CTF HOW TO

HARDWARE-- 1
- ESP32 chip board-- 1
- Memory--- 2

WEB---2
- Curl---2
- Brup Suite--- 2
- ffluf (url)-- 2

Forensics-- 2
PWN--3
STEGANOGRAPHY---3
- IMAGES-- 3

CAR--- 3
Helpful notes--3
Helpful links--3
CTF SPECIFIC-- 3
- HTH--3
- SHMOOCON steganography--- 4
  - Layered QR code / QR code reconstruction--4
  - **STL file-- 4**
  - AWS--- 5
  - PCAP-- 5
  - DOCKER-- 6
- HACK-A-SAT-- 6
- THOTCON--- 6
  - crypto--6
  - RF--- 7
  - Badge---7
- BATTELLE CYBER CHALLENGES
https://solvers.battelle.org/cyber-challenge/cyber-challenge-- 7
  - REVERSE ENGINEERING--7
  - BINARY EXPLOITATION--8
  - FORENSICS / CRYPTO---8
  - MULTI-ARCHITECTURE SHELLCODE---9

HARDWARE

- ## ESP32 chip board
    - How to connect to a esp32 chip board connect through UART.
        - serial connection through the usb port (micro usb / type c) if it has a FTDI chip (usb to serial). FTDI chip is usually connected to the esp32
        - Pin out esp32 chip, connect to Rx, Tx, and ground or io, gpio, and ground. Use uart to usb cable
    - After plugged in, in Terminal run either
        - Picocom
            - example: picocom /dev/ttyUSB0 -b 115200
            - example: picocom /dev/ttyUSB0 -b 9600
                - picocom (port in use) (baud rate ####)
        - Esptool
        - Putty
        - Screen
        - Arduino IDE
        - minicom
    - Helpful notes
        - Common baud rates: 9600, 1200, 2400, 4800, 19200, 38400, 57600, and 115200 bpds
        - To find ports in use run in terminal lsusb or ls /dev/tty*
- ## Memory
    - command to dump 4MB of flash to a file: `python -m esptool --port COM5 -b 115200 read_flash 0 0x400000 flashdump.bin`
- `python3 -m esptool --port` /dev/ttyUSB0 `-b 9600 read_flash 0 0x400000 flashdump.bin`
-
        - Esptool (port used) (bod rate) (command read flash from memory location ### to memory location ###) (name of file to create and put data in)
    - binwalk
    - To view strings use in terminal command *strings* with your .bin file strings flashdump.bin
    - Ghidra
    - GHex
    -

WEB

- Curl
  - Web request
- Brup Suite
- ffluf (url)
-

RF

- GQRX
- Universal Radio
- Apps to use rom ZeroChaos for fox hunt and ect
  - nRF Connect
  - Flipper
  - AirGuard
  - Aruba Utilities
  - Wifi Analyzer
  - WiFiman
  - Meshtastic
  - goTenna
  - Zello
-

Forensics

-

PWN

STEGANOGRAPHY

- IMAGES
    - https://www.aperisolve.com/979702d356135c1ceef557a17e30d9a8#google_vignette
-

CAR

- https://github.com/LittleBlondeDevil/TruckDevil
    - > git clone https://github.com/LittleBlondeDevil/TruckDevil.git
- https://github.com/iDoka/awesome-canbus
-

Helpful notes and tools

- Audacity
- Wireshark
- Ardunio IDE
- Ghidra
- Burp Suite
- Putty
- GHex
-

Helpful links

- https://medium.com/quiknapp/fuzz-faster-with-ffuf-c18c031fc480
- https://cantreally.cyou/
- https://www.dcode.fr/
- https://gchq.github.io/CyberChef/
- https://python-can.readthedocs.io/en/stable/
- https://github.com/iDoka/awesome-canbus

Setup

- sudo apt install python3
- Pwntools
  - sudo apt-get install python3 python3-pip python3-dev git libssl-dev libffi-dev build-essential
  - python3 -m pip install --upgrade pip
  - python3 -m pip install --upgrade pwntools
- CANBus
  - sudo apt update
  - sudo apt -y install can-utils
  - pip install python-can
- Visual Studio Code
  - sudo apt-get install wget gpg
  - wget -qO- https://packages.microsoft.com/keys/microsoft.asc | gpg --dearmor > packages.microsoft.gpg
  - sudo install -D -o root -g root -m 644 packages.microsoft.gpg /etc/apt/keyrings/packages.microsoft.gpg
  - sudo sh -c 'echo "deb [arch=amd64,arm64,armhf signed-by=/etc/apt/keyrings/packages.microsoft.gpg] https://packages.microsoft.com/repos/code stable main" > /etc/apt/sources.list.d/vscode.list'
  - rm -f packages.microsoft.gpg
  -
  - sudo apt install apt-transport-https
  - sudo apt update
  - sudo apt install code # or code-insiders
  -
- Hardwear
  - Picocom
    - sudo apt update
    - sudo apt -y install picocom
  - Esptool
    - sudo pip install esptool
    - sudo apt -y install python3-pip
  - Putty
    - sudo add-apt-repository universe
    - sudo apt update
    - sudo apt install -y putty
  - Screen
    - sudo apt-get update -y
    - sudo apt-get install screen -y
  - Minicom
    - sudo apt-get install minicom -y

