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Cracking WiFi at Scale

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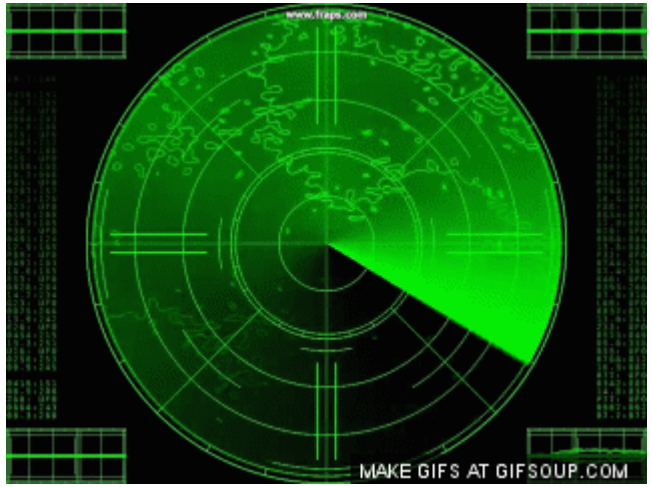
What is WarDriving

- Scanning for wireless networks (while in motion).
- First developed by Pete Shipley. April 2001 @ Defcon 9
- Entomology originated from wardialing
  - popularized the film WarGames



WiFi Protocols

WEP & WPA-PSK

- **W**ow **E**asy **P**rey
- Nobody uses this anymore
- aircrack-ng, WiFite, and more

WPA2+

- Most Common
- Capture 4-way EAPOL Handshake (old and busted)
- PMKID Hash Capture (new hotness)

WPA3+ (WiFi6)

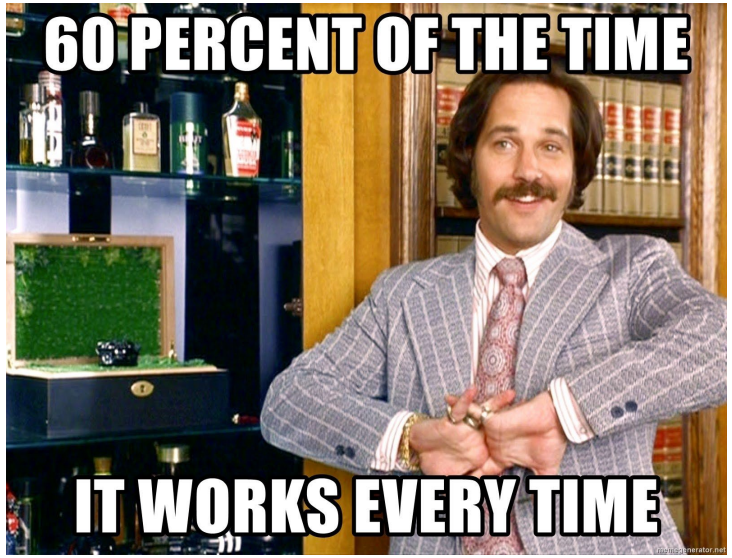
- Harder
- Better
- Faster
- Stronger

4-way EAPOL Handshake

(Old and Busted)

Pros:

- When conditions are right, it works.



Cons:

- Time consuming
- Requires luck
- Happens ONLY when connection is established
  - Wait for new device to authenticate
  - De-auth already connected users and force handshake.
  - NOISY

WPA2: PMKID Harvesting

(New hotness!)

- Research by Jens “atom” Steube of Hashcat Labs in 2018
- Performed on the RSN IE of a single EAPOL frame

```
▷ Frame 70: 173 bytes on wire (1384 bits), 173 bytes captured (1384 bits) on interface 0
▷ Radiotap Header v0, Length 18
▷ 802.11 radio information
▷ IEEE 802.11 QoS Data, Flags: ....R.F.
▷ Logical-Link Control
◢ 802.1X Authentication
    Version: 802.1X-2004 (2)
    Type: Key (3)
    Length: 117
    Key Descriptor Type: EAPOL RSN Key (2)
    [Message number: 1]
  ▷ Key Information: 0x008a
    Key Length: 16
    Replay Counter: 0
    WPA Key Nonce:
    Key IV:
    WPA Key RSC:
    WPA Key ID:
    WPA Key MIC:
    WPA Key Data Length: 22
  ◢ WPA Key Data:
    ◢ Tag: Vendor Specific: IEEE 802.11: RSN
        Tag Number: Vendor Specific (221)
        Tag length: 20
        OUI: 00:0f:ac (IEEE 802.11)
        RSN PMKID: 5838489bf75b31b064814e049f3fe586
```

