Wireless Mobile Communication

Lecture 13

- Cellular System Design Fundamental

Topics to be Covered

- Advantage & Disadvantage of Wireless Network
- Shape of Cell
- Frequecny Allotment
- Frequency Reuse

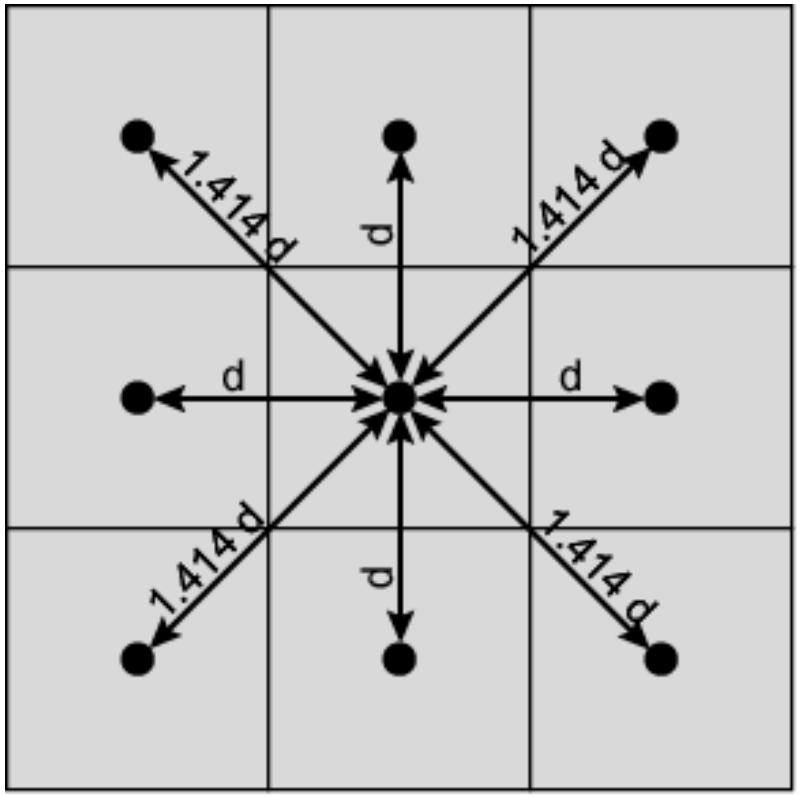
Advantages and disadvantages of wireless

- Advantages
  - Reduced cost of installation
  - reconfiguration, improved speed of deployment and reconfiguration
  - Mobile
- Disadvantages
  - Spectrum availability (radio operates between 3k to 30G Hz
  - Multipath interference (MPI) leads to ghosting effect

