ELEC / COMP 177 – Fall 2015

# Computer Networking
→ Subnets

Schedule

- **Project 2, Final Version**
  - Sunday Oct 18th 2015 by 11:59pm
  - High priority: Pipelining + benchmarks
  - Low priority: HEAD, graceful shutdown

- **Presentation 2**
  - "Security and Privacy" (in last 3 years)
  - Topic due Thursday October 20th

Subnets

Subnets

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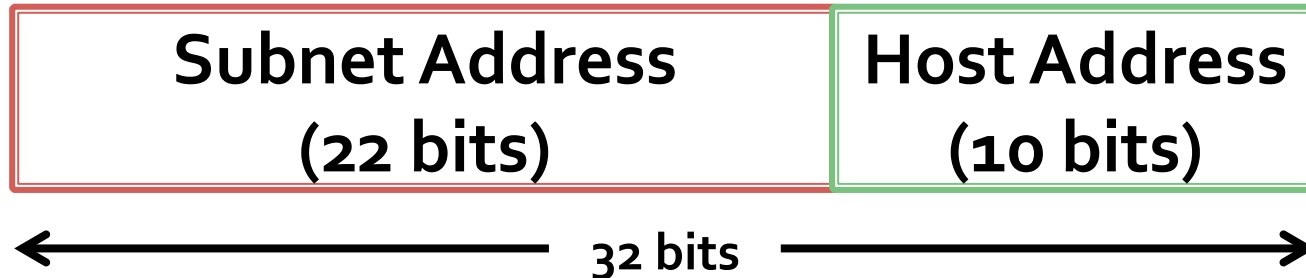 - Estimate: **800 hosts**
- **How big should our subnet be?**

Subnets

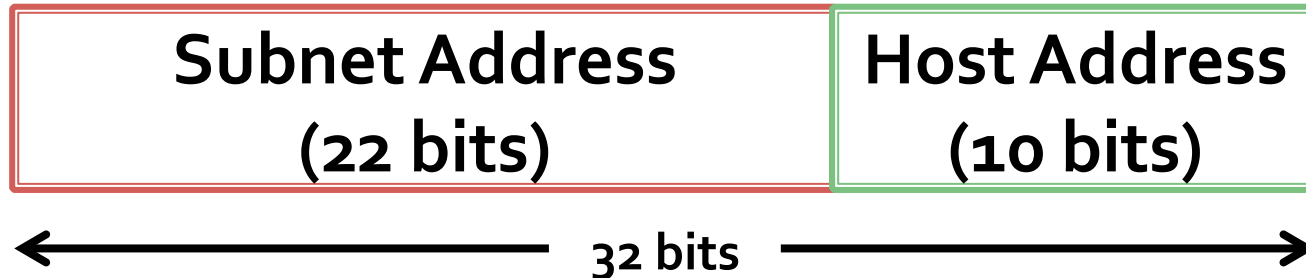| Subnet Address	Host Address
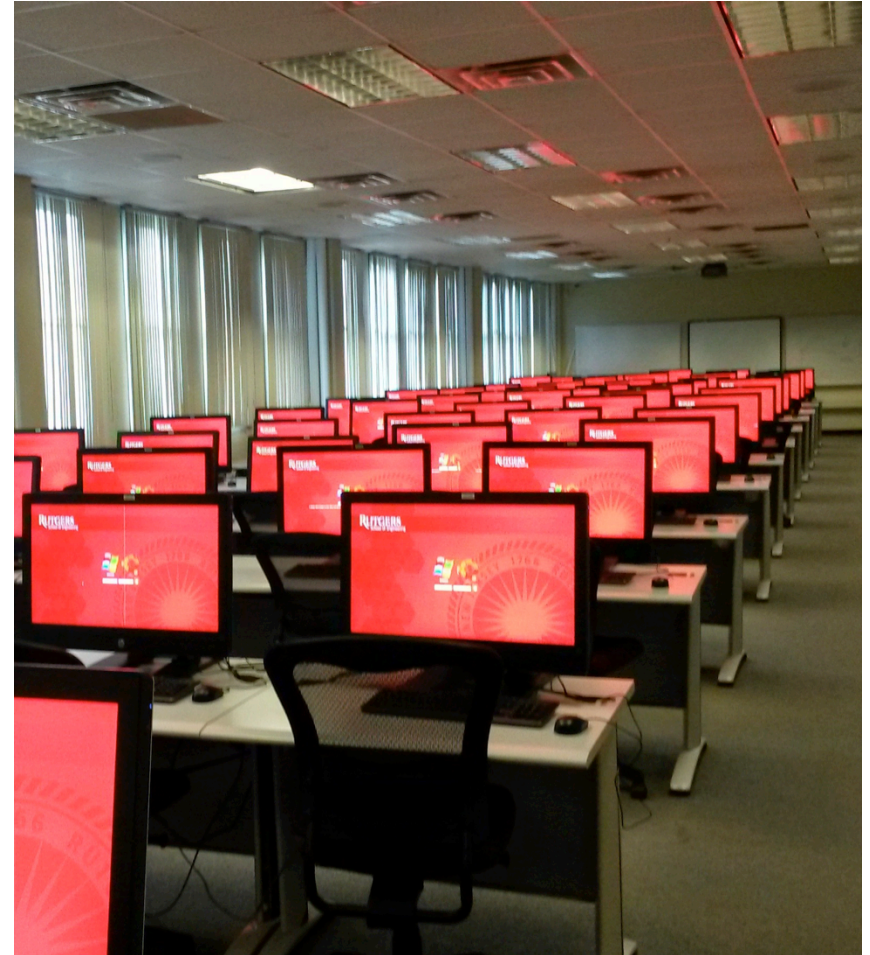
$\longleftarrow$ **32 bits** $\longrightarrow$

