

Address, City, State, and/or Zip

3405 Michigan Union 530 S. State Street

Current City

-  Ann Arbor, Michigan
51,001 like this · 752,64...
-  Lake Ann, Michigan
785 like this · 8,350 wer...
-  Saint Ann'S Bay, Saint A...
742 like this · 3,583 wer...
-  Saint Ann, Missouri
533 like this · 3,920 wer...

Location
Where in the world are you?

家乡 :
安庆
安顺
安康

SKYHOOK
WIRELESS



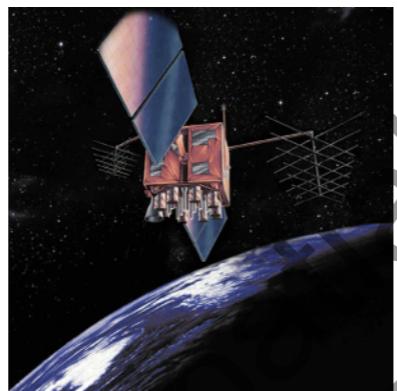
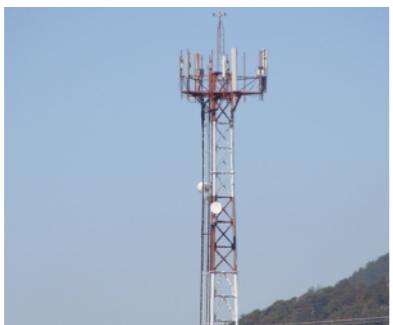
YAHOO!
BOSS

Google
Developers

Positioning

Spatial Computing – University of Minnesota





Signal-based
Positioning

Content-based
Positioning

Slides for Spatial Computing 101
BY Brent Hecht
1.321.5
flickr



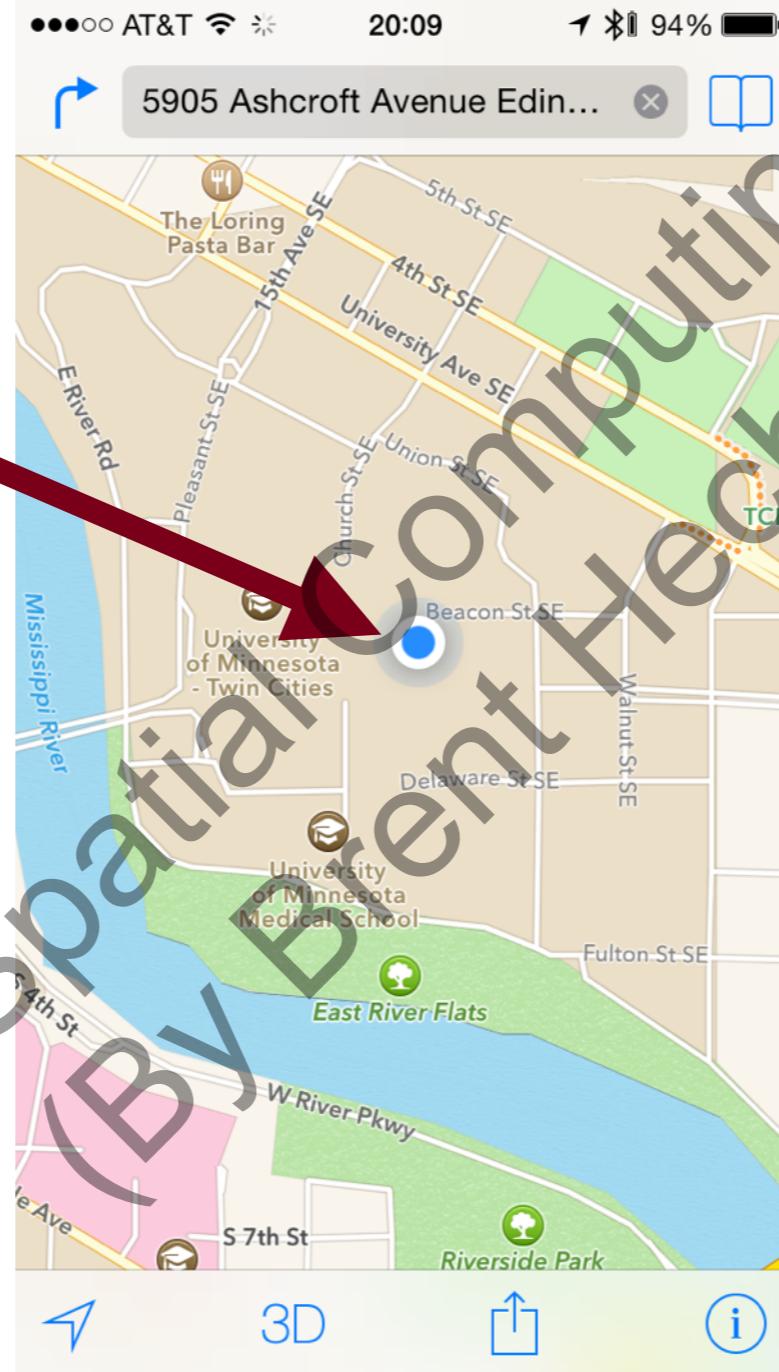
Slides for Spatial
(By Prof. Dr.-Ing. habil. Thomas H. Lutz)



