Computer Security & Privacy

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(based on slides by Daniel Halperin)

Overview

What is computer security?

- There are many reasons for failure
- **Reliability**
  - Accidental failures
- **Usability**
  - Operating mistakes by users
- **Security**
  - *Intentional* failures caused by *intelligent* parties
  - Involves an *adversary*
- All three are connected

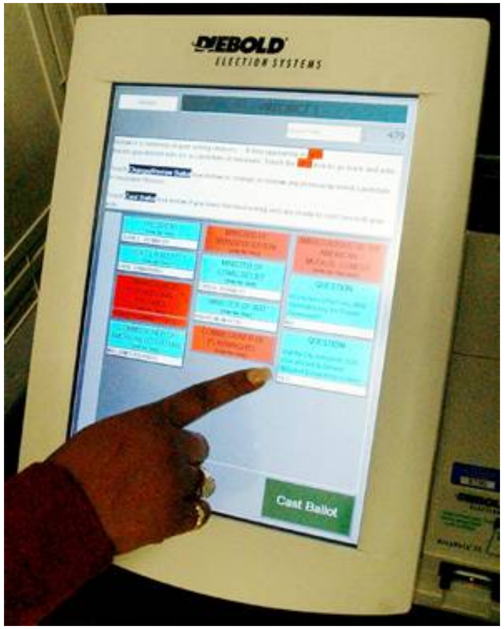
Security Mindset

- Composed of 5 parts
  - Security goals
  - Assets
  - Adversaries
  - Threats
  - Risks
- Perfect security DOES NOT exist
  - Risk management, not “yes or no”
  - Security mindset helps us evaluate risks

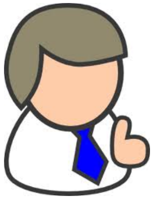
Approaches

- Prevention
  - Stop the attack
- Detection
  - Detect ongoing or past attack
- Response
  - Respond to attacks
- Different approaches for different situations and systems

Example: Electronic Voting



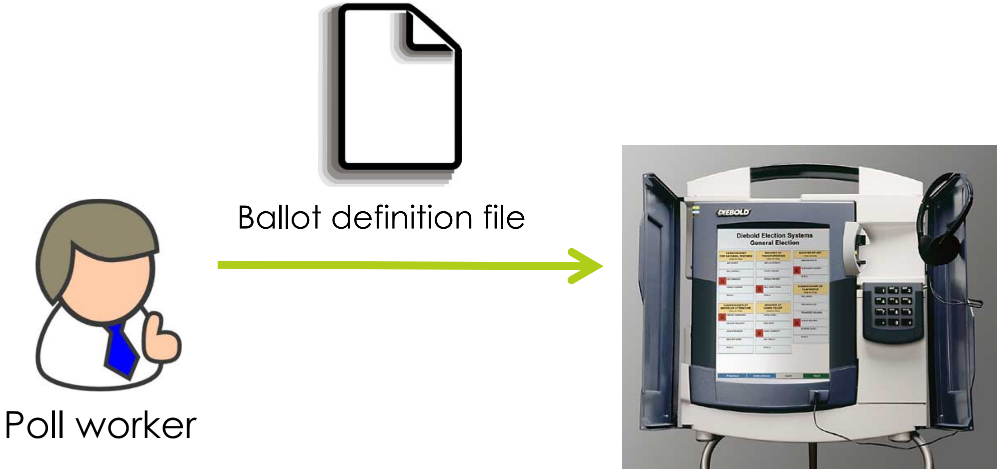
The System



Poll worker

Poll workers load "ballot definition files" on voting machine

The System



Ballot definition file

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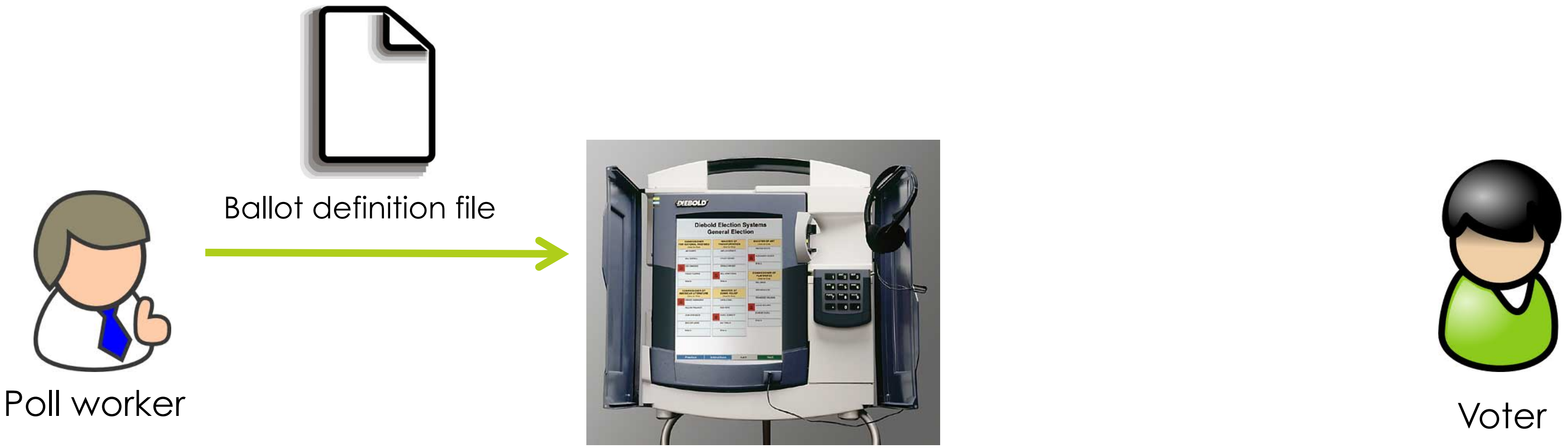


