Security and Privacy Analysis of Tile's Location Tracking Protocol

Akshaya Kumar, Anna Raymaker, and Michael A. Specter

Usenix Security 2026

Georgia Tech

Crowdsourced location tracking protocols

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Finders



Tag

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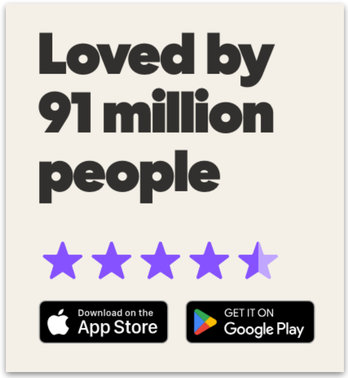
Security and privacy analysis of Tile's protocol



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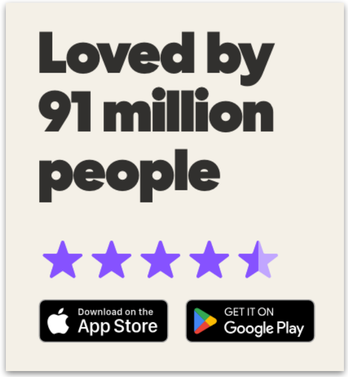



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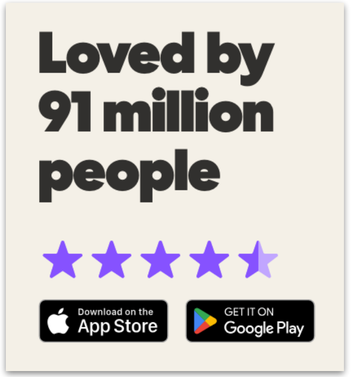



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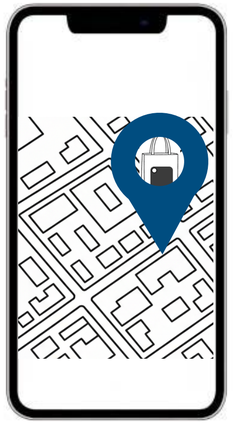
Track lost item using the network



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Helps users track their belongings

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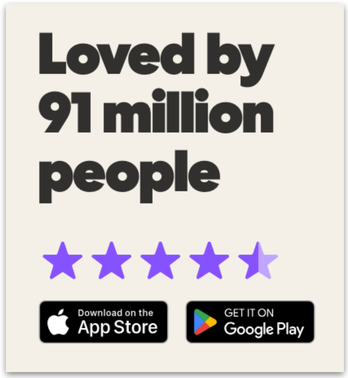



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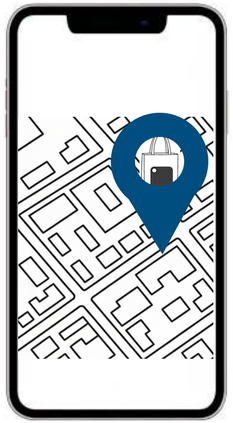

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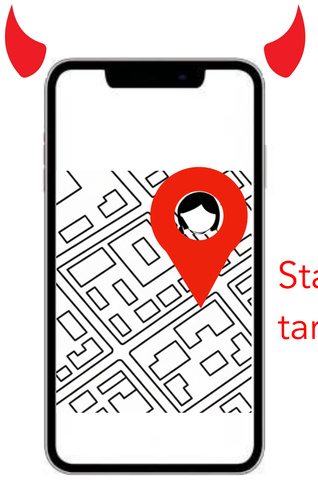

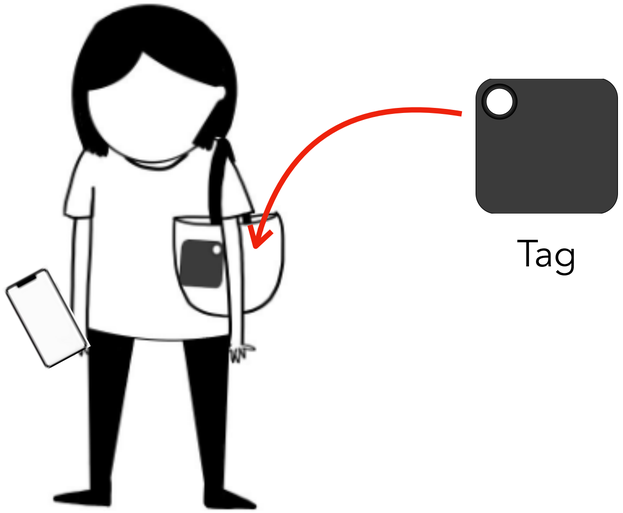

Stalk target by placing tag on target's person/belongings

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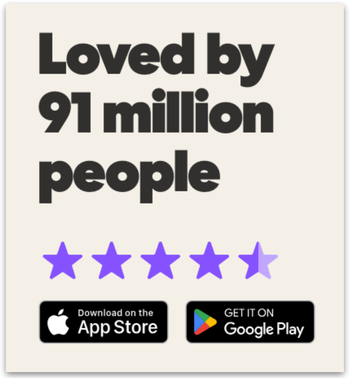



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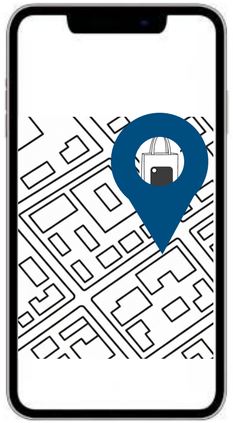

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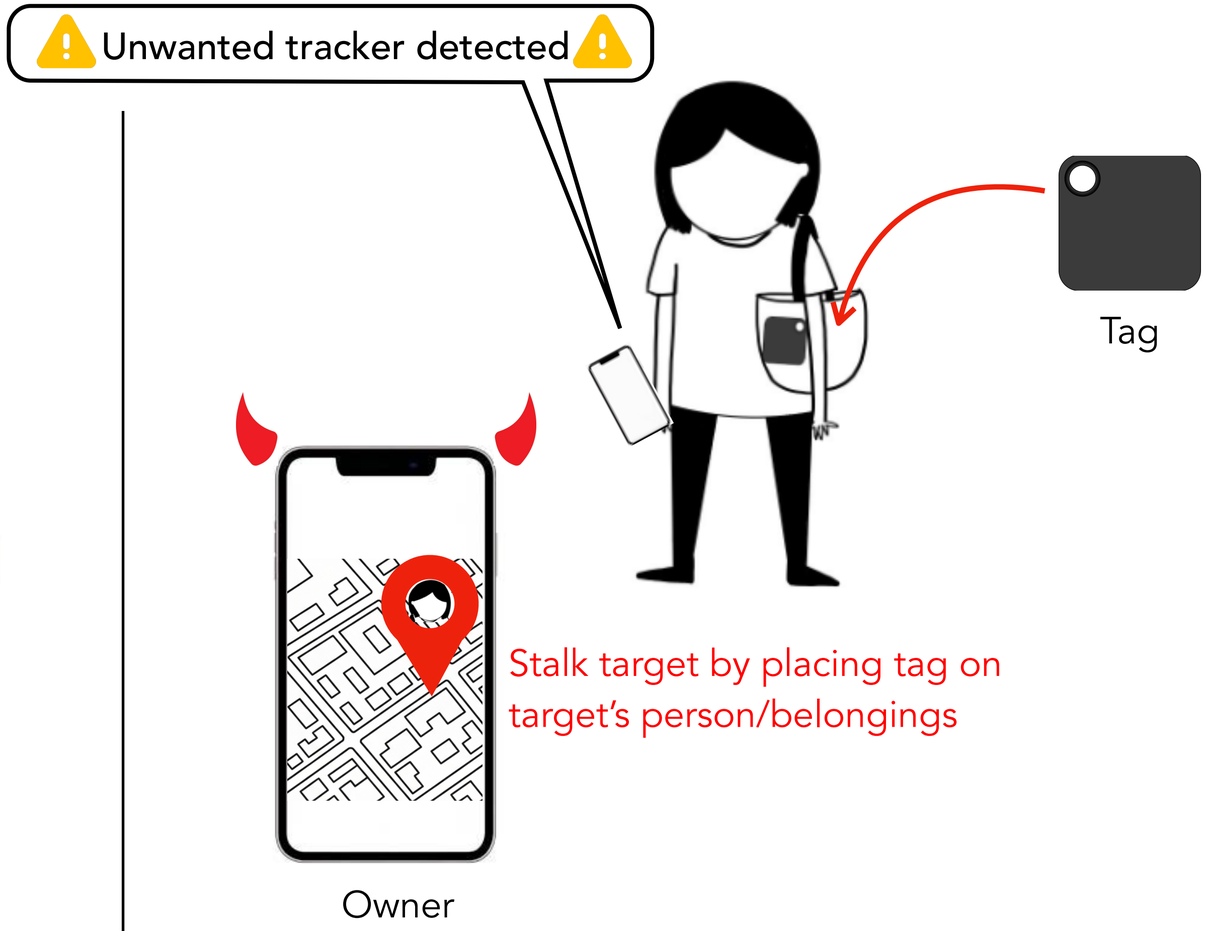

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Tile’s AntiTheft mode and accountability claims

Tile Anti-Theft Mode



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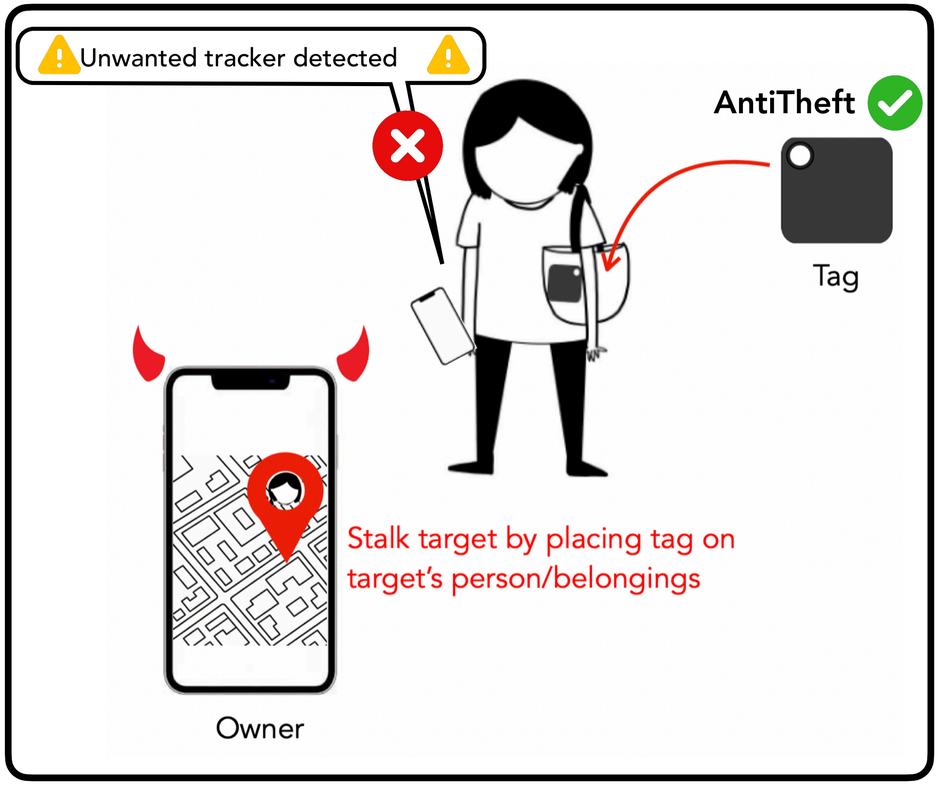

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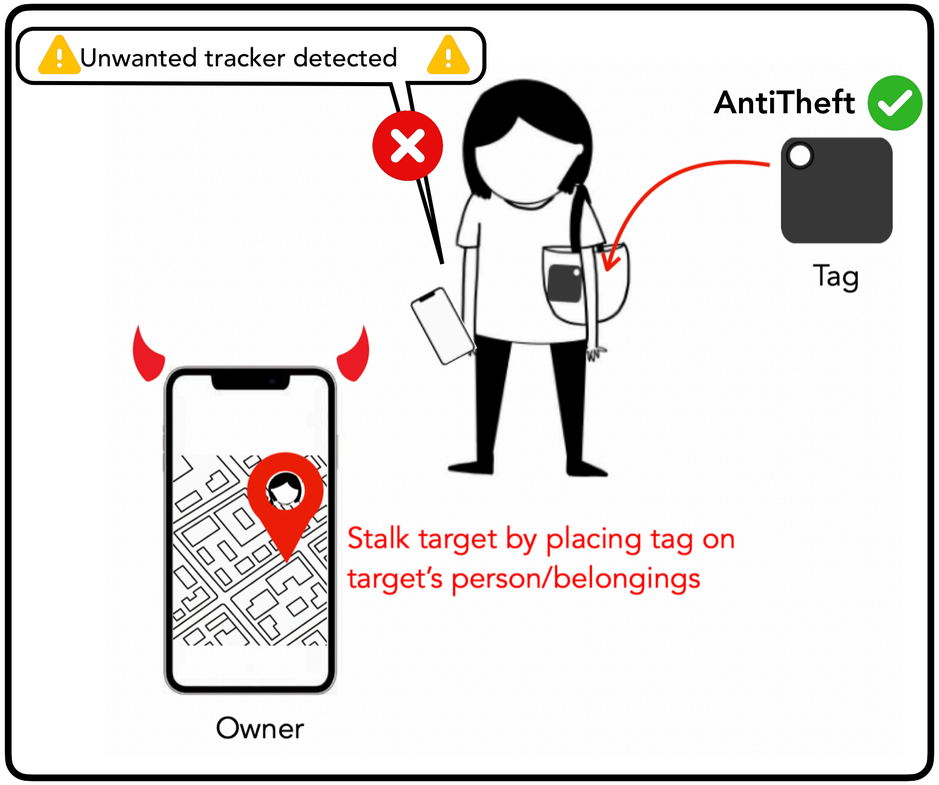

Antistalking		AntiTheft
Victims can detect tags	×	Tags invisible to scans

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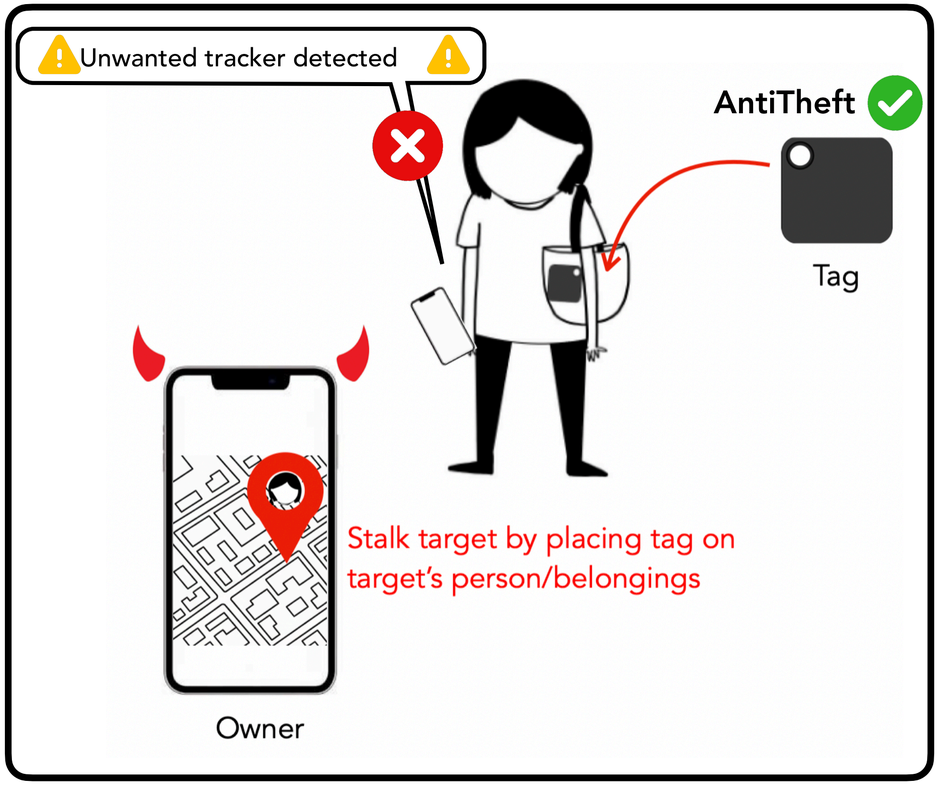

Tile’s accountability guarantees

“… personal information can and will be shared with law enforcement at our discretion, even without a subpoena, to aid in the investigation and prosecution of suspected stalking.”

