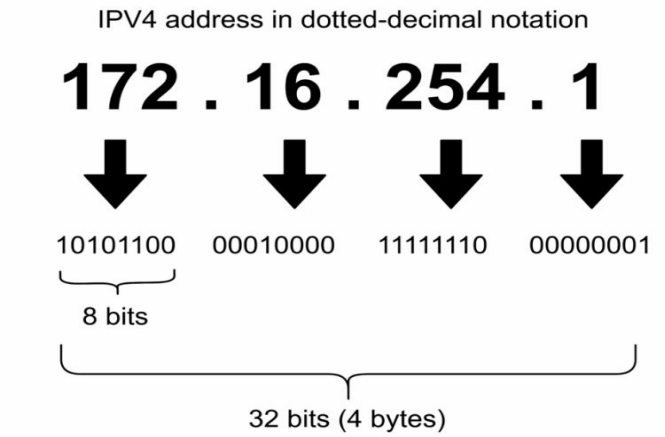
Experiment Number 5: Study of IP Address Configuration (IPV4 and IPV6, subnet, supernet)

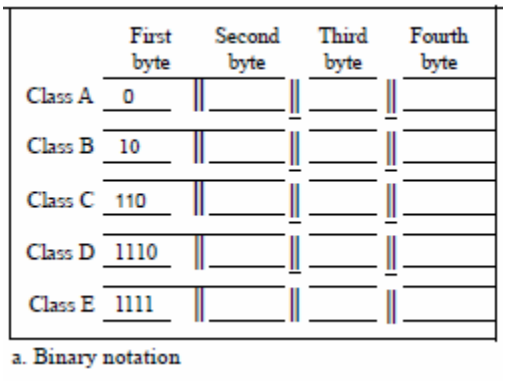
IPV4 Address:

- The IPv4 addresses are unique and universal.
- It uses a 32-bit addressing scheme to define the IP address.
- Thus, it allows generating $2^{\wedge 32}$ addresses (~ 4 billion).
- An IPv4 address followed a dotted-decimal notation in XXX.XXX.XXX.XXX to express the address.
- The XXX could be a value ranging between 0 to 255.
- For instance, an example of an IPv4 address is 172.16.254.1.



- There must be no leading zero (045).
- There can be no more than four numbers in an IPv4 address.
- Each number needs to be less than or equal to 255 (301 is outside this range).
- A mixture of binary notation and dotted-decimal notation are not allowed.

Classful Addressing:



a. Binary notation

Netid and Hostid

- In classful addressing, an IP address in class A, B, or C is divided into netid and hostid.
- These parts are of varying lengths, depending on the class of the address.
- In class A, one byte defines the netid and three bytes define the hostid.
- In class B, two bytes define the netid and two bytes define the hostid.
- In class C, three bytes define the netid and one byte defines the hostid.

Class	*Binary*	*Dotted-Decimal*	*CIDR*
A	11111111 00000000 00000000 00000000	255.0.0.0	/8
B	11111111 11111111 00000000 00000000	255.255.0.0	/16
C	11111111 11111111 11111111 00000000	255.255.255.0	/24

Default masks for classful addressing

Mask

- A 32-bit number made of contiguous 1s followed by contiguous 0s.
- The concept does not apply to classes D and E.
- The mask can help us to find the netid and the hostid.
- For example, the mask for a class A address has eight 1s, which means the first 8 bits of any address in class A define the netid; the next 24 bits define the hostid.

- The last column of Table shows the mask in the form /n where n can be 8, 16, or 24 in classful addressing.
- This notation is also called slash notation or Classless Interdomain Routing (CIDR) notation.
- **CIDR (Classless Inter-Domain Routing or supernetting)** is a method of assigning IP addresses that improves the efficiency of address distribution and replaces the previous system based on Class A, Class B and Class C networks.
- It is as also a 32-bit address, which includes a special number which represents the number of bits that are present in the Block Id.
- a. b. c. d /n -→ Where, n is number of bits that are present in Block Id / Network Id.

