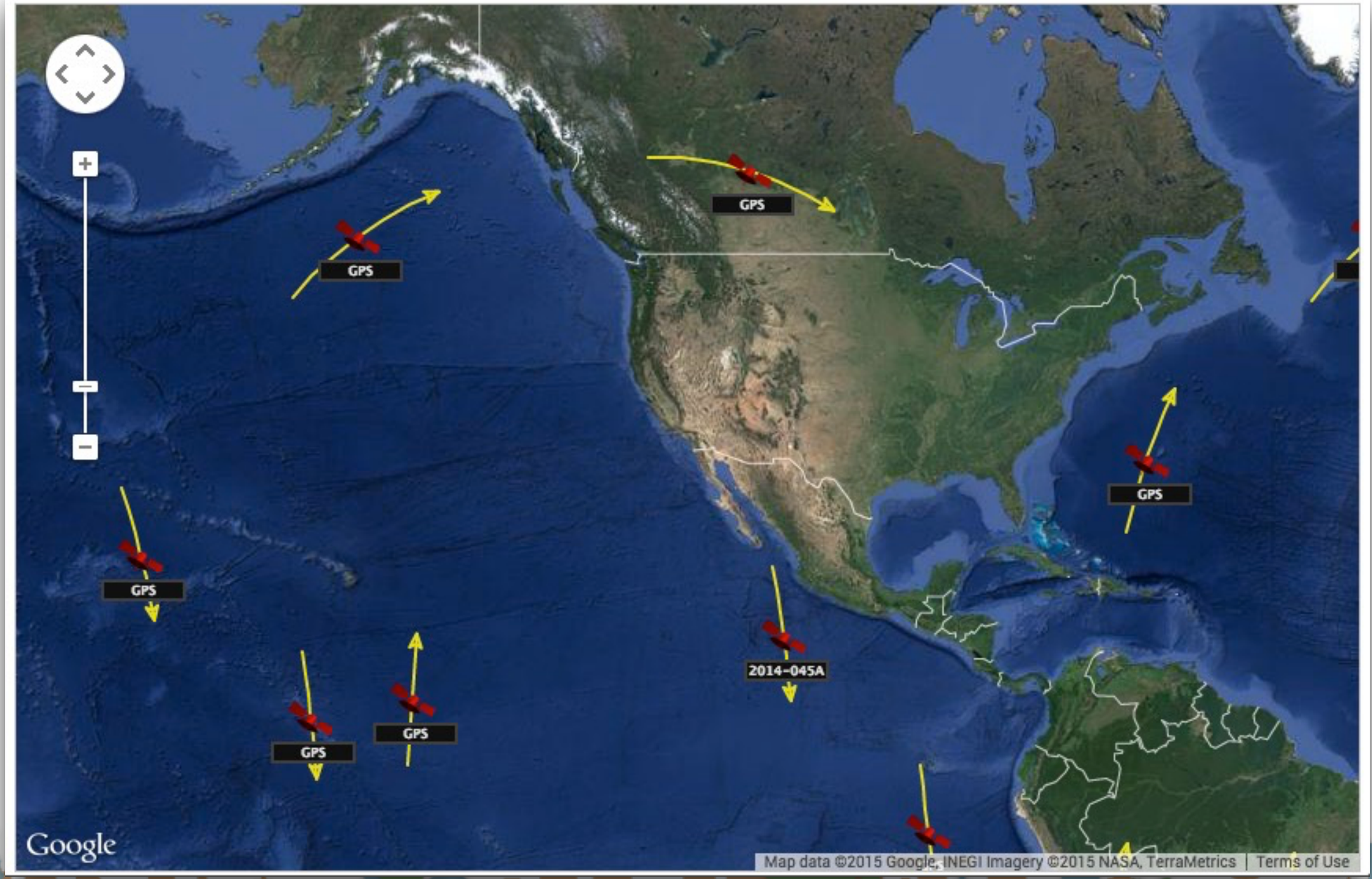
Intro to Location

Mobile and Ubiquitous Games

ICS 163

Donald J. Patterson

Intro to Location



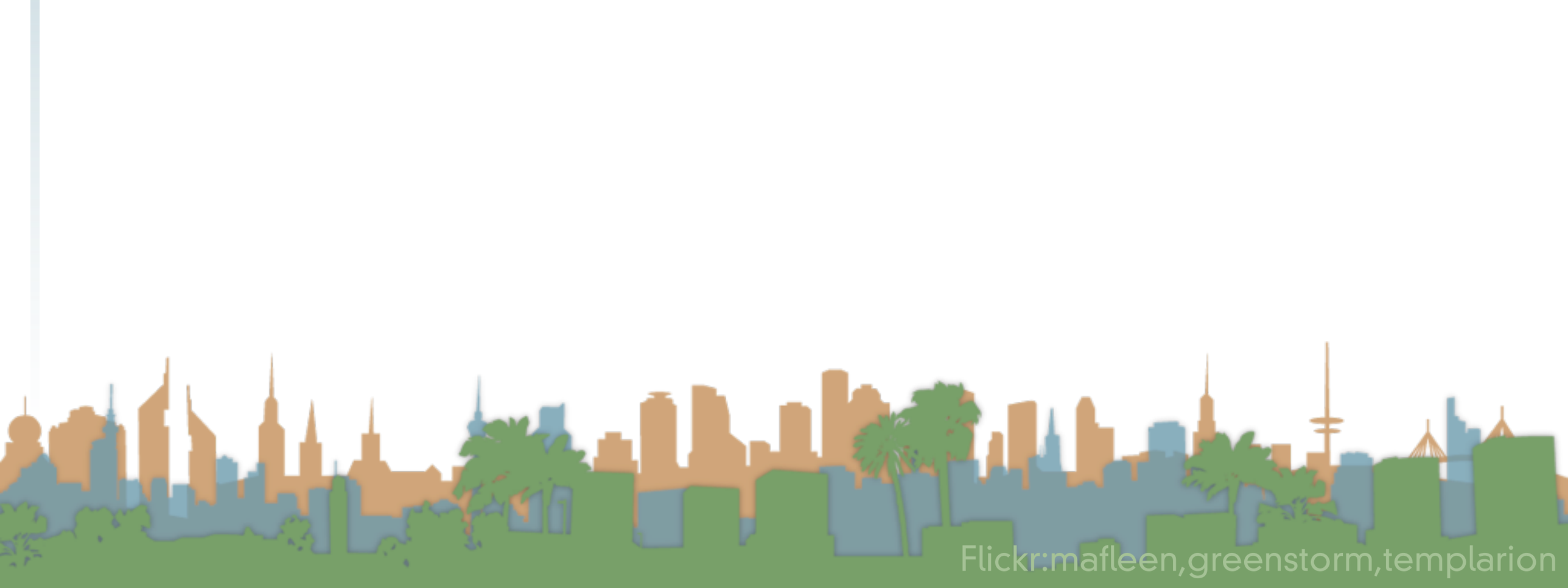
https://in-the-sky.org/satmap.php

Concept Question

How could a hacker figure out where you are when you use GPS from your phone?

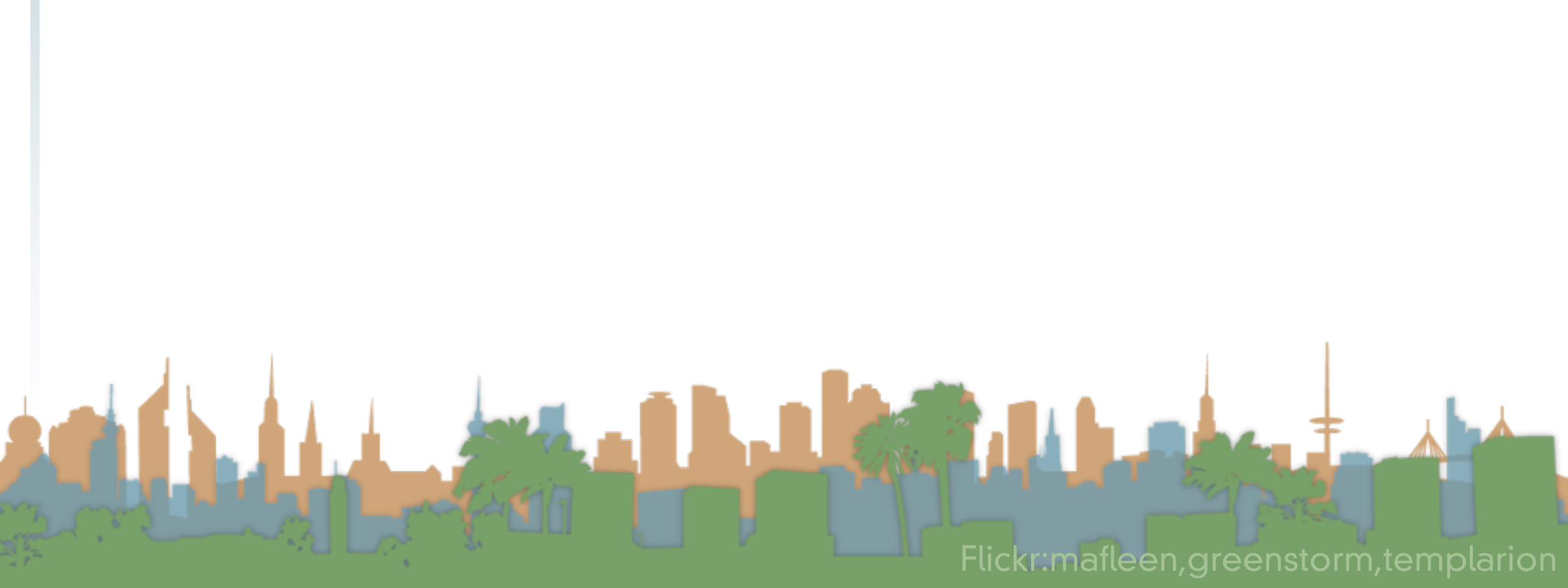
Flickr:mafleen,greenstorm,templarion

Global Location GPS



Global Location GPS

- Basic concept is based on the foghorn paradigm
  - but in 3-D



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Global Location GPS

1 sec

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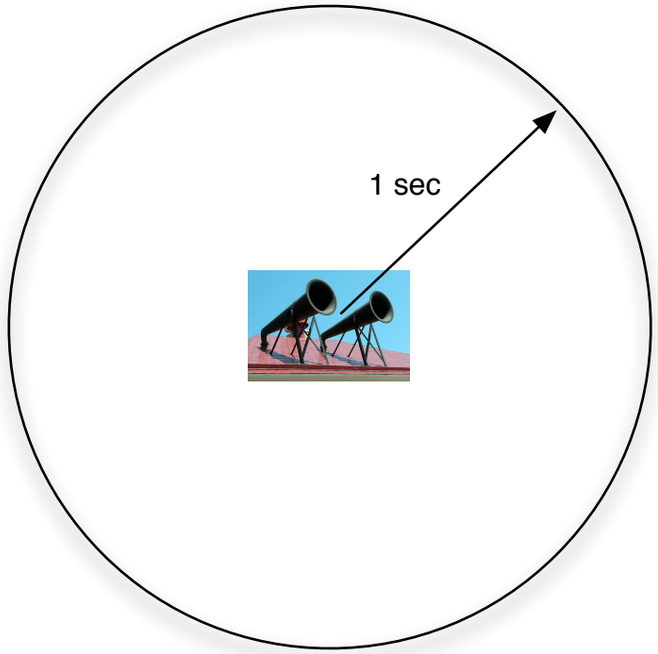