Antistalking
Victims can detect tags

×

AntiTheft
Tags invisible to scans

Our contributions

Methodology: Reverse engineered Tile's Android application and reconstructed its protocol

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Does Tile's protocol guarantee other standard properties?
No, identified other attacks that break antistalking and unlinkability properties

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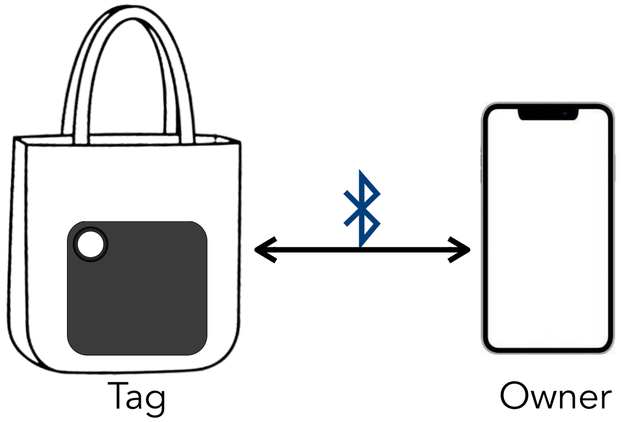

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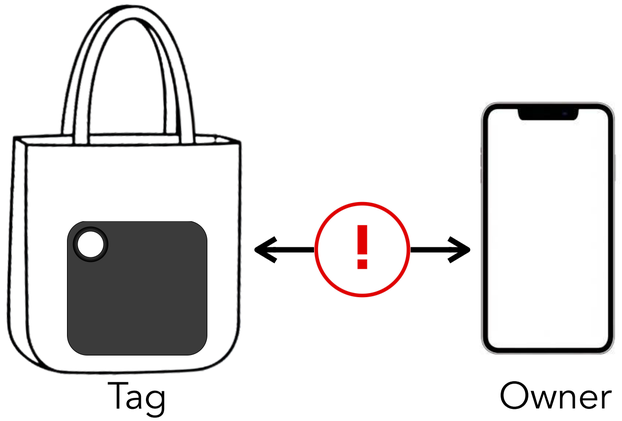

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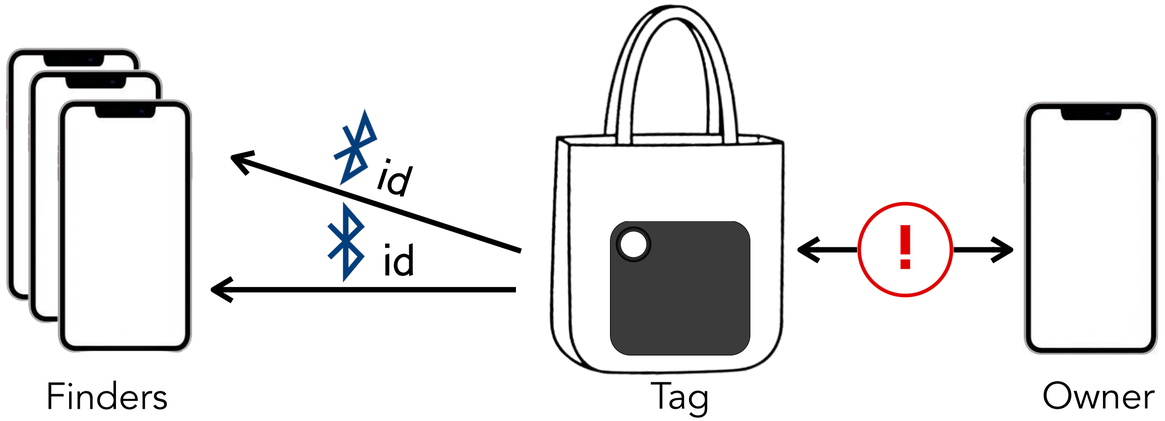

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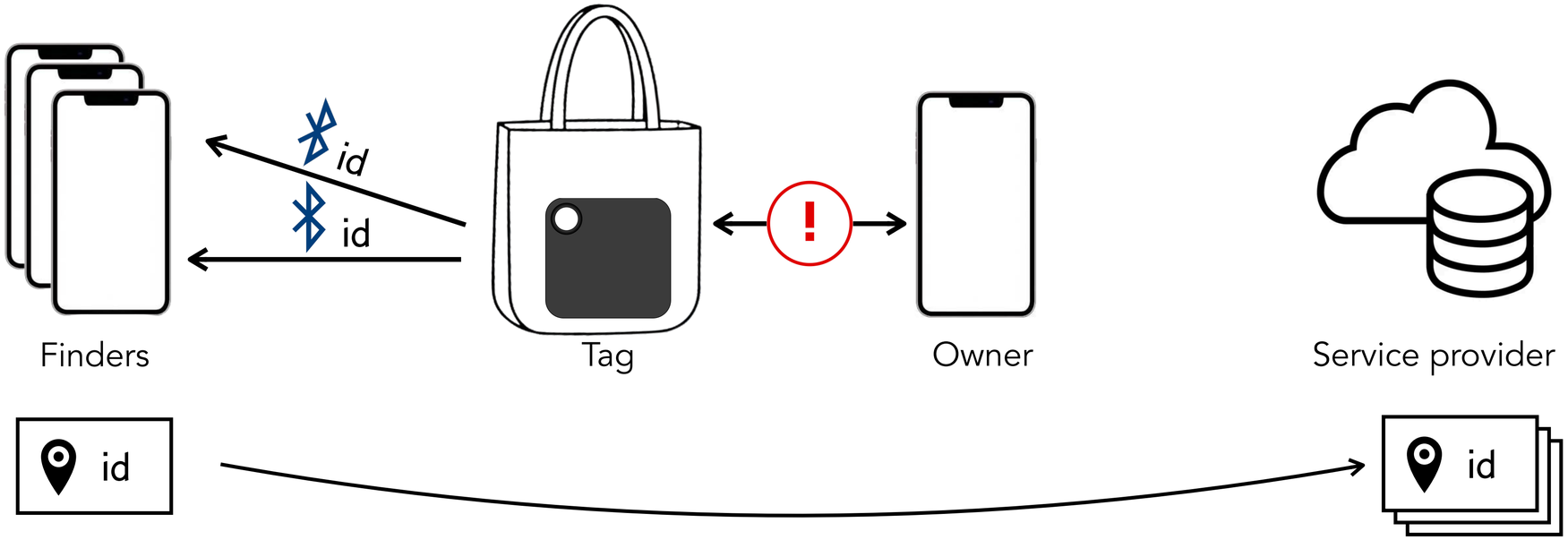

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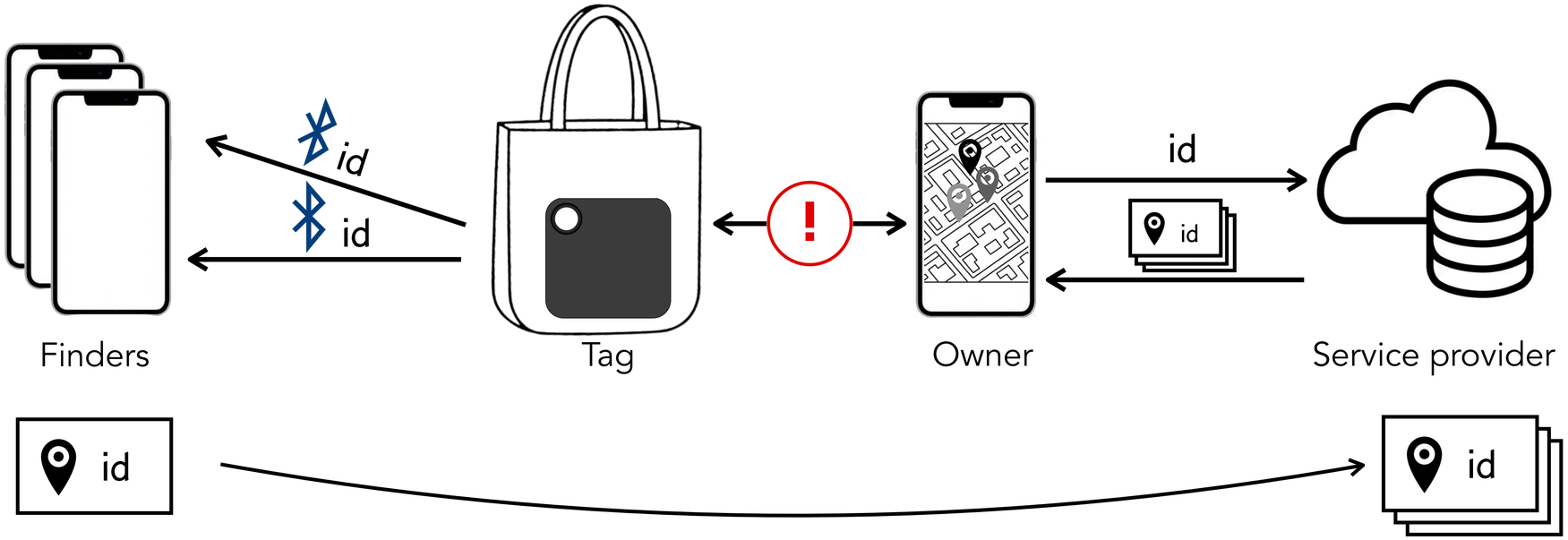

A complex cryptographic landscape: Privacy-antitheft-safety tensions

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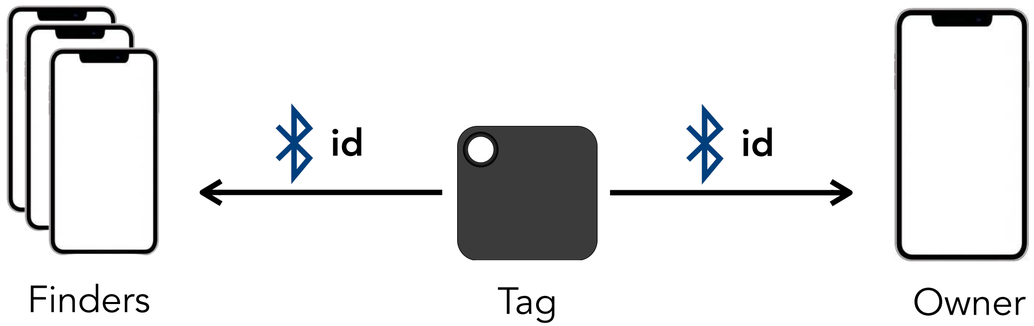

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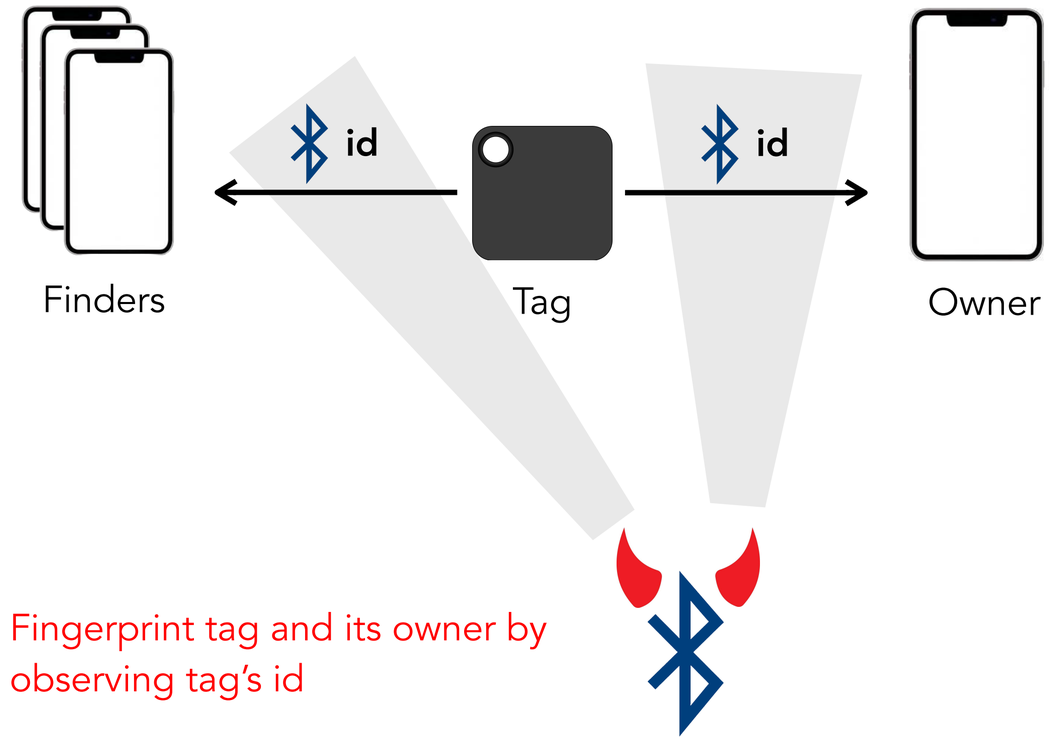

Fingerprint tag and its owner by observing tag's id

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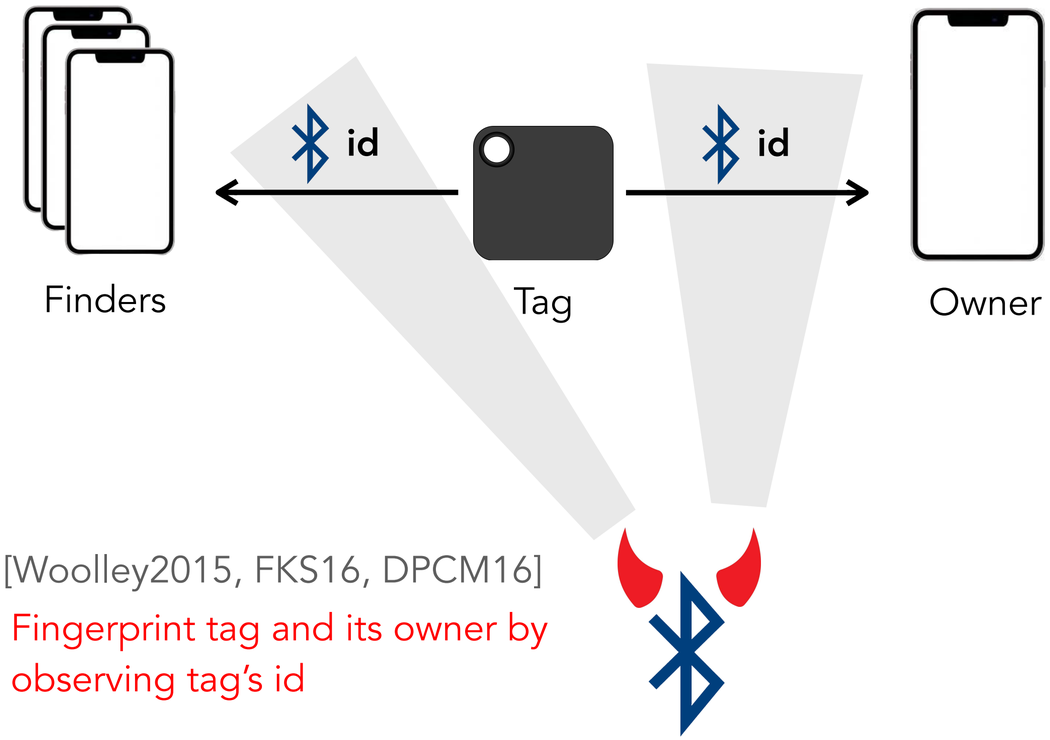

