Move over passwords, passkeys are my new best friend

CLASSIFIED

TOP SECRET

DAPHNE LIU

Daphne Liu

CONFIDENTIAL

- Frontend engineer @ Grow Therapy
- Previously Lyft, Shopify, Yelp
- Improv & sketch comedy

@thebetterdaphne

CRIME SCENE

1. Lack of security.

2. Human forgetfulness.

TOP SECRET

MURDER WEAPON:

Passkeys.

PASSKEYS.

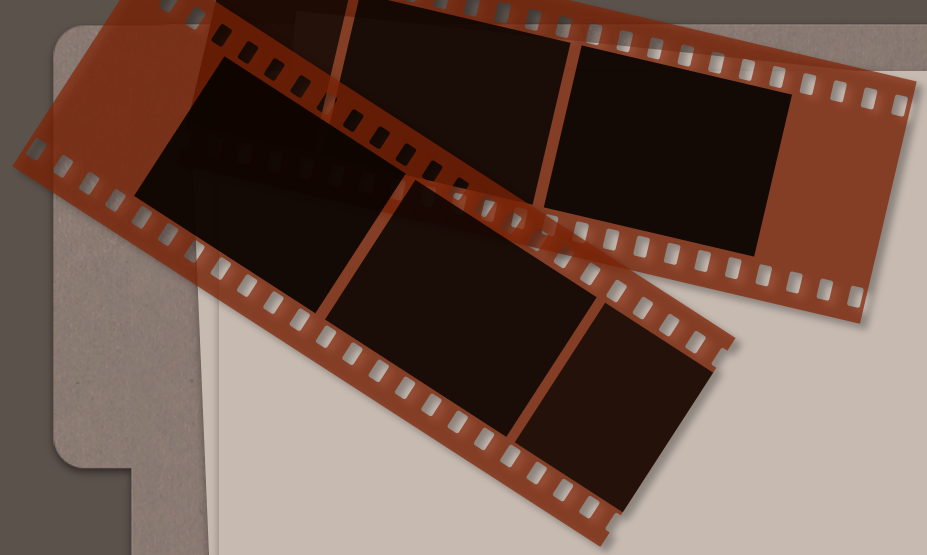
Touch ID

Face ID

Android Biometric Prompt

Windows Hello

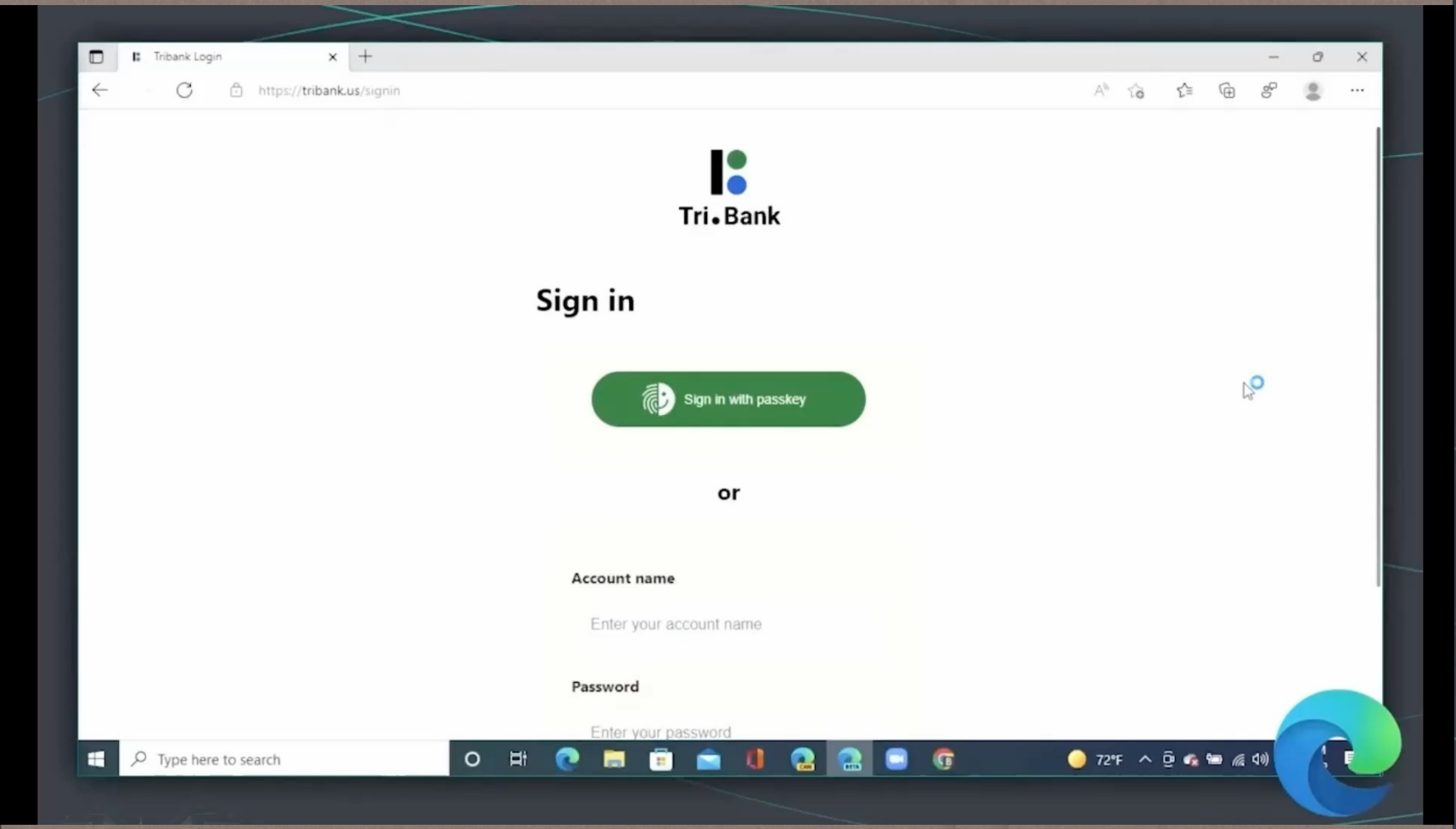
Passkeys are a **replacement for passwords** that let users sign in with their device lock screen.



