SNS COLLEGE OF TECHNOLOGY COIMBATORE

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DEPARTMENT OF MCA

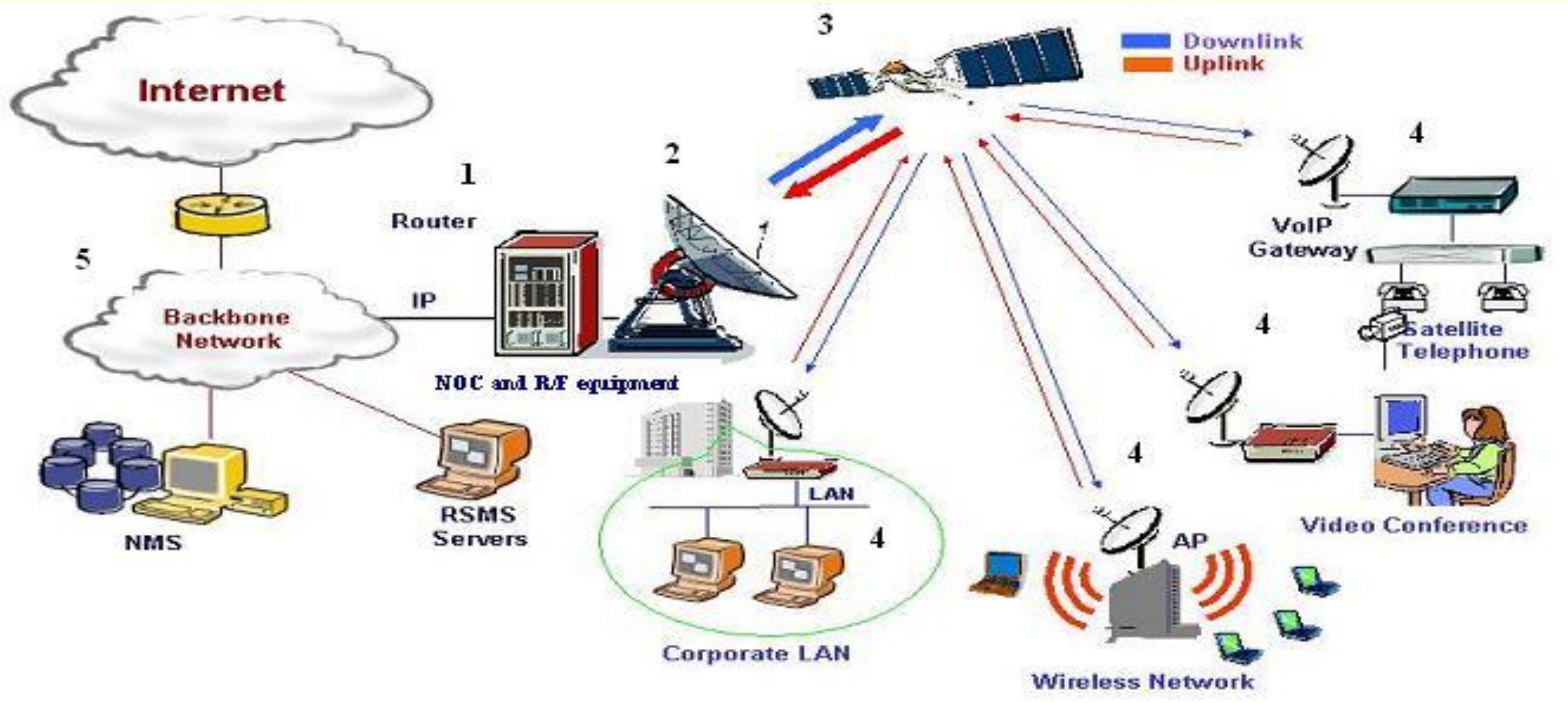
Course Name : 23CAT601 - DATA COMMUNICATION AND NETWORK

