# Module 10: Denial-of-Service

## 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.

## 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

## 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:

1. Perform DoS and DDoS attacks using various Techniques
    - Perform a DoS attack (SYN flooding) on a target host using Metasploit
    - Perform a DoS attack on a target host using hping3
    - Perform a DoS attack using Raven-storm
    - Perform a DDoS attack using HOIC
    - Perform a DDoS attack using LOIC
2. Detect and protect against DoS and DDoS attacks

- Detect and protect against DDoS attacks using Anti DDoS Guardian

# Lab 1: Perform DoS and DDoS Attacks using Various Techniques

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

**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
- **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

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

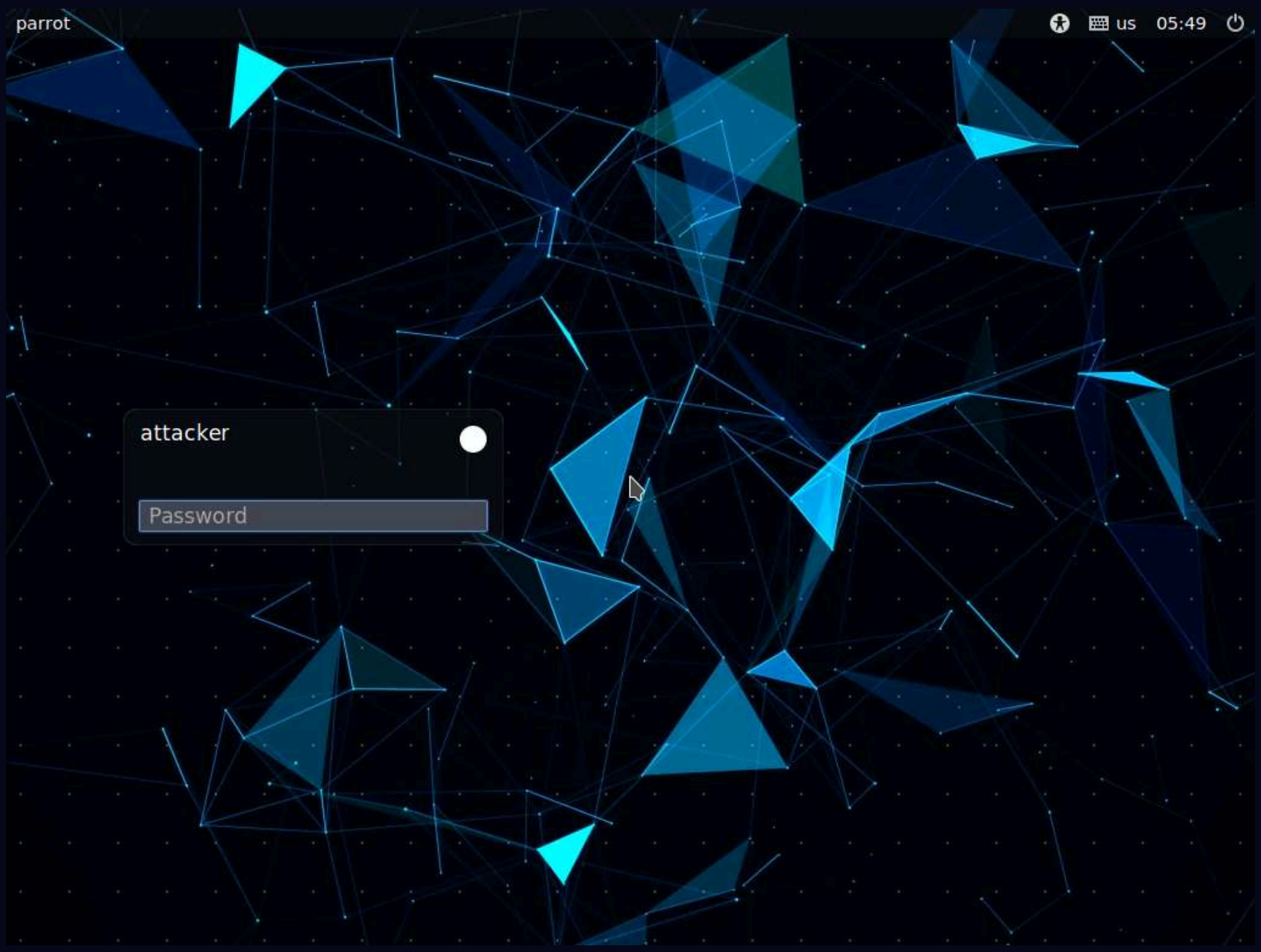
SYN flooding takes advantage of a flaw with regard to how most hosts implement the TCP three-way handshake. This attack occurs when the intruder sends unlimited SYN packets (requests) to the host system. The process of transmitting such packets is faster than the system can handle. Normally, the connection 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.

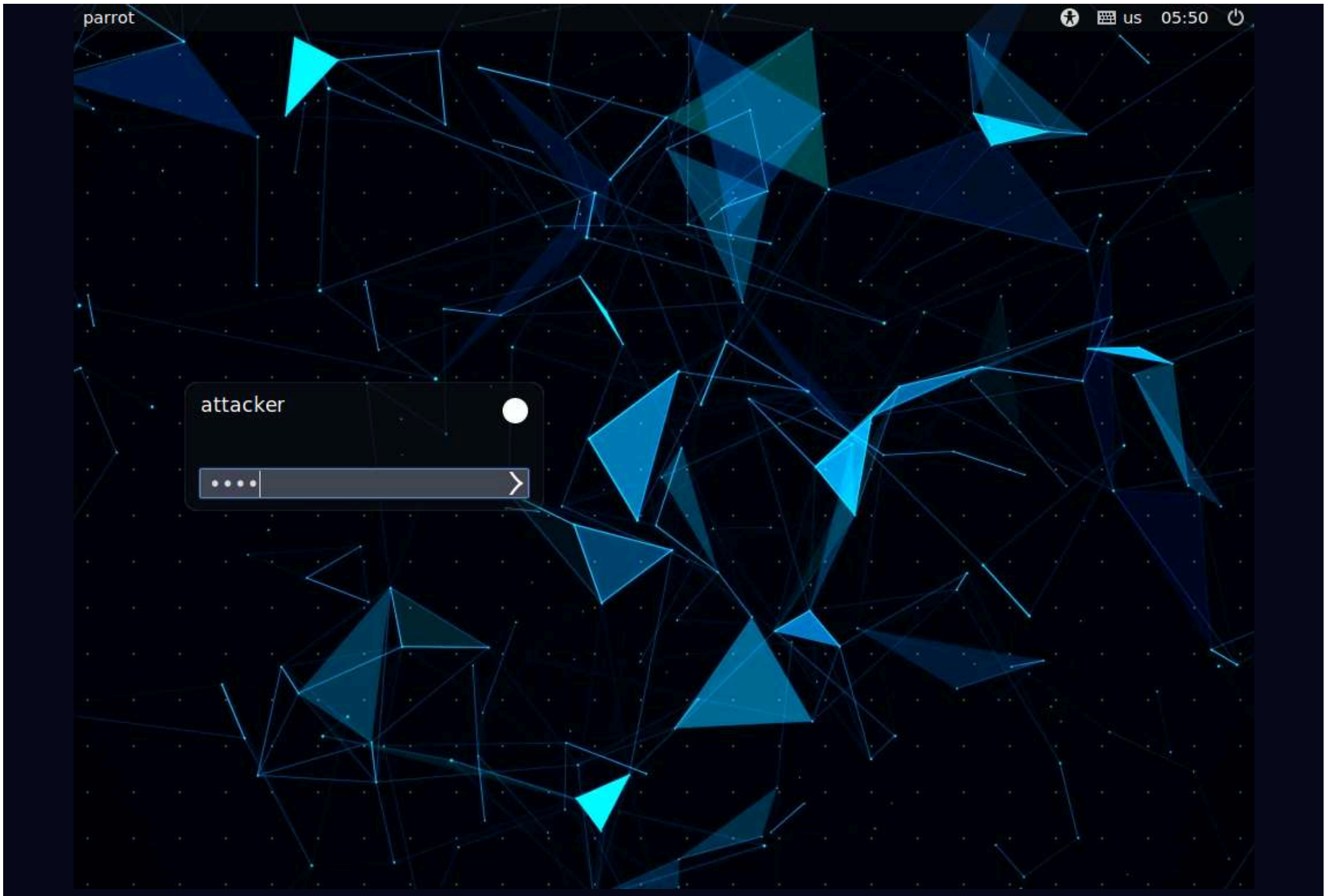
Here, we will use the Metasploit tool to perform a DoS attack (SYN flooding) on a target host.

> 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. By default, the **Parrot Security** machine is selected.

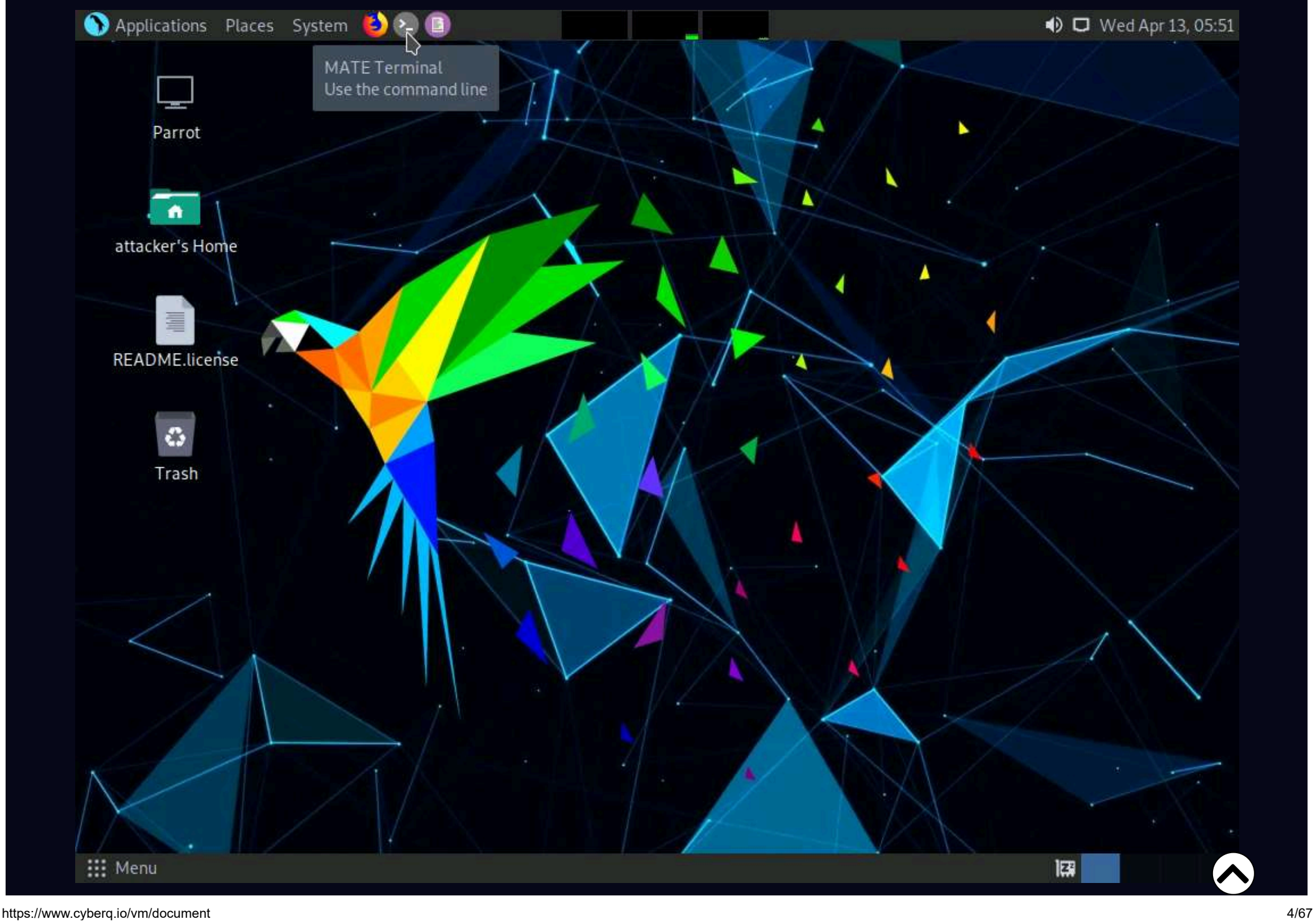



2. In the login page, the **attacker** username will be selected by default. Enter password as **toor** in the **Password** field and press **Enter** to log in to the machine.




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 for you to update the machine, click **No** to close the window.

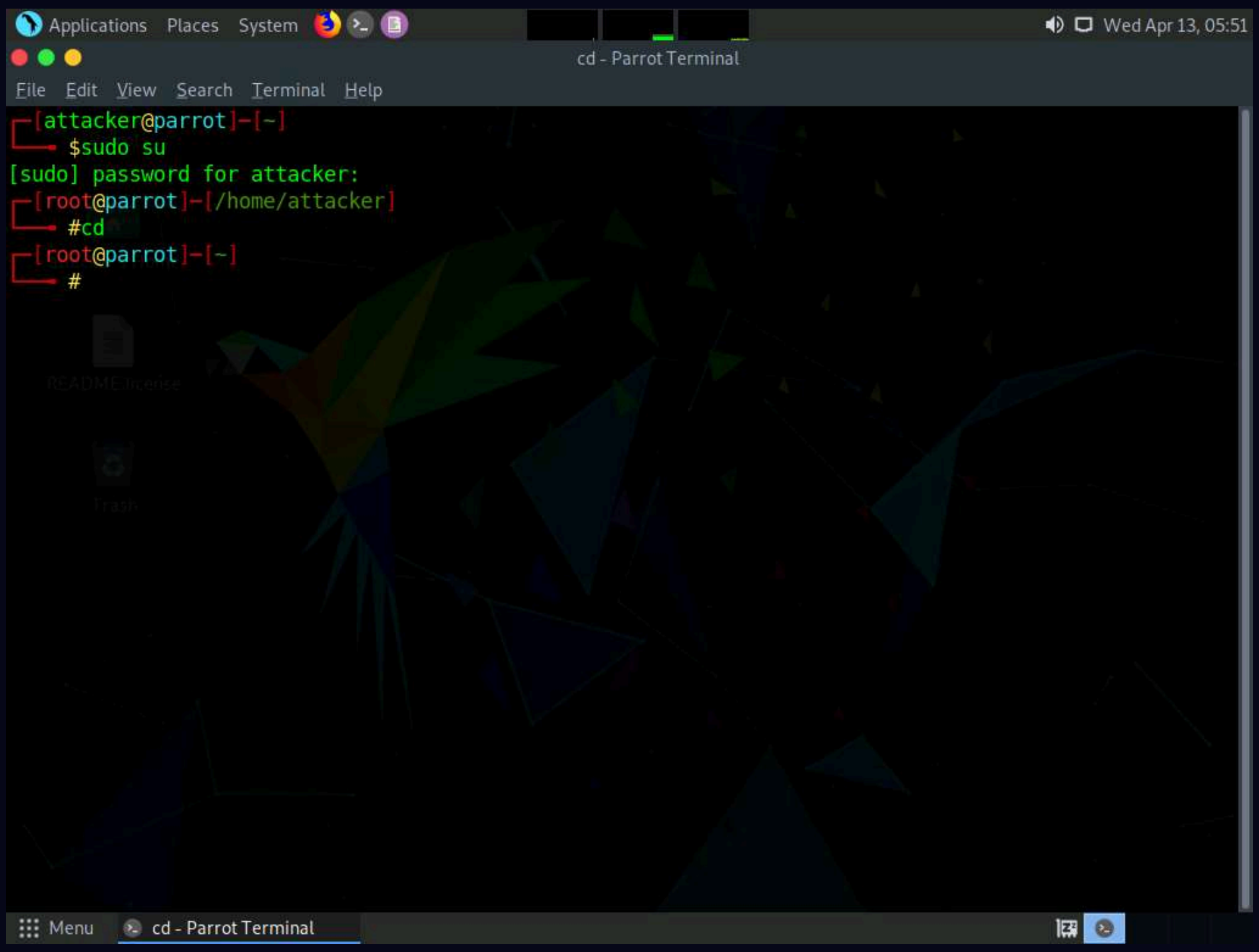


4. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

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.

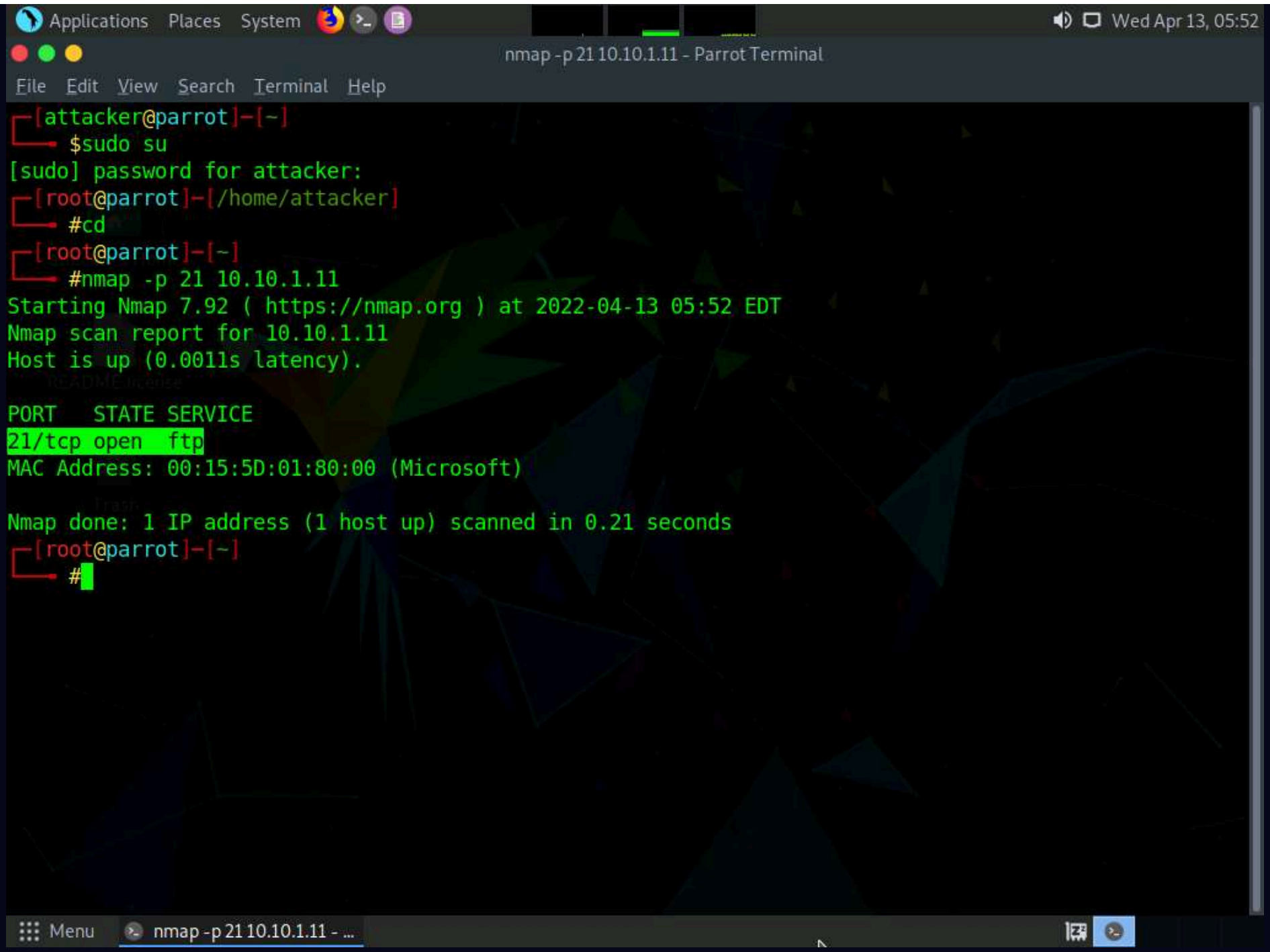



7. First, determine whether port 21 is open or not. This involves using Nmap to determine the state of the port.

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.

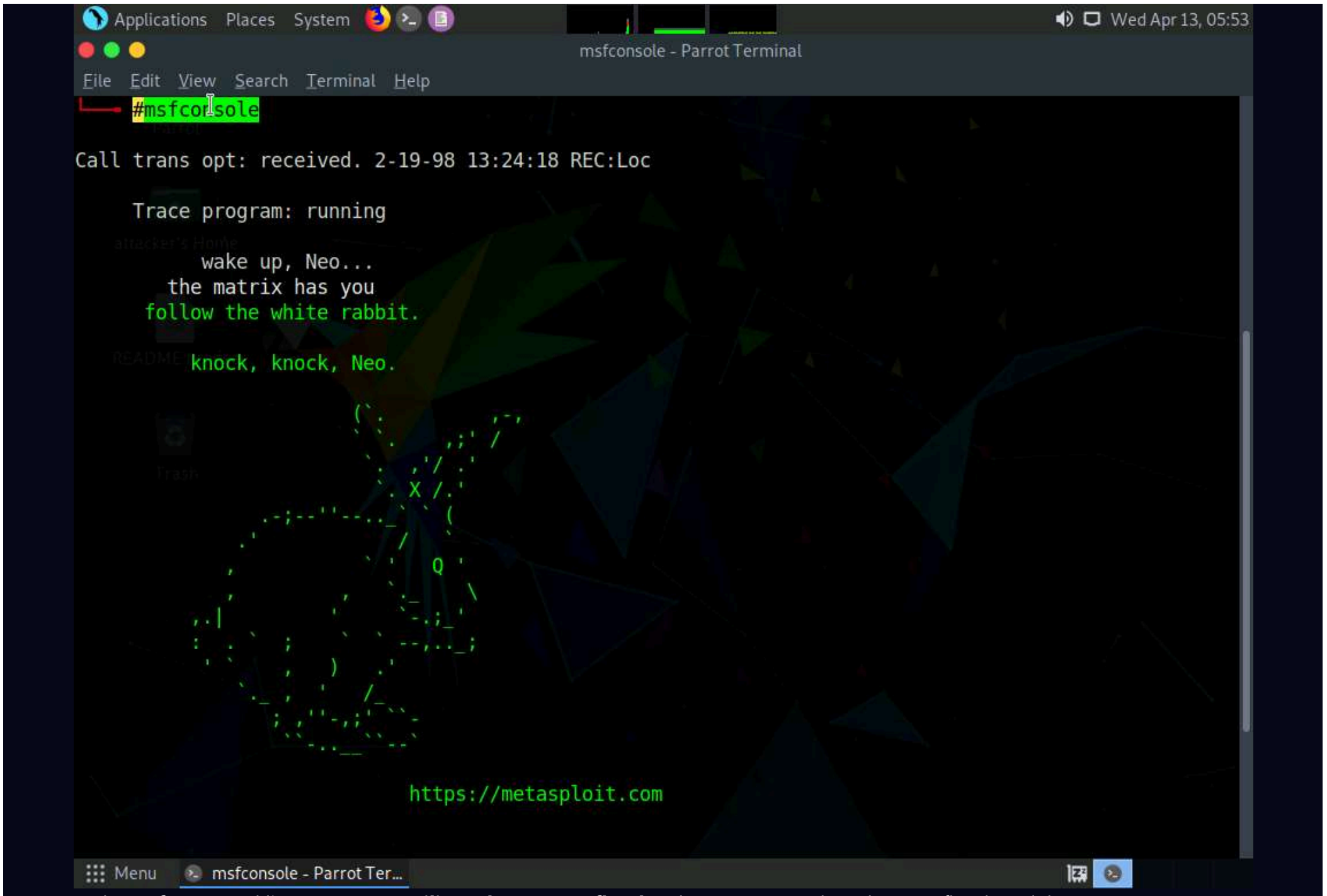
9. The result appears, displaying the port status as open, as shown in the screenshot.



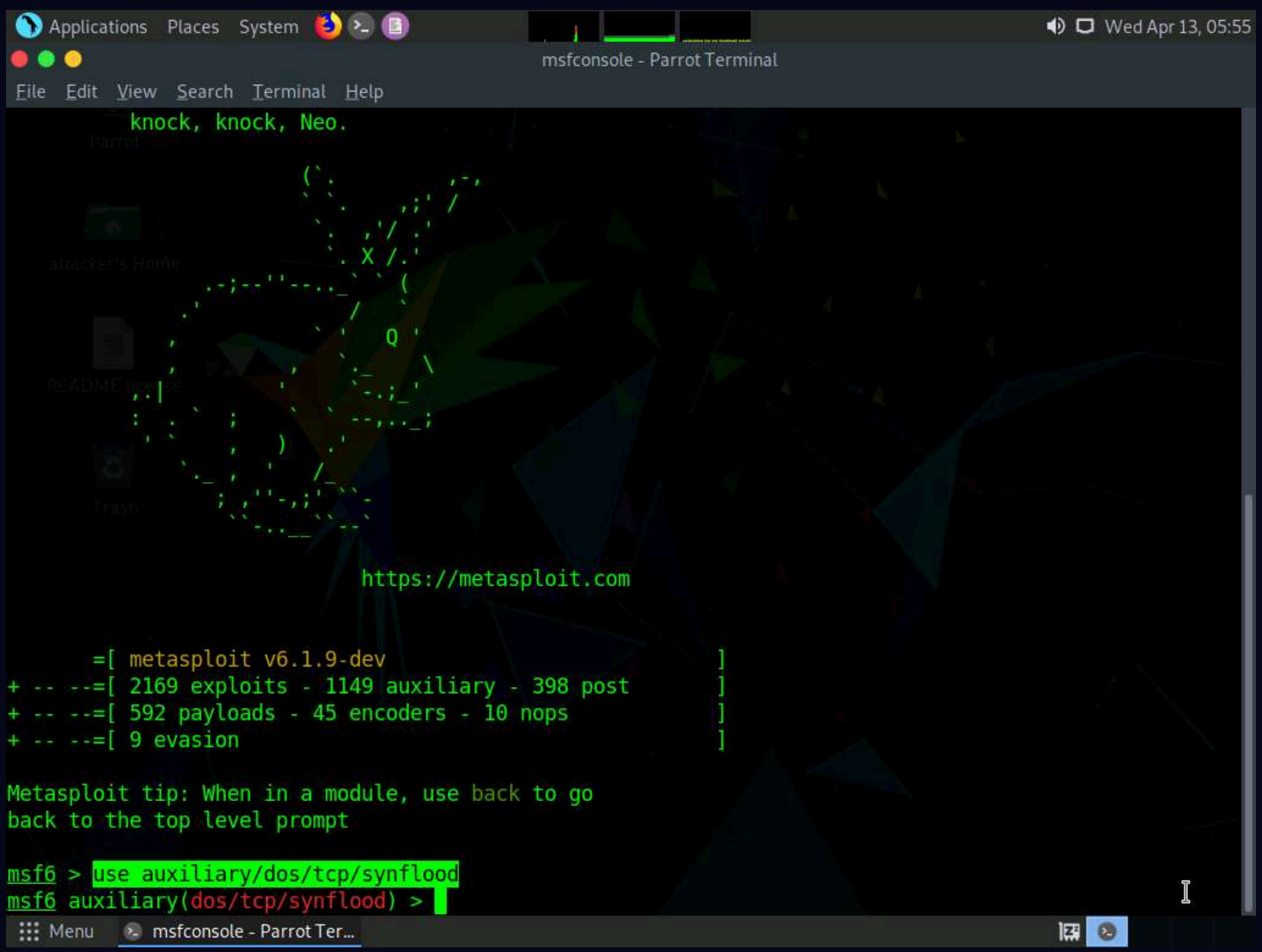

10. Now, we will perform SYN flooding on the target machine (**Windows 11**) using port 21.

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

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

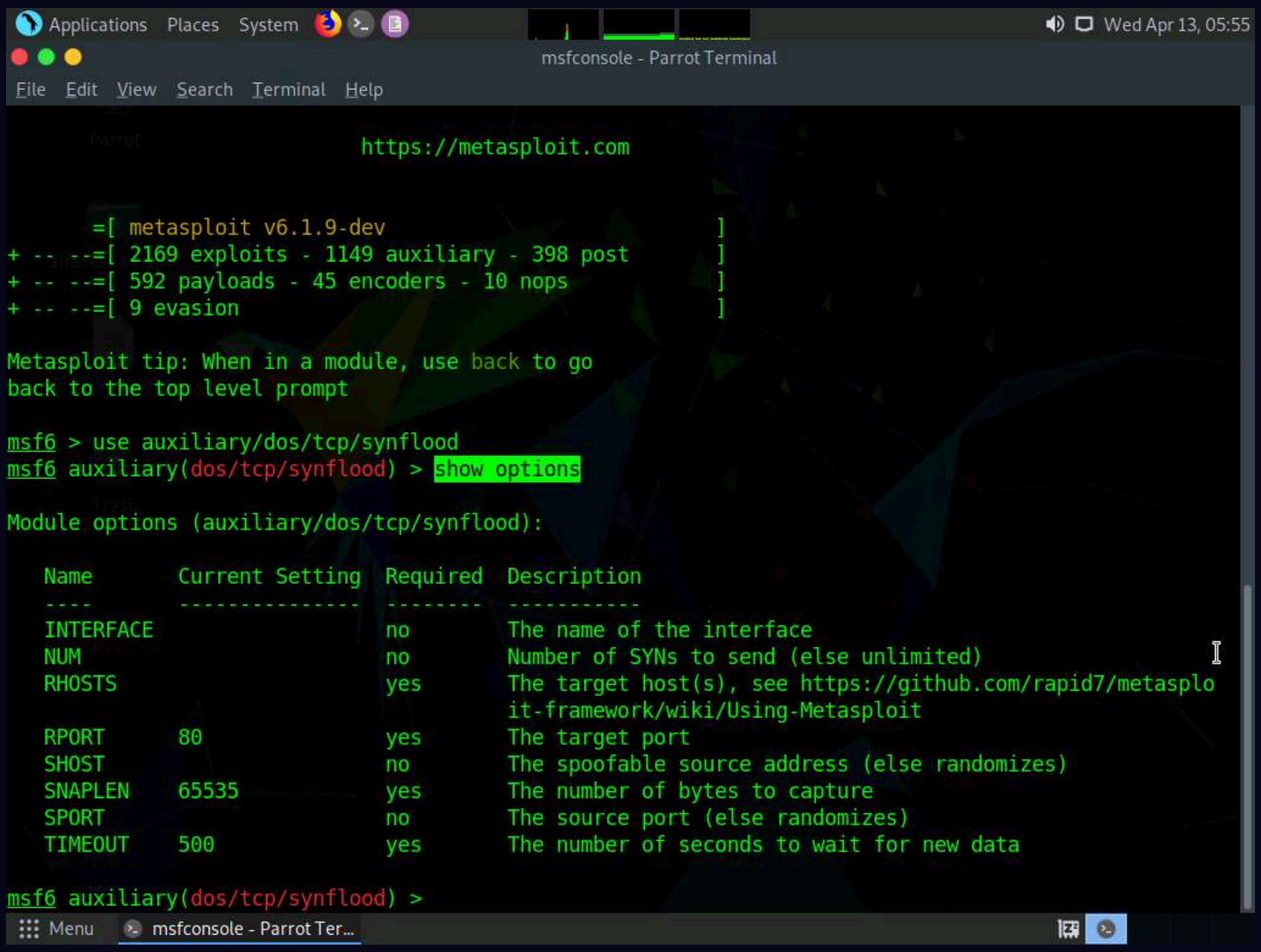



13. In the **msf** command line, type **use auxiliary/dos/tcp/synflood** and press **Enter** to launch a SYN flood module.




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.




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.

```
Applications  Places  System                                   Wed Apr 13, 06:00
                                  msfconsole - Parrot Terminal
File  Edit  View  Search  Terminal  Help
+ -- --=[ 592 payloads - 45 encoders - 10 nops            ]
+ -- --=[ 9 evasion                                       ]

Metasploit tip: When in a module, use back to go
back to the top level prompt

msf6 > use auxiliary/dos/tcp/synflood
msf6 auxiliary(dos/tcp/synflood) > show options

Module options (auxiliary/dos/tcp/synflood):

   Name       Current Setting  Required  Description
   ----       ---------------  --------  -----------
   INTERFACE                   no        The name of the interface
   NUM                         no        Number of SYNs to send (else unlimited)
   RHOSTS                      yes       The target host(s), see https://github.com/rapid7/metasplo
                                         it-framework/wiki/Using-Metasploit
   RPORT      80               yes       The target port
   SHOST                       no        The spoofable source address (else randomizes)
   SNAPLEN    65535            yes       The number of bytes to capture
   SPORT                       no        The source port (else randomizes)
   TIMEOUT    500              yes       The number of seconds to wait for new data

msf6 auxiliary(dos/tcp/synflood) > set RHOST 10.10.1.11
RHOST => 10.10.1.11
msf6 auxiliary(dos/tcp/synflood) > set RPORT 21
RPORT => 21
msf6 auxiliary(dos/tcp/synflood) > set SHOST 10.10.1.19
SHOST => 10.10.1.19
msf6 auxiliary(dos/tcp/synflood) >
Menu   msfconsole - Parrot Ter...
```

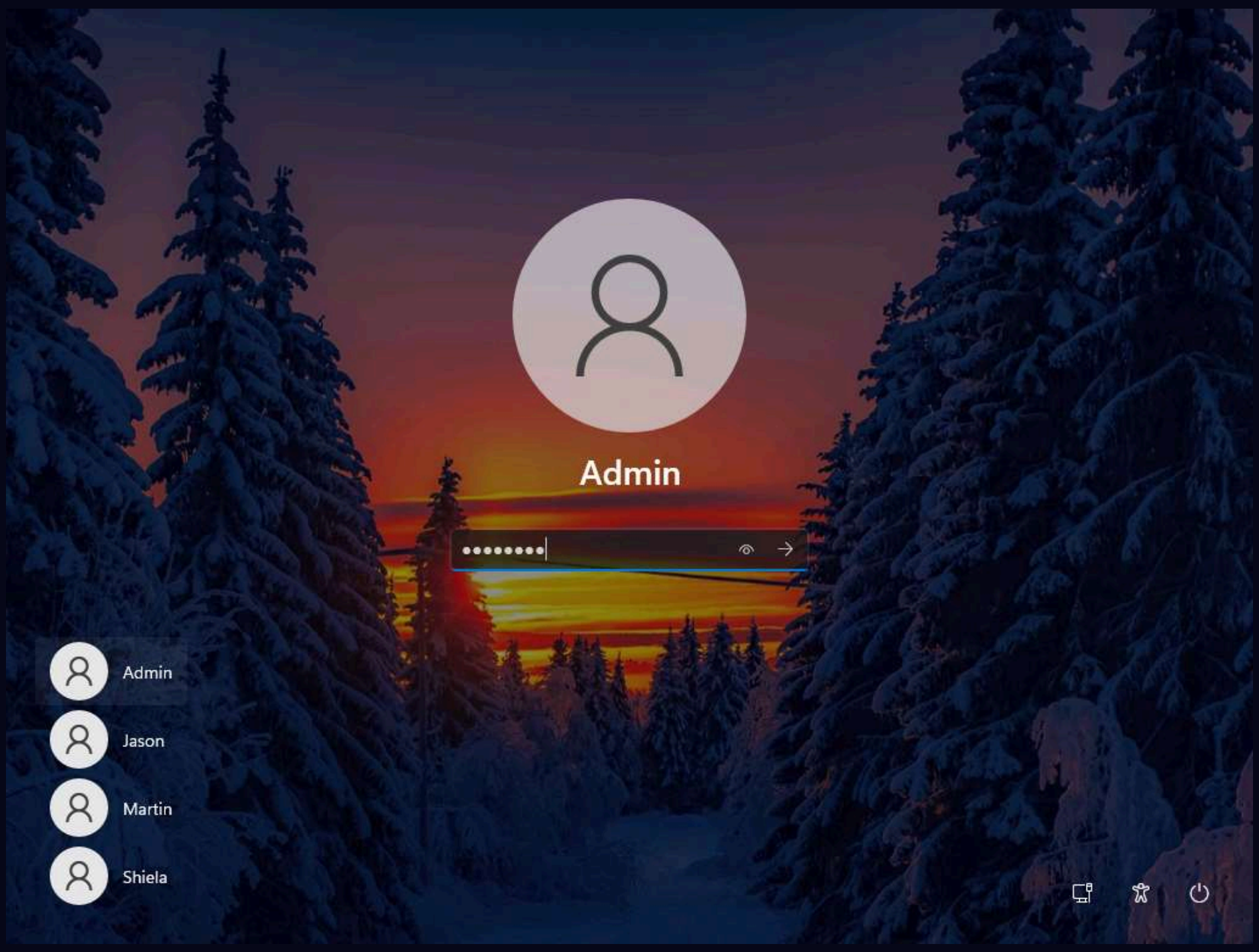
18. Once the auxiliary module is configured with the required options, start the DoS attack on the **Windows 11** machine.

