CTF Challenge #7

Operation: Signal in Static

📄Background

You are a digital forensics analyst brought in to investigate a suspicious image file anonymously posted to an underground forum used by a cybercrime syndicate. The image looks like a corrupted or distorted PNG file — random noise, no clear subject. But intelligence suggests it may carry a hidden message or payload.

A recently apprehended insider confessed that some members hide messages in *"static,"* while metadata or naming patterns help identify how to extract or decode the payload.

You have access to:

- 1 corrupted image (`noise_puzzle.png`)
- A suspicious audio fragment (`weird_signal.wav`)
- A `.txt` note (`readme.txt`)

🔎Objectives

1. **Perform metadata analysis** on all files. (Focus on inconsistencies, timestamps, tool history, and any fields that don't match the context.)

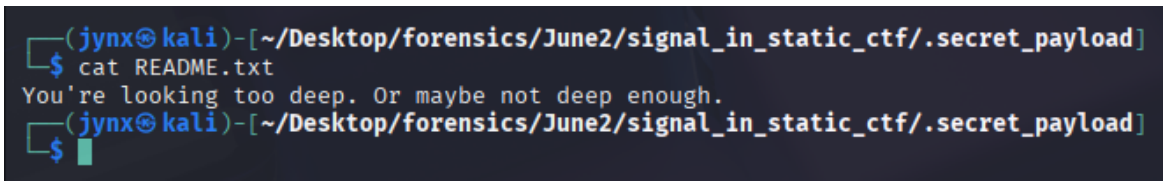
2. **Determine the true nature of the PNG image** – Is it hiding data via stego, appended payload, or EXIF artifacts?
3. **Inspect the audio file** – Is it actually audio, or is it misnamed? Does it contain a DTMF pattern? Spectrogram clue?
4. **Correlate information** between the text note and the image/audio to derive a **single flag**.
5. **Extract the flag** and validate it using the hint mentioned in `readme.txt`.

🛠️ Tools Used

- → `exiftool`
- → `xdg`
- → `steghide`
- → `strings`
- → `stat`
- → `file -i`
- → `xxd`
- → `hexdump`
- → `binwalk`

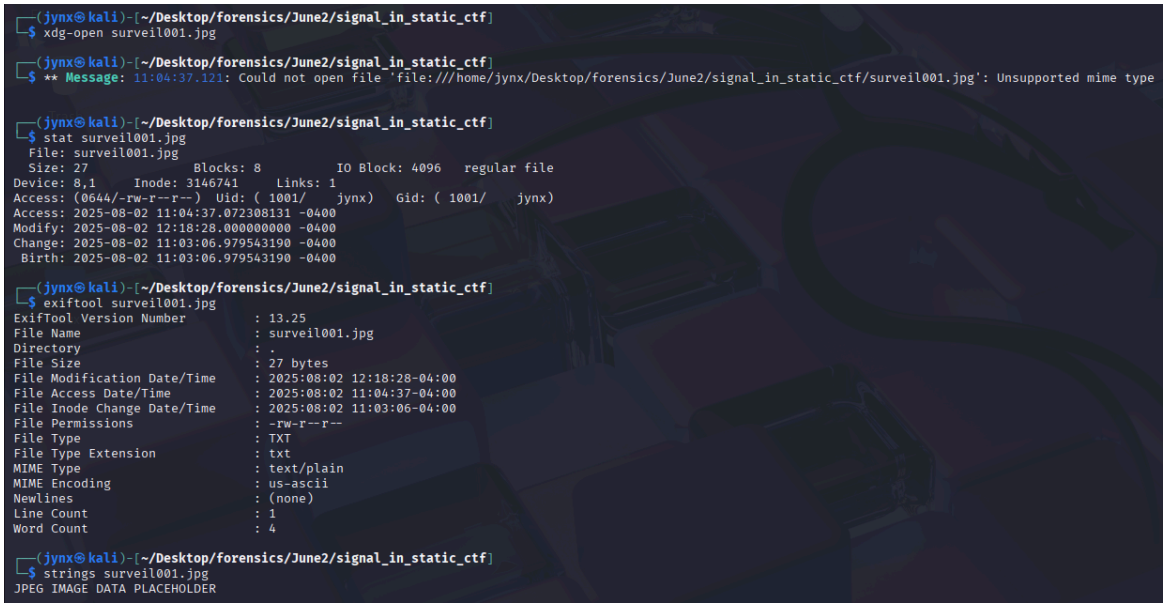
📄Initial Files

File Name	Type	Size	Notes
`readme.txt`	TXT	142 byes	Contains a kind of *smiling challenge* thought in your face. Personally I like it.

