Umm AL-Qura University

Computing College at ALQunfudah

Department of Computer Science

Computer Networks and the Internet CS3002

1 st Semester 1446H

Grade Level: 10th Grade

Network Project

Home Network Design and Performance Evaluation

Group 1

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Part 1: Designing a Local Network

Networks play a vital role in our modern time, providing a means of connecting various devices for the exchange of data and information. Whether the networks are wired or wireless, enabling the connection of devices within homes, enterprises, or even on a global scale. Wired networks provide stability and high speed, while wireless networks give flexibility in movement and connection without cable restrictions.

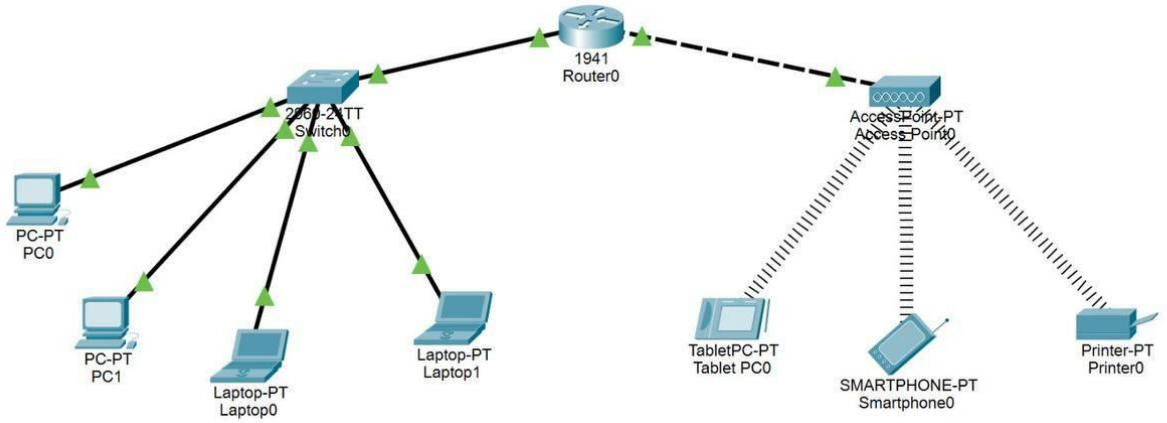


Figure 1: The Local Network

In this part, we will describe the various network components that include two networks: one wired and the other wireless, and their role in achieving effective communication between devices. We will show how these components contribute to enhancing network performance and stability, facilitating the data exchange process and enhancing the overall user experience.

1. 1941 Router :

It is the device responsible for directing data traffic between the local network (LAN) and other networks such as the internet. It routes data packets to their destination via specific protocols, acts as an intermediary between the local network and the external network.

- Type: Cisco ISR 1941 Router.
- Company: Cisco Systems.

Advantages:

- Connects the local network to an external network (such as the Internet).
- Provides security features such as firewall for access control and network protection.
- Manages data traffic between different networks.

Connect to:

- In a wired network: the router connects to the Switch via an Ethernet cable.
- In the wireless network connects to the wireless access point via an Ethernet cable also to provide wireless connectivity.

2. **Switch:** a network device that connects devices in a local area network (LAN) and effectively routes data between devices connected to it. The network switch features a multi-port, allowing multiple devices to be connected via Ethernet cables.
    - Type: Cisco Catalyst 2960-24TT Switch.
    - Extension: Supports Ethernet (10/100/1000 Mbps).
    - Company: Cisco Systems.

    Advantages:
    - Reduces collisions between signals and allows devices to simultaneous communication.
    - Manages the flow of data between devices and sends it to the correct destination in the network.

    Connect to:
    The switch connects to the router using an Ethernet cable and connects to other wired devices via individual Ethernet cables for each device.

3. **Access point :**
    It is a device used to provide a wireless network connection, as it enables data transfer between the network and devices via Wi-Fi signals. The access point is essential in environments that require flexibility in connection and mobility without the need for cables.
    - Type: TP-Link EAP245.
    - Company: TP-Link.

    Advantages:
    - Extend the range of the wireless network.
    - Support a large number of connected devices.
    - Improved signal distribution management.

    Connect to:

The access point connects to the router using an Ethernet cable. Then it allows wireless connection of devices connected to it via Wi-Fi.

4. Ethernet :

It is a physical means of transferring data between devices located in a network. It is used for data transmission at speeds up to 100 mbit/s, especially in the case of FastEthernet cables. Ethernet cable plays a vital role in facilitating effective communication between different devices, ensuring smooth and efficient information exchange within the network.

- Type: Cat6.
- Extension: Supports data transfer at speeds up to 10 Gbps for distances up to 55 meters.
- Company: It can be available from different companies such as Belkin and Mediabridge.

Advantages:

- Provides a stable and stable connection between devices.
- High data transfer speed with reduced latency.

5. Devices in the wired network

1. PC-PT PC0 and PC-PT PC1:

They are stationary computers that are mainly used for office work, games, or applications that require high performance. In a wired network, an Ethernet cable connects to the network switch, allowing it to quickly access the internet and exchange data with other devices.

Advantages:

- High data processing capability.
- Suitable for work that require strong performance such as design, programming, and video editing.

2. (Laptop-PT Laptop0 and Laptop-PT Laptop1):

is a laptop designed to provide high performance in work and study environments. Thanks to its flexible design, it can be used anywhere, be it in the office, at home, or on the go.
Laptops are used in wired networks to provide mobile performance but with stable connectivity. In a wired network, they are also connected via Ethernet cables to take advantage of high data transfer speeds.

Advantages:

- Flexibility in movement and the possibility of carrying the device to different locations.
- Good data processing capabilities, but they are usually less powerful than desktops**.**

6. Devices in the wireless network

1. SMARTPHONE-PT:

are sophisticated devices that combine the advantages of a traditional phone and a computer. They have an operating system that allows downloading applications and surfing the internet, which makes them versatile tools in everyday life.

Advantages:

- Strong connection to Wi-Fi and 4G/5G networks, which facilitates browsing and downloading.
- Advanced shooting capabilities including highresolution cameras.
- Intuitive user interface with touch screen.

2. TabletPC-PT:

tablets feature a large touch screen, acting as a bridge between smartphones and laptops. They are designed to be light and easy to carry, making them ideal for browsing and watching.

Advantages:

- Long-lasting battery, providing continuous use.
- Good performance in running multitasking applications.

- Various connection options including Wi-Fi and Bluetooth.

3. Printer-PT

A device used to convert electronic documents into paper copies. Modern printers have a wireless connection, which allows any device in the network to send documents for printing without the need for a direct connection, saving time and effort. Its features include printing speed and high print quality, which makes it an essential tool in offices, schools and homes. In addition, they can be used for printing in color or black and white, as needed.

Advantages:

- Support for various types of printing, from texts to color images.
- Fast printing and high efficiency. • Features such as scanning and copying.

