SitePassword

A Different Kind of Password Manager

Alan H. Karp alanhkarp@gmail.com

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“Passwords are terrible, and we won’t be using them in 10 years.”

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Everybody

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Everybody

2013 2003 1993 1983 1973 1963

Do You Use a Password Manager?

Do You Use a Password Manager?

- 1Password ($36)
- LastPass ($36)
- DashLane ($60)
- Keeper ($35)
- ZohoVault (Free or $54)
- Avira ($32)
- RememBear (Shutting down)
- PassBolt (Free)
- Bitwarden (Free or $40)
- LogMeOnce ($48)
- NordPass (Free or $36)
- PasswordBoss (Free?)
- RoboForm ($24)
- Your Browser (Free)

Why Use a Password Manager

One of the top recommended security practices but only 40% use them

- Too hard to remember strong passwords for all your sites
  - Easy to remember (guess) passwords
  - Same password at multiple sites or an algorithm that’s easy to figure out
- Many will generate strong passwords for you
- Many will store other data for you
- Simplify filling in forms

Getting Mathematical

Theorem

Any algorithm you can hold in your head is easy to guess.

Getting Mathematical

Theorem

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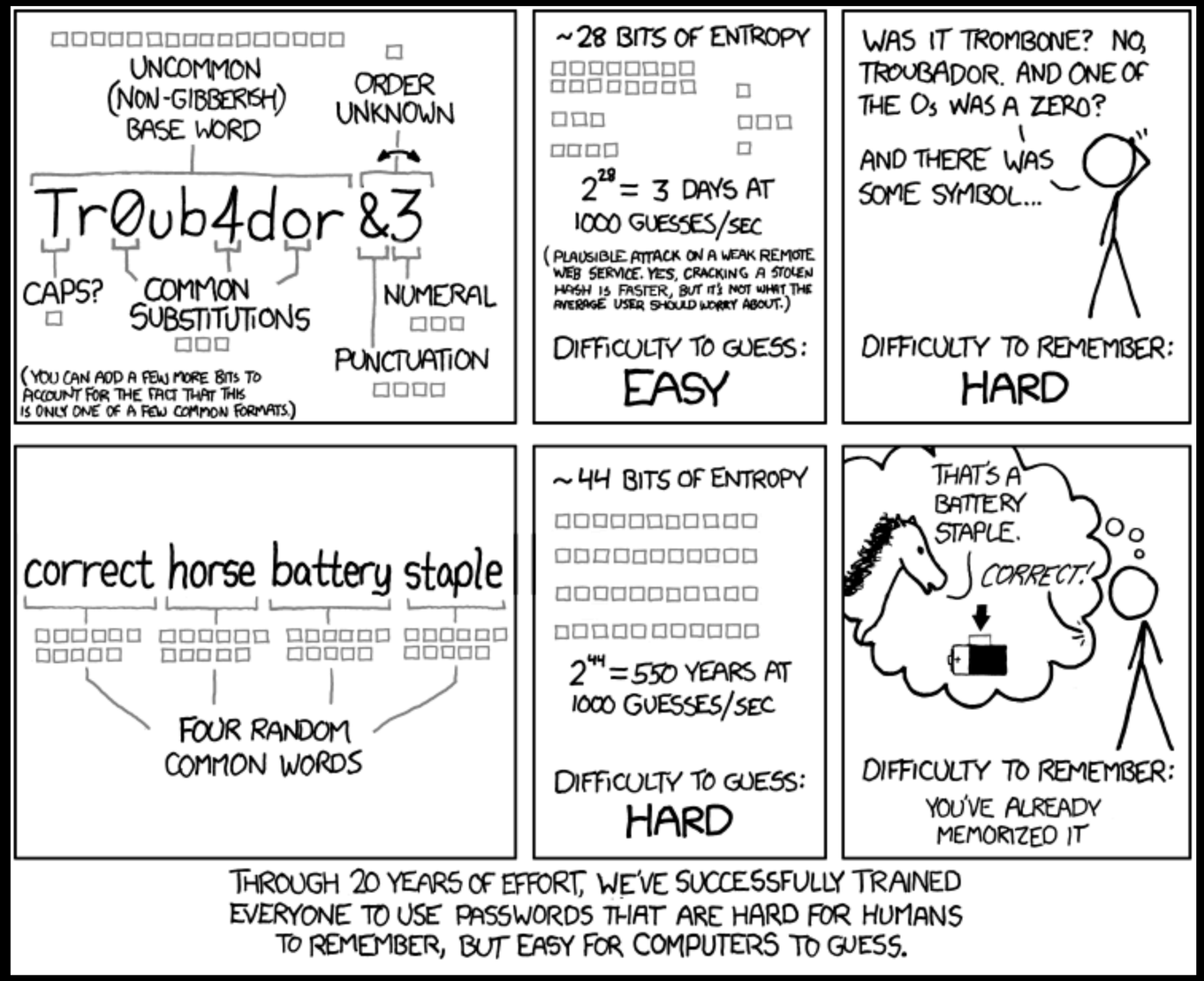
Proof

Well, duh



Requirements for Password Managers

- Easy to use - Or nobody will use it
- Use from anywhere - Get your passwords when at a friend’s house
- Secure - Your password should be safe from theft
- Strong passwords - You should be encouraged (forced?) to use them
- Different for every site - You should be encouraged (forced?) not to reuse them
- Able to find an acceptable one - Web sites have strange password rules
- Easy to change - Some sites require regular changes (Ask me why that’s bad)

What is a Password Manager?

A software application designed to **store** and manage online credentials. It also generates passwords. Usually, the passwords are stored in an encrypted database locked behind a master password. — malwarebytes.com

A password manager is an app on your phone, tablet, or computer that **stores** your passwords, so you don't have to remember them. — ncsc.gov

A password manager is a service that helps you generate and **store** long, unique passwords for all your online accounts. — consumerreports.org

So What’s So Bad about That?

- Where are your password stored?
  - On your machine?
  - In the cloud? Who’s cloud?
  - How are the stored?
- It costs money
    - To manage your account
    - To pay for the cloud resources

And then There’s This to Worry About

LastPass	Notice of Recent Security Incident -	...	7:35 AM

We recently detected unusual activity within a third-party cloud storage service, …

We have determined that an unauthorized party, …was able to gain access to certain elements of our customers’ information. **Our customers’ passwords remain safely encrypted due to LastPass's Zero Knowledge architecture**.