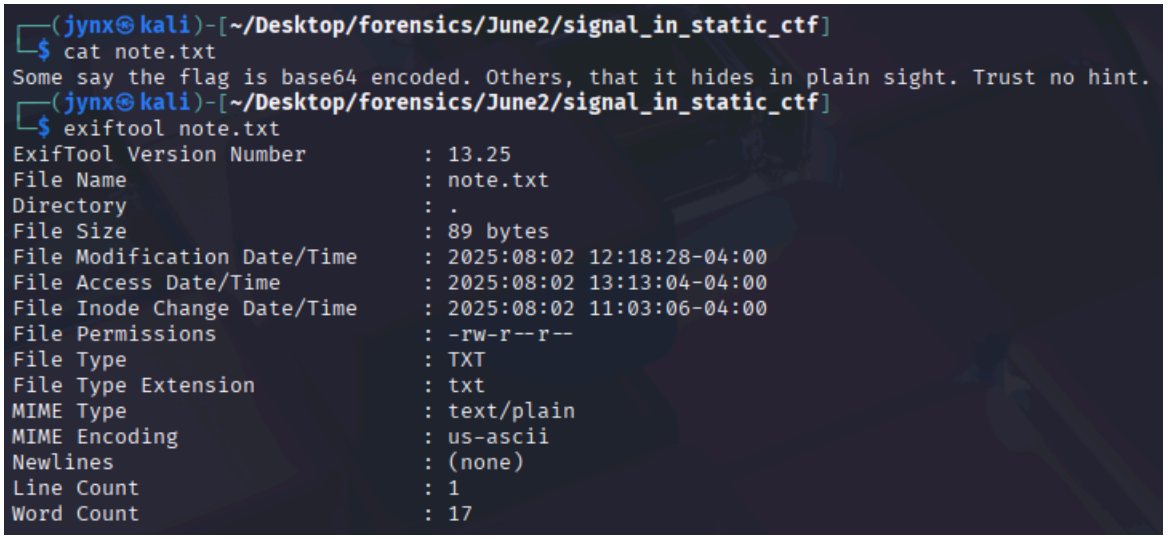


💾Analysis & Observations

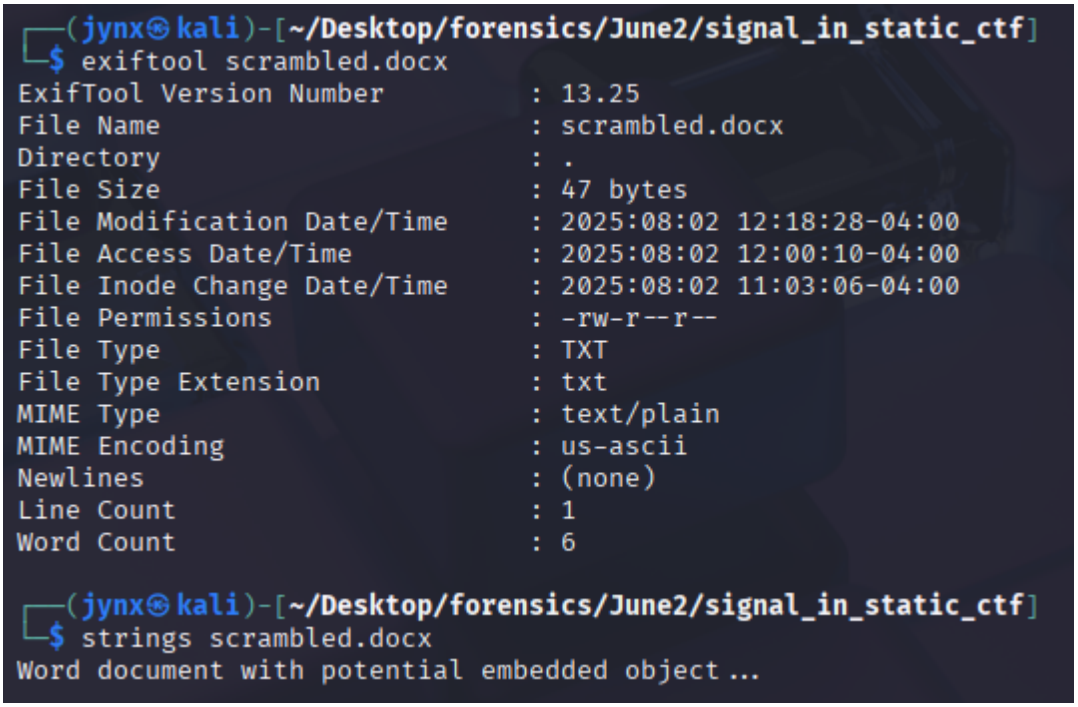
File Name	Type	Size	Notes
`surveil001.jpg`	JPG	27 bytes	Its a decoy file apparently, although not trustable in a CTF context but sure ill let it pass- since its a `.txt` file disguised as `.jpg`. It is instinctive I believe its a decoy a decoy.



