

Computer Networks and Communications(CEN3002)

Project Title: Home Network Design and Performance Evaluation

Group 5

ID	Students' names
444007316	Lujain hasan al-kenani
444004093	Sarah Abdullah Al-Amari
444000451	Saham Al-Harbi
444003238	shaima lafi Al-Zubaidi

Supervisor: Aziz Al-Shahri

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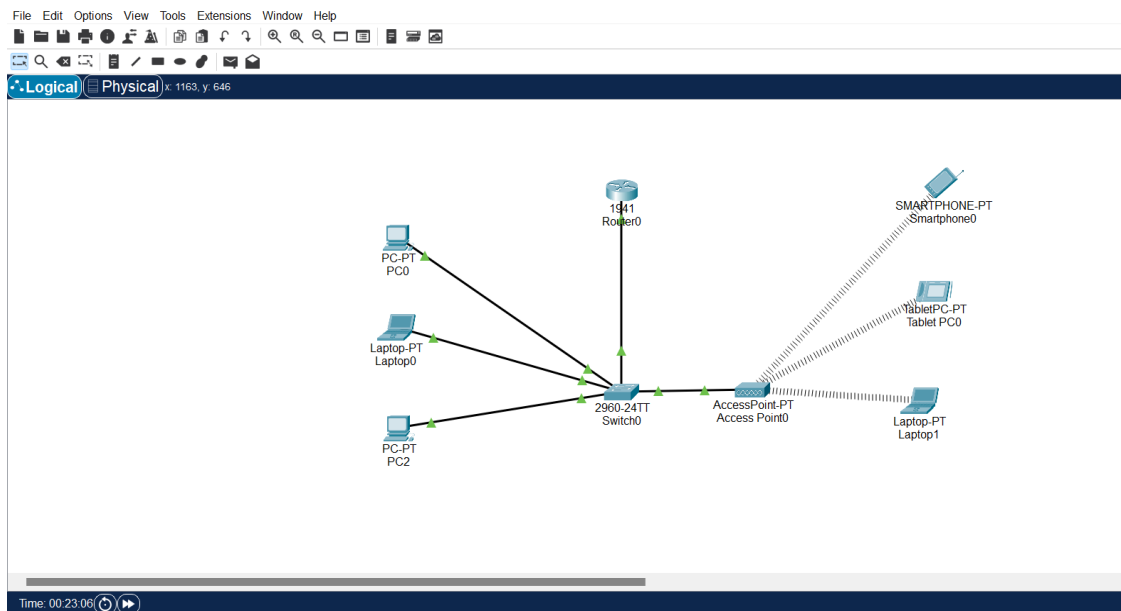
Introduction



LANs have become a backbone in homes and offices, facilitating device communication and internet-dependent tasks. This project focuses on creating a robust local network that combines both wired and wireless connections using various devices. Additionally, it includes assessing network performance through comprehensive tests to enhance connectivity and performance.

Part 1: Designing a Local Network (Sarah Abdullah Al-Amari)

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



describe their selected devices and equipment and explain their role in the network design.

Router

Description: Directs data between different networks, connects to the Internet and provides connectivity between the local and public networks

Role in network design: Transfers data between networks.

Switch

Description: A device that connects computers and other devices in the local network.

Role in network design: Connects devices within the local network and directs data between them efficiently.

Access Point

Description: A device that provides a wireless connection to the network and acts as a link between wireless devices and the wired network.

Role in network design: The access point provides wireless coverage, allowing devices to connect to the network without the need for cables.

Personal Computer PC

Description: It is a multi-purpose device and is used in a variety of important.

Role in Network Design: Acts as a workstation in the network, can be configured to access shared resources such as servers and printers, and allows users to monitor the network and troubleshoot problems by running network management software.

Laptop

Description: A portable computer that combines the power of a desktop computer with the mobility features.

Role in Network Design: Enhances flexibility of network access, allowing users to connect in different locations and typically supports both wired and wireless connections.

Smartphone

Description: A portable device that combines the features of a mobile phone with advanced computing capabilities.

Role in Network Design: A smartphone connects to the network via Wi-Fi or cellular data, enabling continuous connectivity.

