Project Title: Home Network Design and Performance Evaluation

Grade Level: 10th Grade

Group Size: Maximum of 4 Students

Rana Alsharidi 44410337 – Areej Al-sifsafi 444010192 – Majd Alharbi 444010478

Mayar Noli 444005019 – Ghaidaa alshaikhi 44410080

Project Overview:

This project aims to design a local home network using both wired and wireless connections for six devices, evaluate the network's performance, and assess its security. Each student will have specific responsibilities, allowing for collaborative learning and individual accountability.

Part 1: Designing a Local Network

- **Objective**: Create two local network at home with a mix of wired and wireless connections.

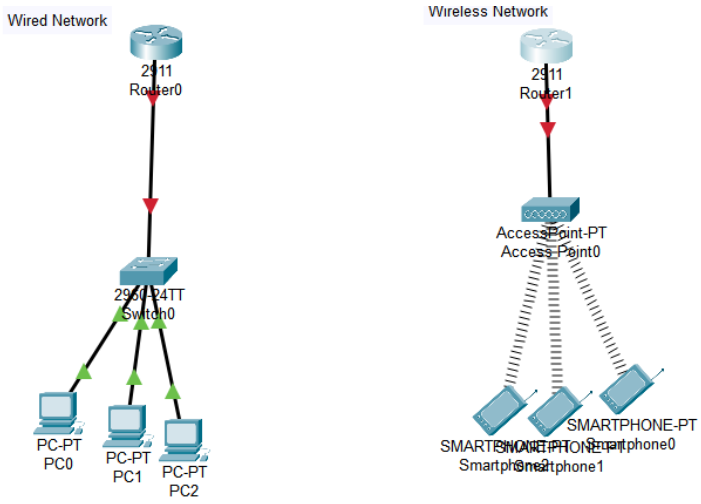
First Network:

- Three devices are connected using wired connections.
- These devices are then connected to a switch, which in turn connects to a router.
- The router provides internet connectivity to the network.

Second Network:

- Three devices are connected using wireless connections.
- These devices connect directly to an access point, which is then connected to a router.
- The router provides internet connectivity to the network.

1. **Select Networking Equipment**: write the type of each device ▪ Research and list the required networking equipment:
    - Router
    - Ethernet cables (for wired connections)
    - Wi-Fi extender (if needed)
2. **Network Layout**:
    - Create a visual diagram showing how devices will connect to the router. Using Packet tracing



Each student can contribute by describing and explaining the role of specific equipment in the network:

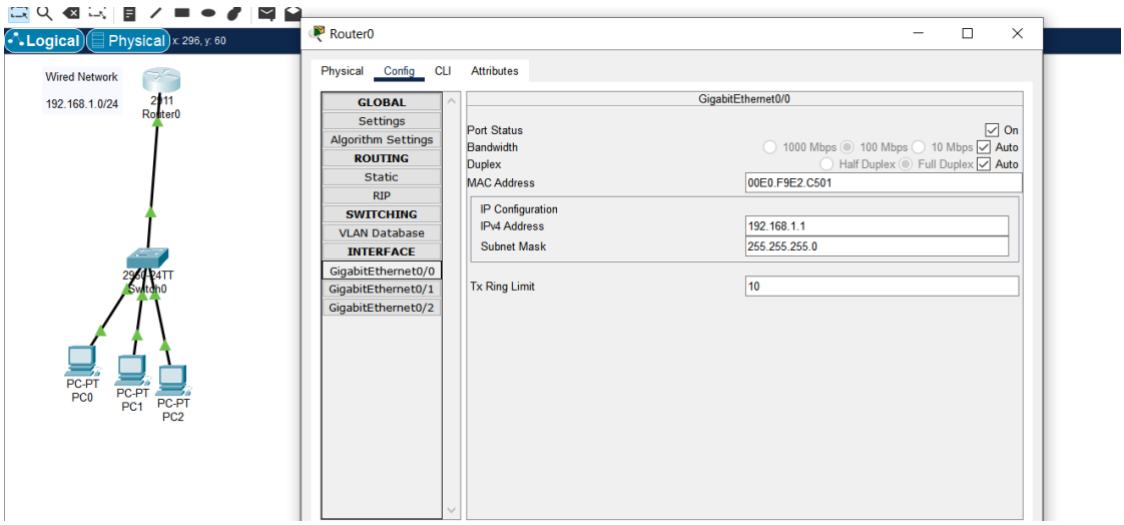
1. Switch (First Network):
    - Connects multiple wired devices together on the same local area network (LAN).
    - It allows communication between devices and forwards data packets to their correct destination.
2. Access Point (Second Network):
    - Acts as a bridge between wireless devices and the wired network.
    - It converts wireless signals from devices into wired signals that the router can understand.
3. Router (Both Networks):
    - Manages the flow of data between devices and external networks (e.g., the internet).
    - It assigns IP addresses and directs traffic to ensure devices can communicate both internally and with the internet.
4. Ethernet Cables (First Network):
    - Provide a stable and fast connection for wired devices to communicate with each other and the router.
    - More secure and reliable than wireless connections.

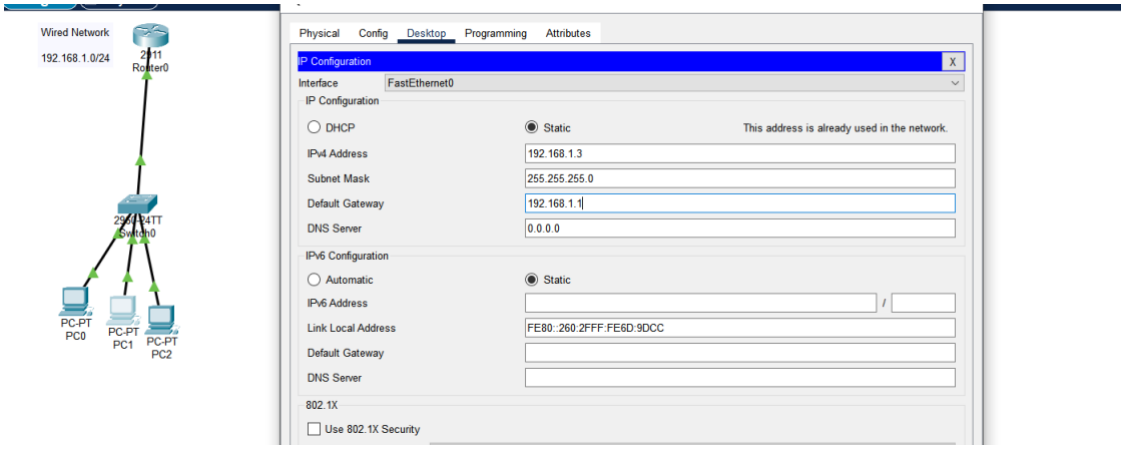
5. Wi-Fi Extender (Optional for Second Network):

