Positioning
Spatial Computing – University of Minnesota
Signal-based Positioning

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

1. Satellite-based Positioning
2. Wifi Positioning
3. Cellular Positioning
Global Navigation Satellite System (GNSS)
First GNSS

GPS

Global Positioning System
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.
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
The more satellites, the better (3 = minimum)
GPS is failing you right now!
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)
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4. Multipath issues (urban canyon effect)
5. Drain on power
GPS BFFs?
Galileo

Beidou-2 / COMPASS
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