

**Final Review**

- VII. 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. Token Ring
  - H. Ethernet
    - 1. binary exponential backoff
    - 2. Ethernet evolution (10Base5, 10Base2, 1Base5, 10BaseT)

----- *Final Coverage Begins Here* -----

- I. Switched Ethernet
  - 1. backward learning
- J. Bridges
  - 1. backward learning
  - 2. collision domains
  - 3. loops
    - a. transparent bridges
    - b. source routing bridges
- VIII. High Speed LANs
  - A. FDDI
    - 1. differences from 802.5 token ring
    - 2. 4B/5B encoding
    - 3. dual ring
    - 4. TTRT
  - B. Fast Ethernet
    - 1. 100 Base T4
      - a. four twisted pairs
      - b. 8B/6T encoding
      - c. 33-1/3 Mbps per pair
    - 2. 100 Base TX
    - 3. 100 Base FX
  - C. Gigabit Ethernet
    - 1. Fiber Channel technology
    - 2. 8B/10B encoding
    - 3. 1000 Base SX
    - 4. 1000 Base LX

5. 1000 Base CX
  6. 1000 Base T
  7. carrier extension
  8. frame bursting
  9. buffered distributor
- IX. Wireless LANs
- A. Classification
    1. Infrastructure
    2. Ad Hoc
    3. MANET
  - B. 802.11 Protocols
    1. infrared
    2. FHSS
    3. DHSS
      - a. 11-bit chipping Barker sequence
      - b. CDMA
    4. 802.11a
      - a. OFDM
    5. 802.11b
      - a. HR\_DHSS
    6. 802.11g
    7. 802.11n
      - a. MIMO
  - C. Management Functions
    1. Channel Selection and Power Management
    2. Authentication, Association, Beacon Management
    3. Passive and Active Scanning
  - D. MAC Sublayer
    1. Hidden Terminal Problem
    2. Exposed Station Problem
    3. DCF
      - a. CSMA/CA
        - i. MACA
        - ii. RTS/CTS
        - iii. MACAW with Virtual channel sensing
        - iv. 1-persistent physical carrier sensing
        - v. timer countdown
        - vi. SIFS, DIFS
    4. 802.11 frame addresses
    5. Frame fragmentation
    6. PCF
      - a. beacon frame
    7. Implementation Details
      - a. Dynamic Rate Adaptation
- X. Cellular and Mobile Wireless Networks
- A. Cellular Architecture

1. Base Station and MSC
2. combined FDM/TDM
3. CDMA
4. GSM
- B. 2G {voice}
  1. BSS, BTC, BSC
- C. 2.5G {voice and data}
  1. GPRS, EDGE, CDMA-2000
  2. SGSN, GGSN (parallel data network)
- D. 3G {voice/data}
  1. UTMS, CDMA-2000,
  2. EVDO
- E. 4G LTE
  1. OFDM
  2. Physical Resource Block
- F. Mobile Networks
  1. home network, agents, correspondent, visited network
  2. permanent address, care-of-address (COA), registration
  3. Indirect Routing
  4. Direct Routing
    - a. anchor foreign agent
- XI. Wireless Sensor Networks
  - A. Details
    1. Network Lifetime
    2. Energy wastes:
      - a. Idle listening, collisions, overhearing, control overhead, overmitting
    3. Communication patterns
      - a. Broadcast, multicast, convergecast, local gossip
    4. Lower Duty Cycle
      - a. TDMA
      - b. Scheduling
      - c. LPL
  - B. WSN Types
    1. Tiered
    2. Cluster-based
  - C. Power-Aware MAC protocols
    1. S-MAC
    2. LPL
- XII. Wireless Measurement
  - A. Performance Measurement Approaches
    1. analytic models, simulation models, empirical measurement
  - B. *"Performance Analysis of the Intertwined Effects between Network Layers for 802.11g Transmissions"*
  - C. *"Characterization of 802.11 Wireless Networks in the Home"*
- XIII. SONET
  - A. optical fiber standard

