

UNIVERSITY OF WATERLOO
Department of Electrical and Computer Engineering

Methods for Simulating Mobile Phones

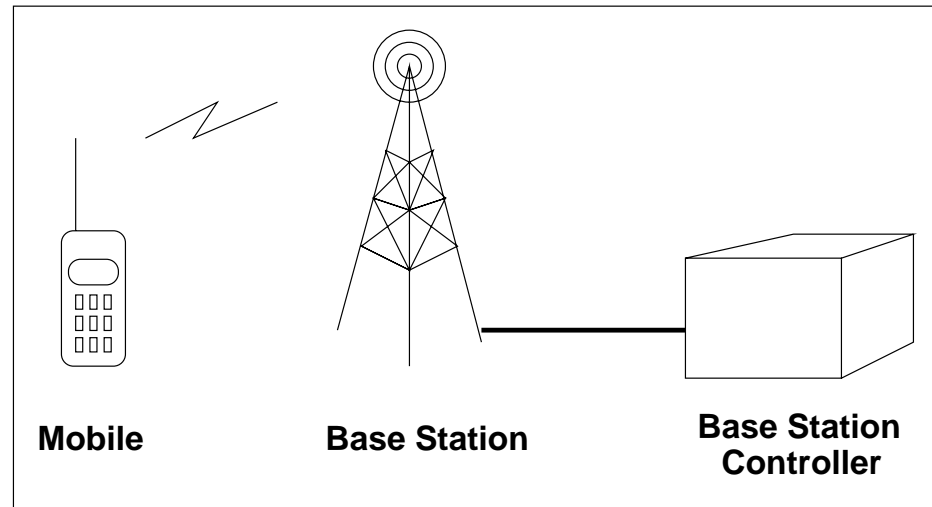


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slides by *SlickSlides*

Components



Mobile: portable phone

Base Station: communication centre; connects mobile to land lines

Base Station Controller: logic centre controlling base station(s)

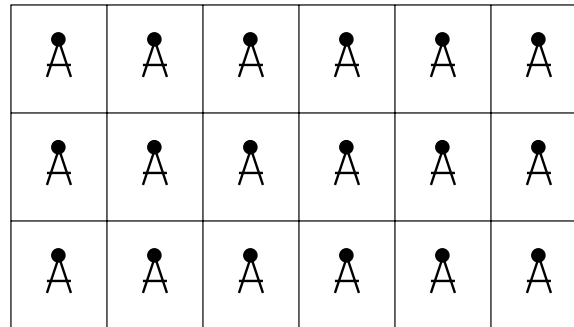
Cells

- geographic region
 - area within transmit range of a base station
 - boundaries are “fuzzy” as broadcast signals degrade gradually
- control region
 - if a mobile is communicating with a base station it can be considered to be in its cell
 - binary concept: either in or outside of specific cell
- can be within geographic area and not in cell \Rightarrow base station fully utilized

Simulation Issues

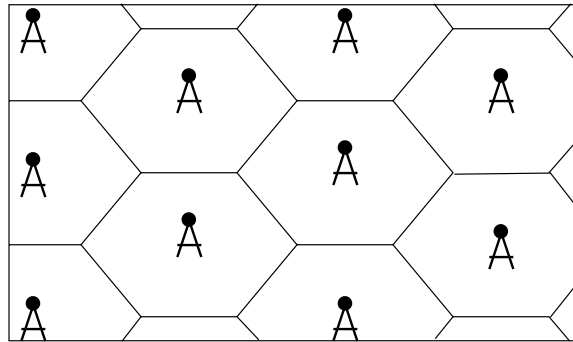
- mobile:
 - signal strength
 - reception sensitivity
 - power consumption
 - blocked calls
 - dropped calls
 - mobility model
 - teletraffic model
 - features: data vs voice traffic
- base station:
 - signal strength
 - hand-off coordination
 - channel allocation: fixed vs dynamic channel allocation