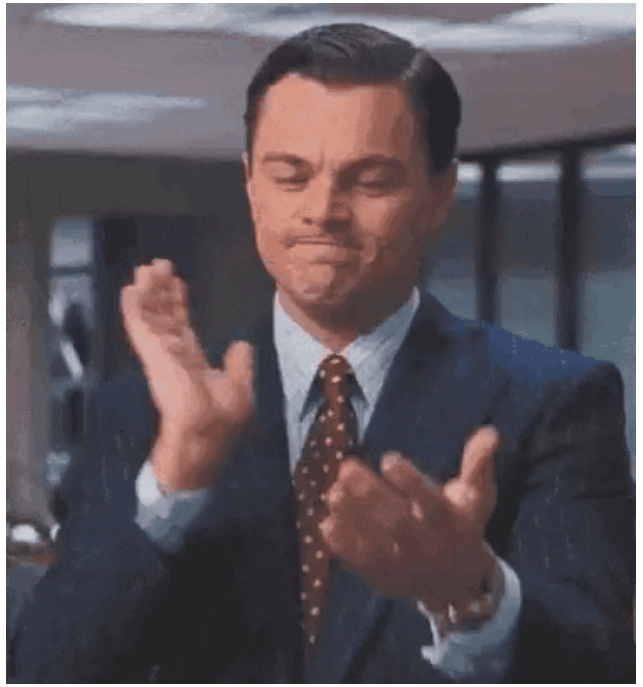
PMKID Harvesting

Pros:

- Quick
- The capture of a full 4-way handshake is not required.
- No users/devices required
- Directly communicates with the AP (aka "client-less" attack)
- No more bad passwords sent by authenticating users/devices.

Cons:

- Only works on WPA2



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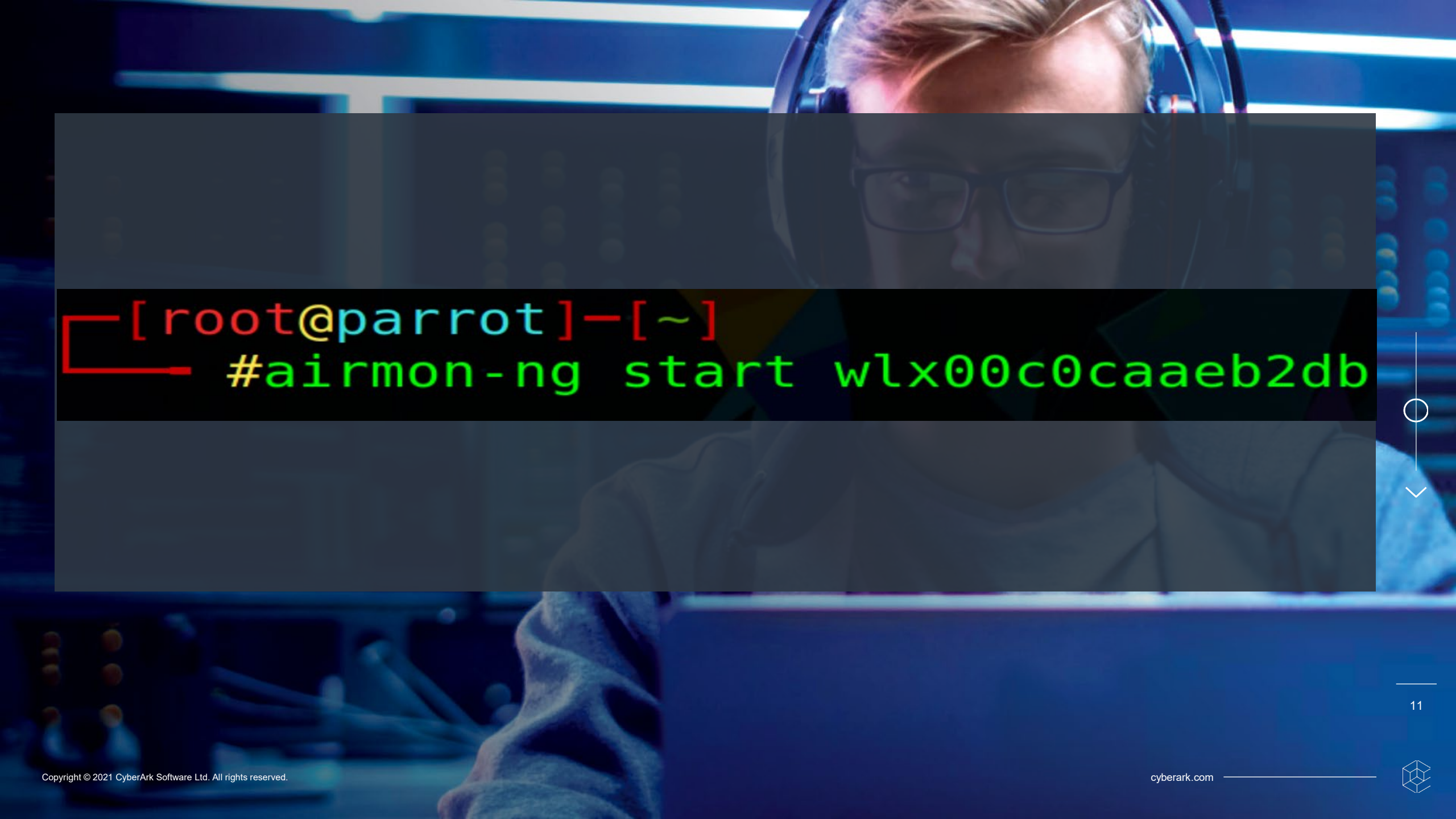
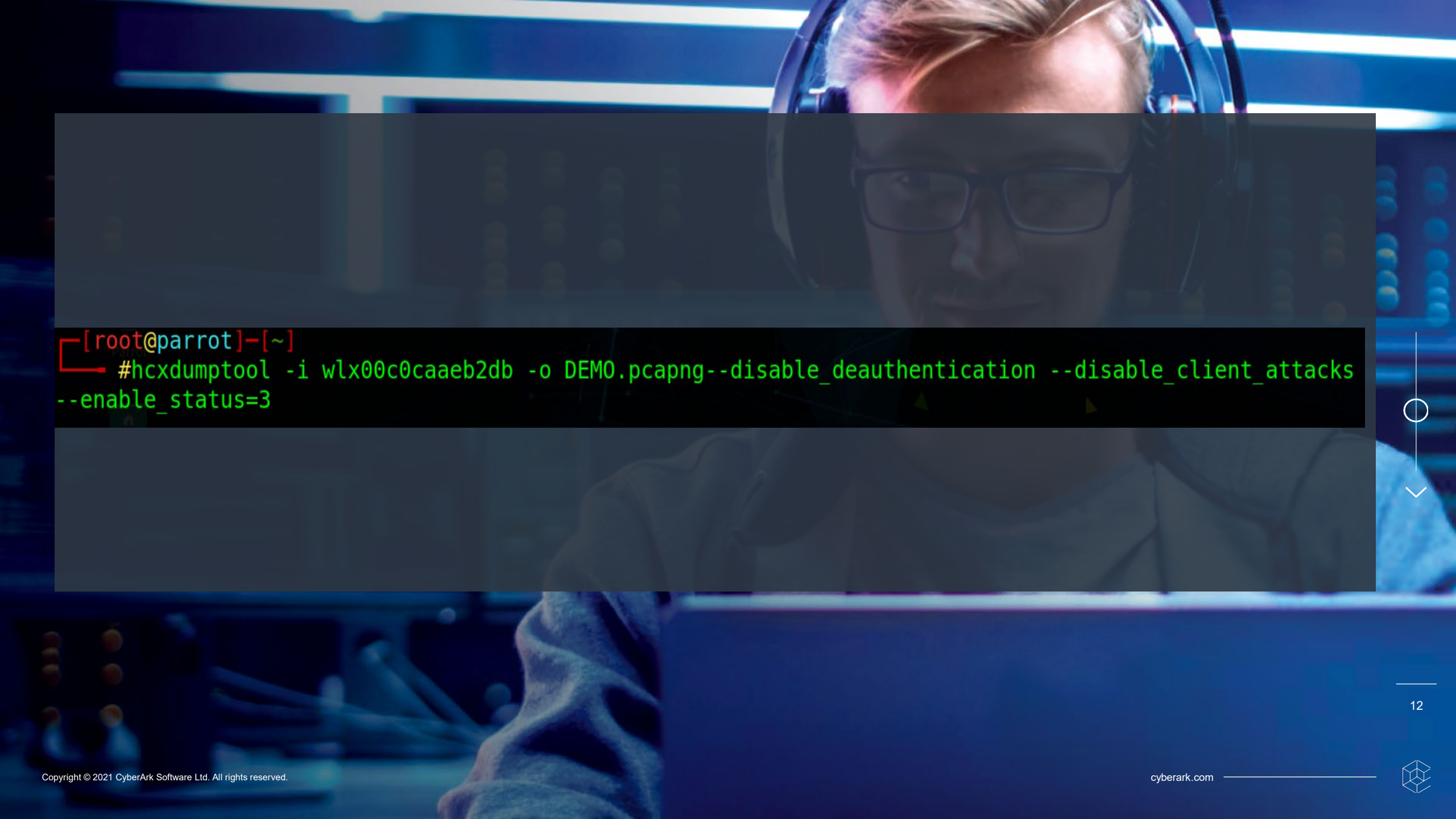
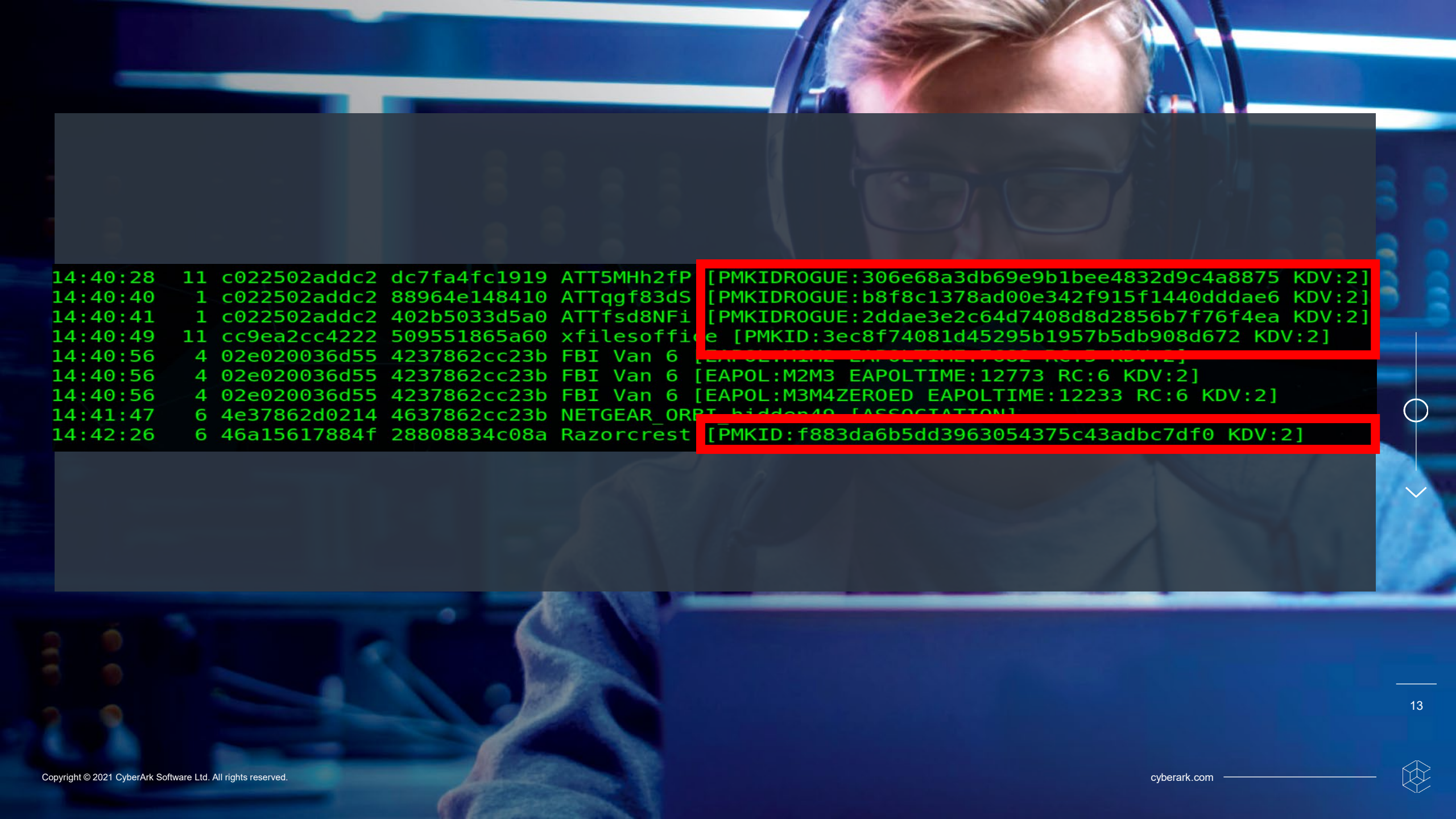
