Measuring the Security Impacts of Password Policies Using Cognitive Behavioral Agent-Based Modeling

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Outline

The Grand Vision

- **Problem:** Those pesky humans make security hard.

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- **Goal:** To create security tools that account for the human.

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- **Goal:** To create security tools that account for the human.
- **Approach:** Human-centric agent-based models.

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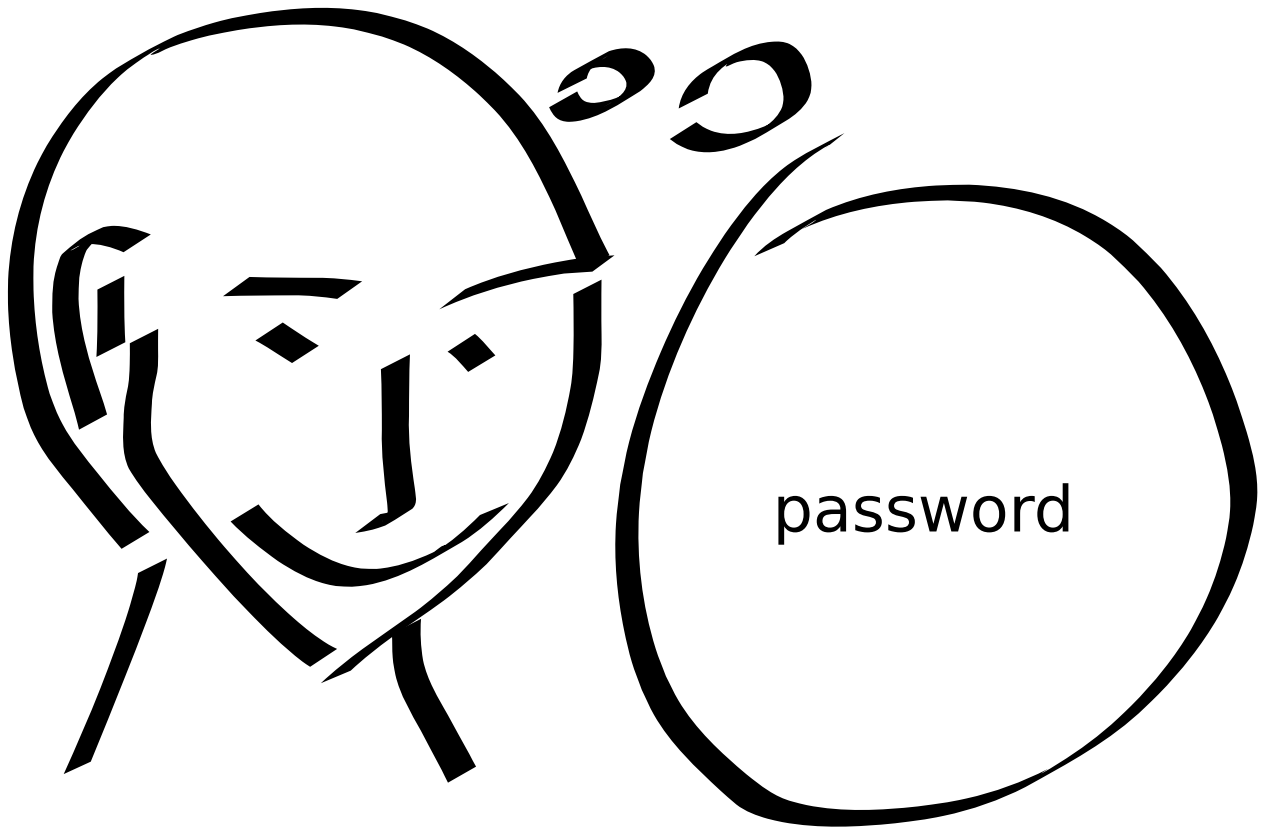
1. The password must be **exactly** 8 characters long.
2. It must contain **at least** one letter, one number, and one special character.
3. The **only** special characters allowed are: @ # $
4. A special character must **not** be located in the first or last position.
5. Two of the same characters sitting next to each other are considered to be a "set." No "sets" are allowed.
6. Avoid using names, such as your name, user ID, or the name of your company or employer.
7. Other words that cannot be used are Texas, child, and the months of the year.
8. A new password cannot be too similar to the previous password.
    a. Example: previous password - abc#1234, acceptable new password - acb$1243
    b. Characters in the first, second, and third positions cannot be identical. (abc*****)
    c. Characters in the second, third, and fourth positions cannot be identical. (*bc#****)
    d. Characters in the sixth, seventh, and eighth positions cannot be identical. (*****234)
9. A password can be changed voluntarily (no Help Desk assistance needed) once in a 15-day period. If needed, the Help Desk can reset the password at any time.
10. The previous 8 passwords cannot be reused.

