NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS LAB

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IN LAB TASKS

Lab Task 1

1.1 Network Configuration

Step 1. Connect to the Internet.

Establish and verify connectivity to the Internet. This step ensures the computer has an IP address.

Step 2. Gather TCP/IP configuration information.

- Use the Start menu to open the command prompt (Start Programs Accessories Command
- Prompt or Start Programs Command Prompt).
- Type ipconfig and press Enter key. The spelling of the ipconfig is critical, but the case is not.
- The screen shows the IP address, subnet mask and the default gateway. The IP address and the default gateway should be in the same network or subnet; otherwise this host wouldn't be able to communicate outside the network

Output:

```
C:\Users\hp>ipconfig
```

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : mshome.net
   Link-local IPv6 Address . . . . . : fe80::85db:1551:2ee5:928a%13
   IPv4 Address. . . . . . . . . . . : 192.168.137.242
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.137.1
```

Step 3. Record the following TCP/IP information for this computer.

a. IP address:

Fe80::85db:1551:2ee5:928a%13

b. Subnet mask:

255.255.255.0

c. Default gateway:

192.168.137.1

Step 4. Compare this computer's TCP/IP configuration to that of others on the LAN. If this computer is on a LAN, compare the information of several machines (Hosts).

a. **Are there any similarities?**
   Yes! the first three bits or octet of IP addresses of all the devices is same which is : 10.4.20. The network part is same as the lab is the network while the host part is different.
b. **What is similar about the IP addresses?**

The first three bits of ip addresses of all the devices is same which is : 10.4.20

c. **What is similar about the default gateway?**

Default gateways of all the devices are same as well as the sub net masks.

d. Record a couple of the IP addresses (of your nearby hosts)

1. 192.168.137.63

2.192.168.137.288

3 192.168.137.184

Step 5. Check additional TCP/IP configuration information.

a. **To see more information, type ipconfig/all and press Enter key. The figure shows the detailed IP configuration of this computer on the screen.**

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

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : mshome.net
   Description . . . . . . . . . . . : Intel(R) Dual Band Wireless-AC 8265
   Physical Address. . . . . . . . . : F4-D1-08-8F-8E-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::85db:1551:2ee5:928a%13(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.137.242(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Thursday, September 18, 2025 1:36:38 PM
   Lease Expires . . . . . . . . . . : Thursday, September 25, 2025 2:28:11 PM
   Default Gateway . . . . . . . . . : 192.168.137.1
   DHCP Server . . . . . . . . . . . : 192.168.137.1
   DHCPv6 IAID . . . . . . . . . . . : 116707592
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2E-69-20-AF-B0-0C-D1-C4-4E-7D
   DNS Servers . . . . . . . . . . . : fe80::f5df:63c1:1cc0:fe6b%13
                                       192.168.137.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       mshome.net
```

b. You should see the following information:

The host name (computer name) : AYESHA
Physical address of this machine: B0-0C-D1-C4-4E-7D
IP address: 192.168.137.242
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.137.1
DNS Servers: 192.168.137.1

c. In the LAN, compare your result with a few nearby computers. What similarities do you see in the physical (MAC) address?

When I compared my computer's MAC address with other computers, the first three parts were the same and the last part was also the same. For the IP addresses, the first three octets were the same and only the last octet was different. The subnet mask and default gateway were the same on all computers.

d. Write down the computer's host name:

AYESHA

e. Write down the host names of a couple of other computer:

- Saif-Probook
- DESKTOP-TM6DVG3

- DESKTOP-196N200
- DESKTOP-M5NRCKD

1.2 Using PING, TRACERT , PATHPING from a Workstation

Sept 1. Establish and verify connectivity to the Internet. This step ensures that the computer has an IP address.

