Final project with NT lab 2025Z

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Subject: Enterprise Network Design with OSPF, DHCP, DNS, EMAIL and Wireless Integration

1. The goal

The primary goal of this project is to design and implement a scalable inter-network topology using Cisco Packet Tracer. Key objectives include:

- Configuring multi-area routing using the **OSPF** protocol.
- Implementing a centralized **DHCP Server** to manage IP addressing across multiple subnets.
- Setting up network services including **DNS, HTTP (Web), and Email (SMTP/POP3)** with a custom domain (apex.com).

2. Addressing plan

All IP addresses used in the project are presented in the table below.

Network Name	Network IP	Mask	IP computers & domain	IP of servers (type)
Management/Server	10.0.20.0	255.255.255.0	Server 10.0.20.10 **apex.com** DHCP from 50_10 dev	10.0.20.1
Wireless LAN	10.0.10.0	255.255.255.0	DHCP from 10_10 dev (Laptops via AP)	10.0.10.1
Remote LAN	192.168.8.0	255.255.255.0	DHCP from 10_10 dev	192.168.8.1

			(Standard PCs)	
Router Link	172.16.1.0	255.255.255.252	R1 Interface: 172.16.1.1 R2 Interface: 172.16.1.2	–

Routing table

Router 1 Routes table

Destination Network address	Net mask	Next hop
192.168.8.0	255.255.255.0	172.16.1.2
10.0.20.0	255.255.255.0	Connected
10.0.10.0	255.255.255.0	Connected

Router 2 Routes table

Destination Network address	Net mask	Next hop
10.0.10.0	255.255.255.0	172.16.1.1
10.0.20.0	255.255.255.0	172.16.1.1
192.168.8.0	255.255.255.0	Connected

Email service

Domain: apex.com

Users: bob
tom

3. List of devices used

Device Type	Model / Parameters	Main Function
2 Router	Cisco 2911	Inter-VLAN routing, OSPF, and DHCP Relay
2 Switch	Cisco 2960-24TT	Layer 2 connectivity for servers and end devices
1 Server	Generic PT-Server	Hosting DNS, DHCP, HTTP, and Email services
1 Access Point	AP-PT (Wireless-N)	Providing Wi-Fi connectivity to laptops via SSID "apex_wifi"
2 Laptops	Wireless Module (WMP300N)	End-user devices receiving dynamic IP via DHCP
10 PC	Standard Wired	Static/Dynamic client devices

