CMSC 132: OBJECT-ORIENTED PROGRAMMING II

Networking

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Networking

- **Internet**
  - Designed with multiple layers of abstraction
  - Underlying medium is unreliable, packet oriented
  - Packet-Switching
    - https://www.youtube.com/watch?v=vSlcoQowe9I

Internet (IP) Address

- **Unique address for machine on the internet**
  - Get from ISP when connecting to internet
  - Allows network to find your machine
- **Internet Protocols IPV4, IPV6**
  - Define how data is sent between computers over packet-switched network
- **(IPV4) Internet Protocol Version 4**
  - 32-bit unsigned integer ⇒ 128.8.128.8
  - Domain name ⇒ cs.umd.edu
- **(IPV6) Internet Protocol Version 6**
  - 128-bit address
  - Designed to replace IPV4
  - Addresses exhaustion of addresses associated with IPV4 (now we have 2^128)
  - https://en.wikipedia.org/wiki/IPv6

IP Address (DNS)

- Domain Name System (DNS)
  - Protocol for translating domain names to IP addresses
    - Example: cs.umd.edu → 128.8.128.44
  - Multiple DNS servers on internet
  - DNS server may need to query other DNS servers
    - edu DNS server queries umd.edu server to find cs.umd.edu

Ports

- Abstraction to identify (refine) destination
  - Provide multiple destinations at single IP address
- IP Address (identifies computer) and port number identifies program/resource in the computer
- A port is an unsigned 16-bit integer (0 to 65,535)
- Many ports pre-assigned to important services
  - 21 ftp (file transfer)
  - 23 telnet (remote terminal)
  - 25 SMTP (email)
  - **80** http (web)
  - Others
  - http://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers

Uniform Resource Identifier (URIs)

- Consists of
  - Scheme
    - http:
    - https: (secure http)
    - mailto:
  - IP address (or domain name)
  - Port (optional, 80 if not specified)
    - http://www.cs.umd.edu:80/
  - Reference to anchor (optional)
  - Query terms
- URL (Uniform Resource Locator) → specific type of URI

Internet Connections

- Two types of connections: **TCP** and **UDP**
- **TCP**
  - Connection oriented
  - Provides reliable connection
  - **Examples:** ftp, ssh, http
  - **Vast majority of internet traffic is TCP**
- **UDP**
  - More like sending a postcard
  - Might get lost with no notification
  - Useful is some specialized cases
    - Messages are small
    - if a packet is lost, would rather just lose it than delay receipt of next packet

Java Networking Examples

- Network I/O: See networkIO package
- TCP Client/Server: See tcpServerClient package
- Toy Web Server: See toyWebServer package