source: `http://kottke.org/12/06/the-worlds-worst-password-requirements-list`

The Password Problem



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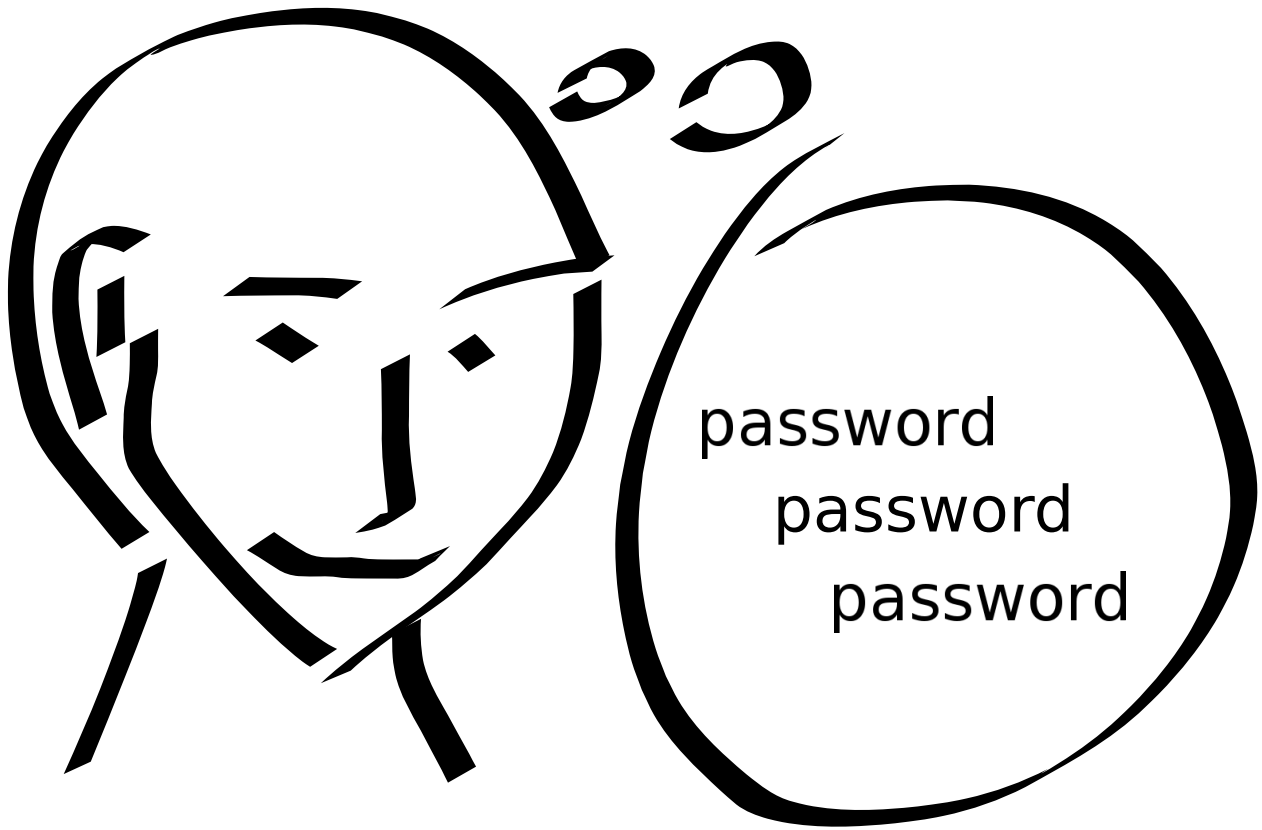

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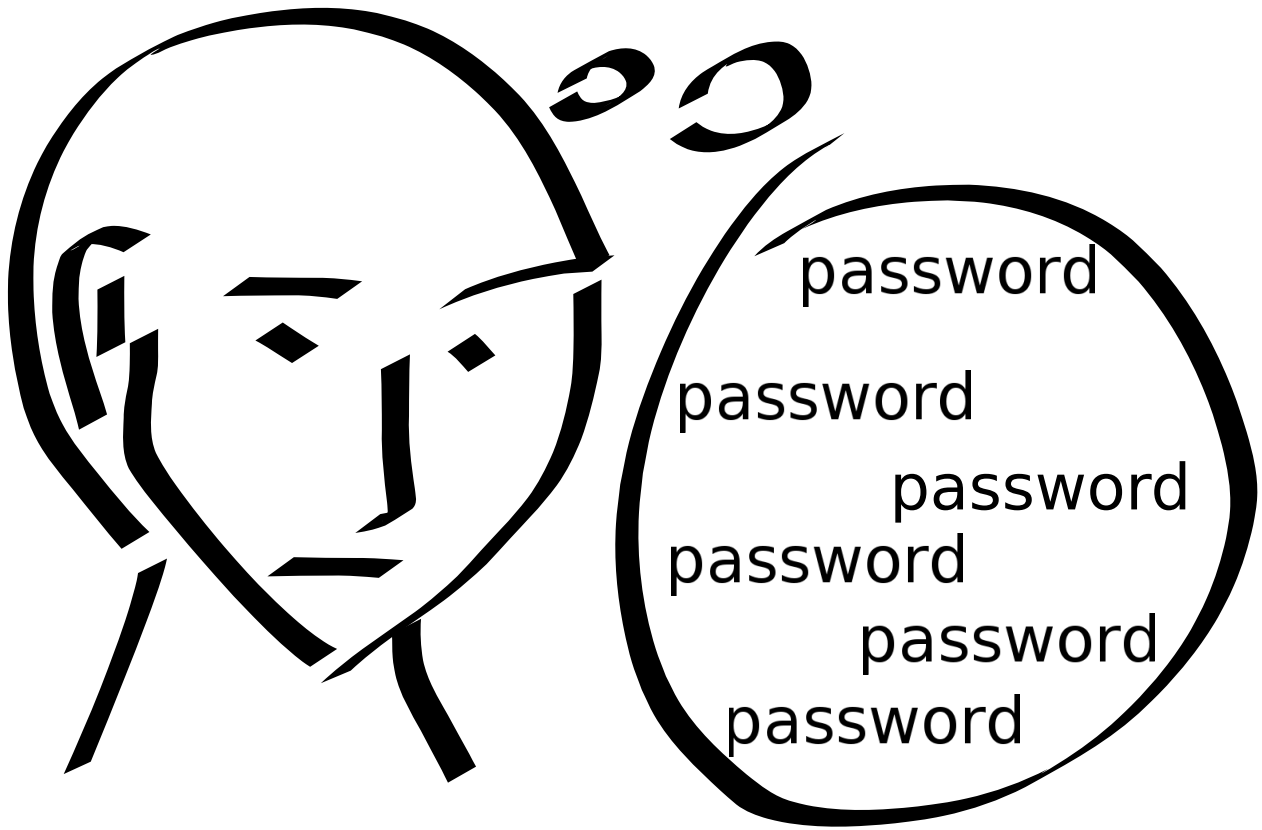