Signal-based positioning is how your smartphone knows where you are!

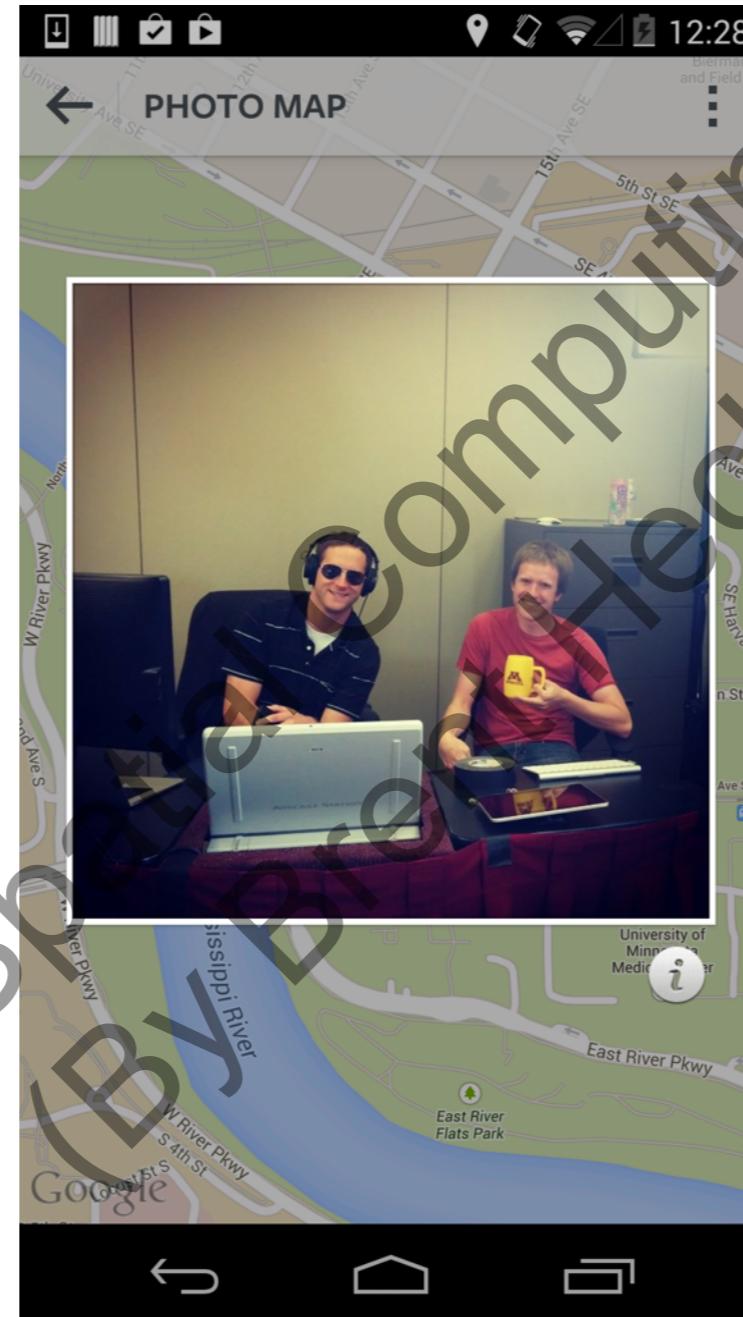
Computing MOOC

Signal-based positioning is responsible for....