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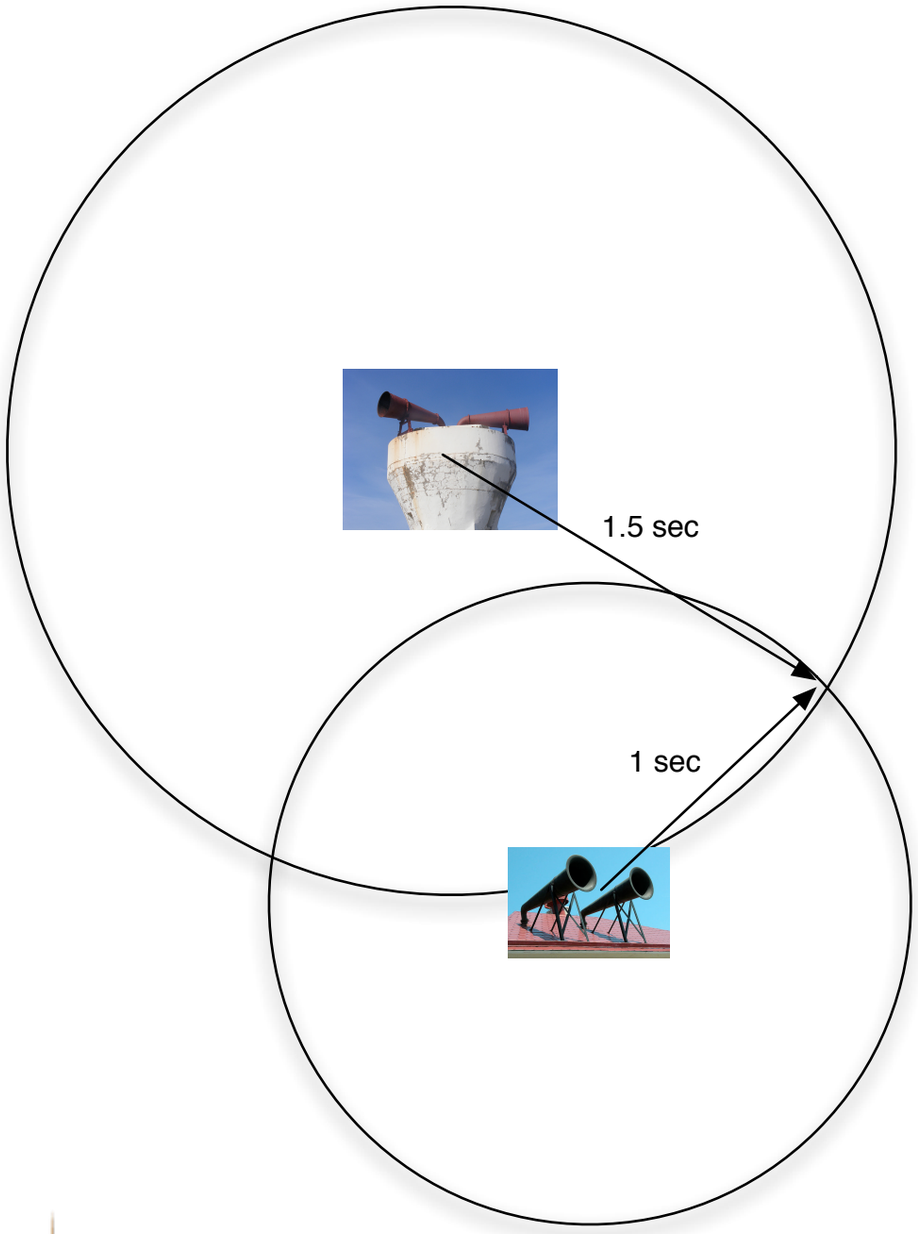

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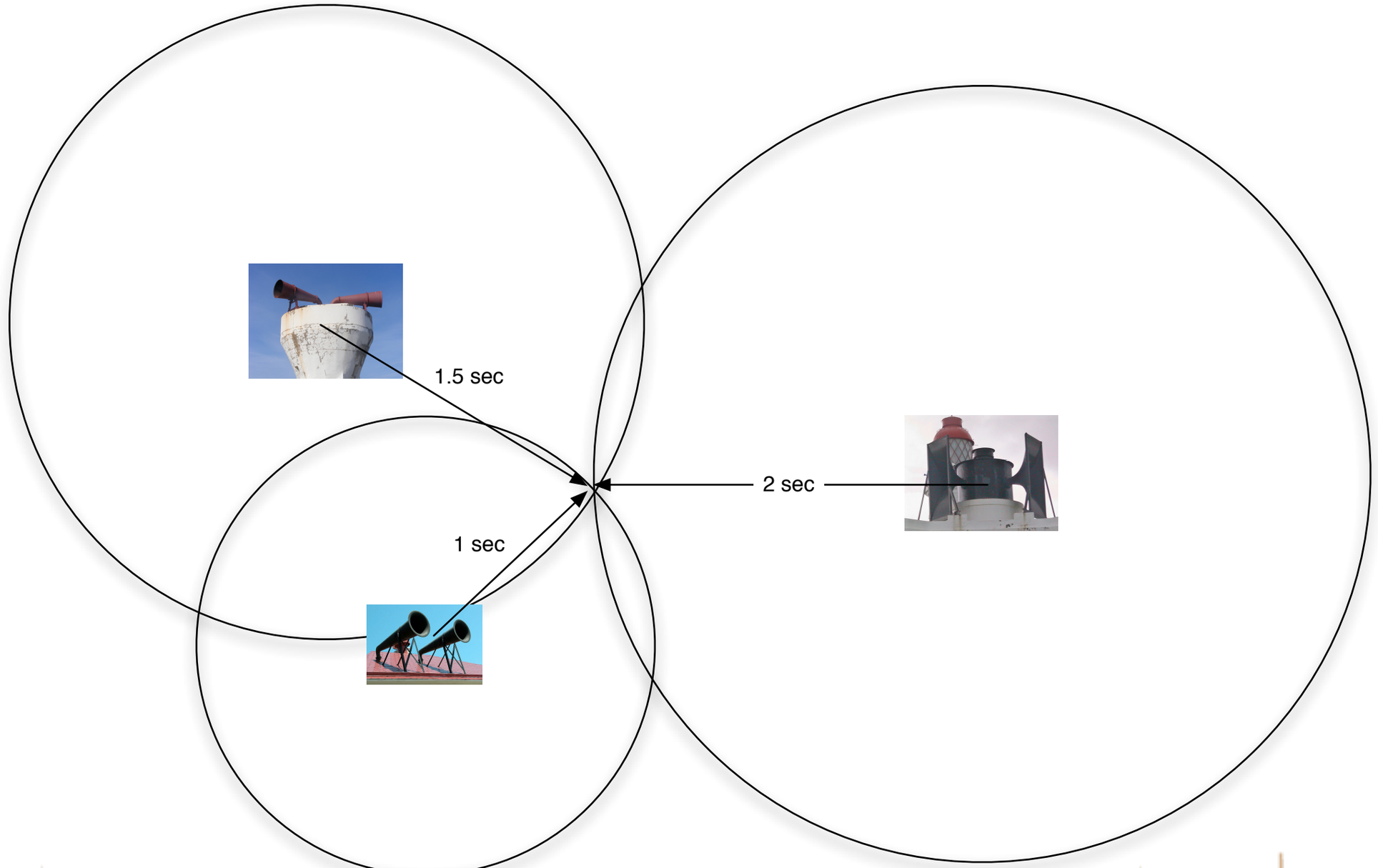

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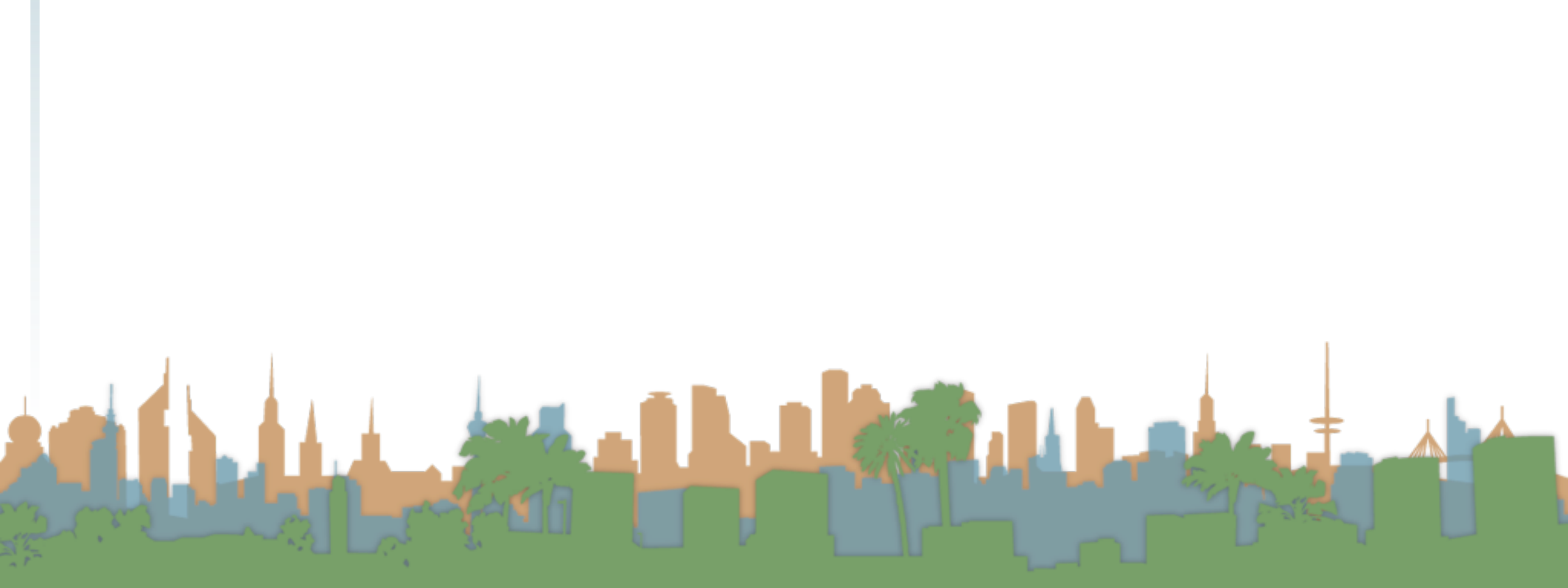

Global Location GPS

- Basic concept is based on the foghorn paradigm
  - but in 3-D
    - Usually you need 1 more source for every unknown you are solving for
      - x,y,z,clock error = 4 satellites + 1

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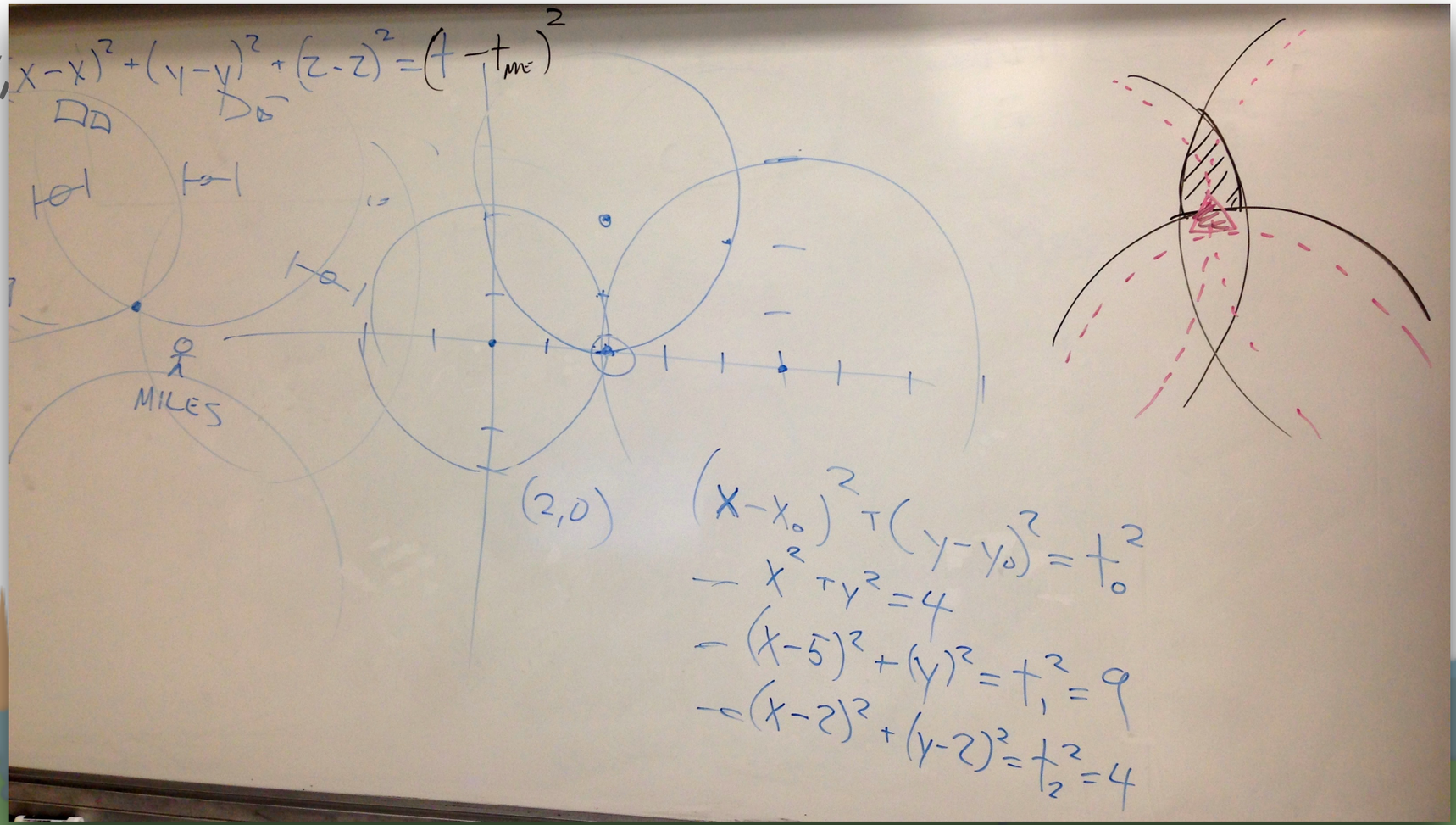

