# Compromising online accounts by cracking voicemail systems

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Amstrad CPC 6128

Captured while playing "La Abadía del crímen"

# Martin Vigo

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From Galicia, Spain

Research | Scuba | Gin tonics

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# History

back to ezines

“You can just enter all 2-digit combinations until you get the right one”

…

“A more sophisticated and fast way to do this is to take advantage of the fact that such machines typically do not read two numbers at a time, and discard them, but just look for the correct sequence”

*Hacking Telephone Answering Machines by Doctor Pizz and Cybersperm*

“Quickly Enter the following string:
123456789876543213579246864297314741933669944885522775395
96372582838491817161511026203040506070809001
(this is the shortest string for entering every possible 2-digit combo.)”

*Hacking AT&T Answering Machines Quick and Dirty by oleBuzzard*

“Defaults For ASPEN Are:

(E.G. Box is 888)

....

Use Normal Hacking Techniques:

```
---------------------------------
i.e.
1111
 |
\|/
9999
1234
4321”
```

*A Tutorial of Aspen Voice Mailbox Systems, by Slycath*

“There is also the old "change the message" secret to make it say something to the effect of this line accepts all toll charges so you can bill third party calls to that number”

*Hacking Answering Machines 1990 by Predat0r*

# Voicemail security in the ‘80s

- Default PINs
- Common PINs
- Bruteforceable PINs
- Efficient bruteforcing sending multiple PINs at once
- The greeting message is an attack vector

# Voicemail security today

checklist time!

# Voicemail security today

- ✓ Default PINs
- Common PINs
- Bruteforceable PINs
- Efficient bruteforcing by entering multiple PINs at once
- The greeting message is an attack vector

🇺🇸

- AT&T
  - 111111
- T-Mobile
  - Last 4 digits of the phone number
- Sprint
  - Last 7 digit of the phone number
- Verizon
  - Last 4 digits of the phone number

🇩🇪

- Vodafone
  - 4 last digits of client number
  - 4 last digits of PUK for CallYa
- Telekom
  - 4 last digits of card number
- O2
  - 8705

# Voicemail security today

- ✓ Default PINs
- ✓ Common PINs
- Bruteforceable PINs
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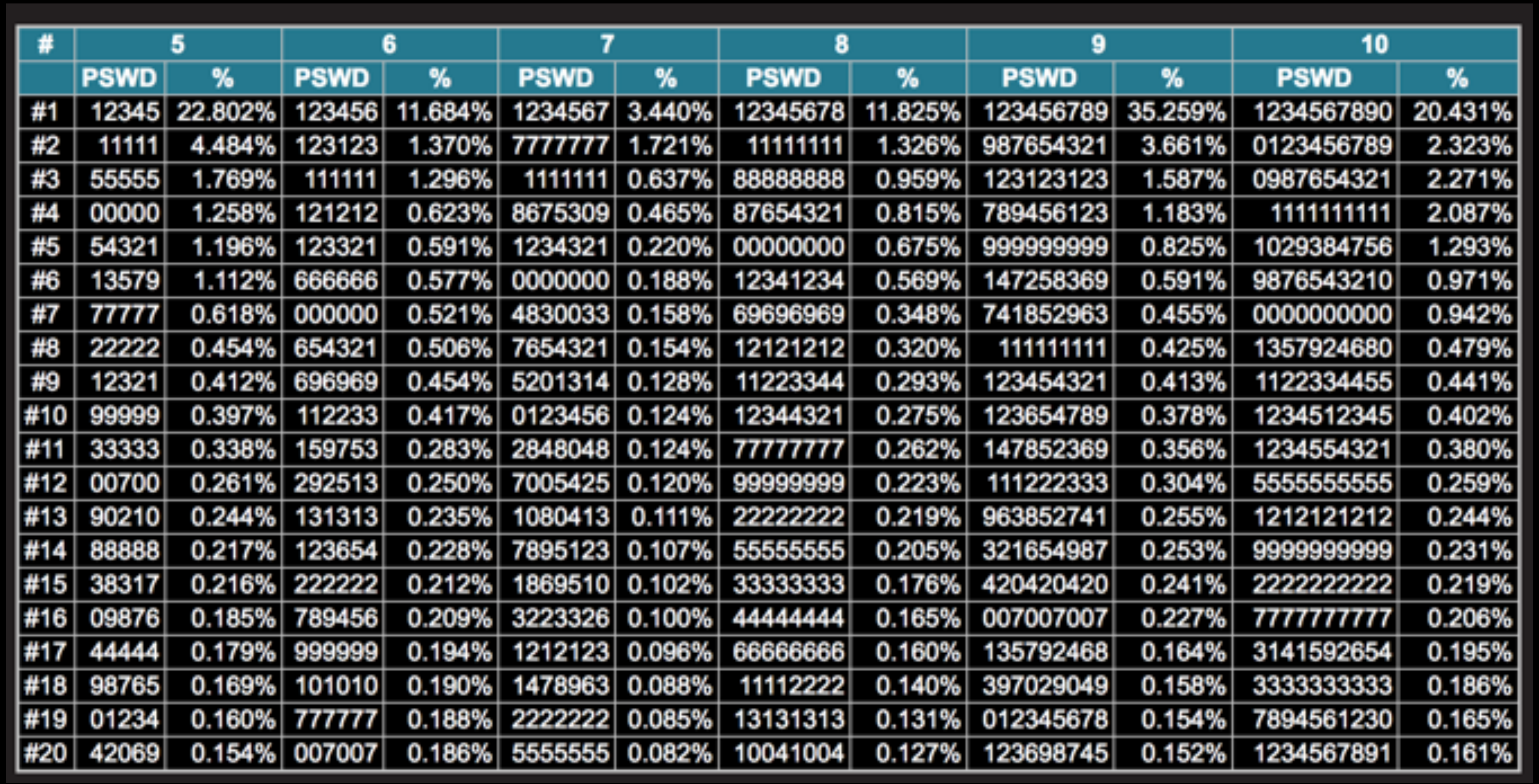
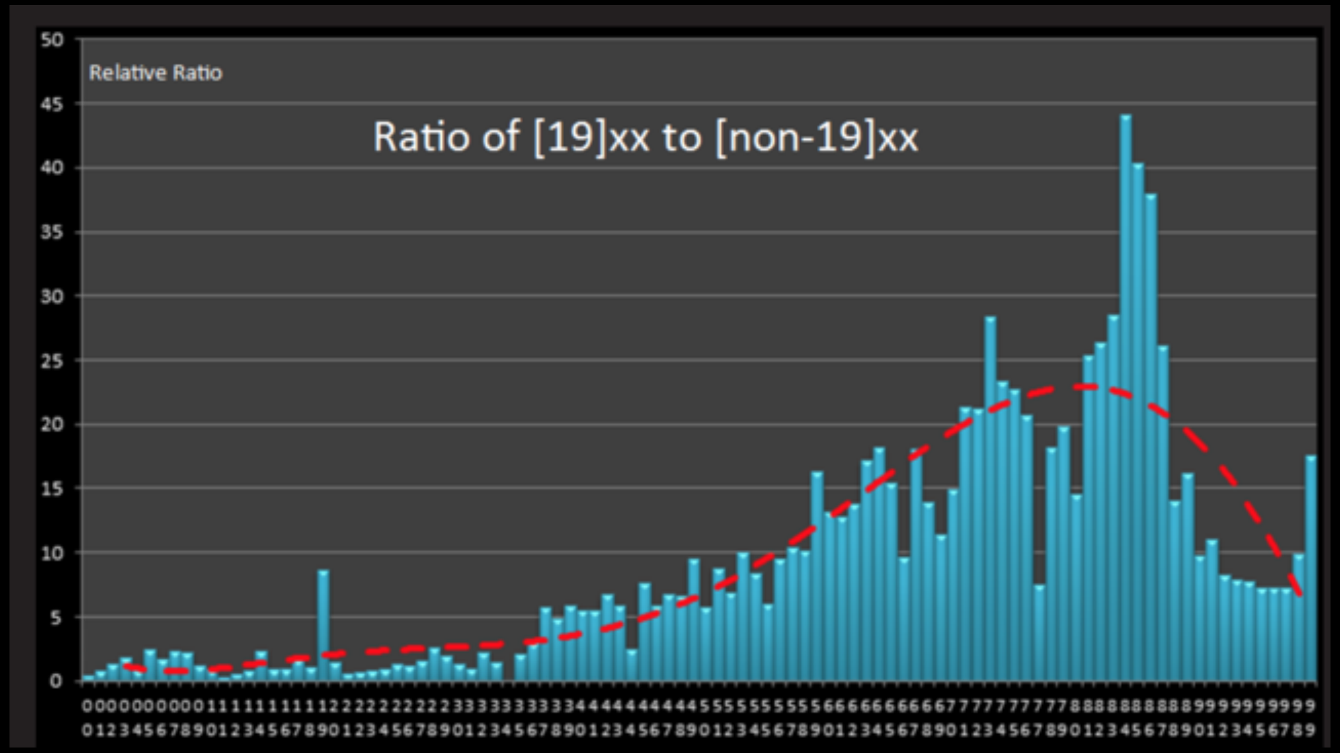
2012 Research study by Data Genetics
https://www.datagenetics.com/blog/september32012