Class : I Year / I Semester

Unit III – NETWORK AND SWITCHING,NETWORK DEVICES

Topic - Subnetting

Internetworks- IP addressing methods, Subnetting

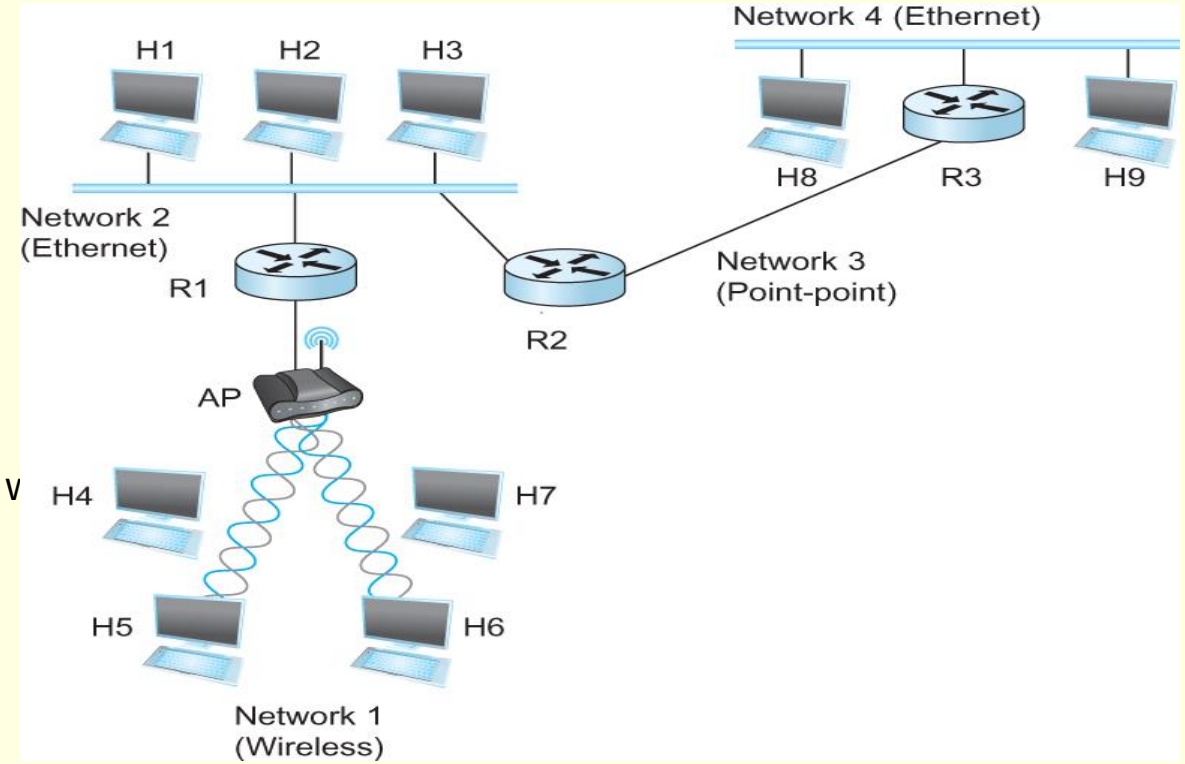


Internetworking

What is internetwork?

- An arbitrary collection of networks interconnected to provide some sort of host-to-host packet delivery service

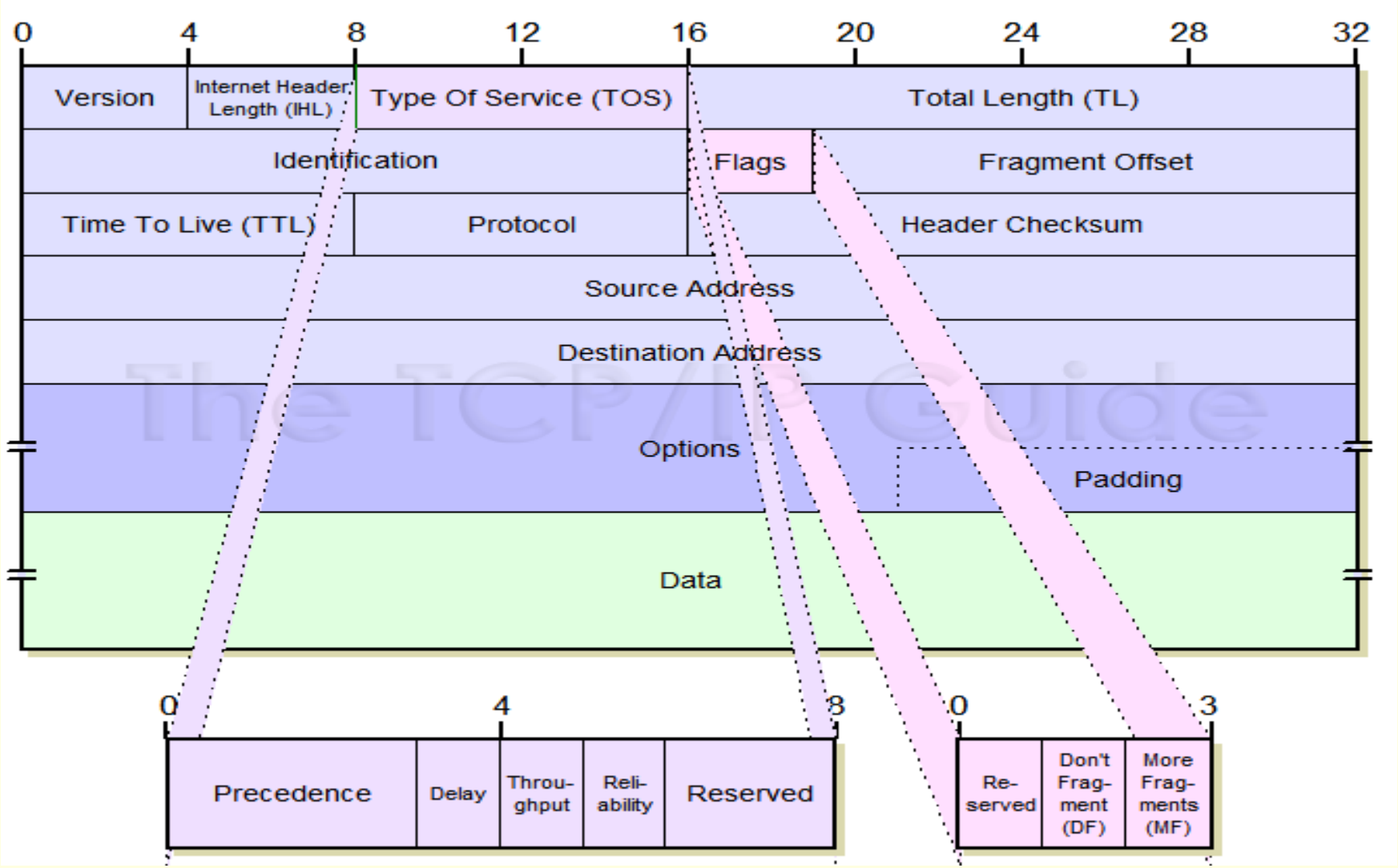
A simple internetwork v



What is IP?

