

Mobile Communications

TCS 455

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Lecture 3

Office Hours:

BKD 3601-7

Tuesday 14:00-16:00

Thursday 9:30-11:30

Mobile?

- The term “mobile” has historically been used to classify all radio terminal that could be moved during operation.
- More recently,
 - the term mobile is used to describe a radio terminal that is attached to a high speed mobile platform
 - e.g., a cellular telephone in a fast moving vehicle
 - the term portable is used to describes a radio terminal that can be hand-held and used by someone at walking speed
 - e.g., a walkie-talkie or cordless telephone inside a home.
 - 802.11?

Reading Assignment

- Read
 - Chapter 1
 - Chapter 3
- Don't pay too much attention to details

Overview of Mobile Communications

- Wireless/mobile communications is the fastest growing segment of the communications industry.
- Cellular systems have experienced exponential growth over the last decade.
- Cellular phones have become a critical business tool and part of everyday life in most developed countries, and are rapidly replacing wireline systems in many developing countries.



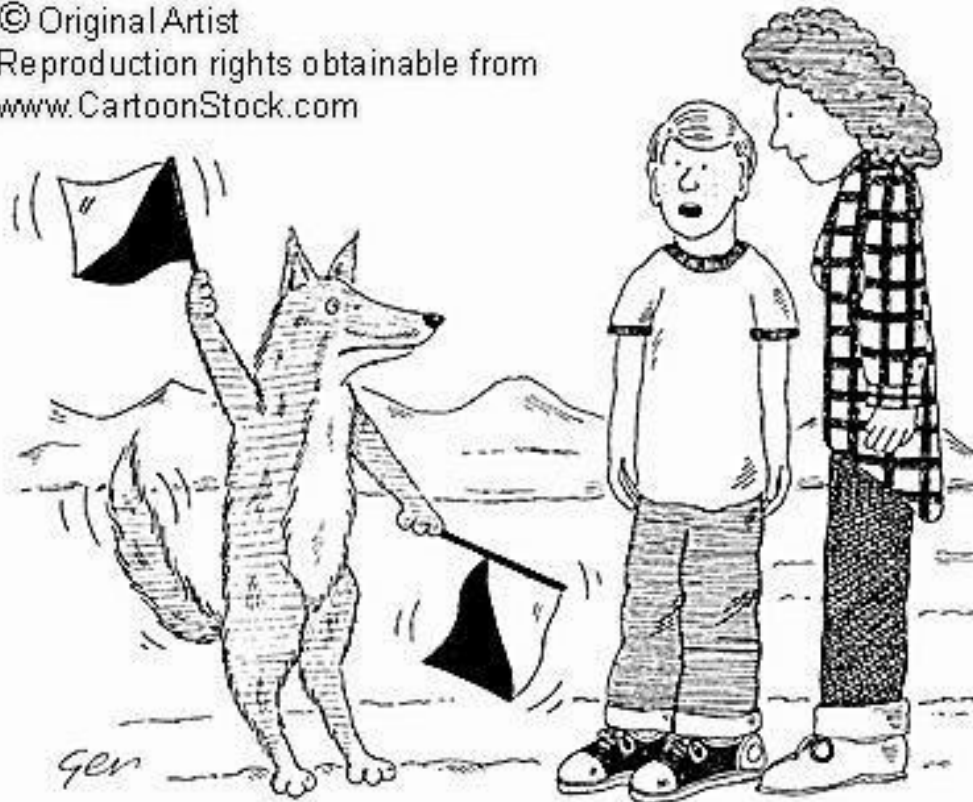
History of Wireless Communications

- The first wireless networks were developed in the Pre-industrial age.
- These systems transmitted information over line-of-sight distances (later extended by telescopes) using smoke signals, torch signaling, flashing mirrors, signal flares, or semaphore flags.