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

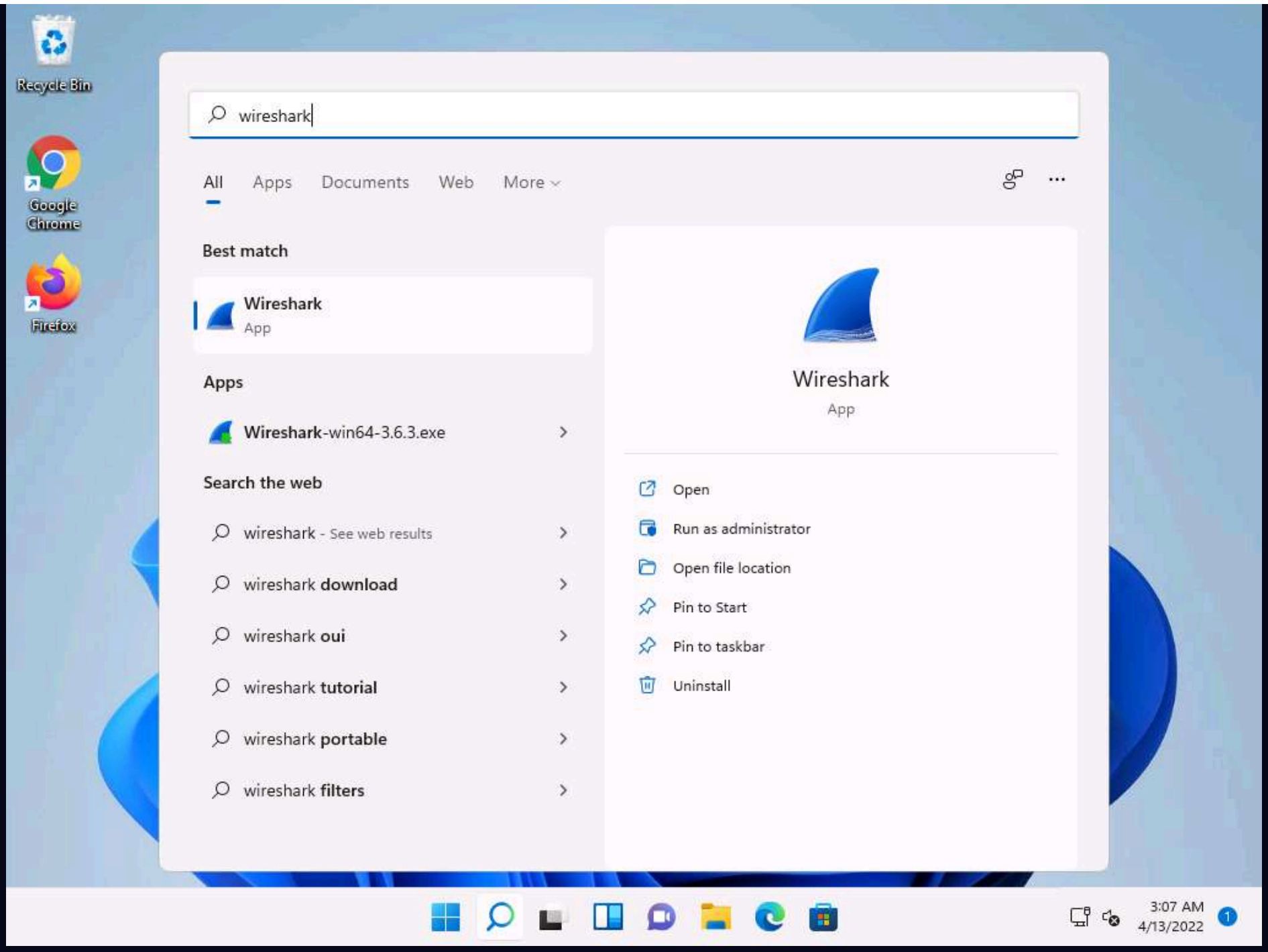
```
Applications  Places  System                                   Wed Apr 13, 06:00
                                  msfconsole - Parrot Terminal
File  Edit  View  Search  Terminal  Help
back to the top level prompt

msf6 > use auxiliary/dos/tcp/synflood
msf6 auxiliary(dos/tcp/synflood) > show options

Module options (auxiliary/dos/tcp/synflood):

   Name       Current Setting  Required  Description
   ----       ---------------  --------  -----------
   INTERFACE                   no        The name of the interface
   NUM                         no        Number of SYNs to send (else unlimited)
   RHOSTS                      yes       The target host(s), see https://github.com/rapid7/metasplo
                                         it-framework/wiki/Using-Metasploit
   RPORT      80               yes       The target port
   SHOST                       no        The spoofable source address (else randomizes)
   SNAPLEN    65535            yes       The number of bytes to capture
   SPORT                       no        The source port (else randomizes)
   TIMEOUT    500              yes       The number of seconds to wait for new data

msf6 auxiliary(dos/tcp/synflood) > set RHOST 10.10.1.11
RHOST => 10.10.1.11
msf6 auxiliary(dos/tcp/synflood) > set RPORT 21
RPORT => 21
msf6 auxiliary(dos/tcp/synflood) > set SHOST 10.10.1.19
SHOST => 10.10.1.19
msf6 auxiliary(dos/tcp/synflood) > exploit
[*] Running module against 10.10.1.11

[*] SYN flooding 10.10.1.11:21...
Menu   msfconsole - Parrot Ter...
```

20. To confirm, click **CEHv12 Windows 11** to switch to the **Windows 11** 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.

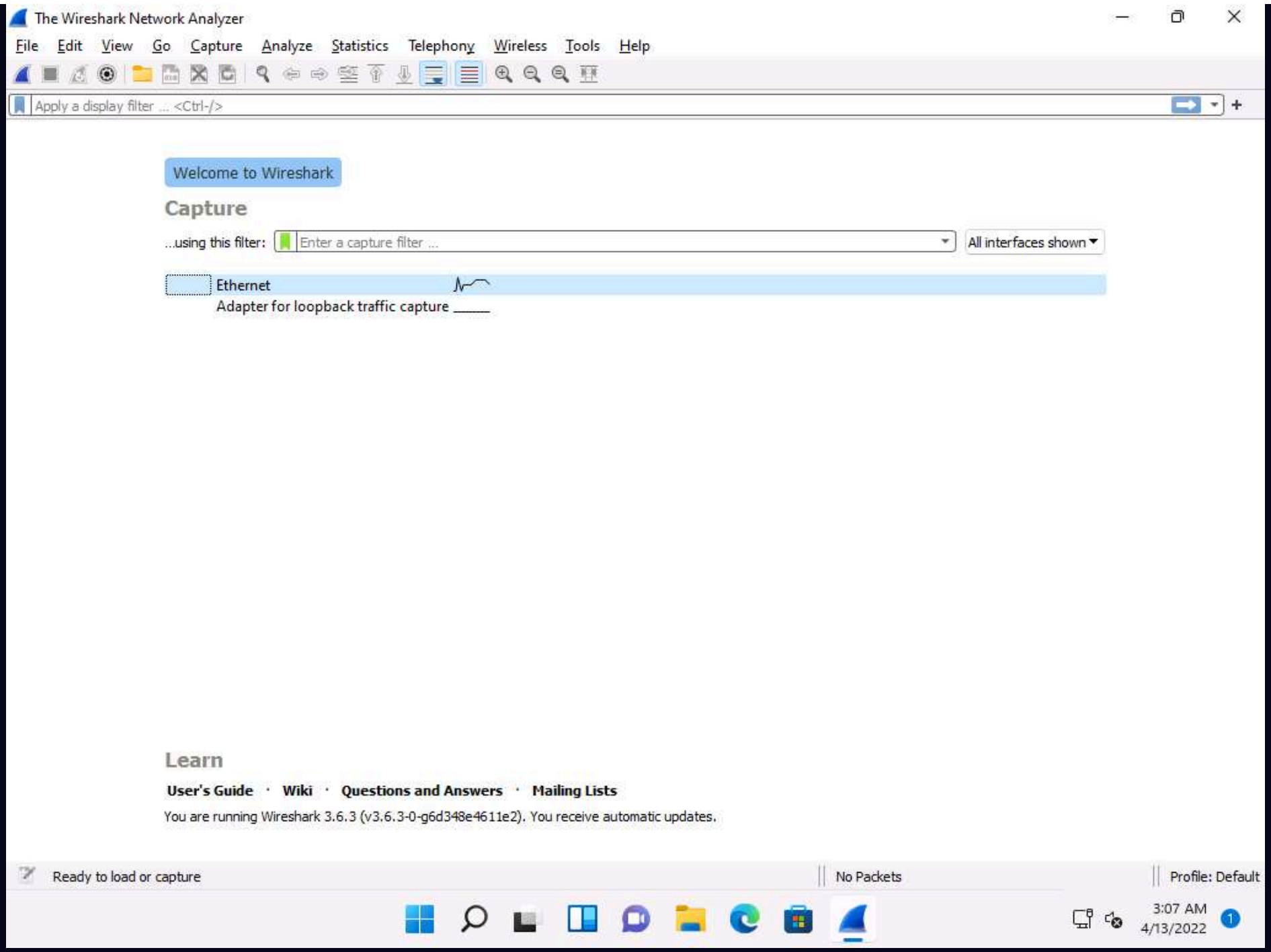



21. Click **Search** icon ( ) on the **Desktop**. Type **wireshark** in the search field, the **Wireshark** appears in the results, click **Open** to launch it.

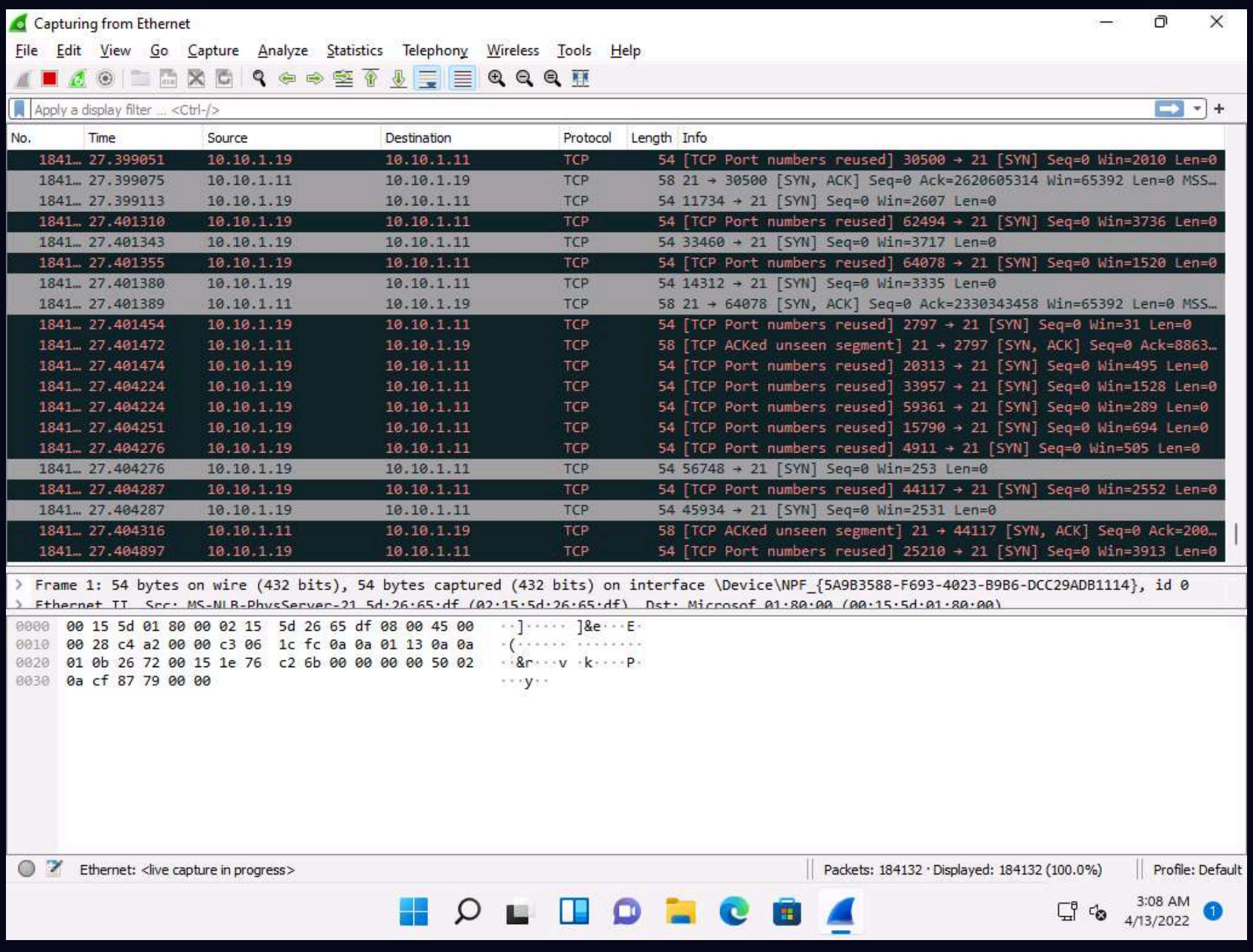



22. The **Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

| |
|---|
| Note: The network interface might differ when you perform the task.<br><br>Note: If a **Software Update** pop-up appears click on **Remind me later**. |

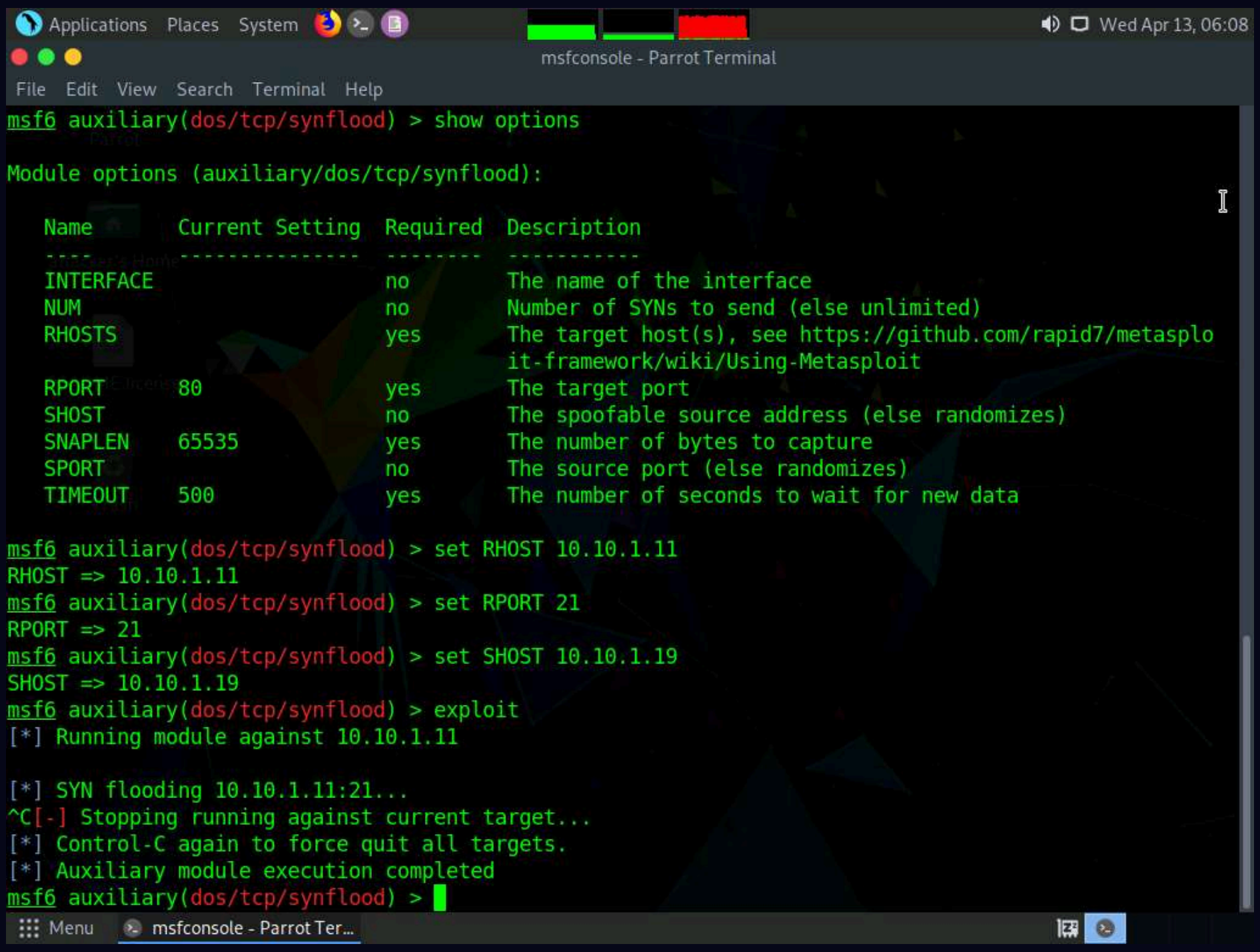



23. **Wireshark** displays the traffic coming from the machine. Here, you can observe that the **Source IP** address is that of the **Windows Server 2019** (10.10.1.19) machine. This implies that the IP address of the **Parrot Security** machine has been spoofed.



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, click on **CEHv12 Parrot Security** to switch to the **Parrot Security** machine and press **Ctrl+C** to terminate the attack.




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.

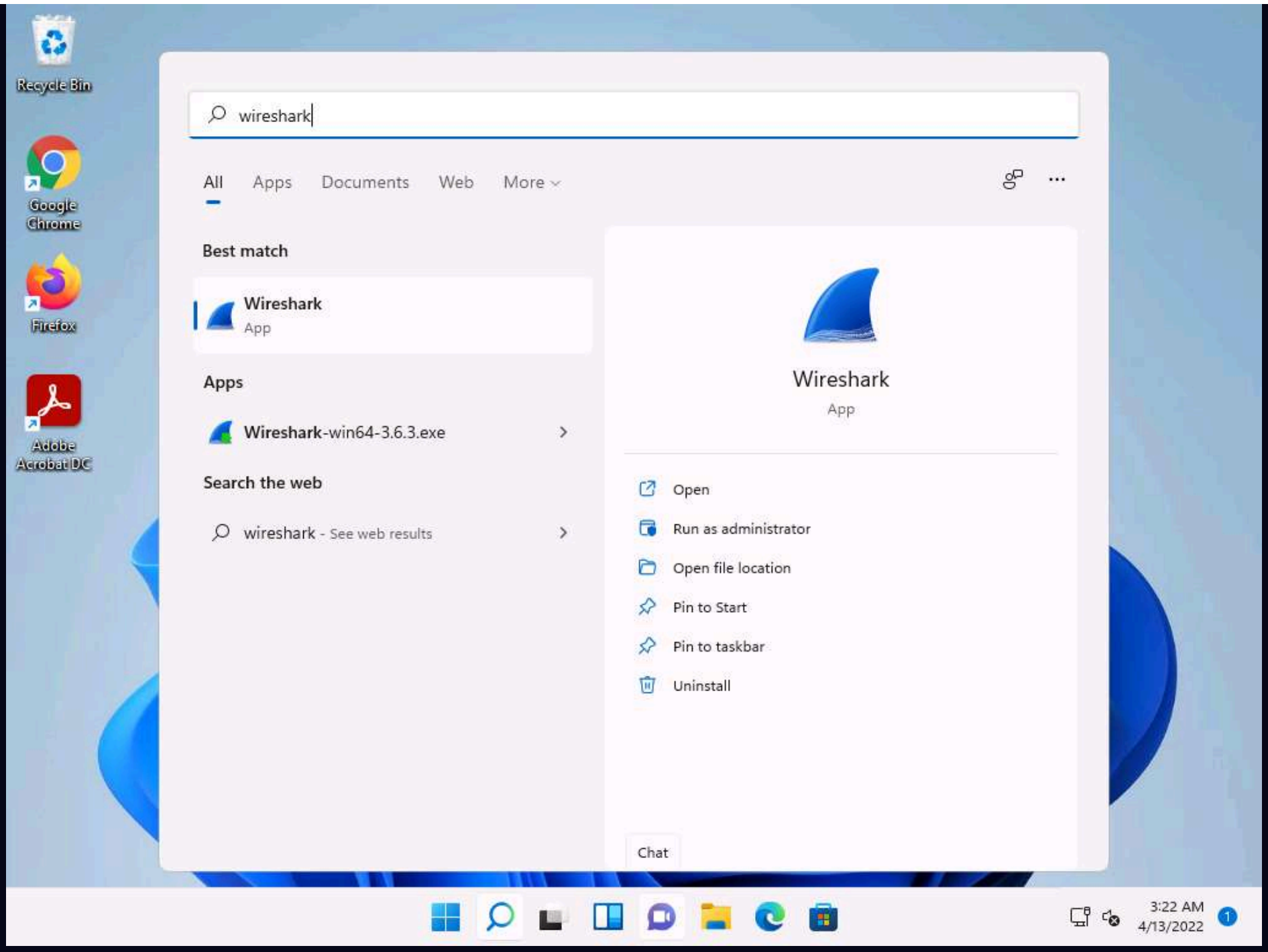
# Task 2: Perform a DoS Attack on a Target Host using hping3

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.

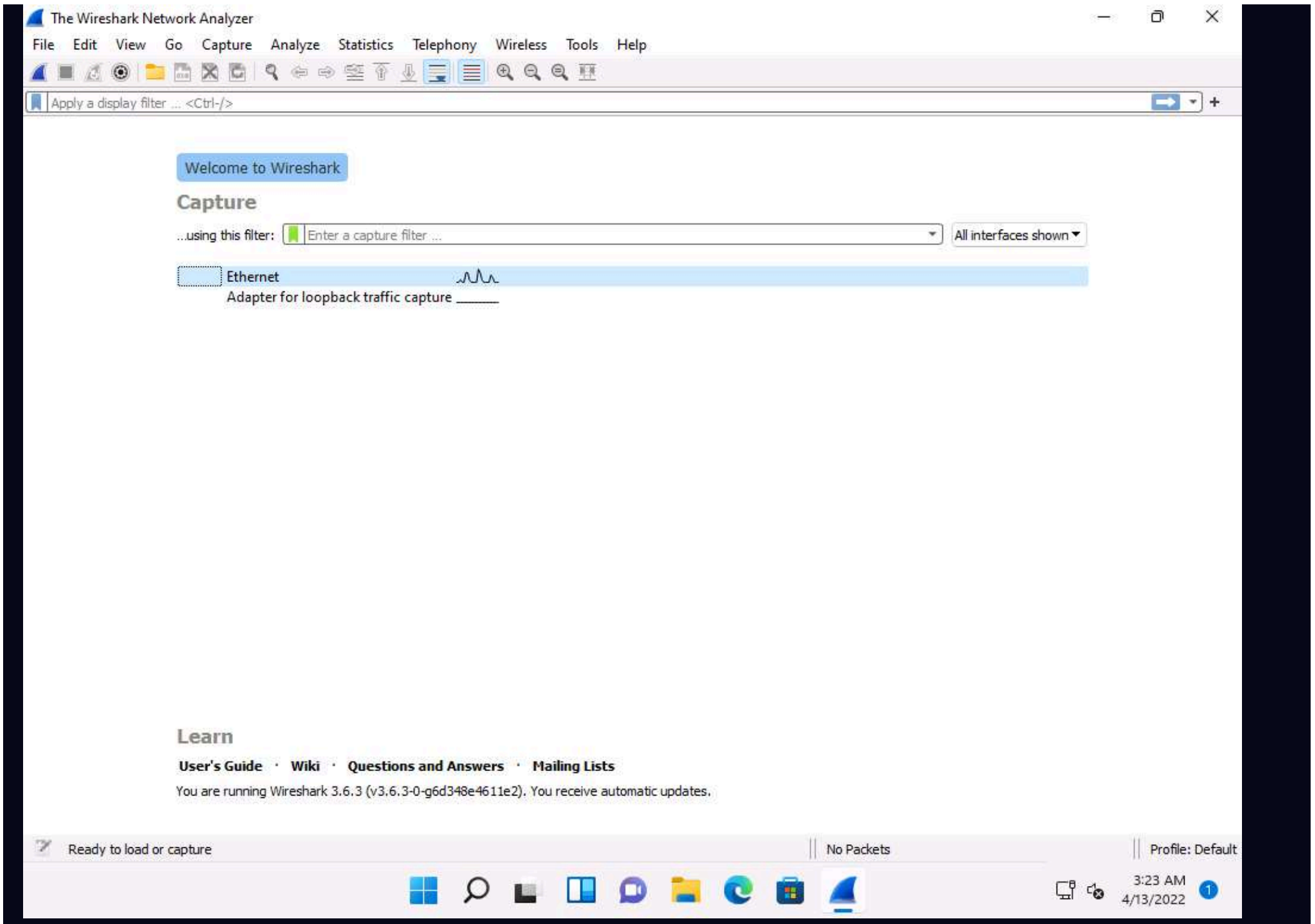
Here, we will use the hping3 tool to perform DoS attacks such as SYN flooding, Ping of Death (PoD) attacks, and UDP application layer flood attacks on a target host.

1. Click **CEHv12 Windows 11** to switch to the **Windows 11** 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.

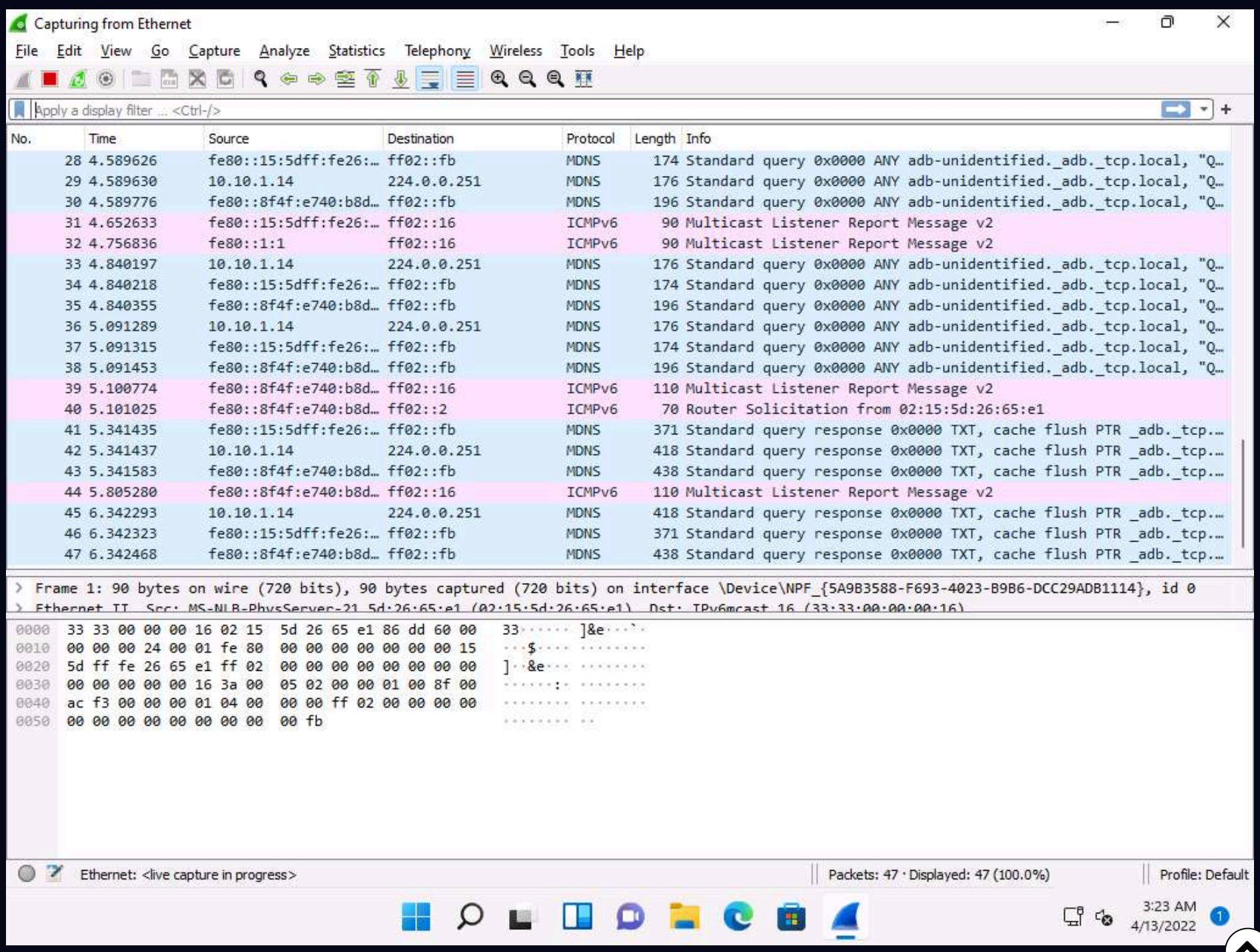



2. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

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

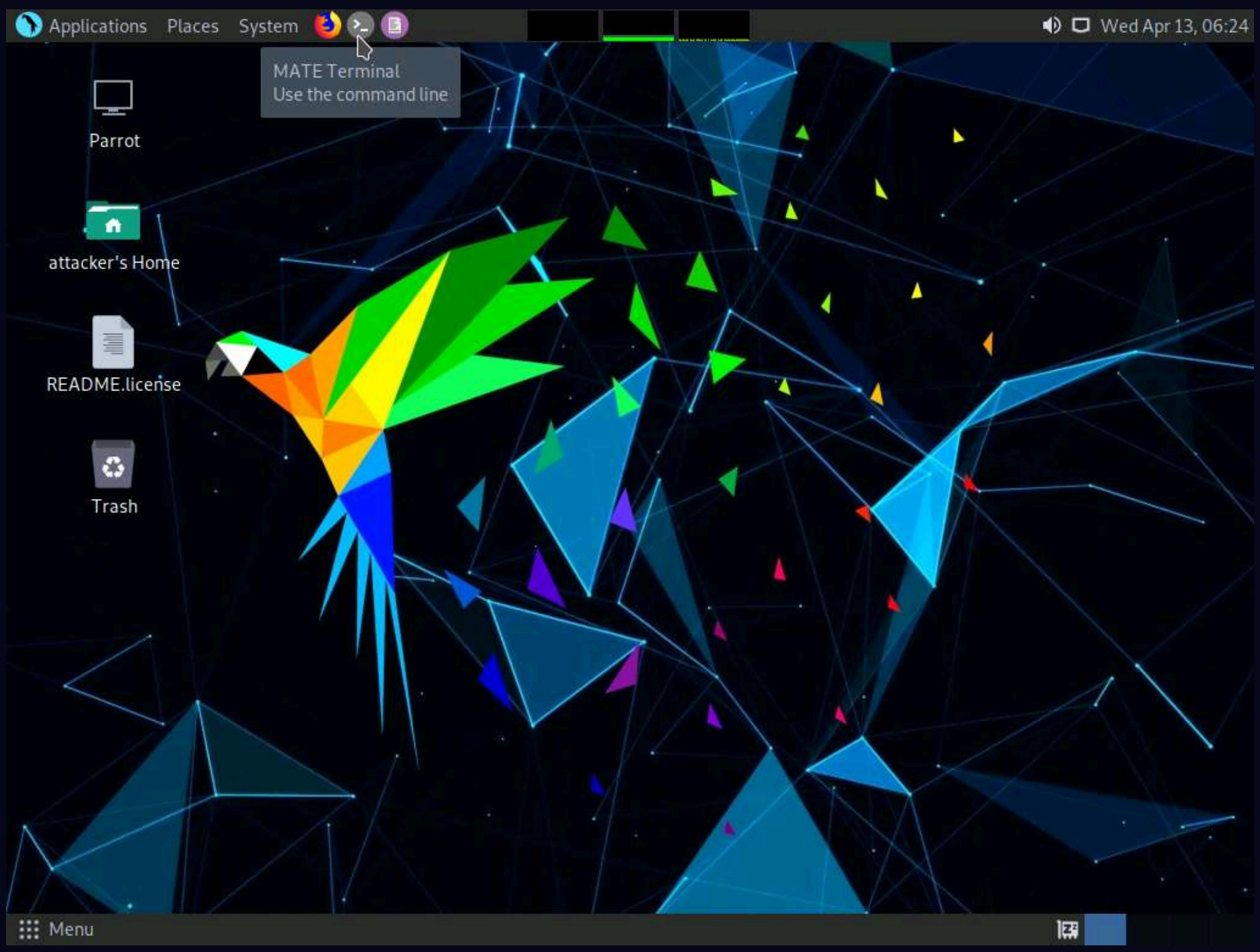



3. **Wireshark** starts capturing the packets; leave it running.