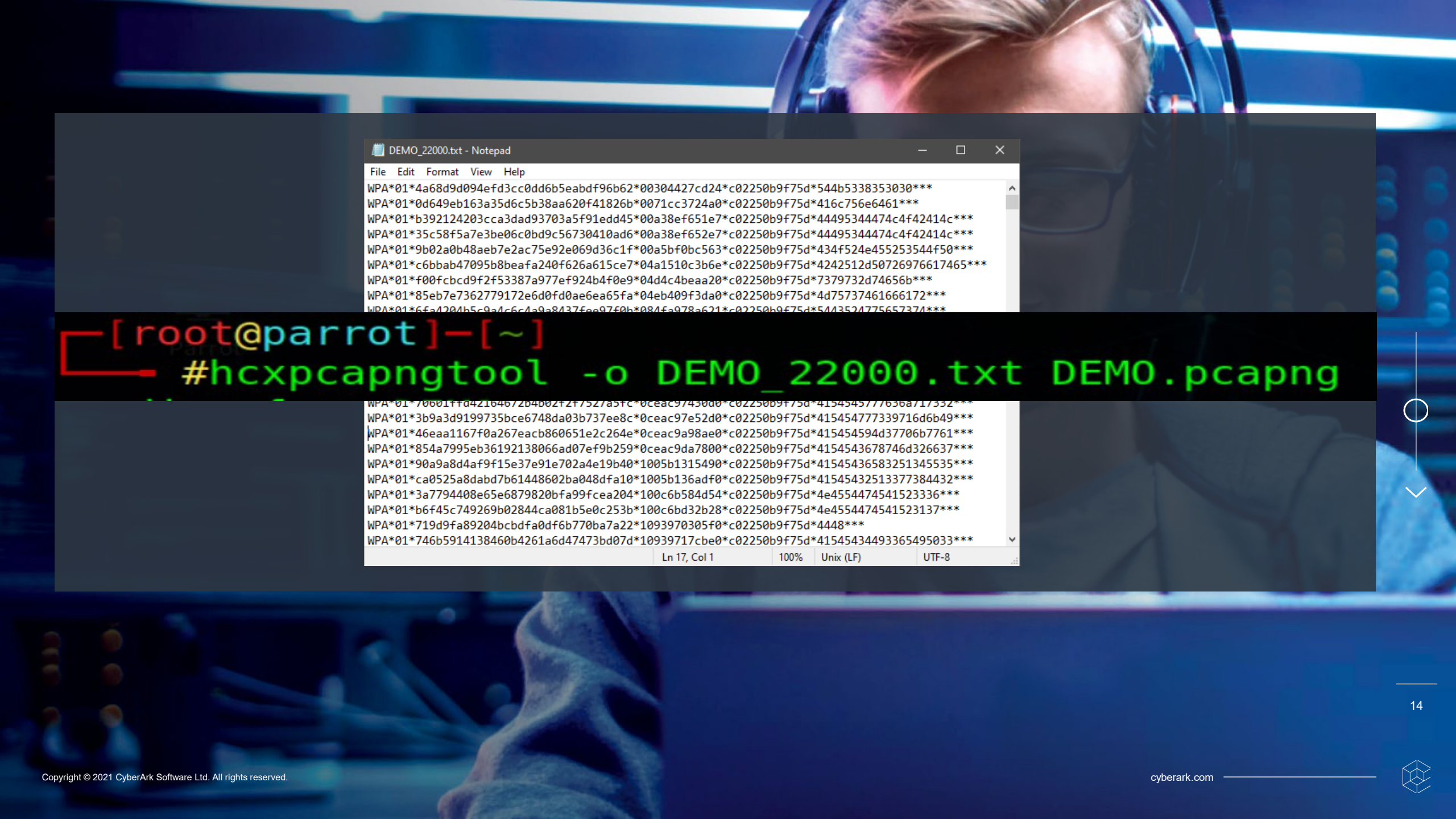
Required Hardware









```
PS C:\Users\binar\OneDrive\Desktop\hashcat-6.2.5>
>> .\hashcat.exe -a 0 -m 22000 -o DEMO_CRACKED.txt .\DEMO_22000.txt .\rockyou.txt
```

