

ELEC / COMP 177 – Fall 2016

# Computer Networking

## → Subnets

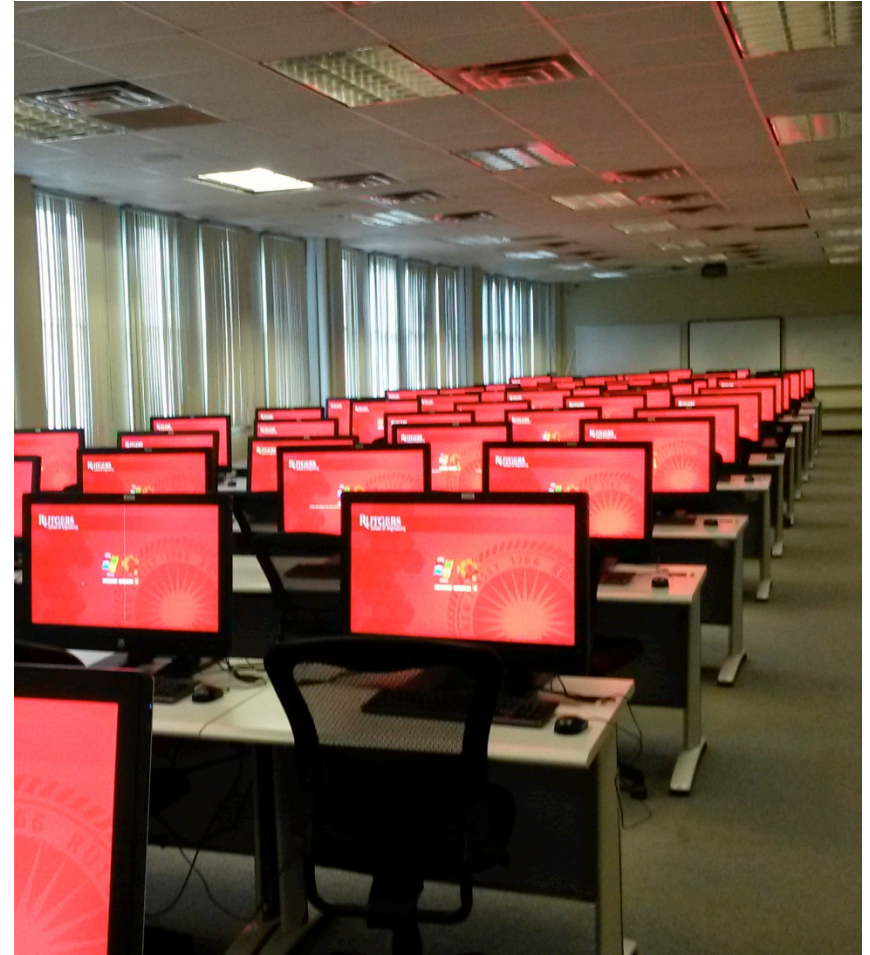
# Schedule

- **Project 3**
  - Starts today!
  
- **Presentation 2 – Security/Privacy**
  - Presentations – **Nov 3<sup>rd</sup>, Nov 10<sup>th</sup>, Nov 15<sup>th</sup>**
    - Upload slides to Canvas by “midnight” on day before presentation

# Subnets

# Subnets

- Imagine we are specifying the network for an “engineering building”
- How many hosts (max) will be connected to the building network?
  - Estimate: **800 hosts**
- **How big should our subnet be?**

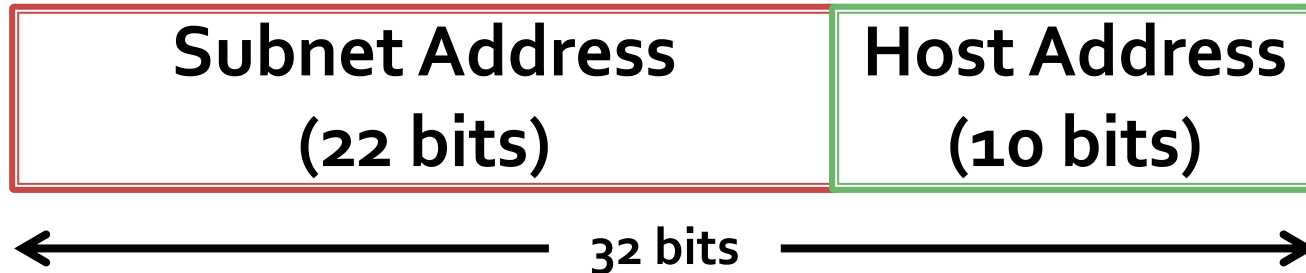


# Subnets



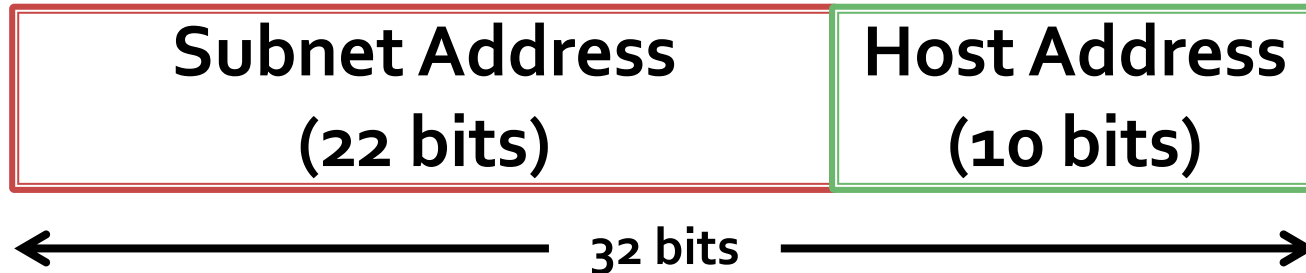
- How big should the host address field be?
  - 8 bits? ( $2^8 = 256$ )
  - 9 bits? ( $2^9 = 512$ )
  - 10 bits? ( $2^{10} = 1024$ )
    - **Sufficiently large for "800 hosts"**