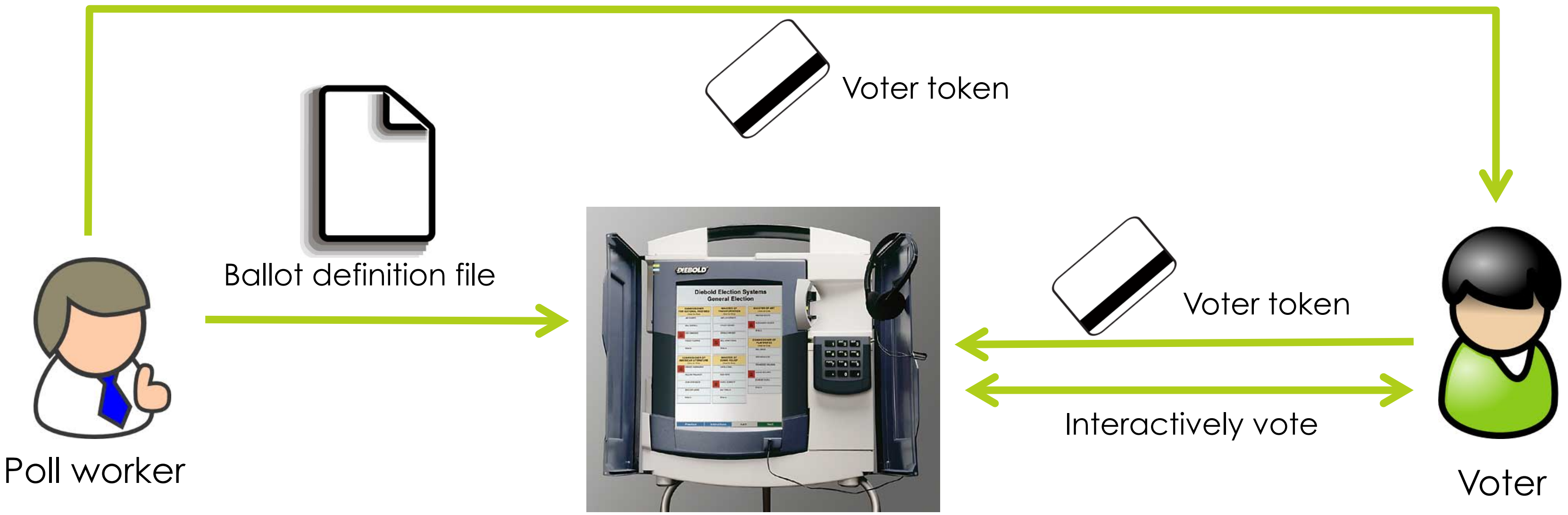
Ballot definition file

Poll worker

Voter

Voters obtain "single-use" tokens from poll workers. Voters use tokens to activate machines and vote.

