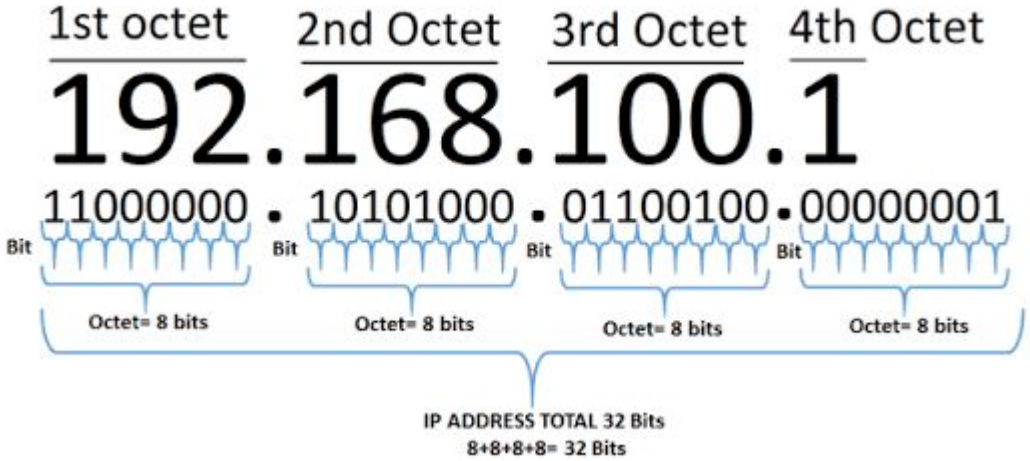
IP Address - IPv4

IP Address -IPv4

- IP address is unique way of representing device on the network
- Address is divided into two parts
  - Network portion
  - Host portion
- The value in each octet ranges from 0 to 255 decimal.



Decimal to Binary

To convert a decimal number of 172 to binary, start with the leftmost column.
Since 172 is greater than 128, that binary bit will be set to 1.
Next, add the value of the next column (128 + 64 = 192). Since 172 is less than 192, that binary bit will be set to 0.
Again, add the value of the next column (128 + 32 = 160). Since 172 is greater than 160, that binary bit will be set to 1.
Continue this process until the columns with binary bits set to 1 add up to 172:

Decimal	128	64	32	16	8	4	2	1
Binary	1	0	1	0	1	1	0	0

Binary to Decimal

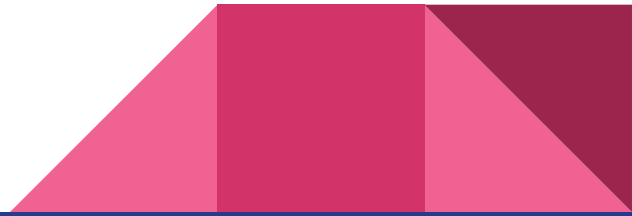
Converting from binary back to decimal is even simpler. Apply the binary number to the conversion table, and then add up any columns with binary bits set to 1. For example, consider the binary number of 11110001:

128	64	32	16	8	4	2	1
1	1	1	1	0	0	0	1

By adding 128 + 64 + 32 + 16+ 1, it can be determined that 11110001 equals 241.