NEWS Grid



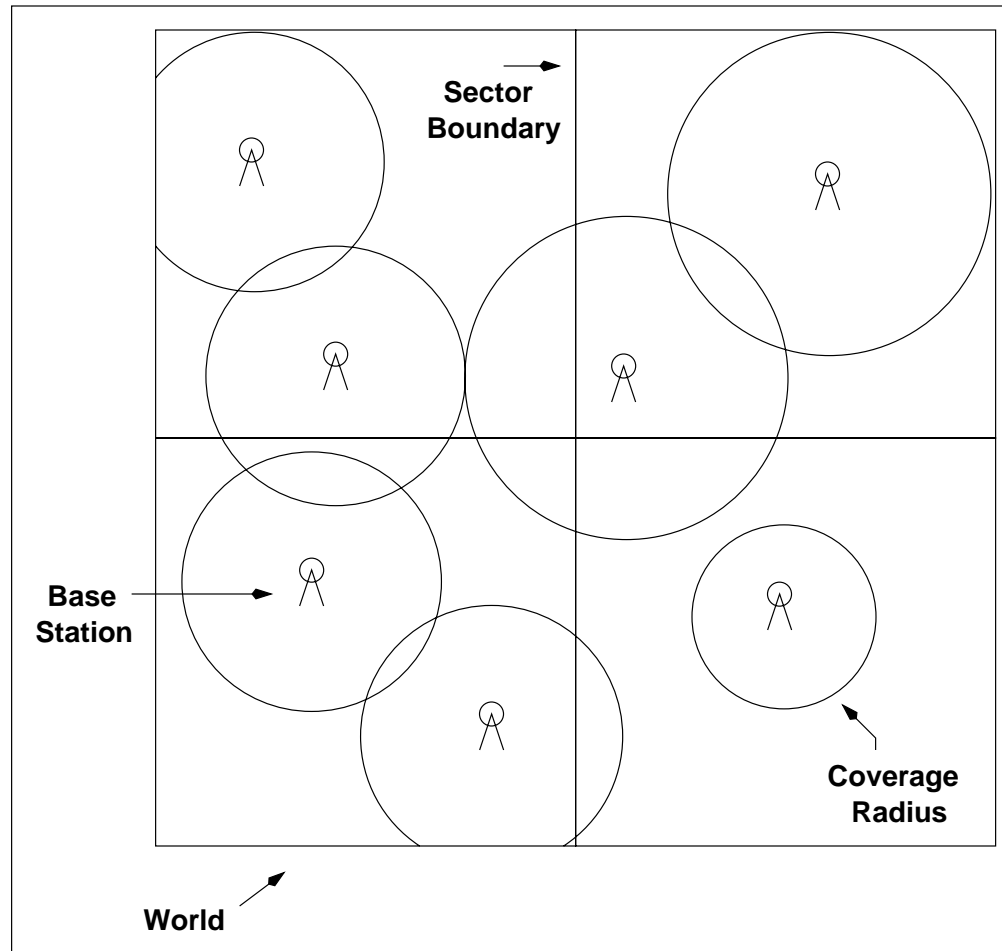
- represent cell as a square
- cells are geographic
- can use queues to enter and leave the cell
- number of servers is based on number of channels
- teletraffic model determines length of “service”
- ignores signal strength and interference

Hexagon Cells



- similar to NEWS Grid
- represent cell as a hexagon
- closer approximation to signal propagation “circle”
- requires more queues

Signal Propagation

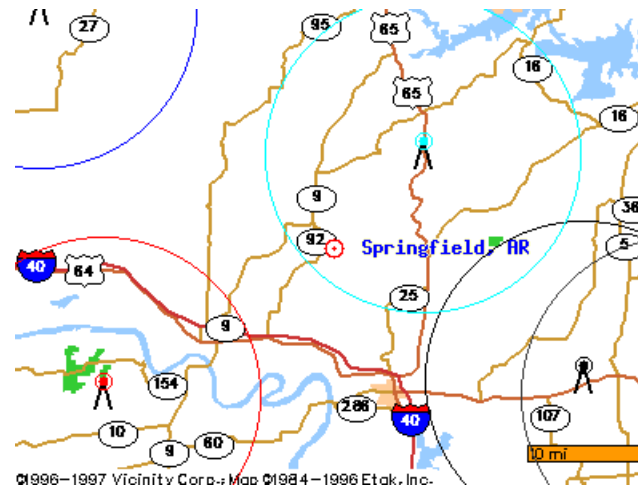


- “cell” based on control region \Rightarrow not geographic
- full mobility model possible
- signal degradation determines hand-off
- very difficult to model with queues

Modeling Time

- discrete event vs continuous
- time-warp modeling vs (accelerated) real-time modeling
- event causality must be maintained
 - motion and utilization of mobiles effects number of free channels in base station
- real-time can be considered a hybrid model
 - time constraints must still be met
 - mobiles do calculations periodically

Springfield



- distributed real-time simulation
- consists of server, multiple clients, and multiple user interfaces
- full mobility model includes: angular direction and acceleration
- probability models can be configured in real-time

Implementation

- coded in Java
 - object-oriented modeling
 - network functionality
 - capable of distributing objects
 - system run clock available
- clients register with server to handle a geographic area: “sector”
- world map (base station locations, etc) distributed by server
- user interfaces can register with and view any client
- synchronization issues:
 - server informs clients of each other \Rightarrow registration race condition
 - user interface duplicates some calculations to reduce network traffic
 - corrective synchronization between clients and user interfaces