The System



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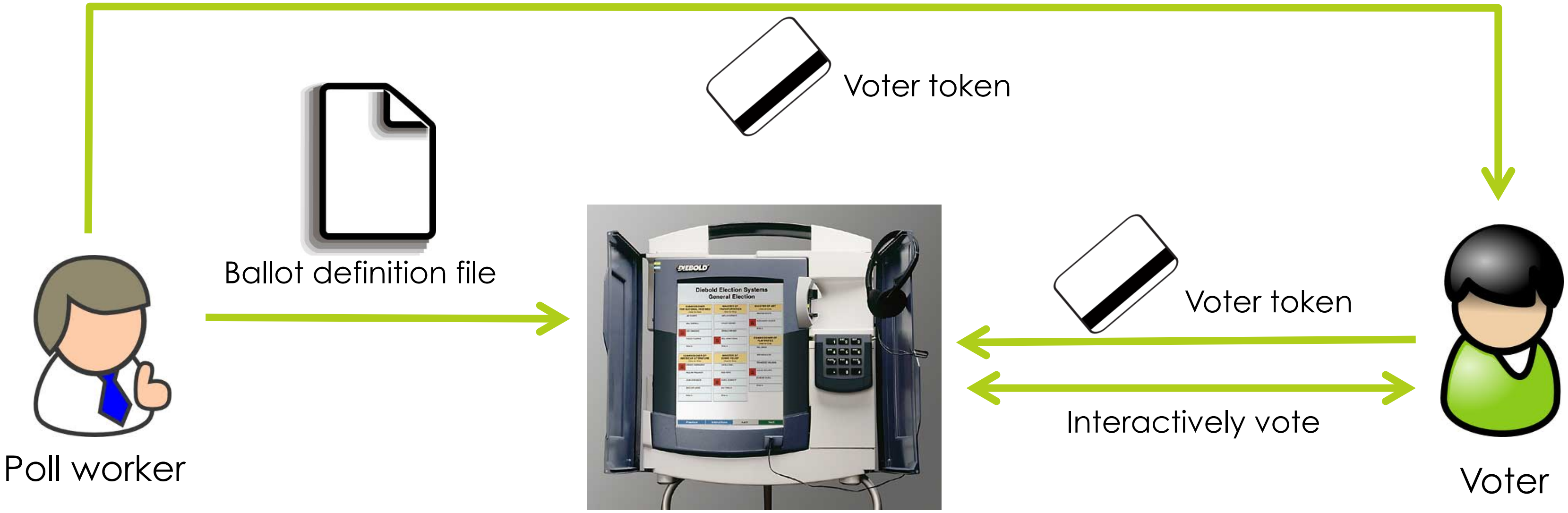
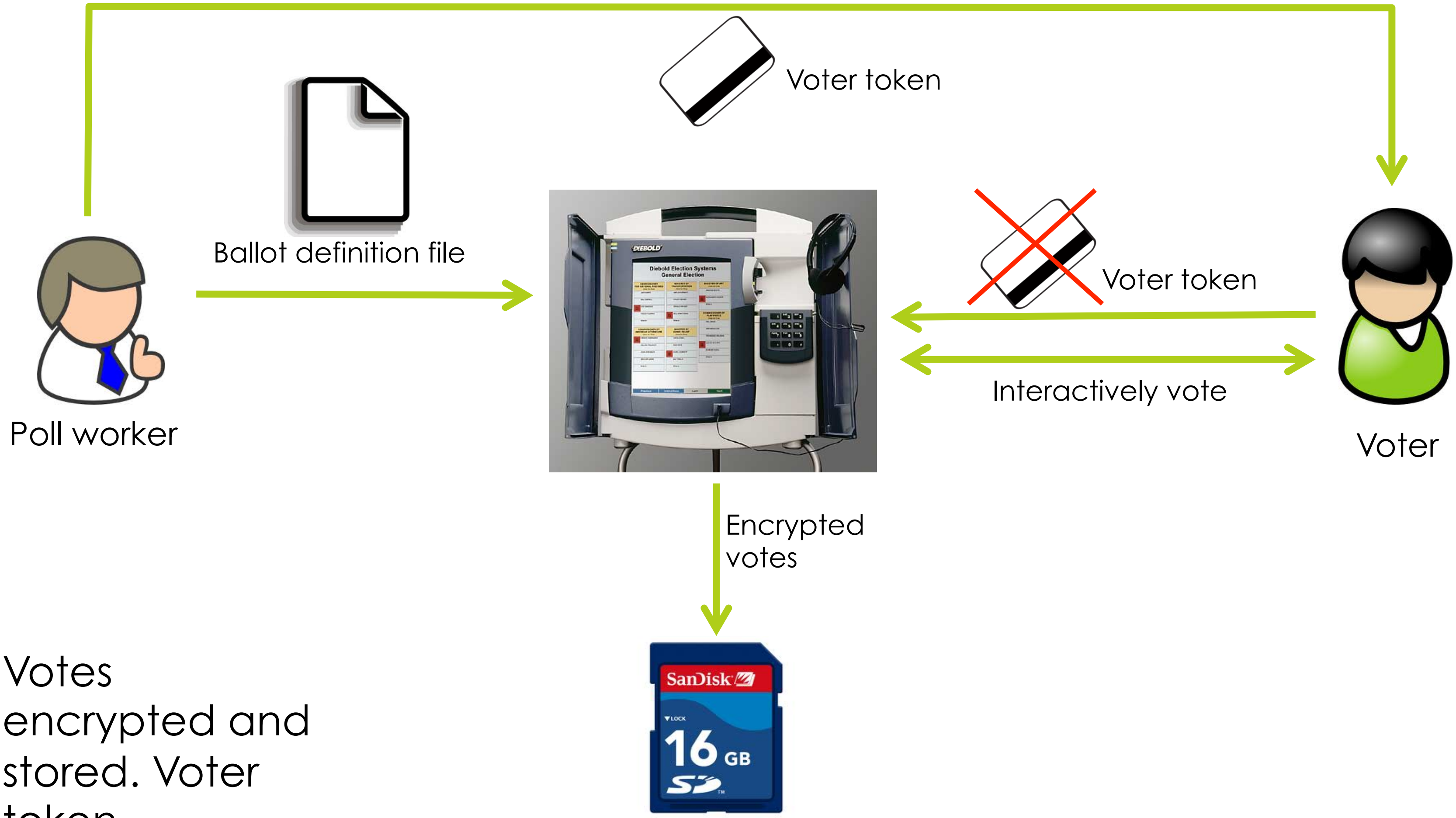


Votes encrypted and stored. Voter token cancelled.

