Topic 1: Fundamentals & Vocabulary

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CS 6
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Basic Hardware

Desktop Computer

Ethernet Cable

Router

Modem
Basic Hardware

- Laptop Computer
  - w/ Wireless Net. Adapter
- Wireless Router
- Ethernet Cable
- Modem
Basic Hardware

Laptop Computer w/ Wireless Net. Adapter

Wireless Modem/Router
Intranet

- Internal network of computers (in a company or home). Also: “LAN”
- Local Area Network
- Geographically local – limited to one building, maybe a few buildings
- Use Ethernet cables or wireless signals to connect computers
Internet

- A network of networks. Also: WAN
- *Wide Area Network*
- Unlimited by geography
- Different wires
Server

- **Client**: requests and receives information
- **Server**: receives and processes info, returns the information

- Examples
  - *Viewing a webpage*
  - *Sending or receiving email*
Server

• **Client**: requests and receives information  
• **Server**: receives and processes info, returns the information  
• Examples  
  • *Viewing a webpage*  
  • *Sending or receiving email*  
• Server is a *role*, not a piece of equipment
*loading

- **Downloading**: receiving data from a server
- **Uploading**: sending data to the server
- “Data”… typically refers to files
- **Bandwidth**: rate of data transmission
  - *Bits per second (bps) < Kbps < Mbps < Gbps*
  - *Not to be confused with Byte = 8 bits: (KB, MB, TB, etc.)*
Data Transfer

• Data formatted in standardized way

• **Header + data/“payload”/body**, e.g.: 011101110010010011111010110110001110100

• Header contains routing information

• *Address to/from, protocol*

• Like envelope + letter at the post office

• What if data stream is too long?
Packets

- Break up large data stream into several packets
- Cutting up your food so you don’t choke
Packets

• Called “digital envelopes” (appropriately)
• Uniform size, contents irrelevant
Packet Switching

• Passed along until destination (hot potato)
• “Is the destination address in my network, or should I pass it on?”
Repeaters

• What if distance between sending and receiving data too far?
• Repeater boosts signal, keeps it going
Internet Structure

- Physically structured? Yes ~ish
Internet Structure

- Local, Regional, and National levels
  - *Just like roads:*
    - *Local roads, state highways, interstates*

- Information only goes up as high as it needs to…
  - *…for the game of hot potato*
Protocols

• Packet envelopes: addresses & protocol
• Guidelines for computers to talk with each other
  • *Different envelopes that data packets can use*
• Transferring web pages uses HTTP
  • *Hypertext Transfer Protocol*
• Direct file transfers → FTP
  • *File Transfer Protocol*
Protocols

• Protocols stacked on top of each other
• HTTP or FTP at “Application Layer”

• Transmission Control Protocol (TCP) at “Transport Layer”

• Internet Protocol (IP) at “Internet Layer”
RECAP…

• Internet is network of networks sharing data with each other
• Data packets sent with header + payload
• Header contains address & protocol
• Data routed to destination by jumping from network to network (hot potato)
Browser

• Translates HTML into a pretty webpage
• *Hypertext Markup Language*
Browser

- Translates HTML
- Hypertext Mark
Cache (browser)

- Temporary storage (*see cacher* “to hide”)
- Downloading can be intensive
- Instead of re-downloading everything, save local copy → cache
  - *Quickly reopen pages (+)*
  - *Delays page from updating (-)*
  - *Takes up lots of disk space (-)*
- Clear your cache through browser options
Browser History

- Internet history: Addresses saved, find a recently viewed page
  - Useful for remembering that one page (+)
  - Privacy issue (-)
- Different from cache: only stores address, but not any content
- Clear internet history in browser options
DNS

• Domain Name Service
• Translates google.com to IP address (e.g., 216.239.39.99)
• Technically http://www.google.com
• Domain names vary (.com, .org)
  • Restricted: .gov, .edu, .mil
  • Genre: .net, .biz, .tv
  • Country: .us, .uk, .cn, .au
Address Details

• With an address, we go from specific to general using the dots (.)

http://moodle.cs.ucr.edu/

• Slashes (/) progress into subfolders

IP Address

• Dotted decimal: four bytes (0 to 255)
  • Ranges from 0.0.0.0 to 255.255.255.255
  • Uniquely identifies all computers on internet

• Uniform Resource Locator (URL)
  • Using words (like google.com) in place of actual IP address for domain names
Static vs. Dynamic IP

• To be on Internet, you need an IP address
• Usually assigned one by ISP (from a pool of available addresses) for your session
  • *Address can change* → *dynamic IP*
• To host a web page directly, generally need a *static IP* address
  • *Costs extra $$*
  • Caveat: web page running 24/7 will rarely be assigned new address
IP Address Limitation

• Current IP limits addresses to $2^8 \times 2^8 \times 2^8 \times 2^8 = 2^{32} \approx 4,000,000,000$ devices
• Some forbidden/reserved addresses
• Every networked device needs an address
  • Includes both webpages and users
  • Server and clients
• Workaround? Routers.
Routers

• Pass along information to its destination
• Occupy one IP address to the world, while hosting many devices itself.
Internal IP Addresses

- modem → internet / computer → router

- Modem: 55.234.66.114
- Router: 192.168.0.1
- Computers: 192.168.0.100, 192.168.0.101, 192.168.0.102
Networked Computers

- **Network Card**: Ethernet, wireless, dial-up (most Ethernet, many wireless)
- **MAC address**: serial number for network card, unique physical address
- *E.g. 00-16-D4-40-8E-4D (> 100 zillion comb.)*
Modems

• Home network requires a **modem** to connect to the Internet

• Different types with different connections
  
  • *Dial-up modems* using telephone lines  
  • *DSL* (Digital Subscriber Line) – telephone  
  • *Cable Modem* – TV (cable) line  
  • *Satellite Modems* – Lineless  
  • *Fiber Optics* (e.g. Google Fiber)
Broadband Availability

• DSL has incomplete availability
  
  Requires upgraded telephone lines
  
  Within certain distance of phone company’s central office (i.e. switching station)

• Fiber to the curb: requires fiber optic cable (placed below ground)

• “Broadband penetration” is now used as a key economic indicator
ISPs

- **Internet Service Provider**: provide access to the internet ($$), and typically give/rent the modem used to connect to it
- Time Warner, Comcast, Charter…
- AOL used to be the biggest
- Repeatedly had lowest customer satisfaction rates, is now #5 … (Good riddance)
AUP / TOS

• Every ISP (and most networks) has
• **AUP**: Acceptable Use Policy, or
• **TOS**: Terms of Service

• Restrictions:
  • *Copyright infringement*
  • *Hacking/illegal trespassing*
  • *Types of internet data (gaming?) – throttling*
  • *Harassment*
  • *For-profit Activities*
ISPs and Beyond

- Tiered structure of Internet
- Where money goes

Home account → Small ISP → Telephone Company → Backbone Company
Reminders

Lab tomorrow (Thursday).

Syllabus

Office hours location:

WCH 309
Questions?