- Memory
    - Binwalk
        - sudo apt update
        - sudo apt -y install binwalk
    - Ghidra
        - sudo apt-get install openjdk-17-jdk
        - download Ghirda from its official repository page and extract it into a directory.
        - After extracting the files, please go to the directory through the cd command.
        - chmod +x ghirdRun
        - ./ghirdaRun
    - Create a desktop entry file
        - “[Desktop Entry]
        - Version=10.0
        - Type=Application
        - Terminal=false
        - Icon=/home/artemix/ghidra/support
        - Exec=sh /home/artemix/ghidra/ghidraRun.sh
        - Name=Ghidra”
        - Replace the data in the **Icon** and **Exec** fields with the location of the Ghidra icon and the launch script in your machine.
        - Save the file as "Ghidra.desktop" in the Desktop directory.
        - Right-click on the file and set it to **Allow Launching** or fire up a terminal and use the chmod command to make it executable for all users.
        - chmod a+x Ghidra.desktop
        -
    - Ghidra using snap
        - sudo apt update
        - sudo apt install snapd
        - sudo snap install ghidra
    - Ghex
        - sudo apt-get update
        - sudo apt-get install ghex -y
- Web
    - Burp
        - **Download:** Burp Suite
        -
- Wireless
    - Wireshark
        -
- JDK 17
    - Open JDK
        - sudo apt update

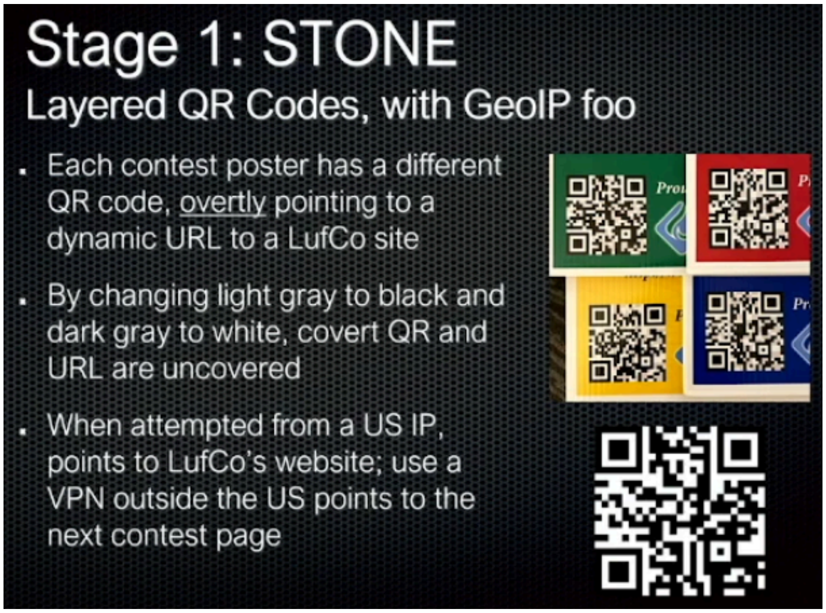
        - sudo apt install -y openjdk-17-jdk
        - sudo apt install -y openjdk-17-jre
    - Oracle JDK 17
        - sudo apt update
        - sudo apt install -y libc6-x32 libc6-i386
        - wget https://download.oracle.com/java/17/latest/jdk-17_linux-x64_bin.deb
        - sudo dpkg -i jdk-17_linux-x64_bin.deb
        - sudo update-alternatives --install /usr/bin/java java /usr/lib/jvm/jdk-17/bin/java 1
    - java -version
- Wine

Linux commands commonly Used by Hackers.