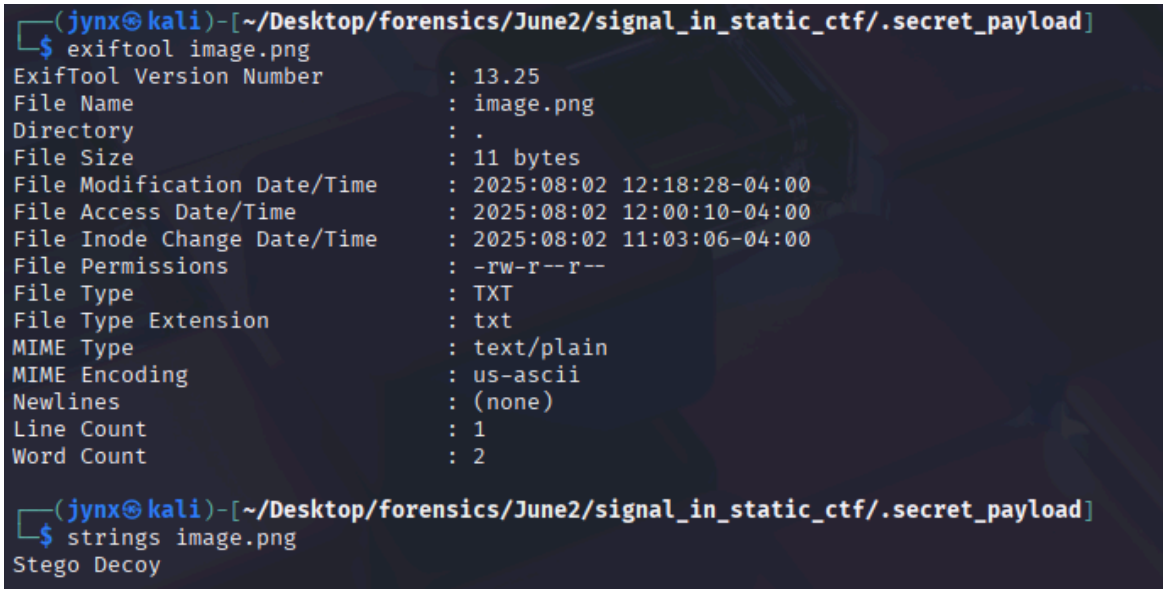
File Name	Type	Size	Notes
`note.txt`	TXT	89 bytes	Its a decoy file, meta-decoy of sorts hinting somewhere but also nowhere.



File Name	Type	Size	Notes
`scrambled.docx`	TXT	47 bytes	A decoy file again, classic meta-decoy file hinting in a direction as well as nowhere-instinctively its red herring as well, in my opinion.

