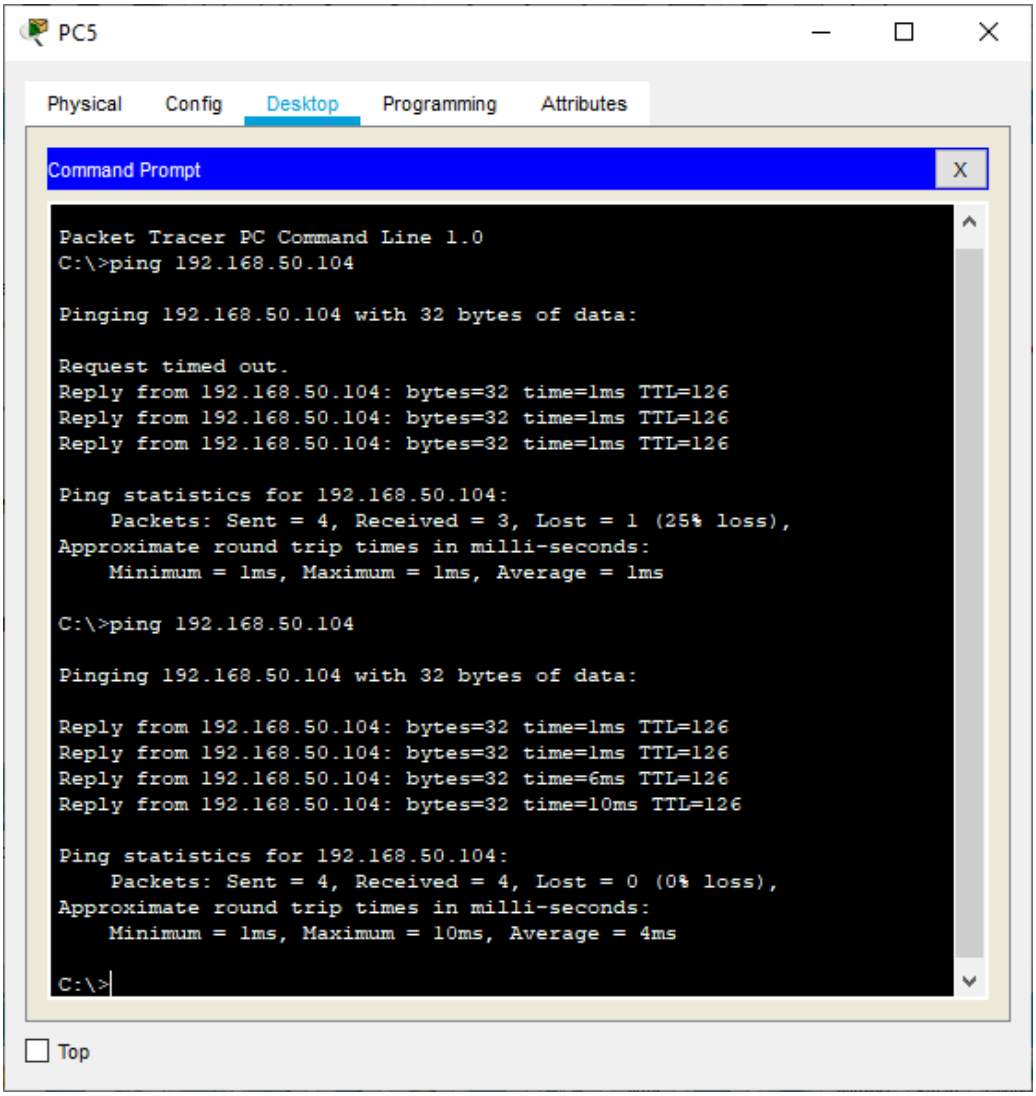
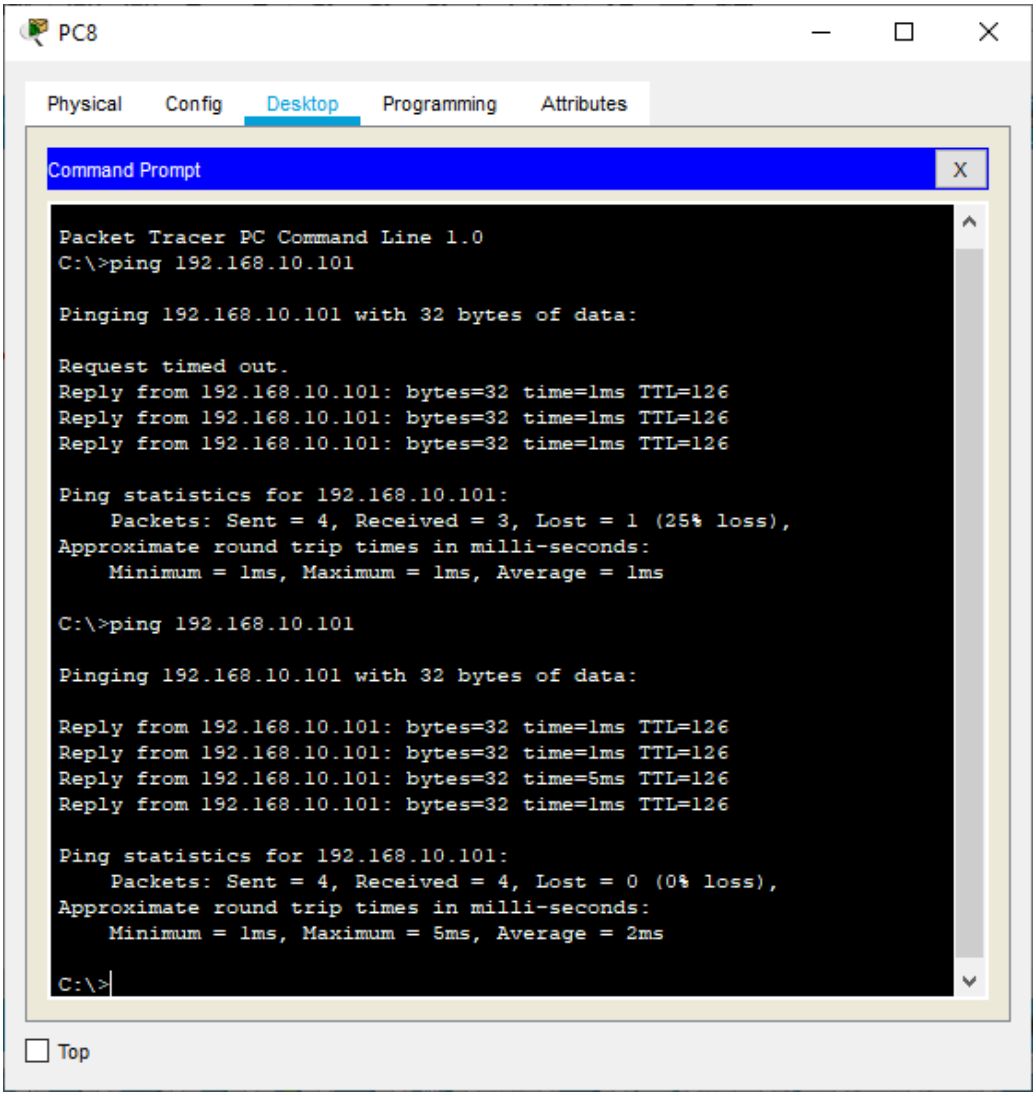
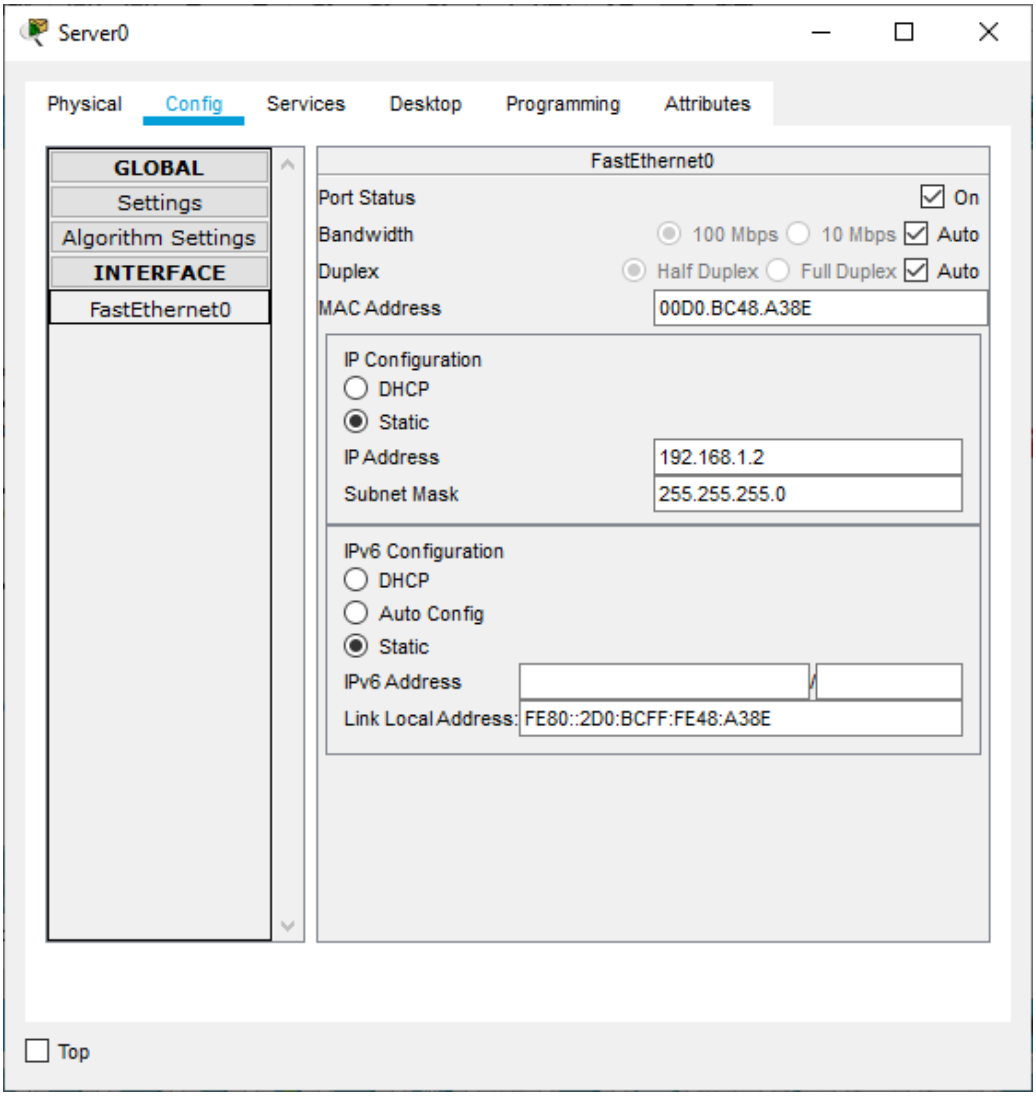


