

## Lecture 3

CS625: Advanced Computer Networks  
Fall 2004

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<http://www.cse.iitk.ac.in/users/braman/courses/cs625-fall2004/outline.html>

## Outline for Today

- Medium access mechanisms
- Adaptive Link-Layer-Control
- Projects discussion
- *Scribe for today?*

## Medium Access Control

- MAC required when a link/channel is shared
- Examples:
  - Talking in a class-room
  - Ethernet
  - Wireless network

## MAC in Ethernet: CSMA/CD

- Carrier-Sense-Multiple-Access with Collision-Detect
- A distributed algorithm
- Each node:
  - Transmits packet when available
  - Detects any collision *while* transmitting
  - Random (exponential) backoff on collision

## MAC in 802.11: CSMA/CA

- CSMA with Collision-Avoidance
  - Since collision detection not possible in wireless
- Slot-based contention scheme, with immediate ACK
- Problems with wireless:
  - Hidden node problem
  - Exposed node problem
- Use RTS/CTS to address these issues

## MAC in Wireless (Continued)

- Further issues:
  - Large number of users ==> high probability of collision
  - Large delay ==> RTS/CTS round-trip is inefficient
- MAC in satellite links:
  - Time-slot reservation based
  - Time-Division-Multiple-Access (TDMA)

## Global System for Mobility (GSM)

- European standard for digital cellular telephony
- *Cells, Base-Stations, and Mobile Clients*
- *Frequency of transmission*
  - Spans 200KHz
- *Uplink and Downlink*
  - 890-915MHz (25MHz width) for uplink
  - 935-960MHz (25MHz width) for downlink
  - Each has 124 *carrier frequencies*

## TDMA/FDMA in GSM

- Frequency-Division-Multiple-Access in GSM
  - Base-station can be allocated many frequencies
- TDMA in GSM:
  - *Burst period* of 15/26 ms (0.577ms)
  - Eight burst periods form a TDMA frame (120/26=4.615ms)
  - Any one of the eight slots can be allocated for a particular cell-phone call
- In effect, TDMA+FDMA operates in GSM

## Some Remarks

- Channel allocation in cellular networks
  - Fixed allocation
  - Dynamic allocation
- Code-Division-Multiple-Access
  - Different users use different *modulation codes*

## Adaptive Link-Layer Control

- Frame length versus throughput
- Mechanisms for adaptive frame-length
  - IP fragmentation
  - Encode parts of IP packet for error control
- Range versus MTU
- Battery consumption versus MTU

## Next Week

- Internet routing
- OSPF: Open Shortest Path First
- Border Gateway Protocol (BGP)