Step 2. Open the Command prompt. Ping the IP address of another computer.

a. In the window, type ping, a space, and the IP address of a computer recorded above.

```
C:\Users\hp>ping 192.168.137.68

Pinging 192.168.137.68 with 32 bytes of data:
Reply from 192.168.137.242: Destination host unreachable.
Reply from 192.168.137.242: Destination host unreachable.
Reply from 192.168.137.242: Destination host unreachable.
Reply from 192.168.137.242: Destination host unreachable.

Ping statistics for 192.168.137.68:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

Ping uses the Internet Control Message Protocol(ICMP) echo-request and echo-reply feature to test physical connectivity. Because ping reports on four attempts, it gives an indication the reliability of the connection. Look over the result and verify that the ping was successful. Was the ping successful**?** If not, report to the instructor.

Answer:

My ping was not successful as I was on my laptop being, not part of the lab network that is why the request to connect with the lab computer failed. I pinged the default gateway (10.5.1.1), and it replied successfully with 0% packet loss. This proves that my laptop was connected to the network and able to communicate with the router. The failure to ping other computers was not due to my network connection, but most likely due to firewall settings, ICMP blocking, or network isolation.

b. Ask the IP address of the nearby computers and ping. Note the result.

```
C:\Users\hp>ping 10.5.1.34

Pinging 10.5.1.34 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.5.1.34:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

d. Ping the IP address of Default gateway and DNS servers. Was the result succesful?

Ping DNS server:

Yes! The ping was successful as you can see below:

```
C:\Users\hp>ping 192.168.18.1

Pinging 192.168.18.1 with 32 bytes of data:
Reply from 192.168.18.1: bytes=32 time=2ms TTL=64
Reply from 192.168.18.1: bytes=32 time=3ms TTL=64
Reply from 192.168.18.1: bytes=32 time=5ms TTL=64
Reply from 192.168.18.1: bytes=32 time=2ms TTL=64

Ping statistics for 192.168.18.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 5ms, Average = 3ms
```

Ping Default gateway:

Yes! The ping was successful as you can see below:

```
C:\Users\hp>ping 192.168.18.1

Pinging 192.168.18.1 with 32 bytes of data:
Reply from 192.168.18.1: bytes=32 time=2ms TTL=64
Reply from 192.168.18.1: bytes=32 time=7ms TTL=64
Reply from 192.168.18.1: bytes=32 time=2ms TTL=64
Reply from 192.168.18.1: bytes=32 time=2ms TTL=64

Ping statistics for 192.168.18.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 7ms, Average = 3ms
```

e. Ping the computer's loopback IP address. Type the following command:

ping 127.0.0.1 The address 127.0.0.1 is reserved for loopback testing. If the ping is successful, then TCP/IP is properly installed and functioning on this computer.

```
C:\Users\hp>ping 127.0.0.1

Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Ping statistics for 127.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\hp>
```

f. Was the ping successful for d?

Yes! The ping was successful. I did a loopback ping (ping 127.0.0.1) and it replied successfully. This shows that my computer is able to talk to itself and its network software (TCP/IP) is working properly.

f. Ping the hostname of the computer that you recorded in previous task.

```
C:\Users\hp>ping AYESHA

Pinging AYESHA [fe80::a476:684d:8b1a:1346%12] with 32 bytes of data:
Reply from fe80::a476:684d:8b1a:1346%12: time<1ms
Reply from fe80::a476:684d:8b1a:1346%12: time<1ms
Reply from fe80::a476:684d:8b1a:1346%12: time<1ms
Reply from fe80::a476:684d:8b1a:1346%12: time<1ms
```

g. Ping the Microsoft website(www.microsoft.com) and record result.

```
C:\Users\hp> ping www.microsoft.com

Pinging e13678.dscb.akamaiedge.net [23.218.109.219] with 32 bytes of data:
Reply from 23.218.109.219: bytes=32 time=99ms TTL=52
Reply from 23.218.109.219: bytes=32 time=102ms TTL=52
Reply from 23.218.109.219: bytes=32 time=99ms TTL=52
Reply from 23.218.109.219: bytes=32 time=99ms TTL=52

Ping statistics for 23.218.109.219:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 99ms, Maximum = 102ms, Average = 99ms
```

Step 3. Trace the route to the NUTECH university website: type

tracert www.nutech.edu.pk and press Enter key.