- Stands for "Internet Protocol." IP provides a standard set of rules for sending and receiving data over the Internet. It allows devices running on different platforms to communicate with each other as long as they are connected to the Internet.
- IP Service Model
- Two parts
  - Global Addressing Scheme
    - Provides a way to identify all hosts in the network
  - Datagram (Connectionless) model for data delivery
    - Best-effort delivery (unreliable service)
    - packets are lost
    - packets are delivered out of order
    - duplicate copies of a packet are delivered
    - packets can be delayed for a long time

Datagram


0
4
8
12
16
20
24
28
32
Version
Internet Header Length (IHL)
Type Of Service (TOS)
Total Length (TL)
Identification
Flags
Fragment Offset
Time To Live (TTL)
Protocol
Header Checksum
Source Address
Destination Address
Options
Padding
Data
0
4
8
Precedence
Delay
Throu-ghput
Reli-ability
Reserved
0
3
Re-served
Don't Frag-ment (DF)
More Frag-ments (MF)

IP Datagram

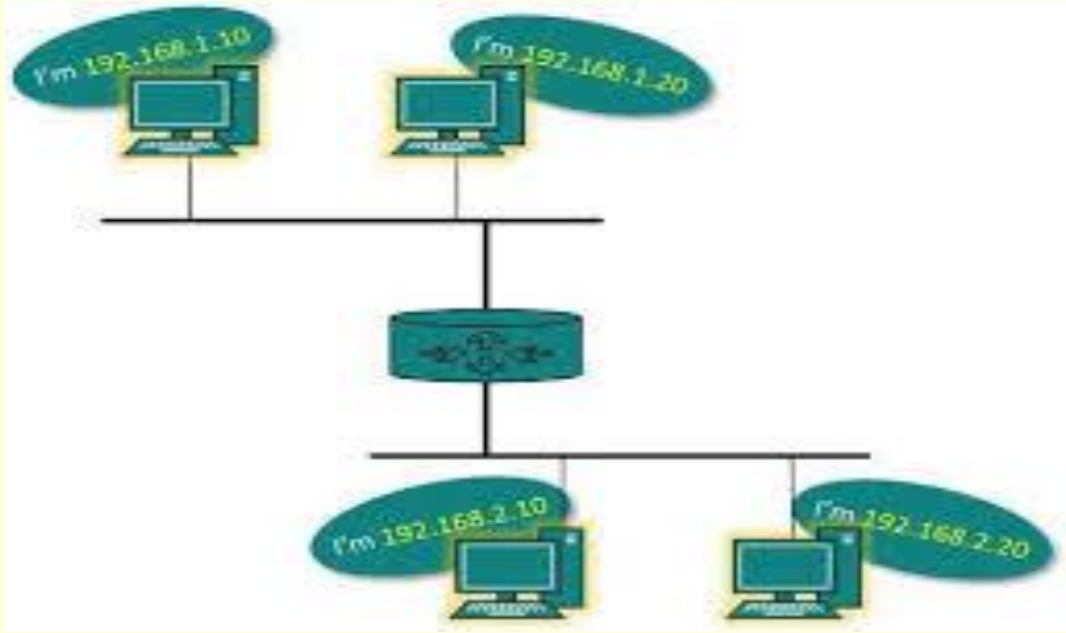
- **Version (4 bits): 0100**
  - currently 4 or 6.
  - Also called IPv4 and IPv6
- **Hlen (4 bits): (Header Length)**
  - Multiply of 4 Bytes
  - 4 bits (0 – 15) * 4 =60 bytes
- **TOS (8 bits):**
  - How the datagram should be handled
  - Precedence, throughput, delay, reliability, Reserve
- **Length (16 bits):**
  - Length of IP datagram
- **Ident (16 bits)**
  - used by fragmentation
  - Each fragment is identified with a sequence of numbers in this field
- **Flag(3 bits)**
  - Can or cannot be fragmented
  - First, middle or last
- **Fragmentation offset(13 bits)**
  - Pointer shows the offset of the data in original datagram
- **Time to Live(8 bits)**
  - Can or cannot be fragmented
  - First, middle or last

IP Datagram

- **TTL (8 bits):**
  - number of hops/routers this packet can travel
  - discard the looping packets
  - Datagram travels through the internet each router decrements it by 1
  - Discard the packet when it becomes 0
- **Protocol (8 bits):**
  - Defines upper layer protocol
  - TCP,UDP,ICMP,etc
- **Header checksum(16 bits)**
  - Check the integrity of header
- **Source address(32 bits)**
  - 4 byte internet address
  - Identify the original source of the datagram
- **Destination address(32 bits)**
  - 4 byte internet address
  - Identify the final source of the datagram
- **Options**
  - Gives more functionality to the IP address.
  - Control routing, timing, management and alignment

Addressing

- An IP address is an address used to uniquely identify a device on an IP network.
- The address is made up of 32 binary bits which can be divisible into a network portion and host portion with the help of a subnet mask.
- 32 binary bits are broken into four octets (1 octet = 8 bits)
- Dotted decimal format (for example, 172.16.81.100)