4. Click **CEHv12 Parrot Security** to switch to the **Parrot Security** machine.

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

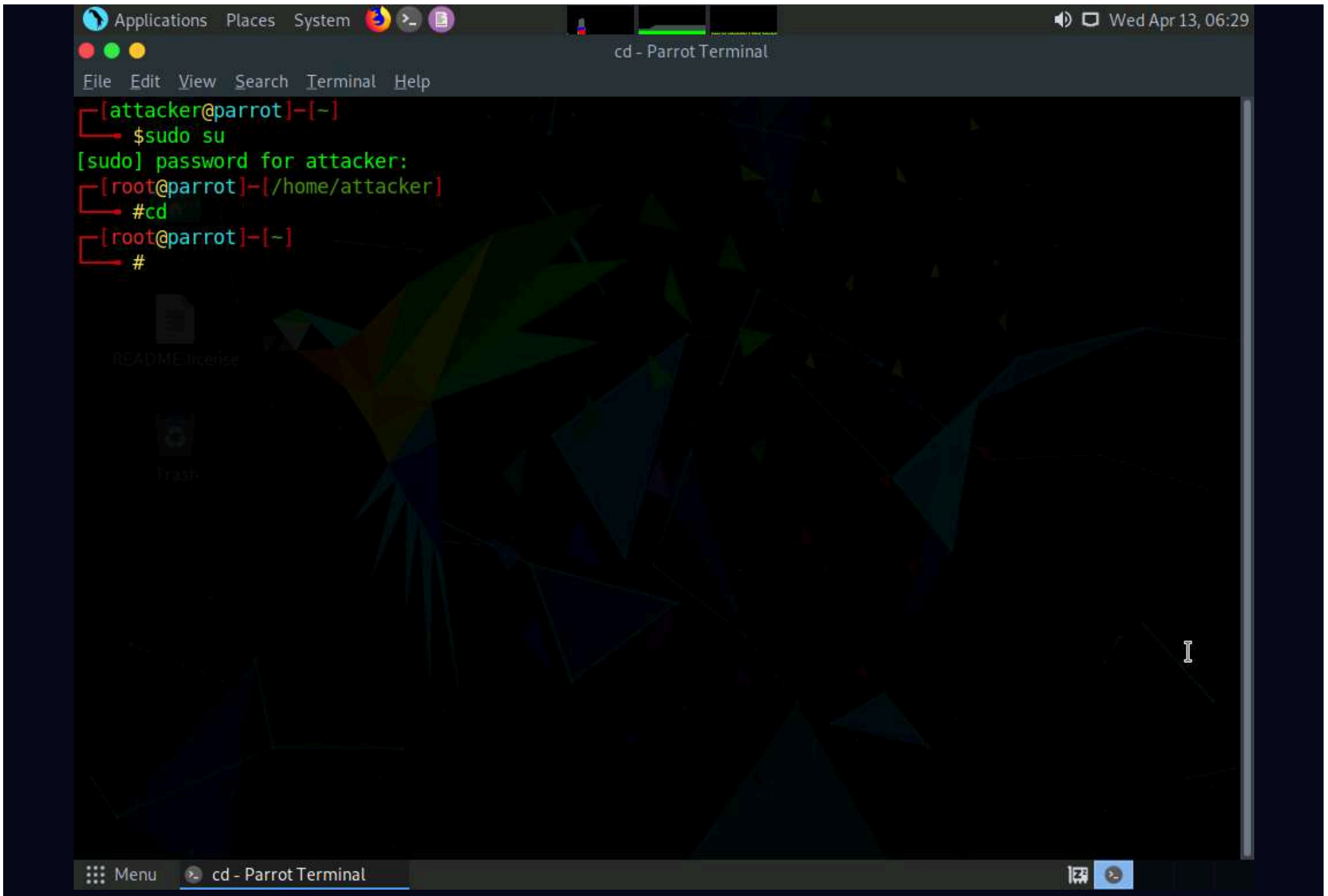



6. The **terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

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.

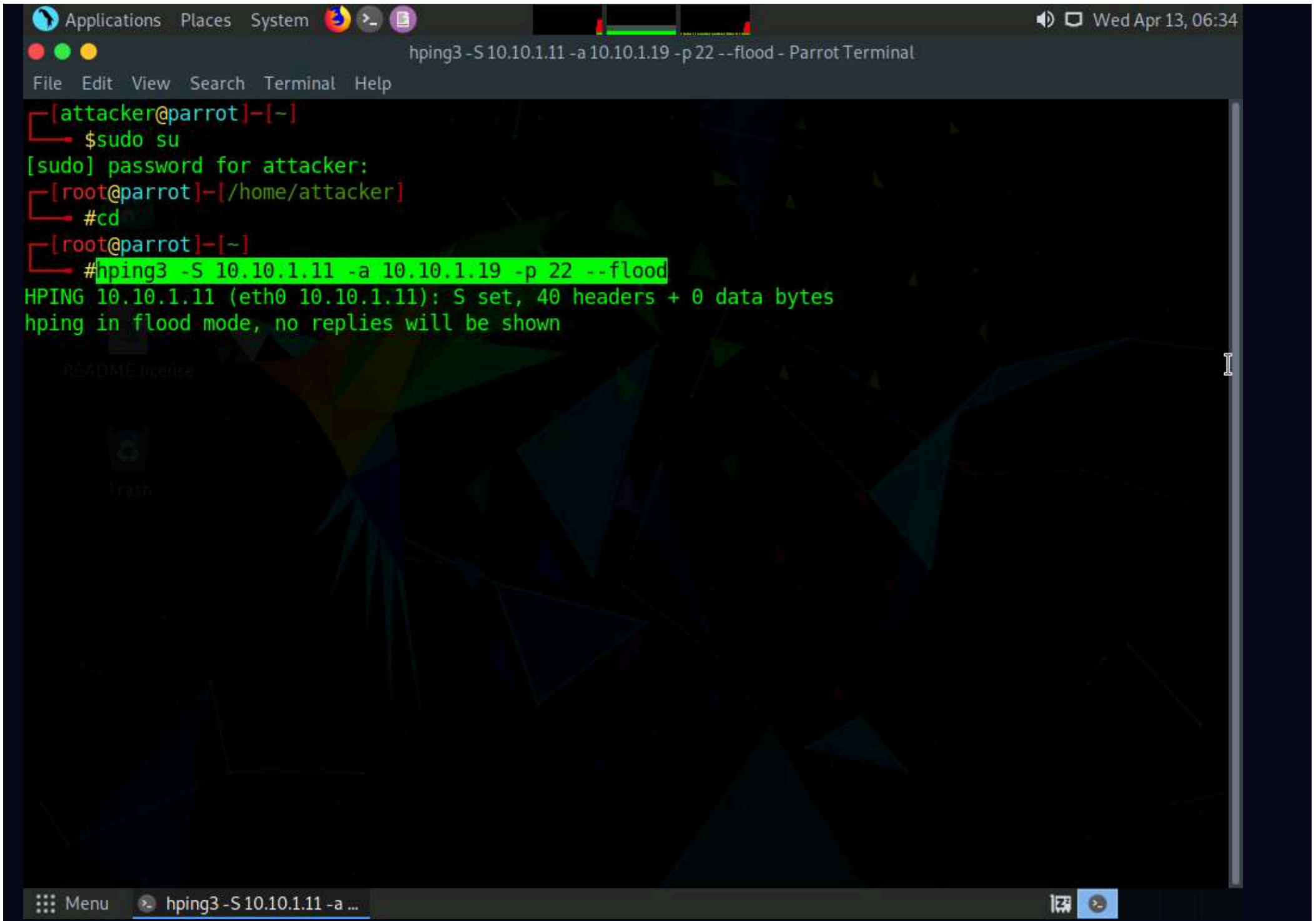
8. Now, type **cd** and press **Enter** to jump to the root directory.




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]**

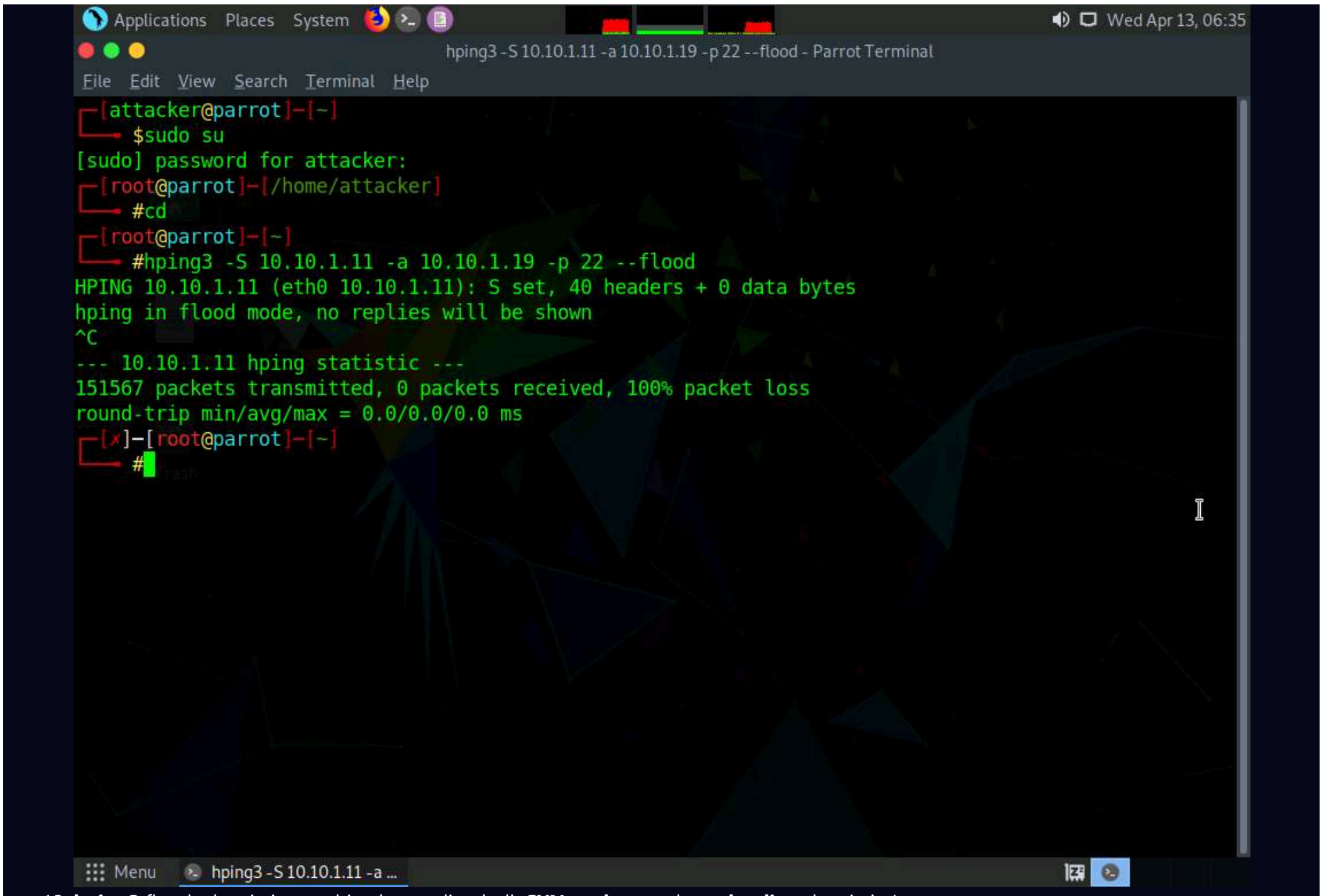
Note: **-S**: sets the SYN flag; **-a**: spoofs the IP address; **-p**: specifies the destination port; and **--flood**: sends a huge number of packets.




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.

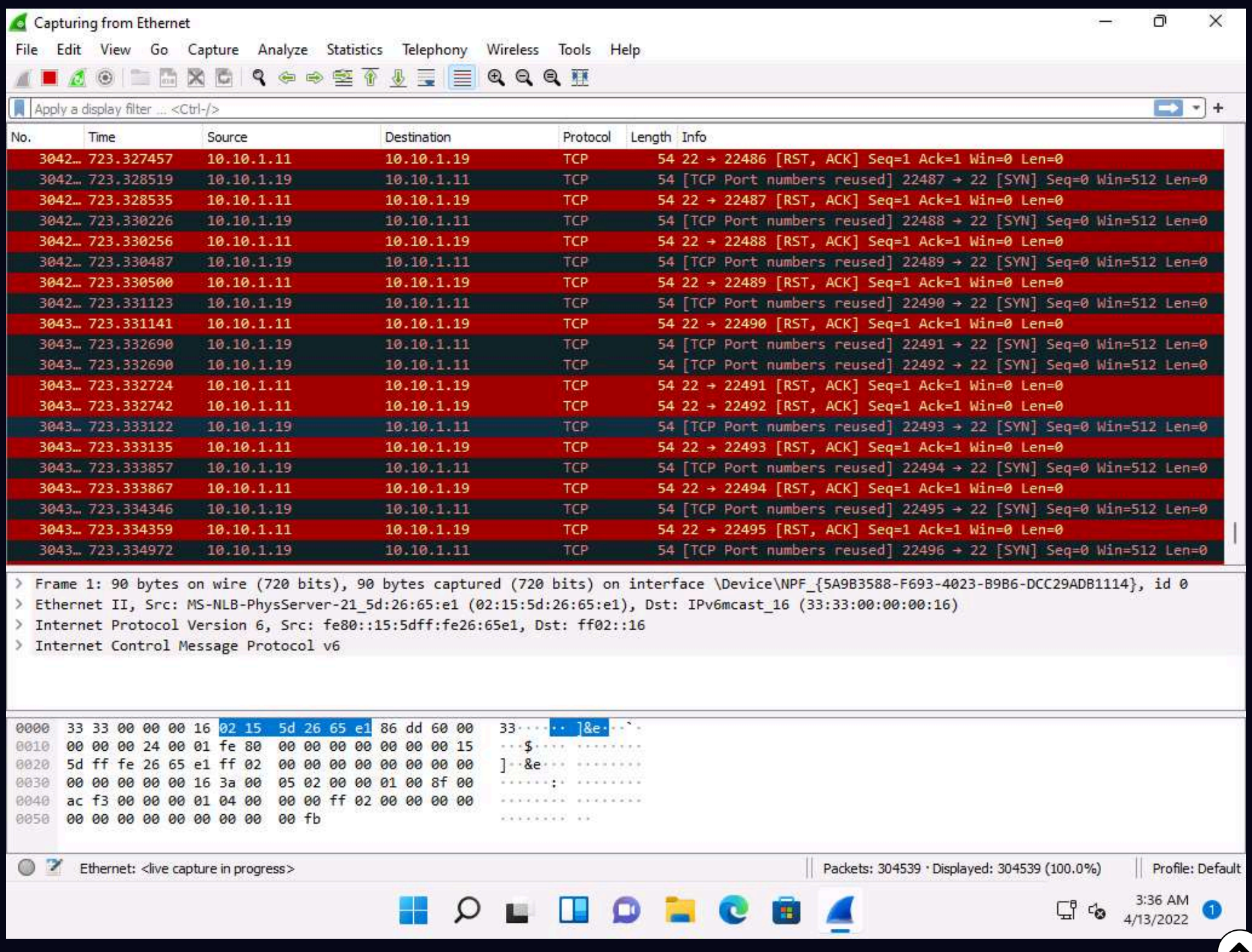
> Note: If you send the SYN packets for a long period, then the target system may crash.

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

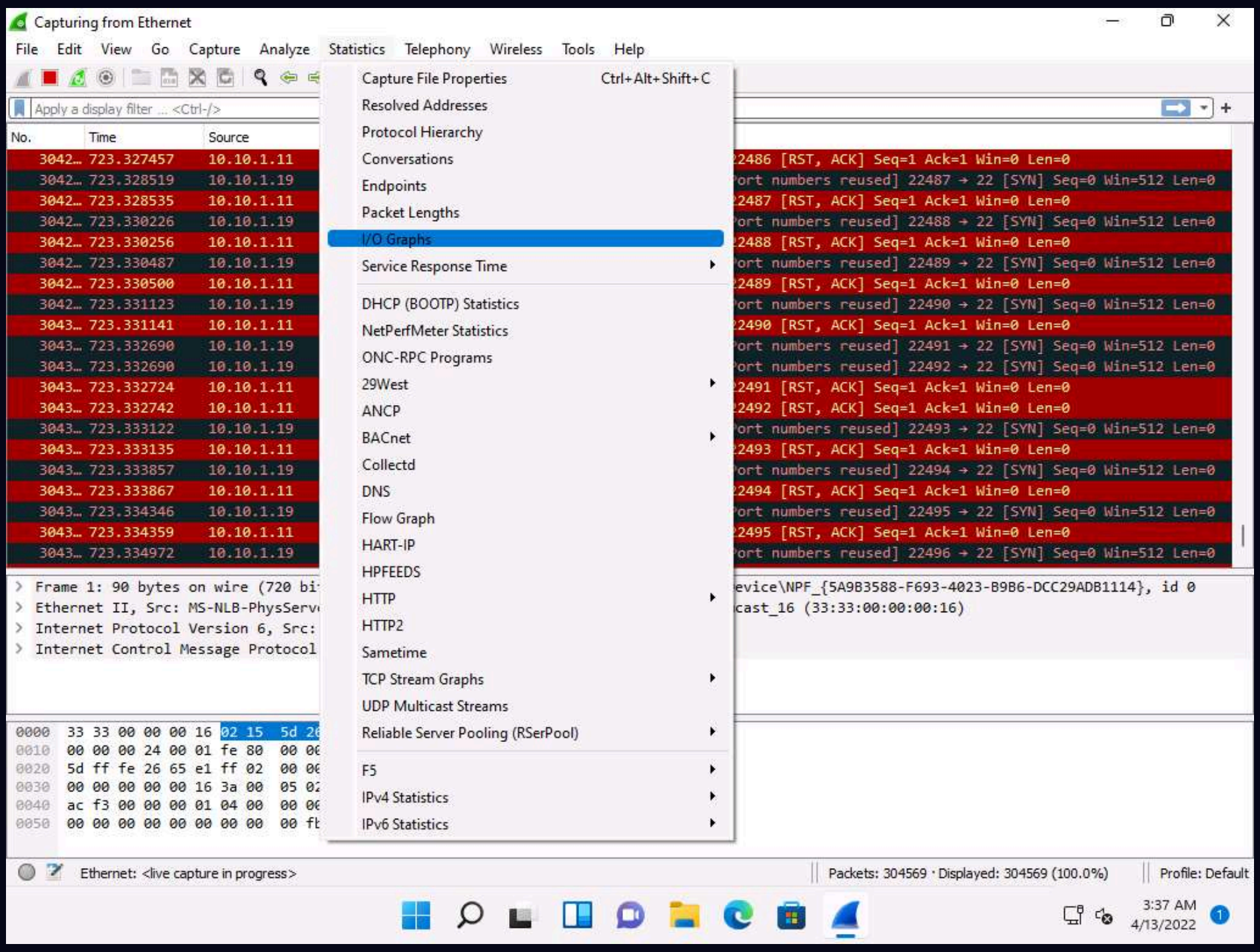



12. **hping3** floods the victim machine by sending bulk **SYN packets** and **overloading** the victim's resources.

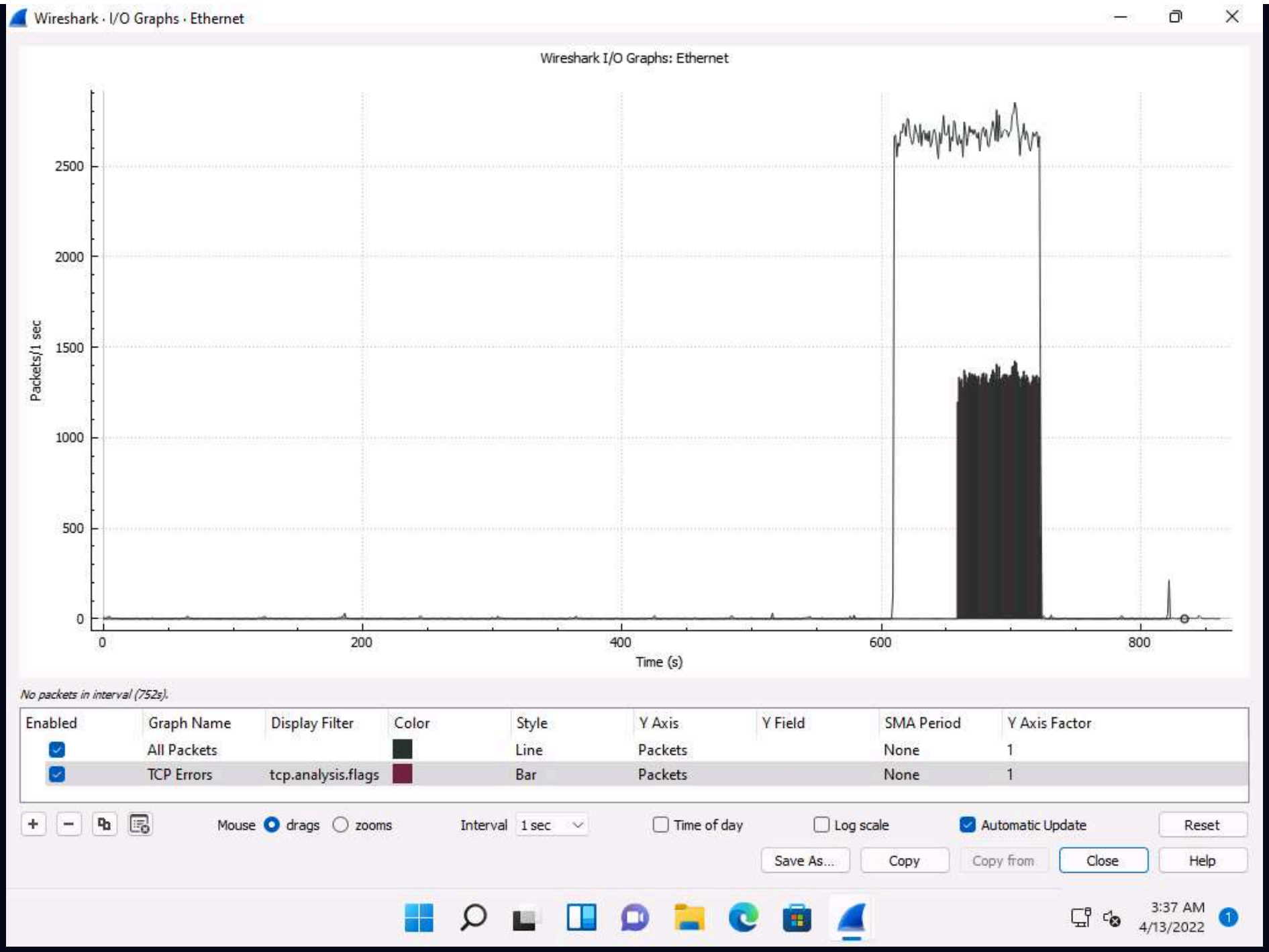
13. Click **CEHv12 Windows 11** to switch to the **Windows 11** machine and observe the TCP-SYN packets captured by **Wireshark**.



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.

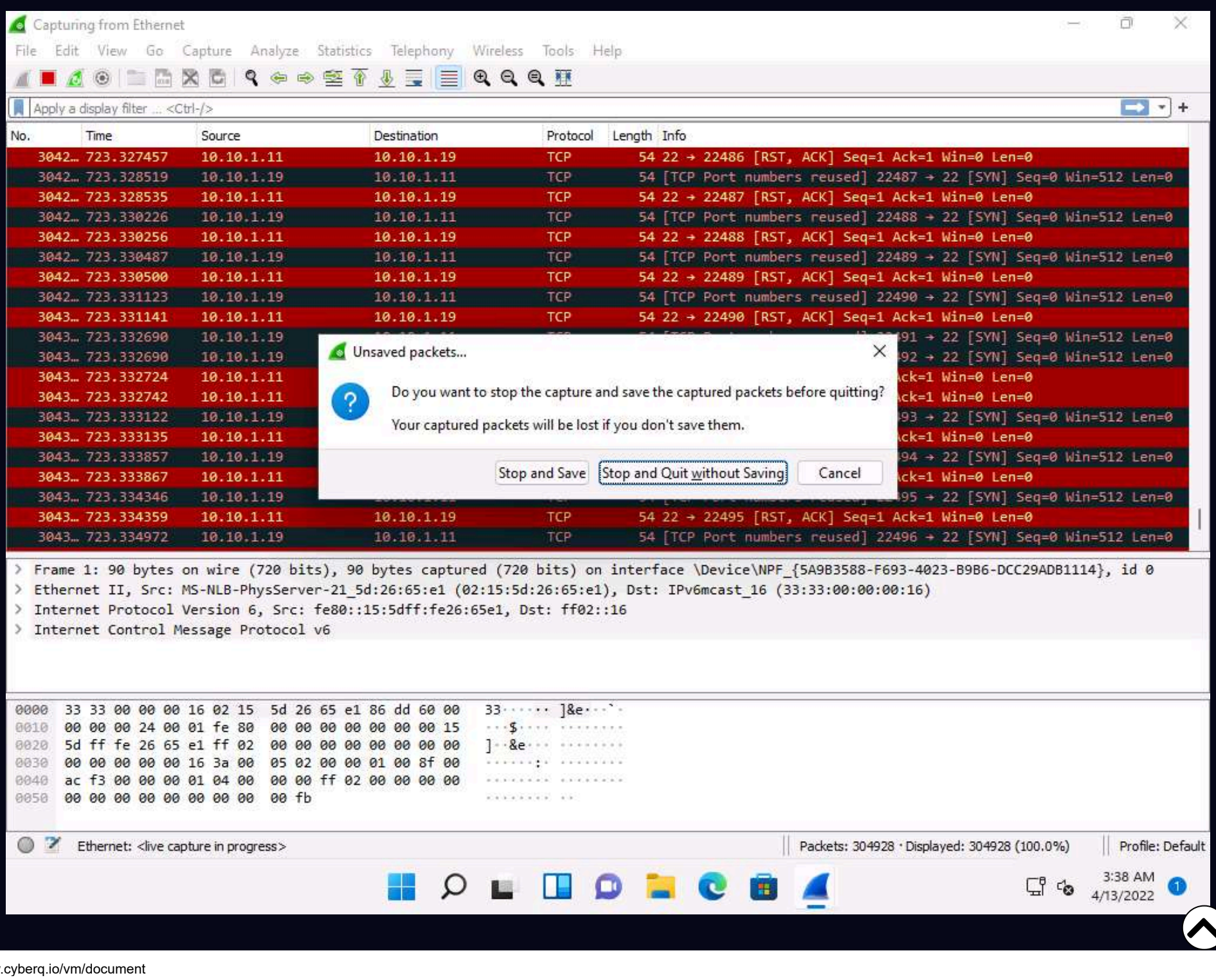



15. The **Wireshark** . **IO Graphs** . **Ethernet** window appears, displaying the graphical view of the captured packets. Observe the huge number of TCP packets captured by Wireshark, as shown in the screenshot.




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

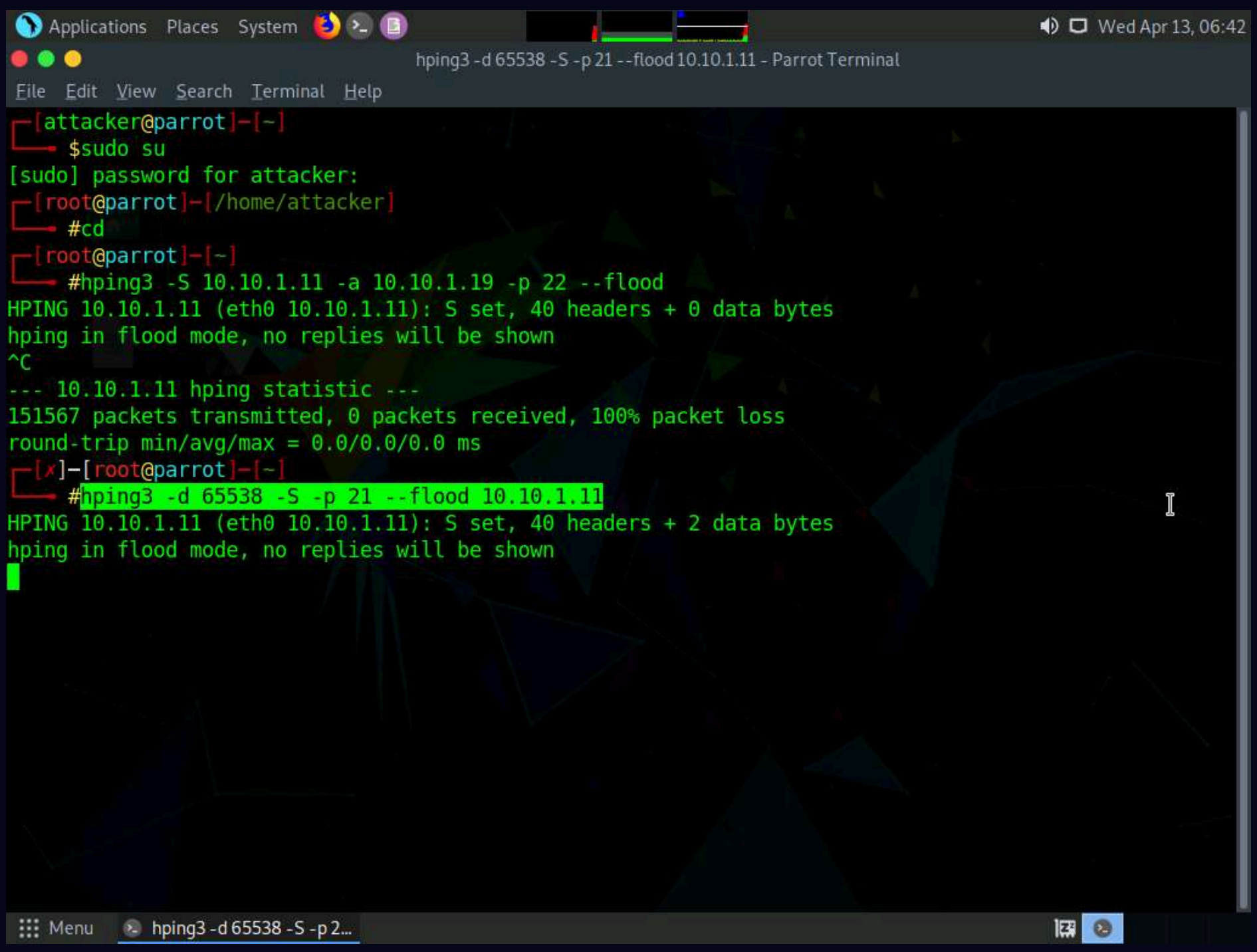
17. Close the **Wireshark** main window. If an **Unsaved packets...** pop-up appears, click **Stop and Quit without Saving**.



18. Now, we shall perform a PoD attack on the target system.

19. Now, click **CEHv12 Parrot Security** to switch to the **Parrot Security** 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.

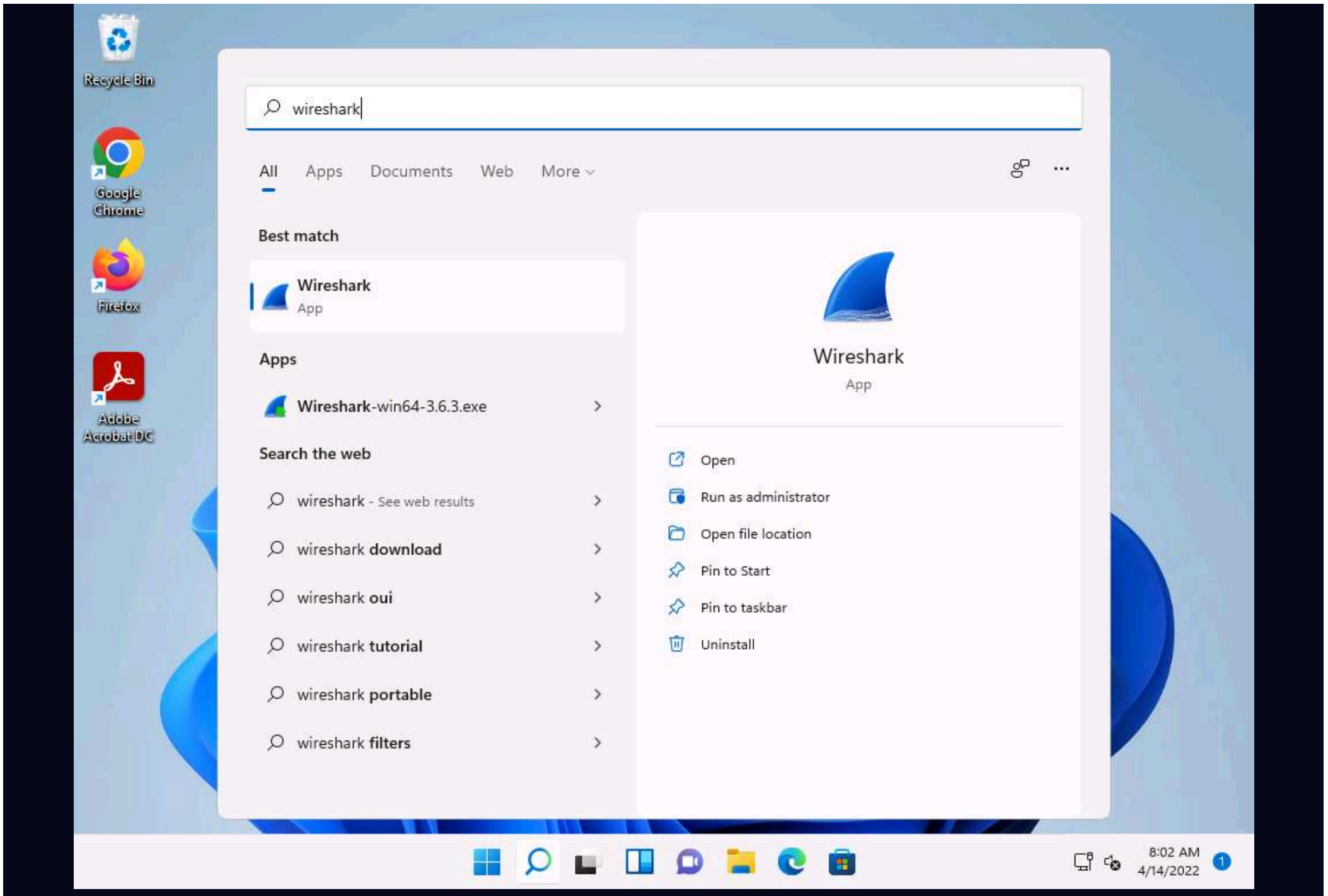
Note: In a PoD attack, the attacker tries to crash, freeze, or destabilize the targeted system or service by sending malformed or oversized packets using a simple ping command.

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.

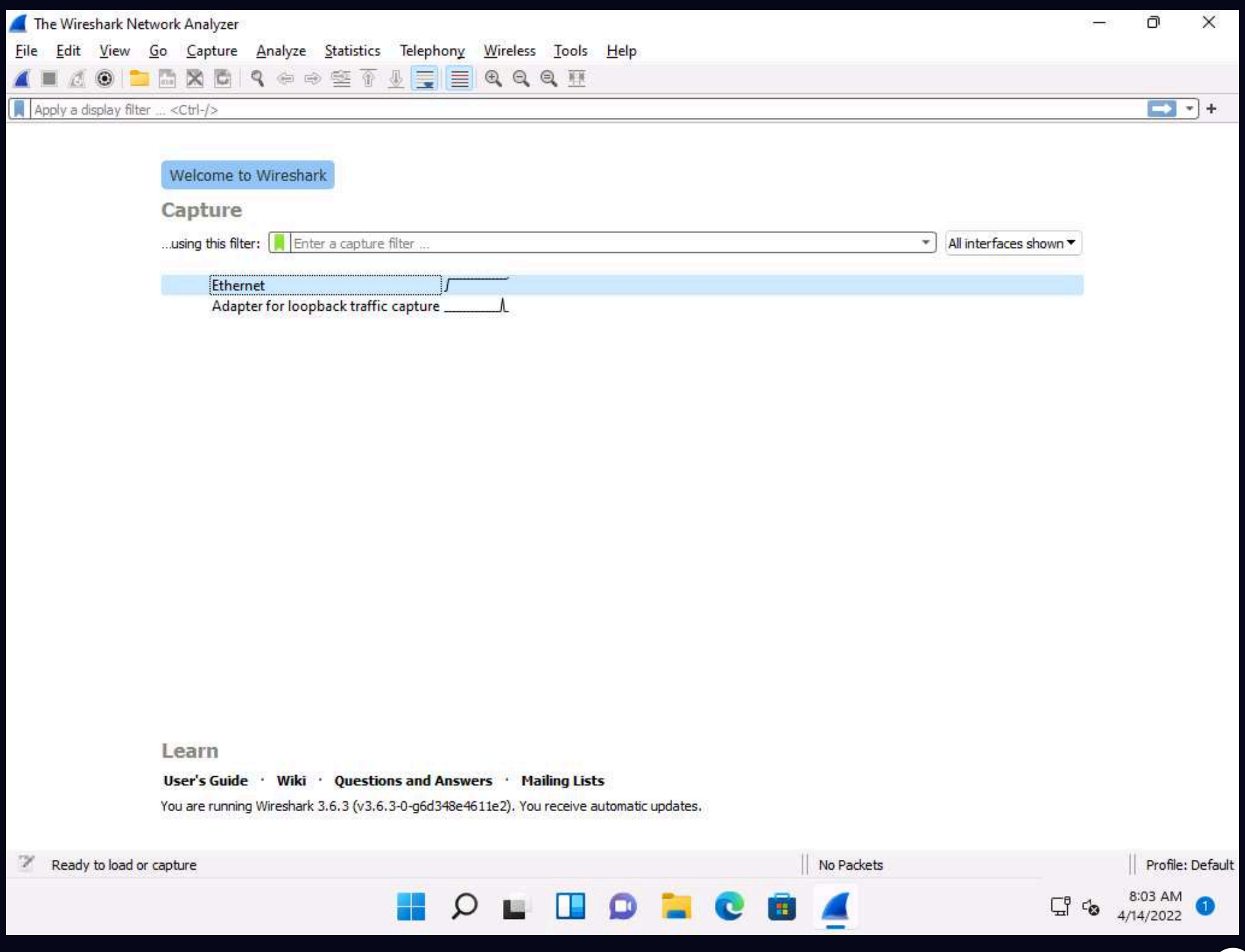
21. **hping3** floods the victim machine by sending bulk packets, and thereby overloading the victim's resources.