1. common master clock
2. byte interleaved TDM
- B. SONET architecture
  1. ADM - add/drop multiplexor
  2. REG - regenerator for optical signals
  3. section/line/path
- C. SONET frame
  1. SPE Synchronous Payload Envelope
  2. Overhead
- D. Multiplexing hierarchy
  1. up to STS-3 and beyond
  2. down to virtual tributaries
- XIV. ATM {Asynchronous Transfer Mode}
  - A. Basics
    1. 53 byte cell-switching technology
    2. virtual circuit design
  - B. Conceptual Model Assumptions
  - C. Header Details
    1. UNI versus NNI
    2. VPI/VCI
  - D. Architecture
    1. variety of traffic types
      - a. original four types
      - b. revised traffic types
    2. AALs
      - a. AAL1
      - b. AAL3/4
      - c. AAL5
    3. CS and SAR sublayers
  - E. Cell Switching Issues
    1. cells not reordered
    2. non-blocking switches
    3. PVCs versus SVCs
- XV. Network Layer
  - A. Introduction
    1. Role of Network Layer
    2. Routing vs Forwarding Table
  - B. IP Issues
    1. IP Datagram Packet
    2. IP Fragmentation and Reassembly
    3. Subnets
      - a. Network Classes
      - b. Subnet Mask
    4. CIDR (Classless Interdomain Routing)
      - a. Contiguous blocks
      - b. Related to BGP

- c. Route Aggregation
- C. Routing Algorithm Classification
  - 1. Non-Adaptive
    - a. flooding
    - b. static
      - i. Dijkstra's Shortest Path routing algorithm **{not covered}**
  - 2. Adaptive
    - a. centralized RCC
    - b. distributed
      - i. intradomain routing
      - ii. interdomain routing
    - c. isolated
- D. Distance Vector Routing
  - 1. Algorithm details
  - 2. Good news/Bad news
    - a. counting to infinity problem
- E. Link State Routing
  - 1. Algorithm details
    - a. reliable flooding
- F. Hierarchical Routing
  - 1. AS's
- G. Routing in the Internet
  - 1. RIP
  - 2. OSPF
    - a. partitioning domains into areas
    - b. router types (area border, backbone, boundary)
    - c. Five types of LSA's
    - d. advanced OSPF features
  - 3. Border Gateway Protocols (BGP)
- H. More IP Issues
  - 1. ARP (Address Resolution Protocol)
    - a. address pairs
  - 2. DHCP (Dynamic Host Configuration Protocol)
    - a. UDP and ports
  - 3. NAT (Network Address Translation)
- I. ICMP
- XVI. Transport Layer
  - A. TCP Sliding Windows
    - 1. advertised window
    - 2. congestion window
  - B. General Congestion Control
    - 1. congestion control versus flow control
    - 2. soft state
    - 3. CC taxonomy
      - a. router-centric
      - b. host-centric

- c. reservation-based
  - d. feedback-based
  - e. window-based
  - 1. power and Jain's Fairness
  - 2. router queuing
    - a. FIFO {Drop Tail}
    - b. Priority Queuing
    - c. Fair Queuing (FQ)
    - d. Weighted FQ (WFQ)
  - C. TCP Congestion Control
    - 1. router congestion notification
    - 2. congestion window (cwnd)
    - 3. AIMD
      - a. congestion avoidance
    - 4. slow start
    - 5. fast retransmit
    - 6. fast recovery
    - 7. TCP Tahoe vs. TCP Reno
    - 8. TCP New Reno
    - 9. RIO vs RTO
  - XVII. Firewalls and IDS {Only covered briefly}
    - A. Why Firewalls?
    - B. Stateless Packet Filters
      - 1. Access Control Lists
    - C. Statefull Packet Filters
    - D. Application Gateways
    - E. Intrusion Detection Systems
  - XVIII. Distributed Denial of Service Tutorial {may not cover}
    - A. Flooding DDoS Attacks
    - B. Direct Attacks
      - 1. TCP-SYN Flooding
    - C. Indirect Attacks
- Final Covers up to Here ---Note: Line will probably move up after lecture-----**