Screenshot 29



Screenshot 30



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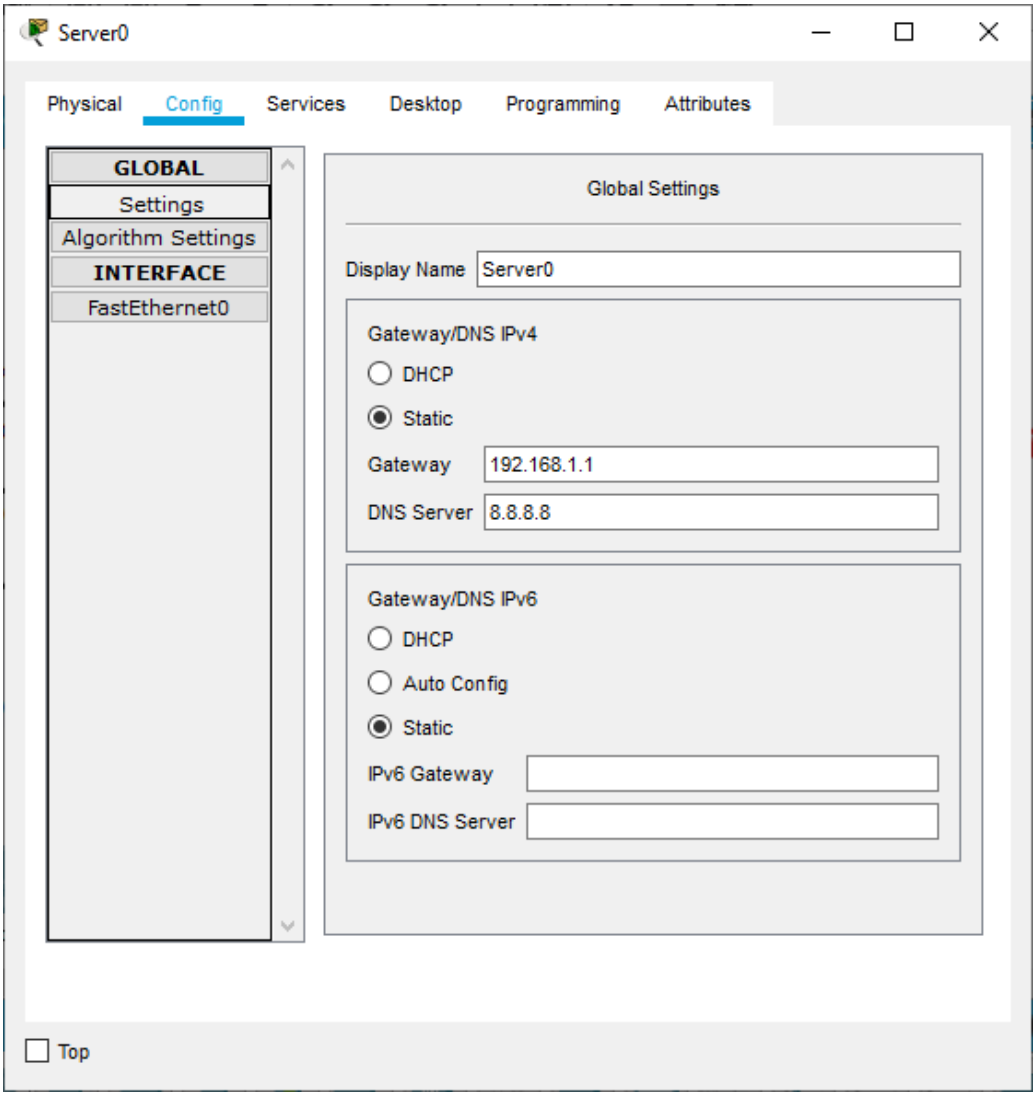

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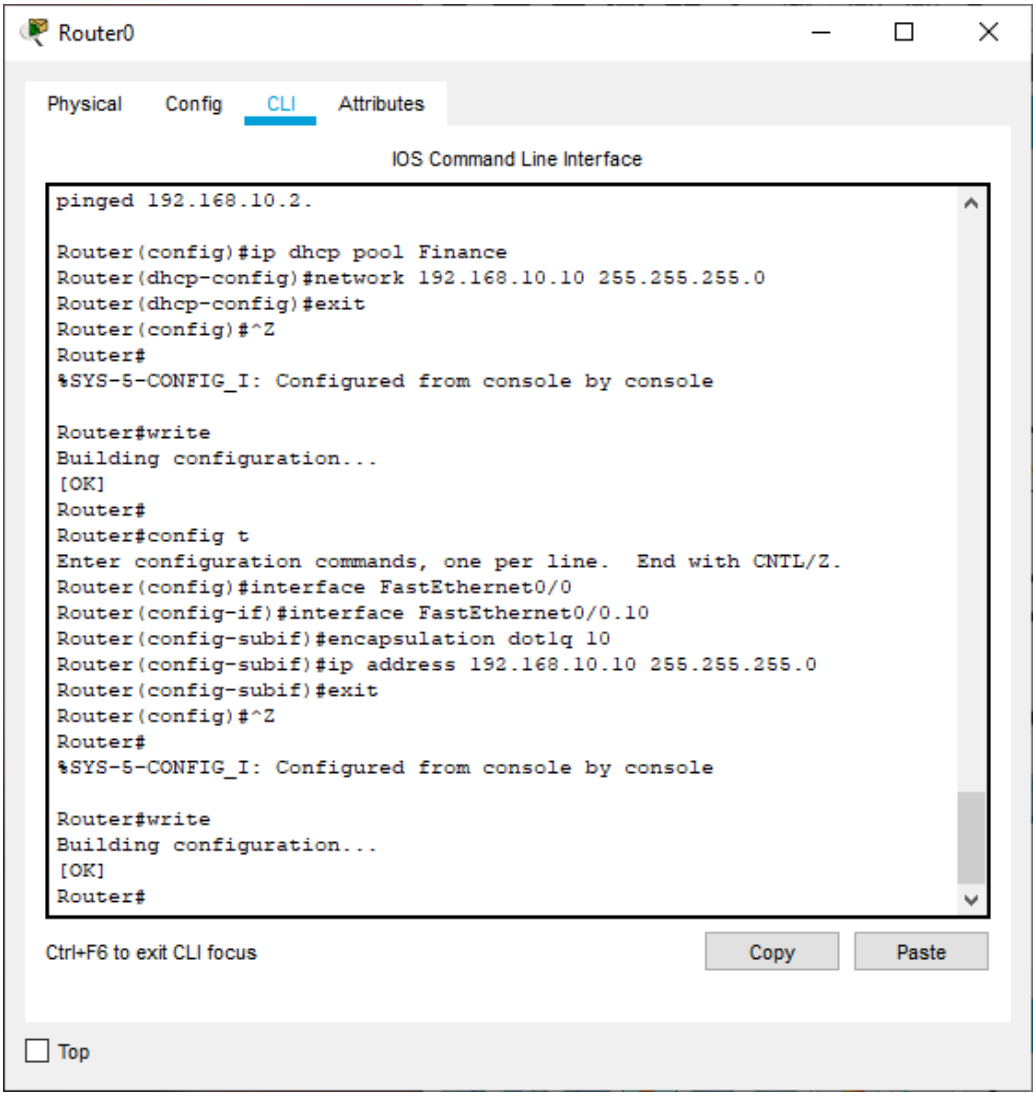