22. Click **CEHv12 Windows 11** to switch to the **Windows 11** machine.

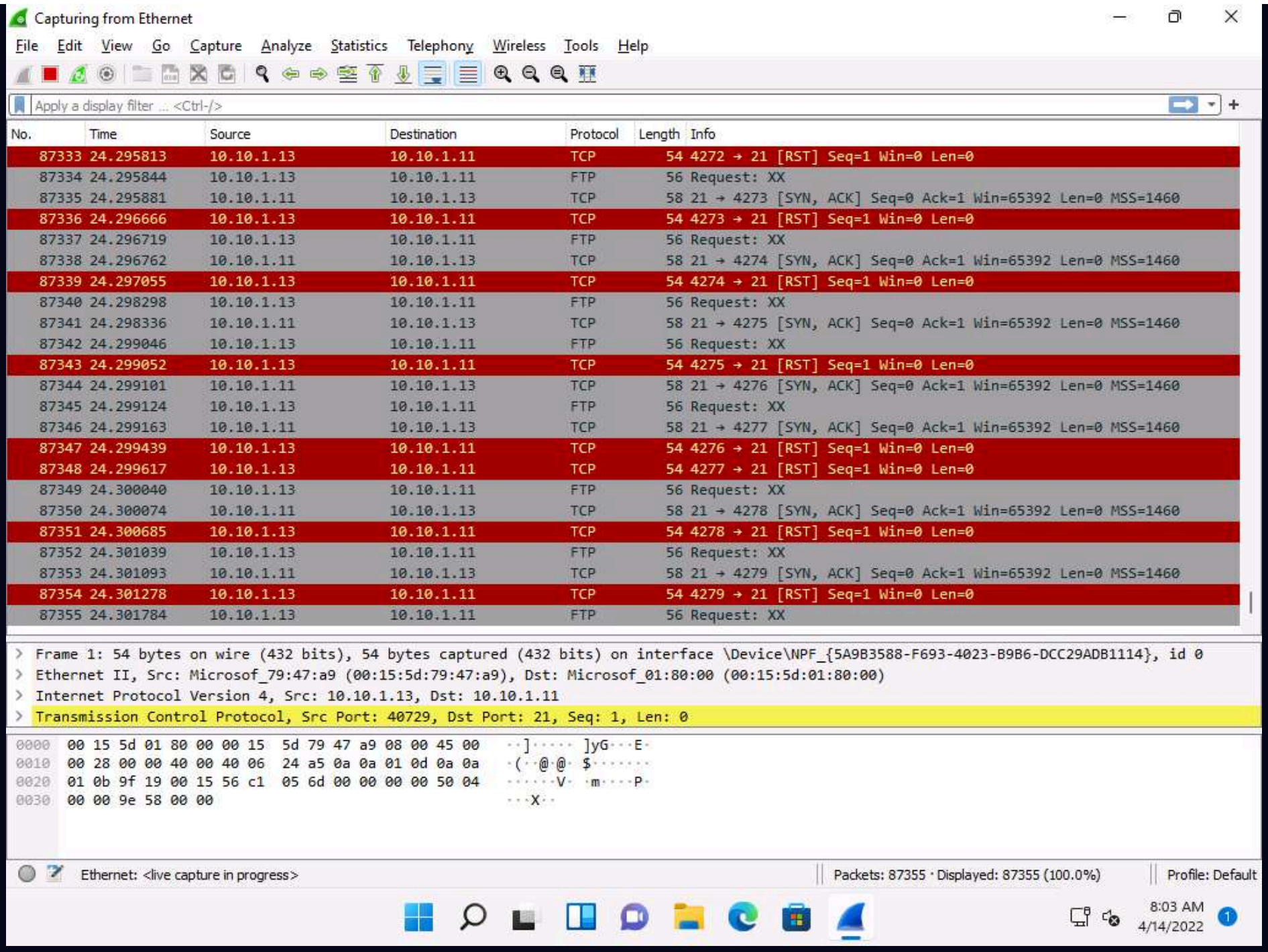
23. Click **Search** icon ( ) on the **Desktop**. Type **wireshark** in the search field, the **Wireshark** appears in the results, click **Open** to launch it.




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



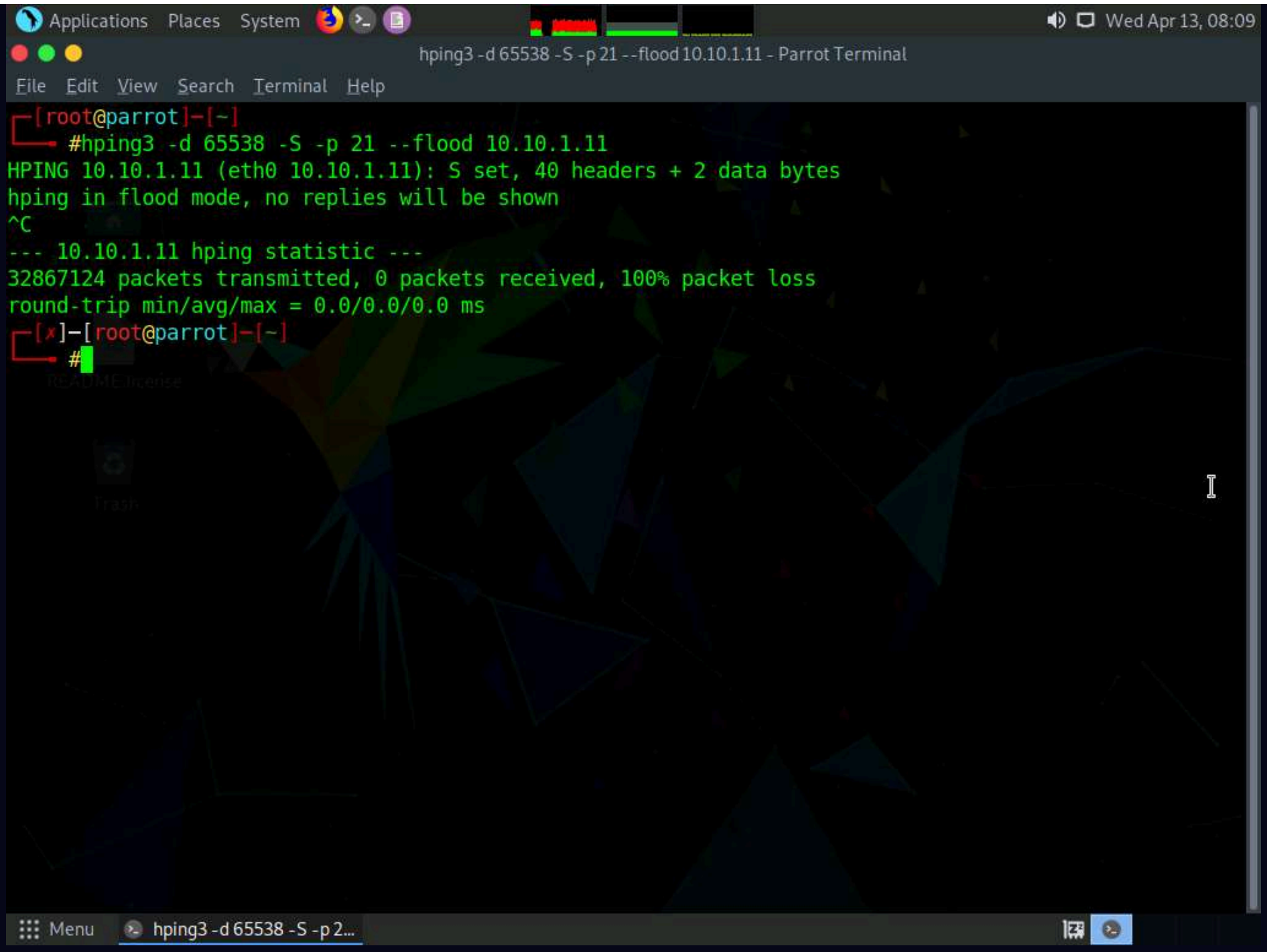

25. Observe the large number of packets captured by **Wireshark**.




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

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

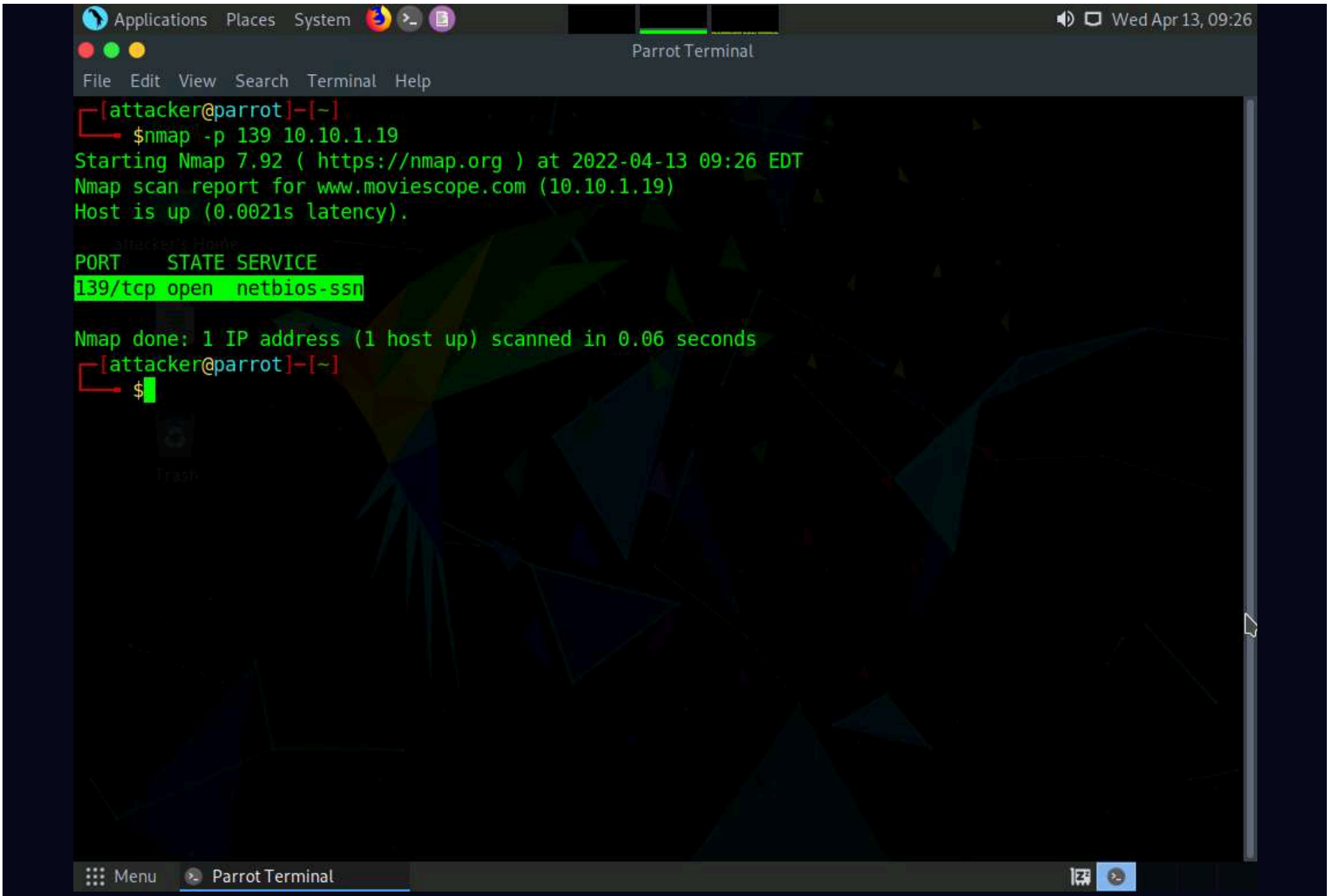
27. Click **CEHv12 Parrot Security** to switch to the **Parrot Security** machine. In the **Terminal** window, press **Ctrl+C** to terminate the PoD attack using hping3.




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.

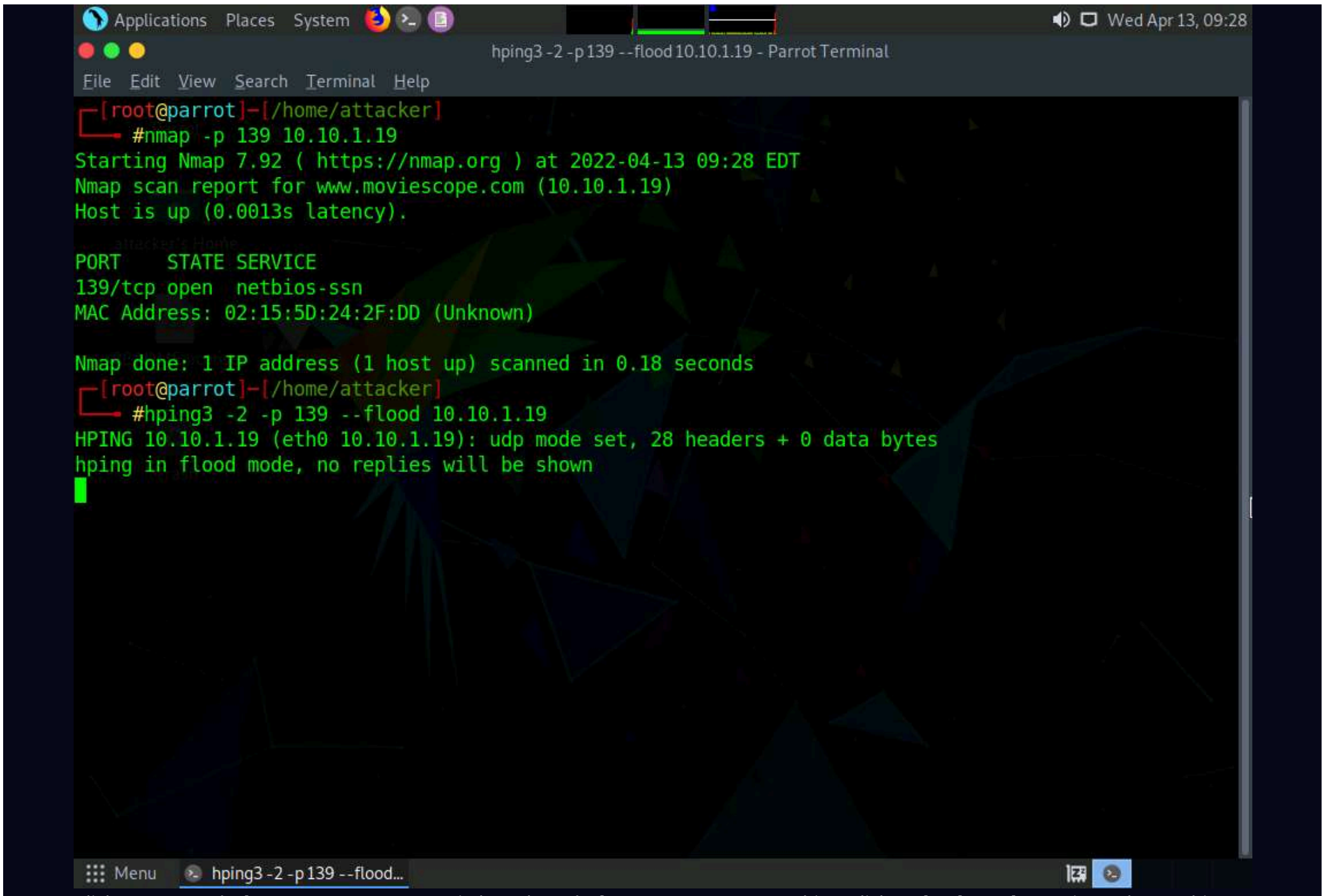
29. In the terminal window, type **nmap -p 139 (Target IP Address)** (here, the target IP address is **10.10.1.19 [Windows Server 2019]**) and press **Enter**.

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

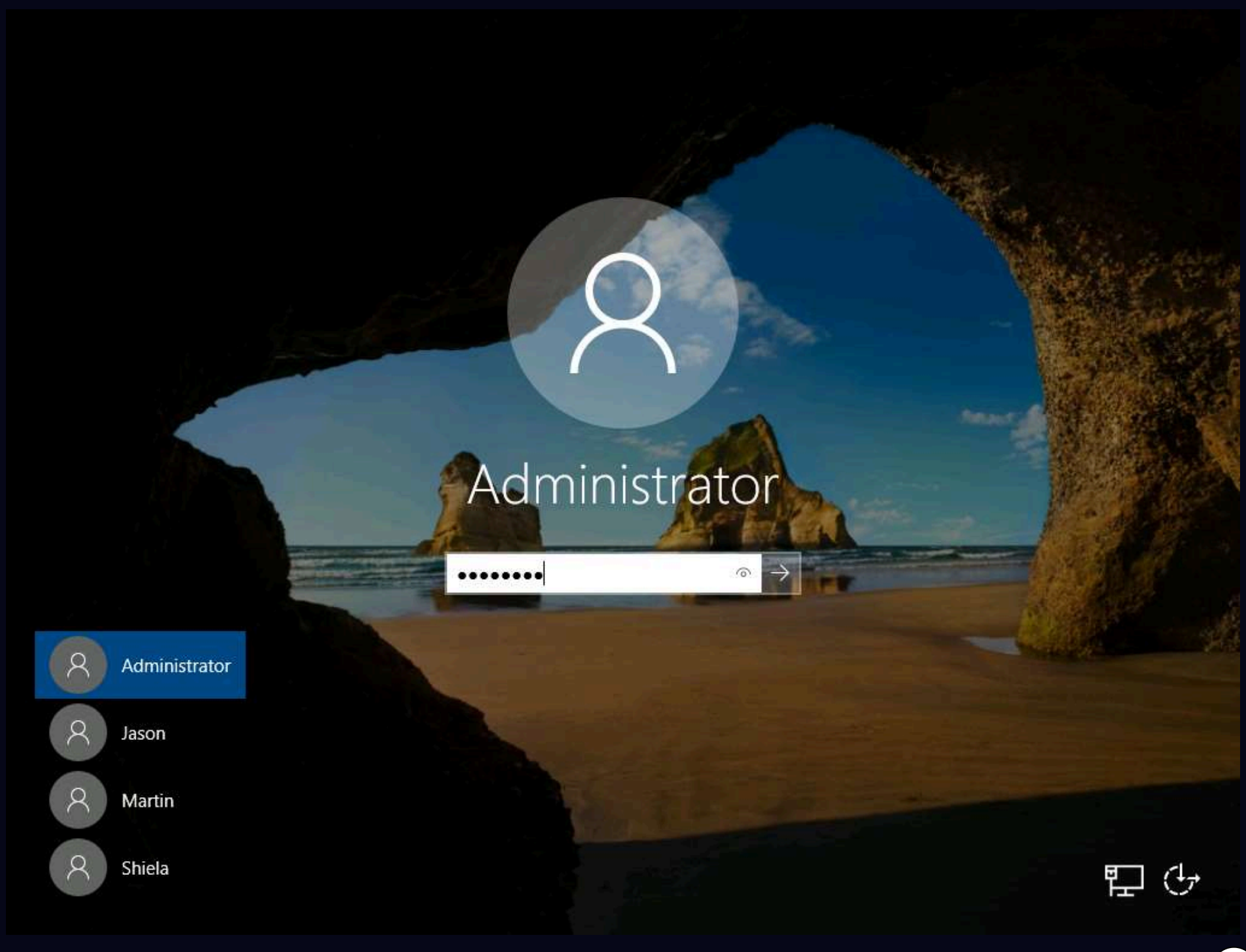



30. Now, type **hping3 -2 -p 139 --flood (Target IP Address)** (here, the target IP address is **10.10.1.19 [Windows Server 2019]**) and press **Enter**.

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

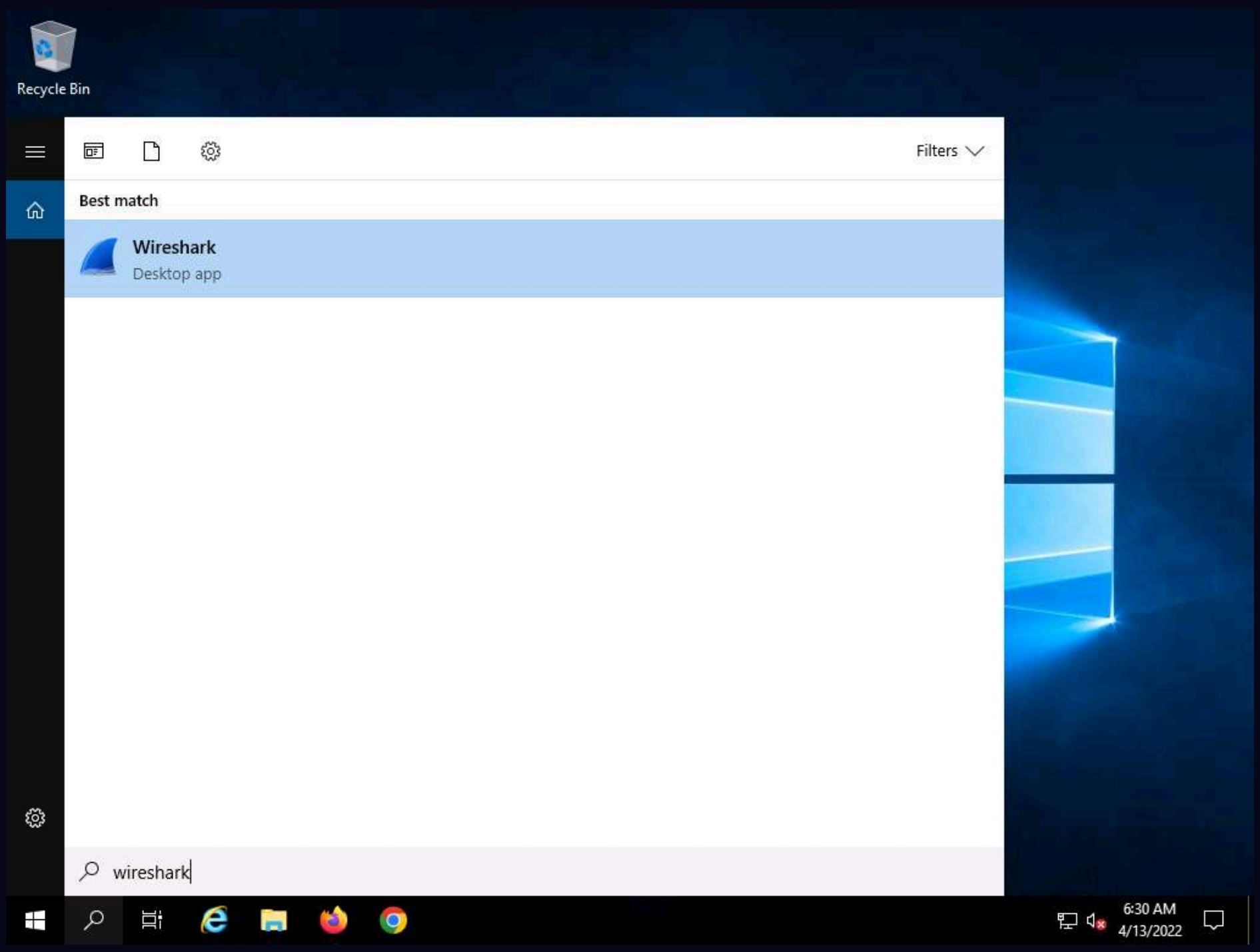



31. Click **CEHv12 Windows Server 2019** to switch to the **Windows Server 2019** machine, click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** account is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.



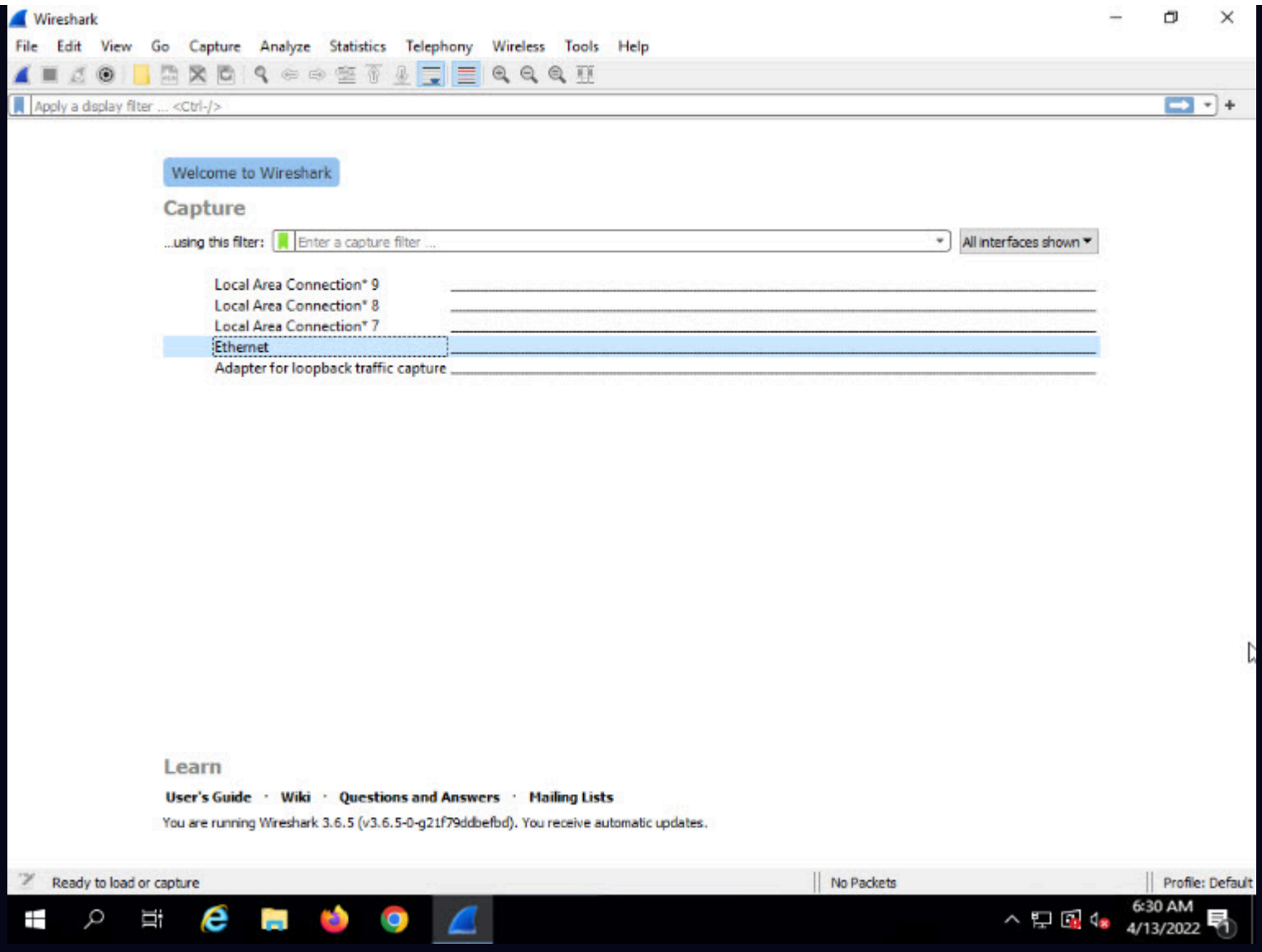
32. In the **Type here to search** field on the **Desktop**, type **wireshark** in the search field, the **Wireshark** appears in the results, click **Wireshark** to launch it.

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

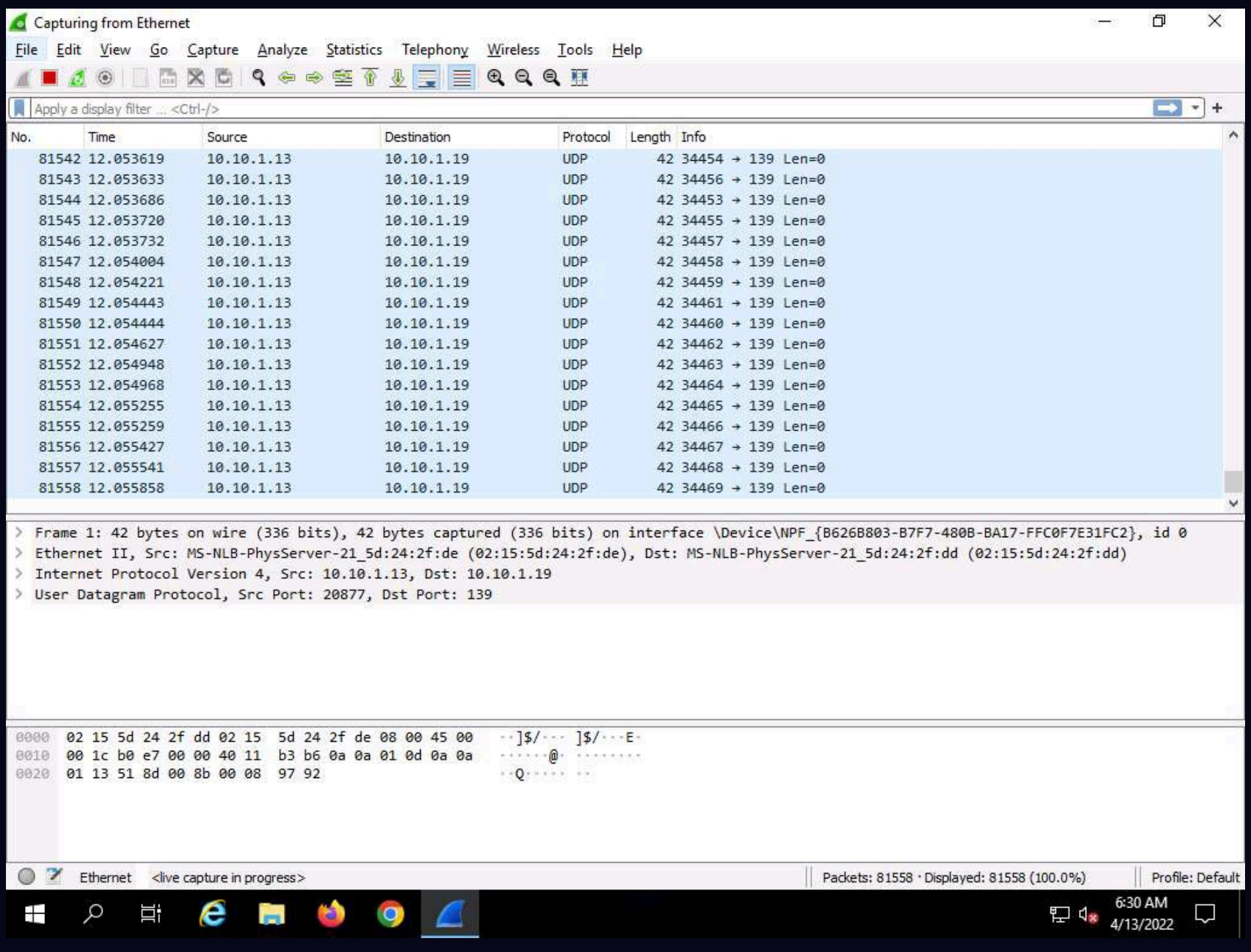



33. **The Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

| Note: The network interface might differ when you perform the task.<br><br>Note: If a **Software Update** pop-up appears click on **Remind me later**. |
|---|




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**.



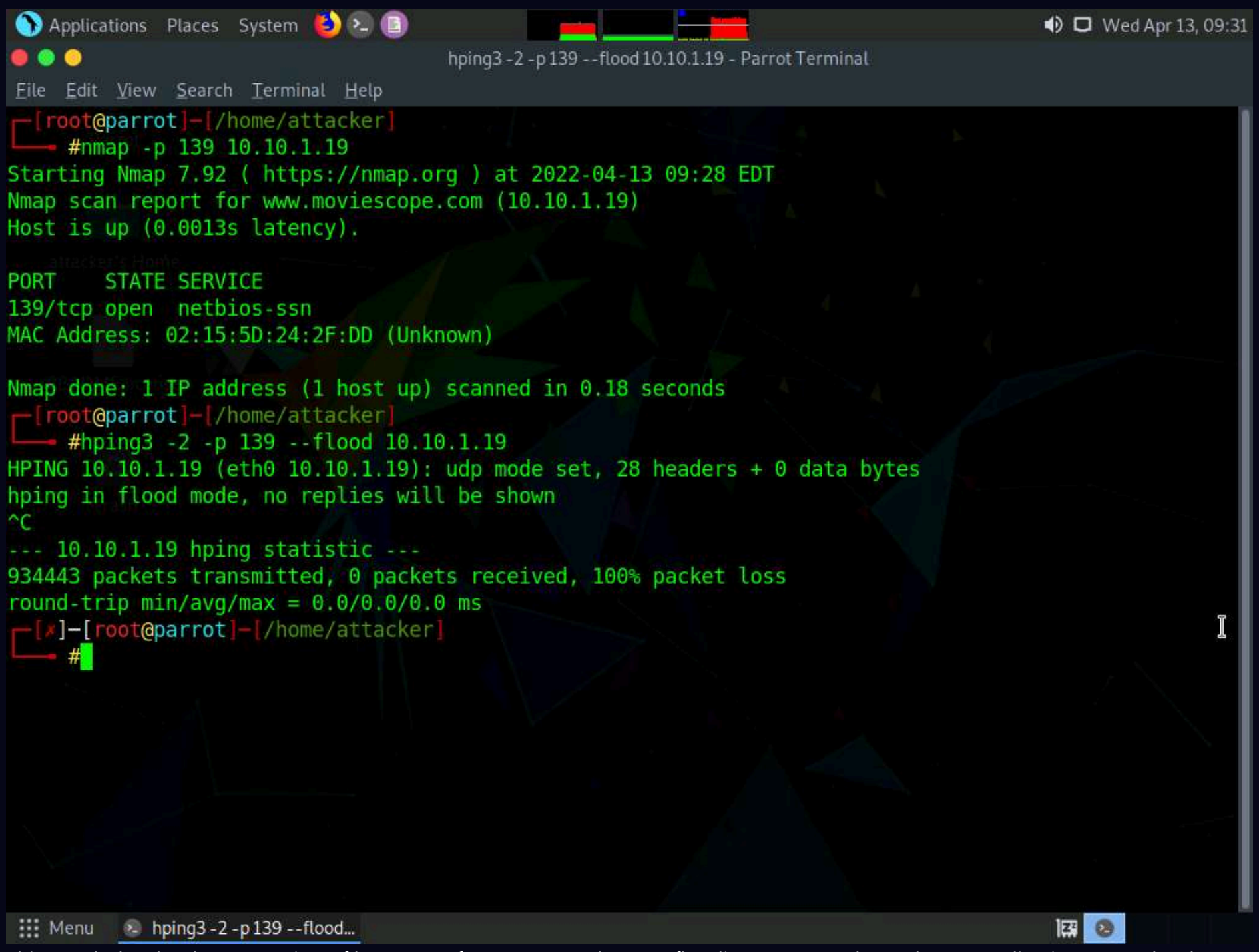

35. Click **CEHv12 Parrot Security** to switch to the **Parrot Security** machine. In the **Terminal** window, press **Ctrl+C** to terminate the DoS attack.

