Troubleshooting the Network Problem

- To help the home user answer the question,
  - “Is the Internet down… or just me?”
- To help a Network Administrator to determine,
  - “If the problem is on the Default Gateway”
- To help you answer the following questions when you can’t access common applications:
  - Is the problem on a device that I manage… or someone else manages?
  - Is the problem is in my network, which device I own/manage has the problem ?
  - If the problem is on my pc, which steps can I take to fix the problem?

Foundation of Networking

- What is “Networking “?
  - Exchanging Communication between two end devices using Medium
- Network Applications and prerequisites
  - Network Based application is aware of Network out there but doesn’t know how much network devices it has to cross before reaching destination
  - Addresses = IP Addresses
  - NIC Cards
  - Default Gateway
  - ISP = Internet Service Provider
  - DNS

- Ipconfig (In DOC command prompt)
  - What information do you know about IP to do your job?

C:\WINDOWS\system32\cmd.exe

```
C:\Users\amrit>ipconfig
```

ipconfig:

The IPCONFIG command displays all current TCP/IP network configuration values.

It gives you basic information to get your IP address, your router's IP address, DNS Server IP address, DHCP Server IP address, etc ...

ipconfig/all for detailed information

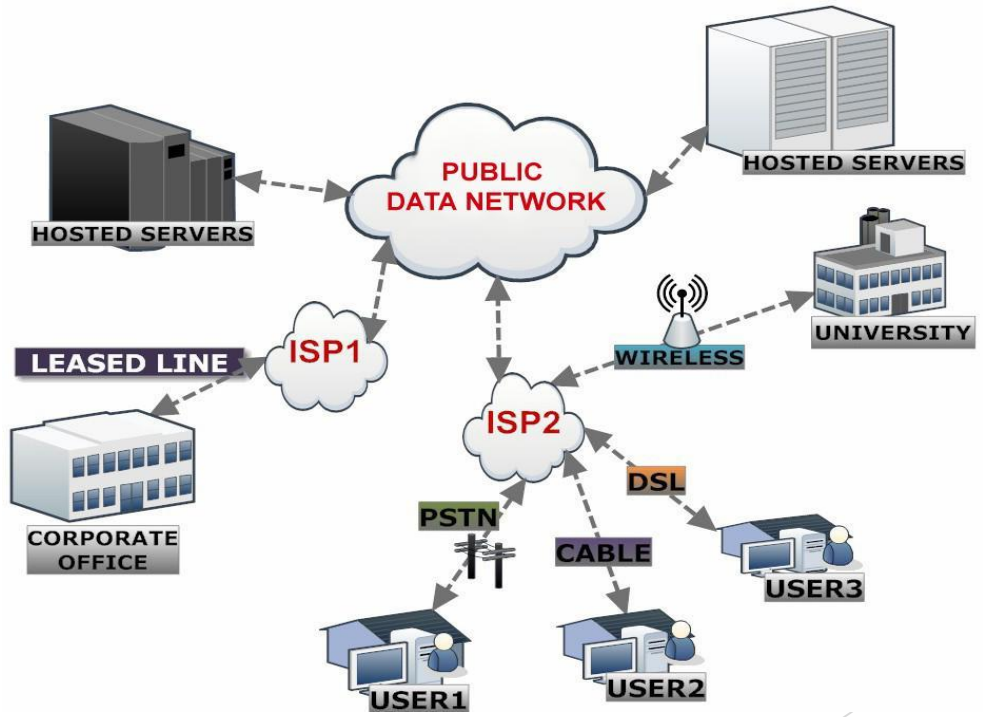
Here is the o/p

```
   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::c162:60bf:8d7a:6d97%14
   Autoconfiguration IPv4 Address. . : 169.254.109.151
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::75a0:ee67:5e50:3850%18
   IPv4 Address. . . . . . . . . . . : 192.168.0.100
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.0.1

Ethernet adapter Bluetooth Network Connection:

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

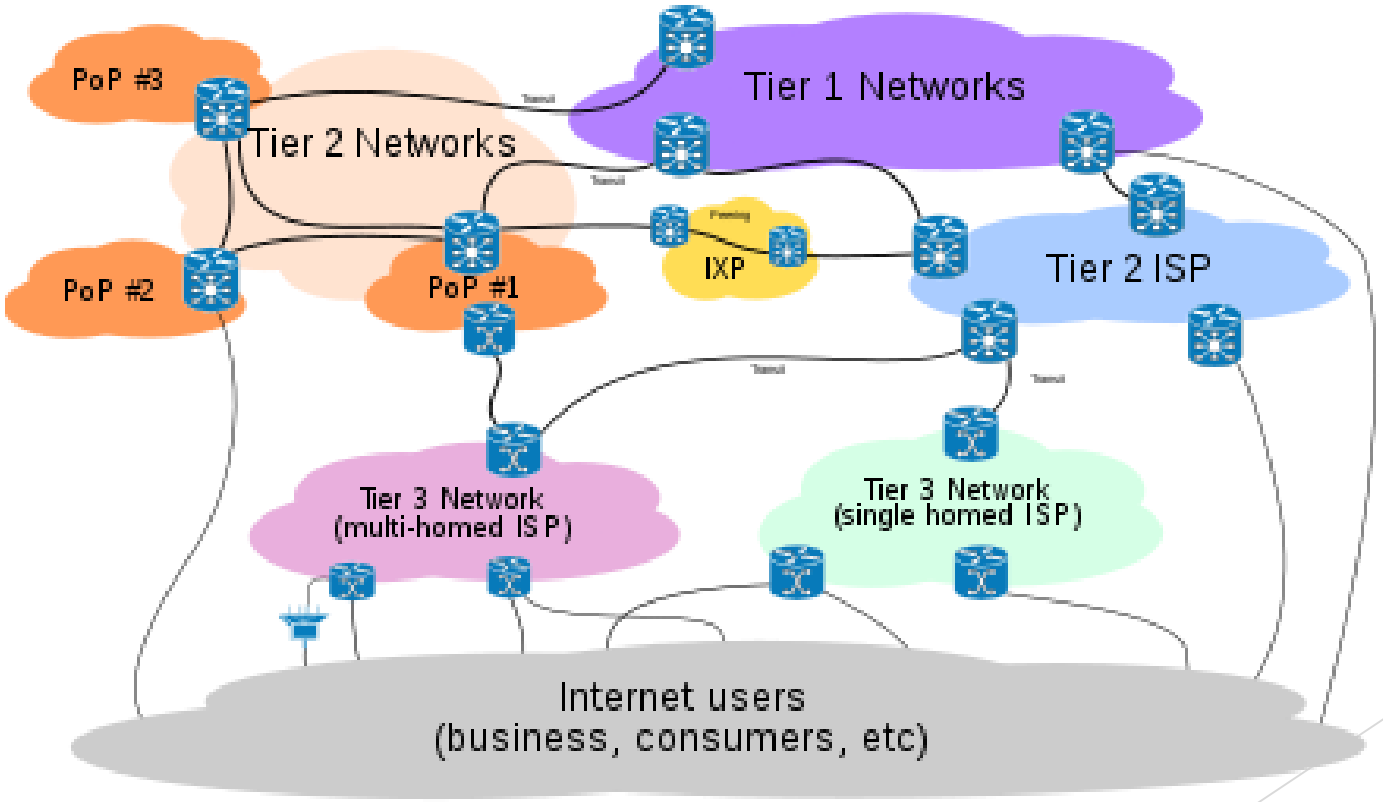
- The IP Address which you PC got should be unique in the Network in which it is connected
- As you have IP Address, every destination you want to reach through network has to have also their unique IP Address
- The destination might be 5 ft. or 5 miles away from your device
