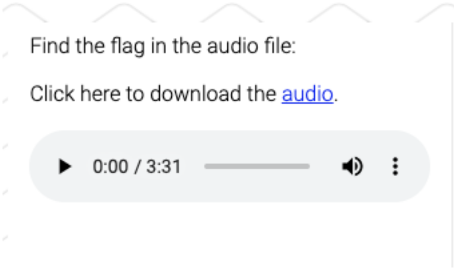
R1 - Challenge 1

Theme: Steganography



Before covering how the audio steganography code works, it pays dividends to understand how audio is stored on disk.

Digital audio works by sampling audio many times per second. Each sample is a signed value that describes a normalised value between -1 and 1. Since this value is a signed integer, we can use steganography to store information in the least significant bit. Commonly, audio is stored as 16-bit "frames" at a framerate of 44.1KHz.

For audio steganography, the capacity of the stored data is given by the song duration multiplied by the sample rate, divided by eight. E.G. for a three-minute song at 44.1KHz, we could encode 992,250 bytes using a least-significant-bit method.

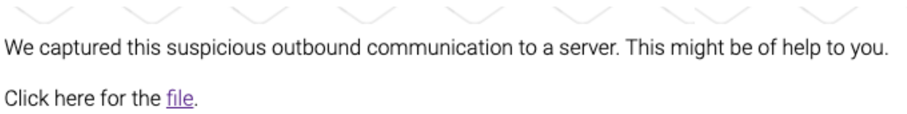
Solution code:

```
#!/bin/python3
import sys
import numpy
import wave
import struct

fname = sys.argv[1]

waveform = []
waveformParams = None

with wave.open(fname, 'rb') as f:

    print("Width {}".format(f.getsampwidth()))

    print("Sampling Rate {}".format(f.getframerate()))

    print("Frames {}".format(f.getnframes()))

    print("Channels {}".format(f.getnchannels()))

    waveformParams = f.getparams()

    waveform = f.readframes(waveformParams.nframes)

waveformLength = len(waveform)

if waveformParams.sampwidth == 2:

    floatform = struct.unpack('h' * (waveformLength / waveformParams.sampwidth),
waveform)
```

```
else:
    floatform = struct.unpack('b' * waveformLength, waveform)
stegLength = waveformParams.nframes / 8
stegData = numpy.zeros(stegLength, dtype=numpy.uint8)
for i in range(stegLength):
    byteVal = 0
    for shift in range(8):
        t = floatform[i * 8 + shift]
        byteVal += (t & 0b1) << (7 - shift)
    stegData[i] = byteVal
with open("stego.saurus", 'wb') as f:
    f.write(stegData.tobytes())
```

R1 - Challenge 2

Theme: Cryptography

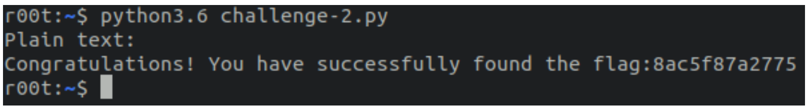


Hash.txt Contains a long string of decimals for participants to decode.

Test.py Python script which could be written by participants to solve the challenge. Solution: 1. Download the text file and analyse it 2. Copy the string of decimals in the text file and put it in a python script to decrypt the decimals. The script removes the repeating "837" number.

```
MESSAGE = "678371118371108371038371148379783711683711783710883797837116837105837111837110837

PLAINTEXT = ""

DECIMALS_LIST = MESSAGE.split('837')

for DECIMAL in DECIMALS_LIST:
    DECIMAL = int(DECIMAL)
    PLAINTEXT = PLAINTEXT + chr(DECIMAL)

print ("Plain text:\n" + PLAINTEXT)
```

3. Run the script to obtain the flag

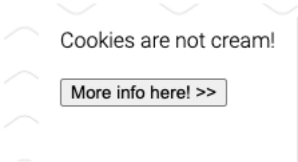


Flag:

`flag:8ac5f87a2775`

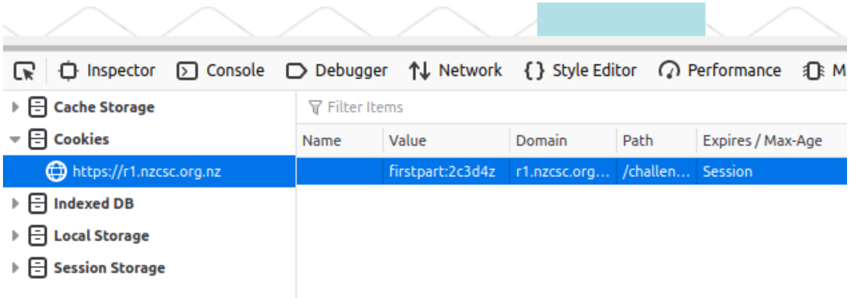
R1 - Challenge 3

Theme: Web-application

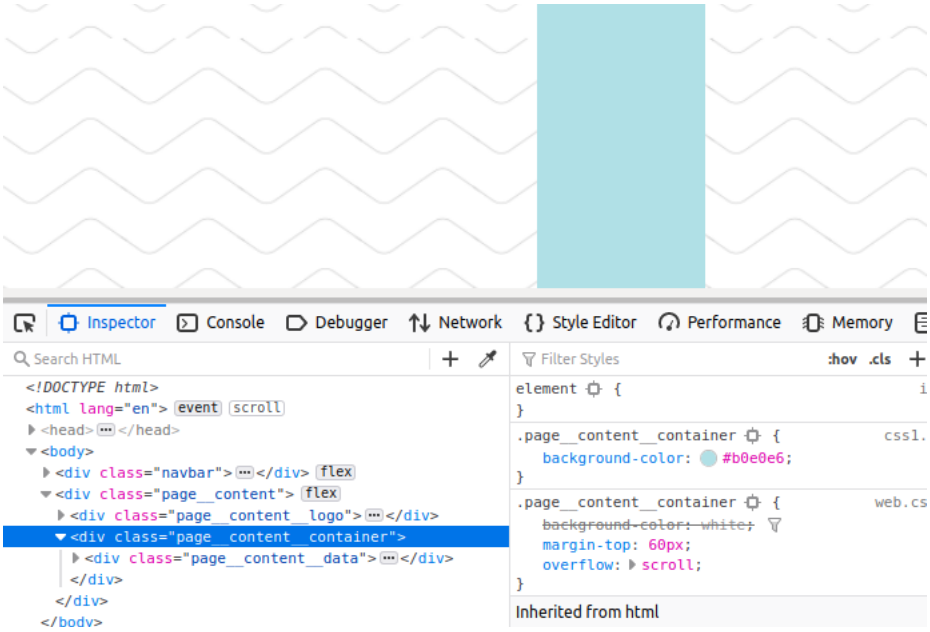


Solution:

1. Part of the flag is hidden in a cookie



2. The other part of the flag is the color of the blue strip in hex

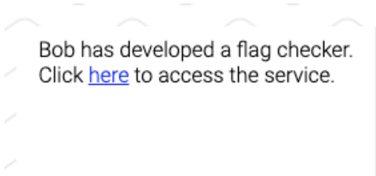


Flag:

`flag:2c3d4zb0e0e6`

R1 - Challenge 4

Theme: Web-application



On access of Challenge 4, we are presented with the Flag Checker service.

By inspecting the source code of the website, we can discover the check$_{f}lag()functionisexecutedwhenweclicksubmit.$

We can see the check$_{f}lag()functioncallsthecheck_{1}tocheck_{4}functionstoseeifeachpartoftheflagiscorrect.Itturnedoutthatitwas$
$forceseveryprintablecharacter, computeitscorrespondinghashwithdifferenthashingalgorithmsandputthemintoadictionaryf$

import hashlib import hmac import string

l = string.printable

p$_1$ = [$quot;8fa14cdd754f91cc6554c9e71929cce7quot;, quot;2db95e8e1a9267b7a1188556b2013b33quot;, quot;0cc175b9c0f1b6a83$

p$_2$ = [$quot;32096c2e0eff33d844ee6d675407ace18289357dquot;, quot;b6589fc6ab0dc82cf12099d1c2d40ab994e8410cquot;, quot;5$

p$_3$ = [$quot;4e07408562bedb8b60ce05c1decfe3ad16b72230967de01f640b7e4729b49fcequot;, quot;6b86b273ff34fce19d6b804eff5$

p$_4$ = [$quot;01969a94bcf90f8aad4c3afefc7bc046quot;, quot;f832cb995a8ecd24789c022d4c93913bquot;$]

brute force first part dict$_1$ = $for_{i}nl$: $dict_1[hashlib.md5(_).hexdigest()] =_d ict_1[hashlib.sha1(_).hexdigest()] =_d ict_1[hashlib.sha256(_).hexdigest()] =_d ict_1[hmac.new(quot;purpleporcupinequot;,_).hexdigest()] =$

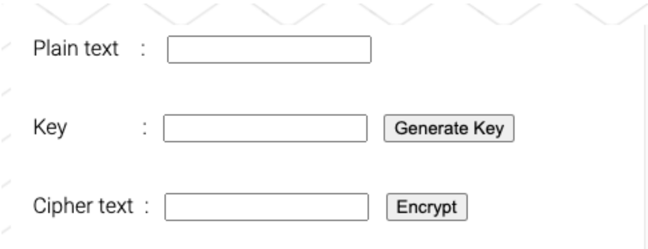
print 39;39;.join([dict$_1[x]forxin(p_1 + p_2 + p_3 + p_4)$])

Flag:

`flag:C0DoU31rWVGus`

R1 - Challenge 5

Theme: Cryptography



EXAMPLES:

Plaintext	Key	Ciphertext
NZCSC'20	LǼ¦cCḿZD	ĊŅé0Ćøht
Cyber Security	4ù[R.ṇµÉòĿw%%&	wÒ97\ýäæÏeĴLQ_
Cryptography	ṇZnĻbªGEYÅèɳ	Ü(ťzkḴ 78õÐ»
[FLAG]	**[REDACTED]**	àĵjÈ4Ȍé¿§[ḾƃÂĻÇŊı

Solution: 1. Analyse and understand the JavaScript codes 2. The first 5 characters of the ciphertext has to be flag: (format for a flag) 3. Write (flag:) in the plain text box and copy the first 5 characters of the ciphertext (àĵjÈ4) to be set as the key, thereafter generate a new ciphertext

4. Use the newly generated ciphertext to set the new state by using the inspect element of the webpage. This is to set the state to the position of the flag.

