# On the Privacy of Real-World Friend-Finder Services

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# Friend-Finder Services

## Friend finders

Popular services that allow their users to discover people that are in the vicinity through their mobile devices

## Position Information

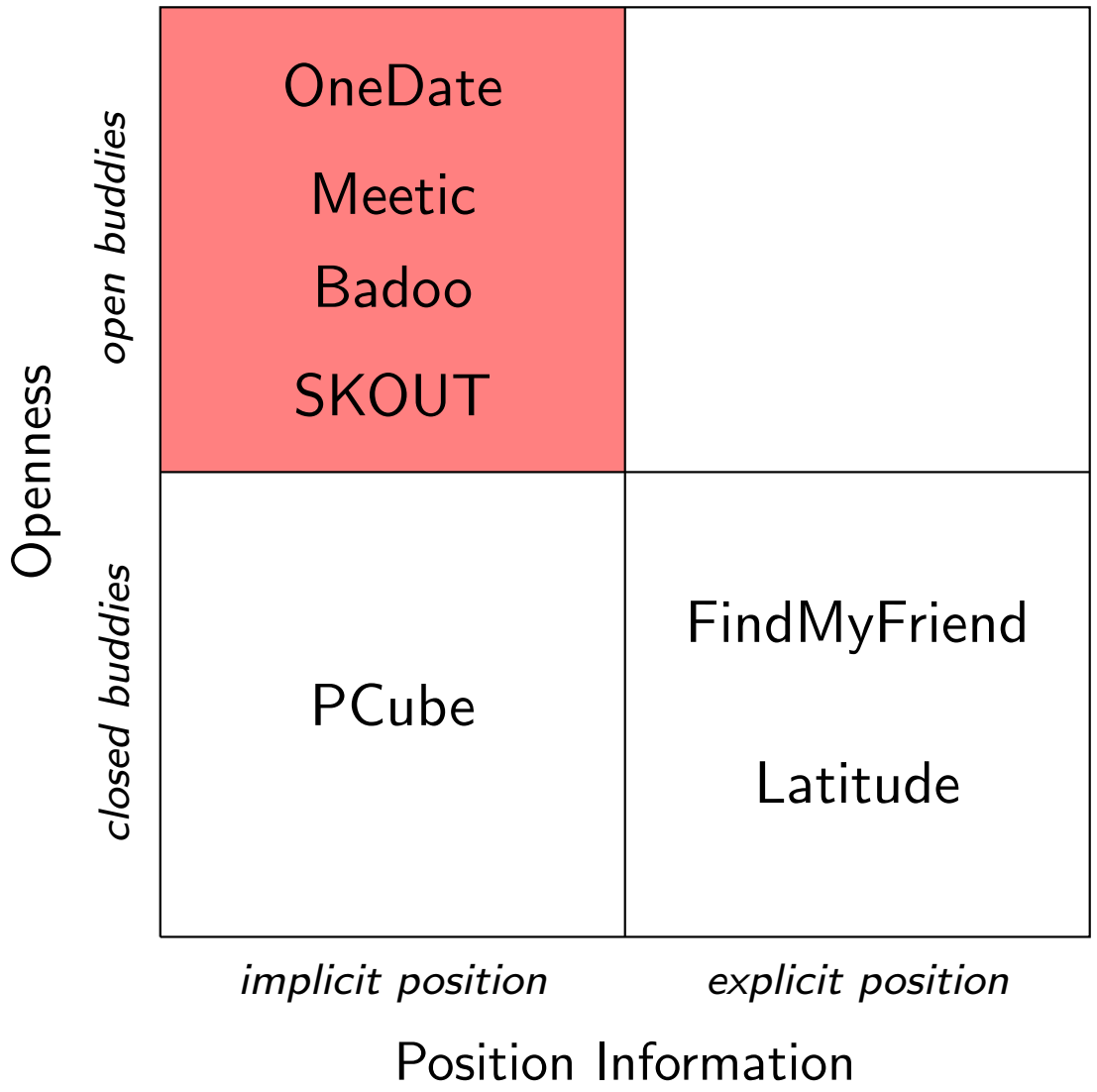
- Explicit position: give *precise* information on users location
- Implicit position: give *only approximate* information
  (e.g., a set of users nearer than a given threshold)

## Openness

- Closed buddies: users can see information of "friends" only
- Open buddies: users can see everybody's information

