

Semester 1, Chapter 10

(Supplement)

Creating Subnets

or

How to Have Fun Without
Knowing It!



Why create subnets?

- Organization
- Smaller Router Tables
- Minimize collision domains
- Minimize broadcast domains



Why create a subnet mask?

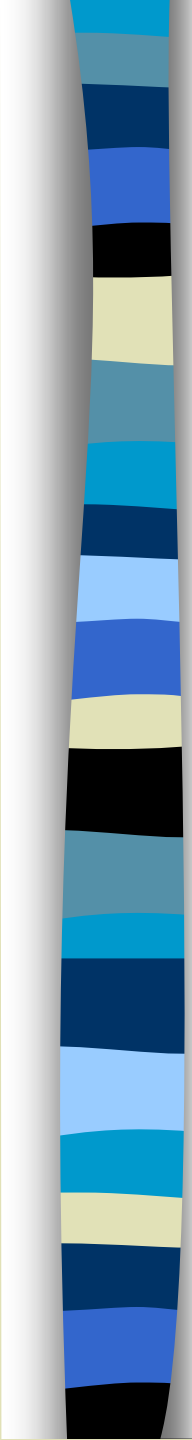
- Tells device which part of an address is the network # including the subnet and which part is the host
- Filters the node IP address to determine which subnet it belongs to
- NETWORK/SUBNET/HOST

Address Classes

If the first octet is between

- 1-126 it is a **Class A** address
- 128-191 it is a **Class B** address
- 192-223 it is a **Class C** address
- 224-239 it is a **Class D** address
- 240-255 it is a **Class E** address

127 is reserved for **loopback** and is used for internal testing on the local machine



The class determines which part of the address belongs to the network and which part belongs to the host

Class A

NNNNNNNN.hhhhhhhh.hhhhhhhh.hhhhhhhh

Class B

NNNNNNNN.NNNNNNNN.hhhhhhhh.hhhhhhhh

Class C

NNNNNNNN.NNNNNNNN.NNNNNNNN.hhhhhhhh



Subnets and Subnet Mask

- Create another section in the IP address called the subnet
- NETWORK/SUBNET/HOST
- Use a subnet mask!



IP Subnet addressing default subnet masks

In Binary Form

■ Class A -

255.0.0.0

Class A

11111111.00000000.00000000.00000000

■ Class B -

255.255.0.0

Class B

11111111.11111111.00000000.00000000

■ Class C -

255.255.255.0

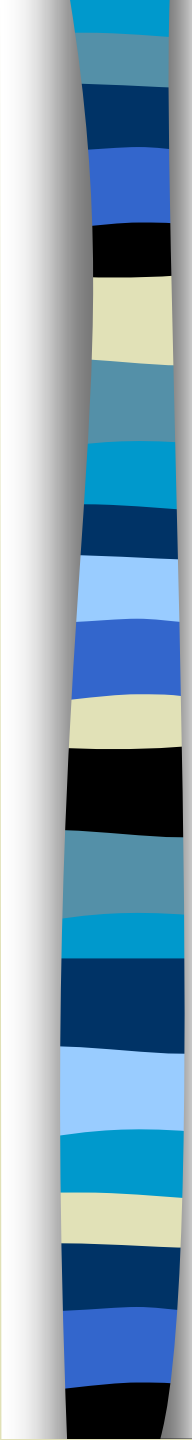
Class C

11111111.11111111.11111111.00000000



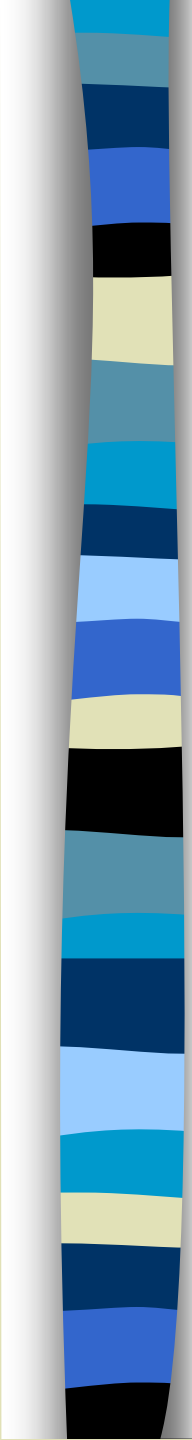
Restrictions on subnets

- Network addresses of all 0's in the host portion are reserved for specifying the network
- Network addresses of all 1's in the host portions are reserved for the broadcast address



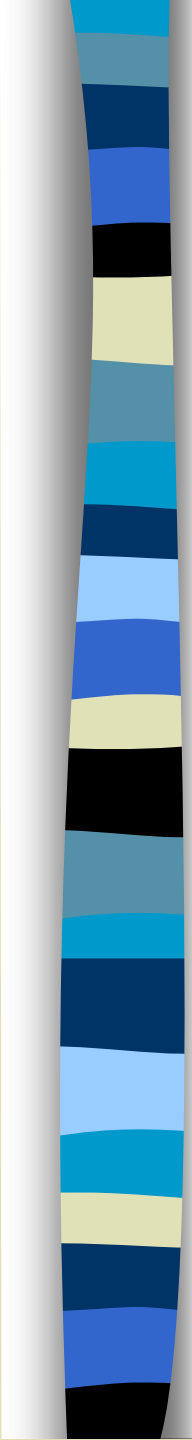
Example 192.56.32.13

- What class is the address?
- C
- What is the network address?
- 192.56.32.0
- What is the broadcast address?
- 192.56.32.255
- What is the default subnet mask?
- 255.255.255.0



192.56.32.13

- 192.56.32.0 is the network address
- 8 bits are available for the host address
- Borrow 1 bit
- NNNNNNNN.NNNNNNNN.NNNNNNNN.Shhhhhh
- What is the subnet mask?
- $2^7 = 128$
- 255.255.255.128



177.56.45.13

- What class is this address?
- Class B
- What is the default subnet mask?
- 255.255.0.0
- Borrow 2 bits for the subnet mask
- NNNNNNNN.NNNNNNNN.SShhhhhh.hhhhhhhh
- What is the subnet mask?
- $2^7 + 2^6 = 128 + 64 = 192$
- 255.255.192.0



Total Number of Subnets

Number of subnets = $2^{\text{number of bits borrowed}}$

Maximum (borrow all bits)

■ Class A $2^{24} = 16,777,216$

3 Octets available

■ Class B $2^{16} = 65,536$

2 Octets available

■ Class C $2^8 = 256$

1 Octet available



196.54.34.22

- Borrow 2 bits for the subnet mask
- Number of subnets - $2^{\text{number of bits borrowed}}$
- $2^2 = 4$ subnets

- Number of hosts per subnet =
- $2^{\text{\# host bits} - \text{\# bits borrowed}} = 2^{8-2}$
- $2^6 = 64$ (also called the range)

196.54.34.22

- Borrowing 2 bits results in 4 subnets (2^2) and 64 hosts per subnet (2^6)
- NNNNNNNN.NNNNNNNN.NNNNNNNN.SShhhhhh
- Lets just look at the last Octet SShhhhhh
- Count to 4 in binary (use 2 digits) or all combinations of 0 & 1 using 2 digits
 - 00 (first subnet)
 - 01 (second subnet)
 - 10 (third subnet)
 - 11 (fourth subnet)