CAREER EPISODE 1

DESIGN AND ANALYSIS OF VLANS

1.1 INTRODUCTION

College	Leelaben Dashrathbhai Ramdas Patel (L.D.R.P.) Institute of Technology & Research
Location	Gandhinagar, India
Sub/ Sem	Computer Networks, 5^{th}
Chronology	July 2019 -Sep 2019
Supervisor	Hitesh Barot
Position	Leader

1.2 FRAMEWORK

1.2.1

Virtual Local Area Network, or VLAN, is a standard network protocol that separates and divides devices into various broadcast domains, enhancing network security and efficiency. Network administrators determine which devices are a part of each VLAN during configuration, as well as their intercommunication privileges and broadcast range. An essential tool in this area is Cisco Packet Tracer, which offers a dynamic simulation environment for testing, debugging, and visualising VLAN settings. With the help of this Programme, users may simulate and model complicated network environments, ensuring that VLAN configurations are configured correctly before being used in real-world situations. Network engineers may design optimised and secure network topologies that are customised to the unique organisational requirements through the collaboration of Cisco Packet Tracer and VLAN configuration.

The project's goal was to use a Cisco Packet Tracer (CPT) to analyse VLAN setup. The project started with an extensive exploration of networking terminologies and their applications. The focus was on understanding VLAN (Virtual Area Network) and its significant role in current networks. Following the research phase, the best router, switch, and laptop were chosen based on specific criteria like bandwidth and performance. The equipment was then interconnected strategically the network model was designed on CPT. Each end device was configured with specific IP and IPv6 addresses. The setup was then analyzed using the IOS command line interface, monitoring data packets sent and received to ensure optimal communication and security across the VLAN network. The system was then simulated and ping tests were done to ensure, the data transferred smoothly between the end devices

1.2.2 OBJECTIVE

The major purpose was to model a VLAN configure it and simulate the design in the Cisco Packet tracker.

Other goals were;

- To increase the overall efficiency of the network by utilizing optimum configuration and topologies
- To decrease the loss of data in the system and also reduce the overall delay time in the transmission of data.

1.2.3 WORKED AREA

I commenced by acquainting myself with the terminologies of networking, diving deep into the concepts of VLAN, and mastering the intricacies of the CPT. Then, I transitioned to the equipment selection phase, where I prioritized optimal performance, scalability, and streamlined network management. In the subsequent phase, I meticulously crafted the system's blueprint, ensuring the impeccable integration of routers, switches, and laptops. I set specific interface parameters and IP configurations, adjusting the IPv6 settings for every laptop, before conducting an initial system evaluation. Post-analysis, I reviewed the results to determine the quality of connections and verified the effective communication within the VLAN. Additionally, I efficiently managed resources, and regularly coordinated with the team, ensuring that every milestone was achieved on schedule.

1.2.4 ORGANOGRAM

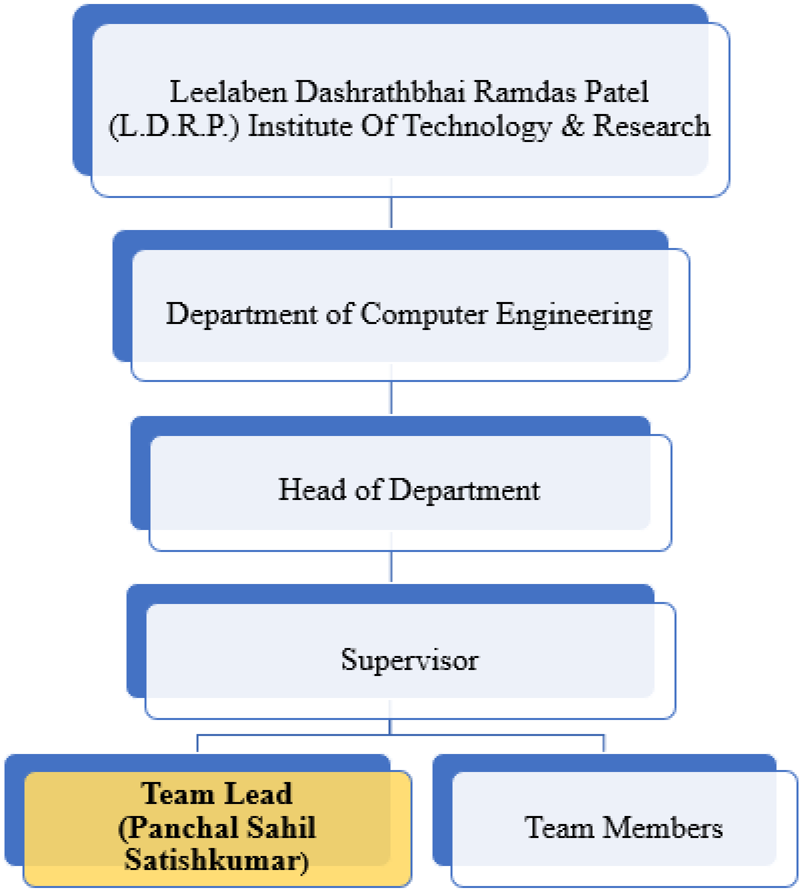

Fig1: Organogram

1.2.5 MAJOR TASKS

- To familiarize oneself with networking terminologies, and delve into VLAN, and the CPT.
- To undertake the equipment selection phase, ensuring optimal performance, scalability, and effective network management.
- To design the system's infrastructure, emphasizing the seamless integration of routers, switches, and laptops.
- To set interface parameters, IP configurations, and IPv6 settings for each laptop, then proceed with an initial system analysis.
- To evaluate the results from the system analysis, assess connection quality, and ensure proper VLAN communication in the network.

1.3 PEAs

1.3.1

I commenced the initiative journey with an in-depth exploration of the myriad terminologies inherent to the networking model and their real-world applications. In particular, I dedicated time to comprehend the intricacies of VLAN (Virtual Area Network) and the role it plays in modern networks. I also acquired knowledge of Cisco Packet tracer, a network modeling and simulating software, which could be of potential use to model, configure, and simulate the proposed network design. I explored Routers, switches, and their working and operational schematics. I also acquired information on configuring such network devices. I researched configuring end devices that can be used by the users to transmit data within the network. I explored various cables such as cross-over cables & straight-through cables to connect the different network components that would be employed in the network model.

1.3.2

To enable the interchange of data packets between various networks inside the system and ensure flawless connectivity, I chose routers to establish communication between them. By sending data exclusively to targeted devices and decreasing extraneous traffic, switches enable the effective movement of data inside local networks, enhancing network performance. To mimic actual user interactions with the network, I used laptops as the endpoints. I chose laptops as the endpoints for data transmission and reception to simulate user actions. I decided on Cisco Packet Tracer as the modeling, configuring, and simulating software since it offered a virtual setting for creating and testing network setups and provided a safe and controlled environment for experimentation. I proposed splitting the network logically into two portions using two VLANs. To ensure proper communication between devices with varied functionality, I chose straight-through cables to link several types of components. Additionally, I used crossover cables to link parts of a network that were of the same kind, allowing for direct connections between switches and routers to improve certain network settings and functionality.

