

# Protocol

set of rules to follow to have proper communication.

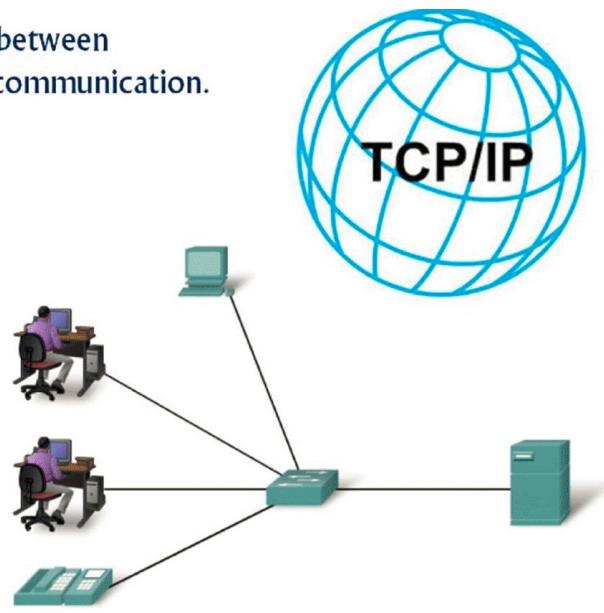
## Network protocols

- TCP/IP (Department of Defense)
- IPx/SPx (Novell)
- Appletalk (Apple)
- Netbios (microsoft)
- OSI (ISO)



## What is TCP/IP?

- ▶ TCP/IP is a standard protocol used between computers and network devices for communication.
- ▶ Internet work based on TCP/IP





$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$	=	160
128	64	32	16	8	4	2	1		
1	0	1	0	1	1	0	0		

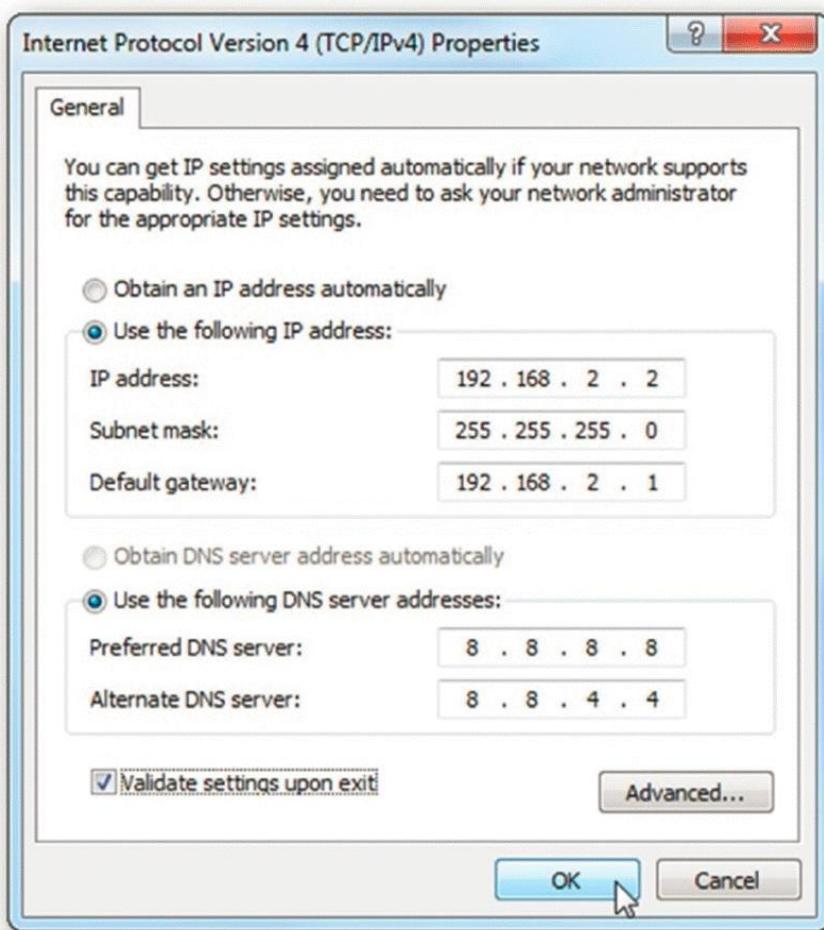
$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$	=	8
128	64	32	16	8	4	2	1		
0	0	0	0	0	1	1	1		