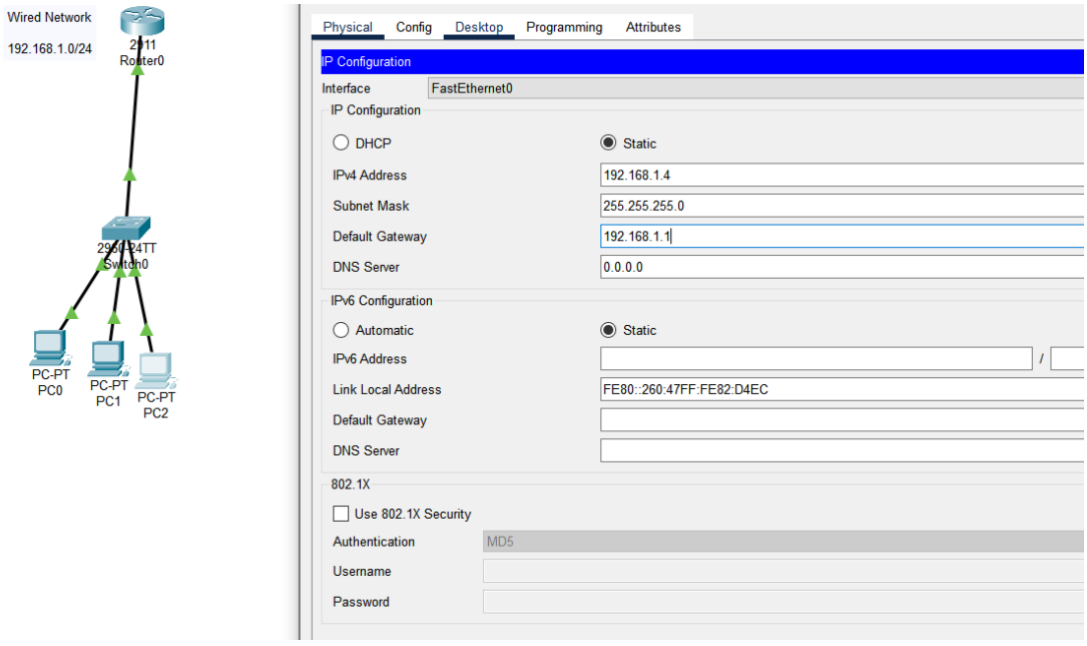
    - Expands the coverage of the wireless network to reach devices that may be too far from the access point or router.

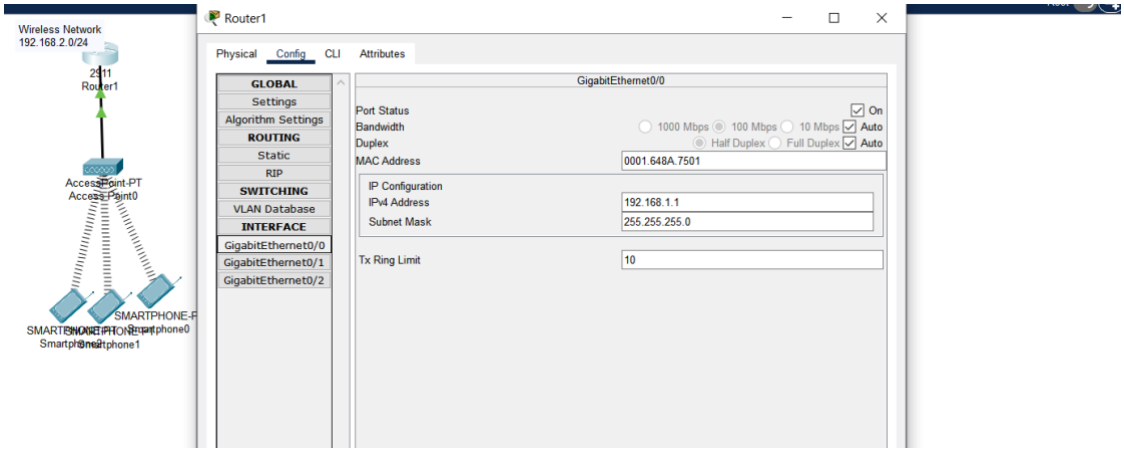
IP Addressing:

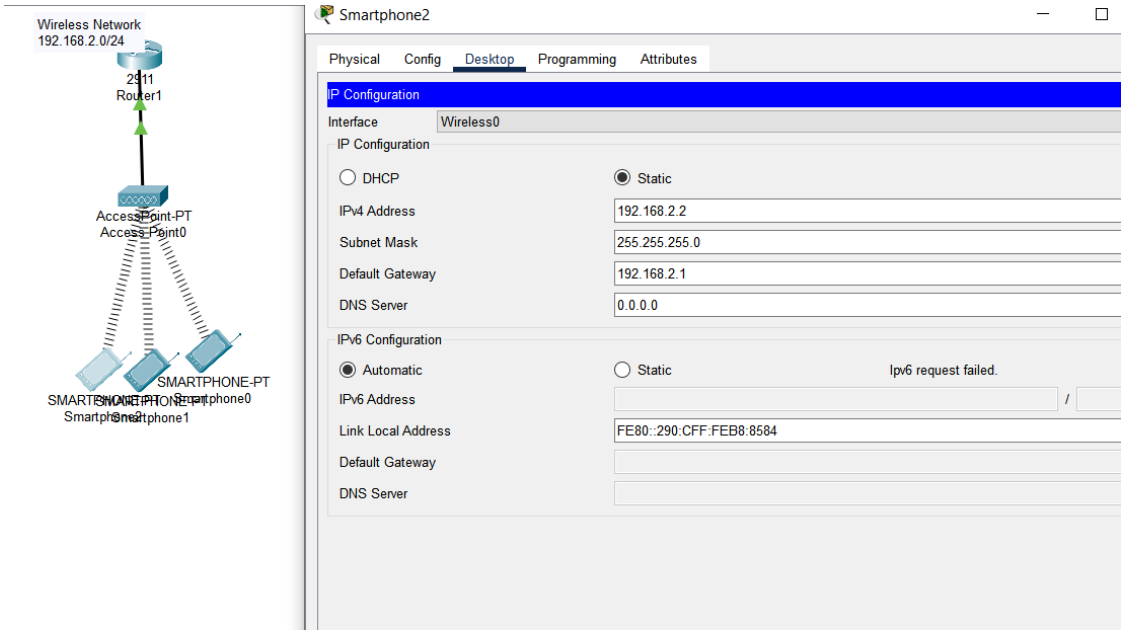
- Assign different subnets to the wired and wireless networks. For example, use 192.168.1.0/24 for the wired network and 192.168.2.0/24 for the wireless network.
- Set up DHCP on the router if needed, or manually assign IP addresses.