IP addressing :

The subnet for the wired has been set:192.168.1.0/24

The subnet for the wireless has been set:192.168.2.0/24

We set up the router manually

Part 2: Evaluating Network Performance

We will conduct a series of experiments to measure *download*, *upload speeds*, *ping (latency)* and *traceroute* at different times and locations.

Experiment 1:

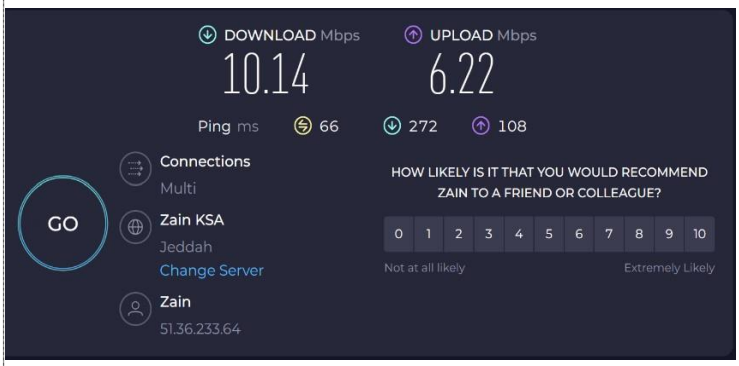
At 9:41 AM and the measure is 38cm the download, upload speeds and ping (latency) and Traceroute are:


```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:805::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:805::200e: time=82ms
Reply from 2a00:1450:4006:805::200e: time=95ms
Reply from 2a00:1450:4006:805::200e: time=219ms
Reply from 2a00:1450:4006:805::200e: time=150ms

Ping statistics for 2a00:1450:4006:805::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 82ms, Maximum = 219ms, Average = 136ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:804::200e]
over a maximum of 30 hops:

  1     1 ms     1 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    39 ms    28 ms    38 ms  2a02:cb80:2340:0:8000::14
  4    46 ms    28 ms    28 ms  2a02:cb80:2340:0:8000::1d
  5    37 ms    27 ms    30 ms  2a02:cb81:1000:201::6
  6     *        *        *     Request timed out.
  7   208 ms    83 ms    78 ms  2001:4860:1:1::2270
  8   191 ms   205 ms   201 ms  2a00:1450:8062::1
  9    83 ms    78 ms    79 ms  2001:4860:0:1::12b2
 10    88 ms    88 ms   217 ms  2001:4860:0:1::837a
 11    91 ms    86 ms    82 ms  2001:4860:0:1::8303
 12   196 ms    87 ms    77 ms  2001:4860:0:1::308d
 13   142 ms    79 ms    82 ms  mrs04s10-in-x0e.1e100.net [2a00:1450:4006:804::200e]

Trace complete.
```

Experiment 2:

At 12:43 PM and the measure is 6.29m the download, upload speeds and ping (latency) Traceroute are:

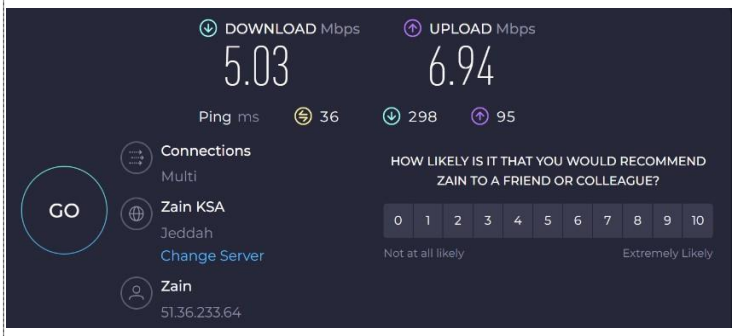



```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:809::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:809::200e: time=135ms
Reply from 2a00:1450:4006:809::200e: time=242ms
Reply from 2a00:1450:4006:809::200e: time=245ms
Reply from 2a00:1450:4006:809::200e: time=93ms

Ping statistics for 2a00:1450:4006:809::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 93ms, Maximum = 245ms, Average = 178ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:809::200e]
over a maximum of 30 hops:

  1     3 ms     1 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    33 ms    34 ms    37 ms  2a02:cb80:2340:0:8000::10
  4    38 ms    29 ms    38 ms  2a02:cb80:2340:0:8000::11
  5    34 ms    28 ms    39 ms  2a02:cb81:1000:200::6
  6    50 ms     *        *     2a02:f040:0:1::29
  7    88 ms   144 ms   203 ms  2001:4860:1:1::2270
  8    76 ms    77 ms    78 ms  2a00:1450:803f::1
  9   194 ms   108 ms    79 ms  2001:4860:0:1::29e
 10   195 ms   175 ms    84 ms  2001:4860:0:1::b3d
 11    72 ms    97 ms    78 ms  mrs09s11-in-x0e.1e100.net [2a00:1450:4006:809::200e]

Trace complete.
```

Experiment 3:

At 4:44 PM and the measure is 7.64m the download, upload speeds and ping (latency) Traceroute are:

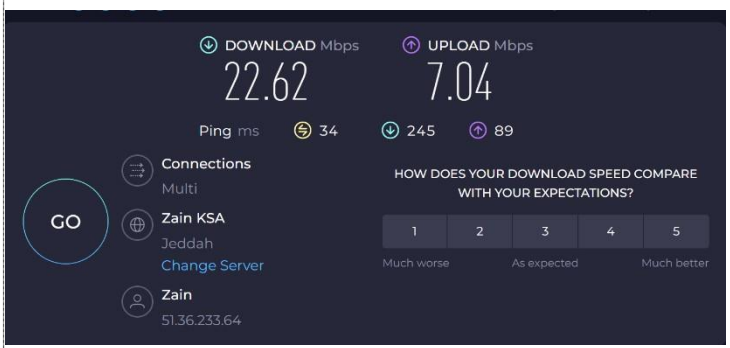



```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:809::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:809::200e: time=72ms
Reply from 2a00:1450:4006:809::200e: time=171ms
Reply from 2a00:1450:4006:809::200e: time=178ms
Reply from 2a00:1450:4006:809::200e: time=185ms

Ping statistics for 2a00:1450:4006:809::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 72ms, Maximum = 185ms, Average = 151ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:809::200e]
over a maximum of 30 hops:

  1     3 ms     2 ms     2 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3   299 ms   125 ms   175 ms  2a02:cb80:2340:0:8000::10
  4   398 ms   202 ms    32 ms  2a02:cb80:2340:0:8000::11
  5   385 ms   343 ms   537 ms  2a02:cb81:1000:200::6
  6     *      653 ms   448 ms  2a02:f040:0:1::29
  7   362 ms   715 ms   407 ms  2001:4860:1:1::2270
  8   212 ms    90 ms   214 ms  2a00:1450:803f::1
  9   124 ms   203 ms   203 ms  2001:4860:0:1::29e
 10   503 ms   510 ms   165 ms  2001:4860:0:1::b3d
 11   577 ms   305 ms   306 ms  mrs09s11-in-x0e.1e100.net [2a00:1450:4006:809::200e]

Trace complete.
```