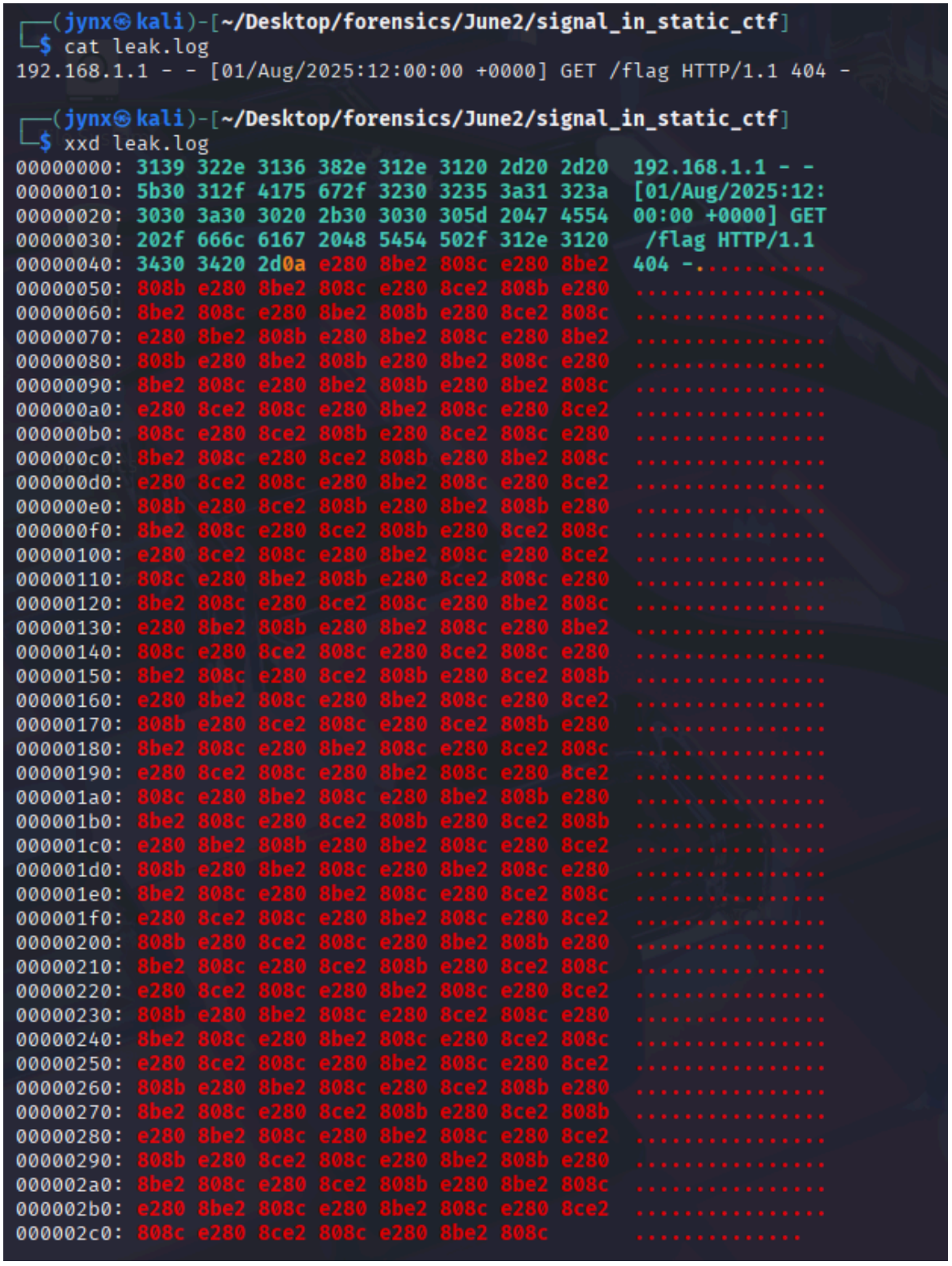


File Name	Type	Size	Notes
`image.png`	TXT	11 bytes	Its a decoy file surely, its a `.txt` file disguised as `.jpg`. The contents as well as the meta data screams **DECOY.**



▼ 🧩 Final Flag(s)

File Name	Notes
leak.log	FLAG{ghost_in_the_log_file}



Upon examining the `leak.log` file, nothing appeared unusual at first glance — a simple HTTP 404 log entry. However, a deeper inspection using `xxd` and `hexdump -C` revealed an unexpected and unusually **long tail of UTF-8 byte sequences** that didn't correspond to printable ASCII. The recurring presence of bytes like `e280 8be2` and `e280 808c` suggested the use of **zero-**

width Unicode characters, which are invisible in plain text but valid in UTF-8 streams. These characters — **Zero Width Space (`\u200B`) and Zero Width Non-Joiner (`\u200C`)** — are classic steganography vectors. Suspecting binary encoding, we hypothesized that `\u200B` and `\u200C` were being used to encode `0` and `1`. Based on that, the Python script was constructed to extract these characters, convert the resulting bitstream into ASCII, and finally retrieve the hidden flag.

