Network Fundamentals Lab: Designing and Configuring a Simple Network with Packet Tracer

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Abstract

This lab report documents the design, implementation, and verification of a simple network topology using Cisco Packet Tracer. The project demonstrates fundamental networking concepts including device connectivity, IP addressing, wireless configuration, and network troubleshooting. The lab successfully established connectivity between end devices (PC and laptop) through a wireless router and cable modem, with verification of internet access to a test server (`cisco.srv`).

1 Introduction

Network fundamentals form the backbone of modern IT infrastructure. This lab exercise provides hands-on experience with:

- Network device deployment and connection.
- IP address assignment via DHCP.
- Wireless network configuration
- Basic network troubleshooting using command-line tools.
- Understanding network topologies and device roles.

The lab was completed using **Cisco Packet Tracer**, a network simulation tool that allows for practical experimentation without physical hardware.

2 Lab Objectives

Learning Objectives

1. Deploy network devices (PC, Laptop, Wireless Router, Cable Modem) in a logical workspace.
2. Configure appropriate physical connections between devices.
3. Implement IP addressing using DHCP.
4. Configure wireless connectivity for mobile devices.
5. Verify end-to-end network connectivity.
6. Document network configurations and test results.

3 Network Topology Design

3.1 Initial Network Design

Figure 1 shows the initial conceptual design of the network:

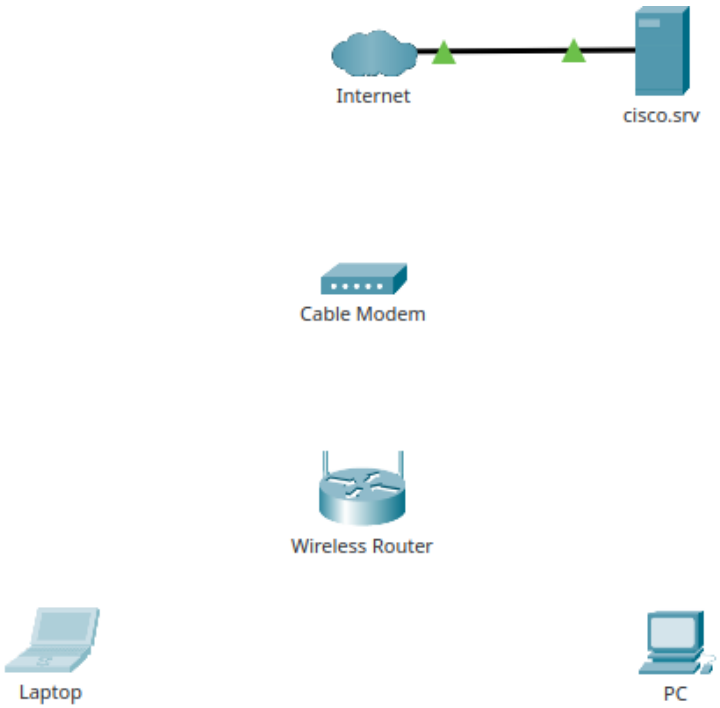

Figure 1: Initial network topology design showing the hierarchy of connections from end devices to the internet.

3.2 Final Network Implementation

The implemented network topology (Figure 2) includes specific device models and interface connections:

4 Implementation Methodology

4.1 Device Deployment and Configuration

The network was built following a structured approach:

4.2 Physical Layer Configuration

Physical Connection Details

Cable Types Used:

- **Copper Straight-Through:** PC → Router (FastEthernet0 → Ethernet1)
- **Copper Straight-Through:** Router → Cable Modem (Internet → Port 1)
- **Coaxial Cable:** Cable Modem → Internet Cloud (Port 0 → Coaxial 7)