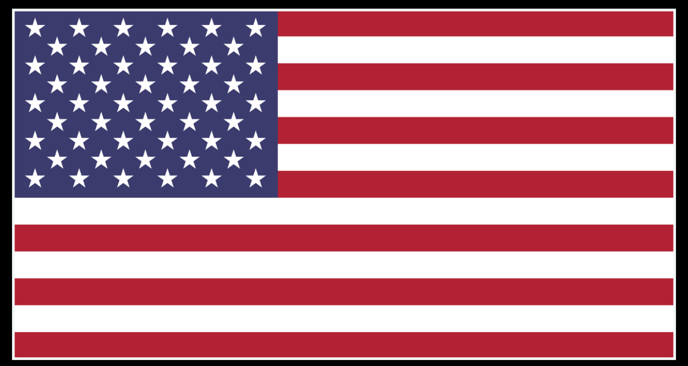


| # | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PSWD | % | PSWD | % | PSWD | % | PSWD | % | PSWD | % | PSWD | % |
| #1 | 12345 | 22.802% | 123456 | 11.684% | 1234567 | 3.440% | 12345678 | 11.825% | 123456789 | 35.259% | 1234567890 | 20.431% |
| #2 | 11111 | 4.484% | 123123 | 1.370% | 7777777 | 1.721% | 11111111 | 1.326% | 987654321 | 3.661% | 0123456789 | 2.323% |
| #3 | 55555 | 1.769% | 111111 | 1.296% | 1111111 | 0.637% | 88888888 | 0.959% | 123123123 | 1.587% | 0987654321 | 2.271% |
| #4 | 00000 | 1.258% | 121212 | 0.623% | 8675309 | 0.465% | 87654321 | 0.815% | 789456123 | 1.183% | 1111111111 | 2.087% |
| #5 | 54321 | 1.196% | 123321 | 0.591% | 1234321 | 0.220% | 00000000 | 0.675% | 999999999 | 0.825% | 1029384756 | 1.293% |
| #6 | 13579 | 1.112% | 666666 | 0.577% | 0000000 | 0.188% | 12341234 | 0.569% | 147258369 | 0.591% | 9876543210 | 0.971% |
| #7 | 77777 | 0.618% | 000000 | 0.521% | 4830033 | 0.158% | 69696969 | 0.348% | 741852963 | 0.455% | 0000000000 | 0.942% |
| #8 | 22222 | 0.454% | 654321 | 0.506% | 7654321 | 0.154% | 12121212 | 0.320% | 111111111 | 0.425% | 1357924680 | 0.479% |
| #9 | 12321 | 0.412% | 696969 | 0.454% | 5201314 | 0.128% | 11223344 | 0.293% | 123454321 | 0.413% | 1122334455 | 0.441% |
| #10 | 99999 | 0.397% | 112233 | 0.417% | 0123456 | 0.124% | 12344321 | 0.275% | 123654789 | 0.378% | 1234512345 | 0.402% |
| #11 | 33333 | 0.338% | 159753 | 0.283% | 2848048 | 0.124% | 77777777 | 0.262% | 147852369 | 0.356% | 1234554321 | 0.380% |
| #12 | 00700 | 0.261% | 292513 | 0.250% | 7005425 | 0.120% | 99999999 | 0.223% | 111222333 | 0.304% | 5555555555 | 0.259% |
| #13 | 90210 | 0.244% | 131313 | 0.235% | 1080413 | 0.111% | 22222222 | 0.219% | 963852741 | 0.255% | 1212121212 | 0.244% |
| #14 | 88888 | 0.217% | 123654 | 0.228% | 7895123 | 0.107% | 55555555 | 0.205% | 321654987 | 0.253% | 9999999999 | 0.231% |
| #15 | 38317 | 0.216% | 222222 | 0.212% | 1869510 | 0.102% | 33333333 | 0.176% | 420420420 | 0.241% | 2222222222 | 0.219% |
| #16 | 09876 | 0.185% | 789456 | 0.209% | 3223326 | 0.100% | 44444444 | 0.165% | 007007007 | 0.227% | 7777777777 | 0.206% |
| #17 | 44444 | 0.179% | 999999 | 0.194% | 1212123 | 0.096% | 66666666 | 0.160% | 135792468 | 0.164% | 3141592654 | 0.195% |
| #18 | 98765 | 0.169% | 101010 | 0.190% | 1478963 | 0.088% | 11112222 | 0.140% | 397029049 | 0.158% | 3333333333 | 0.186% |
| #19 | 01234 | 0.160% | 777777 | 0.188% | 2222222 | 0.085% | 13131313 | 0.131% | 012345678 | 0.154% | 7894561230 | 0.165% |
| #20 | 42069 | 0.154% | 007007 | 0.186% | 5555555 | 0.082% | 10041004 | 0.127% | 123698745 | 0.152% | 1234567891 | 0.161% |



