Localization

INFO 498D – ANDROID

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Localization

"The process of determining location"

User Context

Localization helps determine a person's **context**—what their situation/activity is!

Mobile phone location not necessarily a proxy for user location (see Patel et al. 2006)


8:25 PM
Home
ecorio
Hello,
Ecorio Fan
Shortcuts
Recent Trips
My Carpools
My Transit Trips
Your travel carbon footprint
5168 lbs est. per year
Details
start
reduce
inspire
offset
After installation, Ecorio runs in the background on your phone, keeping track of when you're moving in a car or a bus and tallies up the trips that you take each day.
When you first start Ecorio, you will see a summary of your activity and the current trip that Ecorio is tracking.

Ubiquitous Computing

See also: *Weiser, Mark (1991) The computer for the 21st century. Scientific American, Sept 94-100*

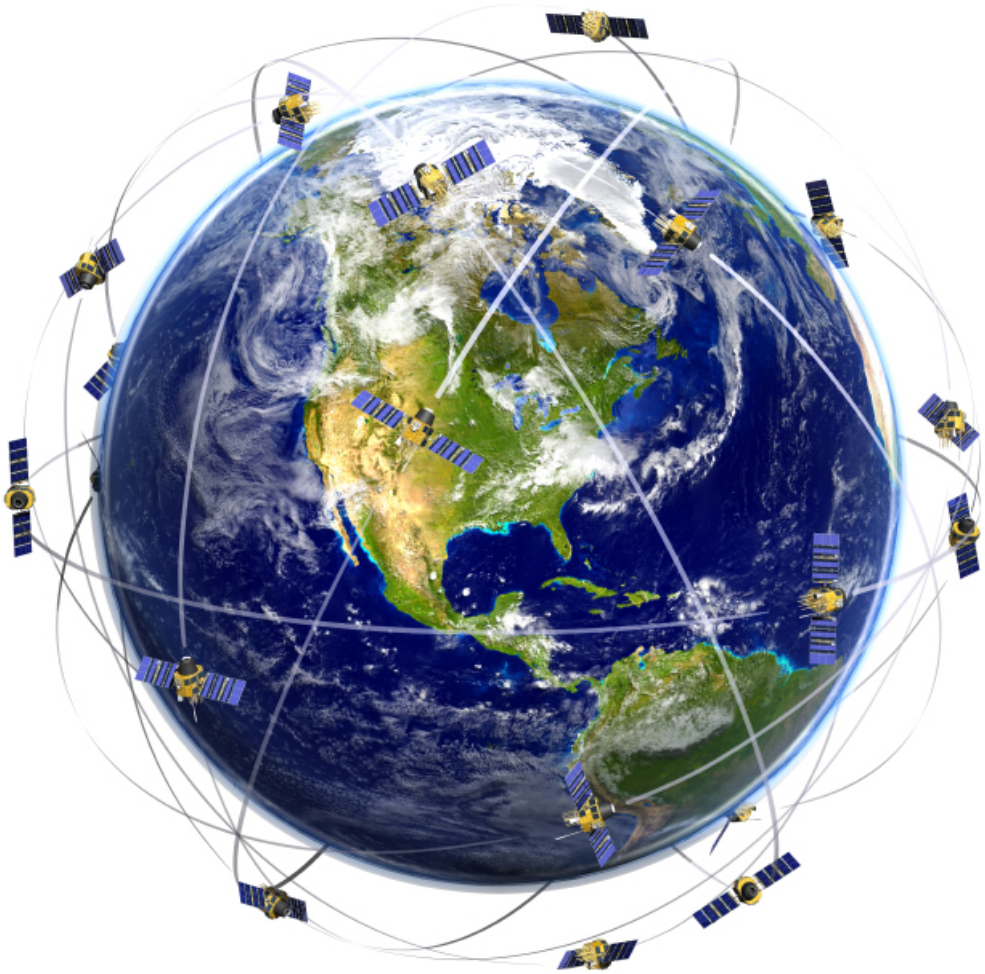
Localization History

Hightower, J. and Borriello, G. 2001. *Location systems for ubiquitous computing.* IEEE Computer, 34 (8), 57-66

Table 1. Current location sensing technologies.