5. Now the next 12 elements of the state will display the flag 6. Copy the rest of the ciphertext (é¿§[ÂÇ) and click generate key and encrypt to obtain the flag

Flag: flag:49e3395f08eb

R1 - Challenge 6

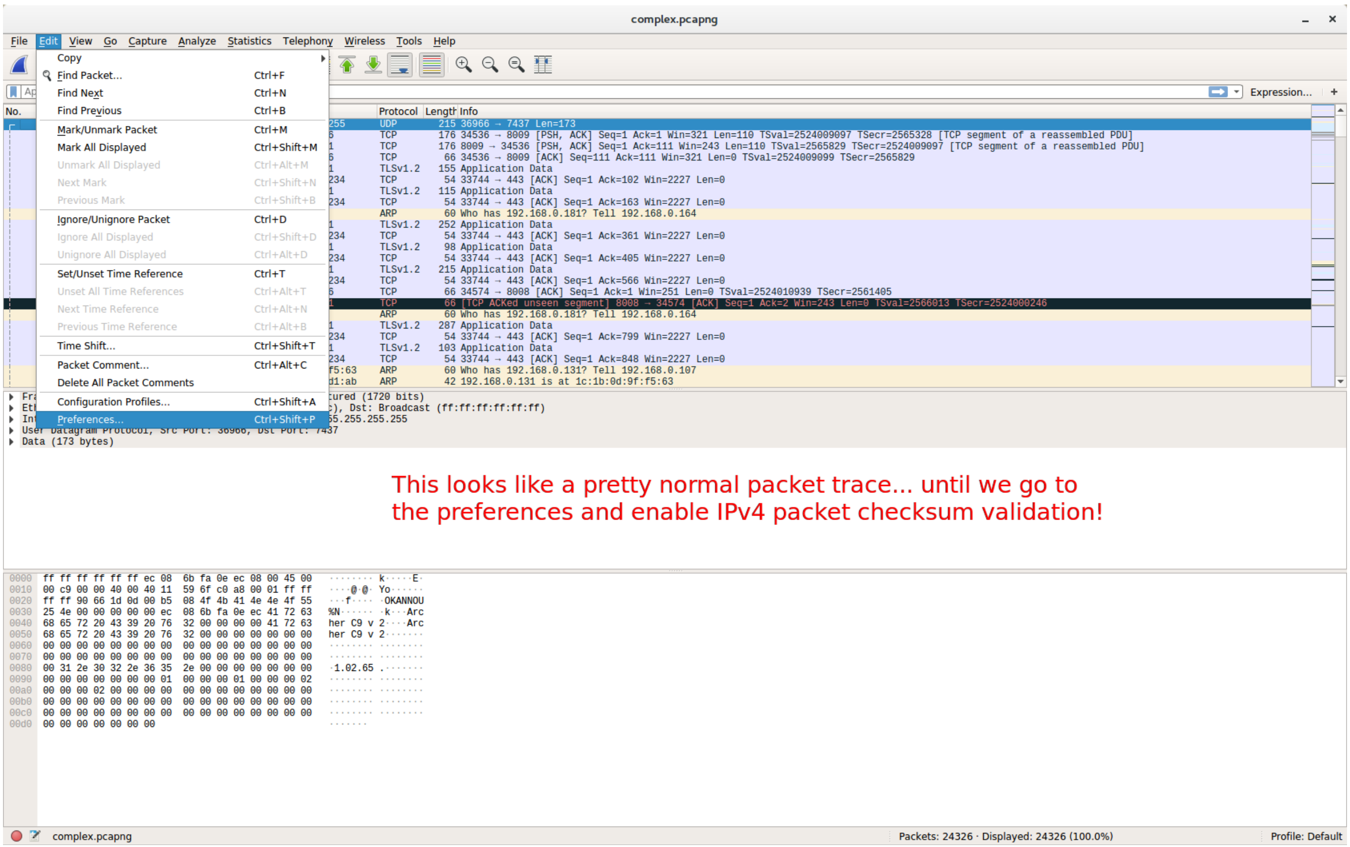
Theme: Network Traffic Analysis

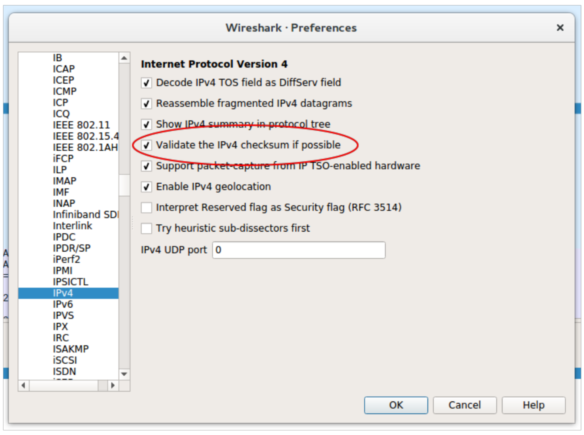
Tools Used:

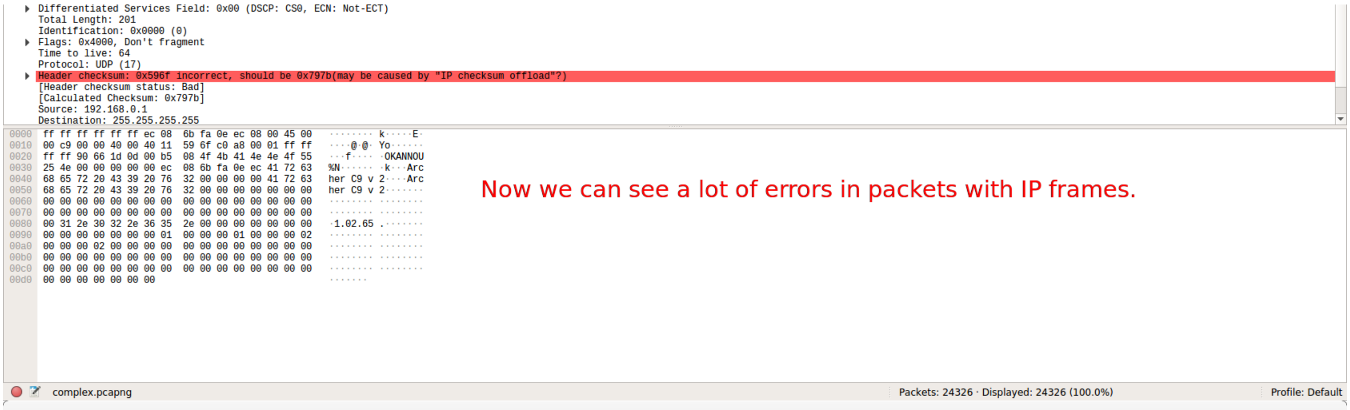
https://www.wireshark.org/

Can you find the flag in the captured network traffic below:

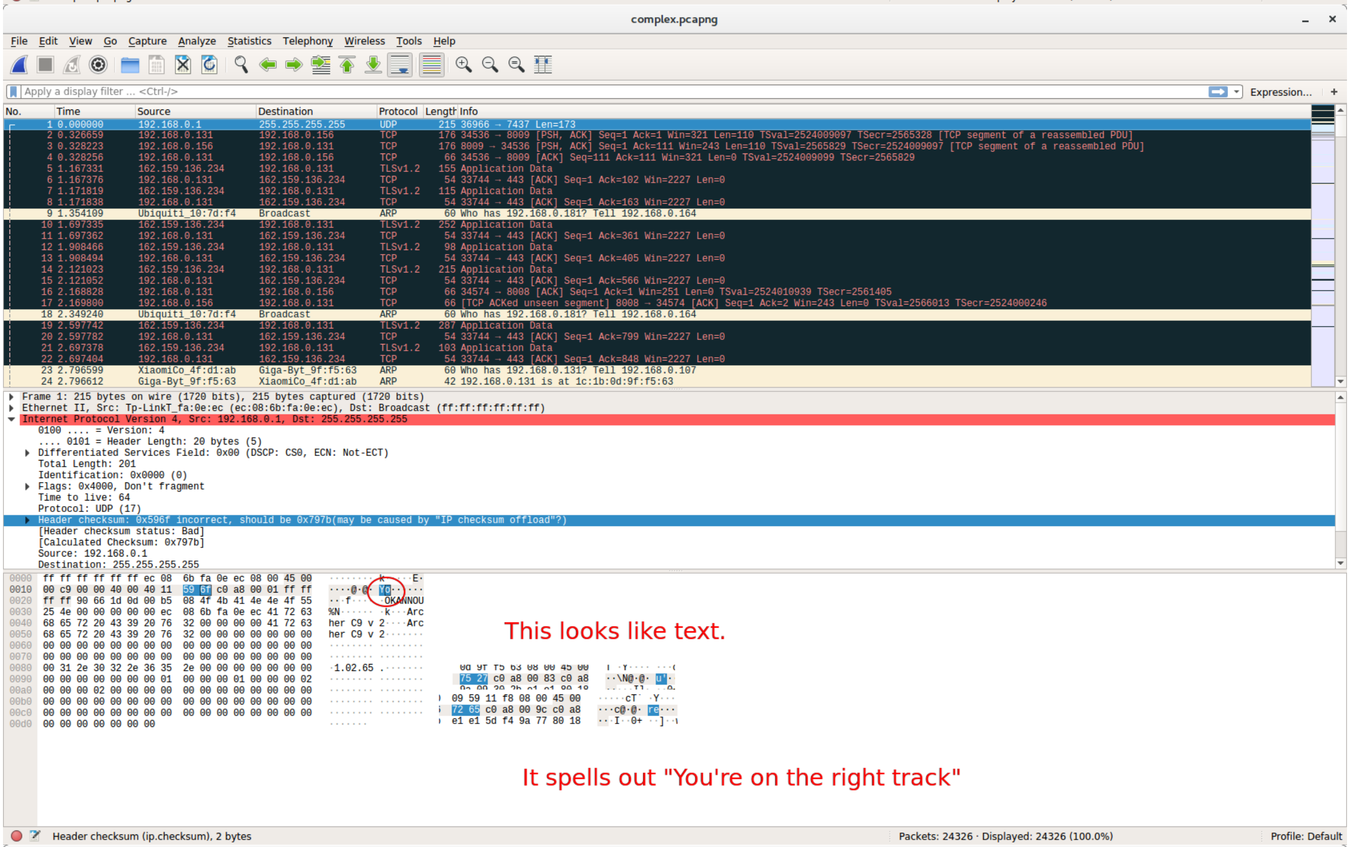
Click here for the file.