# Voicemail security today

- ✓ Default PINs
- ✓ Common PINs
- ✓ Bruteforceable PINs
- Efficient bruteforcing by entering multiple PINs at once
- The greeting message is an attack vector



- AT&T
  - 4 to 10 digits
- T-Mobile
  - 4 to 7 digits
- Sprint
  - 4 to 10 digits
- Verizon
  - 4 to 6 digits

- Vodafone
  - 4 to 7 digits
- Telekom
  - 4 to 10 digits
- O2
  - 4 to 10 digits

# Voicemail security today

✓ Default PINs

✓ Common PINs

✓ Bruteforceable PINs

✓ Efficient bruteforcing by entering multiple PINs at once

- The greeting message is an attack vector

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- Supports multiple pins at a time
  - 0000#1111#2222#
- Without waiting for prompt
  - or error messages

# voicemailcracker.py

bruteforcing voicemails fast, cheap, easy, efficiently and undetected

# voicemailcracker.py

- Fast
  - Uses Twilio's APIs to make hundreds of calls at a time
- Cheap
  - Entire 4 digits keyspace for $40
  - A 50% chance of correctly guessing a 4 digit PIN for $5
  - Check 1000 phone numbers for default PIN for $13
- Easy
  - Fully automated
  - Configured with specific payloads for major carriers
- Efficient
  - Optimizes bruteforcing
  - Tries multiple PINs in the same call
  - Uses existing research to prioritize default PINs, common PINs, patterns, etc.

# Undetected

# Straight to voicemail

- Multiple calls at the same time
    - It’s how *slydial* service works in reality
- Call when phone is offline
    - OSINT
        - Airplane, movie theater, remote trip, Do Not Disturb
    - Query HLR database
    - Online services like realphonevalidation.com
- Class 0 SMS
    - Reports back if it was displayed

- Use backdoor voicemail numbers
    - No need to call the victim!

| 🇺🇸 | |
|---|---|
| AT&T: | 408-307-5049 |
| Verizon: | 301-802-6245 |
| T-Mobile: | 805-637-7243 |
| Sprint: | 513-225-6245 |

| 🇩🇪 | |
|---|---|
| Vodafone: | XXX-55-XXXXXXXX |
| Telekom: | XXX-13-XXXXXXXX |
| O2: | XXX-33-XXXXXXXX |

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- **Undetected**
  - **Supports backdoor voicemail numbers**

# Bruteforce protections

# Different flavors in Germany

## Vodafone

Resets to a 6 digit PIN
and sends it over SMS

## Telekom

Blocks the Caller ID from
accessing mailbox
or even leaving messages

## O2

Connects directly to
customer help-line

# Caller IDs are cheap

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Resets to a 6 digit PIN
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Connects directly to
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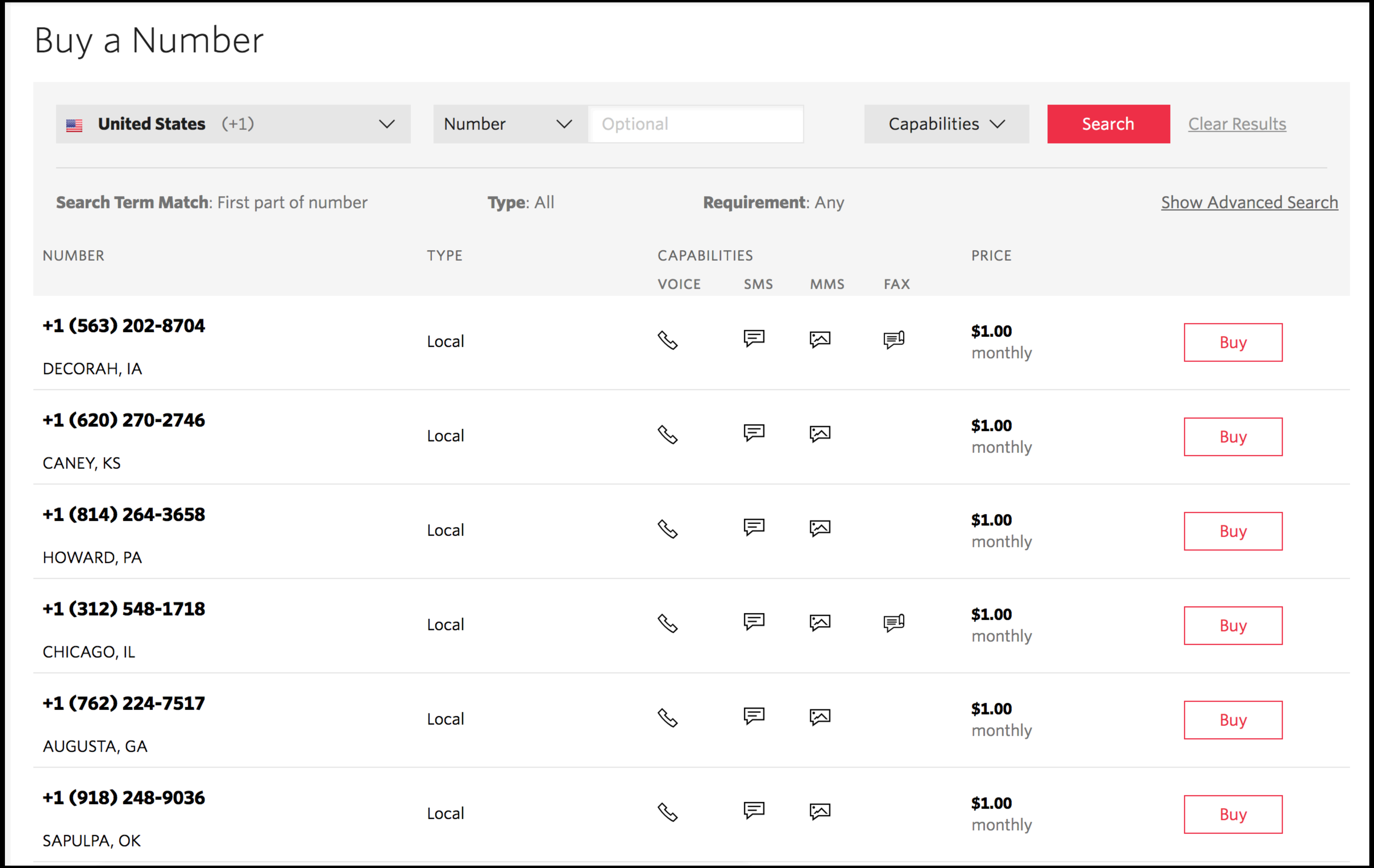

