

Location, Location, Location

Lecture 7
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Outline

- **Administrative remarks and requests**
- **Positioning Technology**
 - GPS and others
- **Location Specifiers**
- **Privacy Issues**



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Asking for help

- **For 3rd edition phones, need to rebuild binaries.**
 - We have code for doing cache-less bluetooth scanning. I need someone to rebuild the library
- **Let's test the theory about phone scanning**
 - Want to try to have everyone call at same time so must bring in phones.
- **Cell tower hand-offs**
 - Discuss potential extra-credit problem set.



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Mobile Connectivity

- **Cellular Network (big brother)**
 - Turn on, connect to tower & register
 - Tower's hand-off control of phone
- **Wifi Base Stations (proactive grown-up)**
 - Turn on; connect to station & register
 - When signal lost, device looks for new one
- **Is there a middle ground?**
 - Suppose there is a group of friends?



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How can you be found?

- **Big brother keeps track of controlling tower**
- **Responsible grown-up always tells DNS its loc.**



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Knowing where you are?

- **Big Brother: Ask network for your location**
- **Big Family: Listen to a bunch of beacons and their locations, then triangulate**
- **Loner: Figure it out for yourself**
 - Cell tower(s) and switching pattern
 - Notice landmarks
 - Dead reckoning



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Universal Location

- **On earth, we need three piece of information:**
 - latitude, longitude, & altitude
 - there are other possibilities
- **Global Positioning Systems can give us that information**
- **Can then use mapping to do something useful with that information**



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Global Positioning Systems

- 1978 US Department of Defense begins project
- 1984 Crash of Korean Flight due to poor navigational equipment ==> gps for civilian use
- 1985 Complete system fully operational
 - 24 satellites (11,000 mile orbit) & \$12 billion
- 2000, selective availability turned off
 - 3 to 15 meter accuracy for everyone



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How it works

- **Receiver measures travel time of random code sent from satellite (about 0.1 sec)**
 - compute distance, call it X
- **Receiver's position can be anywhere on a sphere of radius X with satellite at center**
- **Given four satellite readings, can figure out position in 3 dimensions**
- **Let's look at some government slides**
 - mms.nps.gov/gis/gps/How_GPS_Works.ppt

