Worksheet 8

Introduction:

Through this worksheet, first, you will learn the infrastructure of a simple home network and how your devices, such as smartphones, laptops, desktops, etc. connect with the home router through different network adapters. It also includes how the machines will get IP addresses dynamically and how to apply an IP address manually to a particular adapter. Further, you will also learn to use command, such as ipconfig, Ping and Tracert to verify the IP address and test the connectivity.

Objectives:

- Understand what is a simple home network
- Understand how devices (Smart phone/laptop/desktop) connect with the home router
- Use ipconfig command to verify the IP address for the corresponding adapter in use
- Verify how the machine/adapter receive an IP address (Dynamically)
- How to apply a static IP to the corresponding adapter
- Use ping, tracert command to test the connectivity with the default gateway
- Use ping, tracert command to test the connectivity to internet (8.8.8.8)

What is a Home Network?

A **home network** is a group of devices, such as computers, game systems, printers, and mobile devices, that connect to the Internet and each other. It facilitates communication among devices within the close vicinity of a home.

Main components:
- **End Devices** - computers, game systems, printers, mobile devices and etc.
- **Intermediate Devices** – Broadband Gateway (Home router)
- **ISP** – Internet Service Provider (Dialog, SLTMobitel, etc.)
- **Media Types** – Wired (Ethernet cable/Fiber Cable), Wireless
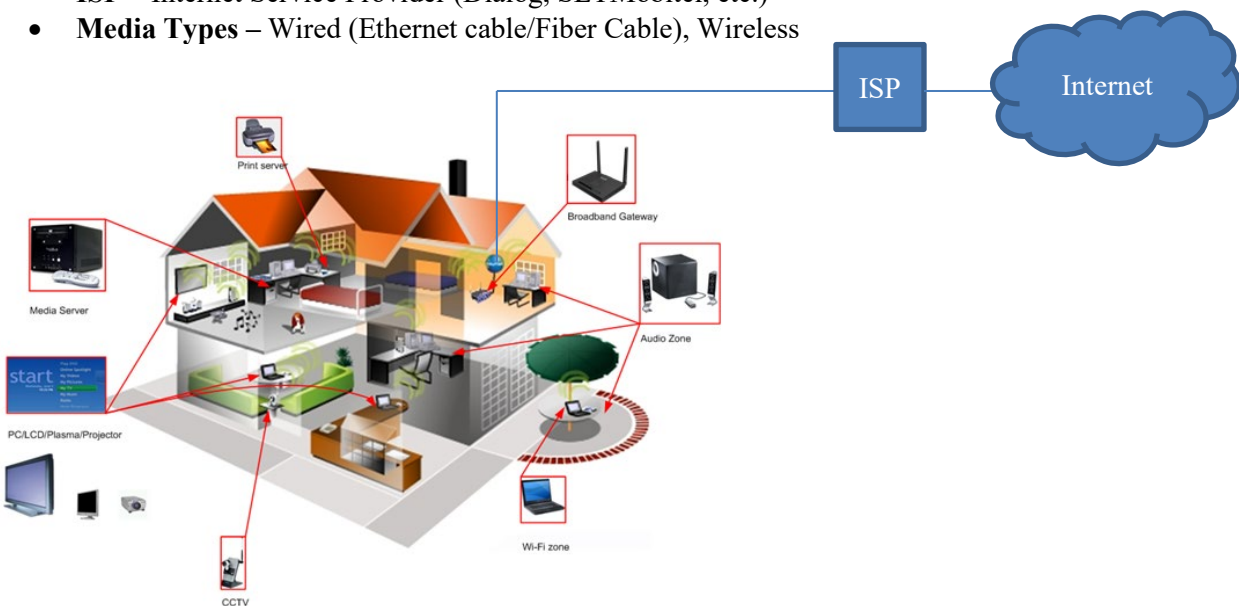
How devices connect with home router?

A **network adapter** is a piece of hardware that acts as the interface for a device to a network. This way, the device can communicate across a network.

