

Yubikeys as an Instrument for Security Education:

Combating Apathy and the Lack of Computer Security Curricula in High Schools

By Leslie Choi and Rebecca Sexton-Lee

1. Internet + Phishing = ?

Lose your cash!

Southern Oregon University Phishing Attack Nets Criminals \$1.9 Million
by titandmin | Jun 20, 2017

Lose your house!

First time homebuyer out more than \$36,000 in spear phishing scam
November 29, 2017

Lose your business!

Ubiquiti Networks victim of \$39 million social engineering attack
By Brian Homan

Lose your election!

The phishing email that hacked the account of John Podesta
October 28, 2016

Lose your Instagram?

Hackers Seem to Be Hijacking Instagram Accounts With Increasing Frequency
By DON REISINGER August 14, 2018

2. Grim Statistics on Phishing

- 76% of businesses victimized (2017), Wombat Security
- 95% of enterprise attacks due to spear phishing (SANS)
- 2018 Verizon Data Breach Investigations Report (DBIR)

"Companies are nearly three times more likely to get breached by social attacks than via actual vulnerabilities, emphasizing the need for ongoing cybersecurity education"

3. One reason? Passwords

Hard to remember, hard to guess VS Easy to remember, easy to guess

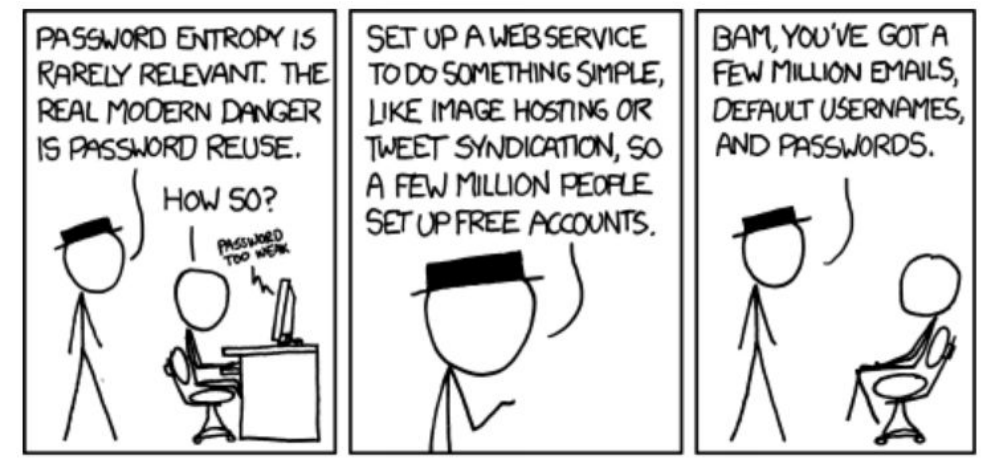


2018 Top 10 passwords

- | | |
|--------------|--------------|
| 1. 123456 | 6. 111111 |
| 2. password | 7. 1234567 |
| 3. 123456789 | 8. sunshine |
| 4. 12345678 | 9. qwerty |
| 5. 12345 | 10. iloveyou |

4. Reuse is Rampant

Password Security Report: 83% of Users Surveyed Use the Same Password for Multiple Sites



5. Broken Passwords Beget Broken Passwords

- 81% of breaches leveraged stolen and/or weak passwords (2017 Verizon DBIR)

Stolen Administrator Credentials Led to Breach of University Systems

October 20th, 2014
December 12, 2017
Mohit Kumar

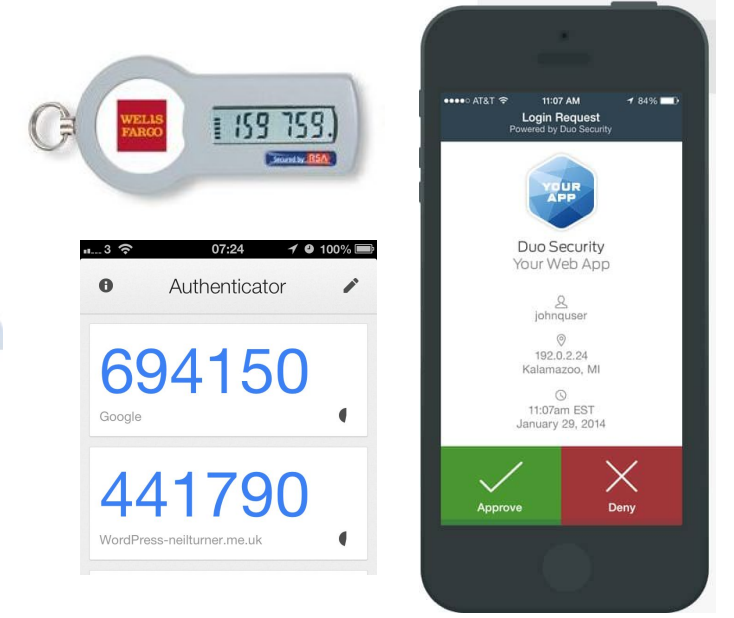
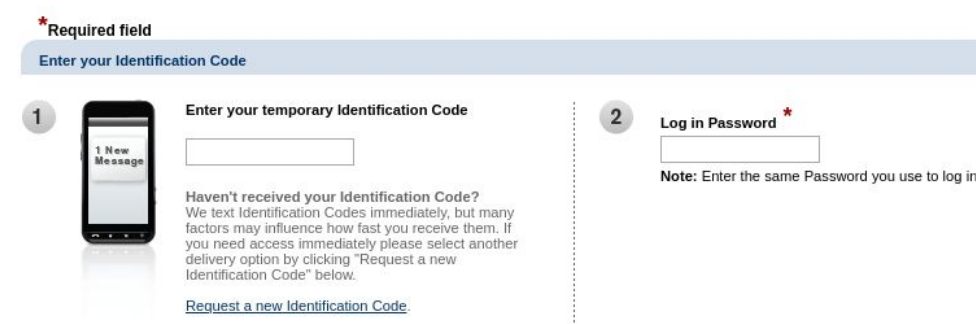
Dropbox employee's password reuse led to theft of 60M+ user credentials