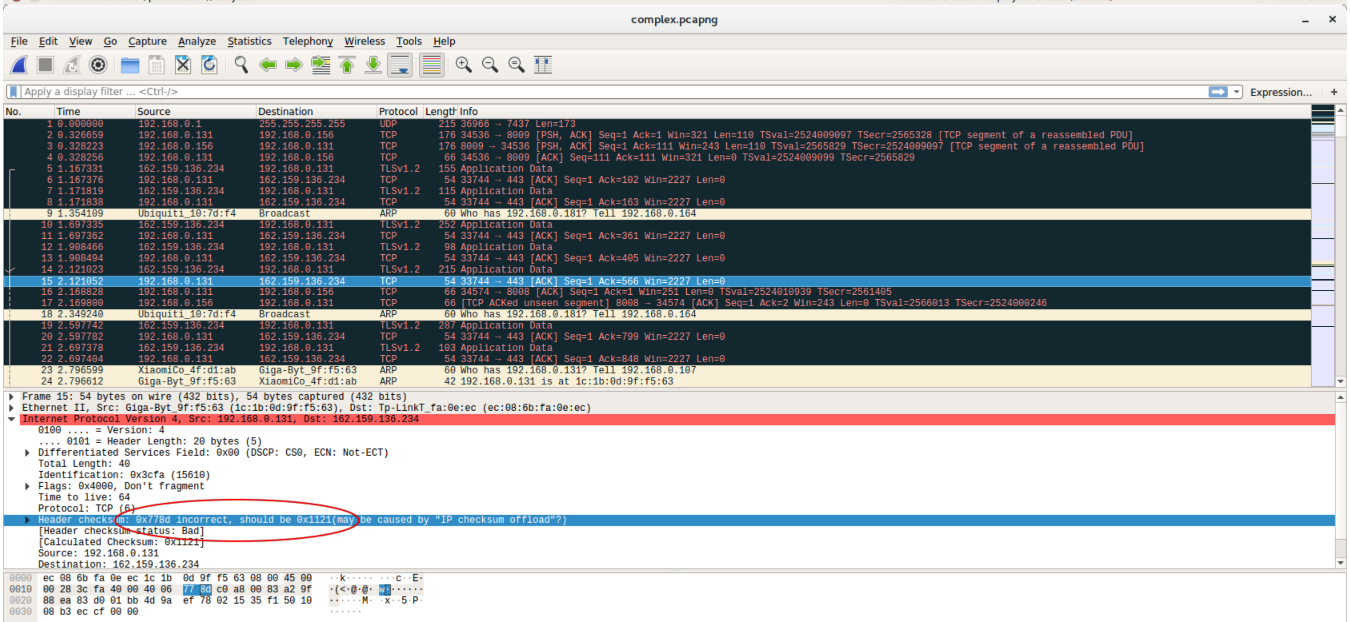


Now we can see a lot of errors in packets with IP frames.



This looks like text.

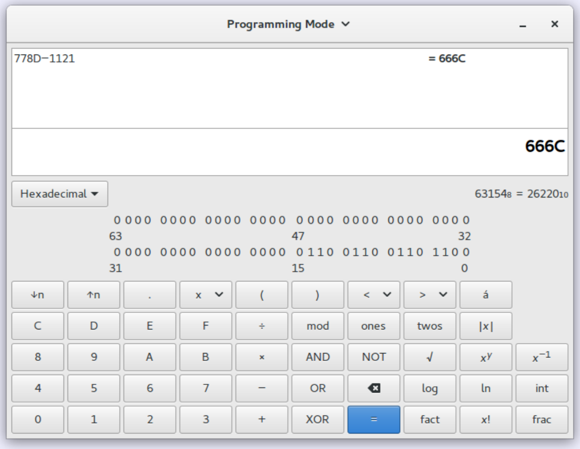
It spells out "You're on the right track"



The rest of the packets with invalid checksums aren't text,
but Wireshark does tell us what the valid checksum should be...