Tablet

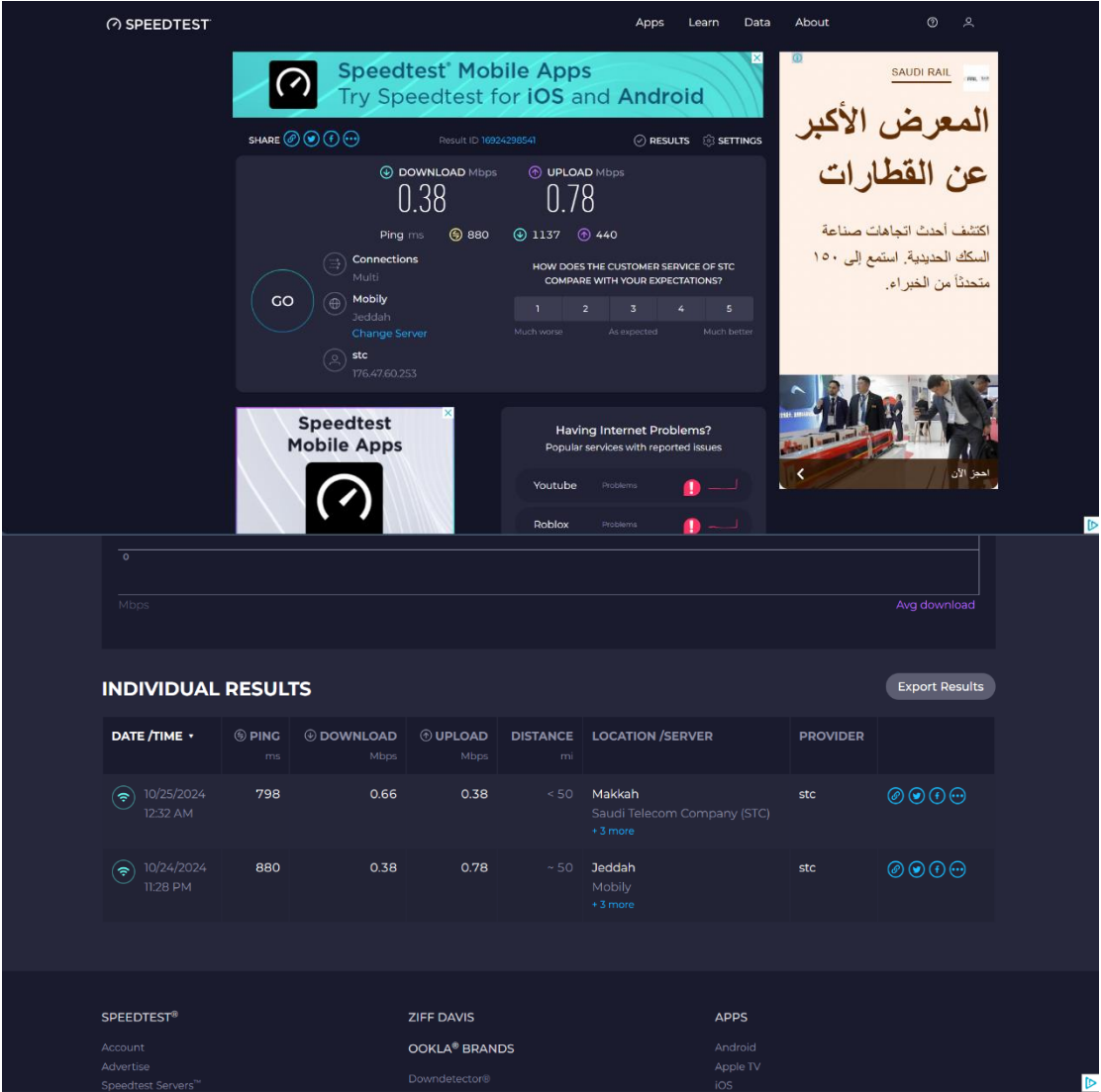
Description: A portable device with a touch screen used for a variety of purposes.

Role in Network Design: Provides another level of mobility and can be used in both personal and professional settings, typically connected via Wi-Fi.

in conclusion, all these devices contribute to the network's functions and flexibility, which contributes to improving performance and user experience.