`decoder.py` file used to uncover the flag

```
# decoder.py
with open("leak.log", "r", encoding="utf-8") as f:
    content = f.read()

# Extract only ZWS and ZWNJ
bits = []
for c in content:
    if c == '\u200B':
        bits.append('0')
    elif c == '\u200C':
        bits.append('1')

# Rebuild bytes from bits
flag = ''.join([chr(int(''.join(bits[i:i+8]), 2))
for i in range(0, len(bits), 8)])
print("Decoded flag:", flag)
```


jynx@kali: ~/Desktop/forensics/June2/signal_in_static_ctf
File Actions Edit View Help
GNU nano 8.4 decoder.py
decoder.py
with open("leak.log", "r", encoding="utf-8") as f:
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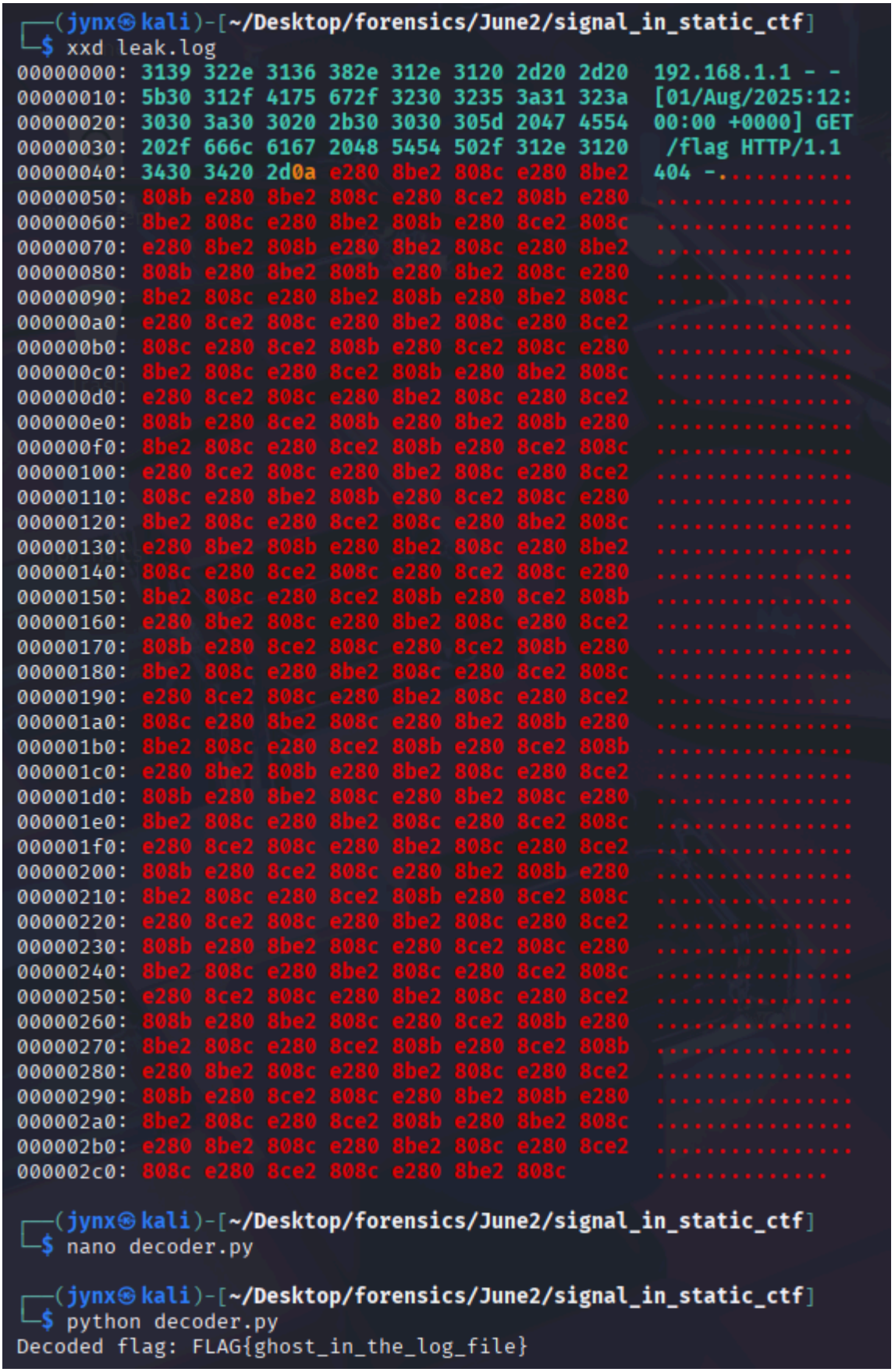
┌──(jynx㉿kali)-[~/Desktop/forensics/June2/signal_in_static_ctf]
└─$ xxd leak.log
00000000: 3139 322e 3136 382e 312e 3120 2d20 2d20 192.168.1.1 - -
00000010: 5b30 312f 4175 672f 3230 3235 3a31 323a [01/Aug/2025:12:
00000020: 3030 3a30 3020 2b30 3030 305d 2047 4554 00:00 +0000] GET
00000030: 202f 666c 6167 2048 5454 502f 312e 3120   /flag HTTP/1.1
00000040: 3430 3420 2d0a e280 8be2 808c e280 8be2 404 -.....
00000050: 808b e280 8be2 808c e280 8ce2 808b e280 ....
00000060: 8be2 808c e280 8be2 808b e280 8ce2 808c ....
00000070: e280 8be2 808b e280 8be2 808c e280 8be2 ....
00000080: 808b e280 8be2 808b e280 8be2 808c e280 ....
00000090: 8be2 808c e280 8be2 808b e280 8be2 808c ....
000000a0: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
000000b0: 808c e280 8ce2 808b e280 8ce2 808c e280 ....
000000c0: 8be2 808c e280 8ce2 808b e280 8be2 808c ....
000000d0: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
000000e0: 808b e280 8ce2 808b e280 8be2 808b e280 ....
000000f0: 8be2 808c e280 8ce2 808b e280 8ce2 808c ....
00000100: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