ASCII Table -- Printable Characters

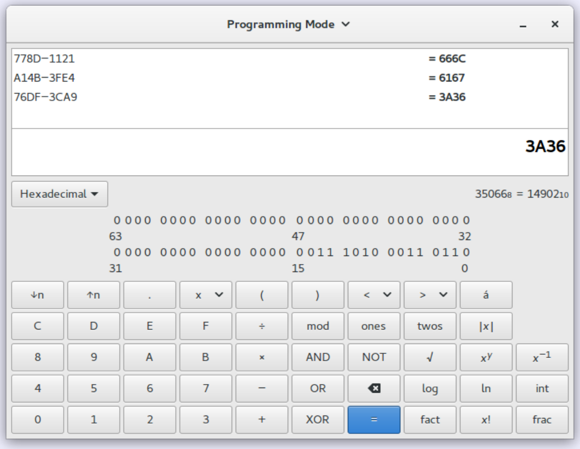
Character	Hex	Decimal	Character	Hex	Decimal	Character	Hex	Decimal
	20	32	@	40	64	`	60	96
!	21	33	A	41	65	a	61	97
"	22	34	B	42	66	b	62	98
#	23	35	C	43	67	c	63	99
$	24	36	D	44	68	d	64	100
%	25	37	E	45	69	e	65	101
&	26	38	F	46	70	f	66	102
'	27	39	G	47	71	g	67	103
(	28	40	H	48	72	h	68	104
)	29	41	I	49	73	i	69	105
*	2a	42	J	4a	74	j	6a	106
+	2b	43	K	4b	75	k	6b	107
,	2c	44	L	4c	76	l	6c	108
-	2d	45	M	4d	77	m	6d	109
.	2e	46	N	4e	78	n	6e	110
/	2f	47	O	4f	79	o	6f	111
0	30	48	P	50	80	p	70	112
1	31	49	Q	51	81	q	71	113
2	32	50	R	52	82	r	72	114
3	33	51	S	53	83	s	73	115
4	34	52	T	54	84	t	74	116
5	35	53	U	55	85	u	75	117
6	36	54	V	56	86	v	76	118
7	37	55	W	57	87	w	77	119
8	38	56	X	58	88	x	78	120
9	39	57	Y	59	89	y	79	121
:	3a	58	Z	5a	90	z	7a	122
;	3b	59	[	5b	91	{	7b	123
<	3c	60	\	5c	92	|	7c	124
=	3d	61	]	5d	93	}	7d	125
>	3e	62	^	5e	94	~	7e	126
?	3f	63	_	5f	95	Delete	7f	127



Let's take the difference and compare it against our favourite ASCII table:
666C -> "fl", which is the first two letters of flag!

ASCII Table -- Printable Characters

Character	Hex	Decimal	Character	Hex	Decimal	Character	Hex	Decimal
	20	32	@	40	64	`	60	96
!	21	33	A	41	65	a	61	97
"	22	34	B	42	66	b	62	98
#	23	35	C	43	67	c	63	99
$	24	36	D	44	68	d	64	100
%	25	37	E	45	69	e	65	101
&	26	38	F	46	70	f	66	102
'	27	39	G	47	71	g	67	103
(	28	40	H	48	72	h	68	104
)	29	41	I	49	73	i	69	105
*	2a	42	J	4a	74	j	6a	106
+	2b	43	K	4b	75	k	6b	107
,	2c	44	L	4c	76	l	6c	108
-	2d	45	M	4d	77	m	6d	109
.	2e	46	N	4e	78	n	6e	110
/	2f	47	O	4f	79	o	6f	111
0	30	48	P	50	80	p	70	112
1	31	49	Q	51	81	q	71	113
2	32	50	R	52	82	r	72	114
3	33	51	S	53	83	s	73	115
4	34	52	T	54	84	t	74	116
5	35	53	U	55	85	u	75	117
6	36	54	V	56	86	v	76	118
7	37	55	W	57	87	w	77	119
8	38	56	X	58	88	x	78	120
9	39	57	Y	59	89	y	79	121
:	3a	58	Z	5a	90	z	7a	122
;	3b	59	[	5b	91	{	7b	123
<	3c	60	\	5c	92	|	7c	124
=	3d	61	]	5d	93	}	7d	125
>	3e	62	^	5e	94	~	7e	126
?	3f	63	_	5f	95	Delete	7f	127

