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  
      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 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 Entwined 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-----