Name : Adwait S Purao

UID : 2021300101

Batch : B2

Experiment no. : 1

Aim : To understand, use and interpret **Network Utilities** (its **commands** & the general significance of the Internet)

What is the Internet?

 The internet is a vast network of interconnected devices such as computers, smartphones, servers, routers, and more that are connected through a web of cables, wireless signals, and satellites.

 These devices use standardized communication protocols, such as **TCP/IP**, to transmit and receive data, allowing them to connect and share information with each other seamlessly.

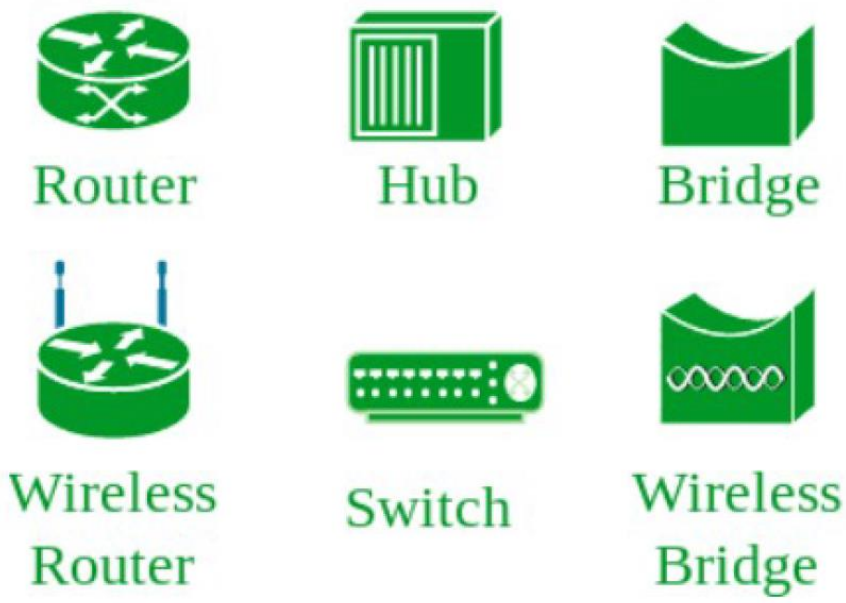
 The internet enables a wide range of activities, including sending and receiving emails, browsing the web, streaming videos, making online purchases, and much more.

 The **World Wide Web (WWW)** is a system of interlinked hypertext documents accessed via the internet. It allows users to access and share information, resources, and services using **web browsers** such as Chrome or Firefox

 The internet has had a profound impact on society and has become an essential tool for communication, education, commerce, and entertainment.

● What is computer newtork ?

An interconnection of multiple devices, also known as hosts, that are connected using multiple paths for the purpose of sending/receiving data or media. Computer networks can also include multiple devices/mediums which help in the communication between two different devices; these are known as **Network devices** and include things such as routers, switches, hubs, and bridges.



● Why is it needed ?

1. Resource sharing: Networks allow users to access shared resources such as printers, storage devices, and applications from any connected device.
2. Communication: Networks enable communication between users through email, instant messaging, video conferencing, and other forms of communication.
3. Data sharing: Networks allow for the sharing of information and data between users and systems, making it easier to collaborate on projects and share knowledge.
4. Remote access: Networks allow users to access their files and applications from remote locations, enabling telecommuting and remote work.
5. Scalability: Networks allow for the easy expansion of resources and the integration of new devices, making it possible to add more users and devices to the network as needed.

Overall, computer networks provide the foundation for efficient and effective communication, collaboration, and information sharing in today's digital world.

● History of Computer Networking

● The history of modern computer networking technology goes back to 1969, when ARPANET (Advanced Research Projects Agency Network) became the first connected computer network. It implemented the TCP/IP protocol suite, which later became the Internet.

● ARPANET was developed by the Advanced Research Projects Agency (ARPA), a subset of the US Department of Defense. Why did the DoD need to develop networked computers? The Cold War, of course! The goal of ARPANET was to keep lines of communication open if the USA and the USSR decided to exchange nuclear devices.