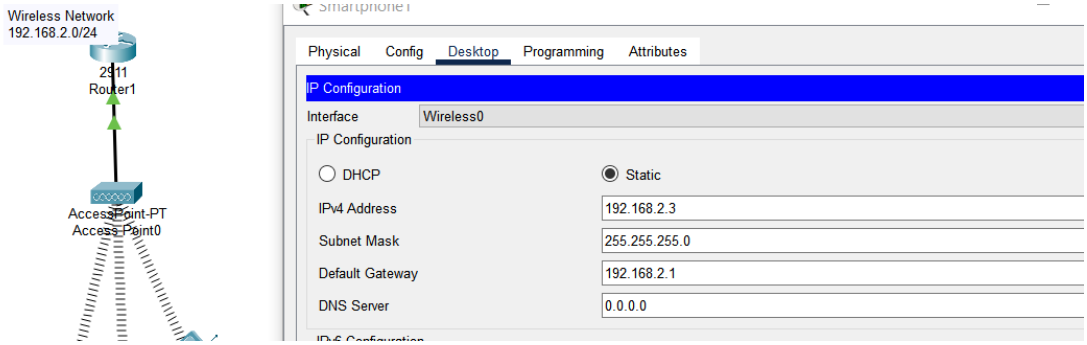


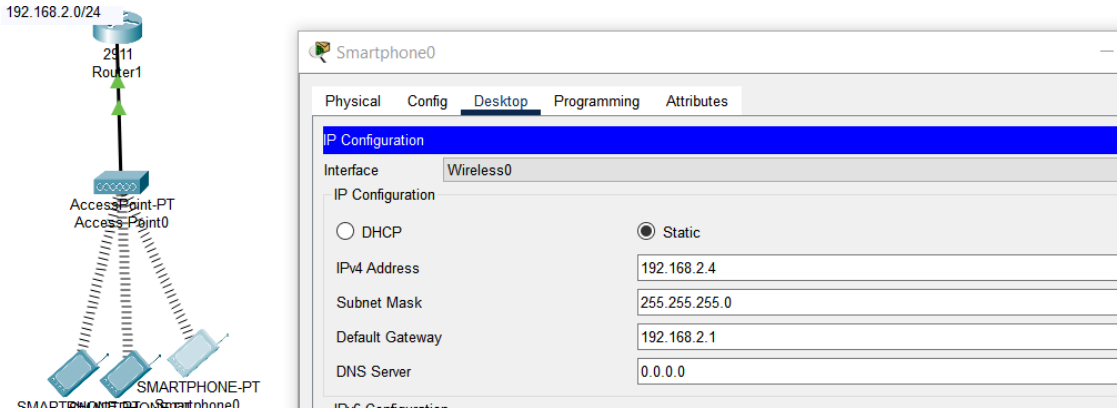

Wired Network
192.168.1.0/24
2811
Router0
2950-24TT
Switch0
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
This address is already used in the network.
IPv4 Address
192.168.1.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.1.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::260:2FFF:FE6D:9DCC
Default Gateway
DNS Server
802.1X
Use 802.1X Security


Wired Network
192.168.1.0/24
2811
Router0
2950-24TT
Switch0
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.4
Subnet Mask
255.255.255.0
Default Gateway
192.168.1.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::260:47FF:FE82:D4EC
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password


Wireless Network
192.168.2.0/24
2911
Router1
Access Point-PT
Access Point0
SMARTPHONE-PT
Smartphone0
Smartphone1
Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/2
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.648A.7501
IP Configuration
IPv4 Address
192.168.1.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10