- So there should be mechanism to connect that destination device, It could be
  - Wired
  - Wireless
- How your Device connects to Wired or Wireless Network?
  - Using NIC cards
- Destination you want to reach example google server may not be in same room that you are or not in same city that you are nor in the country where you are
  - In networking term if your device is in different broadcast domain then what you need to reach destination?
  - Default Gateway i.e. Router

How do you get connected to the Internet?

- Before that what is Internet ?
  - "The **Internet** is the global system of interconnected computer networks that use the Interne Protocol Suite (TCP/IP) to link devices worldwide. It is a *network of networks* that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies."
  - It is network of Networks



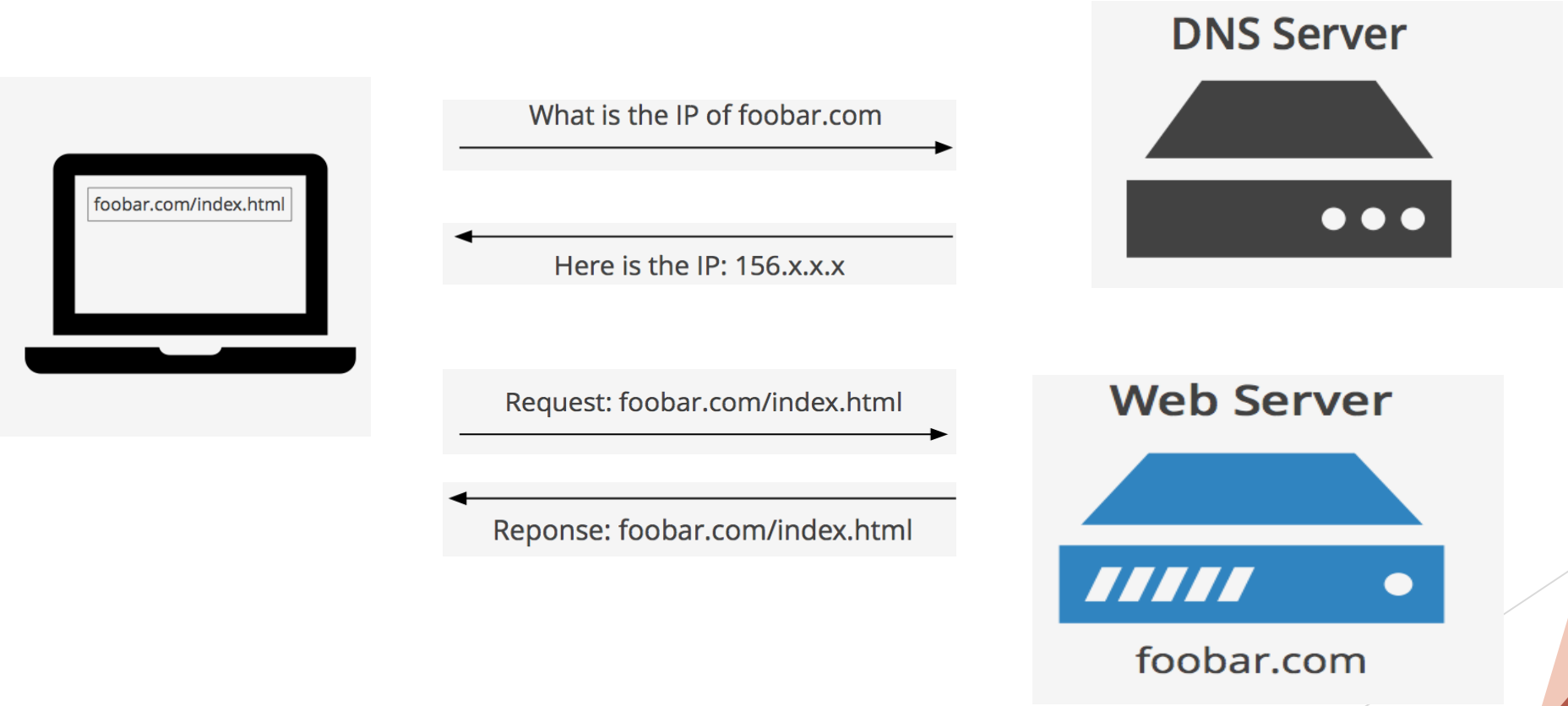
- How do you get connected to Internet?
  - Your ISP makes the Internet a possibility.
  - With a subscription with an ISP, you will get a connection to the Internet.