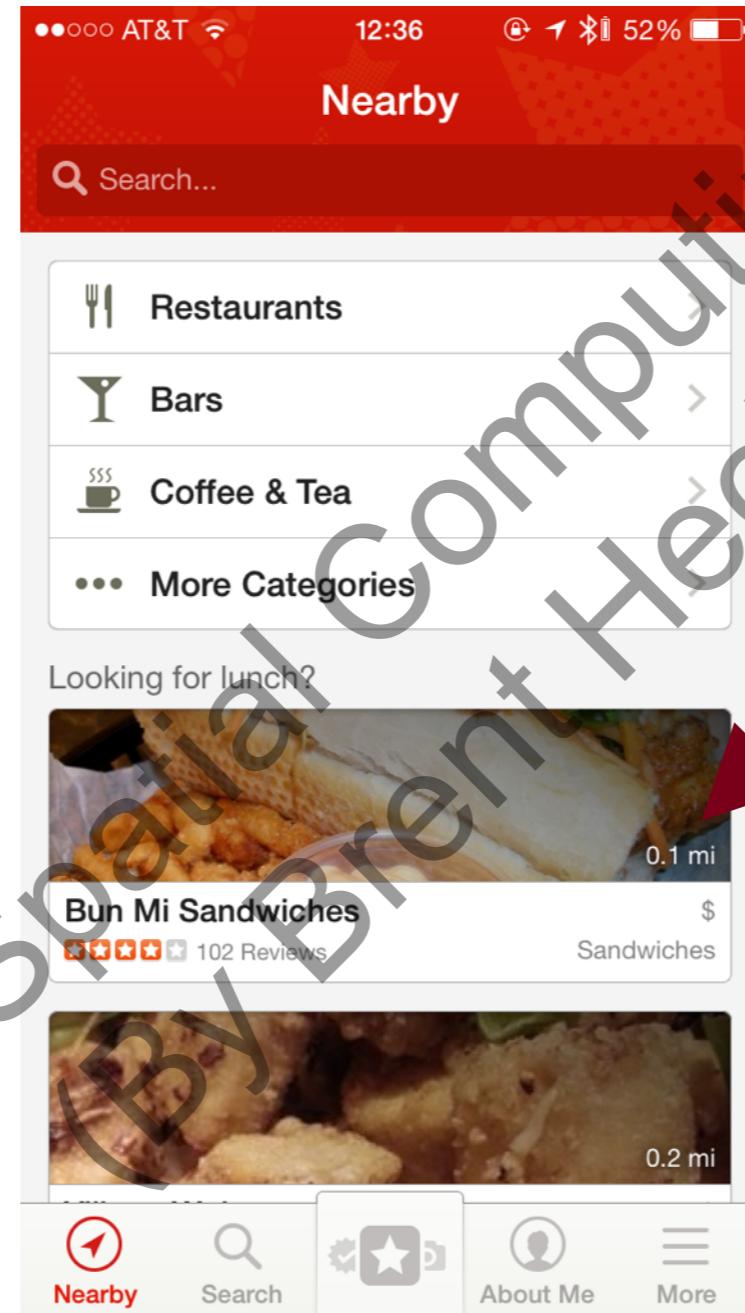
...the little blue dot in mobile map applications

Signal-based positioning is responsible for....



... correctly geotagging Instagram photos, tweets, and other social media VGI.

Signal-based positioning is responsible for....



... helping determine what's nearby in location-based services like Yelp, Foursquare, and so on.