1.3.3

Following the selection of the essential elements, I connected the various nominated components together with straight-through cables for linkage between different types of devices and crossover cables for linking similar types of devices. I incorporated a specific router 'Router0', as the core of the setup, directly linking it to Switch0. To enhance network scalability and flexibility, I introduced two other switches, named Switch1 and Switch2. Both were seamlessly connected to the central Switch0 via crossover cables. For Switch1, I integrated three distinct laptops: Laptop5, Laptop3, and Laptop4, ensuring they had a direct link for optimized data transfer. On the other hand, Switch2 was equipped with three more devices: Laptop0, Laptop1, and Laptop 2. I ensured that every connection was meticulously established, guaranteeing that further analysis and operations would proceed without glitches, laying the foundation for a robust system design.

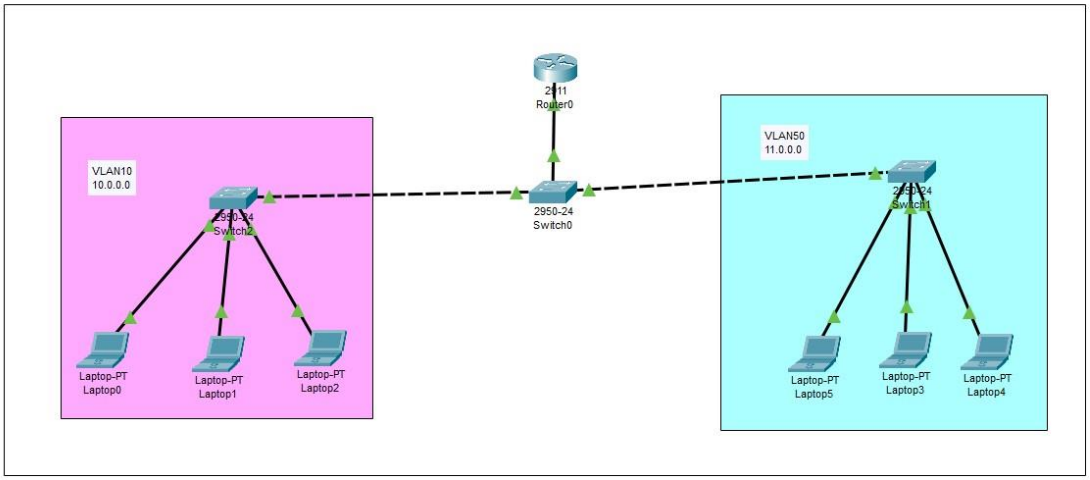

Fig2: Network Architecture

1.3.4

I further began the configuration procedure. I initially allocated the IOS command line interface prior to the analysis of the outcome. I utilized the 10.0.0.0 and 11.0.0.0 network IP addresses for the VLAN10 and VLAN50. For Laptop 0, I set the interface as FastEthernet0 with DHCP IP configuration and static IPv6 configuration. I allocated the link-local address as FE80::202:17FF: FE4A: A92. For laptop 1, I utilized a similar interface along with the IP configuration as well as the IPv6 configuration. I allocated the address of the link-local as FE80::20A:F3FF: FE67:9120. I also assigned FastEthernet0 as the interface with DHCP IP configuration and static IPv6 configuration for Laptop 2 with the address of the link-local as FE80:205:5EFF: FE61:2541. Similarly, for laptop 3, I allocated an identical interface, IP configuration as well as IPv6 configuration with FE80::290:21FF: FE58:ACA7 link-local address. I provided a similar configuration with the change in link-local address as FE80::201:64FF: FE82:A004 for laptop 4. Finally, for laptop 5, I assigned the address of link-local as FE80::2E0:B0FF: FEBC:2B3B with a similar configuration. After setting the essential parameters, I executed the analysis to review the outcome attained.