$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$	=	1
128	64	32	16	8	4	2	1		
0	0	0	0	0	0	0	1		

### Convert Decimal to Binary



## Assigning IPv4 Address to a Host



## Range of IPv4 address

**Taking Example for First Octet :  
Total 8 bits, Value will be 0's and 1's**

**Total IP Address Range**

**0 . 0 . 0 . 0**

**to**

**255.255.255.255**

# IP Address Classification

IP Addresses are divided into 5 Classes

CLASS A 0-127

CLASS B 128 - 191

CLASS C 192-223



CLASS D 224-239 Reserved for Multicasting

CLASS E 240-255 Reserved for Research & Development

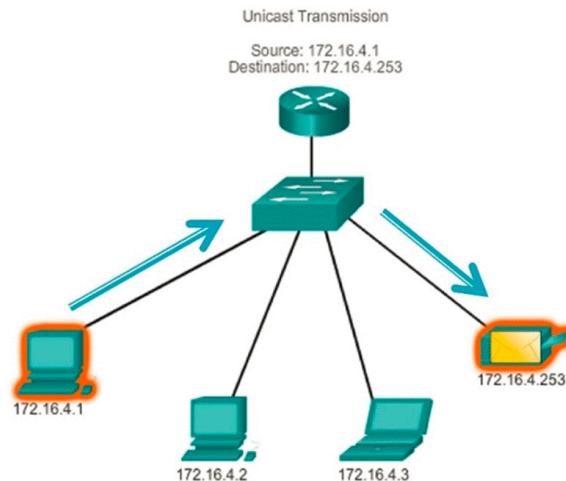
## Types of communication

In an IPv4 network, the hosts can communicate one of three different ways:

1. Unicast
2. Broadcast
3. Multicast

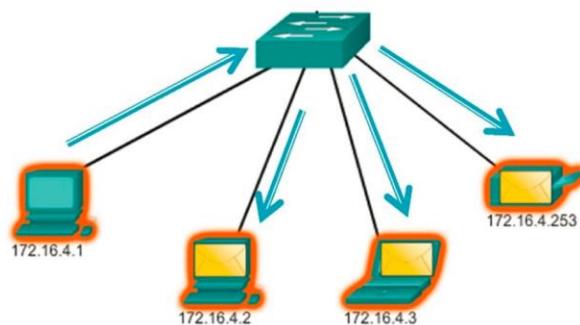
## Unicast Transmission

the process of sending a packet from one host to an individual host.



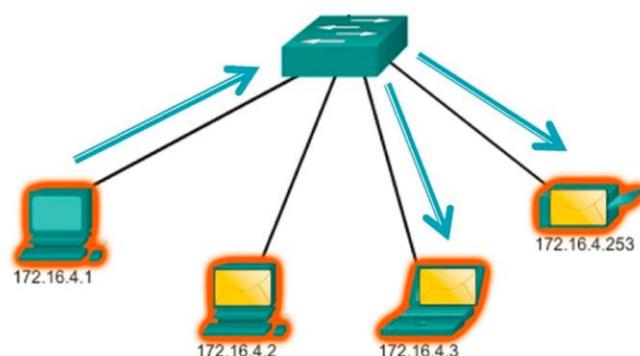
## Broadcast Transmission

The process of sending a packet from one host to all hosts in the network



## Multicast Transmission

- The process of sending a packet from one host to a selected group of hosts, possibly in different networks
- CLASS D    224-239   Reserved for Multicasting