Experiment 4:

At 7:42 PM and the measure is 9m the download, upload speeds and ping (latency) Traceroute are:

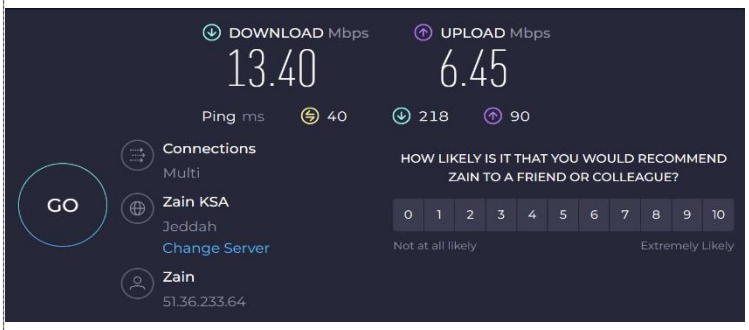



```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:808::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:808::200e: time=93ms
Reply from 2a00:1450:4006:808::200e: time=86ms
Reply from 2a00:1450:4006:808::200e: time=93ms
Reply from 2a00:1450:4006:808::200e: time=129ms

Ping statistics for 2a00:1450:4006:808::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 86ms, Maximum = 129ms, Average = 100ms
```

```
C:\Users\Asus> tracert google.com

Tracing route to google.com [2a00:1450:4006:808::200e]
over a maximum of 30 hops:

  1     2 ms     1 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    41 ms    22 ms    38 ms  2a02:cb80:2340:0:8000::14
  4    31 ms    46 ms    21 ms  2a02:cb80:2340:0:8000::1d
  5    37 ms    36 ms    37 ms  2a02:cb81:1000:201::6
  6     *        *        *     Request timed out.
  7   158 ms   203 ms    81 ms  2001:4860:1:1::2270
  8    95 ms    81 ms   223 ms  2a00:1450:80f4::1
  9   120 ms    76 ms    90 ms  2001:4860:0:1::2488
 10   202 ms    89 ms    94 ms  2001:4860:0:1::1af9
 11    94 ms    90 ms    94 ms  mrs08s06-in-x0e.1e100.net [2a00:1450:4006:808::200e]

Trace complete.
```

Experiment 5

At 10:39 PM and the measure is 10.64m the download, upload speeds and ping (latency) Traceroute are:

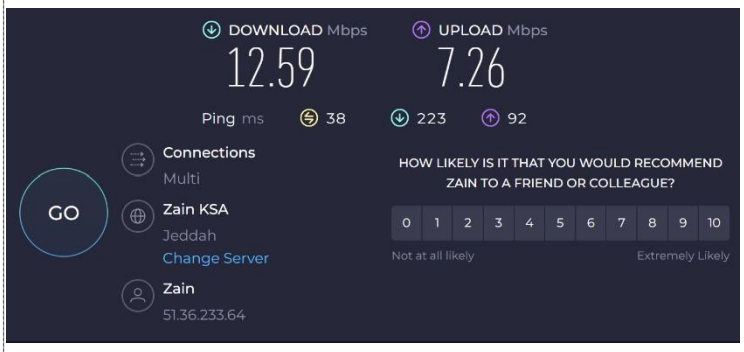



```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:809::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:809::200e: time=172ms
Reply from 2a00:1450:4006:809::200e: time=176ms
Reply from 2a00:1450:4006:809::200e: time=86ms
Reply from 2a00:1450:4006:809::200e: time=78ms

Ping statistics for 2a00:1450:4006:809::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 78ms, Maximum = 176ms, Average = 128ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:809::200e]
over a maximum of 30 hops:

  1     2 ms     2 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    36 ms    28 ms    37 ms  2a02:cb80:2340:0:8000::10
  4     *      688 ms   363 ms  2a02:cb80:2340:0:8000::11
  5   166 ms   203 ms   307 ms  2a02:cb81:1000:200::6
  6   311 ms     *      272 ms  2a02:f040:0:1::29
  7   388 ms   511 ms   456 ms  2001:4860:1:1::2270
  8   204 ms   304 ms   306 ms  2a00:1450:803f::1
  9   329 ms   193 ms   409 ms  2001:4860:0:1::29e
 10   217 ms   305 ms   305 ms  2001:4860:0:1::b3d
 11   228 ms   188 ms   121 ms  mrs09s11-in-x0e.1e100.net [2a00:1450:4006:809::200e]

Trace complete.
```

Experiment 6:

At 1:42 AM and the measure is 5.59m the download, upload speeds, ping (latency) and Traceroute are:

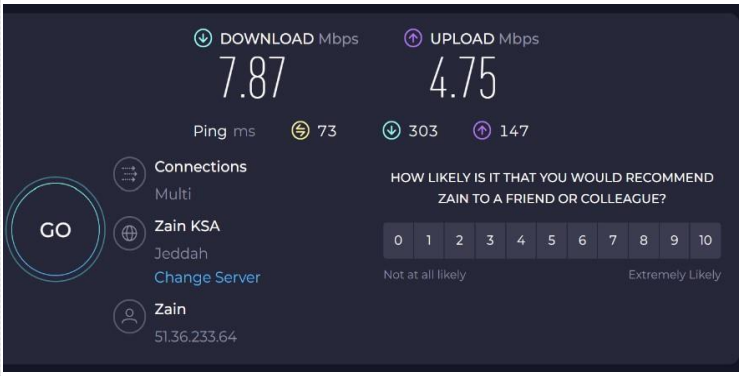



```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:809::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:809::200e: time=82ms
Reply from 2a00:1450:4006:809::200e: time=91ms
Reply from 2a00:1450:4006:809::200e: time=83ms
Reply from 2a00:1450:4006:809::200e: time=84ms

Ping statistics for 2a00:1450:4006:809::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 82ms, Maximum = 91ms, Average = 85ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:809::200e]
over a maximum of 30 hops:

  1     1 ms     1 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    42 ms    32 ms    37 ms  2a02:cb80:2340:0:8000::10
  4     *       37 ms     *     2a02:cb80:2340:0:8000::11
  5    34 ms    38 ms    38 ms  2a02:cb81:1000:200::6
  6    47 ms    29 ms    39 ms  2a02:f040:0:1::29
  7    85 ms    87 ms   185 ms  2001:4860:1:1::2270
  8   202 ms    96 ms    82 ms  2a00:1450:803f::1
  9    91 ms    84 ms    78 ms  2001:4860:0:1::29e
 10   200 ms   203 ms    79 ms  2001:4860:0:1::b3d
 11    78 ms   101 ms    97 ms  mrs09s11-in-x0e.1e100.net [2a00:1450:4006:809::200e]

Trace complete.
```

Experiment 7:

At 4:57 AM and the measure is 8.76m the download, upload speeds and ping (latency) Traceroute are:




```
C:\Users\Asus>ping google.com

Pinging google.com [2a00:1450:4006:809::200e] with 32 bytes of data:
Reply from 2a00:1450:4006:809::200e: time=469ms
Reply from 2a00:1450:4006:809::200e: time=505ms
Reply from 2a00:1450:4006:809::200e: time=392ms
Reply from 2a00:1450:4006:809::200e: time=367ms

Ping statistics for 2a00:1450:4006:809::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 367ms, Maximum = 505ms, Average = 433ms
```

```
C:\Users\Asus>tracert google.com

Tracing route to google.com [2a00:1450:4006:809::200e]
over a maximum of 30 hops:

  1     2 ms     1 ms     1 ms  2a02:cb80:424f:8b05:b0b4:ad9:eba4:7140
  2     *        *        *     Request timed out.
  3    35 ms    37 ms    27 ms  2a02:cb80:2340:0:8000::10
  4    41 ms    28 ms    37 ms  2a02:cb80:2340:0:8000::11
  5    41 ms    29 ms    30 ms  2a02:cb81:1000:200::6
  6    74 ms    44 ms    31 ms  2a02:f040:0:1::29
  7   178 ms    95 ms    77 ms  2001:4860:1:1::2270
  8   156 ms   203 ms   202 ms  2a00:1450:803f::1
  9   221 ms    87 ms    86 ms  2001:4860:0:1::29e
 10   415 ms   621 ms   327 ms  2001:4860:0:1::b3d
 11   230 ms   202 ms   137 ms  mrs09s11-in-x0e.1e100.net [2a00:1450:4006:809::200e]

Trace complete.
```

Check Network Configuration:

display detailed network information: Use the command (ipconfig):

```
C:\Users\Asus>ipconfig

Windows IP Configuration


Ethernet adapter   Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::381c:7ca3:2c9f:562c%5
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter   ىلحملا ةكبشلا لاصتا* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter   ىلحملا ةكبشلا لاصتا* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter   ةكبش Wi-Fi:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2a02:cb80:4053:e5aa:42fc:0:145d:2
   IPv6 Address. . . . . . . . . . . : 2a02:cb80:4053:e5aa:a978:7d80:167b:b828
   IPv6 Address. . . . . . . . . . . : fd42:fc00:14:5d00:64e:a03d:8355:b9c6
   Temporary IPv6 Address. . . . . . : 2a02:cb80:4053:e5aa:7859:257a:88d6:6964
   Temporary IPv6 Address. . . . . . : fd42:fc00:14:5d00:7859:257a:88d6:6964
   Link-local IPv6 Address . . . . . : fe80::d5a6:9db5:649:bbc7%18
   IPv4 Address. . . . . . . . . . . : 192.168.8.128
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::4c7f:ab42:1a8d:753%18
                                       192.168.8.1

Ethernet adapter   ةكبشلا لاصتا Bluetooth:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

Part3: Checking Network Security

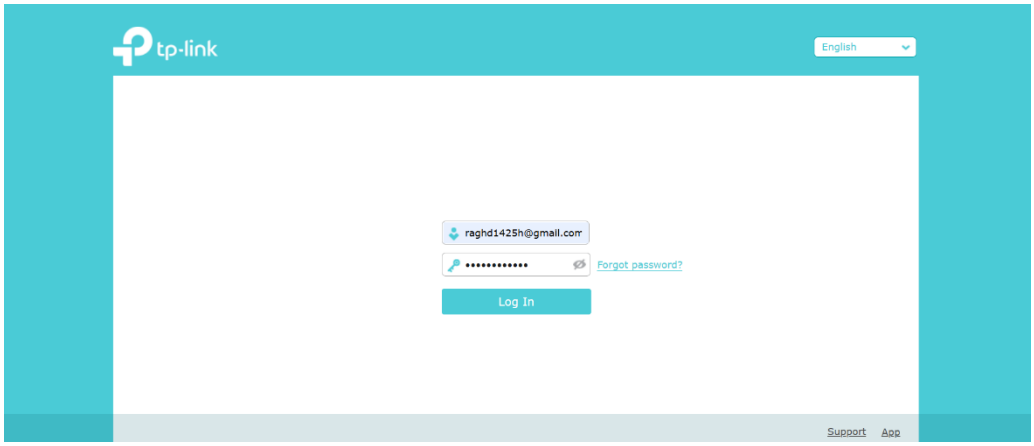
used the ipconfig command to find the network's IP.

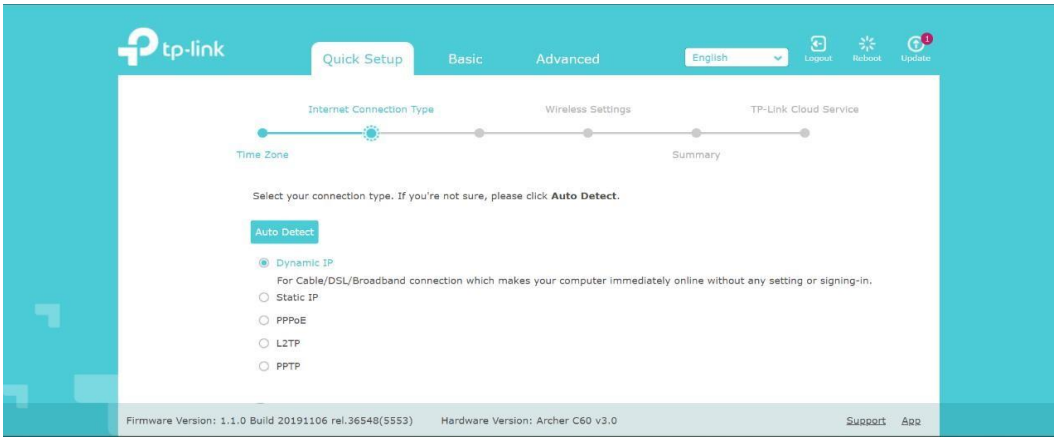
C:\Users\Raghd>ipconfig

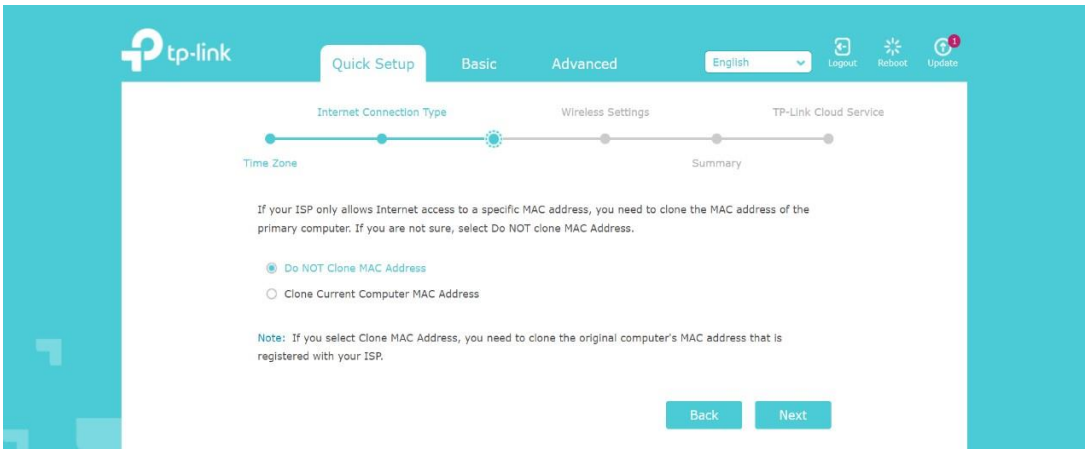
```
Wireless LAN adapter   ۆکبش Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::49c9:7b0f:3014:b793%15
   IPv4 Address. . . . . . . . . . . : 192.168.1.160
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.1.1
```

Connect to the Router:

- Open a web browser, and log in.
- Enter the router's IP address in the address bar. Common addresses include: https //192.168.l.l

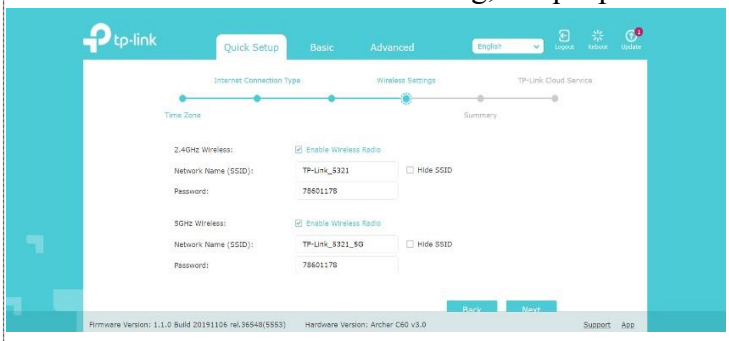




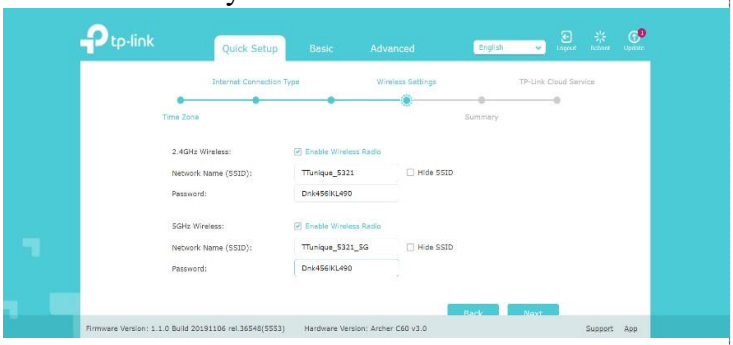


Update Username and Password:

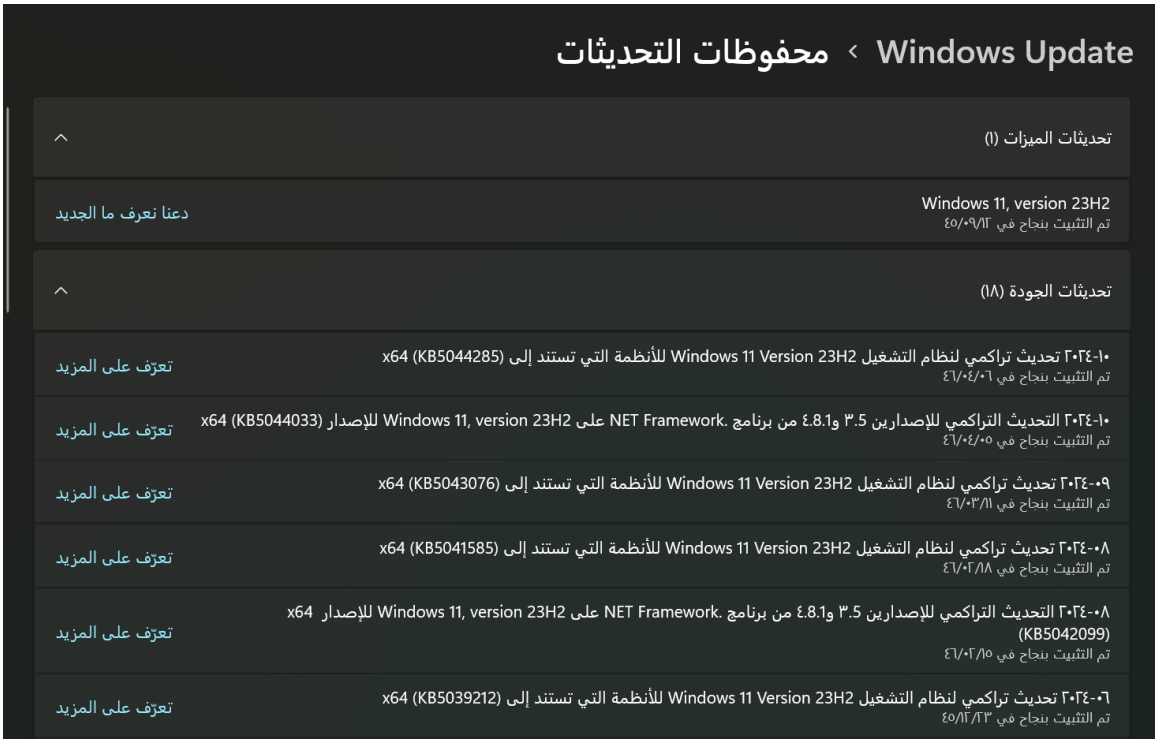
