“If I could do this, I feel anyone could:”

The Design and Evaluation of a Secondary Authentication Manager

Garrett Smith*, Tarun Yadav*, Jonathan Dutson, Scott Ruoti, and Kent Seamons

Brigham Young University and the University of Tennessee Knoxville

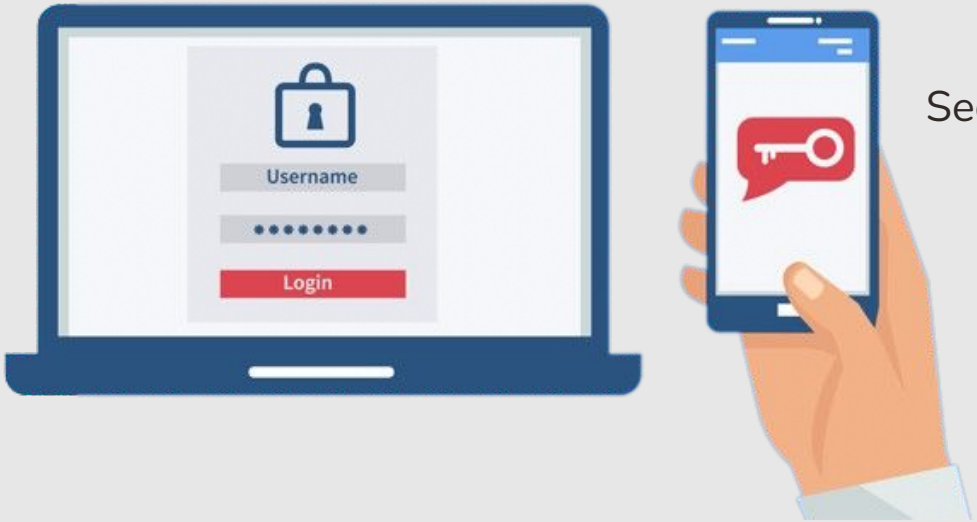
*Denotes Equal Contribution

USENIX 2023

Password Based Authentication

Two-Factor Authentication

Primary Authentication Factor

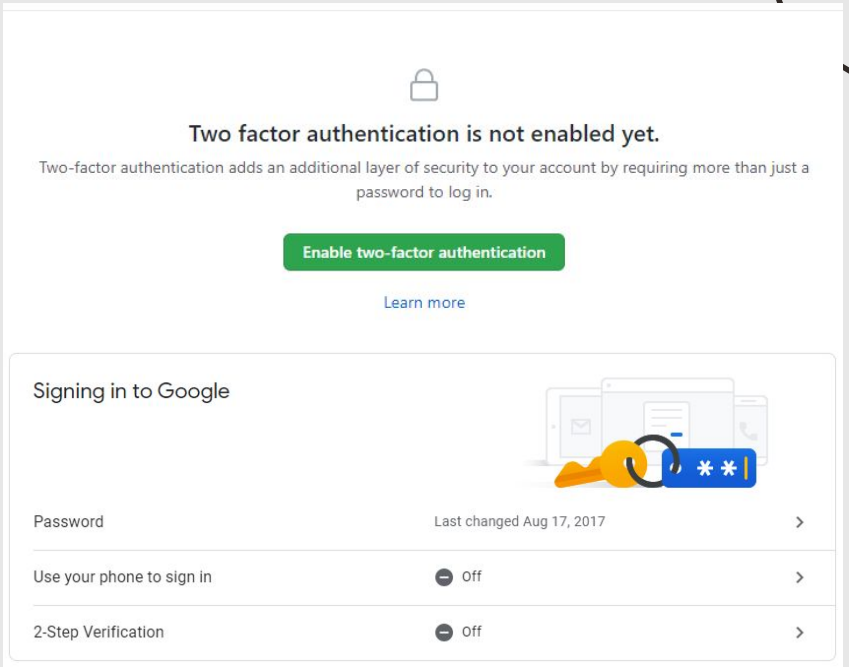


Secondary Authentication Factor (SAF)

2FA Implementations

2FA Implementations vary across websites

- Inconsistent terminology
- Different requirements and recommendations
- Varying workflows



Updating Many Accounts

- First adopting 2FA
- Replacing an existing SAF (getting a new phone)
- Removing a lost SAF
- Adding an SAF

  (backup, spouse/child access)