## Network & Host portions

IP address is divided into Network & Host Portion

**CLASS A**

**N.H.H.H**

**CLASS B**

**N.N.H.H**

**CLASS C**

**N.N.N.H**

**Host:** a specific device in the network  
**Network:** set of devices

### **Class C-Range N.N.N.H      192.168.1.X**

<b>192.168.1.0</b>	First three portions has to be same in order to be in the same network.
<b>192.168.1.1</b>	
<b>192.168.1.2</b>	X = 0-255
<b>192.168.1.3</b>	<b>N.N.N.H</b>
....	
....	
....	
....	
<b>192.168.1.253</b>	
<b>192.168.1.254</b>	
<b>192.168.1.255</b>	

### **Class B - Range N.N.H.H      172.16.X.X**

First two portions has to be same in order to be in the same network  
**X = 0-255**

<b>172.16.0.0</b>	<b>172.16.1.0</b>	<b>172.16.2.0</b>	<b>172.16.255.0</b>
<b>172.16.0.1</b>	<b>172.16.1.1</b>	<b>172.16.2.1</b>	<b>172.16.255.1</b>
<b>172.16.0.2</b>	<b>172.16.1.2</b>	<b>172.16.2.2</b>	<b>172.16.255.2</b>
<b>172.16.0.3</b>	<b>172.16.1.3</b>	<b>172.16.2.3</b>	<b>172.16.255.3</b>
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
<b>172.16.0.254</b>	<b>172.16.1.254</b>	<b>172.16.2.254</b>	<b>172.16.255.254</b>
<b>172.16.0.255</b>	<b>172.16.1.255</b>	<b>172.16.2.255</b>	<b>172.16.255.255</b>

**Class A-Range**      **N.H.H.H**      **10.X.X.X**

First one portions has to be same in order to be in the same network

X = 0-255

10.0.0.0	10.0.1.0	10.0.2.0	10.0.255.0
10.0.0.1	10.0.1.1	10.0.2.1	10.0.255.1
10.0.0.2	10.0.1.2	10.0.2.2	10.0.255.2
10.0.0.3	10.0.1.3	10.0.2.3	10.0.255.3
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
10.0.0.254	10.0.1.254	10.0.2.254	10.0.255.254
10.0.0.255	10.0.1.255	10.0.2.255	10.0.255.255

**Class A-Range**      **N.H.H.H**      **10.X.X.X**

10.1.0.0	10.1.1.0	10.1.2.0	10.1.255.0
10.1.0.1	10.1.1.1	10.1.2.1	10.1.255.1
10.1.0.2	10.1.1.2	10.1.2.2	10.1.255.2
10.1.0.3	10.1.1.3	10.1.2.3	10.1.255.3
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
10.1.0.254	10.1.1.254	10.1.2.254	10.1.255.254
10.1.0.255	10.1.1.255	10.1.2.255	10.1.255.255

**Class A-Range**      **N.H.H.H**      **10.X.X.X**

10.255.0.0	10.255.1.0	10.255.2.0	10.255.255.0
10.255.0.1	10.255.1.1	10.255.2.1	10.255.255.1
10.255.0.2	10.255.1.2	10.255.2.2	10.255.255.2
10.255.0.3	10.255.1.3	10.255.2.3	10.255.255.3
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
10.255.0.254	10.255.1.254	10.255.2.254	10.255.255.254
10.255.0.255	10.255.1.255	10.255.2.255	10.255.255.255

▶ Class C - Range	N.N.N.H	192.168.1.X
▶ Class B - Range	N.N.H.H	172.16.X.X
▶ Class A - Range	N.H.H.H	10.X.X.X