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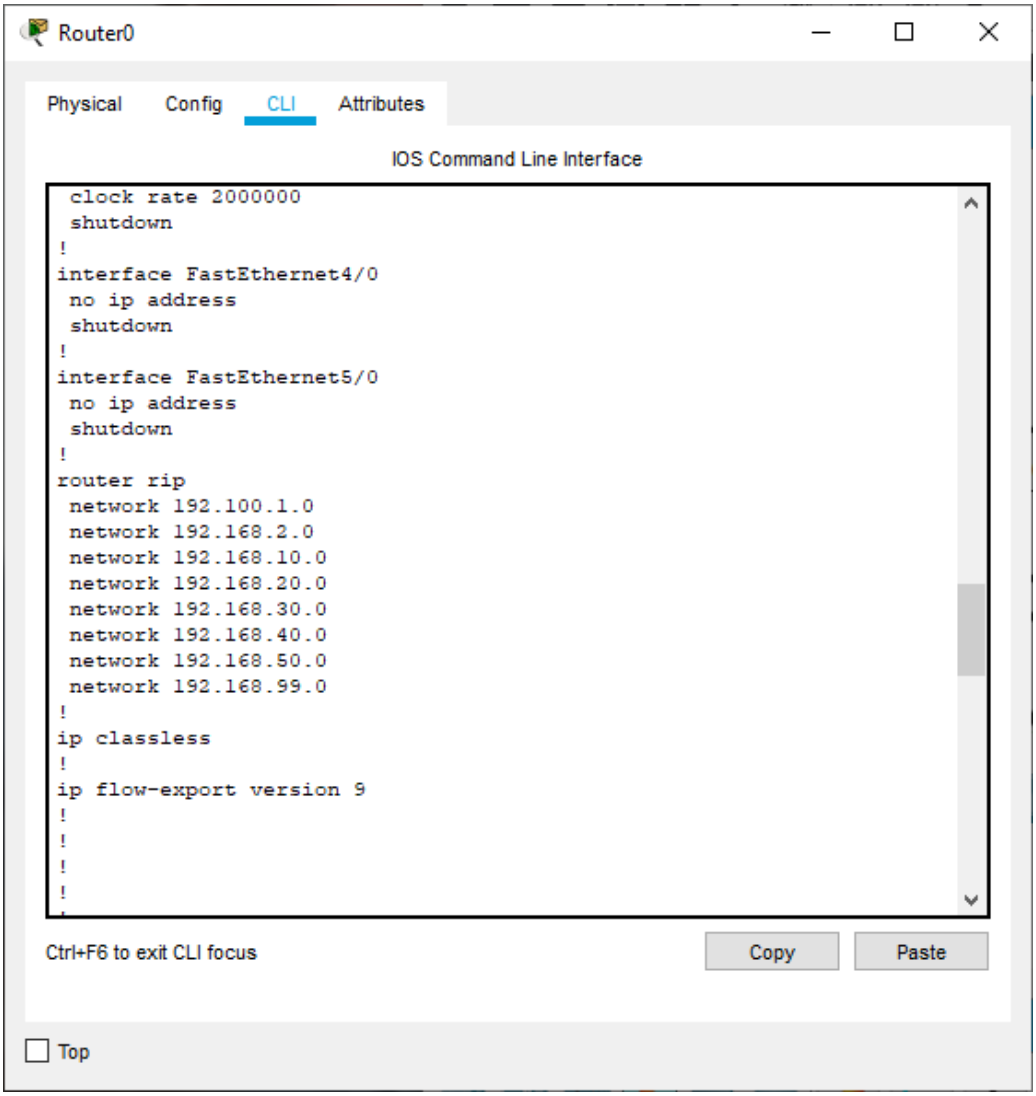

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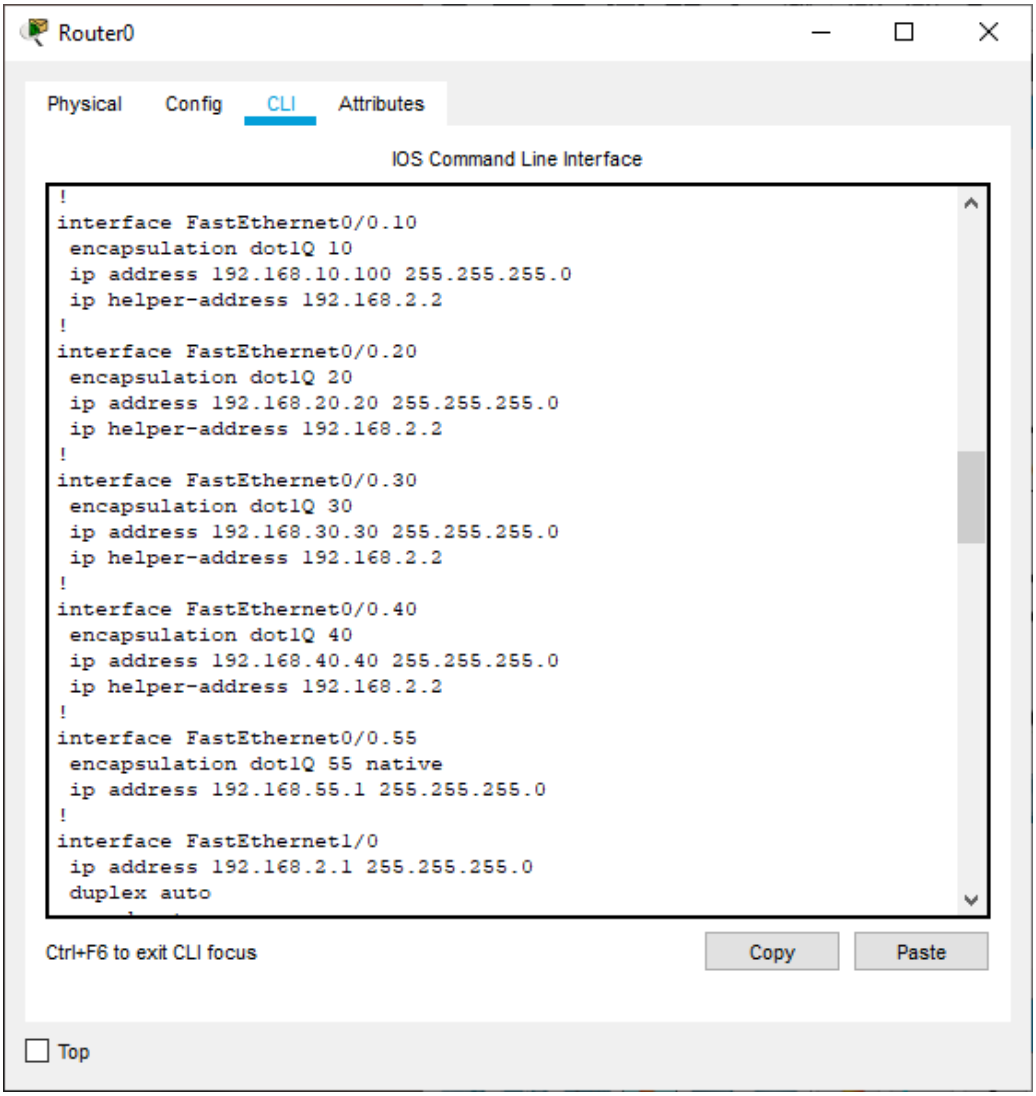

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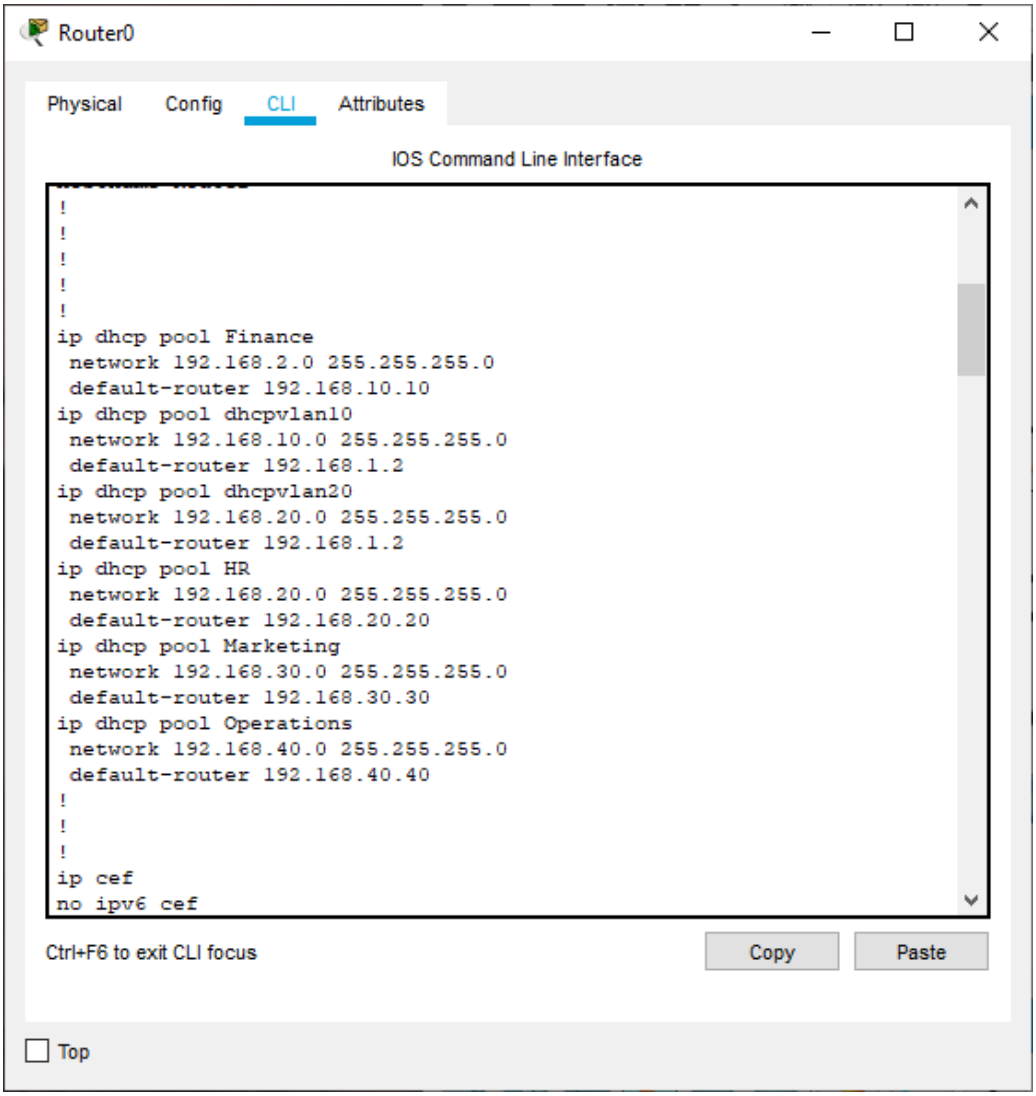