# Friend-Finder Services

## Classification



# Friend-Finder Services

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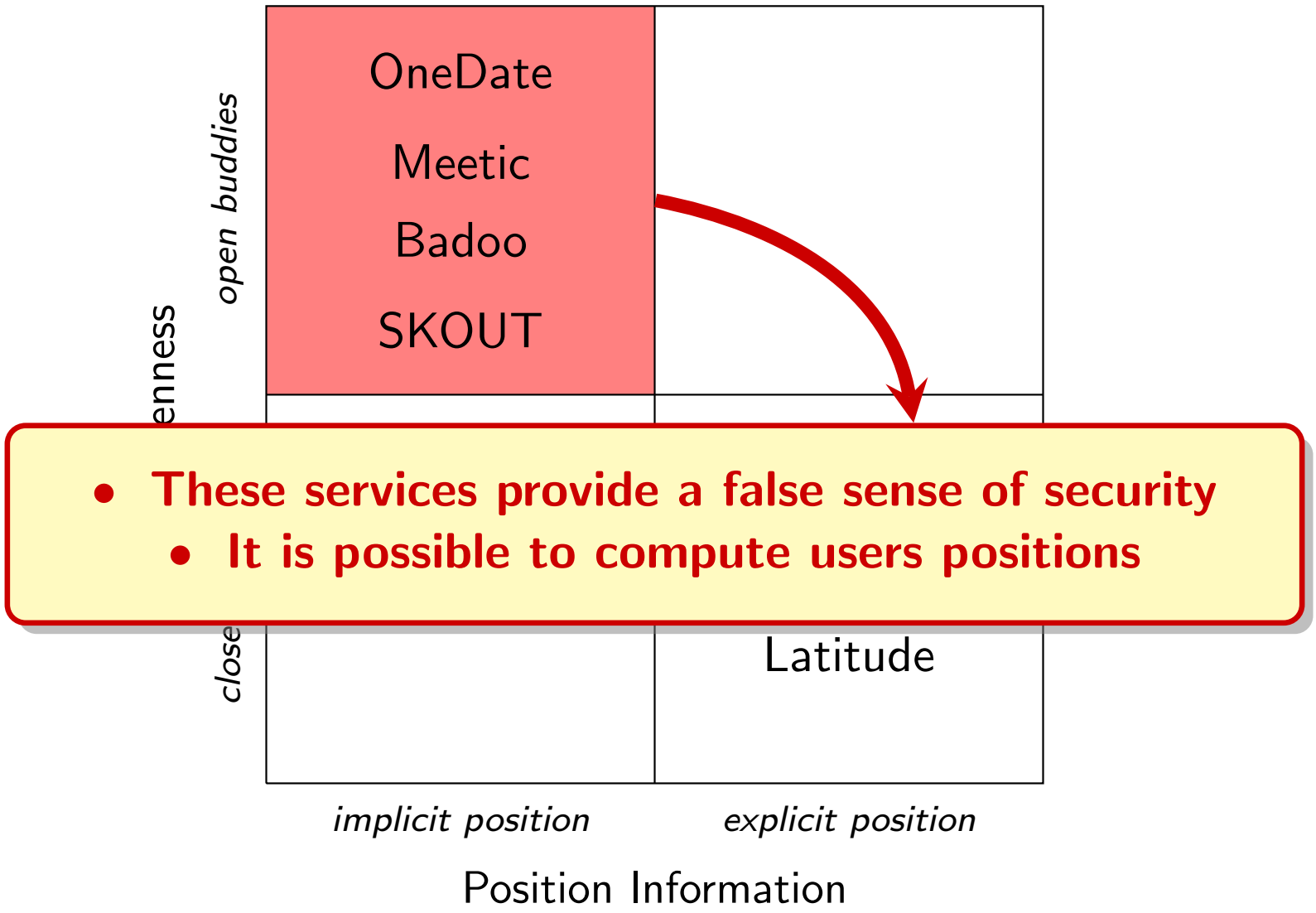



- **These services provide a false sense of security**
- **It is possible to compute users positions**

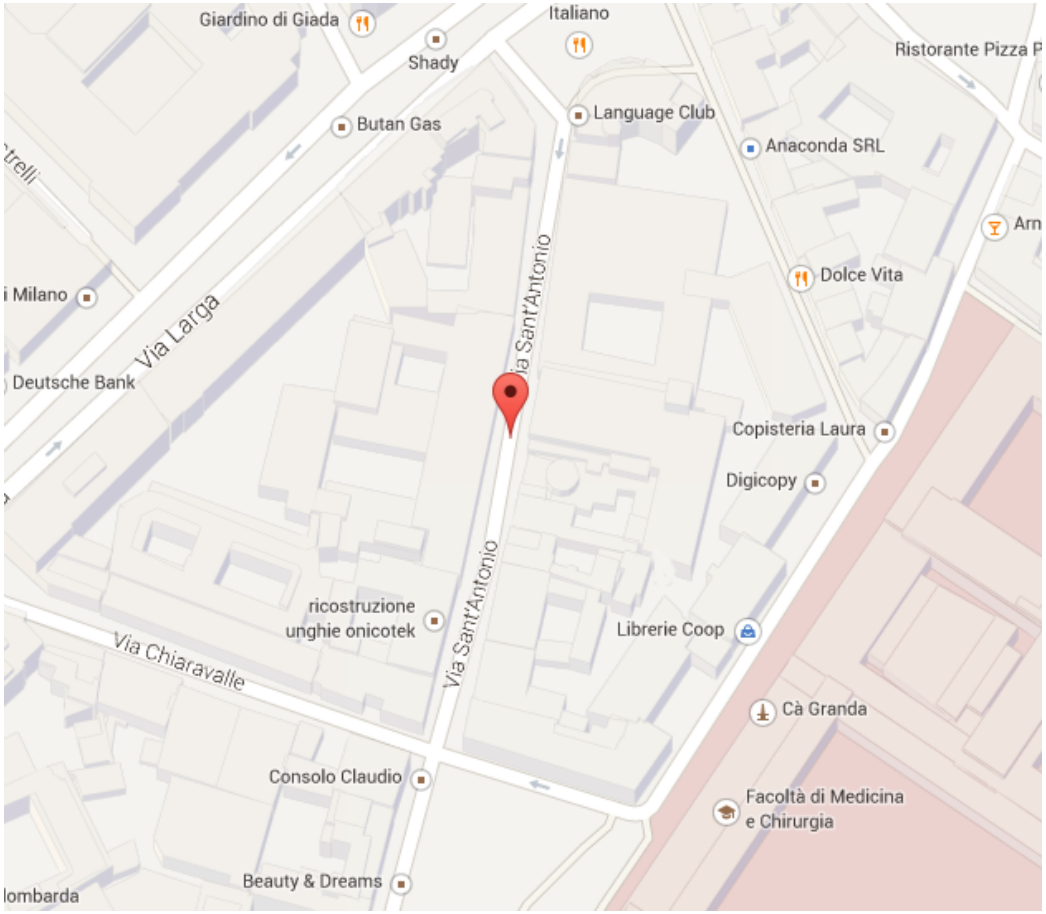
# Analyzing Real-World Friend-Finder Services