A Different Approach

A Different Kind of Password Manager

Don’t Remember Your Passwords, Calculate Them

- No accounts to manage
- No external storage needed
- Even a semi-nerd can self-host
- Can even be used without network access
- You are in control
  - Carry a piece of paper with everything you need to get your passwords.
  - It’s not good if you lose it, but it isn’t terrible either.

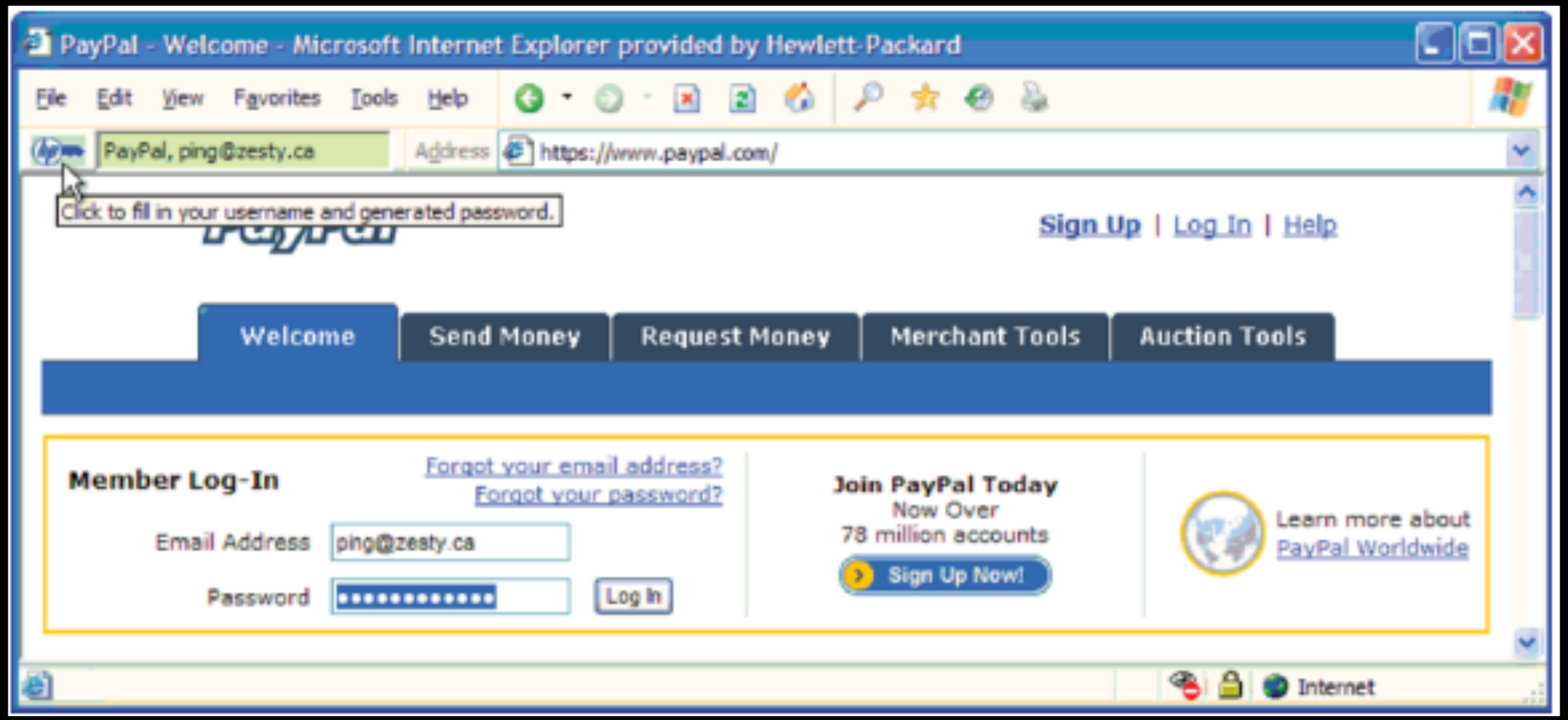
A Brief History of SitePassword

The Earliest Days

2003

HP Anti-Phishing Toolbar for IE

2005



Chrome Extension

2012

- Some Problems
  - No sync across machines
  - Unhappy with personas
  - Only finds 60% of password fields
- Only available for testers
- Only I used it for the next 10 years

And Then
2021

- Google says I have to update it.
- “No problem,” I say to myself. “It’ll only take a week or so.”
- 12 months later …….

Why It Took So Long

- Google's changes
  - From a persistent background page to a transient service worker
  - Everything is async
- Fixed what I didn't like
  - Always(?) finds password field
  - Synchronizes across machines
  - Handles different personas

Let Google Do the Heavy Lifting

- Store settings in bookmarks
  - Google handles synchronization
  - But Google doesn’t merge updates
- Supporting personas with Google Profiles
  - Your work/home split
  - Shared machine