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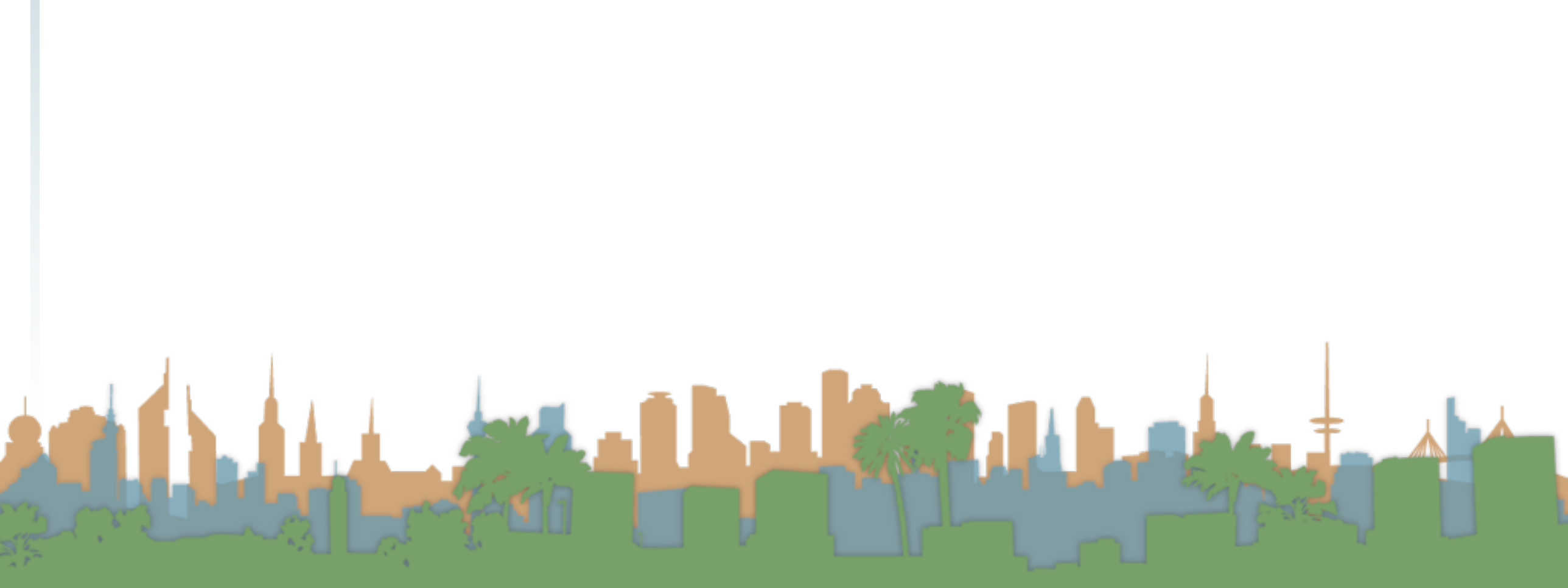

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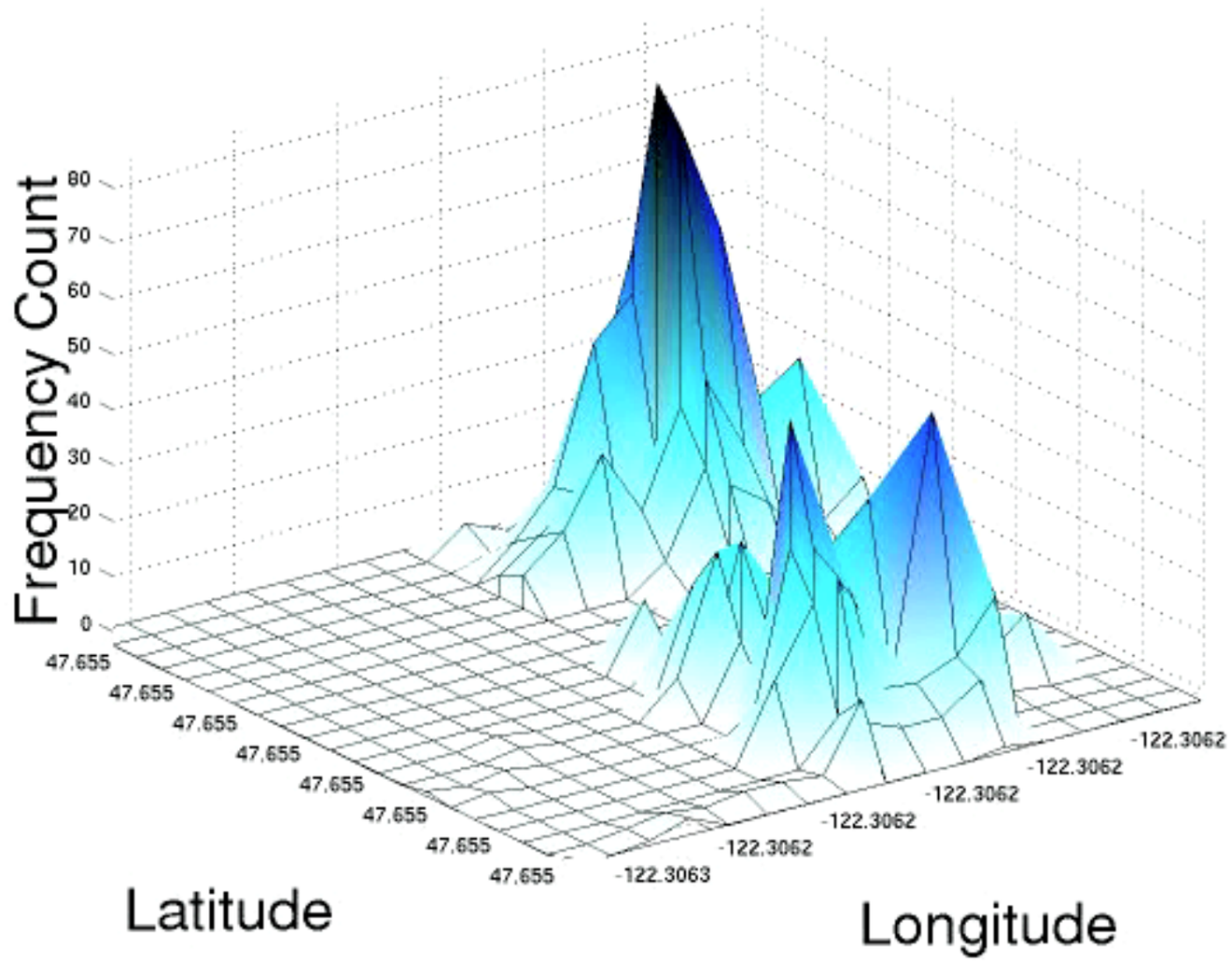

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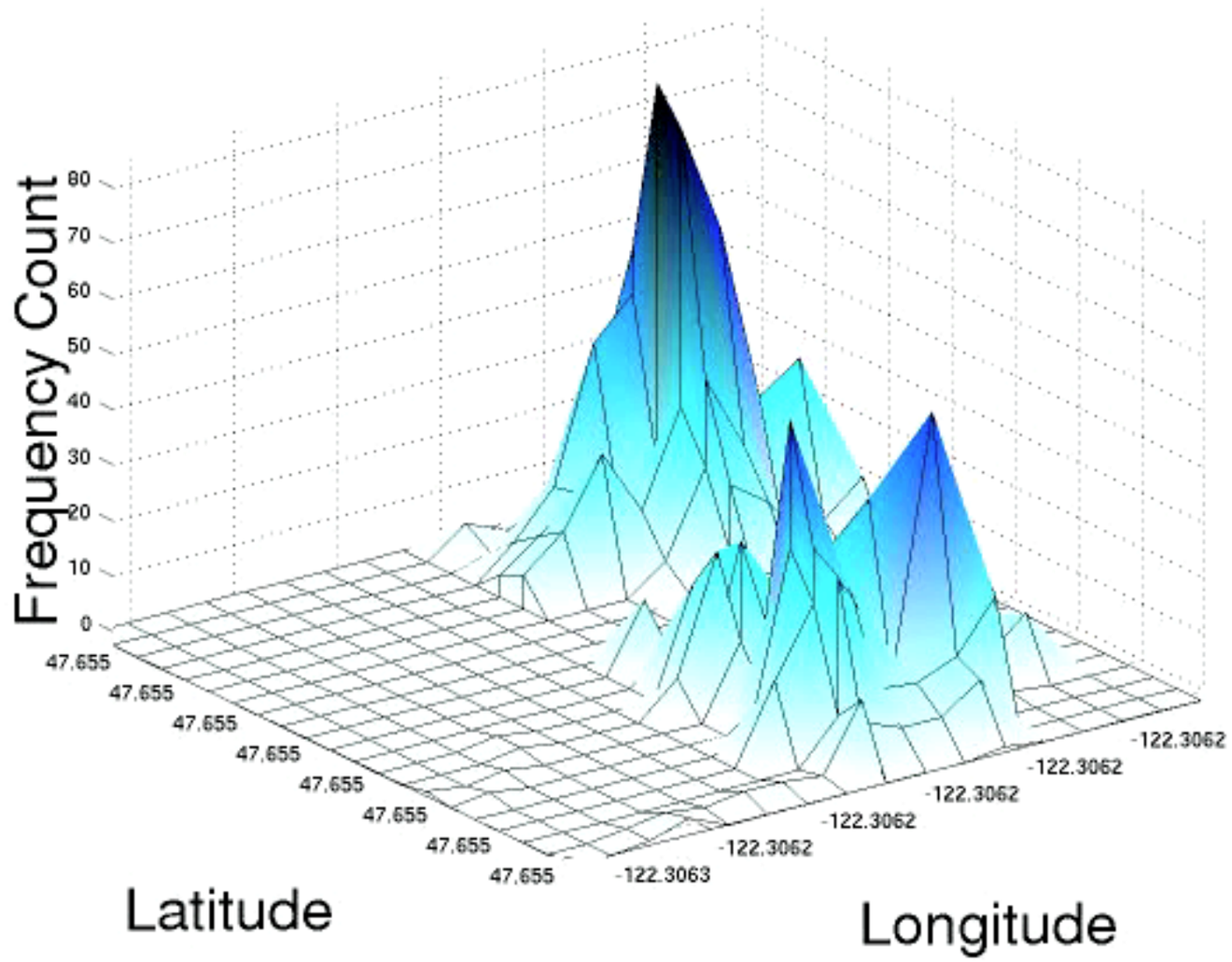