Technology	Technique	Physical	Symbolic	Absolute	Relative	LLC	Recognition	Accuracy and precision if available	Scale	Cost	Limitations
GPS	Radio time-of-flight lateration	•		•		✓		1-5 meters (95-99 percent)	24 satellites worldwide	Expensive infrastructure $100 receivers	Not indoors
Active Badges	Diffuse infrared cellular proximity		•	•			✓	Room size	1 base per room, badge per base per 10 sec	Administration costs, cheap tags and bases	Sunlight and fluorescent light interfere with infrared
Active Bats	Ultrasound time-of-flight lateration	•		•			✓	9 cm (95 percent)	1 base per 10 square meters, 25 computations per room per sec	Administration costs, cheap tags and sensors	Required ceiling sensor grid
MotionStar	Scene analysis, lateration	•		•			✓	1 mm, 1 ms, 0.1° (nearly 100 percent)	Controller per scene, 108 sensors per scene	Controlled scenes, expensive hardware	Control unit tether, precise installation
VHF Omini-directional Ranging	Angulation	•		•		✓		1° radial (≈ 100 percent)	Several transmitters per metropolitan area	Expensive infrastructure, inexpensive aircraft receivers	30-140 nautical miles, line of sight
Cricket	Proximity, lateration		•	○	○	✓		4 × 4 ft. regions (≈ 100 percent)	≈ 1 beacon per 16 square ft.	$10 beacons and receivers	No central management receiver computation
MSR RADAR	802.11 RF scene analysis and triangulation	•		•			✓	3-4.3 m (50 percent)	3 bases per floor	802.11 network installation, ≈ $100 wireless NICs	Wireless NICs required

GPS: Global Positioning System



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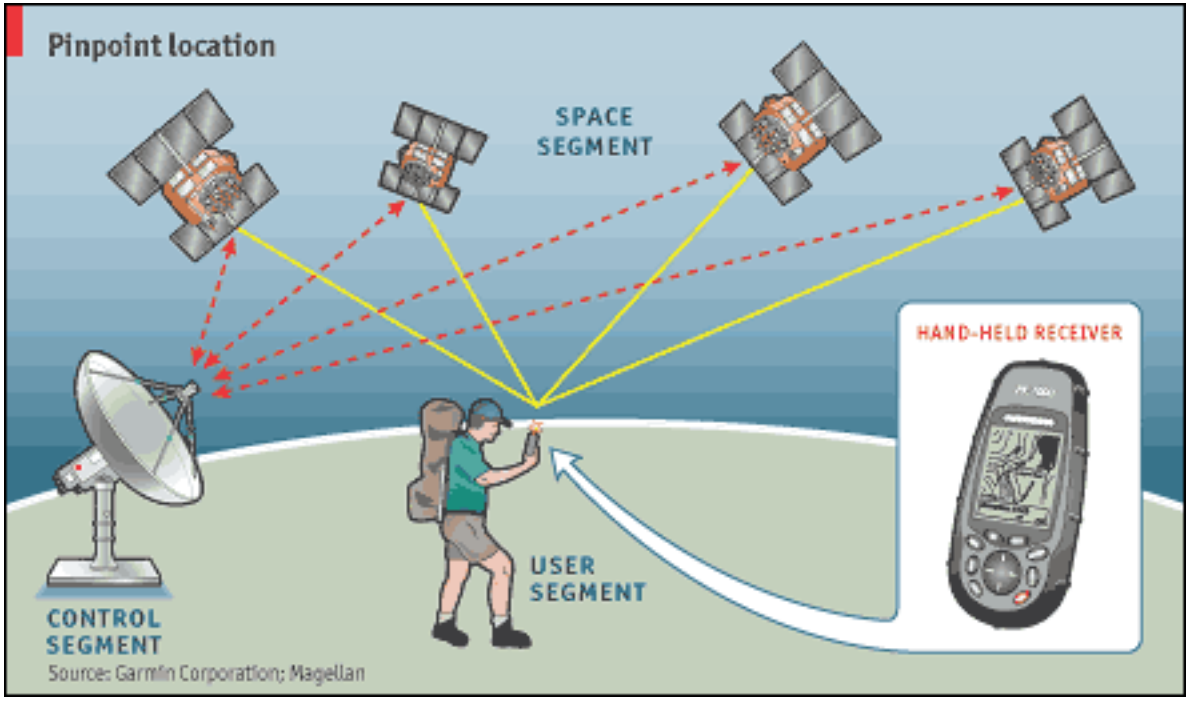
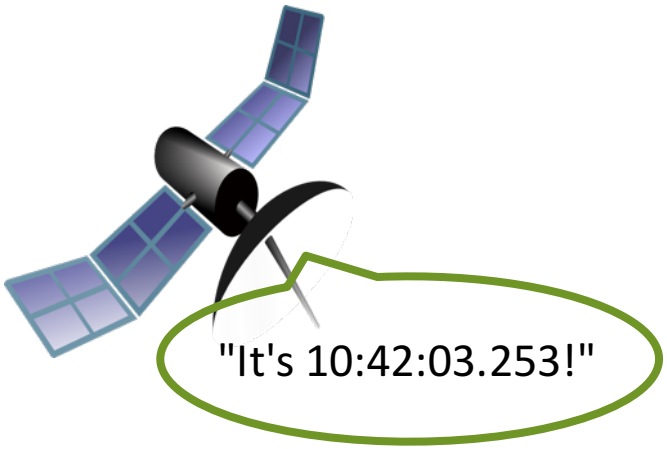
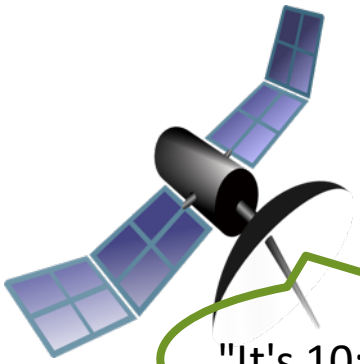