  - So what is ISP?
    - It refers to a company that provides Internet services, including personal and business access to the Internet.



- To browse google.com
  - You type www.gooogle.com
- Or to browse cnn.com
  - You type www.ccn.com
- For human it is easy to remember words rather than Numbers
- But do our End User Devices or Network devices understand Words ?
  - No
  - Then What?
    - They only understand Numbers i.e. IP Address
  - Then what happens when you type www.google.com in browser ?
    - They actually get resolved into IP Address from their Name
    - E.g. www.google.com get resolved to 172.217.12.142
  - How your Computer does that?
    - It does that with the help of DNS Server.

Then What is DNS Server ?

- A DNS server is a computer server that contains a database of IP addresses and their associate hostnames, and in most cases, serves to resolve, or translate, those common names to IP Addresses as requested.



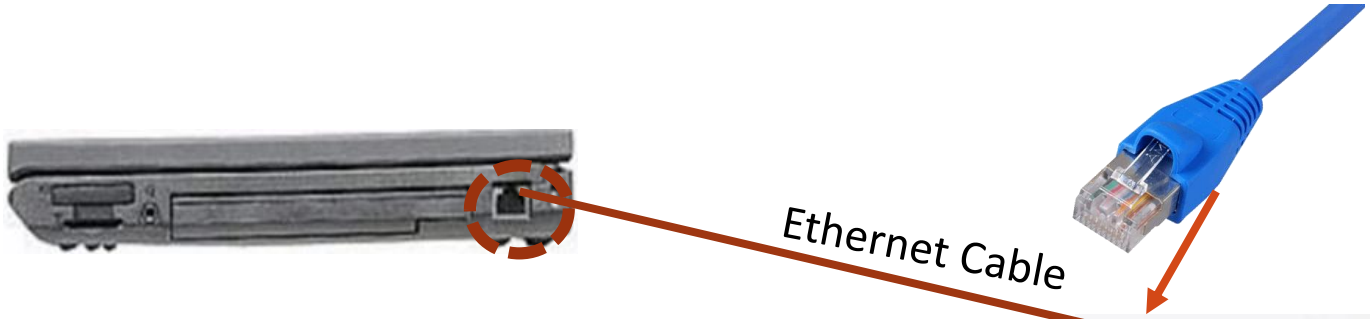
Output of ipconfig/all

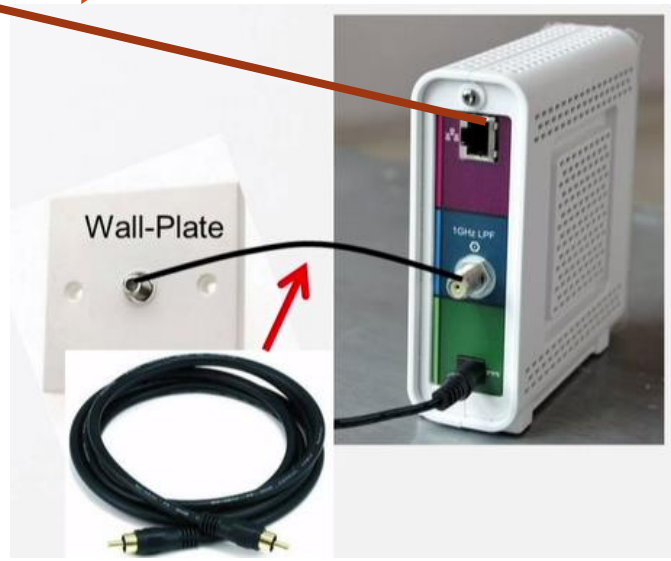
C:\WINDOWS\system32\cmd.exe