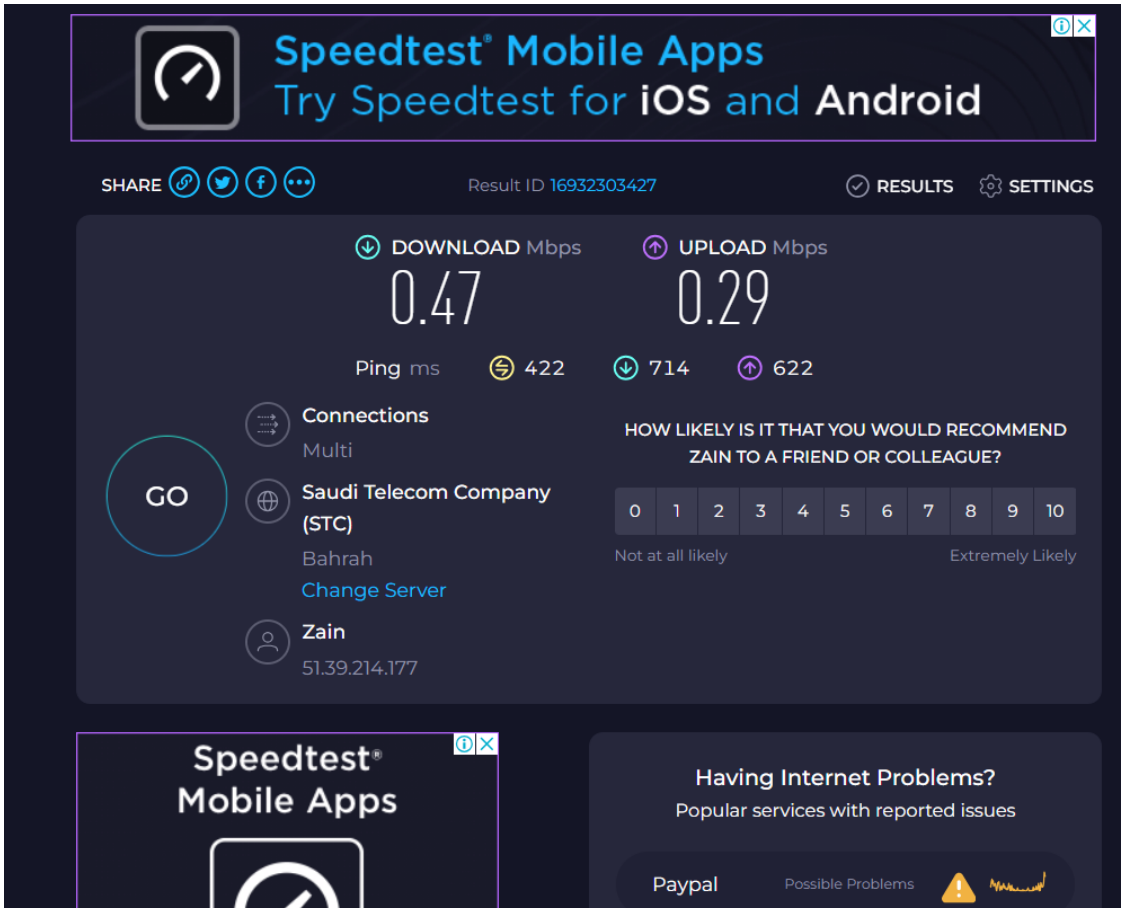

Wireless Network
192.168.2.0/24
2911
Router1
Access Point-PT
Access Point0
SMARTPHONE-PT
Smartphone0
Smartphone1
Smartphone2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
Wireless0
IP Configuration
DHCP
Static
IPv4 Address
192.168.2.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.2.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
Ipv6 request failed.
IPv6 Address
Link Local Address
FE80::290:CFF:FEB8:8584
Default Gateway
DNS Server





Part 2: Evaluating Network Performance Speed Test

- **What to Measure**: Download speed, upload speed, and ping (latency).
- **Tools**: ○ Use online services like **Speedtest.net** or **Fast.com**.
- **Process**: ○ Connect a device directly to the router via Ethernet for accurate results.
    - ○ Run the speed test multiple times at different times of the day to gather data.
- **Expected Results**: Compare results with your Internet Service Provider (ISP) plan to determine if you are getting the promised speeds.



2. Ping Test

- **What to Measure**: Latency (response time) between your device and a specific server.
- **Tools**: ○ Use the Command Prompt (Windows) or Terminal (macOS/Linux).
- **Process**:
  - Open Command Prompt or Terminal.
  - Type `ping [IP address or domain]` (e.g.,
- **Expected Results**: Look for average response time; lower values (typically under 50 ms) are better for a responsive connection.

```
C:\Users\PC>ping www.google.com

Pinging www.google.com [142.250.180.132] with 32 bytes of data:
Reply from 142.250.180.132: bytes=32 time=93ms TTL=108
Reply from 142.250.180.132: bytes=32 time=66ms TTL=108
Reply from 142.250.180.132: bytes=32 time=63ms TTL=108
Reply from 142.250.180.132: bytes=32 time=91ms TTL=108

Ping statistics for 142.250.180.132:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 63ms, Maximum = 93ms, Average = 78ms
```

3. Traceroute

- **What to Measure**: Path and time taken for packets to travel to a specific destination.
- **Tools**: ○ Use the Command Prompt or Terminal.
- **Process**:
  - Open Command Prompt or Terminal.
  - Type `tracert [IP address or domain]` (Windows) or `traceroute [IP address or domain]` (macOS/Linux).
- **Expected Results**: Analyze each hop to see if any are causing delays. High latency at a specific hop may indicate network congestion or routing issues.

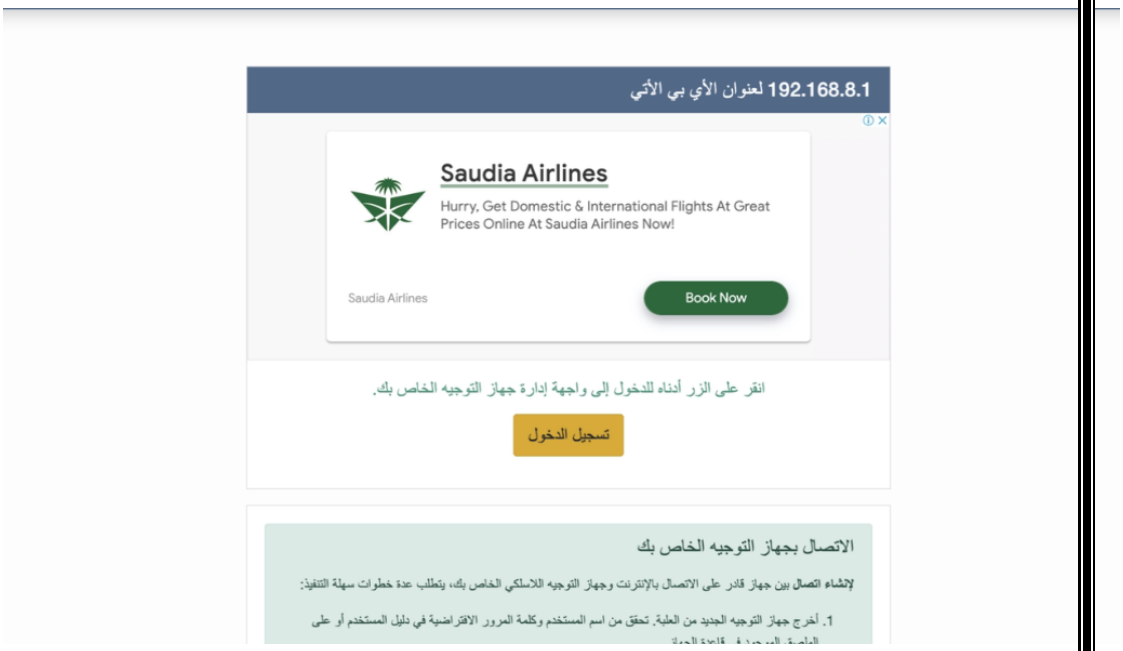
```
C:\Users\PC>tracert www.google.com

Tracing route to www.google.com [142.250.180.132]
over a maximum of 30 hops:

  1     1 ms     2 ms     4 ms  flybox.home [192.168.1.1]
  2     *        *        *     Request timed out.
  3    31 ms    53 ms    29 ms  10.52.71.1
  4     *        *        *     Request timed out.
  5    25 ms    27 ms    30 ms  10.154.206.114
  6    25 ms    22 ms    32 ms  10.181.181.165
  7    52 ms    35 ms    23 ms  10.196.22.50
  8    28 ms    25 ms    34 ms  172.18.165.133
  9    29 ms    29 ms    27 ms  host-81.10.87.48.tedata.net [81.10.87.48]
 10    44 ms    36 ms    37 ms  93.186.129.183
 11    99 ms    76 ms    78 ms  93.186.129.182
 12    94 ms    80 ms    82 ms  ae34.milano50.mil.seabone.net [93.186.129.45]
 13    75 ms    70 ms    65 ms  142.250.165.114
 14    69 ms    68 ms    75 ms  72.14.238.234
 15    72 ms    68 ms    78 ms  142.250.211.29
 16    84 ms    67 ms    67 ms  mil04s43-in-f4.1e100.net [142.250.180.132]

Trace complete.
```