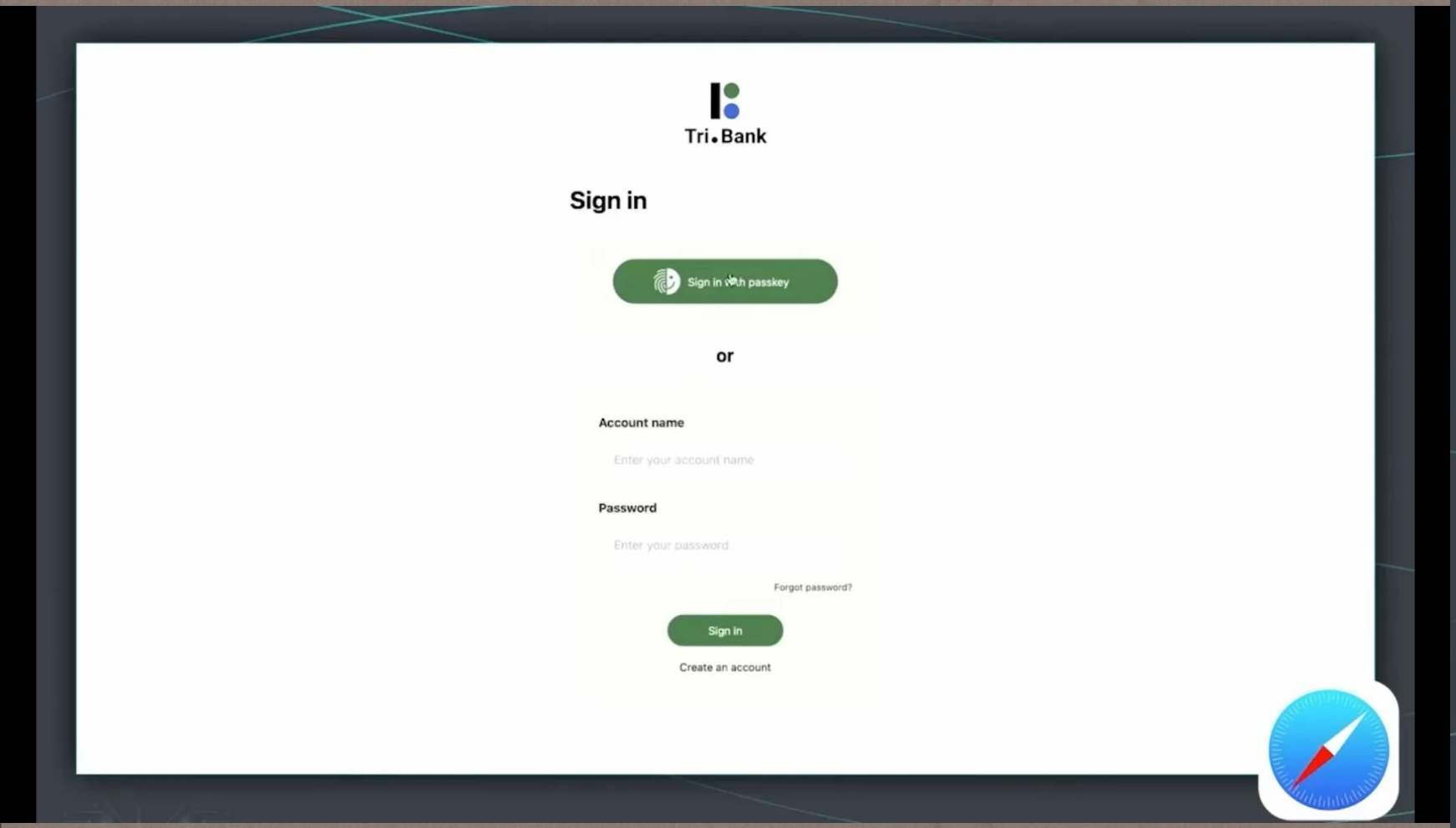
TOP SECRET

Security Footage


11:58
Mon, Jun 13
70°F
Play Store
Gmail
Photos
TriBank


Tribank Login
https://tribank.us/signin
Tri.Bank
Sign in
Sign in with passkey
or
Account name
Enter your account name
Password
Enter your password
Type here to search
72°F


12:08
Mon, Jun 13
70°F
Play Store
Gmail
Photos
TriBank


Tri.Bank
Sign in
Sign in with passkey
or
Account name
Enter your account name
Password
Enter your password
Forgot password?
Sign in
Create an account

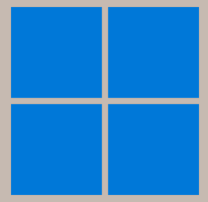

12:11
Mon, Jun 13
72°F
Play Store
Gmail
Photos
TriBank


12:13
Cupertino
74°
Sunny
H:78° L:51°
Weather
MONDAY
13
No more events today
Calendar
FaceTime
MON
13
Calendar
Photos
Camera
Mail
Notes
Reminders
Clock
News
tv
TV
Podcasts
App Store
Maps
Health
Wallet
Settings
iOS

CLOUD SYNC

iCloud Passwords
- Syncs iOS, iPadOS, macOS

Google Password Manager
- Syncs Android



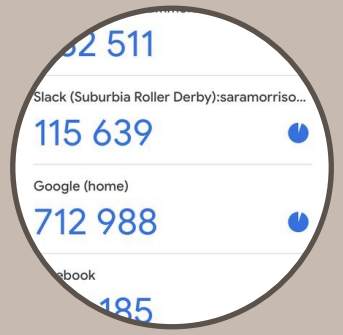
Windows Hello
- No sync yet

1Password
- Syncs Windows, Mac, Linux

Bitwarden
- Syncs Windows, Mac, Linux

SECURITY COMPARISON.

Password



Password + 2FA code

- Google Authenticator, Authy
- SMS or email link

Passkeys

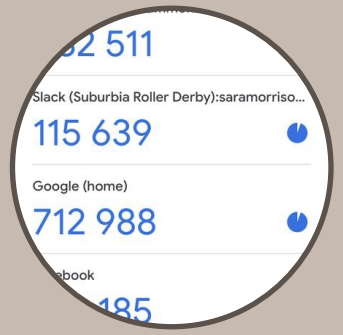
- Biometrics
- Apple Touch ID, Face ID
- Windows Hello
- In password manager

Hardware security key

- Yubikey
- In physical device

Least secure → Most secure

CONVENIENCE COMPARISON.



