PrivacyShield: Relaying BLE Beacons to Counter Unsolicited Tracking

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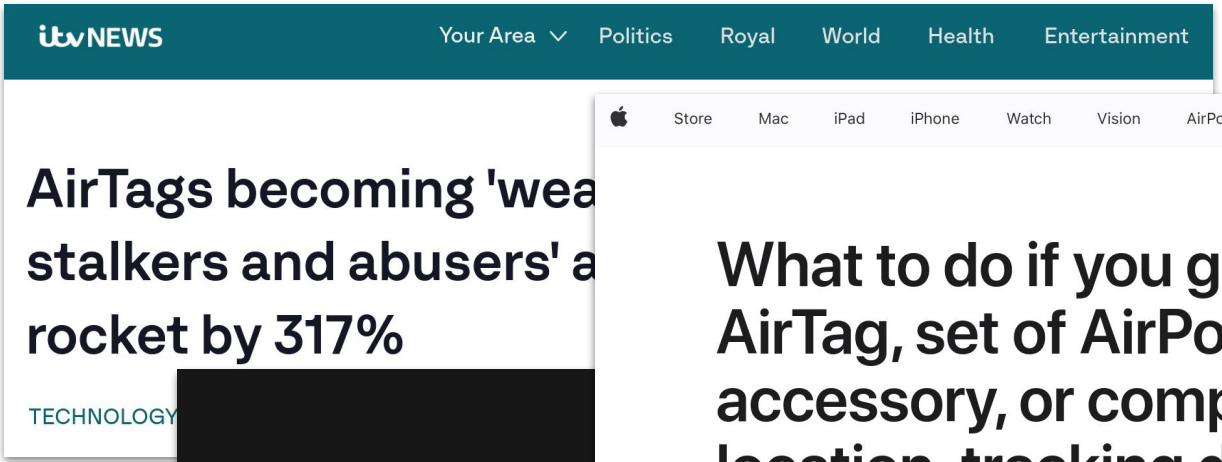
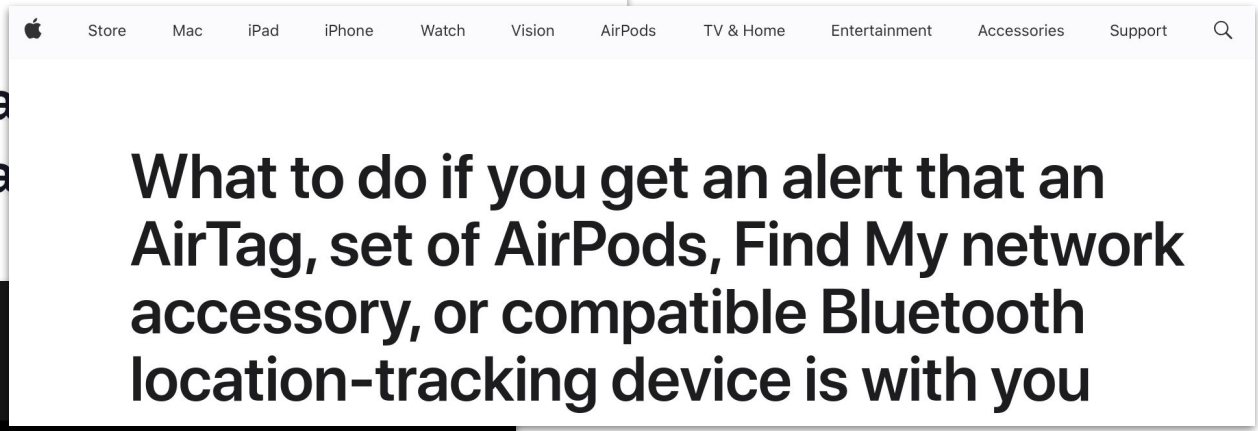
Finding Lost Objects via Apple's Find My