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)
- **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

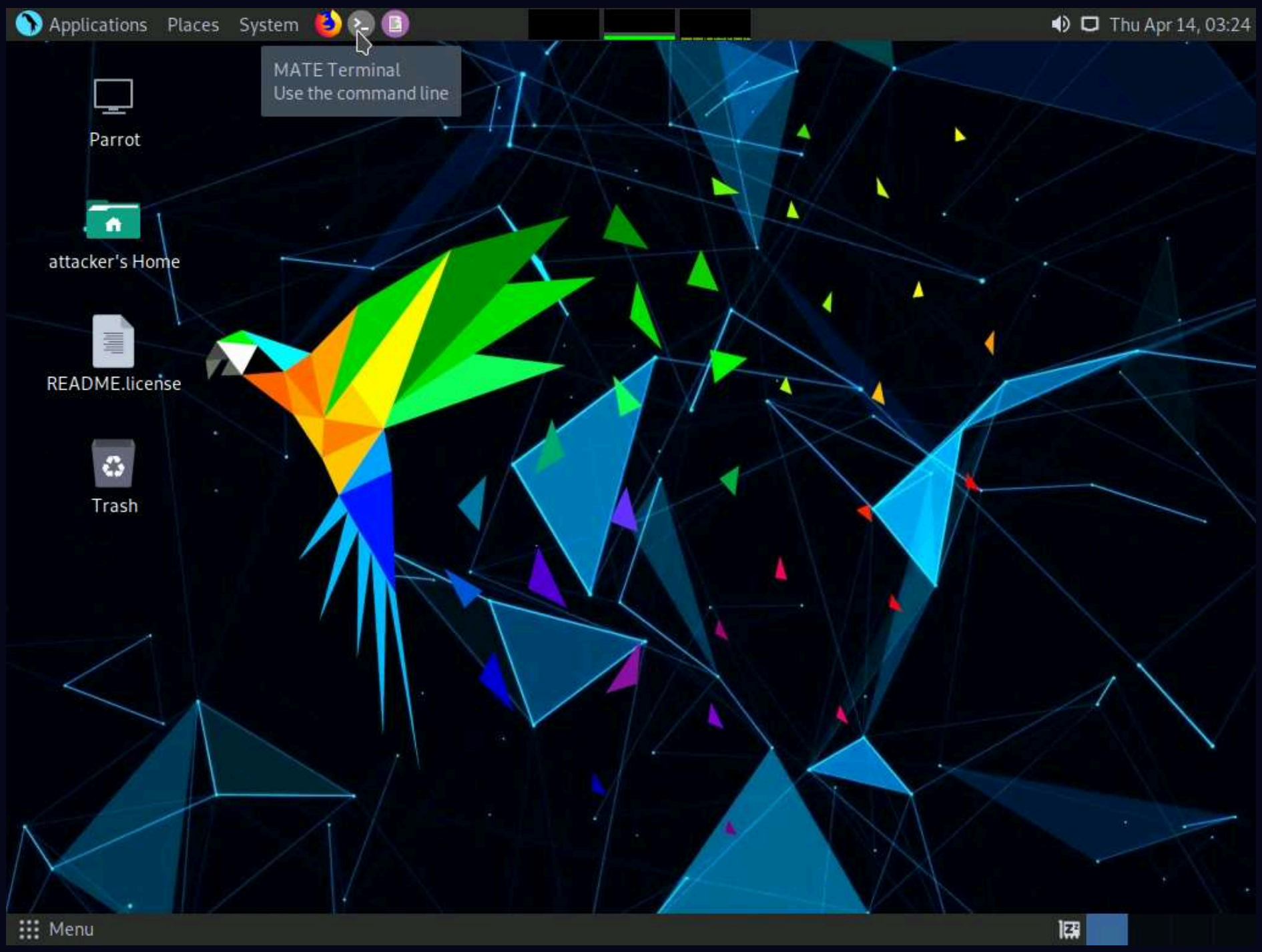
Raven-Storm is a DDoS tool for penetration testing that features Layer 3, Layer 4, and Layer 7 attacks. It is written in python3 and is effective and powerful in shutting down hosts and servers. It can be used to perform strong attacks and can be optimized for non typical targets.

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

1. Click **CEHv12 Parrot Security** switch to the **Parrot Security** machine.

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

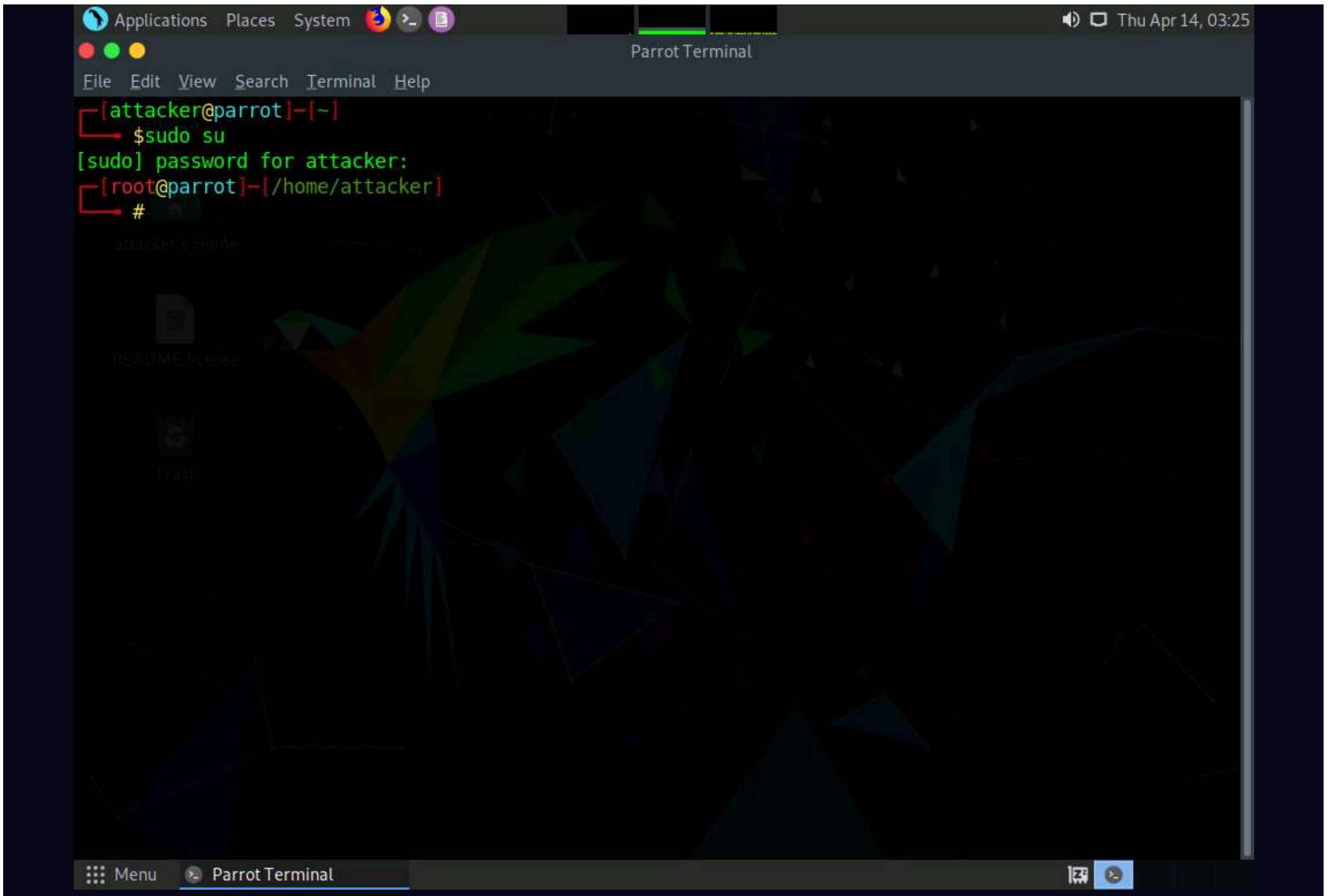
Note: If a **Question** pop-up window appears asking for you to update the machine, click **No** to close the window.



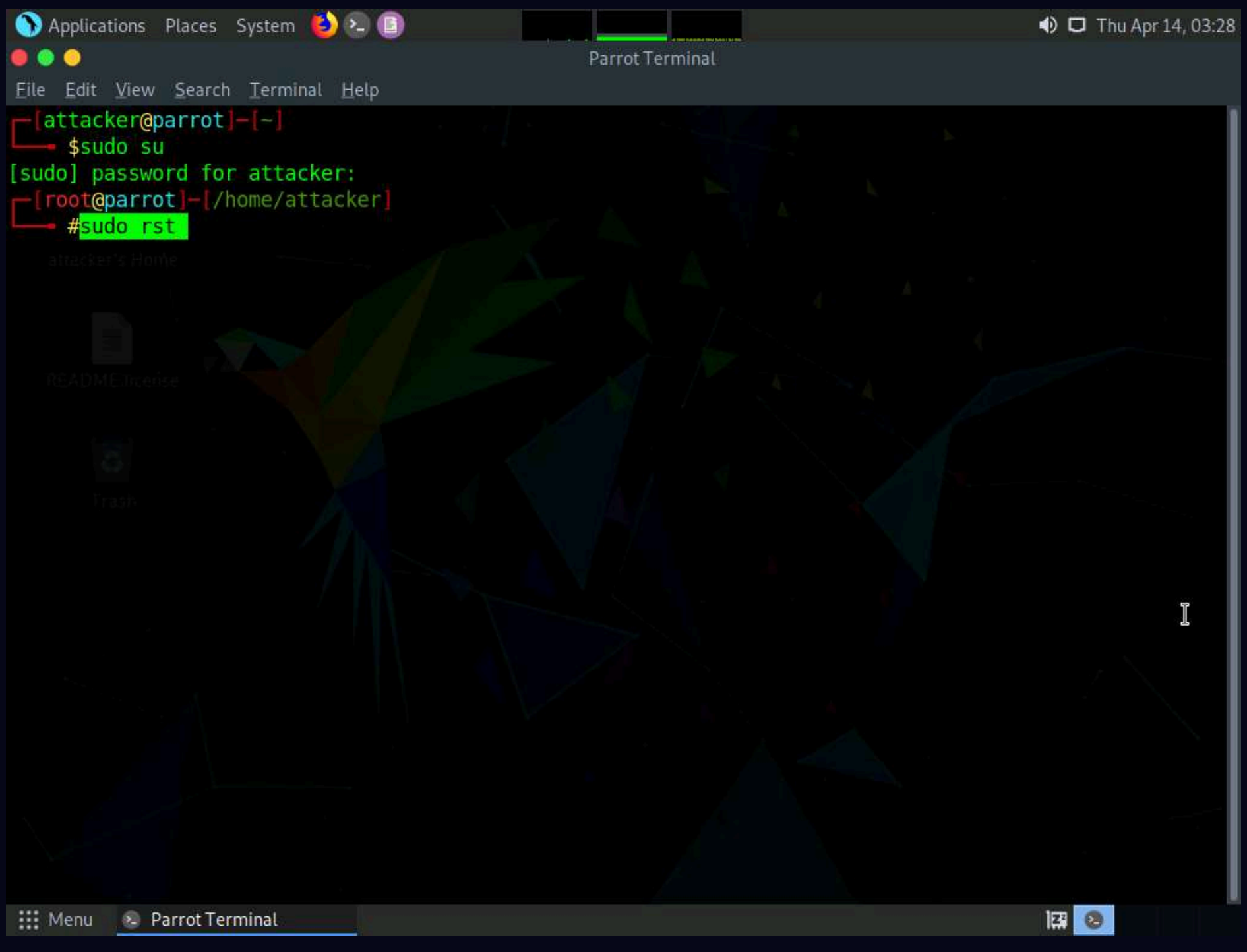

3. A **Parrot Terminal** window appears. In the terminal window, type **sudo su** and press **Enter** to run the programs as a root user.

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

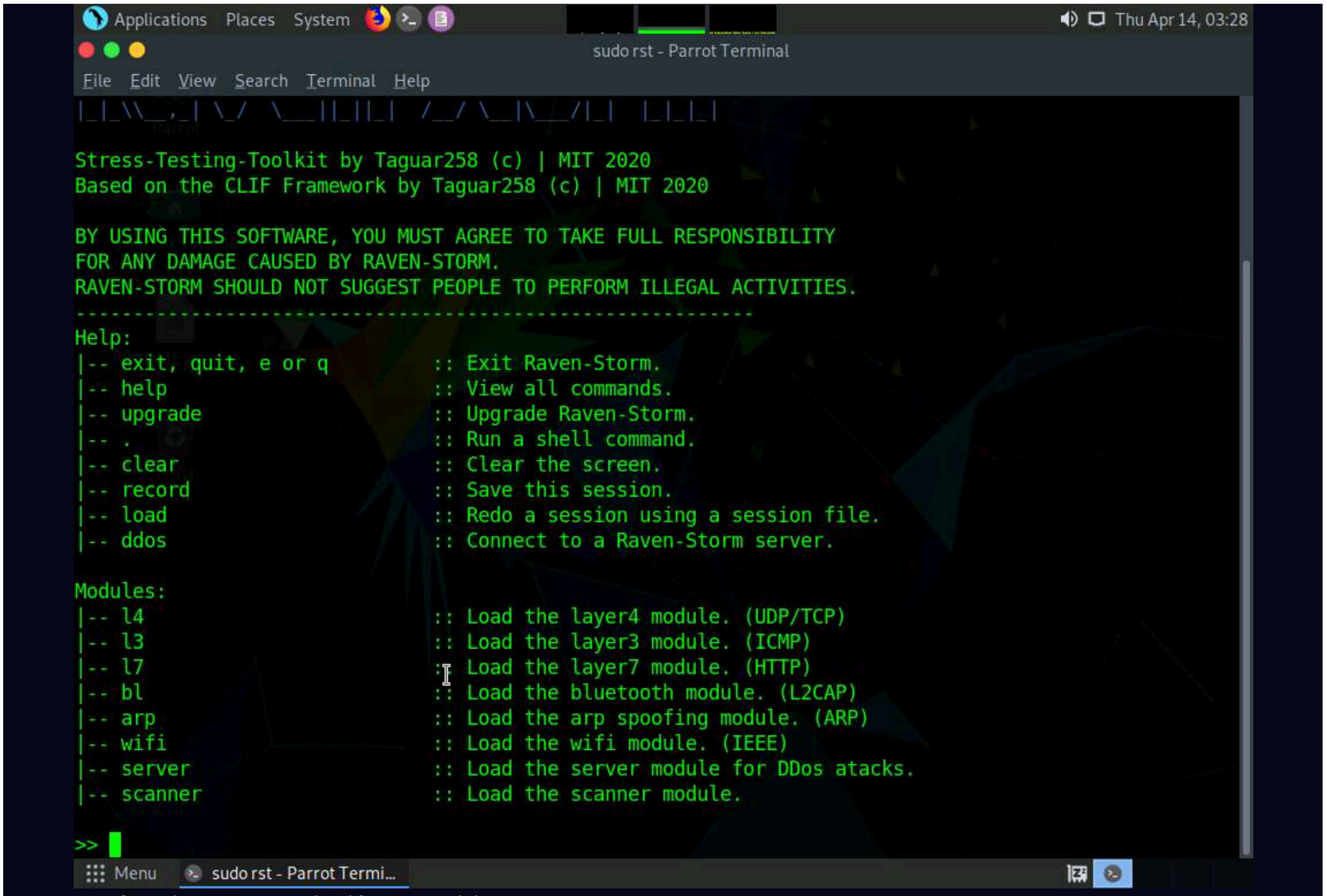
Note: The password that you type will not be visible.



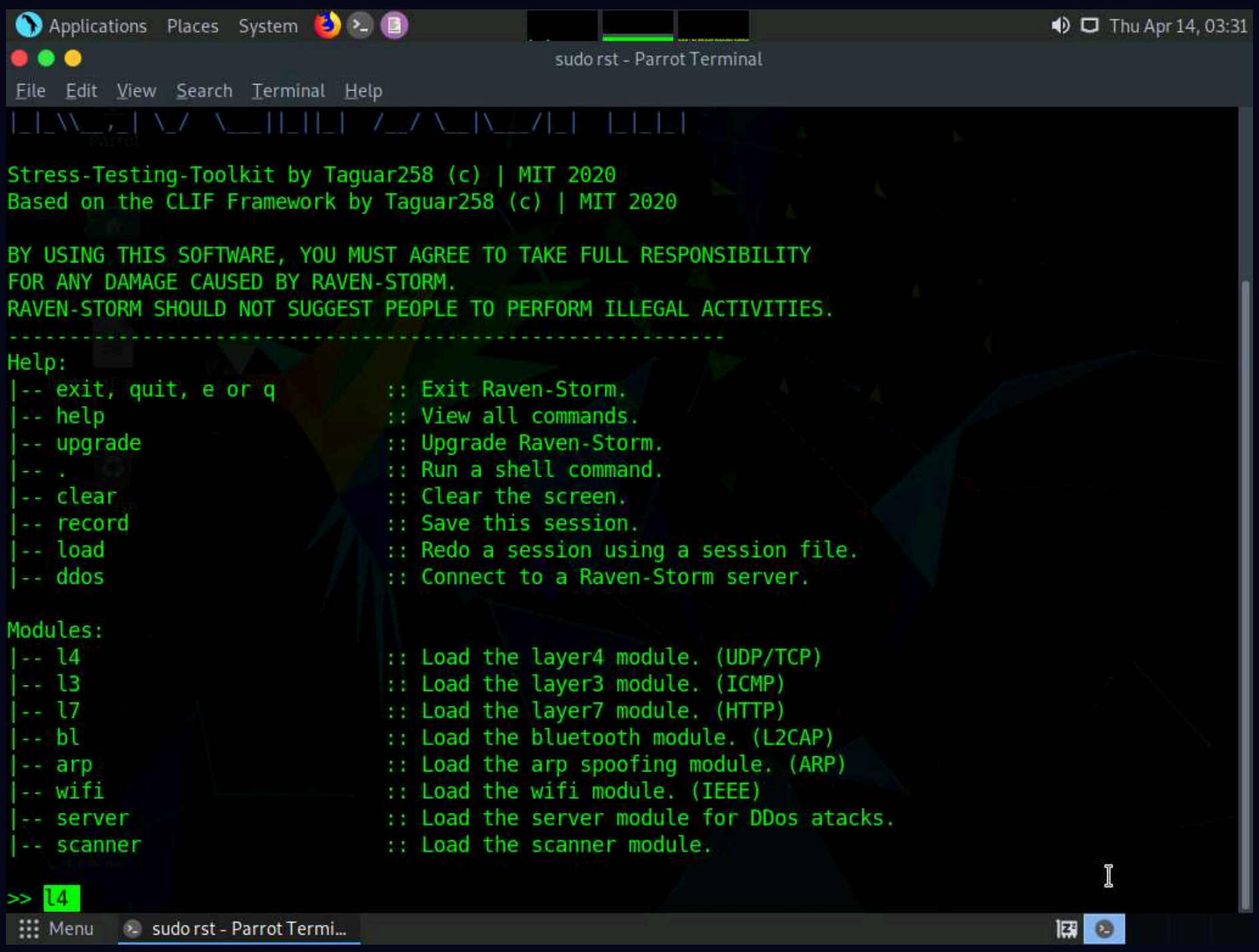

5. Type **sudo rst** and press **Enter** to start Raven-storm tool.




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

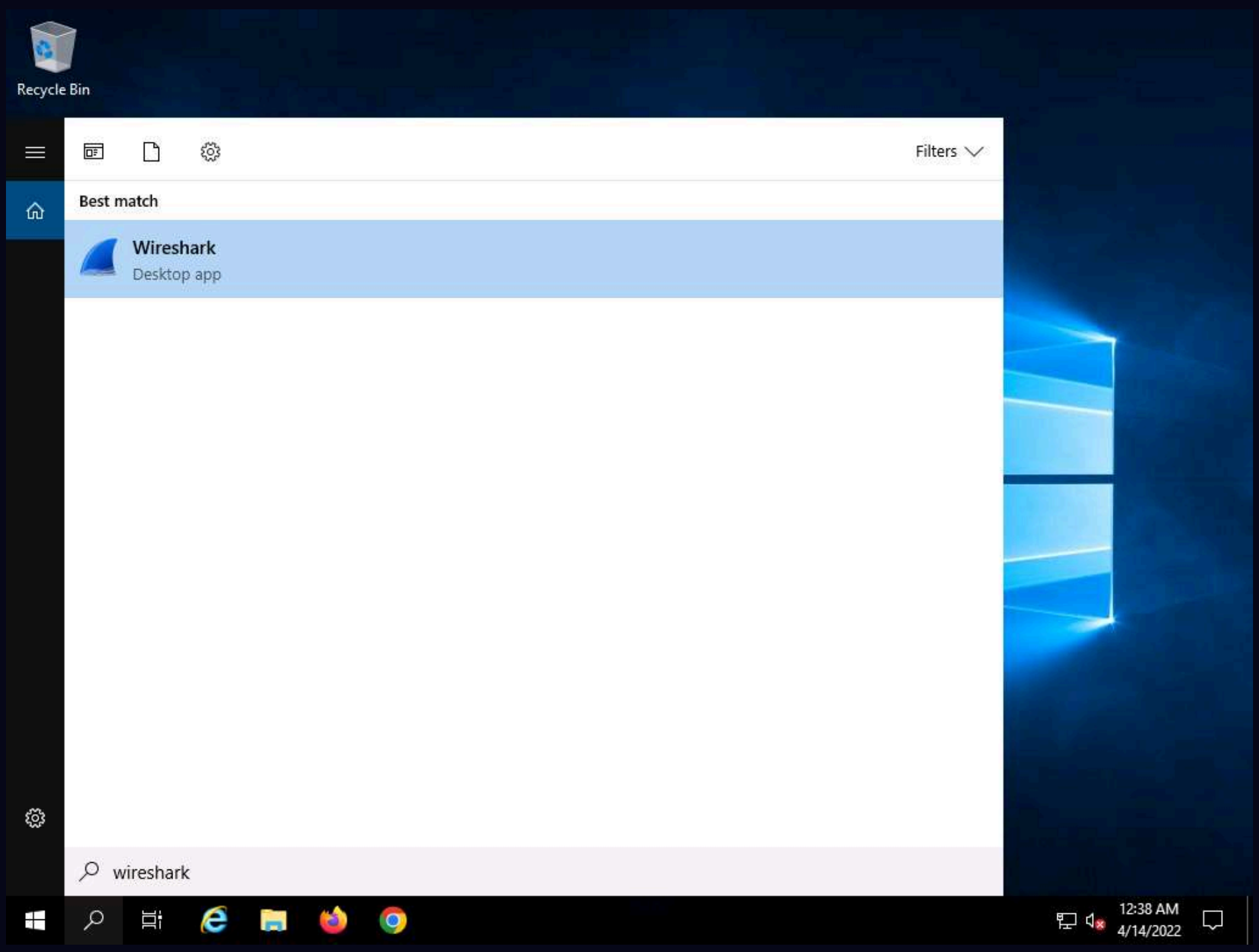



7. Type **l4** and press **Enter** to load **layer4** module (UDP/TCP).



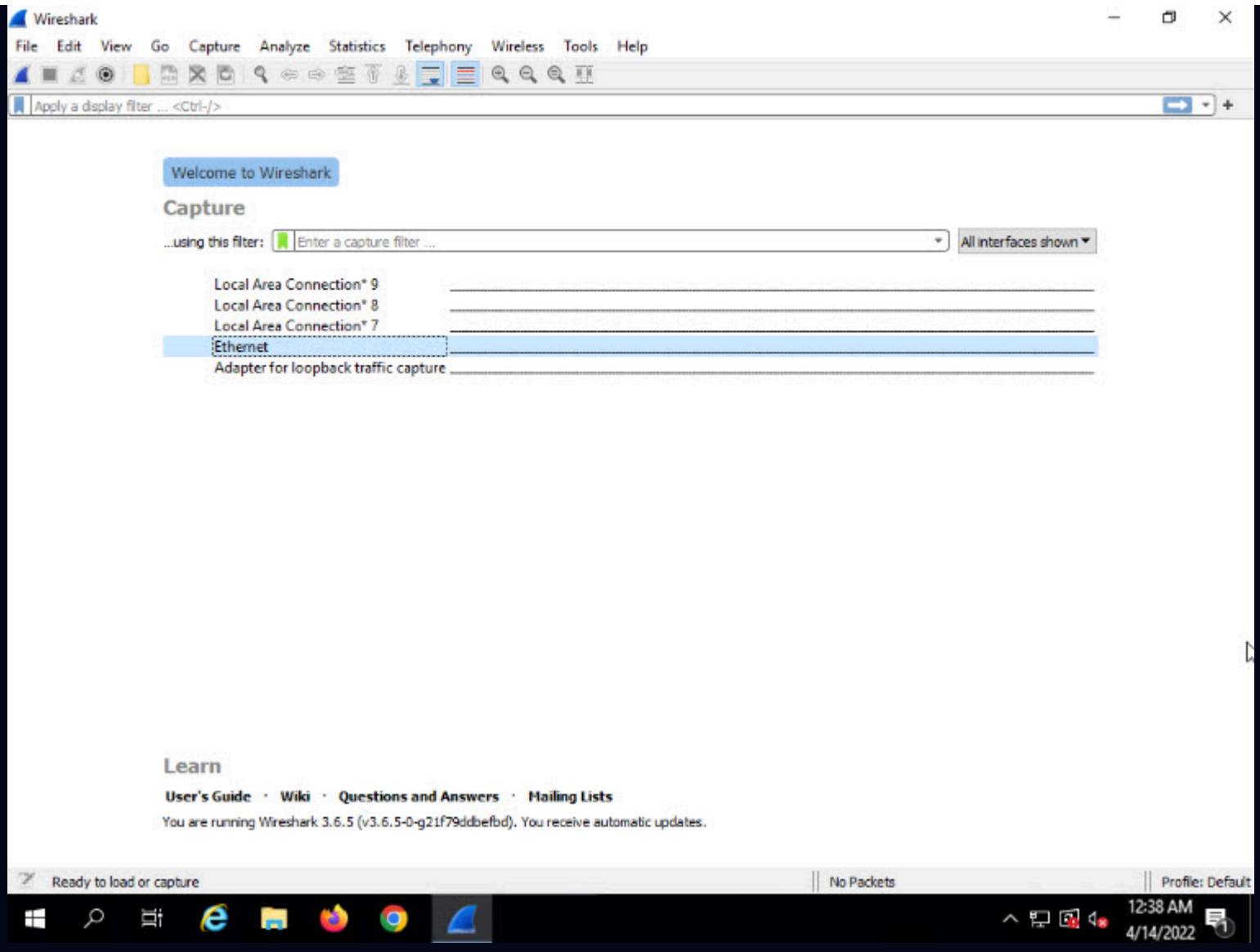

8. Now click **CEHv12 Windows Server 2019** to switch to **Windows Server 2019** machine.

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.

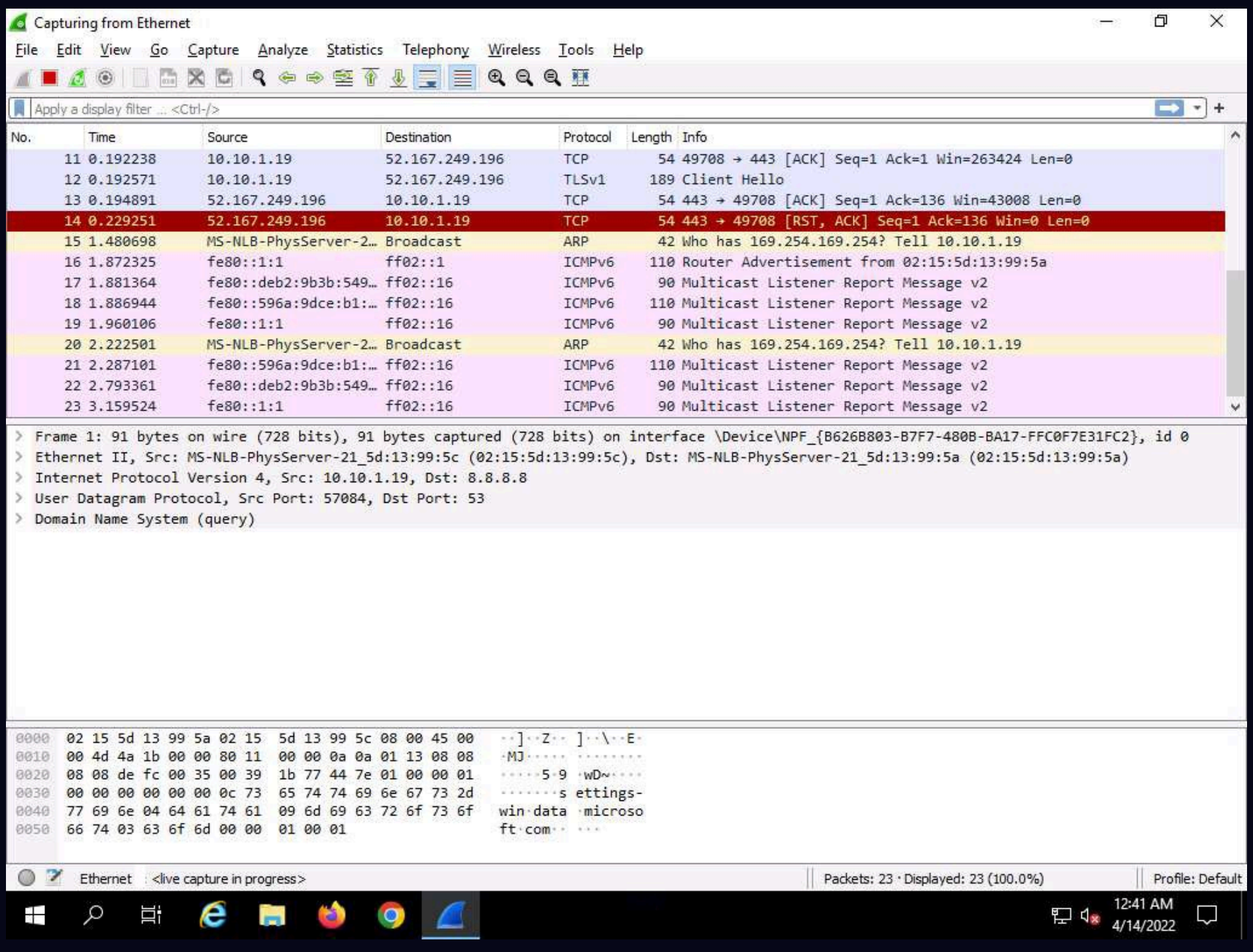



10. The **Wireshark Network Analyzer** window appears. Double-click on the primary network interface (here, **Ethernet**) to start capturing the network traffic.

> Note: The network interface might differ when you perform the task.
>
> Note: If a **Software Update** pop-up appears click on **Remind me later**.

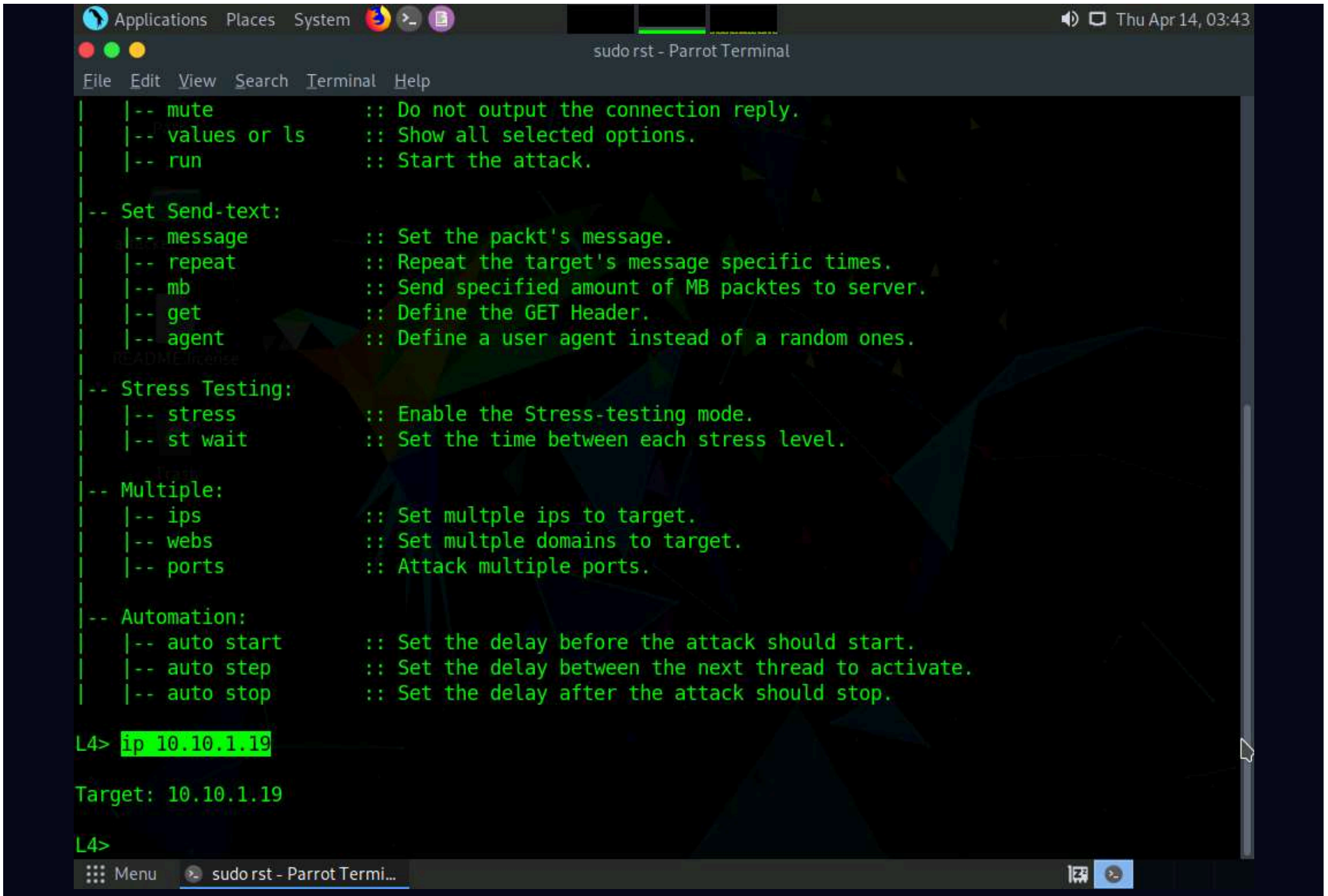



11. **Wireshark** starts capturing the packets; leave it running.