Buy a Number

United States (+1) | Number | Optional | Capabilities | Search | Clear Results

**Search Term Match**: First part of number  **Type**: All  **Requirement**: Any  Show Advanced Search

| NUMBER | TYPE | CAPABILITIES |  |  |  | PRICE |  |
|---|---|---|---|---|---|---|---|
|  |  | VOICE | SMS | MMS | FAX |  |  |
| **+1 (563) 202-8704**<br>DECORAH, IA | Local | ✓ | ✓ | ✓ | ✓ | **$1.00**<br>monthly | Buy |
| **+1 (620) 270-2746**<br>CANEY, KS | Local | ✓ | ✓ | ✓ |  | **$1.00**<br>monthly | Buy |
| **+1 (814) 264-3658**<br>HOWARD, PA | Local | ✓ | ✓ | ✓ |  | **$1.00**<br>monthly | Buy |
| **+1 (312) 548-1718**<br>CHICAGO, IL | Local | ✓ | ✓ | ✓ | ✓ | **$1.00**<br>monthly | Buy |
| **+1 (762) 224-7517**<br>AUGUSTA, GA | Local | ✓ | ✓ | ✓ |  | **$1.00**<br>monthly | Buy |
| **+1 (918) 248-9036**<br>SAPULPA, OK | Local | ✓ | ✓ | ✓ |  | **$1.00**<br>monthly | Buy |

# voicemailcracker.py

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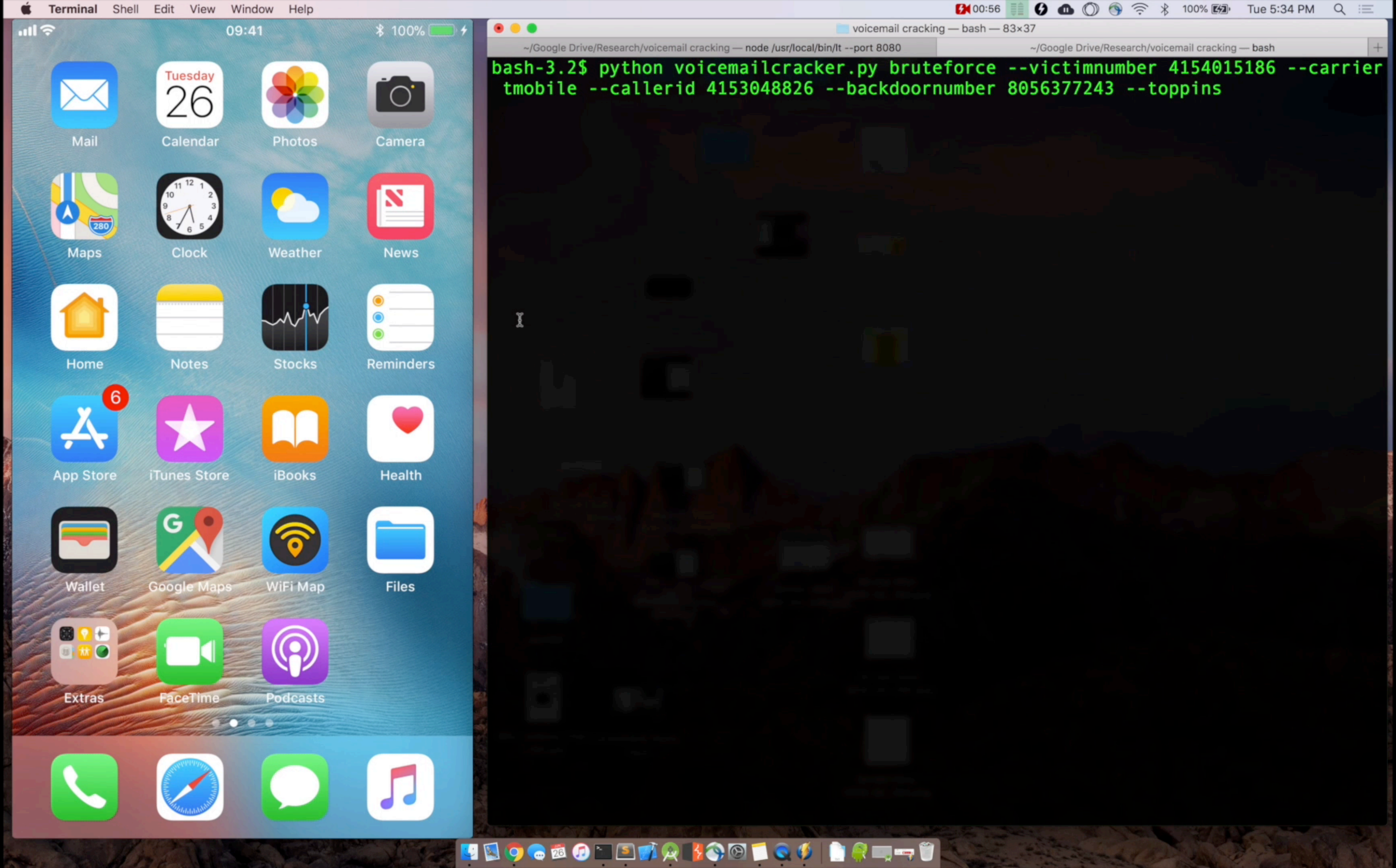
- Easy
  - Fully automated
  - Configured with specific payloads for major carriers
- Efficient
  - Optimizes bruteforcing
  - Tries multiple PINs in the same call
  - Uses existing research to prioritize default PINs, common PINs, patterns, etc.
- **Undetected**
  - **Supports backdoor voicemail numbers**
- **Bruteforce protection bypass**
  - **Supports Caller ID randomization**