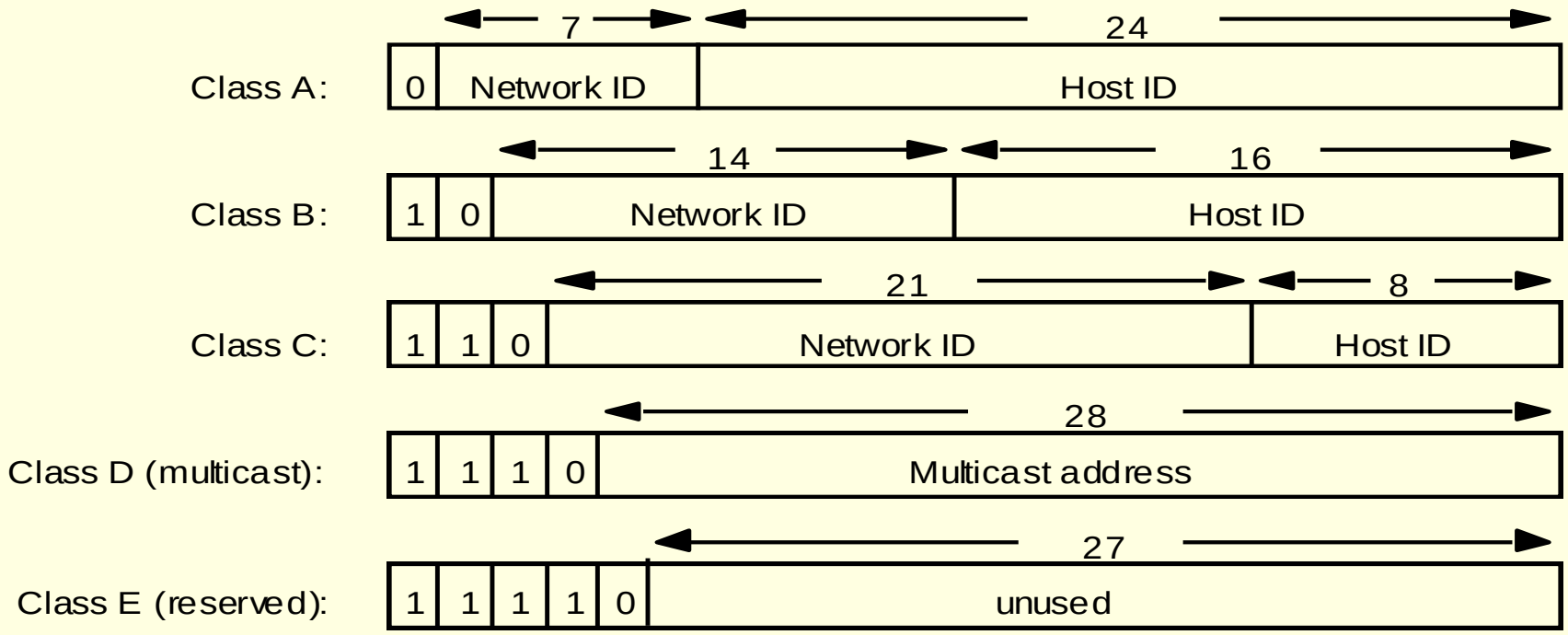


Addressing classes

Five different classes:

The 32 bit IP address is divided into five sub-classes. These are:

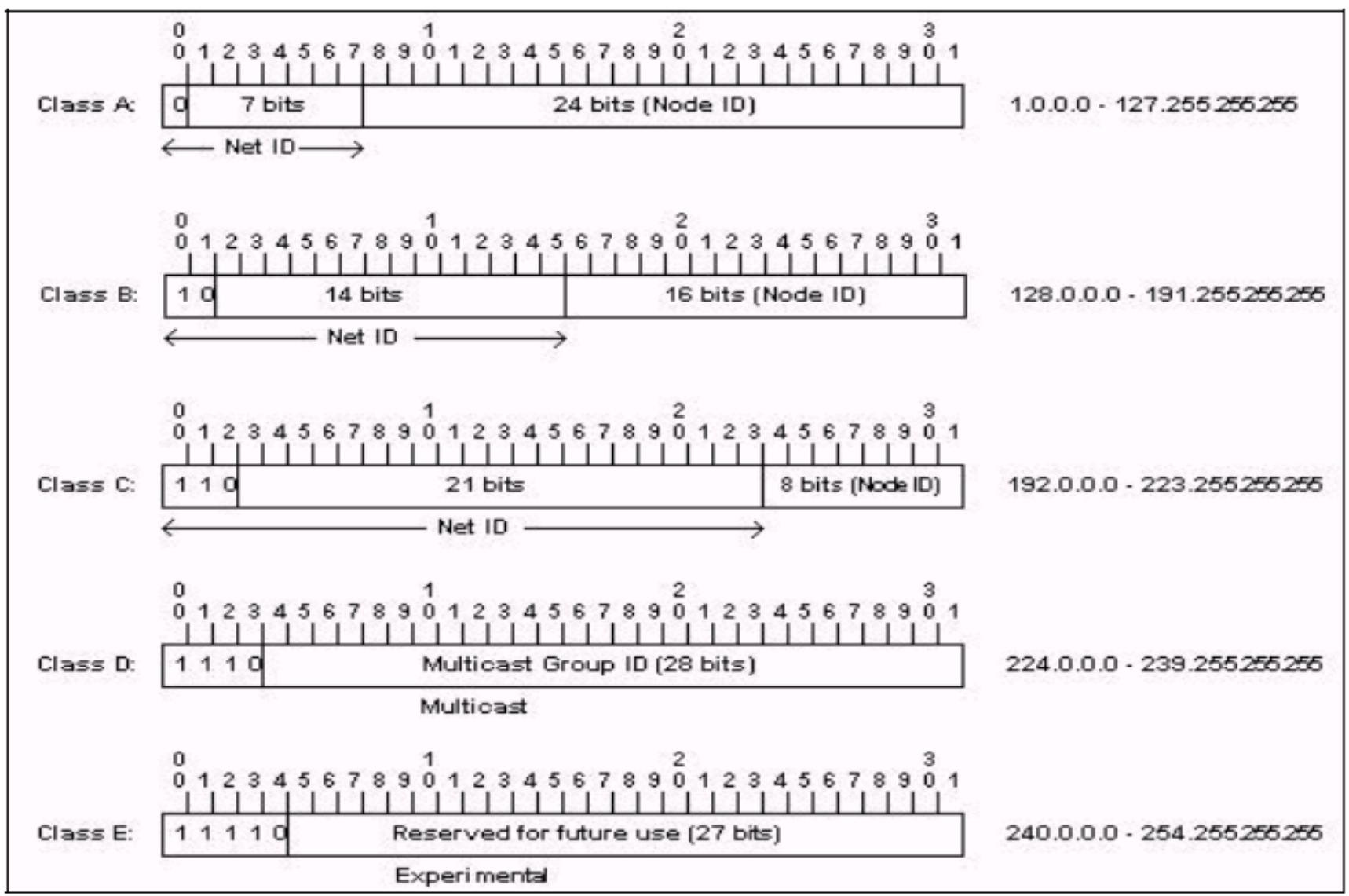
1. Class A
2. Class B
3. Class C
4. Class D
5. Class E