Year	Event
1961	In this year, Leonard Kleinrock proposed the earliest computer networks, which was the idea of ARPANET.
1965	In 1965, Donald Davies coined the term "packet" to describe how to send data between computers on a network.
1969	Although In 1966, the development of ARPANET began, officially started ARPANET in 1969. It was considered one of the first computer networks in which first two nodes, UCLA and SRI (Stanford Research Institute) were connected, and to use packet switching. To provide and define information about network protocols, procedures, and computer communications, the first RFC surfaced as a document in April 1969.
1969	On 29 August 1969, the first IMP and network switch were sent to UCLA. On ARPANET, the first data transmission was sent by using it.
1970	NCP, stands for NetWare Core Protocol, released by Steve Crocker and a team at UCLA for use with NetWare.
1971	In 1971, the first e-mail was sent to across a network to other users by Ray Tomlinson.
1973	While working at Xerox PARC, Robert Metcalfe developed the Ethernet in 1973. In the same year, ARPA deployed the first international network connection, known as SATNET. In 1973, VoIP technology and capabilities were officially introduced, which made a VoIP call. However, until 1995, the software was not available for users that could make VoIP calls.
1974	In this year, the use of first router was began, but they were not considered true IP routers.
1976	Originally called a gateway, Ginny Strazisar develop the first true IP router.
1978	In 1978, the TCP/IP protocol was developed and invented by Bob Kahn for networks; it was developed with help from Vint Cerf.
1981	In the United States, between IBM mainframe systems, BITNET was created in 1981 as a network. The U.S. National Science Foundation developed the CSNET (Computer Science Network) in the same year 1981.
1983	For using TCP/IP, ARPANET finished the transition. The first DNS implement by Jon Postel and Paul Mockapetris in 1983.
1986	This is the year in which a backbone for ARPANET, the National Science Foundation Network was came online, which finally took the place of ARPANET in 1990s. In the same year, with the original BITNET, BITNET II was introduced to deal with bandwidth issues.

1988	In 1988, the first T1 backbone was included with ARPANET. AT&T, Lucent, and NCR introduced the WaveLAN network technology in 1988. In 1988, for the first time, the explanation of network firewall technology was published. In the same year, Digital Equipment Corporation developed it. This paper had the detail about the first firewall, known as a packet filter firewall.
1990	The first network switch was developed and introduced by a U.S. network hardware company named Kalpana in 1990.
1996	In 1996, an IPv6 was introduced as an improvement over IPv4, as well as embedded encryption, improved routing.
1997	In June 1997, the 802.11 standards, containing transmission speeds up to 2 Mbps, for Wi-Fi were introduced.
1999	The 802.11a standard, containing transmission speeds up to 25 Mbps to use the 5 GHz band, was officially made in 1999. Another standard 802.11b was available to use for the public in mid-1999, which offered transmission speeds up to 11 Mbps. In September 1999, for use with 802.11b, the WEP encryption protocol was released.
2003	802.11g devices, contained transmission speeds up to 20 Mbps, were available to the public in January 2003. In the same year, for use with 802.11g, the WPA encryption protocol is released.

Commands on Linux :

1. **Ifconfig**

   You can use the **ifconfig** command to assign an address to a network interface and to configure or display the current network interface configuration information. The **ifconfig** command must be used at system startup to define the network address of each interface present on a system. After system startup, it can also be used to redefine an interfaces address and its other operating parameters. The network interface configuration is held on the running system and must be reset at each system restart.
   The **ifconfig** command interprets the **IFF_MULTICAST** flag and prints its value if it is set.

```
students@students-HP-280-G3-MT:~$ ifconfig
enp4s0    Link encap:Ethernet  HWaddr 3c:52:82:63:e7:90
          inet addr:172.16.31.188  Bcast:172.16.31.255  Mask:255.255.255.0
          inet6 addr: fe80::4c7:4c55:2f2e:5cd6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:455 errors:0 dropped:0 overruns:0 frame:0
          TX packets:120 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:129118 (129.1 KB)  TX bytes:13386 (13.3 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:392 errors:0 dropped:0 overruns:0 frame:0
          TX packets:392 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:32523 (32.5 KB)  TX bytes:32523 (32.5 KB)

students@students-HP-280-G3-MT:~$
```

2. **What is ping**

Ping is short for **Packet Internet Groper**. This command is mainly used for checking the network connectivity among host/server and host. The ping command takes the URL or IP address as input and transfers the data packet to a specified address along with a **"PING"** message. Then, it will get a reply from the host/server. This time is known as **"latency"**.