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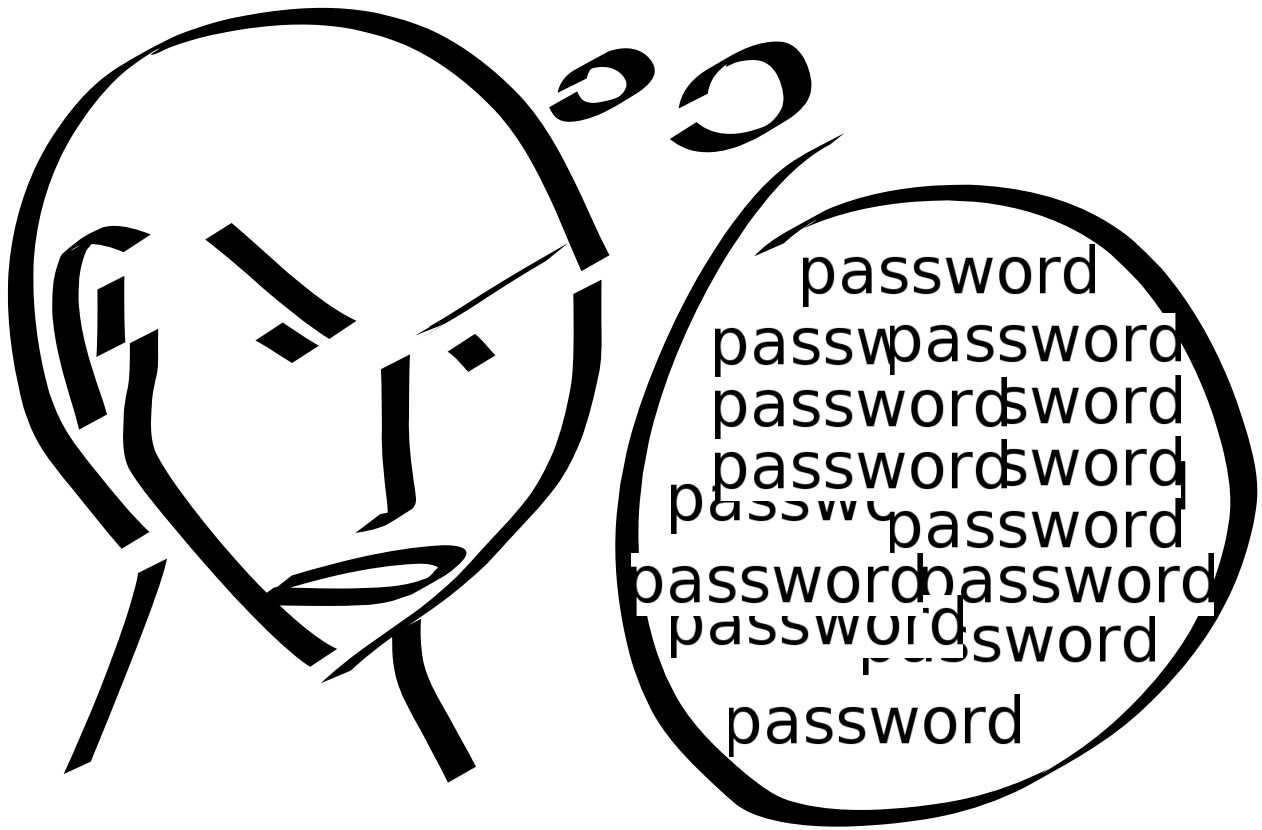
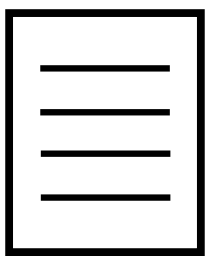


