COMPUTER COMMUNICATION NETWORKS

M Rajasekar

Department of Electronics and Communication Engineering

COMPUTER COMMUNICATION NETWORKS

IPv4 Addressing: CIDR, sub-netting and super-netting

M Rajasekar
Department of Electronics and Communication Engineering

Addressing in Datagram Networks: .

- IP address formats:
  - IPv4 or IPv6

- IPv4 addressing:
  - Follows a hierarchy in assigning IP addresses
  - Unique 32-bit number
  - Represented in dotted-decimal format

193.32.216.9 ⟶ 11000001 00100000 11011000 00001001

Addressing in Datagram Networks(contd):

- ClDR: Classless Inter-domain Routing
- Has a format of ***a.b.c.d/x***
- x denotes the network portion of the address
- Alternately, a network can be represented using a.b.c.d and subnet mask f.g.h.i
- x is referred to as prefix
- Plays an important role in datagram forwarding
- Cider overcomes the previous class based routing
- IP addresses are assigned hierarchically by ISPs
- IP addresses are divided into chunks

Addressing in Datagram Networks(Contd):

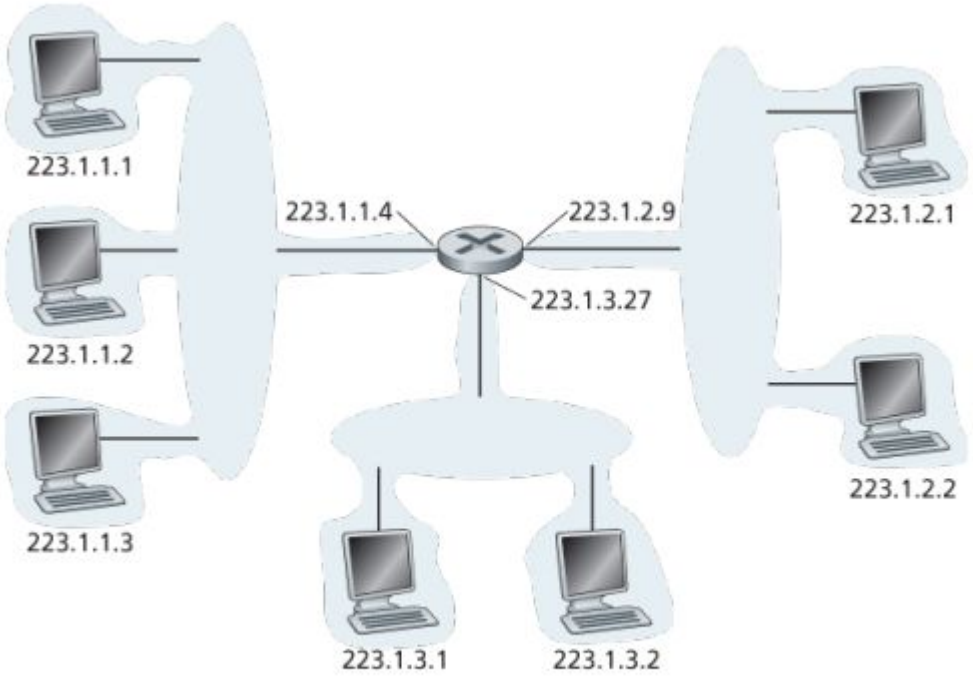

Figure 4.18 Interface addresses and subnets

IPV4 Addressing

To determine the subnets, detach each interface from its host or router, creating islands of isolated networks, with interfaces terminating the end points of the isolated networks. Each of these isolated networks is called a subnet.