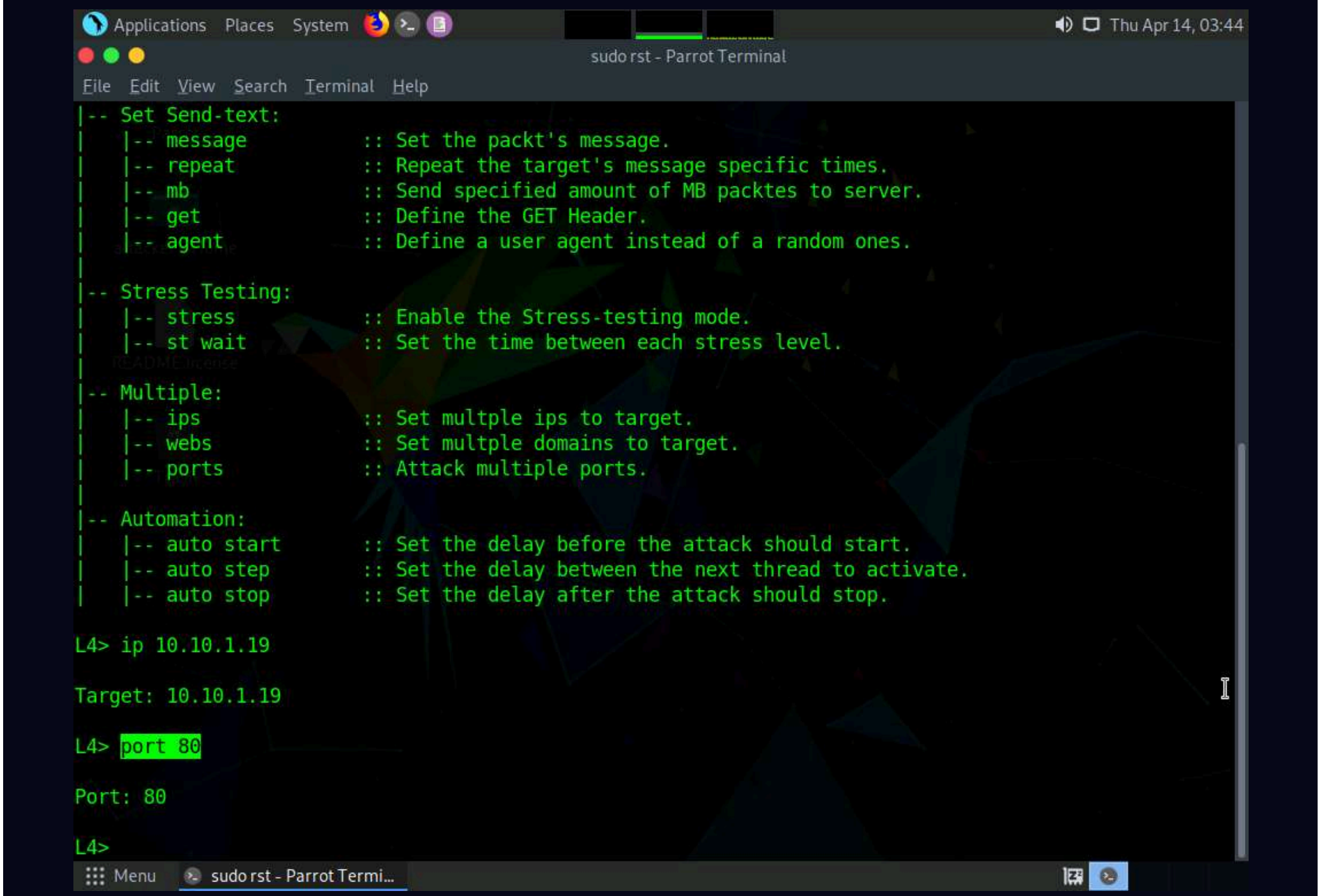



12. Click **CEHv12 Parrot Security** to switch to **Parrot Security** window.

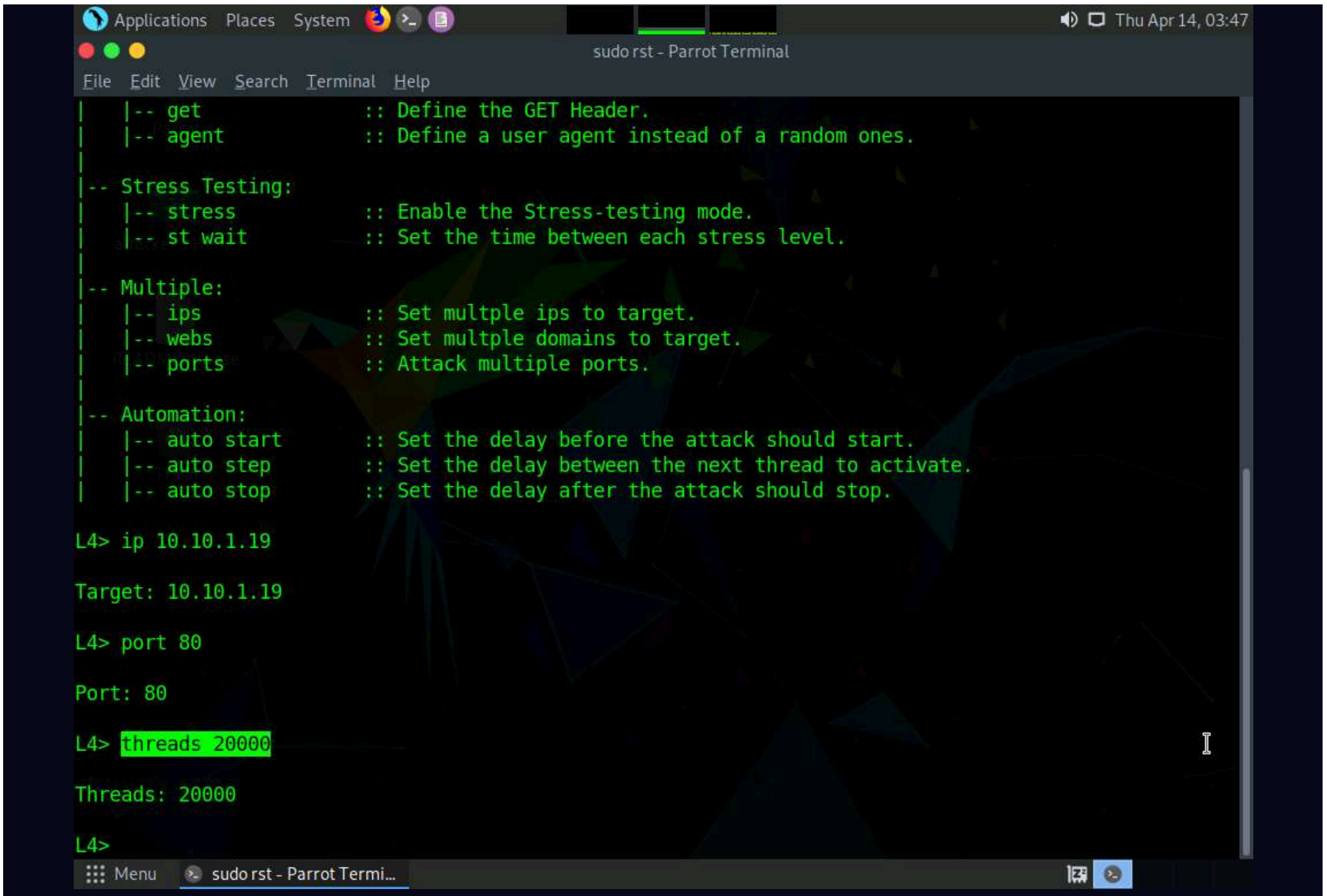
13. In the terminal window, type **ip 10.10.1.19** and press **Enter** to specify the target IP address.



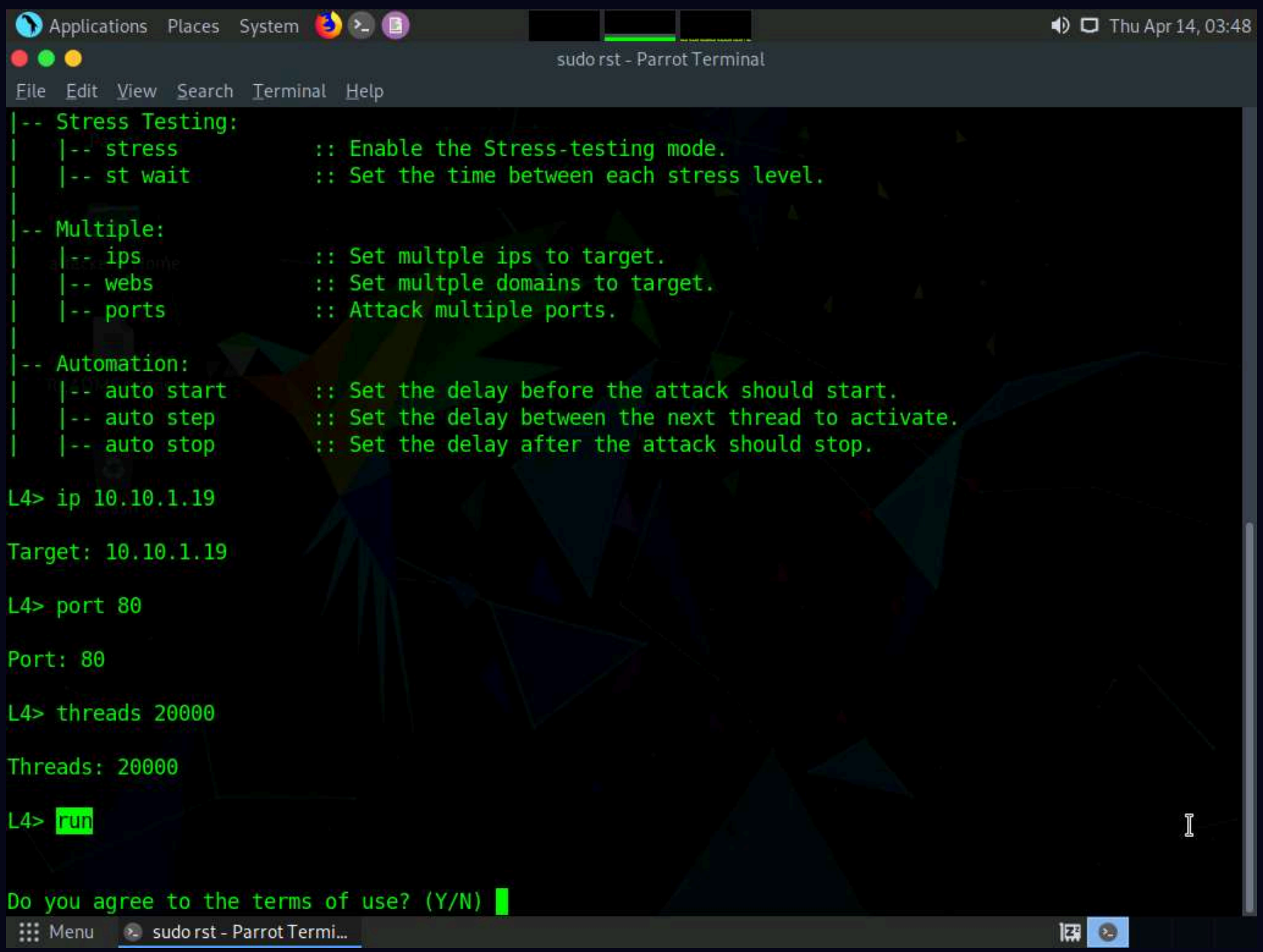

14. Type **port 80** and press **Enter**, to specify the target port.



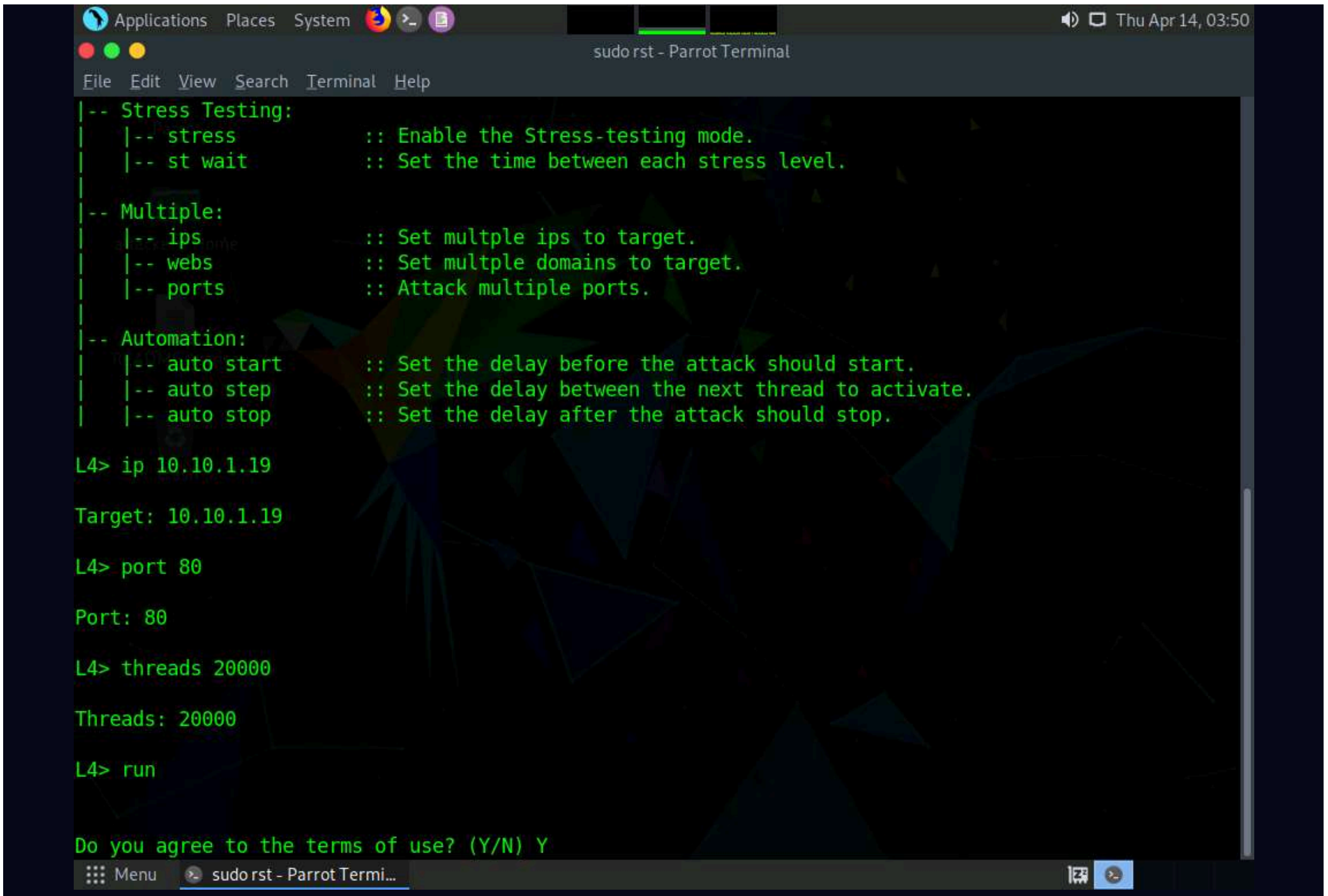

15. Type **threads 20000** and press **Enter**, to specify number of threads.



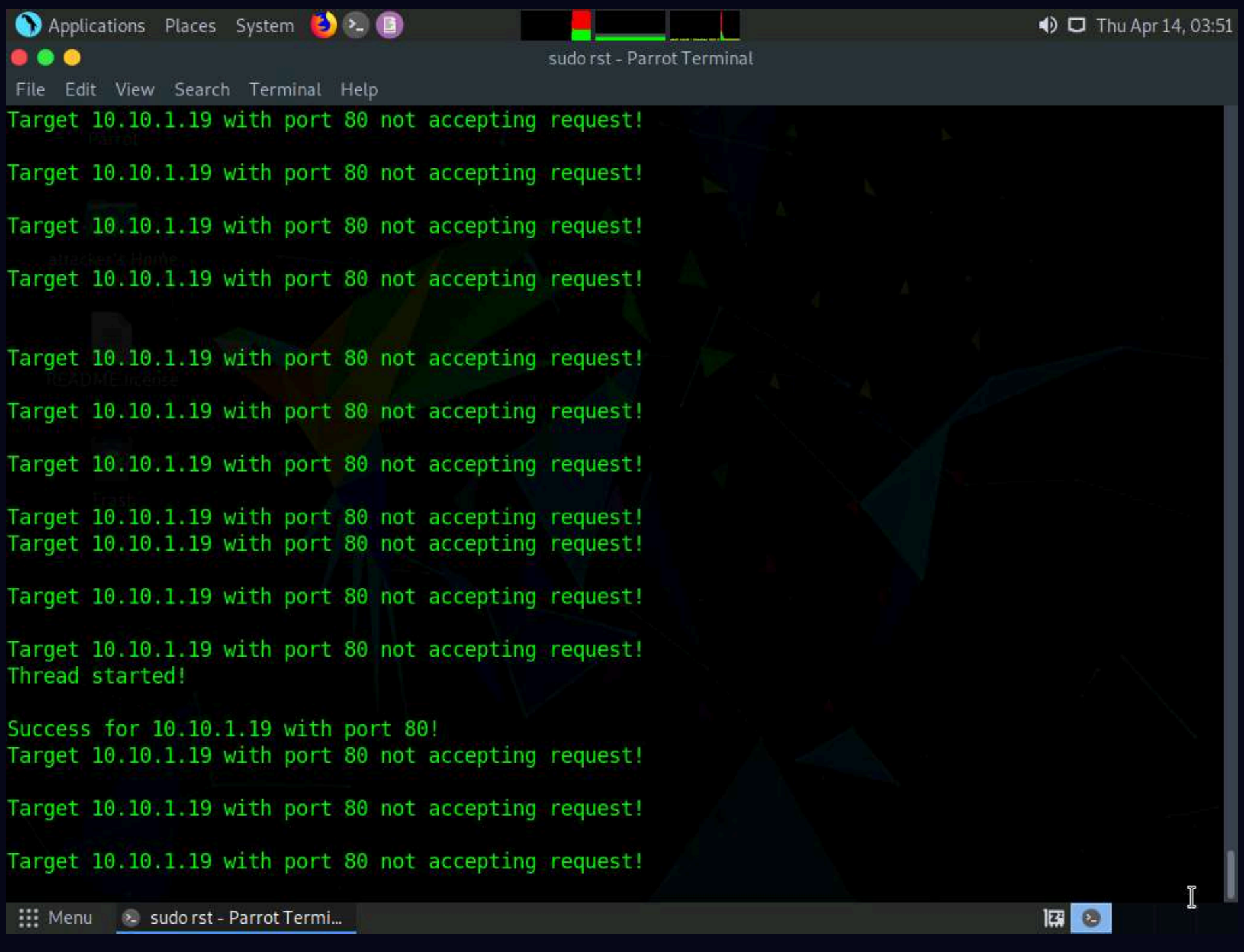

16. Now, in the terminal type **run** and press **Enter**, to start the DoS attack on the target machine.




17. In the **Do you agree to the terms of use? (Y/N)** field, type **Y** and press **Enter**.

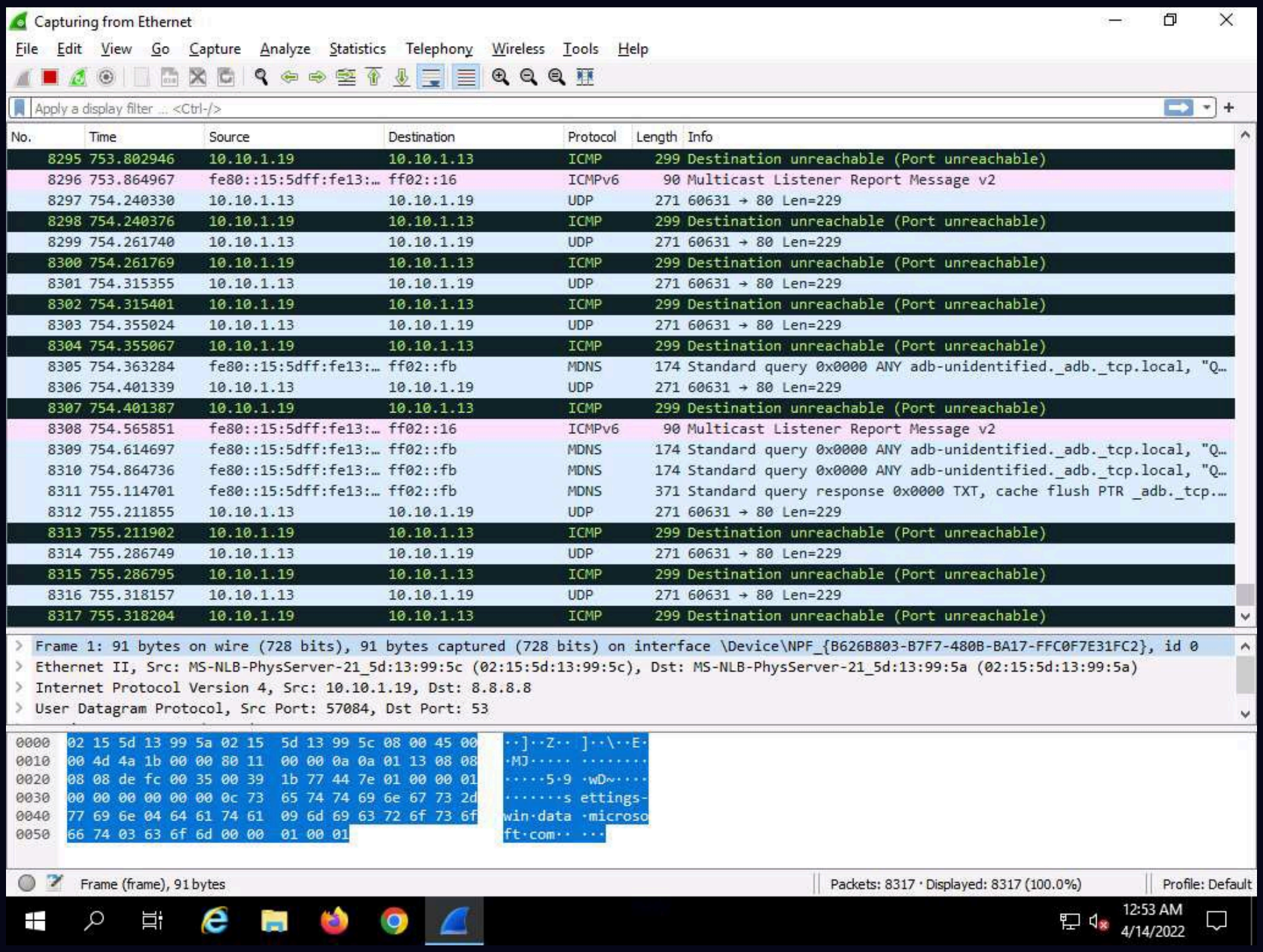



18. Raven-storm starts DoS attack on the target machine (here, **Windows Server 2019**).

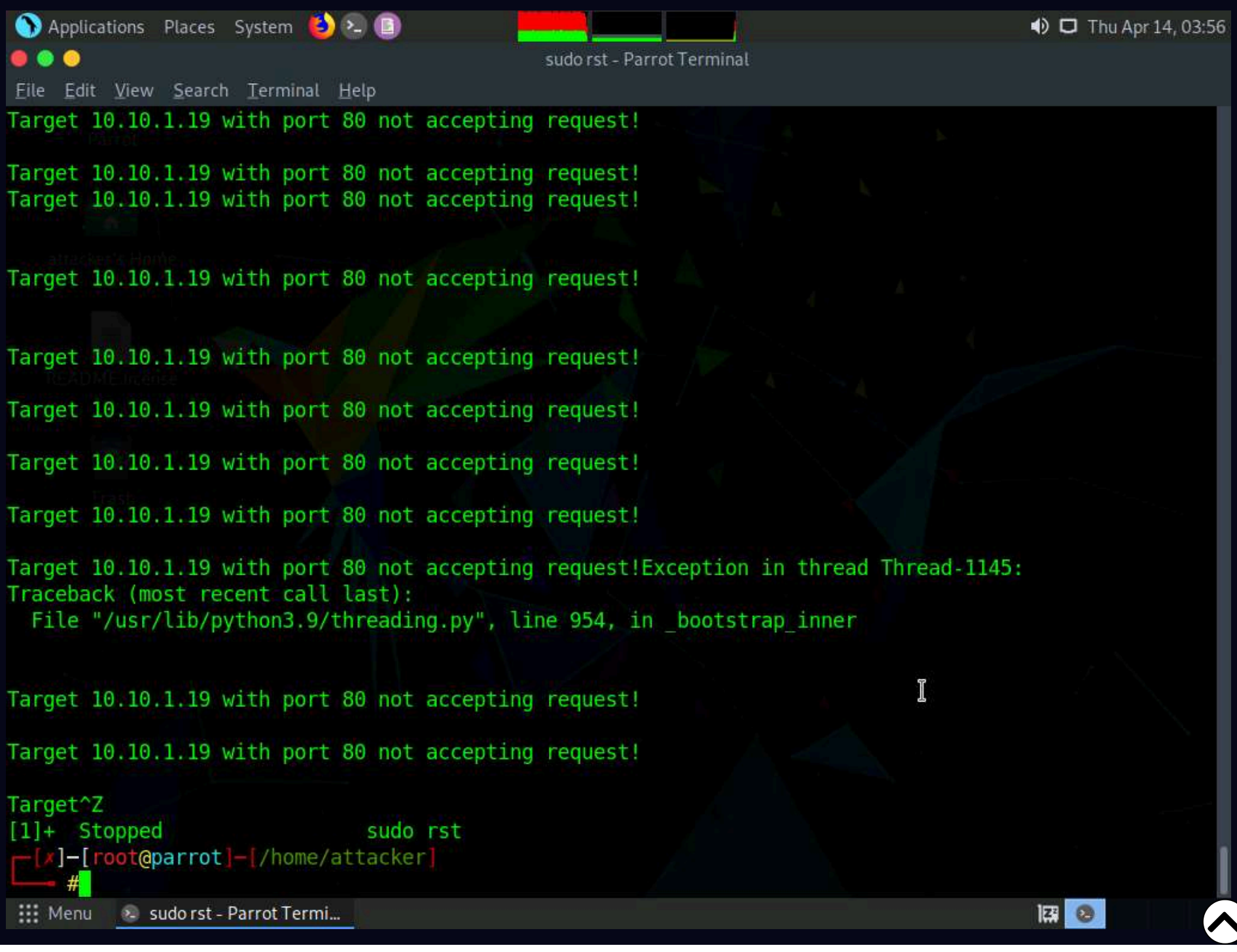



19. Click **CEHv12 Windows Server 2019** to switch to **Windows Server 2019**.

20. You can observe a large number of packets received from **Parrot Security** machine (**10.10.1.13**).




21. Click **CEHv12 Parrot Security** to switch to **Parrot Security** 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.

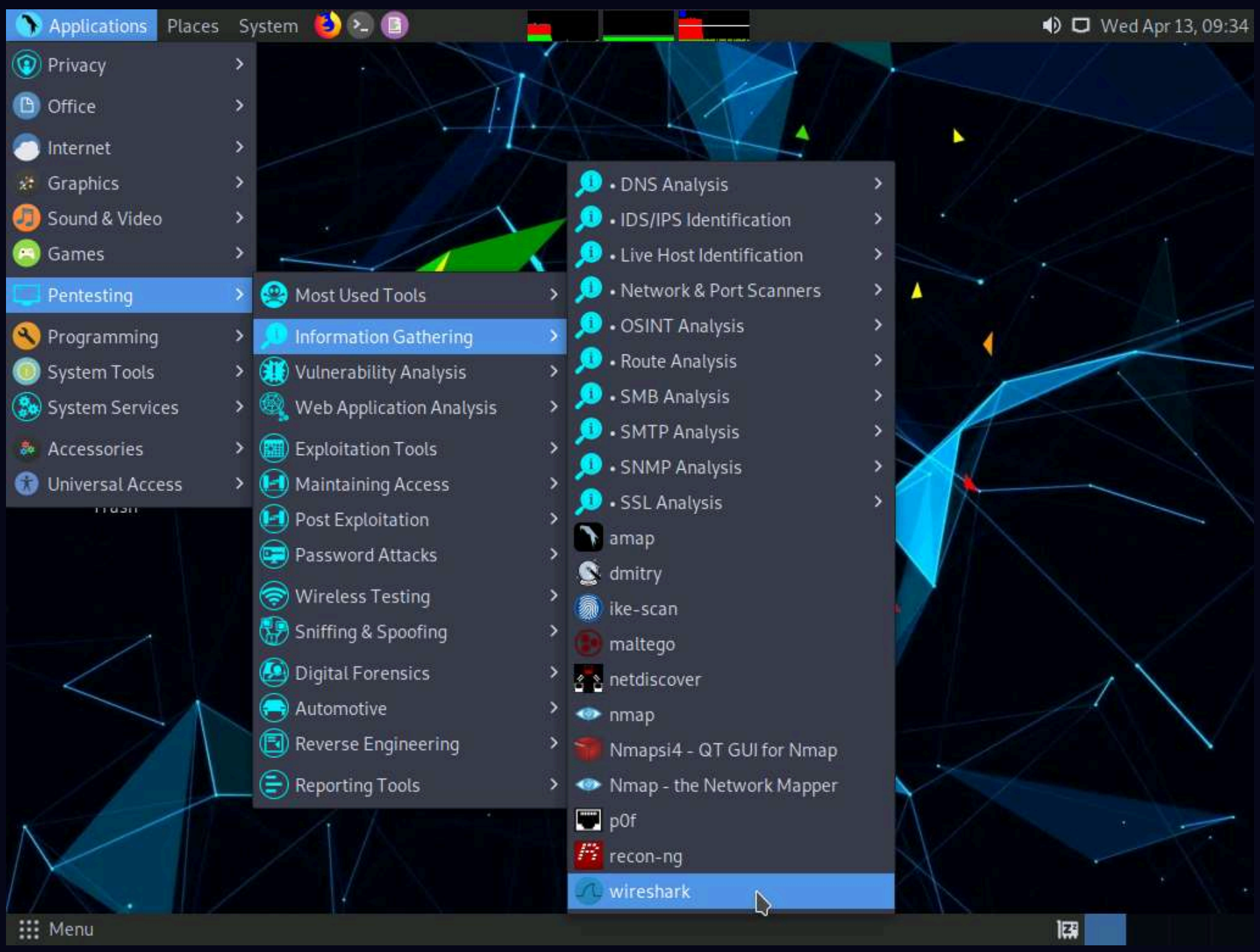
# Task 4: Perform a DDoS Attack using HOIC

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.

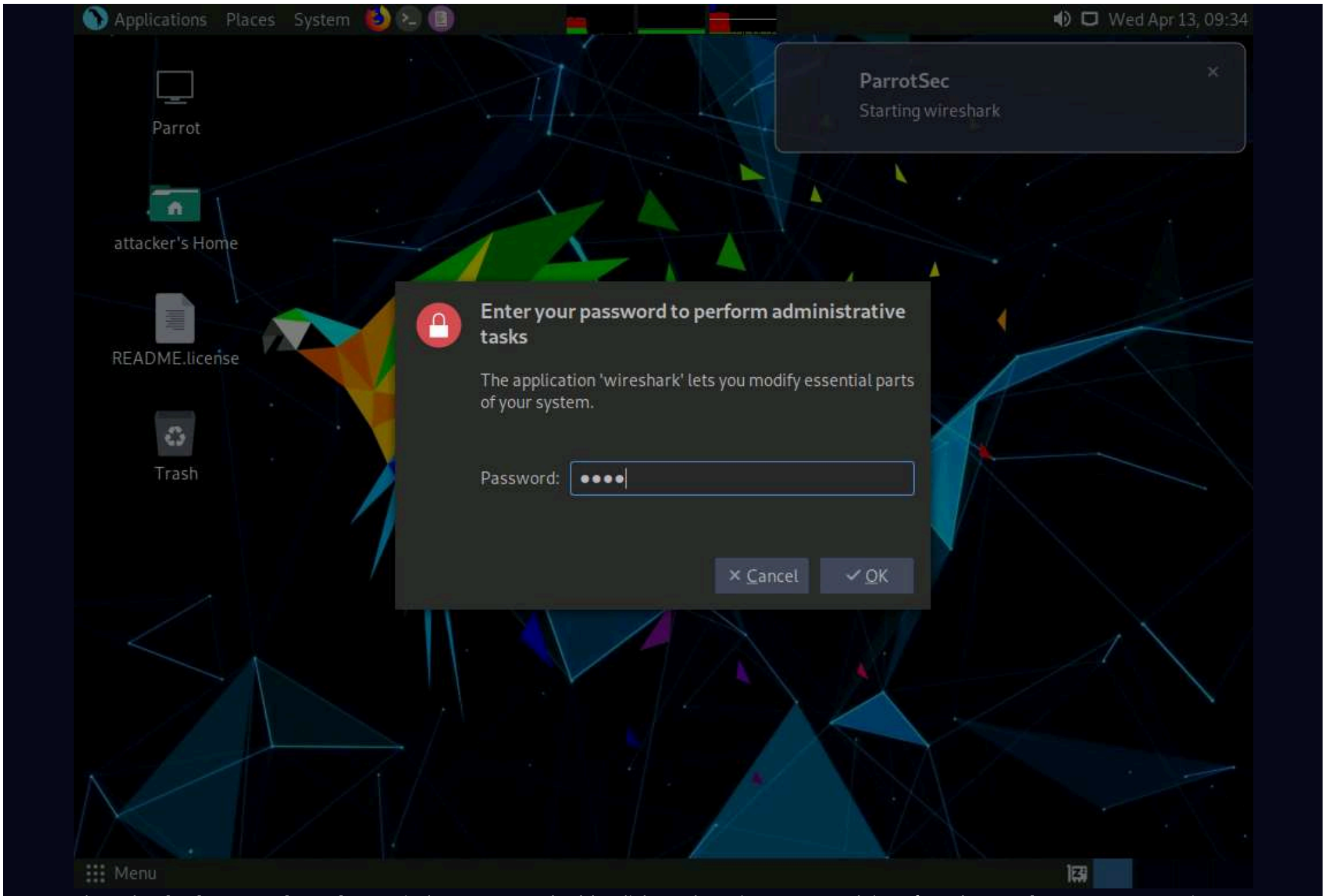
Here, we will use the HOIC tool to perform a DDoS attack on the target machine.

> 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.