We analyzed a real-world dating service with more than 150M users (open buddies, implicit position) and found that it is possible for an attacker to infer the position of its users.

## Contributions

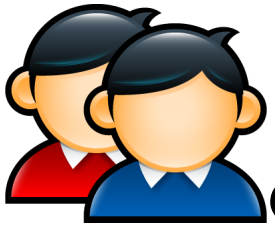
1. Two different attacks to obtain the position of an user
2. Full automation of the two attacks
3. Describe even more threatening attacks enabled by (2)

# Scenario Definition




Victim

Attacker

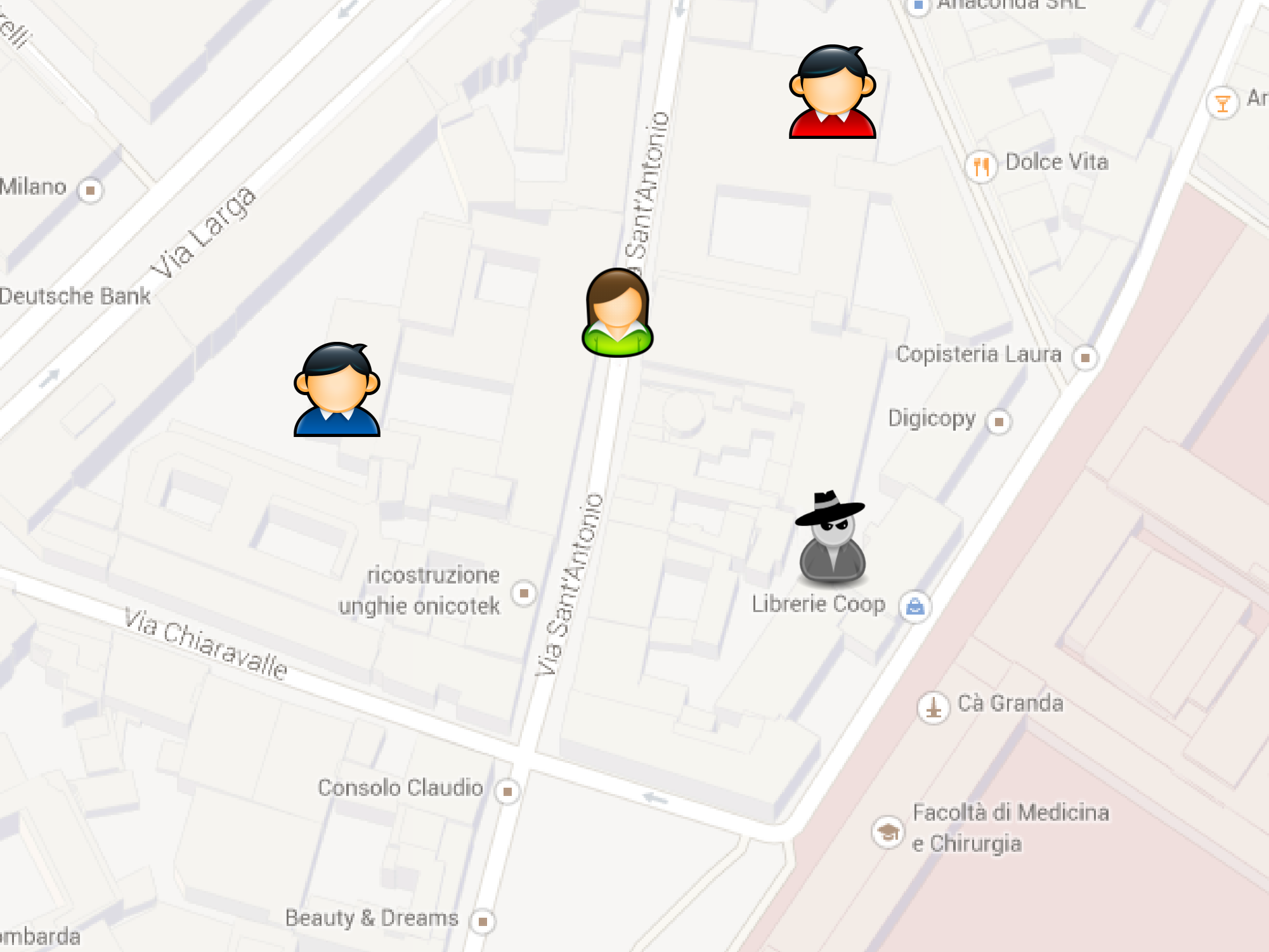


Colluding Buddies

# Attack 1: known distances

## Description

- The service returns an upper bound of the distance between the victim and the attacker