Part 2: Evaluating Network Performance (Saham Al-Harbi)

1. Speed Test:



2. Ping Test:

```
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\seham> ping 192.168.8.1

Pinging 192.168.8.1 with 32 bytes of data:
Reply from 192.168.8.1: bytes=32 time=1ms TTL=64
Reply from 192.168.8.1: bytes=32 time=2ms TTL=64
Reply from 192.168.8.1: bytes=32 time=1ms TTL=64
Reply from 192.168.8.1: bytes=32 time=3ms TTL=64

Ping statistics for 192.168.8.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 1ms
PS C:\Users\seham> |
```

3. Traceroute:

1- Type tracert [IP address or domain]

```
Windows PowerShell
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\seham> ping 192.168.8.1

Pinging 192.168.8.1 with 32 bytes of data:
Reply from 192.168.8.1: bytes=32 time=1ms TTL=64
Reply from 192.168.8.1: bytes=32 time=2ms TTL=64
Reply from 192.168.8.1: bytes=32 time=1ms TTL=64
Reply from 192.168.8.1: bytes=32 time=3ms TTL=64

Ping statistics for 192.168.8.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 1ms
PS C:\Users\seham> tracert 192.168.8.1

Tracing route to homerouter.cpe [192.168.8.1]
over a maximum of 30 hops:

  1    1 ms    1 ms    1 ms  homerouter.cpe [192.168.8.1]

Trace complete.
PS C:\Users\seham> |
```

2- Analysis:

1. Number of hops: The traceroute shows only 1 hop, indicating the destination 192.168.8.1 is directly connected on the local network with no intermediate routers.
2. Latency at each hop: The latency is consistently 1 ms for all 3 packets sent. This is an extremely low latency, suggesting a high-speed, uncongested connection to the destination.
3. No timeouts or lost packets: The trace completed successfully without any

timeouts or lost packets, further confirming the stability and reliability of the network path.

Based on these results, we can conclude that:

- The network path to [192.168.8.1](#) is direct and local, without any intermediate hops or routers.
- The connection is extremely fast, with negligible latency, indicating no congestion or performance issues.
- There are no connectivity problems along the route, as all packets were successfully delivered.

3- Check Network Configuration:

```
Windows PowerShell X Windows PowerShell X + v
PS C:\Users\seham> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 3:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::f637:decd:6b3d:3520%18
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Wireless LAN adapter شبكة لاسلكية 1:

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

Wireless LAN adapter شبكة لاسلكية 2:

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

Wireless LAN adapter شبكة Wi-Fi:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2801:16a2:c184:6d66:73f6:39f5:ab4f:6bad
    IPv6 Address. . . . . : 2801:16a2:c184:6d66:c2ab:2ecb:b11d:2
    IPv6 Address. . . . . : fdc2:ab2e:cbb1:1d00:e214:7884:f834:1df8
    Temporary IPv6 Address. . . . . : 2801:16a2:c184:6d66:2140:e4b4:30dc:ddcf
    Temporary IPv6 Address. . . . . : fdc2:ab2e:cbb1:1d00:2140:e4b4:30dc:ddcf
    Link-local IPv6 Address . . . . . : fe80::f6b9:d95a:f378:6c41%15
    IPv4 Address. . . . . : 192.168.8.106
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : fe80::c0ab:2eff:feeb:b11d%15
                                192.168.8.1

Ethernet adapter شبكة لاسلكية Bluetooth:

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

PS C:\Users\seham> |
```

Part3: Checking Network Security (lujain al-kenani , shaima lafi)

It will focus on securing the network by implementing several basic steps. We will analyze how to update the security settings in the router, enable advanced encryption protocols, and ensure the protection of data transmitted over the network. This part aims to enhance network security, protect connected devices, and ensure user privacy.

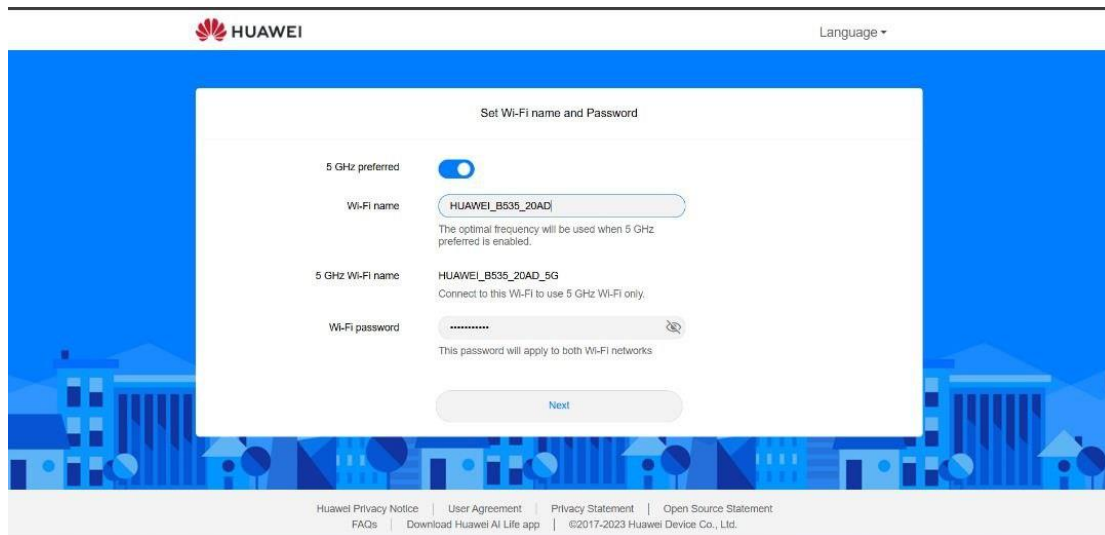
1.Connect to your router's web interface using its IP address 192.168.8