The result shows the complete route to the site and the number of hops in path.

```
C:\Users\hp>tracert www.nutech.edu.pk

Tracing route to www.nutech.edu.pk [104.21.82.247]
over a maximum of 30 hops:

  1     3 ms     2 ms     2 ms  192.168.18.1
  2     4 ms     4 ms     4 ms  10.237.128.1
  3     6 ms     4 ms     8 ms  10.235.2.29
  4     4 ms     4 ms     4 ms  149.40.226.241
  5    24 ms    23 ms    23 ms  110.93.253.110
  6    30 ms    28 ms    31 ms  110.93.252.246
  7   101 ms   104 ms   107 ms  13335.sgw.equinix.com [27.111.228.132]
  8   109 ms   109 ms   101 ms  162.158.160.165
  9   100 ms   100 ms   101 ms  104.21.82.247

Trace complete.
```

Step 4. Close the window. Also see "pathping ip or host" command. Which only shows path from source to destination.

```
C:\Users\hp>pathping www.nutech.edu.pk

Tracing route to www.nutech.edu.pk [104.21.82.247]
over a maximum of 30 hops:
  0  AYESHA [192.168.18.154]
  1  192.168.18.1
  2  10.237.128.1
  3  10.235.2.29
  4  149.40.226.241
  5  110.93.253.110
  6  110.93.252.246
  7     *     13335.sgw.equinix.com [27.111.228.132]
  8  162.158.160.165
  9  104.21.82.247

Computing statistics for 225 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           AYESHA [192.168.18.154]
                                     0/ 100 =  0%   |
  1    3ms     0/ 100 =  0%     0/ 100 =  0%  192.168.18.1
                                     3/ 100 =  3%   |
  2    5ms     4/ 100 =  4%     1/ 100 =  1%  10.237.128.1
                                     0/ 100 =  0%   |
  3    5ms     3/ 100 =  3%     0/ 100 =  0%  10.235.2.29
                                     0/ 100 =  0%   |
  4    7ms     4/ 100 =  4%     1/ 100 =  1%  149.40.226.241
                                     0/ 100 =  0%   |
  5   25ms     6/ 100 =  6%     3/ 100 =  3%  110.93.253.110
                                     0/ 100 =  0%   |
  6   28ms     3/ 100 =  3%     0/ 100 =  0%  110.93.252.246
                                     0/ 100 =  0%   |
  7  103ms     7/ 100 =  7%     4/ 100 =  4%  13335.sgw.equinix.com [27.111.228.132]
                                     0/ 100 =  0%   |
  8  103ms     3/ 100 =  3%     0/ 100 =  0%  162.158.160.165
                                     1/ 100 =  1%   |
  9  102ms     4/ 100 =  4%     0/ 100 =  0%  104.21.82.247

Trace complete.
```

Lab Task 02

Explore 10 cmd networking related commands.

1. **ping <IP or website>** – Tests if you can reach another computer or website

   ping www.nutech.edu.pk:

```
C:\Users\hp>ping www.nutech.edu.pk

Pinging www.nutech.edu.pk [203.124.43.228] with 32 bytes of data:
Reply from 203.124.43.228: bytes=32 time=5ms TTL=52
Reply from 203.124.43.228: bytes=32 time=4ms TTL=52
Reply from 203.124.43.228: bytes=32 time=38ms TTL=52
Reply from 203.124.43.228: bytes=32 time=3ms TTL=52

Ping statistics for 203.124.43.228:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 38ms, Average = 12ms
```

2. **tracert <website>** – Shows the path (hops) taken to reach a website

   www.google.com**:**

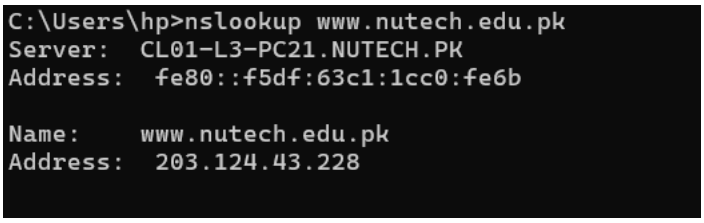
```
C:\Users\hp>tracert www.google.com

Tracing route to www.google.com [142.250.202.228]
over a maximum of 30 hops:

  1     2 ms     *        2 ms  CL01-L3-PC21.mshome.net [192.168.137.1]
  2     *        *        *     Request timed out.
  3     1 ms     1 ms     4 ms  10.5.1.1
  4     8 ms     5 ms     1 ms  10.1.0.10
  5     8 ms    17 ms     3 ms  mbl-99-54-233.dsl.net.pk [203.99.54.233]
  6     3 ms     3 ms     2 ms  172.16.33.57
  7     3 ms     2 ms     5 ms  172.31.5.29
  8     9 ms     2 ms     2 ms  172.31.5.206
  9     3 ms     2 ms     3 ms  172.31.5.170
 10     3 ms     2 ms     3 ms  110.93.202.134
 11    24 ms    23 ms    29 ms  110.93.253.110
 12    24 ms    23 ms    28 ms
```