Dictionary Attack

Technique where attacker runs through common words and phrases such as those from a dictionary to guess passwords.

123456 12345 123456789 password iloveyou princess rockyou 12345678 abc123 nicole daniel babygirl monkey lovely jessica 654321 michael ashley, joker, password, p4ssw0rd, Letmein1!, Winter2022!

14,341,564 passwords

Mask Attack

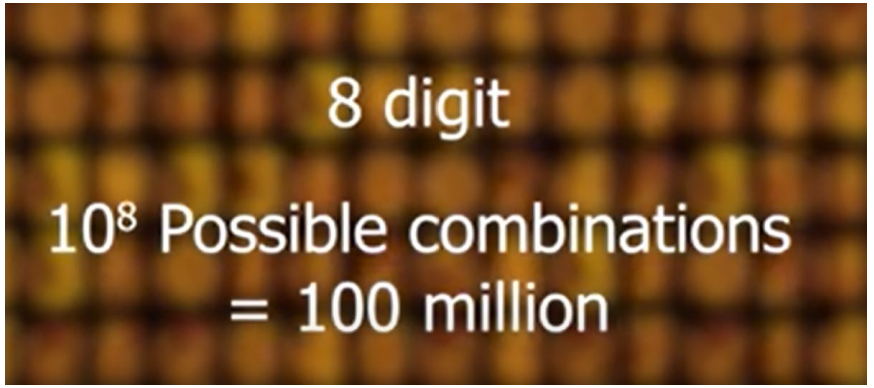
202!$ummeR - ?d?d?d?s?s?l?l?l?l?u

Password1! - ?U?l?l?l?l?l?l?l?d?s

053569894 - ?05?d?d?d?d?d?d

- ?d – digits – 0123456789
- ?l – lower case characters – abcdefghijklmnopqrstuvwxyz
- ?u – Upper case characters – ABCDEFGHIJKLMNOPQRSTUVWXYZ
- ?s – Special characters - <<space>>!”#$%’()*+,-./:;⇔?@[\]^_`{|}~
- ?a - ?|?u?d?s