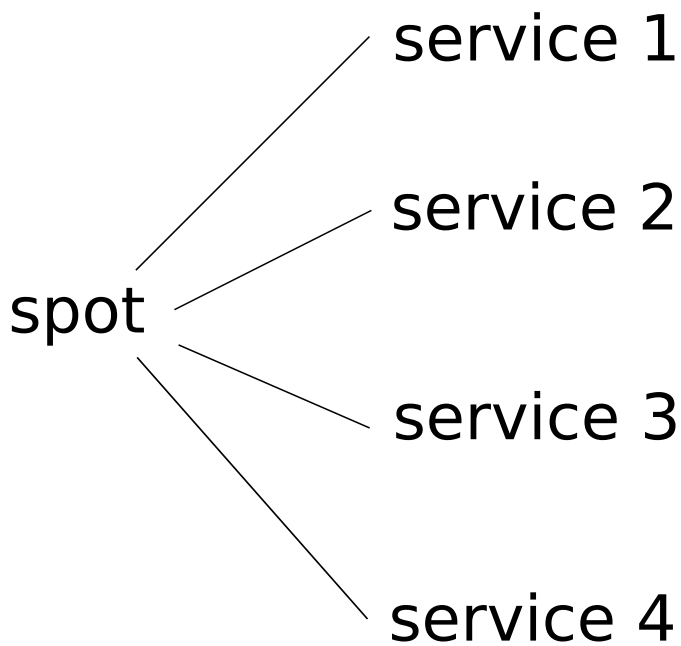
The Password Problem

bank
username:
bob

password:
b47m4n



passwords.txt



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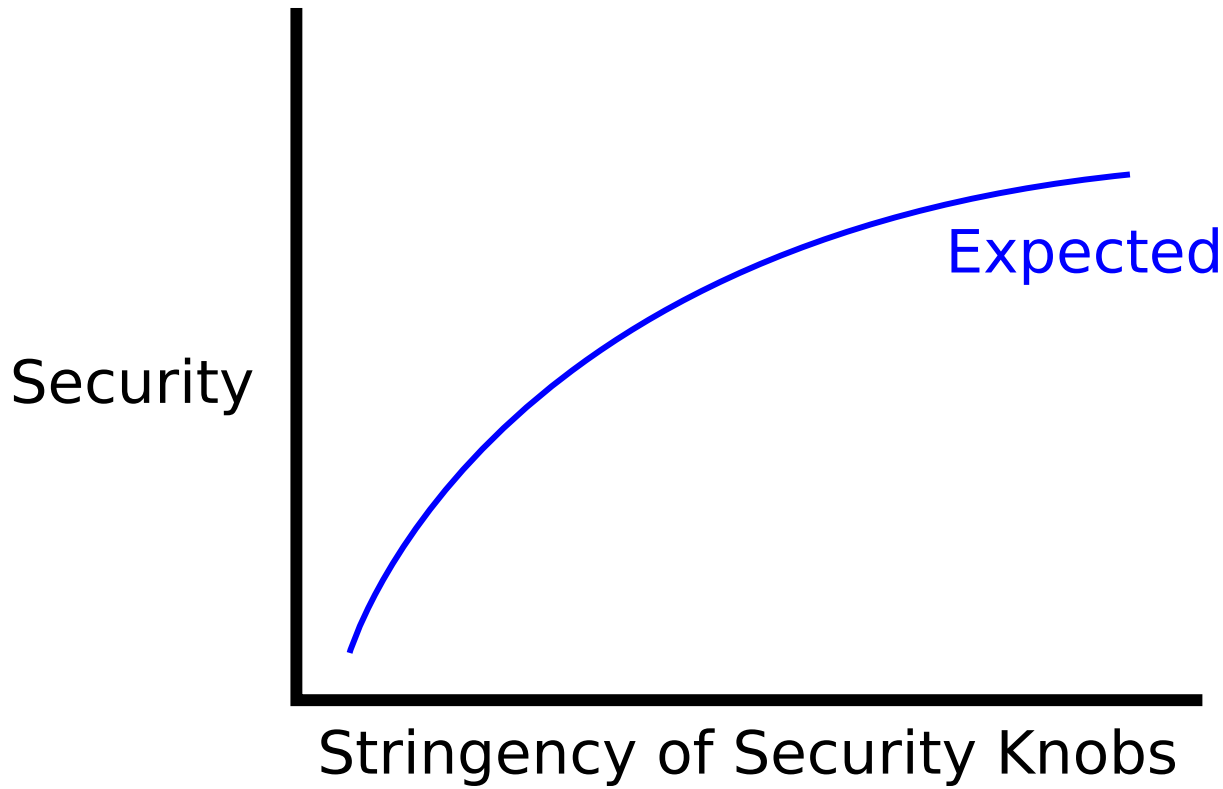
- Can we stop circumvention?
- Can we set better password policies?
- How do we choose these policies?

Agent-Based Simulations for Security



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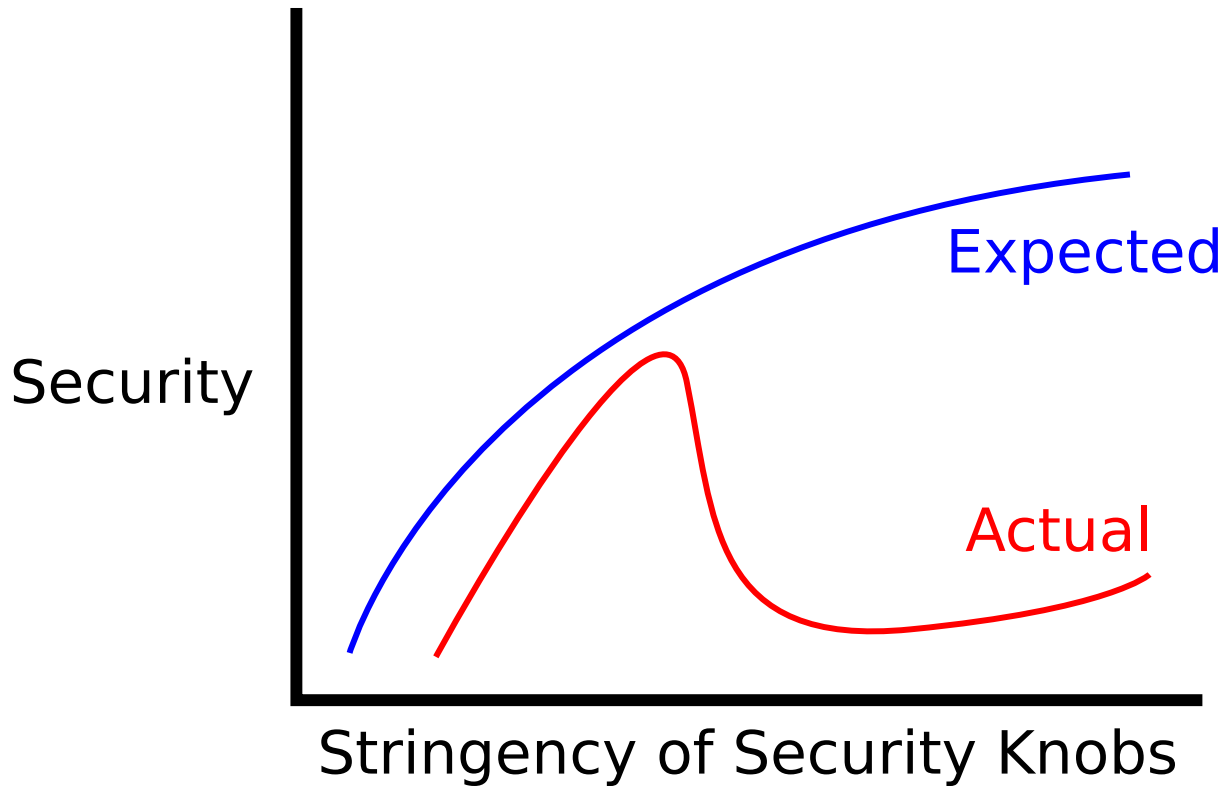

