Authentication

- Passwords
- Hopelessness
- Password Managers
- Password attacks
- Password defenses
- Incident response plan!

The beginning of the end of the password

- This might be the last time I have to talk about passwords in the present tense.
  - Matt Kijowski, Sep 12, 2023
  - Matt Kijowski, Jan 16, 2024
  - Matt Kijowski, Sep 5, 2024

What is Authentication

- The act of showing something to be true, genuine, or valid.

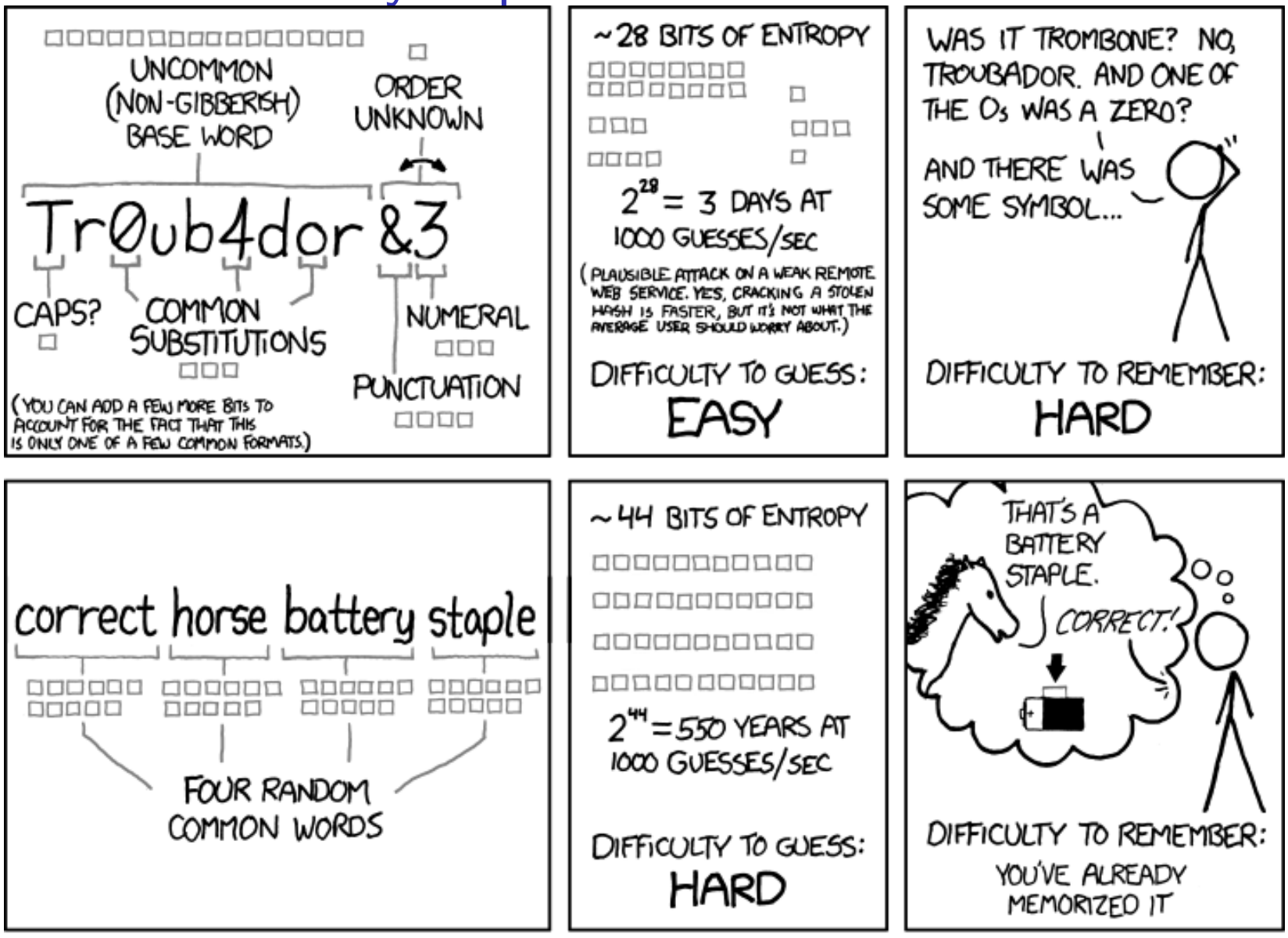
In cybersecurity this usually means

Verifying the identity of a user or process

Passwords

- Most common form of authentication
- “Something you know”
- Different ideas of strong versus weak passwords
- 12345