Log in with the admin credentials (password)



Changing Default Credentials: And Changing the Network Name (SSID)



The screenshot shows the 'Set Wi-Fi name and Password' screen on a Huawei device. The background is a blue cityscape illustration. At the top, there is a Huawei logo and a 'Language' dropdown menu. The main content area is a white card with the title 'Set Wi-Fi name and Password'. Inside the card, there are four settings: '5 GHz preferred' with a toggle switch turned on; 'Wi-Fi name' with a text field containing 'HUAWEI_B535_20AD' and a note below it stating 'The optimal frequency will be used when 5 GHz preferred is enabled.'; '5 GHz Wi-Fi name' with a text field containing 'HUAWEI_B535_20AD_5G' and a note below it stating 'Connect to this Wi-Fi to use 5 GHz Wi-Fi only.'; and 'Wi-Fi password' with a masked text field and a note below it stating 'This password will apply to both Wi-Fi networks'. At the bottom of the card is a 'Next' button. Below the card, there is a footer with links: 'Huawei Privacy Notice', 'User Agreement', 'Privacy Statement', 'Open Source Statement', 'FAQs', 'Download Huawei AI Life app', and '©2017-2023 Huawei Device Co., Ltd.'.

HUAWEI Language ▾

Set Wi-Fi name and Password

5 GHz preferred ☒

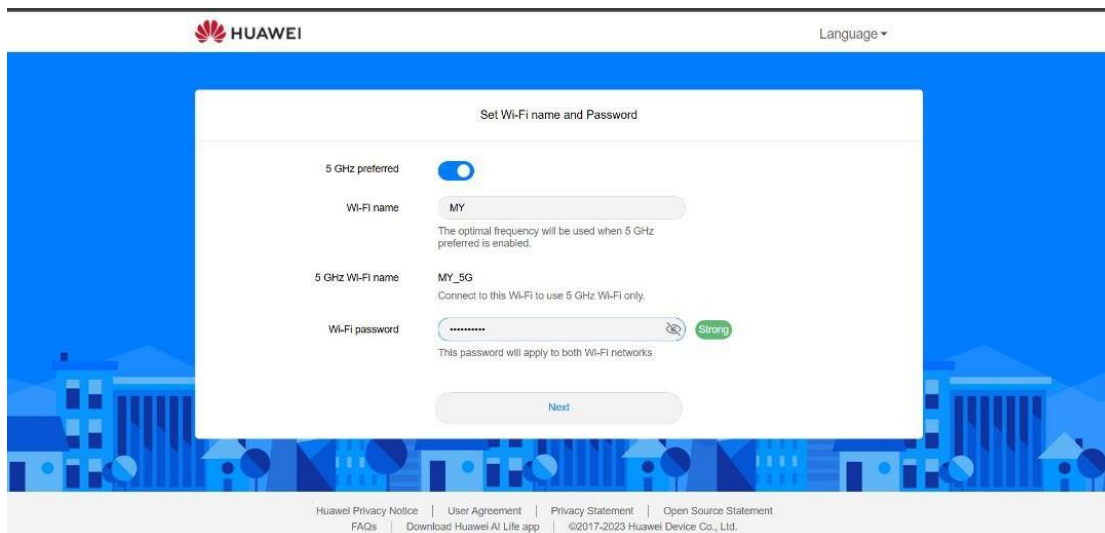
Wi-Fi name HUAWEI_B535_20AD
The optimal frequency will be used when 5 GHz preferred is enabled.