IPv4 address is divided into two parts:

1. Network ID
2. Host ID

Addressing classes



Class: A

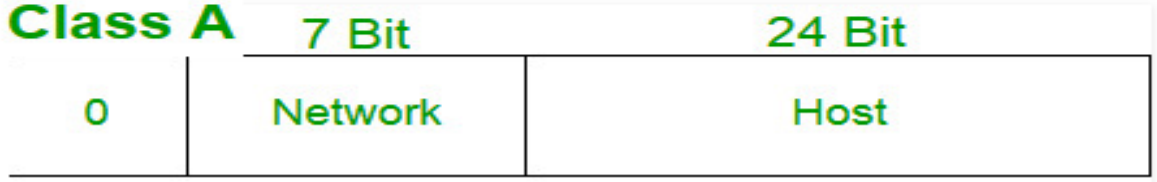
Contain a large number of hosts:

1. The network ID is 8 bits long.
2. The host ID is 24 bits long.

2 address is subracted because 0.0.0.0 and 127.x.y.z are special address.

- 2^7-2= 126 network ID
- 2^24 – 2 = 16,777,214 host ID

IP addresses belonging to class A ranges from 1.x.x.x – 126.x.x.x



Class: B

Contain Medium to large sized networks:

1. The network ID is 16 bits long.
2. The host ID is 16 bits long.

The default sub-net mask for class B is 255.255.x.x.

- 2^14 = 16384 network address
- 2^16 – 2 = 65534 host address

IP addresses belonging to class B ranges from 128.0.x.x – 191.255.x.x.

Class: C

Contain Medium to Small sized networks:

1. The network ID is 24 bits long.
2. The host ID is 8 bits long.

The default sub-net mask for class C is 255.255.255.x.

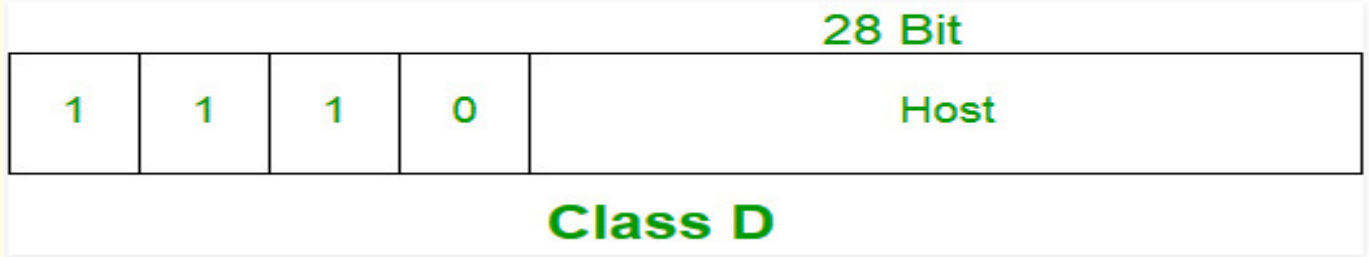
- 2^21 = 2097152 network address
- 2^8 – 2 = 254 host address

IP addresses belonging to class C ranges from 192.0.0.x – 223.255.255.x.

Class: D

Reserved for Multicasting:

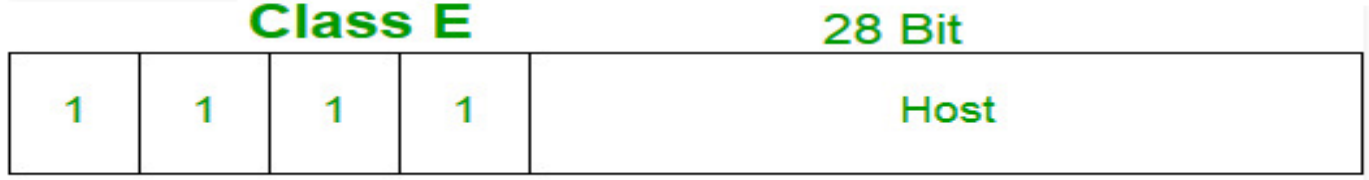
Class D does not posses any sub-net mask. IP addresses belonging to class D ranges from 224.0.0.0 – 239.255.255.255.



