Leveraging Apple's Find My Network for Large-Scale Distributed Sensing

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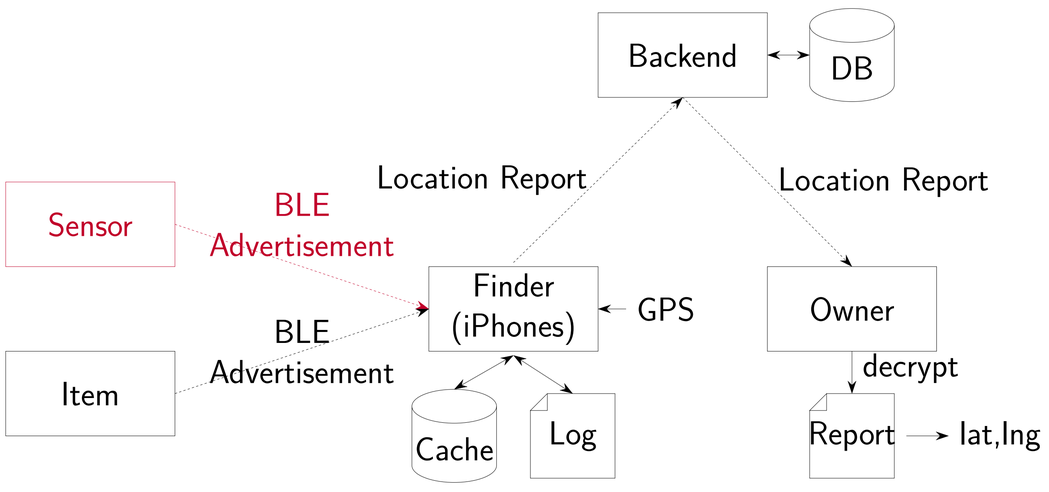
Motivation

Research Question: Is it possible to repurpose Apple's Find My location tracking network to collect arbitrary data from low-cost sensor devices?

Challenges:

- Unknown message processing
- Highly dynamic environments
- Unacknowledged transmissions

Find My Overview

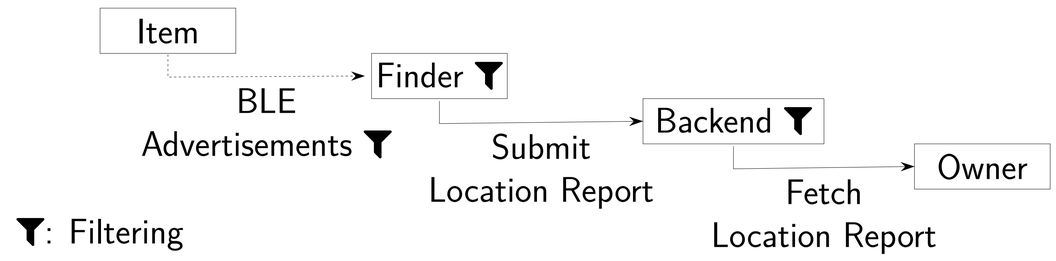


- Crowd-sourced location tracking network of hundreds of millions of devices
- Battery-powered items are located by nearby finders
- Finders report their location to the backend service

Approach

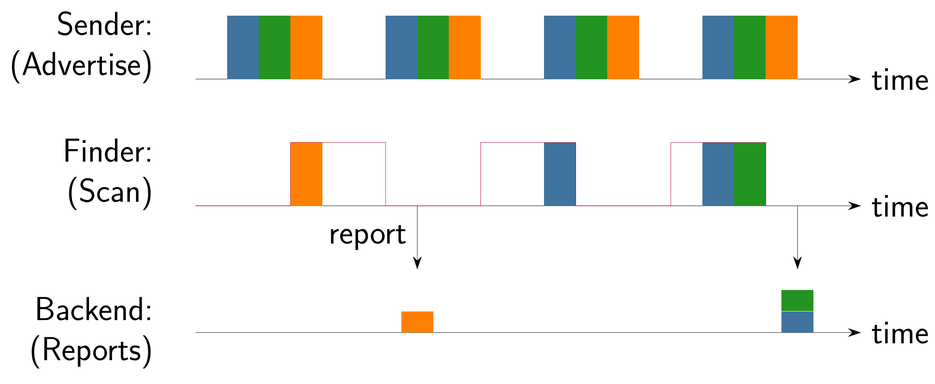
Reverse Engineering

We observed logs, analyzed traffic captures, and disassembled relevant binaries to uncover how an incoming BLE advertisement is transformed into a location report. Advertisements are lost during BLE transmission; the finder devices and backend further filter them.