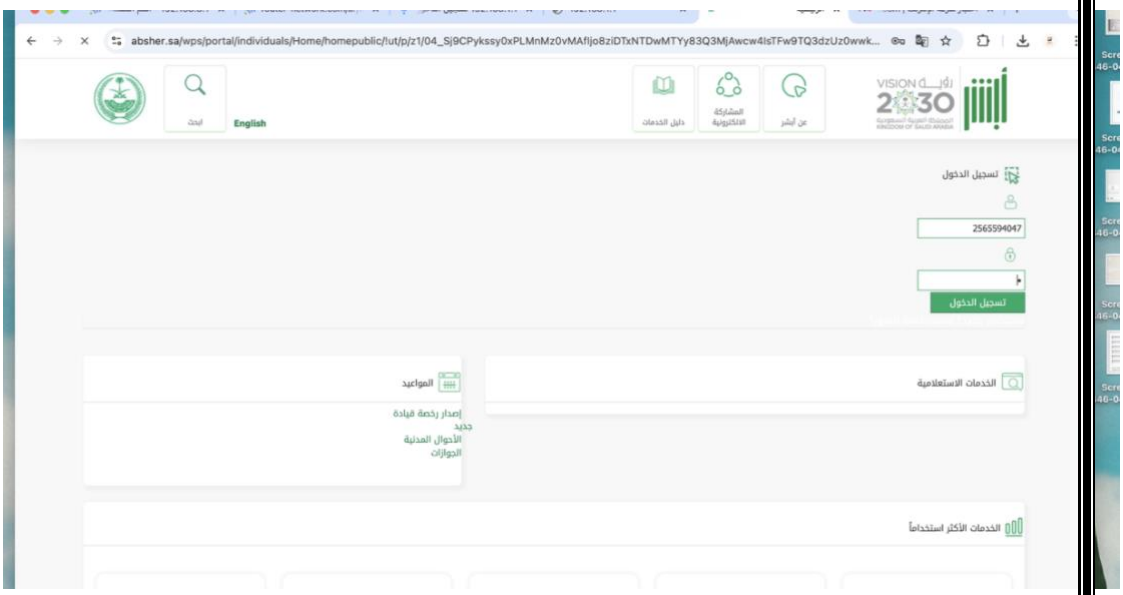
- **3. Check Network Configuration:**
  You can also use `networksetup` to manage and display network settings:
- `networksetup -getinfo <network_service>`
- Replace `<network_service>` with your network service, like `Wi-Fi`
- `networksetup -getinfo Wi-Fi`

```
C:\Users\PC>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-T241OAL
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : home

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Killer E2600 Gigabit Ethernet Controller
   Physical Address. . . . . . . . . : 60-18-95-75-C6-78
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : VirtualBox Host-Only Ethernet Adapter
   Physical Address. . . . . . . . . : 0A-00-27-00-00-0B
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::972c:ca48:dbb1:8f82%11(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.56.1(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
   DHCPv6 IAID . . . . . . . . . . . : 738852903
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2C-95-1D-F2-60-18-95-75-C6-78
   DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1
                                       fec0:0:0:ffff::2%1
                                       fec0:0:0:ffff::3%1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Local Area Connection* 9:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 4C-77-CB-49-74-2F
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
```

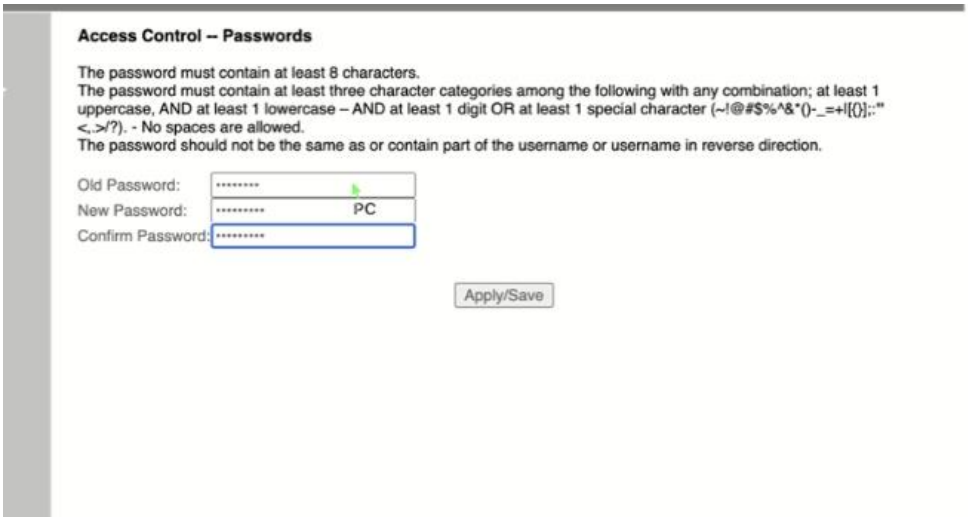
Part3: Checking Network Security

- **Access the Router Settings**:
  - Connect to your router's web interface using its IP address (commonly `192.168.0.1` or `192.168.1.1`). o Log in with the admin credentials (default username and password should be changed if not done already).