[Woolley2015, FKS16, DPCM16]

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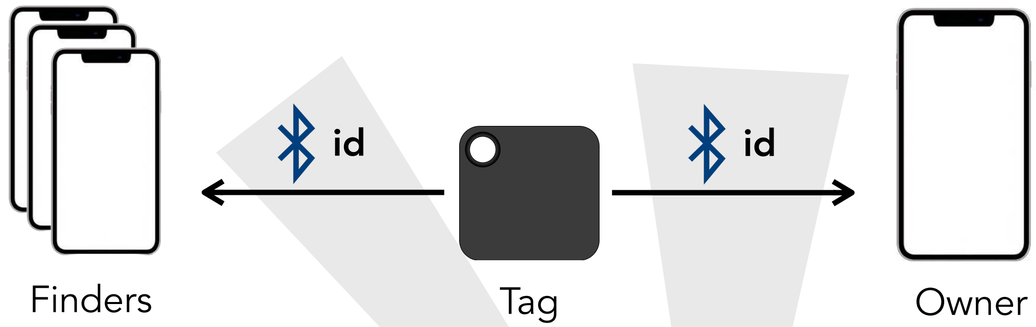

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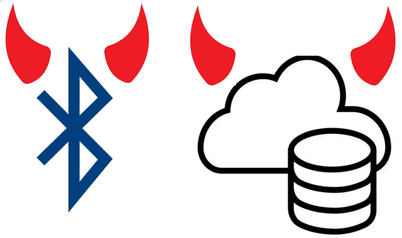

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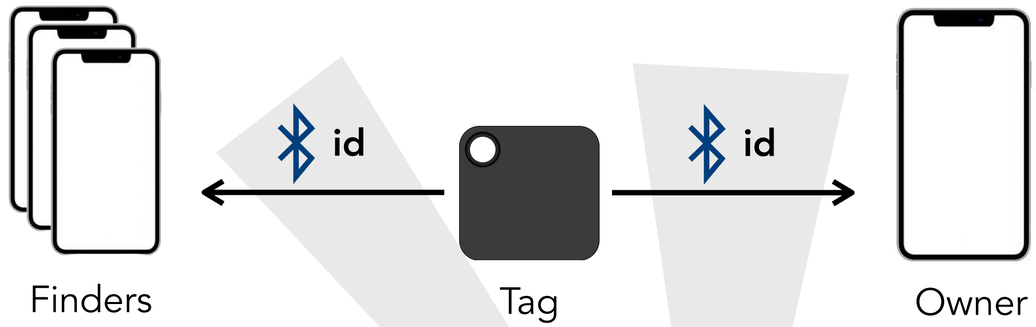

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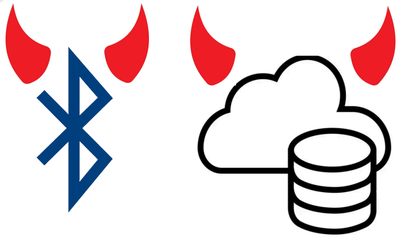

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Hard for Bluetooth attacker and server to link identifiers broadcast by a tag

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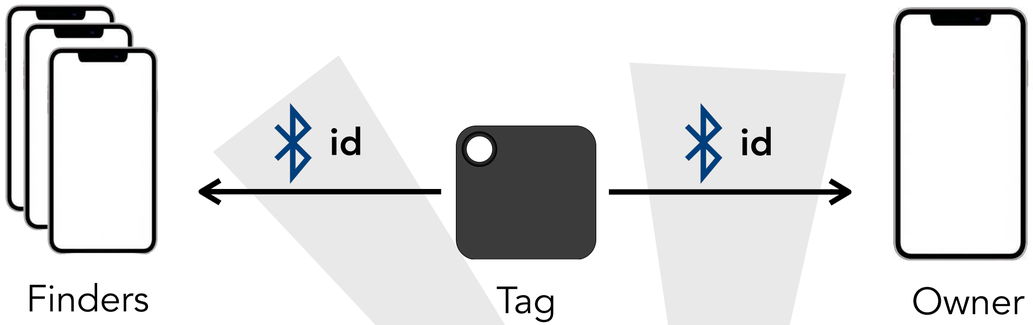

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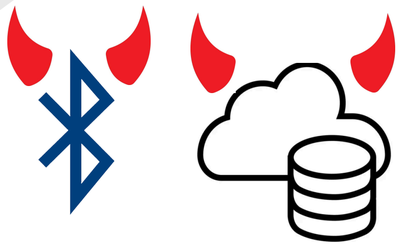

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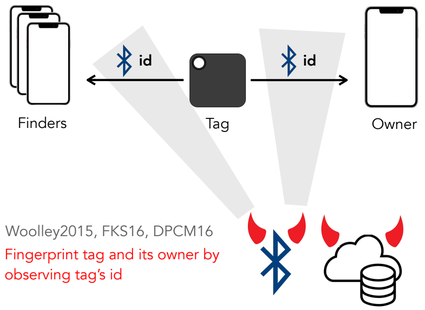

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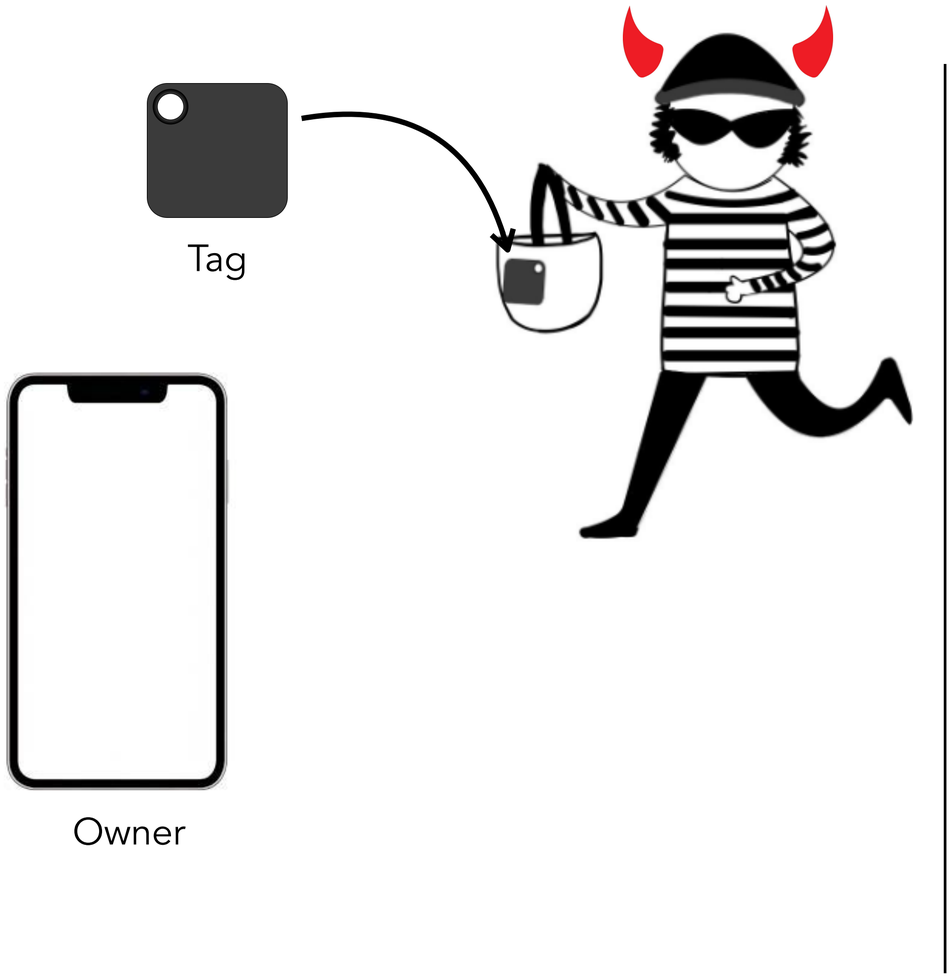

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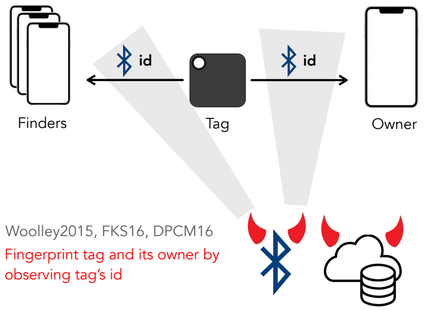

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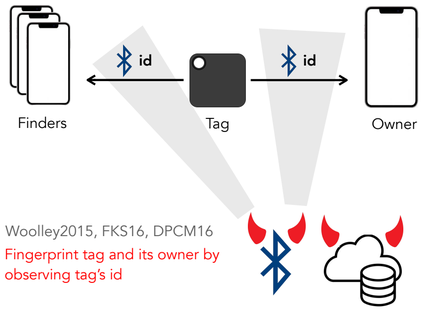

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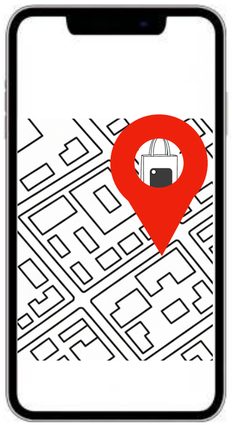

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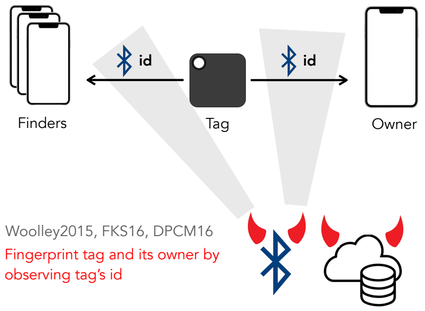

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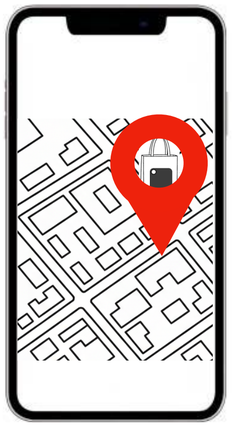

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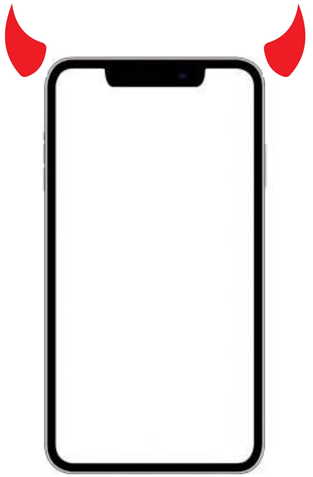

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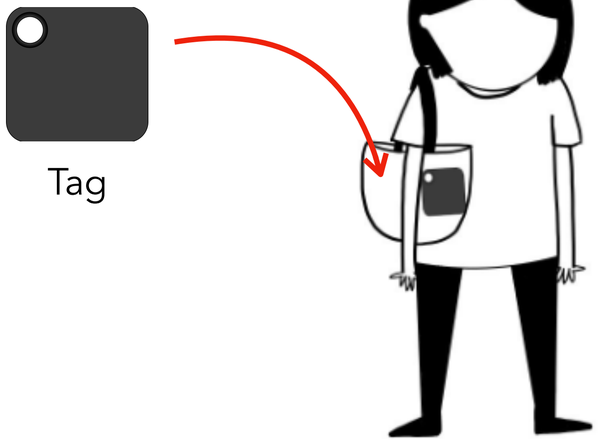

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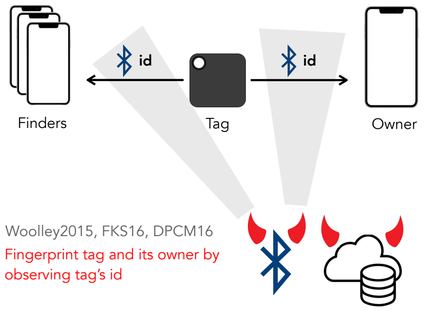

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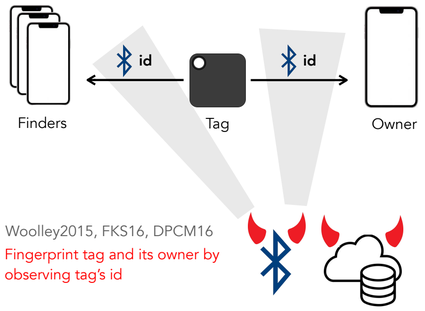

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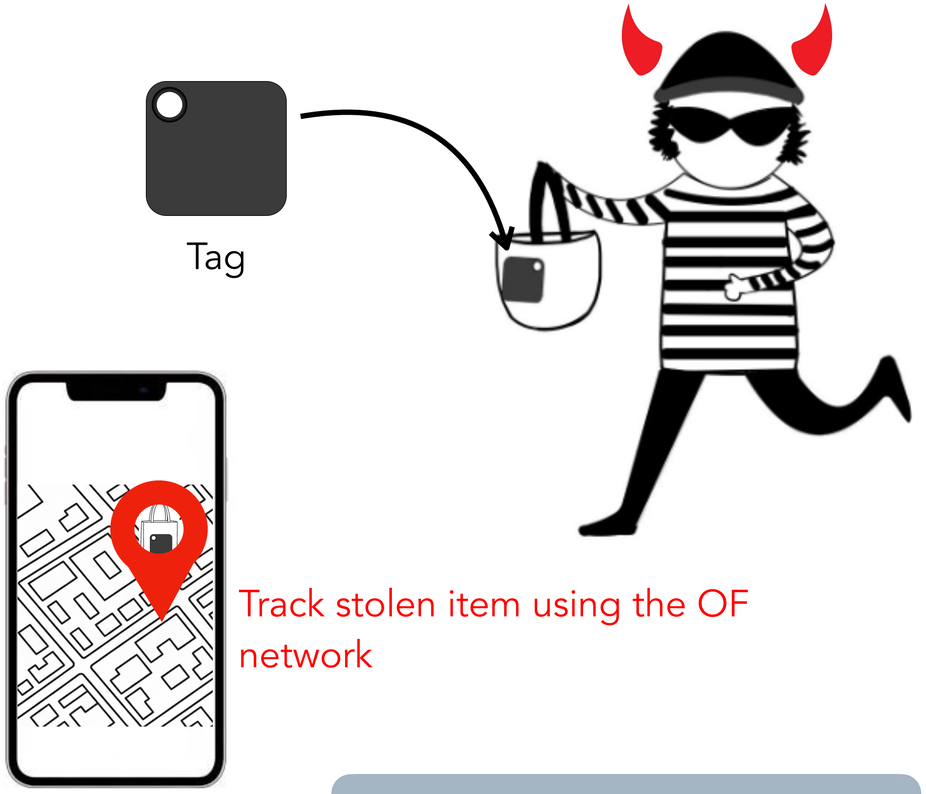