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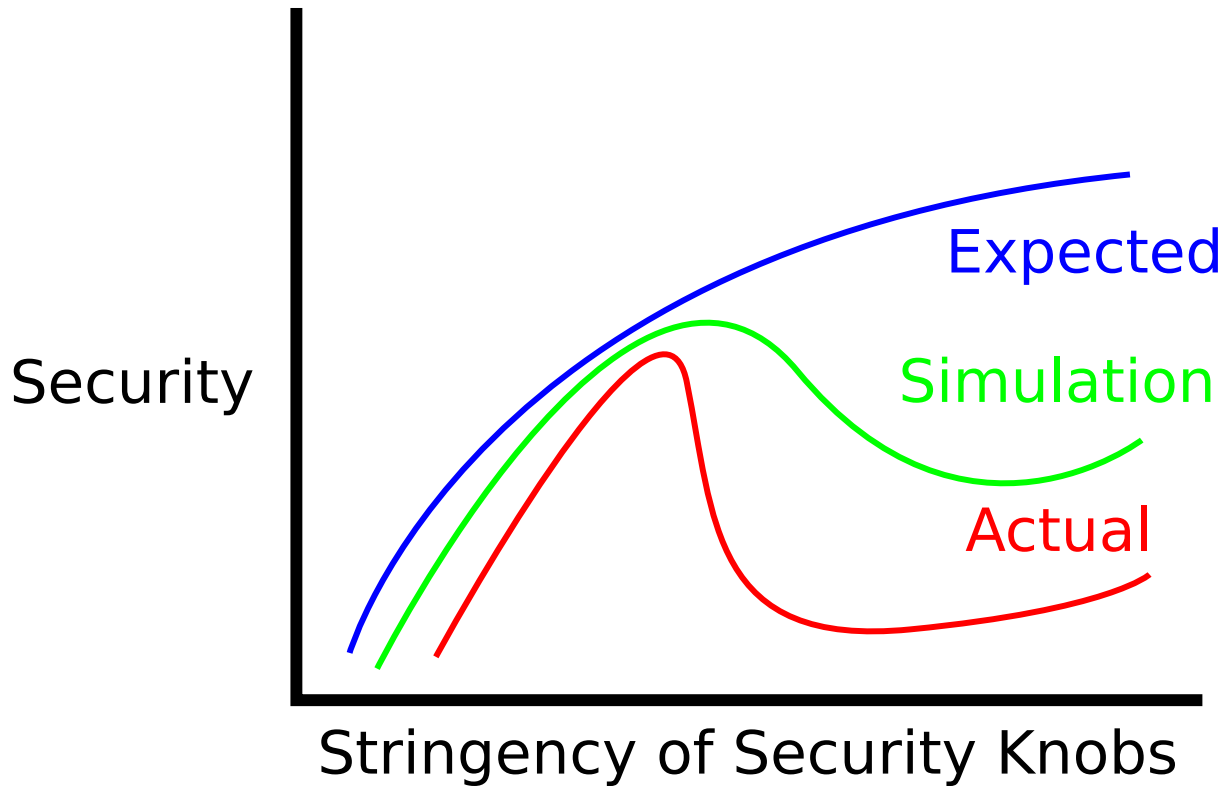
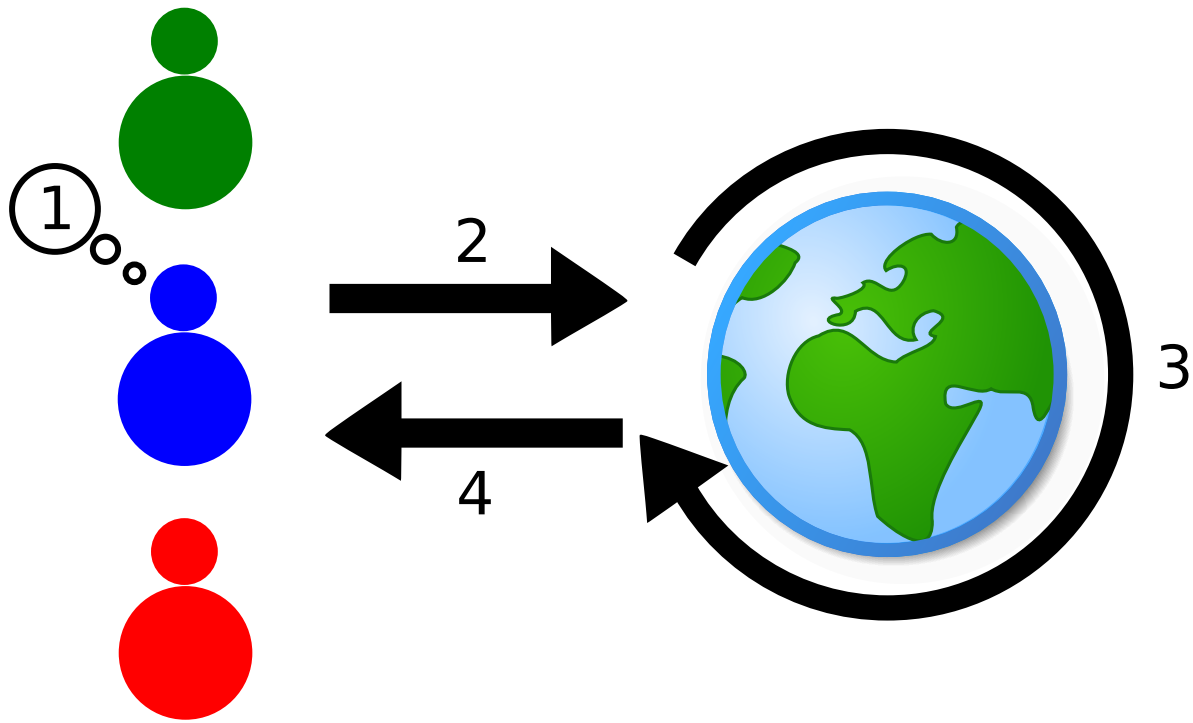