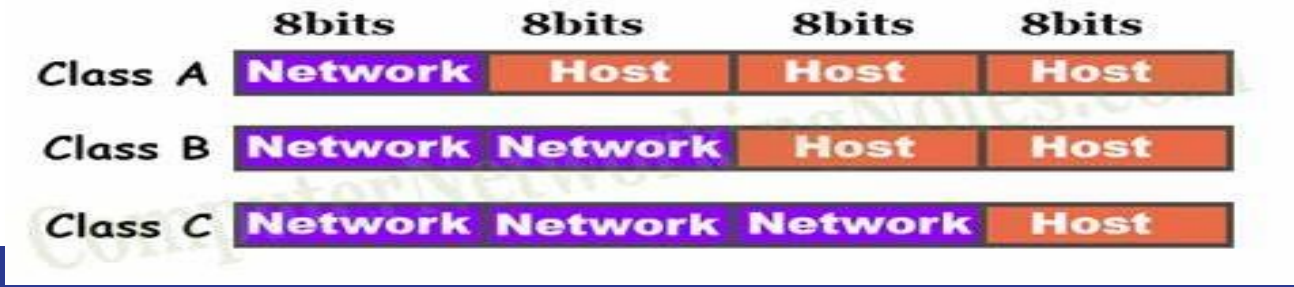
Classes

- There are five classes those are
  - **Class - A (Range 1.0.0.0 to 127.255.255.255)**
  - **Class - B (Range 128.0.0.0 - 191.255.255.255)**
  - **Class - C (Range 192.0.0.0 to 223.255.255.255)**
  - **Class - D (Range 224.0.0.0 to 239.255.255.255)**
  - **Class - E (Range 240.0.0.0 to 255.255.255.255.)**
- Let us see each class in details with example



Class - A, B and C

- Class - A
  - Here the **1st** octet is assign to the **Network ID** and remaining **three** octet are assign to **Host ID**
  - It is used for network that are having more than 65000 host up to 16777264.
- Class - B
  - Here the first two octet are assign to Network portion (ID) and other two octet are assign to Host portion (ID).
  - It is used in network where no host range from 256 to 65000
- Class - C
  - In this case the first three octet are assign to Network ID and one octet is assign to the Host ID.
  - It used in small area network (LAN) as it allows up to 254 host to connect per network



Class - D

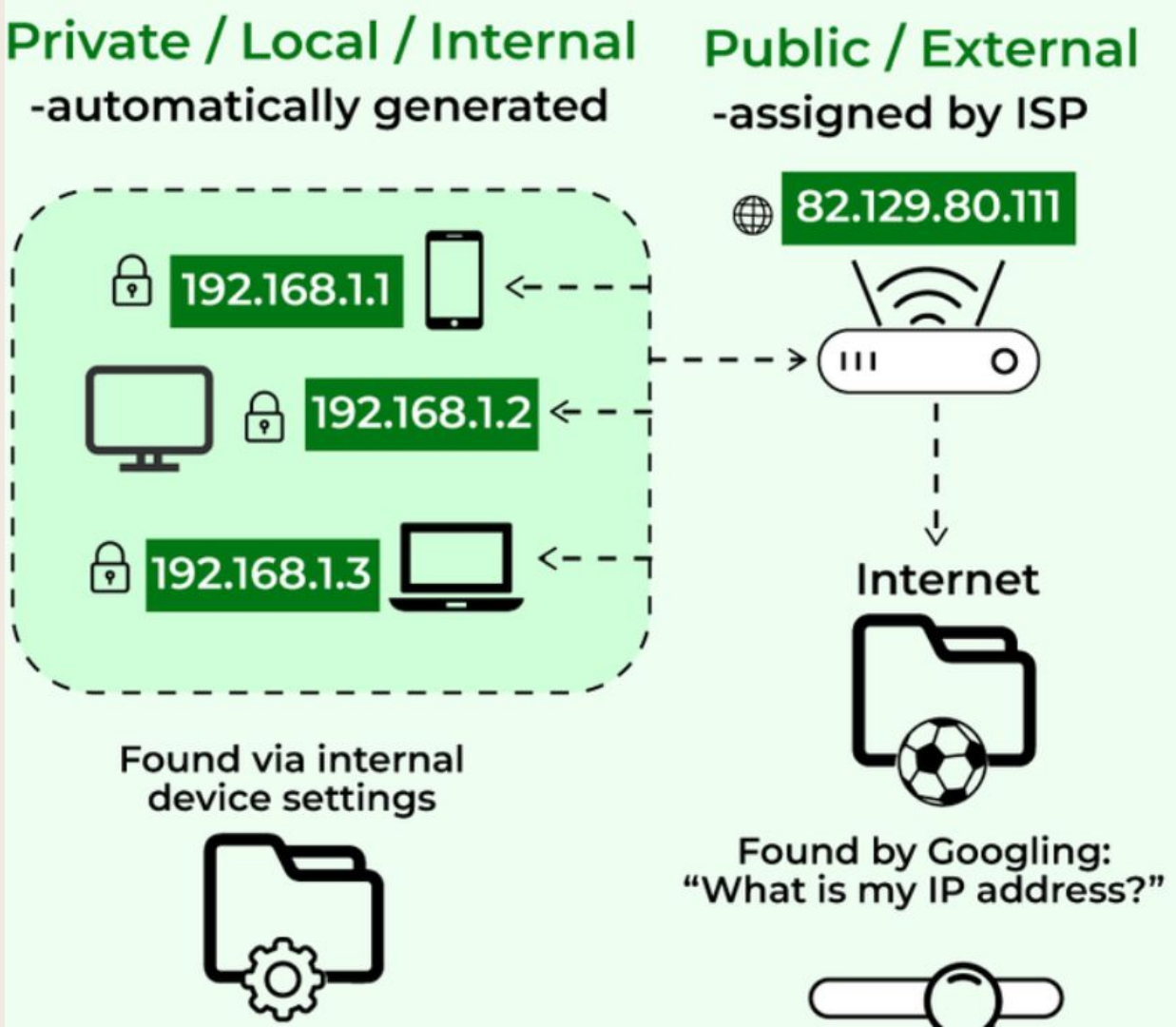
- In class D all octet are assign to Network ID and none is assign to Host ID.
- It is used for multicasting.
- Multicasting allows a single host to send a single stream of data to thousands and lakhs of host across the internet at same time.
- Ex: stock market data from a source to many brokerage site, people, etc