1. ls: Lists directory contents.
2. cd: Changes directory.
3. pwd: Shows the current directory.
4. cp: Copies files and directories.
5. mv: Moves or renames files.
6. rm: Removes files or directories.
7. find: Searches for files in directories.
8. cat: Concatenates and displays file contents.
9. nano / vim: Edits files within the command line.
10. chmod: Changes file permissions, useful for managing access to files.
11. chown: Changes file owner and group.
12. ping: Tests connectivity to other IPs or domains.
13. ifconfig or ip: Displays network interfaces and configurations.
14. netstat: Shows network connections, routing tables, and interface statistics.
15. nmap: Scans networks and discovers hosts and services.
16. whois: Retrieves domain information.
17. dig: Resolves DNS queries.
18. traceroute: Traces the path packets take to reach a host.
19. ssh: Connects to remote machines via Secure Shell.
20. scp: Securely copies files between hosts.
21. ps: Displays current processes.
22. top / htop: Provides a real-time view of system processes.
23. kill: Terminates a process by its ID.
24. pkill: Kills processes by name.
25. bg and fg: Manages jobs in the background and foreground.
26. uname -a: Displays system information.
27. df: Shows disk space usage.
28. du: Checks directory space usage.
29. uptime: Displays system uptime.
30. free: Shows memory usage.
31. history: Shows command history, useful for auditing actions.
32. tar: Archives files into a single file, often for compression.

33. gzip / gunzip: Compresses and decompresses files.
34. zip / unzip: Creates and extracts zip files.
35. wget: Downloads files from the internet.
36. curl: Transfers data from or to a server, supporting protocols like HTTP, FTP, and more.
37. grep: Searches for specific strings in files.
38. sed: Edits streams of text, useful for finding and replacing.
39. awk: A powerful text processing tool for data extraction and reporting.
40. cut: Cuts out sections of each line in a file.
41. sort: Sorts lines of text files.
42. uniq: Finds unique lines in a file, often used with sort.
43. iptables: Manages Linux firewall rules.
44. tcpdump: Captures network packets, useful for analyzing network traffic.
45. openssl: A toolkit for secure communication, generating certificates, etc.
46. chmod: Changes permissions, important for securing files.
47. metasploit: A penetration testing framework with various exploits.
48. hydra: A brute-force tool for various protocols, e.g., SSH, FTP.
49. john: Password cracker for ethical hacking.
50. aircrack-ng: A suite for Wi-Fi network security assessment.

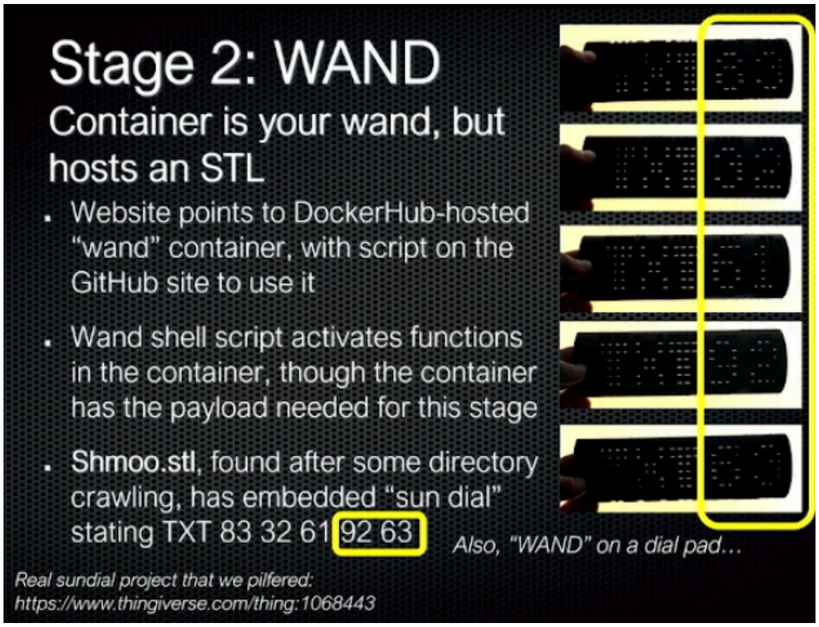
CTF SPECIFIC

- HTH
    -
- SHMOOCON steganography
    - Layered QR code / QR code reconstruction
        - 

Stage 1: STONE

Layered QR Codes, with GeoIP foo

- Each contest poster has a different QR code, overtly pointing to a dynamic URL to a LufCo site
- By changing light gray to black and dark gray to white, covert QR and URL are uncovered
- When attempted from a US IP, points to LufCo's website; use a VPN outside the US points to the next contest page