Milano
Via Larga
Deutsche Bank
Via Sant'Antonio
Dolce Vita
Copisteria Laura
Digicopy
ricostruzione
unghie onicotek
Via Chiaravalle
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Librerie Coop
Cà Granda
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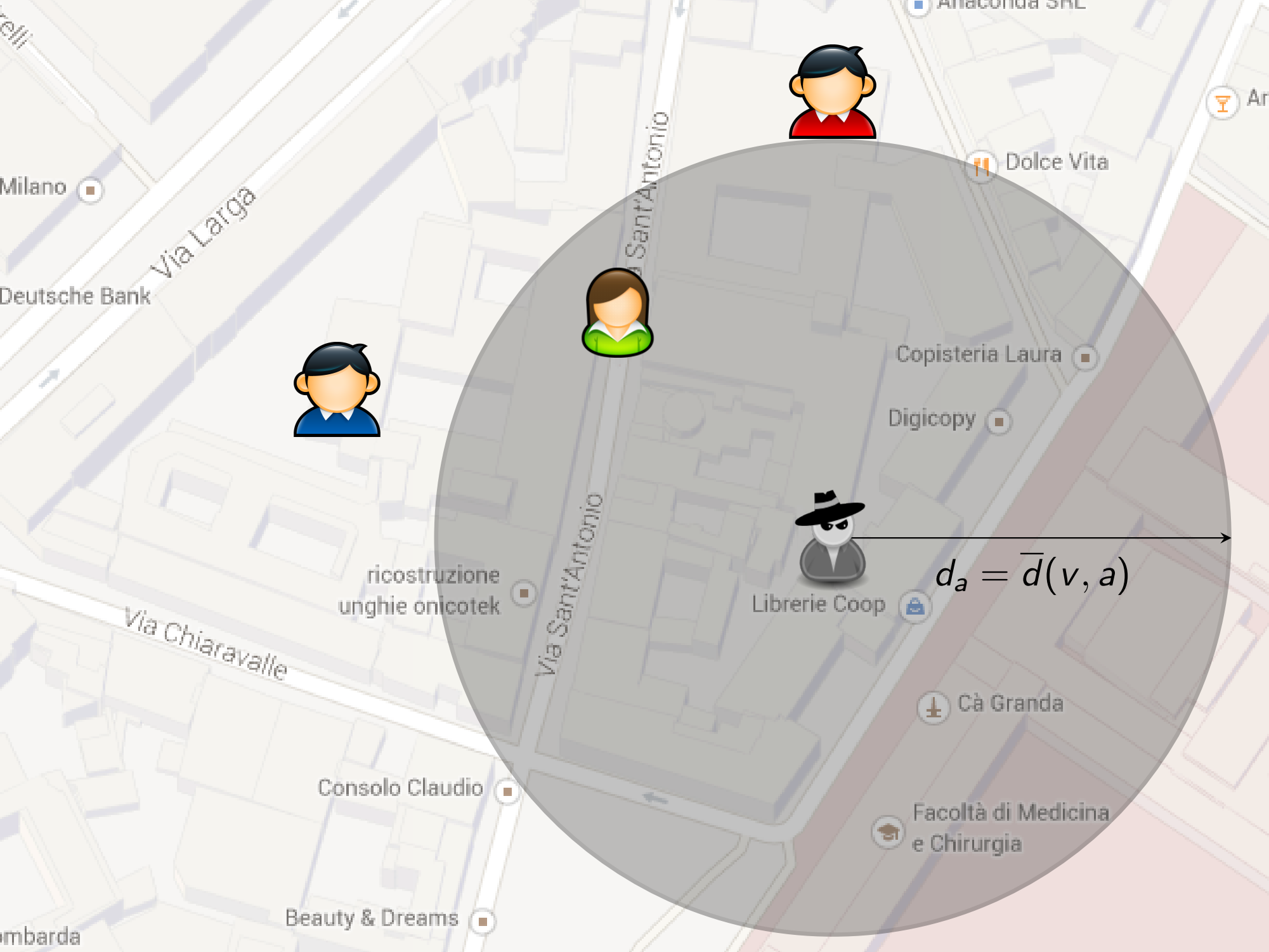