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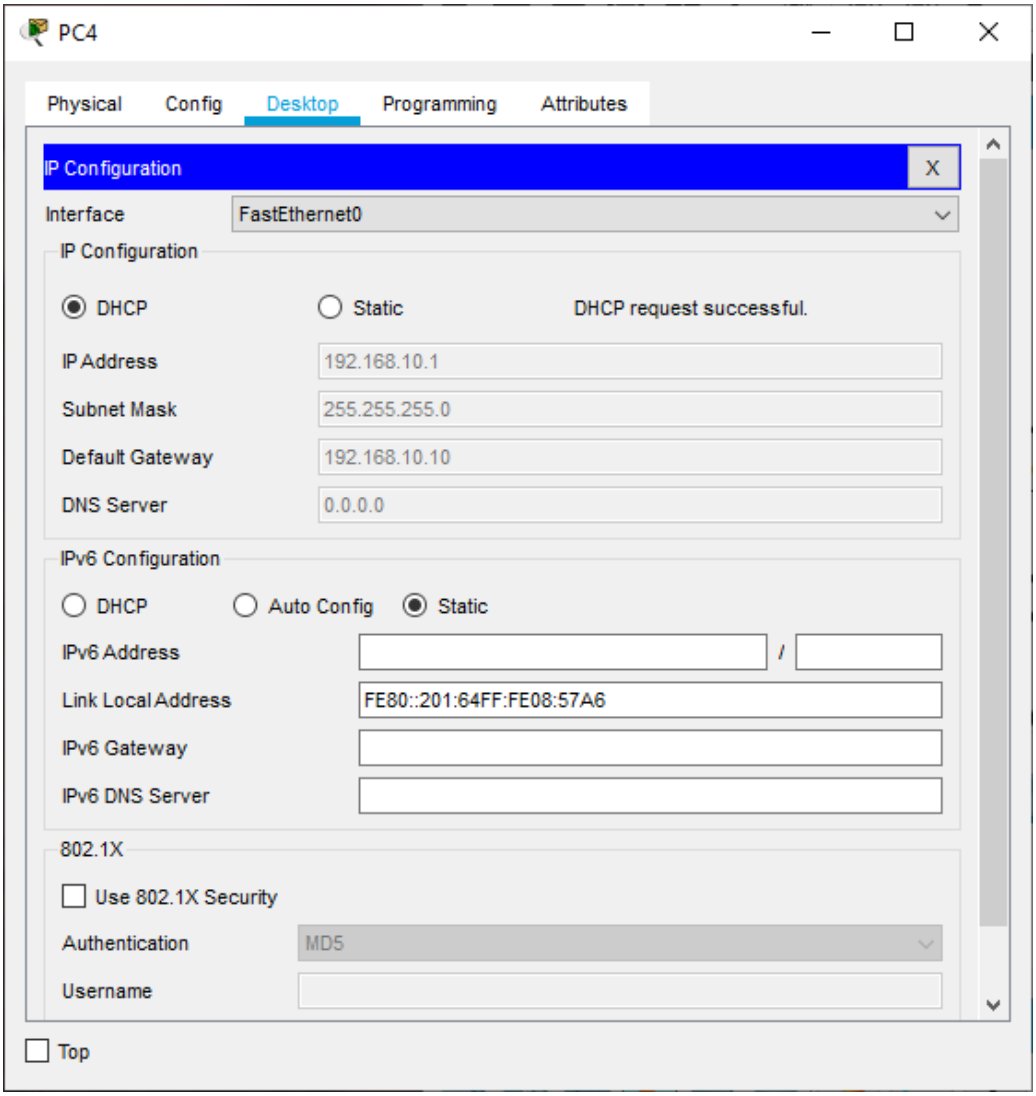

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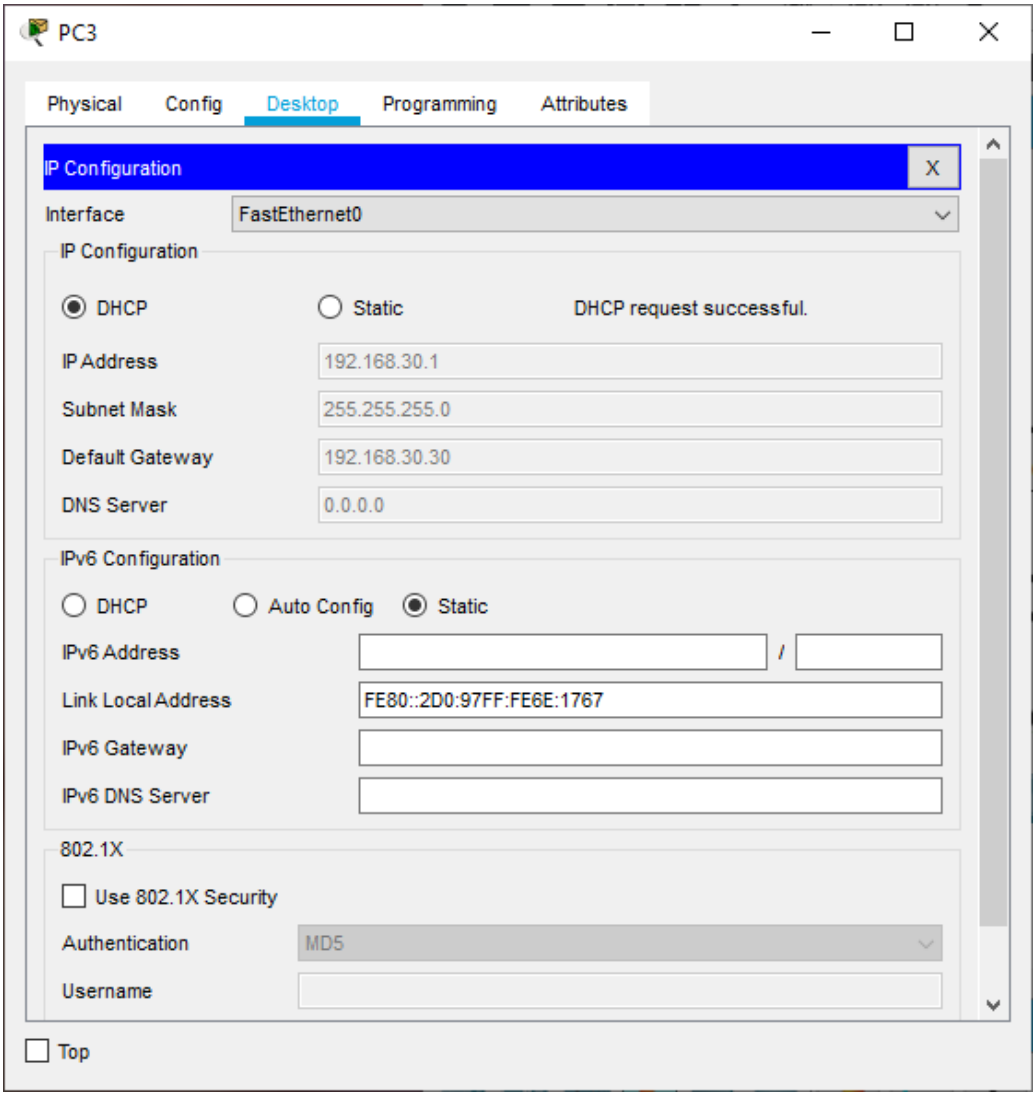