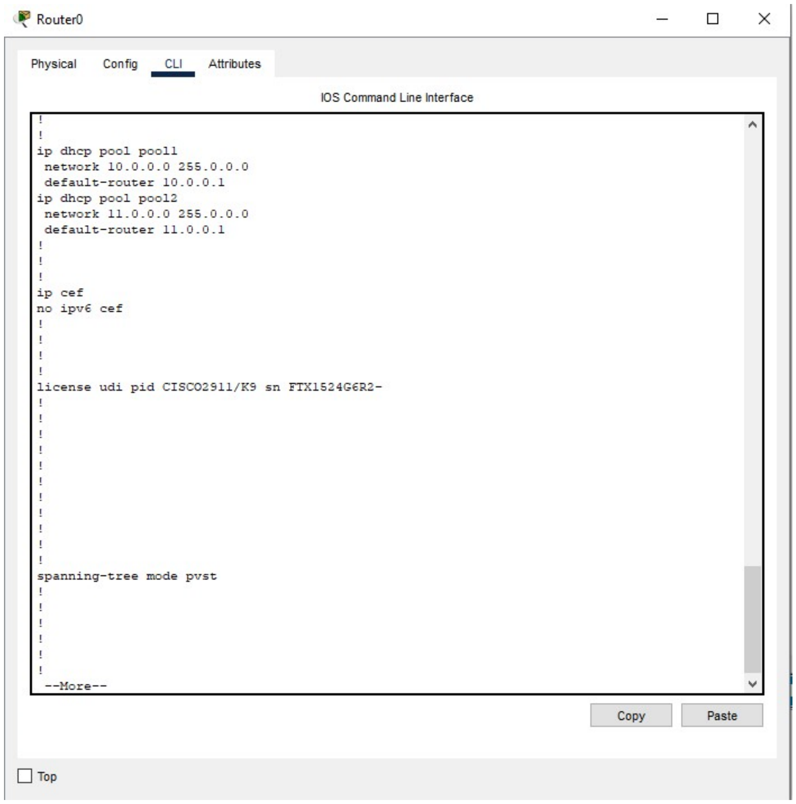

Fig3: IOS CLI

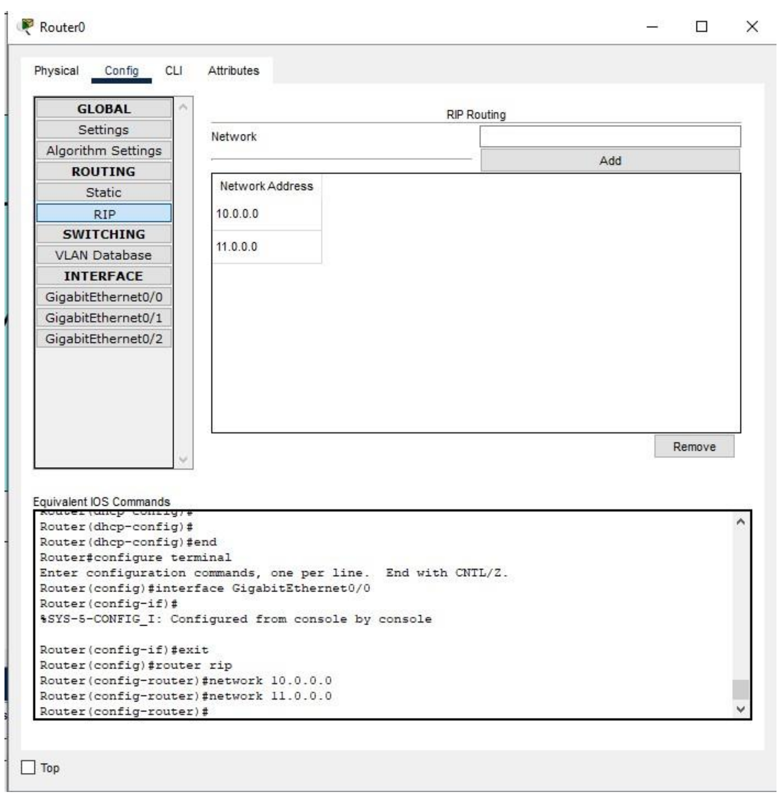

Fig4: Configuration

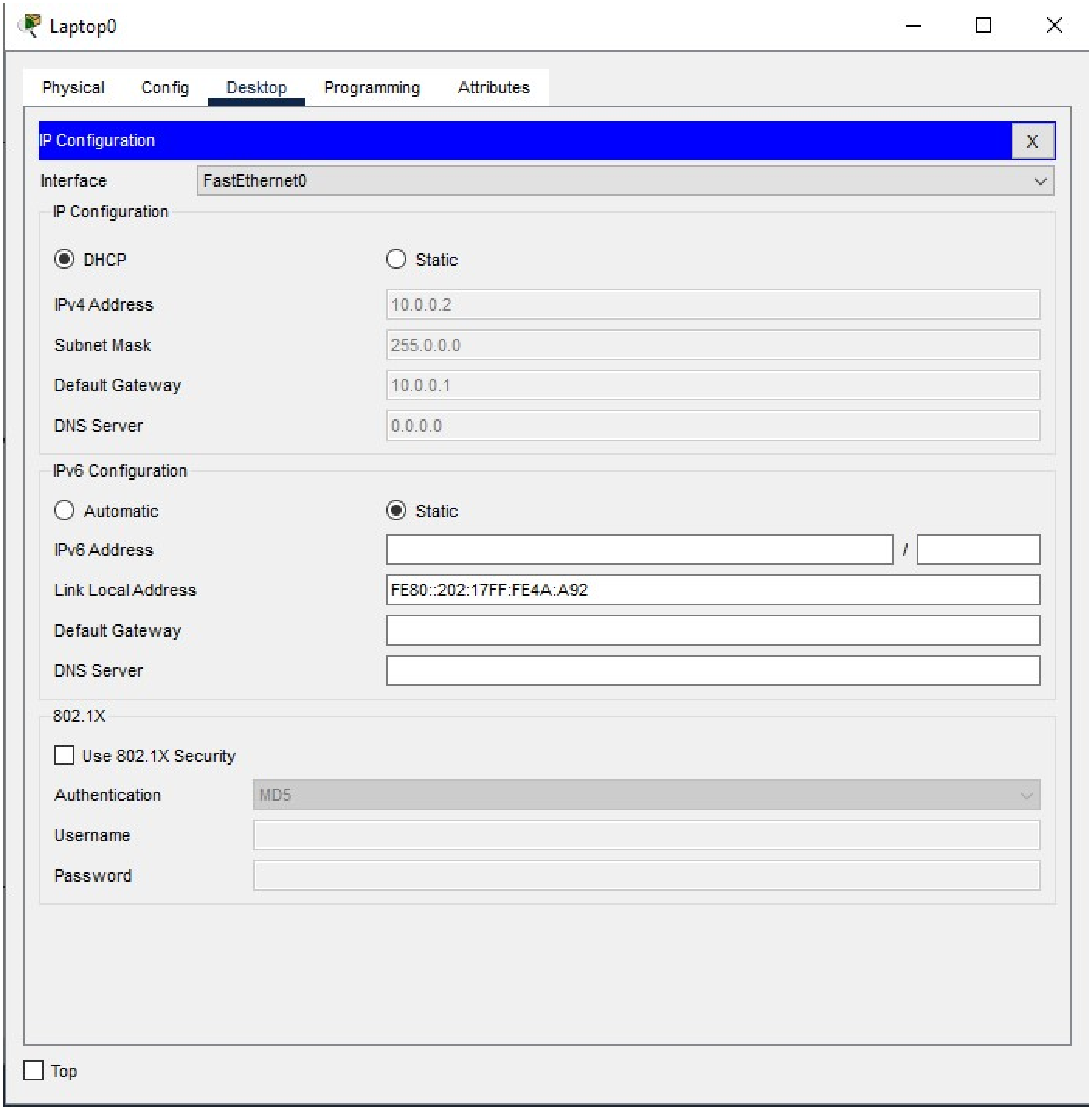

Fig5: Laptop 0

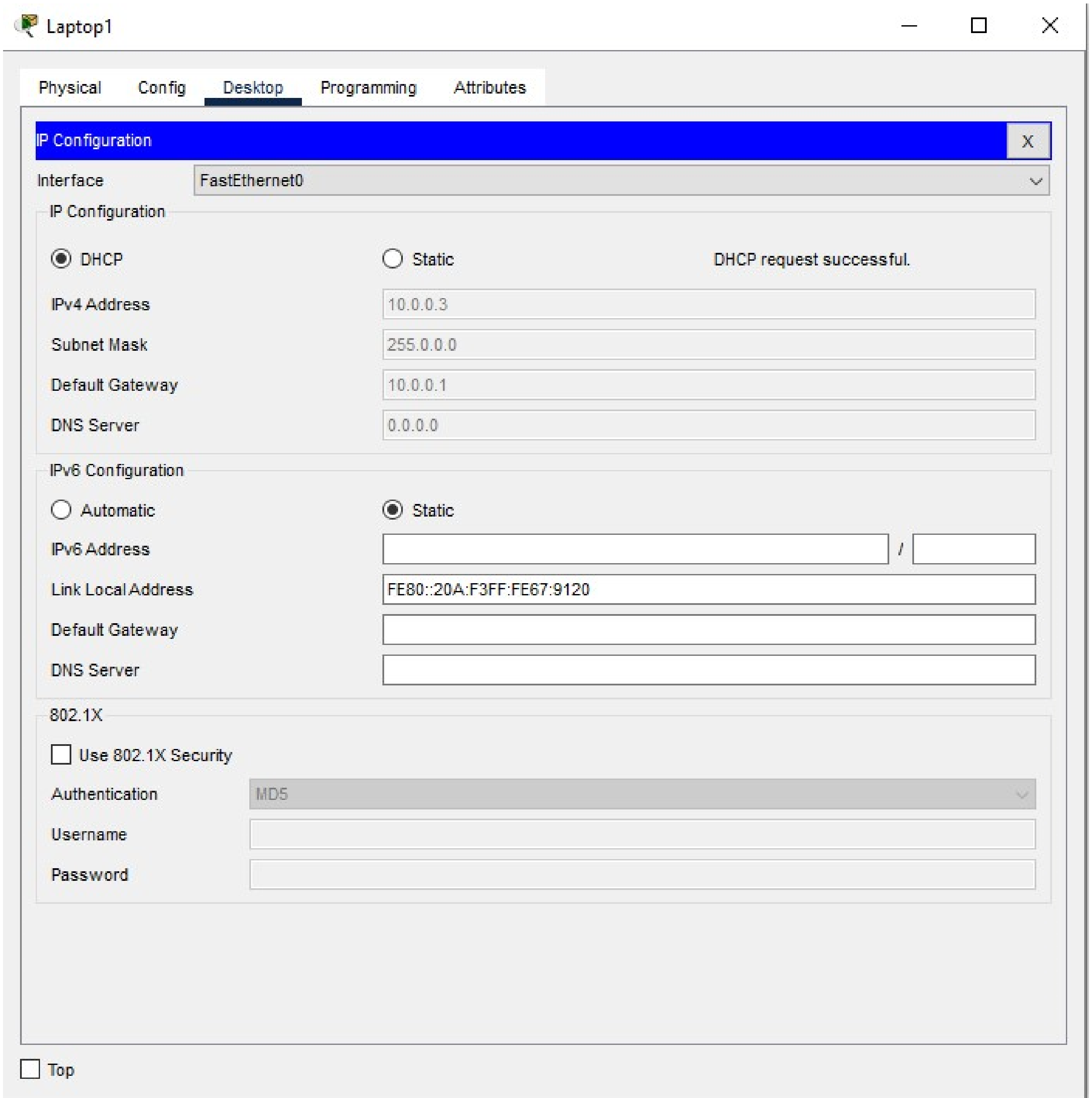

Fig6: Laptop 1

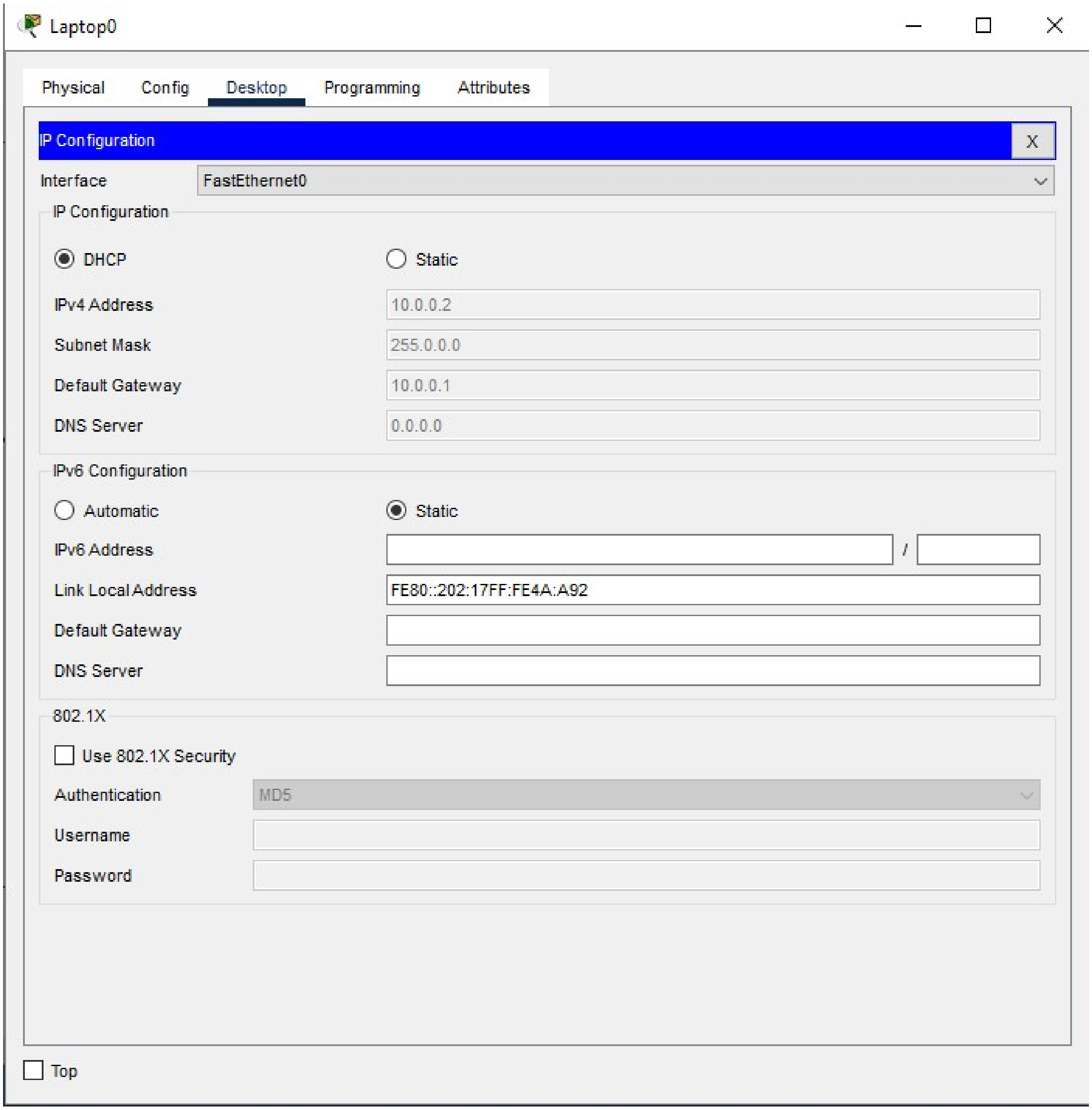

Fig7: Laptop 2

