SII 199 – Computer Networks and Society

Handout # 14:
Privacy in Online Social Networks

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Announcements

- Final project
  - Intermediate report
    - Due: Fri. Nov. 13th
- In class presentations
  - Wed. Nov. 25th
    - 5% bonus mark
    - Any volunteers?
  - Wed. Dec. 2nd
    - 15 minute presentation

- Assignment 3
  - Due: Fri. Nov. 20th
  - Email your solutions to me, or bring to my office (BA 5238)

- Volunteer for lecture notes?
  - Last call!! 😊
The Story ...

• Introduction to computer networks
• The science of networks

• Computer networks and healthcare
• Computer networks and business
• Computer networks and entertainment
• Cloud computing /storage
• Phishing, spam, and fraud in the Internet

• This week: privacy in online social networks
Outline

- **Part I: Privacy in Online Social Networks**
  - OSN service providers and privacy concerns
  - Users and privacy concerns
  - Experiments

- **Part II: Better Privacy for Online Social Networks**
  - The state of privacy in OSNs
  - How can we make things better?
Popularity of OSNs

- Twitter with 500 million active users
  - Handling more than 1.6 billion search queries everyday
  - 340 million tweets daily

- Facebook with more than 1.4 billion active users
  - 300 million photos uploaded daily
  - 300,000 status updates every minute
Information Users Share

- Employer and position
- Address
- Photo
- Birthday
- Mobile number
- Email address
- IM IDs
- Relationship
- Political views
- Religious views
- Degree and school
- ...
Why Privacy Matters

• Information shared on OSNs can be used by criminals or others without user’s consent

• Many stories in media:
  • House Robbery by an unknown FB friend
  • Status update: "Heading to the Hill with Kurt... To see Fire Department."
  • Example 2: man killed ex-lover over FB photo with new man

Digital Criminal Report: among FB and Twitter users
  - 38% posted status updates detailing their holiday plans
  - 1/3 posted status updates saying that they are away for the weekend.
OSN Service Providers

- OSN service providers have some concerns
  - Only because users (might?) have concerns
- They have incentive to encourage sharing information

FB CEO: *Privacy No Longer a Social Norm!*

If we were to create Facebook again today, user info would by default be public, not private.
Users and Privacy

**Question 1**: Are users concerned about privacy?

**Question 2**: How can we answer Question 1?

- **Surveys not good**
  - Asking questions changes user’s view and therefore the accuracy of results
- **Measurements are not easy**
  - Most OSNs try to protect their network
Our Approach

- **Approach 1:**
  - Use robots and get OSN’s permission
  - Did not work
    - Against terms of service

- **Approach 2:**
  - Use real agents

- 12 accounts (6 groups)
- Each sending 20 friend requests
  - Everyday
  - For two weeks
- Check results after two weeks

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Acceptance, Pending, and Rejection

- 54% of 3,360 requests were accepted.
  - Max: 76%
  - Min: 45%
### Privacy and Gender

<table>
<thead>
<tr>
<th>Code</th>
<th>% males who accepted req</th>
<th>% females who accepted req</th>
<th># received req</th>
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<td>MP2</td>
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Number of Friends

- Acceptance, pending, and rejection percentage vs. day.

![Graph showing the number of friends, acceptance, pending, and rejection percentage over days.](image-url)
Number of Mutual Friends

- Acceptance, pending, rejection vs. number of mutual friends
Visibility

- Percentage of friends whose account visibility did not change before and after accepting friend request.
Visibility – Personal Info

- Percentage of people who revealed information after accepting the requests.

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<th>Code</th>
<th>Photo</th>
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Visibility – Contact Info

- Percentage of people who revealed information after accepting the requests.

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Visibility – Employment and Education Info

- Percentage of people who revealed information after accepting the requests.

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Default Settings

- 55% changed default settings

Percentage of friends with modified privacy settings, who made all the information they restricted public access to available to our agents.
Part I: Summary of Results

- 54% of the 3,360 requests accepted.

- 95% of the users who accepted our requests revealed some previously unknown info.

- 55% of the users who accepted our requests have changed their default privacy settings.
  - More than 75% of them revealed all the info they have explicitly made publicly invisible by accepting requests.
Our Champion!