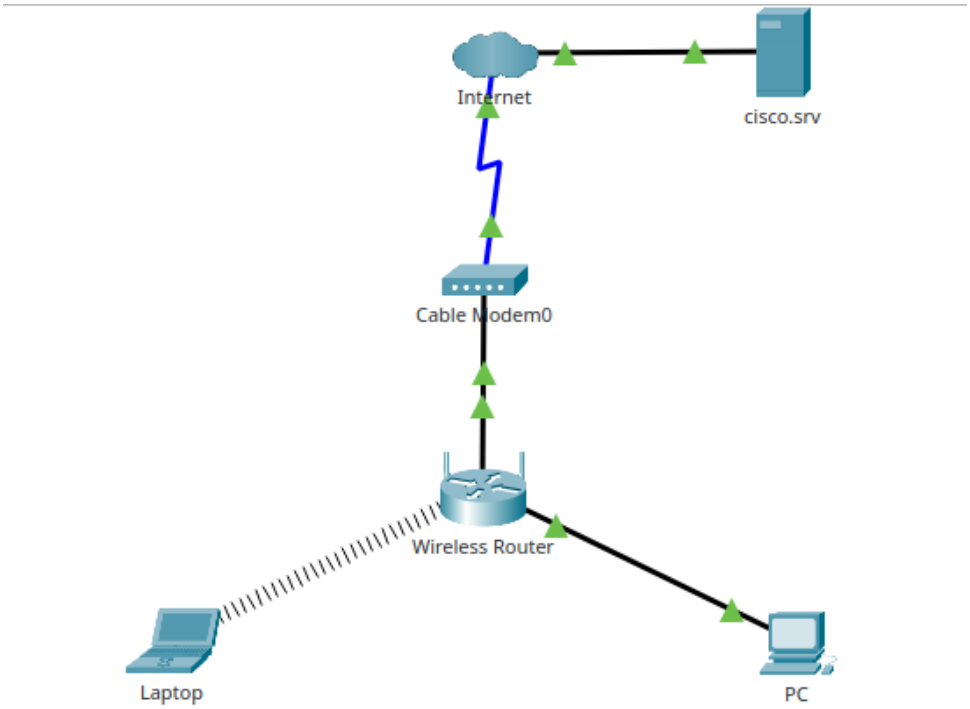

Figure 2: Final implemented network topology with device models and connection interfaces.

Table 1: Network Device Configuration Summary

Device	**Role**	**Configuration**
PC	Wired End Device	FastEthernet0 → Router Ethernet1
Laptop	Wireless End Device	WPC300N Wireless Module → HomeNetwork
Wireless Router	Network Hub	DHCP Server, Wireless AP, Default Gateway
Cable Modem	ISP Interface	Ethernet → Coaxial conversion

4.3 Wireless Network Card Replacement

The laptop required physical hardware modification to enable wireless connectivity:

4.4 Wireless Network Connection

Figure 5 shows the wireless network connection interface:

5 Configuration and Verification

5.1 PC Configuration and Testing

The PC was configured to obtain IP address automatically via DHCP. Connectivity was verified using command-line tools:

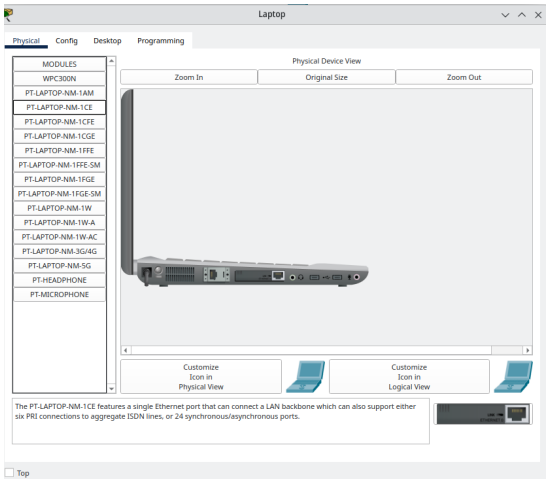

Figure 3: Laptop with original Ethernet module.