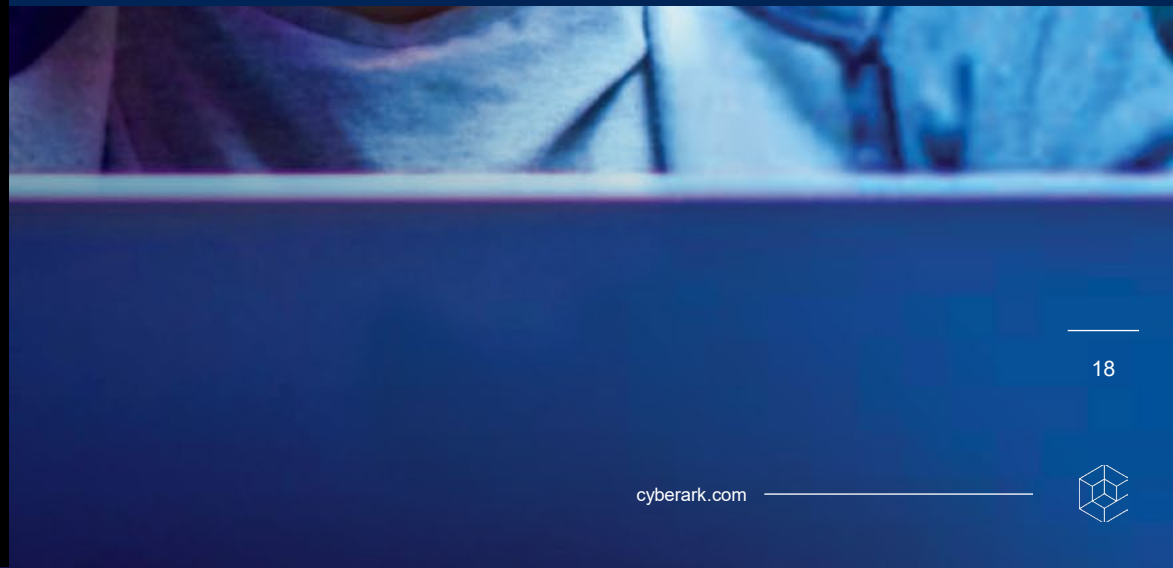
Typical Israel Phone Number Format
(05N)XXX-XXXX (Mobile) = 10 Characters
(0A)XXX-XXXX (Landline) = 9 Characters



```
tito@napo: ~

Session..........: hashcat
Status...........: Running
Hash.Mode........: 22000 (WPA-PBKDF2-PMKID+EAPOL)
Hash.Target......: /home/tito/hash_cracking/hashes/ANDY_5k_Dallas.txt
Time.Started.....: Wed Dec  8 17:10:43 2
Time.Estimated...: Wed Dec  8 19:13:06 2021 (1 hour, 41 mins)
Kernel.Feature...: Pure Kernel
Guess.Mask.......: 210?d?d?d?d?d?d?d [10]
Guess.Queue......: 1/1 (100.00%)
Speed.#1.........:   823.2 kH/s (41.32ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#2.........:   829.4 kH/s (40.96ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#3.........:   830.3 kH/s (353.18ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#4.........:   816.4 kH/s (41.70ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#5.........:   820.9 kH/s (41.44ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#6.........:   830.3 kH/s (40.97ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#7.........:   834.1 kH/s (40.87ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#8.........:   825.9 kH/s (41.15ms) @ Accel:128 Loops:1024 Thr:128 Vec:1
Speed.#*.........:
Recovered........: 0/5669 (0.00%) Digests, 0/4854 (0.00%) Salts
Remaining........: 5669 (100.00%) Digests, 4854 (100.00%) Salts
Recovered/Time...: CUR:0,N/A,N/A AVG:0.00,N/A,N/A (Min,Hour,Day)
Progress.........: 8168358870/48540000000 (16.83%)
Rejected.........: 0/8168358870 (0.00%)
Restore.Point....: 0/10000000 (0.00%)
Restore.Sub.#1...: Salt:2526 Amplifier:0-1 Iteration:2048-3072
Restore.Sub.#2...: Salt:2582 Amplifier:0-1 Iteration:3072-4095
Restore.Sub.#3...: Salt:869 Amplifier:0-1 Iteration:2048-3072
Restore.Sub.#4...: Salt:2466 Amplifier:0-1 Iteration:0-1024
Restore.Sub.#5...: Salt:2507 Amplifier:0-1 Iteration:1024-2048
Restore.Sub.#6...: Salt:2589 Amplifier:0-1 Iteration:3072-4095
Restore.Sub.#7...: Salt:2631 Amplifier:0-1 Iteration:3072-4095
Restore.Sub.#8...: Salt:2552 Amplifier:0-1 Iteration:0-1024
Candidate.Engine.: Device Generator
Candidates.#1....: 2104825750 -> 2108706031
Candidates.#2....: 2101900791 -> 2109165442
Candidates.#3....: 2101231234 -> 2109284666
Candidates.#4....: 2105798179 -> 2100457880
Candidates.#5....: 2106606031 -> 2102798179
Candidates.#6....: 2105442719 -> 2100000791
Candidates.#7....: 2106713321 -> 2102666307
Candidates.#8....: 2107046242 -> 2103825750
Hardware.Mon.#1..: Temp: 62c Util: 99% Core:1605MHz Mem:6500MHz Bus:16
Hardware.Mon.#2..: Temp: 60c Util: 99% Core:1620MHz Mem:6500MHz Bus:16
Hardware.Mon.#3..: Temp: 61c Util:100% Core:1590MHz Mem:6500MHz Bus:16
Hardware.Mon.#4..: Temp: 63c Util: 99% Core:1605MHz Mem:6500MHz Bus:16
Hardware.Mon.#5..: Temp: 60c Util: 99% Core:1620MHz Mem:6500MHz Bus:16
Hardware.Mon.#6..: Temp: 61c Util: 99% Core:1620MHz Mem:6500MHz Bus:16
Hardware.Mon.#7..: Temp: 61c Util: 99% Core:1620MHz Mem:6500MHz Bus:16
Hardware.Mon.#8..: Temp: 61c Util: 99% Core:1620MHz Mem:6500MHz Bus:16
```

```
......: hashcat
......: Running
......: 22000 (WPA-PBKDF2-PMKID+EAPOL)
......: .\Merged_07_unique.txt
d.....: Wed Dec 08 15:15:29 2021 (2 mins, 31 secs)
ted...: Mon Feb 21 03:57:09 2022 (74 days, 12 hours)
ure...: Pure Kernel
......: File (.\rockyou.txt)
......: 1/1 (100.00%)
......:     9573 H/s (23.62ms) @ Accel:32 Loops:32 Thr:16 Vec:1
......: 147/3078 (2.90%) Digests, 122/4437 (2.75%) Salts
......: 4929 (97.10%) Digests, 4315 (97.25%) Salts
ime...: CUR:0,N/A,N/A AVG:0.00,N/A,N/A (Min,Hour,Day)
......: 262376306/63646036245 (0.41%)
......: 260868978/262376306 (99.43%)
nt....: 0/14344385 (0.00%)
.#1...: Salt:46 Amplifier:0-1 Iteration:3168-3200
ngine.: Device Generator
#1....: 123456789 -> sebastiana
```



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The KRACKEN

(Not really. It's Napo.)