00000110: 808c e280 8be2 808b e280 8ce2 808c e280 ....
00000120: 8be2 808c e280 8ce2 808c e280 8be2 808c ....
00000130: e280 8be2 808b e280 8be2 808c e280 8be2 ....
00000140: 808c e280 8ce2 808c e280 8ce2 808c e280 ....
00000150: 8be2 808c e280 8ce2 808b e280 8ce2 808b ....
00000160: e280 8be2 808c e280 8be2 808c e280 8ce2 ....
00000170: 808b e280 8ce2 808c e280 8ce2 808b e280 ....
00000180: 8be2 808c e280 8be2 808c e280 8ce2 808c ....
00000190: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
000001a0: 808c e280 8be2 808c e280 8be2 808b e280 ....
000001b0: 8be2 808c e280 8ce2 808b e280 8ce2 808b ....
000001c0: e280 8be2 808b e280 8be2 808c e280 8ce2 ....
000001d0: 808b e280 8be2 808c e280 8be2 808c e280 ....
000001e0: 8be2 808c e280 8be2 808c e280 8ce2 808c ....
000001f0: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
00000200: 808b e280 8ce2 808c e280 8be2 808b e280 ....
00000210: 8be2 808c e280 8ce2 808b e280 8ce2 808c ....
00000220: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
00000230: 808b e280 8be2 808c e280 8ce2 808c e280 ....
00000240: 8be2 808c e280 8be2 808c e280 8ce2 808c ....
00000250: e280 8ce2 808c e280 8be2 808c e280 8ce2 ....
00000260: 808b e280 8be2 808c e280 8ce2 808b e280 ....
00000270: 8be2 808c e280 8ce2 808b e280 8ce2 808b ....
00000280: e280 8be2 808c e280 8be2 808c e280 8ce2 ....
00000290: 808b e280 8ce2 808c e280 8be2 808b e280 ....
000002a0: 8be2 808c e280 8ce2 808b e280 8be2 808c ....
000002b0: e280 8be2 808c e280 8be2 808c e280 8ce2 ....
000002c0: 808c e280 8ce2 808c e280 8be2 808c   ....
┌──(jynx㉿kali)-[~/Desktop/forensics/June2/signal_in_static_ctf]
└─$ nano decoder.py
┌──(jynx㉿kali)-[~/Desktop/forensics/June2/signal_in_static_ctf]
└─$ python decoder.py
Decoded flag: FLAG{ghost_in_the_log_file}