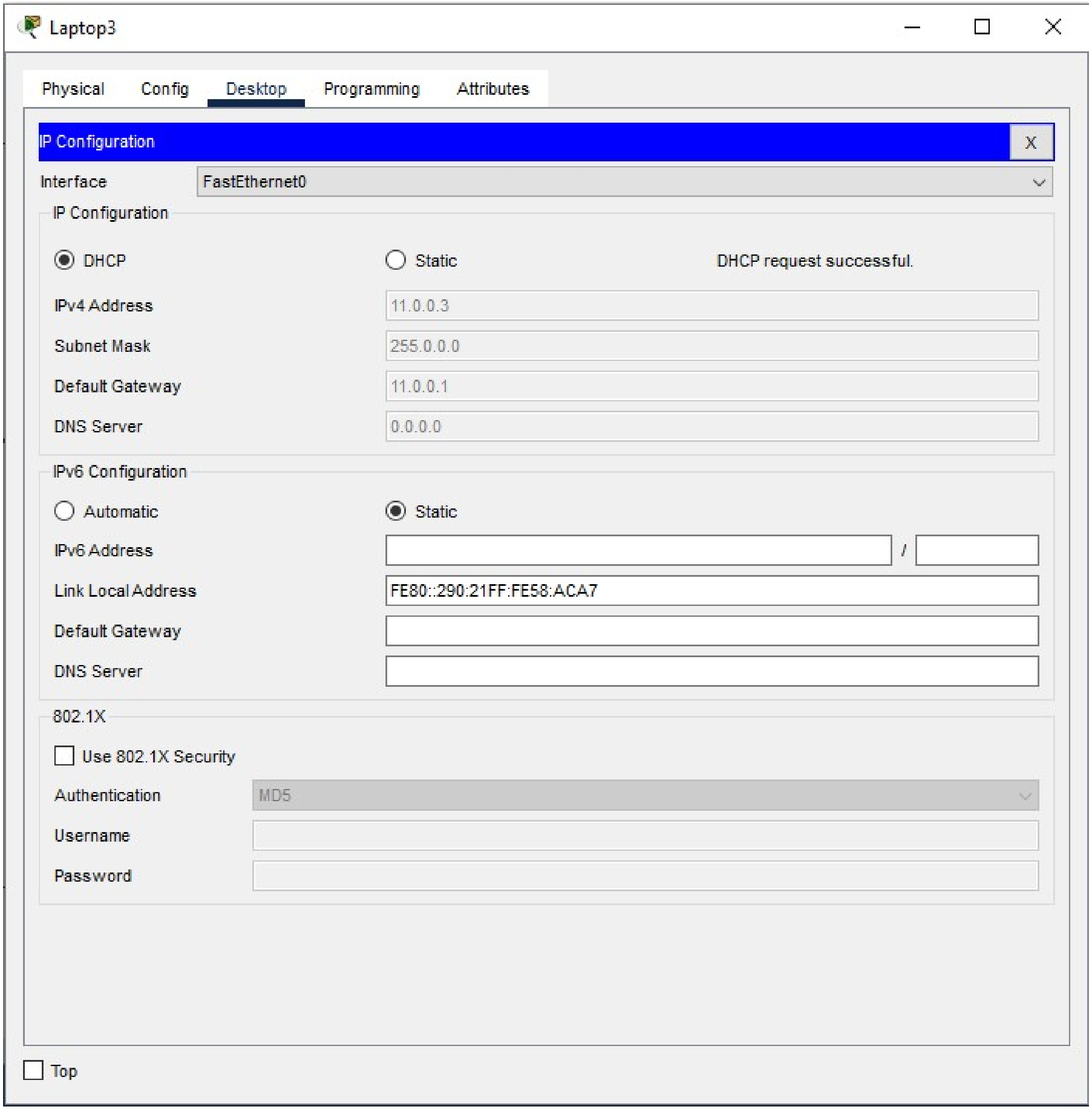

Fig8: Laptop 3

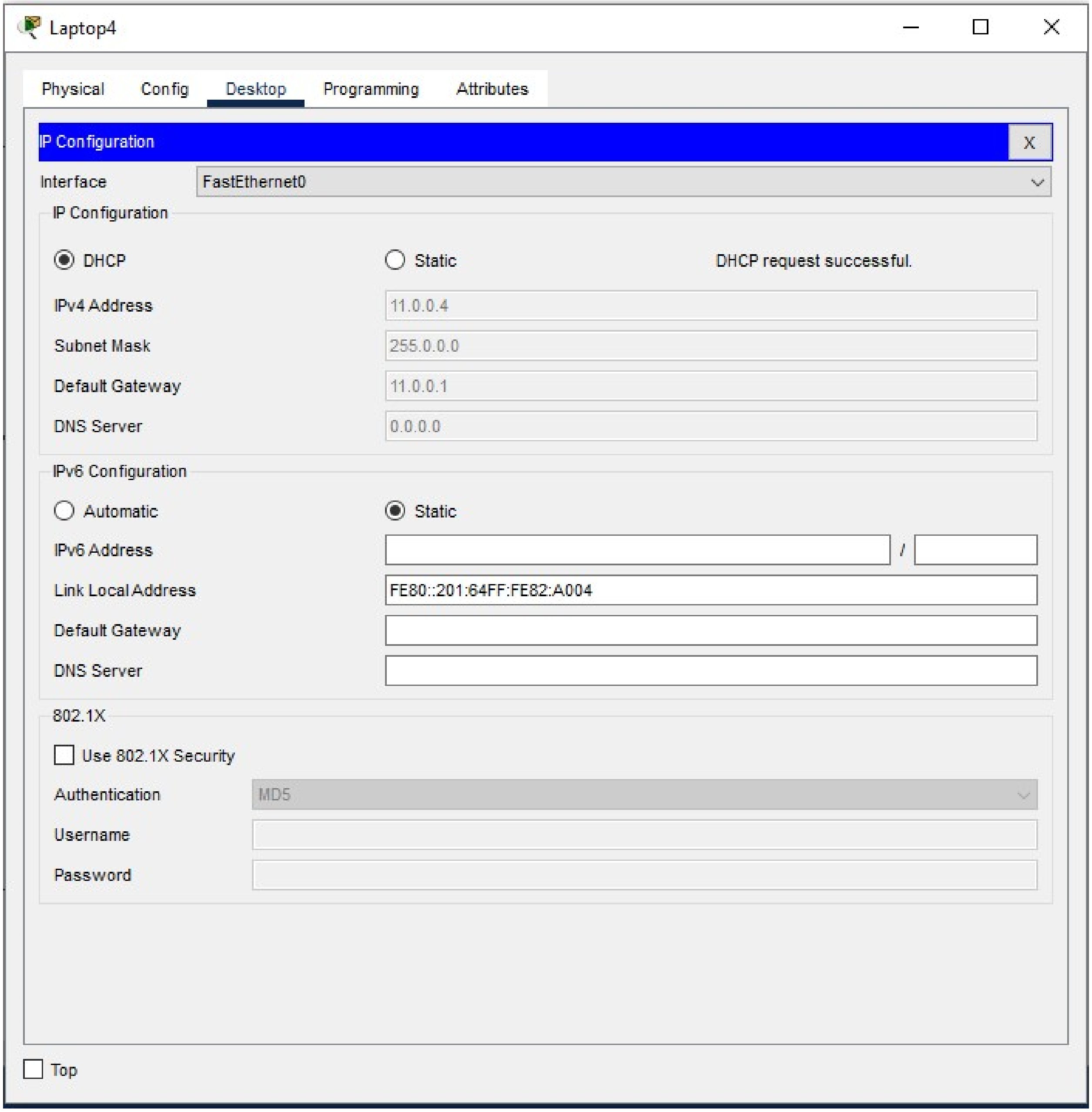

Fig9: Laptop 4

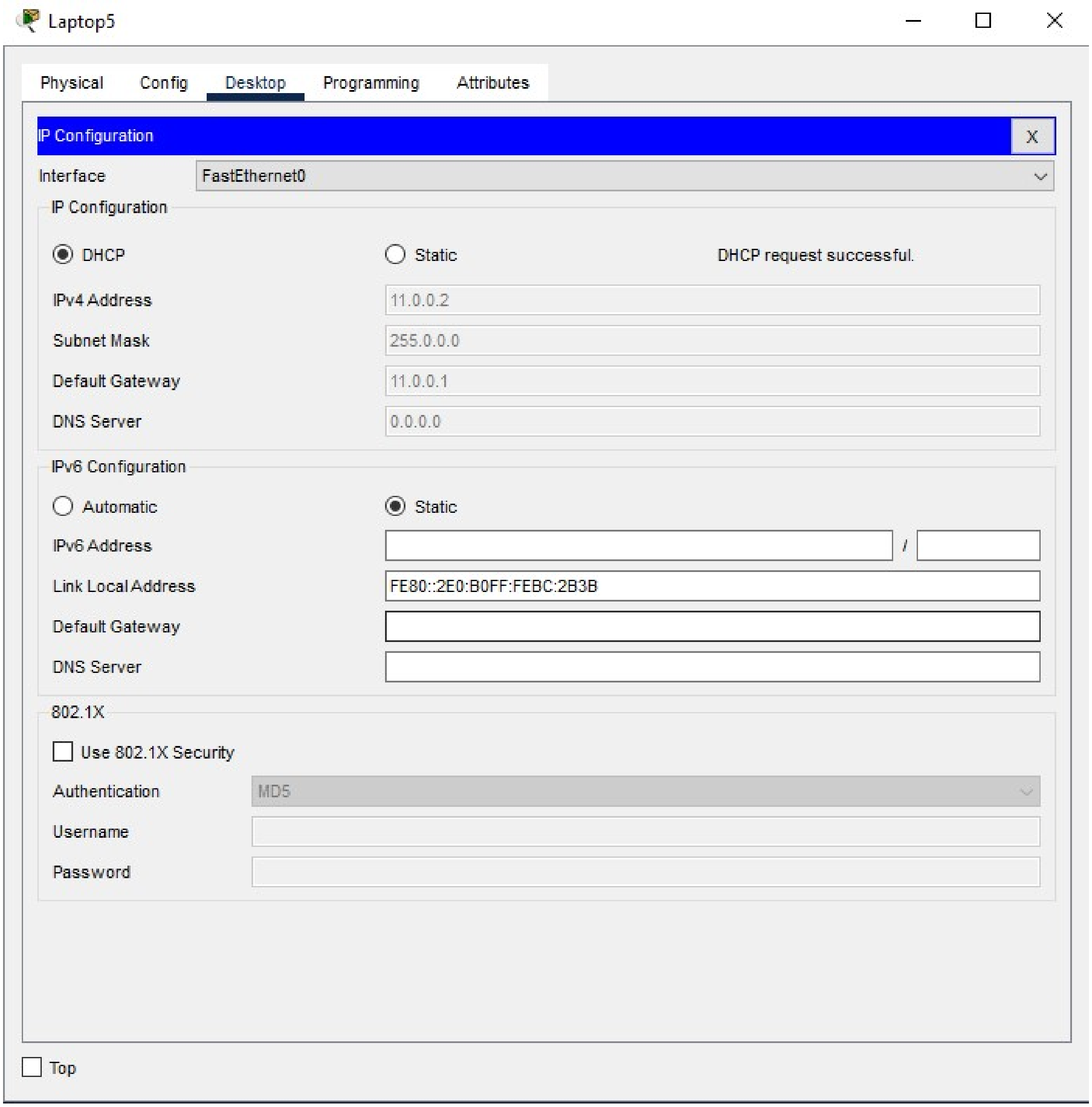

Fig10: Laptop 5

1.3.5 RESULTS

From pinging of Laptop 0 to Laptop 5, I received all the 4 packets sent. 4 received which stated 0 loss. I also witnessed minimum round trip as 0ms, optimum as 0ms, and average as 0ms. I also noted that Laptop 1 sent 4 packets to Laptop 3 whereas Laptop 3 received 4 packets with 0 loss. I further noticed that the round-trip times were max at 0ms, min at 30ms, and average as 7ms. For the test to laptop 4 from laptop 2, I observed the results as; 4 packets sent all of the packets received, and 0 loss. I determined the minimum round-trip times as 0ms, maximum as 2ms, and average as 0ms. I was thus able to achieve an appropriate connection within the system architecture.