- 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

Subnet Address (22 bits)	Host Address (10 bits)

← 32 bits →

- 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
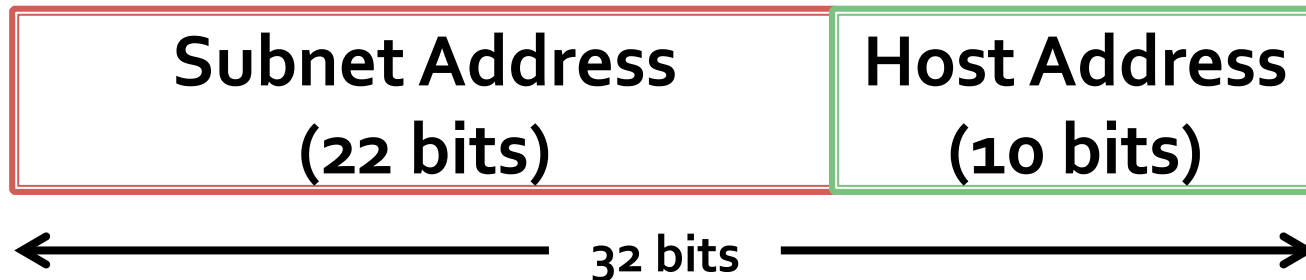
Subnet Address (22 bits)	Host Address (10 bits)

← 32 bits →

- **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

Subnet Address (22 bits)	Host Address (10 bits)

← 32 bits →

- **Problem 2:**
  - The bits don't fit in the fields any more…
- Decimal: `192.168.1.0/22`
- Binary:

`11000000.10101000.000000`**`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

- 11000000.10101000.0000000|00.00000000
  - 192.168.0.0/22
- 11000000.10101000.0000010|00.00000000
  - 192.168.4.0/22
- 11000000.10101000.0000100|00.00000000
  - 192.168.8.0/22
- 11000000.10101000.0000110|00.00000000
  - 192.168.12.0/22
- . . .
- 11000000.10101000.1111110|00.00000000
  - 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.xxxxxxxx
```

Subnet Naming

11000000.10101000.111111xx.xxxxxxxx

- 11000000.10101000.1111110**0.00000000**
  - **192.168.252.0**
  - All zeros in host field = "**Subnet Name**"
  - Not allowed for host address
- 11000000.10101000.1111110**0.00000001**
  - **192.168.252.1** – **Lowest possible** IP address
- . . .
- 11000000.10101000.1111111**1.11111110**
  - **192.168.255.254** – **Highest possible** IP address
- 11000000.10101000.1111111**1.11111111**
  - **192.168.255.255**
  - All ones in host field = "**Broadcast Address**"
  - Not allowed for host address

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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

IP Address and Netmask:

192.168.252.0/22

[Calculate] [Random IP]

IP Address:	192.168.252.0
Netmask:	255.255.252.0
Wildcard Mask:	0.0.3.255
CIDR Notation:	/22
Network Address:	192.168.252.0
Usable Host Range:	192.168.252.1 - 192.168.255.254
Broadcast Address:	192.168.255.255
Binary Netmask:	11111111.11111111.11111100.00000000
Total number of hosts:	1,024
Number of usable hosts:	1,022
IP Class:	C (192.0.0.0 - 223.255.255.255)
Move to adjacent network	[Backward] [Forward]

G+1 150