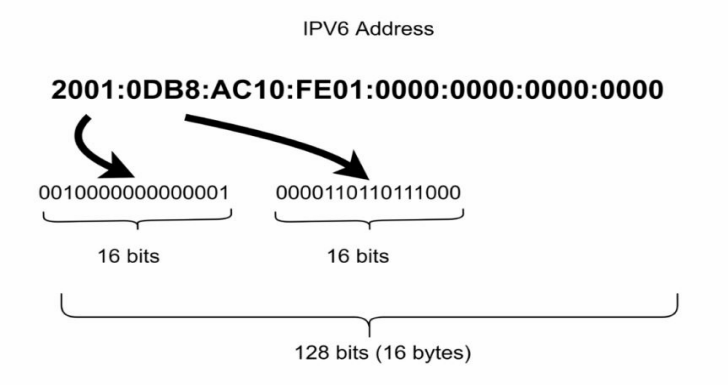
IPv6

- The Internet Protocol Version 6 (IPv6) is the most recent version of the Internet Protocol.
- It is also known as Internet Protocol next generation (IPng).
- IPv6 is a relatively newer version of IP address, and its use is still not widespread compared to IPv6.

Need for IPv6

- The major issues with IPv4 are the limitation of the number of addresses and the growth of routing tables.
- The IPv4 uses a 32-bit addressing scheme that is capable of generating 2^32 unique addresses.
- However, with the ever-increasing need for IP addresses in network communication, this number is simply not sufficient.

- IPv6 uses a 128-bit addressing scheme and capable of generating 2^128 unique addresses (3.403×1038).
- This is a significantly large number and deemed sufficient for the near future.

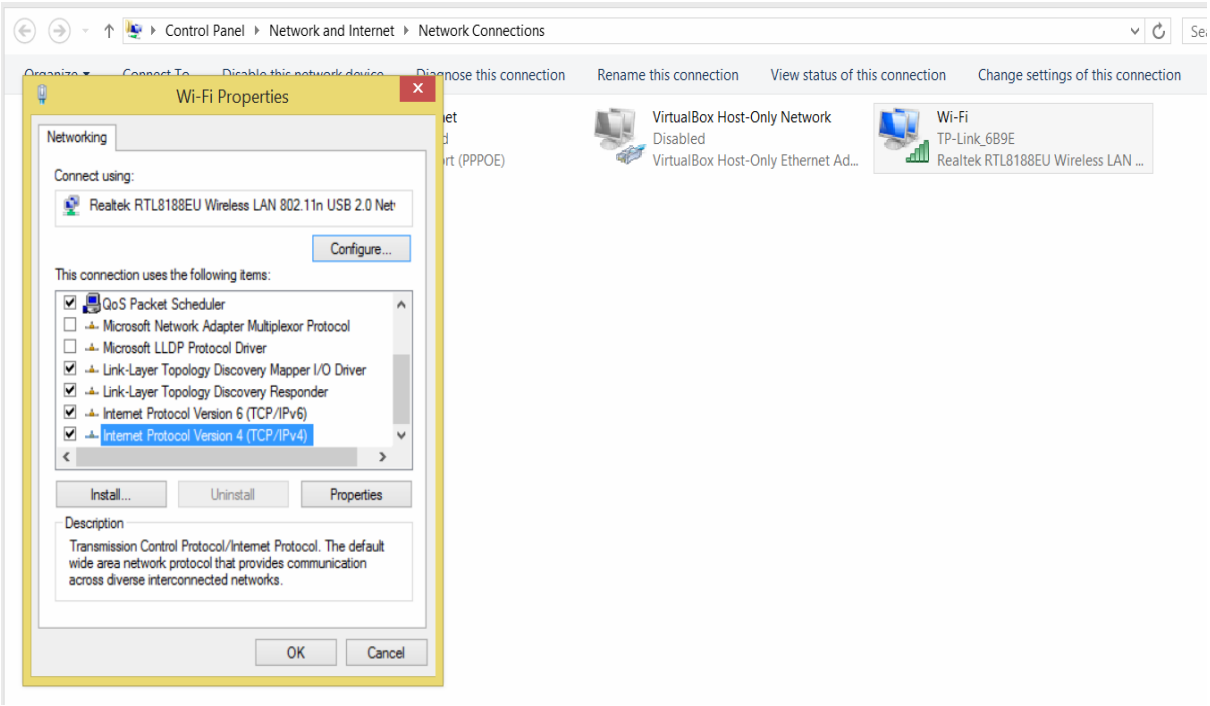


- An IPv6 address is 128-bit long. Each 16-bits is separated with a colon(:).