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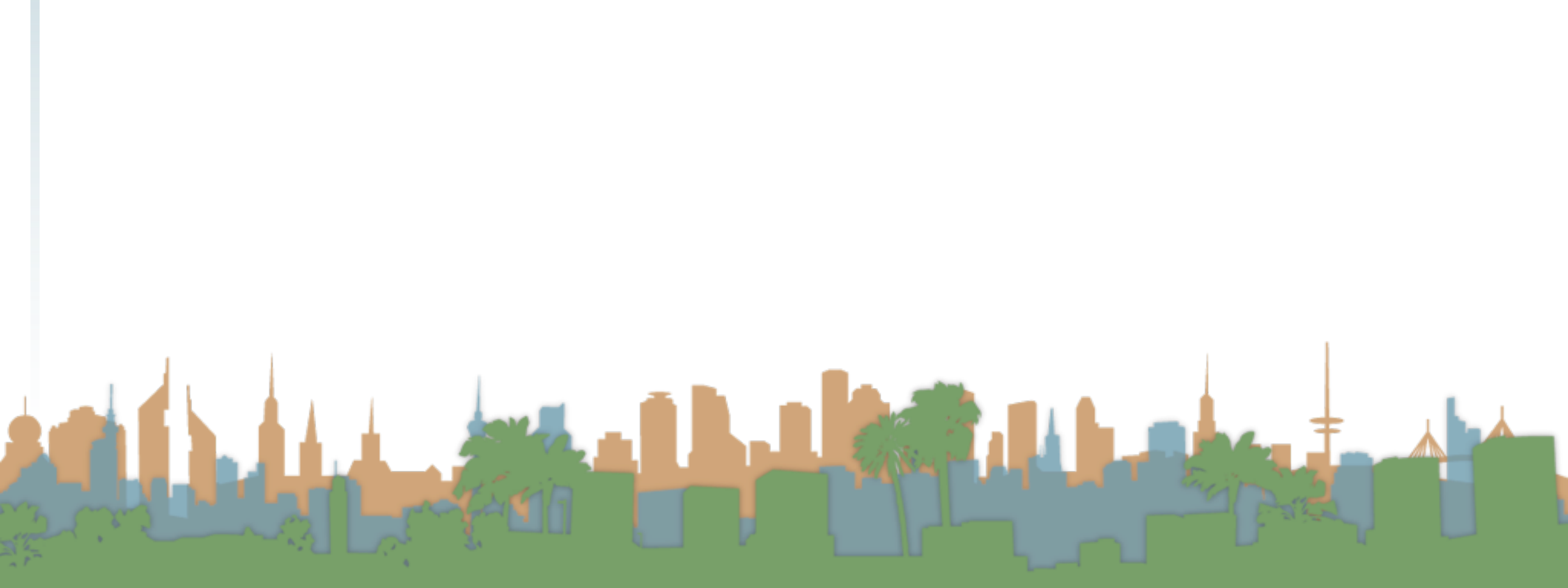

Global Location GPS

- GPS accuracy
  - 13 m 95% of the time horizontal
  - 22 m 95% of the time vertical system
  - 40 ns 95% of the time
- How do you design for this?

Global Location GPS

- GPS accuracy
  - 13 m 95% of the time horizontal
  - 22 m 95% of the time vertical system
  - 40 ns 95% of the time
    - How do you design for this?
- Urban canyons
  - What are they?
  - Japanese response, European response

Global Location GPS

http://en.wikipedia.org/wiki/File:Qzss-45-0.09.jpg
http://en.wikipedia.org/wiki/File:Qzss-01-120s2.gif

Global Location GPS

- The current and future of GPS
  - Japanese Quasi-Zenith System

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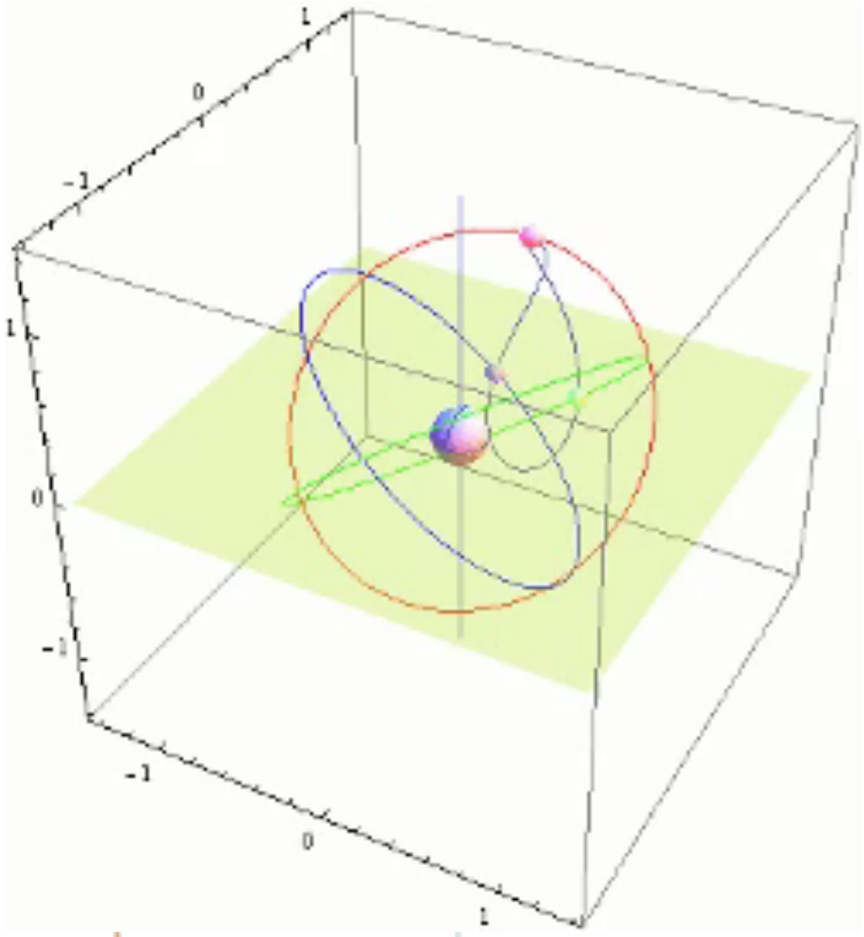

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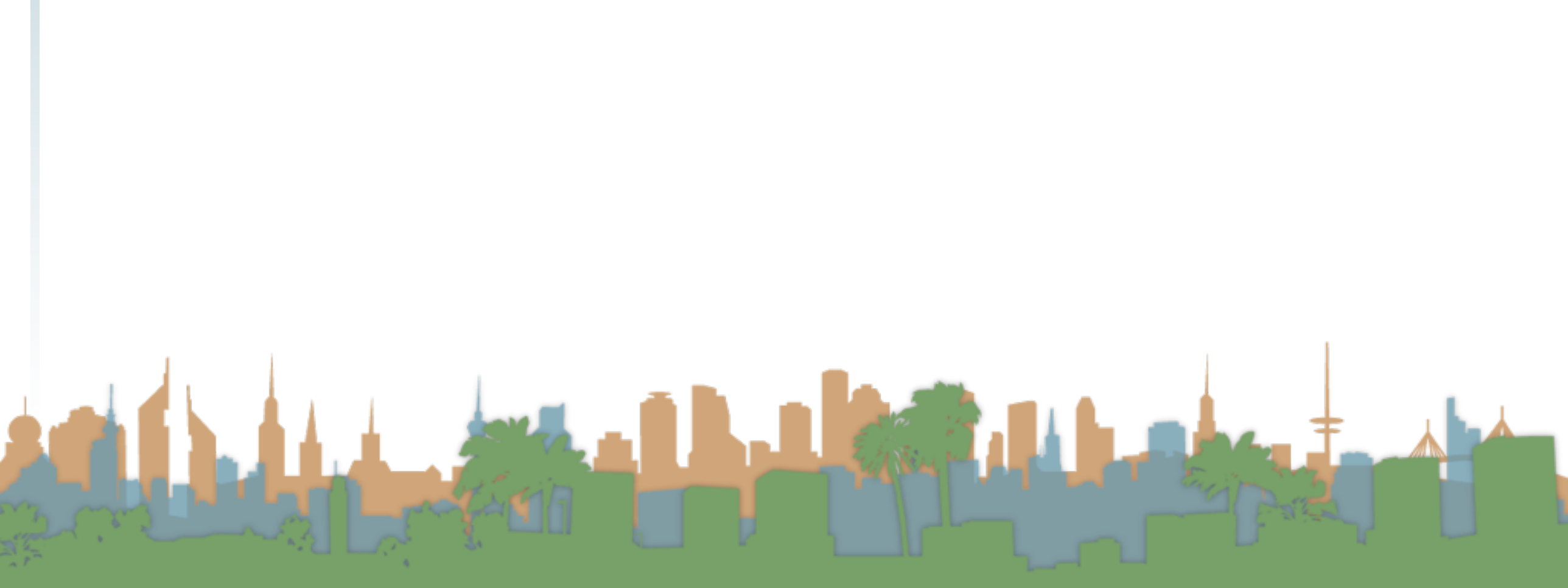

Global Location GPS

- The current and future of GPS
  - WAAS
    - Additional satellites in geosynchronous orbit
  - DGPS assistance from a land based receiver
  - Galileo
    - European competitor
    - GPS compatible
  - GLONASS
    - Russian competitor

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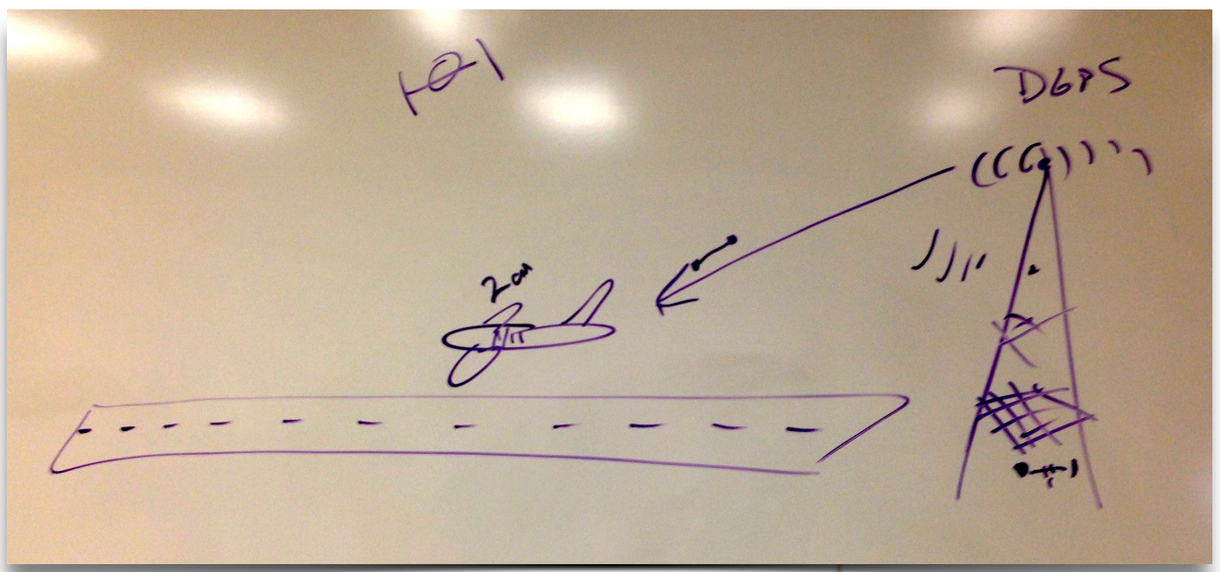

Intro to Location

Apple iPhone 6

- iPhone 6 vs. Galaxy Alpha vs. Xperia Z3 Compact: Three kings
- Apple iPhone 6 review: Scaled to order
- Apple iOS 8 preview: Opening Up
- Read opinions
- Compare
- Pictures
- 360° view
- Related phones
- In the news (new)
- Manual

CHECK PRICE

GENERAL	2G Network	GSM 850 / 900 / 1800 / 1900 - A1549 (GSM), A1549 (CDMA), A1586
		CDMA 800 / 1700 / 1900 / 2100 - A1549 (CDMA), A1586
	3G Network	HSDPA 850 / 900 / 1700 / 1900 / 2100 - A1549 (GSM), A1549 (CDMA), A1586
		CDMA2000 1xEV-DO - A1549 (CDMA), A1586
		TD-SCDMA 1900 / 2000 - A1586
	4G Network	LTE 700/800/850/900/1700/1800/1900/2100/2600 (1/2/3/4/5/7/8/13/17/18/19/20/25/26/28/29) - A1549 (GSM), A1549 (CDMA)
		LTE 700/800/850/900/1800/1900/2100/2600 TD-LTE 1900/2300/2500/2600 (1/2/3/4/5/7/8/13/17/18/19/20/25/26/28/29/38/39/40/41) - A1586
	SIM	Nano-SIM
	Announced	2014, September
	Status	Available. Released 2014, September
BODY	Dimensions	138.1 x 67 x 6.9 mm (5.44 x 2.64 x 0.27 in)
	Weight	129 g (4.55 oz)
		- Fingerprint sensor (Touch ID) - Apple Pay (Visa, MasterCard, AMEX certified)
DISPLAY	Type	LED-backlit IPS LCD, capacitive touchscreen, 16M colors
	Size	750 x 1334 pixels, 4.7 inches (~326 ppi pixel density)
	Multitouch	Yes
	Protection	Shatter proof glass, oleophobic coating
		- Display Zoom
SOUND	Alert types	Vibration, proprietary ringtones
	Loudspeaker	Yes
	3.5mm jack	Yes
MEMORY	Card slot	No