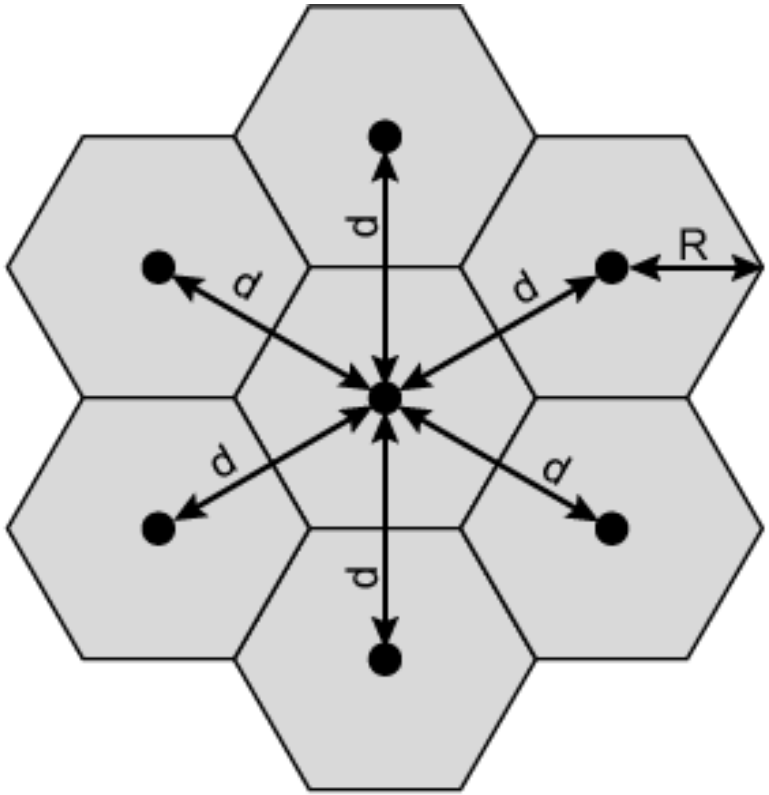
Shape of Cells

- Square
  - Width *d* cell has four neighbors at distance *d* and four at distance $\sqrt{2}d$
  - Better if all adjacent antennas equidistant
    - Simplifies choosing and switching to new antenna
- Hexagon
  - Provides equidistant antennas
  - Radius defined as radius of circum-circle
    - Distance from center to vertex equals length of side
  - Distance between centers of cells radius *R* is $\sqrt{3}R$
  - Not always precise hexagons
    - Topographical limitations
    - Local signal propagation conditions
    - Location of antennas

Cellular Geometries



(a) Square pattern



(b) Hexagonal pattern

The cell concept: frequency reuse

- Concepts date back in 1947 at Bell labs.
- Assuming 12 channels are available in a metropolitan area of 60 miles radius.
  - 1 macrocell supports 12 simultaneous conversations
  - Divide a macrocell into 7 microcells, a reuse factor of 128 is realized, allowing 1,536 conversations.
  - Divide a macrocell into 7 picocells, the system supports in theory 6, 168 conversations.