Password + 2FA code

- Need to lookup code in app

Password

- Need to memorize unique passwords

Hardware security key

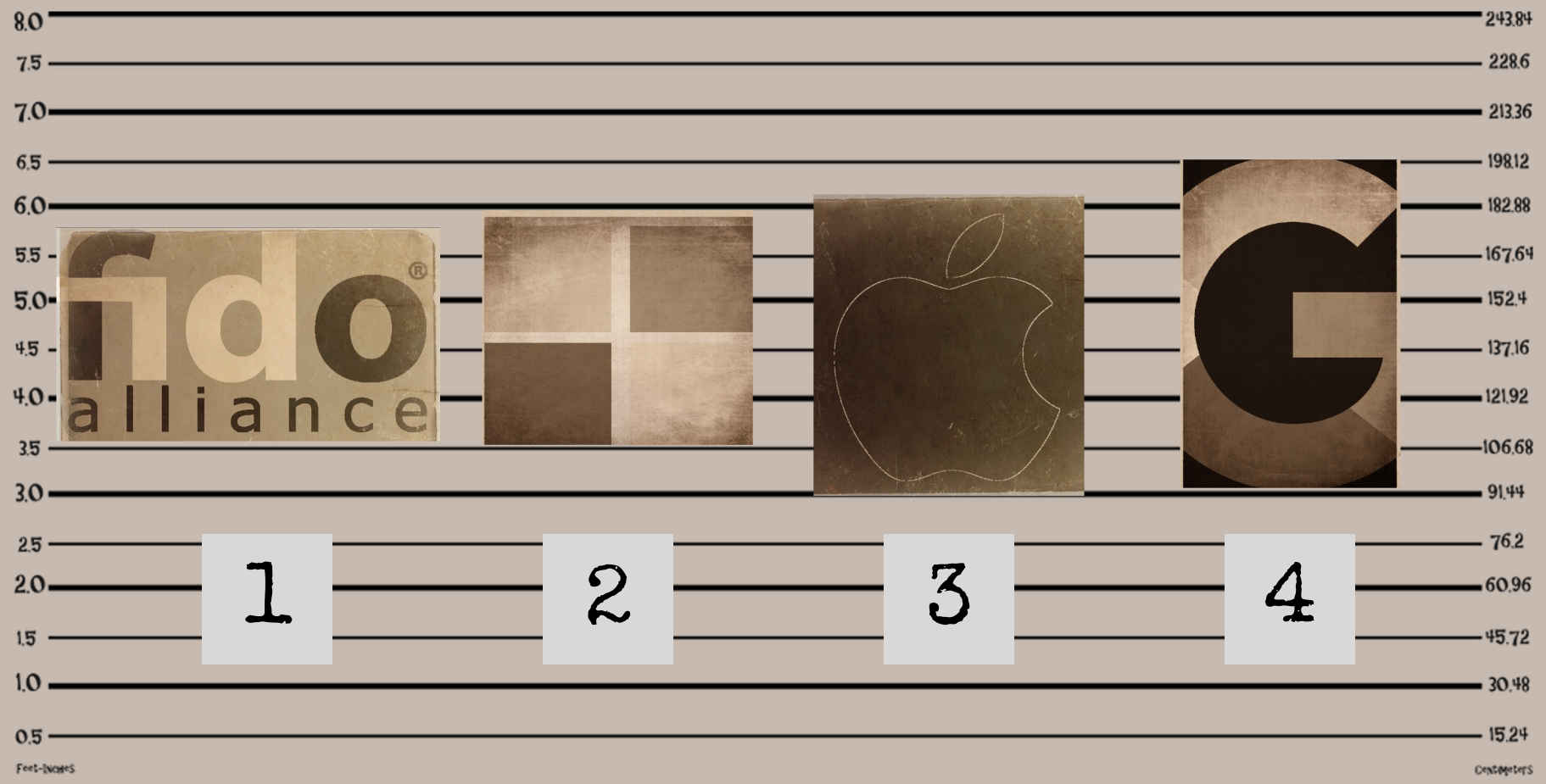
- Need to carry Yubikey

Passkeys

- Built into phone/computer

Least convenient → Most convenient

SUSPECTS



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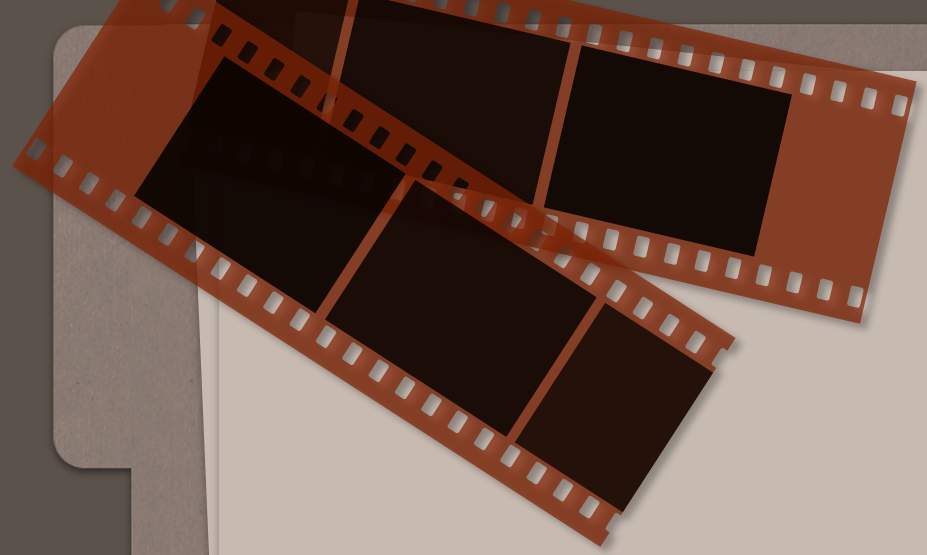
Definitely

~~Don't~~ try this at home!

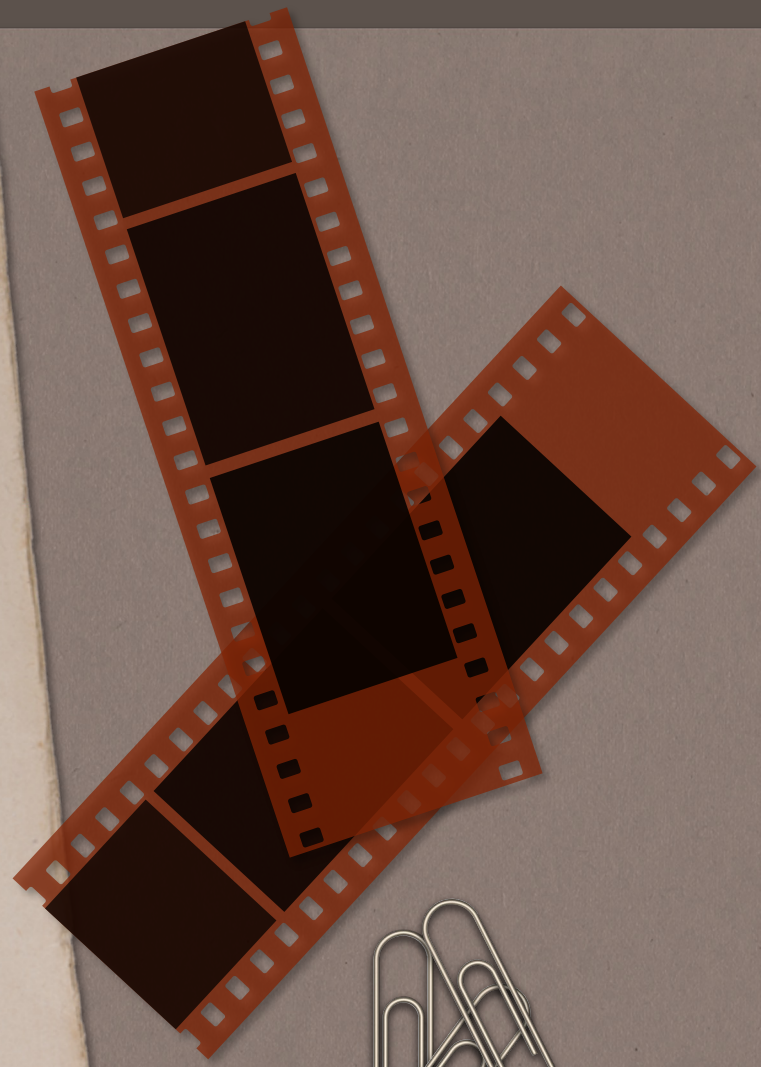


Let's learn about how passkeys work

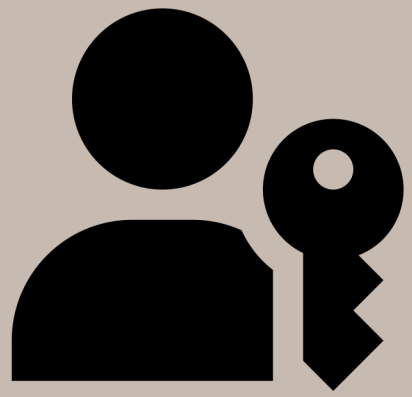
ALSO KNOWN AS.

"Passkeys"

A.K.A. Discoverable Credential



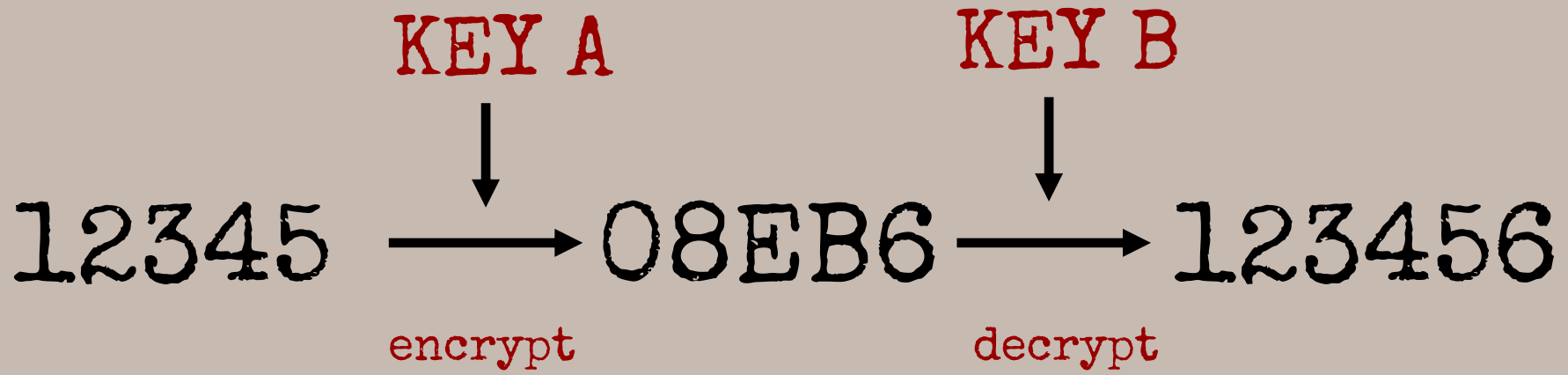
PASSKEYS



Passkeys are secure as they're built with **public key cryptography.**

PUBLIC KEY CRYPTOGRAPHY.