- Once logged in, navigate to the settings where you can change the admin username and password.
- Choose a strong, unique password to enhance security.



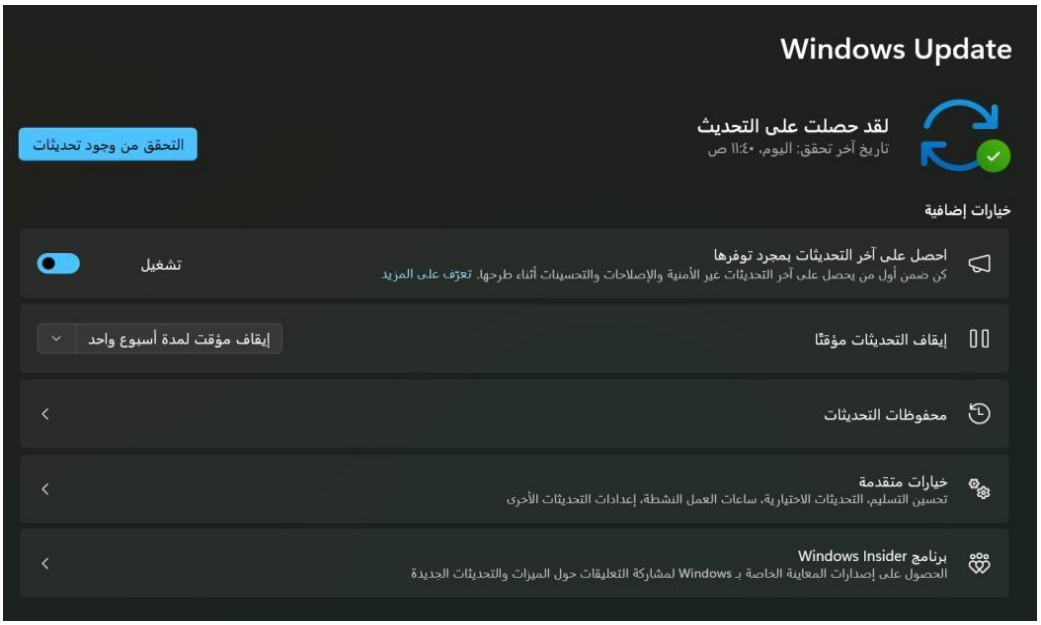
Before the change



After the change

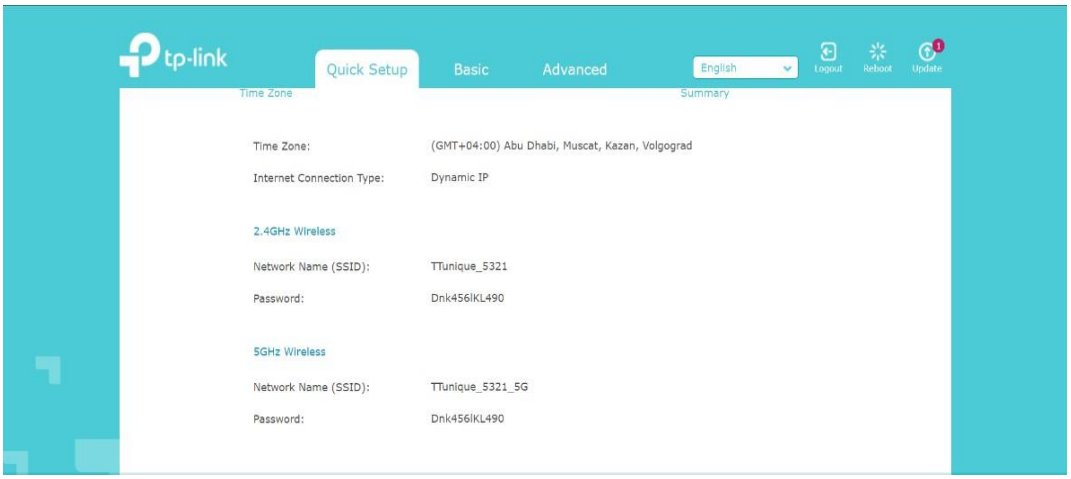


Check for Updates:



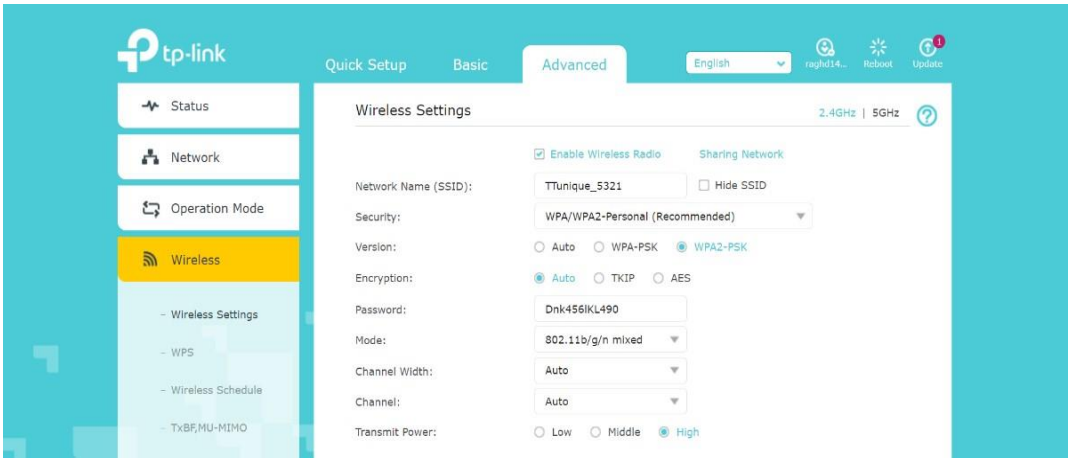
Network Name (SSID):

- The network name has been changed from TP-Link_5321 to TTunique_5321



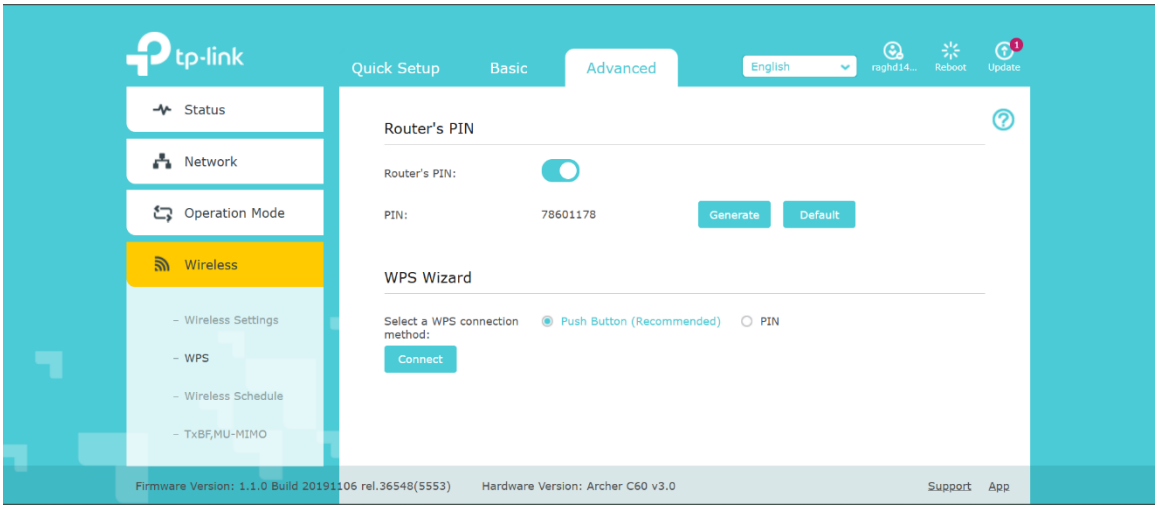
Wi-Fi Security Protocol:

- Select Strong Encryption:
  - In the wireless security settings, I choose WPA2.



Disable WPS:

- Turn off Wi-Fi Protected Setup (WPS), which can be a security risk



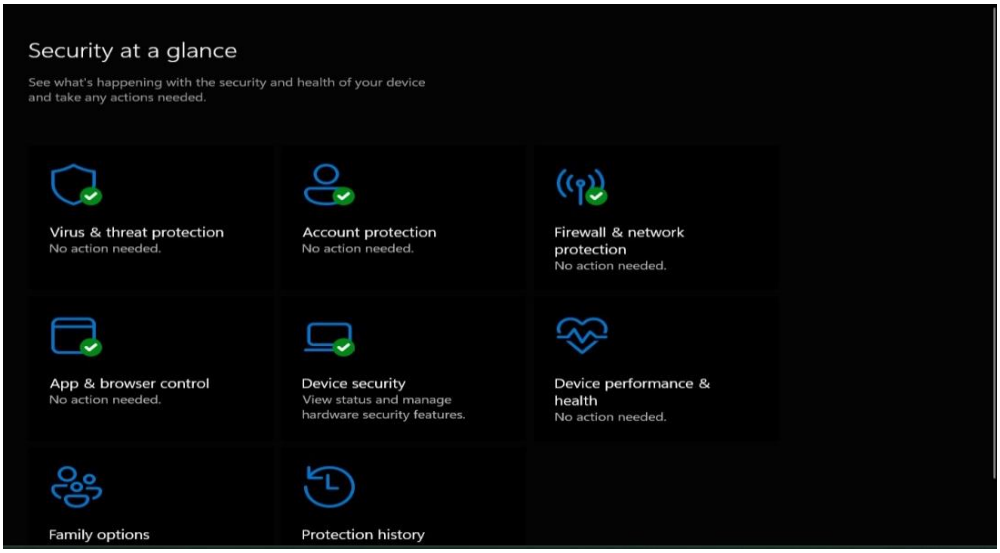
Wireless Network Security

Check Encryption:

- Verify that your wireless network is encrypted (WPA2 or WPA3).

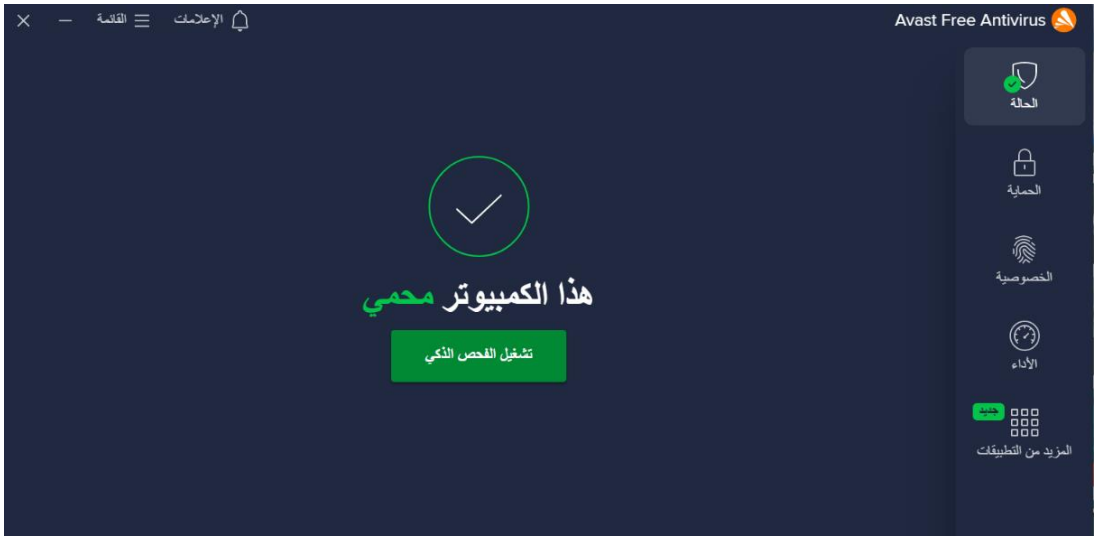
Secure Connected Devices:

- I verified that my network-connected computer has the latest software and security patches installed.



Antivirus Software:

- I installed reliable antivirus software on all my compatible computers and devices.
- Name the software on my computers: Avast Free Antivirus .

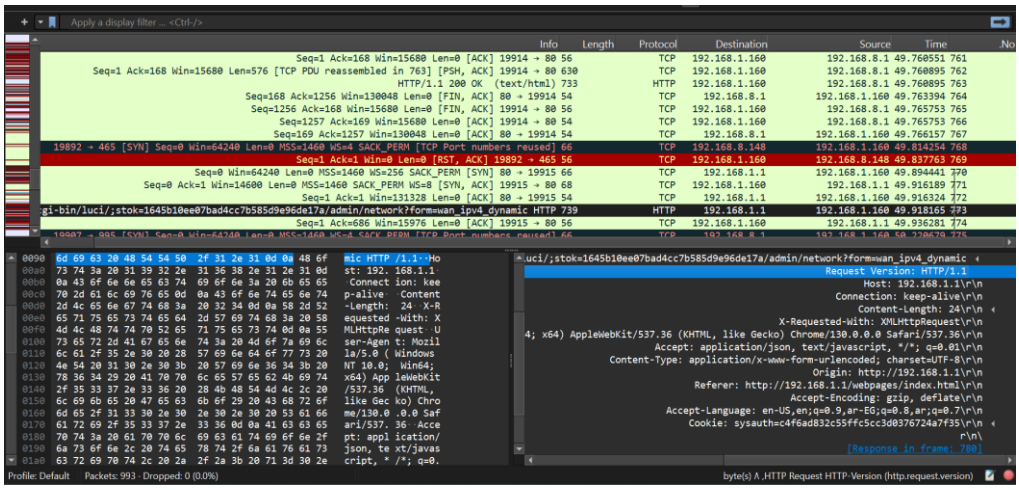


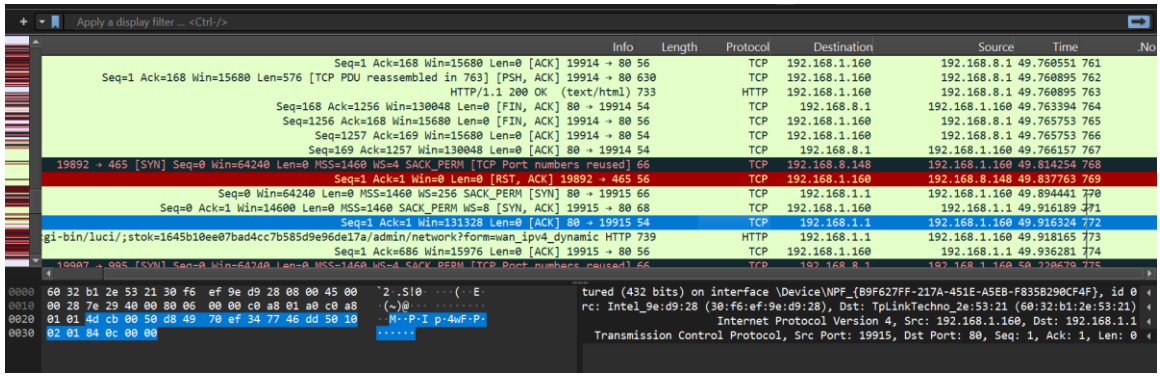
Firewall configuration:

- I activated personal firewalls on my computers and devices to monitor and control incoming and outgoing network traffic.

Monitor Network Activity:

- Use tools like Wireshark or PRTG Network Monitor to analyze traffic and detect any unusual activities.



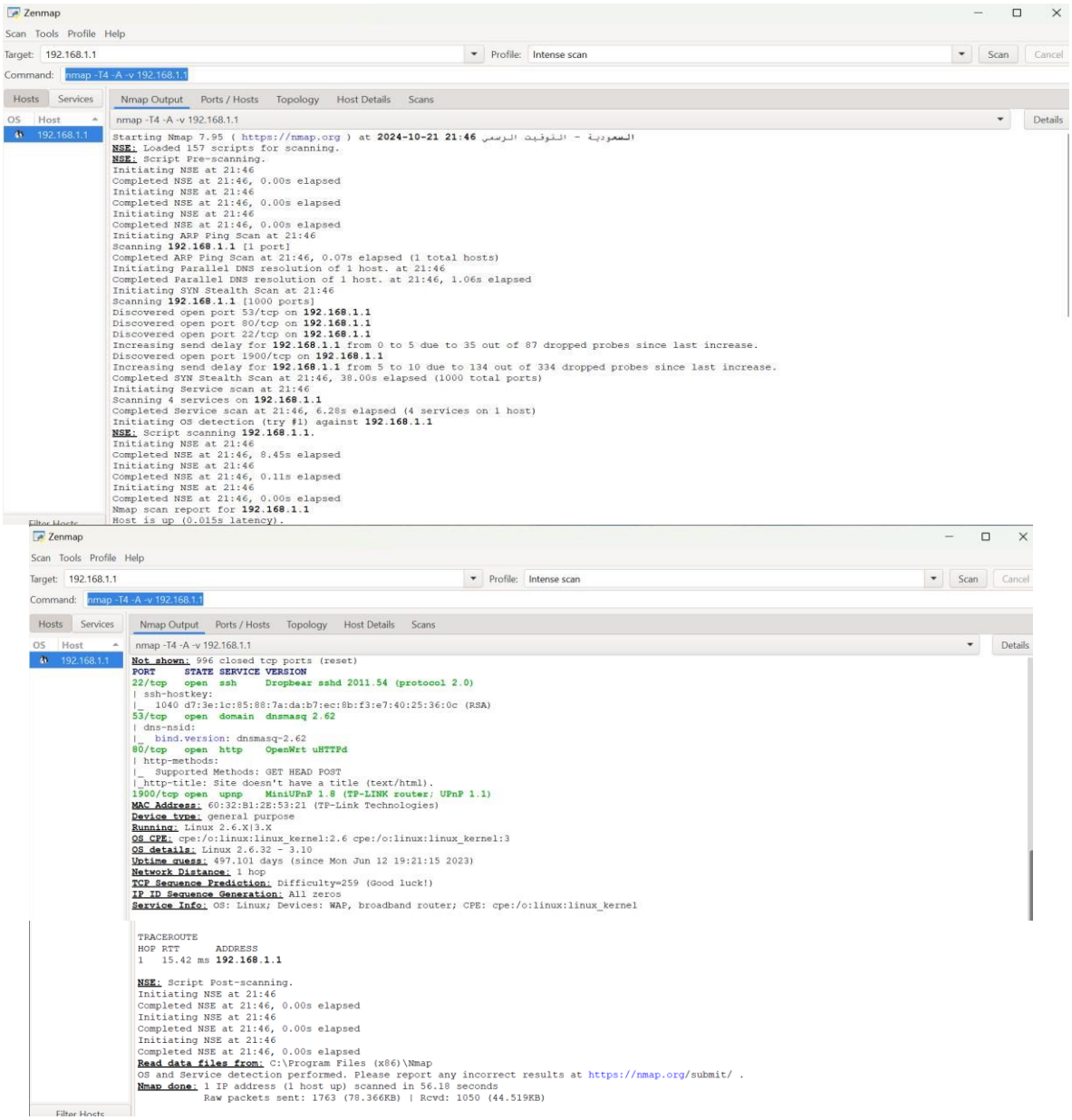


Network Traffic Analysis:

- Use network scanning tools (e.g., Nmap) to identify open ports on your router and devices.

  IP: 192.168.1.1

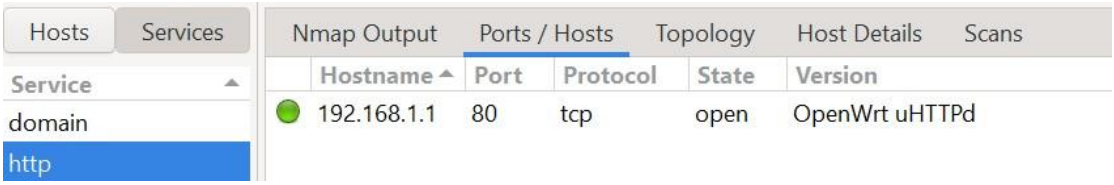
- Commanda: nmap -T4 -A -v 192.168.1.1



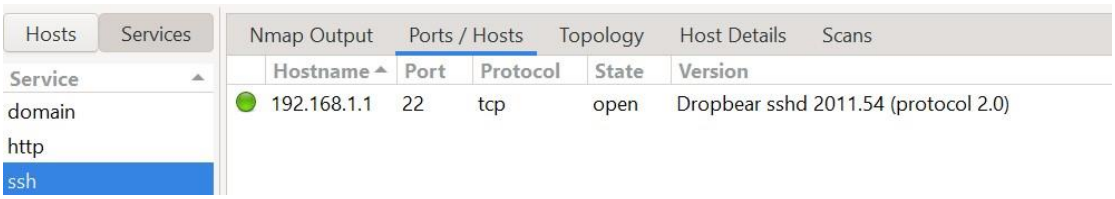
Review the Results:

- Check the output for open ports and services running on your devices
    - DOMAIN:

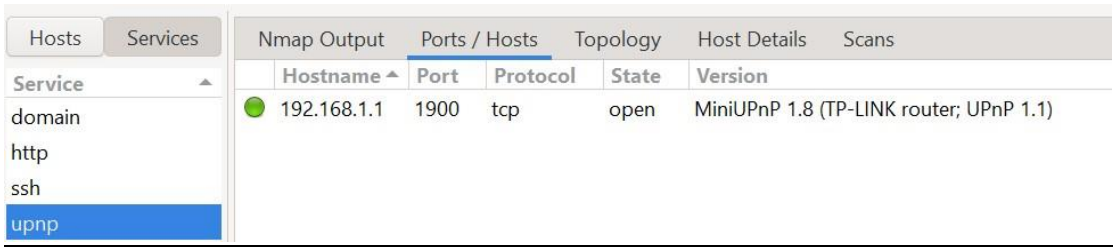
    - HTTP:



- SSH:



- UPNP:



Mapping the Network: Topology