Note: Low latency and fast ping means faster connection.

```
PING google.com (216.239.38.120) 56(84) bytes of data.
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=1 ttl=55 time=3.8
1 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=2 ttl=55 time=3.5
4 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=3 ttl=55 time=3.7
6 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=4 ttl=55 time=3.6
5 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=5 ttl=55 time=3.6
0 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=6 ttl=55 time=3.5
9 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=7 ttl=55 time=3.5
6 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=8 ttl=55 time=3.5
9 ms
64 bytes from any-in-2678.1e100.net (216.239.38.120): icmp_seq=9 ttl=55 time=3.6
7 ms
^C
--- google.com ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8015ms
rtt min/avg/max/mdev = 3.548/3.645/3.814/0.117 ms
students@students-HP-280-G3-MT:~$
^C
--- google.com ping statistics ---
```

```
students@students-HP-280-G3-MT:~$ ping 172.16.31.208
PING 172.16.31.208 (172.16.31.208) 56(84) bytes of data.
64 bytes from 172.16.31.208: icmp_seq=1 ttl=64 time=0.663 ms
64 bytes from 172.16.31.208: icmp_seq=2 ttl=64 time=0.233 ms
64 bytes from 172.16.31.208: icmp_seq=3 ttl=64 time=0.284 ms
64 bytes from 172.16.31.208: icmp_seq=4 ttl=64 time=0.556 ms
64 bytes from 172.16.31.208: icmp_seq=5 ttl=64 time=0.183 ms
^C
--- 172.16.31.208 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4096ms
rtt min/avg/max/mdev = 0.183/0.383/0.663/0.191 ms
students@students-HP-280-G3-MT:~$
```

3. **What is IP Address ?**

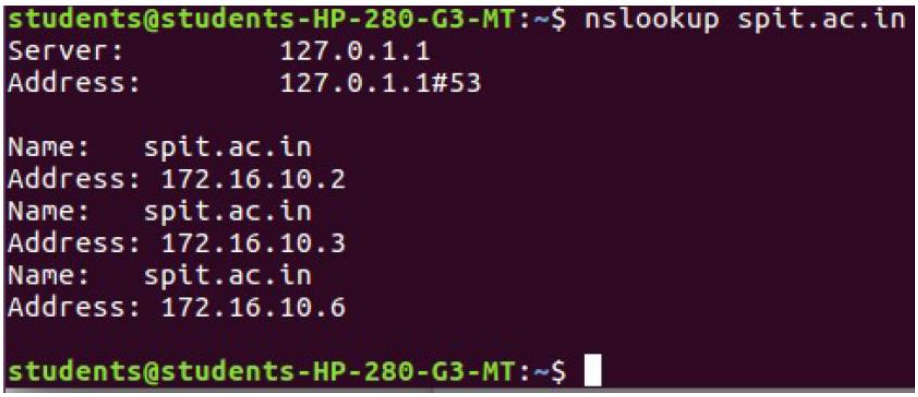
An IP address is a unique address that identifies a device on the internet or a local network. IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet or local network.

In essence, IP addresses are the identifier that allows information to be sent between devices on a network: they contain location information and make devices accessible for communication. The internet needs a way to differentiate between different computers, routers, and websites. IP addresses provide a way of doing so and form an essential part of how the internet works.

4. **Nslookup Command**

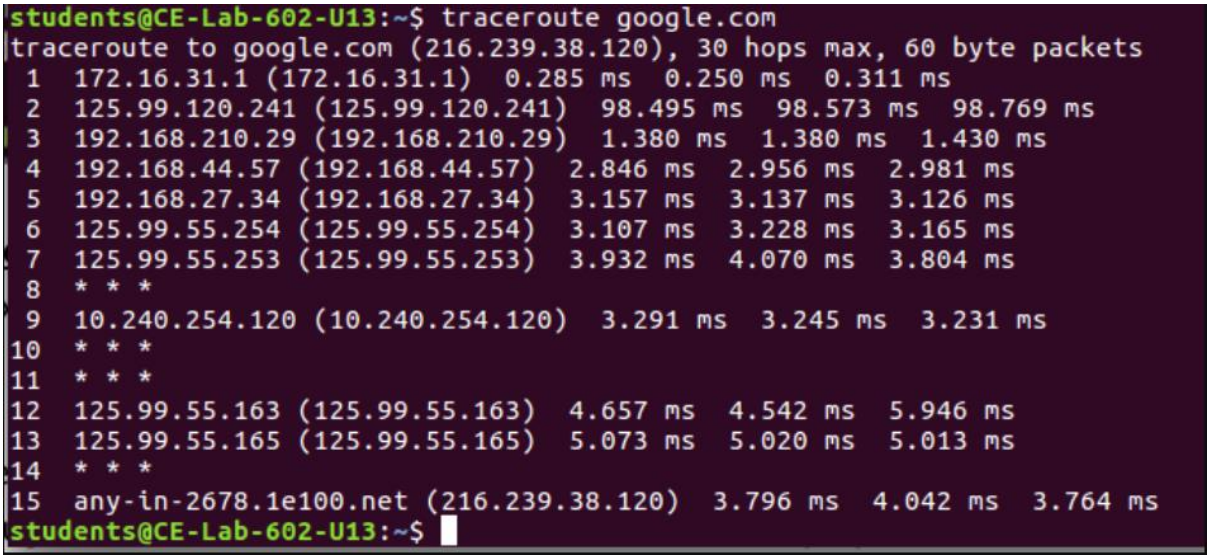
Name server lookup (nslookup) is a command-line tool that lets you find the internet protocol (IP) address or domain name system (DNS) record of a specific hostname. This command also allows reverse DNS lookup by inputting the IP addresses of the corresponding domains.