```
                                    fec0:0:0:ffff::3%1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Broadcom 802.11n Network Adapter
   Physical Address. . . . . . . . . : C0-18-85-BF-7A-D3
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::75a0:ee67:5e50:3850%18(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.0.100(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Sunday, December 3, 2017 9:27:44 AM
   Lease Expires . . . . . . . . . . : Wednesday, December 13, 2017 8:26:15 AM
   Default Gateway . . . . . . . . . : 192.168.0.1
   DHCP Server . . . . . . . . . . . : 192.168.0.1
   DHCPv6 IAID . . . . . . . . . . . : 96475269
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-21-A2-52-D9-D4-BE-D9-4E-A1-0A
   DNS Servers . . . . . . . . . . . : 192.168.0.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

- IPv4 Address tells what IP do you have in this device
- Subnet Mask tell currently in which local network your device is
- Default gateway, the Router you have in your network acting as Gateway
- Here DNS Server IP is same as Default Gateway, it doesn’t mean router acting as DNS Server actually my pc forwards DNS queries to DNS Servers through my default gateway

- I can’t get to my favorite website!!! In wired network





Is my laptop connected to cable?

No

Ensure Cable/DSL modem
is powered-on and connected
to wall-plate

Find the Ethernet Cable connecting
to your DSL/Cable modem and plug it
in to your laptop

What about wireless network?

Is the Wi-Fi – Radio button is switched on?

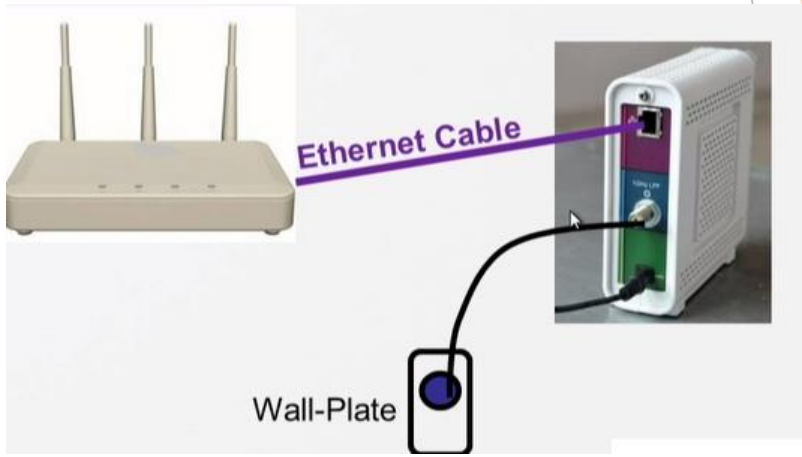
No

Turn on the Wi-Fi radio

Wait at least 1-Minute

Connectivity Restored?

Yes !!!

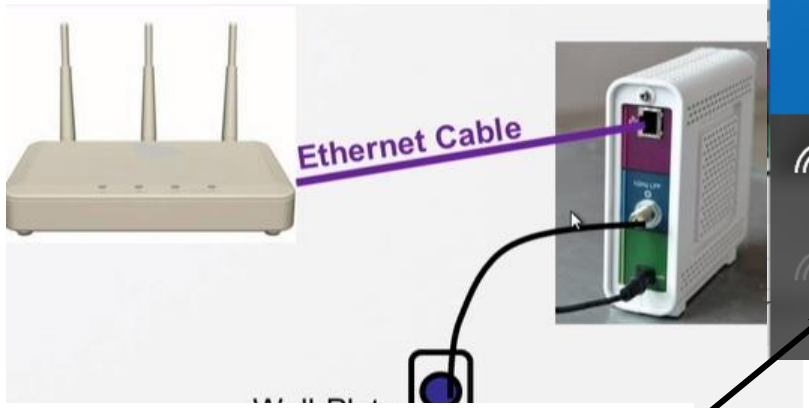


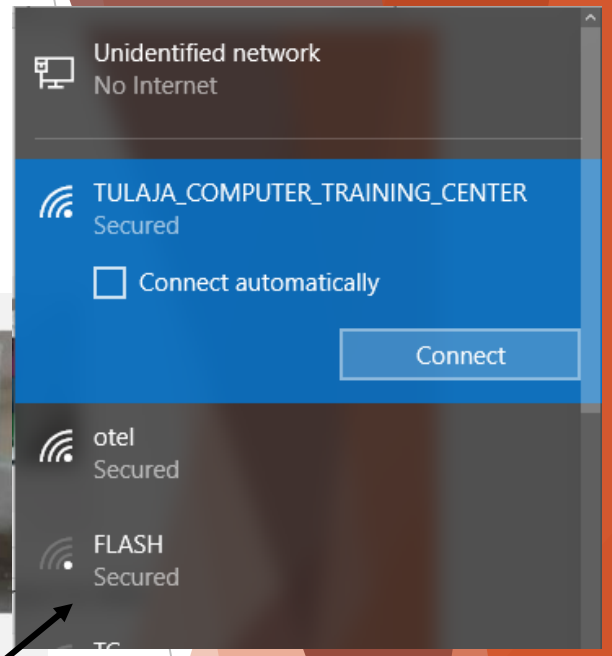
Here the default gateway is Wi-Fi Router not the modem