Bird's Eye View of DASH



source for earth image: `http://commons.wikimedia.org/wiki/File:Ambox_globe.svg`

References:
1. A Dual-Process Cognitive Model for Testing Resilient Control Systems (Jim Blythe)
2. Implementing Models (Jim Blythe and Jean Camp)

DASHWords - Overview

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  - create accounts
  - sign in to accounts
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- Key underlying models:
  - cognitive burden
  - password recall
  - attack threats

Modeling Cognitive Burden:

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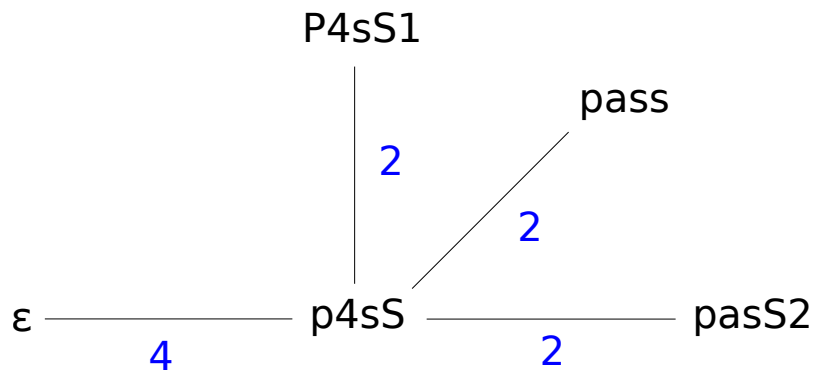

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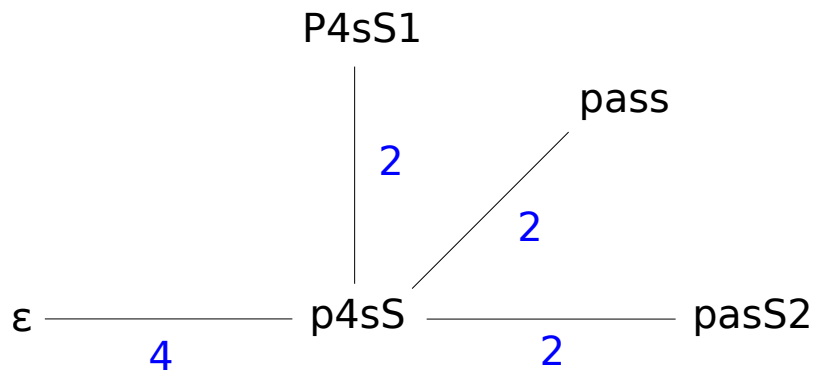

$$L(S) = 4 + 2 + 2 + 2 = 8$$

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- Agent actions and results affect belief strengths.