Demo

Ask | Site | Did | Boo | Site

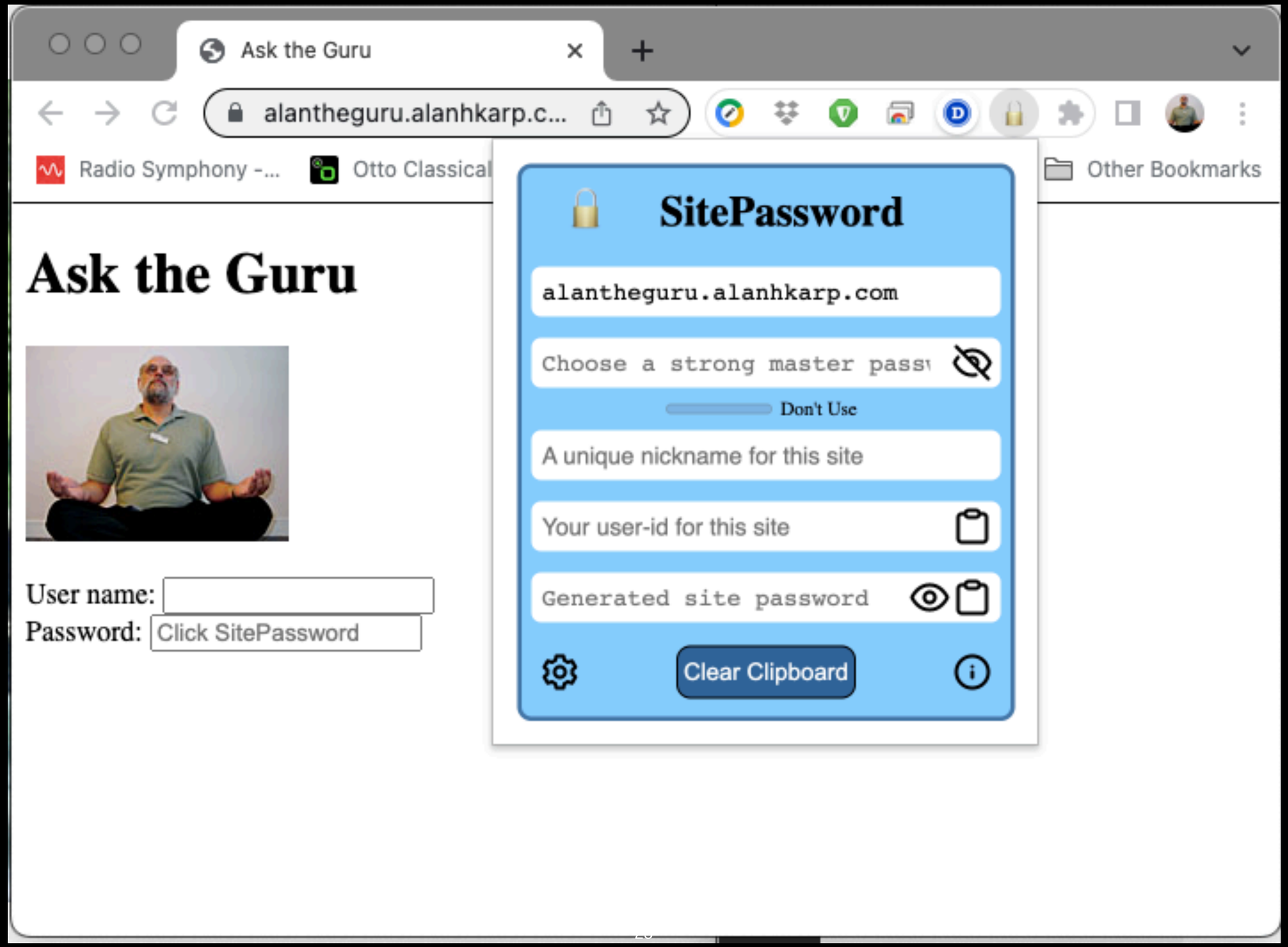
alantheguru.alanhkarp...

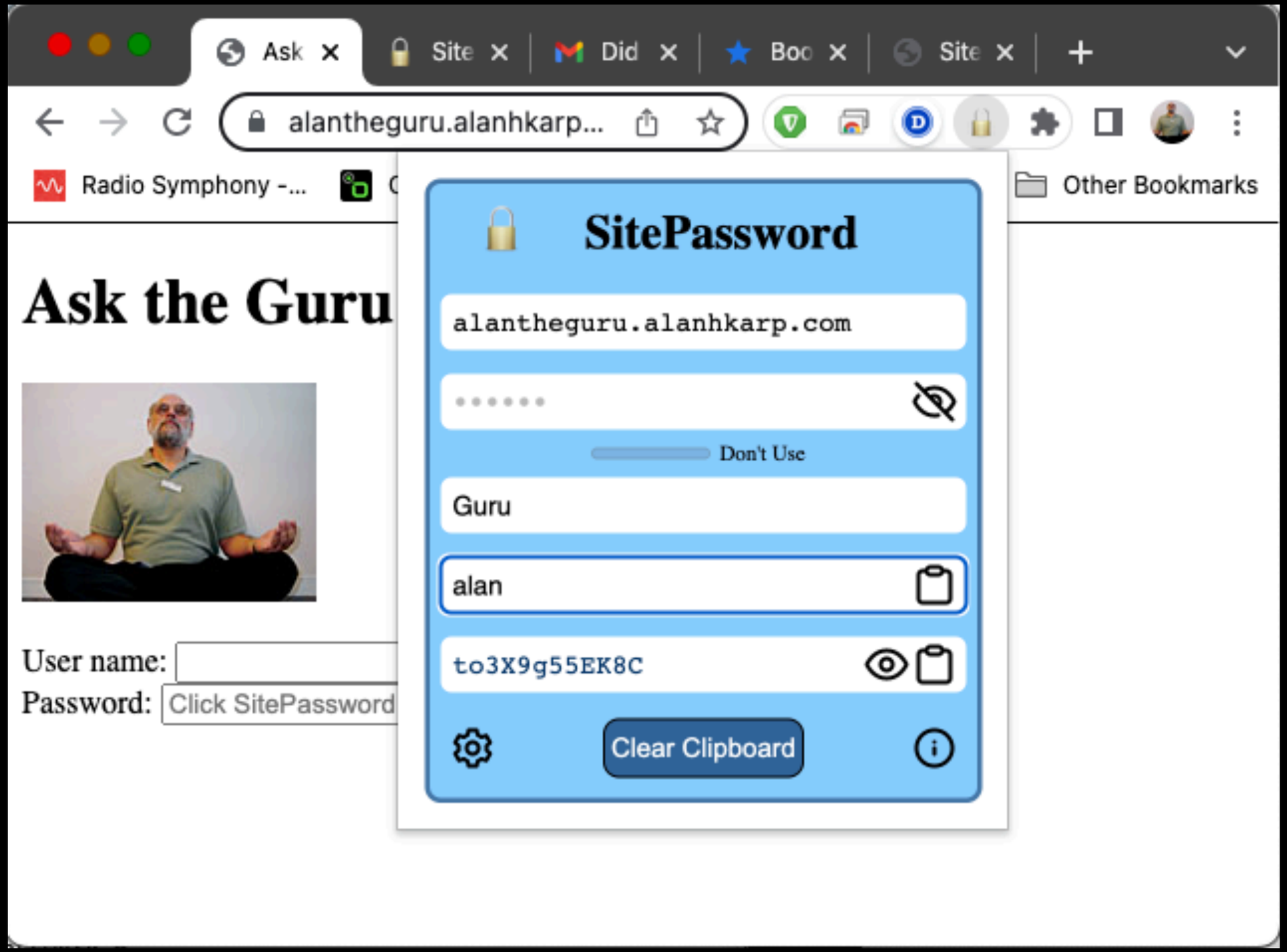
Radio Symphony -... | Otto Classical | Pandora | » | Other Bookmarks