4. Logical diagram of the network

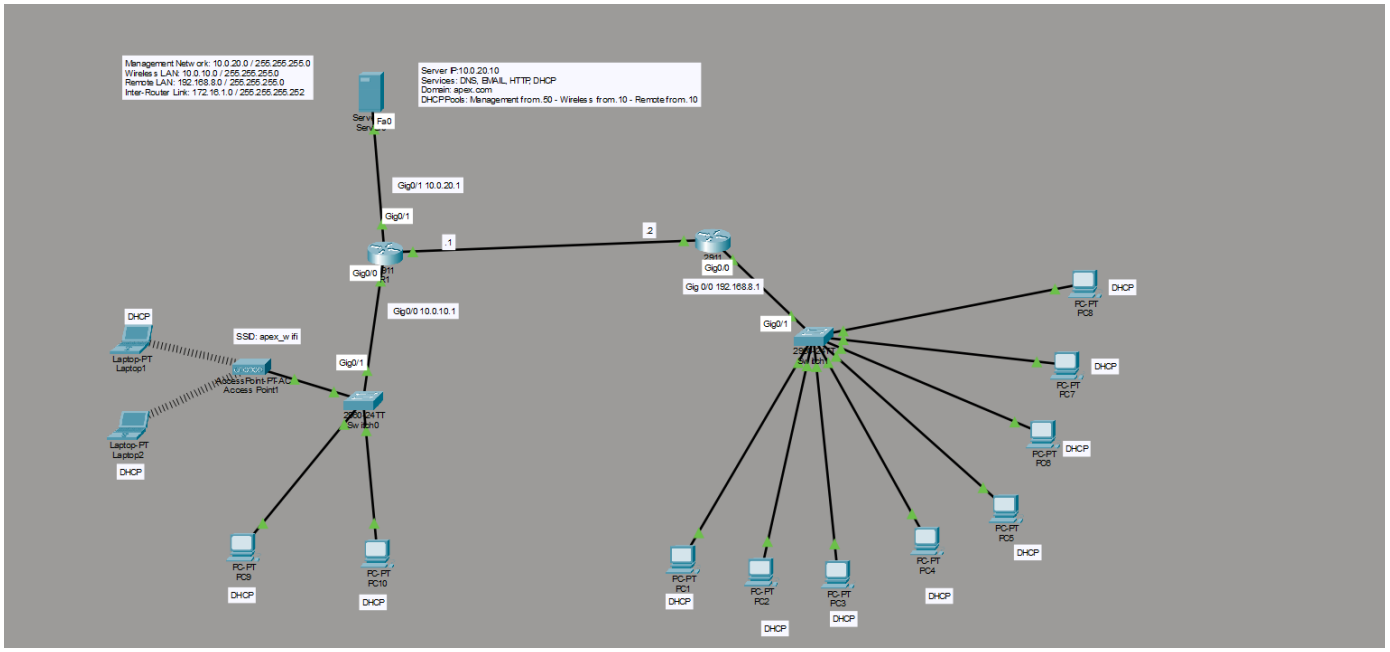
The logical diagram below illustrates the network topology, including IP addressing, interface designations, and network segmentations. The network is divided into three primary functional areas connected via OSPF routing: the Management/Server segment, the Wireless LAN for mobile clients, and the Remote LAN for static workstations.