Time of Flight



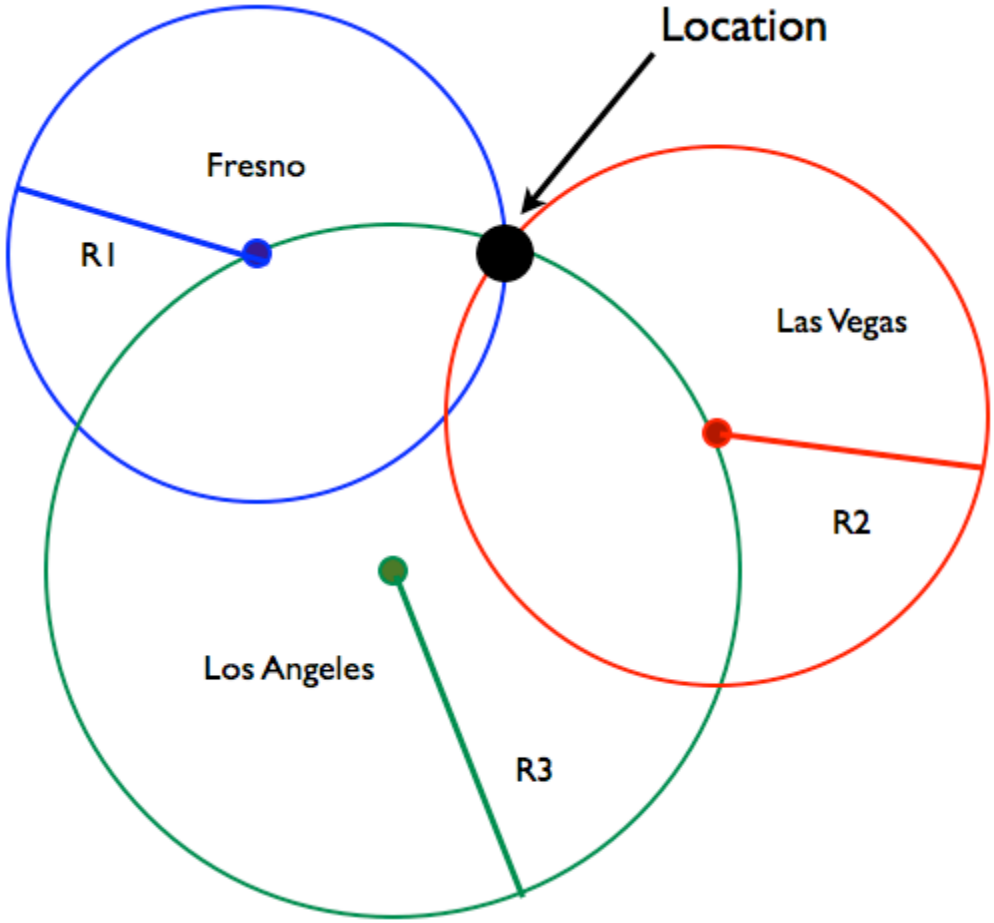
Time of Flight



"It's 10:42:03.253!"

I heard "*It's 10:42:03.253!*" at 10:24:03.256, so the satellite is .003sec away!