Ask the Guru

User name:

Password: Click SitePassword


Ask the Guru
alantheguru.alanhkarp.c...
Radio Symphony -...
Otto Classical
Other Bookmarks
Ask the Guru
User name:
Password:
Click SitePassword
SitePassword
alantheguru.alanhkarp.com
Choose a strong master pass
Don't Use
A unique nickname for this site
Your user-id for this site
Generated site password
Clear Clipboard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Don't Use
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Clear Clipboard

Ask | Site | Did | Boo | Site

alantheguru.alanhkarp...

Radio Symphony -... | Otto Classical | Pandora | » | Other Bookmarks

Ask the Guru

User name: alan

Password: Click here for password

Ask the Guru

alantheguru.alanhkarp.c...

Radio Symphony -... Otto Classical Pandora Friam Hangout » Other Bookmarks

Ask the Guru

User name: alan

Password: ••••••••••••

Ask | Site | Did | Boo | Site

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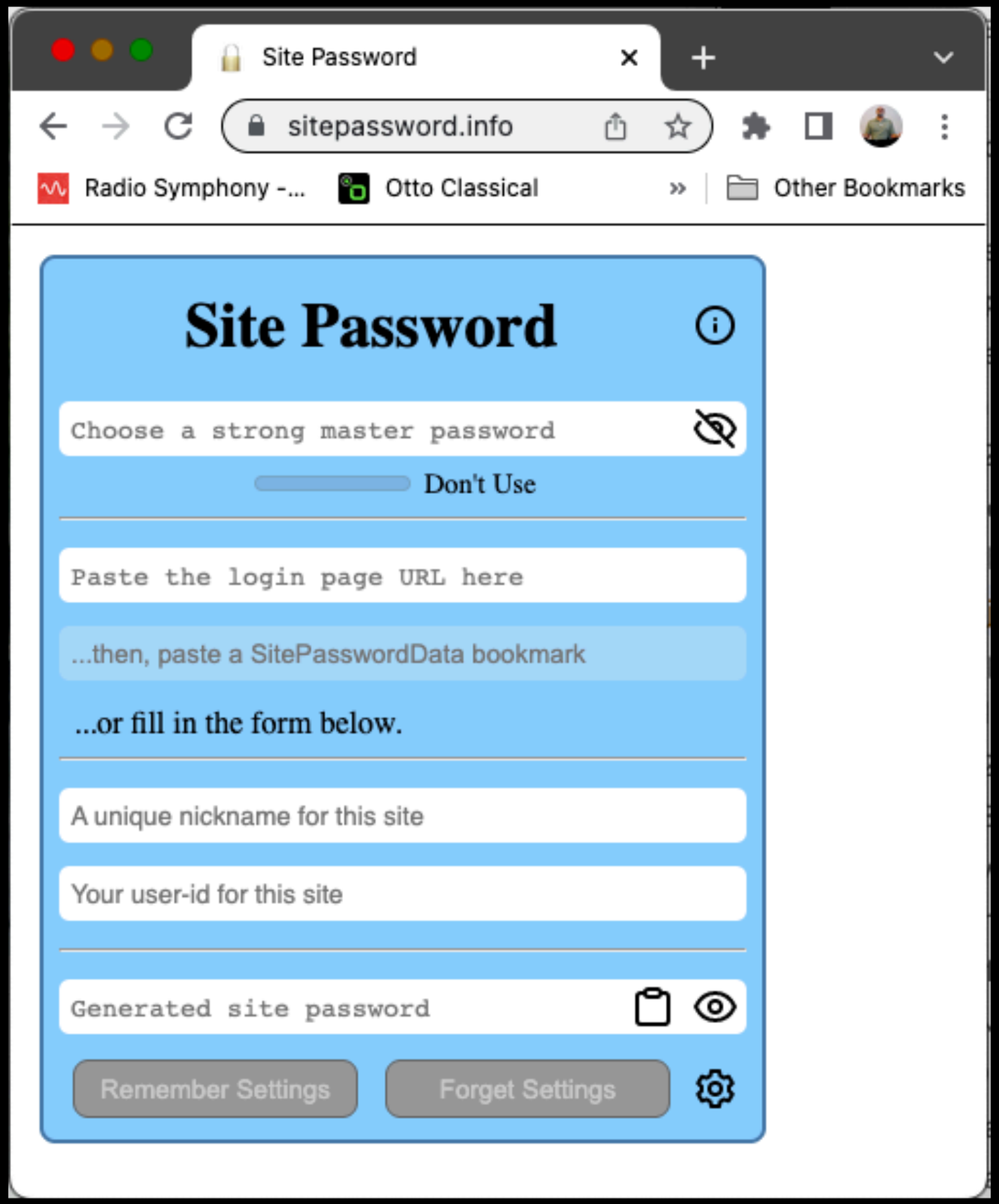
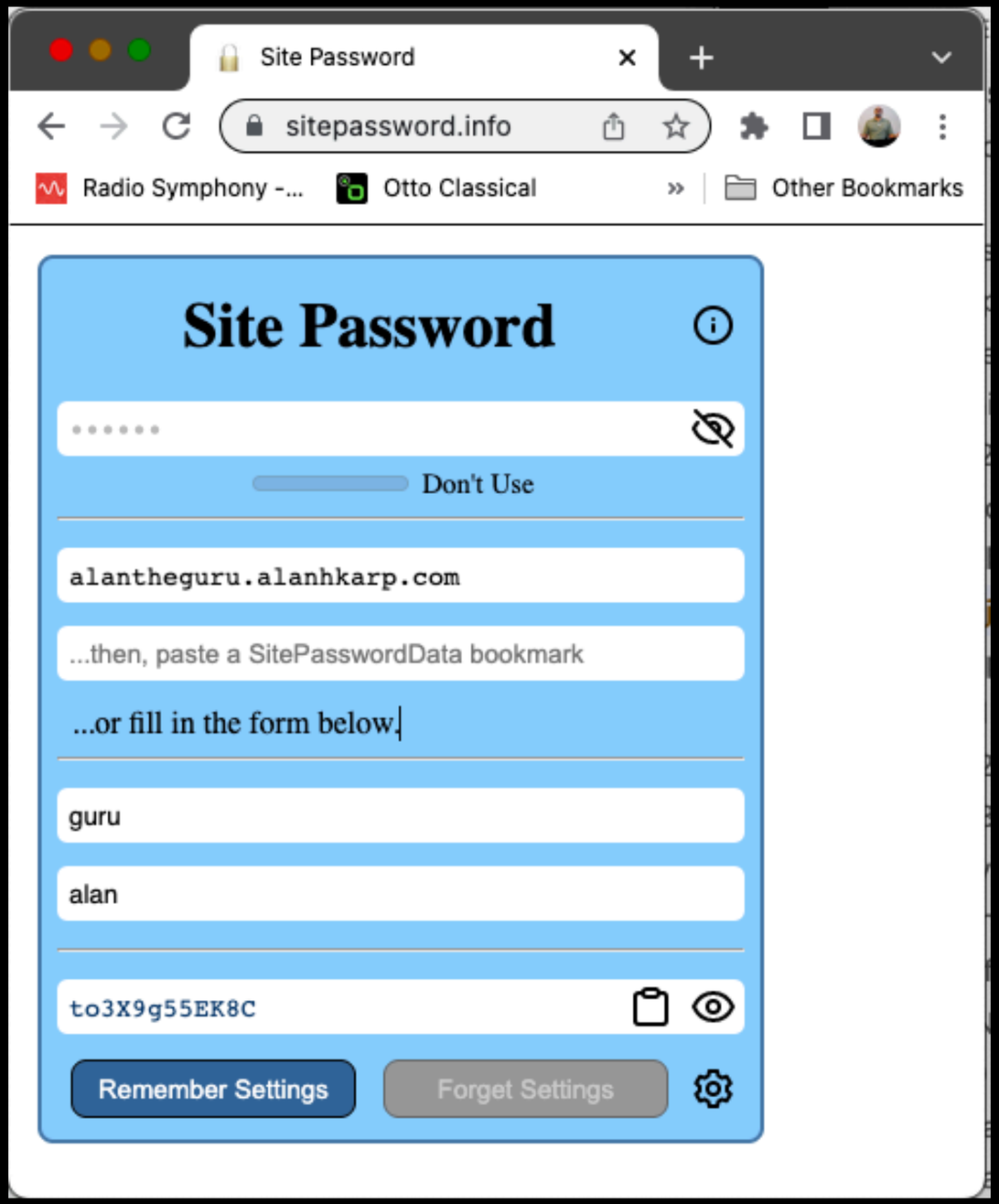