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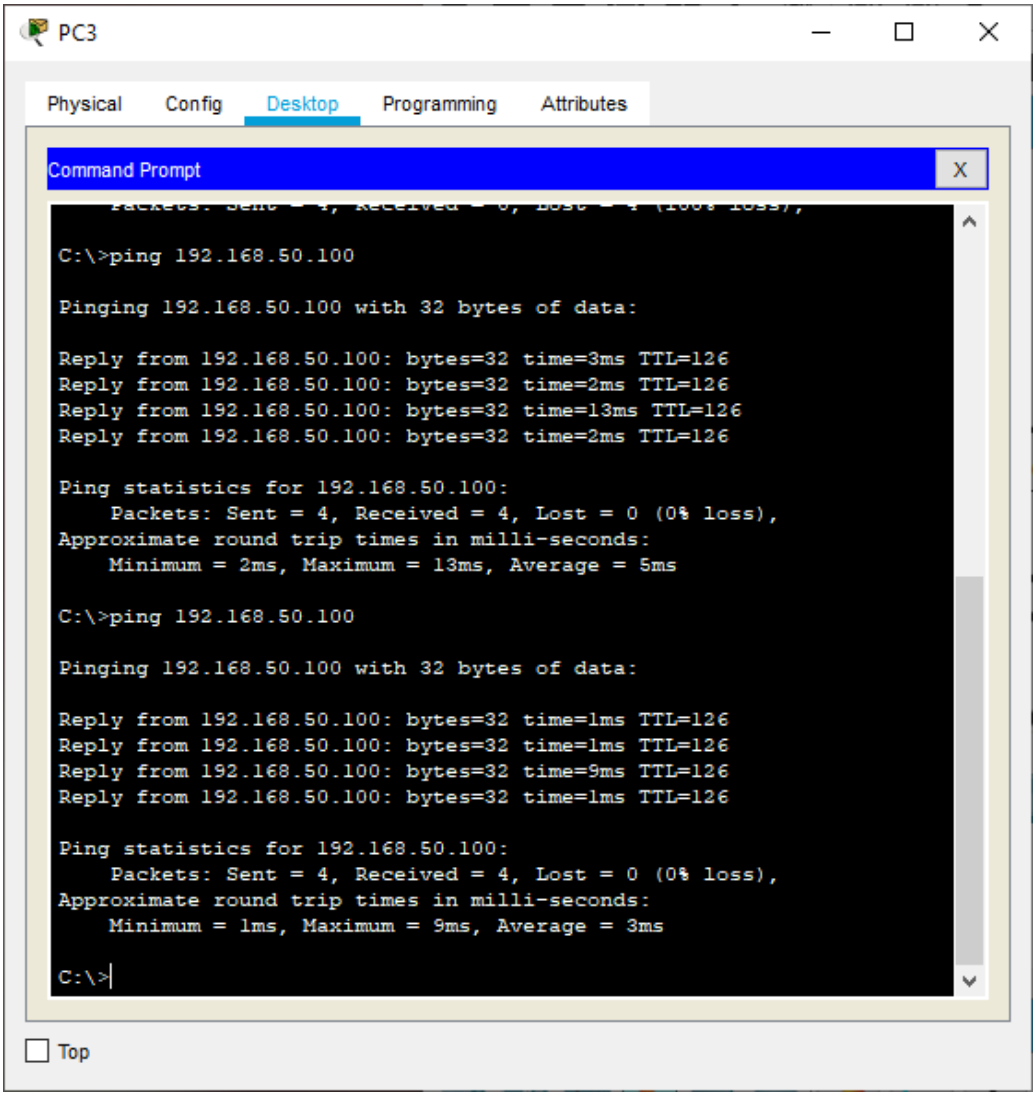

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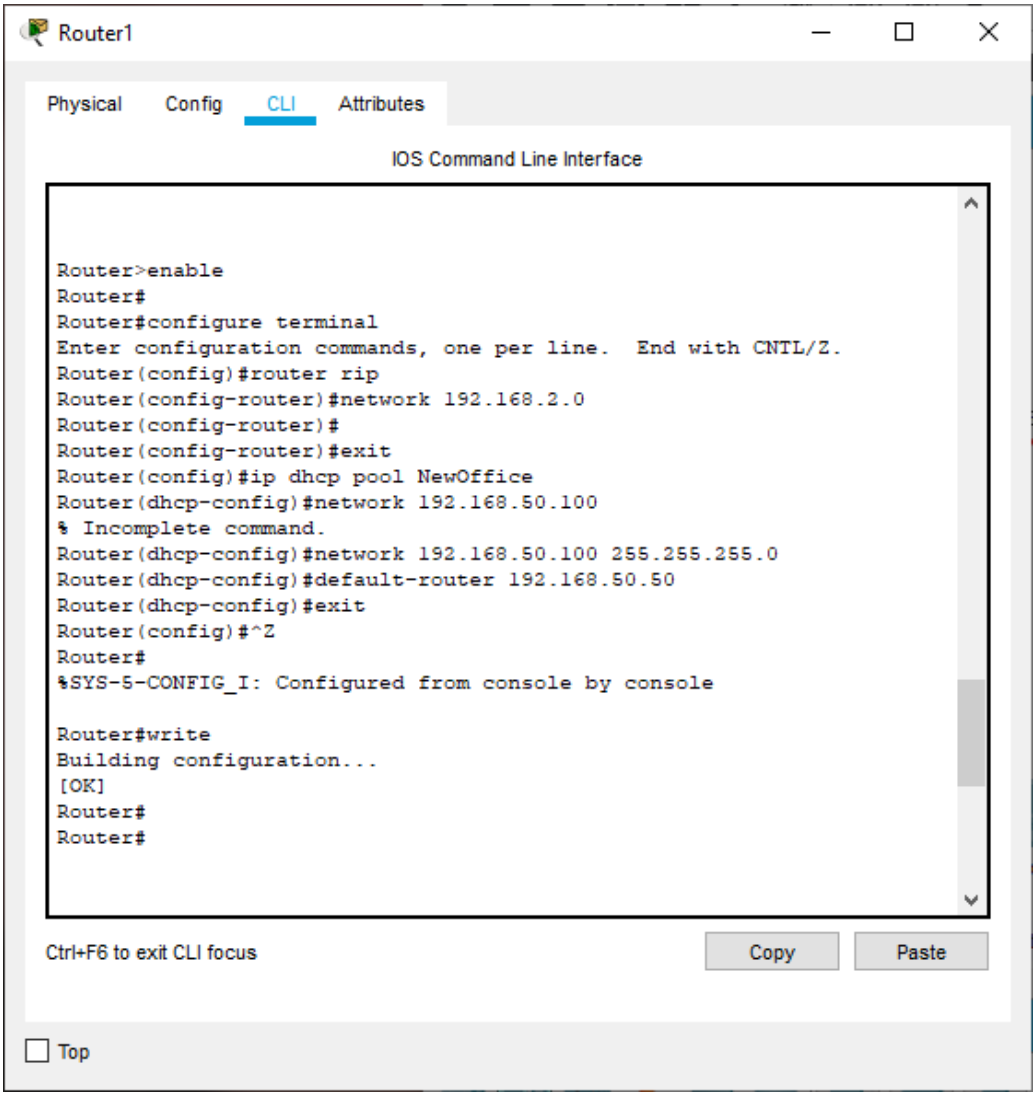