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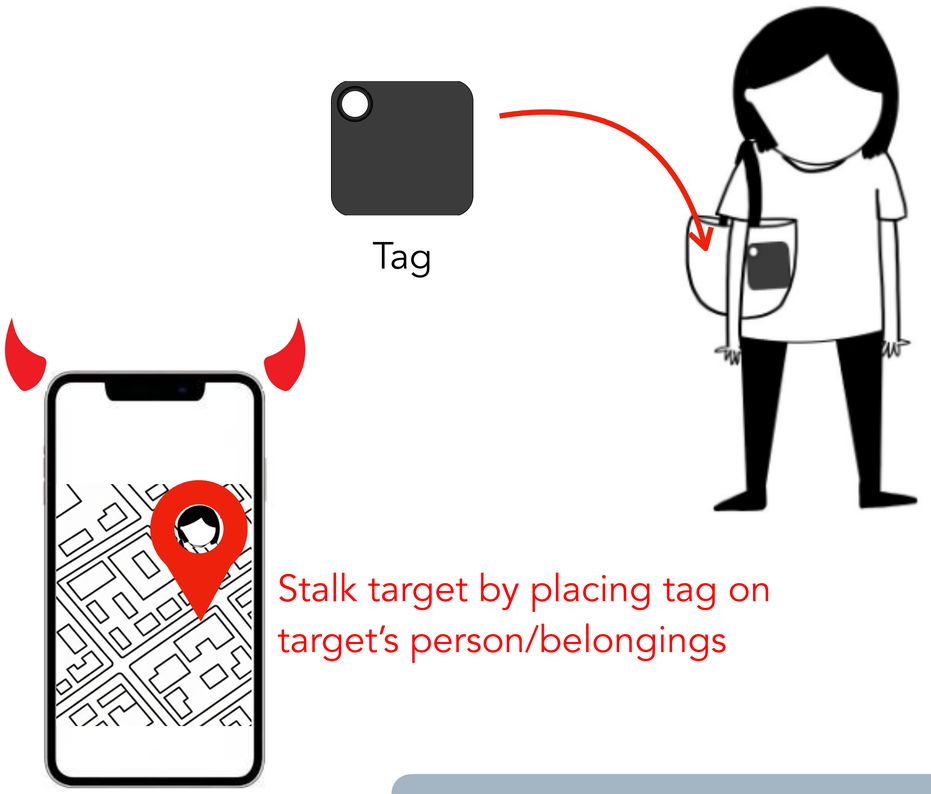

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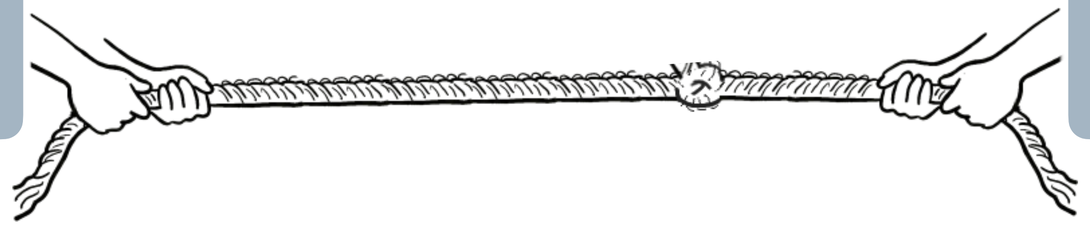

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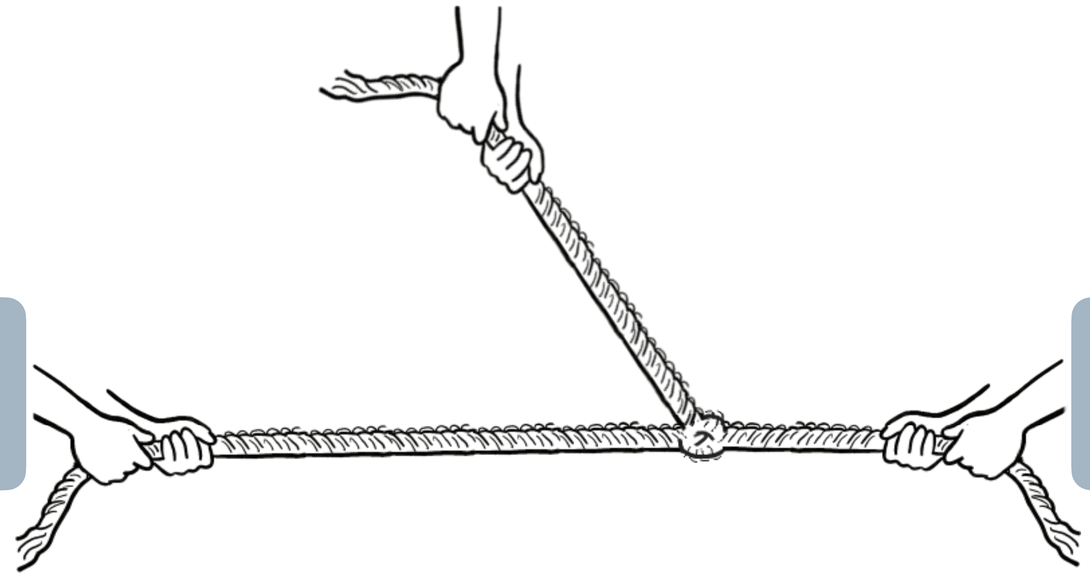

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Tile’s protocol

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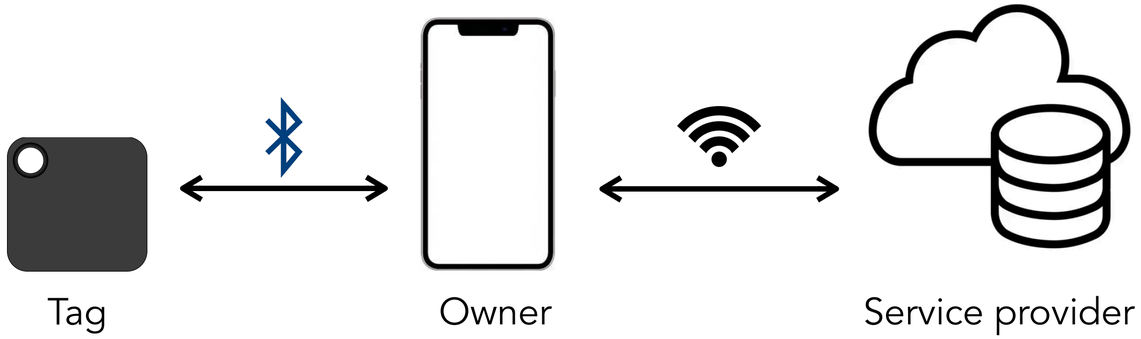

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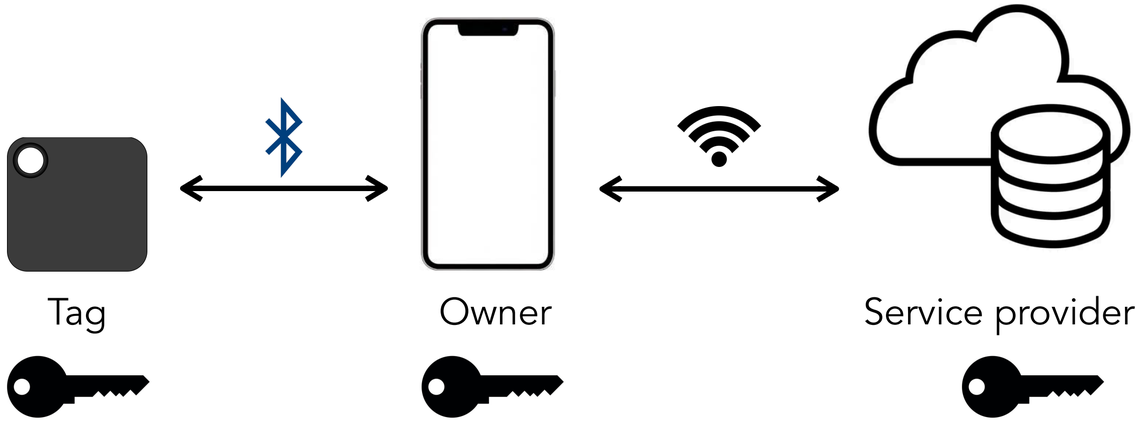
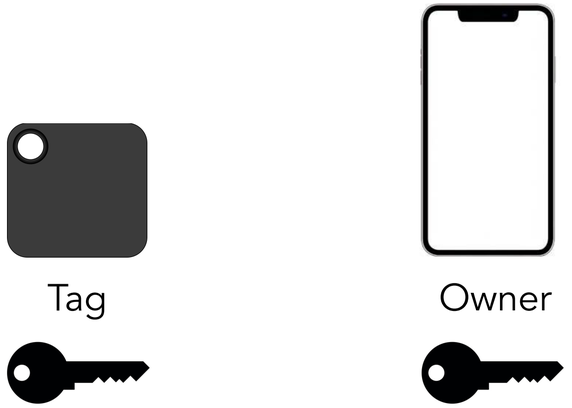


Tile’s protocol

2. Post-pairing interactions



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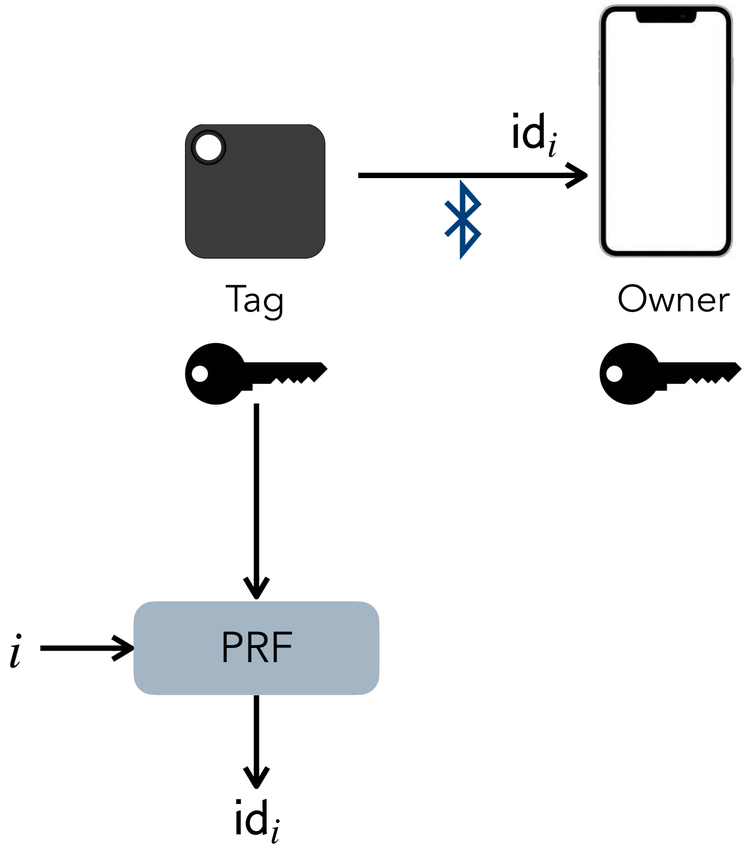

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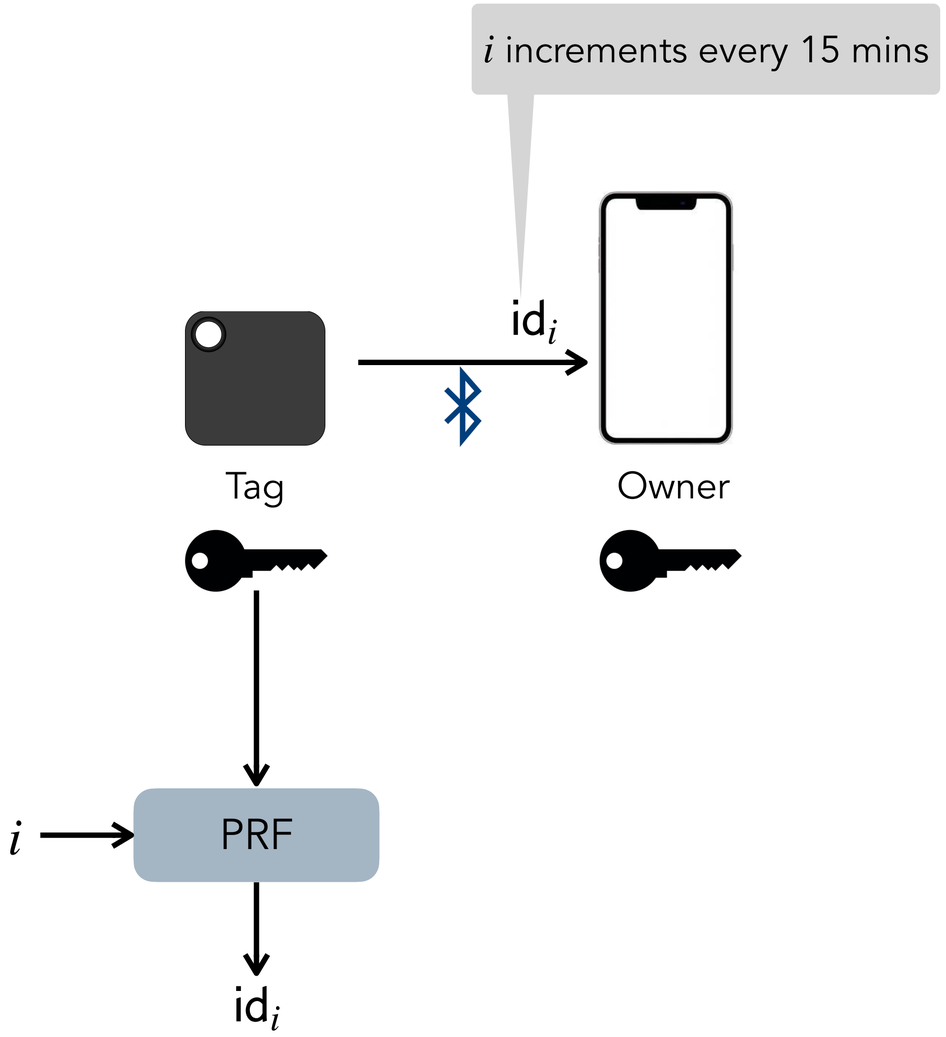

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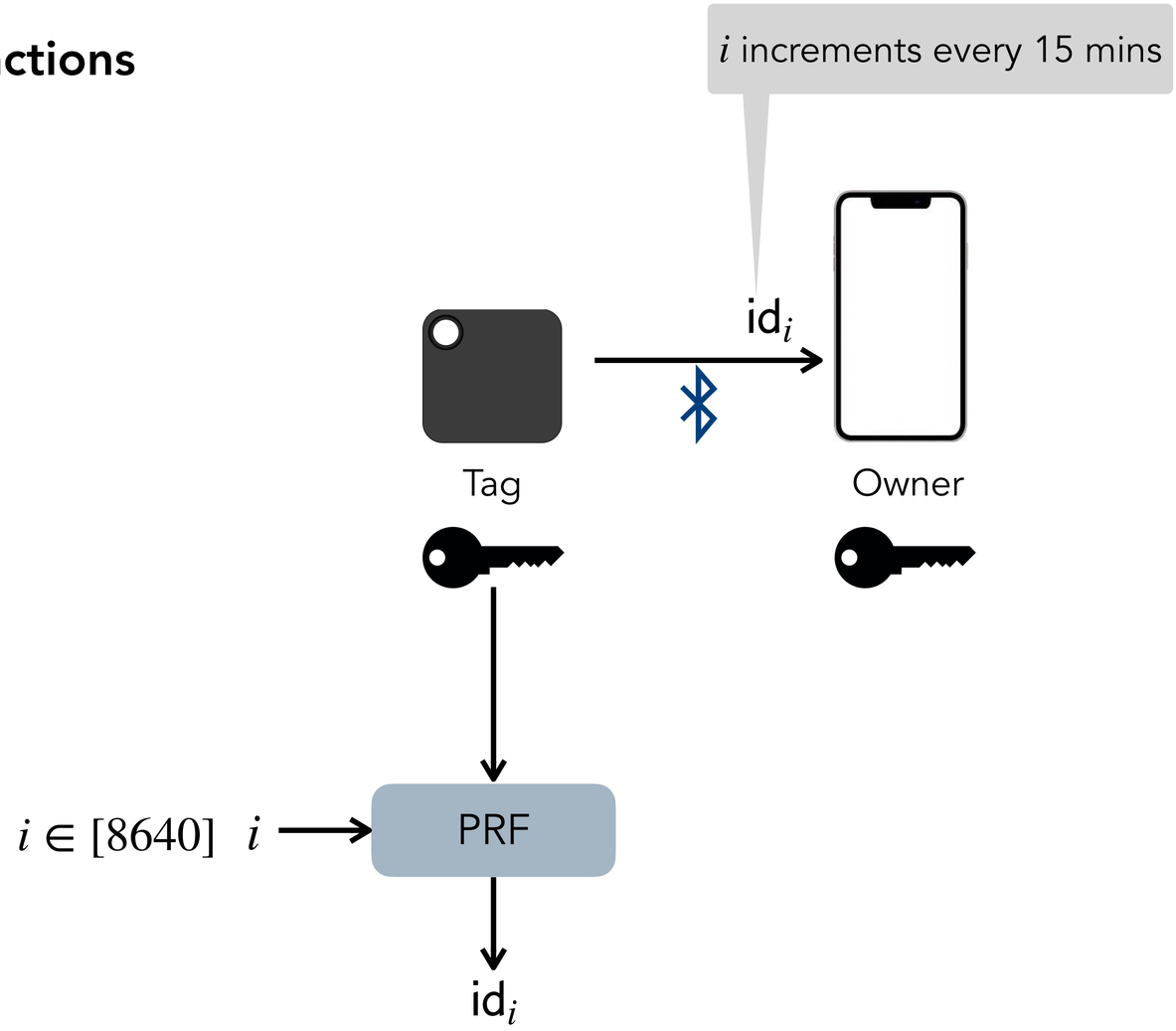