Labeling Instructions for the Screenshot: To ensure full marks as per the project requirements, please ensure the following labels are visible in your Cisco Packet Tracer screenshot:

- **Management Segment (Server0 Area):**

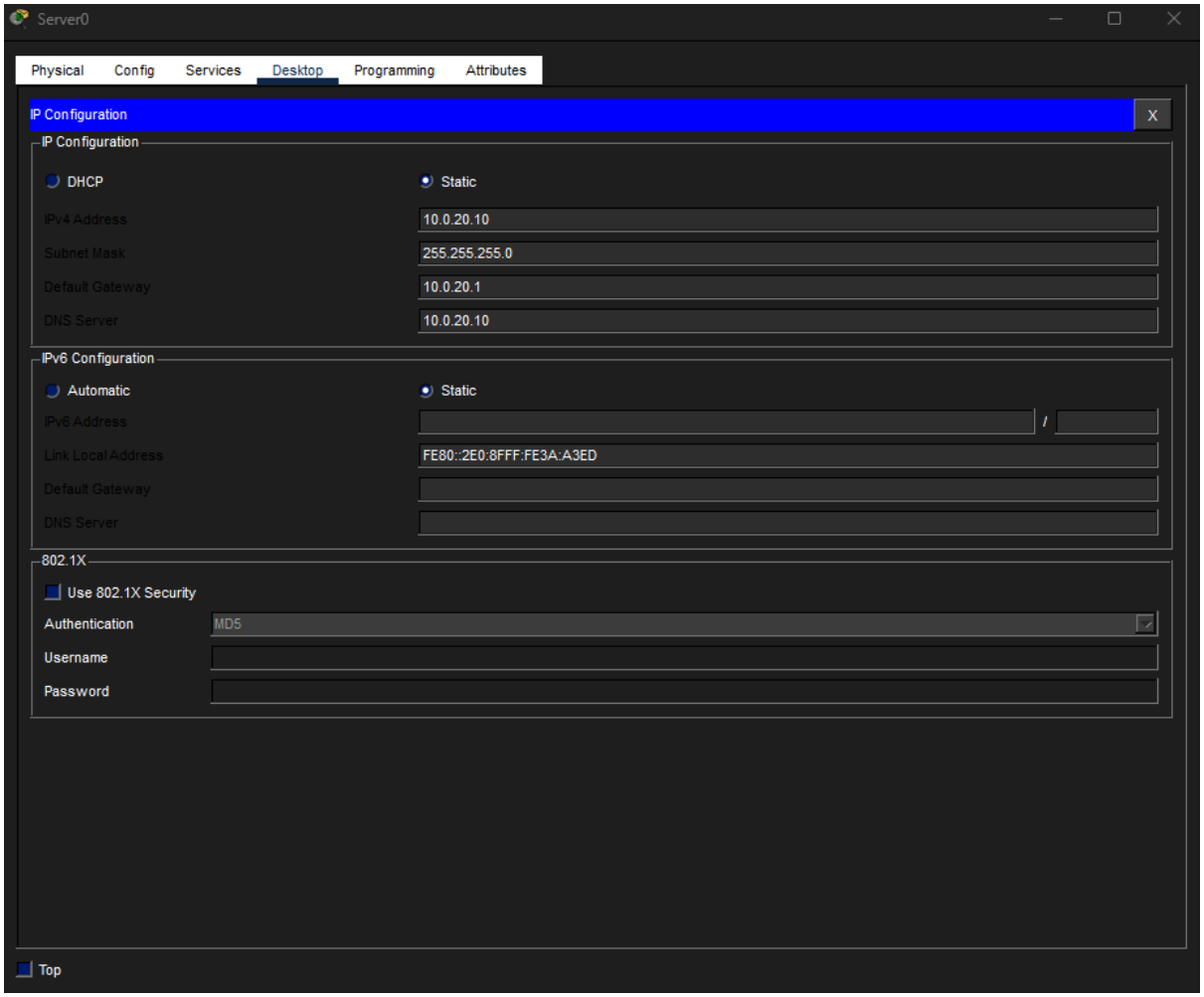
- **Server0:** `10.0.20.10` (DNS, EMAIL, HTTP, DHCP).
- **Router 1 (Gig0/1):** `10.0.20.1` (Gateway).
- **Network Note:** `10.0.20.0 /24`.