Trilateration

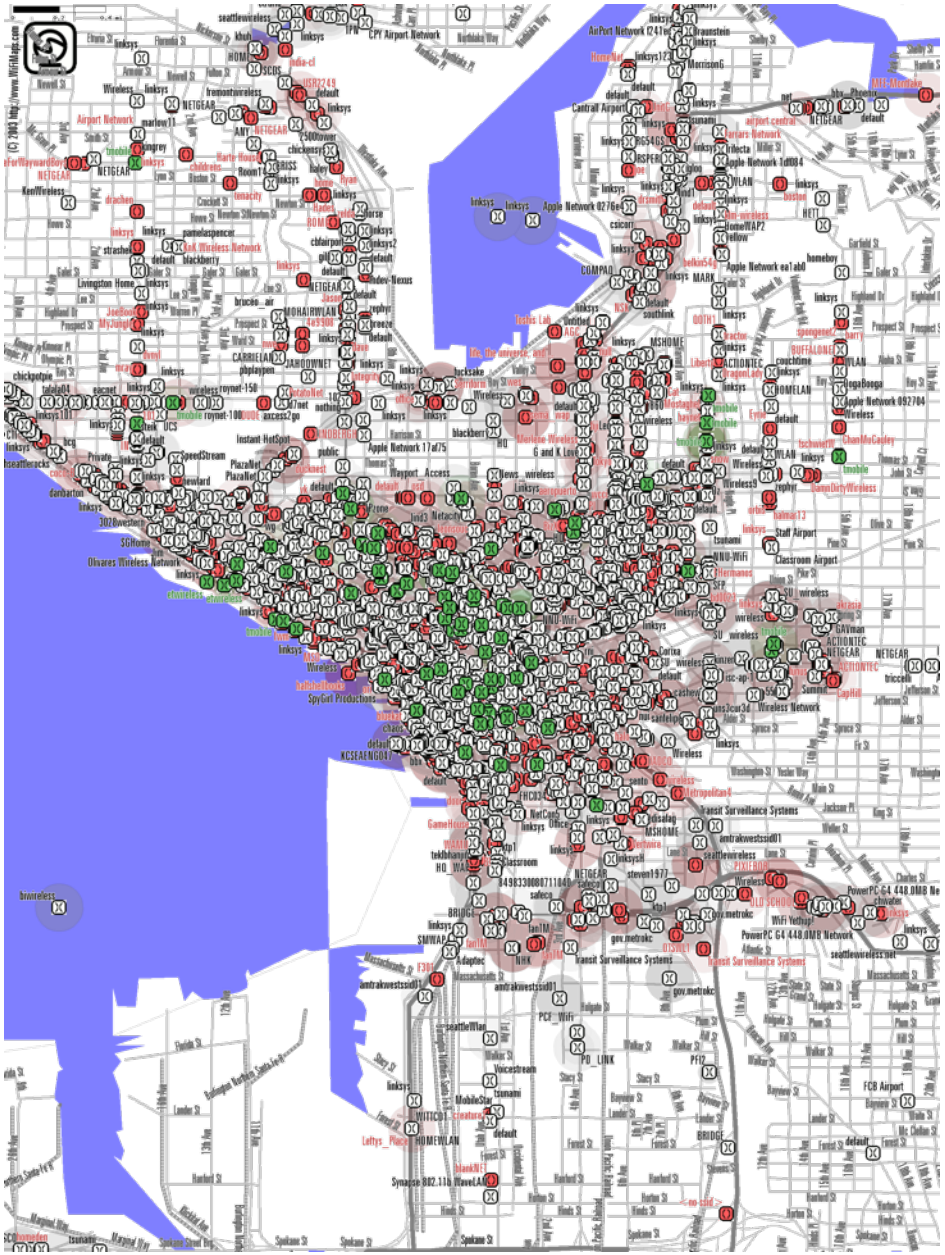


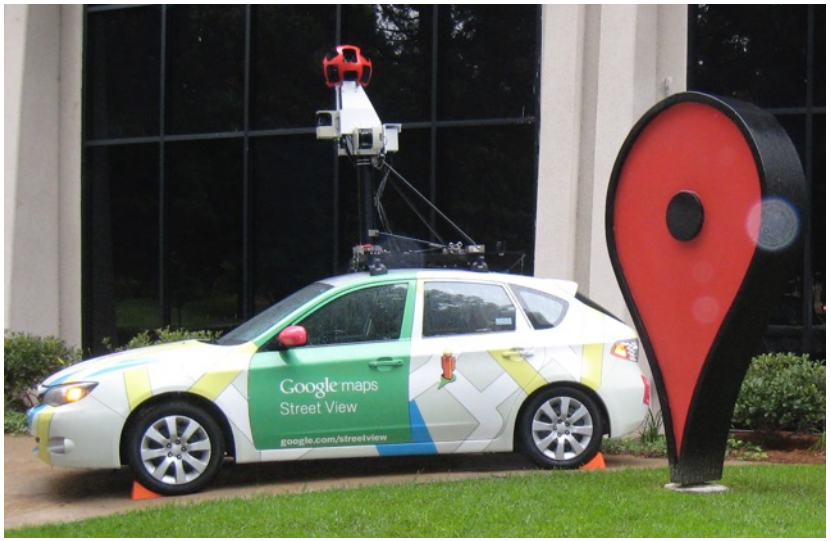
GPS Limitations

Cell Tower Localization