Class - E

- **Class E** IP address is reserved for experimental purposes and future use.
- It does not contain any subnet mask in it.
- The first higher octet bits are always set to 1111, and next remaining bits specify the host address.

Private Address

- Private address was introduce to conserve the public address
- How to find private address of the device : ipconfig command
- Class - A:
  10.0.0.0 to 10.255.255.255
- Class - B:
  172.16.0.0 to 172.31.255.255
- Class - C:
  192.168.0.0 to 192.168.255.255



Subnet Mask

- It helps you know which portion of the address identifies the network and which portion of the address identifies the host
- Class A, B, and C networks have default masks
  Class A: 255.0.0.0
  Class B: 255.255.0.0
  Class C: 255.255.255.0
- There are two ways to denote subnet masks: •
  - mask is 255.255.255.224. We can rewrite as /27 as there are 27 bits.
    For example: 192.168.5.32/27 denotes the network 192.168.5.32 with a mask of 255.255.255.224.

AND processing

You use ANDing most often when comparing an IP address to its subnet mask. The end result of ANDing, these two numbers together is to yield the network number of that address.

Question 1
What is the network number of the IP address 192.168.100.115 if it has a subnet mask of 255.255.255.240?

Answer
Step 1 Convert both the IP address and the subnet mask to binary:

192.168.100.115 = 11000000.10101000.01100100.01110011

255.255.255.240 = 11111111.11111111.11111111.11110000

Step 2 Perform the AND operation to each pair of bits—1 bit from the address ANDed to the corresponding bit in the subnet mask. Refer to the truth table for the possible outcomes:

192.168.100.115 = 11000000.10101000.01100100.01110011

255.255.255.240 = 11111111.11111111.11111111.11110000

ANDed result = 11000000.10101000.01100100.01110000

Step 3 Convert the answer back into decimal:

11000000.10101000.01100100.01110000 = 192.168.100.112

The IP address 192.168.100.115 belongs to the 192.168.100.112 network when a mask of 255.255.255.240 is used.