Site Password
sitepassword.info
Radio Symphony -...
Otto Classical
Other Bookmarks
Site Password
Choose a strong master password
Don't Use
Paste the login page URL here
...then, paste a SitePasswordData bookmark
...or fill in the form below.
A unique nickname for this site
Your user-id for this site
Generated site password
Remember Settings
Forget Settings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guru
alan
to3X9g55EK8C
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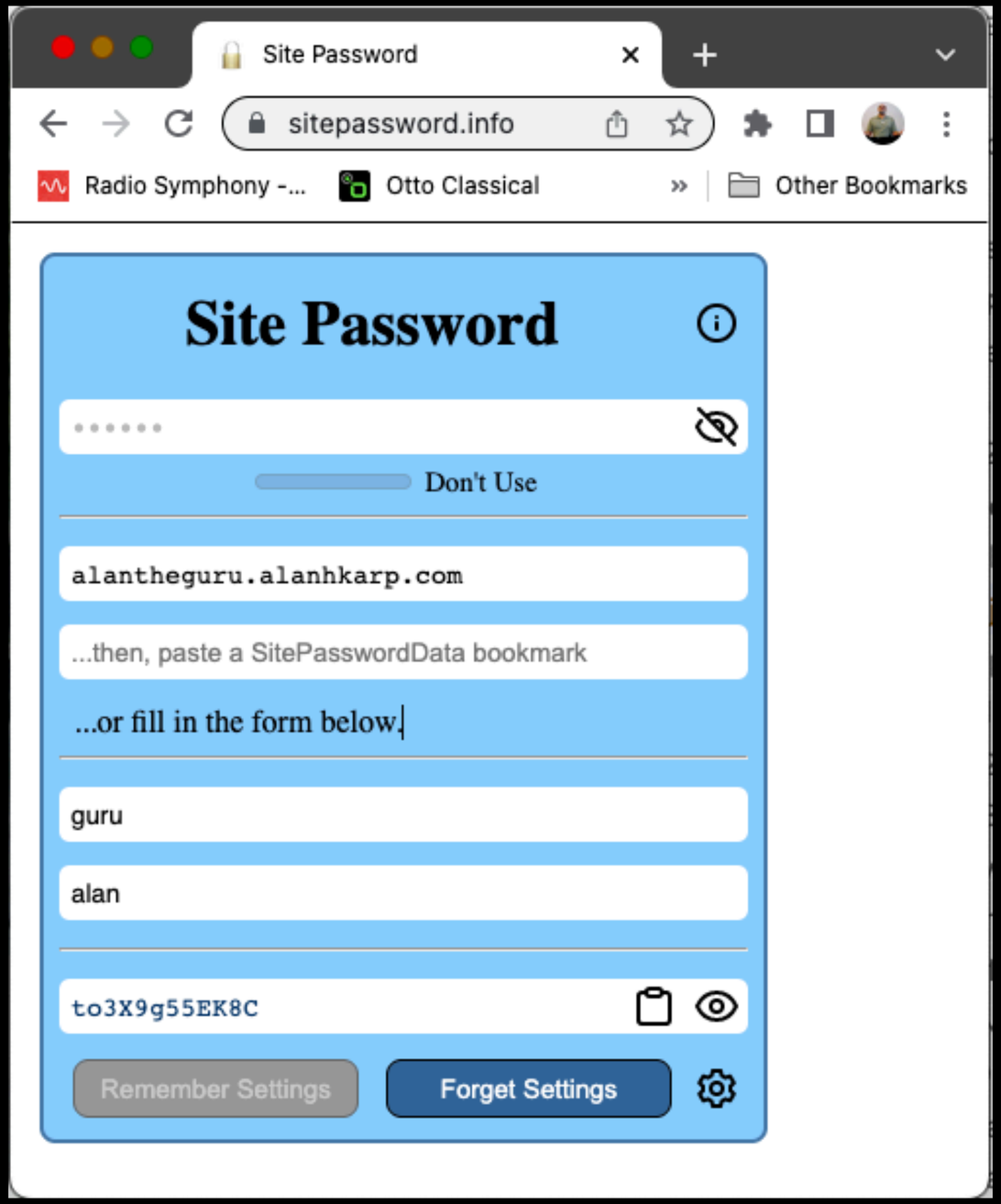