Signal-based positioning is responsible for....



... helping scientists understand how species migrate.

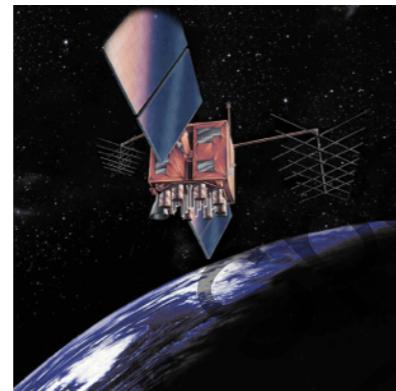
Signal-based positioning is responsible for....



...allowing farmers to implement optimal strategies
for their crops.

Key Types of Signal-based Positioning

in your smartphone and in general



**Signal-based
Positioning**

- 1. Satellite-based
Positioning**
- 2. Wifi Positioning**
- 3. Cellular
Positioning**

Global Navigation Satellite System (GNSS)

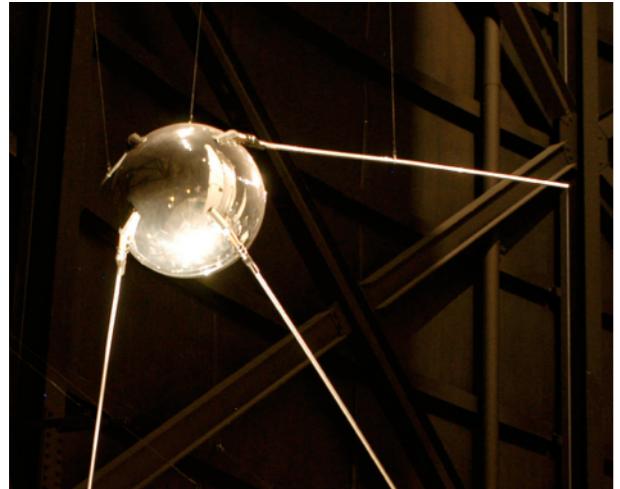
Slides for Spatial Computing Heidelberg
(BY)remixable

First GNSS

GPS

Global Positioning System

Slides for Spacecraft Imparting Mooc
(By Brent Kasthurirangan)



Scientists in America figure out how to track Sputnik using its radio transmissions



The U.S. wanted to be able to better target missiles (among other military applications)



KAL 007 shot down after drifting into Soviet space

GPS is a U.S. government technology born out of the Cold War

Slides for Spatial Computing Mooc
(By Berndt Recht)



