CS5222 Computer Networks and Internets

Tutorial 7 (Week 8)

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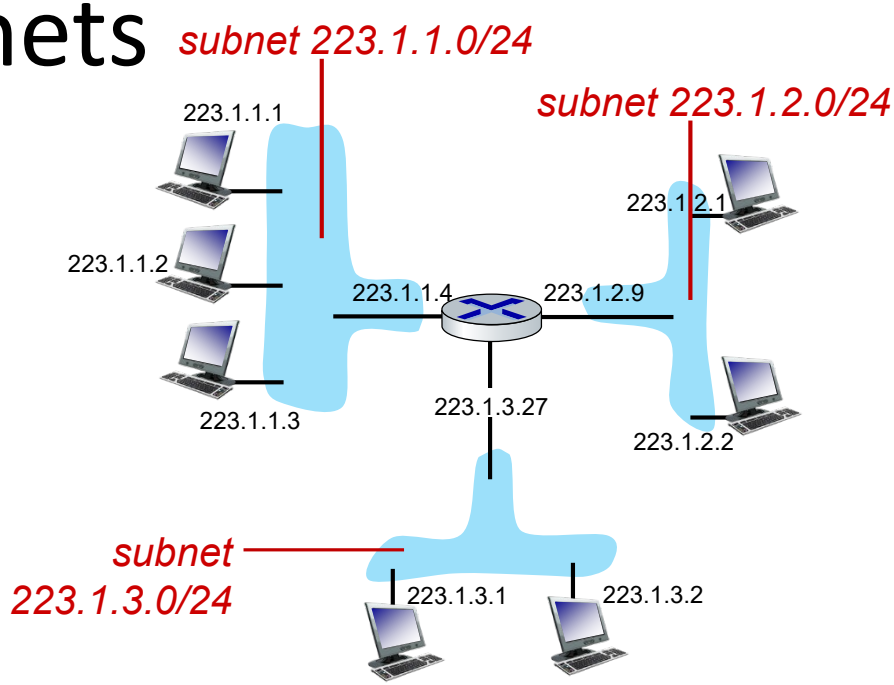
Slides based on book *Computer Networking: A Top-Down Approach.*

Subnets

Recipe for defining subnets:

- detach each interface from its host or router, creating "islands" of isolated networks
- each isolated network is called a *subnet*
- Subnet mask/24:

255	255	255	0
11111111	111111111	11111111	00000000

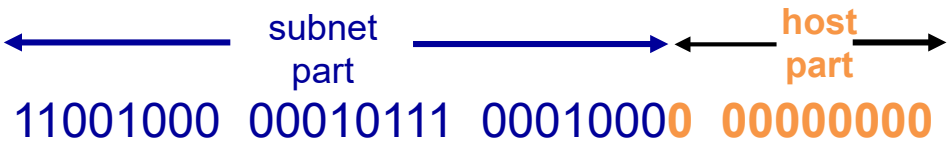


subnet mask: /24
(high-order 24 bits: subnet part of IP address)

IP addressing: CIDR

CIDR: Classless InterDomain Routing (pronounced “cider”)

- subnet portion of address of *arbitrary* length
- address format: a.b.c.d/x, where x is # of bits in subnet portion of address



200.23.16.0/23

Working with Addresses

Write down the IP address.	11000000 10101000 01100100 01010000 192 168 100 80
If you have a prefix length, just write down the number of 1's. If you have a network mask, compute the binary as with the IP address.	11111111 11111111 11111111 11000000 8 +8 +8 +2 = 26 Subnet mask: 255.255.255.192/26
AND these two.	11000000 10101000 01100100 01000000
Convert back to dotted decimal. This is the network address.	192 168 100 64

Working with Addresses

Write down the IP address.	11000000 192	10101000 168	01100100 100	01010000 80
If you have a prefix length, just write down the number of 1's. If you have a network mask, compute the binary as with the IP address.	11111111 8	11111111 +8	11111111 +8	11000000 +2 = 26
Inverse every bit in the mask	00000000	00000000	00000000	00111111
AND IP address with the inversed mask	00000000	00000000	00000000	00010000
Convert back to dotted decimal. This is the host address.	0	0	0	16

Work on questions

1. Consider a datagram network using 8-bit host addresses. Suppose a router uses the longest prefix matching and has the following forward table:

Prefix Match	Interface
00	0
010	1
011	2
10	2
11	3

For each of the four interfaces, give the associated range of destination addresses and the number of addresses in the range.

Answer:

- Interface 0: 00000000 to 00111111,
  - 64 in total (62 for hosts, one for the subnetwork address, one for broadcast address)
- Interface 1: 01000000 to 01011111,
  - 32 in total
- Interface 2: 01100000 to 01111111, 32; and 10000000 to 10111111, 64;
  - in total 96=32+64
- Interface 3: 11000000 to 11111111, 64 in total

2. Suppose that an IP address in a network is 10.16.3.65/23. What is the lowest host address in this subnet? What is the broadcast address of this subset?

Answer: As the network mask of this subset is: 255.255.254.0, the address space of this network is 10.16.2.0 to 10.16.3.255.

Thus, the lowest host address is 10.16.2.1/23. The broadcast address is 10.16.3.255/23

3. What is the maximum number of IP addresses that can be assigned to hosts on a local subnet that uses the subnet mask 255.255.255.224?

Answer: 255.255.255.224 is 11111111.11111111.11111111.11100000.

Thus, the number of bits used for hosts is 5. Thus, at most $2^5 - 2 = 30$ hosts can be supported. (0-subnet and 1-broadcast)

4. You have an interface on a router with the IP address of 192.168.192.10/29. Including the router interface, how many hosts can have IP addresses on the LAN attached to the router interface?

Answer: Only 3 bits in the last octet are used for hosts in the network.

Thus, it can support $2^3 - 2 = 6$ hosts.

5. Suppose that an enterprise obtains a block of IP addresses where the network address is 212.1.18.0/23. The enterprise would like to partition the network into 5 subnets where the number of hosts to be supported in these 5 subnets are as follows: 230, 125, 60, 30, 30. Show your design of address allocation.

Answer: There are 9 bits (=32-23) for host addresses.

- To support 230 hosts, we need at least 8 bits for hosts.
- To support 125 hosts, we need at least 7 bits for hosts.
- To support 60 hosts, we need at least 6 bits for hosts.
- To support 30 hosts, we need at least 5 bits for hosts.

Therefore, the network can be partitioned as follows (we only show the last two bytes):

00010010. xxxxxxxx (for the first subnet) 212.1.18.0/24

00010011. 0xxxxxxx (for the second subnet) 212.1.19.0/25

00010011. 10xxxxxx (for the third subnet) 212.1.19.128/26

00010011. 110xxxxx (for the forth subnet) 212.1.19.192/27

00010011. 111xxxxx (for the fifth subnet) 212.1.19.224/27

Therefore, the network addresses of 5 subnets are: 212.1.18.0/24, 212.1.19.0/25, 212.1.19.128/26, 212.1.19.192/27, 212.1.19.224/27