Authentication Manager

Password Manager

SAF Manager

SAF Setup Abstraction

SAF Manager

Authentication

List Available Methods

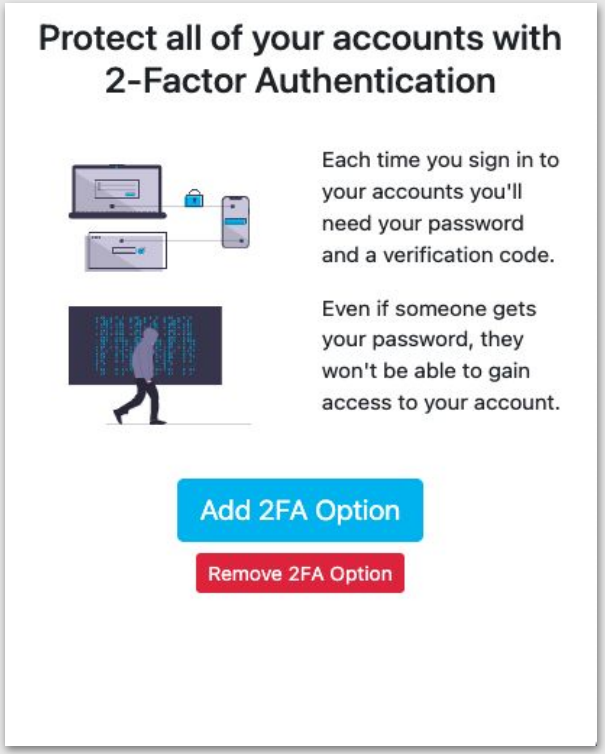
Select Method

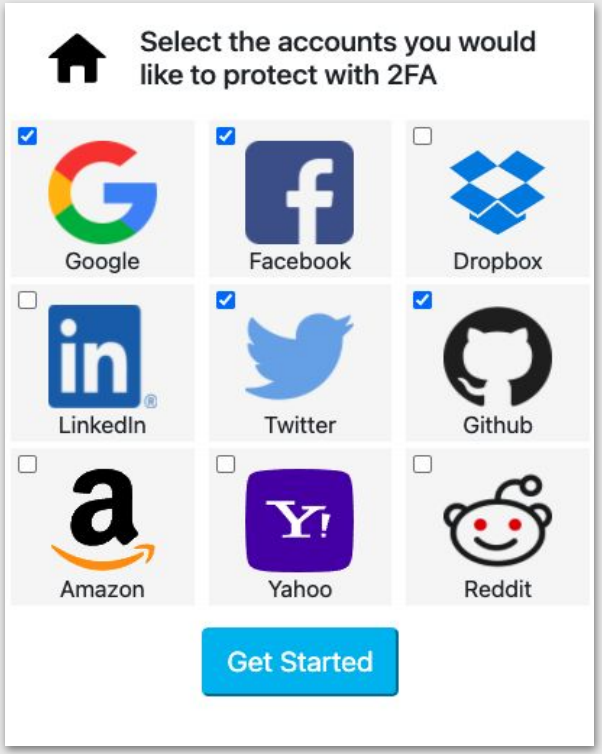
Initiate Protocol

Verify Second Factor

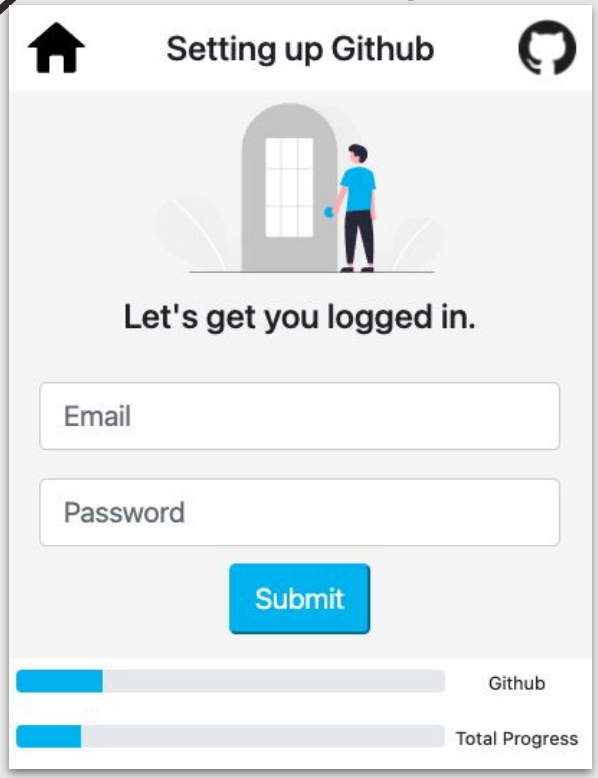
Website

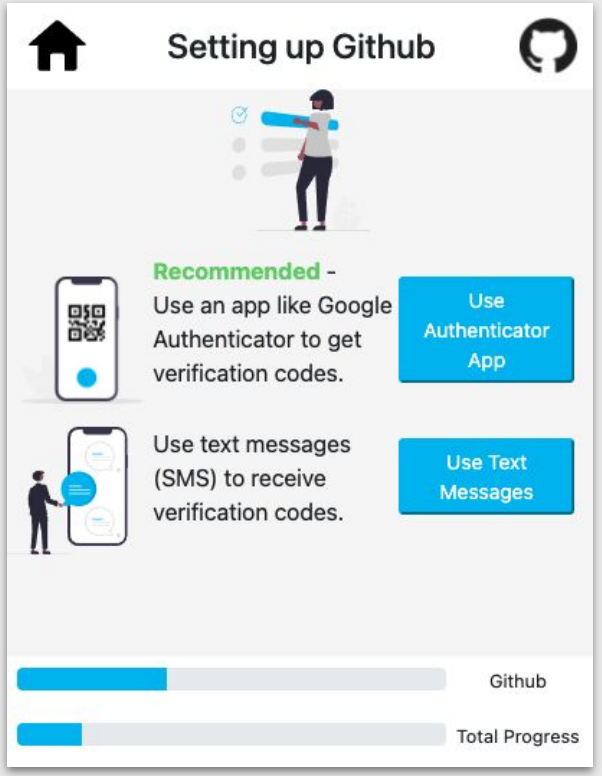
Prototype

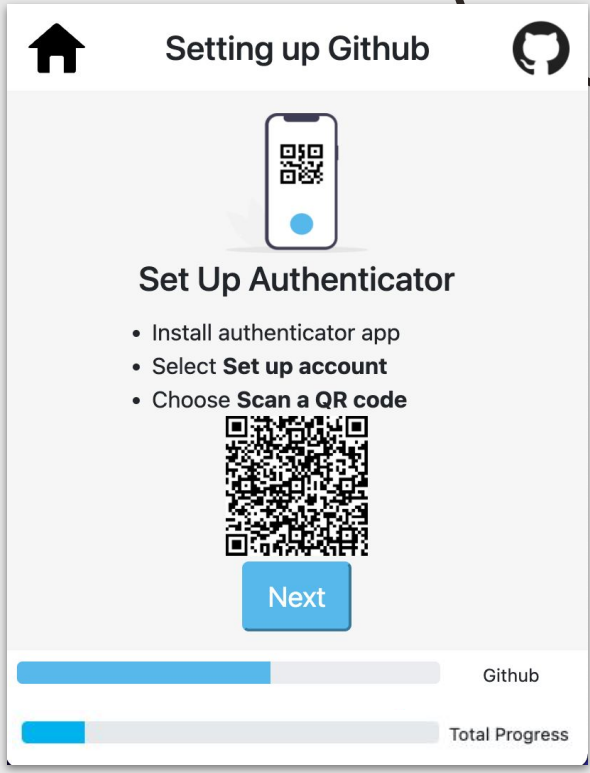

Protect all of your accounts with 2-Factor Authentication
Each time you sign in to your accounts you'll need your password and a verification code.
Even if someone gets your password, they won't be able to gain access to your account.
Add 2FA Option
Remove 2FA Option


Select the accounts you would like to protect with 2FA
Google
Facebook
Dropbox
LinkedIn
Twitter
Github
Amazon
Yahoo
Reddit
Get Started

