

Mobility

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Why Care About Mobility?

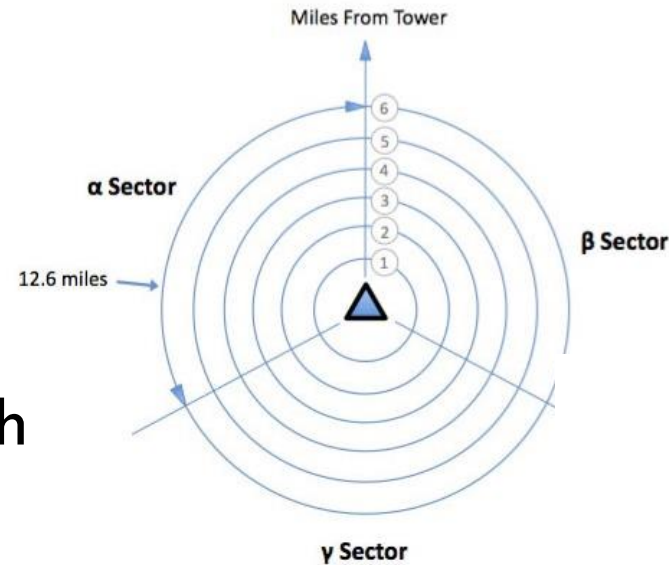
Leverage trends across communities to understand population-level trends

- Urban mobility and access to green space
- Epidemic monitoring and contact tracing
- Community-level predictors of long-term health

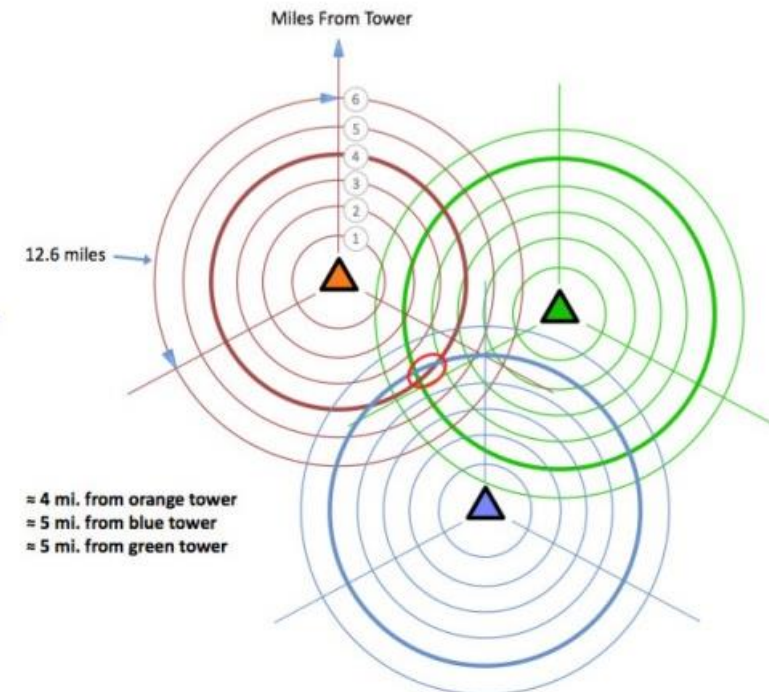
How Can We Get Mobility Information?

1. Cell tower triangulation

- Distance from single tower is calculated using signal strength and round-trip time (RTT)
- One tower will get your rough location within a “sector”
- Three towers needed for precise location