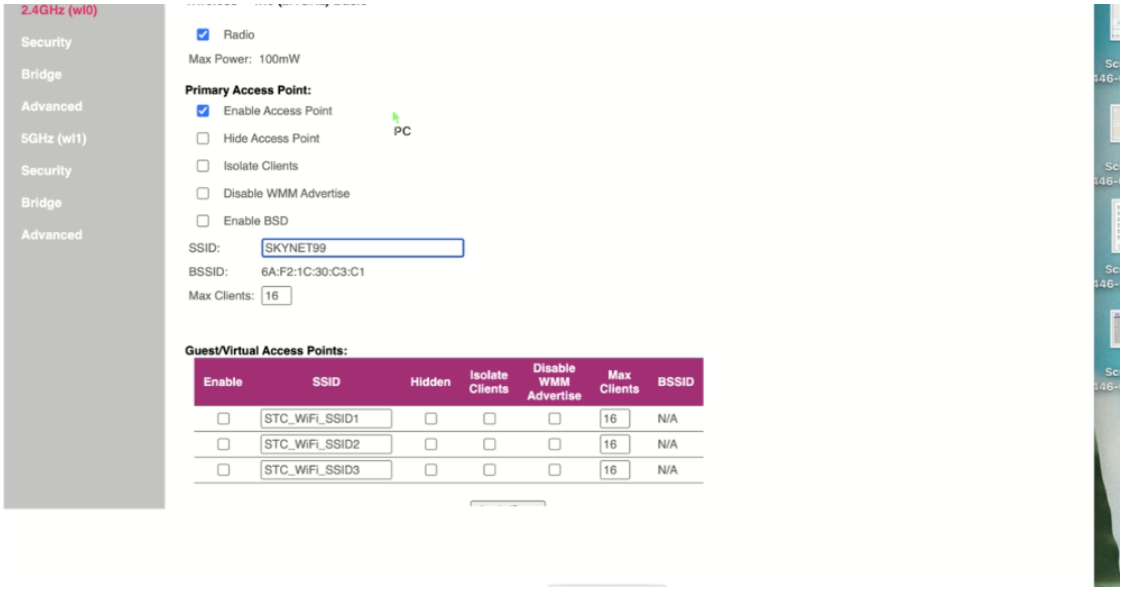




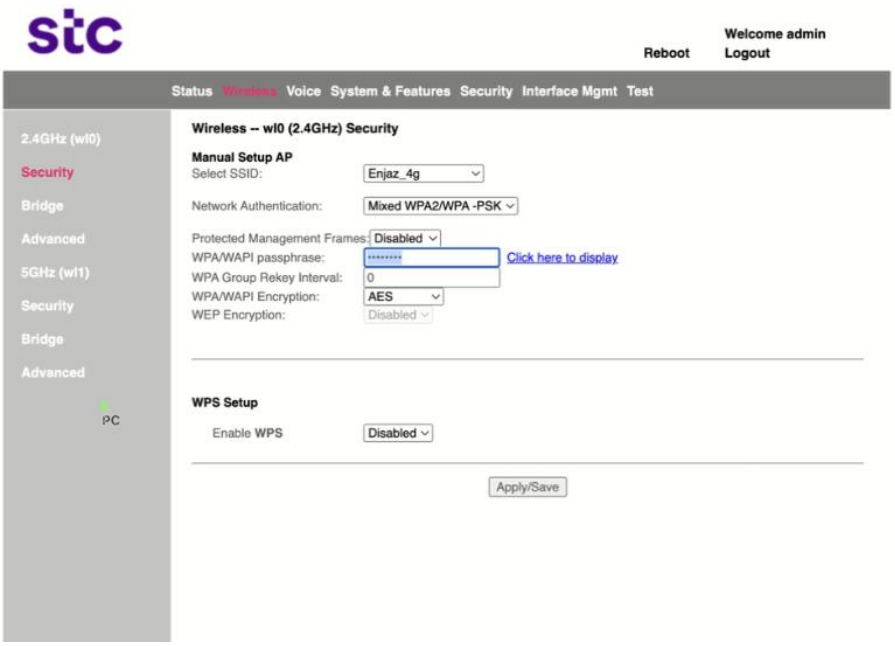
-
- **Change Default Credentials**:
  - Ensure the default admin username and password are changed to a strong, unique password.



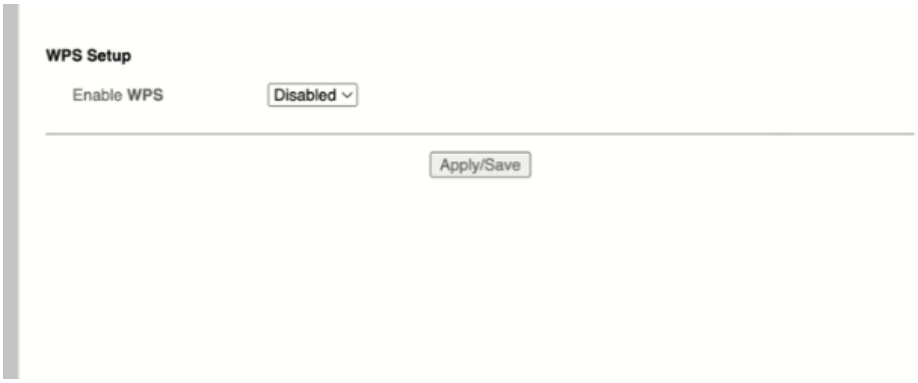
- **Update Firmware**:
  - Check for firmware updates and install them to protect against known vulnerabilities.
- **Network Name (SSID)**:
  - Change the default SSID to something unique to make it harder for attackers to identify your router.



- **Wi-Fi Security Protocol**:
  - Use WPA3 or at least WPA2 for encryption. Avoid WEP, as it is outdated and insecure.



- **Disable WPS**: ○ Turn off Wi-Fi Protected Setup (WPS), which can be a security risk.