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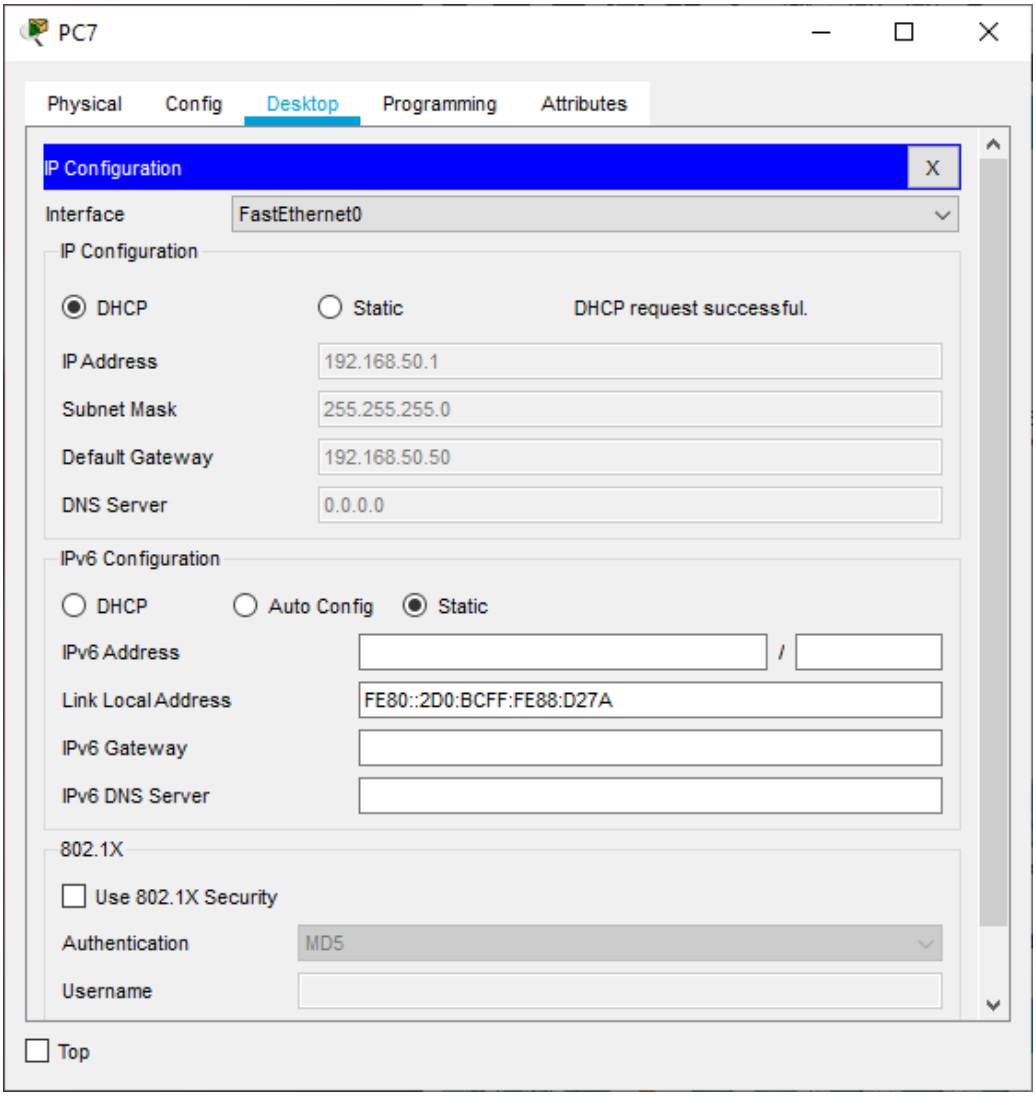
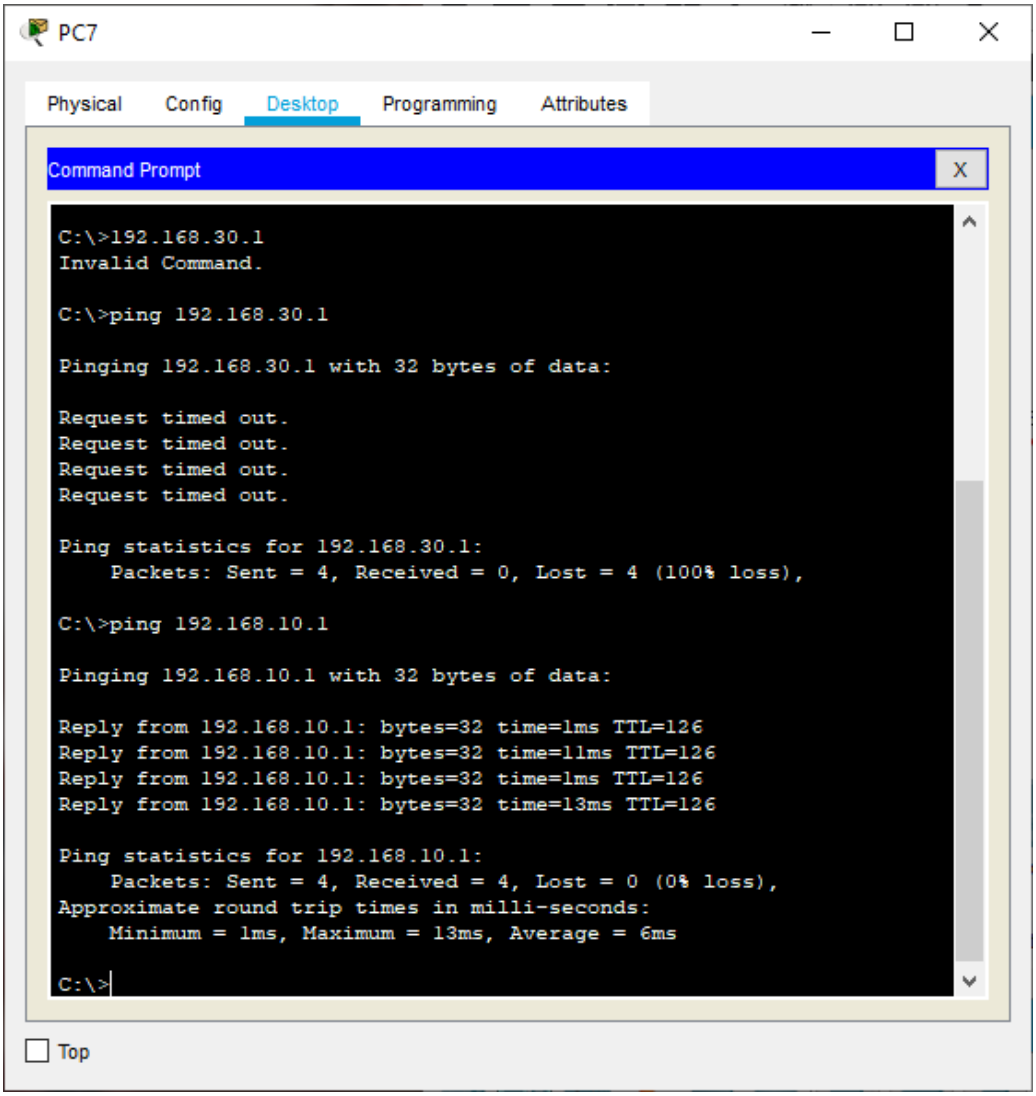
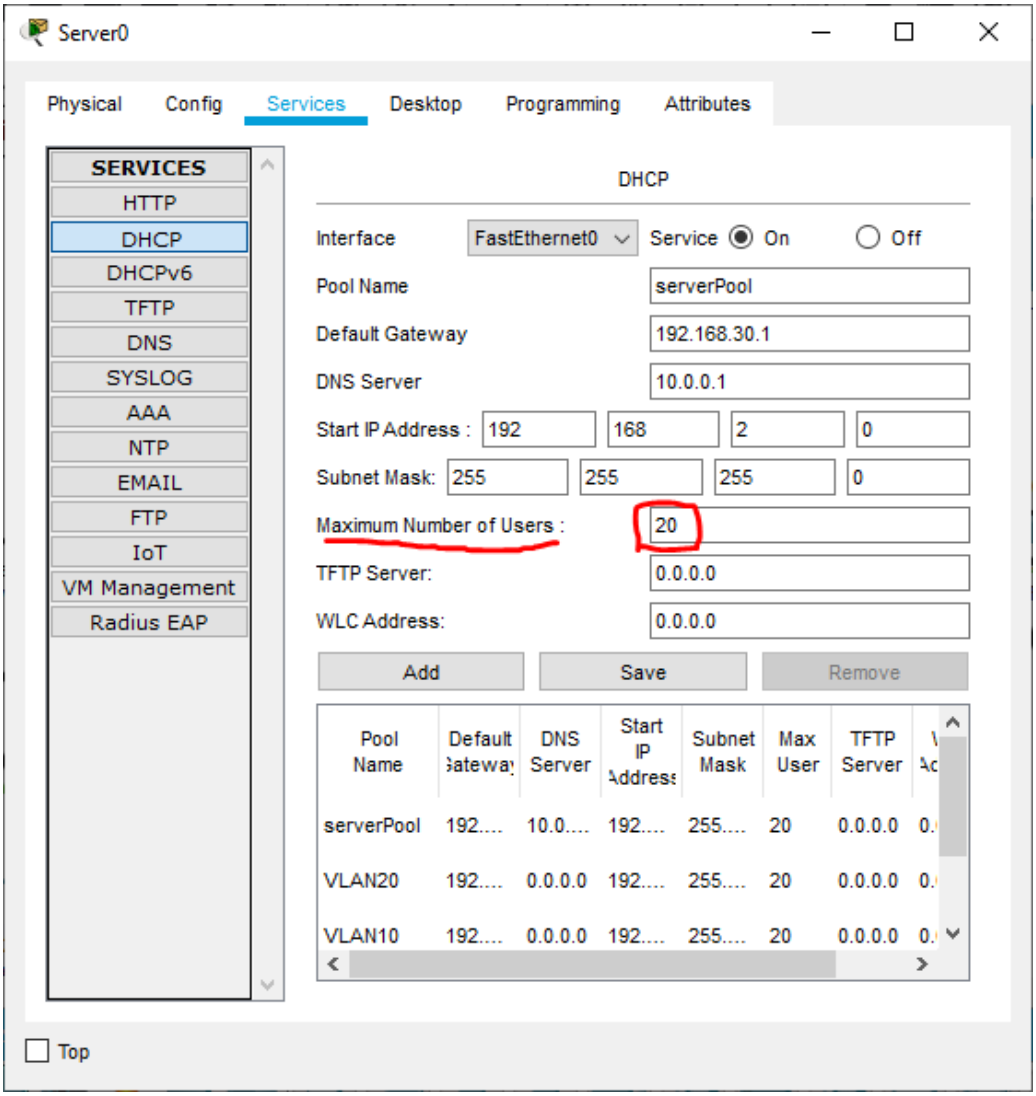