# Demo

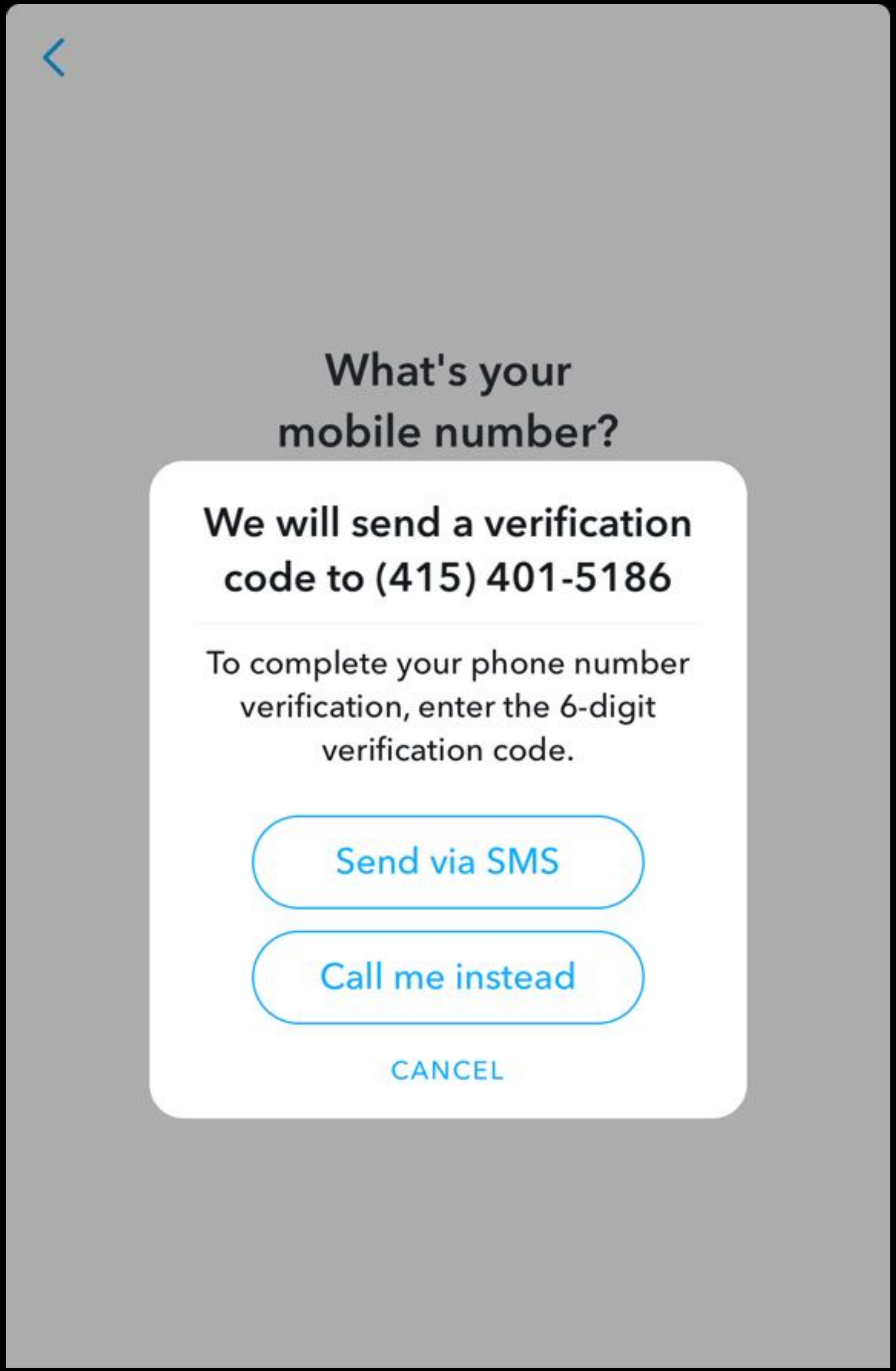
bruteforcing voicemail systems with voicemailcracker.py



```
bash-3.2$ python voicemailcracker.py bruteforce --victimnumber 4154015186 --carrier
 tmobile --callerid 4153048826 --backdoornumber 8056377243 --toppins
```

# Impact

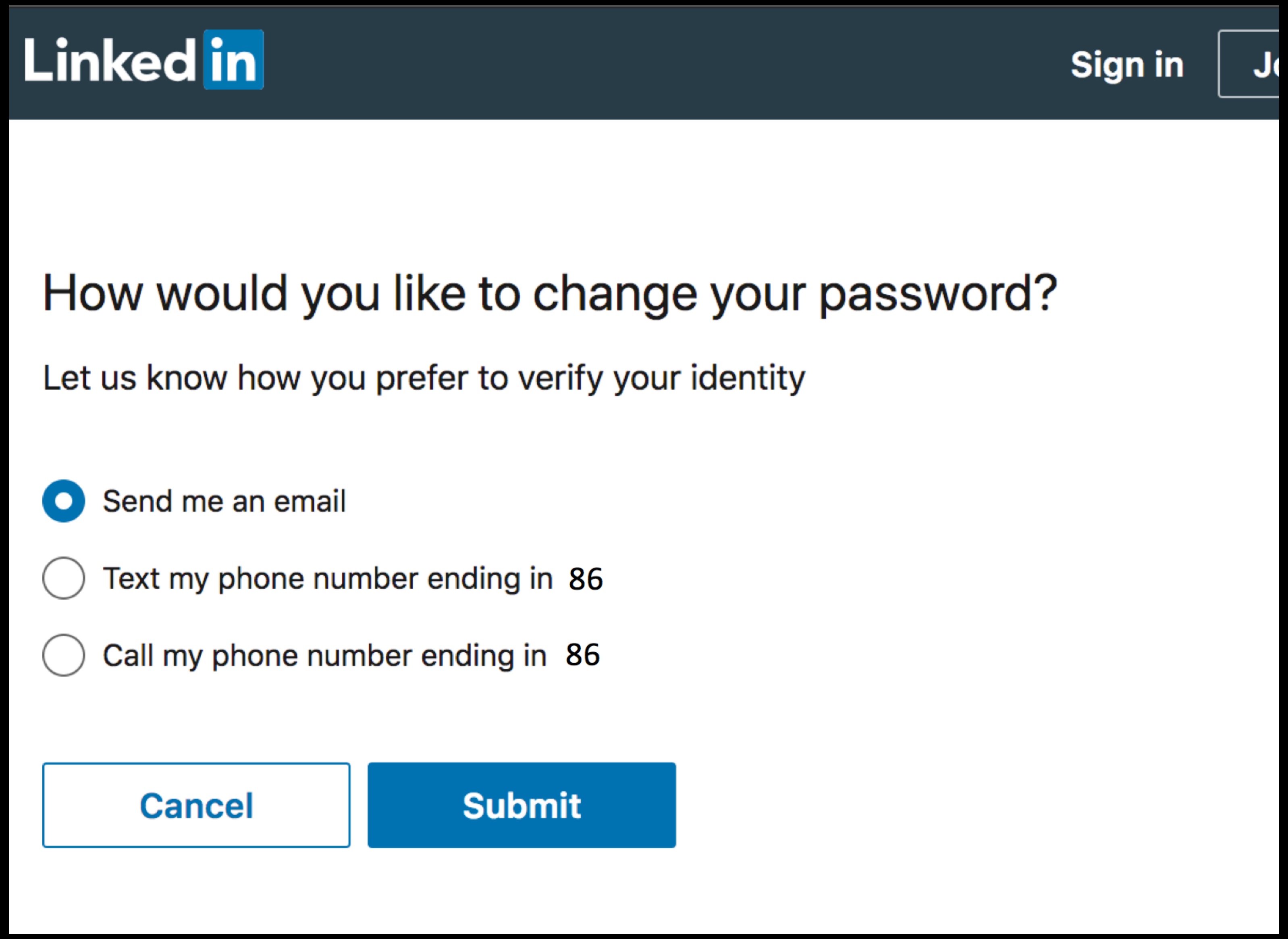
so what?



What's your mobile number?

We will send a verification code to (415) 401-5186

To complete your phone number verification, enter the 6-digit verification code.