A.K.A. Asymmetric encryption



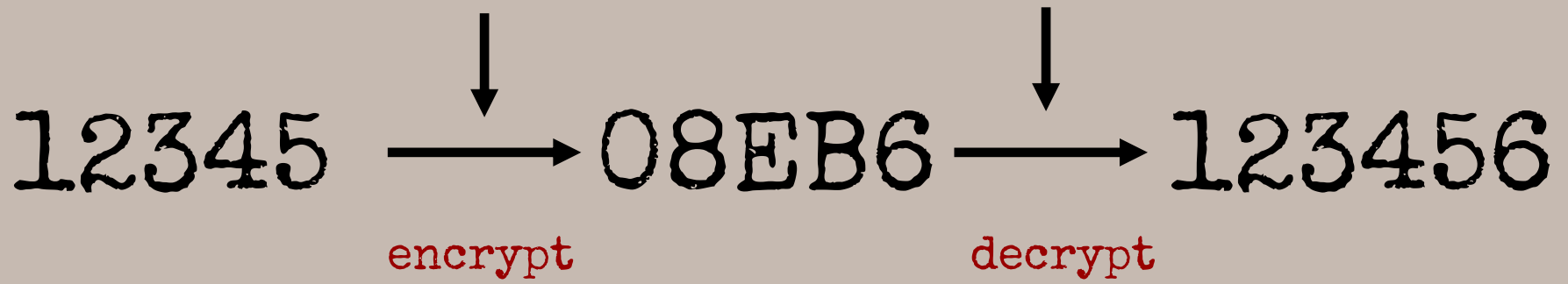
Computerphile

PUBLIC KEY CRYPTOGRAPHY.

A.K.A. Asymmetric encryption

"Mailing address" — Public Key

"physical mailbox key" — Private Key



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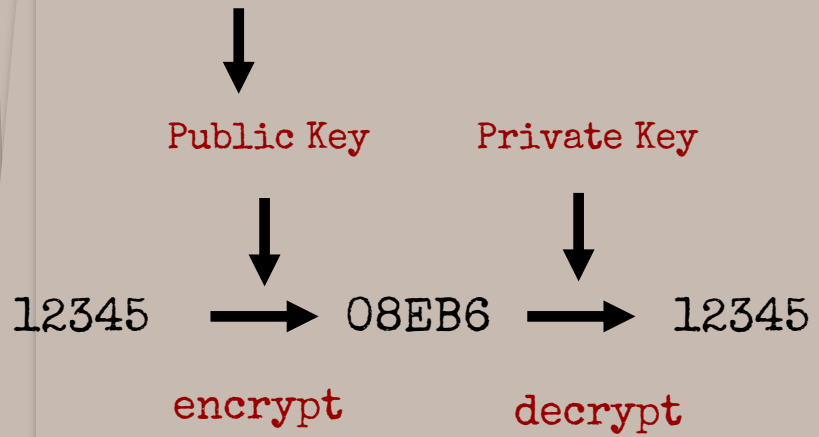
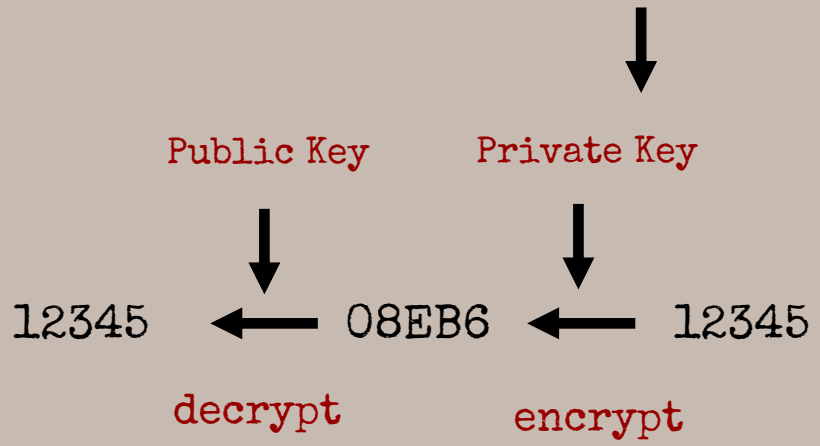
Current flow

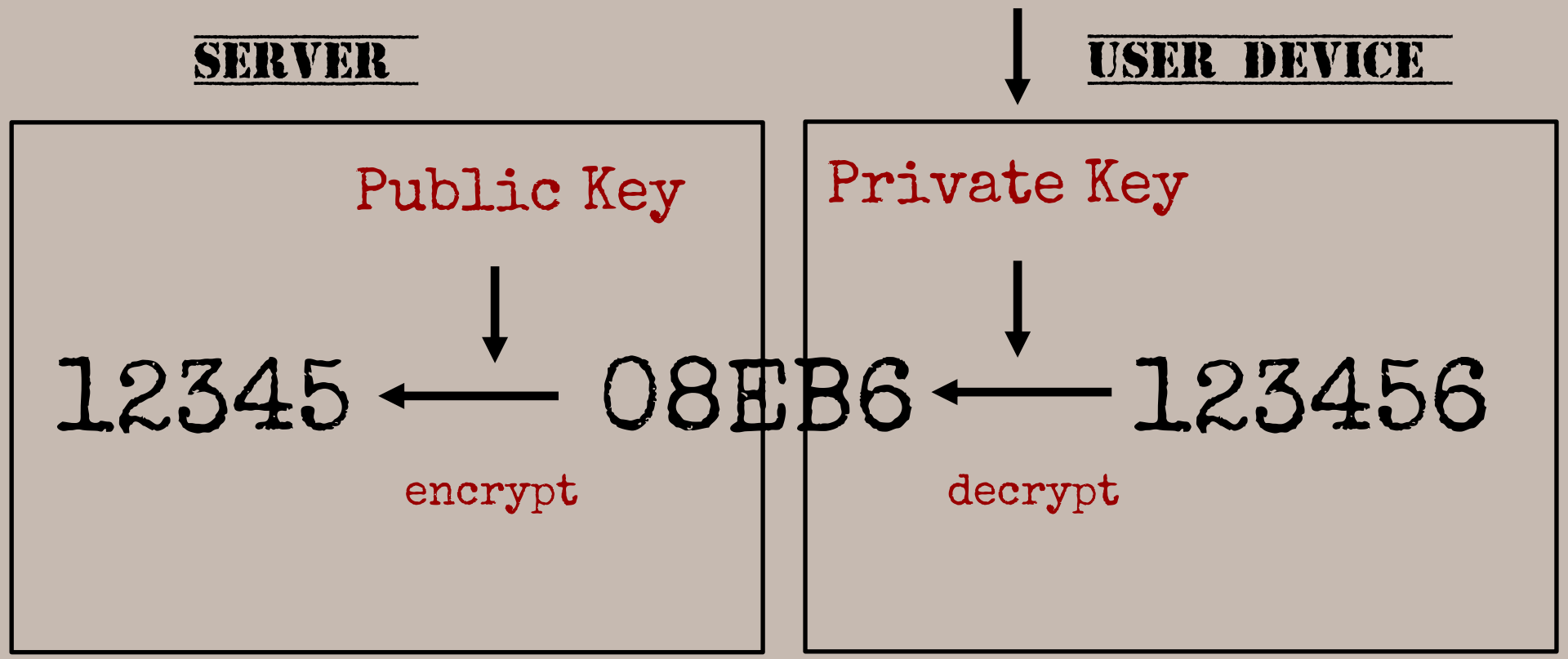


Opposite flow



PASSKEYS

PUBLIC KEYS AND PASSKEYS



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WEB AUTHENTICATION API.

A.K.A.

WebAuthn

Built-in API used to generate public and private keys for login.