Class: E

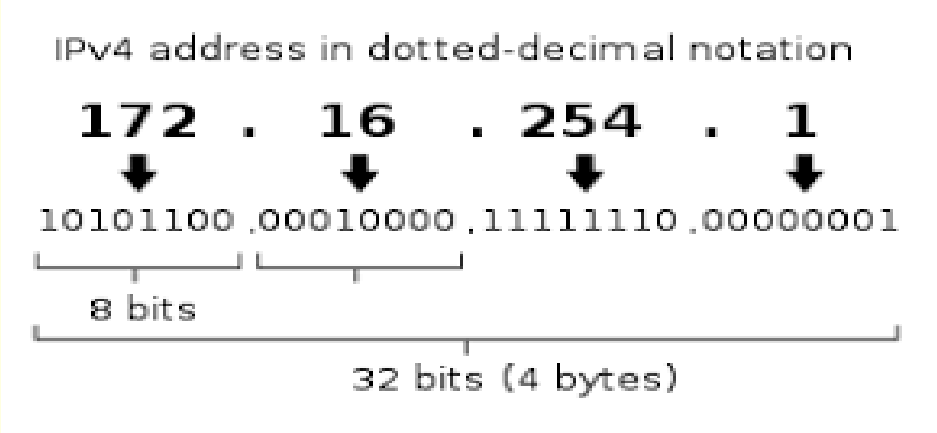
Experimental and research purpose:

class E ranges from 240.0.0.0 – 255.255.255.254.
The higher order bits of first octet of class E are always set to 1111.



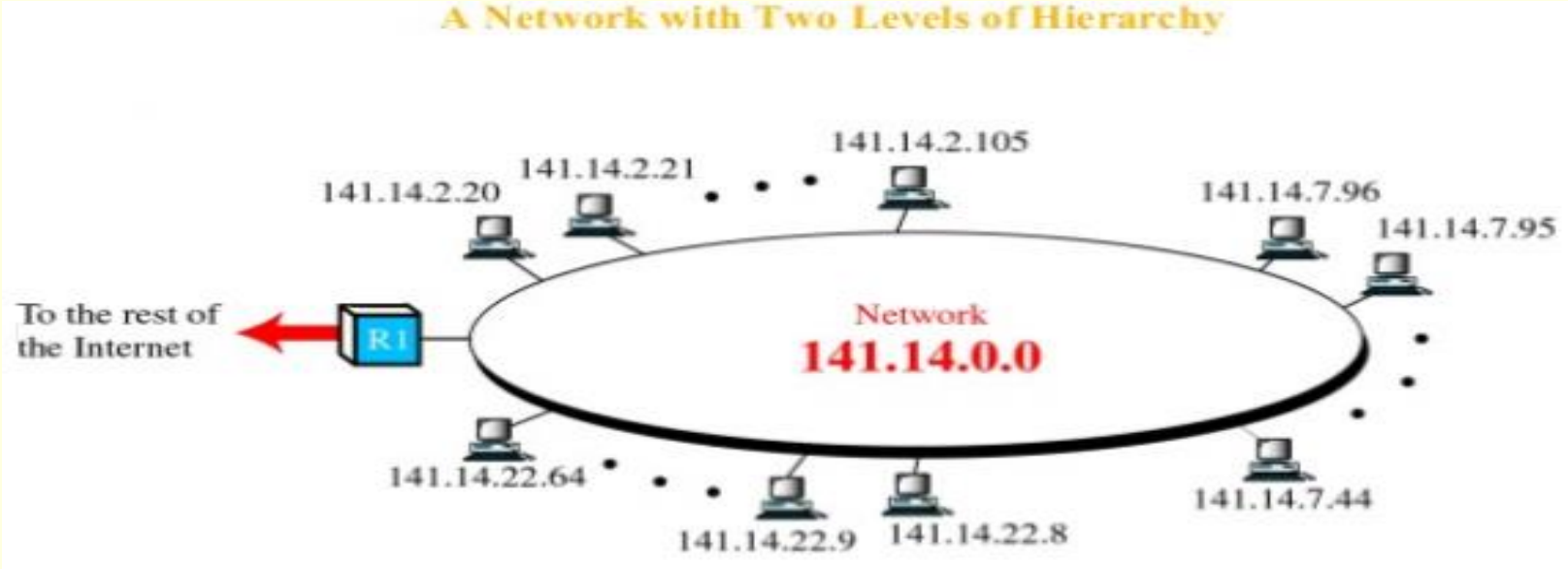
Dotted Decimal Notations

To make the 32 bit form shorter and easier to read, internet addresses are written in decimal points separating the bytes – **dotted decimal notation**

