PLATFORM ENGINEERING

NAME:DEVADHARSHINI.B

ASSIGNMENT NO:01

IPV4 & IPV6 ADDRESSES

IPV4 ADDRESS FORMAT:

- IPv4 or Internet Protocol version 4, address is a 32-bit string of numbers separated by periods.
- It uniquely identifies a network interface in a device. IP is a part of the TCP/IP(Transmission ControlProtocol/Internet Protocol) suite, where IP is the principal set of rules for communication on the Internet.
- An IP address is needed to be allocated on the devices, such as PCs, printers, servers, routers, switches, etc., to be able to communicate with each other in the network and out the Internet.

IPv4 addresses are expressed as a set of four numbers in decimal format, and each set is separated by a dot. Thus, the term 'dotted decimal format.' Each set is called an 'octet' because a set is composed of 8 bits. The figure below shows the binary format of each octet in the 192.168.10.100 IP address:

Format	1st Octet	2nd Octet	3rd Octet	4th Octet
Dotted Decimal	192	168	10	100
Binary	1100 0000	1010 1000	0000 1010	0110 0100

A number in an octet can range from 0 to 255. Therefore, the full IPv4 address space goes from 0.0.0.0 to 255.255.255.255.

The IPv4 address has two parts, the network part and the host part. A subnet mask is used to identify these parts.

NETWORK PART:

The network part of the IPv4 address is on the left-hand side of the IP address. It specifies the particular network to where the IPv4 address belongs. The network portion of the address also identifies the IP address class of the IPv4 address.

HOST PART:

The host portion of the IPv4 address uniquely identifies the device or the interface on your network. Hosts that have the same network portion can communicate with one another directly, without the need for the traffic to be routed.

IPV6 ADDRESS FORMAT:

- An IPv6 address is a 128-bit alphanumeric value that identifies an endpoint device in an Internet Protocol Version 6 (IPv6) network. IPv6 is the successor to a previous addressing infrastructure, IPv4, which had limitations IPv6 was designed to overcome. Notably, IPv6 has drastically increased address space compared to IPv4.
- Unlike IPv4, which uses a dotted-decimal format with each byte ranges from 0 to 255, IPv6 uses eight groups of four hexadecimal digits separated by colons.
- For example, given below is a 128 bit IPv6 address represented in binary format and divided into eight 16-bits blocks:

0010000000000001 0000000000000000 0011001000111000 1101111111100001
0000000001100011 0000000000000000 0000000000000000 1111111011111011

Each block is then converted into Hexadecimal and separated by ‘:’ symbol:

2001:0000:3238:DFE1:0063:0000:0000:FEFB

Even after converting into Hexadecimal format, IPv6 address remains long. IPv6 provides some rules to shorten the address. The rules are as follows:

- **Rule.1:** Discard leading Zero(es):

In Block 5, 0063, the leading two 0s can be omitted, such as (5th block):

2001:0000:3238:DFE1:63:0000:0000:FEFB

- **Rule.2:** If two of more blocks contain consecutive zeroes, omit them all and replace with double colon sign ::, such as (6th and 7th block):

2001:0000:3238:DFE1:63::FEFB

Consecutive blocks of zeroes can be replaced only once by :: so if there are still blocks of zeroes in the address, they can be shrunk down to a single zero, such as (2nd block):

2001:0:3238:DFE1:63::FEFB

IP ADDRESSING SCHEMES:

- IP address is an address that is used to uniquely identify a device on an IP network. IP address is made up of 32 binary bits. These binary bits can be further divided into network portion and host portion with the help of a **subnet mask**.

- The 32 binary bits are broken into four octets of 8 bits each. Each octet is converted to decimal and separated by a period (dot).
- The IP address is thus expressed in a dotted decimal format (for example, 192.18.80.200), where the value in each octet can range from 0 to 255 decimal (or 00000000 – 11111111 binary).

IP ADDRESSING SCHEME IN IPV4:

- Here we are going to discuss the different classes & ranges of IP addresses and how these are defined. These classes are defined on the basis of different combinations of first 8 bits (First octet) out of the total 32 bits of IP address.
- Following are the different classes of IP addresses and the corresponding range. We will refer the following table showing the corresponding value of first 8 bits (in on mode).

Bit's position	1	2	3	4	5	6	7	8
Decimal value	128	64	32	16	8	4	2	1

CLASS-A:

- In this class out of 32 bits only first 8 bits are assigned to the network part, hence it has default subnet mask of 255.0.0.0. In this class the first bit is reserved and is always kept off.
- Lower range can be found out by keeping all the bits off (means the corresponding numerical value is not added).