The System



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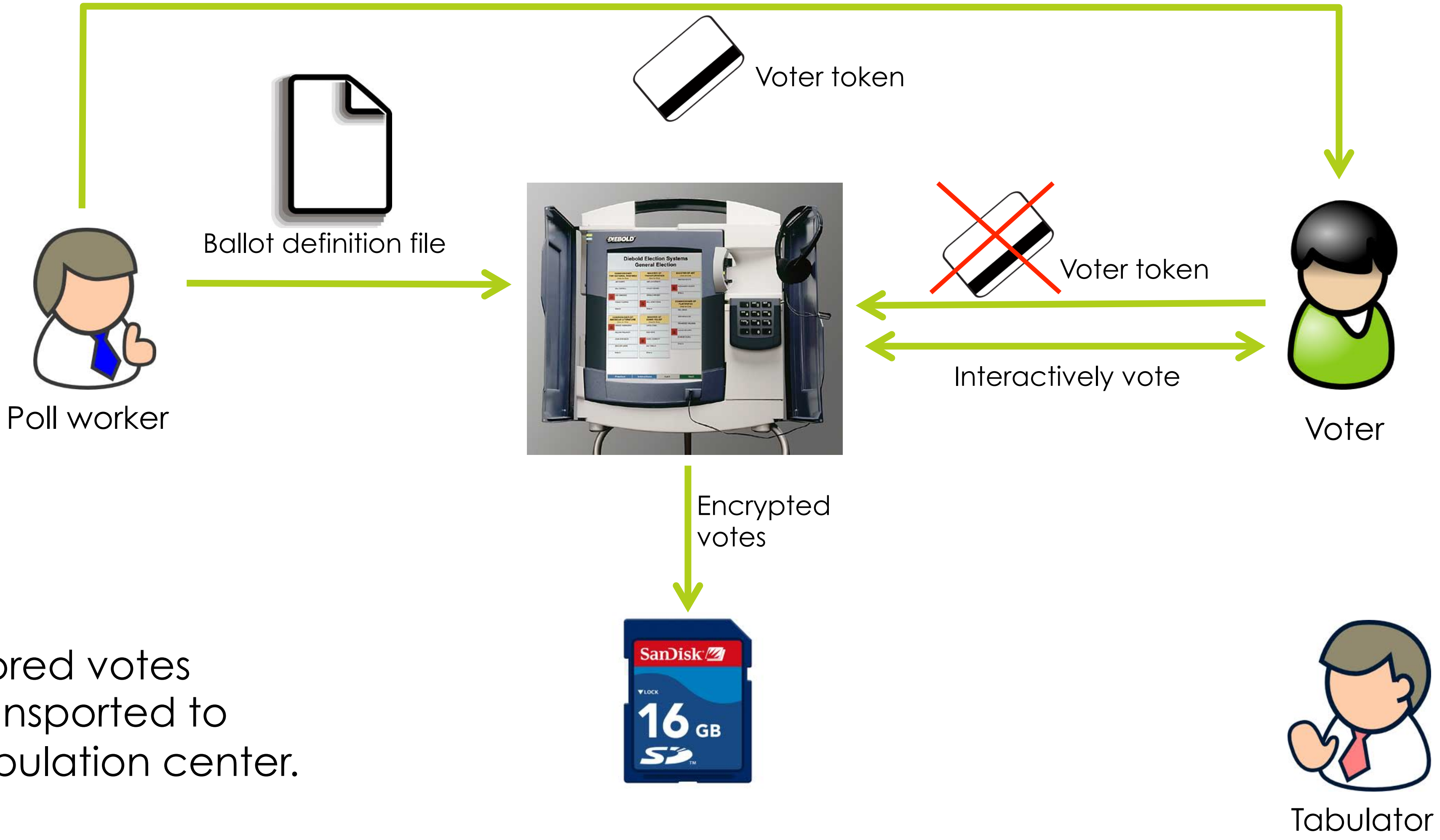
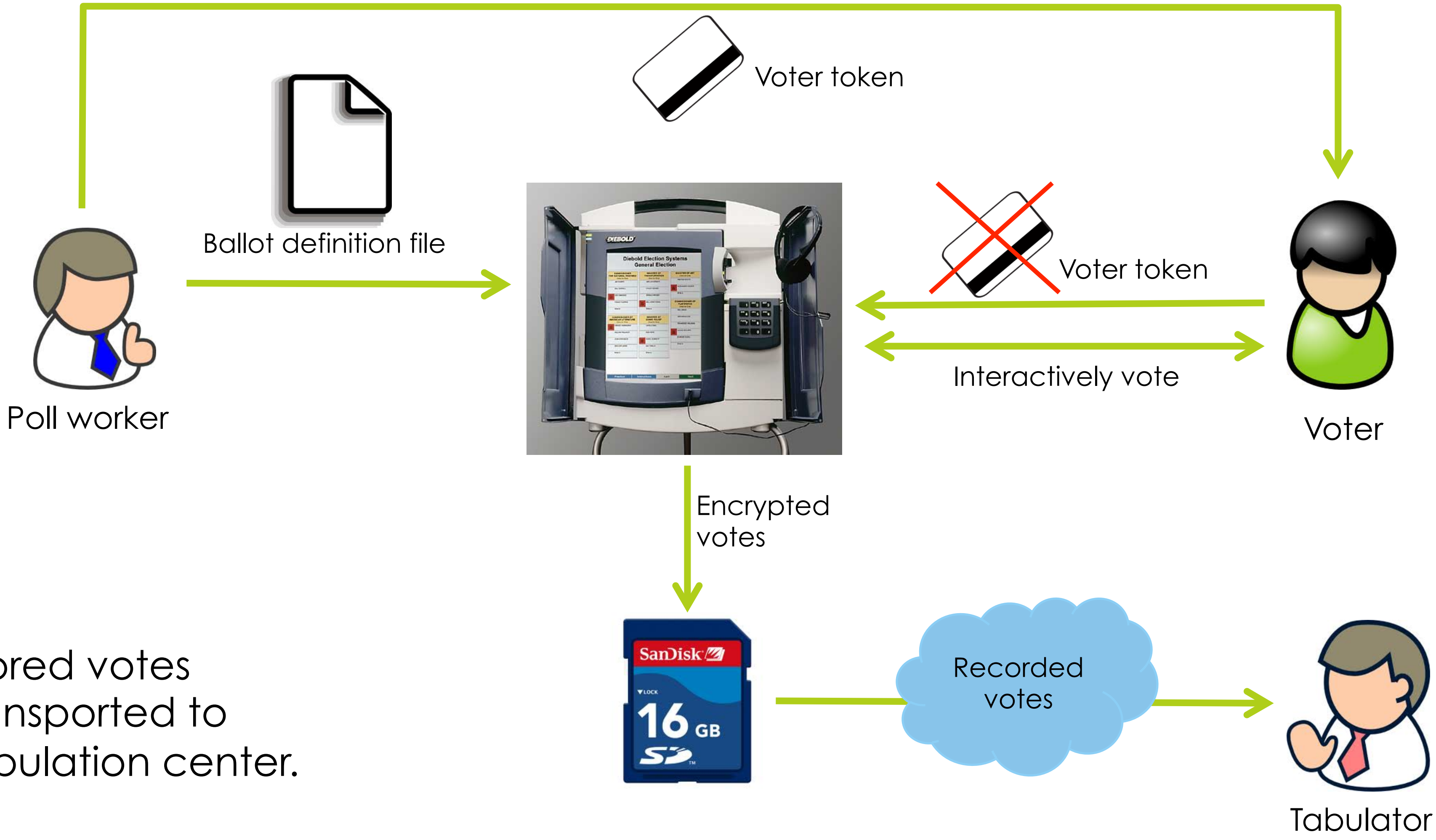