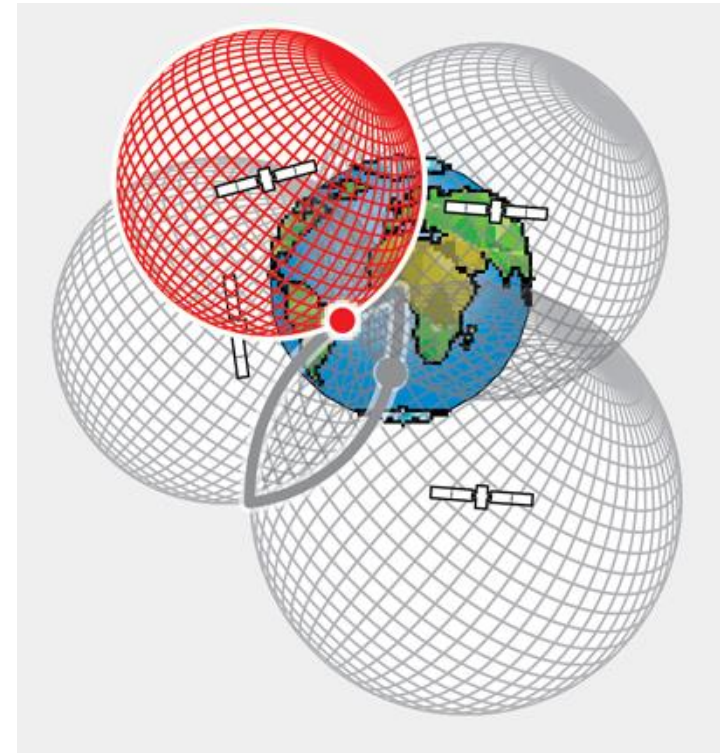
Often a combination of triangulation (using angles) and trilateration (using distances)



How Can We Get Mobility Information?

2. GPS

- Similar to cell tower triangulation
- Requires four satellites to calculate (x, y, z, time)



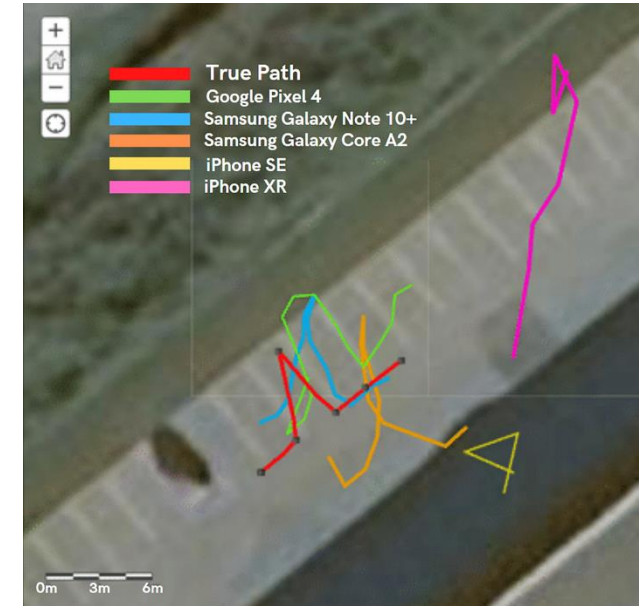
What About Indoors?

Typical accuracy is 5–30 meters

Distance measurements using wireless signals assume line-of-sight

- Lots of environmental obstructions from trees, buildings, etc.
- Obstructions → poor signal strength → inaccurate distance measurements

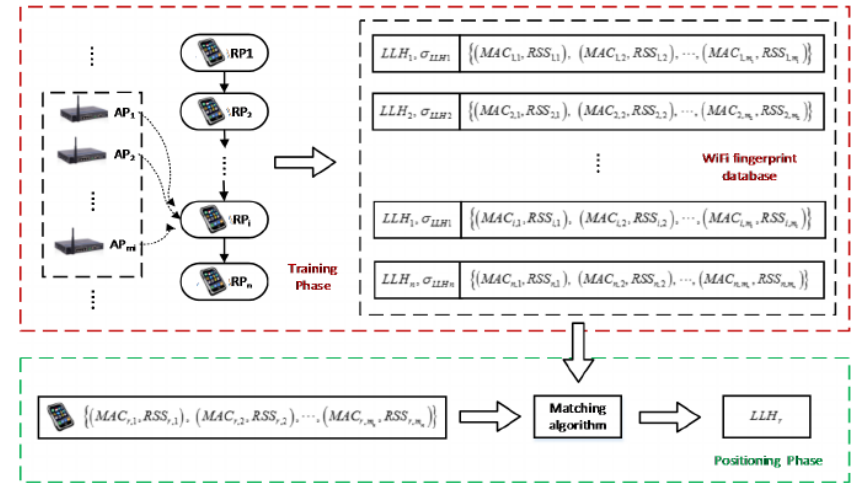
Indoor localization is a task of its own



How Can We Get Mobility Information?