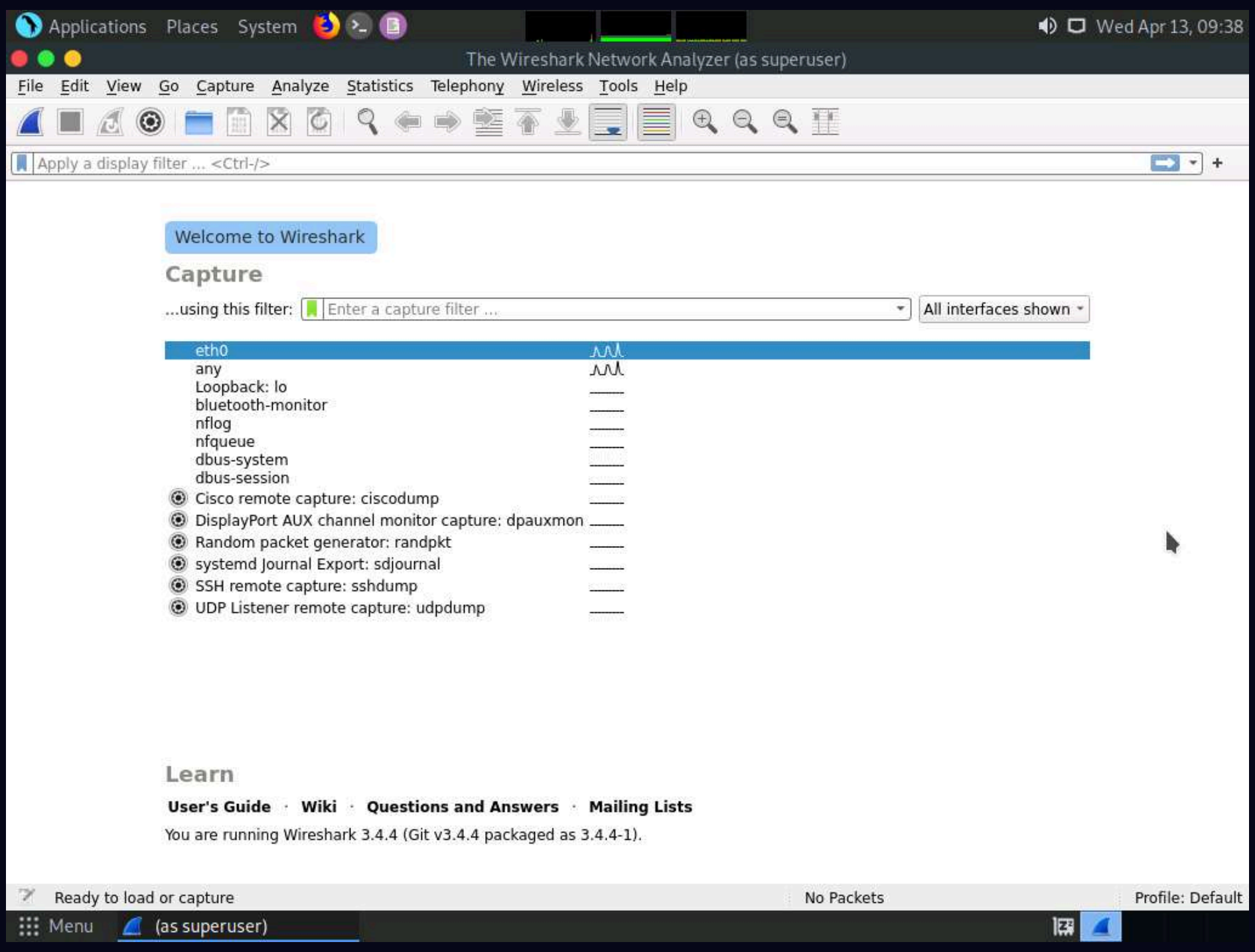
1. Click **CEHv12 Parrot Security** switch to the **Parrot Security** machine. Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting** --> **Information Gathering** --> **wireshark**.




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



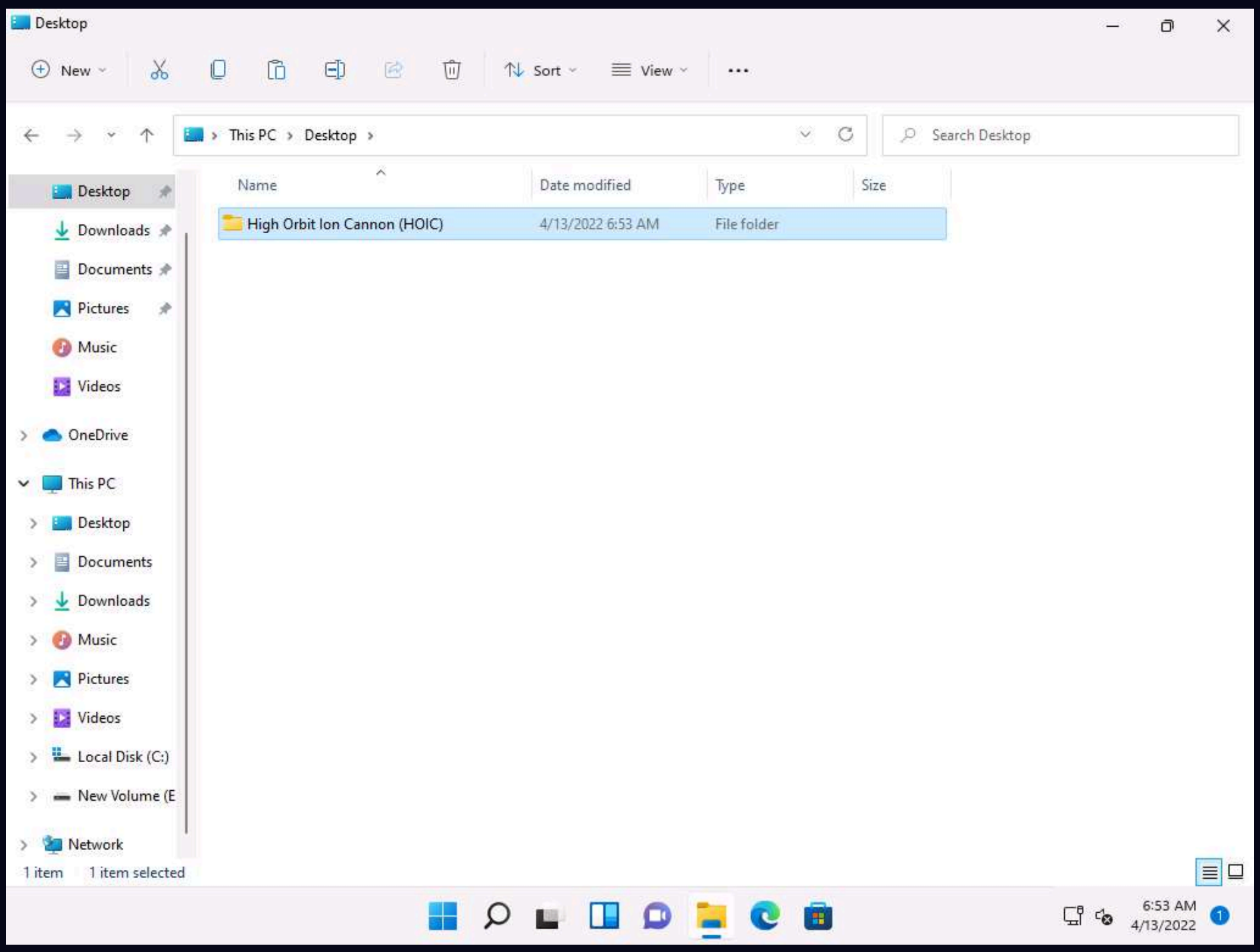

3. The **Wireshark Network Analyzer** window appears; double-click on the primary network interface (here, **eth0**) to start capturing the network traffic.




4. Click **CEHv12 Windows 11** to switch to the **Windows 11** machine.

5. 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.

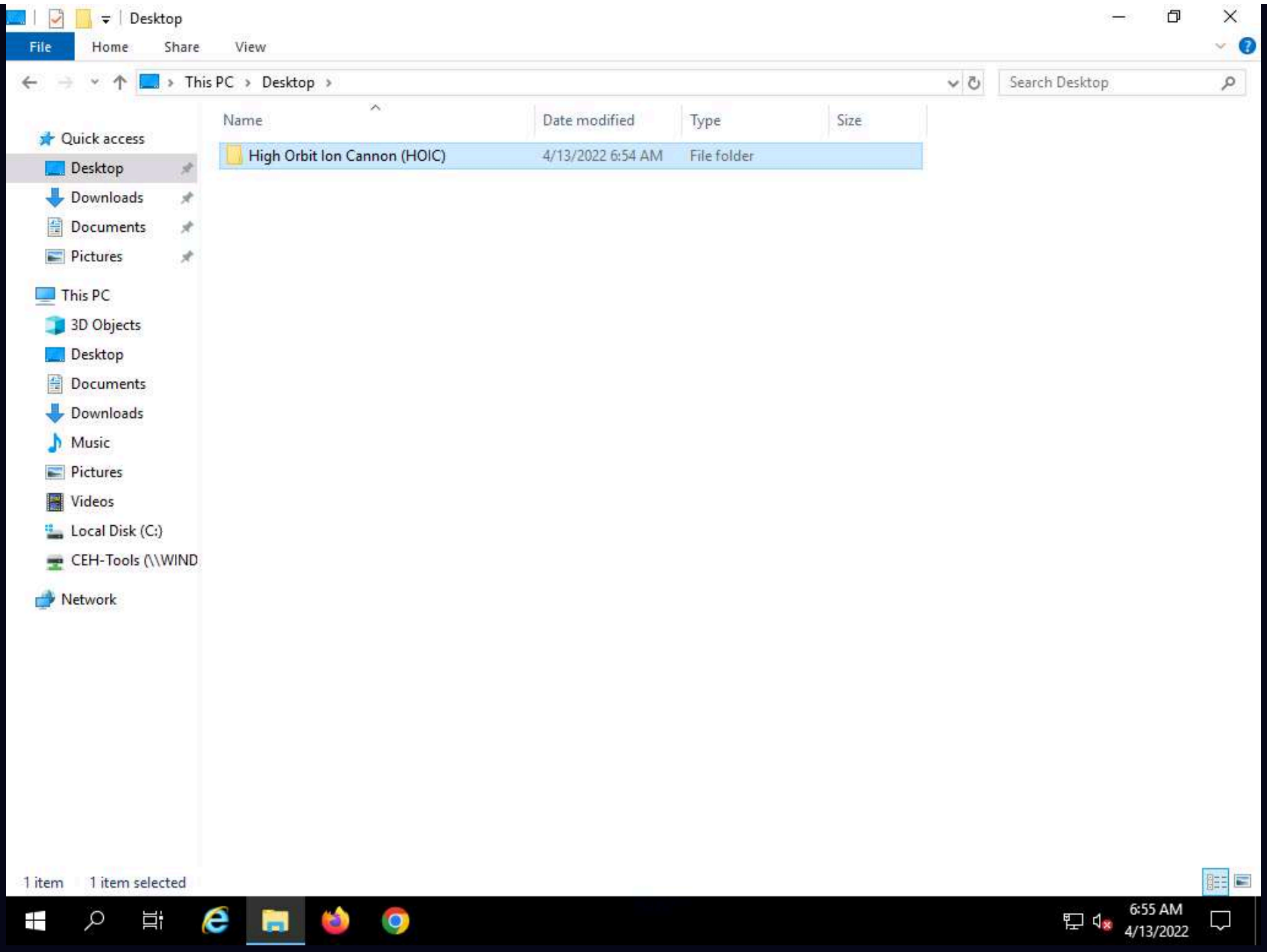



6. Similarly, follow the previous step (**Step #5**) on the **Windows Server 2019** (click **CEHv12 Windows Server 2019** to switch to the **Windows Server 2019**) and **Windows Server 2022** (click **CEHv12 Windows Server 2022** to switch to the **Windows Server 2022**) machines.

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.

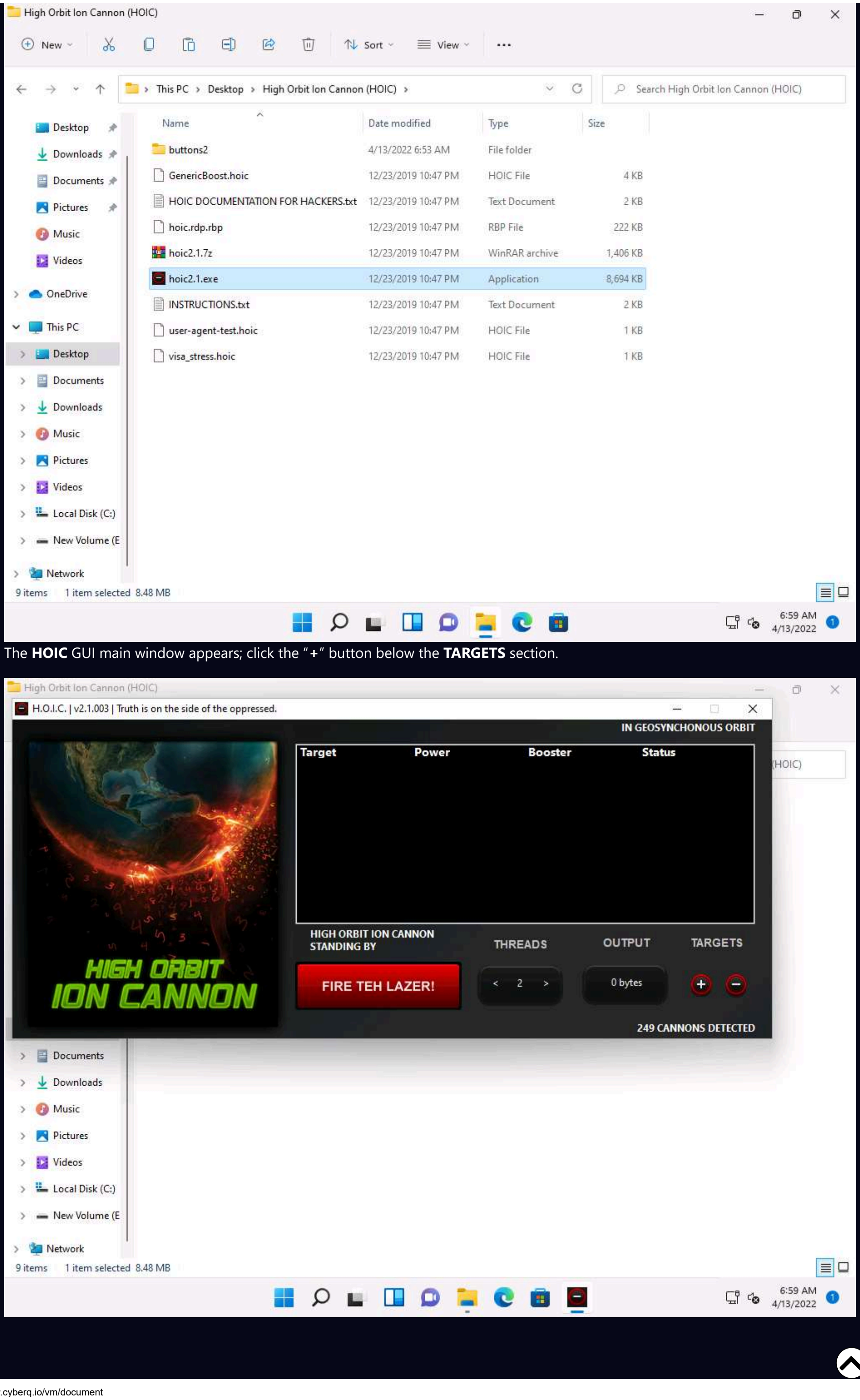
Note: In **Windows Server 2022**, click **Ctrl+Alt+Del** to activate the machine, by default, **CEH\Administrator** profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.

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.**



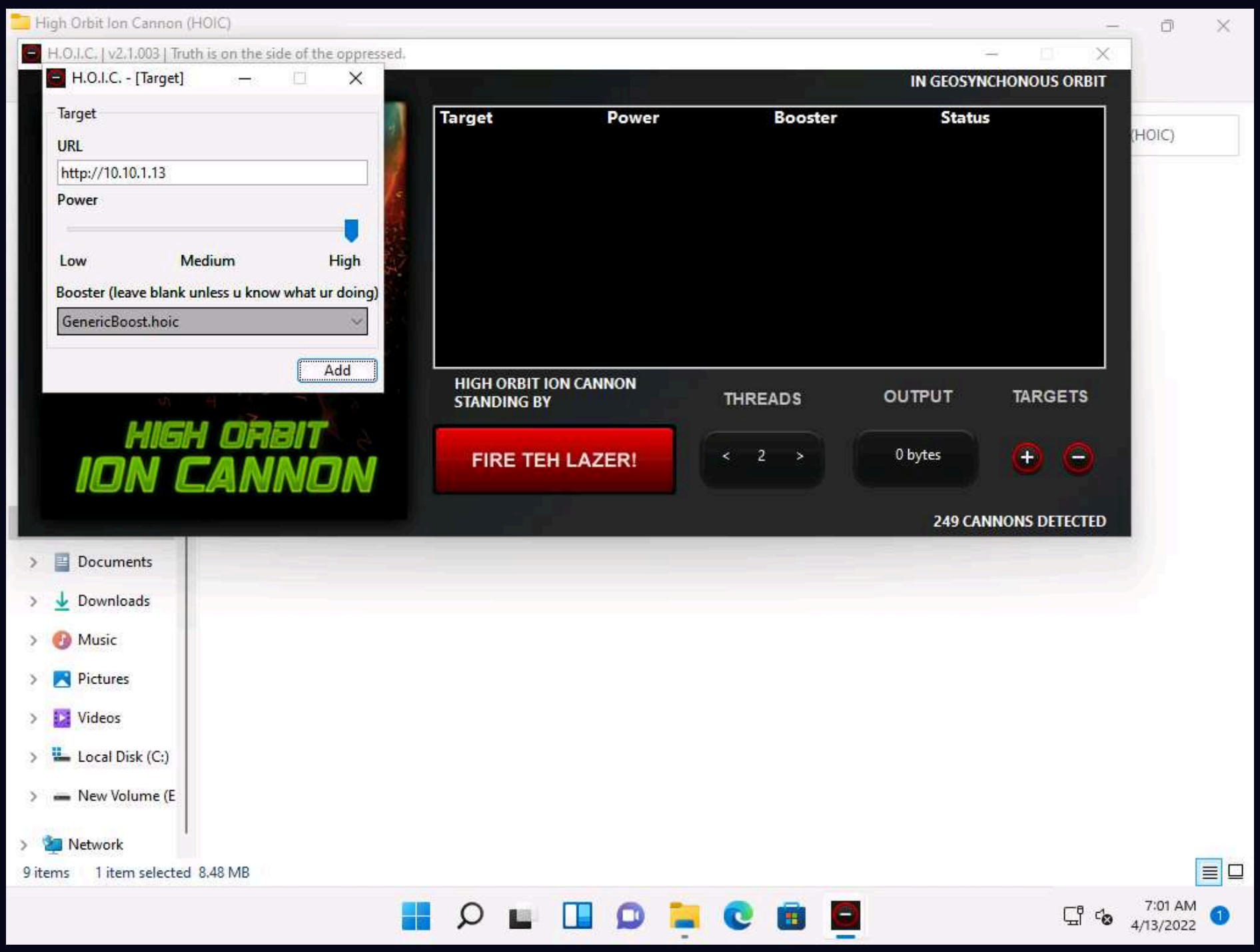

7. Now, click **CEHv12 Windows 11** to switch to the **Window 11** machine and navigate to **Desktop**. Open the **High Orbit Ion Cannon (HOIC)** folder and double-click **hoic2.1.exe**.

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

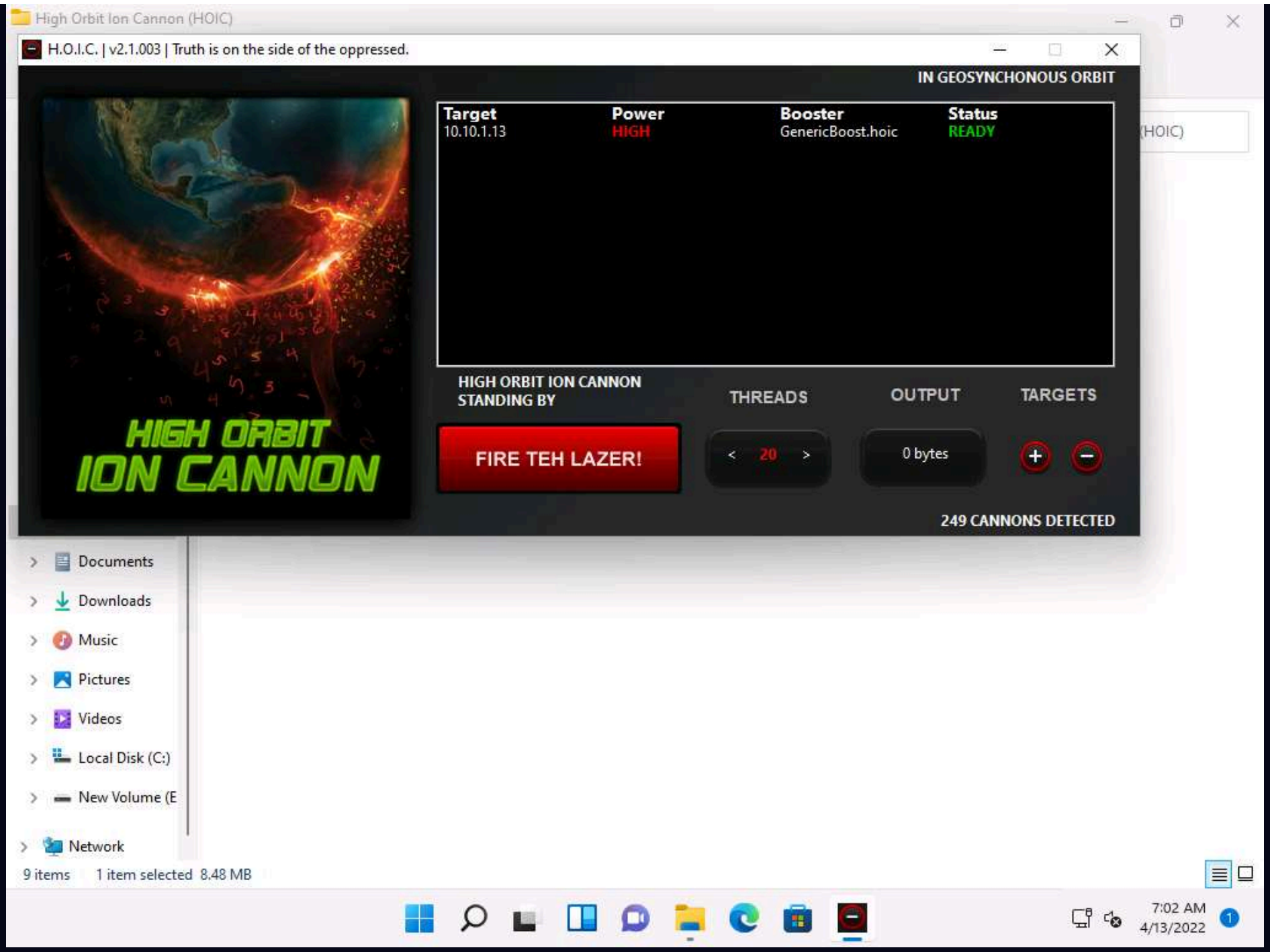



8. The **HOIC** GUI main window appears; click the "**+**" button below the **TARGETS** section.

9. 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**.



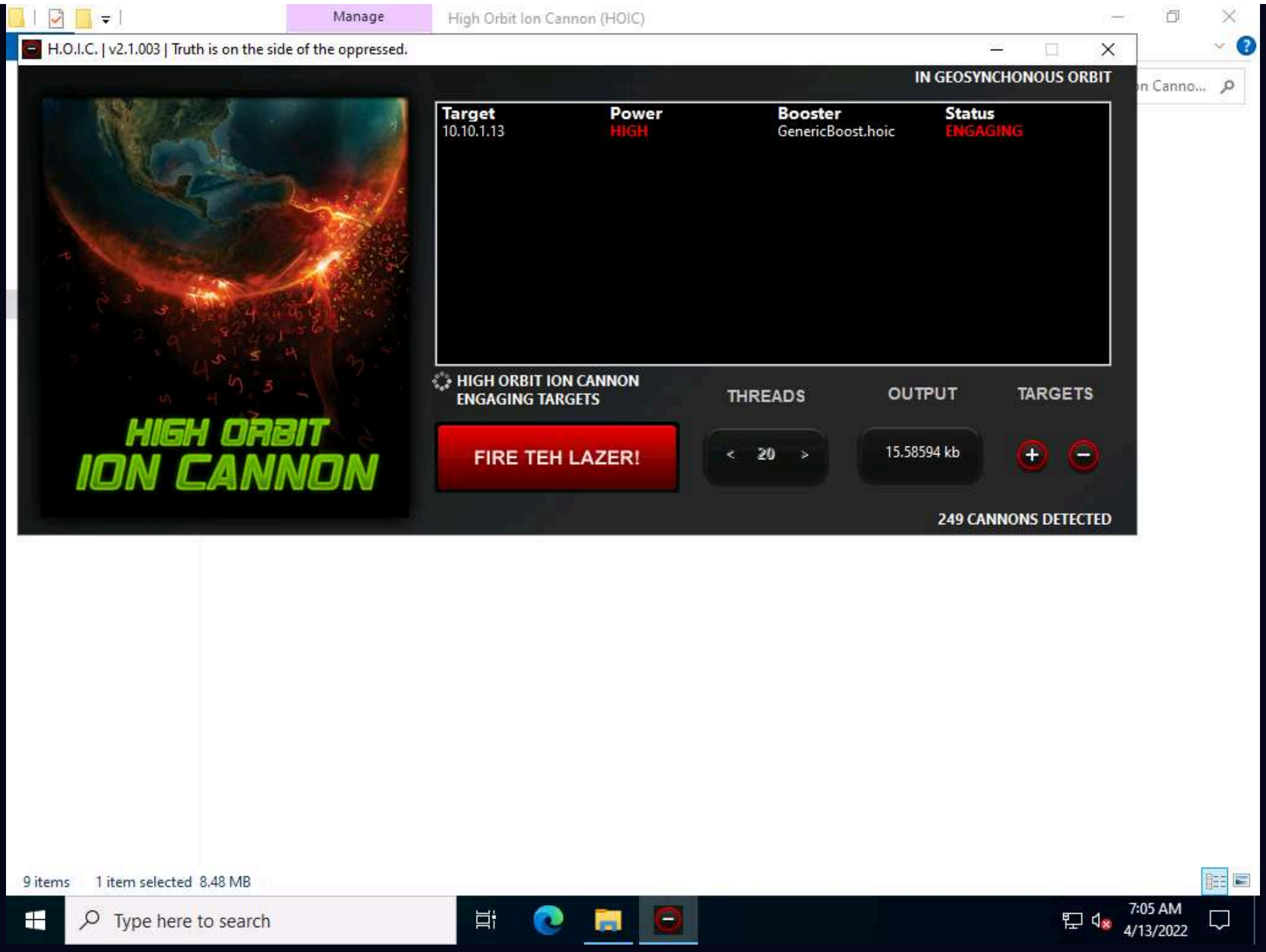

10. Set the **THREADS** value to **20** by clicking the **>** button until the value is reached.



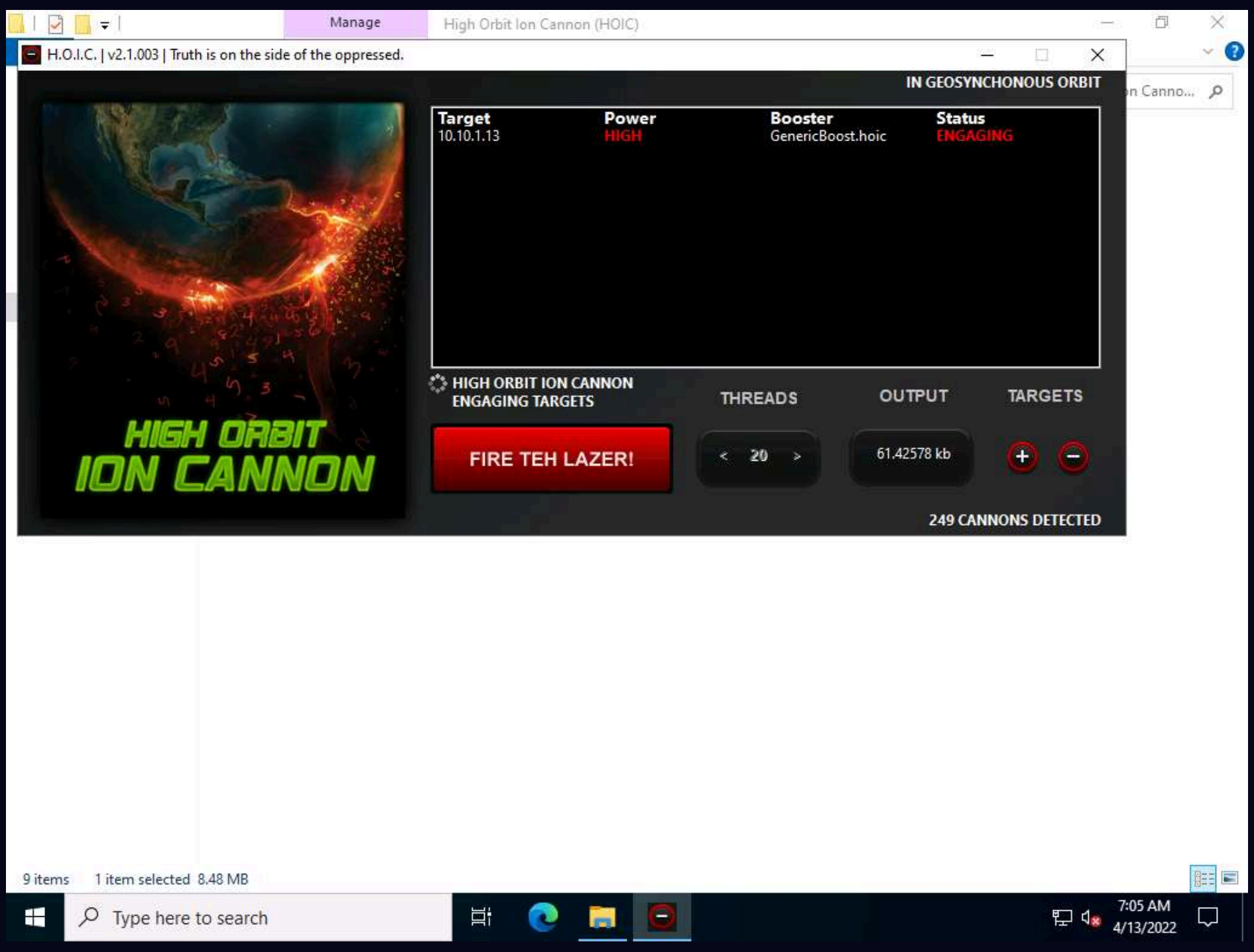

11. Now, switch to the **Windows Server 2019** (click **CEHv12 Windows Server 2019** to switch to the **Windows Server 2019**) and **Windows Server 2022** (click **CEHv12 Windows Server 2022** to switch to the **Windows Server 2022**) machines and follow **Steps 7-10** to configure HOIC.

12. 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** machine.

> Note: To switch to the **Windows 11**, click **CEHv12 Windows 11**.
>
> Note: To switch to the **Windows Server 2019**, click **CEHv12 Windows Server 2019**.
>
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.

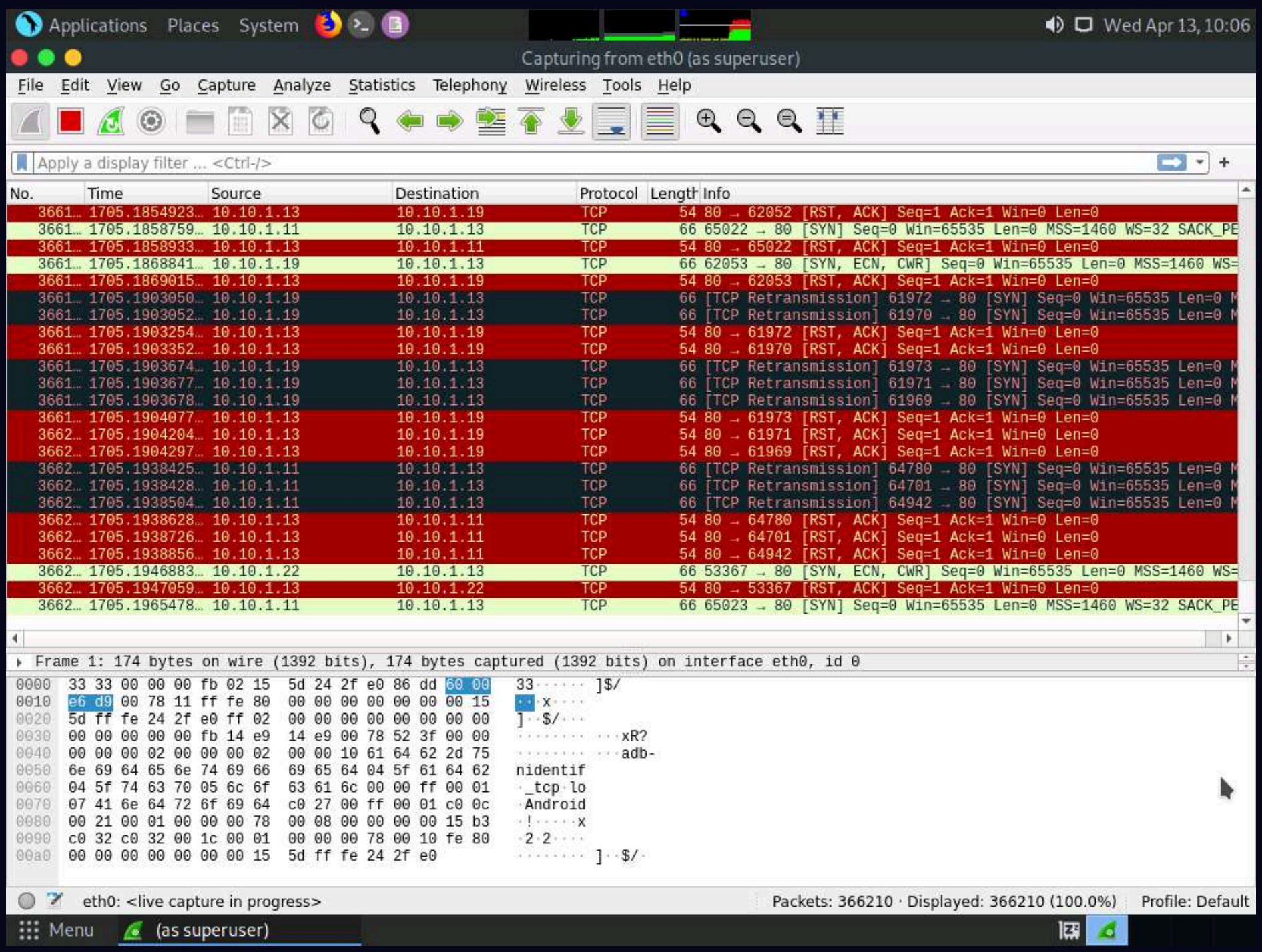



13. Observe that the **Status** changes from **READY** to **ENGAGING**, as shown in the screenshot.




14. Click **CEHv12 Parrot Security** switch to the **Parrot Security** machine.

15. 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.