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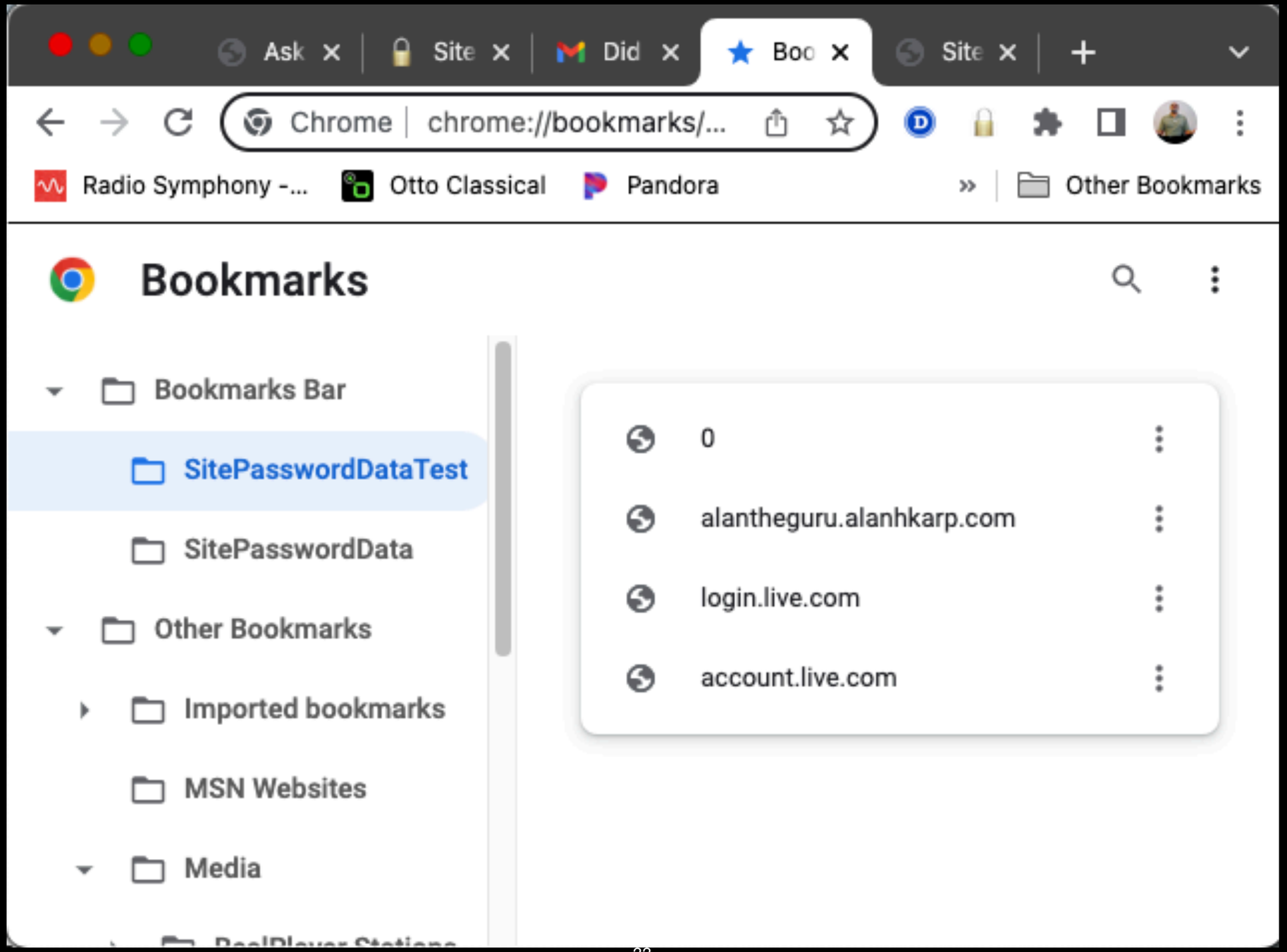
Ask
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Radio Symphony -...
Otto Classical
Pandora
Other Bookmarks
Bookmarks
Bookmarks Bar
SitePasswordDataTest
SitePasswordData
Other Bookmarks
Imported bookmarks
MSN Websites
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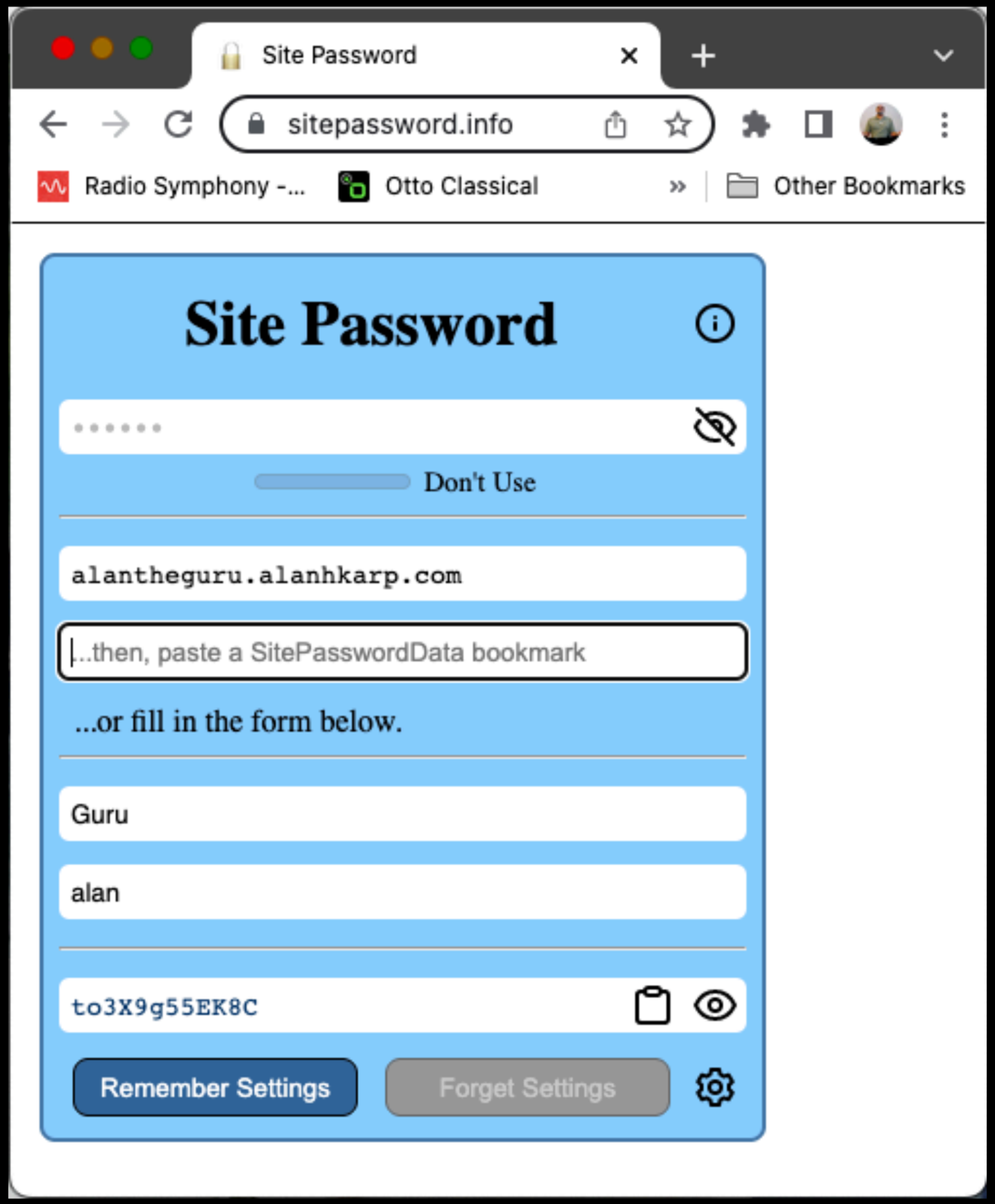
alantheguru.alanhkarp.com
login.live.com
account.live.com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Guru
alan
to3X9g55EK8C
Remember Settings
Forget Settings

