Location tracking

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8-533 / 8-733 / 19-608 / 95-818: Privacy Policy, Law, and Technology
Outline

• Locating Technologies
• Location Risk/Benefit Survey
• Location-Sharing Applications and Privacy Controls
• Locaccino
• How private can location data be?
Locating Technologies
Global Positioning System
WiFi Positioning
Cellular Triangulation
IP Location

Location of my IP address 72.204.154.191:
New Orleans in United States.
Click for big IP address image.
Locating Technologies

- Platforms
  - Laptop computers
  - Mobile phones

- Applications
  - Advertising/Marketing
    - Location-based advertising
  - Information services
    - Directions
    - Find the nearest …
    - Local weather, local events
  - People finding
    - Meet new friends, play games, socialize
    - Coordination
    - Monitor kids, employees, elderly
Location Risk/Benefit Survey
Method

- Conducted April 2008, \( n = 587 \)
- Provided list of use scenarios
  - Rate the likelihood of scenario
  - Rate the magnitude of harm or benefits
- Ranked each risk/benefit

Expected Utility = Likelihood \( \times \) Magnitude
Location-Sharing Applications

- Not very useful
- People are concerned about their privacy
- Risks outweigh benefits
Benefit Scenarios

Perceived Benefits

- Finding New People
- Having Fun
- Recruiting Activities
- Finding Coworkers
- Self Tracking
- Friends
- Planning Family Activities
- Coordinating Meeting
- Finding Friends Nearby
- Tracking Relatives
- Okayness Checking
- Finding Information
- Tracking Children
- Finding Others in Emergencies
Risk Scenarios

Perceived Risks

- Being Judged
- Revealing Activities
- Spied On by Boss
- Bothered by Ads
- Tracked by Govt
- Bothered when Alone
- Found when avoiding
- Intruded upon
- Being Stalked
- Revealing Home
Location-Sharing Applications and Privacy Controls
Privacy features

• Most current location sharing services allow sharing to be either on or off, per person

• Many have a “make me invisible feature” (e.g. Loopt and Brightkite)

• Some have the ability to limit by location granularity (e.g. Google Latitude and FireEagle)

• Commercial services don’t have fine-grained privacy controls or ability to see who is tracking your location
Loopt privacy settings

Privacy Settings

Profile Privacy
Choose who can see your profile information. Your friends can always see your entire profile.

Entire Profile:  
- My Friends and Their Friends
- My Friends Only

Location Privacy
Choose who can see your location with the settings below.

Who can find me?
- Nobody
- Some Friends

I want to block my location from...
Loopt privacy settings

Choose who can see your location with the settings below.

Who can find me?

- Nobody
- Some Friends
Google Lattitude privacy settings
Google Lattitude privacy settings
Google Lattitude privacy settings

Location sharing

- Detect your location [Learn more] Your location is updated automatically
- Set your location Manually select a location on the map
- Hide your location Friends can not see your location
Location-Sharing Applications

• Reviewed 89 Applications in August 2009
  – Date of Launch
  – Privacy Policy
  – Privacy Controls
  – Immediately Accessible Privacy Settings
Privacy Overview

• Types of Applications
  – Open: Requested by anyone (52)
  – Closed: Requested by friends only (29)

<table>
<thead>
<tr>
<th>Category</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Policy</td>
<td>66%</td>
<td>34%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Privacy Controls</td>
<td>76%</td>
<td>17%</td>
<td>1%</td>
<td>6%</td>
</tr>
<tr>
<td>Accessible Privacy Settings</td>
<td>17%</td>
<td>75%</td>
<td>2%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Types of Restrictions

• Friends Only (49.4%)
• Granularity (11.2%)
• Blacklist (15.7%)
• Invisible (33.7%)

% of applications
Types of Restrictions

- Per-Request (2.25%)
- Time-Expanding (2.25%)
Most Frequent Controls

- Friends Only (49.4%)
- Invisible (33.7%)
Privacy Controls

• Frequency of Restrictions

Restrictions Per Application

# Applications vs. # Rules
Best ways to mitigate the greatest expected risks

• Blacklist (16%)
• Granularity (12%)
• Group-based rules (12%)
• Location-based rules (1%)
• Time-based rules (1%)

% of applications
Recommendations for developers

• Need for more expressive privacy controls in most applications

• Providing expressive controls could reduce concerns

• Developers must balance expressiveness and user burden
Recommendations for users

• Understand why you want to use location-sharing application (social, coordination, etc.)
• Find application well-suited to your needs
• Configure privacy controls
• Avoid public posting of your location with your real name
A User-Controllable Location-Sharing Tool

Welcome to Locaccino. Our location-centered social application allows you to share your location with your friends. Whether they are checking to see if your flight landed safely, planning a Friday night outing, or just wondering if you are in the office to grab coffee, Locaccino is there to help you share!

Privacy Controls

Locaccino is the only location-sharing system that gives you precision control over who can see your location. While most location-based systems only allow you to list which of your contacts should or shouldn’t be able to see your location, our privacy settings allow you to create rules as simple or complex as you want them to be!

“...we all should have the right to draw the curtain when we want.”

—Stephen Baker
Locaccino is a location sharing application that lets you:

- Securely share your location with selected friends and family in your Facebook network.
- Specify the people, places and times when you want to share your location. With Locaccino, allowing your co-workers to see your location only from 8AM - 5PM is a snap.
- See a complete history of people who requested your location.
- No need to check-in to your favorite spots! Locaccino gives you continuous and live updating of your location on your smartphone or on your laptop computer.