Types of Network Adapters
- Network Interface Card
- USB Adapters
- PCI Adapters

Network Interface Card (NIC)

NIC is installed on the device's motherboard. This includes wired-capable devices, like desktops and laptops, and also tablets, cellphones, and other wireless devices. However, a network card is different in that it's an additional device that enables wireless or wired capabilities on a device that didn't previously support it. For example, a wired-only desktop computer that doesn't have a wireless NIC can use a wireless network adapter to interface with Wi-Fi.

Network adapters transmit and receive data on both wired and wireless networks. One wireless network adapter may have an antenna attached to it to maximize its potential for reaching a wireless network, but others may have the antenna hidden away within the device (Eg: Smartphones).
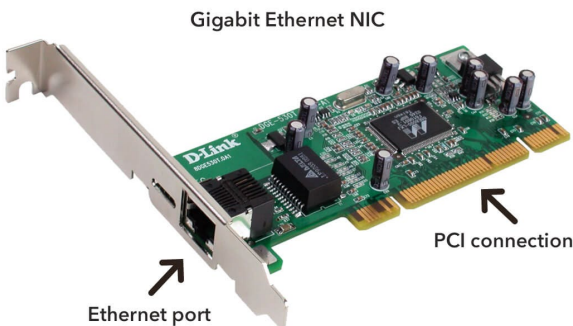
Ethernet NIC

Wireless NIC

How to connect your Laptop with the Home router using an Ethernet cable?

Ethernet Port on a Laptop

Ethernet Cable

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Verify IP addresses

1. Connect with your Home router
2. Open the Command prompt (cmd) and type "**ipconfig**" command to verify the addressing details for adapters in use.
   To get more detail, use **"ipconfig /all"**

```
Command Prompt                                                    —  □  ✕

Microsoft Windows [Version 10.0.19044.1645]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Dell>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : LAPTOP-U9T766TJ
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : sliitstaff.local

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : sliitstaff.local
   Description . . . . . . . . . . . : Realtek PCIe GbE Family Controller
   Physical Address. . . . . . . . . : E8-6A-64-5A-B8-A6
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : VirtualBox Host-Only Ethernet Adapter
   Physical Address. . . . . . . . . : 0A-00-27-00-00-16
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
```

*Scroll down to see more

3. If you're using wireless connection to connect with the home router, see the **Wireless LAN adapter Wi Fi** section to get the details

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : sliitstaff.local
   Description . . . . . . . . . . . : Qualcomm Atheros QCA9377 Wireless Network Adapter
   Physical Address. . . . . . . . . : F8-A2-D6-BB-F6-8D          ◄─── MAC Address
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::4db1:ac04:66d7:d266%16(Preferred)
   IPv4 Address. . . . . . . . . . . : 172.29.9.79(Preferred)     ◄─── IP Address
   Subnet Mask . . . . . . . . . . . : 255.255.248.0
   Lease Obtained. . . . . . . . . . : Tuesday, September 13, 2022 8:21:49 AM
   Lease Expires . . . . . . . . . . : Thursday, September 22, 2022 10:22:26 AM
   Default Gateway . . . . . . . . . : 172.29.8.1
   DHCP Server . . . . . . . . . . . : 172.16.20.3
   DHCPv6 IAID . . . . . . . . . . . : 133735126
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-23-84-DD-25-E8-6A-64-5A-B8-A6
   DNS Servers . . . . . . . . . . . : 172.16.10.10
                                       172.16.10.20
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