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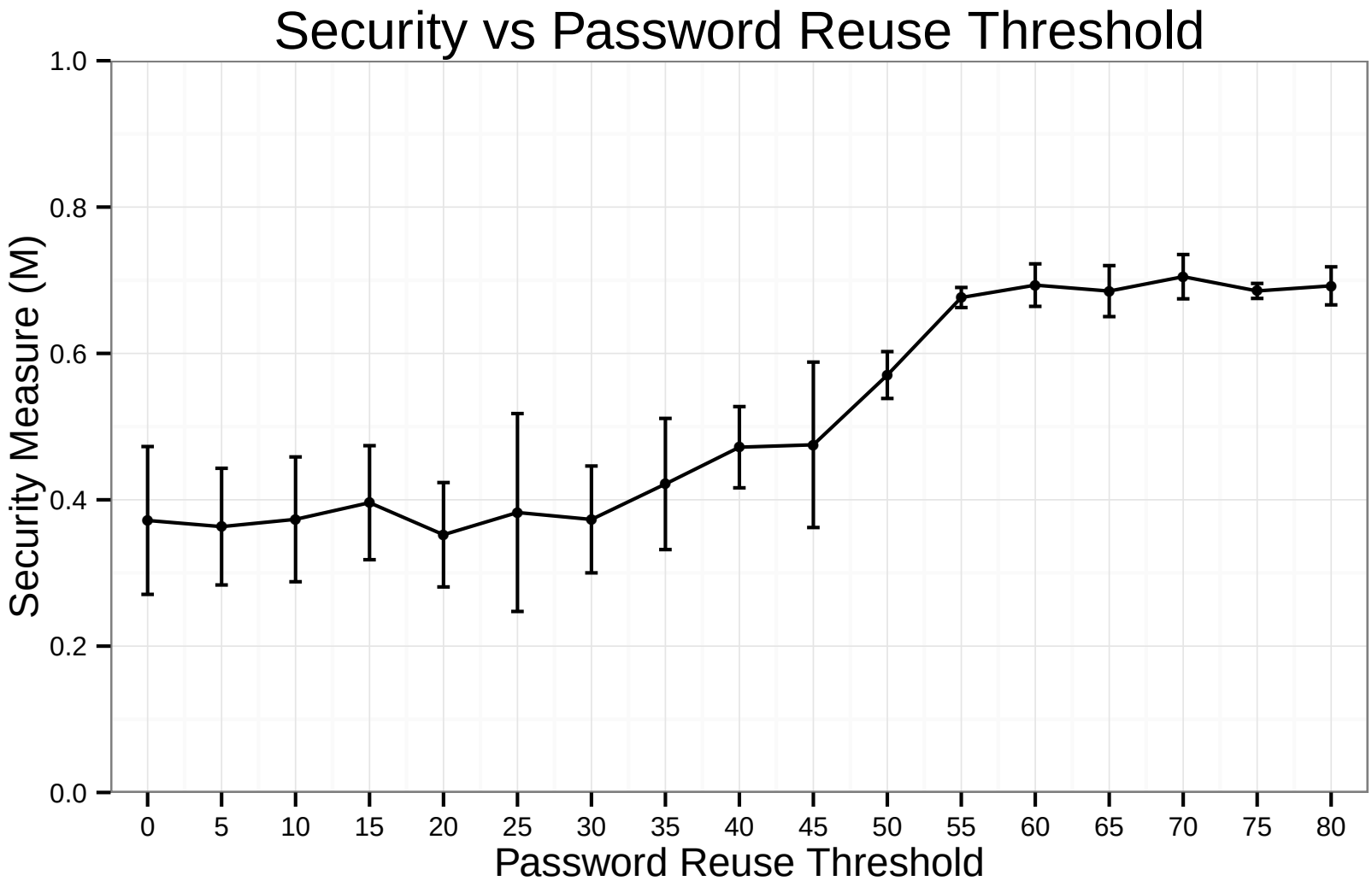
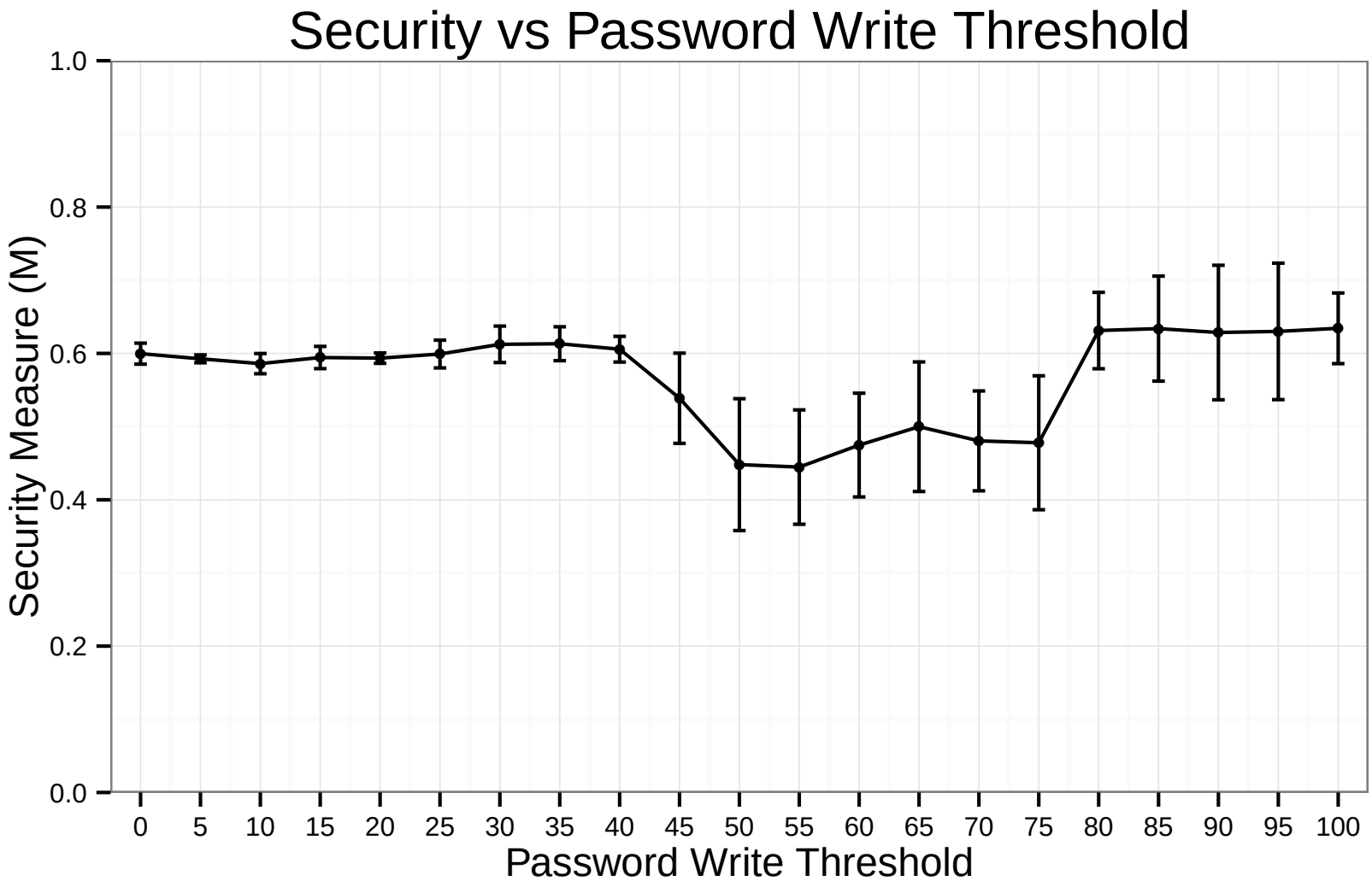
- Aggregate Security:

$$M = P(SAFE) = (1 - P_{DA}) * (1 - P_{SP}) * (1 - P_{RA})$$

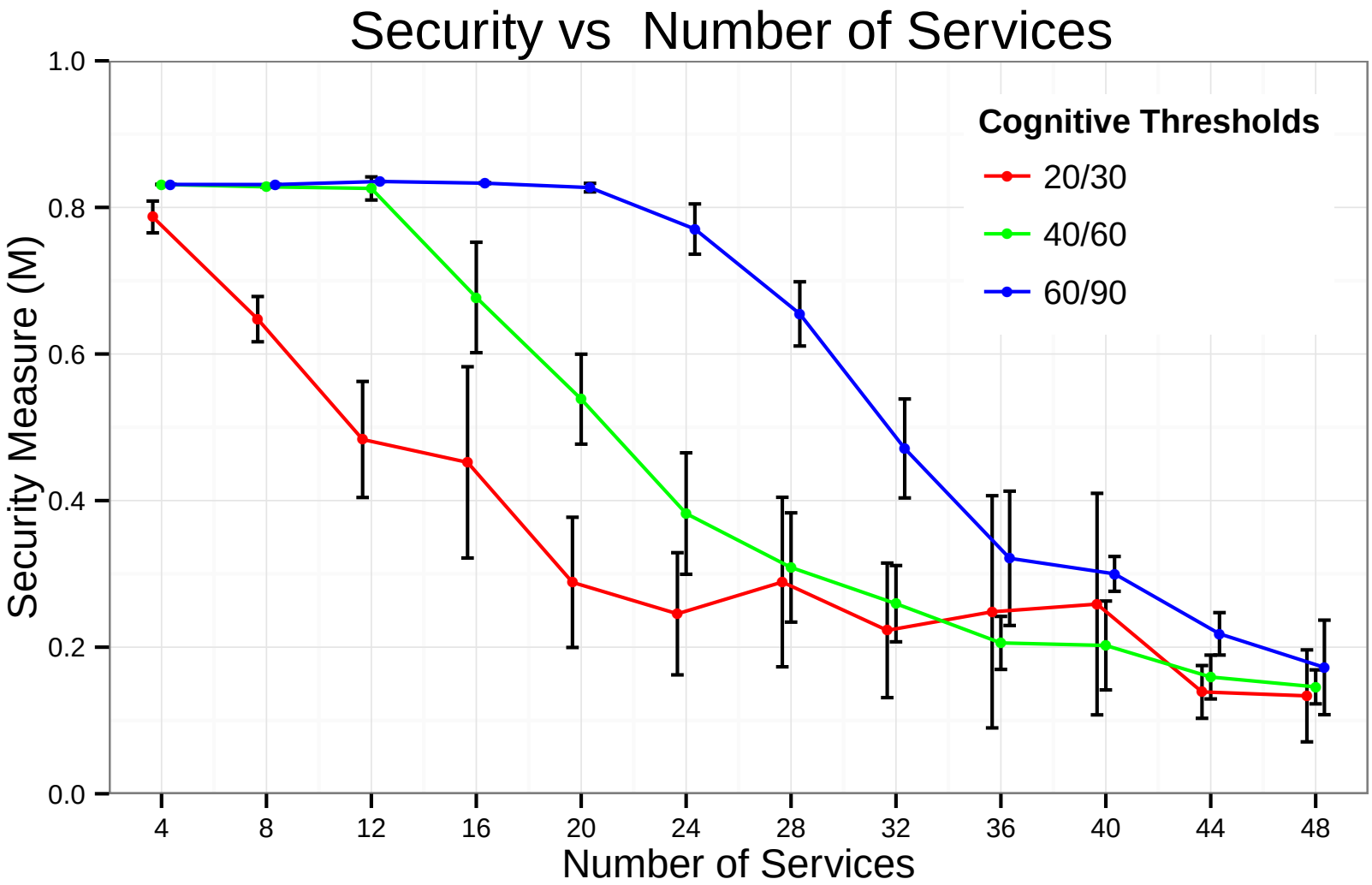
Results - Security vs Password Reuse Threshold



Results - Security vs Password Write Threshold



Results - Security vs Number of Services



Future Work

- Future Password-Related Work:
  - Other circumventions
  - Group dynamics
  - Endorsing circumventions
  - More accurate modeling
  - Validation
- Autologouts
- Other problems?

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- This necessitates better policy tools.
- Agent-based simulations may help.

Thank you!

Contact Information:

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