Intro to L

4.7

Performance

5.0

5 5 5

Votes: 1606 Login

Like 7.7k g+1 160

		simultaneous HD video and image recording, touch focus, face/smile detection, HDR (photo/panorama)
	Video	1080p@60fps, 720p@240fps, check quality
	Secondary	1.2 MP, 720p@30fps, face detection, HDR, FaceTime over Wi-Fi or Cellular
FEATURES	OS	iOS 8, upgradable to iOS 8.1
	Chipset	Apple A8
	CPU	Dual-core 1.4 GHz Cyclone (ARM v8-based)
	GPU	PowerVR GX6450 (quad-core graphics)
	Sensors	Accelerometer, gyro, proximity, compass, barometer
	Messaging	iMessage, SMS (threaded view), MMS, Email, Push Email
	Browser	HTML5 (Safari)
	Radio	No
	GPS	Yes, with A-GPS, GLONASS
	Java	No
	Colors	Space Gray, Silver, Gold
		- Active noise cancellation with dedicated mic - Siri natural language commands and dictation - iCloud cloud service - iCloud Keychain - TV-out - Maps - Audio/video player/editor - Organizer - Document viewer/editor - Photo viewer/editor - Voice memo/dial/command - Predictive text input
BATTERY		Non-removable Li-Po 1810 mAh battery (6.9 Wh)
	Stand-by	(2G) / Up to 250 h (3G)
	Talk time	(2G) / Up to 14 h (3G)
	Music play	Up to 50 h
MISC	SAR US	1.18 W/kg (head) 1.18 W/kg (body)
	SAR EU	0.98 W/kg (head) 0.97 W/kg (body)
	Price group	

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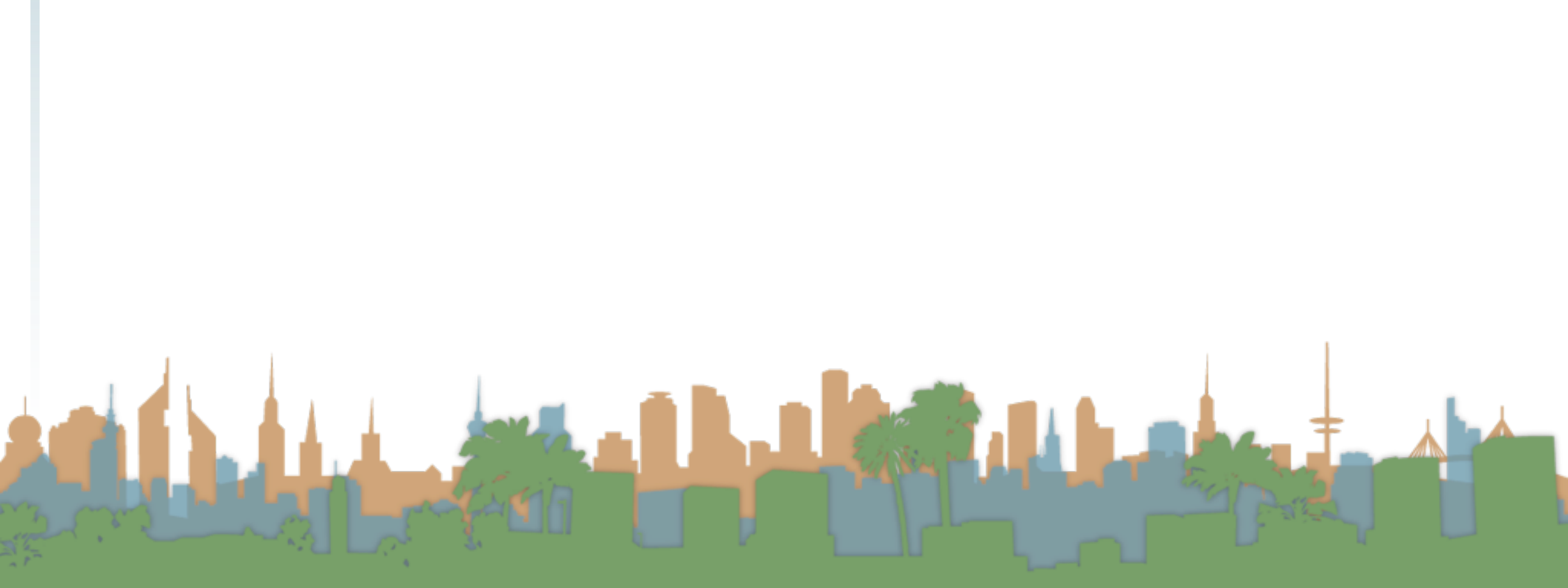
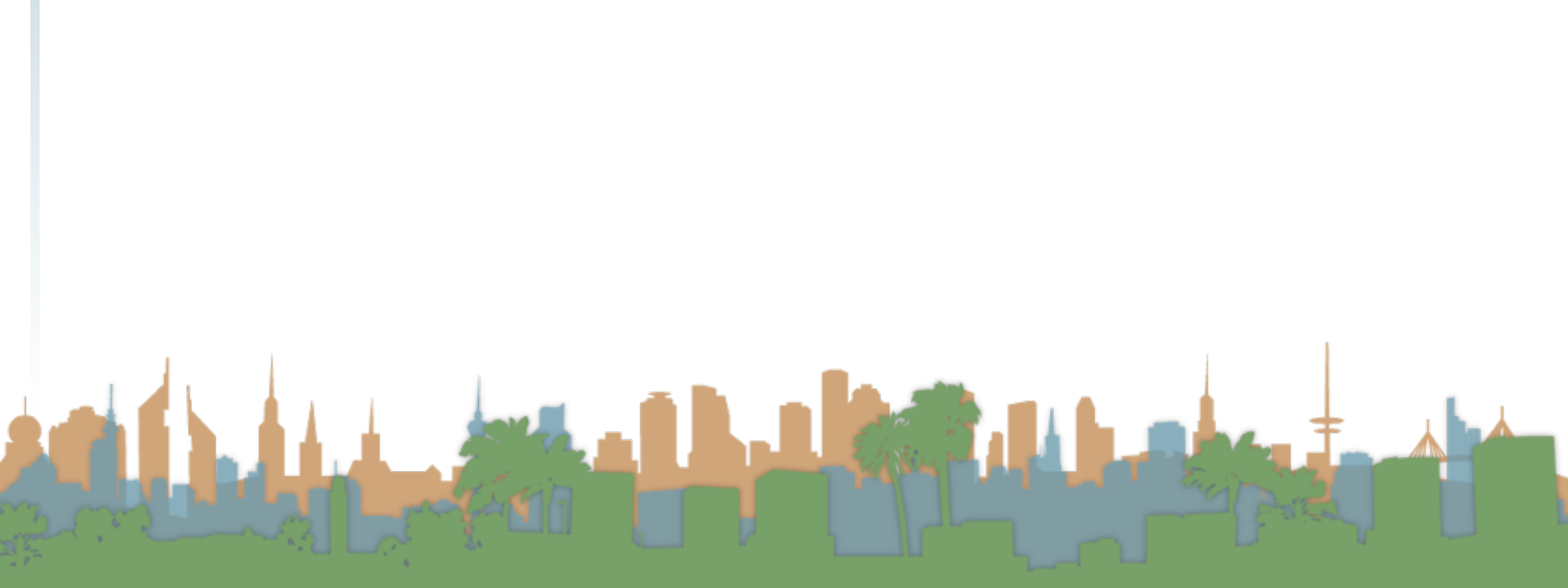
Global Location GPS



Global Location GPS

- The current and future of GPS
  - BeiDou
    - Chinese competitor
    - centralized system



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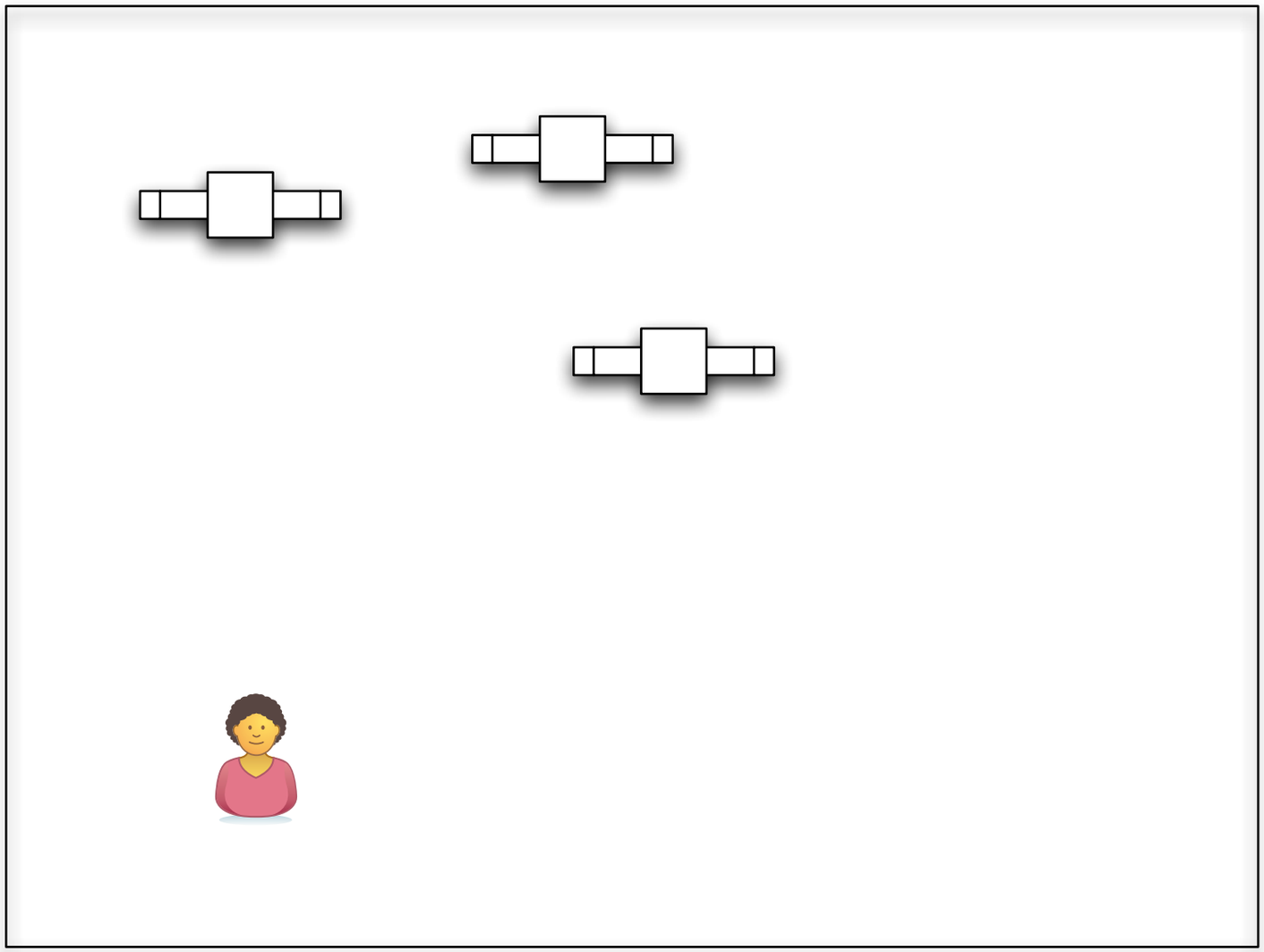