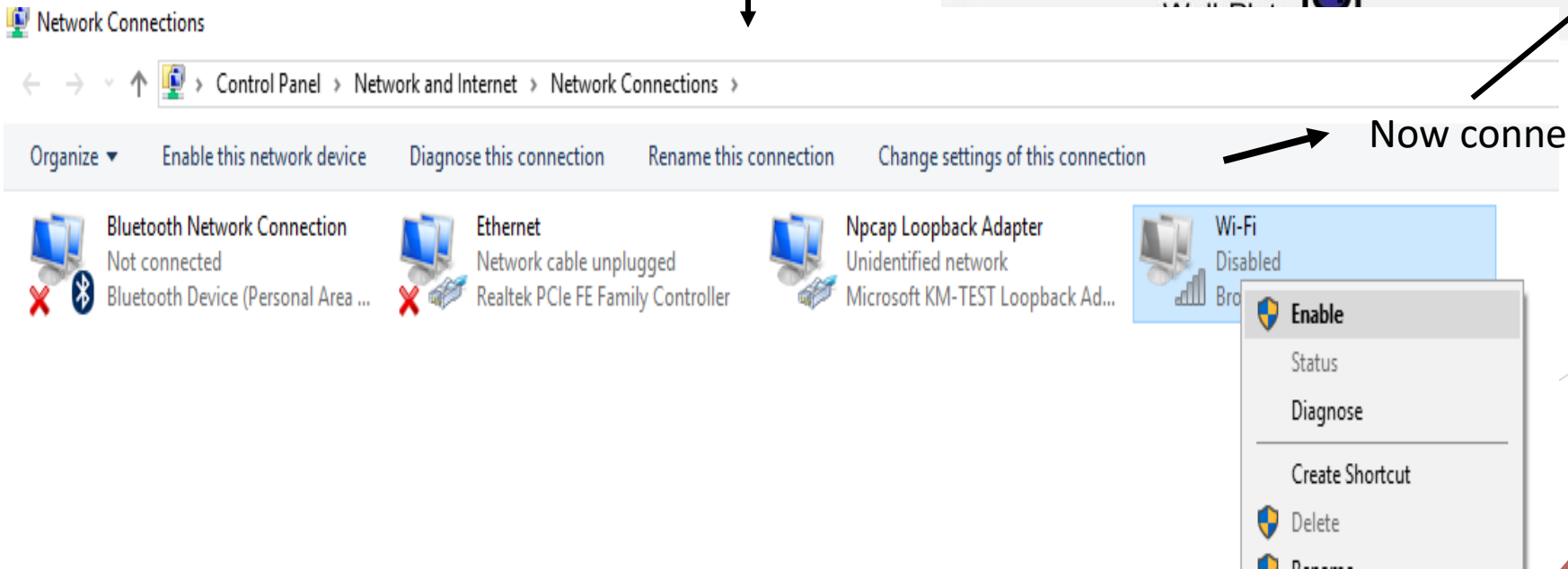
Is the Wi-Fi radio turned on in your software?

NO

Turn on the Wi-Fi radio in you software







Now connect to SSID

Here you can see the connectivity problem:

- Might be Wi-Fi radio software disabled
- Wi-Fi radio switch is off

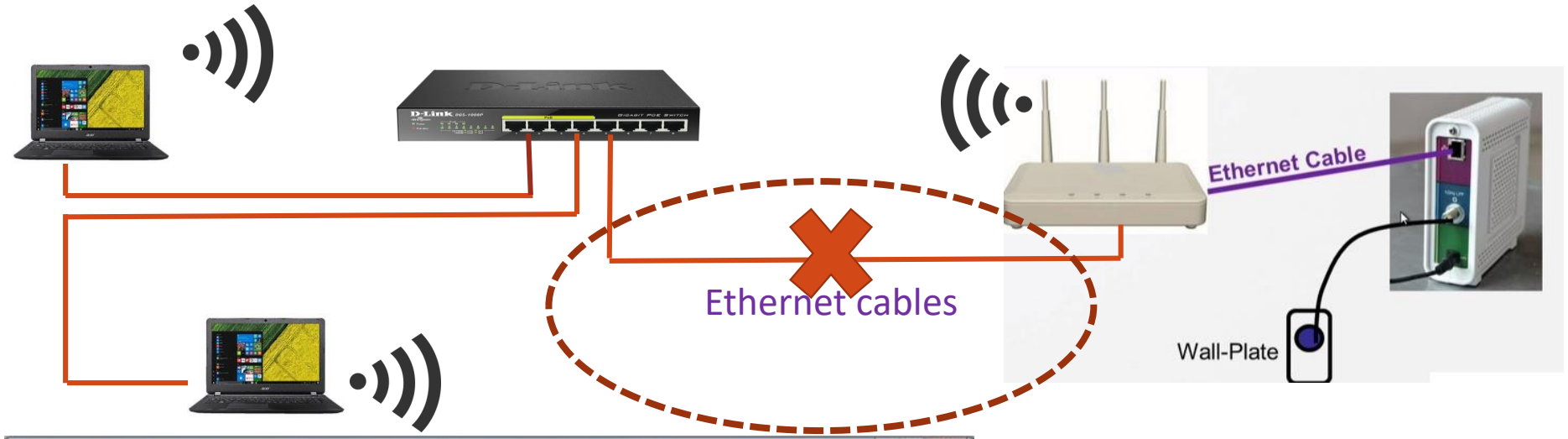
Ok After that, Does your device display any graphic indicating it is connected to Wi-Fi ?

NO → Has your device discovered your Wi-Fi Network?

NO → Turn on your Wi-Fi Access-Point or move Closer to it.

Wall and metals creates interference to Wi-Fi signal

Initial Problem: Everything is really slow…or…I can reach some things but not others!




```
Command Prompt
 20...00 00 00 00 00 00 00 e0 Microsoft 6to4 Adapter
 17...00 00 00 00 00 00 00 e0 Teredo Tunneling Pseudo-Interface
 39...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter #5
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0          1.1.1.1         1.1.1.2     20
          0.0.0.0          0.0.0.0         10.7.1.1       10.7.1.237     20
          1.1.1.0    255.255.255.0         On-link           1.1.1.2    276
          1.1.1.2  255.255.255.255         On-link           1.1.1.2    276
        1.1.1.255  255.255.255.255         On-link           1.1.1.2    276
         10.7.1.0    255.255.255.0         On-link        10.7.1.237    276
       10.7.1.237  255.255.255.255         On-link        10.7.1.237    276
       10.7.1.255  255.255.255.255         On-link        10.7.1.237    276
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    306
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    306
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    306
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    306
        224.0.0.0        240.0.0.0         On-link           1.1.1.2    276
        224.0.0.0        240.0.0.0         On-link        10.7.1.237    276
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    306
  255.255.255.255  255.255.255.255         On-link           1.1.1.2    276
```

Two Gateways:

- For Wired Network , 1.1.1.1
- For Wireless Network , 10.7.1.1

Load balance in between two
i.e. few packets move from 1.1.1.1
And few packets move from 10.7.1.1

What if Wired Network goes down?

Troubleshooting Tools

- Ping
- Trace
- Nslookup

Ping Command

```
C:\Windows\system32>
```

PING:

Allows you to send a SIGNAL to another Device on the NETWORK to see if it is ACTIVE.