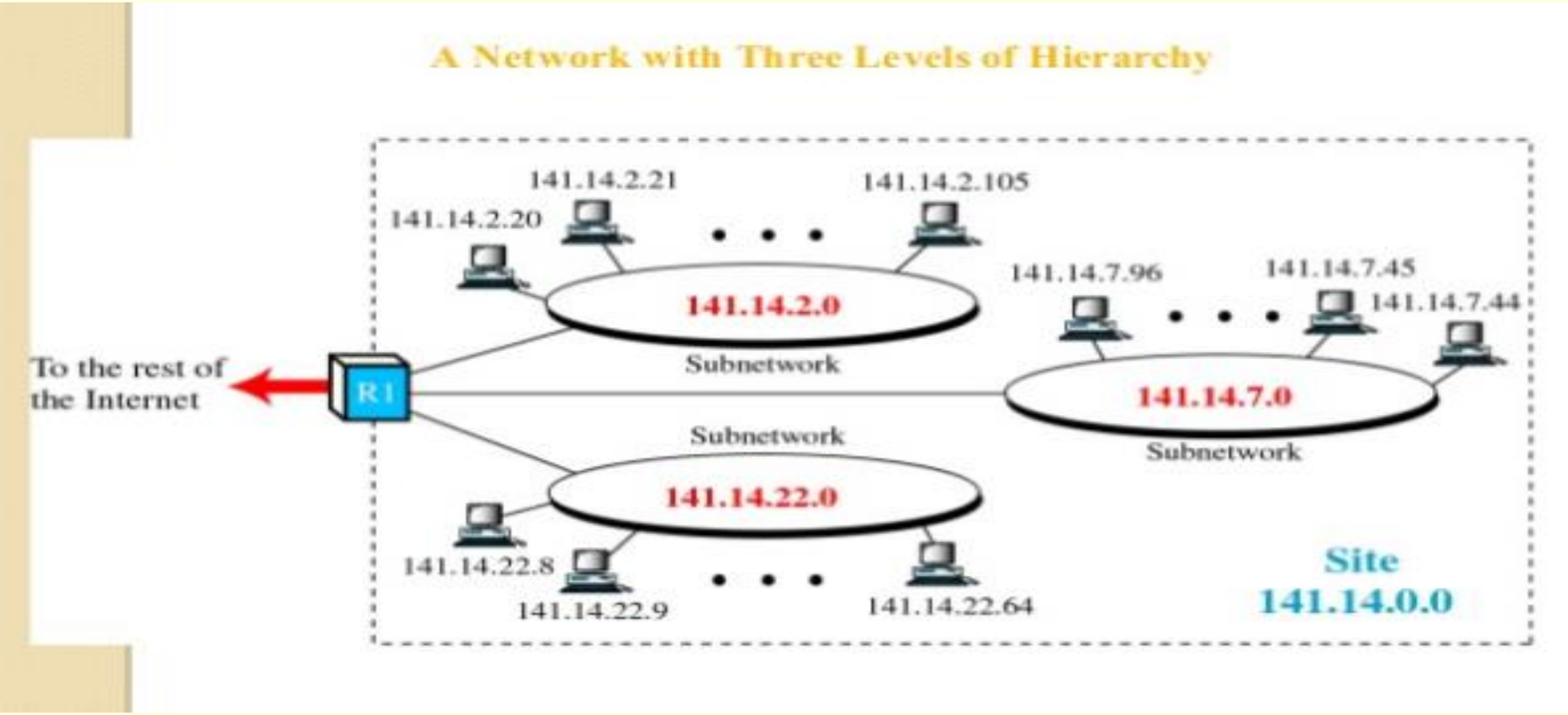


Subnetting

IP Subnetting is a process of dividing a large IP network in smaller IP networks**.**