- STL file
  - 

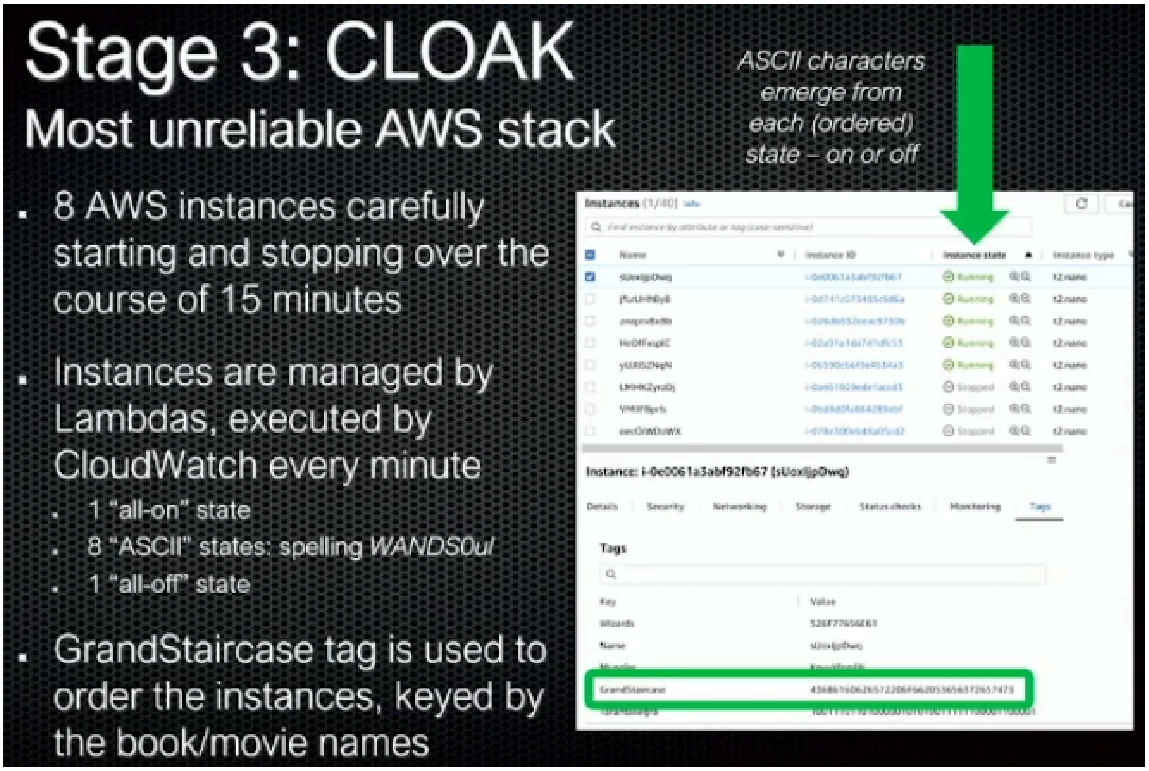
    # Stage 2: WAND

    ## Container is your wand, but hosts an STL

    - Website points to DockerHub-hosted "wand" container, with script on the GitHub site to use it
    - Wand shell script activates functions in the container, though the container has the payload needed for this stage
    - **Shmoo.stl**, found after some directory crawling, has embedded "sun dial" stating TXT 83 32 61 92 63

    Also, "WAND" on a dial pad…

    Real sundial project that we pilfered: https://www.thingiverse.com/thing:1068443

    - Load in blender
      - Rener light hitting it
- AWS
  - 

    # Stage 3: CLOAK

    ## Most unreliable AWS stack

    - 8 AWS instances carefully starting and stopping over the course of 15 minutes
    - Instances are managed by Lambdas, executed by CloudWatch every minute
      - 1 "all-on" state
      - 8 "ASCII" states: spelling *WANDS0ul*
      - 1 "all-off" state
    - GrandStaircase tag is used to order the instances, keyed by the book/movie names