Stored votes transported to tabulation center.

The System



Voter token

Ballot definition file

Poll worker

Voter token

Interactively vote

Voter

Encrypted votes

Recorded votes

Tabulator

Stored votes transported to tabulation center.

What about our model?

- What are the **goals** of this system?
- What are the **assets**?
- Who are the **adversaries**?
- What are the potential **threats**?

Overall security goals

- Confidentiality / privacy
- Integrity
- Authenticity
- Availability

User Authentication

(Passwords)

Types of authentication

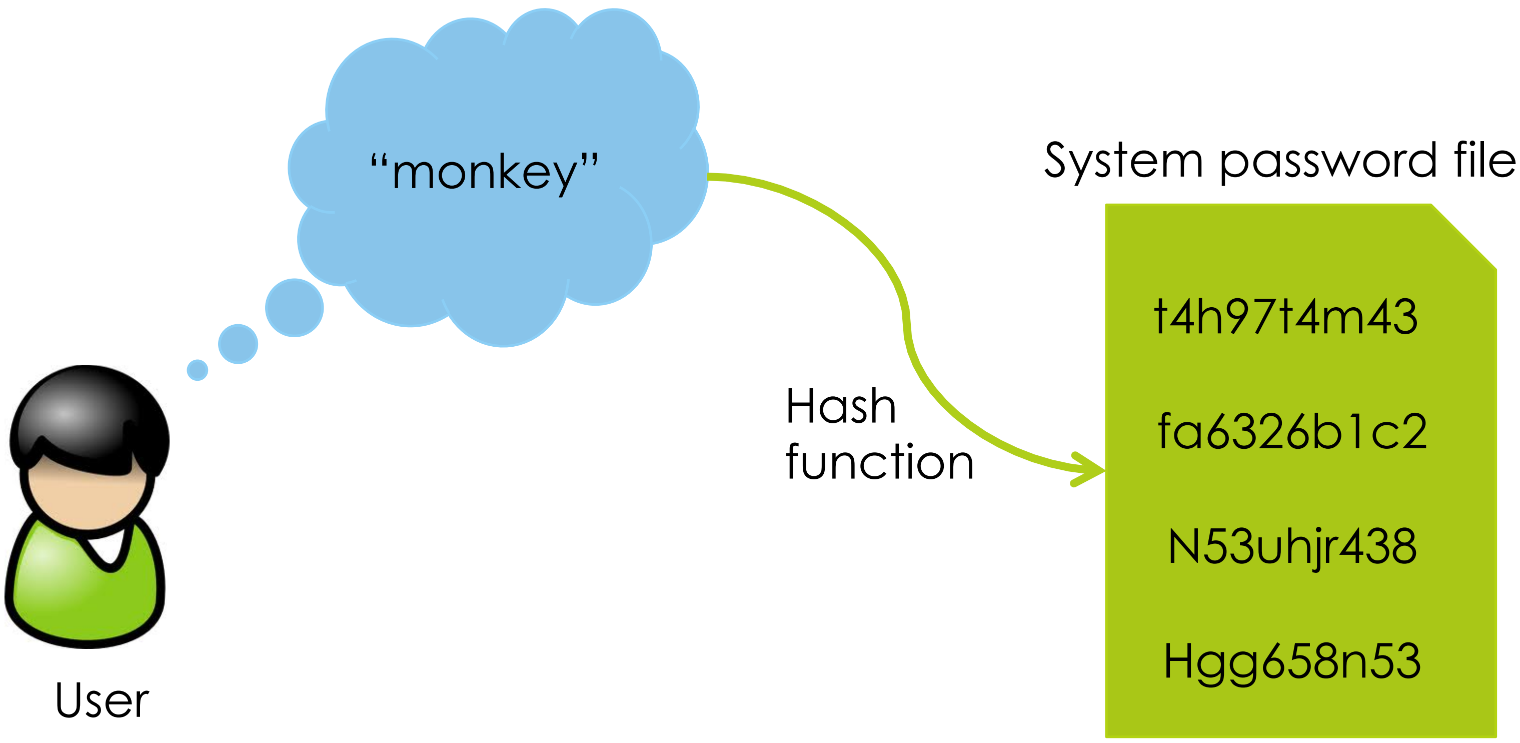
- 3 general types
  - Something you know
  - Something you have
  - Something you are
- Best solution: **multi-factor authentication**