Subnetting

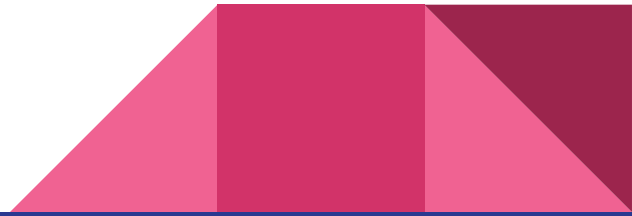
Subnetting allows you to create multiple logical networks that exist within a network

128	69	32	16	8	4	2	1
1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32

1) Given the Class C network of 192.168.5.0/24, subnet the network to create the network
   netA: must support 14 hosts
   netB: must support 28 hosts
   netC: must support 2 hosts
   netD: must support 7 hosts
   netE: must support 28 host

Answer :

In order to create the five needed subnets, you would need to use three bits from the Class C host bits. Two bits would only allow you four subnets.



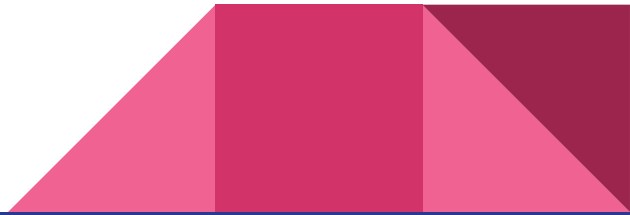
netA: 192.168.5.0/27 host address range 1 to 30

netB: 192.168.5.32/27 host address range 33 to 62

netC: 192.168.5.64/27 host address range 65 to 94

netD: 192.168.5.96/27 host address range 97 to 126

netE: 192.168.5.128/27 host address range 129 to 158



VLSM (variable length subnetting mask)

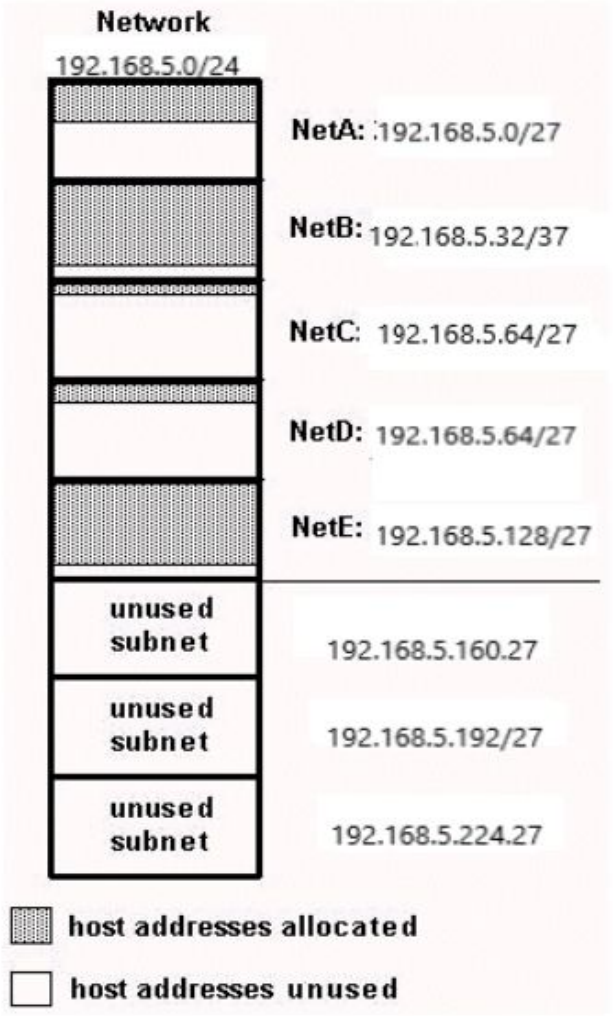
- In VLSM, each subnet chooses the block size based on its requirement. So, if requirements change, subnetting will be required multiple times.

