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](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 \(\Rightarrow 128.8.128.8\)
- Domain name \(\Rightarrow\) 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 \(2^{^128}\))

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

Uniform Resource Identifier (URIs)

- Consists of
  - Scheme
    - http:
    - https: (secure http)
    - mailto:
  - IP address (or domain name)
  - Port (optional, 80 if not specified)
  - 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 in 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