- 76% Acceptance Rate
  - 88% male users
  - 70% female users
- Received 396 friend requests during project execution time.
- Lots of messages
Outline

- **Part I: Privacy in Online Social Networks**
  - OSN service providers and privacy concerns
  - Users and privacy concerns
  - Experiments

- **Part II: Better Privacy for Online Social Networks**
  - The state of privacy in OSNs
  - How can we make things better?
The State of Privacy in Online Social Networks (OSN)
No Control over What Facebook Does with My Social Information
Users Need to Duplicate their Social Information
Must Register to See Friends’ Content
Privacy Terms Can Be Contradictory

Profile information is used by Facebook primarily to be presented back to and edited by you when you access the service and to be presented to others permitted to view that information by your privacy settings. In some cases where your privacy settings permit it (e.g., posting to your wall), other Facebook users may be able to supplement your profile.

Profile information you submit to Facebook will be available to users of Facebook who belong to at least one of the networks you allow to access the information through your privacy settings (e.g., school, geography, friends of friends). Your name, network names, and profile picture thumbnail will be available in search results across the Facebook network and those limited pieces of information may be made available to third party search engines. This is primarily so your friends can find you and send a friend request. People who see your name in searches, however, will not be able to access your profile information unless they have a relationship to you (friend, friend of friend, member of your networks, etc.) that allows such access based on your privacy settings.

Facebook may send you service-related announcements from time to time through the general operation of the service. For instance, if a friend sends you a new message or poke, or someone posts on your wall, you may receive an email alerting you to that fact.

Generally, you may opt out of such emails from the Notifications page, though Facebook reserves the right to send you notices about your account even if you opt out of all voluntary email notifications.

Facebook may use information in your profile without identifying you as an individual to third parties. We do this for purposes such as aggregating how many people in a network like a band or movie and personalizing advertisements and promotions so that we can provide you Facebook. We believe this benefits you. You can know more about the world around you and, where there are advertisements, they’re more likely to be interesting to you. For example, if you put a favorite movie in your profile, we might serve you an advertisement highlighting a screening of a similar one in your town. But we don’t tell the movie company who you are.
Privacy Terms Can Be Contradictory

Generally, you may opt out of such emails from the Notifications page, though Facebook reserves the right to send you notices about your account even if you opt out of all voluntary email notifications.
Privacy Terms Are Confusing!

by the third party advertisers. Third party advertisers have no access to your contact information stored on Facebook unless you choose to share it with them.

This privacy policy covers the use of cookies by Facebook and does not cover the use of cookies or other tracking technologies by any of its advertisers.

Changing or Removing Information

Access and control over most personal information on Facebook is readily available through the profile editing tools. Facebook users may modify or delete any of their profile information at any time by logging into their account. Information will be updated immediately. Individuals who wish to deactivate their Facebook account may do so on the My Account page. Removed information may persist in backup copies for a reasonable period of time but will not be generally available to members of Facebook.

Where you make use of the communication features of the service to share information with other individuals on Facebook, however, (e.g., sending a personal message to another Facebook user) you generally cannot remove such communications.

Security

Facebook takes appropriate precautions to protect our users' information. Your account information is located on a secured server behind a firewall. When you enter sensitive information (such as credit card number or your password), we encrypt that information using secure socket layer technology (SSL). (To learn more about SSL, go...
Privacy Terms Are Confusing!

Where you make use of the communication features of the service to share information with other individuals on Facebook, however, (e.g., sending a personal message to another Facebook user) you generally cannot remove such communications.
Privacy Terms Could Make Some Very Nervous

Facebook may also collect information about you from other sources, such as newspapers, blogs, instant messaging services, and other users of the Facebook service through the operation of the service (e.g., photo tags) in order to provide you with more useful information and a more personalized experience.
Facebook may also collect information about you from other sources, such as newspapers, blogs, instant messaging services, and other users of the Facebook service through the operation of the service (e.g., photo tags) in order to provide you with more useful information and a more personalized experience.
The State of Privacy in OSNs

- Not very good
- It’s not only Facebook, it’s all OSNs
How Can We Make Things Better?
Today: Users have No Control over Social Info

Content:
- Photos
- Video
- Apps.