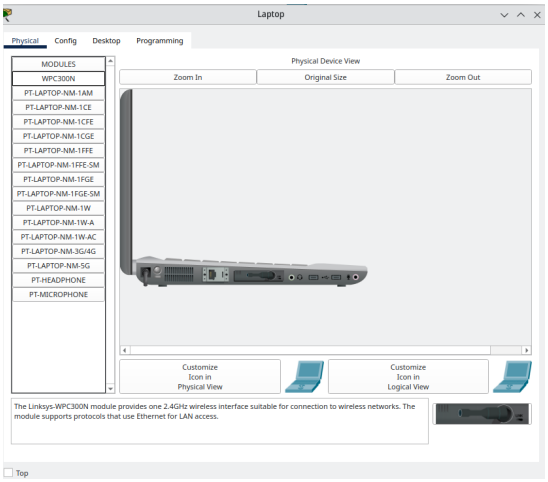

Figure 4: Laptop with WPC300N wireless module.

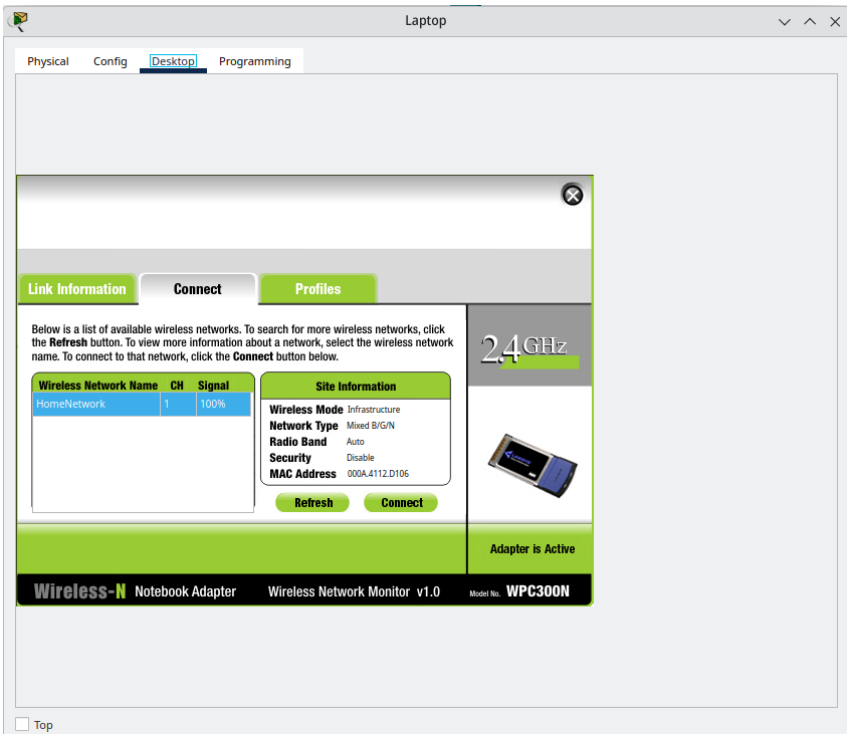

Figure 5: Wireless network connection interface showing available networks.

