Notes from Zoom Office Hours

* Round trip delay is propagation
* QUESTION ON 5B: GIVEN on link state, determine the best way to go about which neighbors should be in a forwarding table
  + Dijkstra's Algorithm
* Frame vs. segment vs. datagram
  + Datagram is used transport layer
  + Segment: used in TCP -> sends data as packets
* Pipelining is go back n and selective repeat

**Chapter 1: Introduction and Basic Concepts**

• Packet switching vs. circuit switching.

• "Hosts" vs. "Switches/Routers"

• The definition and purpose of a protocol.

• Standards, and the historic role of RFCs in defining them.

• “Network edge” vs. “Network core"

• LAN vs. WAN

• Wi-Fi standard

• Cellular communication

• Guided vs. unguided media.

• Communication media speed and performance differences.

• “Store-and-forward” communication.

• Communication delays.

• The basic history and original intent of the Internet's design (why packet switching and not circuits like old phones?)

• “Routing” vs. “forwarding"/"switching”.

• Throughput

• End-to-end communication delay.

• Protocol layers, and the concept of a protocol stack.

• The OSI and TCP/IP protocol layers.

• Protocol types: open vs. proprietary, and ad-hoc vs. de jure.

• An Application Programming Interface (API).

**Chapter 2: Application Laye**r

• “Client-server” vs “peer-to-peer” application architectures.

• Sockets and system calls.

• Inter-process communication.

• Transport services.

• TCP vs UDP as examples of transport layers (beneath the application layer).

• Basic web protocol concepts: HTTP, HTML, URL

• Do web application-layers protocols use TCP or UDP?

• “stateless protocol” (like HTTP, and why HTTP is stateless)

• Persistent vs non-persistent HTTP?

• RTT

• HTTP security (and lack thereof)

• “cookies” (and how they give servers a means to track clients'/state)

• FTP, SMTP, IMAP, and POP (basic awareness of their purpose and general nature)

• DNS (basic awareness of structure, and need for scalability)

• Basic DNS record types (“A”, “MX”, and “NS” resource records).

• Iterative vs. recursive lookup in DNS

**Chapter 3: Transport Layer**

• Communication between processes (transport layer) vs. between hosts (Network layer)

• TCP vs. UDP

• “Multiplexing” and “demultiplexing” (specifically in the transport layer).

• Demultiplexing using more information under TCP than UDP.

• The simple UDP checksum (its purpose).

• State machines and their use to describe a protocol.

• Stop-and-wait vs. Pipelining

• Go-back-N (GBN) error recovery vs. Selective Repeat (SR).

• The minimum number of sequence numbers required for GBN vs. SR.

• “Flow control” vs. “congestion control” (and how TCP ensures both)

• TCP’s "Slow Start"/AIMD and its relationship to "congestion control"

**Chapter 4: Network Layer - Data Plane**

• Communication between processes (transport layer) vs. between hosts (Network layer)

• Understanding the difference between “routing” and “forwarding”.

• Network layer service models and terms like: bandwidth, packet loss, packet ordering, packet delivery timing, and congestion feedback.

• Virtual-circuit (connection-oriented) vs packet switching (connectionless) service at the network layer.

• Forwarding tables of routers.

• The definition of a subnet, and how “longest prefix matching” works in routing tables (which you should remember use address ranges, not specific IP addresses).

• Explain the difference between the “control plane” and “data plane” in a router.

• The three types of switching fabrics in a router.

• How packets may be queued at input, or output, ports in a router.

• Head-of-line (HOL) blocking (at the input port of a router).

• The role of (the need for) a Time To Live (TTL) field in IP header?

• The Header Checksum field of IP header (used to check the sanity of IP header, not the data field).

• Subnet masks and Classless Inter-Domain Routing (CIDR) IP addresses.

• DHCP, and its basic functionality.

• Network Address Translation (NAT), and how it works.

• Where to find the ICMP protocol (the layer that implements it, and its purpose).

**Chapter 5: Network Layer - Control Plane**

• The difference between centralized (global) and decentralized (distributed) routing algorithms.

• The difference between link-state and distance-vector routing algorithms.

• The count-to-infinity problem (for distance vector routing).

• OSPF and BGP as examples of link-state and distance-vector routing algorithms.

* Link state routing is conceptual: a way of doing things
  + OSPF is an example of link state routing NEED TO KNOW
  + ISIS is an example too
* BGP is an example of distance vector routing but with more information.
  + Considers an extreme cost for things u dont want to go through
  + Telling them you will get the info to one spot through a specific route.
  + Doesn’t have the count to infinity problem

**Chapter 6: Link Layer**

• Frame vs. segment vs. datagram

* Datagram is used transport layer
* Segment: used in TCP -> sends data as packets
* Frame encapsulates datagram
  + Adds a headline and footer
  + Adds a MAC Address

• MAC address vs IP address.

* MAC Address put in the header of a frame to put the info of source and destination

• Error correction vs detection

* Error Detection occurs in:
  + There is noise in the signal
  + Receiver detects errors and asks for retransmission
  + Not 100% reliable, protocol may miss somethings
* Error Correction
  + Receiver identifies and corrects error without need for retransmission.

• Parity vs CRC

* Parity: Used for error correction and detection
  + The use
  + Can be used for many things
  + Result of XOR
* CRC: division and ends in a perfect 0
  + More powerful for error detection

• Sharing a medium, MAC protocols, and ARP

* Access control
* Dealing with the fact that many people want access to channel

• The three basic ideas / types of MAC protocols: channel partitioning,

random access, and taking turns.

* Channel partitioning: how people talk
  + Giving people specific time or frequencies to talk
* Random access: when people talk
  + Dependent on how people talk
  + Allows for transmissions

• Alloha, Slotted Aloha, and Ethernet

* Ethernet: Transmit over wires, how do we use it
  + Treat wire like the air
  + One person blasts a lot of data
* Alloha: Mac protocol
  + Only one thing can transmit in that channel
  + Based on radio broadcasting: Explains the why
  + Collision occurs, leads to
  + Continuous transmission
* Slotted Aloha
  + More likely to detect a collision
  + Coordinates when signals are sent
  + Transmits at discrete points
  + Find out there's a problem quicker: Leads to faster bandwidth

• CSMA and CSMA/CD

* Listening to check for errors
* CSMA/CD: Detect collision and deal with them one way
* CSMA/CA: Imma try to do something that make sure I don’t collide with other people
  + Transmit on different time periods of a clock

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