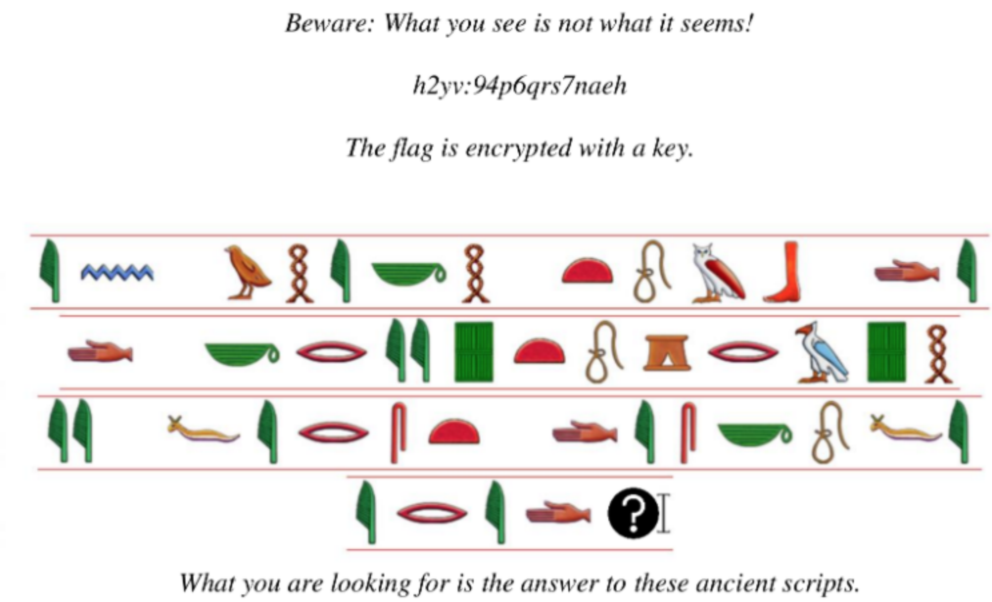


Here's the next few characters decoded. It spells "flag:6" so far... the rest of the characters are the rest of the flag.

Congratulations :)

R1 - Challenge 7

Theme: Cryptography



Beware: What you see is not what it seems!

h2yv:94p6qrs7naeh

The flag is encrypted with a key.

What you are looking for is the answer to these ancient scripts.

Solution

flag:qwh493dof2c0

This question is not a straightforward question as warned in the puzzle “Beware! What you see is not what it seems!”. Participants do not need to solve the hieroglyphs to get the flag. However, the hieroglyphs serve as a clue that the decoder used needs a key.

Hieroglyphs – In Whose Tomb Did Cryptography First Discovered? https://discoveringegypt.com/Hieroglyph-typewriter-ipad.html

Answer: Khnumhotep II

Cipher used: Vinegère Cipher Key: cryptii (default key from cryptii.com)

You will need to append 0123456789 to the end of the alphabet since it is an alphanumeric cipher.

R1 - Challenge 8

Theme: Reverse Engineering

Click here to download the binary

In the reversing challenge, the goal was to extract a 128-bit AES key from the binary and use it to communicate with the C2 server. The purpose of the challenge was to show that, alone, a secure cypher mode is not a sufficient authentication factor.

The intended solution was the use of Ghidra; however, other options of extracting the keys are equally as valid. To this end, the binary utilises a few anti-debugging techniques.

The key is constructed from three locations within the binary and loaded into memory. From here, OpenSSL talks to the C2 server transmitted an AES-128-GCM encrypted packet containing uint$32_t(1). Ifapacketissentcontaininguint32_t(0), theC$

Solution Code: getFlag.py

from cryptography.hazmat.primitives.ciphers.aead import AESGCM import os import struct import requests

The Key needs to be reversed The solution has this key in secret.key key = quot;quot; with open(quot;secret.keyquot;, quot;rbquot;) as f: key = f.read()

The request for a flag is uint$32_t(0) AEADisused, soflippingacyphertextbitwon39; twork$

Context aesgcmctx = AESGCM(key)

Payload and IV payload = struct.pack(quot;Iquot;, 0) iv = os.urandom(16)

Encrypt and append cyphertext = iv + aesgcmctx.encrypt(iv, payload, None)

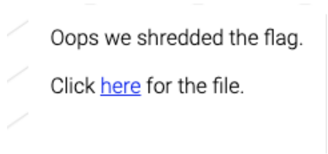
Get the flag cryptflag = requests.post(quot;http://sushi.nzcsc.org.nz/c2quot;, data=cyphertext).content

Decrypt it! cfiv = cryptflag[:16] cfdata = cryptflag[16:] print(quot;Got: quot;.format(aesgcmctx.decrypt(cfiv, cfdata, None).decode()))

R1 - Challenge 10

Theme: Shredded File

Tools Used: To solve the challenge, we first run the binary file.



The above image shows the result of running shred.bin. The text is "Ooops, your important files are shredded. To obtain the shredded parts, you need to pay xxxx NZD. The price can be negotiated :D " Of course, we will not be paying to retrieve the file back, but we could try running "strings" on the file.

After running the "strings" command, you will find that the file contains .zip file. We could extract the zip file by using online tools like CyberChef. Extracting .zip file will result in 10 files of secret where each of the files contains some form of string. The string is encoded Base64.

Since the original binary file's name is shred, we could expect that an original secret file is shredded into these 10 parts of secret. However, concatenating these 10 parts of shredded will not work. The result of running shred.bin is a hint to solve this challenge. As can be seen that the result of running shred.bin contains 10 vertical lines. This hints that the first character in the original file will be in the first shredded part, the second character of the original file will be in the second shredded part, so on and so forth. We can combine the files manually or write a script to work for us. The below python script can be used to combine the files.

