The Challenges of Measuring Privacy
The Case of Online Social Networks

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Hello!

- PhD from Universitat Oberta de Catalunya, Spain
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- Engineering degree from INPT, Morocco
- 10 years in IT / Security fields

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Agenda

- Definitions
- Privacy and Online Social Networks
- Challenges of Measuring Privacy
- Tool: Information Privacy Assessment Metric
- Conclusion

- Q&A
What is privacy?

- A fundamental human right
- Not observed or disturbed by other people
- Select what personal info is known to what people
- Protection from malicious and unauthorized entities
- Policies to enforce the protection of private information
- Hide some details from others
Definitions: Privacy vs Security

Privacy: Fair protection of personal data

Security: Protection of all types of information and systems
Definitions: Online Social Networks

• OSNs: User-generated content services that allow (Boyd 2007):
  1. Create profiles
  2. Build Relationships
  3. Post activities and interests
Definitions: Microblogging

- Small Snippet
- 140 to 310 characters
- Light-weight and simple
- Frequent posts
- 1 to many messaging
- Ex: Twitter
Privacy and Online Social Networks
Privacy and Online Social Networks

• Stakeholders:
  - Service Provider
  - General Public
  - Third Parties
  - Other Users
  - Other Users
Privacy and Online Social Networks

• Data types:

- Service provider
- Incidental data
- Entrusted data
- Behavioral data
- Service data
- Disclosed data
- Hidden data
Privacy and Online Social Networks

• Two categories of privacy threats:

**User-Related Threats**
- Misconfiguration of privacy settings
- No control over what other users may publish
- Data collection
- Hidden links

**System-Related Threats**
- Design flaws
- Data Retention
- Analyzing and selling data to third-parties
- Vulnerable to attacks

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# Privacy and Online Social Networks

## Classic Attacks
- DoS attacks
- SQL injection
- XSS
- Social spamming
- Flooding
- Phishing
- Malware attacks

## Specific Attacks
- Identity clone
- Social profiling
- Link prediction and disclosure
- Communication tracking
- Sybil attack
- Clickjacking
- De-anonymizing attacks
Privacy and Online Social Networks

Privacy Paradox

Protecting privacy

Sharing data
Privacy and Online Social Networks

PayThink: New breaches put social media data in the spotlight

Facebook and Cambridge Analytica: What You Need to Know as Fallout Widens
Privacy and Online Social Networks

• Data rich in sensitive personal information
• Voluntarily sharing personal information
• Service providers can store, process, and sell user's data
• Privacy policies are vague and difficult to understand

A need to measure privacy in OSNs
Challenges of Measuring Privacy
Challenges of Measuring Privacy

• “If you cannot measure it, you cannot improve it”. *William Thomson*

• Metrics: tools designed to facilitate decision making and to improve performance

Challenges of Measuring Privacy

• Privacy metrics:
  • evaluate the privacy level
  • identify the flaws
  • make decision
  • assess and predict potential privacy threats
Challenges of Measuring Privacy

The challenge: How to measure and evaluate the privacy in OSNs?

• Factors to consider?
  • Data published
  • Hidden data
  • Social graph
  • Which stakeholders to include
  • Etc.
## Challenges of Measuring Privacy

<table>
<thead>
<tr>
<th>Privacy Metrics</th>
<th>Description</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Scores</td>
<td>$PR(i) = \sum_i PR(i,j) = \sum_i \beta_i \cdot V(i,j)$</td>
<td>Visibility and sensitivity of items in a profile</td>
</tr>
<tr>
<td>PrivAware</td>
<td>$PR = \frac{\sum_i V_i}{\sum_i i}$</td>
<td>Visibility and the number of items in a profile</td>
</tr>
<tr>
<td>Privometer</td>
<td>A score generated based on the sensitivity of the profiles of users and their social graphs</td>
<td>Sensitivity of items in a profile and social graph</td>
</tr>
<tr>
<td>Privacy Index</td>
<td>$PIDX = \frac{\sum_i \beta_i \cdot V(i,j)}{\sum_i i}$</td>
<td>Visibility, sensitivity, and the number of items in a profile</td>
</tr>
</tbody>
</table>
Challenges of Measuring Privacy

1. The user’s perspective
2. Different attributes
4. Only the visibility to other users
5. No security requirements
Information Privacy Assessment Metric (IPAM)
Information Privacy Assessment Metric
Information Privacy Assessment Metric

- Comprehensive and generic framework
- Compute privacy scores
- Compare between different systems

**End Users**
- 1. Identify Risks
- 2. Privacy Protection

**System Provider**
- 1. Position vis-à-vis Competition
  2. Enhance privacy protection
Information Privacy Assessment Metric

- Plan-Do-Study-Act (PDSA) Cycle

- Plan
  - Scope and objectives identification
  - Architecture analysis
  - Business processes identification
  - Key assets and services identification
  - Security boundaries and controls identification
  - Risk assessment analysis

- Do

- Study
  - Privacy Assessment Engine
    - Goal 1
    - Goal 2
    - Goal 3
    - Goal 4

- Act
  - Privacy Score
  - Strategies and recommendations
Information Privacy Assessment Metric

SUI = System Under Investigation
Information Privacy Assessment Metric

Privacy Assessment Engine

- Goal 1
- Goal 2
- Goal 3
- Goal 4

Privacy Score

Study

Act

Strategies and recommendations
Information Privacy Assessment Metric

Goal-Question-Metric (GQM) paradigm.

1. How the system protects the users?
2. How the system protects the data?
3. How the system protects itself?
4. Functions in the system might affect the privacy of the system
Information Privacy Assessment Metric

• Total Privacy Score (TPS):

\[
TPS = Privacy Protection Score (PPS) - Privacy Risk Score (PRS)
\]

\[0 \leq TPS \leq 100\%\]

• For each question, we calculate:

\[
ScoreQuestion = f (Impact_{Privacy}, Impact_{Security}, Visibility)
\]

Information Privacy Assessment Metric

• Compare 9 operational microblogging Online Social Networks using IPAM Metric
Towards Assessing Information Privacy in Microblogging Online Social Networks. The IPAM Framework
Conclusion
Conclusion

• Users enjoy the experience of sharing interests and connecting with friends
• **BUT**, a large amount of personal information becomes accessible to everyone → More attacks and data breaches

• Privacy metrics are needed to measure and quantify the privacy in OSNs

**IPAM framework:**
  o End users: understand privacy in OSNs.
  o System providers: implement recommendations and strengthen their position in the market
More Information about IPAM


Thank you for your attention!
Reference


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