SAVEETHA SCHOOL OF ENGINEERING

CAPSTONE PROJECT

Design and Implementation of a Secure LAN and WAN Network Infrastructure in Packet Tracer

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COURSE CODE: CSA0747

COURSE NAME: Computer Network for IoT

INTRODUCTION:

The network infrastructure will consist of multiple Local Area Networks (LANs) and a Wide Area Network (WAN), providing the necessary backbone for communication between different network segments. LANs are typically deployed within small geographical areas, such as offices, schools, or buildings, and are responsible for connecting internal devices such as computers, printers, and servers. On the other hand, WANs interconnect multiple LANs across broader geographical distances, allowing communication between various branch offices, regional data centers, or even across countries.

In addition to building and configuring the network, security is a paramount concern. The project will incorporate robust security measures to protect the network from external threats and unauthorized access. These measures include the implementation of encryption protocols to secure data during transmission across the WAN, as well as firewall rules to control incoming and outgoing traffic. Firewalls will be configured to filter traffic based on source and destination IP addresses, protocols, and ports, ensuring only authorized devices and users can access sensitive network resources.

Objective:

- Design and Build LAN and WAN Networks
- Efficient IP Address Allocation and Subnetting
- Router Configuration
- Implement Network Security Measures
- Simulate and Validate Network Performance
- Enhance Network Scalability and Reliability

LITERATURE REVIEW

The design and security of network infrastructures, such as Local Area Networks (LANs) and Wide Area Networks (WANs), are essential for modern organizations. LANs connect devices within a small area like an office, while WANs link multiple LANs across larger distances, allowing communication between different locations (Tanenbaum & Wetherall, 2011). Efficient networking combines both LANs and WANs to support reliable communication across distributed systems (Stallings, 2020).

1. Subnetting and IP Address Management

Subnetting is the process of dividing an IP address range into smaller sub-networks to optimize IP usage and improve network performance. It reduces congestion and enhances security by segmenting traffic (Odom, 2020). Research shows that subnetting also helps manage IP addresses efficiently and isolate different parts of the network for better control (Ullah & Tahir, 2019).

2. Router Configuration and Routing Protocols

Routers play a crucial role in connecting LANs and WANs, using protocols to manage data flow. Static routing requires manual setup, while dynamic routing (e.g., RIP, OSPF) adapts automatically to changes in the network (Kurose & Ross, 2020). Dynamic routing is especially useful in large networks, allowing seamless data flow and easy scalability (Bhuyian et al., 2017).

3. Network Security: Encryption and Firewalls

Encryption ensures that data transmitted across the network, especially over WANs, is secure from unauthorized access (Pfleeger & Pfleeger, 2015). Firewalls, on the other hand, filter network traffic, allowing only authorized data to pass through. Effective firewall management is essential for protecting networks from potential threats (Cheswick, Bellovin, & Rubin,

METHODOLOGY

Software:

- Cisco Packet Tracer

Network Design:

Network consist of

- 1 Routers
- 2 Switches
- 2 PC
- 2 Laptops

Methodology:

The methodology for designing and implementing the network infrastructure in Cisco Packet Tracer consists of the following steps:

1. Network Topology Design:

- **Design the network with eight LANs and one WAN link.**
- **Each LAN will include switches, routers, and end devices (PCs), connected to a central WAN for communication across sites.**

2. Subnetting:

- **Calculate the required subnets by dividing the allocated IP address range.**
- **Assign appropriate subnets to each LAN and the WAN link based on the number of devices in each network.**

3. Router Configuration:

- **Configure each router to allow communication between subnets and across the WAN.**
- **Implement static or dynamic routing protocols (such as RIP or OSPF) depending on the network's requirements.**

4. Network Security:

- **Implement security measures, such as enabling encryption protocols (VPN) for WAN communication to protect data during transmission.**
- **Configure firewall rules on the routers to control and filter traffic, ensuring that only authorized access is allowed.**