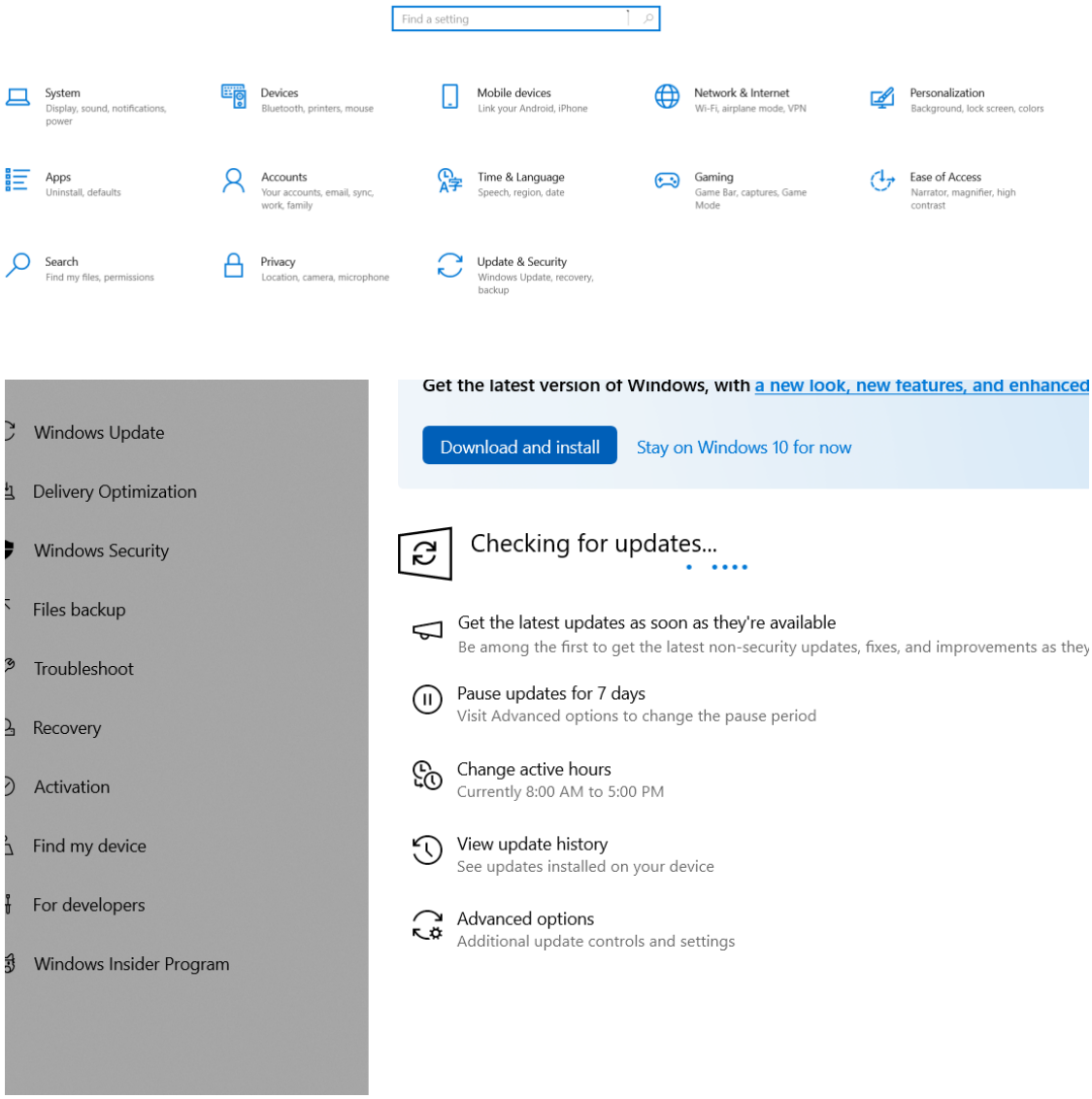


2. Wireless Network Security

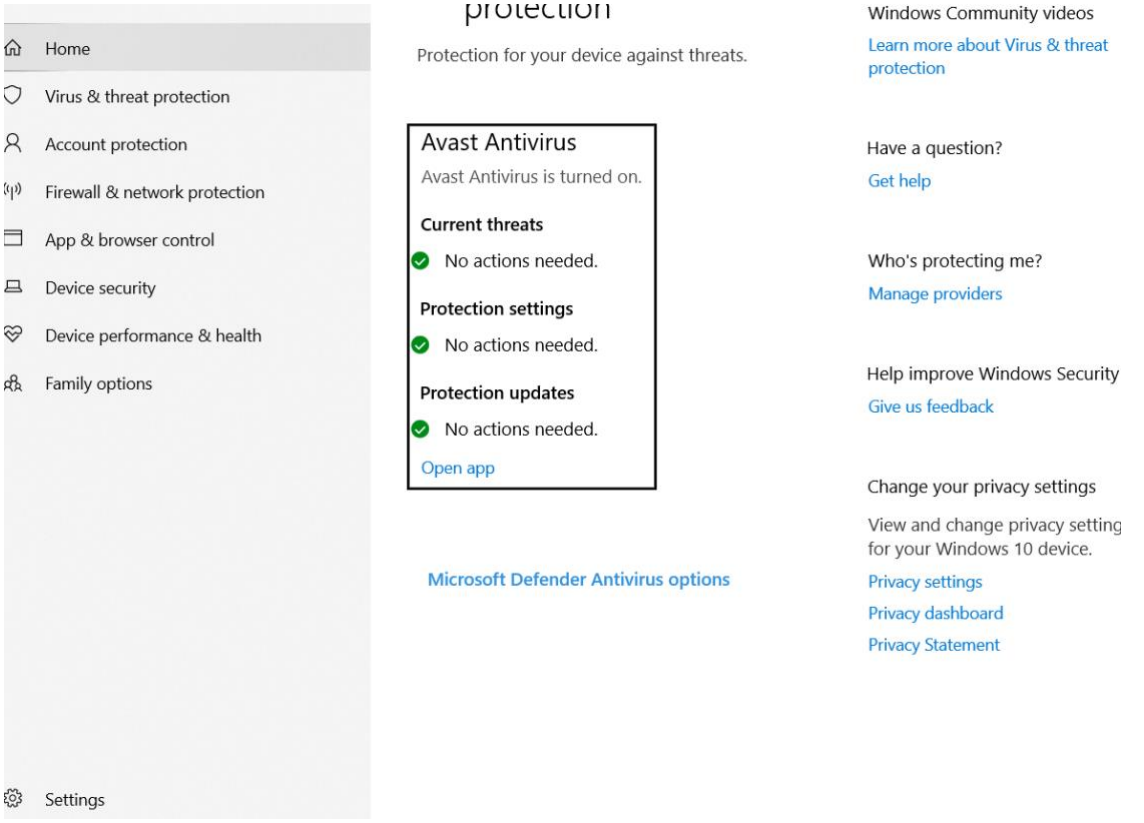
- **Check Encryption**:
  - Verify that your wireless network is encrypted (WPA2 or WPA3). ○ .