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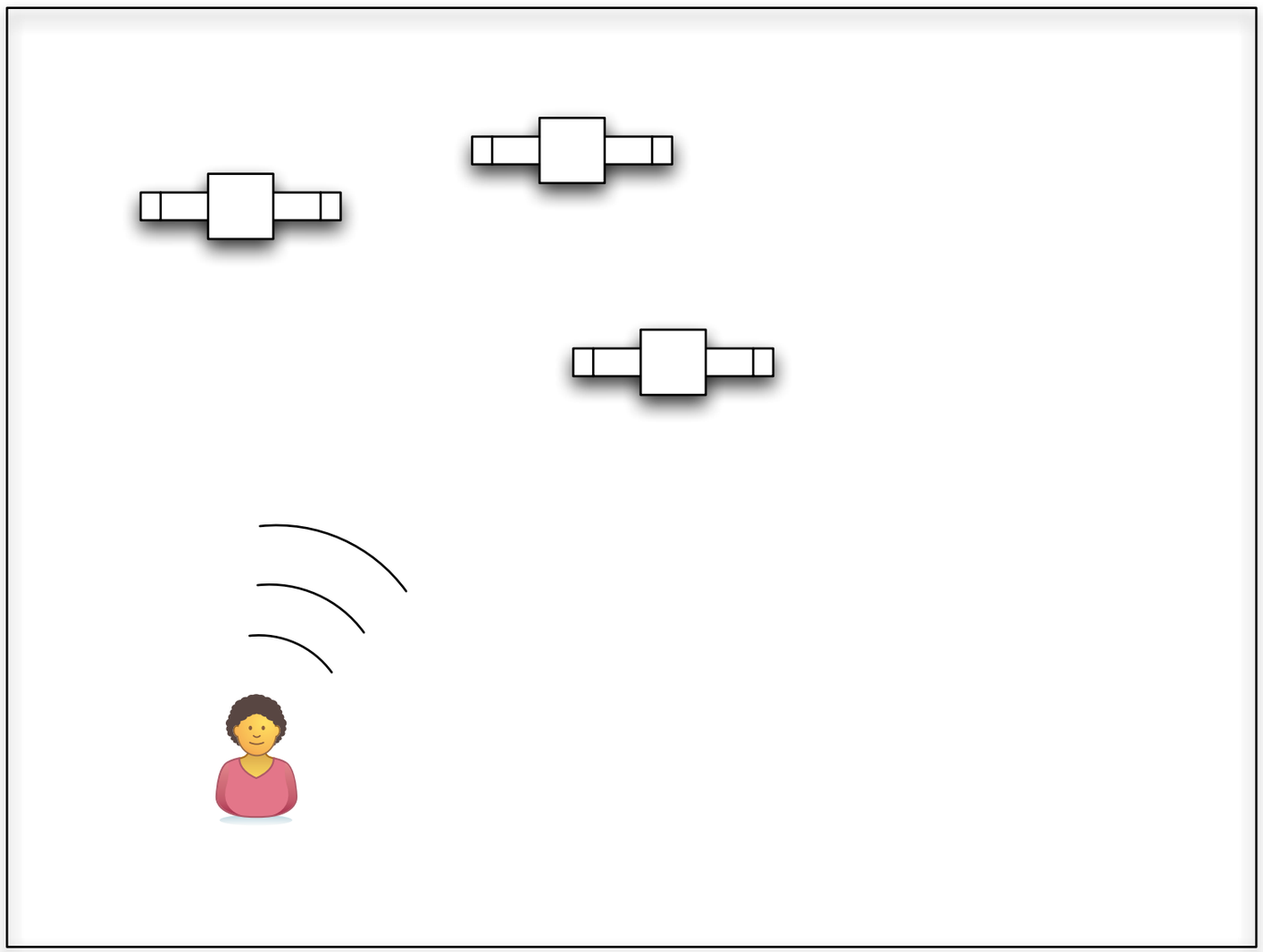

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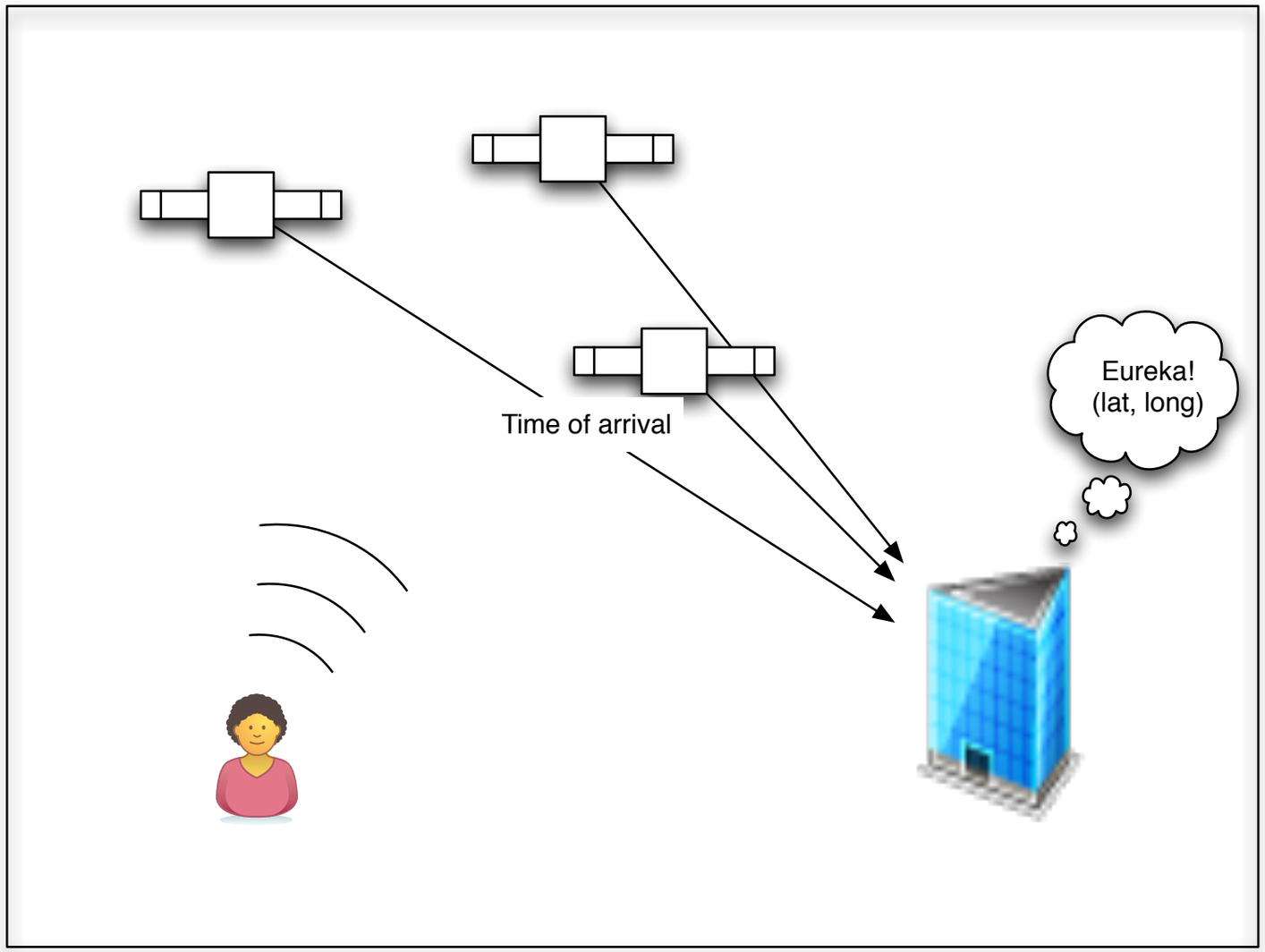

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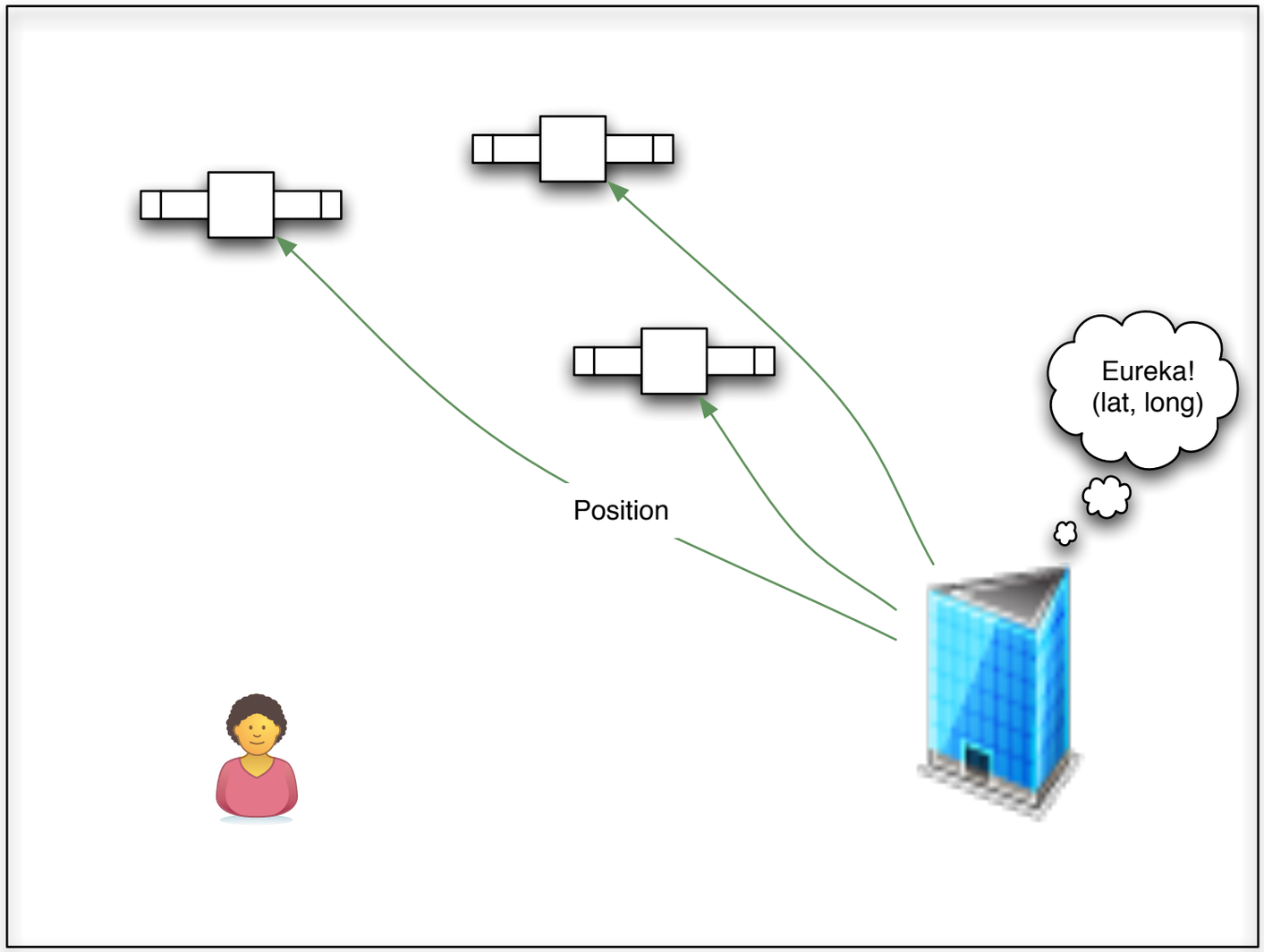

