Project Report for Computer Networks

Networking in University

ABSTRACT

Computer networks play a pivotal role in the operations of a university, facilitating education, administration, communication, e-library access, and automation. An effective and efficient network infrastructure is essential to support the systematic and cost-effective transmission of information through messages, files, and resources. This project offers insights into key concepts like topology design, IP address configuration, and wireless network communication within different areas of a university.

The primary objective of this project is to design and simulate the topology of a university network using Cisco Packet Tracer. This network simulation will showcase the implementation of networking systems that enhance mobility and connectivity. The network design incorporates a range of devices, including:

1. Router (1941)
2. Switches (2960-24TT)
3. Email server
4. DNS server
5. WEB server (HTTP)
7. PCs
8. Laptops

Network Design Scope:

The university network includes the following key areas:

- Academic Buildings: AB1 and AB2 and AB3
- Dome Building and Library
- IT Consulting Area

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CHAPTER 1: INTRODUCTION

Motivation

In today's digital world, the significance of a well-designed network cannot be overstated. Educational institutions are at the forefront of digitalization, and to support this transition, a robust and adaptable network is essential. Wireless networking has emerged as a vital component of modern educational environments, offering ease of connection and the flexibility to access resources without the constraints of wired networks. Implementing a wireless network on campus simplifies device management, minimizes the clutter of cables, and enhances the ability to track connected devices.

As the use of laptops and mobile devices continues to grow among students and faculty, the need for wireless connectivity becomes increasingly important. This project focuses on establishing a wireless network that supports academic and administrative activities by enabling mobile, secure, and efficient access to digital resources.

Project Statement

This mini-project aims to simulate a university's campus network using wireless networking. The network is divided into two primary areas: the campus zone and the hostel zone. The project's core objective is to demonstrate the implementation of wireless technology to create a mobile and efficient network environment. Key functionalities include DNS, Email, and HTTP servers to support resource utilization for both staff and students. By integrating these services, the network ensures seamless internet access, data sharing, and interaction with web-based applications.

CHAPTER 2: LITERATURE REVIEW

Packet Tracer Overview [1]

Cisco Packet Tracer is a powerful simulation tool used for designing, configuring, and testing network topologies. It provides a virtual environment to simulate real-world network scenarios using a drag-and-drop interface. Packet Tracer is particularly valuable for educational purposes, allowing users to practice configuring routers, switches, and other network devices in a controlled setting.

Networking Devices and Components

1. Router: A router directs data packets based on IP addresses, functioning primarily as a network layer device. It connects different LANs and WANs, maintaining a dynamic routing table to make decisions on data packet routing.

2. Switch: A switch connects devices within a network by using MAC addresses to forward data packets at the data link layer. Some switches also offer layer-3 functionality, incorporating routing features to handle data more efficiently.

3. Servers: Servers provide resources and services to clients within the network. In this project, we employ DNS, Email, and Web servers to facilitate internet browsing, communication, and resource management.

4. Wireless Networks: These networks enable mobility for devices like laptops and smartphones, allowing users to access the network without physical cable connections. Wireless networks play a crucial role in supporting a flexible and dynamic learning environment.

5. Ethernet: Serving as the backbone of the network, Ethernet provides high-speed data transfer capabilities and is essential for connecting different network segments. Gigabit Ethernet and Fast Ethernet are employed for efficient data transmission.

6. Computing Devices: These include PCs, laptops, and smartphones that access the network for educational and administrative purposes.

Internet Protocol (IP)

IP addresses uniquely identify devices on a network, enabling communication and data exchange. The network design employs structured IP addressing to manage device communication and maintain network integrity.

SSH Protocol [3]

SSH (Secure Shell) provides secure remote access to network devices, encrypting data to prevent unauthorized access and eavesdropping. This protocol is essential for network administration and management.

CHAPTER 3: WORK DONE

Designing the Network Topology

The network was designed using Cisco Packet Tracer, focusing on efficient layout and connectivity. The topology included routers, switches, wireless access points, and various servers to create a robust and scalable network architecture.

Devices Used In The Network

Devices	Quantity
1) Router (2911)	3
2) Multilayer Switches (3560-24PS)	3
3) Switches	12
4) DNS server	1
5) WEB server (HTTP)	1
6) FTP server	1
7) EMAIL server	1
8) PCs	12
9) Printers	12

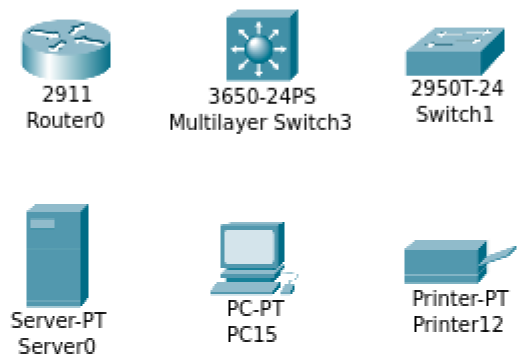

Fig1.1 Devices used in the network

Implementation of IP Addressing and Subnetting

To manage network traffic and ensure efficient communication, IP addressing schemes were developed. Subnetting was implemented to segment the network into manageable portions, enhancing security and reducing broadcast traffic.