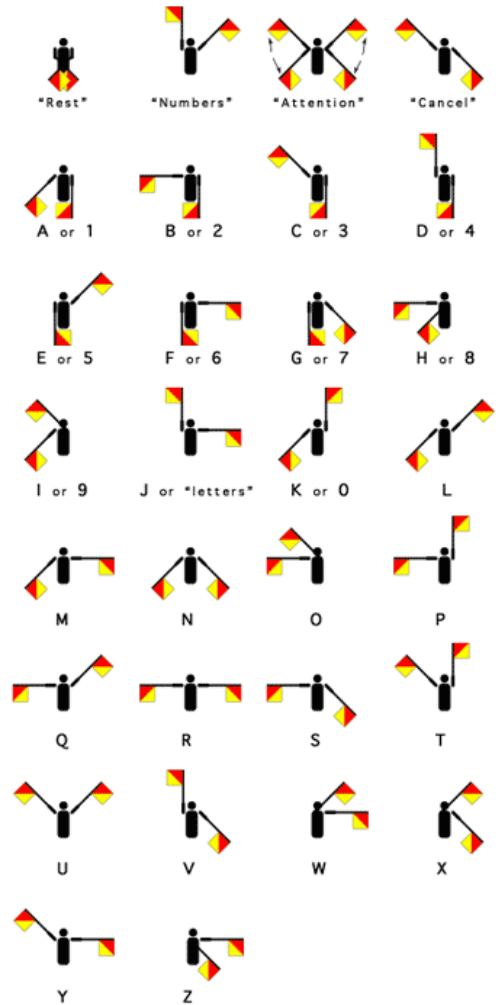


Semaphore

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'I think Lassie is trying to tell us something, ma.'



History of Wireless Comm. (2)

- Early communication networks were replaced first by the **telegraph network** (invented by Samuel Morse in 1838) and later by the telephone.
- In 1895, Marconi demonstrated the first radio transmission.
- Early radio systems transmitted analog signals.
- Today most radio systems transmit digital signals composed of binary bits.
- A digital radio can transmit a continuous bit stream or it can group the bits into packets.
- The latter type of radio is called a packet radio and is characterized by bursty transmissions



History of Wireless Comm. (3)

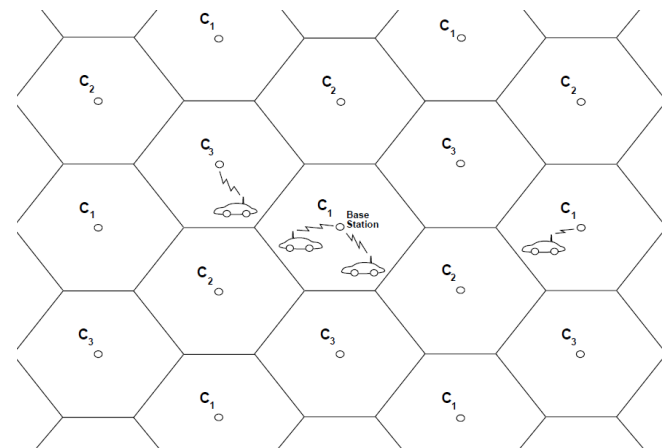
- The first network based on packet radio, ALOHANET, was developed at the University of Hawaii in 1971.
- ALOHANET incorporated the first set of protocols for channel access and routing in packet radio systems, and many of the underlying principles in these protocols are still in use today.
- Lead to Ethernet and eventually wireless local area networks

History of Wireless Comm. (3)

- The most successful application of wireless networking has been the cellular telephone system.
- The roots of this system began in 1915, when wireless voice transmission between New York and San Francisco was first established.
- In 1946 public mobile telephone service was introduced in 25 cities across the United States.
- These initial systems used a central transmitter to cover an entire metropolitan area.
 - Inefficient!
 - Thirty years after the introduction of mobile telephone service, the New York system could only support 543 users.

History of Wireless Comm. (4)

- A solution to this capacity problem emerged during the 50's and 60's when researchers at AT&T Bell Laboratories developed the **cellular concept**.
- Cellular systems exploit the fact that the power of a transmitted signal falls off with distance.
- Thus, two users can operate on the same frequency at spatially-separate locations with minimal interference between them.
 - Frequency reuse



History of Wireless Comm. (5)

- The second generation of cellular systems, first deployed in the early 1990's, were based on digital communications.
- The shift from analog to digital was driven by its higher capacity and the improved cost, speed, and power efficiency of digital hardware.
- While second generation cellular systems initially provided mainly voice services, these systems gradually evolved to support data services such as email, Internet access, and short messaging.
- Unfortunately, the great market potential for cellular phones led to a proliferation of (incompatible) second generation cellular standards.
- As a result of the standards proliferation, many cellular phones today are multi-mode.

What is this course?

- Communication field
- More on theory.
- Little focus on hardware or software
- “Most people felt the theory was silly and therefore they would keep asking me if you are so smart, why aren’t you rich? I don’t have any good answer to that because I felt I was smart because I understood all those theories but I wasn’t rich. So, I thought what I’m gonna do is do enough engineering to get rich and when people ask me that question, I can say, I am! And I suggest all of you, if you have theoretical leading to focus on some engineering also.”