5 GHz Wi-Fi name HUAWEI_B535_20AD_5G
Connect to this Wi-Fi to use 5 GHz Wi-Fi only.

Wi-Fi password
This password will apply to both Wi-Fi networks

Next

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The screenshot shows the same 'Set Wi-Fi name and Password' screen, but with custom settings. The '5 GHz preferred' toggle is still on. The 'Wi-Fi name' text field now contains 'MY' and the note below it is the same. The '5 GHz Wi-Fi name' text field now contains 'MY_5G' and the note below it is the same. The 'Wi-Fi password' text field is masked, and a green 'Strong' indicator is visible to the right of the field. The 'Next' button is at the bottom of the card. The footer is the same as in the first screenshot.

HUAWEI Language ▾

Set Wi-Fi name and Password

5 GHz preferred ☒

Wi-Fi name MY
The optimal frequency will be used when 5 GHz preferred is enabled.

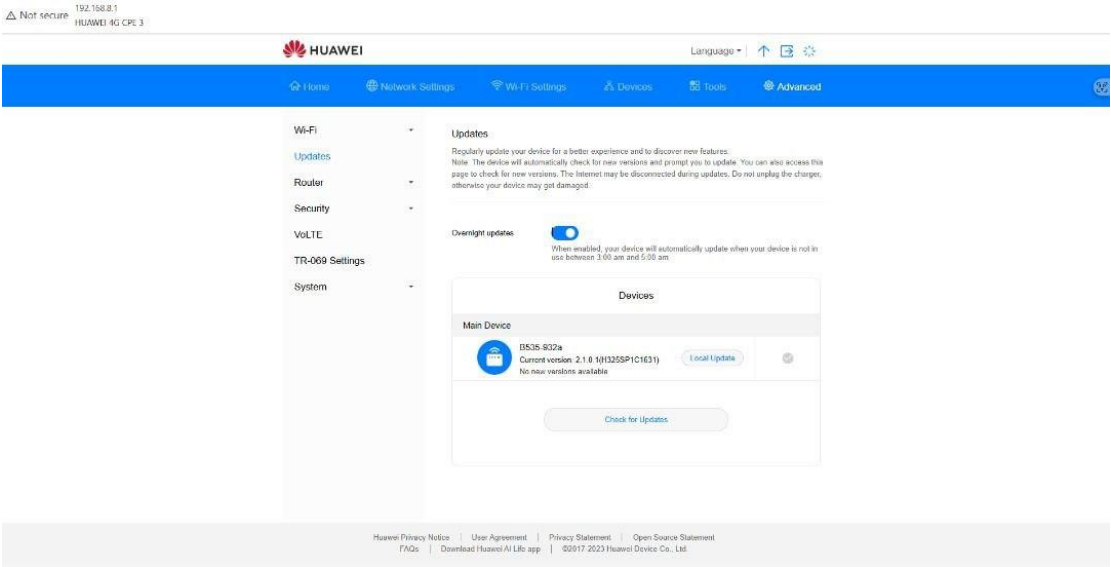
5 GHz Wi-Fi name MY_5G
Connect to this Wi-Fi to use 5 GHz Wi-Fi only.