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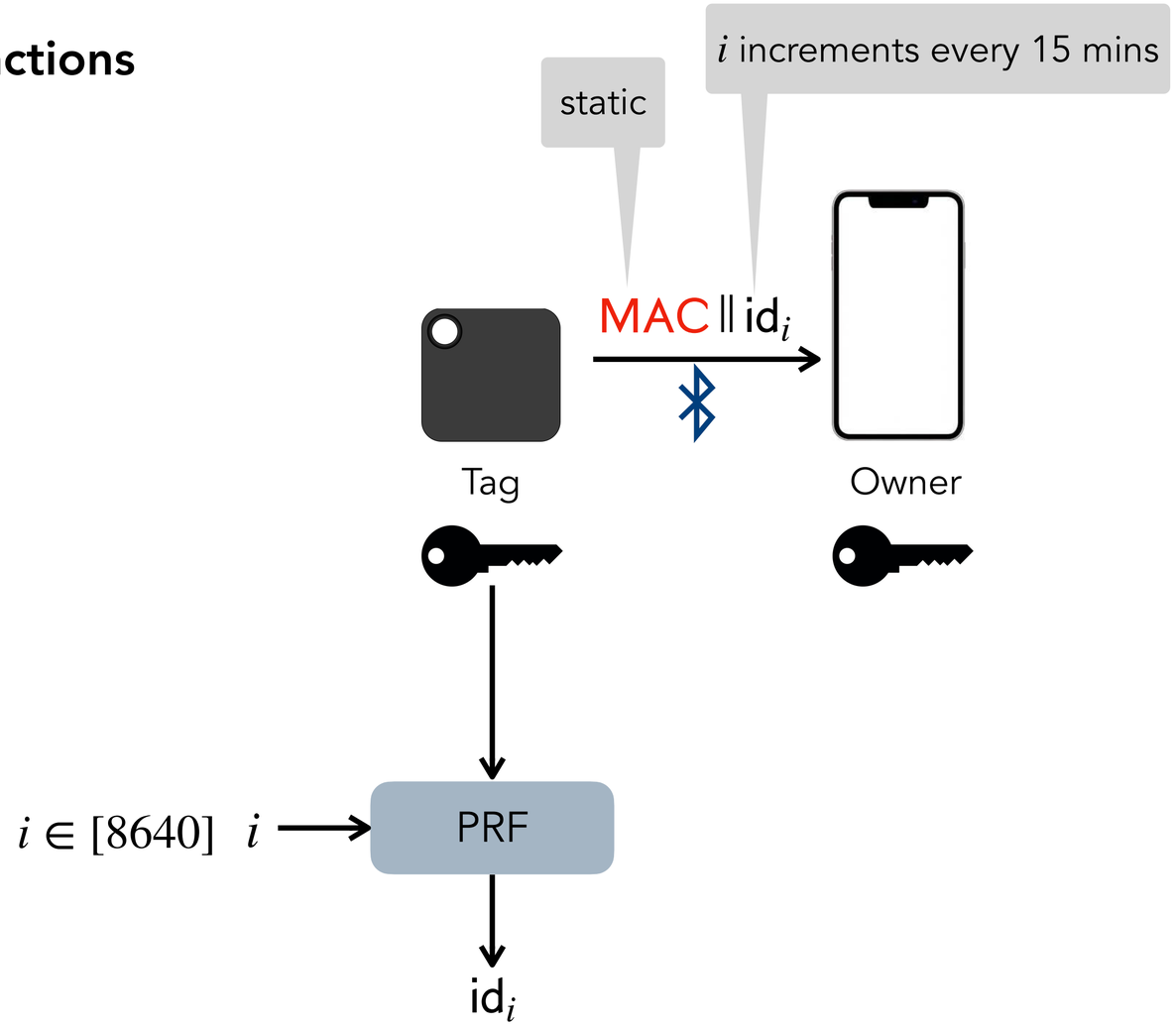

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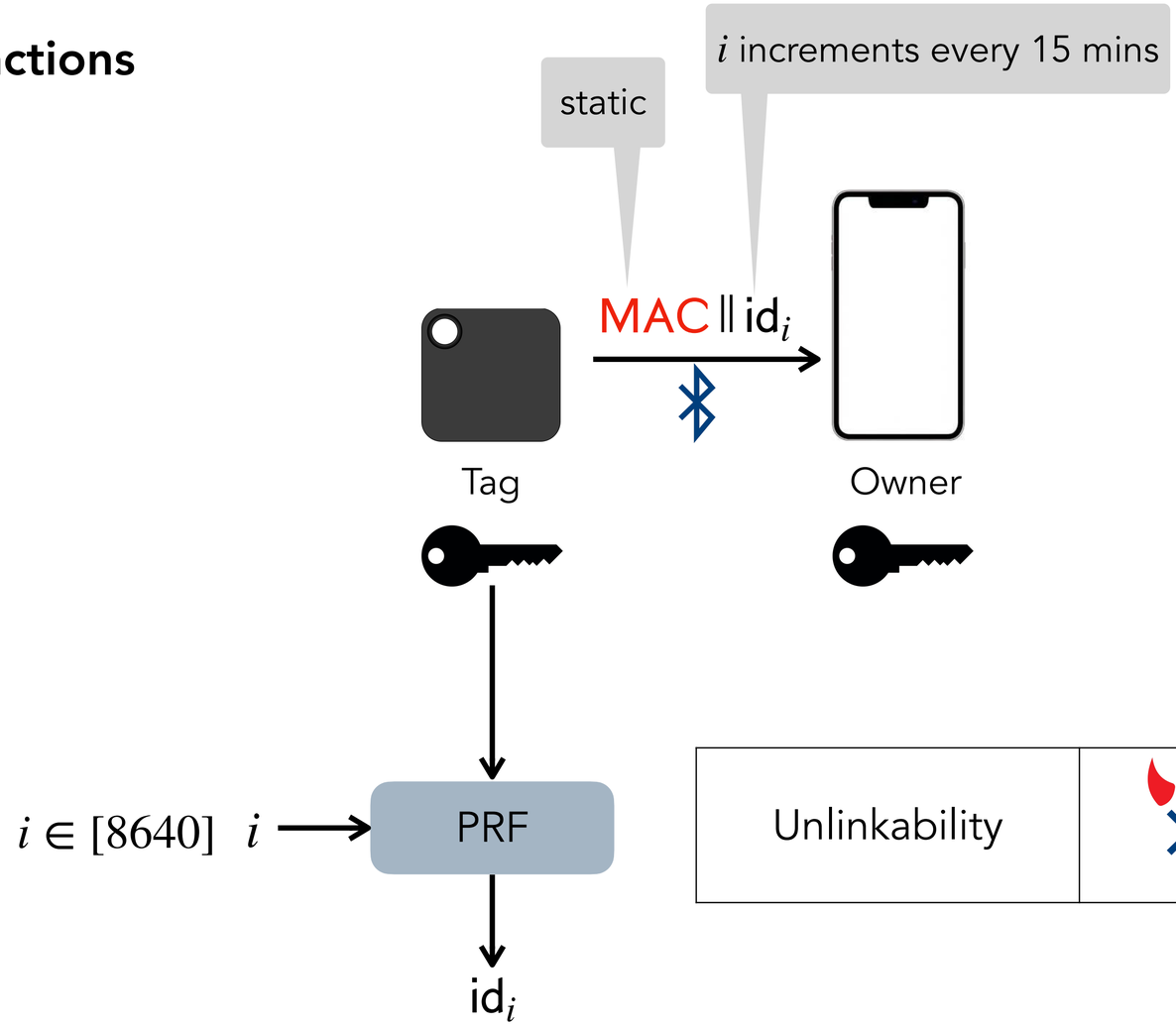

Unlinkability		

Tile's protocol

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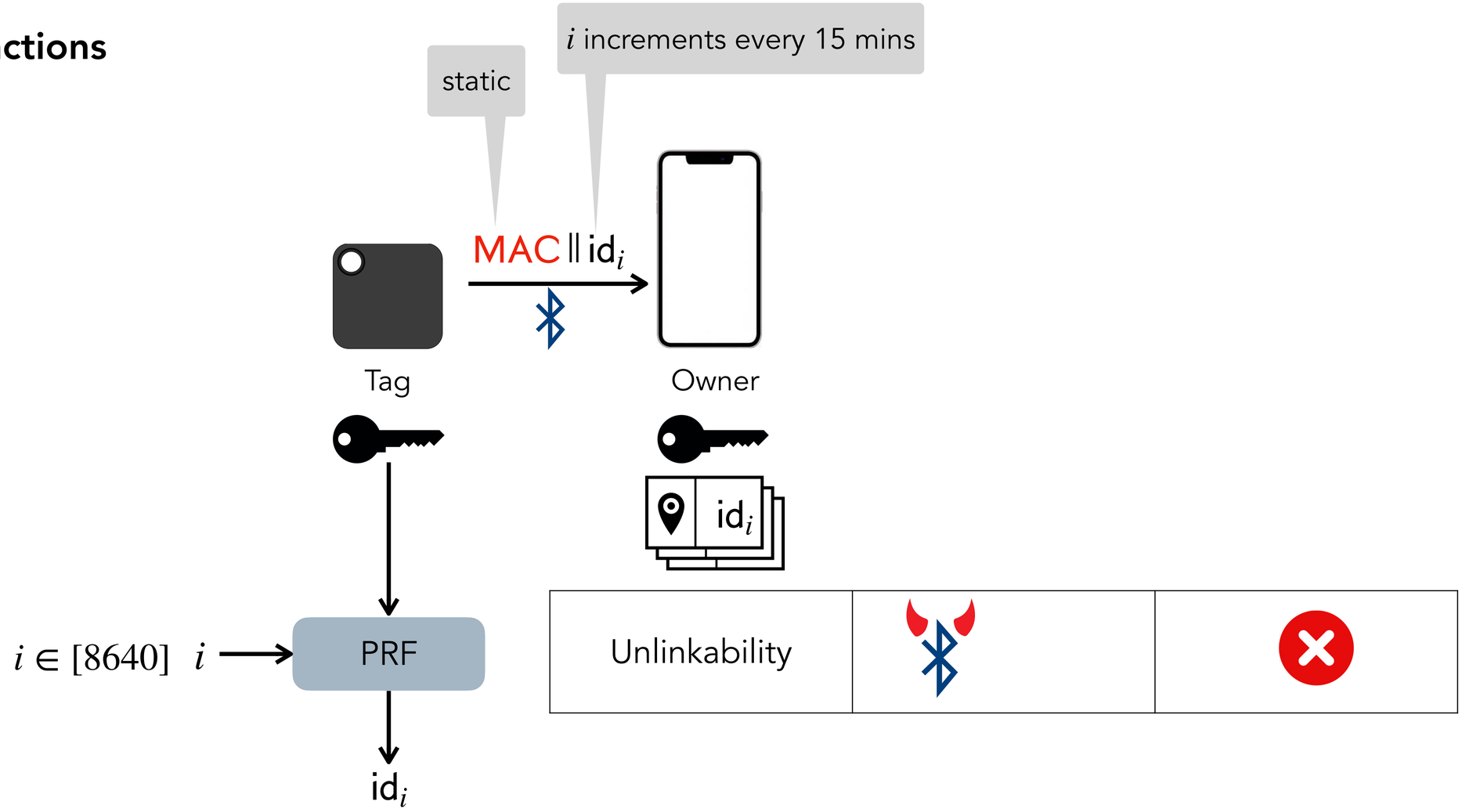

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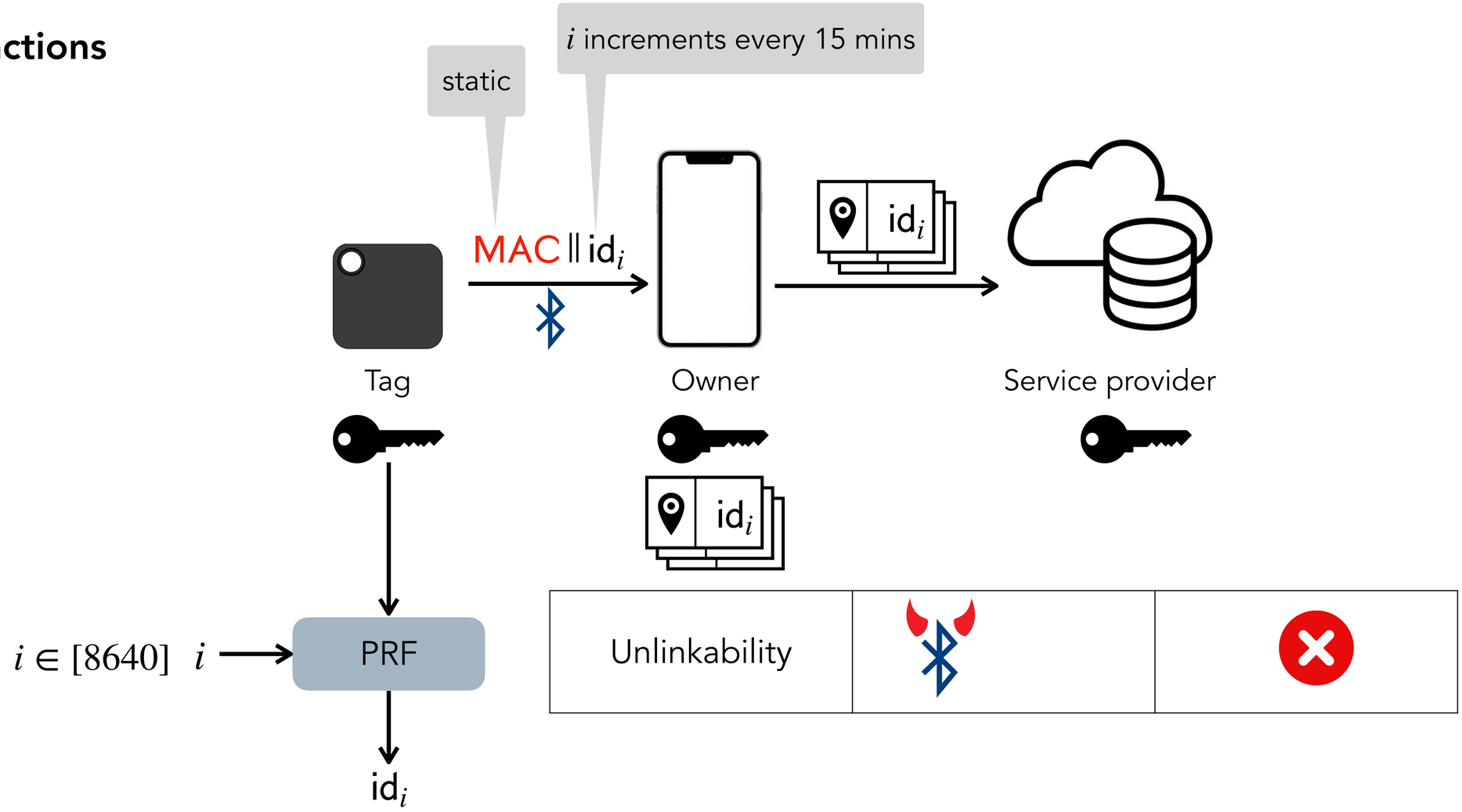