Default Gateway

A **default gateway** is a node within the router which makes it possible for devices in one network to communicate with devices in another network. If a computer, for example, requests a web page, the request goes through the default gateway before exiting the local network (LAN) to reach the internet. It is an intermediate point between the local network and the internet which transfers internal data to the internet and back again.
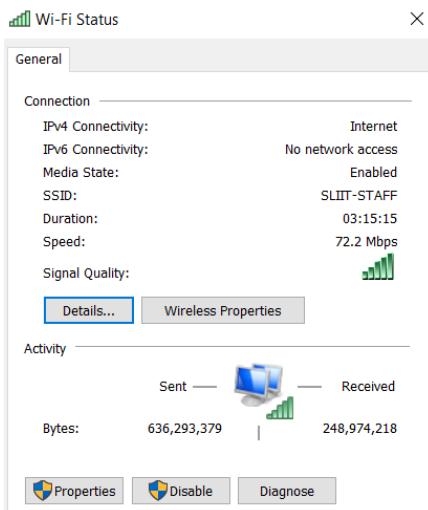
* If you're using wired connection to connect with the home router, see the **Ethernet adapter Ethernet** section to get the details

Verify how the device receives an IP address

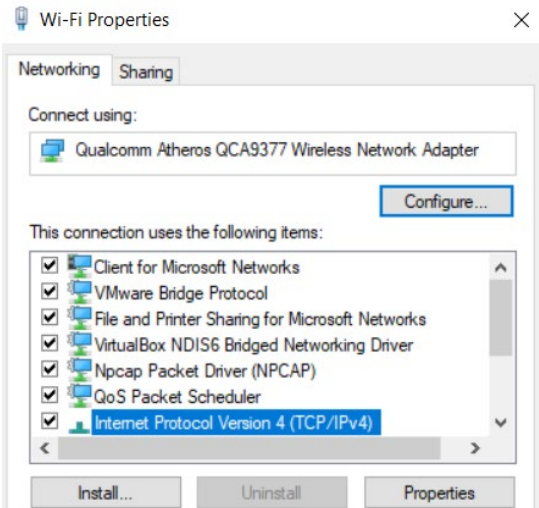4. On Windows go to, Control Panel > Network & Internet > Network & Sharing Center
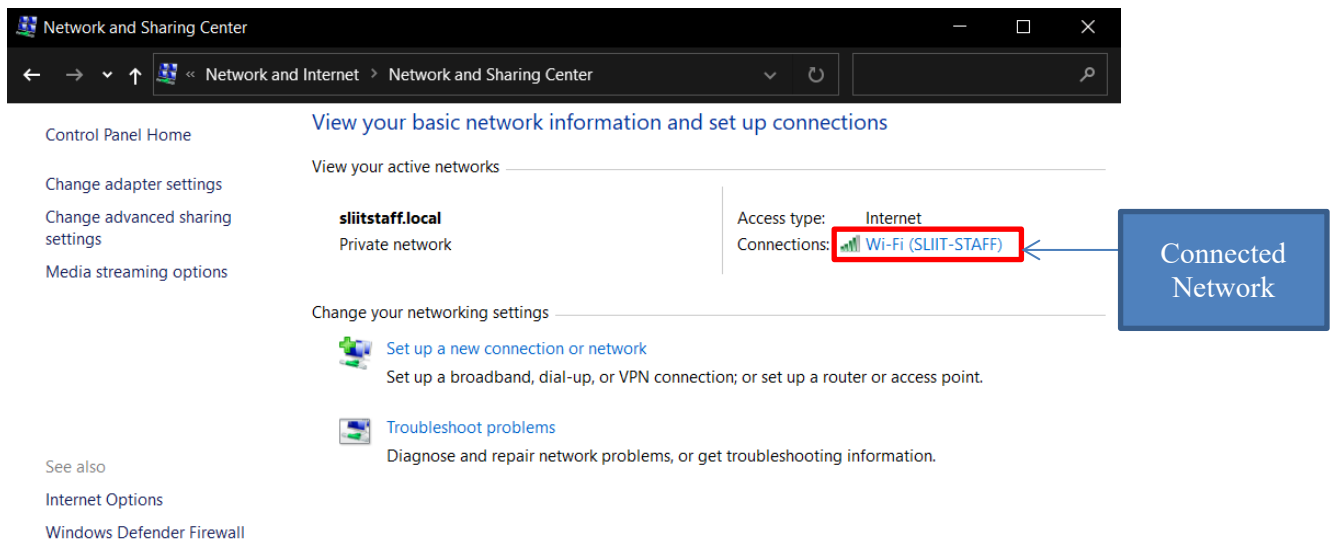
5. Click on the Connected Network and Go to **Properties**