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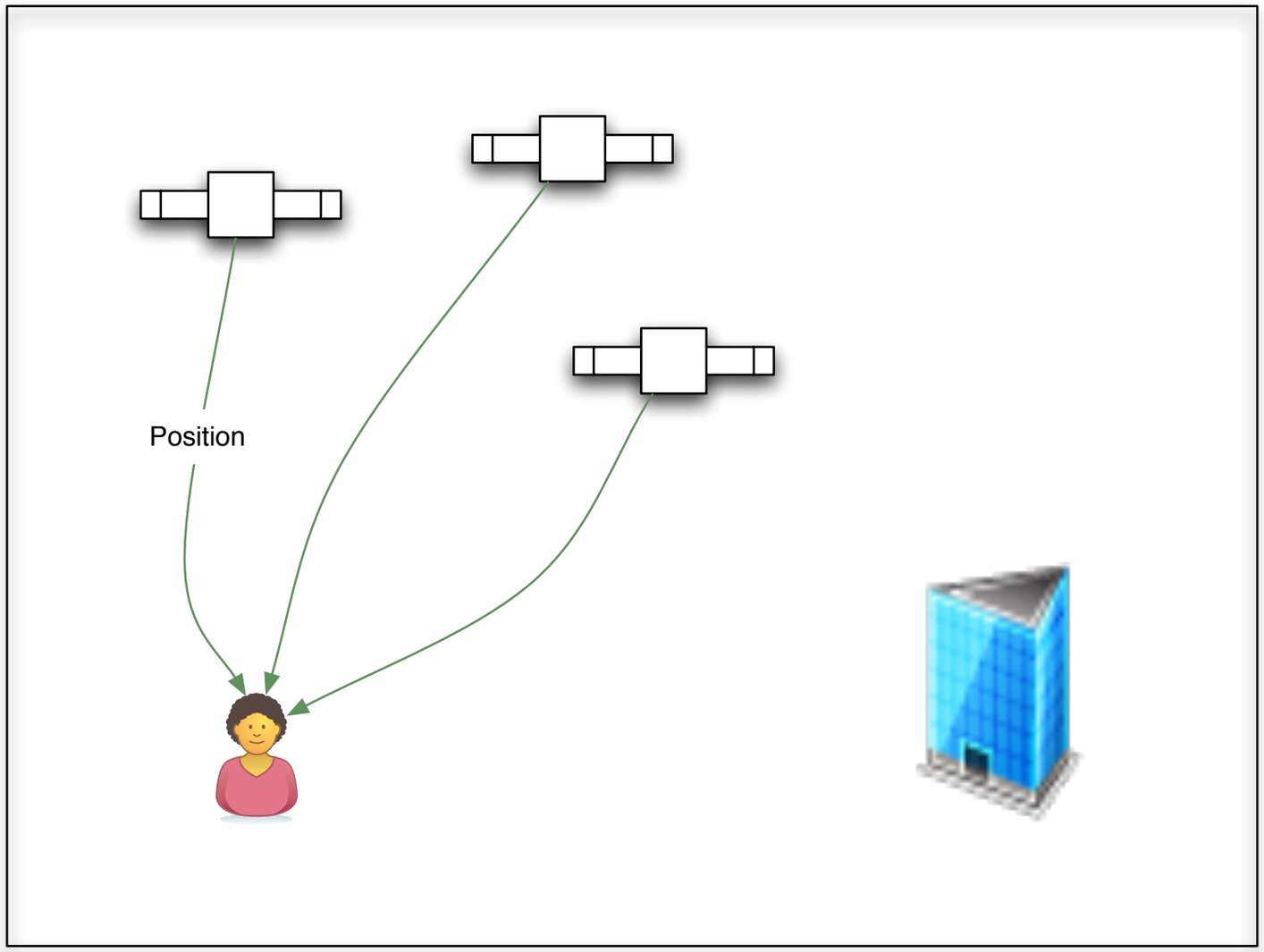

Intro to Location

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- What are the implications of this design on
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  - reliability?
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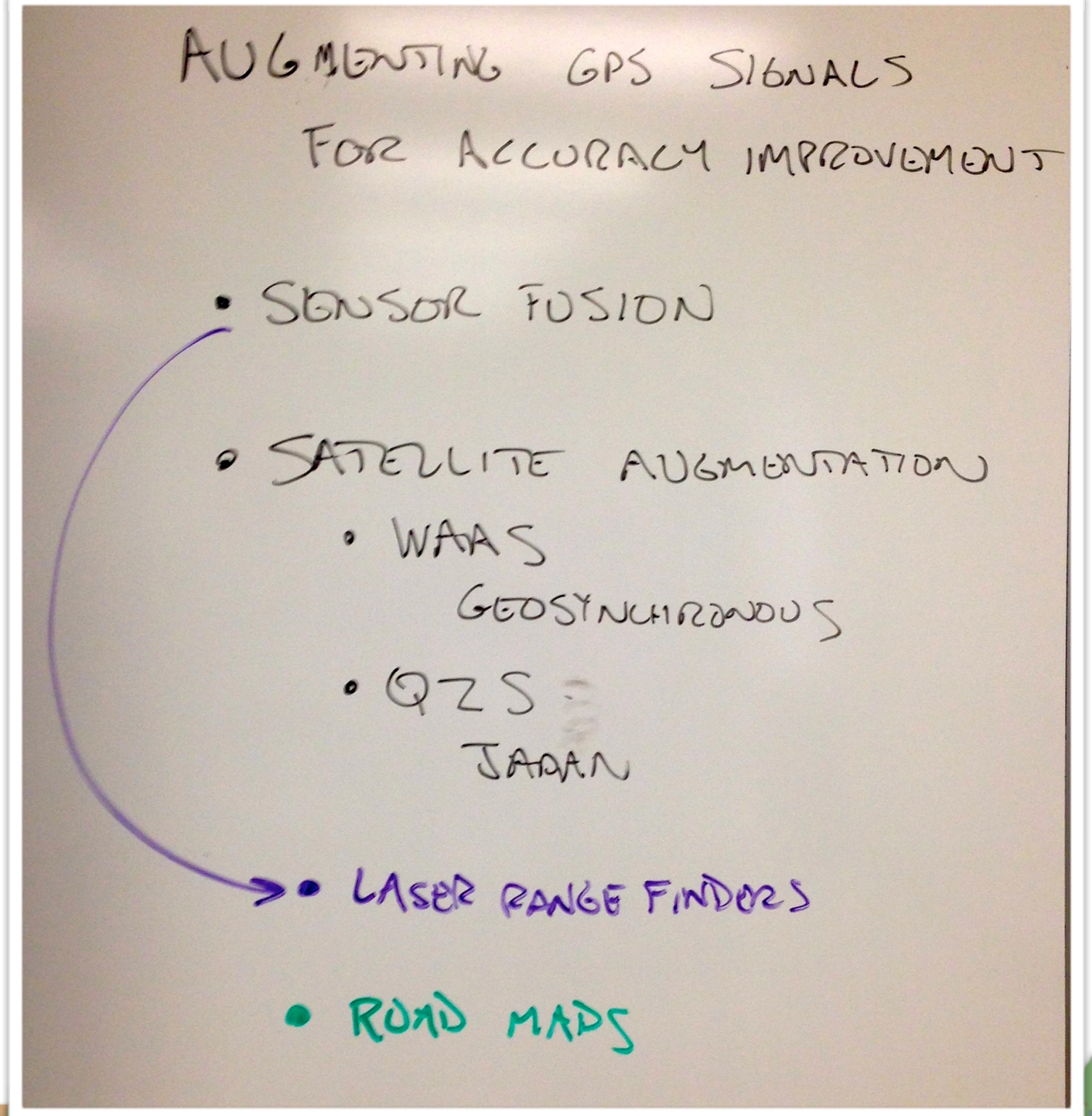
How does a phone find your location?

- "Real" GPS
- "Assisted" GPS
  - Help with "Real" GPS
  - Send your position
- Cell-tower based localization
- WiFi based localization
- IP based localization

- What are the properties of each?
- What are other crazy ideas of how to figure out your location?

Intro to Location



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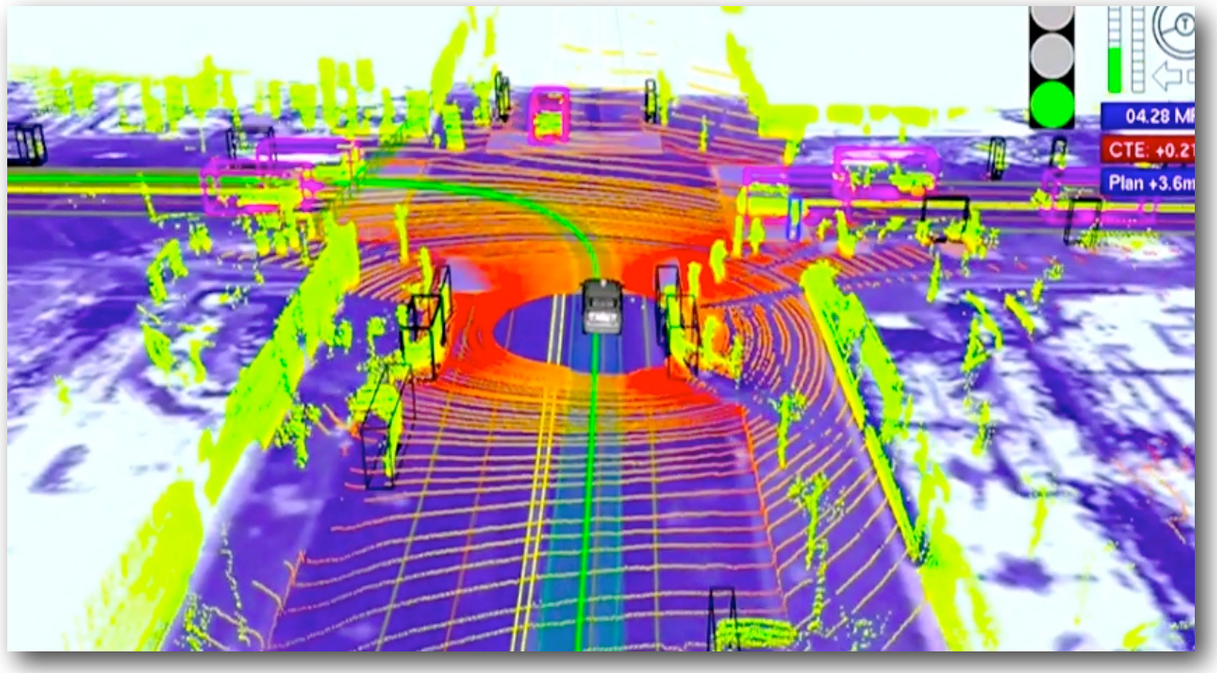
Google's self-driving car



Two things seem particularly interesting about Google's approach. First, it relies on very detailed maps of the roads and terrain, something that Urmson said is essential to determine accurately where the car is. Using GPS-based techniques alone, he said, the location could be off by several meters.

http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/how-google-self-driving-car-works

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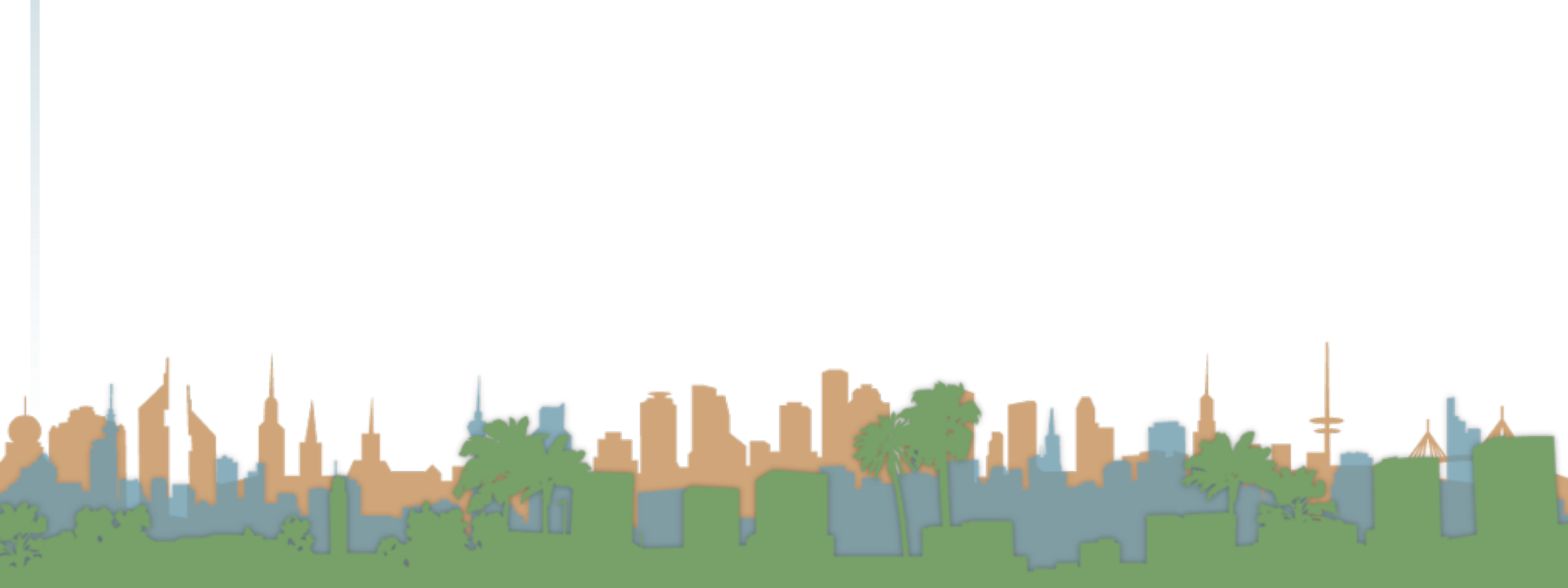