The nslookup tool is useful for DNS-related tasks, such as server testing or troubleshooting issues. To use this tool, type “nslookup” into a command-line interface (CLI) such as the Command Prompt on Windows or Terminal on Linux and macOS.



5. **Traceroute**

Linux traceroute command is a network troubleshooting utility that helps us determine the number of hops and packets traveling path required to reach a destination. It is used to display how the data transmitted from a local machine to a remote machine. Loading a web page is one of the common examples of the traceroute. A web page loading transfers data through a network and routers. The traceroute can display the routes, IP addresses, and hostnames of routers over a network. It can be useful for diagnosing network issues.



6. **<u>Sudo apt-get install</u>**

   sudo apt-get install command is used to download the latest version of your desired application from an online software repository pointed to by your sources.list configuration file and and install that application on your Linux machine.

   A good analogy is to think of your computer as a factory and the apt-get command as the manager in that factory who is responsible for the installation of new equipment, removal of equipment that is no longer needed, and update desired equipment to their latest versions, while maintaining records of the equipment names and versions which are currently present in the factory.

```
students@students-HP-280-G3-MT:~$ sudo apt-get install traceroute
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  traceroute
0 upgraded, 1 newly installed, 0 to remove and 155 not upgraded.
Need to get 53.6 kB of archives.
After this operation, 130 kB of additional disk space will be used.
WARNING: The following packages cannot be authenticated!
  traceroute
Install these packages without verification? [y/N] y
Get:1 http://httpredir.debian.org/debian jessie/main amd64 traceroute amd64 1:2.
0.20-2+b1 [53.6 kB]
Fetched 53.6 kB in 2s (22.1 kB/s)
Selecting previously unselected package traceroute.
(Reading database ... 244949 files and directories currently installed.)
Preparing to unpack .../traceroute_1%3a2.0.20-2+b1_amd64.deb ...
Unpacking traceroute (1:2.0.20-2+b1) ...
Processing triggers for man-db (2.7.5-1) ...
Setting up traceroute (1:2.0.20-2+b1) ...
update-alternatives: using /usr/bin/traceroute.db to provide /usr/bin/traceroute
 (traceroute) in auto mode
update-alternatives: using /usr/bin/lft.db to provide /usr/bin/lft (lft) in auto
 mode
update-alternatives: using /usr/bin/traceproto.db to provide /usr/bin/traceproto
 (traceproto) in auto mode
update-alternatives: using /usr/sbin/tcptraceroute.db to provide /usr/sbin/tcptr
aceroute (tcptraceroute) in auto mode
students@students-HP-280-G3-MT:~$
```

7. **ARP command**

The arp stands for the “Address Resolution Protocol” and it makes changes in the kernel’s table which contains the arp addresses.

The arp command allows users to manipulate the neighbor cache or ARP table. It is contained in the Net-tools package along with many other notable networking commands (such as ifconfig). The arp command has since been replaced by the ip neighbour command.

```
students@students-HP-280-G3-MT:~$ arp -a
? (172.16.31.189) at f4:4d:30:4f:7e:e6 [ether] on enp4s0
? (172.16.31.1) at e0:07:1b:c2:64:60 [ether] on enp4s0
? (172.16.31.208) at 3c:52:82:67:82:4d [ether] on enp4s0
students@students-HP-280-G3-MT:~$
```

