

## Midterm Review

## I. Introduction

## A. Definitions

1. network vs distributed system
2. classify networks
  - a. transmission technology - broadcast, multicast, point-to-point
  - b. size - LAN, MAN, WAN
  - c. topology - star, ring, tree
3. performance measures
  - a. throughput
  - b. utilization
  - c. response time
  - d. end-to-end delay
    - i. processing delay
    - ii. queueing delay
    - iii. transmission delay
    - iv. propagation delay
  - e. latency
  - f. goodput
  - g. fairness

## B. Elementary TCP Sockets

1. Client/server model
2. structure of sockaddr\_in
3. socket functions
  - a. *socket*
  - b. *connect*
  - c. *bind*
  - d. *listen*
  - e. *accept*
  - f. *close*

## C. Seven Layer ISO OSI Reference Model

## D. Introduction to TCP/IP Protocol Stack

1. IP addresses
2. HTTP/DNS {skipped these slides}

## II. Miscellaneous topics before physical layer

## A. Multiplexing

1. TDM
2. FDM
3. statistical multiplexing {concentrator}

*{Note – multiplexing was covered just before  
PCM in the Physical Layer section}*

## B. Switching

1. circuit switching
2. message switching
3. packet switching

- C. Store-and-Forward Networks
  - 1. cut-through routing
  - 2. virtual circuit networks
  - 3. datagram networks
  - 4. connectionless versus connection-oriented networks

### III. Physical Layer

- A. Definitions
  - 1. baud {modulation rate}
  - 2. data rate {capacity}
  - 3. bandwidth
  - 4. voice-grade line
- B. Nyquist Theorem
  - 1. signal constellations
- C. Shannon's Result
  - 1. signal-to-noise ratio
  - 2. decibel definition
- D. Analog vs Digital
  - 1. data
  - 2. signals
  - 3. transmissions
  - 4. attenuation
  - 5. amplifiers vs repeaters
  - 6. modem
  - 7. codec
  - 8. advantages vs disadvantages
- E. Data Encoding Techniques
  - 1. digital data, analog signals
    - a. Amplitude modulation
    - b. Frequency modulation
    - c. Phase modulation
  - 2. digital data, digital signals
    - a. NRZL
    - b. NRZI
      - i. differential codes
    - c. Bi-phase codes
      - i. Manchester
      - ii. differential Manchester
  - 3. analog data, digital signals
    - a. PCM
    - b. T1 carrier
    - c. delta modulation
- F. Transmission Media
  - 1. twisted pair
    - a. UTP Cat 3,4, 5,5e,6
    - b. ADSL

- c. Hub topology
    - 2. Coaxial cable
      - a. baseband
        - i. 10BASE2
        - ii. 10BASE5
      - b. broadband {CATV}
    - 3. Optical Fiber
      - a. three types of fiber
- IV. Data Link Layer
- A. Transmission Errors
    - 1. error detection and error correction
    - 2. Hamming distance
    - 3. CRC
      - a. polynomial code
      - b. generating function  $G(x)$
      - c. CRC algorithm
  - B. Synchronous vs asynchronous transmissions
    - 1. bit, character, block level
  - C. Framing
    - 1. bit stuffing
    - 2. byte stuffing
  - D. Tanenbaum's DL protocols
    - 1. Utopia
    - 2. Stop-and-Wait {introduce ACKs}
    - 3. PAR {noisy channel}
      - a. old version
        - 1. ACK, timer, duplicate frames
      - b. "new version" {ACKs, timers, premature timeouts}
    - 4. Sliding Window Protocols
      - a. piggybacking ACKs
      - b. 1-bit sliding window (protocol 4)
      - c. Go Back N (protocol 5)
      - d. Selective Repeat (protocol 6)
      - e. NAKs, ACKtimer

-----**only up to here for Mid Term!**-----

- V. Medium Access Sublayer (MAC)
  - A. "The Channel Allocation Problem"
    - 1. assumptions
  - B. LAN Performance Notation
    - 1. relative propagation time - **a**
    - 2. S, I, and G {throughput, input load, offered load}
  - C. ALOHA
  - D. Slotted ALOHA
  - E. CSMA
    - 1. non-persistent
    - 2. 1-persistent

- 3. p-persistent
- F. CSMA/CD
- G. Ethernet