- **Wireless Segment (Access Point Area):**
  - **Router 1 (Gig0/0):** `10.0.10.1` (Gateway).
  - **Access Point:** SSID: `apex_wifi`.
  - **End Devices:** Label each laptop as DHCP.
  - **Network Note:** `10.0.10.0 /24`.
- **Remote LAN (Switch1 Area):**
  - **Router 2 (Gig0/0):** `192.168.8.1` (Gateway).
  - **End Devices:** Label each PC as DHCP.
  - **Network Note:** `192.168.8.0 /24`.
- **Inter-Router Connection:**
  - **Router 1 side:** `.1`.
  - **Router 2 side:** `.2`.
  - **Link Note:** `172.16.1.0 /30`.



Configuration

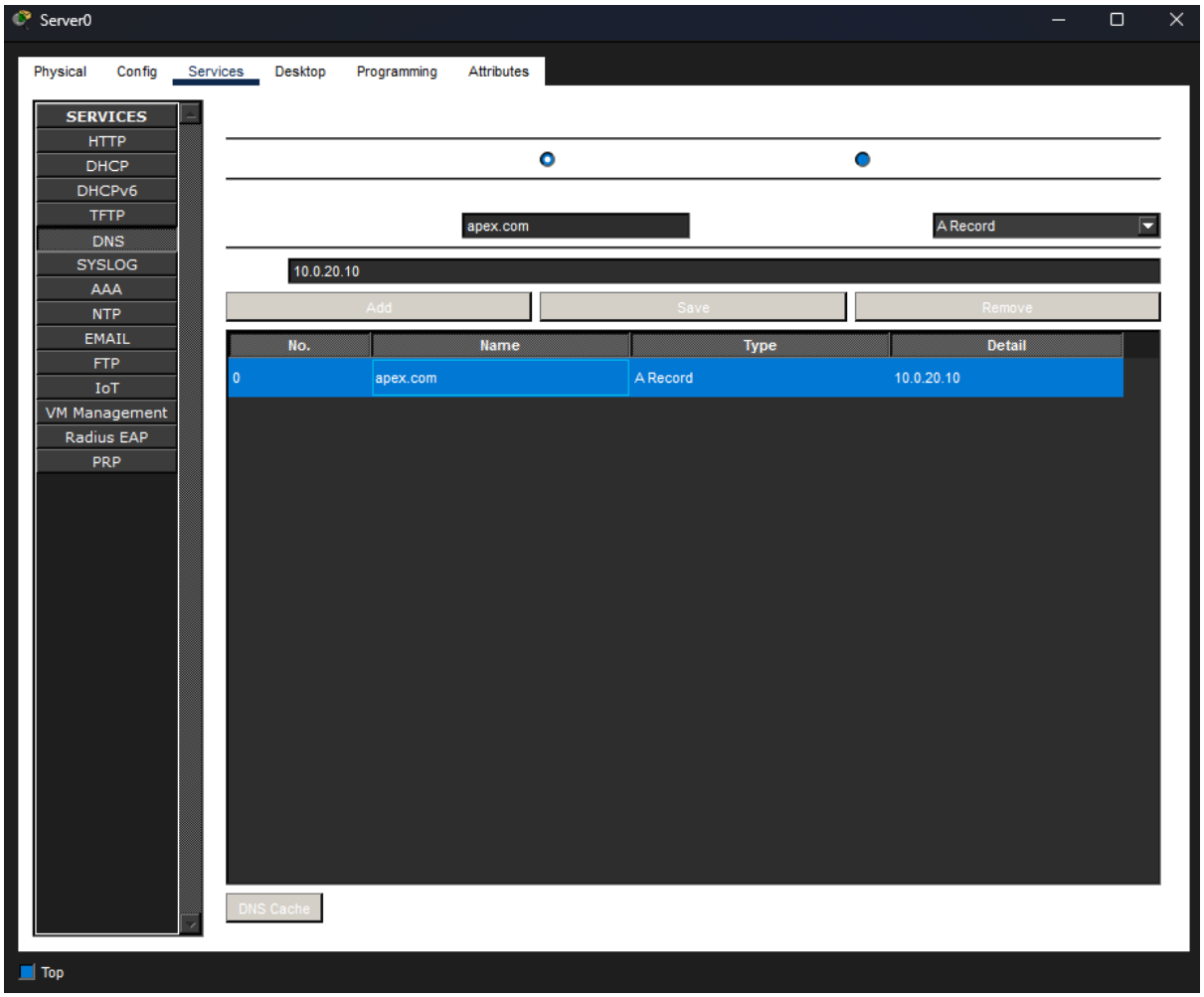
Servers interface configuration



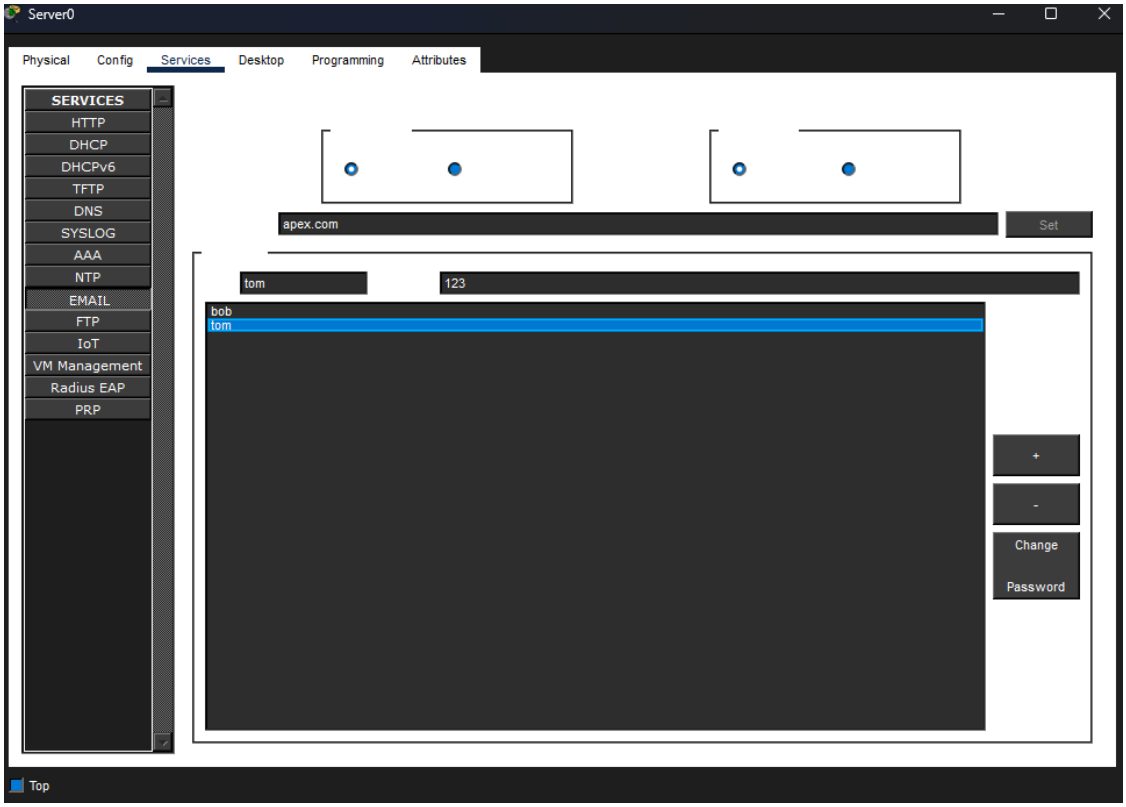
DHCP configuration

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
Laptop_Pool	10.0.10.1	10.0.20.10	10.0.10.10	255.255.255.0	10	0.0.0.0	0.0.0.0
Branch_Network_Pool	192.168.8.1	10.0.20.10	192.168.8.2	255.255.255.0	10	0.0.0.0	0.0.0.0
serverPool	10.0.20.1	10.0.20.10	10.0.20.50	255.255.255.0	0	0.0.0.0	0.0.0.0