Wi-Fi password Strong
This password will apply to both Wi-Fi networks

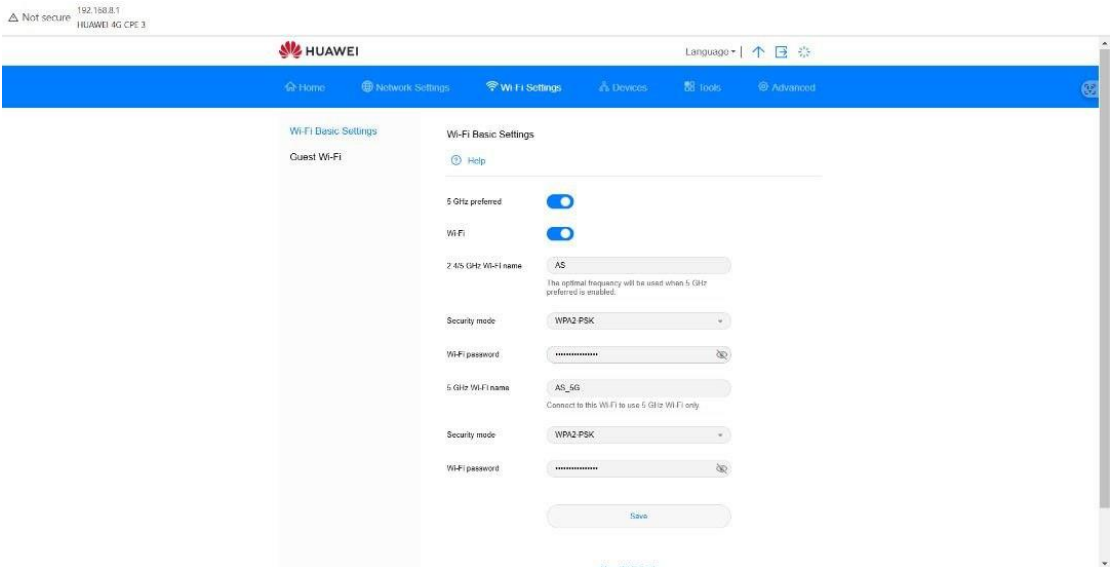
Next

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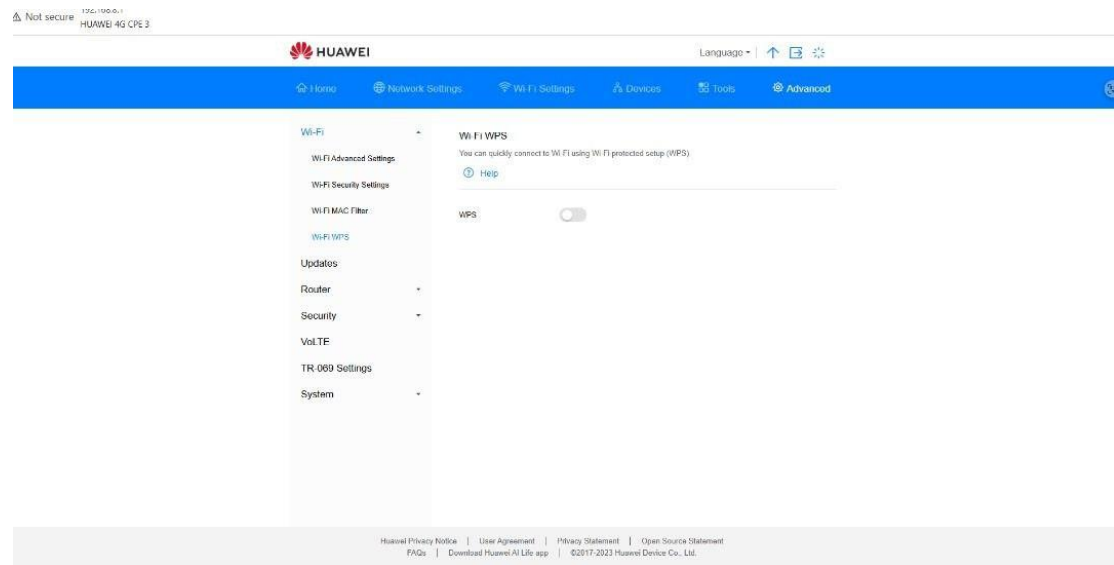
Updating Firmware:



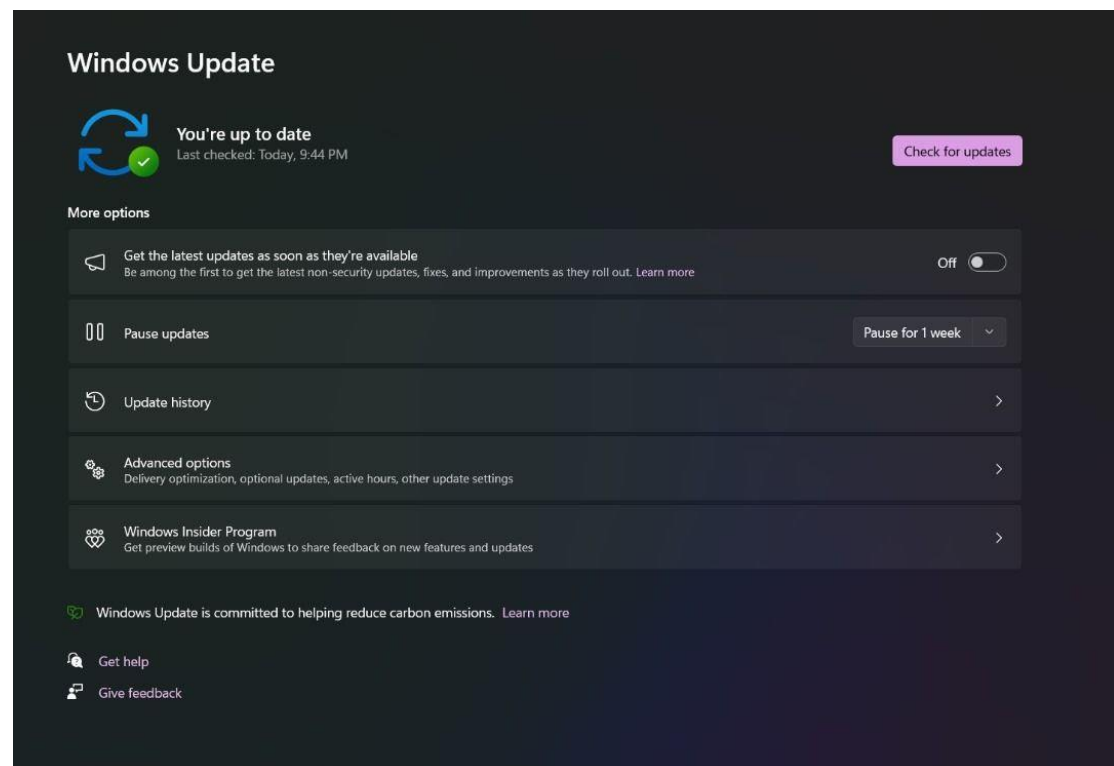
Wireless Network Security Protocol:



Disabling WPS:



Make sure that operating systems and applications are updated on all devices connected to your network, such as smartphones and computers, to enhance their security.



Network Traffic Analysis (Optional):

The image displays two screenshots of the Wireshark network traffic analysis tool. The top screenshot shows a list of captured packets, primarily HTTP GET requests to various API endpoints. The bottom screenshot shows a detailed view of a TCP connection, including the sequence of packets and the corresponding byte ranges.

Top Screenshot: Packet List

No.	Time	Source	Destination	Protocol	Length	Info
2511	73.484168	192.168.8.4	192.168.8.1	HTTP	658	GET /api/monitoring/converged-status HTTP/1.1
2512	72.684378	192.168.8.4	192.168.8.1	HTTP	658	GET /api/system/deviceinfo HTTP/1.1
2621	73.826810	192.168.8.4	192.168.8.1	HTTP	664	GET /api/user/web-feature-switch HTTP/1.1
2666	73.173195	192.168.8.4	192.168.8.1	HTTP	658	GET /api/system/deviceinfo HTTP/1.1
2677	73.198491	192.168.8.4	192.168.8.1	HTTP	668	GET /api/app/operatorinfo/lang-en.us HTTP/1.1
2679	73.193285	192.168.8.4	192.168.8.1	HTTP	617	GET /language/lang_en-us.js?v=172988130555 HTTP/1.1
3017	74.203950	192.168.8.4	192.168.8.1	HTTP	661	GET /api/global/module-switch HTTP/1.1
3031	74.215387	192.168.8.4	192.168.8.1	HTTP	665	GET /api/device/basic_information HTTP/1.1
3072	74.360190	192.168.8.4	192.168.8.1	HTTP	668	GET /api/app/operatorinfo/lang-en.us HTTP/1.1
3073	74.365113	192.168.8.4	192.168.8.1	HTTP	656	GET /api/webserver/token HTTP/1.1
3074	74.369410	192.168.8.4	192.168.8.1	HTTP	658	GET /api/lm/switch-ipmode HTTP/1.1
3126	74.594455	192.168.8.4	192.168.8.1	HTTP	668	GET /api/monitoring/converged-status HTTP/1.1
3138	74.651308	192.168.8.4	192.168.8.1	HTTP	612	GET /res/img_login.png HTTP/1.1
3139	74.663205	192.168.8.4	192.168.8.1	HTTP	664	GET /api/user/web-feature-switch HTTP/1.1
3243	74.698803	192.168.8.4	192.168.8.1	HTTP	668	GET /api/security/bridgemode HTTP/1.1
3257	74.741453	192.168.8.4	192.168.8.1	HTTP	665	GET /api/device/basic_information HTTP/1.1
3261	74.769511	192.168.8.4	192.168.8.1	HTTP	642	GET /res/smarthomeapp.png?r=1691492403 HTTP/1.1