IP Table Example for a College Network

Device	Interface	VLAN	IP Address	Subnet Mask	Default Gateway
Router	GigabitEthernet0/0.10	10	192.168.1.1	255.255.255.0	-
Router	GigabitEthernet0/0.20	20	192.168.2.1	255.255.255.0	-
Router	GigabitEthernet0/0.30	30	192.168.3.1	255.255.255.0	-
Router	GigabitEthernet0/0.40	40	192.168.4.1	255.255.255.0	-
Router	GigabitEthernet0/0.50	50	192.168.5.1	255.255.255.0	-
Router	GigabitEthernet0/0.60	60	192.168.6.1	255.255.255.0	-

Router	GigabitEthernet0/0.70	70	192.168.7.1	255.255.255.0	-
Router	GigabitEthernet0/0.80	80	192.168.8.1	255.255.255.0	-
Router	GigabitEthernet0/0.90	90	192.168.9.1	255.255.255.0	-
Router	Serial0/2/0	N/A	10.10.10.5	255.255.255.252	-
Router	Serial0/2/1	N/A	10.10.10.1	255.255.255.252	-
Switch (M-L)	VLAN 10	10	192.168.1.2	255.255.255.0	192.168.1.1
Switch (M-L)	VLAN 20	20	192.168.2.2	255.255.255.0	192.168.2.1
Switch (M-L)	VLAN 30	30	192.168.3.2	255.255.255.0	192.168.3.1
Switch (M-L)	VLAN 40	40	192.168.4.2	255.255.255.0	192.168.4.1
Switch (M-L)	VLAN 50	50	192.168.5.2	255.255.255.0	192.168.5.1
Switch (M-L)	VLAN 60	60	192.168.6.2	255.255.255.0	192.168.6.1
Switch (M-L)	VLAN 70	70	192.168.7.2	255.255.255.0	192.168.7.1
Switch (M-L)	VLAN 80	80	192.168.8.2	255.255.255.0	192.168.8.1
Switch (M-L)	VLAN 90	90	192.168.9.2	255.255.255.0	192.168.9.1

Admin Switch	FastEthernet0/1-24	10	DHCP (Client)	255.255.255.0	192.168.1.1
PC (Admin)	FastEthernet	10	DHCP (Client)	255.255.255.0	192.168.1.1
Server	GigabitEthernet0	N/A	20.0.0.1	255.255.255.0	20.0.0.254

Configuration of Network Devices

Network devices such as routers, switches, and access points were configured with appropriate settings to support seamless connectivity. Servers were set up to handle web, email, and DNS services, ensuring smooth operation and resource access across the network.

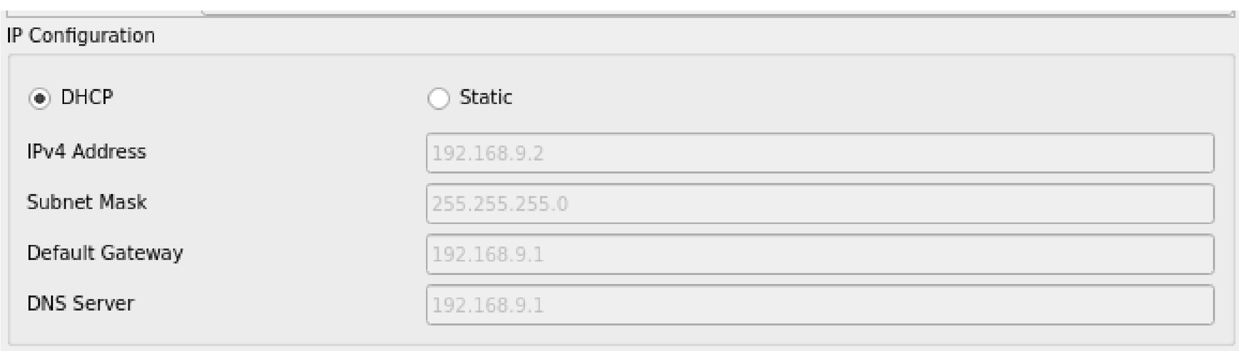

Fig1.2 Configuration PCs

```
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/0.10  192.168.1.1     YES manual up                    up
GigabitEthernet0/0.20  192.168.2.1     YES manual up                    up
GigabitEthernet0/0.30  192.168.3.1     YES manual up                    up
GigabitEthernet0/0.40  192.168.4.1     YES manual up                    up
GigabitEthernet0/0.50  192.168.5.1     YES manual up                    up
GigabitEthernet0/0.60  192.168.6.1     YES manual up                    up
GigabitEthernet0/0.70  192.168.7.1     YES manual up                    up
GigabitEthernet0/0.80  192.168.8.1     YES manual up                    up
GigabitEthernet0/0.90  192.168.9.1     YES manual up                    up
```

Fig1.3 Configuration Router

```
10   VLAN0010                         active    Gig1/0/2
20   VLAN0020                         active    Gig1/0/3
30   VLAN0030                         active    Gig1/0/4
40   VLAN0040                         active    Gig1/0/5
50   VLAN0050                         active    Gig1/0/6
60   VLAN0060                         active    Gig1/0/7
70   VLAN0070                         active    Gig1/0/8
80   VLAN0080                         active    Gig1/0/9
90   VLAN0090                         active    Gig1/0/10
```

Fig1.4 Configuration Multilayer switch

CHAPTER 4: RESULTS AND DISCUSSION

Performance Evaluation

The network was tested for performance metrics, including latency, packet loss, and throughput. The simulation demonstrated successful connectivity between different network segments, reliable access to servers, and efficient data transmission.