Configuring IP Settings:

- Static network settings include assigning the IP address, and other related information like gateway, DNS etc manually which enable it to become a part of a network.
- Dynamic settings make use of Dynamic Host Configuration Protocol (DHCP) to assign IP address and other networking information to your system automatically from a pre-set pool of addresses.
- Click on Start -> Run -> type ncpa.cpl -> OK
- Right click on any active network connection
- Select Internet Protocol Version 4 (TCP/IPv4) or (IPv6) -> Properties.
- Click on ‘Use the following IP address’.
- Provide the IP address
- Click on Subnet mask [automatically identifies]
- Provide the default gateway [Apart from IP address]

- Click on OK -> Close



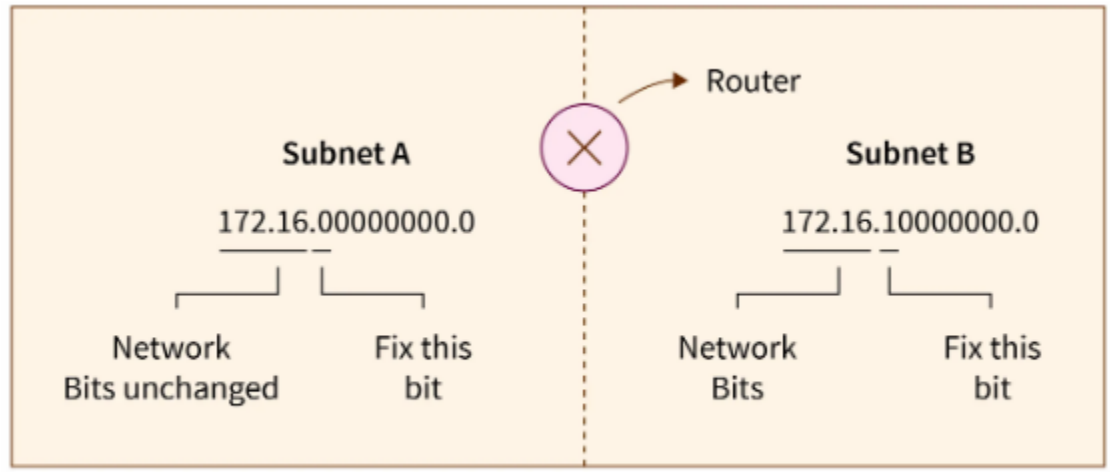
Subnet

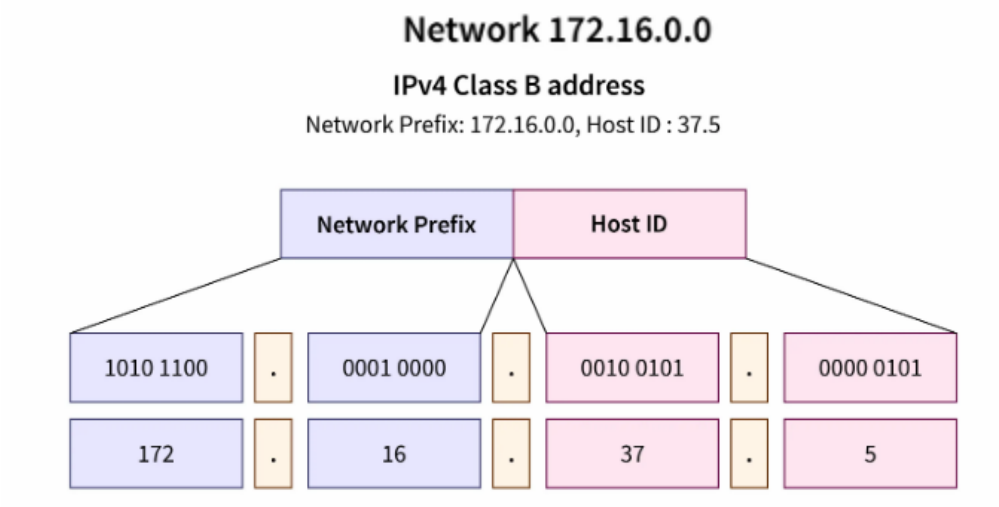
- When a bigger network is divided into smaller networks, to maintain security, then that is known as Subnetting.
- So, maintenance is easier for smaller networks.
- For example, if we consider a class A address, the possible number of hosts is 224 for each network, it is obvious that it is difficult to maintain such a huge number of hosts, but it would be quite easier to maintain if we divide the network into small parts.
- The MSB of host id is set to 1.

Uses:

- Reallocating IP Addresses
- Improves Network Speed
- Improving Network Security
- Reliving Network Congestion

- Efficiency





Supernet

- Supernetting, multiple networks are combined into a bigger network termed as a Supernetwork or Supernet.
- When multiple networks are combined to form a bigger network, it is termed super-netting
- Super netting is used in route aggregation to reduce the size of routing tables and routing table updates