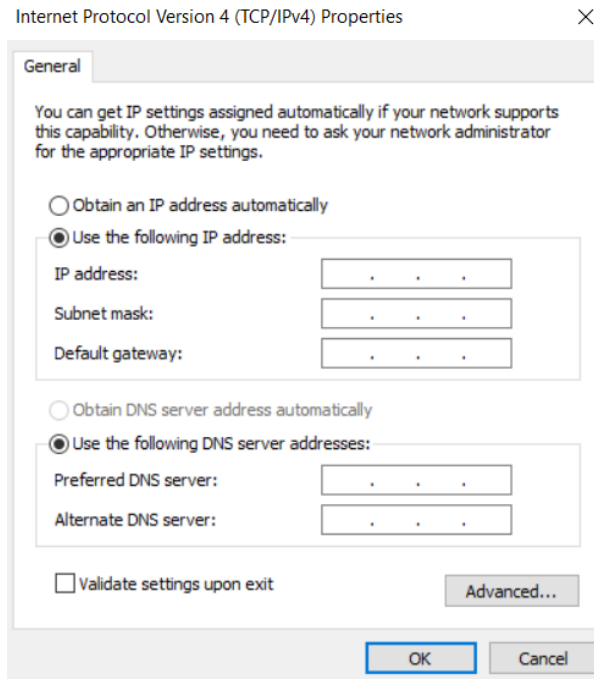6.   Select **Internet Protocol Version 4** and click **Properties**

> Obtaining addressing details automatically trough a DHCP server

The DHCP service is used to automatically assign address details to devices connected to a network. If the network has DHCP service enabled, your device will automatically receive the address details (machine IP address, default gateway IP, DNS server IP, etc.) after you connect to the network
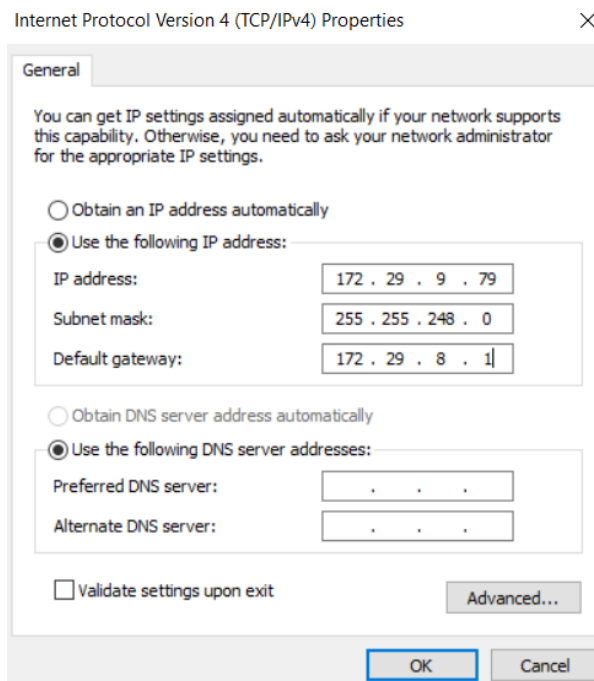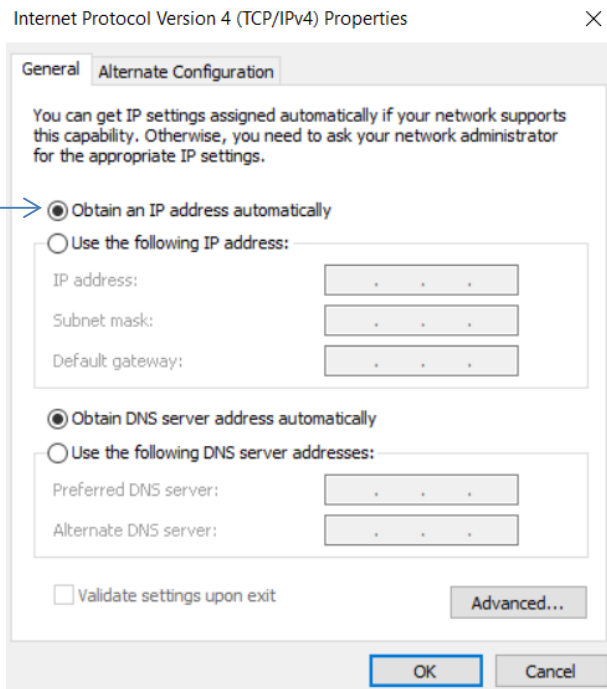
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Apply a static IP to a device