Kate Conger, Matthew Lynley
8/30/2016
Hackers are passing around a massive collection of 2.2 billion stolen logins
Chris Smith @chris_writes
January 29th, 2018 at 10:33 AM

"The common vein is the ability to use a single password to access thousands if not millions of user data"

6. 2-Factor Authentication (2FA) to the Rescue?

Chase Online <smrfs@emailonline.chase.com> 2:48 PM (0 minutes ago)
Note: This is a service message regarding the Identification Code you requested.
Your Identification Code is: 40153014



7. 2FA Issues

- For the privileged:** Users must be able to afford a smart-phone
- Hard to learn:** Each site has its own version of 2FA for users to learn
- Hard to use:** Multiple applications must be accessed to use
- And now..... **vulnerable to attack**

2FA Might Be Secure, But It's Not Usable: A Summative Usability Assessment of Google's Two-factor Authentication (2FA) Methods

Claudia Ziegler Acemyan, Philip Kortum, Jeffrey Xiong, more...
September 27, 2018
<https://doi.org/10.1177/1541931218621262>

Amnesty International reveals how 2FA is being bypassed automatically

Alan Martin_martin 20 December 2018

UK bank falls victim to SS7 attacks, allowing cybercriminals to drain accounts and reminding us why SMS two-factor authentication sucks

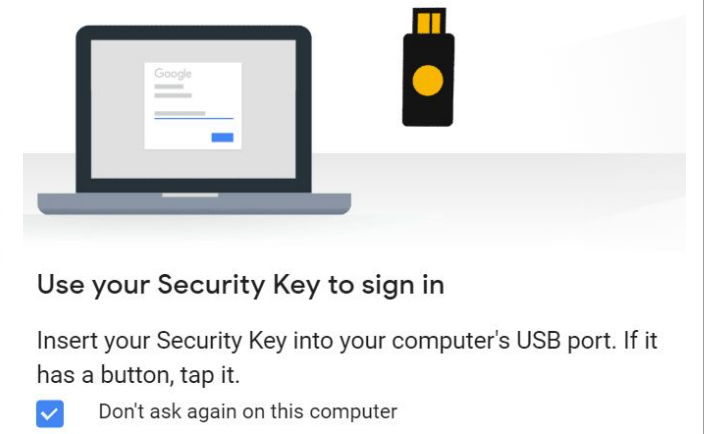


8. Yubikeys, WebAuthn, U2F to the Rescue?



WebAuthn

W3C approves WebAuthn as the web standard for password-free logins
EMIL PROTALINSKI @EPRO MARCH 4, 2019 5:00 AM



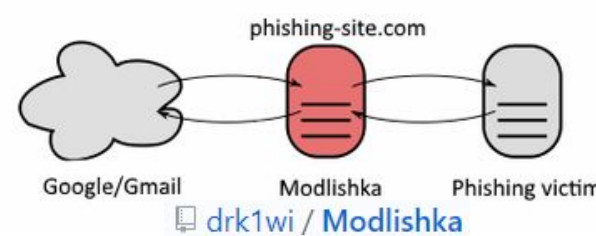
9. Security with Usability for only \$20!

23 Google: Security Keys Neutralized Employee Phishing

"The beauty of WebAuthn is that it eliminates the need for users to constantly type in their passwords, which negates the threat from common password-stealing methods like phishing and man-in-the-middle attacks."

Phishing NG. Bypassing 2FA with Modlishka.