    ASCII characters emerge from each (ordered) state – on or off

    Instances (1/40) Info

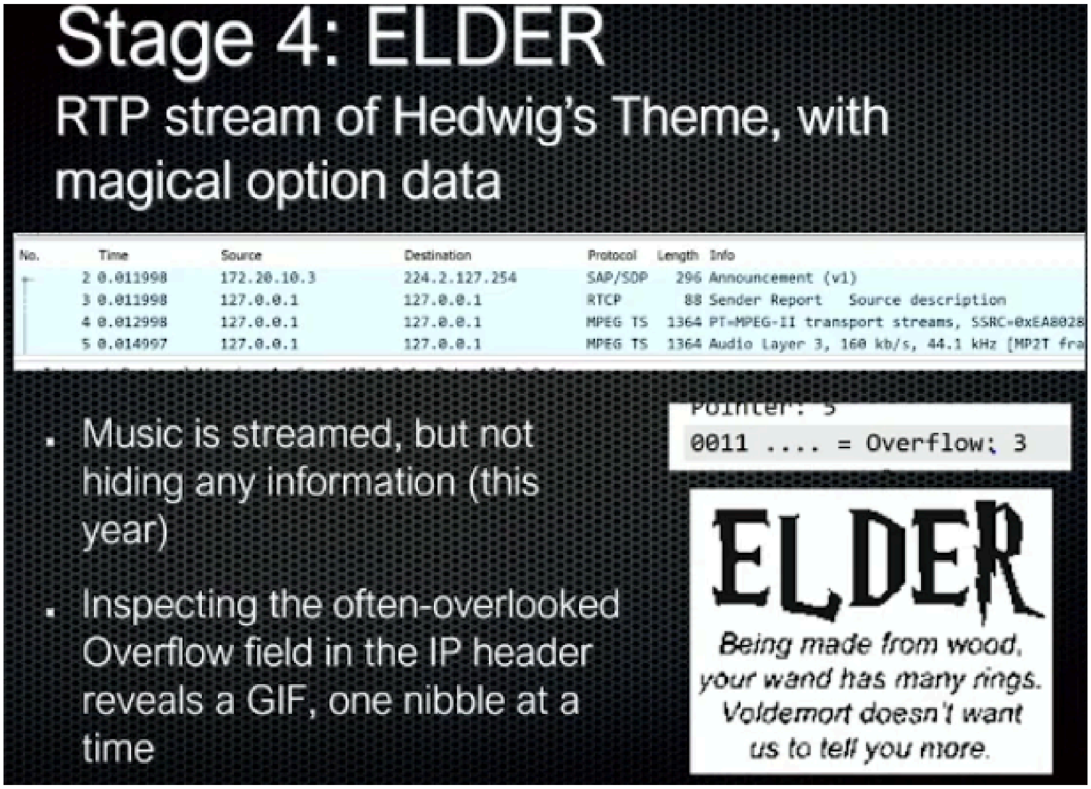
☑	Name	Instance ID	Instance state	Instance type
☑	sUoxljpDwq	i-0e0061a3abf92fb67	Running	t2.nano
□	jfLrUHhBy8	i-0d741c073485c9d6a	Running	t2.nano
□	zneptvBxBb	i-026db652eeac97506	Running	t2.nano
□	HcOffxuplC	i-02a91a1da747dfc55	Running	t2.nano
□	yUURISZNqN	i-06590cb6f9e4534a3	Running	t2.nano
□	LMMK2yrzDj	i-0a6619[illegible]accd5	Stopped	t2.nano
□	VMIIFBprls	i-0bd8d0fa884285ebf	Stopped	t2.nano
□	oecOiWDoWX	i-078e300eb48a05cd2	Stopped	t2.nano

    Instance: i-0e0061a3abf92fb67 (sUoxljpDwq)

    Details | Security | Networking | Storage | Status checks | Monitoring | Tags

    Tags

Key	Value
Wizards	526F77656E61
Name	sUoxljpDwq
Muggles	[illegible]
GrandStaircase	4368616D6265722066[illegible]7473
[illegible]	[illegible]

- PCAP
  - 

    ## Stage 4: ELDER

    RTP stream of Hedwig's Theme, with magical option data

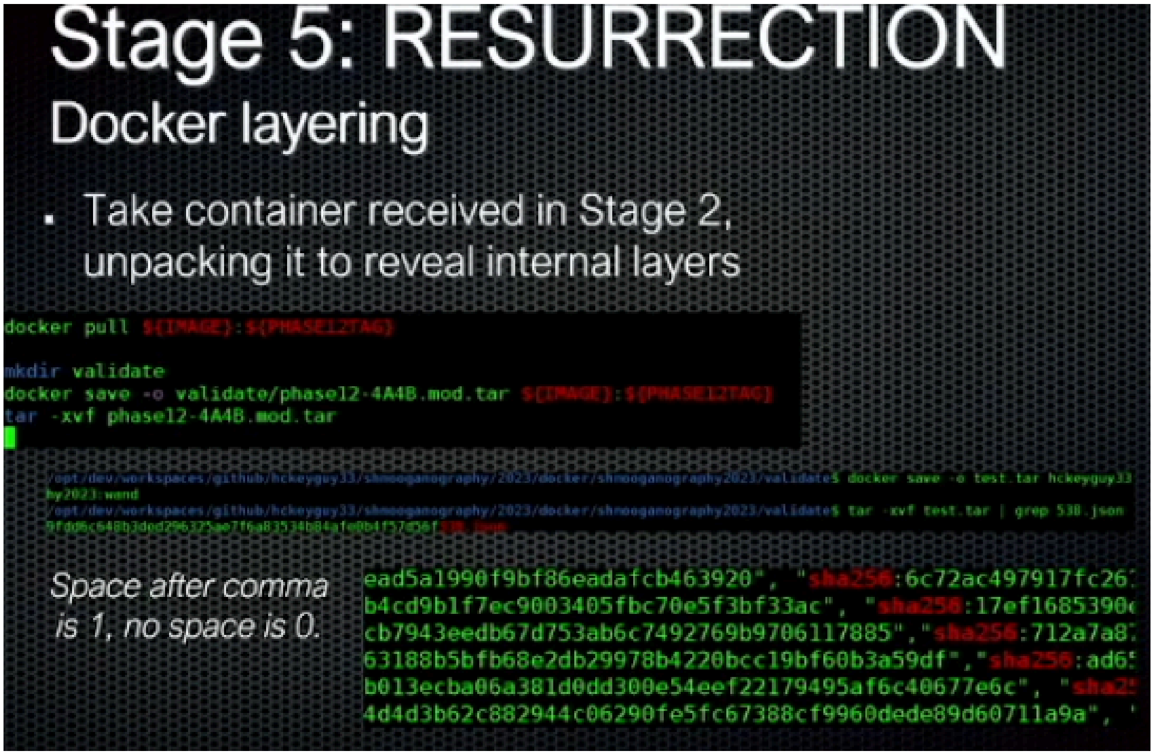
    ```
    No.  Time       Source        Destination    Protocol  Length Info
       2 0.011998   172.20.10.3   224.2.127.254  SAP/SDP    296 Announcement (v1)
       3 0.011998   127.0.0.1     127.0.0.1      RTCP        88 Sender Report   Source description
       4 0.012998   127.0.0.1     127.0.0.1      MPEG TS   1364 PT=MPEG-II transport streams, SSRC=0xEA8028
       5 0.014997   127.0.0.1     127.0.0.1      MPEG TS   1364 Audio Layer 3, 160 kb/s, 44.1 kHz [MP2T fra
    ```