1.26in / 3.19cm
⇒ small

$25 ⇒ cheap

Abuse of Find My for Unsolicited Tracking

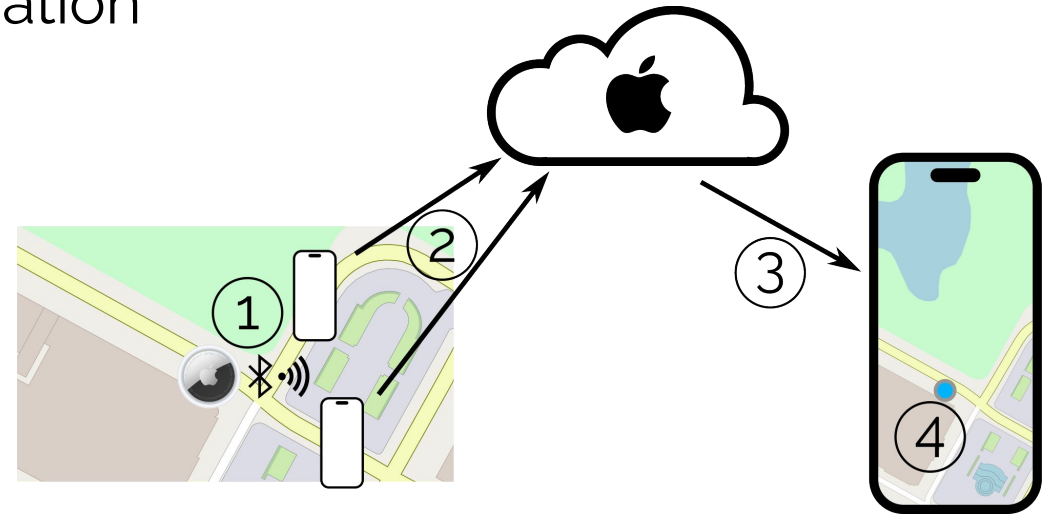




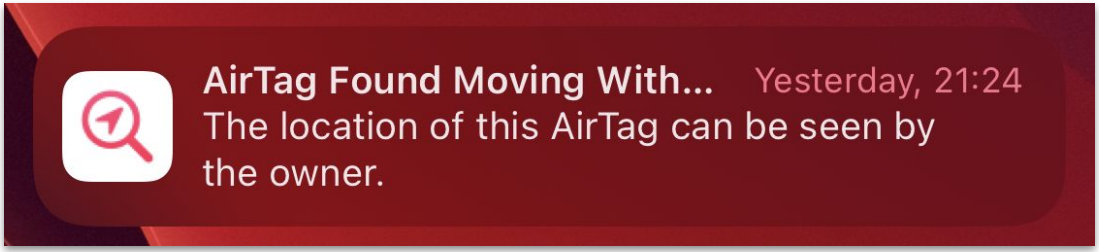
⇒ Stalking via Find My is a problem!

Locating a Tag

1. Tag broadcasts BLE beacon
2. Finder devices upload location + beacon hash
3. Owner device down–loads location reports
4. Owner device displays location on map



Existing Anti-Stalking Measures and Attacks



Device must be of type “AirTag” (not “iPhone” / “MacBook” / …)

⇒ Attack 1: Masquerade as iPhone

Tag must be (1) separated from owner, (2) detected continuously, (3) “follow” the victim (not stay stationary)

⇒ Attack 2: Use time window before being detected

⇒ Attack 3: Rotate beacon identifier

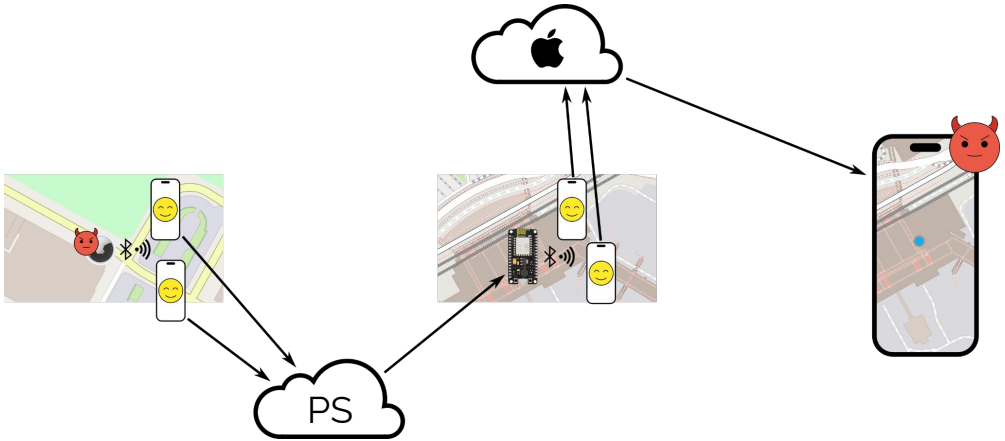
Core Insights

1. Existing anti-stalking measures focus on stalking *detection*
   ⇒ insufficient, easy to evade
2. Apple ignores *preventive* academic proposals
   ⇒ no *protection*, only *detection*
3. BLE beacons do not carry location information
   ⇒ displayed location independent of beacon *content*
4. BLE beacons are unauthenticated
   ⇒ can be easily relayed