## Number of hosts address in each class

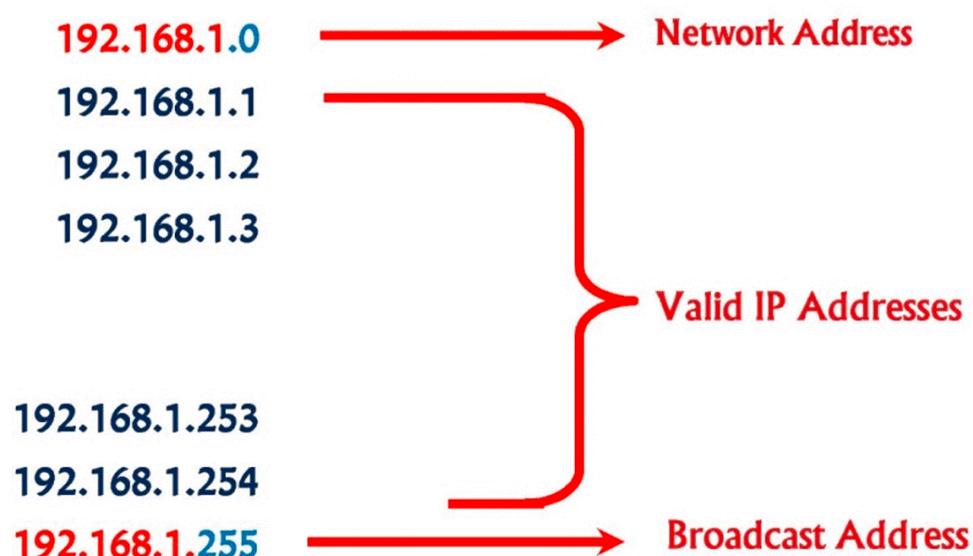
▶ Class C - Range	host bits= 8	$2^8 = 256$
▶ Class B - Range	host bits= 16	$2^{16} = 65536$
▶ Class A - Range	host bits= 24	$2^{24} = 16777216$

## Number of valid hosts address

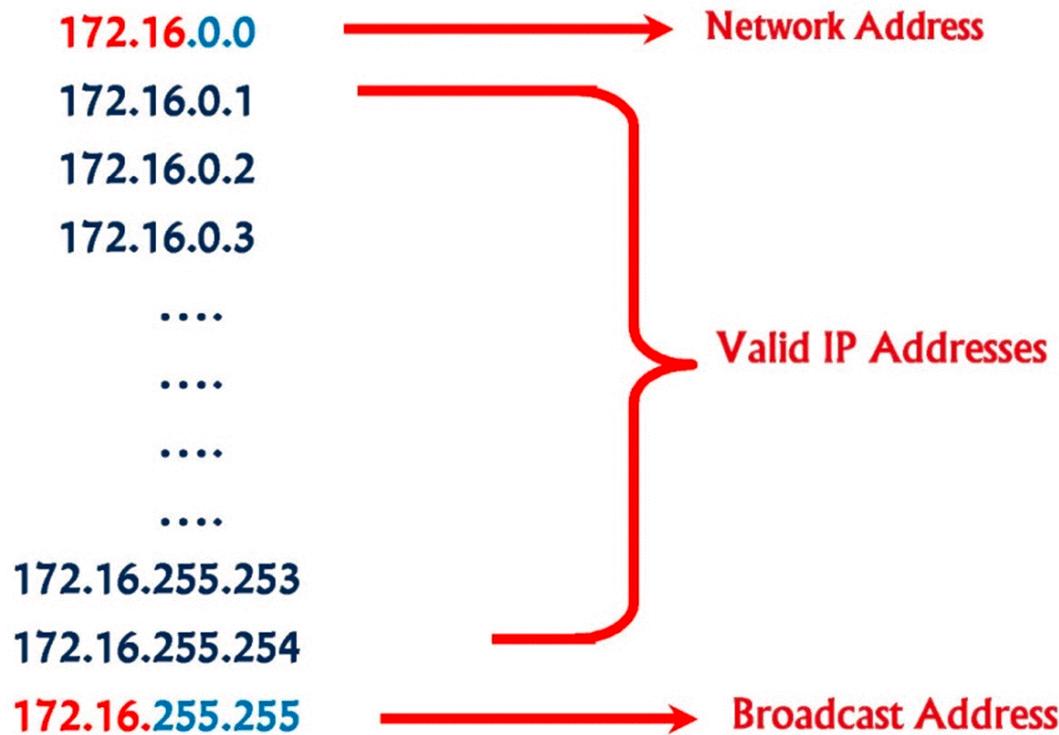
▶ Class C	N.N.N.H	host bits= 8	$2^8 = 256-2$
▶ Class B	N.N.H.H	host bits= 16	$2^{16} = 65536-2$
▶ Class A	N.H.H.H	host bits= 24	$2^{24} = 16777216-2$

