CERIAS

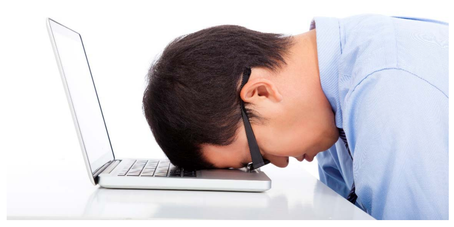
The Center for Education and Research in Information Assurance and Security

Just In Time Hashing

Jeremiah Blocki (jblocki@purdue.edu) and Benjamin Harsha (bharsha@purdue.edu)

Key Problem

- **Users are impatient and do not want to wait to log in**
- **The time users are willing to wait is not sufficient to provide protection against offline attacks**



The Just In Time Method

- **Key idea: It takes users a second or two to type their password**
- **Start hashing when they start typing instead of when they stop**
- **Instead of storing the usual H(salt, pwd), store $H(c_n, H(c_{n-1}, \ldots H(c_1,salt)\ldots)$**

Security analysis

- **Is there any advantage to an adversary facing a Just In Time hashed password in an offline attack?**
- **The adversary can use previous password attempts to speed up future attempts**
- **People pick passwords that are similar to each other!**

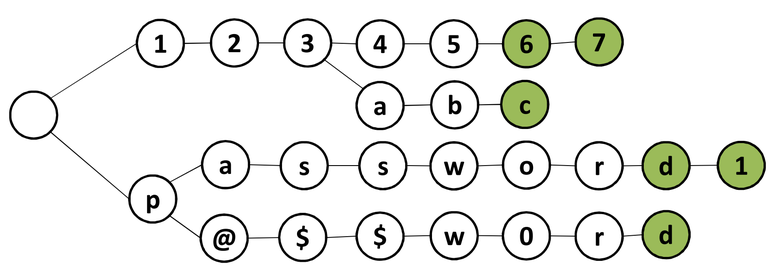


Fig 1: Several common passwords that share paths for JIT hashing

Just In Time with Memory Hardness

- **Adversary gains an advantage if they can store previous attempts**
- **Using memory hard functions helps make storing all previous attempts infeasible**

User Study: How much time do we have for key stretching?

- **How long do users actually take to type their passwords?**
- **Is muscle memory involved? Is it consistent?**
- **How do they correct their typos? How often do they make typos?**
- **Precautions: Third party code review, only collecting timing and error correction data**

Implementation

- **Simple implementations exist, just use output of hash function and continue character by character**
- **Working it into the function itself helps, especially with memory hard functions**
- **Must deal with users making errors and correcting them**
- **Implementation based on Argon2, winner of Password Hashing Competition in 2015 [1,2]**

Next Steps

- **Finish modifications to Argon2**
- **Complete user study and analyze results**
- **Complete write up**

References & Acknowledgements

1. https://password-hashing.net/argon2-specs.pdf
2. https://password-hashing.net/

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