WiFi Localization

War Driving



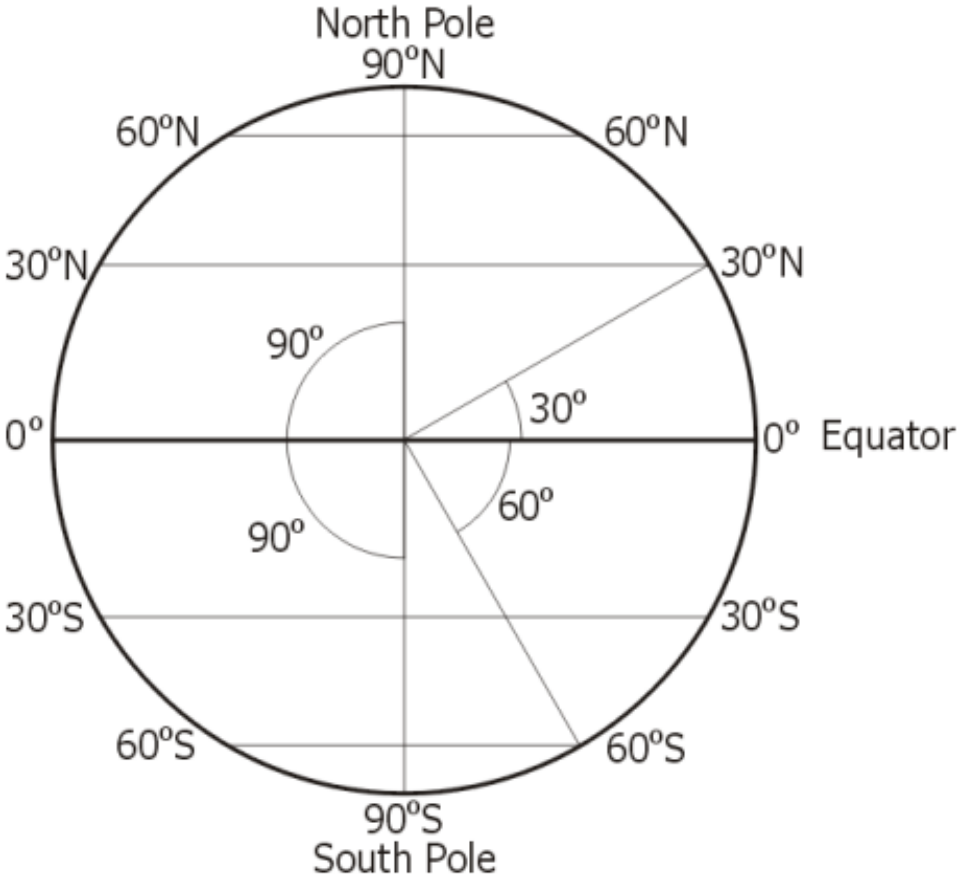

Google maps
Street View
google.com/streetview

Representing Location