Passwords

- Most common type of user authentication
- How should we store passwords on the server?
  - In cleartext?
  - Encrypted?
  - Hashed?
- **Hashing** transforms the data into a fixed-length sequence of bits that has the following properties:
  - Seemingly random
  - Hard to reverse
  - Fragile
  - Unlikely to collide
  - Slow to compute

How it works

- Instead of password, store Hash(password)



"monkey"

User

Hash function

System password file

t4h97t4m43

fa6326b1c2

N53uhjr438

Hgg658n53

Problem: randomness

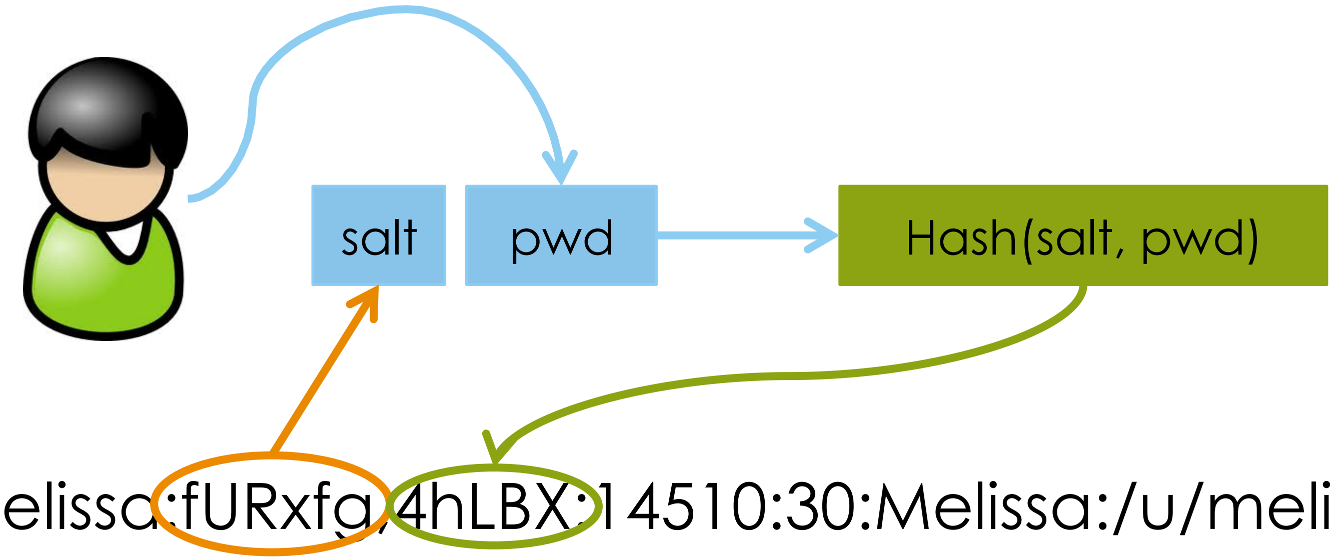
- Problem: Passwords are not truly random
  - 26 upper-case, 26 lower-case, 10 digits, 32 punctuation
    - 94^8 = **6 quadrillion** possible 8-character passwords
  - Humans use ~**1 million** common passwords

- Problem: password file /etc/passwd is word-readable
  - Windows: C:\WINDOWS\system32\config\SAM

- **Dictionary attack**
  - Common passwords come from a small “dictionary”
  - Attacker computes hashes of all words in the dictionary
  - For 1,000,000 passwords → about 14 hours
  - Words for *all users*

Solutions

- How could we fix this problem?
- **Salt**: different "dictionary" of hashes for every user