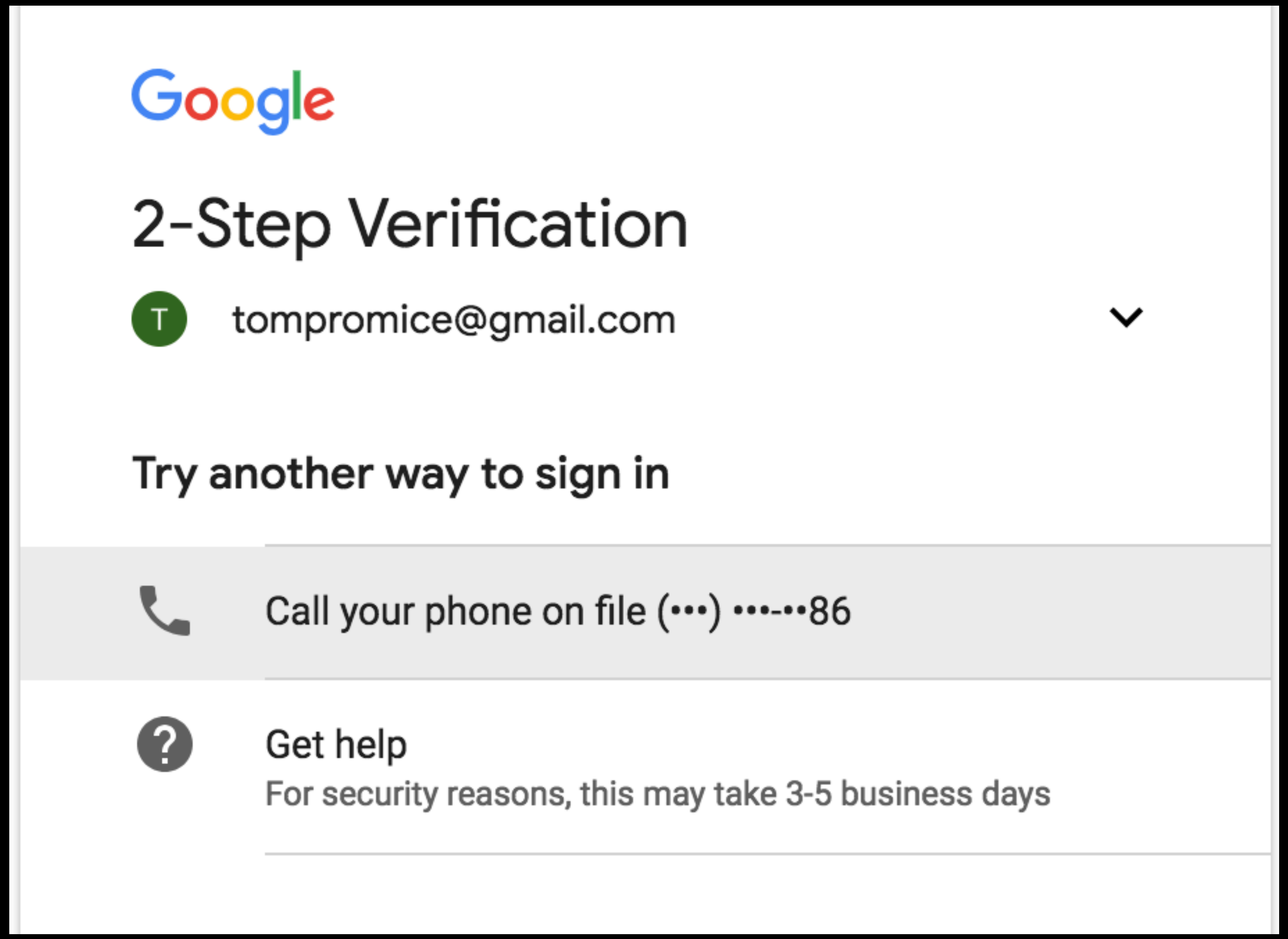
How would you like to change your password?

Let us know how you prefer to verify your identity

● Send me an email

○ Text my phone number ending in 86

○ Call my phone number ending in 86



2-Step Verification

T tompromice@gmail.com

Try another way to sign in

☎ Call your phone on file (•••) •••-••86

? Get help
For security reasons, this may take 3-5 business days

# What happens if you don’t pick up?

Voicemail takes the call and records it!

# Attack vector

1. Bruteforce voicemail system, ideally using backdoor numbers
2. Ensure calls go straight to voicemail (call flooding, OSINT, etc.)
3. Start password reset process using “Call me” feature
4. Listen to the recorded message containing the secret code
5. Profit!

**voicemailcracker.py can do all this automatically**

# Demo

compromising WhatsApp

...search/conferences/Defcon 26 — node /usr/local/bin/lt --port 8080
~/Google Drive/Research/voicemail cracking — bash
demo1.mp4
09:41
100%
WhatsApp
2:02
July 4
WEDNESDAY, 2018
WhatsApp
Signal
New Tab
Electronics
To read
Hacking
Research
Postman
SDR training
sec660
Please select how y...

```
bash-3.2$ python voicemailcracker.py message --victimnumber
4154015186 --carrier tmobile --callerid 4153048826 --backdoo
rnumber 8056377243 --pin 1983
```

You've gone incognito

Now you can browse privately, and other people who use this device won't see your activity. However, downloads and bookmarks will be saved. Learn more

Chrome **won't save** the following information:

- Your browsing history
- Cookies and site data
- Information entered in forms

Your activity **might still be visible** to:

- Websites you visit
- Your employer or school
- Your internet service provider

We done? Not yet…

# User interaction based protection

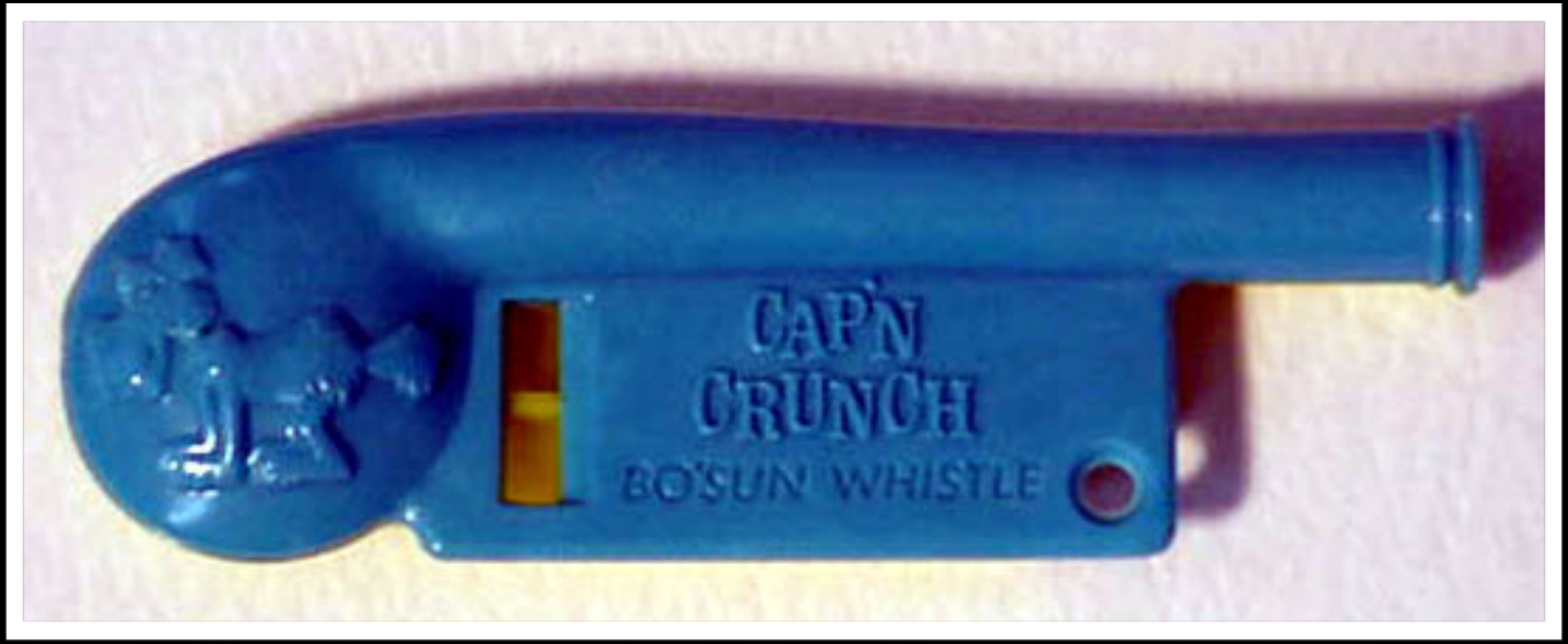
*Please press any key to hear the code…*