First and last address in each range are reserved for Network ID and Broadcast ID.

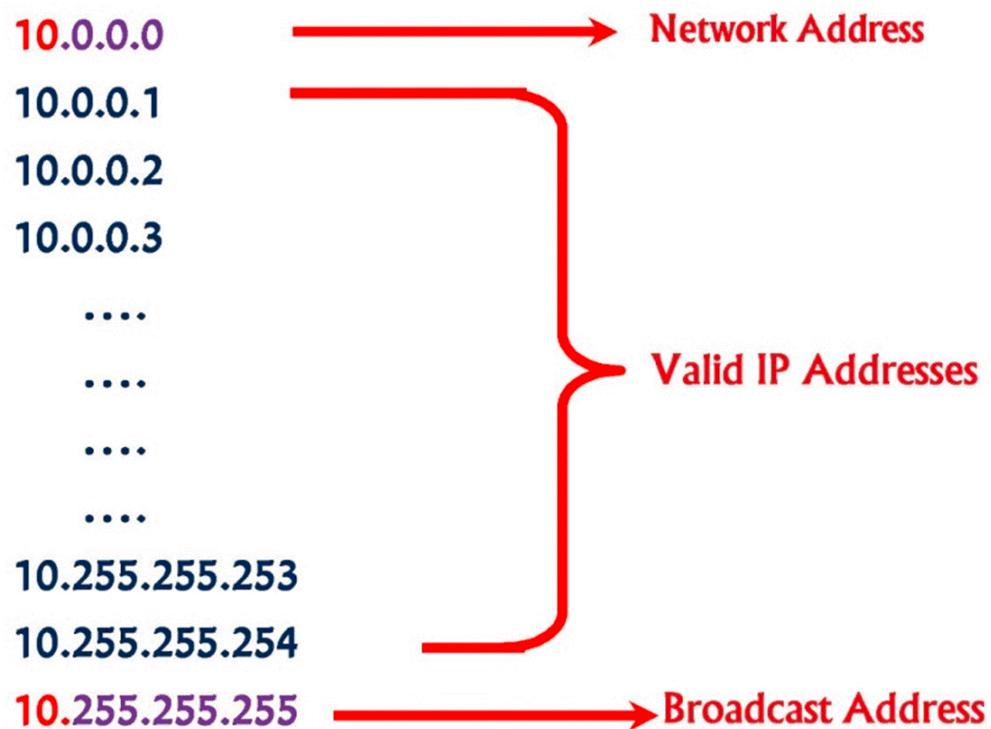
## Class-C



## Class - B



## Example - Class A



# Network & Broadcast Address

## Network ID :

- First IP of the range
- All ZERO's in the host portion
- Reserved for Identifying complete network.