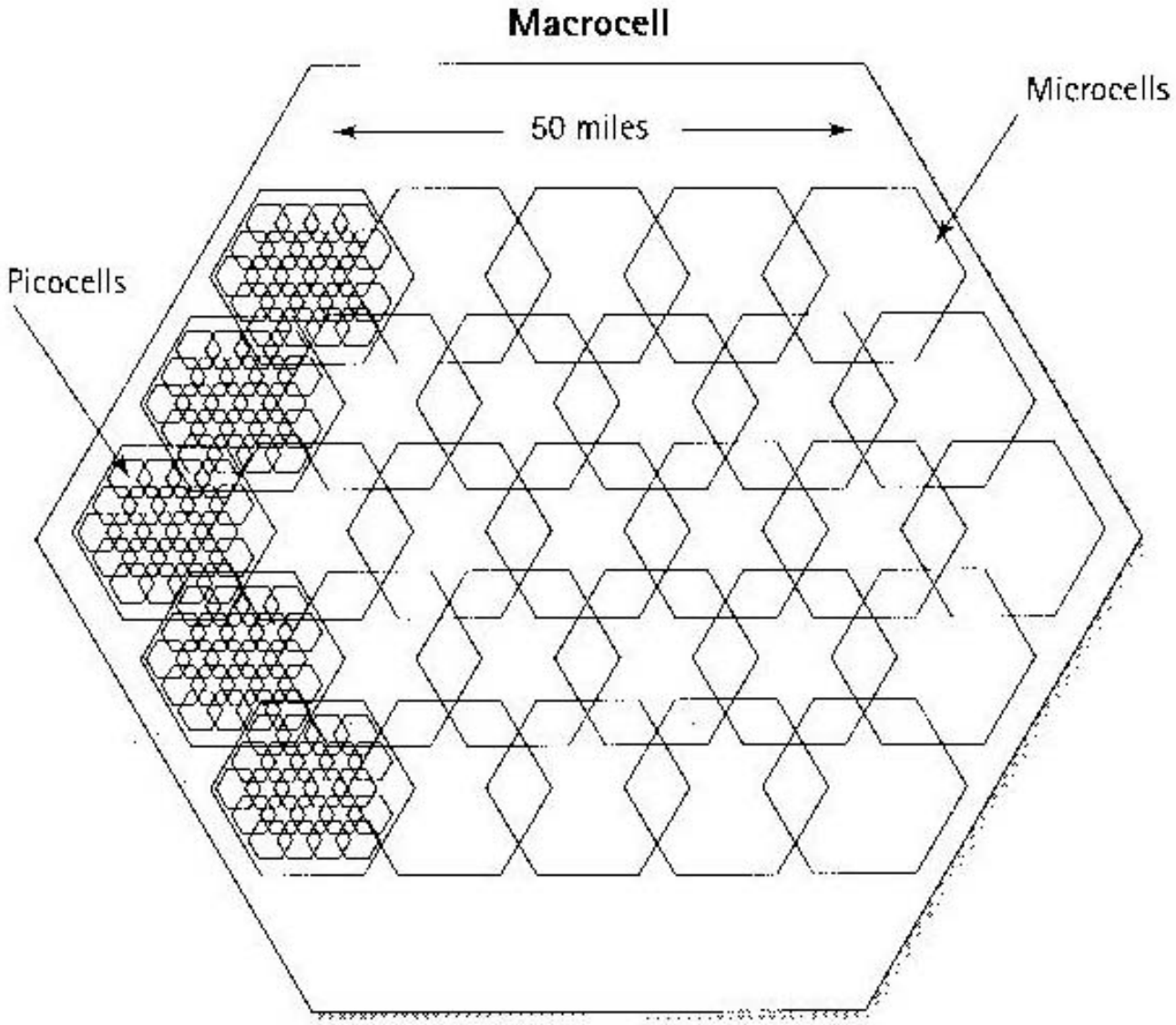


Figure 11–1 Macrocells, microcells, and picocells

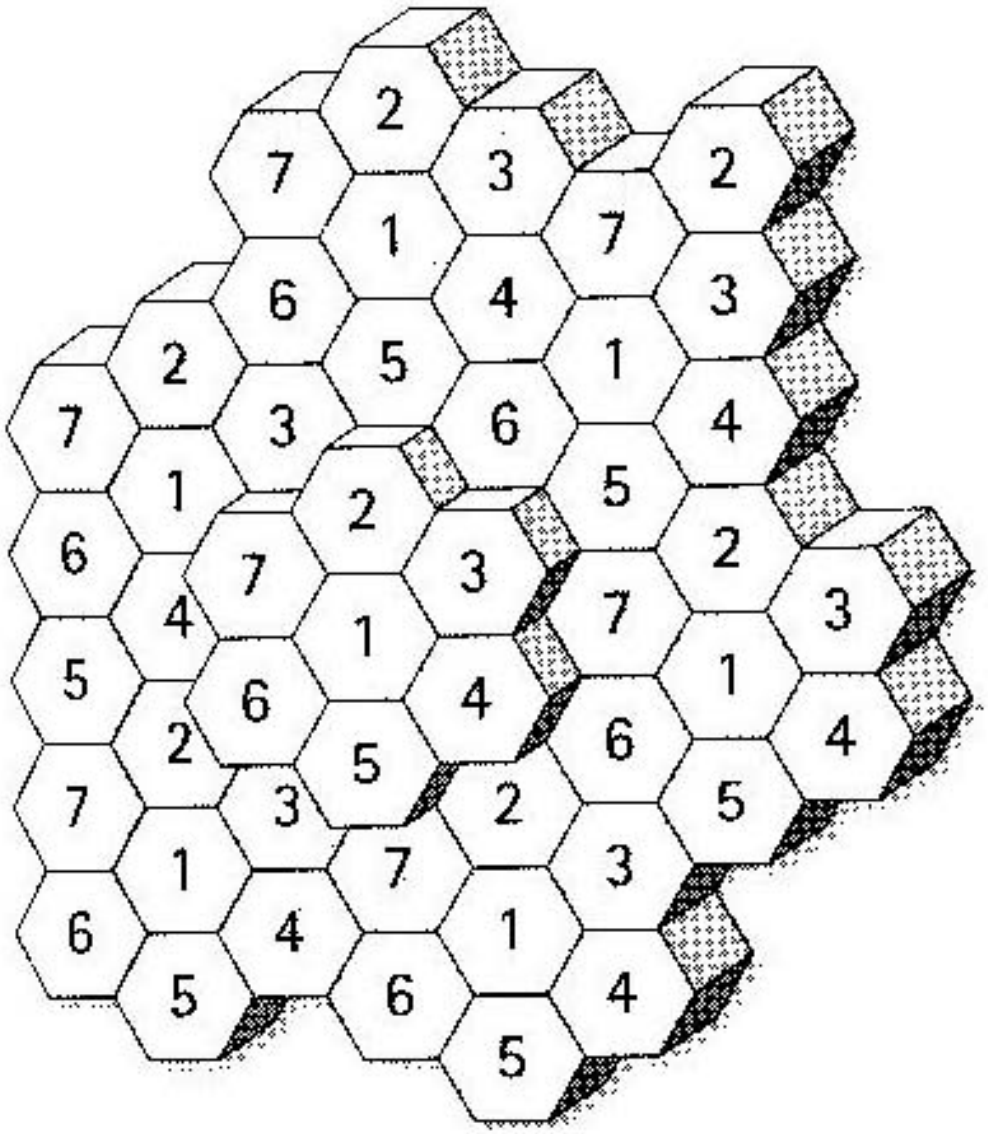


Figure 11-2 Seven-Cell reuse pattern