*Please press [ARANDOMKEY] to hear the code…*

*Please enter the code…*

Can we beat this recommended protection?

# Hint



# Another hint

- ✓ Default PINs
- ✓ Common PINs
- ✓ Bruteforceable PINs
- ✓ Efficient bruteforcing by entering multiple PINs at once
- □ The greeting message is an attack vector

We can record DTMF tones as the greeting message!

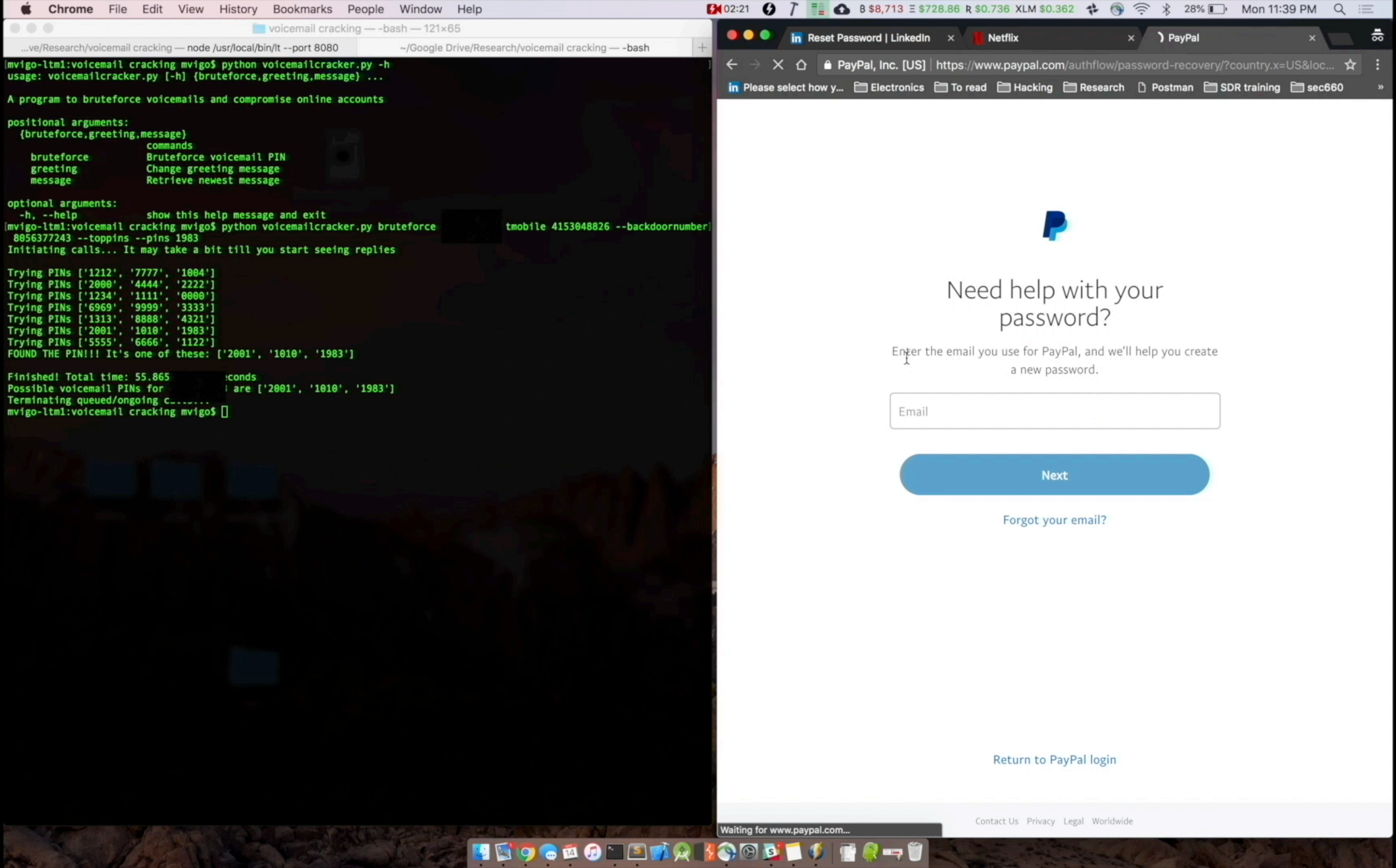
# Attack vector

1. Bruteforce voicemail system, ideally using backdoor numbers
2. Update greeting message according to the account to be hacked
3. Ensure calls go straight to voicemail (call flooding, OSINT, etc.)
4. Start password reset process using “Call me” feature
5. Listen to the recorded message containing the secret code
6. Profit!

**voicemailcracker.py can do all this automatically**

# Demo

compromising Paypal


Chrome File Edit View History Bookmarks People Window Help
02:21
B $8,713 Ξ $728.86 R $0.736 XLM $0.362
28%
Mon 11:39 PM
voicemail cracking — -bash — 121×65
...ve/Research/voicemail cracking — node /usr/local/bin/lt --port 8080
~/Google Drive/Research/voicemail cracking — -bash
Reset Password | LinkedIn
Netflix
PayPal
PayPal, Inc. [US] https://www.paypal.com/authflow/password-recovery/?country.x=US&loc...
Please select how y...
Electronics
To read
Hacking
Research
Postman
SDR training
sec660
Waiting for www.paypal.com...

```
mvigo-ltm1:voicemail cracking mvigo$ python voicemailcracker.py -h
usage: voicemailcracker.py [-h] {bruteforce,greeting,message} ...

A program to bruteforce voicemails and compromise online accounts

positional arguments:
  {bruteforce,greeting,message}
                        commands
    bruteforce          Bruteforce voicemail PIN
    greeting            Change greeting message
    message             Retrieve newest message

optional arguments:
  -h, --help            show this help message and exit
mvigo-ltm1:voicemail cracking mvigo$ python voicemailcracker.py bruteforce [redacted] tmobile 4153048826 --backdoornumber
 8056377243 --toppins --pins 1983
Initiating calls... It may take a bit till you start seeing replies

Trying PINs ['1212', '7777', '1004']
Trying PINs ['2000', '4444', '2222']
Trying PINs ['1234', '1111', '0000']
Trying PINs ['6969', '9999', '3333']
Trying PINs ['1313', '8888', '4321']
Trying PINs ['2001', '1010', '1983']
Trying PINs ['5555', '6666', '1122']
FOUND THE PIN!!! It's one of these: ['2001', '1010', '1983']

Finished! Total time: 55.865 [redacted]conds
Possible voicemail PINs for [redacted] are ['2001', '1010', '1983']
Terminating queued/ongoing c[redacted]...
mvigo-ltm1:voicemail cracking mvigo$ 
```

Need help with your password?