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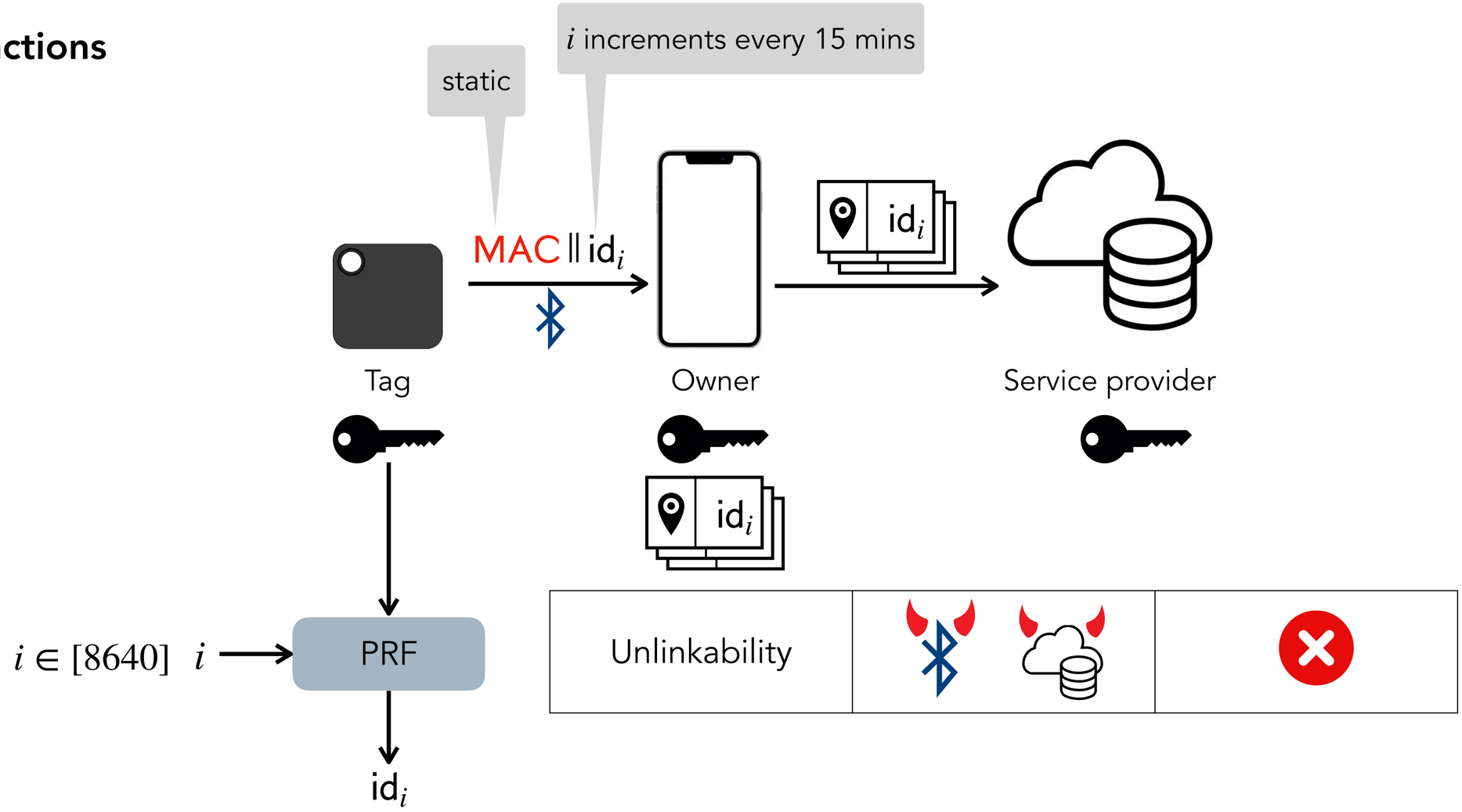

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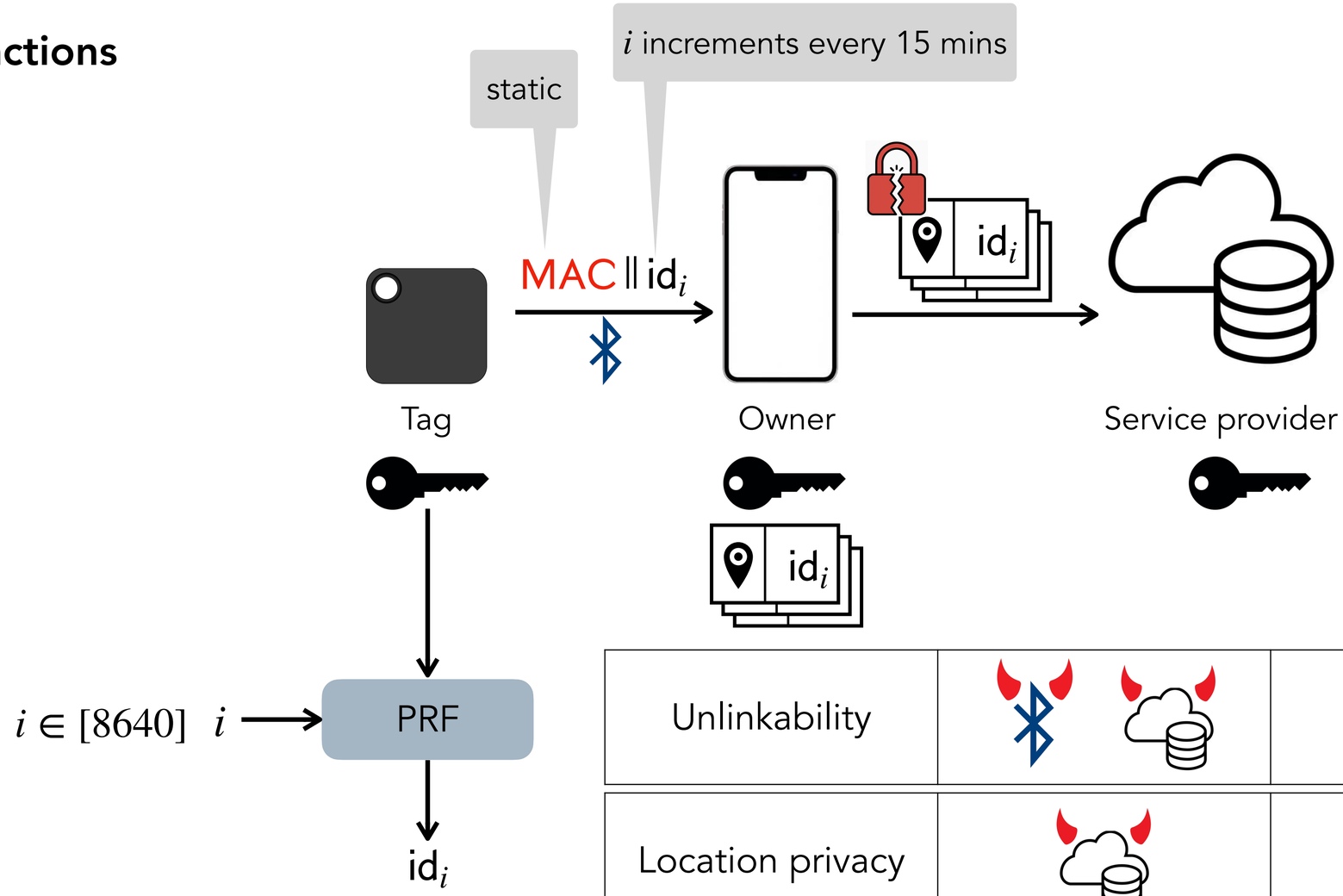

Unlinkability		
Location privacy		

Tile’s protocol

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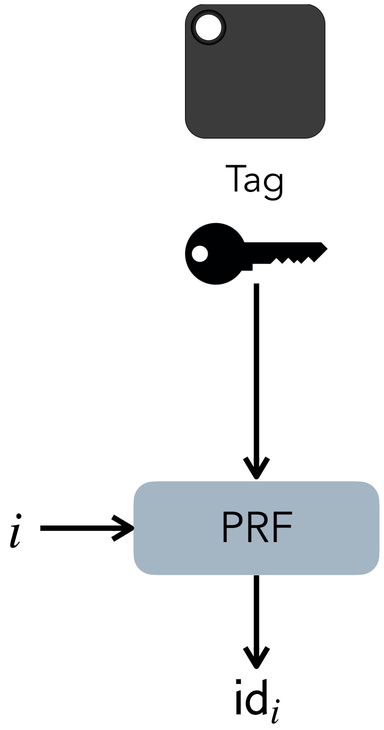

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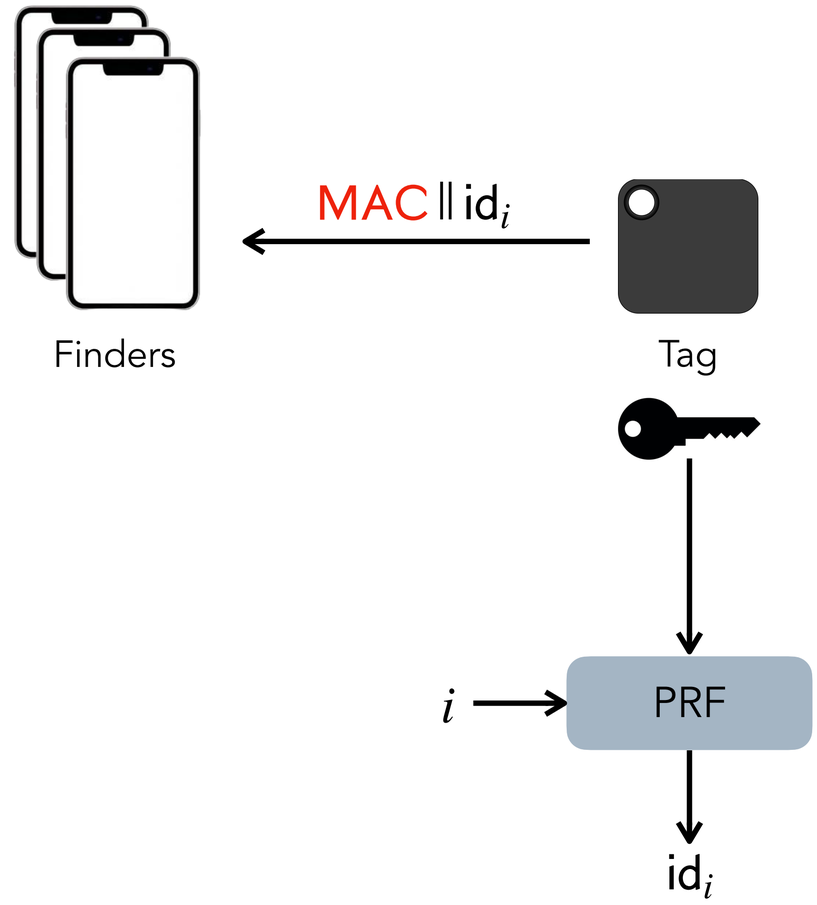

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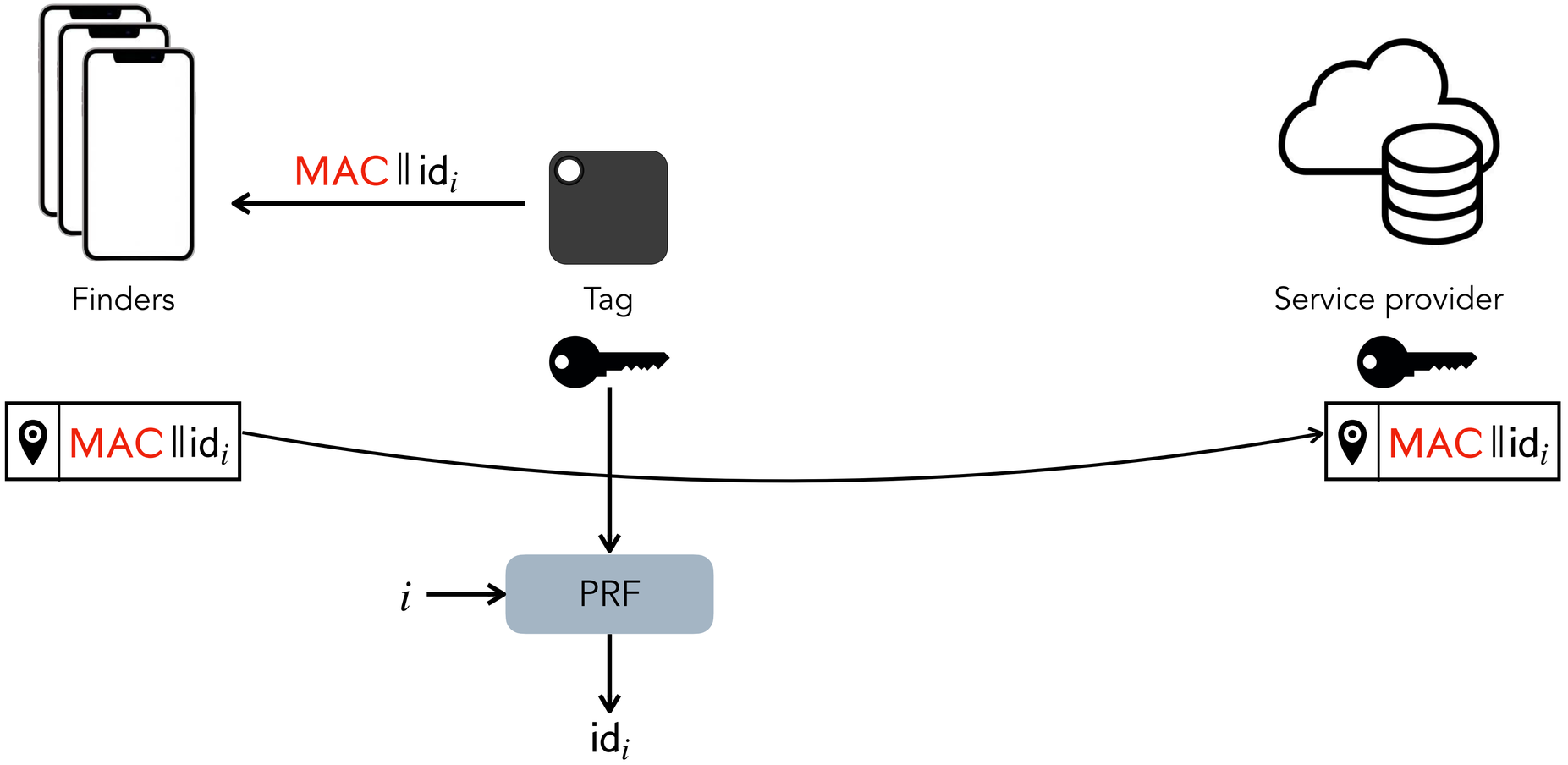

