Mobile Communications

TCS 455

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Lecture 4

Office Hours:
BKD 3601-7
Tuesday 14:00-16:00
Thursday 9:30-11:30

Announcements

- Read
  - Chapter 1
    - Don't pay too much attention to details
  - Chapter 3: 3.1 – 3.2
    - Posted on the web
- Many papers posted on the SIIT online lecture note system.

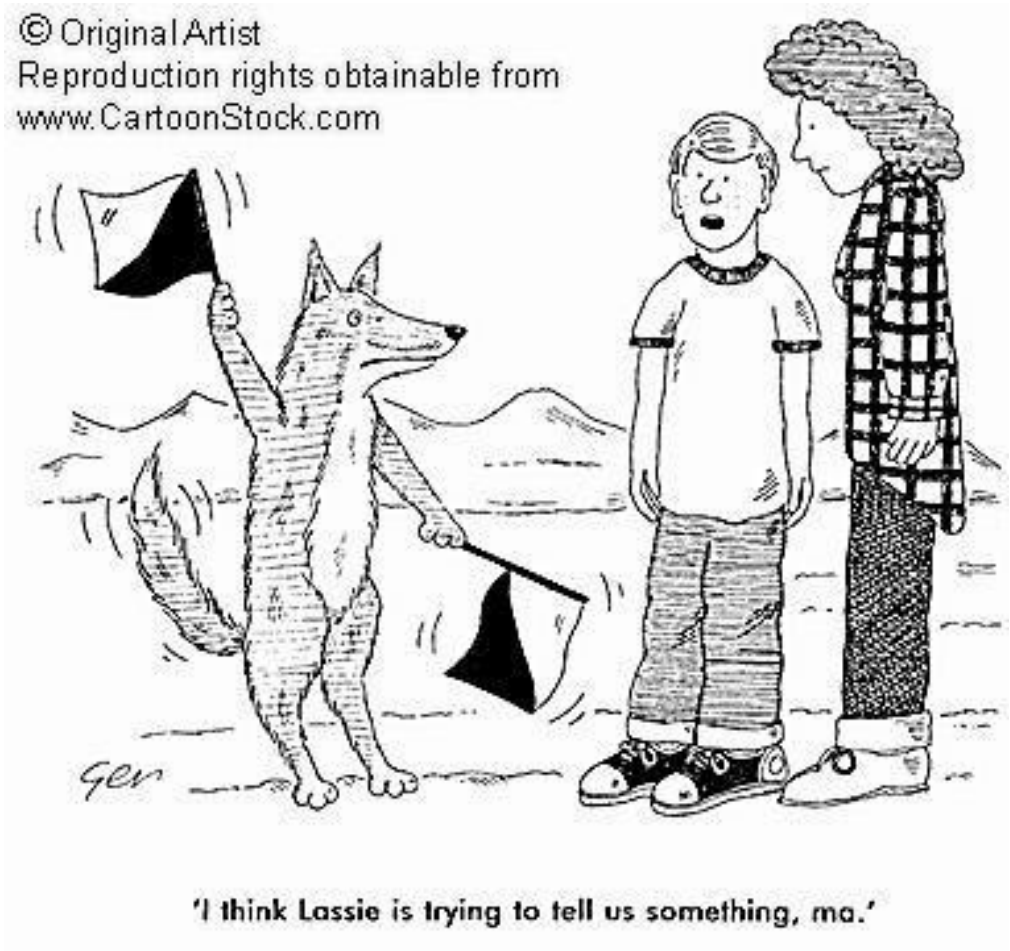
Overview of Mobile Communications

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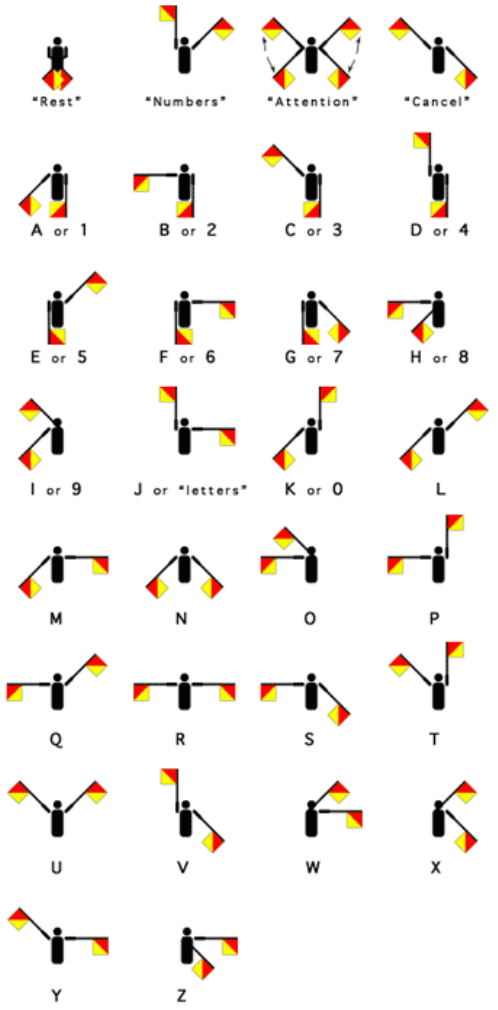
'I think Lassie is trying to tell us something, ma.'