salt

pwd

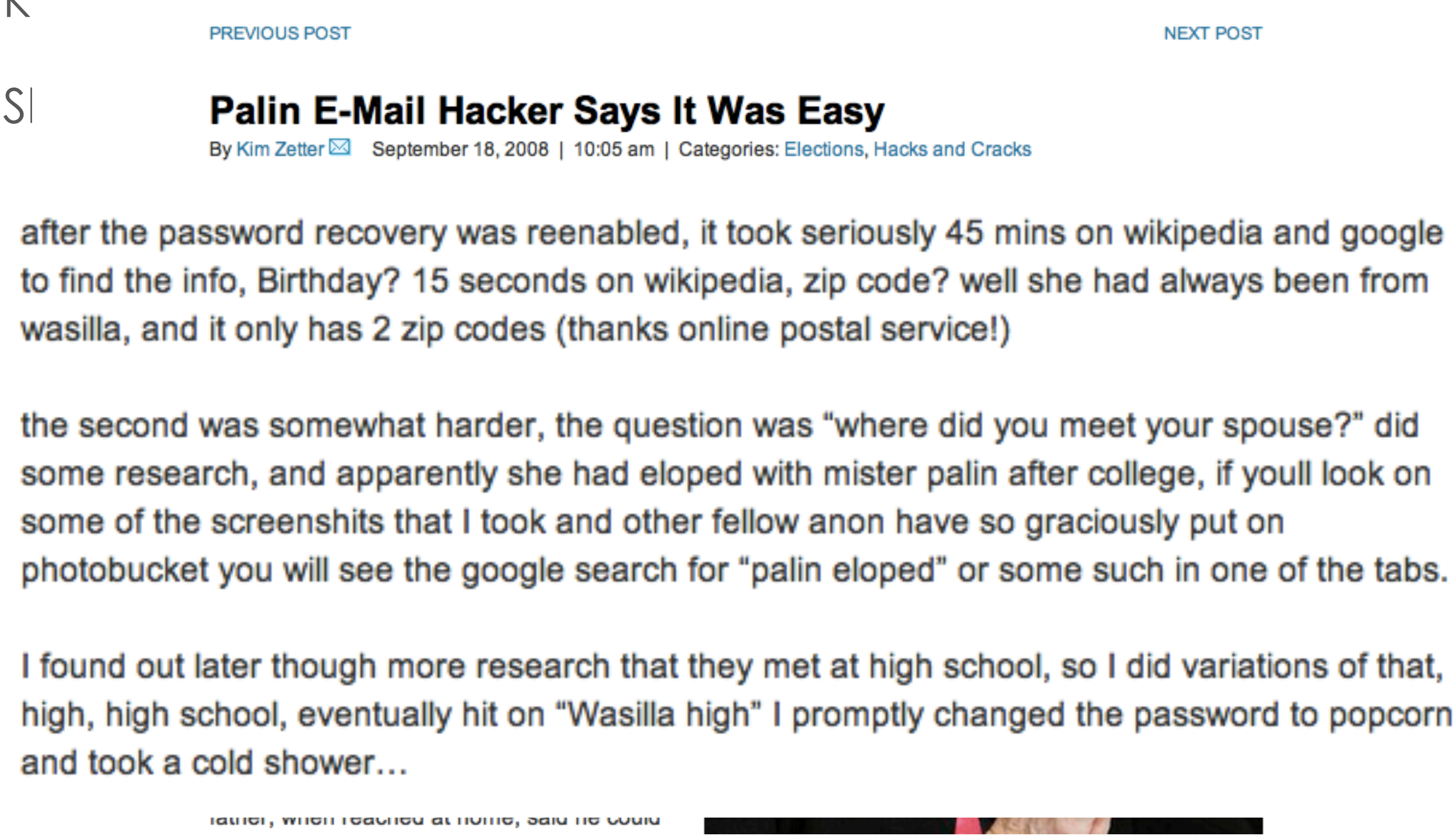
Hash(salt, pwd)

melissa:fURxfg,4hLBX:14510:30:Melissa:/u/melissa:/bin/csh

- Dictionary attack not impossible – just much harder!

Other password problems

- K
- Sl



PREVIOUS POST

NEXT POST

Palin E-Mail Hacker Says It Was Easy

By Kim Zetter September 18, 2008 | 10:05 am | Categories: Elections, Hacks and Cracks

after the password recovery was reenabled, it took seriously 45 mins on wikipedia and google to find the info, Birthday? 15 seconds on wikipedia, zip code? well she had always been from wasilla, and it only has 2 zip codes (thanks online postal service!)

the second was somewhat harder, the question was “where did you meet your spouse?” did some research, and apparently she had eloped with mister palin after college, if youll look on some of the screenshits that I took and other fellow anon have so graciously put on photobucket you will see the google search for “palin eloped” or some such in one of the tabs.

I found out later though more research that they met at high school, so I did variations of that, high, high school, eventually hit on "Wasilla high" I promptly changed the password to popcorn and took a cold shower…

father, when reached at home, said he could

http://www.wired.com/threatlevel/2008/09/palin-e-mail-ha/

Social Engineering

What is social engineering?

- Manipulating people
  - Actions they wouldn’t ordinarily take
  - Information they wouldn’t ordinarily reveal
- *Stereotype*: hackers typing away at computers in dark basements
- *Reality*: hackers as social people
- Employees can be a company’s worst enemy