Class C	N.N.N.H	192.168.1.X	192.168.1.0
Class B	N.N.H.H	172.16.X.X	172.16.0.0
Class A	N.H.H.H	10.X.X.X	10.0.0.0

## Broadcast Address

### Broadcast address

- Last IP address of the range
- All ONE'S in the host portion
- Used to send broadcast to all with in the same network

Class C	N.N.N.H	192.168.1.X	192.168.1.255
Class B	N.N.H.H	172.16.X.X	172.16.255.255
Class A	N.H.H.H	10.X.X.X	10.255.255.255

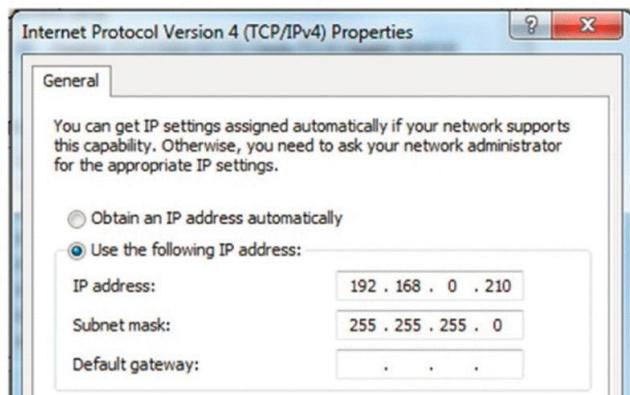
## Valid IP

- Valid IP Addresses lie between the Network Address and the Broadcast Address.
- Only Valid IP Addresses are assigned to hosts/clients

# Subnet-mask

Subnet Mask differentiates the Network and Host Portion.

- 1 represent network
- 0 represent hosts



Class A	N.H.H.H	255.0.0.0
Class B	N.N.H.H	255.255.0.0
Class C	N.N.N.H	255.255.255.0

## Reserved Address

- ▶ Class D              224.x.x.x - 239.x.x.x
- ▶ Class E              240.x.x.x - 255.x.x.x
- ▶ Network ID & Broadcast ID
- ▶ 0.x.x.x              not valid
- ▶ 127.x.x.x            for loopback address (testing TCP/IP)

## Public IP

- ▶ Used on public network( INTERNET)
- ▶ Recognized on internet
- ▶ Given by the service provider ( from IANA)
- ▶ Globally unique
- ▶ Paid to service provider ( or IANA )
- ▶ Registered

## Private IP

- ▶ Used with the LAN or within the organization
- ▶ Not recognized on internet
- ▶ Given by the administrator
- ▶ Unique within the network or organization
- ▶ Free
- ▶ Unregistered IP

## Private IP Address

There are certain addresses in each class of IP address that are reserved for Private Networks. These addresses are called private addresses.

**Class A**            **10.0.0.0**            to            **10.255.255.255**            **(10.x.x.x)**

**Class B**            **172.16.0.0**            to            **172.31.255.255**

**Class C**            **192.168.0.0**            to            **192.168.255.255**            **(192.168.x.x)**

# Assignment of IP Addresses

Regional Internet Registries (RIRs)

The major registries are: (IANA.org)