3. **pathping <website>** – Ping + tracert, also shows packet loss

   pathping www.instagram.com:

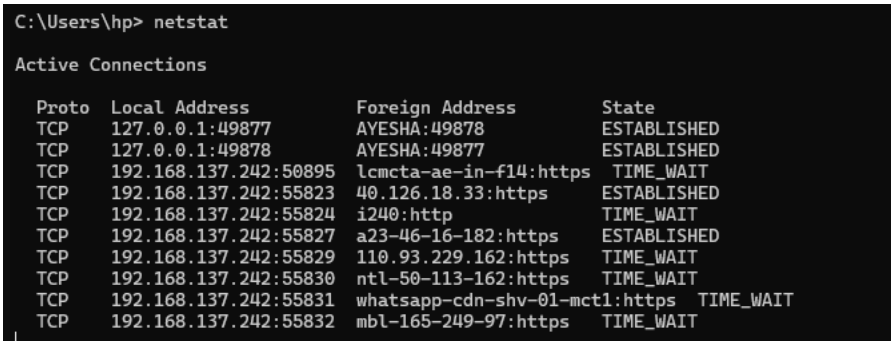
```
C:\Users\hp>pathping www.instagram.com

Tracing route to z-p42-instagram.c10r.instagram.com [157.240.227.174]
over a maximum of 30 hops:
  0  AYESHA.mshome.net [192.168.137.242]
  1  CL01-L3-PC21.mshome.net [192.168.137.1]
  2     *        *        *
```

4. **nslookup <website>** – Finds the IP address of a website (DNS check)



5. **getmac** – Displays your computer's MAC address

6. **netstat** – Shows active network connections



7. **netsh wlan show profiles** – Lists all saved Wi-Fi networks on your PC

```
C:\Users\hp>netsh wlan

The following commands are available:

Commands in this context:
?               - Displays a list of commands.
add             - Adds a configuration entry to a table.
connect         - Connects to a wireless network.
delete          - Deletes a configuration entry from a table.
disconnect      - Disconnects from a wireless network.
dump            - Displays a configuration script.
export          - Saves WLAN profiles to XML files.
help            - Displays a list of commands.
IHV             - Commands for IHV logging.
refresh         - Refresh hosted network settings.
reportissues    - Generate WLAN smart trace report.
set             - Sets configuration information.
show            - Displays information.
start           - Start hosted network.
stop            - Stop hosted network.

To view help for a command, type the command, followed by a space, and then
 type ?.
```

8. **ipconfig /release: Releases new ip addresses:**

```
C:\Users\hp>ipconfig /release

Windows IP Configuration

No operation can be performed on Local Area Connection* 1 while it has
 its media disconnected.
```

9. **cls**: Clears the Screen

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : mshome.net
   Link-local IPv6 Address . . . . . : fe80::85db:1551:2ee5:928a%13
   IPv4 Address. . . . . . . . . . . : 192.168.137.242
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.137.1

C:\Users\hp>cls
```

As we can see above that there is some other commands so clc clears.As you can see below that now the screen is clear.