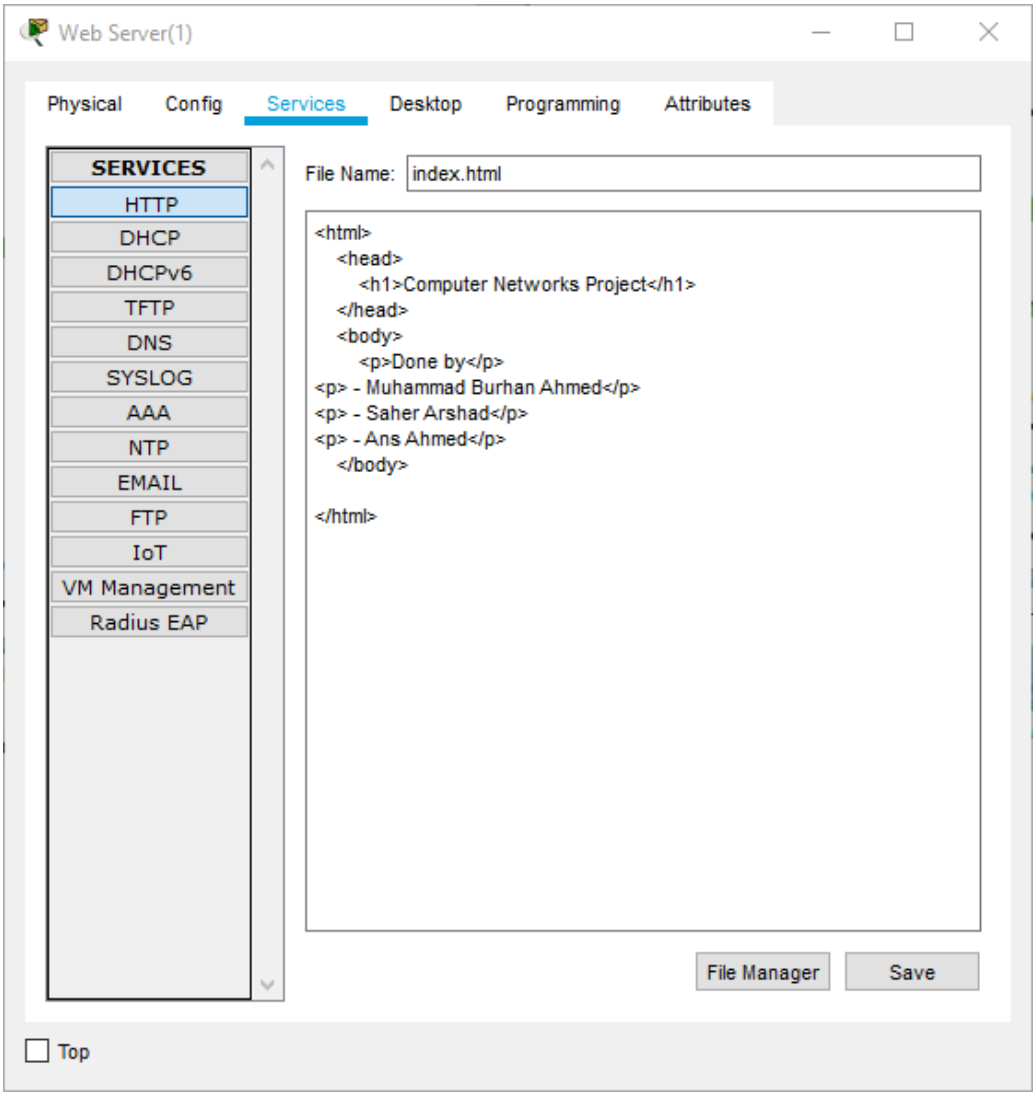
Screenshot 41



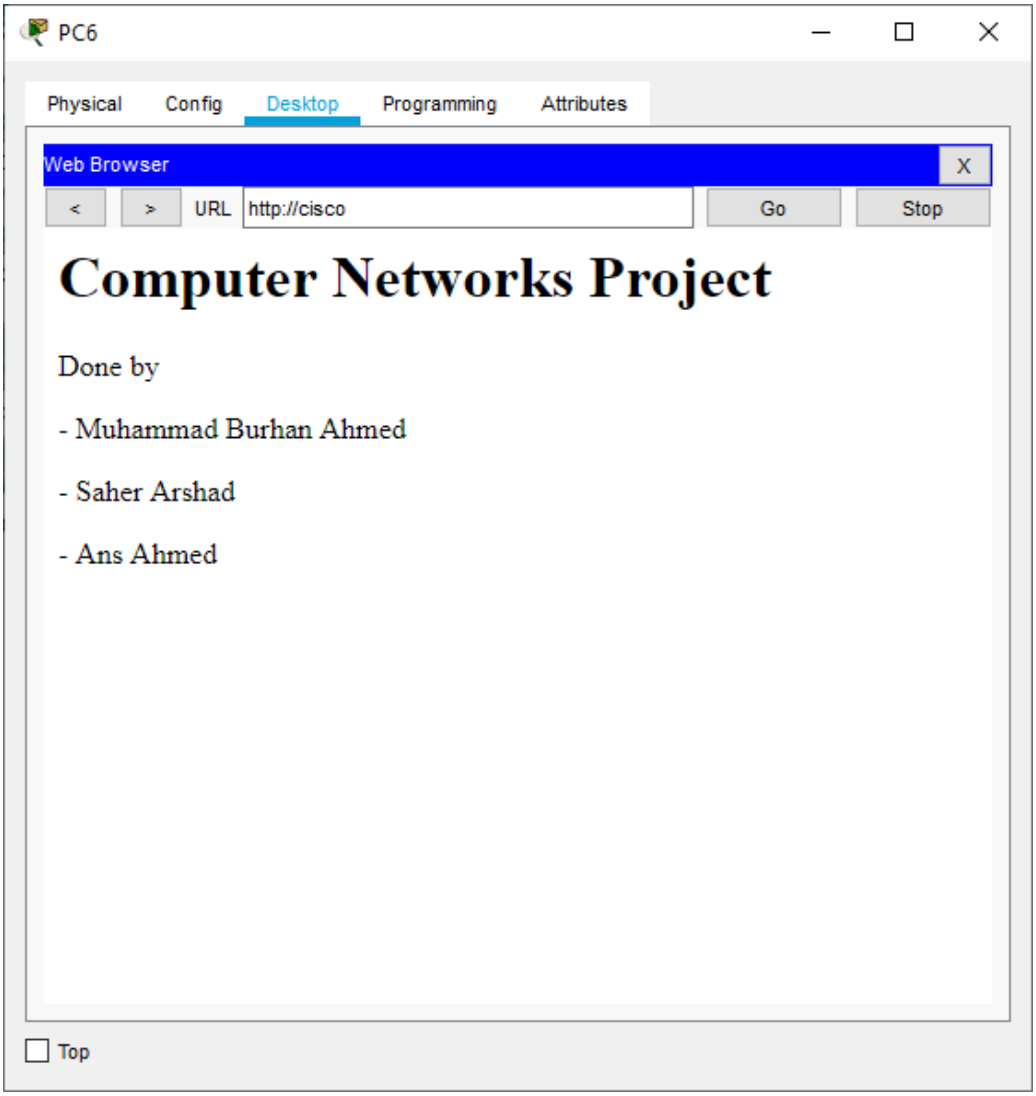
Screenshot 42



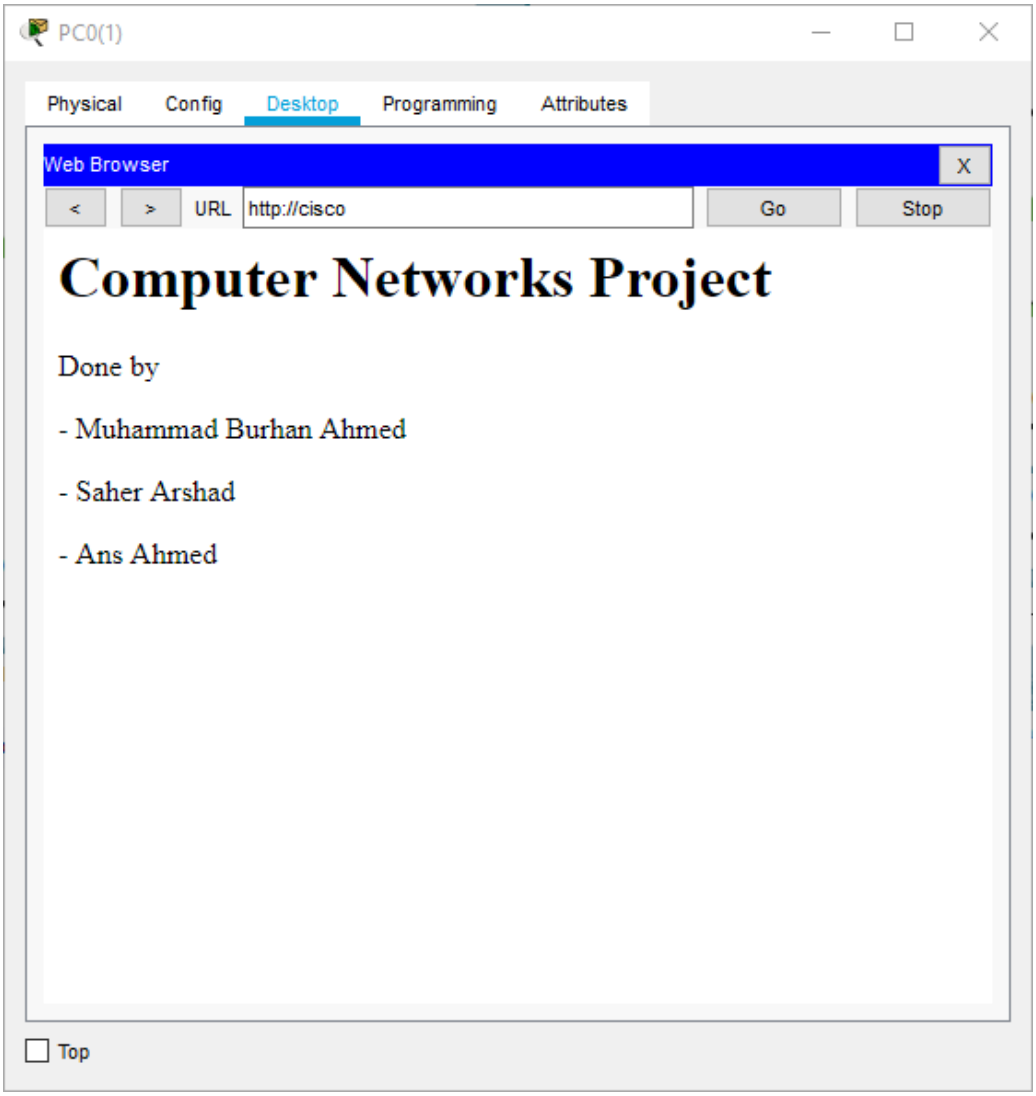
Screenshot 44



Screenshot 45



Screenshot 46



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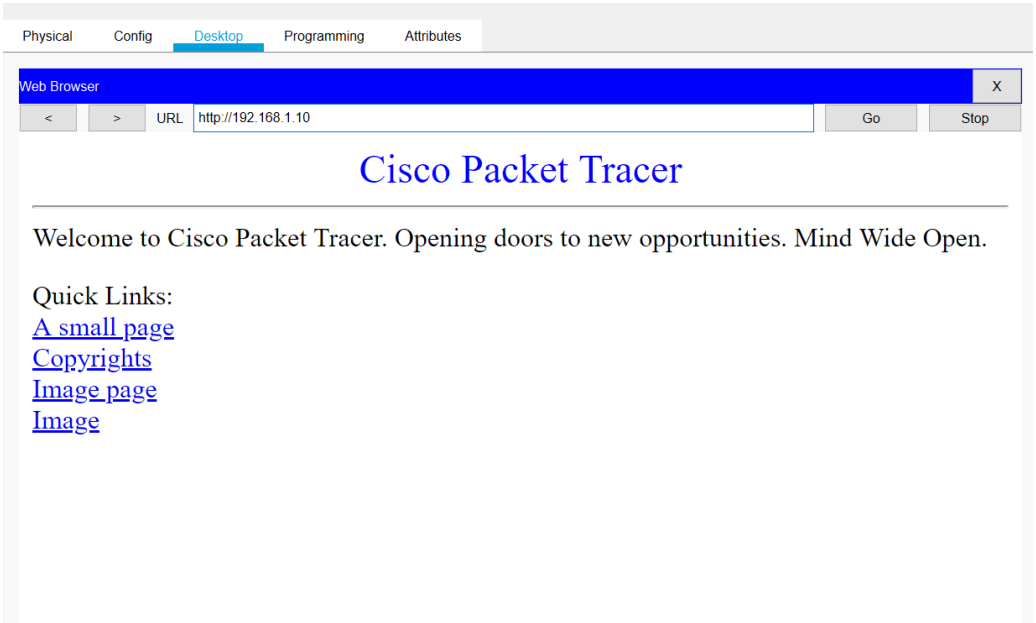