    - Music is streamed, but not hiding any information (this year)
    - Inspecting the often-overlooked Overflow field in the IP header reveals a GIF, one nibble at a time

    ```
    Pointer: 5
    0011 .... = Overflow: 3
    ```

    ELDER

    Being made from wood, your wand has many rings. Voldemort doesn't want us to tell you more.

    - https://cantreally.cyou/posts/shmoocon-shmooganography/
- DOCKER
  - 

    ## Stage 5: RESURRECTION

    Docker layering

    - Take container received in Stage 2, unpacking it to reveal internal layers

    ```
    docker pull ${IMAGE}:${PHASE12TAG}

    mkdir validate
    docker save -o validate/phase12-4A4B.mod.tar ${IMAGE}:${PHASE12TAG}
    tar -xvf phase12-4A4B.mod.tar
    ```

    ```
    /opt/dev/workspaces/github/hckeyguy33/shmooganography/2023/docker/shmooganography2023/validate$ docker save -o test.tar hckeyguy33
    hy2023:wand
    /opt/dev/workspaces/github/hckeyguy33/shmooganography/2023/docker/shmooganography2023/validate$ tar -xvf test.tar | grep 538.json
    9fdd6c648b3ded296325ae7f6a83534b84afe0b4f57d56f538.json
    ```

    Space after comma is 1, no space is 0.

    ```
    ead5a1990f9bf86eadafcb463920", "sha256:6c72ac497917fc26
    b4cd9b1f7ec9003405fbc70e5f3bf33ac", "sha256:17ef1685390
    cb7943eedb67d753ab6c7492769b9706117885","sha256:712a7a8
    63188b5bfb68e2db29978b4220bcc19bf60b3a59df","sha256:ad6
    b013ecba06a381d0dd300e54eef22179495af6c40677e6c", "sha2
    4d4d3b62c882944c06290fe5fc67388cf9960dede89d60711a9a", '
    ```

- HACK-A-SAT
- THOTCON
    - crypto
        - Find the flag in the text string: f33_qn_E0G
            - Hint: Rot & Decay
            - Apply ROT13
                - flag{s33_da_R0t}
        - Find the flag hidden in this text. Think Bacon: 01100010010_01001310011101100_00001400010001100_0101000101010111
            - Its binary but in a weird format
                - flag{n0t_k3v1n_b4c0n_l0lz}
        - In the hands of an allied spy, you've found a small piece of paper with a strange sequence of characters: 'RmxhZ3tiYXNlNjRfaXNfZWFzeX0='. What could it mean?
            - Base 64 encoding (give away is the “=”)
                - base64_is_easy
        - Ykj pynih fgl iak weru tlmt utut hor dp oyu ytd? Smisu nn ia eeco ayhc sr heme. ftuo{so1o_t0_so_n0k}
            -
                -
        - Ftue ue FTAFOAZ 0jO agd fiqxrft kqmd. Iq tabq kag tmhq mz mymluzs fuyq mzp qzvak xqmdzuzs eayqftuzs zqi. Rxms{d0f12_ue_ea_qmek}
            - ROT [A-Z]+12
                - This is THOTCON 0xC our twelfth year. We hope you have an amazing time and enjoy learning something new. Flag{r0t12_is_so_easy}
        - Ace of Base TGVzcyBjcnlwdG8sIG1vcmUgZW5jb2RpbmcuIGZsYWd7MV9zYXdfdGgzX3MxZ259==
            - Base 64 encoding (give away is the “=”)
                - Less crypto, more encoding. Flag{1_saw_th3_s1gn}
        - Cracking the Code A cryptic message, "nzdpmphz", has found its way to you. The circumstances surrounding the receipt of this message suggest that it holds an important secret, but it appears to be encrypted. Your task is to decrypt this mystery text, which will serve as the flag.
            - Caesar cipher with a shift of 1 to the right
                - mcology
    - RF
        - Find the Signal
            - Search for radio peak that is transmitting. This one was transmitting on 99.1
            - Morse code can be herd. Translate the morse code