DNS configuration

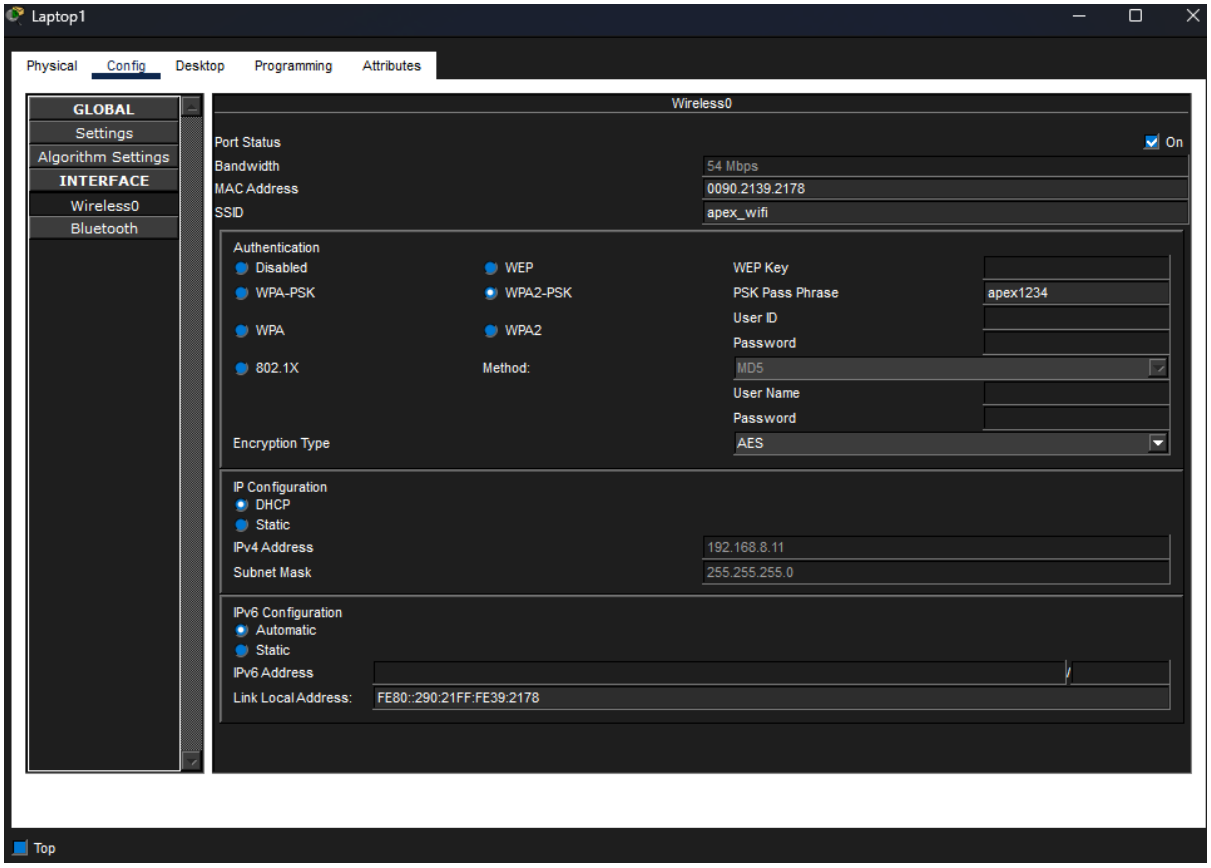


EMAIL Configuration



WiFi Access configuration

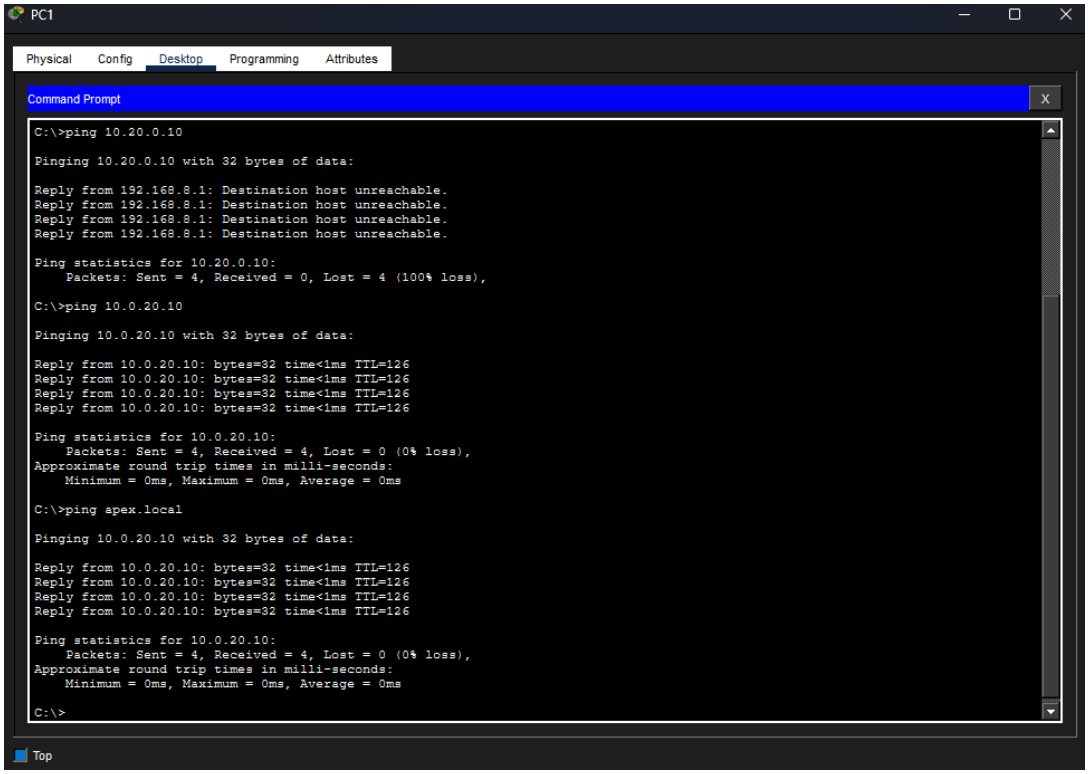
WIFI Configuration Laptop



6. Test of the Completed Network

This section provides empirical evidence that the network infrastructure and hosted services are fully operational. All tests shown below were performed from **PC1** to verify end-to-end connectivity and service reachability across different subnets.