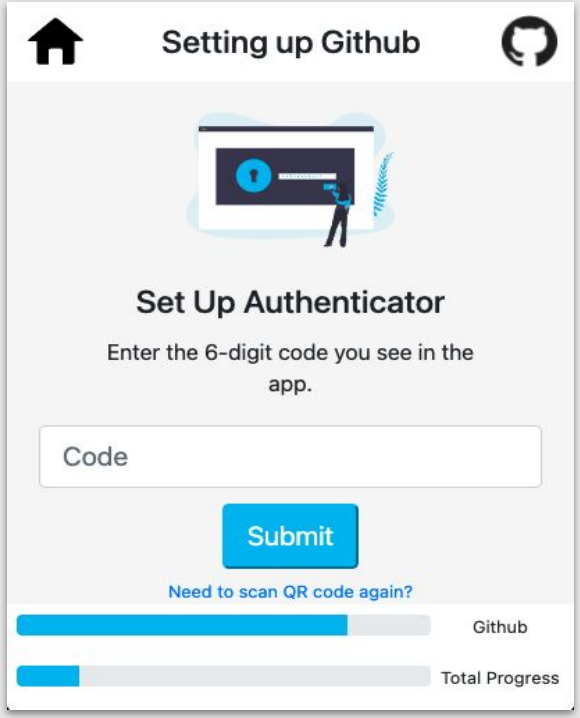
Prototype

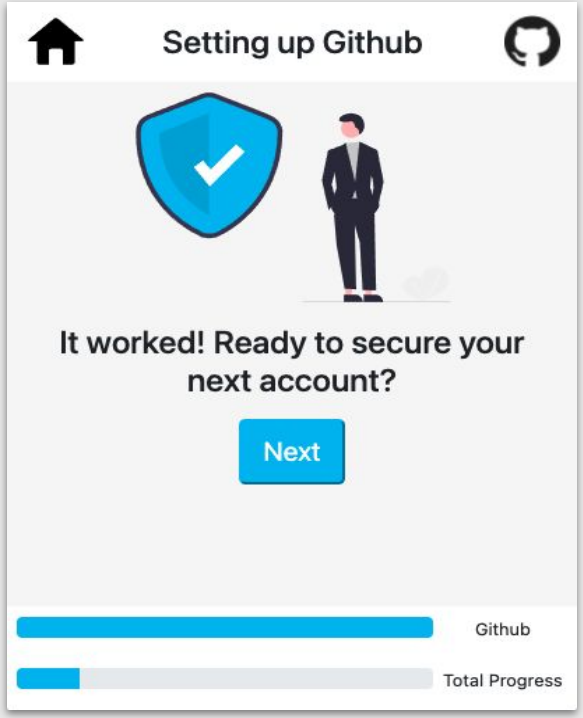

Setting up Github
Let's get you logged in.
Email
Password
Submit
Github
Total Progress


Setting up Github
Recommended -
Use an app like Google Authenticator to get verification codes.
Use Authenticator App
Use text messages (SMS) to receive verification codes.
Use Text Messages
Github
Total Progress

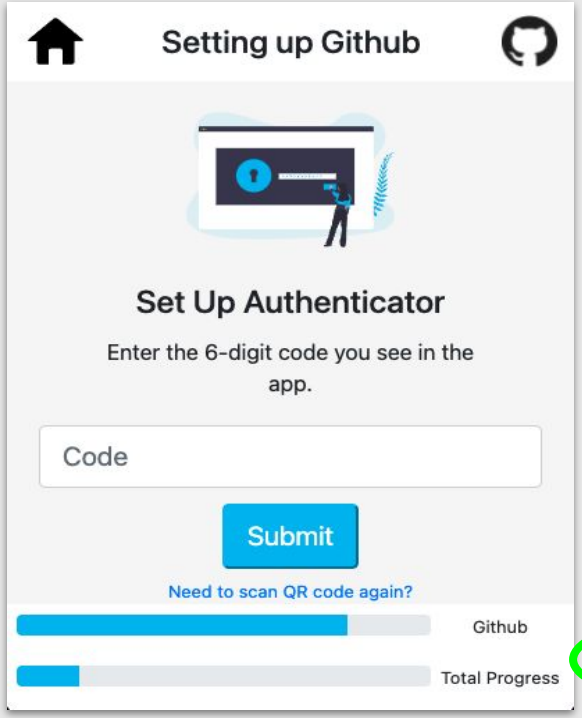

Setting up Github
Set Up Authenticator
Install authenticator app
Select Set up account
Choose Scan a QR code
Next
Github
Total Progress