Enter the email you use for PayPal, and we'll help you create a new password.

Email

Next

Forgot your email?

Return to PayPal login

Contact Us Privacy Legal Worldwide

# Vulnerable services

small subset

# Password reset

PayPal
NETFLIX
ebay
LinkedIn

# 2FA

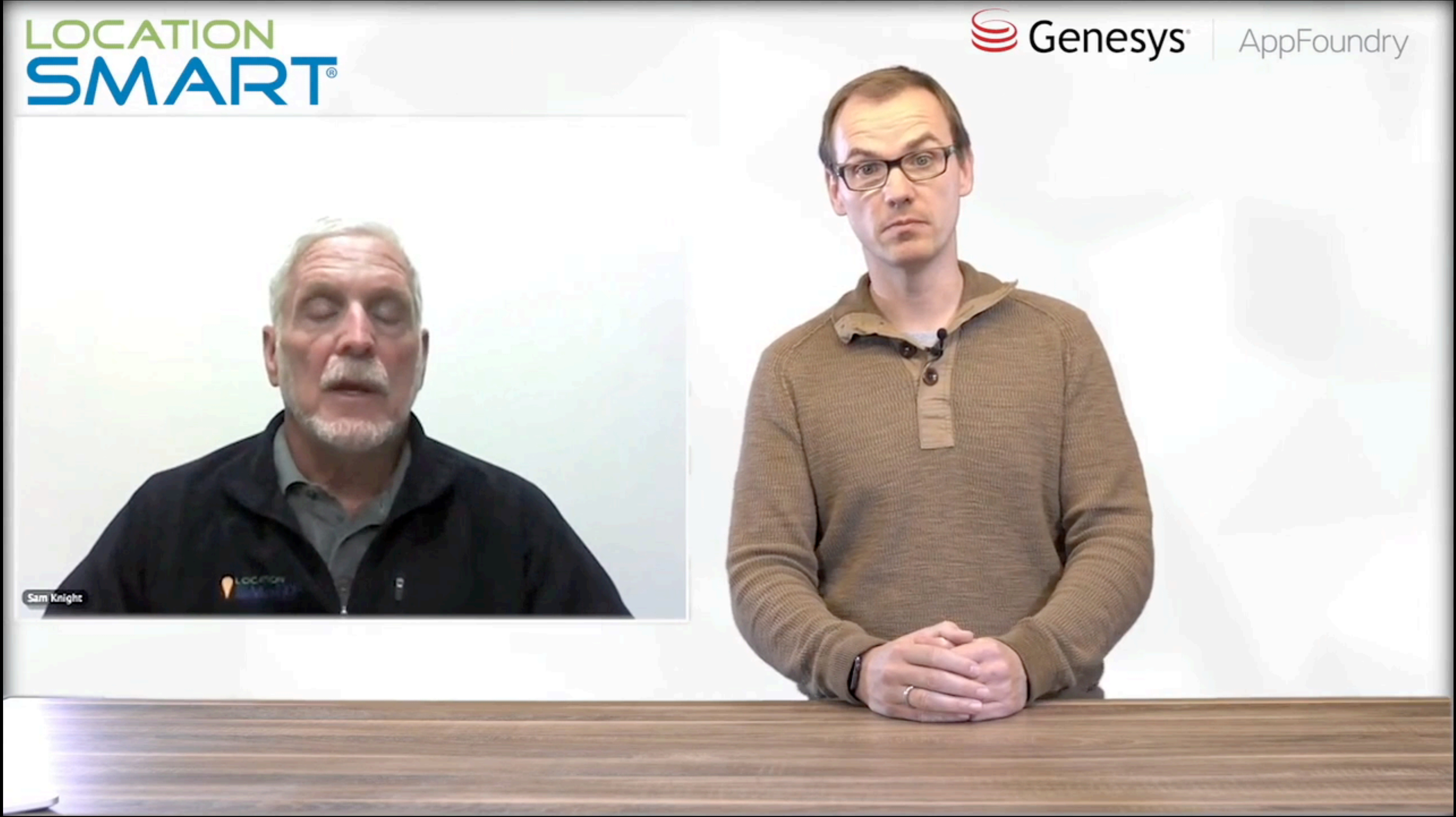
Google
Microsoft
YAHOO!

# Verification

# Physical security

Dial to open the door with a free charge call!
Remote open the door for visitors.
K6 GSM/3G Access Control

# Consent



LOCATION SMART®
Genesys | AppFoundry
Sam Knight

# Open source

# voicemailautomator.py

- No bruteforcing
- Limited to 1 carrier
- Change greeting message with specially crafted payloads
- Retrieve messages containing the secret temp codes

**Git repo: github.com/martinvigo/voicemailautomator**

# Recommendations

# Still…do I care?

```
if (carriersSetDefaultPins == TRUE)
    if (testingForDefaultPinsCheapFastUndetectedAutomatable == TRUE)
        if (updatingGreetingMessageAutomatable == TRUE)
            if (retrievingNewestMessageAutomatable == TRUE)
                if (speechToTextTranscription == TRUE)
                    if (accountCompromiseIsAutomatable == TRUE)
                        print “Yes, I should care”
```

# Recommendations for online services

- Don’t use automated calls for security purposes
- If not possible, detect answering machine and fail
- Require user interaction before providing the secret
    - with the hope that carriers ban DTMF tones from greeting messages

# Recommendations for carriers

- Ban DTMF tones from greeting messages
- Eliminate backdoor voicemail services
  - or at least no access to login prompt from them
- Voicemail disabled by default
  - and can only be activated from the actual phone or online

- No default PIN
- Don’t allow common PINs
- Detect and prevent bruteforce attempts
- Don’t process multiple PINs at once

# Recommendations for you

- Disable voicemail
  - or use longest possible, random PIN
- Don’t provide phone number to online services unless required
  - or it’s the only way to get 2FA
  - use a virtual number to prevent OSINT and SIM swapping
- Use 2FA apps only

# TL;DR

Automated phone calls are a common solution for password reset, 2FA, verification and other services. These can be compromised by leveraging old weaknesses and current technology to exploit the weakest link, voicemail systems

Strong password policy

2FA enforced

Abuse/Bruteforce prevention

A+ in OWASP Top 10 checklist

Military grade crypto end to end

Lots of cyber

**Password reset | 2FA | Verification | Consent**

**over phone call**

# Danke schön!

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- martinvigo@gmail.com
- linkedin.com/in/martinvigo
- github.com/martinvigo
- youtube.com/martinvigo