Tel Aviv, IL Research

Cracked Passwords by Length

Password Length	Occurrences
10	2349
8	744
9	368
11	14
12	14
13	7
14	7
Sum	**3,559**

05N XXX XXXX

XXX XXXX

05 XXX XXXX

Top 4 Masks for Cracked Passwords

MASK	Occurrences	Meaning
?d?d?d?d?d?d?d?d?d?d	2349	10 digits
?d?d?d?d?d?d?d?d	596	8 digits
?d?d?d?d?d?d?d?d?d	368	9 digits
?l?l?l?l?l?l?l?l	320	8 lower case letters
Total	**3,633**	

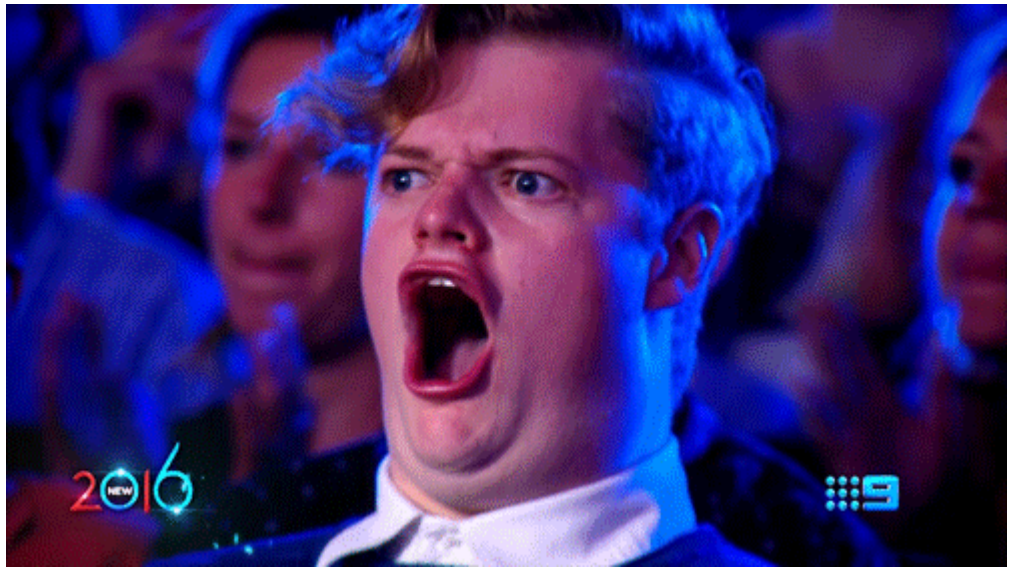
05N XXX XXXX

XXX XXXX

05 XXX XXXX

In Summary

- Cracked more than 3,500 WiFi networks in and around Tel-Aviv
  - Over **70% of the 5k sample**!
- Israeli ISP's are configuring mobile phone # as WiFi password!



Dallas, TX Research

Top 4 Masks for Cracked Passwords

MASK	Occurrences	Meaning
?214?d?d?d?d?d?d?d	99	214 Area Code
?469?d?d?d?d?d?d?d	56	469 Area Code
?972?d?d?d?d?d?d?d	48	972 Area Code
?817?d?d?d?d?d?d?d	5	817 Area Code
Total	**208**	

Cracked Passwords by…RockYou.txt

- 251 Passwords Cracked
- 9%

San Francisco, CA Research

Top 4 Masks for Cracked Passwords

MASK	Occurrences	Meaning
?d?d?d?d?d?d?d?d?d?d	2349	10 digits
?d?d?d?d?d?d?d?d	596	8 digits
?d?d?d?d?d?d?d?d?d	368	9 digits
?l?l?l?l?l?l?l?l	320	8 lower case letters
Total	**3,633**	

Cracked Passwords by ??

Password Length	Occurrences
10	2349
8	744
9	368
11	14
12	14
13	7
14	7
Sum	**3,559**

Great SSID Names

- Leather Club is 3 Blocks Over
- APT203_YOU WALK TOO LOUD
- FBI Van #6
- Drop it like it’s Hotspot
- That’s what she SSID
- Girls Gone Wireless
- Abraham Linksys
- It burns when IP
- NachoWiFi
- PASSWORD is PASSWORD
- Hey Kids get off my WiFi
- Wu Tang LAN

How should I protect myself?