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- All require tower to know where it is

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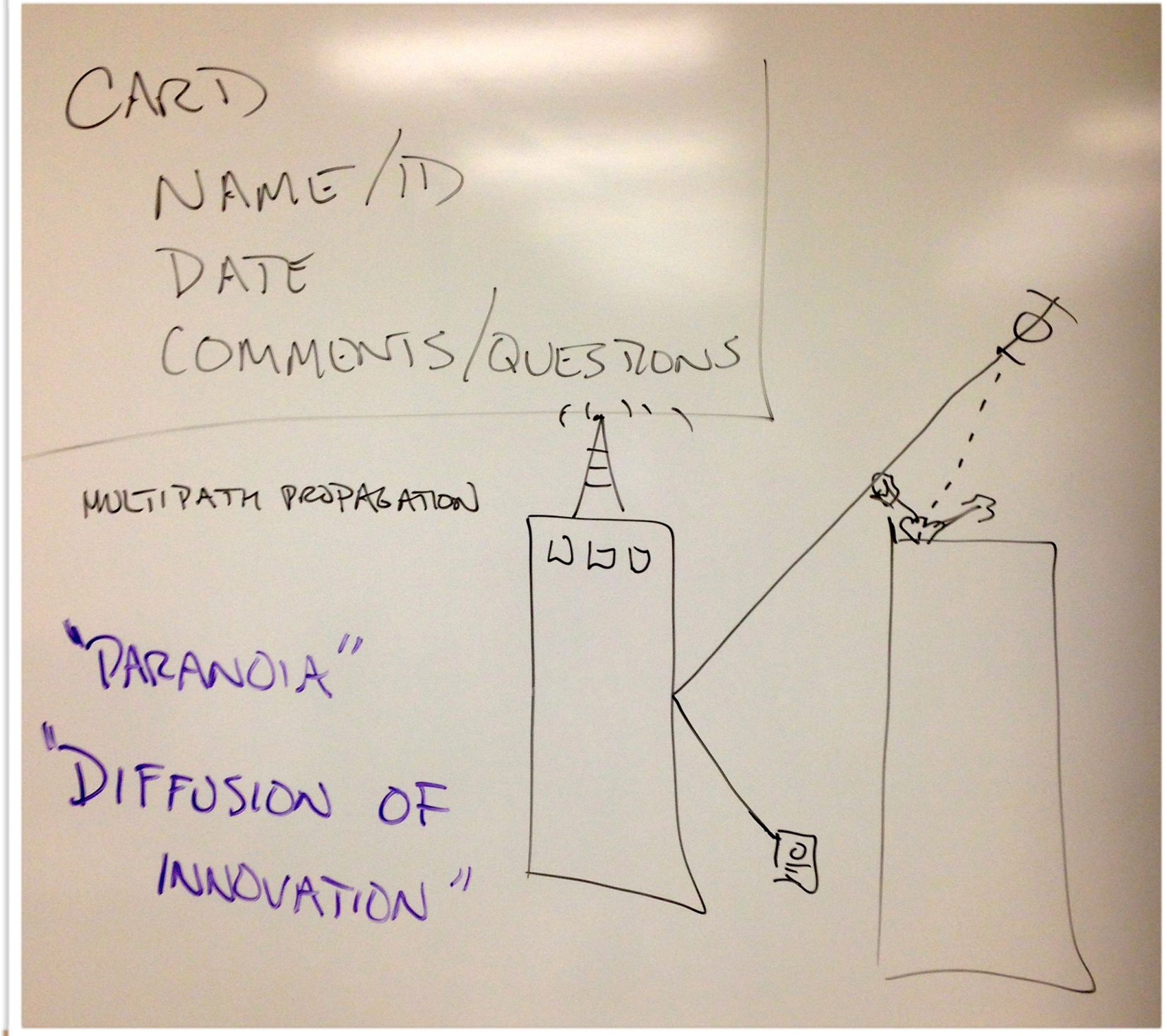

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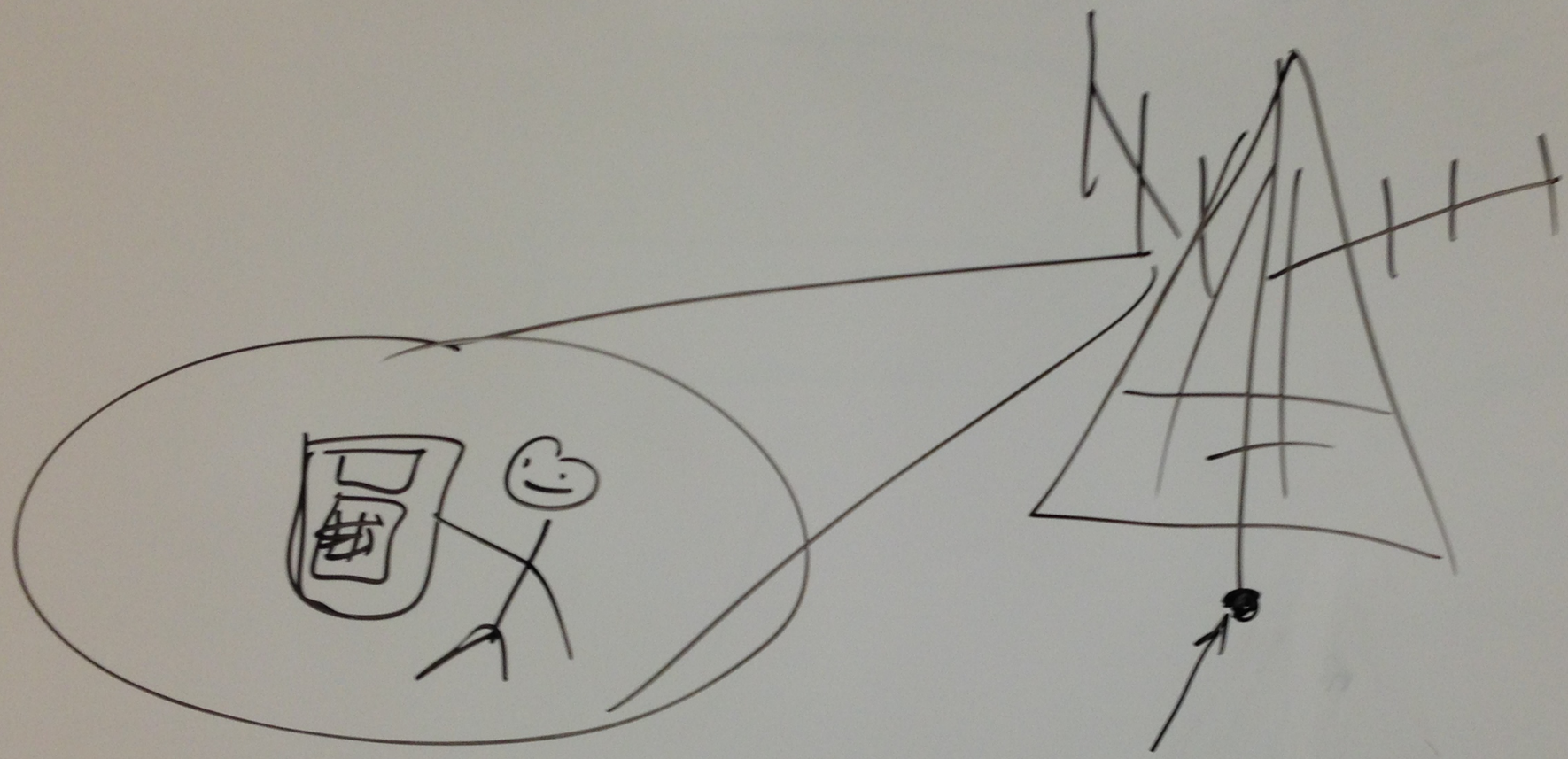
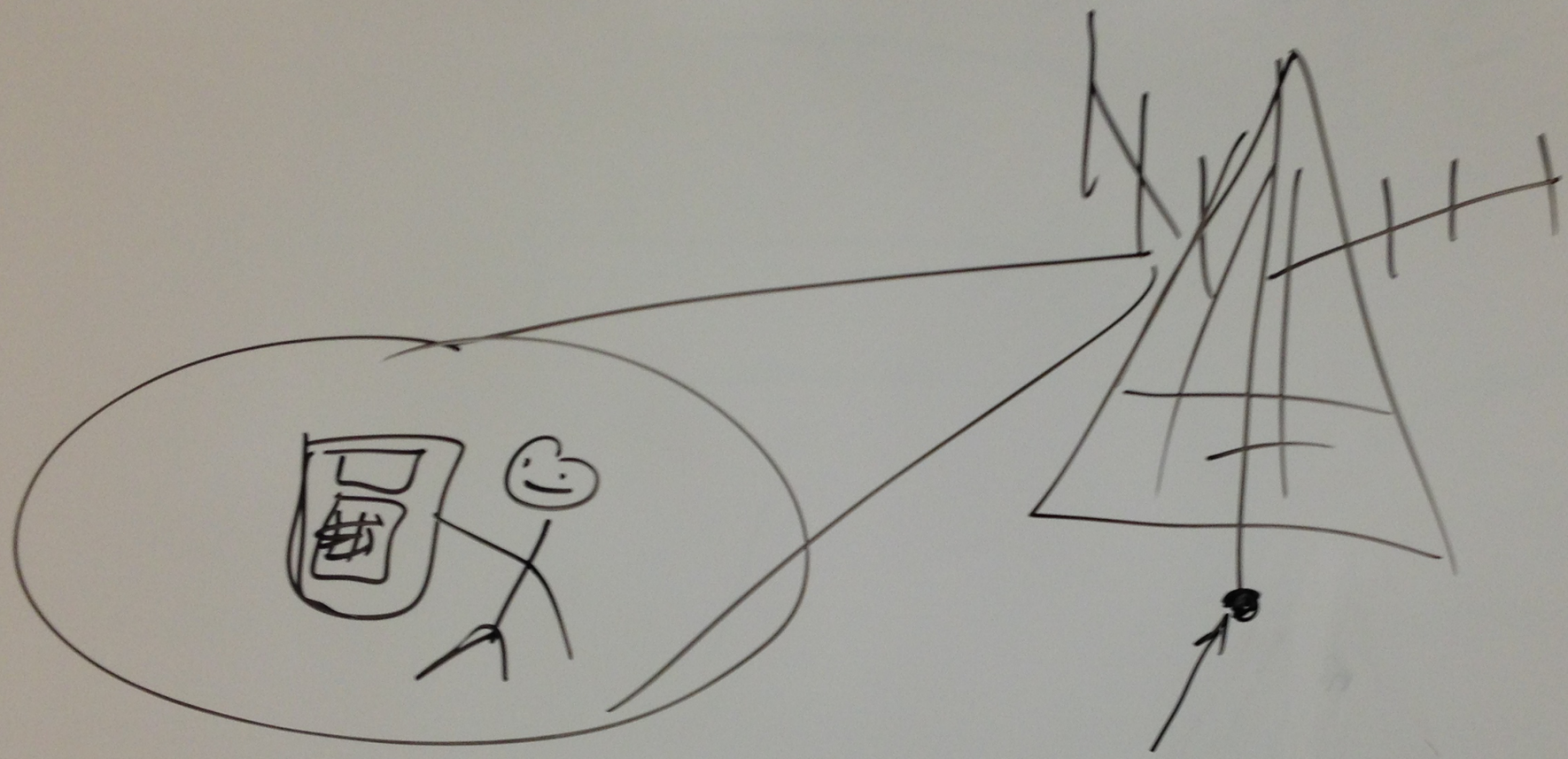


NO GPS
RELIES ON TELEPATHY



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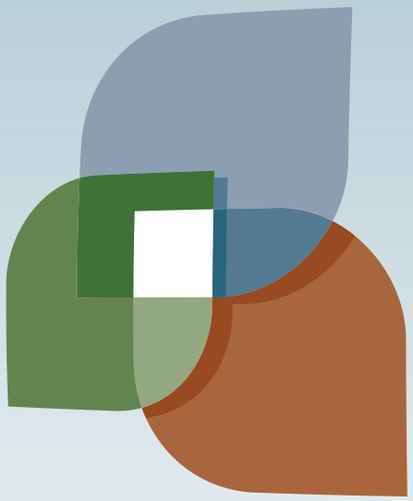

LUCI