            - m0rs3c0d3
    - Badge
        - esptool can be installed with `pip install esptool`
        - Dump memory
            - command to dump all 4MB of flash to a file: `python -m esptool --port COM5 -b 115200 read_flash 0 0x400000 flashdump.bin`
        - found badge flags as strings: `flag{welcome_to_the_8bit_world}` and `flag{lets_fight!}`
        - To view strings use in terminal command *strings* with your .bin file
          strings flashdump.bin
- BATTELLE CYBER CHALLENGES
  https://solvers.battelle.org/cyber-challenge/cyber-challenge
    - REVERSE ENGINEERING
        - Keepin' It Real:
            - Our engineers have managed to recover an old control system, but they can't figure out how to get the thing to work! Device documentation says that it shipped with some kind of client software that is no longer available. Luckily, they were able to recover the system firmware image…
            -
        - What the... Frob?:
            - What the... Frob?
            -
        - Humpty Dumpy's Fall:
            - Humpty Dumpty sat on a wall.... you know the rest. Can you figure out how the kings men and horses botched the repair on poor humpty?
            -
        - The Legend of the Headless Horseman:
            - A mysterious figure has been terrorizing the village of Sleepy Hollow. He rides a massive horse, swings a might scythe and has been collecting heads from any who draw near. A group of locals, Ichabod Crane, Katrina Van Tassel and Abraham "Brom Bones" Van Brunt have been working to discover the secret behind this mysterious menace, but just as they were on the verge of putting the pieces together, the Headless Horseman struck!
            -
        - Feed the Magical Goat:
            - Once upon a time, there was a little reverse engineer who found a special bell. When the bell was struck, they say a magical billy goat appeared looking for food. Everyone knows billy goats will

        eat anything, but this is all the little reverse engineer had lying around.