Social info (list of friends)
Lockr: Users Regain Control over Social Info

Content:
- Photos
- Video
- Apps.

Social info (list of friends)
What is Lockr?
Lockr Uses Social Attestations

- Social attestation is a piece of data

From: Yashar
To: Stefan

Relationship: “Friend”
Signed by Yashar
Lockr Uses Social Attestations

- Social attestation is a piece of data

From: Yashar
To: Stefan

Relationship: “Colleague”
Signed by Yashar
Create Social Network by
Passing Out Attestations
Create Social Network by Passing Out Attestations

Friend
Create Social Network by
Passing Out Attestations
Create Social Network by
Passing Out Attestations
Create Social Network by
Passing Out Attestations
Create Social Network by
Passing Out Attestations

Classmate
Create Social Network by
Passing Out Attestations
Set Social ACL: “Friends”
Attestation Verification

1. User sends attestation to OSN
2. OSN verifies attestation
3. OSN sends back content
Can Work with Any OSN
Even with Peer-to-Peer Systems
Lockr is a Social Network with Privacy Benefits

- Users form one social network using social attestations
- Users continue to share their content with existing delivery mechanisms:
  - Third-party OSNs, such as Facebook
  - P2P systems, such as BitTorrent
- Users protect their content with social ACLs
What Privacy Problems Does Lockr Solve?
Problem #1: Users Have No Control over Their Social Information
With Lockr, Users Can Choose Where To Store Their Attestations
With Lockr, Users Can Choose Where To Store Their Attestations
With Lockr, Users Can Choose Where To Store Their Attestations
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With Lockr, Users Can Choose Where To Store Their Attestations
Problem #2: Users Must Register to See Friends’ Content
Lockr Removes the Need for Registration

For attestation verification, users must:
1. Show their correct attestation
2. Provide identity, such as e-mail, LiveID, PGP
Our Current Implementation

- Lockr Center
  - Attestation manager as a Facebook app.
- Lockr for Flickr
- Lockr for BitTorrent

- Code available for download: http://www.lockr.org
Lockr Center

![Facebook Lockr Center page](image)

Please install the **Lockr Firefox extension** to upload and see protected Flickr images. After you have Lockr for Firefox installed, as a start point you can visit this Flickr album to see how Lockr works in action.

---

Page built by Lockr Center
Lockr Center: Attestation Manager

- Roles: storing, issuing and exchanging attestations.
- Facebook application.
Lockr for Flickr

- Client-side: FireFox Add-on
- Server-side: need support from Flickr
  - Instead, use proxy to supplement lack of server-support

- Can deploy Lockr even if no server-side support
  - Through hacks
Lockr for Flickr: Upload Image

Choose the privacy settings [?]

- Private (only you see them)
- Visible to Friends
- Visible to Family
- Public (anyone can see them)
- Social Relations

Show advanced settings...

UPLOAD

Or, cancel and return to your photos.
Lockr for Flickr: Valid Attestation
Lockr for Flickr: Invalid Attestation

You need to have Lockr to see this image.

Visit http://www.lockr.org/

Add your comment

How do I format my comment?

PREVIEW OR POST COMMENT
Lockr for BitTorrent

- Introduce the notion of *social torrent*
  - Torrent + social ACL + digital signature
- Extended BitTorrent to add a social handshake
  - Exchange social attestations

- Java-based implementation in Vuze
  - formerly known as Azureus
Summary of Part II

• The state of privacy in today’s OSN is bad
• Lockr achieves privacy benefits:
  • Users regain control over the social info
  • No need for site registration
  • Relationship keys for social deadlock
  • Zero-knowledge to reduce the value of attestations revealed to 3rd-party sites
  • Hash-chains for relationship key expiration
Conclusion

- The state of privacy in today’s OSNs is bad.
- Users seem to be unaware of some privacy implications.
- Lockr addresses many existing privacy issues.
- Using regain control of their social info.
  - Place social info in a single location where you trust.
  - OSNs continue providing content hosting services.
- Lockr removes the need to register with various OSNs.
  - Still provides similar usability level.
- OSNs cannot sell social data.
- Question: what are the incentives to switch to Lockr?