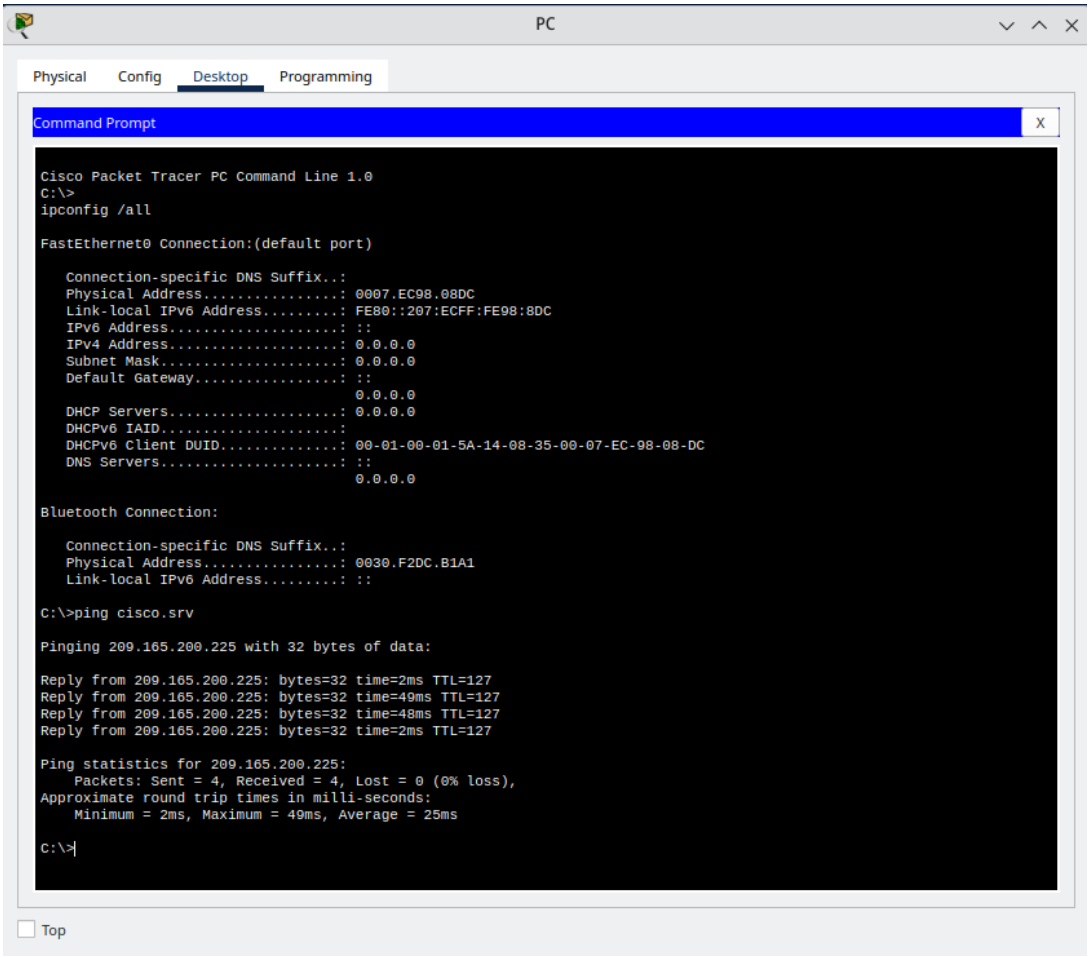

Figure 6: PC command prompt showing ipconfig results and successful ping to cisco.srv.

5.2 Key Test Results

Connectivity Verification

Successful Tests:

- DHCP address assignment: `192.168.0.x` range.
- Ping to `cisco.srv`: 4/4 packets received.
- Web access from laptop browser.
- Wireless association and authentication.

5.3 IP Addressing Analysis

Table 2: IP Address Assignment Results.

Device	IPv4 Address	Subnet Mask	Default Gateway
PC	192.168.0.2	255.255.255.0	192.168.0.1
Laptop	192.168.3	255.255.255.0	192.168.0.1
Wireless Router LAN	192.168.0.1	255.255.255.0	N/A

6 Technical Insights

6.1 DHCP Process Observation

The Dynamic Host Configuration Protocol (DHCP) process was observed in real-time:

- DHCP DISCOVER broadcast from client.
- DHCP OFFER from router (DHCP server).
- DHCP REQUEST from client.
- DHCP ACK from server.
- Automatic assignment of IP, subnet mask, default gateway, DNS.

7 Conclusion

Table 3: Technical skills validated.

Skill Category	**Specific Competencies**
Network Design	Topology planning, device selection, interface mapping
Physical Layer	Cable type selection, interface configuration, module replacement
IP Networking	DHCP understanding, subnetting, default gateway configuration
Wireless Technology	WLAN configuration, security modes, signal strength analysis
Troubleshooting	Ping testing, ipconfig analysis, connectivity verification
Network Simulation	Packet Tracer proficiency, virtual lab environment navigation

This lab successfully demonstrated the complete lifecycle of a simple network deployment:

1. **Design Phase:** Planned network topology with appropriate devices.
2. **Implementation Phase:** Deployed and connected physical devices.
3. **Configuration Phase:** Set up IP addressing and wireless connectivity.
4. **Verification Phase:** Tested end-to-end connectivity and validated. configurations