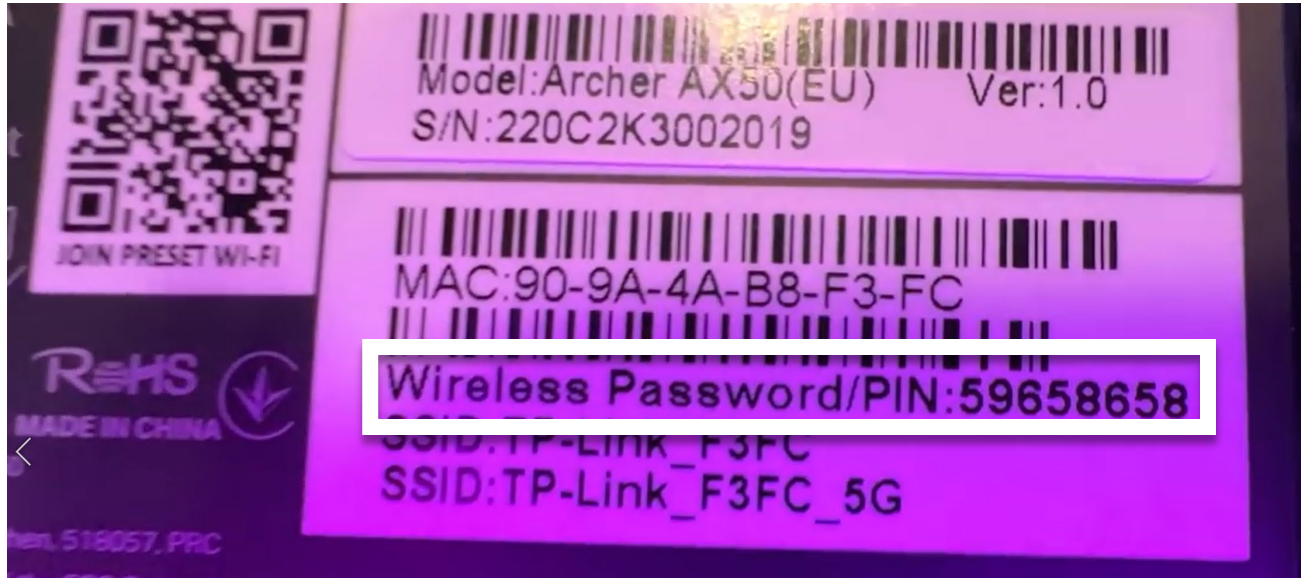
Why is this important?

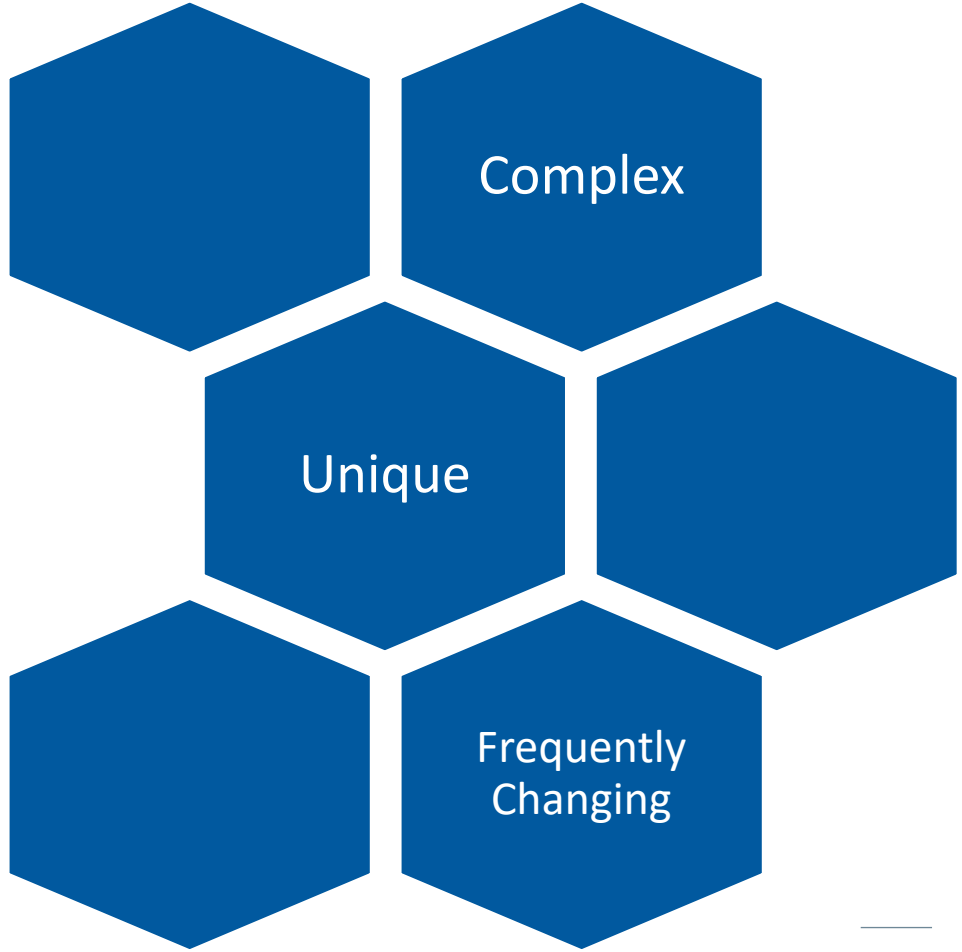
- Compromised Networks present a serious risk.
  - Steal Bandwidth
  - Can launch other attacks (ie. MitM)
  - Pivot to other devices

- Huge shift to remote workforce.
- End user networks are not as fortified as corporate Networks.

How should I protect myself?

- Change default username/password of your router
- Update your router firmware
- Don’t bother disabling SSID broadcast
- Disable WPS
- Upgrade to WPA3+
- Choose a STRONG SSID password





Summary

- There is a new WPA2 password attack discovered by atom @hashcat that doesn't require client interaction. **hcxdumptool** can capture wireless traffic containing the PMKIDs to crack. Doesn't make cracking magically easier, just eliminates need to have client access.
- The appropriate defense is a lengthy and complex WPA2 password that would take decades to crack. Or just to upgrade to the new WPA3 encryption standard, if possible.
- Dallas > Tel Aviv


Androneo Banderas
• Mavic Pro Platinum 2
• Raspberry Pi Model 3B
• Kali Linux Distro
• Alfa Anteros AWUS036ACH
Next up…WarFlying?!

Thank You!

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