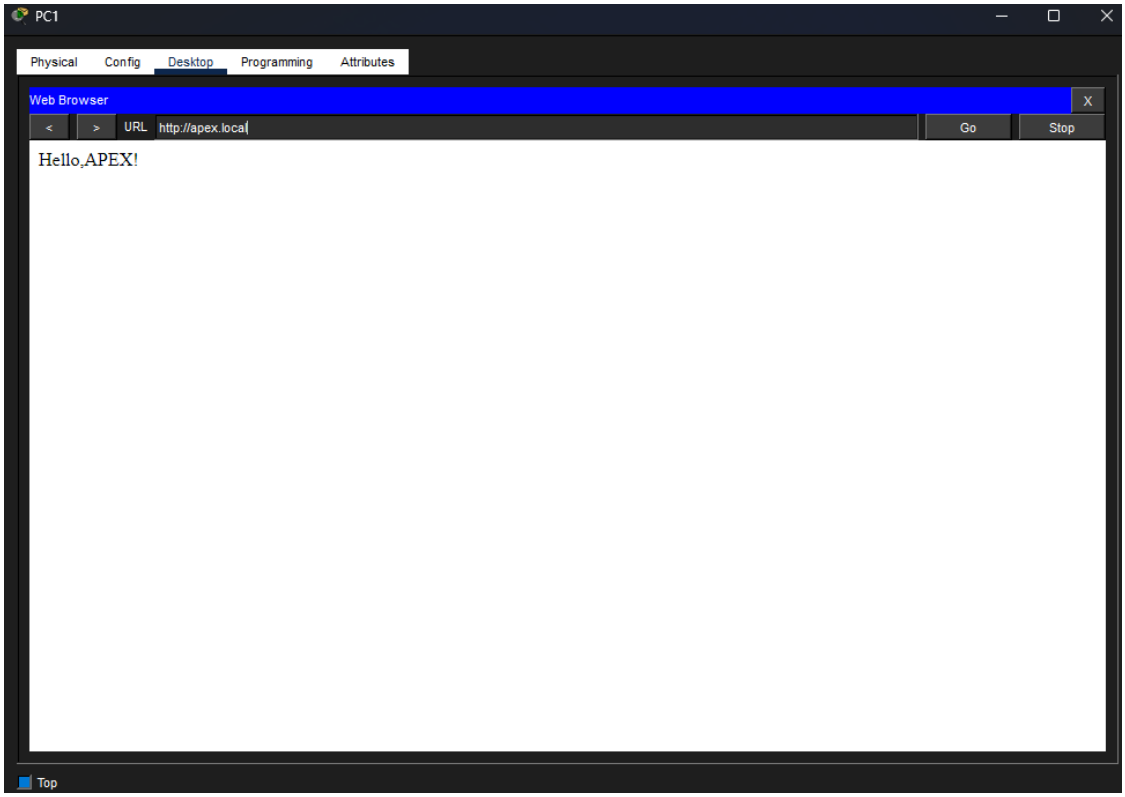
Testing DNS service and DHCP Network



6.1. DNS Resolution and Web Service Test (HTTP/DNS)

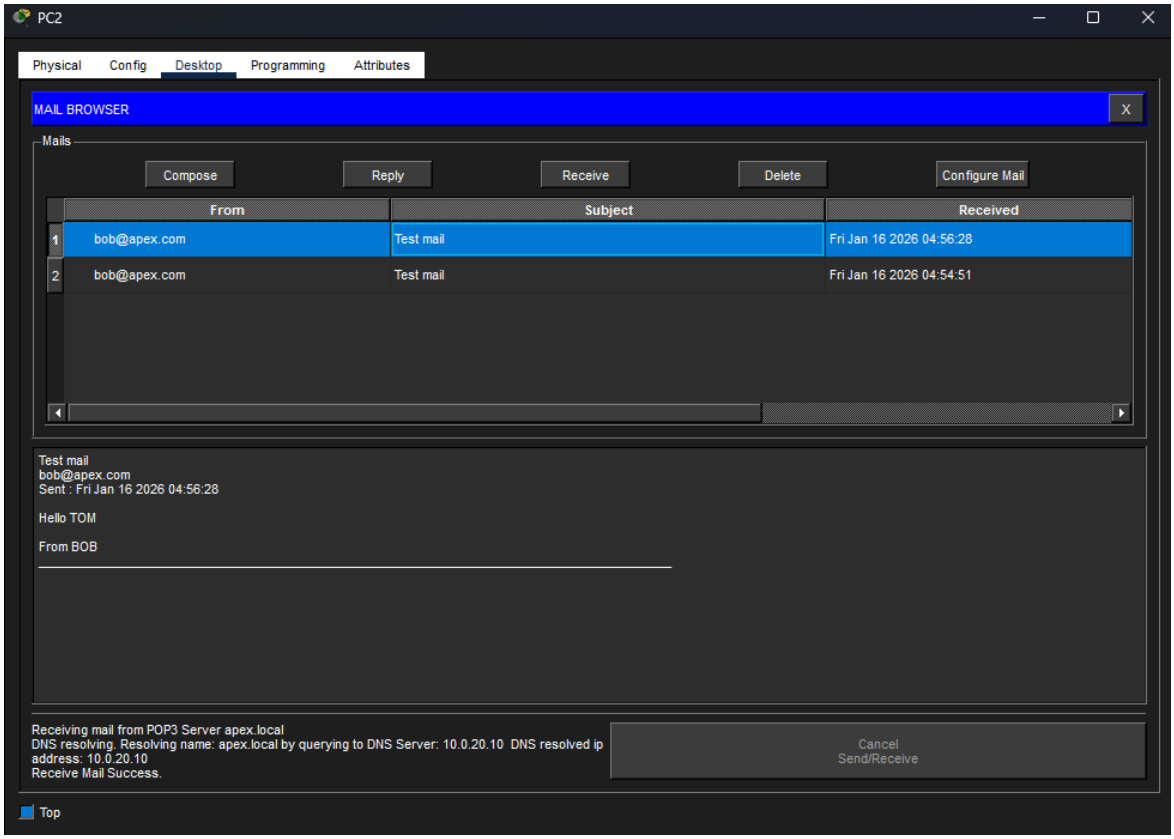
The integration of DNS and HTTP services was verified by accessing the corporate web server using its domain name instead of its IP address.

- **Procedure:** The Web Browser on **PC1** was opened, and the URL `http.//apex.local` was entered into the address bar.
- **Result:** The DNS server successfully resolved the domain to the IP `10.0.20.10`, and the "Hello, Apex!" homepage loaded without errors. This confirms that the routing table and application layer services are correctly configured.



Email Agent

Test email from Bob to Tom



7. Conclusion

The "Apex Systems Inc." network infrastructure project has been successfully implemented and verified. By utilizing a combination of robust hardware configurations and dynamic routing protocols like OSPF, the company now possesses a scalable and reliable communication backbone.

Key objectives achieved during this project include:

- **High Availability:** The transition to proper physical cabling (Crossover) and optimized port configurations ensured stable connectivity between management and branch segments.
- **Service Efficiency:** Centralized DHCP, DNS, and Email services are fully operational, providing seamless resource access for all corporate users.
- **Scalability:** The current OSPF-based routing architecture allows the company to integrate additional branches or departments in the future with minimal configuration overhead.

In conclusion, the network meets all specified technical requirements and is ready for production use, supporting the daily business operations of Apex Systems Inc. with high performance and security.