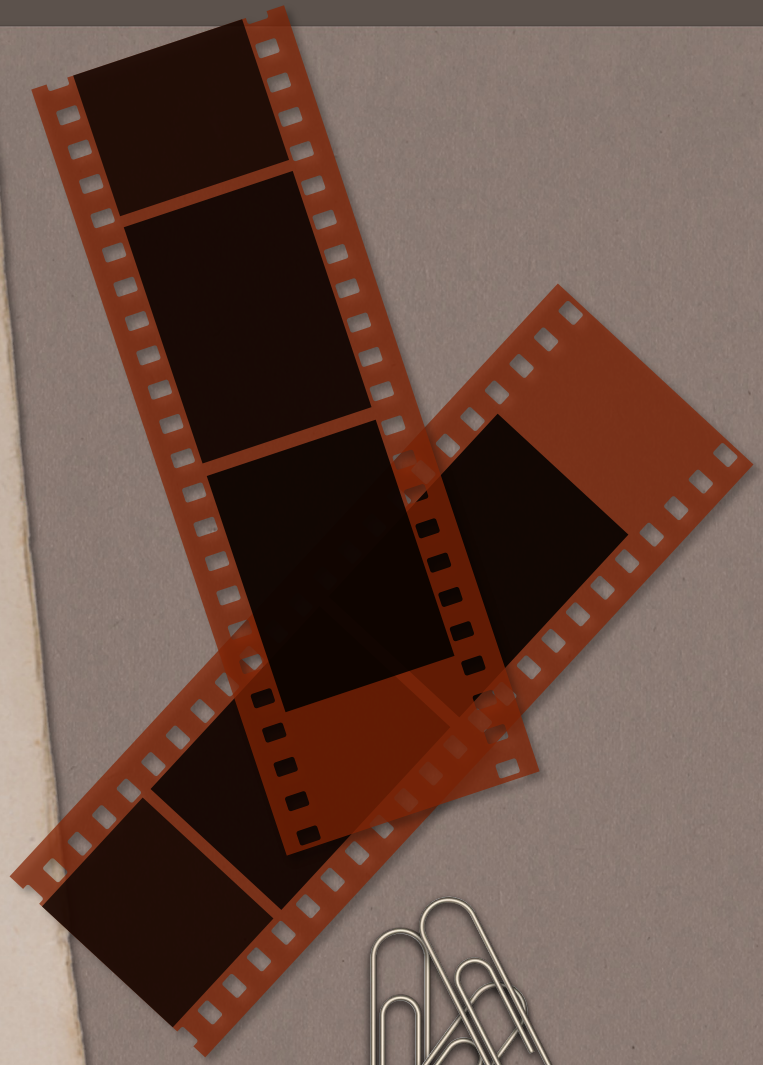
WEBAUTHN USE CASES.

1. Supplement passwords - using a hardware device as second factor (ex. Yubikey)

2. Replace passwords - using a hardware device as a single factor (passkeys)

PASSKEY FLOWS.

1. Registration
2. Authentication



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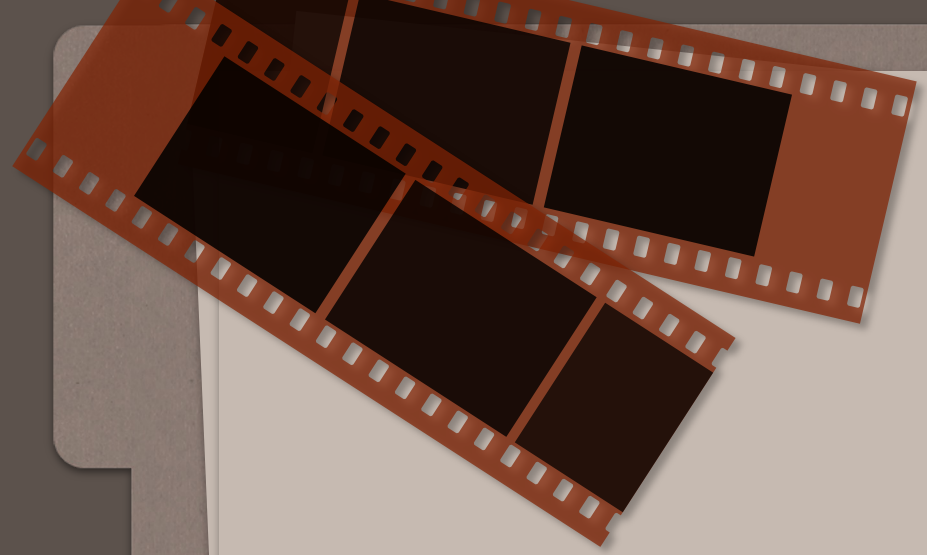
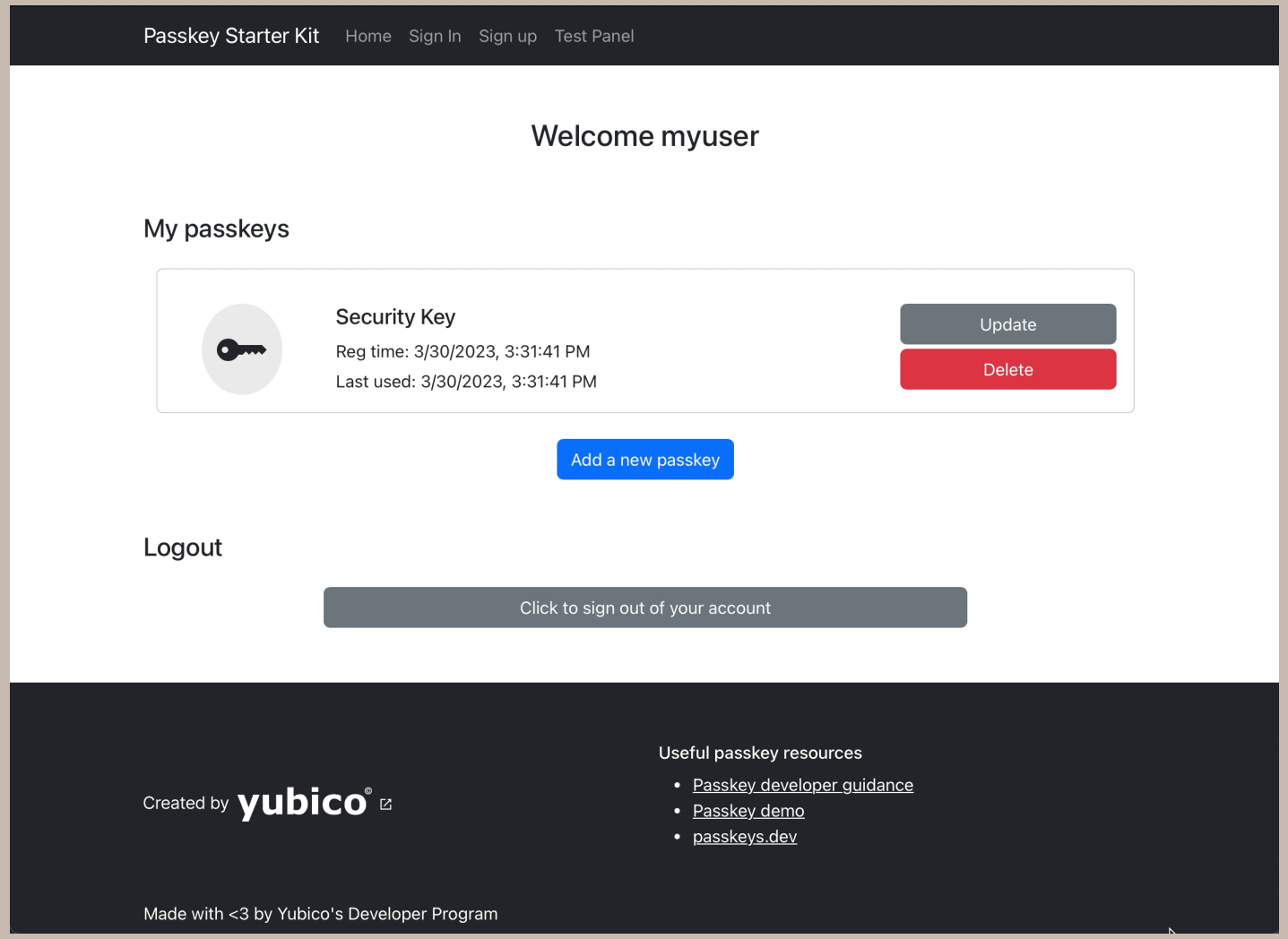