# Subnet Naming



- Imagine you could use any IP address range for this network
- **Will 192.168.1.0/24 work?**  
**(like we use in lab out of habit?)**
  - **Definitely not!**

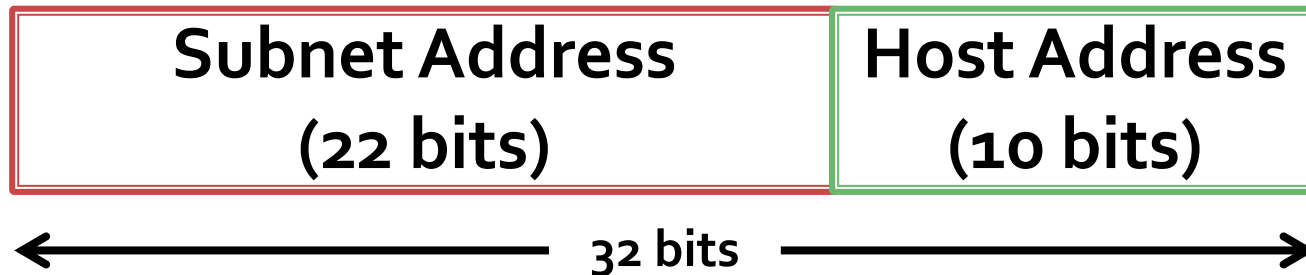
# Subnet Naming



## ■ Problem 1:

- The length of the subnet address is 22 bits, not 24 bits
- This address should be of the form **a.b.c.d/22**

# Subnet Naming



## ■ Problem 2:

- The bits don't fit in the fields any more...

■ Decimal: 192.168.1.0/22

■ Binary:

11000000.10101000.00000000.01.00000000

You have "subnet address" bits in the host address field...



# Subnet Naming

- **What addresses would work?**

- Host field needs to be all 0's

- 11000000.10101000.0000000000.00000000

- 192.168.0.0/22

- 11000000.10101000.0000000100.00000000

- 192.168.4.0/22

- 11000000.10101000.0000001000.00000000

- 192.168.8.0/22

- 11000000.10101000.0000001100.00000000

- 192.168.12.0/22

- ...

- 11000000.10101000.11111100.00000000

- 192.168.252.0/22

# Subnet Naming

- Let's choose **192.168.252.0/22**
- **What addresses are available for hosts within the subnet?**

11000000.10101000.111111xx.xxxxxxxxxx

# Subnet Naming

11000000.10101000.111111xx.xxxxxxxxxx

- 11000000.10101000.11111100.00000000
  - **192.168.252.0**
  - All zeros in host field = “**Subnet Name**”
  - Not allowed for host address
- 11000000.10101000.11111100.00000001
  - **192.168.252.1** – **Lowest possible IP** address
- . . .
- 11000000.10101000.11111111.11111110
  - **192.168.255.254** – **Highest possible IP** address
- 11000000.10101000.11111111.11111111
  - **192.168.255.255**
  - All ones in host field = “**Broadcast Address**”
  - Not allowed for host address

# Router Naming

- What should the default gateway be for a host in this subnet?
- Any valid IP within the subnet
  - From 192.168.252.1 – 192.168.255.254
- Convention?
  - Either the lowest address (“ . 1”) or highest address (“ . 254”) – easier to remember
- **The default gateway needs to be part of the subnet for hosts to reach it!**

# Subnet -vs- Netmask

- These are equivalent
  - 192.168.252.0/22
  - 192.168.252.0, netmask 255.255.252.0
    - 11111111.11111111.111111|00.00000000
- The netmask merely indicates the size of the subnet
  - /22 is easier for humans
  - 255.255.252.0 represents computer memory

# Subnet Calculator

<http://www.tunnelsup.com/subnet-calculator>

IP Address and Netmask:

192.168.252.0/22

Calculate

Random IP

<b>IP Address:</b>	192.168.252.0
<b>Netmask:</b>	255.255.252.0
<b>Wildcard Mask:</b>	0.0.3.255
<b>CIDR Notation:</b>	/22
<b>Network Address:</b>	192.168.252.0
<b>Usable Host Range:</b>	192.168.252.1 - 192.168.255.254
<b>Broadcast Address:</b>	192.168.255.255
<b>Binary Netmask:</b>	11111111.11111111.11111100.00000000
<b>Total number of hosts:</b>	1,024
<b>Number of usable hosts:</b>	1,022
<b>IP Class:</b>	C (192.0.0.0 - 223.255.255.255)

Move to adjacent network

Backward

Forward

G+1 150