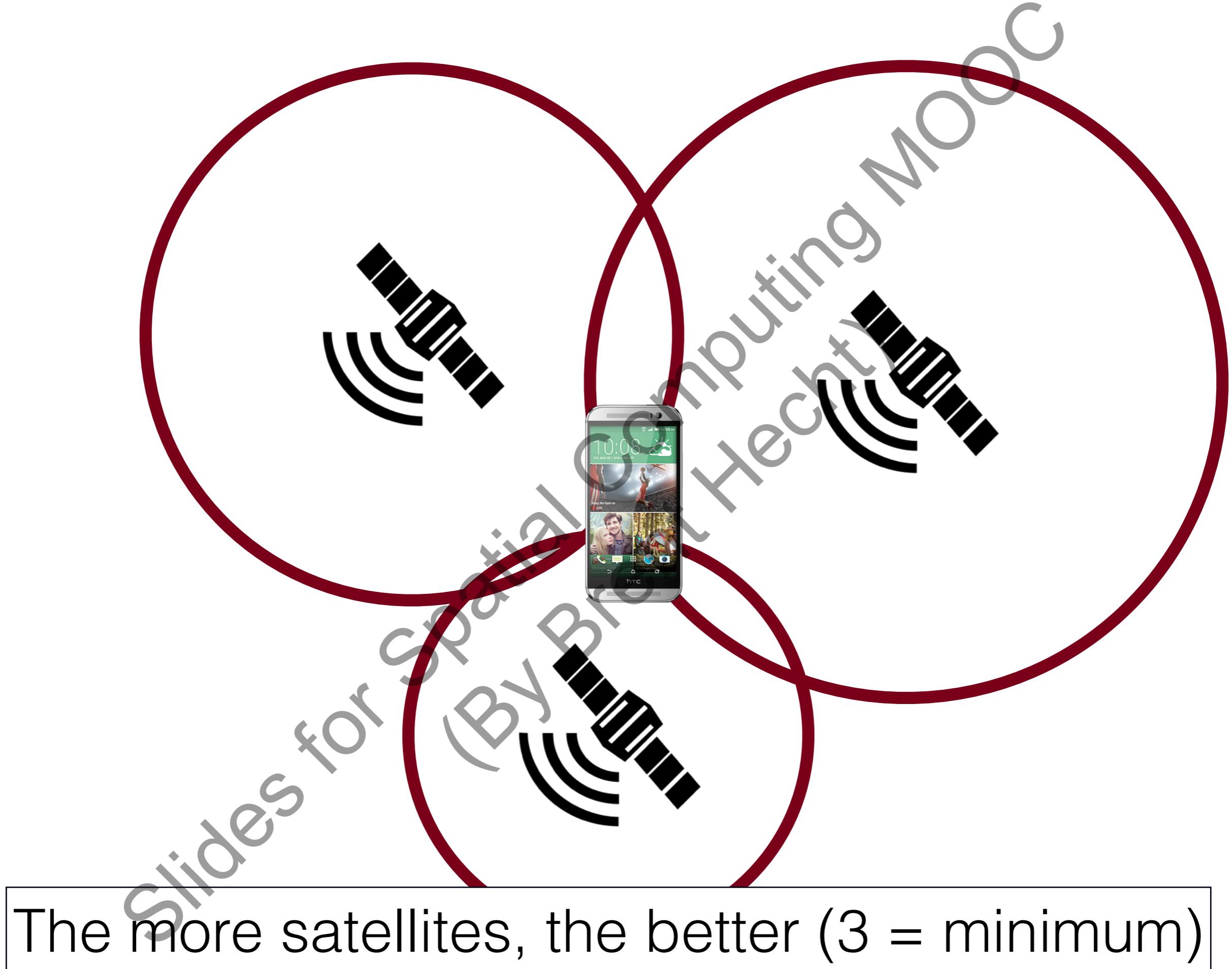
Slices for National Computing
GPS BFFs

GPS is a U.S. government technology born out of the Cold War

How does GPS work?



- 24 satellite (+ some extras)
- each is on fixed, 12-hour orbit
- transmit radio signals at fixed intervals
- devices use trilateration



**GPS is failing you
right now!**

Slides for Spatial Computing Mooc
(By Brent Yorgey)

GPS limitations

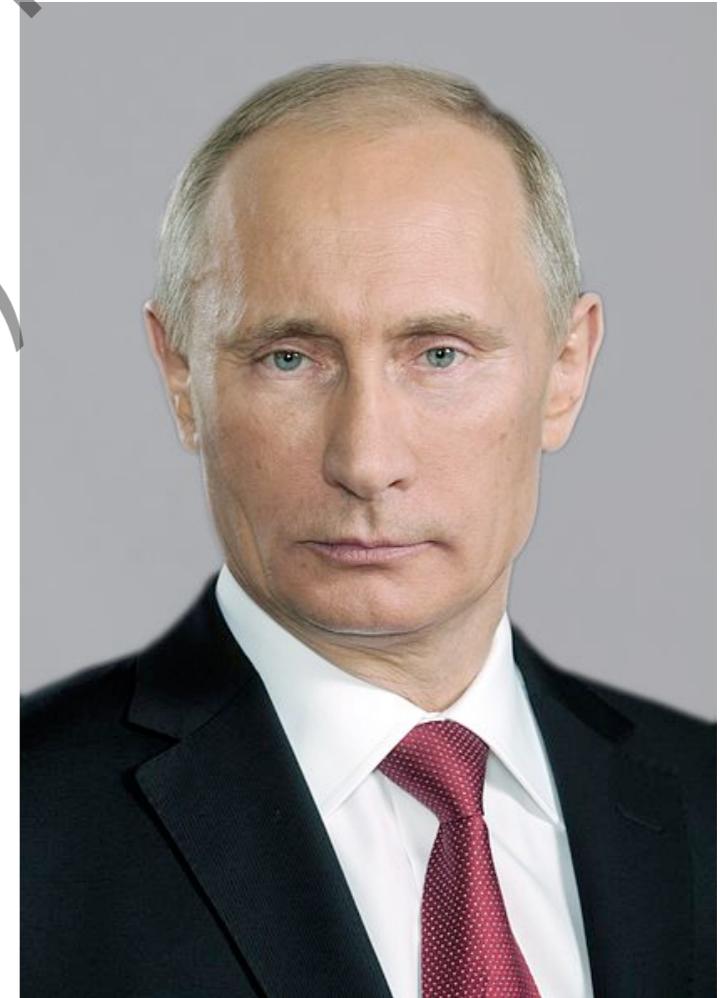
1. Does not work well indoors
(that's changing a bit)
2. Accuracy can be limited
3. Time-to-first-fix stinks
4. Multipath issues (urban canyon effect)