Click the Facebook login button to join or login.

No login button? Click here.
Location sharing rules

CUPS students
CUPS students (Kursat, Joanna and 8 others) can see your location wherever you are, on weekdays between 8:00 am and 7:00 pm

Chuck
Chuck can see your location wherever you are, at all times

Locaccino team
Locaccino team (Jason, Paul and 11 others) can see your location wherever you are, on weekdays between 7:00 am and 6:00 pm

Colleagues
Faculty (David, Erica and 26 others) can see your location wherever you are, on weekdays between 8:00 am and 6:00 pm

On campus
All your friends can see your location when you are at Some place, at all times

Seattle
Seattle friends (Stuart, Helen and 2 others) can see your location when you are at seattle, at all times
Rule Editing

Cancel  Save changes

Who  Who can see my location?
You currently do not share your location with any friends.  [Add friends]

Where  Where can they see my location?
e.g. my friends can see my location only when I am at the "Carnegie Mellon University campus"

- I can be located in all locations  - I can be located in these locations...

When  When can they see my location?
- I can be located all the time  - I can be located part of the time...

Cancel  Save changes
### Rule Editing

**Rule name**: CUPS students

**Who** Who can see my location?
- Add friends

**Where** Where can they see my location?
- e.g. my friends can see my location only when I am at the "Carnegie Mellon University campus"
- I can be located in all locations
- I can be located in these locations...

**When** When can they see my location?
- I can be located all the time
- I can be located part of the time...
  - Sun
  - Mon
  - Tue
  - Wed
  - Thu
  - Fri
  - Sat

**From**: 8:00 am  **To**: 7:00 pm  **All day**

**Cancel**  **Save changes**
Rule Editing

Rule name: on campus

Who
Who can see my location?

Add friends

- All my friends

Where
Where can they see my location?

- I can be located in all locations
- I can be located in these locations...

Add Location

Some place

When
When can they see my location?

- I can be located all the time
- I can be located part of the time...

Cancel  Save changes
<table>
<thead>
<tr>
<th>Friends who can locate me right now</th>
<th>Friends who cannot locate me right now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck Cranor</td>
<td>Ben Streeter</td>
</tr>
<tr>
<td>Lorrie Cranor</td>
<td>Joshua Sunshine</td>
</tr>
<tr>
<td></td>
<td>Hazel Mary</td>
</tr>
<tr>
<td></td>
<td>Ziv Zipano</td>
</tr>
<tr>
<td></td>
<td>Greg Norcie</td>
</tr>
<tr>
<td></td>
<td>Linda Francona</td>
</tr>
<tr>
<td></td>
<td>Linda Little</td>
</tr>
<tr>
<td></td>
<td>Earl Crane</td>
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<tr>
<td></td>
<td>Mike Cronin</td>
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<tr>
<td></td>
<td>David Pierpont</td>
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<tr>
<td></td>
<td>Dena Tsamitis</td>
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<td></td>
<td>Jules Polonetsky</td>
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<td></td>
<td>Norman Sadah</td>
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<tr>
<td></td>
<td>Serge Egelman</td>
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<td></td>
<td>Eran Toch</td>
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<td></td>
<td>Seth Carlson</td>
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<tr>
<td></td>
<td>Sally Yanagihara</td>
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<tr>
<td></td>
<td>Janice Tsai</td>
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<tr>
<td></td>
<td>Megan Spence</td>
</tr>
<tr>
<td></td>
<td>Kursat Ozenc</td>
</tr>
<tr>
<td>Who and When</td>
<td>Type</td>
</tr>
<tr>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>Kami Vania</td>
<td>Real</td>
</tr>
<tr>
<td>Janice Tsai</td>
<td>What-if</td>
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<tr>
<td>Norman Sadeh</td>
<td>Real</td>
</tr>
<tr>
<td>Linda Little</td>
<td>What-if</td>
</tr>
<tr>
<td>Wang Kai Jimmy</td>
<td>What-if</td>
</tr>
<tr>
<td>Norman Sadeh</td>
<td>What-if</td>
</tr>
<tr>
<td>Patrick Kelley</td>
<td>What-if</td>
</tr>
</tbody>
</table>
Norman requested your location at 8:39 AM on Friday when you were at Carnegie Mellon University, Smith Hall. Your location sharing settings allowed the request.

You indicated that you were happy with this.

Why did you want Norman to see your location?

- I want Norman to know where to meet me.
- I want Norman to know that I am in a safe location.
- I want Norman to know the locations I go to and activities I do.
- This is not a sensitive location. I do not mind sharing it with Norman.
- I don’t mind if Norman knows where I am at this time of day.
- There is no particular reason, I just didn’t mind sharing my location with Norman.
- None of these. Please answer below:

Submit

- Close without saving feedback.
Step 1.5 Installing the Locator

- Double click on the Locaccino Locator installer to start the installation.
- Locaccino requires your computer password in order to complete the installation process. We do not store or use this password for anything else.
For optimum performance and battery life, we recommend that you enable Wi-Fi on your phone.
How private can location data be?
Limits on anonymizing location data

• Why is it difficult to anonymize location data?

• How unique is location data?

• Strategies for using location data more anonymously
  – Example: monitoring highway traffic flow