Beauty & Dreams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$d_a = \overline{d}(v, a)$
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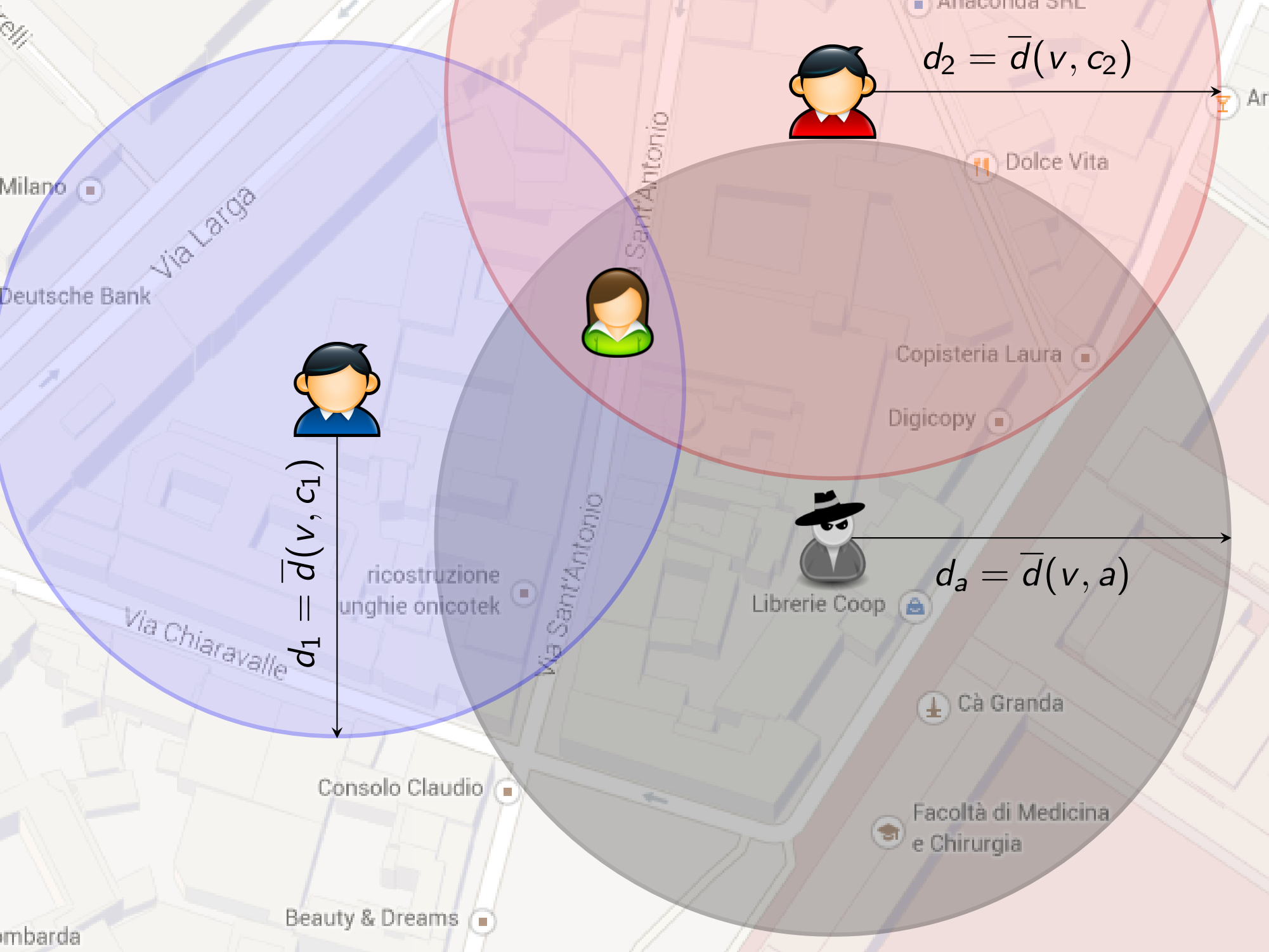
$d_2 = \overline{d}(v, c_2)$
$d_1 = \overline{d}(v, c_1)$
$d_a = \overline{d}(v, a)$
Milano
Via Larga
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# Attack 2: unknown distances

