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)
I. Switched Ethernet
   1. backward learning
J. Bridges
   1. backward learning
   2. collision domains
   3. loops
      a. transparent bridges
      b. source routing bridges

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

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  
1. RFID  
   A. Classification  
      1. Infrastructure  
      2. Ad Hoc  
      3. MANET  
5. single vs multi-hop  
B. 802.11 Protocols  
   1. infrared  
   2. FHSS  
   3. DSSS  
      a. 11-bit chipping Barker sequence  
      b. CDMA  
   4. 802.11a  
      a. OFDM  
   5. 802.11b  
      a. HR_DSSS  
   6. 802.11g  
   7. 802.11n  
      a. OFDM  
      b. 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  
         ii. 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 frames
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 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"
D. "Performance Anomaly for 802.11b"

XII. 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. T-MAC
   3. LPL
   4. X-MAC

XIII. 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

XIV. 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
      a. estimating RTT

XV. 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

XVI. 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

----Final Covers up to Here ---

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