5. Simulation and Testing:

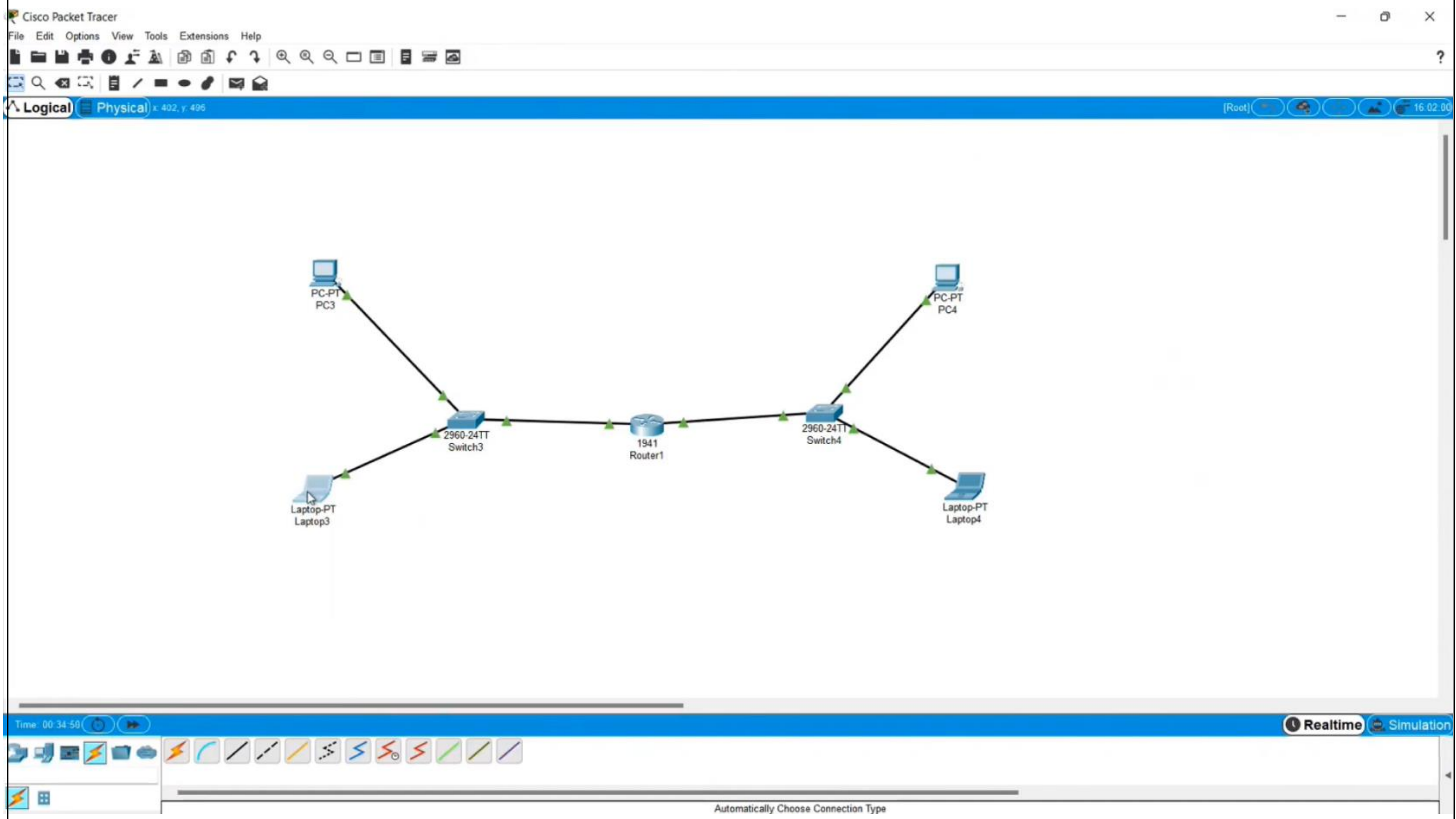
- **Use Packet Tracer’s simulation tools to test network connectivity, verifying that all LANs can communicate through the WAN.**
- **Validate that security measures, such as encryption and firewall rules, are working correctly by testing against potential security threats.**