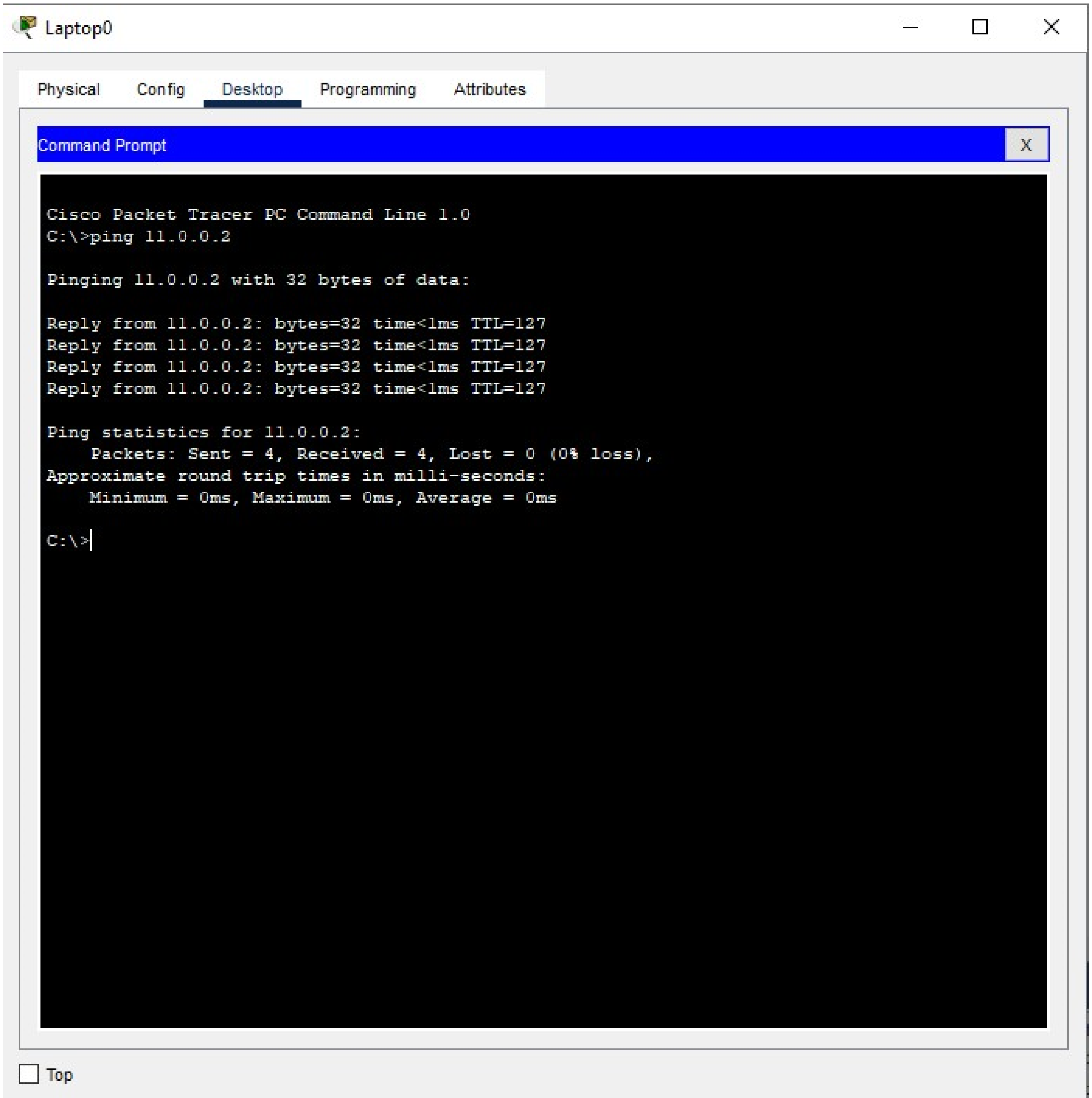

Fig11: Laptop 0 to Laptop 5(Ping Test)

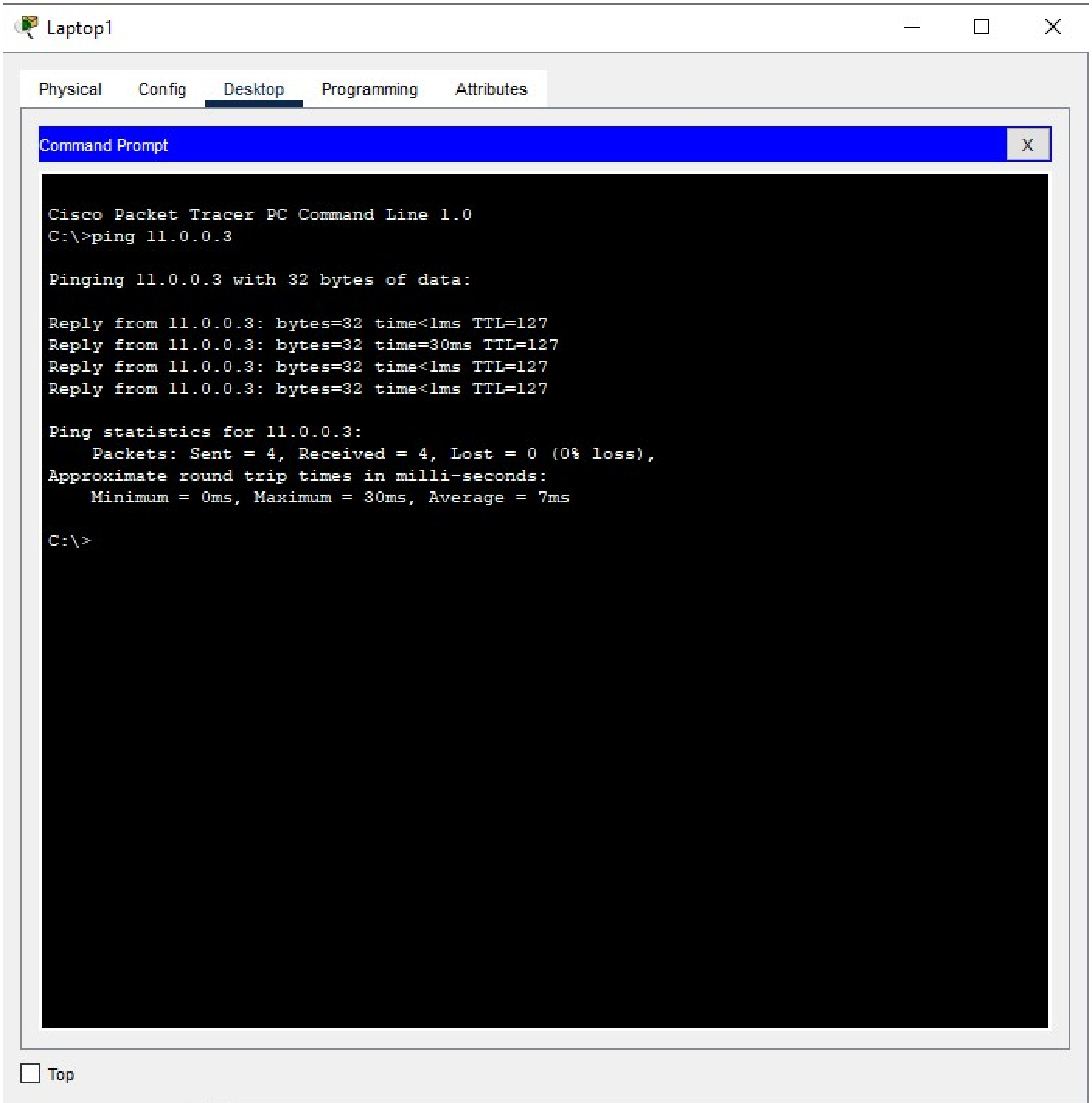

Fig12: Laptop 1 to Laptop 3(Ping Test)