3. Device Security

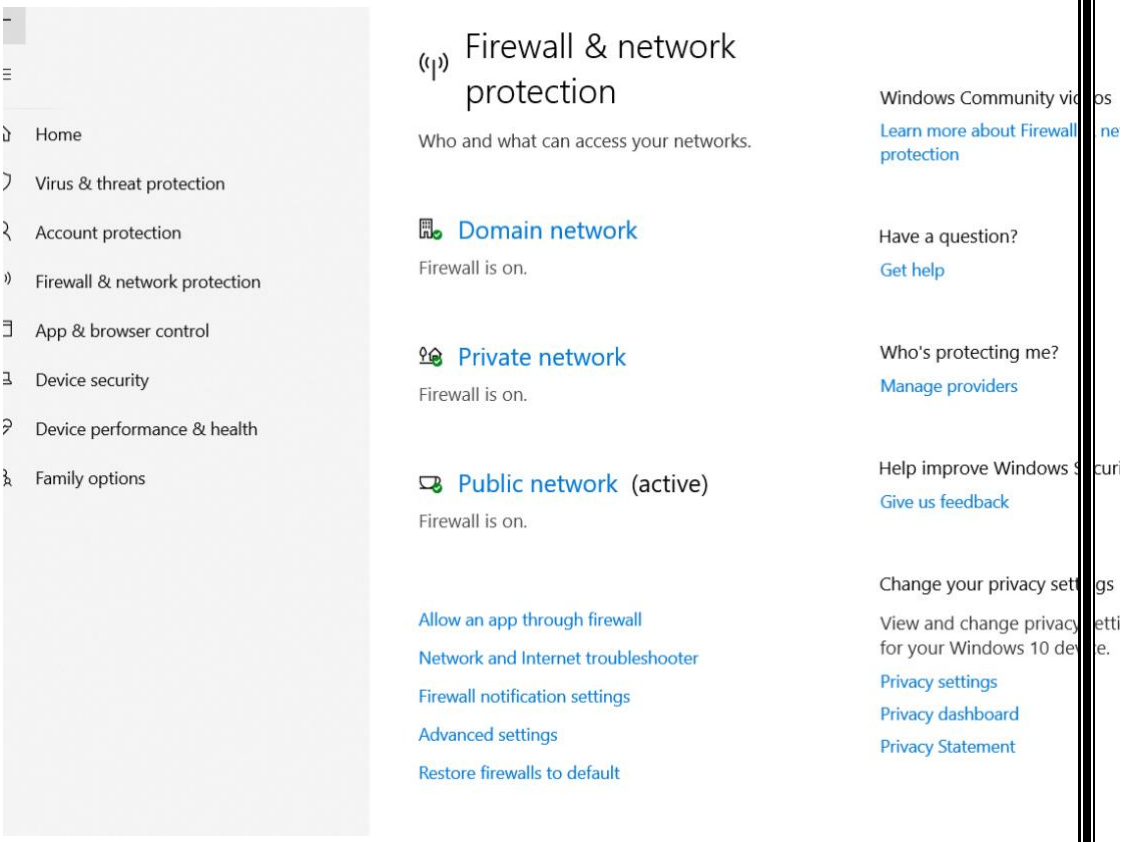
- **Secure Connected Devices**:
  - Ensure all devices connected to your network (computers, smartphones, smart TVs, IoT devices) have up-to-date software and security patches.



- **Antivirus Software**:
  - Install and regularly update antivirus software on computers and devices.

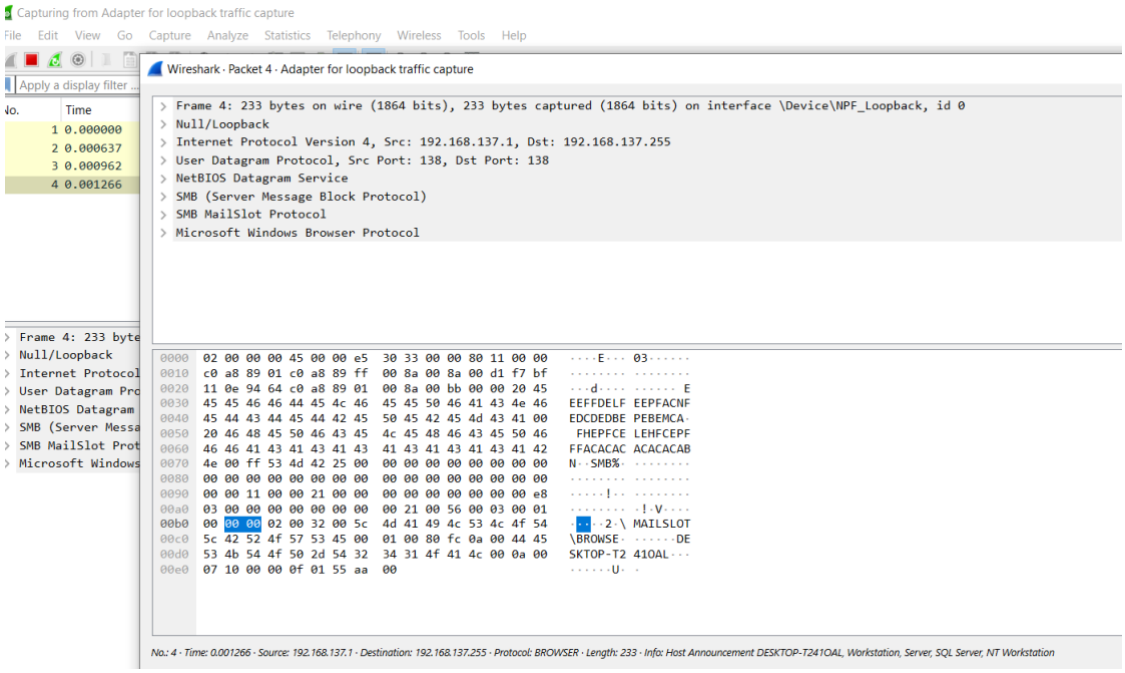


- **Firewall Configuration**:
  - Enable the router's firewall and ensure that personal firewalls are active on computers and devices.



4. Network Traffic Analysis(optional)

- **Monitor Network Activity**:
  - Use tools like Wireshark or PRTG Network Monitor to analyze traffic and detect any unusual activities.
- **Scan for Open Ports**:
  - Use network scanning tools (e.g., Nmap) to identify open ports on your router and devices. Close any unnecessary ports.



Ghaida Al-shaikhi	Part one
Mayar noli – Majd Al-harbi	Part two
Areej Al-sifsafi – Rana Al-shardi	Part three