Bit's position	1	2	3	4	5	6	7	8
Decimal value	0	0	0	0	0	0	0	0 Total=0

- Higher range can be calculated by turning all the bits on (except the 1st bit which is reserved as off).

Bit's position	1	2	3	4	5	6	7	8
Decimal value	0	64	32	16	8	4	2	1 Total=127

- Hence the IP range of this class should be 0-127 but 0.0.0.0 doesn't represent a valid network and 127.0.0.0 to 127.255.255.255 is reserved for local host loop back verify TCP/IP services diagnostic functions.
- So the Valid IP range for class A is **1-126**. Some examples are 10.x.x.x, 125.x.x.x, 79.x.x.x, 98.x.x.x etc.

CLASS-B:

- In this class first 16 bits are assigned to network part & so it has default subnet mask of 255.255.0.0. For range assignment first two bits are reserved, first bit always on and second bit always off.Its lower range is 128 as last six bits are off.

Bit's position	1	2	3	4	5	6	7	8
Decimal value	128	0	0	0	0	0	0	0 Total=128

- Its higher range is 191 as last six bits are on,

Bit's position	1	2	3	4	5	6	7	8
Decimal value	128	0	32	16	8	4	2	1 Total=191

- So the range of class B is **128-191**. Some examples are 130.x.x.x, 156.x.x.x, 178.x.x.x, 190.x.x.x.

CLASS-C:

- This class has 24 bits for network part and so its default subnet mask is 255.255.255.0. To assign the range first 3 bits are reserved, 1st & 2nd bits are always on and 3rd bit is always off.
- Its lower range is 192 as last five bits are off.

Bit's position	1	2	3	4	5	6	7	8
Decimal value	128	64	0	0	0	0	0	0 Total=192

- Its higher range is 223 by putting last five bits on.

Bit's position	1	2	3	4	5	6	7	8
Decimal value	128	64	0	16	8	4	2	1 Total=223

- So the class C range is **192-223**. Some examples are 200.x.x.x, 215.x.x.x, 221.x.x.x, 195.x.x.x.

CLASS-D:

The range of this class is from 224-239 and can't be allocated to hosts. This class is used for multicasting by various routing protocols. Some common examples are

224.0.0.5-Used by all OSPF routers
224.0.0.6-Used by OSPF DRs (Designated Routers)
224.0.0.9-Used by RIP-2
224.0.0.10-Used by EIGRP
224.0.0.12-Used by DHCP Server/Relay Agent
224.0.0.14-Used by RSVP encapsulation
224.0.0.18-Used by VRRP
224.0.0.22-Used by IGMP

CLASS-E:

The range of this class is from 240-255 and is not meant for general use. These are typically used for experiments.

IP ADDRESSING SCHEME IN IPV6:

IPv6 addresses are divided into three parts: the prefix, the subnet ID, and the interface ID. The prefix is used to identify the network, the subnet ID is used to identify subnets within the network, and the interface ID is used to identify the device.

RESERVED PORTS:

- Reserved ports, also known as well-known ports, are network ports that are assigned and typically used by specific services or protocols. These ports are standardized by the Internet Assigned Numbers Authority (IANA) to

ensure consistent usage across different network devices and applications.

- Port numbers in the range 1 to 1023 are considered "reserved" or "privileged." TCP/IP conventions require that a connection using such low port numbers have special privileges, such as root privileges on the originating machine.
- Port numbers 1024 - 49151 are reserved for user server applications. Port numbers 49152 - 65535 are reserved for clients.
- If you have a server in the client port range (49152 - 65535), define that server in the TCP/IP network services database to prevent port number conflicts.

APPLICATIONS:

- Skype uses port 80 (HTTP) and port 443 (HTTPS) for communication.
- FTP uses port 21 for control and port 20 for data transfer.
- SSH uses port 22 for secure remote access.
- DNS uses port 53 for name resolution.
- MySQL uses port 3306 for database management.

SUMMARY:

Both IPV4 and IPV6 have their place in modern computer networking. Understanding reserved ports is essential to keeping applications running smoothly on a network. It's important to note that while reserved ports are commonly associated with specific services or protocols, it is possible for applications to use different ports if needed. As technology evolves, we may see new addressing schemes and protocols emerge to handle the ever-increasing demand for network connectivity.