Subnetting

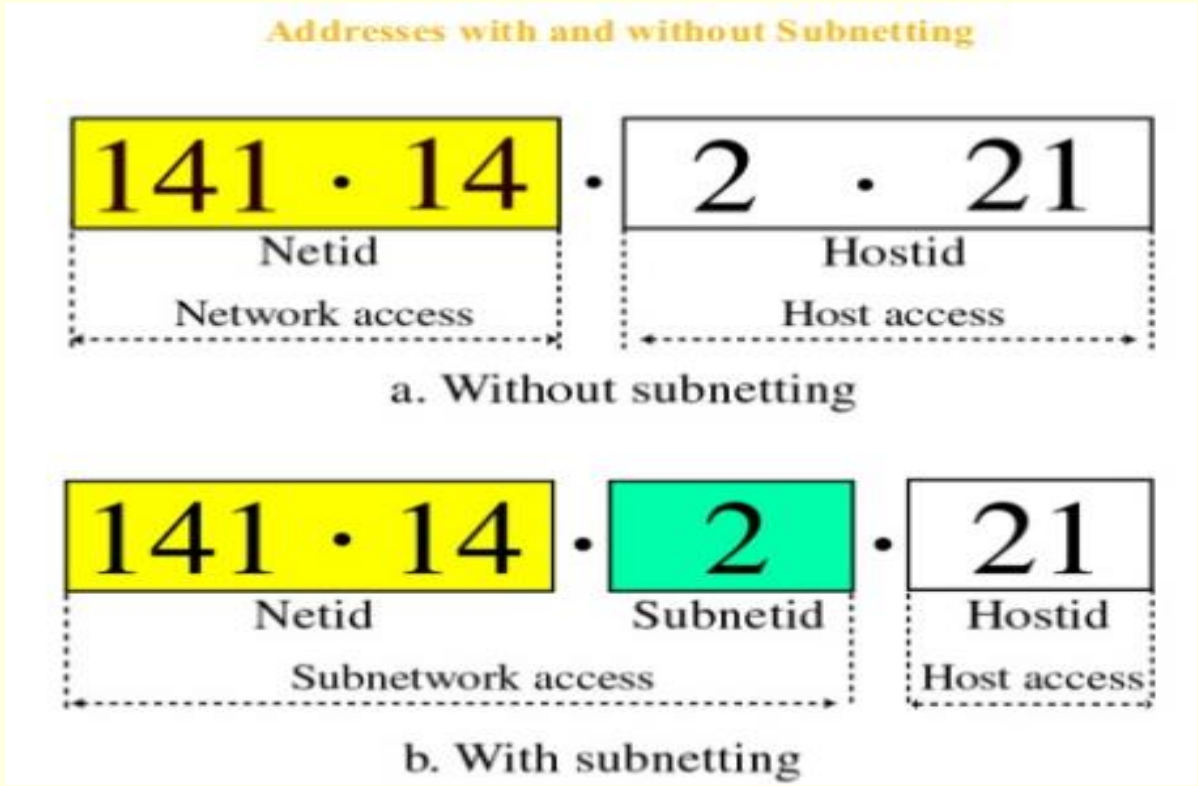


The rest of internet is not aware that the network is divided into three physical subnetworks

Three levels of Hierarchy

Adding subnetworks creates an intermediate level of hierarchy in the IP addressing system.

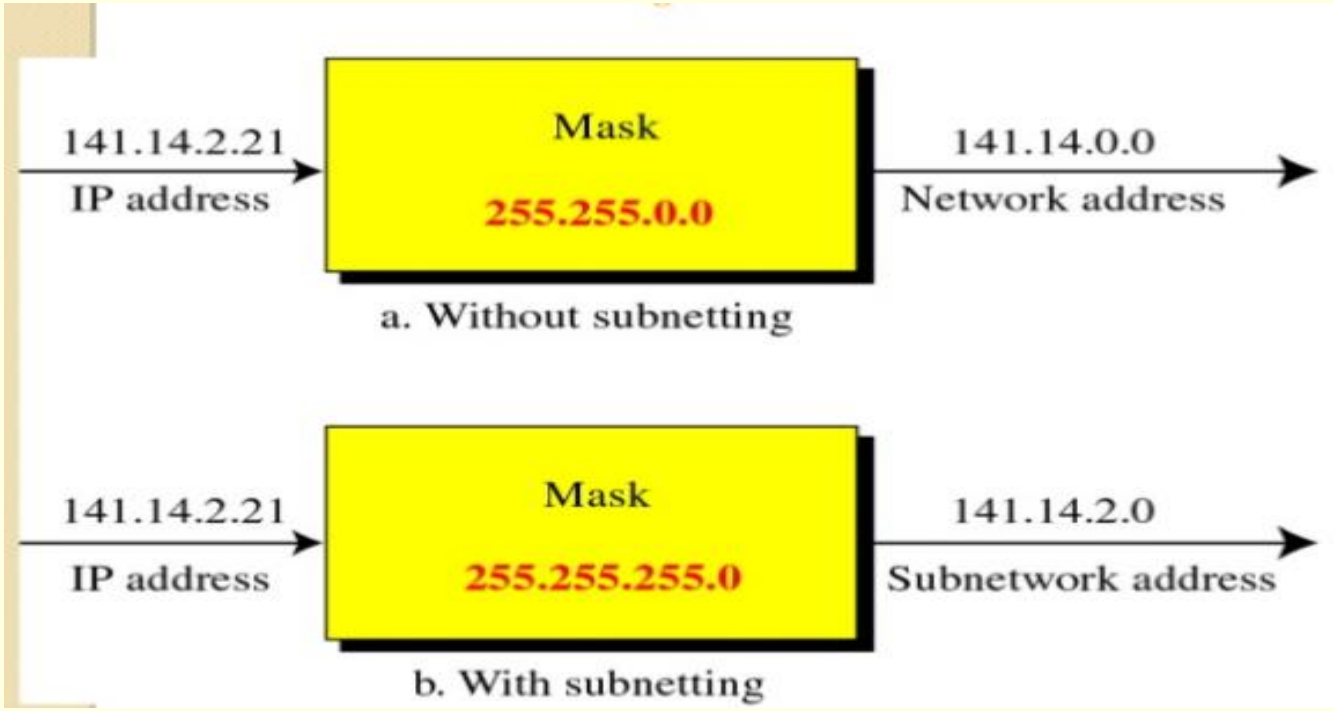
1. netid : Define the site
2. subnetid: Defines the physical subnetwork
3. Hostid: Defines the connection of the host to the subnetwork.



Masking

Masking is a process that extracts the address of the physical network from an IP address.

1. Not subnetted: It extracts the network address from an IP address
2. Subnetted: Extracts the subnetwork address from an IP address.



Boundary level masking

1.The bytes in the IP address that correspond to 255 in the mask will be repeated in the subnetwork address.

2. The bytes in the IP address that correspond to 0 in the mask will change to 0 in the subnetwork address.

IP address	45	23	21	8
Mask	255	255	0	0
Subnetwork Address	45	23	0	0

Nonboundary level masking

1.The bytes in the IP address that correspond to 255 in the mask will be repeated in the subnetwork address.

2. The bytes in the IP address that correspond to 0 in the mask will change to 0 in the subnetwork address.

3. For other bytes, use bit wise and operator

IP address	45	123	21	8
Mask	255	192	0	0
Subnetwork Address	45	64	0	0

Thank You