Did you approve this $1,000 purchase?

Inbox × Demo ×

Alan Karp <alanh... Nov 11, 2022, 2:02 PM (11 days ago)

to me

Log into https://alantheguru.alanhkarp.com if you did not place this order.

Alan Karp

Did you approve this $1,000 pu

Ask the Guru

allantheguru.alanhkarp.com

Radio Symphony -... Otto Classical Pandora Friam Hangout » Other Bookmarks

Ask the Guru

User name:

Password: Click SitePassword

Did you approve this $1,000 pu

Ask the Guru

allantheguru.alanhkarp.com

Radio Symphony -... Otto Classical P Other Bookmarks

Ask the Guru

User name:

Password: Click SitePassword

SitePassword

allantheguru.alanhkarp.com

Don't Use

guru

Your user-id for this site

Generated site password

Warning: The domain name

allantheguru.alanhkarp.com

is different from what you saved for this site name. You may be at a fake site that is trying to steal your password.

Get me to safety!

Trust me. I know what I'm doing.

Clear Clipboard

Did you approve this $1,000 pu

Ask the Guru

allantheguru.alanhkarp.com

Radio Symphony -... Otto Classical P Other Bookmarks

Ask the Guru

User name:

Password: Click SitePassword

SitePassword

allantheguru.alanhkarp.com

••••••

Don't Use

A unique nickname for this site

Your user-id for this site

Wk?q!@Y92p6B

Clear Clipboard

Clear master password on use.

Password is 12 characters long

Starts with letter

Requires at least 1 lowercase letter(s)

Requires at least 1 uppercase letter(s)

Requires at least 1 number(s)

Requires at least 0 of /!=@?._-

Download Site Data

SiteData.html

File | /Users/alan/Downloads/SiteData.html

Radio Symphony -... | Otto Classical | Pandora | Friam Hangout | My Personal Web... | Espeak on the Int... | SiteGround Web H... | Dale's Zoom | » | Other Bookmarks

Site Name	Domain Name	User Name	Password Length	Start with Letter	Allow Lower	Min Lower	Allow Upper	Min Upper	Allow Numbers	Min Numbers	Allow Specials	Min Specials	Specials
Guru	alantheguru.alanhkarp.com	Alan	12	true	true	1	true	1	true	1	false	0	/!=@?._-
microsoft	login.live.com	alanhkarp@outlook.com	12	true	true	1	true	1	true	1	false	0	/!=@?._-
microsoft	account.live.com	alanhkarp@outlook.com	12	true	true	1	true	1	true	1	false	0	/!=@?._-

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Ask the Guru

User name: alan

Password: Click here for password

Usable Security

Ping's 10 Princples for a Secure UX

1. Path of Least Resistance: Make the easy way the secure way.
2. Appropriate Boundaries: Make distinctions matter to the user.
3. Explicit Authorization: Authorize only by explicit user action.
4. Visibility: All security related decisions must be viewable.
5. Revocability: Make it easy to revoke granted permissions.
6. Expected Ability: Don't make user think the tool will do what it can't
7. Trusted Path: It should not be possible to spoof the UI.
8. Identifiability: Give each object an identifer that the user understands.
9. Expressiveness: Allow users to express policies that they want.
10. Clarity. Make effects of actions apparent to the user before acting.