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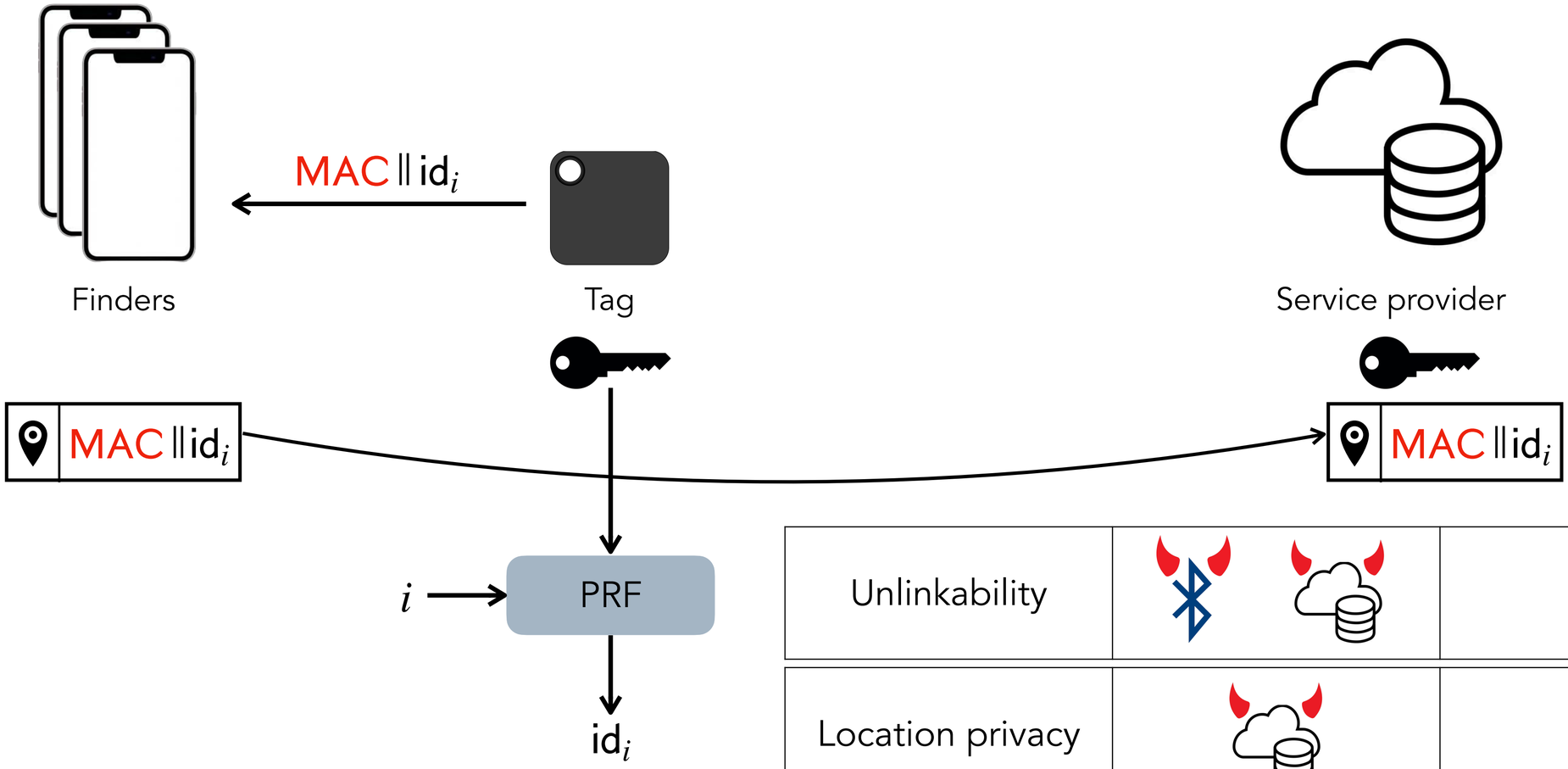
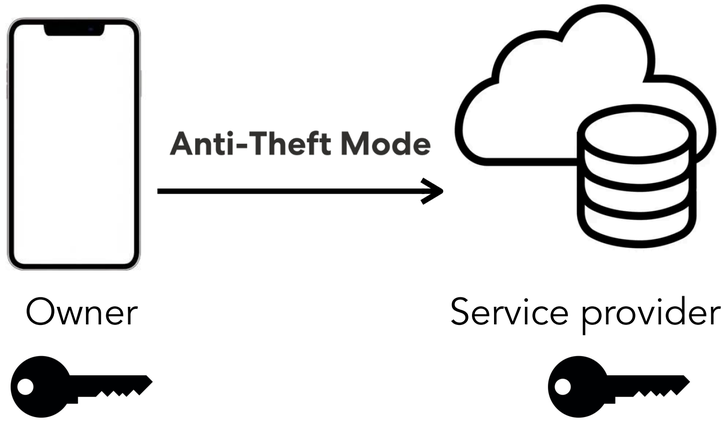


Unlinkability		
Location privacy		

Tile’s protocol

3. The Anti-Theft mode



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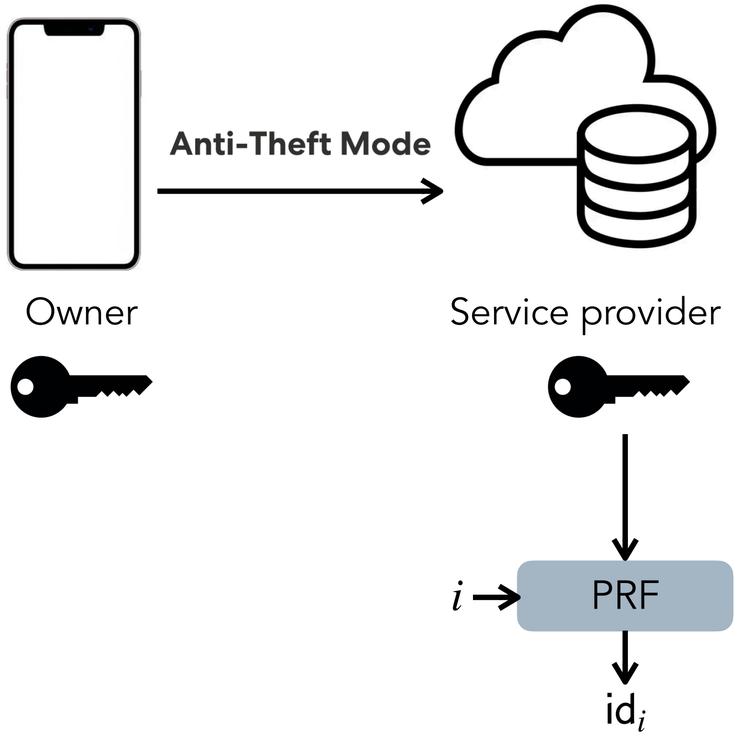

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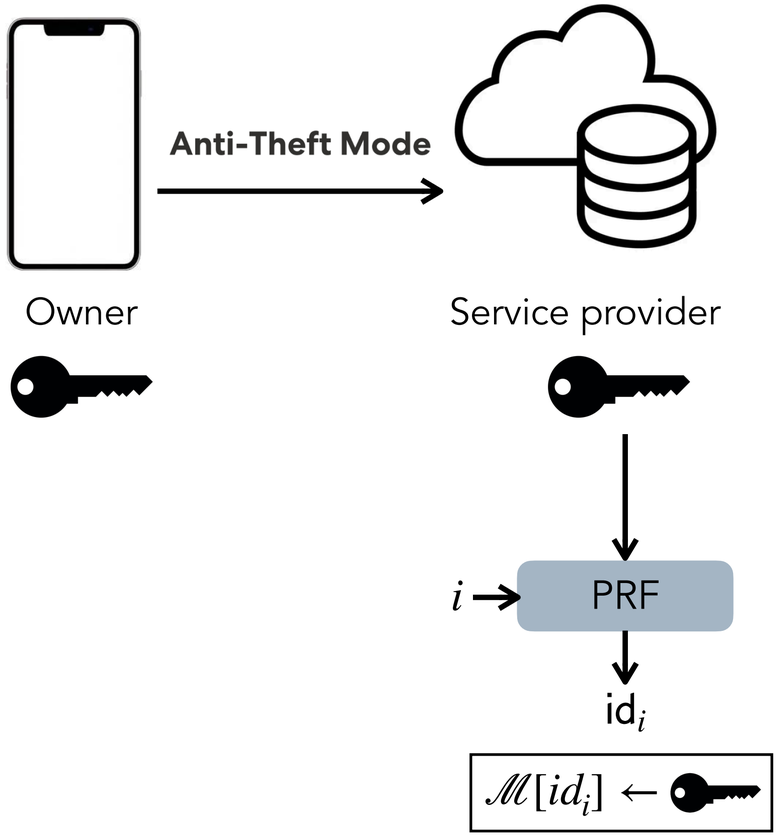

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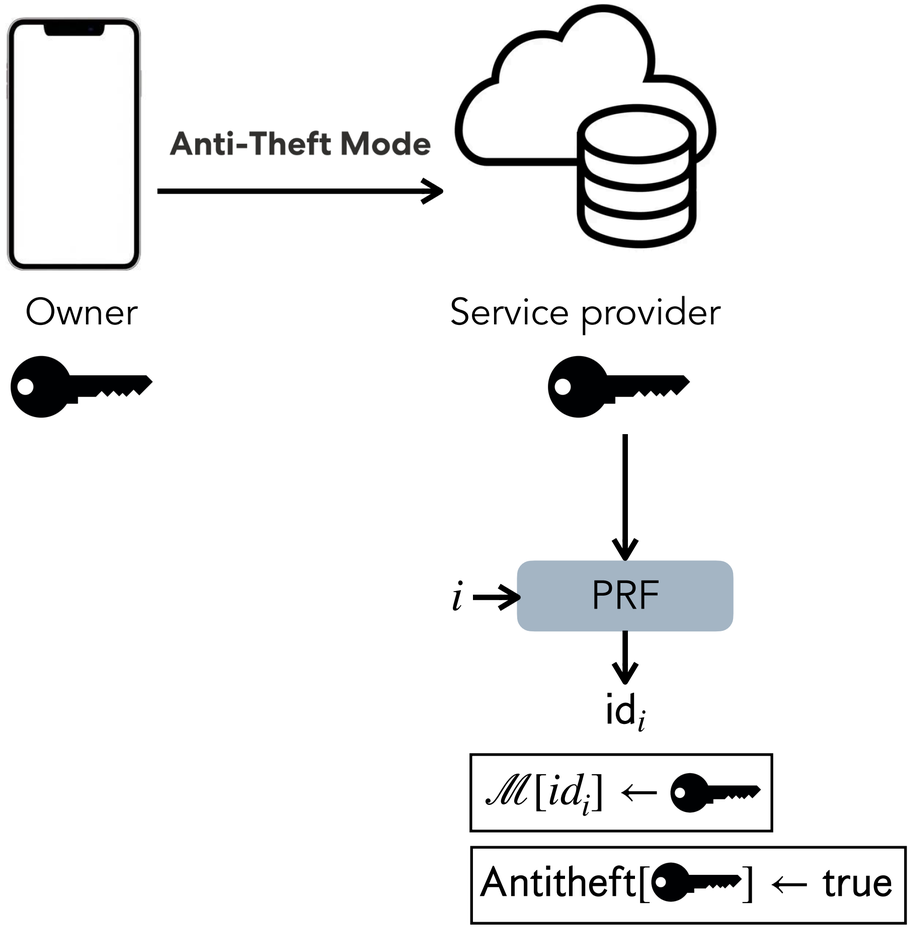

Tile’s protocol

4. Stalking detection



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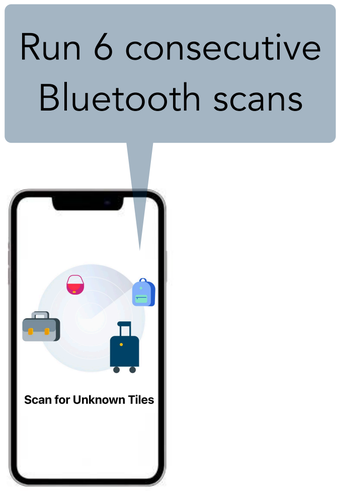

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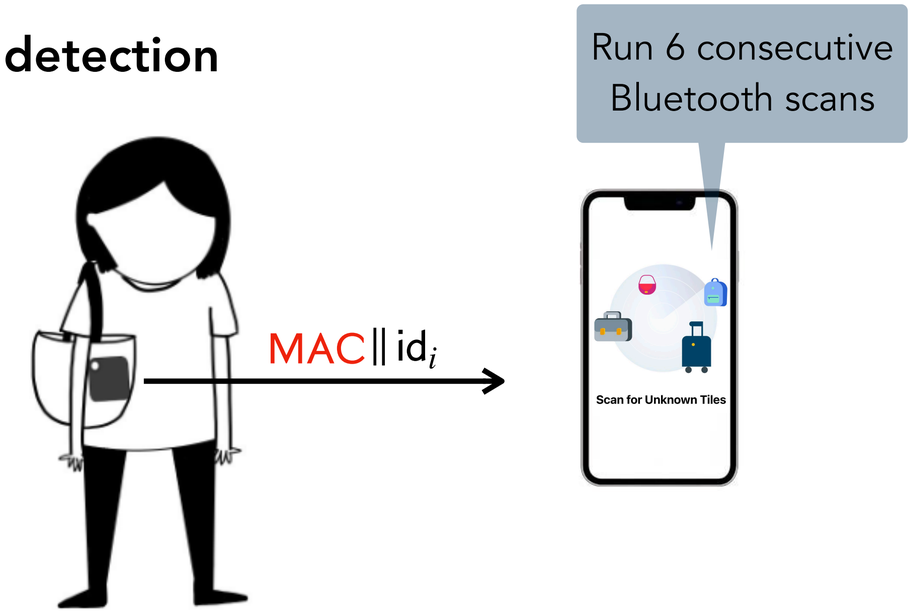

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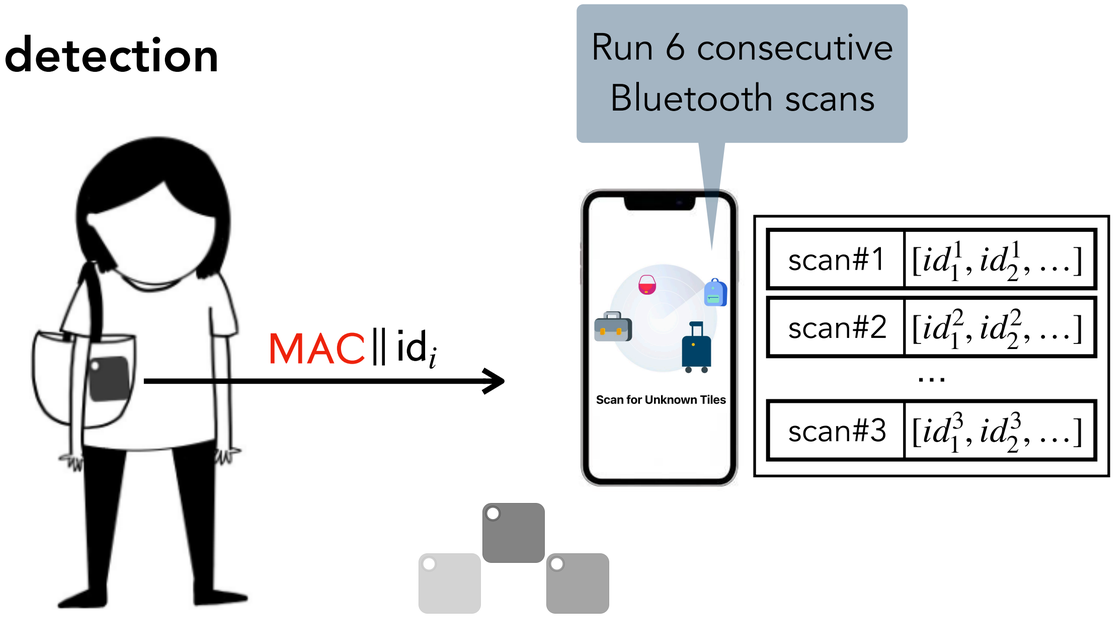