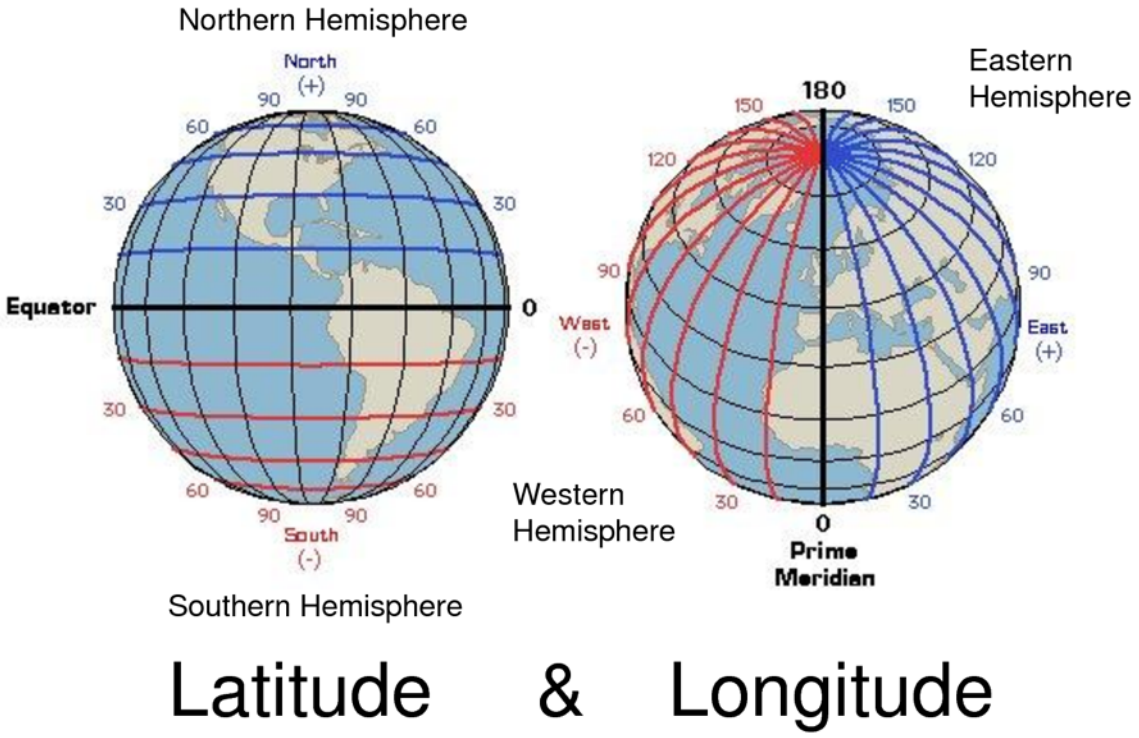
Space

Place

Measuring Latitude



Latitude & Longitude



Rough approximation: .01 degrees ~= 1 mile