My User Experience Goals

Make it as easy to use as Candy Crush

- No Help button - It’s a crutch for developers
- Can’t break anything by experimenting
- Encourage good practices
  - Warn on weak master password
  - Use clipboard only when needed and warn after use
- Choose a readable font, particularly for site password
- Focus the field the user will be needing next

My User Experience Goals

Where I failed

- Can’t always make “Click here for password” show up
  - Resorted to tooltip, but it takes a second or so to appear
- Forgetting settings for a domain
  - Delete the corresponding bookmark
- Pasting bookmark into web version
  - Too easy to miss that the form was filled in
- Closing the popup

Password Manager Security

Mobile Devices

- Situation is really bad
- Too easy to spoof app identity
- iframes inside Android WebView can spoof messages
- One password manager pulled their app

Built into the Browser

- Pluses
  - Better than not using a password manager
  - Never resorts to the clipboard
  - Always finds password field
- Minuses
  - Most lack features of stand-alone password managers
  - Some don’t generate passwords, only store them
  - Many don’t detect the password policy

As Bad as it Gets

Chrome does all 4 things a password manager should never do

1. Autofils with no user action

   Make it easy to steal passwords

2. Can’t customize generated password

   Might not be able to use password generator

3. Has an option to show existing passwords

   Encourages password reuse

4. Uses same password for alan.alanhkarp.com and allan.alanhkarp.com

   You can be fished if alan and allan have different owners

It’s More than Just Passwords Strength

- Autofill
  - Put the password into a form controlled by an attacker
- Storage Security
  - Stolen, didn’t get the passwords but got the metadata
- User Communication
  - Allows weak/reused passwords
  - Generated passwords sometimes weak (oMMMMMMT?m*m)

It’s More than Just the Passwords

- Avoid using clipboard but sometimes the only viable backup
- Phishing sites and phishing the password manager password
- Domain name errors - google.evil.com treated as google.com
- Attacks based on accessibility features
- Code size - one password manager is over 200,000 lines of code
  - SitePassword 1,500 lines of JavaScript, 750 HTML, 250 CSS
- Worst of all - Not using a password manager due to lack of trust

The Evil Coffee Shop Attack

Autofill with no user action

1. The user sets up several sites with a password manager.
2. User connects to a rogue router in a coffee shop.

   The attacker can inject, block, and change network packets.
3. Attacker directs user’s browser to a vulnerable page at the target site.
4. Attacker injects login form into the vulnerable page by modifying packets.
5. Your password manager fills it in.
6. Repeats for another site with a vulnerable page.

Related Attacks

- HTTP login page - submits forms with HTTPS
  - Doesn’t happen much now but (Schwab, eBay)
- Broken HTTPS
  - Usually an expired certificate (HP)
- HTTPS with active content fetched over HTTP
- XSS (Cross Site Scripting) on any page at the victim site
- Clickjacking

SitePassword Security

The Good

- Require click on password field
- Callback registered only on visible password fields
- Use iframe domain name if its password field clicked
- Use zxcvbn() from Dropbox for password strength meter
- Site name and user name act as salt to defeat pre-computation attacks
- Warn if password might still be on the clipboard

SitePassword Security

The Not So Good but for Good Reasons

- Uses bookmarks for sync
  - Metadata not encrypted
  - Bookmarks stored on disk and in Google cloud
- Site password visible by default
  - Gives you a sense of how random looking the site passwords are
  - Don’t often open the popup
- 12-character passwords by default
- Doesn’t handle dartmouth.edu/~alanhkarp

SitePassword Security

The Ugly - An Offline attack against master password

- You create an account at a bad guy's site
- Bad guy knows site password and username and can guess site name
- Bad guy starts guessing master passwords
- Mitigation
  - Strong master password
  - Hash a minimum of 100 times to get site password
  - Any guesses that produce the known site password must be tried online
- Defeated by a hard to invert hash function that produces lots of collisions

War Stories

Finding the Password Field

Websites do some weird #%^@

- Put password field in an iframe with a different domain name than page
- Login form at a completely different domain
- Add password field dynamically
- Add password field with type=text and change to type=password
- Make password field visible only after you click a button
- Add CSS at runtime that makes password field visible

Finding the Password Field

Websites do some weird #%^@

- Change contents of page based on the fragment
  - Requires a separate event listener
- Password field in a shadow root (shadow DOM)
  - Must walk the DOM to find it
- Clears the field after I set it (Who the %#^@ knows why)
- Don’t want to update password field at sitepassword.info

Is the Password Field Visible?

Harder to figure out than you may think.

- Does window.computedStyle(element) say it’s visible?
  - Correct most of the time but not always
- Is parent visible?
  - offsetParent != null if position != ‘fixed’
- One clickjacking trick
  - element.style.opacity = “0” reported visible
- Other tests needed?

Crazy #%^@

Done by big companies with professional programmers

- Many domain names for the same login page
- Username and password fields have the same id
- A bunch of errors when the page loads
  - Failed cross domain accesses for data that’s never used
  - Takes 30 seconds to time out on 4 bad GETs - myacm.acm.org
- Unnecessary dependencies
  - Many use jQuery on their login pages

How Bad Is It?

One password manager has special cases for over 200 sites.

Summary

Future Work

- User studies
- Other browsers
  - Brave, Edge, Opera - Works
  - Firefox - Should work but doesn’t
  - Safari - Need to figure out how to use Xcode properly
- IoS and Android apps
  - Monitoring a serious security issue

References

- Ping’s 10 Principles - http://zesty.ca/pubs/icics-2002-uidss.pdf
- Oesch Thesis - https://trace.tennessee.edu/cgi/viewcontent.cgi?article=7785&context=utk_graddiss
- Oesch Paper - https://www.usenix.org/system/files/sec20-oesch_0.pdf
- https://eprints.whiterose.ac.uk/158056/8/Revisiting_Security_Vulnerabilities_in_Commercial_Password_Managers_2.pdf
- https://www.usenix.org/system/files/soups2019-pearman.pdf
- https://crypto.stanford.edu/~dabo/pubs/papers/pwdmgrBrowser.pdf

Takeaways

- Use a password manager - a bad one is better than none at all
- Turn off any setting that fills in the password without a user action
- Prepare for the worst - Some have gone out of business
- Use it wisely - use strong passwords even if you don’t have to

OR

Take control and use SitePassword