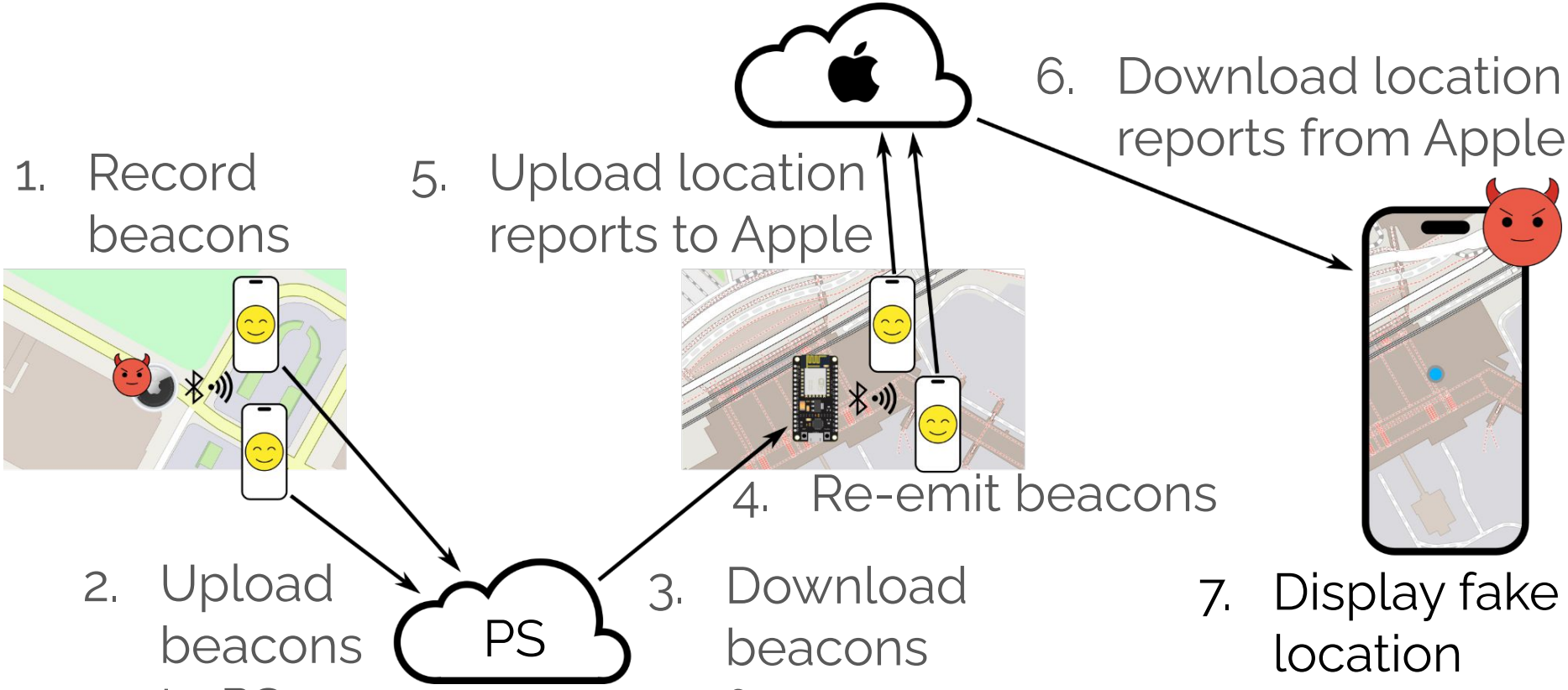
PrivacyShield: Contributions

1. Preventive, relay-based protection scheme
2. Prototype implementation
3. Effectiveness study

⇒ First protective system without requiring vendor cooperation



PrivacyShield: Relay Workflow



PrivacyShield: Features

1. Immediate protection
2. Independent of vendor cooperation
3. Robust against custom / modified tags
4. Selective location masking of nearby tags
5. Support for decentralized relay server setup

PrivacyShield: Findings

	Beacons emitted every…			
Devices	200ms	500ms	1s	2s
$n_o = n_r = 1$	✔	✔	–	N/A
$n_o \cong 70, n_r = 1$	✗	✗	✗	✗
$n_o \cong 70, n_r = 2$	✔	✔	–	✗

⇒ Location masking via relaying is feasible and works

⇒ Possibility of “drowning” legitimate reports even when at a disadvantage

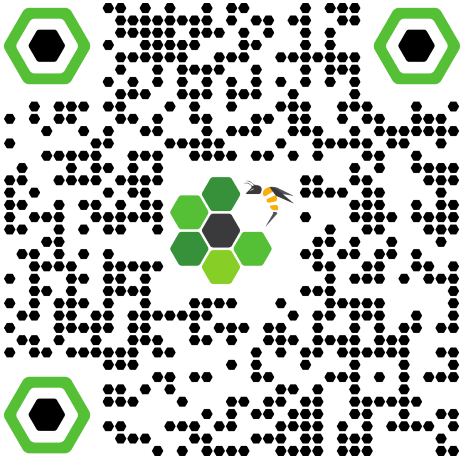
Conclusion

Stalking via offline finding systems is an insufficiently addressed problem

Existing measures can be easily bypassed

PrivacyShield serves as a stop-gap solution by masking a victim's location via BLE beacon relaying

Code: https://github.com/HexHive/PrivacyShield



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