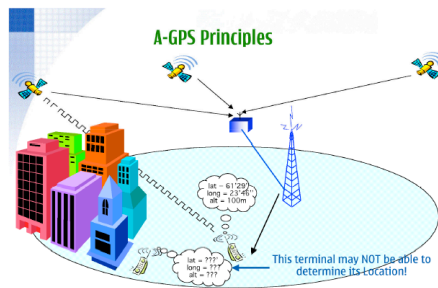


Location Again

Location API's and Room-Size Location
March 6, 2007
Larry Rudolph



GPS & Cell Location



Location Server's Location

- Where should the server be located?
 - On handset
 - Respond to inquires about location with option to deny
 - When handset lost or disconnected, cannot find it.
 - In network
 - Privacy concerns

Client's Role

- **Ask server for location of handset**
 - Must know how to contact handset
 - Long round-trip, so done asynchronously
- **How to ensure privacy?**
 - emergency call --> always allow
 - ask server's owner
 - *when and how often?*

What information?

- **Current position (Cell or GPS or Other)**
 - How current? How precise?
 - Heading and orientation information
 - Waypoints (and associated notes)
- **Request periodic updates**
 - what happens when client disconnects
- **Lots of competing systems**
 - J2ME, Symbian, and each operator



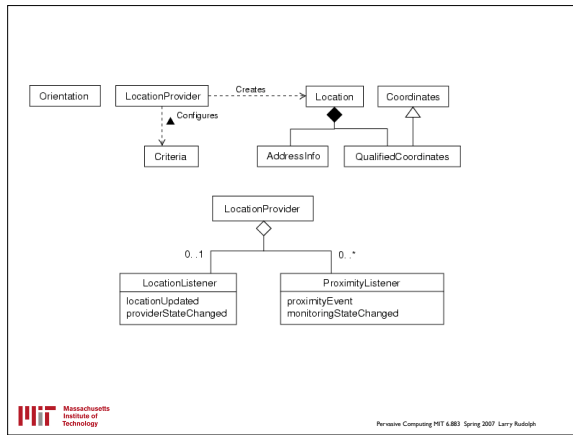
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Lots more details

- **Time, angle of arrival, speed, acceleration**
- **Type of location technology specs**
 - number of satellites, cell towers, weather
 - pitch, roll, magnetic compass quality
- **My strategy:**
 - first list all information you think is important
 - then check with standard



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● <http://www.jcp.org/en/jsr/all> (J2ME Packages)

Indoor Tracking Proximity Events

Room Level Tracking

Beacons & Listeners

- **Room-level tracking requires beacons & listeners**
- **Two choices:**
 - Scatter listeners throughout environment
 - Detect your position & update server
 - *Server provides location info & alerts*
 - Scatter beacons throughout environment
 - Your handheld is listener

Tradeoffs

- Handheld is beacon
 - better power usage
 - better precision (precise listener location)
 - less interference
- Handheld is listener
 - Control over privacy
 - (Can you suggest others)



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Bluetooth Beacons

- **Bluetooth devices respond to inquires**
 - with BT-ID and Name
 - range: 10 meters (room level)
 - leakage through walls & floors
 - *hear floor 7, 8, and 9 -- x you are on 8*
- **Inexpensive (\$20 / beacon)**
 - Handhelds have BT



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Bluetooth Beacons

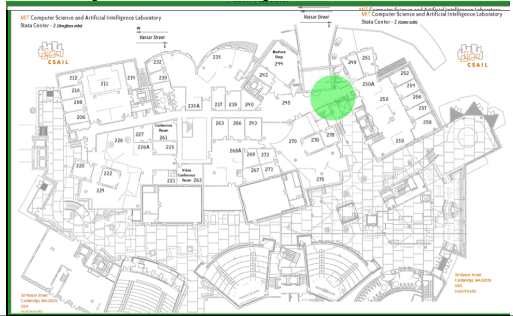
- First decision -- Where to put beacons
 - Put them in PC's -- they are everywhere
 - Unfortunately, they disappear :(
- Put them in powered usb hub, near AC outlet
 - Initialize via laptop, then remove laptop
 - BT Dongle will continue to respond to inquiry



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When detect BT dongle update map location

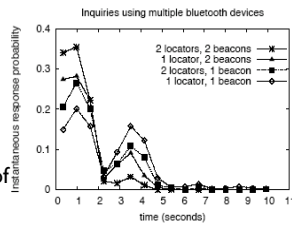


What doesn't work

- Signal strength does not work well
 - need radio map
- Track while walking
 - 10 sec to detect, walking rate ~ 1 m/s, easy to miss dongle altogether
- Embed location info in dongle name
 - takes even longer to detect
- Cached BT names, must not use

Several Hacks needed

- Takes too long to recognize dongles
- Faster if use two dongles
- Signal come and goes
- Incorporate model of human motion
- Probabilistic filtering



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More hacks

- If you know where you are,
 - then know where you might go next
 - can do inquiry of specific dongles

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