Registration

A.K.A. Attestation

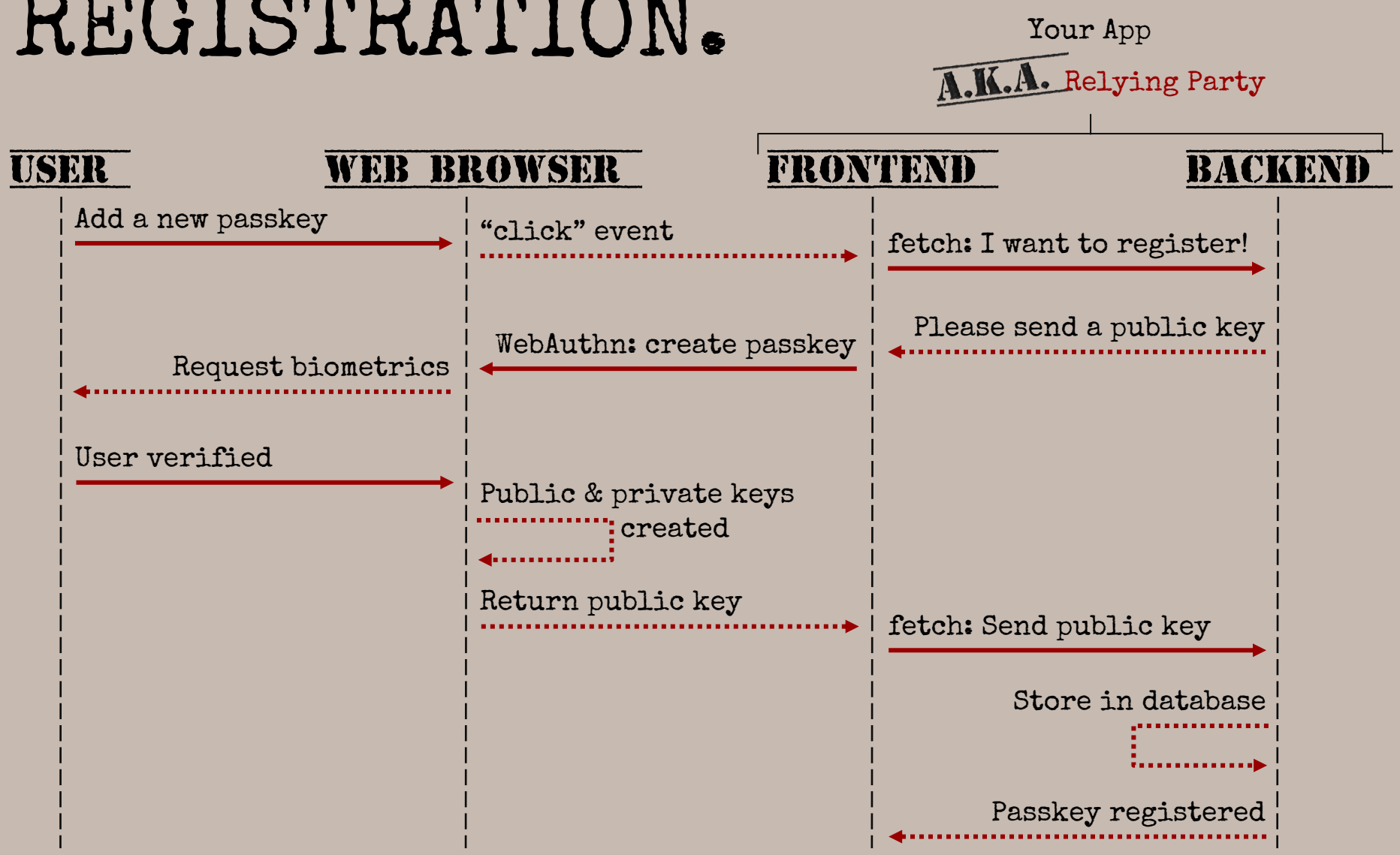
Creating a new passkey

REGISTRATION.



yubicolabs

REGISTRATION.



FRONTEND

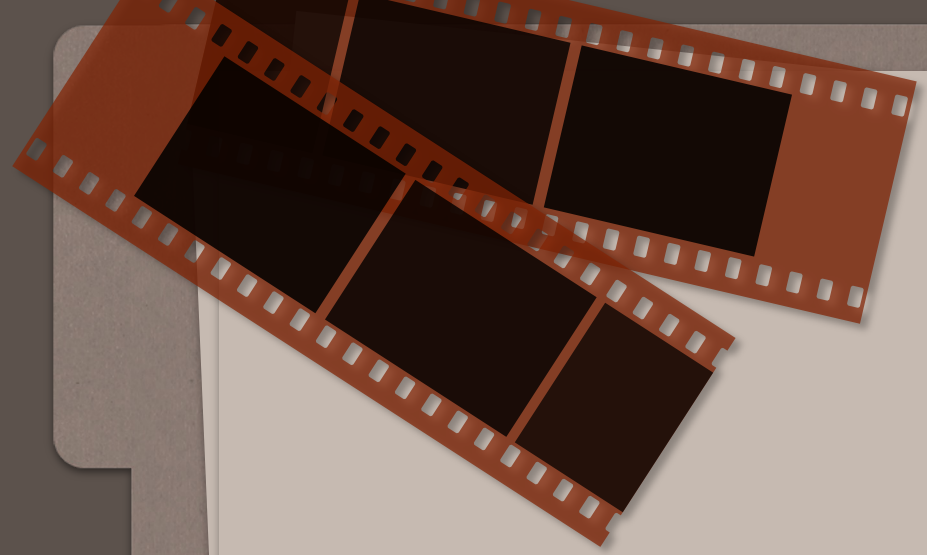
```
/**
 * API call to your server
 * Should return a `PublicKeyCredentialCreationOptions`
 */
async function startRegistration(): Promise<PublicKeyCredentialCreationOptions> {
  await fetch(/*...*/);
}

/**
 * API call to your server
 * Should send newPublicKey to your server for storage
 */
async function postNewPublicKey(newPublicKey: AuthenticatorAttestationResponse) {
  await fetch(/*...*/, { method: "POST", body: newPublicKey });
}

async function registerPasskey() {
  const options = await startRegistration();
  const newPublicKey = await navigator.credentials.create({
    publicKey: options,
  });
  await postNewPublicKey(newPublicKey.response);
}

<button onclick="registerPasskey()">Add a new passkey</button>
```

yubico

BACKEND

```
const options: PublicKeyCredentialCreationOptions = {
  // Your website origin and name
  rp: { id: "themysterymachine.com", name: "The Mystery Machine" },
  user: {
    id: new Uint8Array([79, 252, 83, 72, 214, 7, 89, 26]), // database ID
    displayName: "Daphne Liu", // human friendly name
    name: "daphneliu", // user name to distinguish between same display name
  },
  // randomly generated byte array
  challenge: new Uint8Array([117, 61, 252, 231, 191, 241, ...]),
  pubKeyCredParams: [{ type: "public-key", alg: -7 }]
};
```