Hard for a smartphone to see satellites down there!



GPS limitations

1. Does not work well indoors
(that's changing a bit)
2. Accuracy can be limited
3. Time-to-first-fix stinks
4. Multipath issues (urban canyon effect)
5. Drain on power



Slides for Spring Computing
(B) GPS BFFs?



WIKIPEDIA

The Free Encyclopedia

[Main page](#)[Contents](#)[Featured content](#)[Current events](#)[Random article](#)[Donate to Wikipedia](#)[Wikimedia Shop](#)[Interaction](#)[Help](#)[About Wikipedia](#)[Community portal](#)[Recent changes](#)[Contact page](#)[Tools](#)[What links here](#)[Related changes](#)[Upload file](#)[Special pages](#)[Permanent link](#)[Page information](#)[Wikidata item](#)[Article](#) [Talk](#)[Read](#) [Edit](#) [View history](#)[Search](#)[Create account](#) [Log in](#)

List of smartphones using GLONASS Navigation

From Wikipedia, the free encyclopedia



This article includes a [list of references](#), but its sources remain unclear because it has insufficient [inline citations](#). Please help to [improve this article](#) by introducing more precise citations. (October 2012)

This is a list of smartphones that support GLONASS, the Russian GNSS.

Contents [hide]

- 1 Acer
- 2 Alcatel
- 3 Apple
- 4 Asus
- 5 BlackBerry
- 6 HTC
- 7 Huawei
- 8 LG
- 9 Meizu
- 10 Motorola
- 11 Nokia
- 12 OnePlus

https://en.wikipedia.org/wiki/List_of_smartphones_using_GLONASS_Navigation

[Print/export](#)[Create a book](#)[Download as PDF](#)[15 Starmobile](#)[16 Sony](#)



Galileo

Beidou-2 /
COMPASS

Positioning

Spatial Computing – University of Minnesota

Attributions

"Cell tower in jovel chiapas" by Leogeograph - Own work. Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Cell_tower_in_jovel_chiapas.JPG#mediaviewer/File:Cell_tower_in_jovel_chiapas.JPG

"new holland tractor" by Dan Davison / CC BY 2.0 (<https://flic.kr/p/8qXrXN>)

"Boeing 747-2B5B, Korean Air Lines AN0600191" by Michel Gilliland - Gallery page <http://www.airliners.net/photo/Korean-Air-Lines/Boeing-747-2B5B/0600191/LPhoto> <http://cdn-www.airliners.net/aviation-photos/photos/1/9/1/0600191.jpg>. Licensed under GNU Free Documentation License 1.2 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Boeing_747-2B5B,_Korean_Air_Lines_AN0600191.jpg#mediaviewer/File:Boeing_747-2B5B,_Korean_Air_Lines_AN0600191.jpg

[“Wifi”] By RRZEicons (Own work) [CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0>)], via Wikimedia Commons