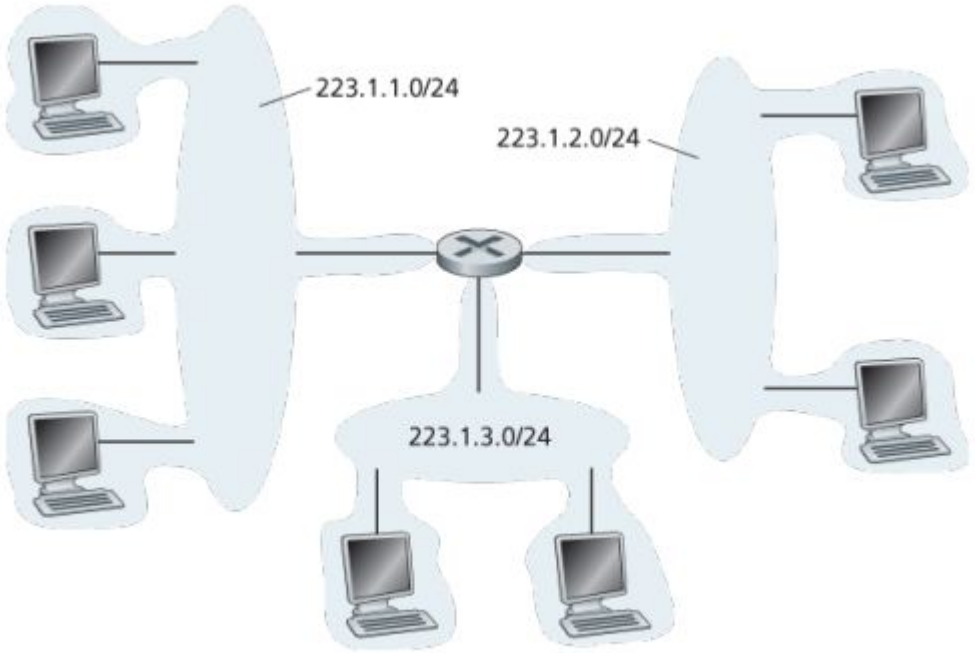

Figure 4.19 Subnet addresses

How many subnets are here?

Addressing in Datagram Networks(Contd):

- Consider an address space 223.1.3.0/24
- 24 bits from the leading bit are common to all IP addresses in this address space
- The remaining 8 bits are free variables which can take a value from 0 (all zeros) to 255 (all ones)
- The first address in the address space (223.1.3.0) is assigned to the network while the last address (223.1.3.255) in the address space is used for network broadcast
- The remaining IP address (223.1.3.1 – 223.1.3.254) can be assigned to any IP interface

Addressing in Datagram Networks(Contd):

- As the prefix is 24 in the address space 223.1.3.0/24, the subnet mask in binary form is given by 24 ones followed 8 zeros
- In dotted decimal form the subnet mask becomes 255.255.255.0
- Consider another example 223.1.3.64/28
- As the leading 28 bits are common the last 4 bits are free variables (i.e., last 8 bits vary from 0100 0000 to 0100 1111)
- So the addresses vary from 223.1.3.64 (assigned to the network) to 223.1.3.79 (assigned for network broadcast)
- So we have the remaining 14 addresses for IP interfaces
- Subnet mask for 223.1.3.64/28 is 255.255.255.240

Subnetting and Supernetting:

- Network prefix increases when a network is divided into smaller subnets
- The number of available IP addresses decreases as network prefix increases
- Subnetting example:
- Consider the network address 223.1.3.0/24. It is divided into 4 subnets of 64 (=2^6) IP addresses each as follows:
- For 4 (=2^2) unique subnets (each having their own network address), the prefix length is extended by 2 bits (i.e., 24+2)
- That results in the last 6 bits being free variables for a unique combination of the 25^{th} and 26^{th} bit

Subnetting and Supernetting(Contd):

- **Subnetting example:** Note that the 1st to 24th bit is common across all subnets

25th bit	26th bit	Network address	# IP address	Subnet mask
0	0	223.1.3.0/26	64	255.255.255.192
0	1	223.1.3.64/26	64	255.255.255.192
1	0	223.1.3.128/26	64	255.255.255.192
1	1	223.1.3.192/26	64	255.255.255.192

- Suppose subnet 223.1.3.64/26 is to be further divided into 4 ($=2^2$) subnets of 16 ($=2^4$) IP addresses each.
- The last four bits are treated as free variables for a unique combination of the 26th and 27th bit. Prefix extended by 2
- The resulting subnets are given in the next slide

Subnetting and Supernetting(contd):

25th bit	26th bit	27th bit	28th bit	Network address	# IP address	Subnet mask
0	0	Free	Free	223.1.3.0/26	64	255.255.255.192
0	1	0	0	223.1.3.64/28	16	255.255.255.240
0	1	0	1	223.1.3.80/28	16	255.255.255.240
0	1	1	0	223.1.3.96/28	16	255.255.255.240
0	1	1	1	223.1.3.112/28	16	255.255.255.240
1	0	Free	Free	223.1.3.128/26	64	255.255.255.192
1	1	Free	Free	223.1.3.192/26	64	255.255.255.192

Subnetting and Supernetting:

- **Supernetting example:** Also known as route summarization or route aggregation.
- IP address space which is hierarchically divided can also be aggregated. The prefix is reduced in the process
- From the table in the slide 11, we can note that the four subnets 223.1.3.64/28, 223.1.3.80/28, 223.1.3.96/28 and 223.1.3.112/28 can be combined into 223.1.3.64/26 as up to the 26^{th} bit is common in the addresses under these subnets
- Similarly, all the subnets in slide 11 can be combined into 223.1.3.0/24 (or simply 223.1.3/24) as up to the 24^{th} bit is common in all these subnets

THANK YOU

M Rajasekar

Department of Electronics and Communication Engineering

rajasekarmohan@pes.edu