ActivPass: Your Daily Activity is Your Password

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1 Background and Motivation

2 ActivPass System

3 Experiment Setup

4 Results

5 Key Points
Password sharing becomes a habit

Netflix CEO: Curse you, password sharing! Literally

On what’s typically a snoozy earnings discussion, Reed Hastings shares what he claims is the log-in info for the head of rival HBO. And the password would make your grandma gasp.
Background and Motivation: Issue of Password Sharing

Effect of sharing

APR 22, 2013 12:35PM ET

10 Million People Watch Netflix Without Paying

REBECCA GREENFIELD
Service providers lose revenue

Analyst: Netflix could boost revenue by cracking down on password sharing

Technology • July 25, 2014 9:04PM
Existing solutions

Biometric based and hardware based solution are not applicable in every scenario.
OTP: another promising solution

- A random string
- Does not carry any private information

Sharing OTP without compromising Privacy
We do a lot of activities in our daily life and they are *dynamic* in nature.
Background and Motivation: Opportunity

Some of these activities are

- capture-able hence verifiable
- carry private information hence we do not want to share
Background and Motivation: Key Intuitions

We can remember our recent past activities

It is difficult to guess other’s activities

Could not guess who she is talking with

Talking with someone
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ActivPass System: Working Principle

1. A user sends an SMS.
2. The system asks, "Whom did you send an SMS today 8 AM?"
3. The user enters their answer.
4. The system authenticates the user against their activity log.
5. The system generates a password using the Activity Log and Password Generation Module (PGM).
6. The user is granted access to Netflix.
ActivPass System: Working Principle

1. The user is prompted with the question: "Whom did you send an SMS today 8 AM?"
2. The user enters their answer.
3. The Activity Listener and Handler checks the Activity Log.
4. The Password Generation Module (PGM) generates a password based on the activity.
ActivPass System: Working Principle

[Diagram showing the working principle of ActivPass system]
ActivPass System: Working Principle

- Whom did you send an SMS today 8 AM?
- Enter Your Answer
- Submit

Activity Listener and Handler
Activity Log
Password Generation Module (PGM)
- Which activity should be chosen for challenge generation?
- How the challenge should be formed from chosen activity?
- Is a single challenge sufficient for authentication?
• Which activity should be chosen for challenge generation?
• **How the challenge should be formed from chosen activity?**
• Is a single challenge sufficient for authentication?
ActivPass System: Design

- Which activity should be chosen for challenge generation?
- How the challenge should be formed from chosen activity?
- **Is a single challenge sufficient for authentication?**
Background and Motivation

ActivPass System

Experiment Setup

Results

Key Points
Experiment Setup: Details of Experiment

Participant’s details
- Number of Participants: 70
- Age range: 18 - 47 (median age: 26)
- Gender: 70% male and 30% female
- Profession: students, researchers, faculty, office staff

Activity sources
1) Mobile activities (call, SMS, audio) 2) Facebook (group, pages, chat-friend) 3) Browsing history

Question formats
1) MCQ 2) Binary questions (yes/no) 3) Text based questions
Experiment Setup: Experiment Procedure

- Identify friends
- Collect activities
- Generate challenges
- Test recall and guess
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Experiment Setup: Experiment Procedure

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1. Background and Motivation

2. ActivPass System

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4. Results

5. Key Points
Results: Metric

Metrics

**Recall Rate (RR):** It is percentage of correct recall made by Alice about her own activity.

**Guessability (G):** It is percentage of correct guess made by Alice’s friends about Alice’s activity.
Results: Insights

Which activity should be chosen for challenge generation?

**Non-outlier activities**

Whom did you send an SMS at 8.30 am today? A) friend1 B) friend2 C) friend3 D) girlfriend

- Frequent activities are easy to guess
- High guessability $\Rightarrow$ discard frequent activities

**Not so recent activities**

Whom did you chat with **six days ago** at 6.30 pm? [Hint: L* (* means any number of character)]

- Not so recent activities are hard to recall
- Low Recall $\Rightarrow$ consider last three days activities
Results: Insights

How the challenge should be formed from chosen activity?

Text based question without hint

Whom did you call at 8.30 pm yesterday?

- Text based question without hint is hard to recall
- Low Recall Rate ⇒ discard

Binary question

Did you visit stackoverflow today?

- Binary question is easy to guess
- High guessability ⇒ discard binary question
### Result

<table>
<thead>
<tr>
<th>Source</th>
<th>Question-format</th>
<th>MCQ</th>
<th>Text-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook</td>
<td>93.9, 25.4</td>
<td>92.3, 6.5</td>
<td></td>
</tr>
<tr>
<td>Web</td>
<td>80.6, 21</td>
<td>N/A, N/A</td>
<td></td>
</tr>
<tr>
<td>Call</td>
<td>87.5, 23.6</td>
<td>90, 5.9</td>
<td></td>
</tr>
<tr>
<td>SMS</td>
<td>88, 20.8</td>
<td>86.2, 4.5</td>
<td></td>
</tr>
</tbody>
</table>

Results in **Blue** represents Recall Rate and **Magenta** represents Guessability

Average Recall Rate **86.3%** and average Guessability **14.6%**
Result: Number of challenges in challenge set

Is a single challenge sufficient for authentication?
- With too many questions, the system will be difficult to use.

- Probability that out of three questions, two questions answered correctly by authentic user is $\approx 0.95$ and by impostor is $\approx 0.05$.

- Final results confirm the computed probability.
Result: User Study

User Study

Easy to learn

Memory wise effortless

Replace question answer based password recovery
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Key Points

- Recent past outlier activities are good candidate for challenge generation

- This type of password system can restrict password sharing and can be used for password recovery

- There is scope of further improvement in challenge generation through personalization
Thank You!!

Thanks to Google India for awarding me travel grant for this event.