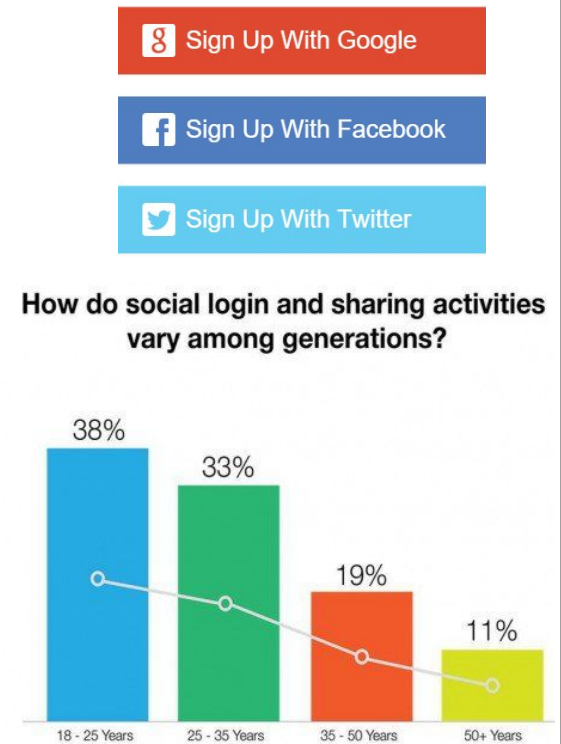
Written on January 2, 2019



"Currently, the only way to address this issue, from a technical perspective, is to entirely rely on 2FA hardware tokens, that are based on U2F protocol."

10. A Yubikey curriculum

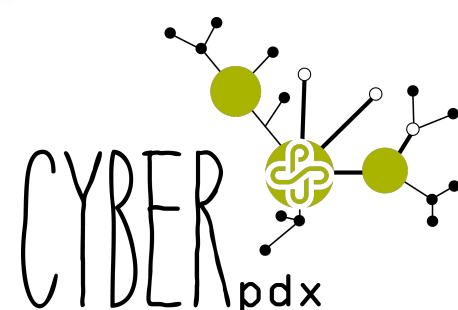
- Motivate the need for Yubikeys/U2F
- Give participants Yubikeys
- Have students use Google's 2FA wizard to register key
- Swap laptops and login using the registered key
- Why Google accounts?
 - 93% of users prefer single sign-on via social login
 - Younger generation adopting social login quickly with 97.9% preferring Facebook and Google for it.
 - Usability of Google's wizard shown to be good



11. Deploy in CyberPDX

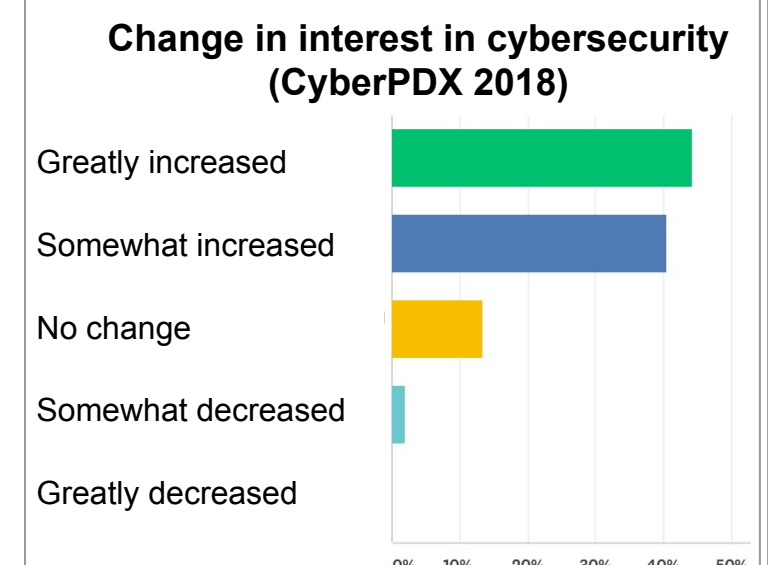
"CyberPDX: A Camp for Broadening Participation in Cybersecurity" (USENIX Security ASE 2017)

- Teach curriculum to high-school sophomores as a vehicle for helping broaden participation in cybersecurity
- 60% female, 40% under-represented minorities
- Diverse socio-economic representation
- Aim to increase self-efficacy in cybersecurity for students from under-represented groups



12. Track Outcomes to Determine Impact

- Career impacts
 - Interest in cybersecurity
 - Choice of courses in high school
 - Attending college
 - Choice of undergraduate major
 - Career choice
- Security impacts
 - Percentage still using Yubikeys
 - Percentage successfully phished



"I didn't think I was good enough to pursue computer science, but...why wouldn't I be good enough?...I think we're all pretty confident because we see that it's very simple to learn as long as you have patience in yourself and are not afraid to ask questions."

-Promising Practices for Engaging Adolescent Girls in Cybersecurity Education

This material is based upon work supported by the National Science Foundation under Grant No. CNS-0627752 and by the generous donations of Intel Corporation. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or Intel. NSF Grant #1821841, GenCyber camps 18-OR-PSUx-UV-C2-0709A (2018) and 19-OR-PSUx-UV-T2 (2019).