mdn



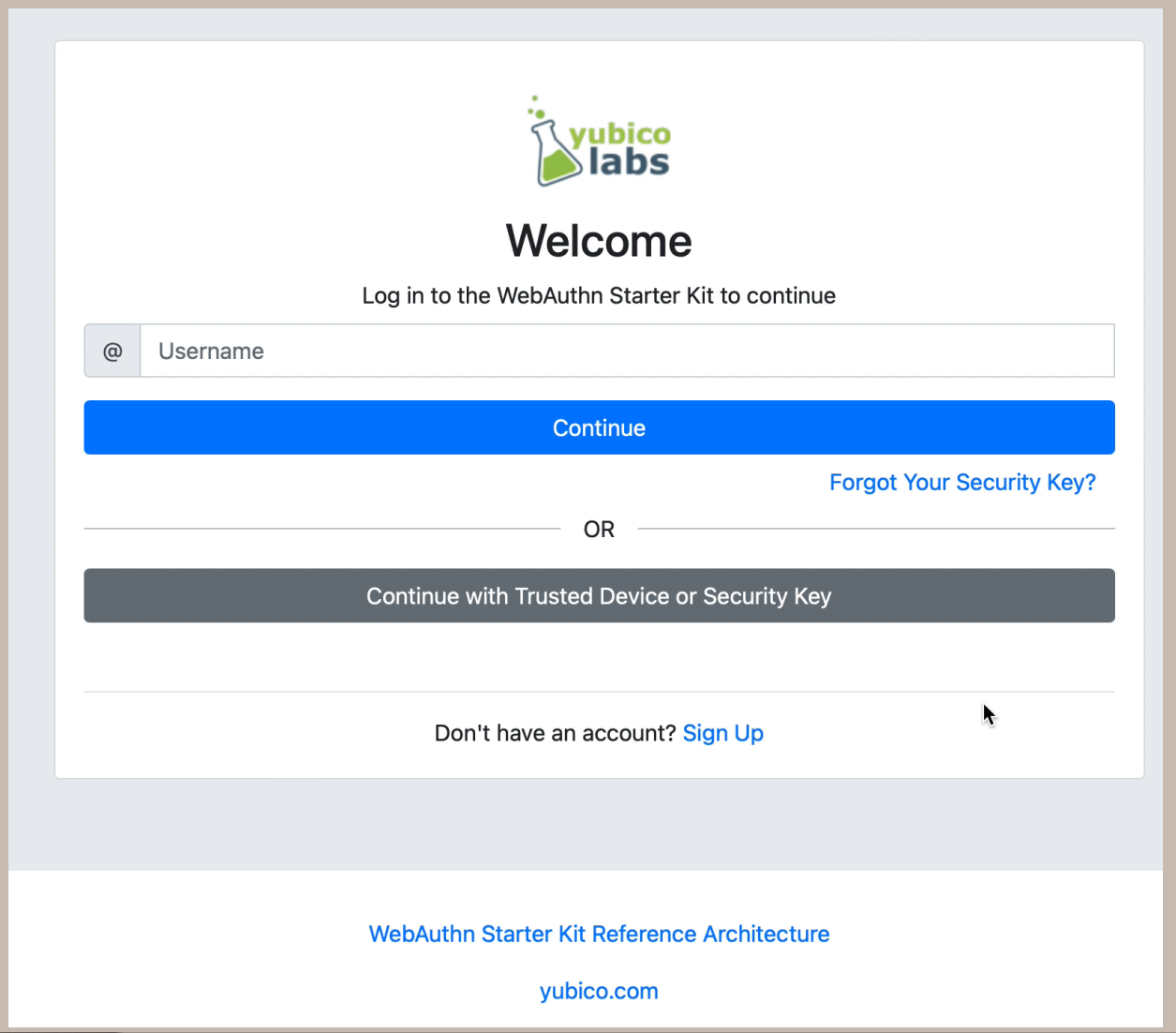
TOP SECRET

Authentication

A.K.A. Assertion

Log in with a passkey

AUTHENTICATION.



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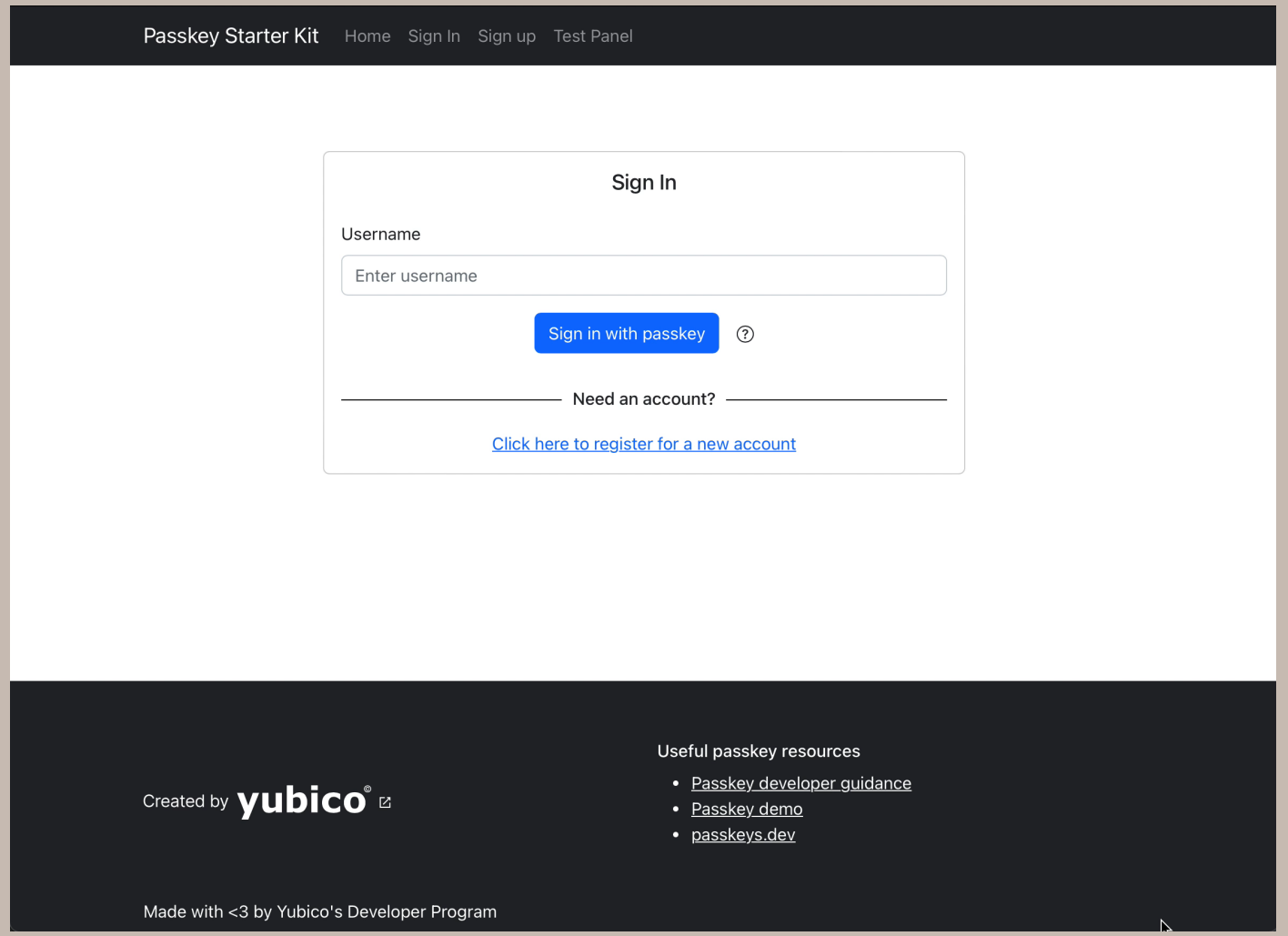
AUTOFILL AUTHENTICATION.



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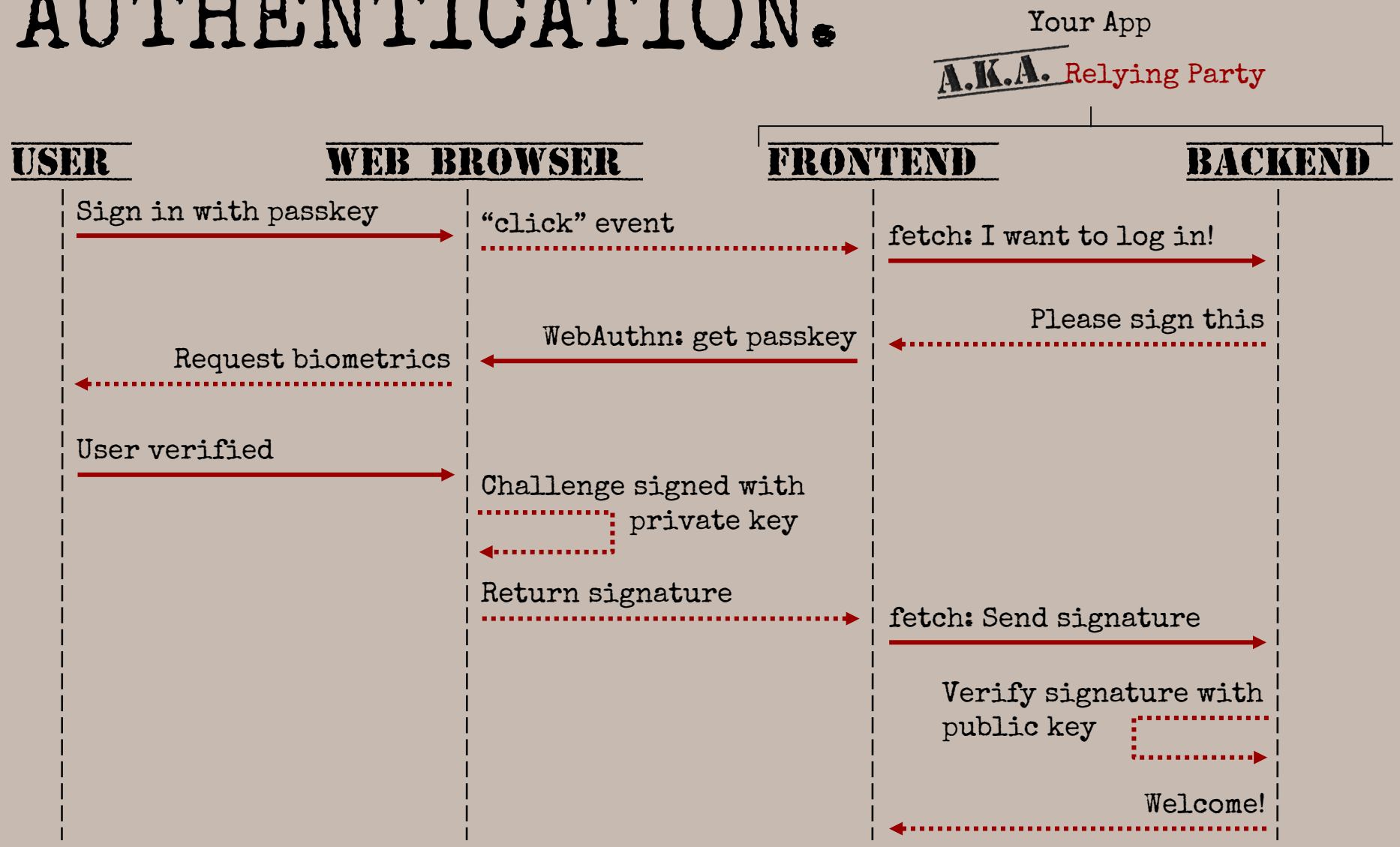
AUTHENTICATION.



