802.11 Wireless
ITS 437

Introduction

• 802.11 is not "Ethernet over radio waves"
• The protocol and the frame formats are different
• Wireless uses some unique terminology
• 802.11 Resource:
  "802.11 Wireless Networks: The Definitive Guide", by Matthew Gast, on Safari Online Books.

802.11 Basics

• 802.11 is a family of standards
• Different frequency bands
• Different encoding methods
• Different range
• 802.11a operates in the 5GHz band, everything else is in the 2.5GHz band
• We are not alone.... (in the 2.5GHz band)
  • Cordless Phones
  • Bluetooth
  • Baby Monitors

The 802 Family
802.11 Infrastructure Mode

- ESS - Extended Service Set
- SSID - Service Set Identifier
- The "Name" of the network

Ad-Hoc Network Mode

- Direct communication station to station
- With Zeroconf, mDNS, and Service Discovery
- Create small peer-to-peer networks automatically
- Exchange information among laptops, PDAs, printers, etc.
- Most operating systems allow the user to select the network mode
- A bad choice by the user means misery for everyone....

Basic MAC Operation

- CSMA/CA - Carrier Sense Multiple Access with Collision Avoidance
- Also called DCF - Distributed Coordination Function
- Listen for a current transmission
- After transmissions stop, wait for the DIFS (DCF Inter-Frame Spacing) plus a random additional time
- First transmitter "wins"
- Next frame in a sequence is sent after a shorter SIFS (Short Inter-Frame Spacing), locking out other transmitters

MAC Timing
What About Collisions?

- Non-broadcast packets are acknowledged
- Un-acknowledged frames are retransmitted
- Retransmissions wait for a longer than normal back-off period
- A configurable counter limits the number of retransmissions for a frame

Hidden Nodes

- Two stations can both see the AP, but not each other

RTS/CTS and the NAV

- If hidden nodes exist, transmissions will collide
- Both frames are lost
- Random back-off before retransmit should fix the problem
- Expensive if this happens a lot with large frames
- Stations can send a RTS frame
  - Include the Network Allocation Vector (NAV), essentially “I need the network for NAV amount of time”
  - AP responds with CTS including a NAV
  - The hidden station uses this as a “virtual carrier sense”

NAV-based carrier sense