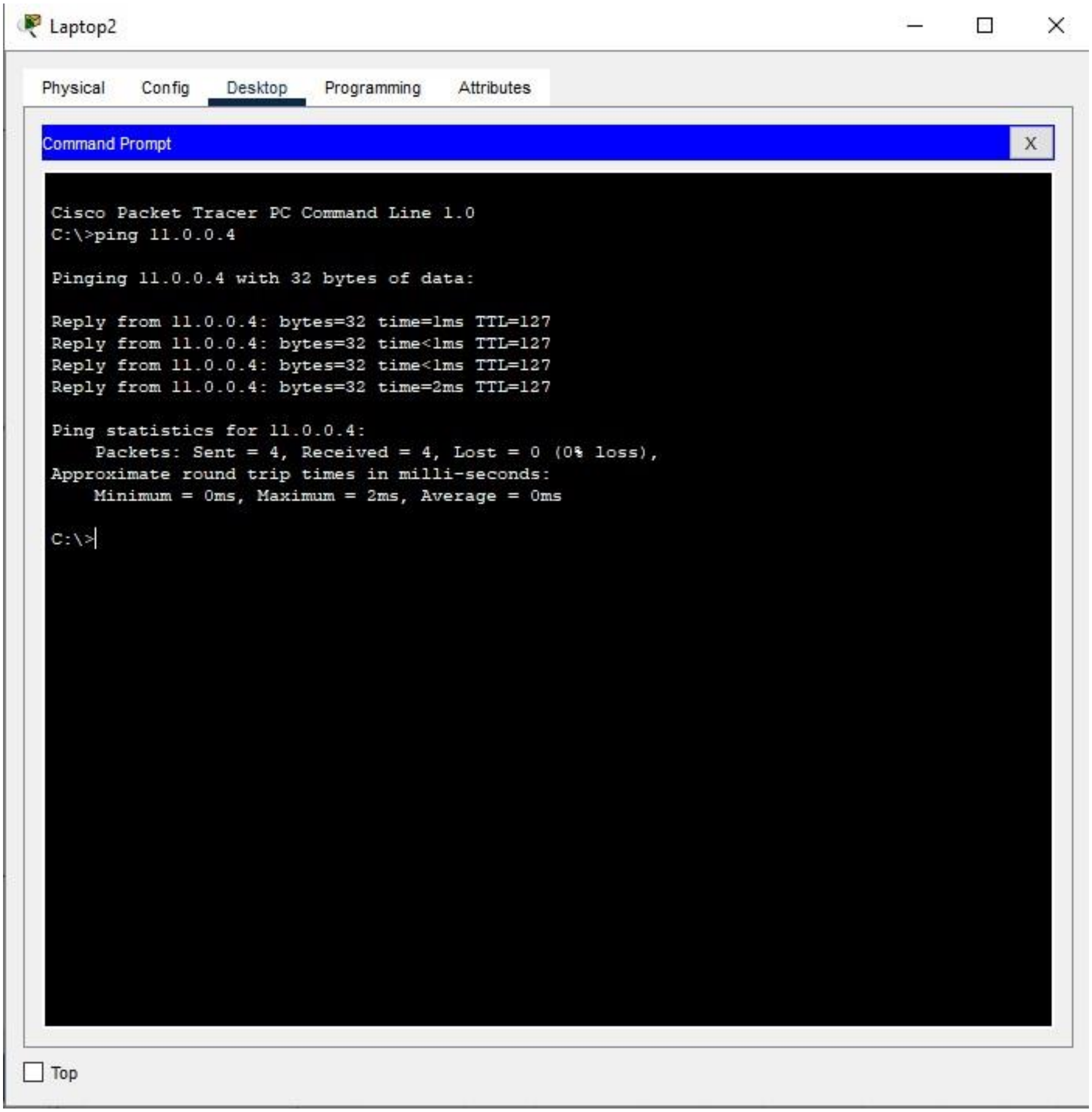

Fig13: Laptop 2 to Laptop 4(Ping Test)

1.4 TECHNICAL PROBLEM AND SOLUTION

In the phase of modeling of network, specifically interconnecting components and configuring the laptops for the network, I identified an unexpected issue. Some of the laptops, specifically Laptop-PT Laptop4 and Laptop-PT Laptop5, encountered intermittent connectivity problems. Despite being configured with the appropriate IPv6 and IP settings, these devices occasionally failed to communicate seamlessly with other network components, which was evident from inconsistent ping results. Upon delving into the root cause of a issue, I discovered that the problem was a result of IP address conflicts within the network. I determined that two devices, unintentionally, had been assigned overlapping IP ranges, leading to communication bottlenecks. The solution I implemented was providing DHCP addressing to the end devices connected to the network. As I provided the DHCP address the computer automatically received a unique IP address. By doing so, not only did I rectify the immediate issue, but I also put in place a mechanism to prevent similar problems from arising in subsequent network expansions or modifications.

1.5 CREATIVE WORKS

I designed a system, incorporating Router0 and switches, ensuring seamless connectivity between various laptops and devices. After configuring each laptop with specific IP and IPv6 settings, I analyzed to evaluate the results achieved. I incorporated DHCP IP addressing to all the end devices to ensure no IP overlapping was present in the system.

1.6 TEAM COORDINATION

Upon stepping into the role of project leader, I promptly took charge of both operations and the distribution of tasks. I methodically delegated duties to each member of my team, always ensuring that their skill sets aligned with the requirements of their assignments. Through regular meetings and consultations with the supervisor and the rest of the team, I addressed potential challenges and worked collaboratively to find solutions. Monitoring the progress of each team member became a priority, allowing me to provide them with the tools and guidance they needed to succeed. My leadership was characterized by proactive decision-making and a keen attention to detail, which played a significant role in the seamless execution of the initiative.

1.7 ICS CODES

I heeded the ICS code 35.110 for the implementation of LAN in the system.

1.8 SUMMARY

1.8.1

The endeavor aimed to design and evaluate VLAN configuration using the Cisco Packet tracker which was completed in time and ensured to be working without any issues. It commenced with a deep dive into networking terms and their practical applications. Emphasis was placed on grasping the nuances of VLAN (Virtual Area Network) and its pivotal contributions to contemporary networks. After this research phase, optimal routers, switches, and laptops were selected, keeping in mind criteria such as bandwidth and efficiency. The components were systematically connected, with Router0 linked to Switch0 and subsequent devices arranged appropriately. Every laptop was set up with distinct IP and IPv6 configurations. The system was simulated in CPT and the efficiency of the transmission of data was seen as a result with very less delay time within the network. The final structure underwent analysis via the IOS command line interface, tracking data packets to confirm seamless communication and fortified security within the VLAN setup. With the attainment of accurate configuration, the objectives of the endeavor were achieved.

1.8.2

The venture helped me to know in detail about the Cisco Packet tracker and VLAN. I enhanced my ability to resolve the difficulties that could evolve in similar projects. I further learned to handle the team and avoid disputes. I honed my leadership skills as I led the team to a successful completion of the project