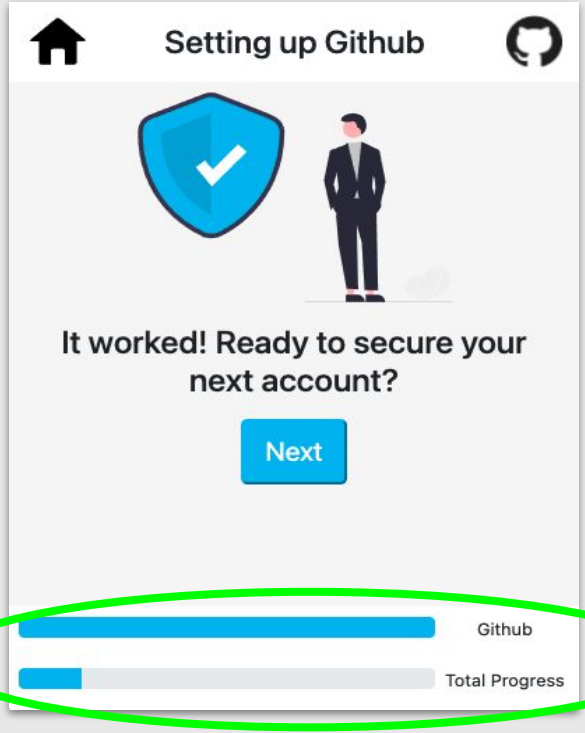
Prototype


Setting up Github
Set Up Authenticator
Enter the 6-digit code you see in the app.
Code
Submit
Need to scan QR code again?
Github
Total Progress


Setting up Github
It worked! Ready to secure your next account?
Next
Github
Total Progress

Prototype


Setting up Github
Set Up Authenticator
Enter the 6-digit code you see in the app.
Code
Submit
Need to scan QR code again?
Github
Total Progress


Setting up Github
It worked! Ready to secure your next account?
Next
Github
Total Progress

User Study Design

Dependent Variables

- Success rate
- Completion Time
- Usability
  - System Usability Scale

Independent Variables

- 2FA Setup Process
  - Manual
  - Automated
- 2FA Experience
  - Novice 2FA Users
  - Experienced Users

Study Design

Independent Variables	Group A	Group B	Group C
2FA Experience	Novice User	Novice User	Advanced User
2FA Methods	Manual Method	SAF Manager	SAF Manager

Study Design

- 60 Participants - Prolific Academic
- A|B, C Assigned by 2FA usage
- A|B Assigned randomly

Measure	Items	A	B	C	Total
Gender	Female	13	12	4	29
	Male	7	8	16	31
Age	18-24	4	1	1	6
	25-34	7	5	9	20
	35-44	5	4	2	11
	45-54	2	5	4	11
	55+	2	4	2	9

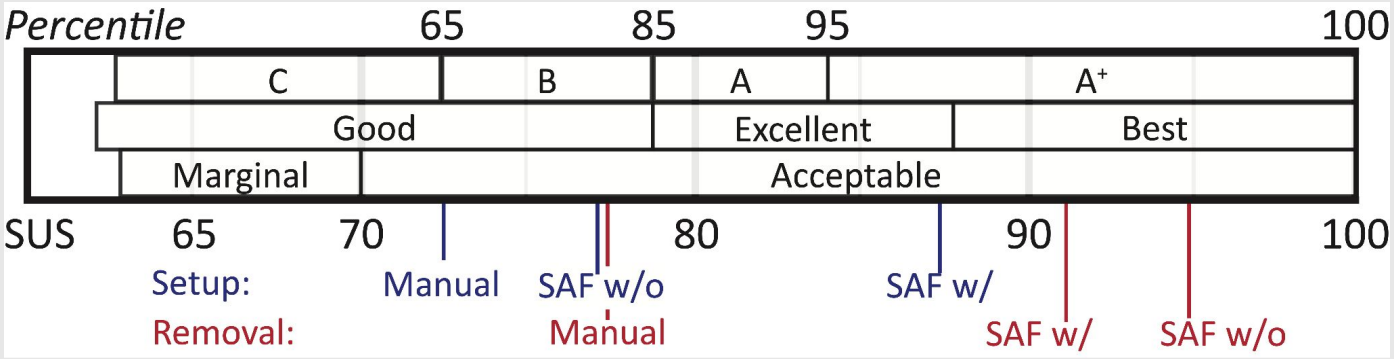
Results - Success Rate

Group	Tool Used	Success Rate
A	Existing Websites	75% - (15)
B	SAF Manager	100% - (20)
C	SAF Manager	90% - (18)