## Description

- The service does not return $\overline{d}$ for every user
- However, the list of nearby people is sorted according to the distance
- Idea: we move a colluding buddy $c_1$ *away* from the attacker until it switches position in the nearby list with the victim
- Then, we know $d(v, a) < d(c_1, a) \Rightarrow \overline{d}(v, a) = d(c_1, a)$
- Repeat from 3 different starting position, so that we can triangulate

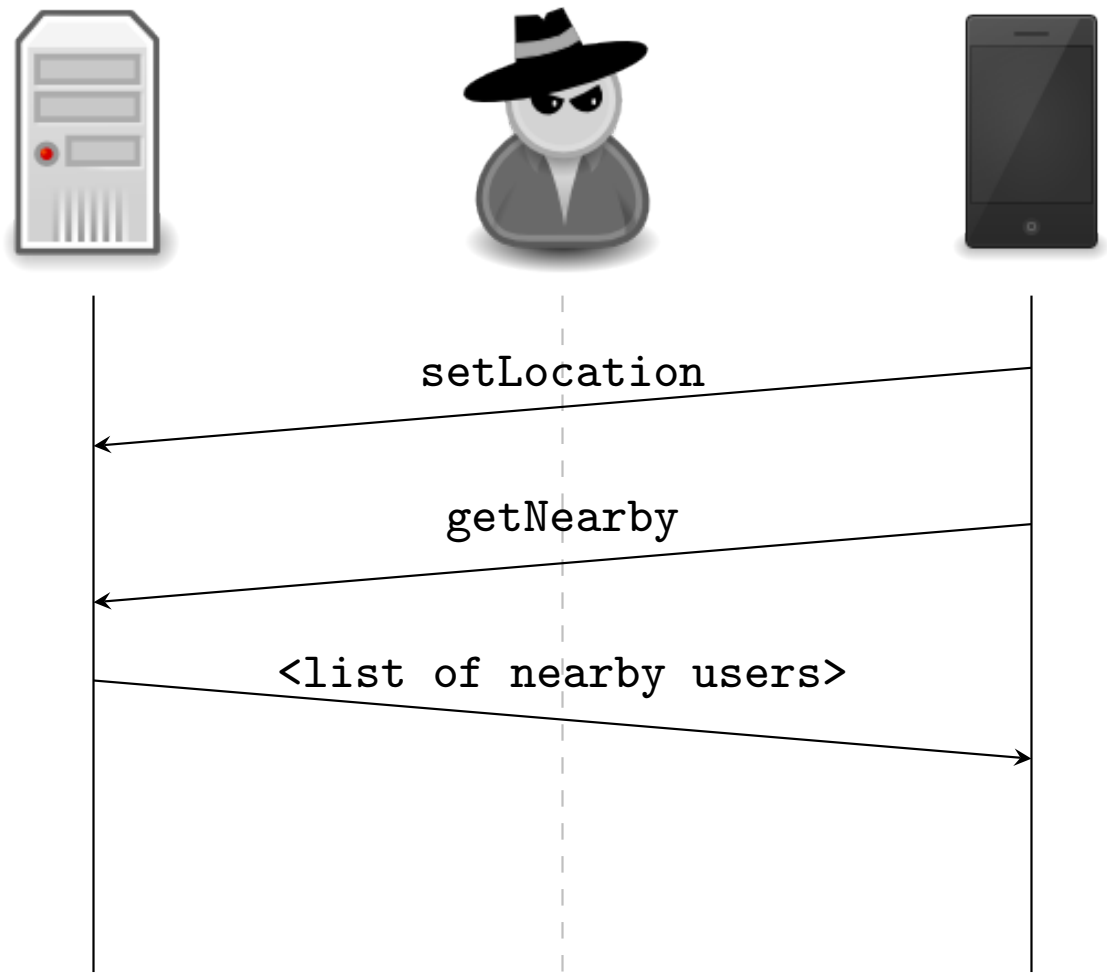
# Attack Automation

*The attacks we just illustrated can be performed manually by a single attacker, simulating colluding buddies through false location updates*

## Developing an automatic client

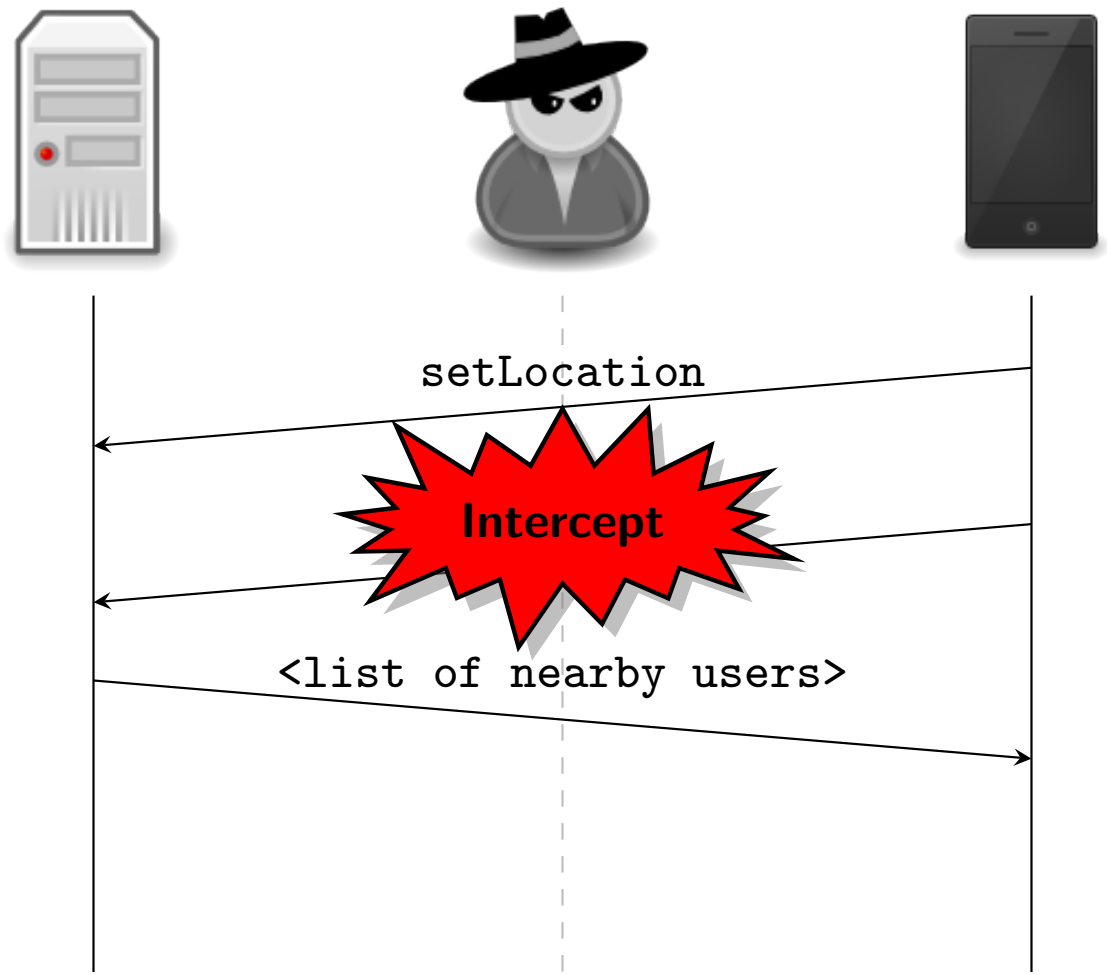
To make the attack automatic, we must be able to programmatically query the service from different positions