Bottom Screenshot: Packet Details

Frame 167: 666 bytes on wire (5328 bits), 666 bytes captured (5328 bits) on interface 0
Ethernet II, Src: IntelCor_00:bf:db (14:4f:8a:a0:bf:db), Dst: e2:d1:99:ad:20:c0 (e2:d1:99:ad:20:c0)
Internet Protocol Version 4, Src: 192.168.8.4, Dst: 192.168.8.1
Transmission Control Protocol, Src Port: 7281, Dst Port: 80, Seq: 1, Ack: 1, Len: 612
Hypertext Transfer Protocol

Packet List (Bottom Screenshot):

No.	Time	Source	Destination	Protocol	Length	Info
9	8.631147	202.170.91.49	192.168.8.4	TCP	54	443 → 7050 [FIN, ACK] Seq=1 Ack=1 Win=0 Len=0
10	8.623384	202.170.91.49	192.168.8.4	TCP	85	[TCP Out-Of-Order] 443 → 7050 [PSH, ACK] Seq=4294967266 Ack=1 Win=83 Len=31
11	8.623961	192.168.8.4	202.170.91.49	TCP	54	7050 → 443 [ACK] Seq=1 Ack=4294967266 Win=513 Len=0
12	8.624143	192.168.8.4	202.170.91.49	TCP	54	7050 → 443 [ACK] Seq=1 Ack=2 Win=513 Len=0
13	8.627305	202.170.91.49	192.168.8.4	TCP	54	443 → 7049 [FIN, ACK] Seq=1 Ack=1 Win=0 Len=0
14	8.677787	202.170.91.49	192.168.8.4	TCP	85	[TCP Out-Of-Order] 443 → 7049 [PSH, ACK] Seq=4294967266 Ack=1 Win=83 Len=31
15	8.828041	202.170.91.49	192.168.8.4	TCP	85	9443 → 7049 [PSH, ACK] Seq=1 Ack=1 Win=83 Len=31
16	8.828042	202.170.91.49	192.168.8.4	TCP	100	[TCP Out-Of-Order] 9443 → 7049 [PSH, ACK] Seq=4294967251 Ack=1 Win=83 Len=40
17	8.828043	202.170.91.49	192.168.8.4	TCP	54	9443 → 7049 [FIN, ACK] Seq=32 Ack=1 Win=83 Len=0
18	8.828197	192.168.8.4	202.170.91.49	TCP	54	7048 → 443 [ACK] Seq=1 Ack=4294967266 Win=510 Len=0
19	8.828924	192.168.8.4	202.170.91.49	TCP	54	7048 → 443 [ACK] Seq=1 Ack=2 Win=510 Len=0
20	8.829059	192.168.8.4	202.170.91.49	TCP	66	7049 → 9443 [ACK] Seq=1 Ack=4294967251 Win=510 Len=0 SLE=1 SRE=32
21	8.829143	192.168.8.4	202.170.91.49	TCP	54	7049 → 9443 [ACK] Seq=1 Ack=32 Win=510 Len=0
22	8.829217	192.168.8.4	202.170.91.49	TCP	54	7049 → 9443 [ACK] Seq=1 Ack=33 Win=510 Len=0
23	8.829347	192.168.8.4	202.170.91.49	TCP	54	7049 → 9443 [FIN, ACK] Seq=1 Ack=33 Win=510 Len=0
24	9.134574	202.170.91.49	192.168.8.4	TCP	54	9443 → 7049 [ACK] Seq=33 Ack=2 Win=83 Len=0
25	9.134718	202.170.91.49	192.168.8.4	TCP	54	[TCP Dup ACK 2441] 9443 → 7049 [ACK] Seq=33 Ack=2 Win=83 Len=0

**Frame 1: 55 bytes on wire (440 bits), 55 bytes captured (440 bits) on interface 0
Ethernet II, Src: IntelCor_00:bf:db (14:4f:8a:a0:bf:db), Dst: e2:d1:99:ad:20:c0 (e2:d1:99:ad:20:c0)
Internet Protocol Version 4, Src: 192.168.8.4, Dst: 20.198.119.163
Transmission Control Protocol, Src Port: 5569, Dst Port: 443, Seq: 1, Ack: 1, Len: 1**

Packet Bytes:
0000 e2 d1 99 ad 20 c0 14 4f 8a a0 bf db 08 00 45 00
0010 00 10 40 15 00 00 00 0c 00 00 00 00 00 00 00 00