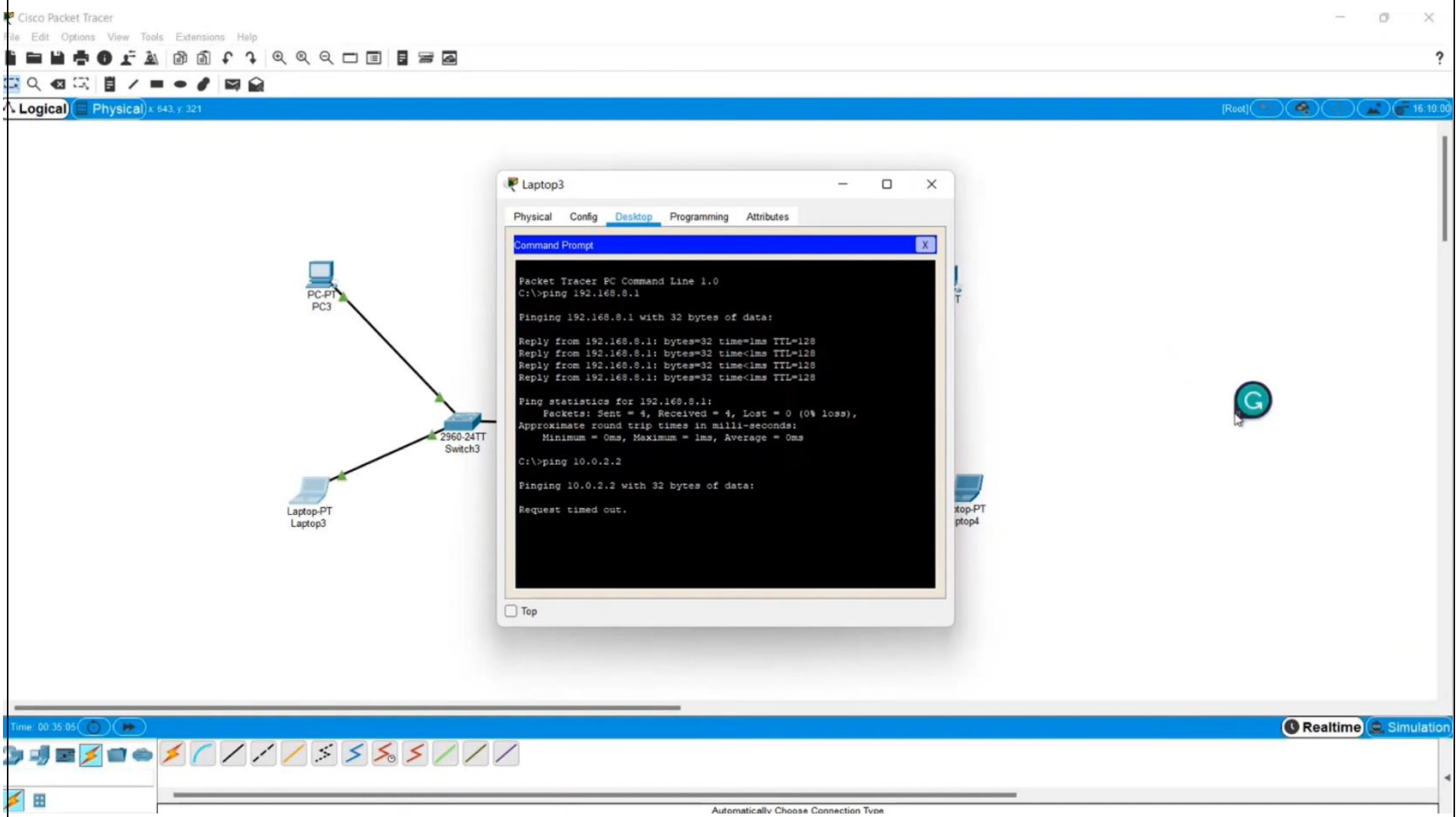
6. Documentation:

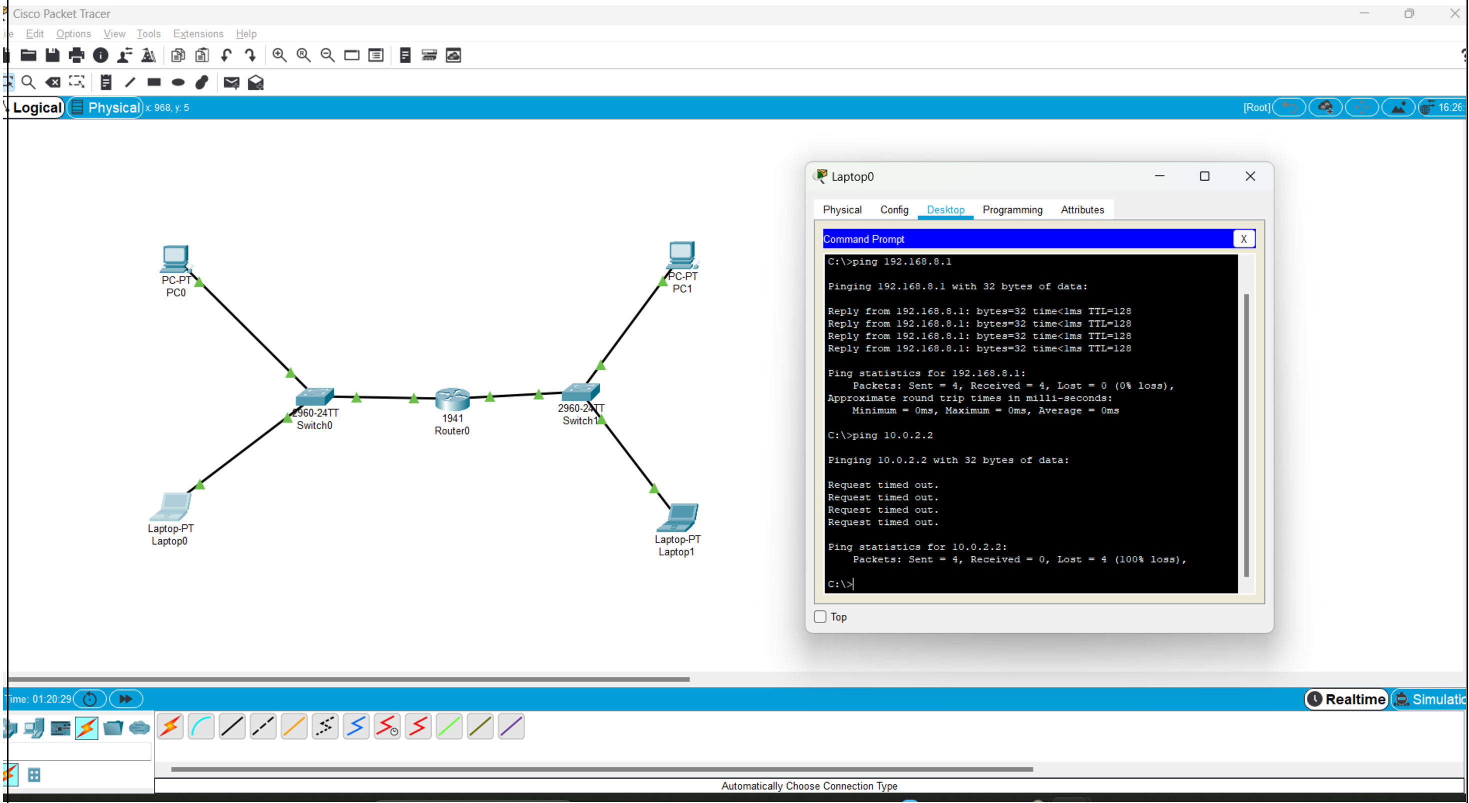
- **Document the IP addressing scheme, routing configurations, and security measures.**
- **Capture results from Packet Tracer simulations to confirm the functionality and security of the network.**