CorrectHorseBatteryStaple



THROUGH 20 YEARS OF EFFORT, WE'VE SUCCESSFULLY TRAINED EVERYONE TO USE PASSWORDS THAT ARE HARD FOR HUMANS TO REMEMBER, BUT EASY FOR COMPUTERS TO GUESS.

Password weaknesses

- People
- Weak passwords
- Phishing
- Shoulder surfing
- Leaks (raw or hashed!)
- Dictionaries
- Rainbow Tables
- Brute force
- Side channel attacks!!!
  - Password resets
  - Removal of MFA devices
  - Account recovery
- Bypass attacks
- People

Password Attacks

Generally can be classified into two types:

- Online Password attacks
- Offline Password attacks

Online Password Attacks

Attacks the login interface directly, frequently limited by speed (of network / response from authenticator / input).

- Brute force
- Smarter brute force (dictionary / rainbow tables)
- Shoulder surfing (watching someone enter password)
- Pass the hash (application accepts hashes or passwords)
- Bypass (steal / access an already authenticated system)

This slide is bad...

But is a good example of an online password attack that does NOT require the internet.

9 9 9 9 1 1 1 1 1 3 1 1 1 1 5 1 1 1 1 7 1 1 1 1 9 1 1 1 3
7 1 1 1 3 9 1 1 1 5 3 1 1 1 5 5 1 1 1 5 7 1 1 1 5 9 1 1 1
7 7 1 1 1 7 9 1 1 1 9 3 1 1 1 9 5 1 1 1 9 7 1 1 1 9 9 1 1
3 1 7 1 1 3 1 9 1 1 3 3 3 1 1 3 3 5 1 1 3 3 7 1 1 3 3 9 1
1 3 5 7 1 1 3 5 9 1 1 3 7 3 1 1 3 7 5 1 1 3 7 7 1 1 3 7 9
1 1 3 9 7 1 1 3 9 9 1 1 5 1 3 1 1 5 1 5 1 1 5 1 7 1 1 5 1
5 1 1 5 3 7 1 1 5 3 9 1 1 5 5 3 1 1 5 5 5 1 1 5 5 7 1 1 5
7 5 1 1 5 7 7 1 1 5 7 9 1 1 5 9 3 1 1 5 9 5 1 1 5 9 7 1 1
7 1 5 1 1 7 1 7 1 1 7 1 9 1 1 7 3 3 1 1 7 3 5 1 1 7 3 7 1
1 7 5 5 1 1 7 5 7 1 1 7 5 9 1 1 7 7 3 1 1 7 7 5 1 1 7 7 7
1 1 7 9 5 1 1 7 9 7 1 1 7 9 9 1 1 9 1 3 1 1 9 1 5 1 1 9 1
3 1 1 9 3 5 1 1 9 3 7 1 1 9 3 9 1 1 9 5 3 1 1 9 5 5 1 1 9
7 3 1 1 9 7 5 1 1 9 7 7 1 1 9 7 9 1 1 9 9 3 1 1 9 9 5 1 1
1 3 3 1 3 1 3 5 1 3 1 3 7 1 3 1 3 9 1 3 1 5 3 1 3 1 5 5 1
3 1 7 3 1 3 1 7 5 1 3 1 7 7 1 3 1 7 9 1 3 1 9 3 1 3 1 9 5
1 3 3 1 5 1 3 3 1 7 1 3 3 1 9 1 3 3 3 3 1 3 3 3 5 1 3 3 3

Offline Password Attacks

We will perform one of these in our next lab.