1. Click "**Use the following IP address**" button

Fill the following fields with relevant details according to network.
- IP address
- Subnet mask
- Default gateway

*You can refer step 3 to get the network details

2. Click "Ok" to apply the changes and click "Close" for the other opened tabs

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Test Connectivity

1. Test the connectivity with the default gateway

   Open the Command prompt (cmd) and type "**ping <IP address of the Default Gateway>**" to test the connectivity with the default gateway

   ```
   Command Prompt

   C:\Users\Dell>ping 172.29.8.1

   Pinging 172.29.8.1 with 32 bytes of data:
   Reply from 172.29.8.1: bytes=32 time=4ms TTL=255
   Reply from 172.29.8.1: bytes=32 time=3ms TTL=255
   Reply from 172.29.8.1: bytes=32 time=5ms TTL=255
   Reply from 172.29.8.1: bytes=32 time=3ms TTL=255

   Ping statistics for 172.29.8.1:
       Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
   Approximate round trip times in milli-seconds:
       Minimum = 3ms, Maximum = 5ms, Average = 3ms
   ```

   If you're receiving ICMP replies from the default gateway, the connection is successful. If not check the addressing details again.

   Type "**tracert <IP address of the Default Gateway>**" to check the path to the default gateway

   ```
   C:\Users\Dell>tracert 172.29.8.1

   Tracing route to 172.29.8.1 over a maximum of 30 hops

     1     3 ms     2 ms     3 ms  172.29.8.1

   Trace complete.
   ```

   The "tracert" command output will show you the IP address details for the intermediate nodes

2. Test the connectivity to the Internet

   Open the Command prompt (cmd) and type "**ping 8.8.8.8**" to test the connectivity to the Internet

   *8.8.8.8 is the primary DNS server for Google DNS.

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```
C:\Users\Dell>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=47ms TTL=120
Reply from 8.8.8.8: bytes=32 time=46ms TTL=120
Reply from 8.8.8.8: bytes=32 time=47ms TTL=120
Reply from 8.8.8.8: bytes=32 time=47ms TTL=120

Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 46ms, Maximum = 47ms, Average = 46ms
```

If you're receiving ICMP replies, the connection is successful.

Type "**tracert 8.8.8.8**" to check the path

```
C:\Users\Dell>tracert 8.8.8.8

Tracing route to dns.google [8.8.8.8]
over a maximum of 30 hops:

  1      5 ms     3 ms     4 ms  172.29.8.1
  2      5 ms     6 ms     3 ms  119.235.6.113
  3     11 ms    26 ms    34 ms  10.12.2.186
  4     12 ms    18 ms     8 ms  103.87.125.97
  5    124 ms   132 ms   131 ms  103.87.124.93
  6     60 ms    39 ms    38 ms  103.87.124.66
  7     47 ms    49 ms    49 ms  74.125.48.62
  8     70 ms    59 ms    56 ms  209.85.243.27
  9     48 ms    48 ms    58 ms  142.251.241.1
 10     48 ms    47 ms    48 ms  dns.google [8.8.8.8]

Trace complete.
```

Reference:
- https://www.youtube.com/watch?v=bBmQ9gcp1gk