```
C:\Users\hp>
```

10. **hostname** – Displays your computer's name

```
C:\Users\hp>hostname
AYESHA
```

Lab Task 03

Create your cisco id (https://id.cisco.com/signin/register)

1. First, I went to https://id.cisco.com/signin/register.
2. Then I entered my **email address** and created a **password**.
3. After that, I completed the registration process and my Cisco account was created successfully.
4. Finally, I signed in with the same email and password to confirm that my account is working.

(Below is the picture as proof of successful login)

Lab Task 04

Study of following Network Devices in Detail

- **Repeater**
- **Hub**
- **Switch**
- **Bridge**
- **Router**

● **Gate Way**

Prepare an approximately 2-page report on the above topic detailing only the content that you understand.

Repeater:

- A **Repeater** is used in networks to extend the physical distance of a connection.
- **Technical Role:** It works purely at the Physical Layer (Layer 1) of the OSI model.
- **What It Does:** It receives a weak or corrupted signal, regenerates it, and sends it forward without changing the data.
- **Specialty:** It does not read MAC or IP addresses — it simply cleans and boosts the signal.
- **Use Case:** Used in long Ethernet cables (older networks) or in Wi-Fi range extenders.
- **Professional Insight:** Modern networks rarely use separate repeaters because switches already have signal regeneration built-in, but repeaters are still very common in wireless networks (Wi-Fi repeaters/mesh nodes).

Hub:

- A Hub is the simplest form of a network connection device.
- **Technical Role:** Works at Physical Layer (Layer 1**)** just like a repeater.
- **What It Does:** When it receives a frame from one device, it broadcasts it to all ports.
- **Specialty:**
  - It does not filter traffic — every computer connected receives every packet.
  - This causes collisions in Ethernet networks, which slows them down.
- **Professional Insight:**
  - Because hubs create a single collision domain, they are now considered obsolete and replaced by switches.
  - They are still used in labs for packet sniffing because hubs allow you to see all network traffic easily (good for learning).

Switch:

- A **Switch** is one of the most important network devices.

- **Technical Role:** Works at Data Link Layer (Layer 2)**,** but modern switches can work at Layer 3 as well (called Layer-3 Switches).
- **What It Does:**
  - Switches use MAC address tables to send frames only to the correct destination port instead of broadcasting to everyone.
  - This eliminates collisions and increases performance.
- **Specialty:**
  - Maintains a CAM (Content Addressable Memory) Table where MAC addresses are mapped to ports.
  - Supports full-duplex communication**,** meaning devices can send and receive data simultaneously.
  - Can perform VLAN segmentation for network security and management.
- **Professional Insight:**
  - Managed switches can monitor traffic, configure VLANs, limit bandwidth, and even implement security rules (Port Security).
  - Enterprise networks rely heavily on switches for segmentation and security.

Bridge:

- A **Bridge** is like a simpler version of a switch.
- **Technical Role:** Operates at the Data Link Layer (Layer 2)**.**
- **What It Does:** Connects two network segments and filters traffic based on MAC address.
- **Specialty:**
  - Reduces collisions by dividing a network into multiple collision domains.
  - Learns MAC addresses by listening to incoming frames and builds a table to forward traffic efficiently.
- **Professional Insight:**
  - Physical bridges are rare now because switches have replaced them, but the concept of bridging still exists in Wi-Fi (when you "bridge" a wireless network with a wired one).
  - Used in Virtual Machines (VMware/Hyper-V) as a virtual bridge between host and guest network adapters.

Router:

- A Router is a highly intelligent device that connects multiple networks together.
- **Technical Role:** Works at Network Layer (Layer 3)**.**
- **What It Does:**
  - Uses IP addresses to decide where to forward packets.
  - Maintains a routing table and uses algorithms like RIP, OSPF, EIGRP, BGP to find the best path.
- **Specialty:**
  - Can perform NAT (Network Address Translation) allowing multiple devices to share one public IP.
  - Separates broadcast domains**,** so broadcasts don't flood the whole network.
  - Can apply Access Control Lists (ACLs**)** for security.
- **Professional Insight:**
  - Routers can be physical (Cisco, MikroTik) or software-based (pfSense).
  - Home Wi-Fi routers are actually 3 devices in one: Router + Switch + Access Point.

Gateway:

- A Gateway is the entry/exit point for a network — it connects two different types of networks**.**
- **Technical Role:** Works at multiple OSI layers**,** depending on what protocol conversion is happening.
- **What It Does:**
  - Converts data from one protocol to another (for example, IP to another protocol).
  - Your default gateway is usually your router's IP address.
- **Specialty:**
  - Without a gateway, your computer cannot communicate with devices outside its local network.
  - Gateways can also perform firewalling, filtering, or proxying traffic.
- **Professional Insight:**
  - In enterprise networks, a dedicated gateway firewall is often used to protect the entire network from the internet.
  - VPN gateways allow secure remote access to private networks.