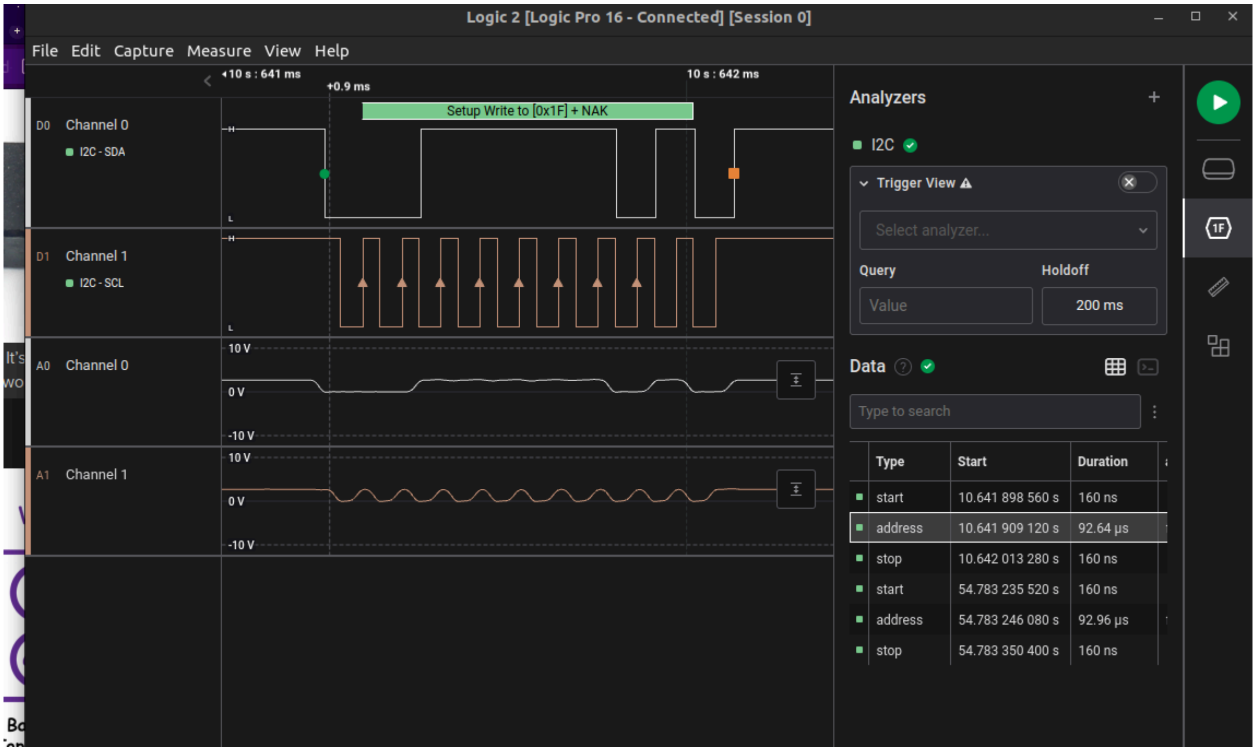
        -

- BINARY EXPLOITATION
    - Holy Grail of ROP:
        - The ROP God has tasked King Arthur with finding the function called "holy_grail". You must aid him on his quest! But be warned, the way is guarded by a text-based sorcerer whom loves old British comedy movies, and just to make things harder, you're going to have to find "holy_grail" 3 times! ...Or was it 5 times? Use your pwning knowledge to answer the sorcerer's questions and ROP your way to the holy grail and bring this holy relic home for the glory of England!
        -
    - Ghosted:
        - You're trying to save some money on your flight home so you've decided to fly Ghost Airlines, unfortunately their chatbot AI is being very unhelpful and is totally ignoring you! Can you figure out a way around the ghosting and hack your way home?
        -
- FORENSICS / CRYPTO
    - The Thanksgiving Bandits:
        - Last year, the notorious Thanksgiving Bandits struck for the third time. They stole over 1,000 potatoes that were meant to be mashed for the annual Thanksgiving Day feast. Two years ago, they burgled 400 pounds of cranberries, and they took 104 pumpkin pies the year before that. No one knows how they pull off such masterful heists or what they do with their score, but everyone agrees that they must be stopped at all costs.
        -
    - Dragons and Dwarves:
        - A wise dragon decided that dwarves were too easily stealing his treasure while he slept. To thwart these villains he has placed his prized possessions inside a magic portal that transmutes the valuables into worthless junk unless one knew the magic pass phrase.
        -
- MULTI-ARCHITECTURE SHELLCODE
    - Unicorns Undercover:
        - You arrive at the meeting location. It's dark The handoff is scheduled to take place at 10 p.m. The unicorns arrive, but you don't see the flag. They approach you and the first one says, "push eax, call joke." The second says, "jalr blankstare." They

stare at each other. They stare at you. They aren't speaking the same language.

-

Logic analyzer



Query: Value

Holdoff: 200 ms

Type	Start	Duration
start	10.641 898 560 s	160 ns
address	10.641 909 120 s	92.64 µs
stop	10.642 013 280 s	160 ns
start	54.783 235 520 s	160 ns
address	54.783 246 080 s	92.96 µs
stop	54.783 350 400 s	160 ns

name	type	start_time	duration	ack	address	read	data
I2C	start	5.78338656	1.60000001e-07				
I2C	address	5.78339712	0.00012096	true	0x1F	false	
I2C	data	5.78352432	0.00010976	true			0x42
I2C	data	5.78364016	0.00010992	true			0x44
I2C	data	5.78375616	0.00010976	true			0x47
I2C	data	5.783872	0.00010976	true			0x49
I2C	data	5.783988	0.00010976	true			0x49
I2C	data	5.78410384	0.00011088	true			0x4D
I2C	data	5.7842208	0.00010976	true			0x4F
I2C	data	5.7843368	0.00010976	true			0x3F
I2C	stop	5.78445792	1.6e-07				
I2C	start	5.79451088	1.6e-07				
I2C	address	5.79452144	0.00012128	true	0x1F	true	
I2C	data	5.79471984	9.568e-05	true			0x4B
I2C	data	5.79488128	9.456e-05	true			0x4B
I2C	data	5.79504176	9.232e-05	true			0x55
I2C	data	5.79519984	9.248e-05	true			0x78
I2C	data	5.79535824	9.44e-05	true			0x36
I2C	data	5.79551888	9.2e-05	true			0x76
I2C	data	5.79567728	9.392e-05	true			0x73
I2C	data	5.7958384	9.152e-05	false			0x30

```
I2C    stop    5.79600112    1.6e-07

I2C    start    15.2575363    1.60000001e-07

I2C    stop    15.2575906    1.6e-07

I2C    start    15.2589378    1.59999998e-07

I2C    stop    15.2707021    1.60000001e-07

I2C    start    15.2720619    1.6e-07

I2C    stop    15.2733035    1.59999998e-07

I2C    start    15.2734474    1.6e-07

I2C    stop    15.2751781    1.60000001e-07
```

- Car hacking village 2024
    - R
        - K:
            - Ou