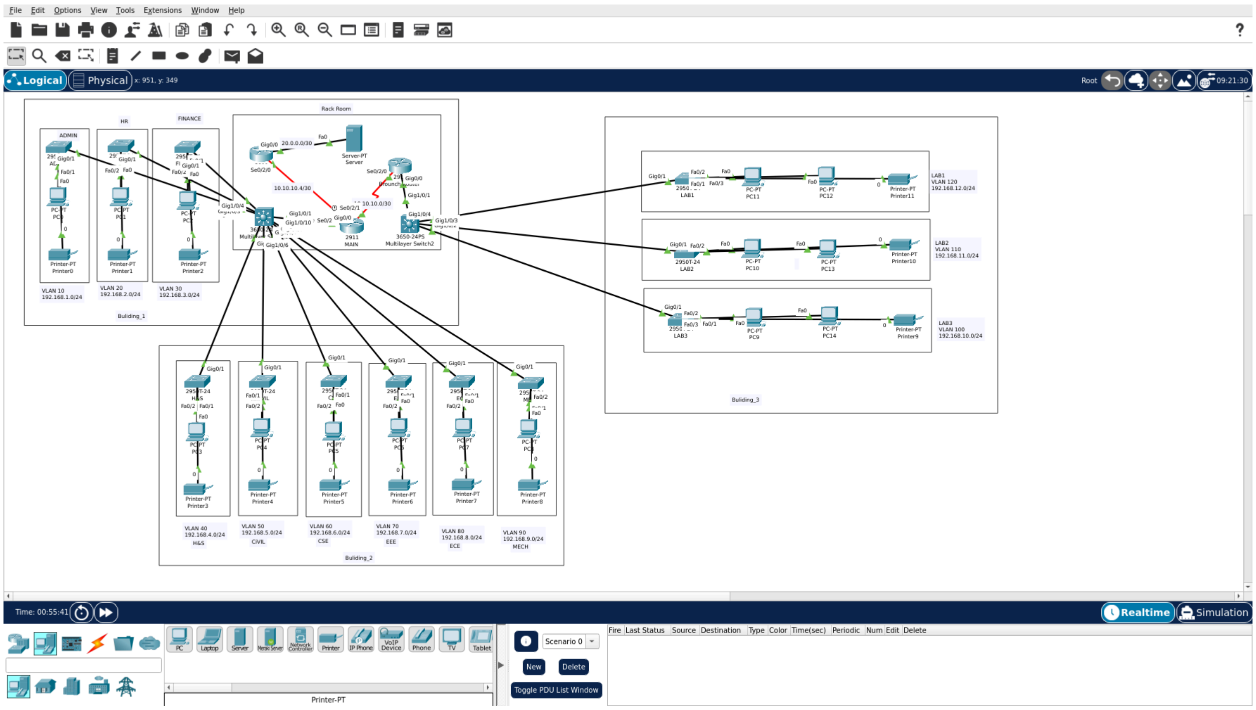

Fig1.5 Result

```
C:\>ping 192.168.12.1

Pinging 192.168.12.1 with 32 bytes of data:

Reply from 192.168.12.1: bytes=32 time=47ms TTL=255
Reply from 192.168.12.1: bytes=32 time<1ms TTL=255
Reply from 192.168.12.1: bytes=32 time<1ms TTL=255
Reply from 192.168.12.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.12.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 47ms, Average = 11ms
```

Fig1.6 PC to Switches ping

```
C:\>ping 10.10.10.1

Pinging 10.10.10.1 with 32 bytes of data:

Reply from 10.10.10.1: bytes=32 time=63ms TTL=254
Reply from 10.10.10.1: bytes=32 time=1ms TTL=254
Reply from 10.10.10.1: bytes=32 time=78ms TTL=254
Reply from 10.10.10.1: bytes=32 time=1ms TTL=254

Ping statistics for 10.10.10.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 78ms, Average = 35ms
```

Fig1.7 PC to Router Ping

Challenges and Solutions

Challenges encountered during the project included optimizing network security and managing bandwidth. Solutions were implemented to enhance security protocols and prioritize critical network traffic.

CHAPTER 5: CONCLUSIONS AND FUTURE WORK

Conclusions

The project successfully demonstrated the design and implementation of a wireless network within a university setting. The use of Cisco Packet Tracer allowed for detailed simulation and testing of network configurations, ensuring a robust and scalable design.

Future Work

Future enhancements may include expanding the network to incorporate advanced security features, implementing real-world deployment, and integrating additional services such as cloud-based applications and IoT devices.