# Attack Automation



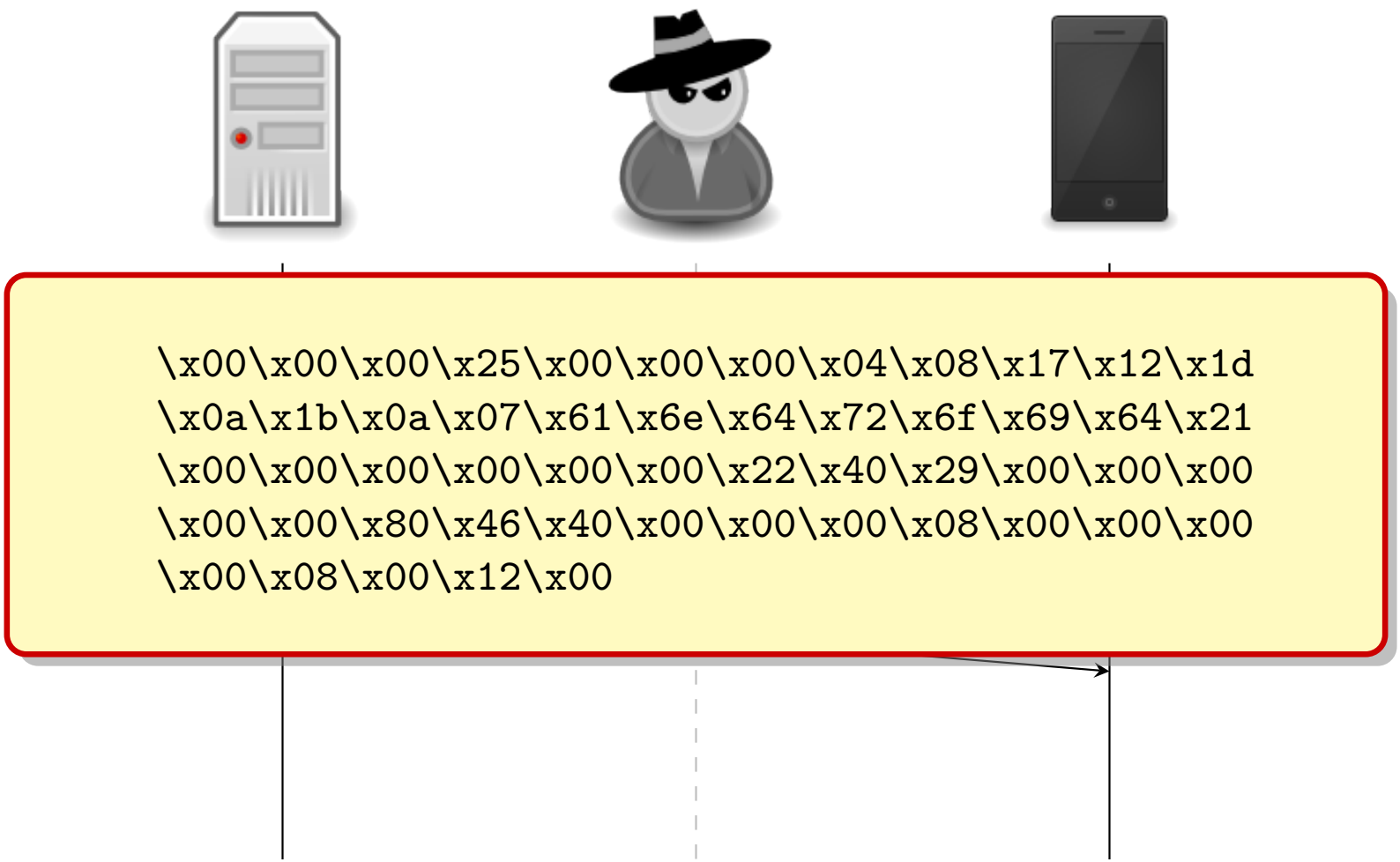

**We install the mobile app in an emulator and use it to communicate with the service server**

# Attack Automation



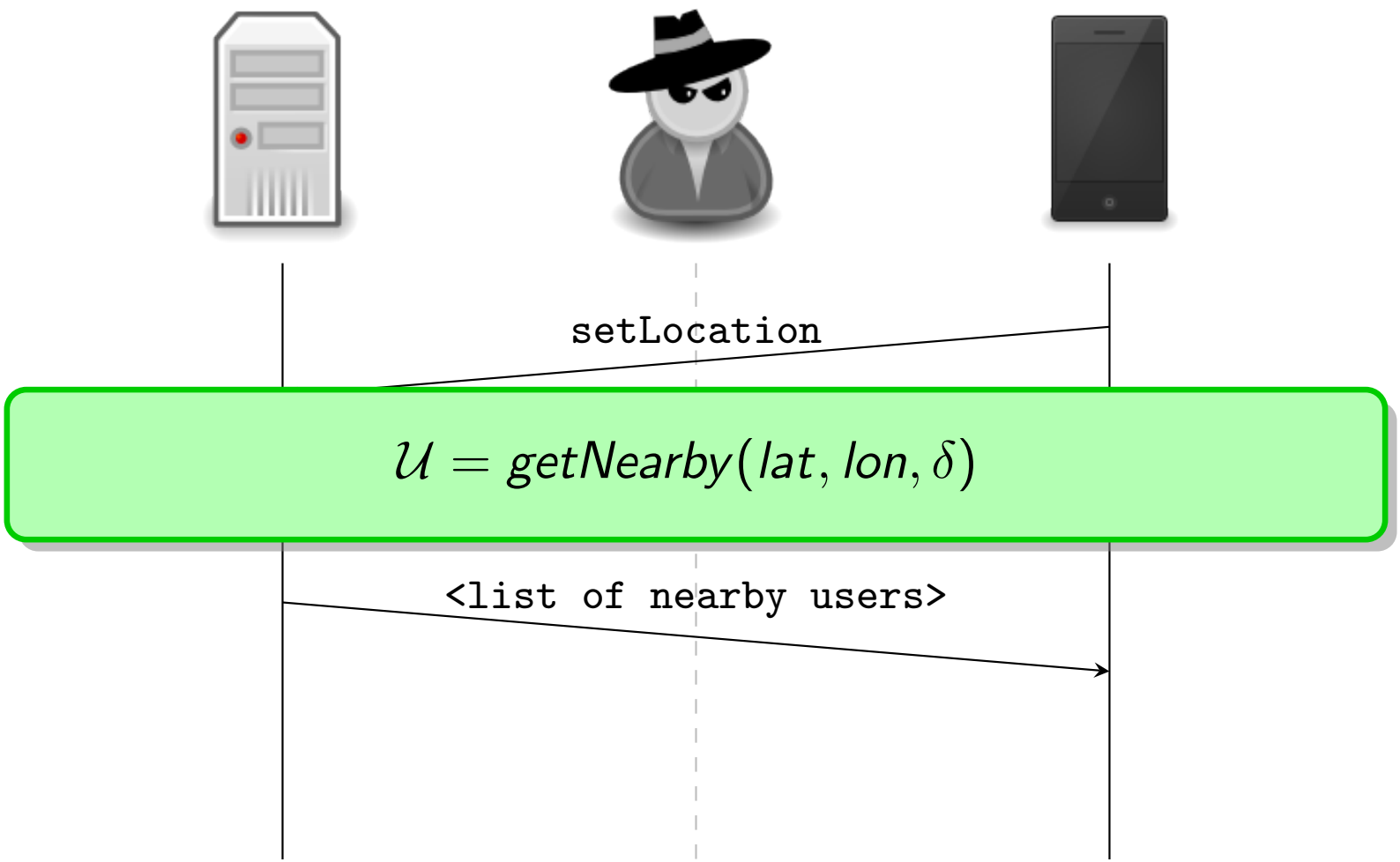

**We sniff the network traffic and dump the communication**

# Attack Automation




**The comm is marshalled with a custom protocol**

# Attack Automation




**We implement a replay attack in python**

# Additional attacks

The *getNearby* primitive allows to obtain *precise* distance information because such information are exchanged by the protocol, altough not shown in the GUI

## Automatic attacks enabled by the primitive

- "*Who is there?*"
- "*Where is Alice?*"
- "*Follow Alice*"

# Defenses?

*The attacker leverages public information that must be disclosed in open-buddies friend finder services*

## Mitigation guidelines

- Do not allow un-authenticated queries
- Set a limit on queries-per-user
- Switch to encrypted network protocols
  (Not sufficient *per-se*, but makes it harder for attackers)
- Identify attack patterns
  (e.g., FTL jumps)

# Conclusions

## Analyzing real-world friend-finder services

- Analyzed a real-world dating service with $>$ 150M users
- Found two attacks to find the precise position of its users
- Automated the attacks to show their dangerousness

# On the Privacy of Real-World Friend-Finder Services

**Thank you!**
**Any questions?**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