!/usr/bin/python3

files = []

for i in range(10): with open(quot;secret.partquot; + str(i+1), quot;rquot;) as file: files.append(file.read())

output = 39;39;

for char in range(len(files[0])): for i in range(10): if char == len(files[i]): continue else: output += files[i][char]

print(output)

This results in

QSBwYXBlciBzaHJlZGRlciBpcyBhIG1lY2hhbmljYWwgZGV2aWNlIHVzZWQgdG8gY 3V0IHBhcGVyIGludG8gZWl0aGVyI
2ZXJubWVudCBvcmdhbml6YXRpb25zLCBidXNpbmVzc2VzLCBhbmQgcHJpdmF0Z SBpbmRpdmlkdWFscyB1c2Ugc2hyZW
Y29uZmlkZW50aWFsLCBvciBvdGhlcndpc2Ugc2Vuc2l0aXZlIGRvY3VtZW50cy4gU2 hyZWRkaW5nIHRvdGFsbHkgd29ya3M
bGVhc2UgcmVtZW1iZXIgdGhhdCB0aGlzIGlzIG91ciB0b3Agc2VjcmV0IGZpbGUuIEt lZXAgaXQgc2FmZSEgZmxhZzo2c2c0c

Finally, online tool such as Cryptii, can be used to decode the Base64 string. The decoded string contains flag,

flag:6sg4s1ax0n2, at the end.

R1 - Challenge 11

Bob's computer has been pwned and some of his important files were encrypted by a ransomware. Can you help him retrieve the data from the memory dump?
Hint: Bob loves Notepad

Click here for the memory file.

In challenge 11 we are presented with a memory file. The unintended solution is to run either strings or grep on it and the flag is shown in plaintext. The intended solution is described as follows. We first download the memory file and used volatility to identify the profile using the imageinfo option.

We can then perform more analysis using this profile option. For example, we can observe the various commands that were executed using the cmdscan utility.

From here, we can observe several interesting things. 1. There is a powershell command that was executed 2. We know the content of key.txt We can base64 decode the powershell command to see what it's doing.

It is downloading a ransomware.exe from a url. We can then proceed to download that ransomware. Once we obtain the executable, we can do a simple strings analysis on it. We could observe several python libraries in the strings output.

We assume it was compiled with pyinstaller and proceed to decompiling it. We could use a Pyinstaller Extractor (https://github.com/extremecoders-re/pyinstxtractor) for this.

We have now obtained the compiled bytecode file ransomware.pyc. To decompile this back to source file, we can use the tool decompyle3 for this (https://github.com/rocky/python-decompile3).

We can see from the source code that it's encrypting files in AES CBC mode with an IV of 'abcdefghijklmnop' hardcoded in the source file. It also writes the sentence "Encrypted Data" before the encrypted data. Now we have the key and the IV to

decrypt the encrypted files. As the hint suggested, we should have a look at the Notepad memory. We can use volatility for this.

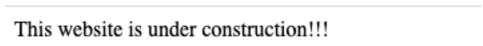
We first list the processes using pslist. And then find the PID of notepad and dump the memory of it. We can do a strings on the memory dump because the encrypted data was written to the file in base64.

Next we can open up strings.dmp and search for the text "Encrypted Data". We will see the encrypted data in base64.

Finally, we use CyberChef to decrypt the data.

Flag: flag:RUpF6X0dntqV

R1 - Challenge 12



This is a Server-Side Template Injection (SSTI) challenge. There are various ways to solve this, but all solutions were based on the insecure usage of the `render_template_string()` function. Upon visiting the website, we are presented with a text saying the website is under construction.

However, robots.txt showed two hidden directories.

Navigating to the /secretagent directory, we can observe the webapp. When clicking the button, it shows our User Agent string.

The other directory /secretsource shows the source code of this webapp. It shows that it's a simple Flask app. During the analysis, we can observe several interesting things.

1. The flag is read from app/flag.txt and stored in the secret variable in the app's config. 2. The User Agent string is passed to an initial filter which rejects any strings with unwanted characters or strings. 3. A length check of 70 is then performed on the User Agent string 4. If the string "s3cr3tAg3nt" is present in the User Agent string, it returns a fake flag.

The vulnerability lies in the usage of `render_template_string`, which allowed code injection from user-supplied inputs. We could observe this by capturing the request in Burp and sending it to Repeater.

We can see that the supplied input 7*7 was evaluated to 49. This confirms the vulnerability and we can proceed to exploitation.

Normally, we could just read the config variable by the payload config. However, since it is disallowed, we could not use it.

However, we could reference the config variable from the `url_for` function's `__globals__` attribute. So an ideal payload would be the following.

However, we still need to bypass the WAF. Fortunately we can use the disallowed strings and characters by referencing from the request.args variables.

Now all that is left is to bypass the length restriction. We can overcome this by setting variables in jinja. For example, rest of the payload. We can also add the secret variable for displaying it more clearly.

Flag: flag:cjf1nnsfpo2b