Topics

- Hardware Elements
- Software Elements
- Internet Access
- Very basic security
Hardware Elements

- **Scope of this talk:** Ethernet networks
- **Network Interface Card (NIC)**
- **Creating a local-area network**
  - hub
  - switch
  - wireless access point
- **Bridges, routers, gateways**
Examples

- “Simple” direct connection:
  - two computers
  - two NICs (very inexpensive)
  - Ethernet cable (crossover cable)
Examples

- Hub/switch
  - 2+ computers
  - one NIC per computer
  - Ethernet cables (straight-through)
Examples

- Wireless
  - wireless equivalent of a hub: **access point**
  - one **wireless** NIC per computer (more expensive)
  - **no** Ethernet cables
  - 802.11b encryption: **marginal** security
Examples

- Bridge

“uplink” port
Software Elements

- Scope of this talk: IPv4-based networks
- IP addresses and private local networks
- Dynamic Host Configuration Protocol (DHCP)
- Network Address Translation (NAT) / IP Masquerading
IP Addresses and Private Local Networks

- **IP address:** 32-bit value
  - \{0-255\}\.\{0-255\}\.\{0-255\}\.\{0-255\}
  - data routed through Internet based on IP address

- **Special cases**
  - 127.0.0.1: “localhost”
  - private networks (never routed)
    - 10.x.x.x: 1 ~16M-host network
    - 172.16.x.x – 172.31.x.x: 16 ~65k-host networks
    - 192.168.0.x – 192.168.255.x: 256 ~250-host networks
  - broadcast addresses
Dynamic Host Configuration Protocol (DHCP)

- Rely on DHCP server to discover network details
- Useful for mobile clients
- Client broadcasts request, server responds with:
  - IP address
  - routing information
  - name servers, host name
Network Address Translation (NAT)

- One node (host, router, etc.) with both a global IP address and local IP address
- NAT node: “representative” for all hosts on the local network
- Sequence of events
  - local client initiates connection
  - gateway (first step of routing) is NAT node
  - NAT node rewrites “contact information” and forwards data between client and the world
Example: Basic Network

- 2+ computers sharing files

Hub/switch: $20/40

192.168.1.x

Wireless access point: $60-80

“Uplink” port

x=1 x=2 x=3

x=4 x=5 x=6
Example: DHCP-based clients

- Most useful when clients come and go

DHCP Server

192.168.1.x

hub/switch: $20/40

$60-80

wireless access point

x=1 x=2 x=3

x=10

x=4 x=5 x=6
Example: NAT-based Internet access

- Want all clients to be Internet-enabled

```
102.160.1.x
24.21.252.x

x=1 x=2 x=3

hub/switch: $20/40

wireless access point: $60-80

x=4 x=5 x=6

The "uplink" port

The Internet!
```
Example: NAT-based Internet access

- Want all clients to be Internet-enabled

```
x=1 x=2 x=3
```

```
192.168.1.x
```

```
x=4 x=5 x=6
```

```
24.21.252.10
```

"uplink" port

```
The Internet!
```

"wireless broadband router": $120-200
Internet Access

- Modem dial-up
  - uses phone lines
  - 56 kbps, ~$20/mo

- Cable Modem
  - shared communication medium
  - ~1-2 Mbps downstream / ? upstream, $40-50/mo

- Digital Subscriber Line (DSL)
  - dedicated line to the switching station
  - 384 kbps downstream / 128kbps upstream (higher levels of service available), ~$60-100/mo
Security

- Network level
  - NAT-based routers: natural firewall
  - vulnerable open ports: **not good**
- Linux-based (may apply to other Unix’s)
  - disable: ftpd, telnetd, etc.
  - use ssh! (can use to minimize open firewall ports)
  - learn to examine log files
- Windows-based (if you must)
  - turn off IIS (get apache for serving web pages)
  - delete Outlook
Summary

- Building home networks
  - determine your budget
  - determine which functionality you need
  - can be done at a reasonable price

- Basic guidelines
  - need 1 NIC (wired/wireless) per computer
  - additional hardware may be needed
  - sharing an Internet connection? get a “broadband router” – it’s too easy!