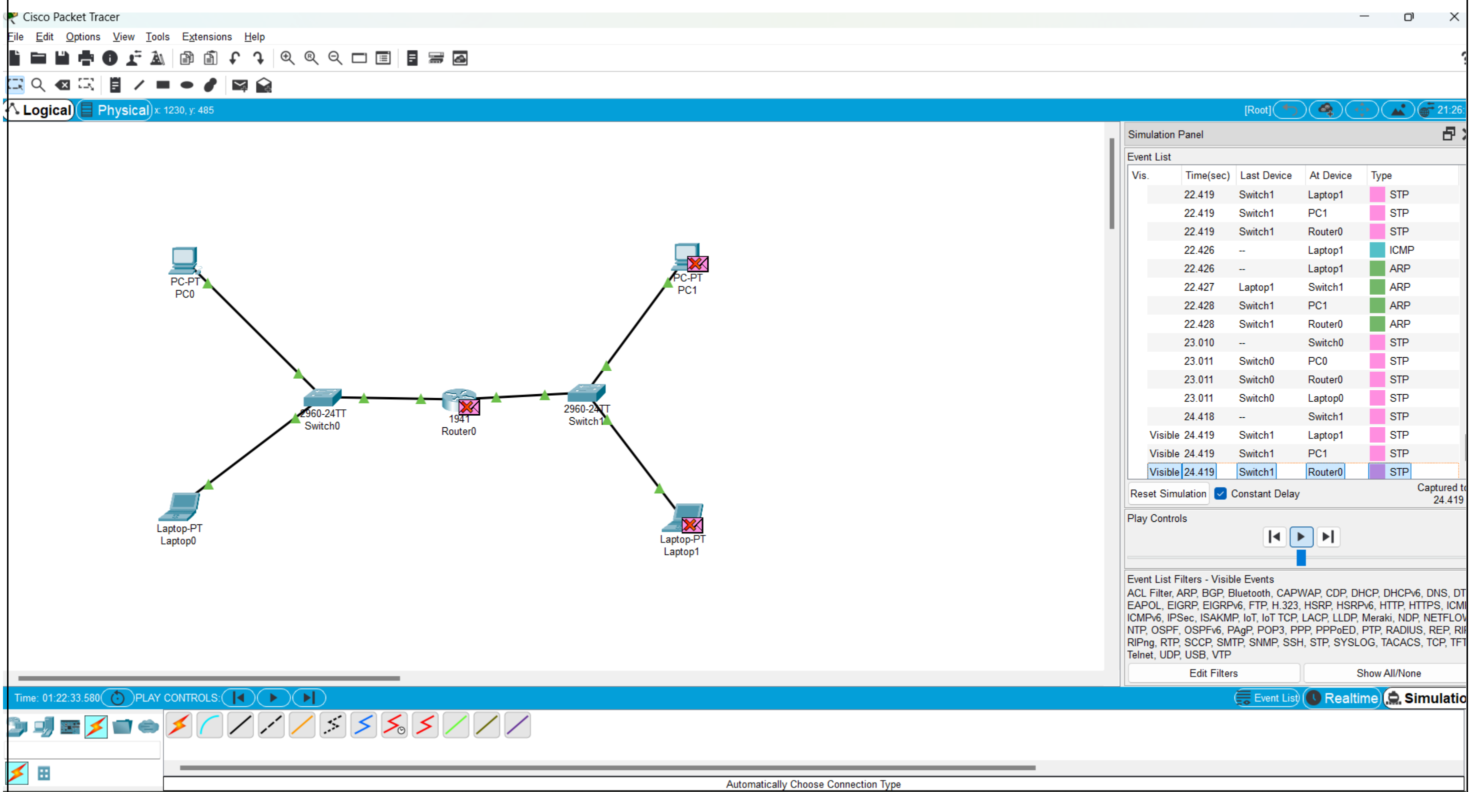
This step-by-step methodology ensures a well-structured and secure network design while enabling smooth communication between LANs via the WAN link.

RESULTS:
Network Design:






Cisco Packet Tracer
Laptop0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
C:\>ping 192.168.8.1
Pinging 192.168.8.1 with 32 bytes of data:
Reply from 192.168.8.1: bytes=32 time<1ms TTL=128
Reply from 192.168.8.1: bytes=32 time<1ms TTL=128
Reply from 192.168.8.1: bytes=32 time<1ms TTL=128
Reply from 192.168.8.1: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.8.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping 10.0.2.2
Pinging 10.0.2.2 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 10.0.2.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
Top
PC-PT
PC0
PC-PT
PC1
2960-24TT
Switch0
1941
Router0
2960-24TT
Switch1
Laptop-PT
Laptop0
Laptop-PT
Laptop1
Realtime
Automatically Choose Connection Type


Cisco Packet Tracer
Simulation Panel
Event List
PC-PT
PC0
PC-PT
PC1
2960-24TT
Switch0
1941
Router0
2960-24TT
Switch1
Laptop-PT
Laptop0
Laptop-PT
Laptop1
Reset Simulation
Constant Delay
Play Controls
Event List Filters - Visible Events
Edit Filters
Show All/None
Realtime
Automatically Choose Connection Type

CONCLUSION:

This project successfully demonstrates the design and implementation of a secure and efficient network infrastructure using Cisco Packet Tracer. By integrating eight Local Area Networks (LANs) with a Wide Area Network (WAN) and applying subnetting techniques, we effectively optimized IP address allocation and ensured seamless communication between network segments. The configuration of routers and routing protocols enabled smooth data flow across the network, while the implementation of security measures, such as encryption and firewall rules, safeguarded the network from potential threats.

The simulation and testing phase validated the network's functionality and security, highlighting its scalability, reliability, and robustness. This project provides a strong foundation for understanding real-world network design and management, emphasizing the importance of both connectivity and security in modern network infrastructures.