CST 311
Final Review

A lot of different pieces of ideas, concepts, technologies and protocols come together to create the Internet

Understanding these helps us be better _____

Difficult class?

Broad Themes

- Layering
- Packet traversal/encapsulation
- Network Architecture
- IP Addressing
- Web browsing example
- Performance
- Protocols
- Security

Layering

- Breakdown communication responsibility
- Make hard problems easier
- Details

Packet traversal

1. Application creates message and sends through socket to transport layer
2. Transport layer adds its envelope and sends to IP layer
3. Source IP and Destination IP added at IP layer along with other envelope information to packet
4. Data link layer adds envelop and follows medium access rules to send frame to gateway
5. Packet travels up to IP layer - routing table is used to figure out the next hop
6. Depending on the next hop, appropriate data link layer to send the frame (source and destination IP remain the same, while at the data link layer the addresses are changed to be in a different envelope)
7. So on all the way until the destination is reached

Network Architecture

- Internet is a ‘Network of networks’
  - Internet Protocol – “thin waist”
  - Routing based on network part of IP address
- Applications on the Internet
  - Client/Server
  - Peer-to-peer
  - _____

IP Adressing

- Hosts
  - Need to have IP address to communicate
  - Need gateway address to “see” Internet
  - Host-only networking
- Initialization (Power on)
  - ARP
  - DHCP

Browsing example

1. Host has IP Address, Gateway address and DNS Server address configured (Manual or DHCP)
2. User enters www.csumb.edu in the browser
3. Browser opens UDP socket to local DNS server and send request
4. Browser gets response from DNS with IP address for www.csumb.edu
5. Browser opens TCP socket to the IP address of www.csumb.edu
    a. TCP Connection Established
6. Browser sends HTTP Get message on the TCP Connection
7. Browser receives HTTP response
8. Browser displays data on the screen

Packet arrival

1. Frame arrives at the destination data link layer
2. After any error checking, sends to IP layer
3. IP looks at the destination address and recognizes that the packet is meant for itself - send packet up to transport layer after removing IP envelop
4. Transport layer will process based on whether TCP or UDP
5. Send to Application layer after removing transport envelope

Performance

- End to end delay
  - Processing
  - Transmission
  - Propagation
  - Queuing
- Capacity
  - Bandwidth
  - Throughput

Protocols

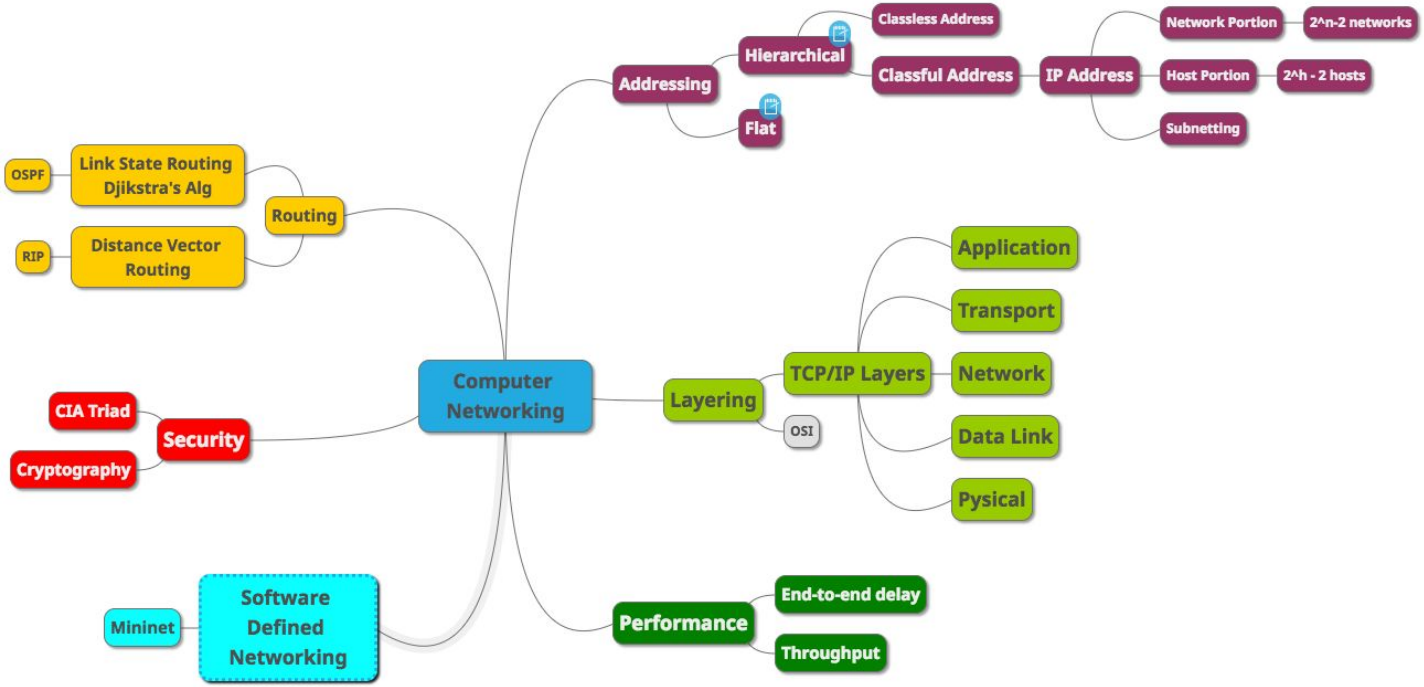
- Rules for communication
- Precise computer science skills
- HTTP
- TCP
- IP
- ARP
- CSMA/CA
- ...

Security

- Confidentiality
- Integrity
- Availability
- Authentication
- Authorization

- Symmetric Encryption
- Public Key Encryption
- Public Key Infrastructure
- Security at each layer (each link)

Concept map



Use this as starting point and add more leaves and notes.

Meta

- Problem Solving
  - Virtual Machines
  - Unix command line
  - Debugging networking problems
    - ifconfig
    - ping
  - Learning from online resources
- Apply Networking Concepts to Other Fields
  - Separation of concerns
  - Protocol development

Going forward

Above & Beyond

1. Pick a project of personal interest
2. Read challenging material in your field of interest
3. Curate your social media followings

Cultivate

Positive attitude &

Growth mindset

Good luck!

Let me know how I can help you!

(Connect with me on LinkedIn)