Results - Completion Time

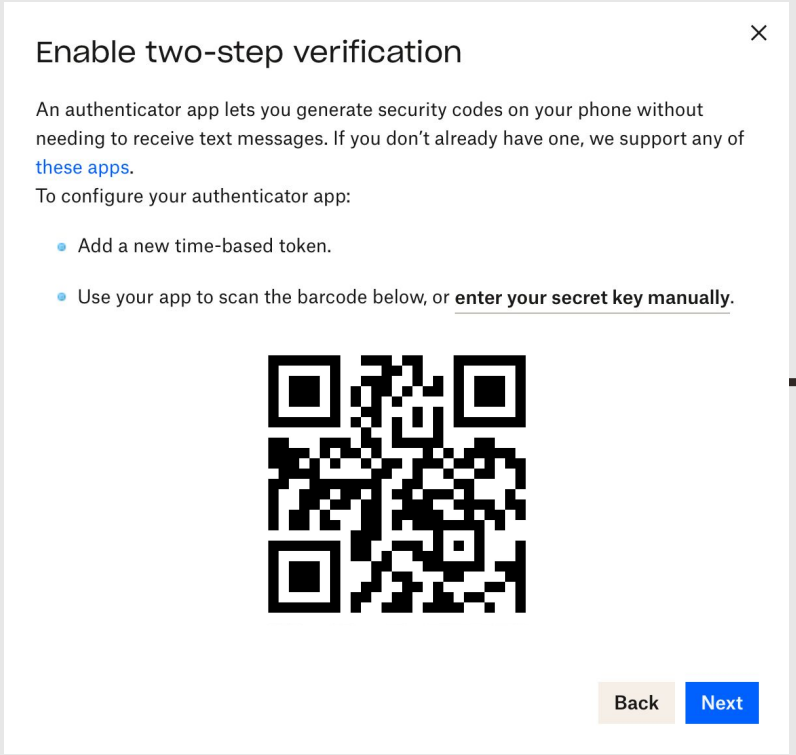
Group	Tool Used	Completion Time
A	Existing Websites	7 minutes 52 seconds
B	SAF Manager	5 minutes 15 seconds
C	SAF Manager	4 minutes 22 seconds

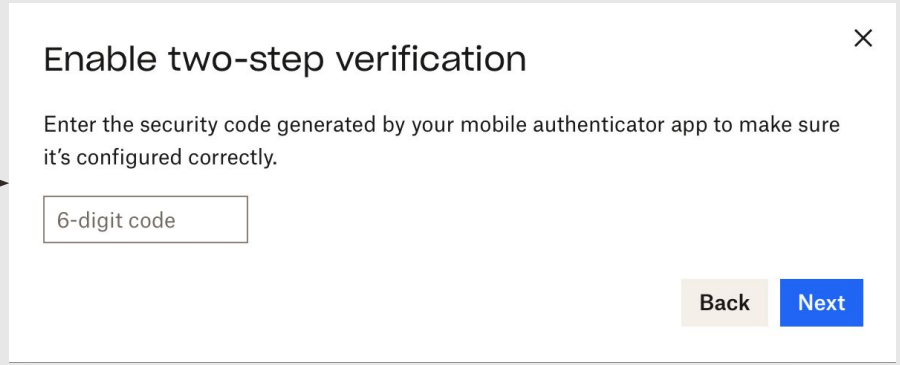
Results - System Usability Scale



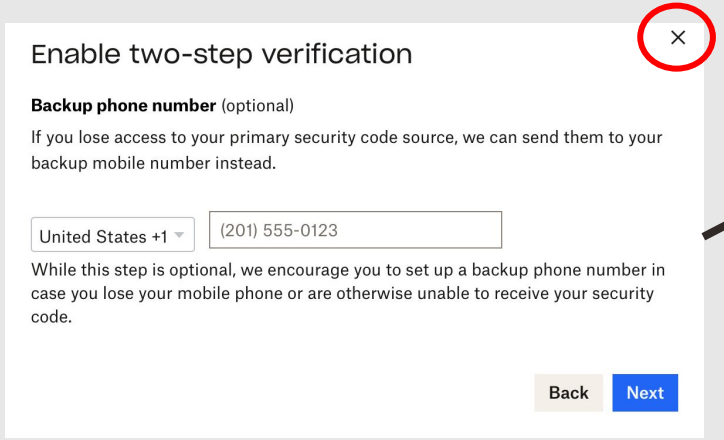
	Study Group	Setup Method	2FA Experience
Manual	Group A	Manual	Novice
SAF W/o	Group B	SAF Manager	Novice
SAFE W/	Group C	SAF Manager	Experienced