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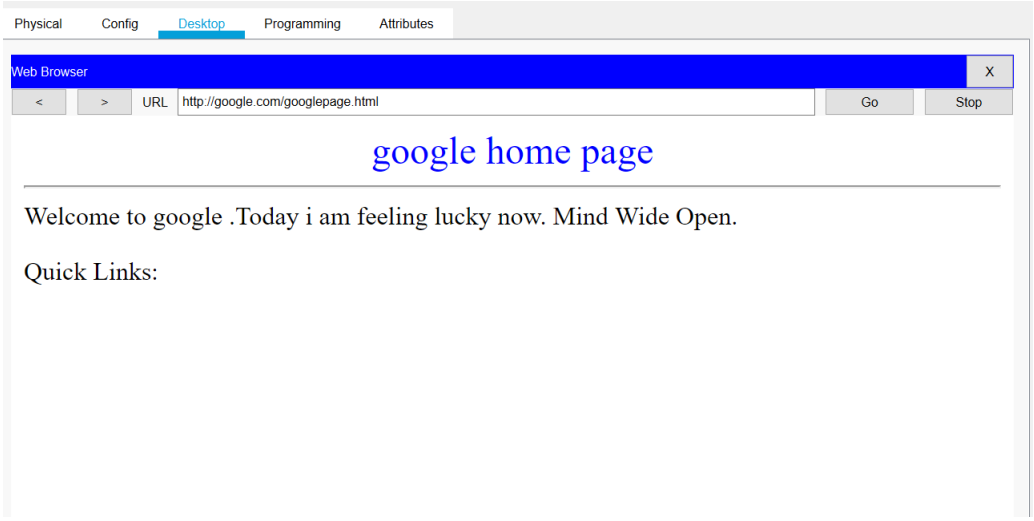

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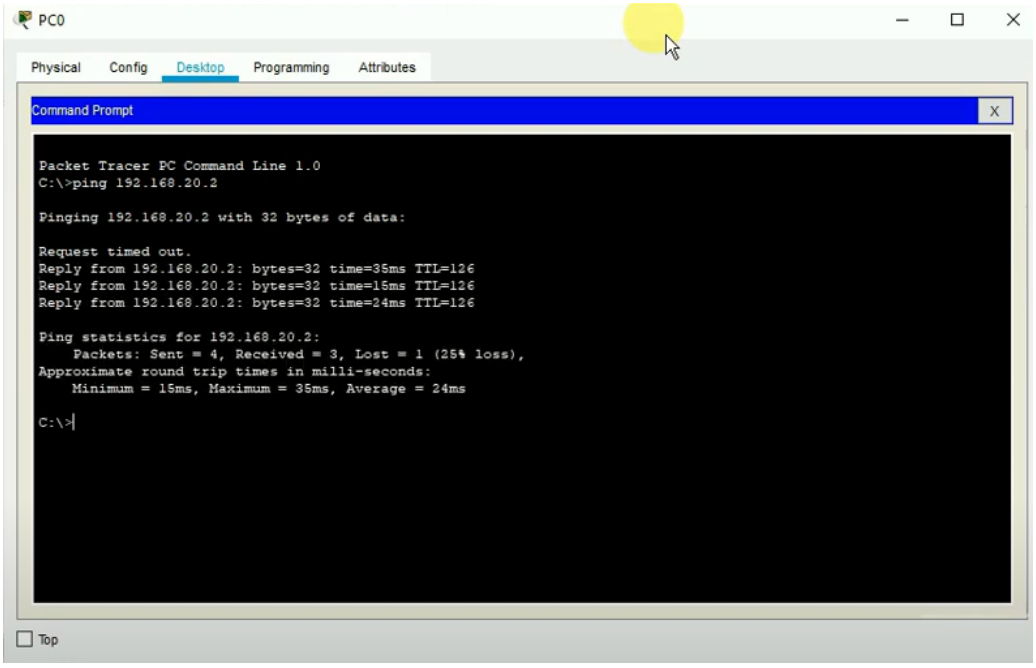
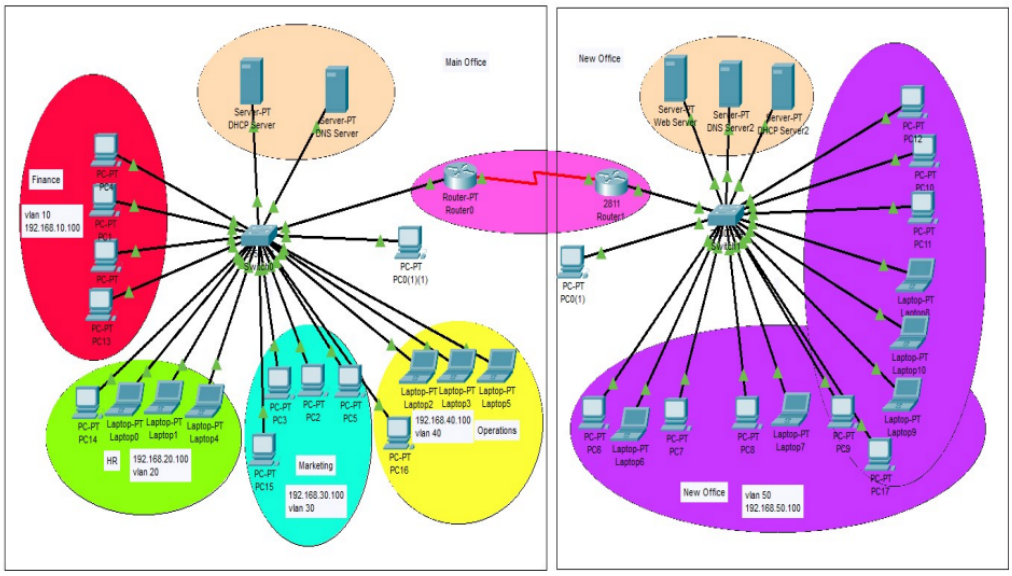


Screenshot 50


Main Office
Server-PT DHCP Server
Server-PT DNS Server
Finance
vlan 10
192.168.10.100
PC-PT PC4
PC-PT PC1
PC-PT PC0
PC-PT PC13
Router-PT Router0
2811 Router1
PC-PT PC0(1)(1)
PC-PT PC0(1)
Switch0
PC-PT PC14
Laptop-PT Laptop0
Laptop-PT Laptop1
Laptop-PT Laptop4
HR
192.168.20.100
vlan 20
PC-PT PC3
PC-PT PC2
PC-PT PC5
PC-PT PC15
Marketing
192.168.30.100
vlan 30
Laptop-PT Laptop2
Laptop-PT Laptop3
Laptop-PT Laptop5
192.168.40.100
vlan 40
Operations
PC-PT PC16
New Office
Server-PT Web Server
Server-PT DNS Server2
Server-PT DHCP Server2
PC-PT PC12
PC-PT PC10
PC-PT PC11
Laptop-PT Laptop8
Laptop-PT Laptop10
Laptop-PT Laptop9
PC-PT PC17
PC-PT PC6
Laptop-PT Laptop6
PC-PT PC7
PC-PT PC8
Laptop-PT Laptop7
PC-PT PC9
New Office
vlan 50
192.168.50.100

6 Conclusion

In conclusion, the complex engineering problem of implementing a computer network using Cisco Packet Tracer for the Computer Networks course has been successfully completed. The project involved setting up a main office with multiple VLANs, configuring DHCP and DNS servers, and establishing communication between different offices.

By carefully designing and configuring the network infrastructure, we were able to create separate VLANs within the main office, allowing for efficient management of network resources and improved security. The DHCP server was configured to assign IP addresses dynamically to devices within each VLAN, ensuring smooth network connectivity.

Additionally, the implementation of a DNS server enabled the translation of domain names to IP addresses, facilitating seamless communication and accessibility of resources within the network. The DNS server played a crucial role in resolving domain names to the appropriate IP addresses, allowing users to access the web server and other services hosted within the network. Furthermore, the addition of a new office with a single VLAN demonstrated the scalability of the network design. The new office was seamlessly integrated into the existing network, with communication established between the main office and the new office. This allowed for efficient collaboration and resource sharing between the two locations.

Overall, the successful implementation of this complex engineering problem showcases the knowledge and skills acquired in the Computer Networks course. It highlights the ability to design and configure a robust network infrastructure using Cisco Packet Tracer, ensuring reliable communication, efficient resource allocation, and secure connectivity. The project has provided valuable hands-on experience in network design and administration, preparing us for real-world networking scenarios in the field of computer engineering.

7 References

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