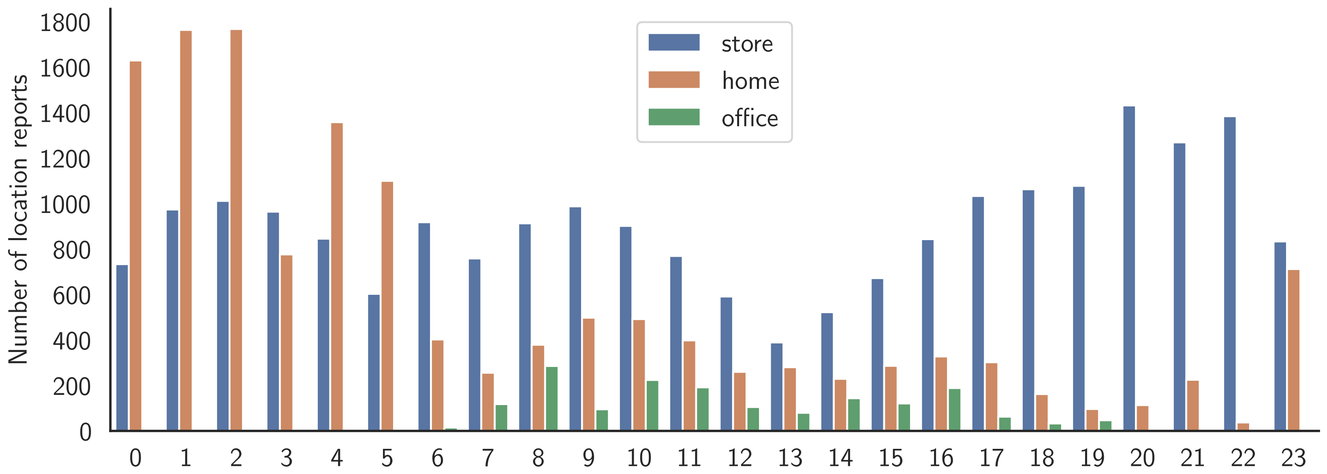
Protocol Design

End-to-end transmission protocol for efficient and reliable data collection from sensing devices by emulating tracked devices [2]. Data is transferred in units of frames, each encoded in a series of BLE advertisements.

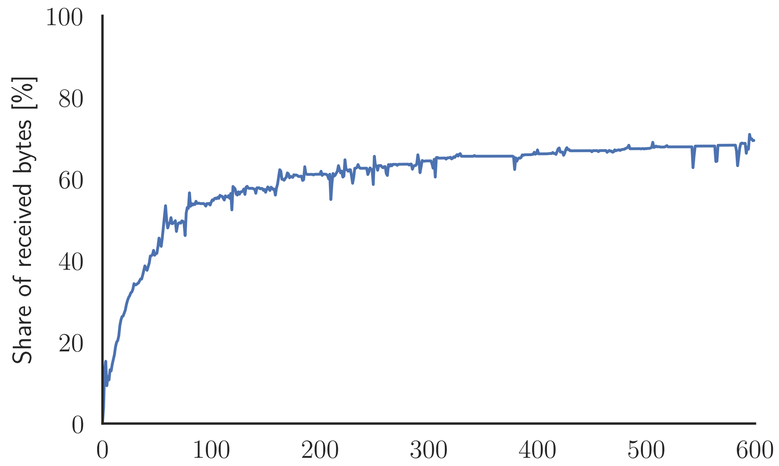


Preliminary Experimental Results

- **32× higher throughput (1.1bit/s per sensor) than recent prior work [3]**
- **First approach that considers reliability over Find My compared to prior work [1-3]**



The transmission characteristic depends on the number of nearby finders and their power state and is highly dynamic.



The transmission success increases with the frame duration.

[1] Bellon, A., Yen, A., and Pannuto, P. TagAlong: Free, Wide-Area Data-Muling and Services. In HotMobile (2023).

[2] Heinrich, A., Stute, M., and Hollick, M. OpenHaystack: A Framework for Tracking Personal Bluetooth Devices via Apple's Massive Find My Network. In WiSec (2021).

[3] Tonetto, L., Carrara, A., Ding, A., and Ott, J. Where Is My Tag? Unveiling Alternative Uses of the Apple FindMy Service. In WoWMoM (2022).