PASSKEY MODAL.

- Pops up over web UI, so should be behind a button.
- Can be setup when user clicks button.

PASSKEY AUTOFILL.

A.K.A. Conditional UI

- Appears as dropdown under username input.
- Needs to be setup ahead of time.

FRONTEND

```
/**
 * API call to your server
 * Should return a `PublicKeyCredentialRequestOptions`
 */
async function startAuthentication(): Promise<PublicKeyCredentialRequestOptions> {
  await fetch(/*...*/);
}

/**
 * API call to your server
 * Should send signature to your server to check if it's valid
 */
async function postNewSignature(signatureResult: AuthenticatorAssertionResponse):
Promise<boolean> {
  await fetch(/*...*/, { method: "POST", body: signatureResult });
}

async function loginWithPasskey() {
  const options = await startAuthentication();
  const signatureResult = await navigator.credentials.get({ publicKey: options });
  const valid = await postNewSignature(signatureResult.response);
  if (valid) {
    // User is logged in
  }
}

<button onclick="loginWithPasskey()">Sign in with passkey</button>
```

FRONTEND

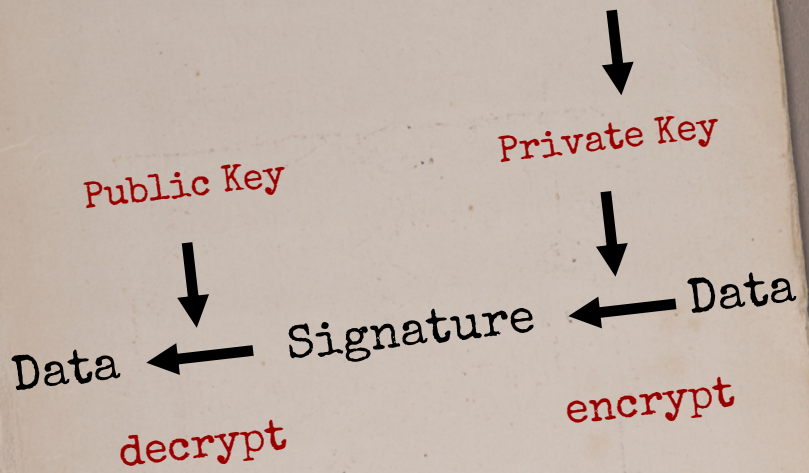
```
async function waitForAutofillPasskeyLogin() {
  const isSupported = await PublicKeyCredential.isConditionalMediationAvailable?.();
  if (!isSupported) return;

  const options = await startAuthentication();
  try {
    // Will be waiting until autofill is called
    const signatureResult = await navigator.credentials.get({
      publicKey: options,
      mediation: "conditional",
    });
    const valid = await postNewSignature(signatureResult.response);
    if (valid) {
      // User is logged in
    }
  } catch {
    // Autofill was cancelled
  }
}

window.onload = waitForAutofillPasskeyLogin;

<input type="text" id="username-field" autocomplete="username webauthn" />
```

BACKEND

```
const options: PublicKeyCredentialRequestOptions = {
  // Your website origin
  rpId: "themysterymachine.com",
  // randomly generated byte array
  challenge: new Uint8Array([117, 61, 252, 231, 191, 241, ...]),
};
```

mdn

WHAT IS ENCRYPTED?



?

BACKEND

OVERSIMPLIFICATION

```
interface AuthenticatorAssertionResponse {
  clientDataJSON: ArrayBuffer; // unencrypted stuff that was hashed then signed
  authenticatorData: ArrayBuffer; // more unencrypted stuff that was signed

  signature: ArrayBuffer; // encrypted signature

  userHandle: ArrayBuffer; // database ID, same as user.id
}
```

WebAuthn.io

Using WebAuthn

Add WebAuthn to your site with one of these libraries:

Python
- duo-labs/py_webauthn
- Duo Labs
- Library

TypeScript
- SimpleWebAuthn
- Matthew Miller
- Library

TypeScript
- passwordless-id/webauthn
- Arnaud Dagnelies
- Library

Ruby
- cedarcode/webauthn-ruby
- Cedarcode
- Library

Ruby
- ruby-passkeys/devise-passkeys
- Ruby passkeys
- Library

Ruby
- ruby-passkeys/warden-webauthn
- Ruby passkeys
- Library

Java
- webauthn4j/webauthn4j
- Yoshikazu Nojima
- Library

Java
- java-webauthn-server
- Yubico
- Library

Java
- vertx-auth/webauthn
- Eclipse Vert.x
- Library

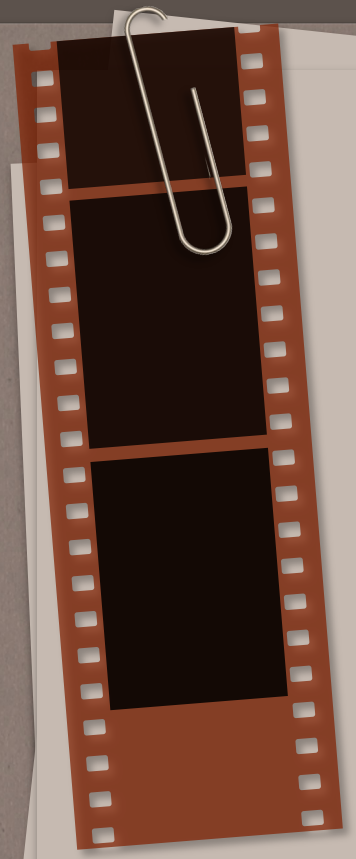
WHY PASSKEYS?

1. More secure
   - Passkeys are bound to website origin and phishing resistant.
2. Easier
   - Familiar UI, don't need separate hardware.
3. Faster
   - Works in 10 seconds or less.

RESOURCES.

- https://webauthn.io
- https://passkeys.dev/device-support
- https://passwordless.id
- https://developer.mozilla.org/en-US/docs/Web/API/Web_Authentication_API
- https://yubicolabs.github.io/passkey-workshop/
- https://github.com/w3c/webauthn/wiki/Explainer:-WebAuthn-Conditional-UI
- https://web.dev/passkey-form-autofill/
- https://developers.google.com/codelabs/passkey-form-autofill#2
- https://www.youtube.com/watch?v=wN5lpttf_Hc
- https://www.youtube.com/watch?v=SWocv4BhCNg&pp=ygUIcGFzc2tleXM%3D

PERPETRATORS



CASE CLOSED

THANK YOU!

@thebetterdaphne

linkedin.com/in/daphliu

daphneliu.com

CREDITS.

Presentation Template: SlidesMania

Images: Unsplash

To get the old photo effect I've used a website called funny.pho.to/old-photo-effect/ and then removed the white background using remove.bg

And to generate the TOP SECRET, CLASSIFIED and CONFIDENTIAL texts I've used a website called cooltext.com