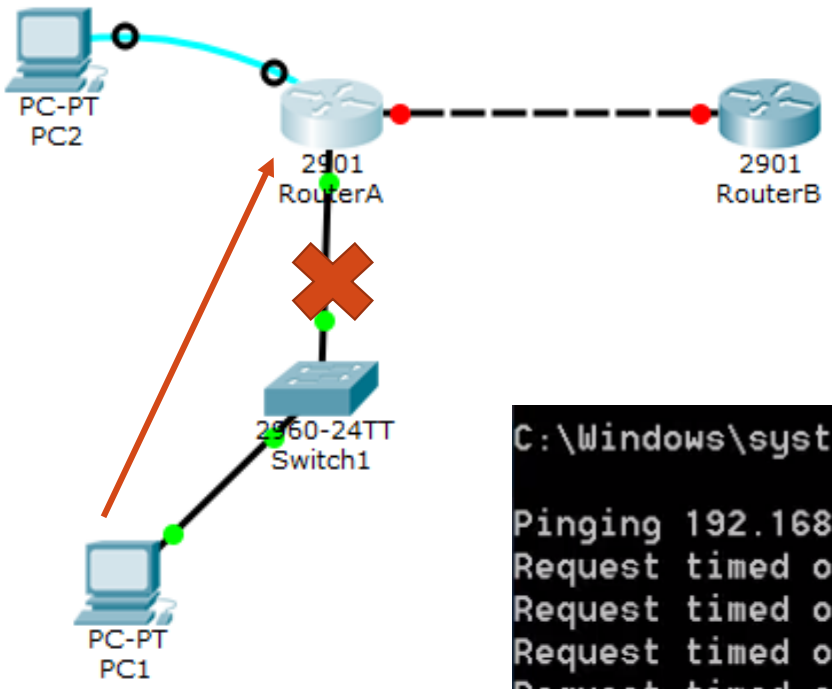
How does it work?

Uses the ICMP (Internet Control Message Protocol) to send out an "echo request" to the destination device, and gets back an "echo response" if the device you are trying to reach of in fact ACTIVE.

```
C:\Windows\system32>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

- Sending 4 packets to destination 192.168.1.1
- Each packet of size 32 bytes
- Receiving reply of 4 packets
- 0% loss
- Time taken to get response for each packet is less than a millisecond

Ping Loss



PC sending icmp request to RouterA

Link between router and switch gets broken

Check the result

```
C:\Windows\system32>ping 192.168.2.200

Pinging 192.168.2.200 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.2.200:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

4 packet sent as icmp request

4 get lost due to link brekage, so 100% loss

Tracert

TRACERT:

TRACERT let's you see, the step-by-step route a packet takes to the destination you specify.

So, if you send a packet to google.com, before the packet actually reaches google.com servers, it will go through many different routers before it finally reaches google.com.

You can also use the term HOPS instead of routers. So, if it takes 10 routers to get to google.com, you can instead say, "it took 10 hops".

Let's check what's happening here

Traced packet is crossing hops !!!

Default Gateway

ISP router where my router is connected

Finally, npnog.org

```
:\Users\amrit>tracert npnog.org

racing route to npnog.org [202.52.0.148]
ver a maximum of 30 hops:

  1     5 ms     2 ms     2 ms  192.168.1.1
  2    14 ms    18 ms    17 ms  100.64.0.1
  3    14 ms    20 ms    28 ms  103.250.132.66
  4    21 ms    15 ms    18 ms  202.51.66.65
  5   212 ms   222 ms   227 ms  ix-xe-0-0-2-0.tcore2.MLV-Mumbai.as6453.net [180.87.39.53]
  6   221 ms   211 ms   200 ms  if-ae-2-2.tcore1.MLV-Mumbai.as6453.net [180.87.38.1]
  7   124 ms   127 ms   141 ms  180.87.38.94
  8   126 ms   120 ms   120 ms  103.225.212.178
  9    61 ms    60 ms    66 ms  ge-210.41.nren-rtr.wlink.com.np [202.79.41.210]
 10    62 ms    67 ms    60 ms  mail.npnog.org [202.52.0.148]

race complete.
```

NSLookup

NSLOOKUP:

This command will fetch the DNS records for a given domain name or IP address. Remember, the IP addresses and domain names are stored in DNS Servers, so the nslookup command lets you query the DNS Records to gather information.

```
C:\Users\amrit>nslookup google.com
Server:  UnKnown
Address:  192.168.0.1

Non-authoritative answer:
Name:    google.com
Addresses:  2a00:1450:400e:808::200e
          172.217.19.206
```

What's happening Here?

Querying DNS Server for google.com record i.e. ip address of google.com

my router is receiving DNS query to forward valid DNS Server

Showing ip address of google.com