- Frequently much faster (attack speed can scale with attacker resources)
- Can be invisible to defenders (you dont know if/when your password is compromised)
- Many of the same attacks as online (brute force, dictionary, rainbow tables, etc.)
- Requires an offline source to attack
  - File containing stolen password hashes
  - Phishing the user themselves
  - Key logging software that captures the password

'/etc/shadow' Exercise

- Create a new user `sudo adduser tempuser`
- Give it a weak password (that you can share with other students)
  - No more than one use of the password: `password` per table please!!
- Print out that user's salted + hashed password
  - `sudo cat /etc/shadow | grep tempuser`
- Submit that entire output to Pilot (include the user name and all trailing `:::`
  - Reminder: plain text files only!!!
- I recommend deleting the created user as well:
  - `sudo userdel tempuser`

Authentication defenses

- Password managers
- Multi-Factor Authentication (MFA / 2FA)
- Keys/tokens (PKI)
- Biometrics
- Policies and procedures

Password Managers

- Allow for much stronger passwords
- Convenient for users
  - Until they are ***very*** inconvenient...
- Helps prevent easily guessable passwords
- Helps prevent re-used passwords

Multi-factor Authentication (MFA)

- If passwords are so weak, then we will use another form of authentication alongside them.
- Hopefully a second form of authentication is chosen that is both secure and easy to remember.
- Processes introduced to deal with lost or forgotten MFA can provide attackers avenues of entry or data gathering.

Key based authentication

- Public/Private Key pairs
  - User provides ***public key*** securely upon account setup
  - User authenticates with ***private key***
- Digital Certificates build upon key based authentication
  - Includes digital signature of a certification authority
  - Server verifies credibility of the certificate authority

Biometric authentication

Relies on unique biological characteristics of the user such as:

- fingerprints
- facial recognition
- speech recognition
- retinal scan
- etc.

Token based authentication

User authenticates and receives a unique encrypted string to use for authentication against other related servers.

Typically used with APIs with multiple frameworks and clients.

Policies and Procedures

- How the people and processes handle all parts of authentication
- How many password attempts?
- How long do you wait for MFA?
- How do you verify a user during account recovery?
- etc.

Incident Response

You (will) get hacked. Then what?

Mat Honan - A case study

- circa 2012
- Wired.com tech blogger
- twitter @mat
- Apple fanboy (joking, but does use apple products)
  - `m*******@me.com`
- Enjoys amazon.com delivery of goods to his home address

The incident

- August 2012
- 5pm iphone resets
- phone power on and iphone is at setup screen
  - (backups etc were done nightly so no fear yet)
- plug phone in to laptop to restore/recover
  - notification on macbook of incorrect gmail credentials
  - macbook has new (unknown) 4 digit pin protection

What would you do?

The hack

These are the steps the attacker went through:

- First all, the reason behind it, they (attacker) wanted @mat Twitter handle
  - Yes I chose not to update this slide to the new name of X, they are all still tweets in my mind...
  - backround research revealed @mat is Matthew Honan
  - find physical address from various online lookups
  - find email address from various online lookups
- try to sign into twitter with that gmail address
  - this confirmed that the gmail address is @mat
- try to sign into that gmail address
  - ***no 2fa!!!! :(:(!!!!***
  - account recovery is `m******@me.com`

The hackening continued

- me.com allows for account recovery with two simple things
  - last 4 of your credit card
  - billing address

Lets go shopping!!

- There is a way to trick amazon into giving up the last 4 digits of your CC
  - Attacker orders an item through Amazon.com as the victim by adding a new CC!!!!
  - Attacker then resets the amazon.com password by using the above malicious CC as an account recovery proof of identity
  - Attacker can now see last 4 of all CC in Amazon as well as billing addresses

Scorched earth

- This lets people into me.com (AppleID)
- which gave them his gmail
- which gave them his twitter
- which was really his entire digital life...
- Hacker resets twitter account info, password, and recovery email
- Hacker initiates google account removal, deleting ***ALL google data and account*** (no twitter recovery email anymore)
- Hacker initiates me.com account removal, deleting ***ALL apple data, purchased songs, movies, stored pictures, and removes access to phone and laptop***
- Hacker tweets about his victory

Incident response plan

- Know what ALL forms of authentication are for critical services
- Setup MFA for critical/all accounts
- Know how to disable/re-enable the MFA
- Be prepared to provide necessary information
- Be aware of chained accounts / vulnerabilities