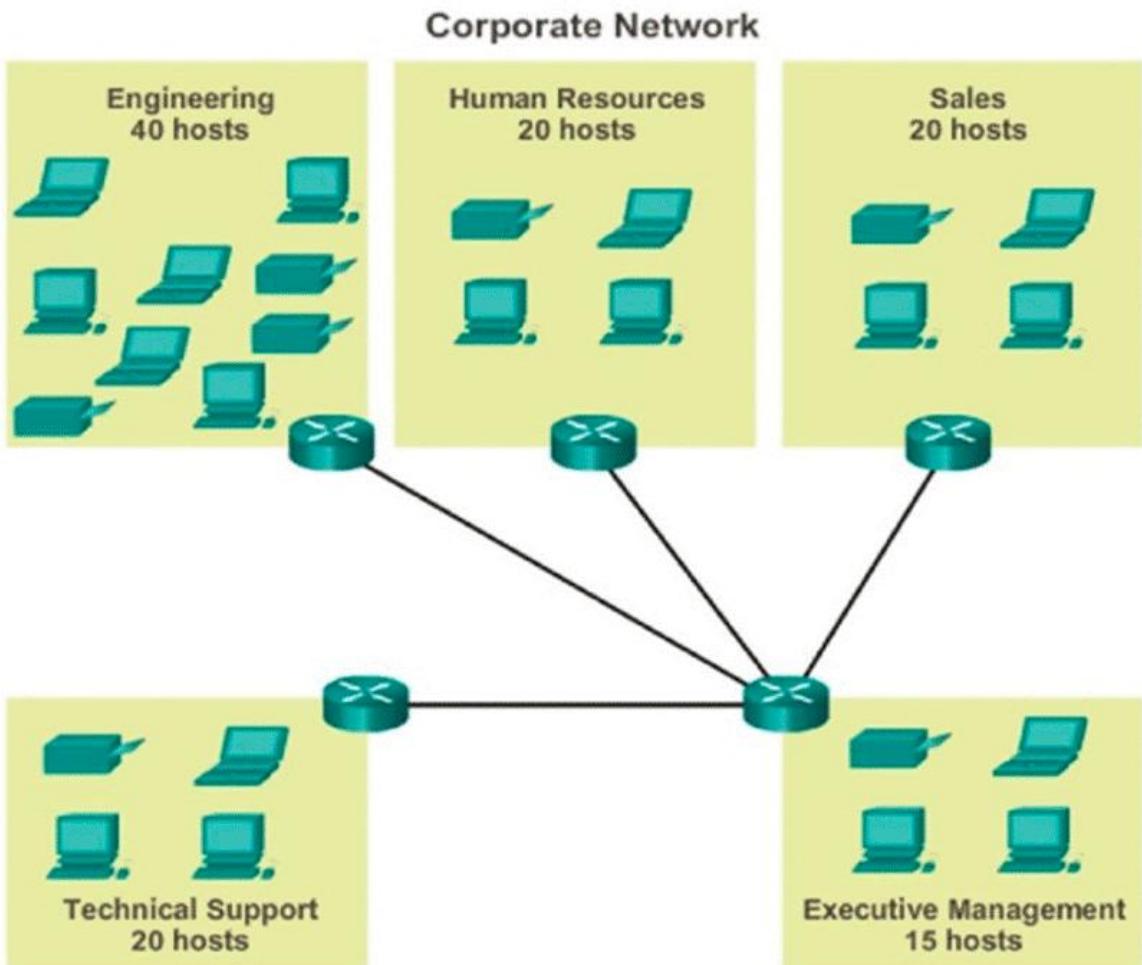
<http://www.iana.org/assignments/ipv4-address-space/ipv4-address-space.xhtml>

Assignment of IP Addresses



# Subnetting

- ▶ is the process of Dividing a Single Network into Multiple smaller networks.
- ▶ helps in minimizing the wastage of IP address.



# FLSM & VLSM

**Subnetting** can be performed in two ways.

- **FLSM**      (Fixed Length Subnet Mask)
- **VLSM**      (Variable Length subnet mask)

**Subnetting** can be done based on requirement.

- Requirement of Hosts?       $2^h - 2 \geq \text{requirement}$
- Requirement of Networks?       $2^n \geq \text{requirement}$

H = host bits , N = Network Bits

**What we do in Subnetting**

- Converting Host bits into Network Bits (reducing number of host bits)
  - i.e. Converting 0's into 1's

## 2 Power Table

$2^1$	2
$2^2$	4
$2^3$	8
$2^4$	16
$2^5$	32
$2^6$	64
$2^7$	128
$2^8$	256
$2^9$	512
$2^{10}$	1024
$2^{11}$	2048
$2^{12}$	4096
$2^{13}$	8192
$2^{14}$	16384

# Value in Subnet mask

VALUES IN SUBNET MASK		
Bit	Value	Mask
1	128	10000000
2	192	11000000
3	224	11100000
4	240	11110000
5	248	11111000
6	252	11111100
7	254	11111110
8	255	11111111

