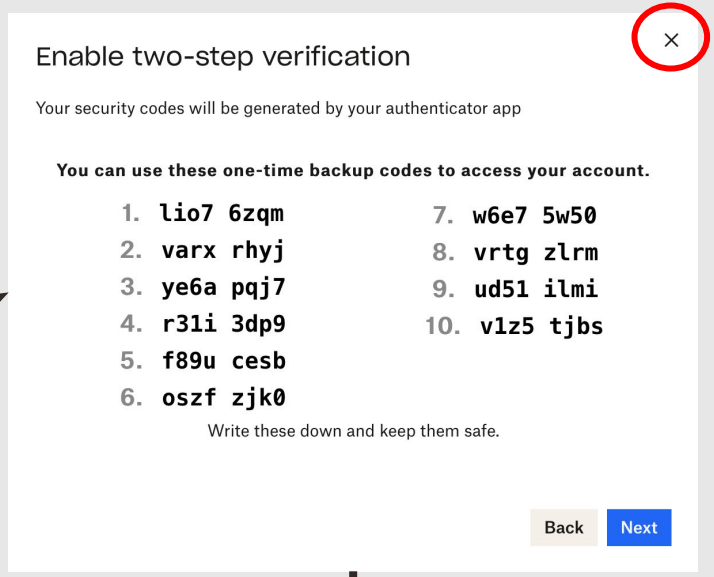
Common Issues

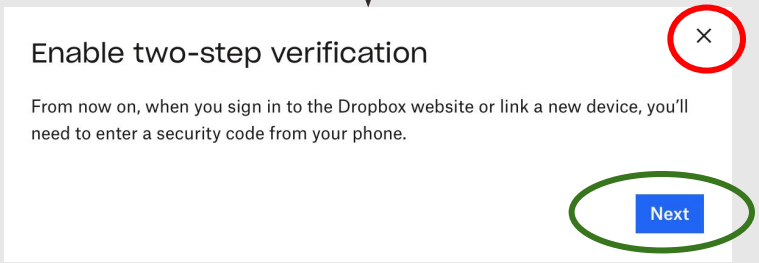




Common Issues







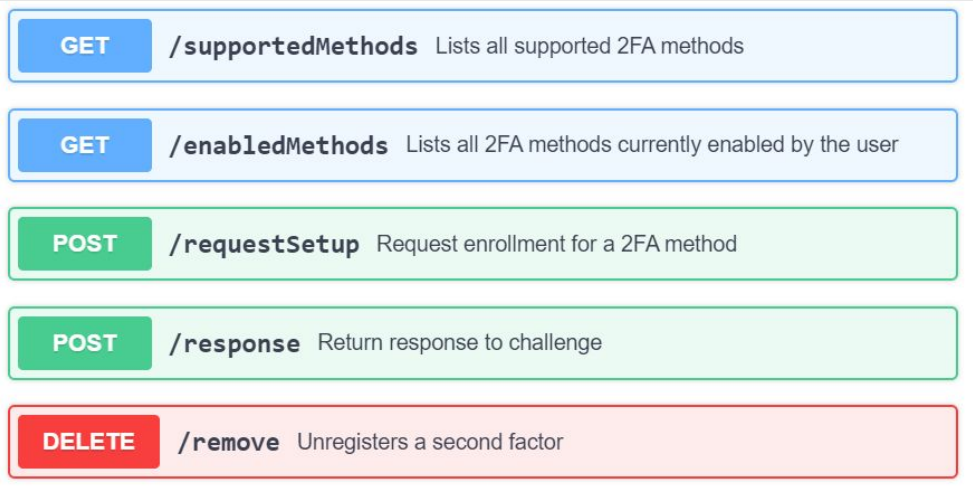
Design Limitations

- Limited Scalability

- Adoption

How can we address scalability?

- Web API
- Crowdsourcing
- Web Standards



Where do we go from here?

- Recovery
- Passwordless Authentication
- Improve Existing Workflows
- Standardize 2FA Experience
- Unified Authentication Manager

Thanks!

Any Questions?

Read our paper or see our source code!