"Rest"
"Numbers"
"Attention"
"Cancel"
A or 1
B or 2
C or 3
D or 4
E or 5
F or 6
G or 7
H or 8
I or 9
J or "letters"
K or 0
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z

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)

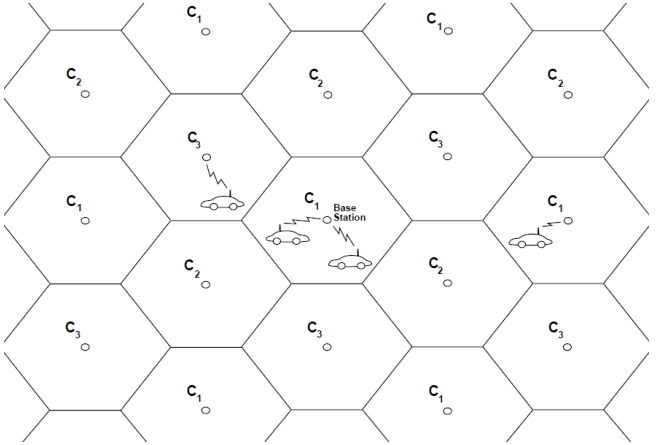
- The first network based on packet radio, **ALOHANET**, was developed at the University of Hawaii in 1971.
- ALOHANET incorporated the first set of protocols for channel access and routing in packet radio systems, and many of the underlying principles in these protocols are still in use today.
- Lead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

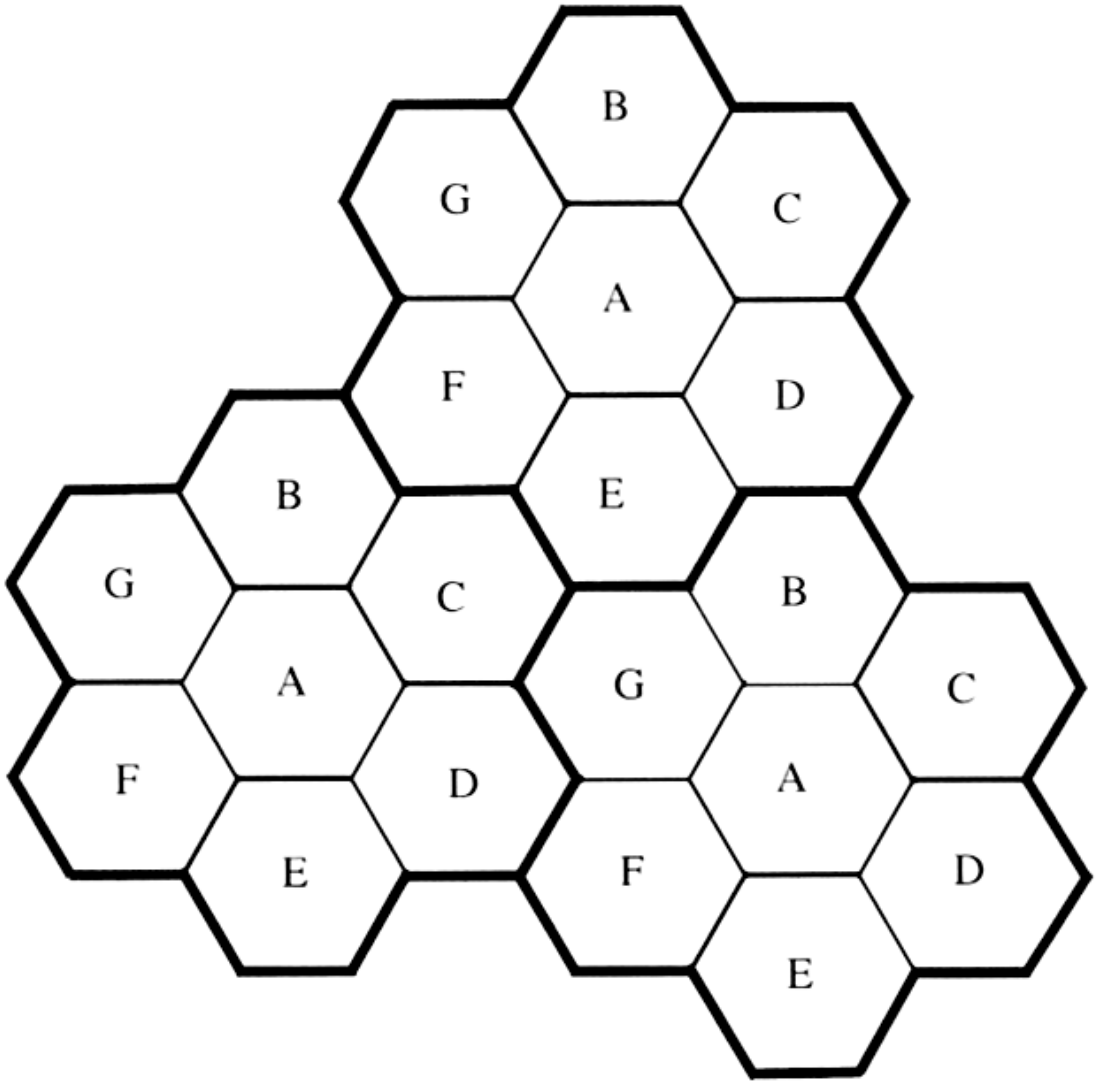
- A solution to this capacity problem emerged during the 50's and 60's when researchers at AT&T Bell Laboratories developed the **cellular concept**.
- Cellular systems exploit the fact that the power of a transmitted signal falls off with distance.
- Thus, two users can operate on the same frequency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



History of Wireless Comm. (5)

- The second generation (**2G**) 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**.

N = 7



Activity 1

- You have seen N = 3, 4, 7
- Find the next five **lowest** values of N.