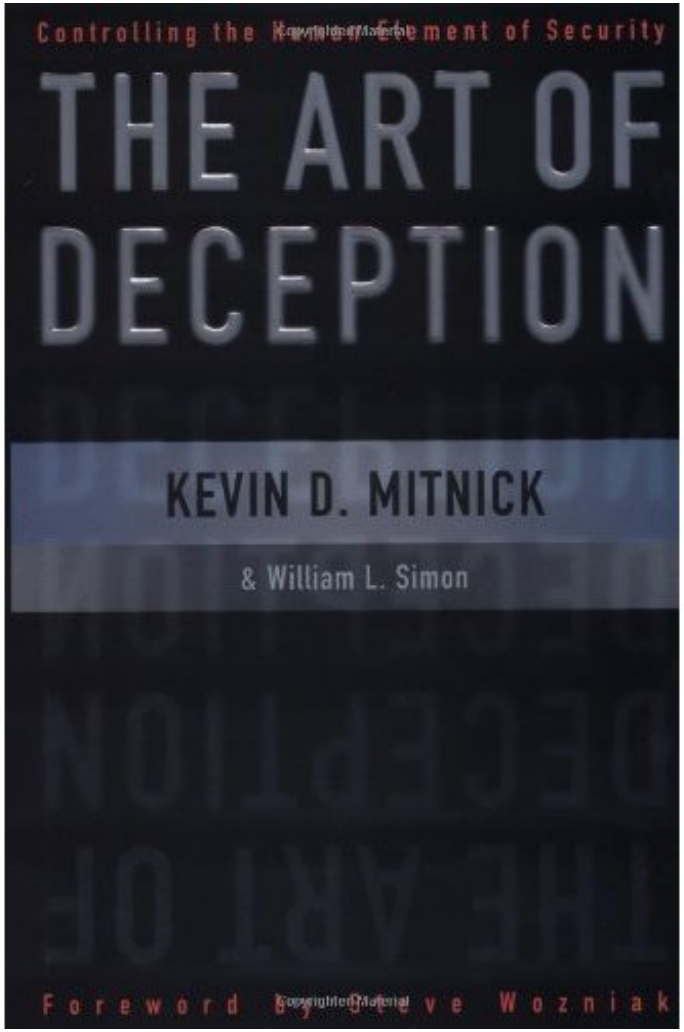
A situation

- Imagine Eve wants a phone, but doesn’t want the mandatory calling plan
- Eve calls the store and gets the name of an employee
- Eve calls another branch of the store, pretending to be that employee
  - Says that they sold a customer a phone and plan, but were out of the phones
  - “Can you help the customer out?”
- Eve goes to the second branch and picks up the phone
  - Gets it free of charge!

Phishing

- Email pretends to be from a legitimate source
- Asks for private user information
- Surprisingly effective: if it looks legitimate, people believe it

The Art of Deception


Controlling the Human Element of Security
THE ART OF DECEPTION
KEVIN D. MITNICK
& William L. Simon
Foreword by Steve Wozniak

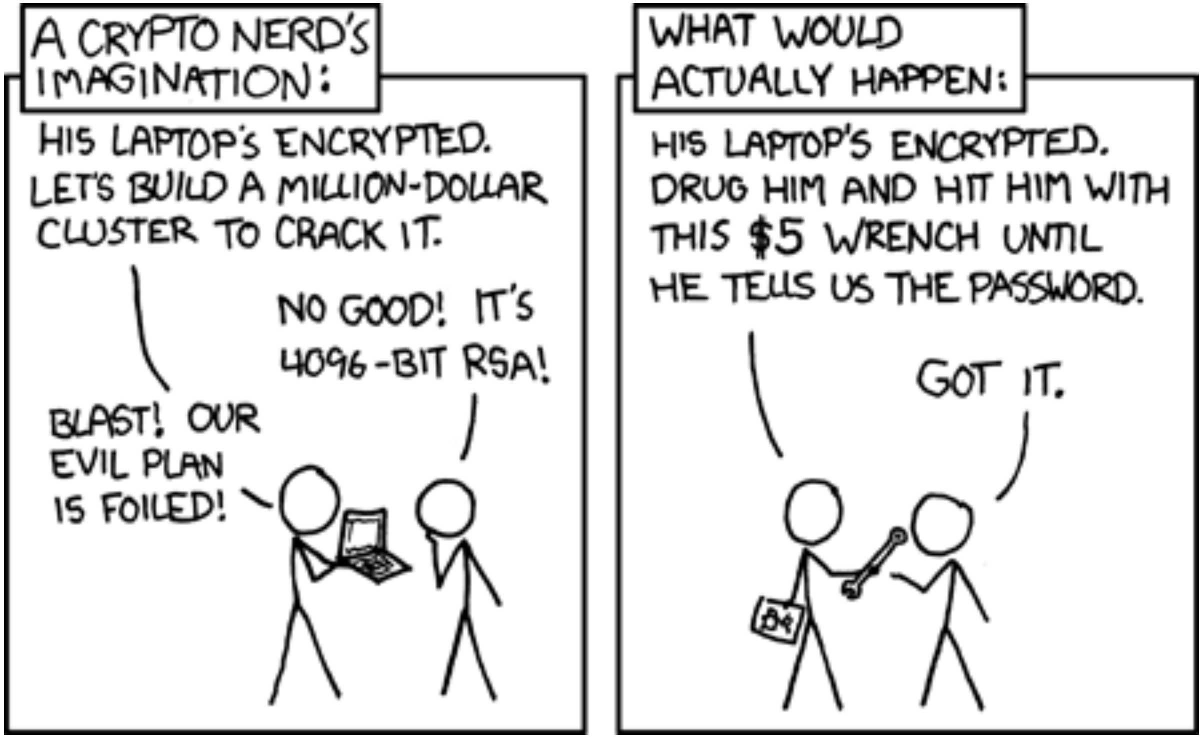
Software Security, Physical Security, Web Security, Cryptography…

…and so much more!

A Bank

Let’s try it! Goals, assets, adversaries, threats, risks

xkcd


A CRYPTO NERD'S IMAGINATION:
HIS LAPTOP'S ENCRYPTED. LET'S BUILD A MILLION-DOLLAR CLUSTER TO CRACK IT.
NO GOOD! IT'S 4096-BIT RSA!
BLAST! OUR EVIL PLAN IS FOILED!
WHAT WOULD ACTUALLY HAPPEN:
HIS LAPTOP'S ENCRYPTED. DRUG HIM AND HIT HIM WITH THIS $5 WRENCH UNTIL HE TELLS US THE PASSWORD.
GOT IT.

http://xkcd.com/538/

http://www.realuser.com/index.htm