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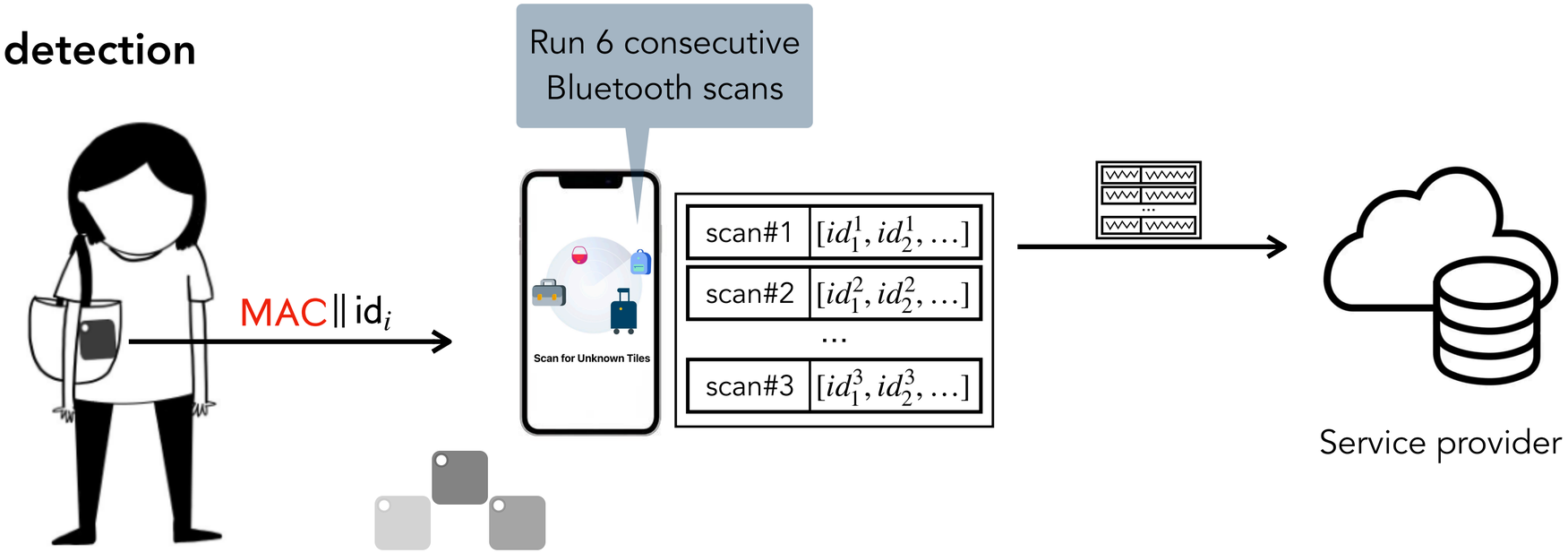

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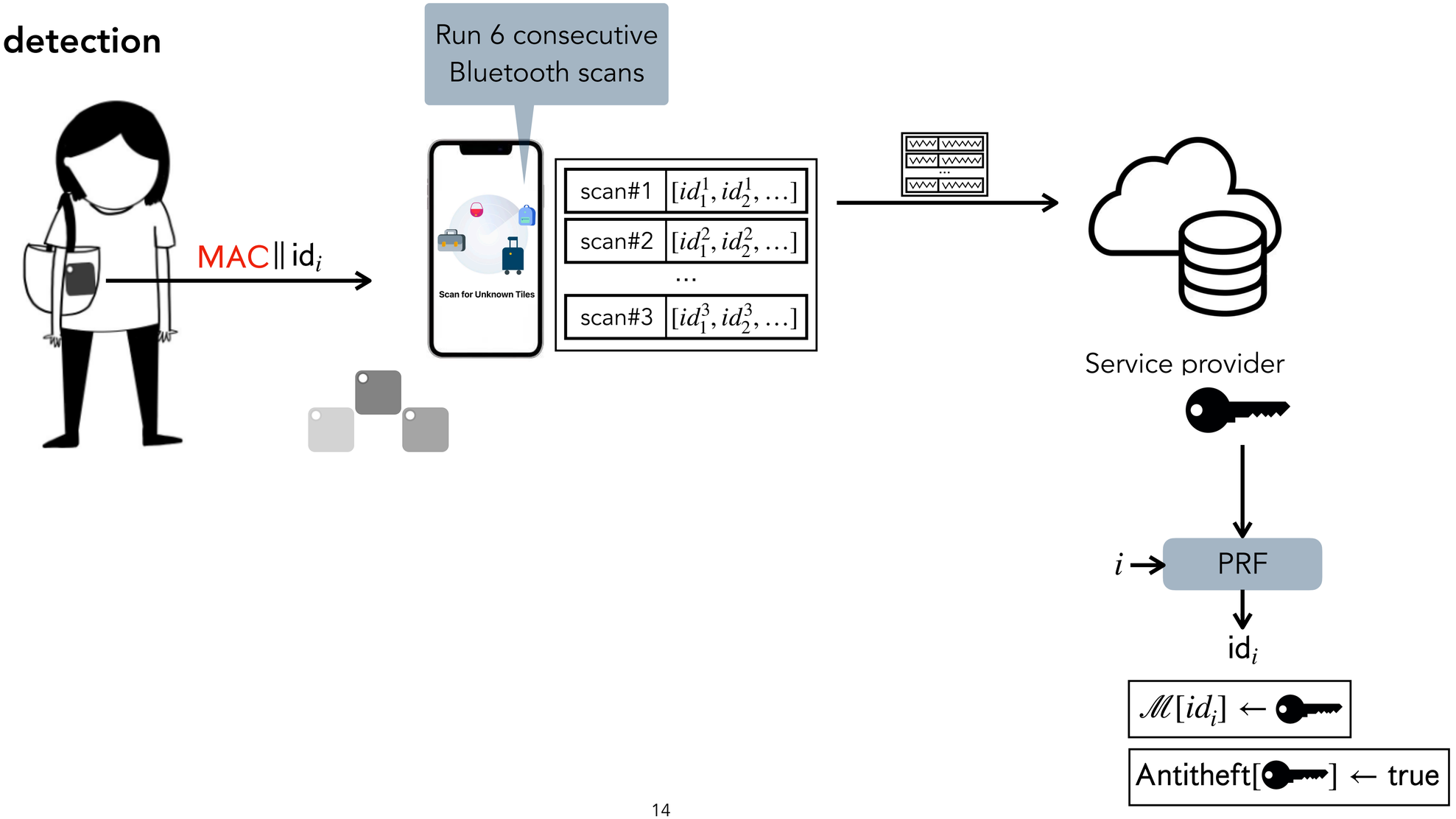

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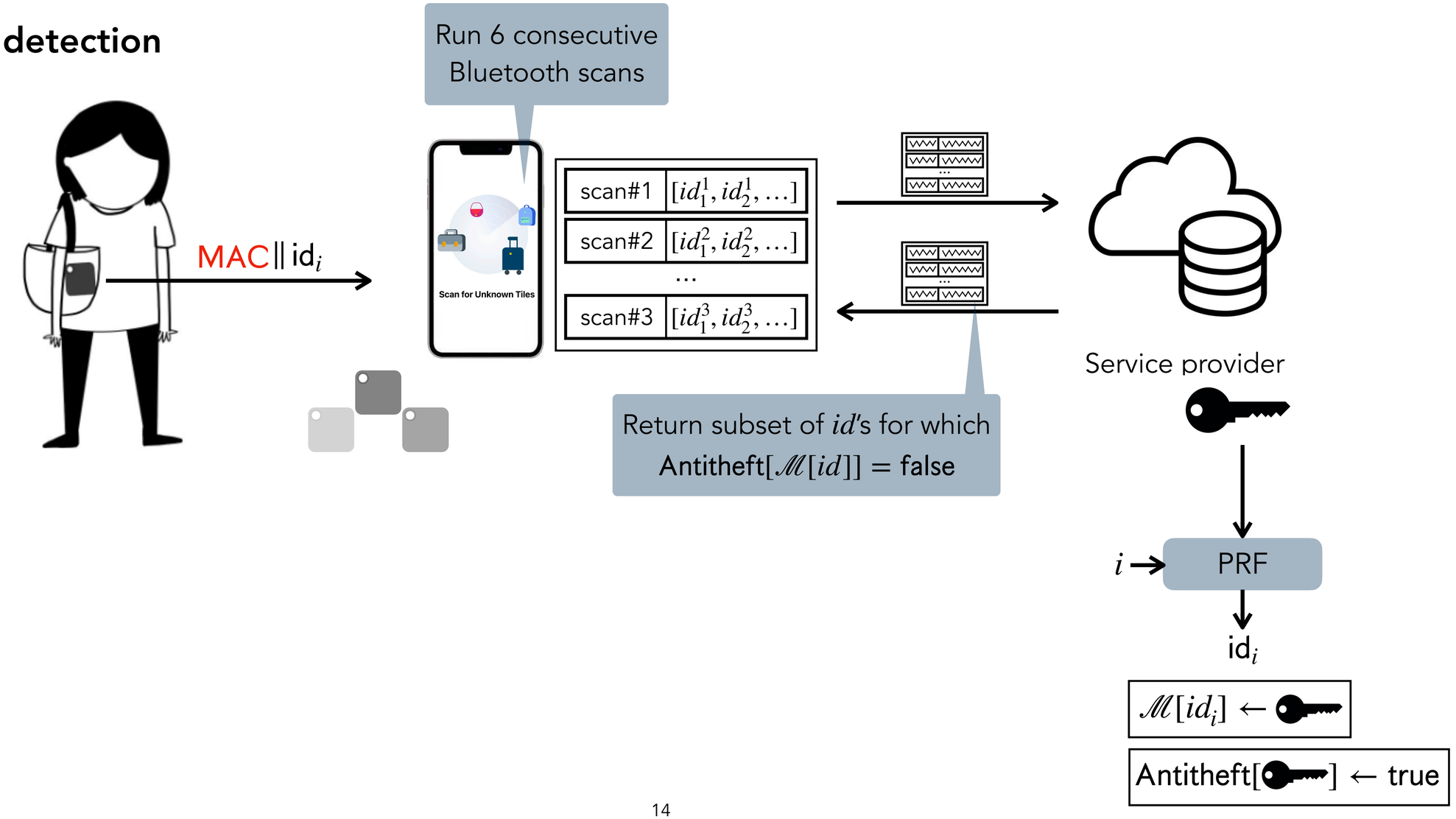

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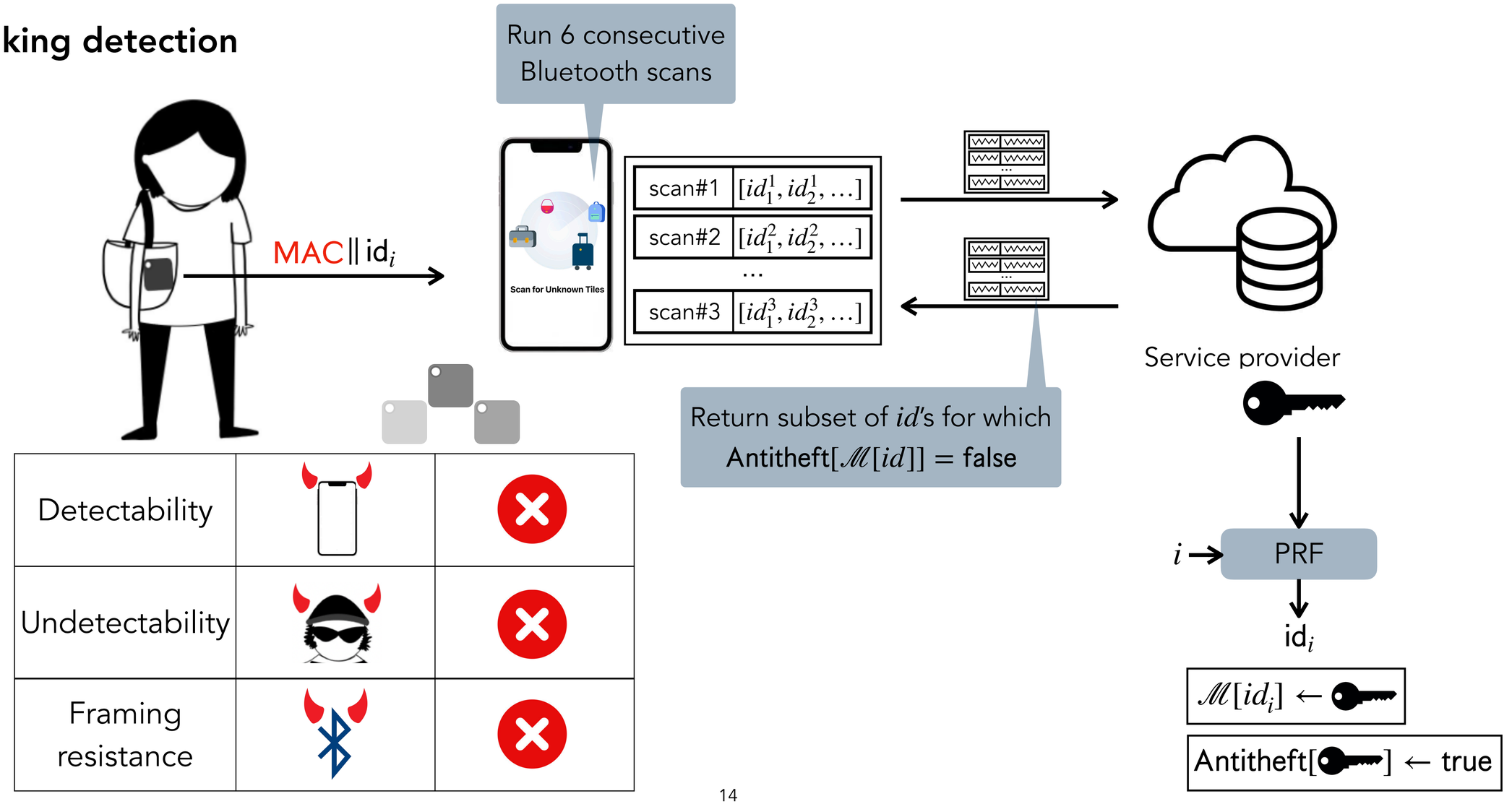

Detectability		
Undetectability		
Framing resistance		

Summary of Tile’s analysis

Privacy ✗

No unlinkability

No location privacy

Safety ✗

Usability concerns with detectability

Detectability relies on lack of privacy

No way to locate detected Tiles

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Privacy ✗

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Usability concerns with detectability

Detectability relies on lack of privacy

No way to locate detected Tiles

Insecurities arise from failure to balance conflicting goals:
(i) unlinkability x detectability
(ii) undetectability x detectability
(Many other things go wrong; details in the paper!)

Takeaways

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2. Tile case study shows what can go wrong

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3. **Prioritize people over stuff:** Anti-theft directly opposed to anti-stalking; should be dropped as a goal
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Akshaya Kumar, Anna Raymaker, Michael A. Specter

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https://tinyurl.com/TileAnalysis

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