3. Wi-Fi

- Wi-Fi access points are used to locate devices
 - Trilateration: Distance-based measurements
 - Fingerprinting: Each location has a signature of nearby access points and signal strengths
- Devices are used to locate Wi-Fi access points
 - Companies like Google and Apple maintain tables that map Wi-Fi networks to locations



Public Wi-Fi location databases [\[edit \]](#)

A number of public Wi-Fi location databases are available (only active projects):

Name	Unique Wi-Fi networks	Observations	Free database download	SSID lookup	BSSID lookup	Data License
Combin Positioning Service ^[26]	>2,400,000,000 ^[27]	>67,000,000,000 ^[27]	No	Yes	Yes	Proprietary
LocationAPI.org by Unwired Labs ^[28]	>1,500,010,000 ^[29]	>4,100,000,000	No	No	Yes	Proprietary

Privacy Considerations

Location data is used by many government agencies and companies (ideally de-identified)

De-identification is often not enough

While the medical data—officially, the Massachusetts “Group Insurance Commission” (GIC) data—had been “deidentified” by removing fields containing patients’ name, address, and social security number (SSN) prior to the the data release, the nearly one hundred remaining fields included ZIP code, birth date, and sex. As Ohm (2010) tells the story, Sweeney

knew that Governor Weld resided in Cambridge, Massachusetts, a city of fifty-four thousand residents and seven ZIP codes. For twenty dollars, she purchased the complete voter rolls from the city of Cambridge—a database containing, among other things, the name, address, ZIP code, birth date, and sex of every voter. By combining this data with the GIC records, Sweeney found Governor Weld with ease. Only six people in Cambridge shared his birth date; only three were men, and of the three, only he lived in his ZIP code.^{2,3}

News / Canada



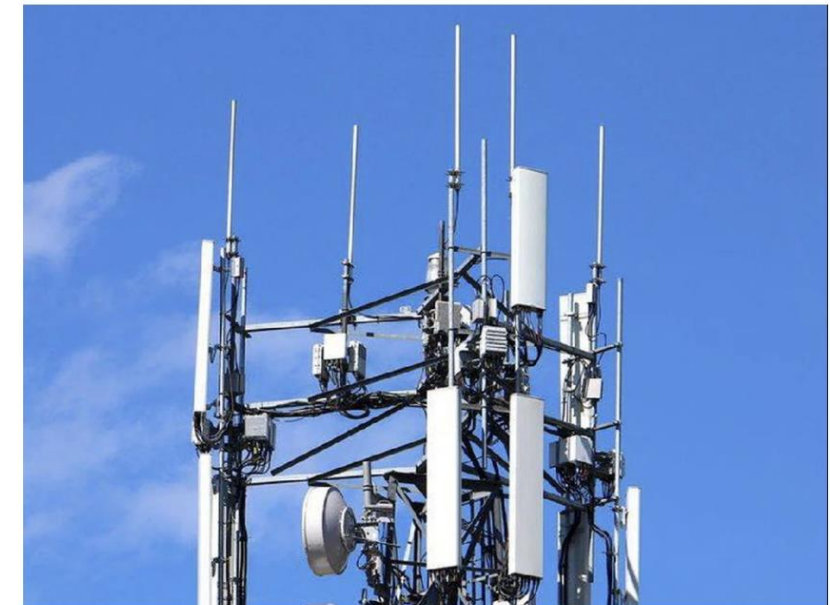
Canada's public health agency admits it tracked 33 million mobile devices during lockdown

The Public Health Agency of Canada accessed data such as cell-tower location to monitor people's activity during lockdown, it said

Swikar Oli

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665 Comments



A Telus cell tower. The company provided anonymized location data from across Canada between March and October of 2021. File

The Public Health Agency of Canada accessed location data from 33 million mobile devices to monitor people's movement during lockdown, the agency revealed this week.

Resources

Cell Tower Triangulation
([GPYes '23](#))

We Tested Mobile GPS/GNSS Accuracy and Found Some
Surprising Results
([!important Safety Technologies](#))

Privacy and Data-Based Research
([Heffetz and Ligett '13](#))