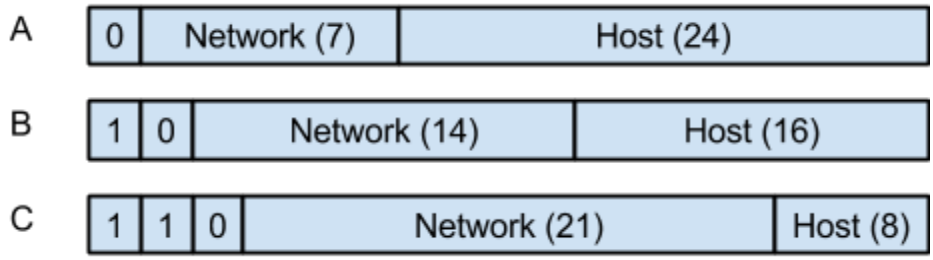
Network Layer Addressing

CS640, Spring 2014

Class-Based

- Divide 32-bits into two parts: network and host
  - Network part is the same for all hosts in a switched network
  - Host part is unique to each host
- Three classes: A, B, & C



  - First few bits determine class
  - Number of host bits determines the maximum number of hosts within a network
    - A: 2^24 - 1 = about 16.7 million hosts
    - B: 2^16 - 1 = 65,535 hosts
    - C: 2^8 - 1 = 255 hosts

Subnetting

- Divide a network (class A, B, C) into multiple subnetworks (separate physical networks)
- Divide 32-bits into three parts: network, subnet, and host

- 32-bit subnet mask defines number of bits used for host
  - 1's identify network & subnet part
  - 0's identify host part
- To determine subnet address:
  - Binary-based:
    bitwise AND subnet mask and host IP
  - Dotted-decimal-based:
    For *i* = 1; *i* <= 4; *i*++
    If *mask[i]* == 255
    subnet[i] = *host[i]*
    Else if *mask[i]* == 0
    subnet[i] = *0*
    Else
    difference = 256 - *mask[i]*
    subnet[i] = round **down** *host[i]* to nearest multiple of difference

- To determine subnet mask:
    - Network must accommodate at least *max_hosts*
    - *round_max_hosts* = round **up** *max_hosts* to nearest power of 2
    - Binary-based:
      subtract 1 from *round_max_hosts* and compute bitwise NOT
    - Dotted-decimal-based:
      exponent = $\log_2$ *round_max_hosts*
      i = 4
      While *exponent* > 8
          mask[i] = 0
          exponent = *exponent* - 8
          i = *i* - 1
      mask[i] = 256 - 2^*exponent*

Supernetting (Classless Interdomain Routing)

- Assign network numbers in powers of 2
- Use a mask to identify number of bits used for network number
- Write masks use slash notation
    - Number after slash is number of bits used for network (and subnet)
    - E.g., class A is /8, class B is /16, class C is /24
    - E.g., subnet with mask 255.255.255.0 is /24, subnet with mask 255.255.254.0 is /23, subnet with mask 255.255.252.0 is /22, …

Practice

1. What is the subnet address for the host IP 192.168.0.38 given the mask 255.255.255.0?

2. What is the subnet address for the host IP 172.16.125.34 given the mask 255.255.192.0?

3. How many hosts can the network 172.16.32.0/20 accomodate?

4. What is the subnet addres in slahs notation for the subnet 10.8.0.0 and the mask 255.248.0.0?