8. **IPCONFIG:**

network_command_ipconfig

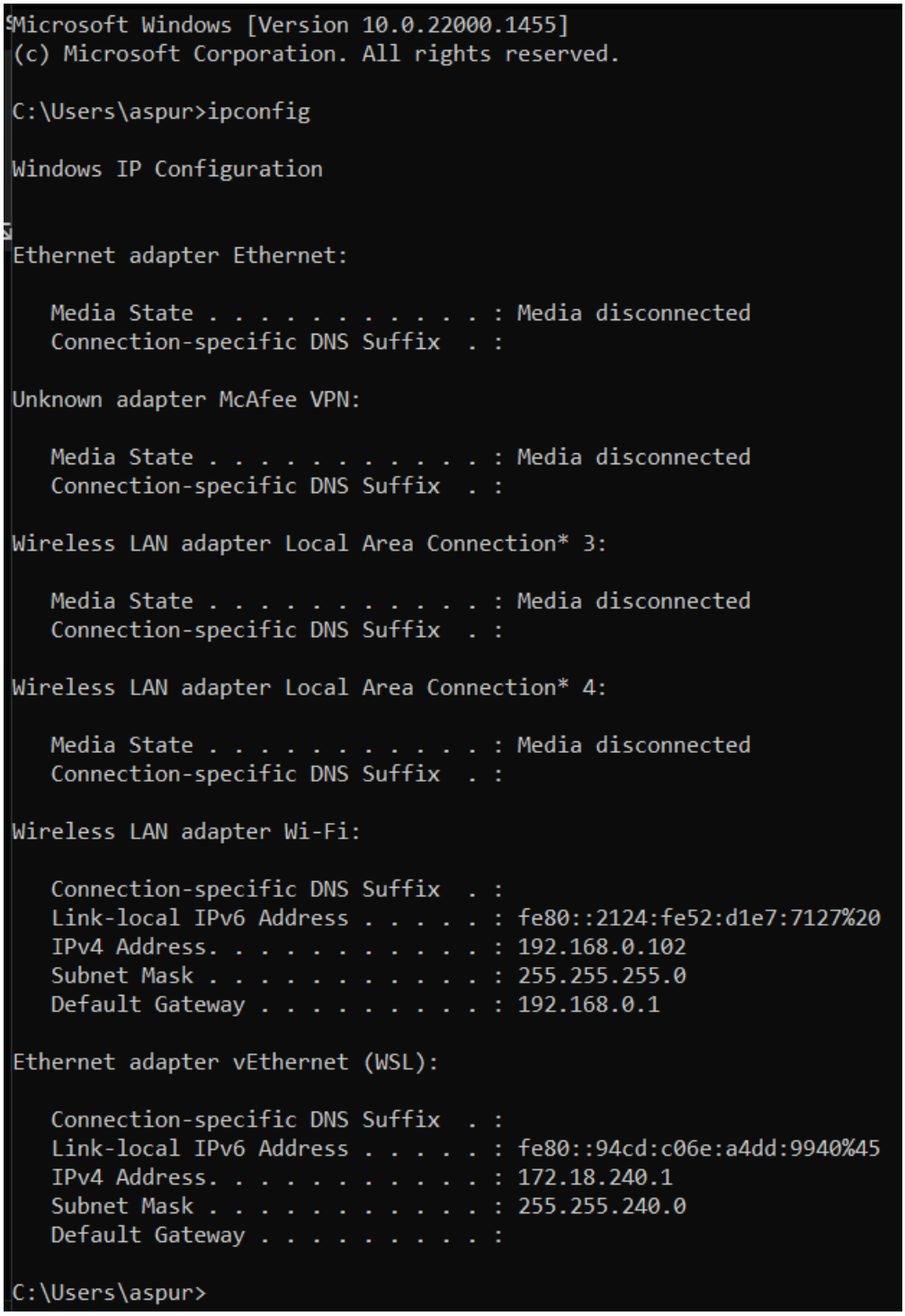
The IPCONFIG network command provides a comprehensive view of information regarding the IP address configuration of the device we are currently working on.

The IPConfig command also provides us with some variation in the primary command that targets specific system settings or data, which are:

IPConfig/all - Provides primary output with additional information about network adapters.

IPConfig/renew - Used to renew the system’s IP address.

IPConfig/release - Removes the system’s current IP address.

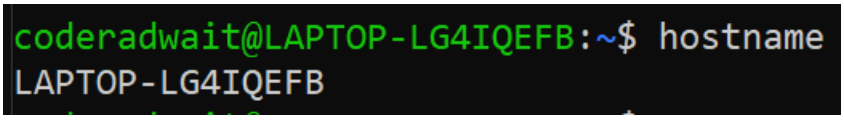


9. **HOSTNAME:**

network_command_hostname

The HOSTNAME command displays the hostname of the system. The hostname command is much easier to use than going into the system settings to search for it.

Command to enter in Prompt – hostname



Conclusion:

In short, network utilities and its commands are helpful tools for managing and improving my network. I can use them to quickly find and fix problems with my network.

We also learnt about the history of computer network and implemented the various commands in command prompt.