- Example - : in subnetting

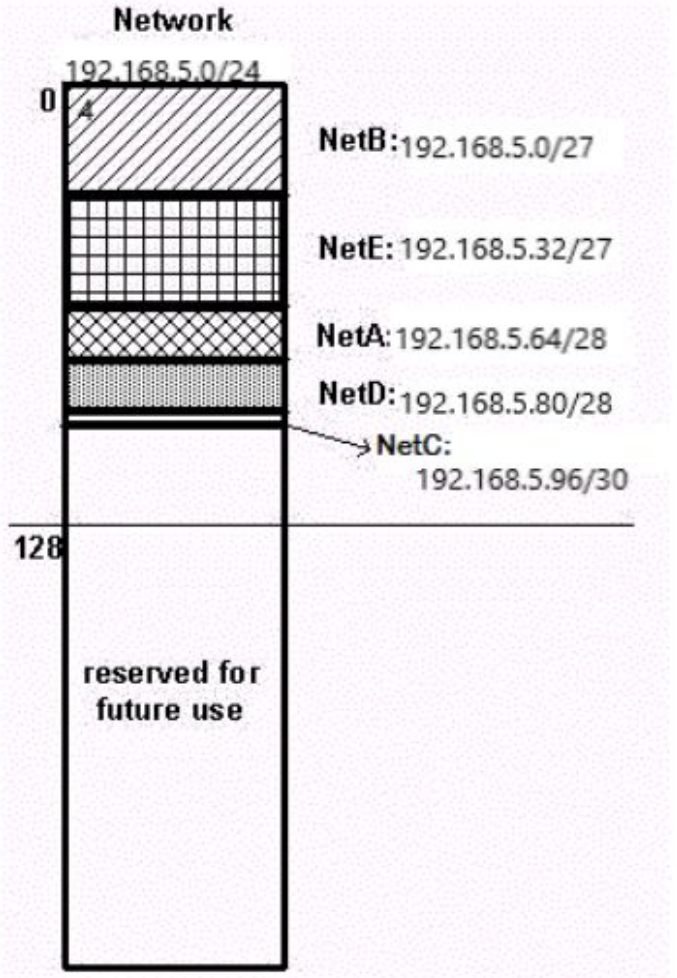
  We have assign the 30 host address in each subnet rather than it usage where **netC: require to support 2 hosts** but we have assign **netC: 192.168.5.64/27 host address range 65 to 94** around 30 where it utilizes only 2 and remaining 28 are being wasted to avoid that we use VlSM approach.

Determine what mask allows the required number of hosts:

- Ans:
  netA: requires a /28 (255.255.255.240) mask to support 14 hosts
  netB: requires a /27 (255.255.255.224) mask to support 28 hosts
  netC: requires a /30 (255.255.255.252) mask to support 2 hosts
  netD : requires a /28 (255.255.255.240) mask to support 7 hosts
  netE: requires a /27 (255.255.255.224) mask to support 28 hosts


Network
192.168.5.0/24
NetA: 192.168.5.0/27
NetB: 192.168.5.32/37
NetC: 192.168.5.64/27
NetD: 192.168.5.64/27
NetE: 192.168.5.128/27
unused subnet
192.168.5.160.27
unused subnet
192.168.5.192/27
unused subnet
192.168.5.224.27
host addresses allocated
host addresses unused

After VLSM


Network
192.168.5.0/24
0
NetB: 192.168.5.0/27
NetE: 192.168.5.32/27
NetA: 192.168.5.64/28
NetD: 192.168.5.80/28
NetC: 192.168.5.96/30
128
reserved for future use

CIDR (Classes inter domain routing)

- Classless Inter-Domain Routing (CIDR) is a method of IP address allocation and IP routing that allows for more efficient use of IP addresses.
- CIDR is based on the idea that IP addresses can be allocated and routed based on their network prefix rather than their class, which was the traditional way of IP address allocation.
- CIDR addresses are represented using a slash notation, which specifies the number of bits in the network prefix.
- example:
- so, network 172.16.0.0 255.255.0.0 can be represented as 172.16.0.0/16.