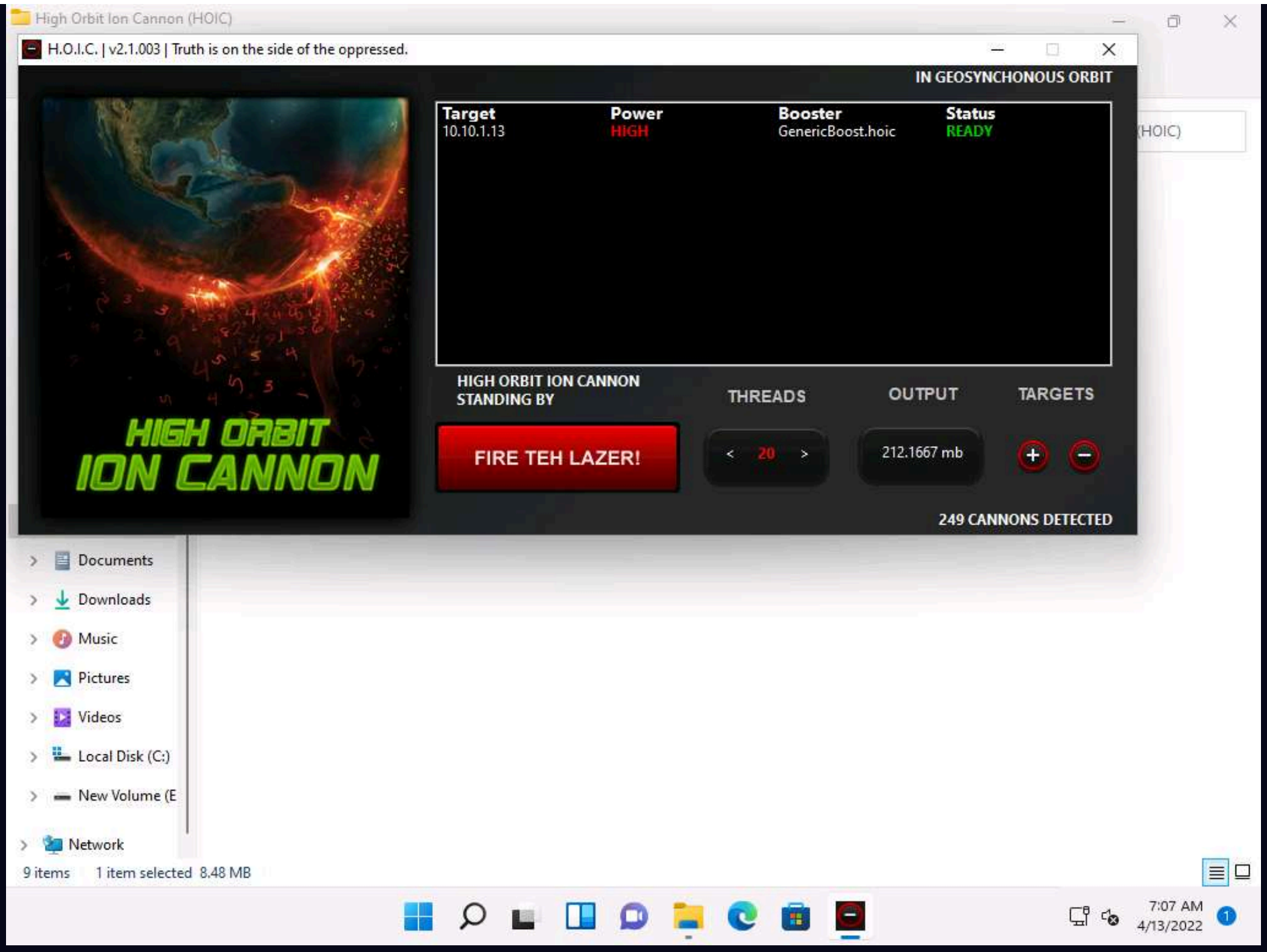

16. You can observe that the performance of the machine is slightly affected and that its response is slowing down.

17. 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.

18. 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.

> Note: To switch to the **Windows 11**, click **CEHv12 Windows 11**.
>
> Note: To switch to the **Windows Server 2019**, click **CEHv12 Windows Server 2019**.
>
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.
>
> Note: To switch to **Parrot Security** machine click **CEHv12 Parrot Security**.




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

# Task 5: Perform a DDoS Attack using LOIC

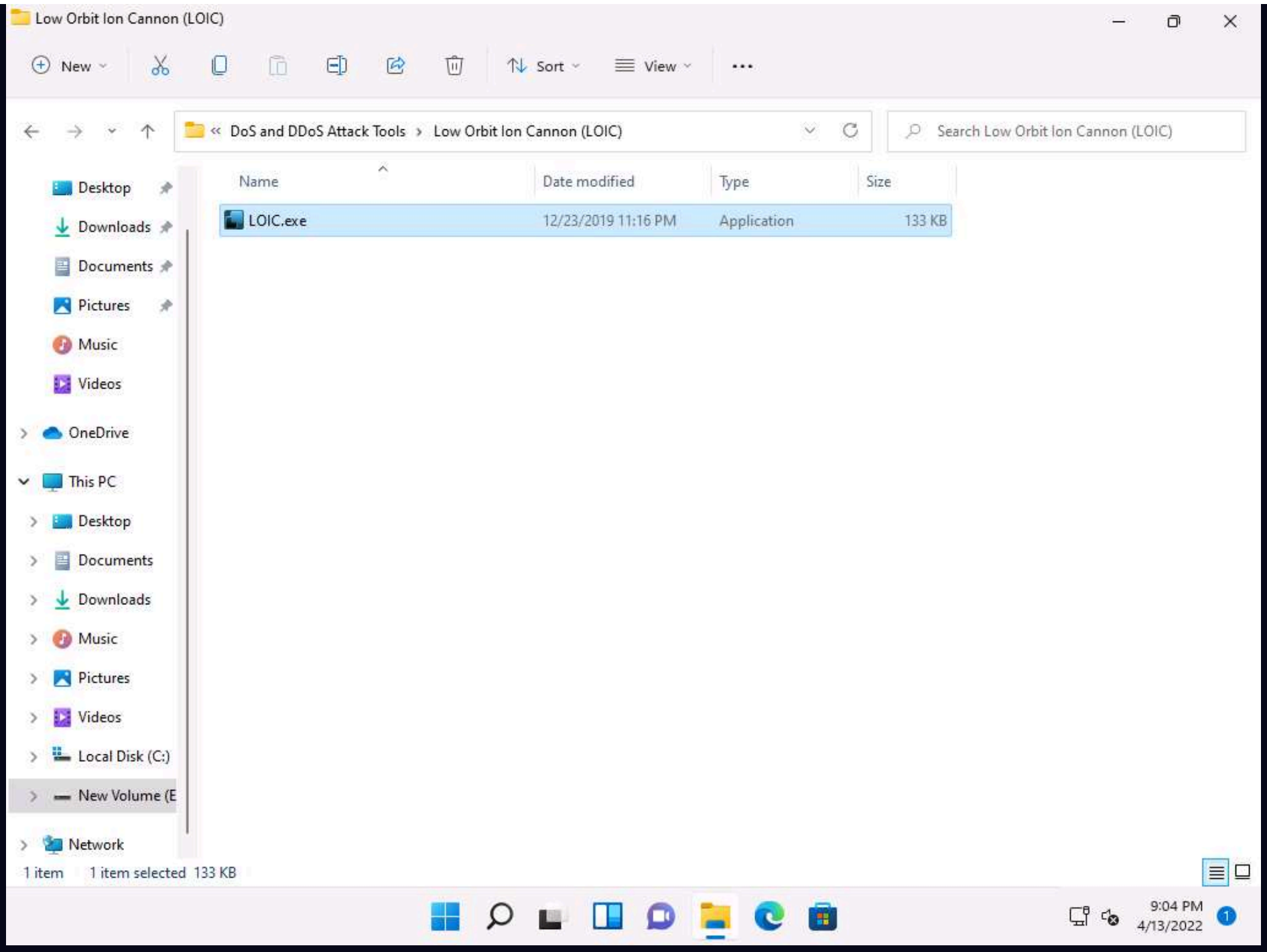
LOIC (Low Orbit Ion Cannon) is a network stress testing and DoS attack application. We can also call it an application-based DOS attack as it mostly targets web applications. We can use LOIC on a target site to flood the server with TCP packets, UDP packets, or HTTP requests with the intention of disrupting 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. Click **CEHv12 Windows 11** to switch to the **Windows 11** 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**.

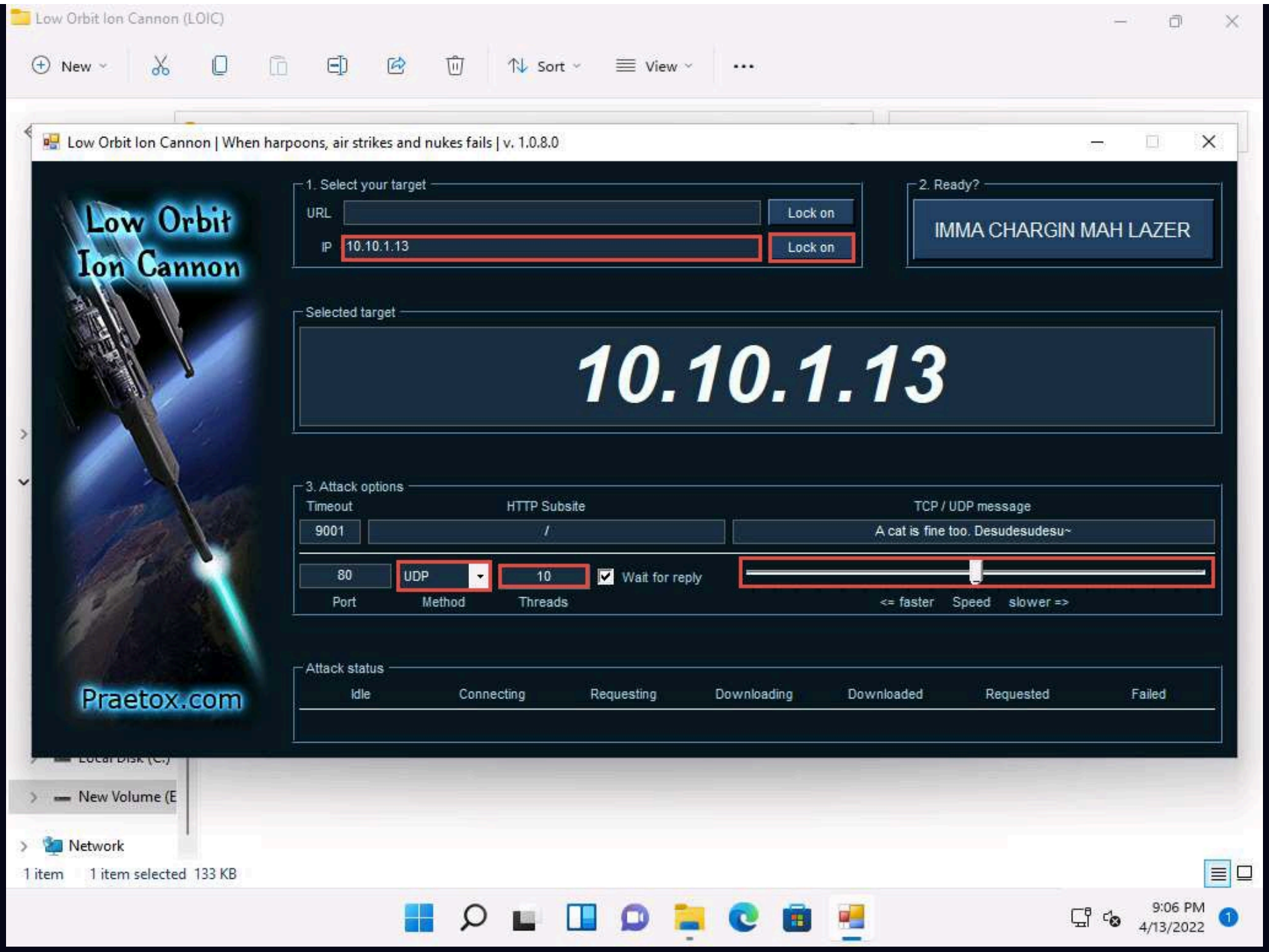
> Note: If an **Open File - Security Warning** pop-up appears, click **Run**.




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.

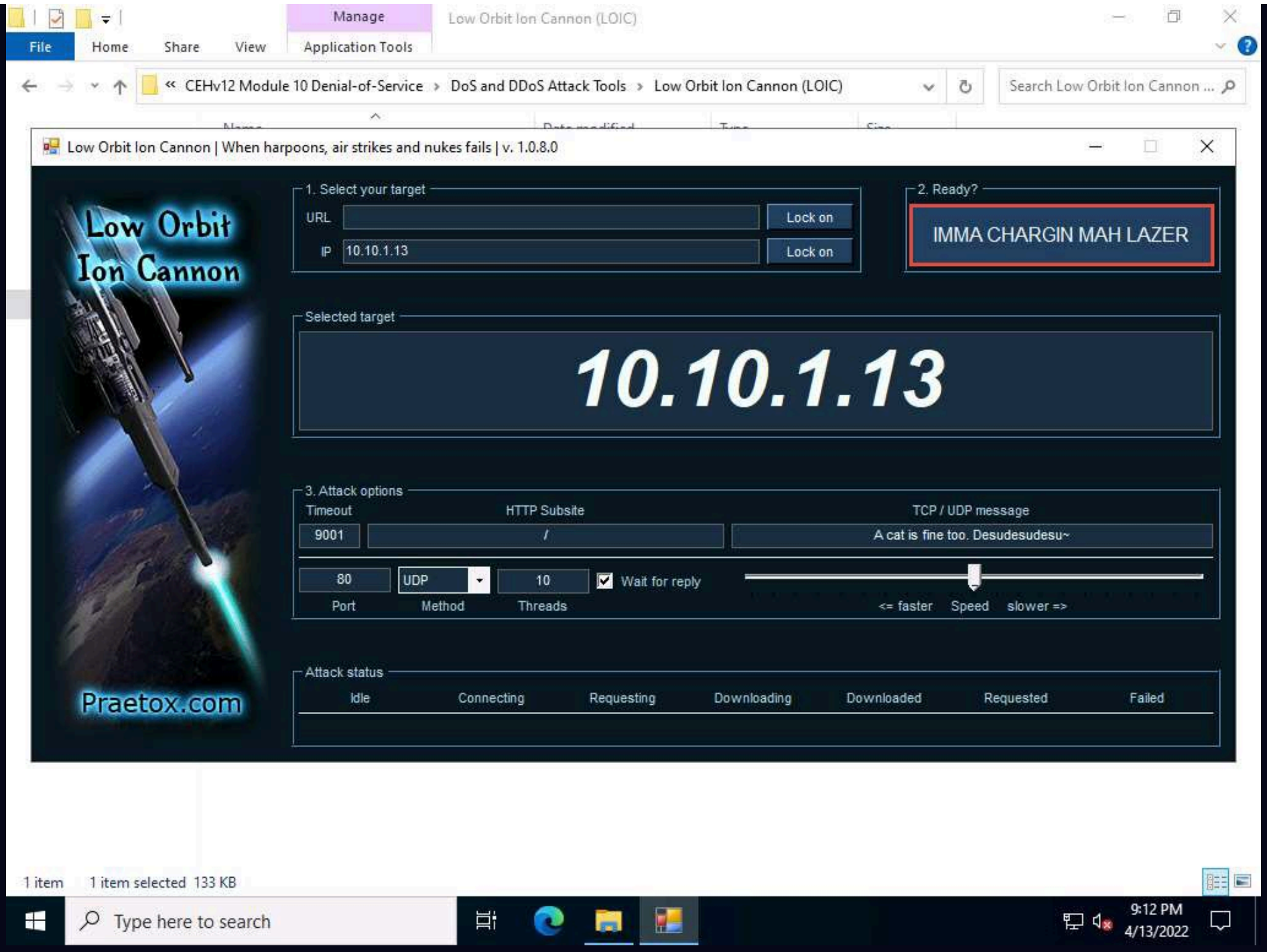



4. Now, switch to the **Windows Server 2019** and **Windows Server 2022** machines and follow **Steps 1 - 3** to launch LOIC and configure it.

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

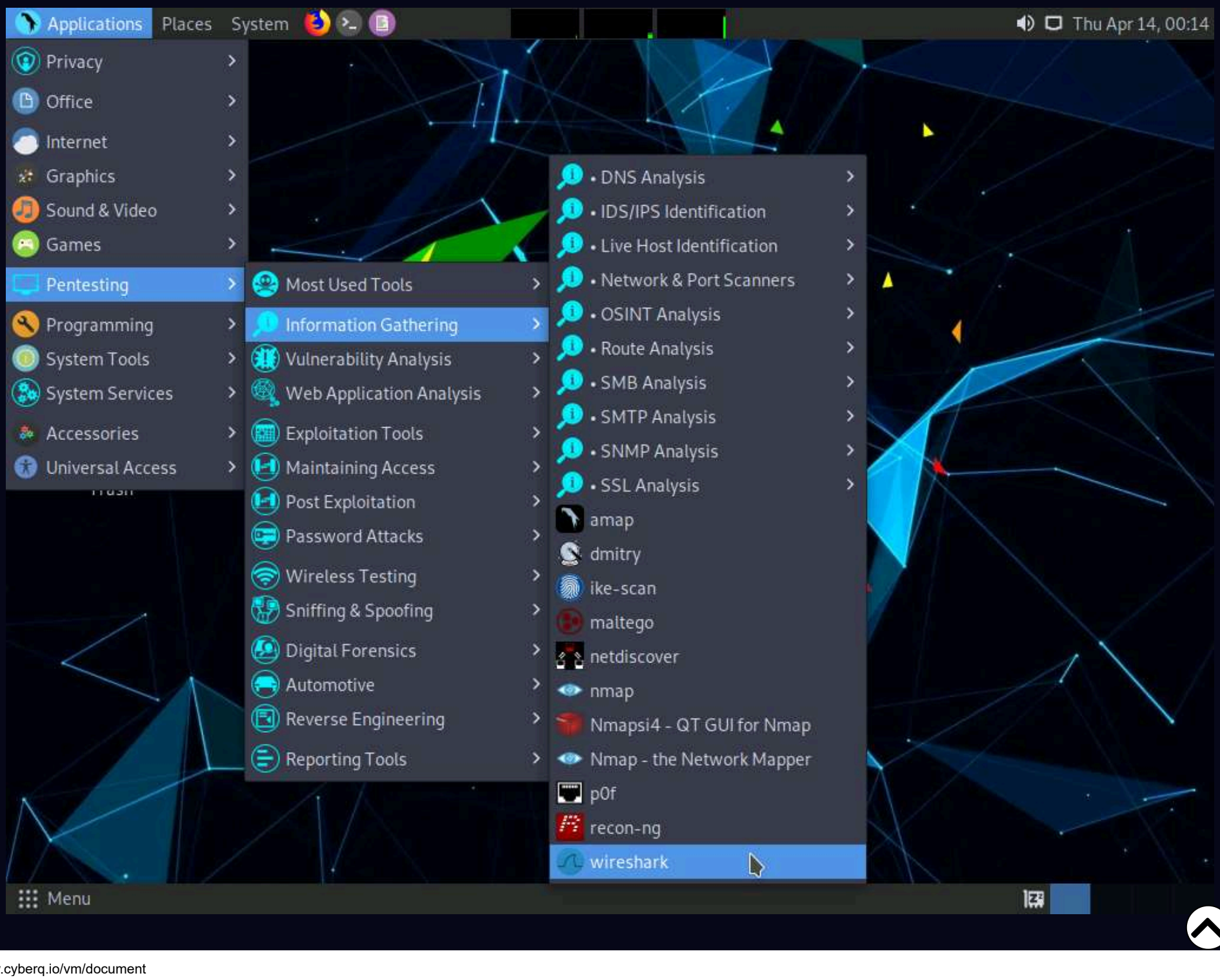
5. Once **LOIC** is configured on all machines, switch to each machine (**Windows 11, Windows Server 2019**, and **Windows Server 2022**) and click the **IMMA CHARGIN MAH LAZER** button under the **Ready?** section to initiate the DDoS attack on the target **Parrot Security** machine.

> Note: To switch to the **Windows 11**, click **CEHv12 Windows 11**.
>
> Note: To switch to the **Windows Server 2019**, click **CEHv12 Windows Server 2019**.
>
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.

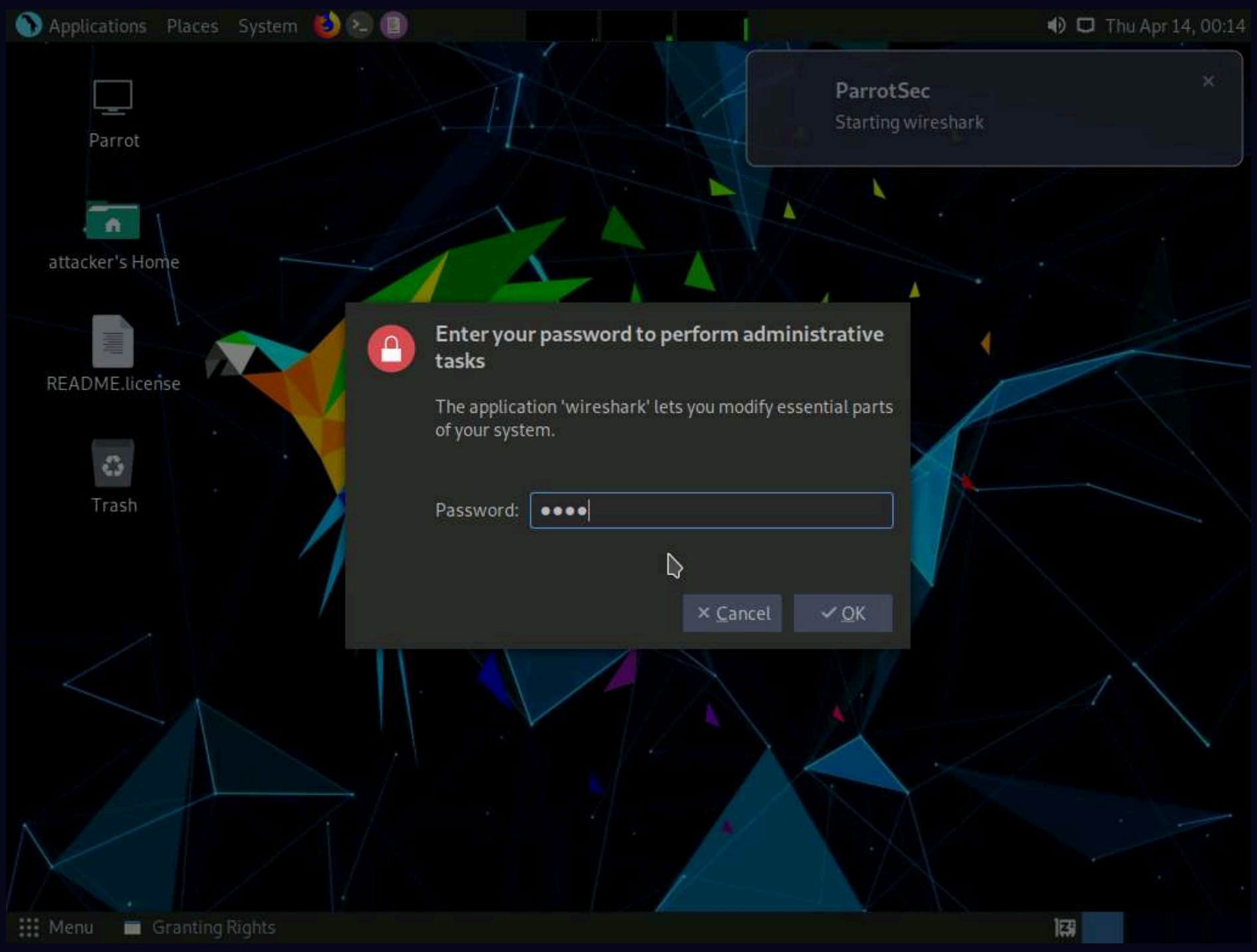



6. Click **CEHv12 Parrot Security** to switch to the **Parrot Security** machine.

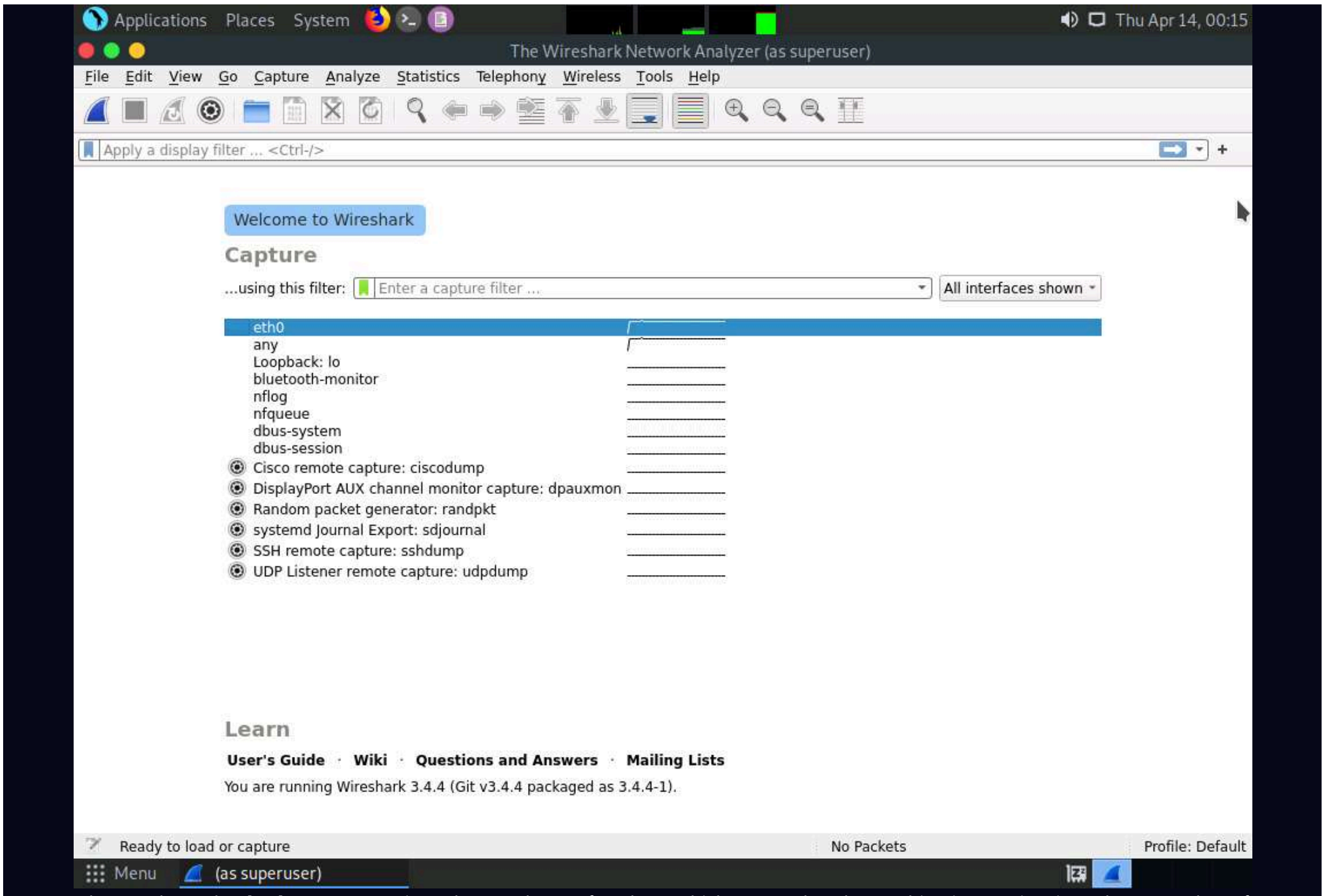
7. Click **Applications** in the top-left corner of **Desktop** and navigate to **Pentesting** --> **Information Gathering** --> **wireshark**.



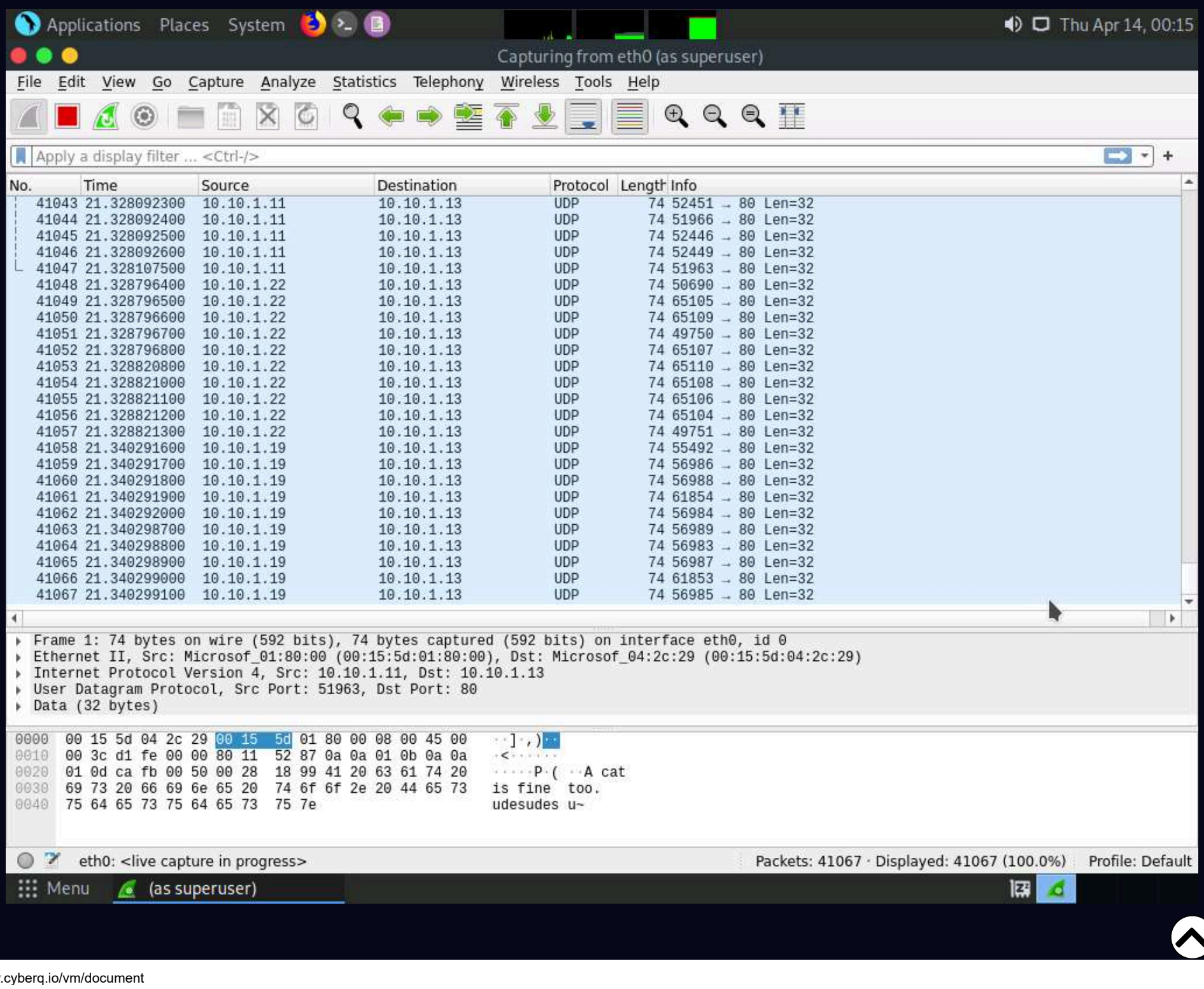
8. A security pop-up appears, enter the password as **toor** in the **Password** field and click **OK**.




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



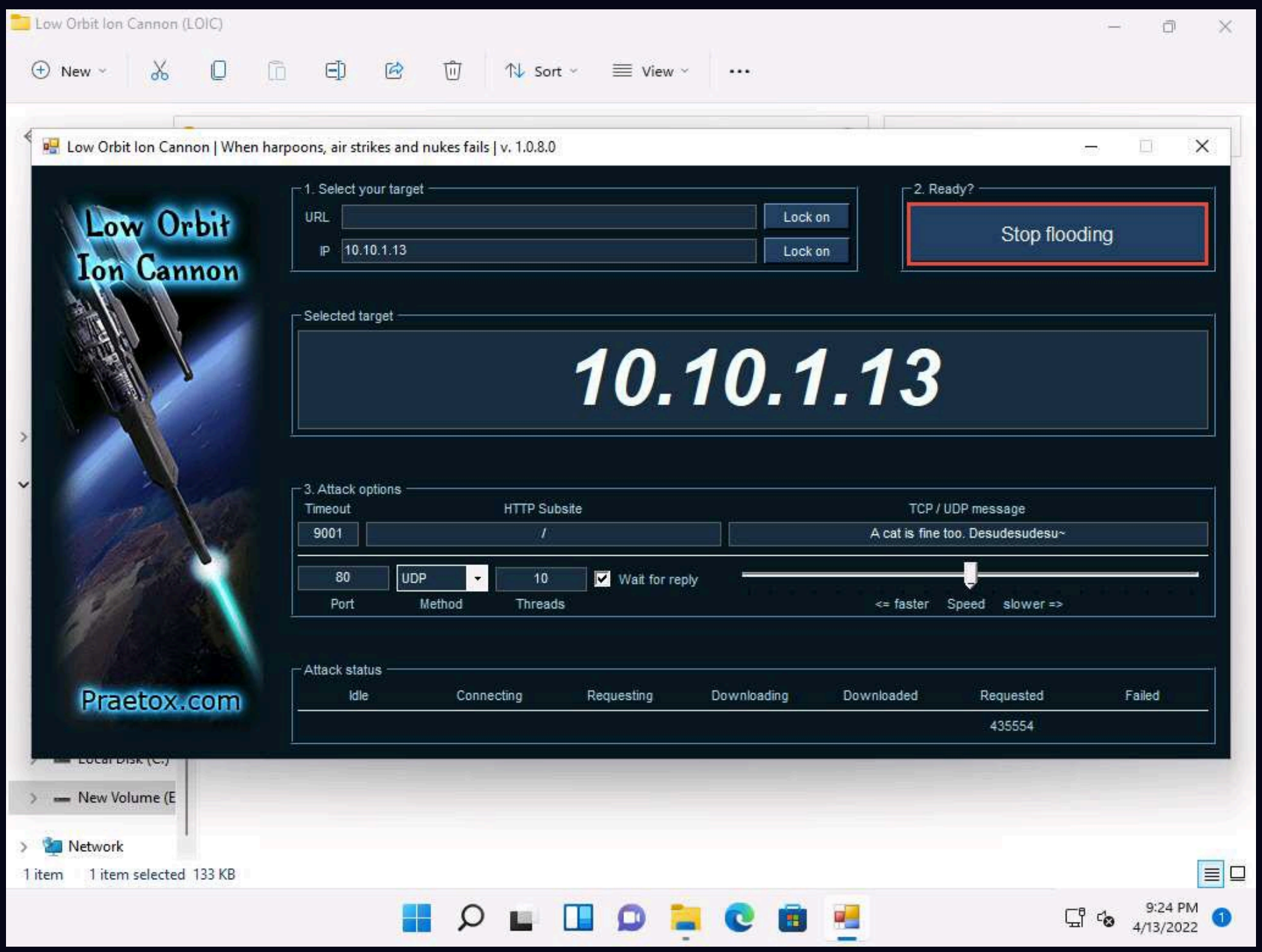

10. Observe that **Wireshark** starts capturing a large volume of packets, which means that the machine is experiencing a huge number of incoming packets. These packets are coming from the **Windows 11, Windows Server 2019**, and **Windows Server 2022** machines.



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.

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

> Note: To switch to the **Windows 11**, click **CEHv12 Windows 11**.
>
> Note: To switch to the **Windows Server 2019**, click **CEHv12 Windows Server 2019**.
>
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.




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.

# Lab 2: Detect and Protect Against DoS and DDoS Attacks

**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

**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

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

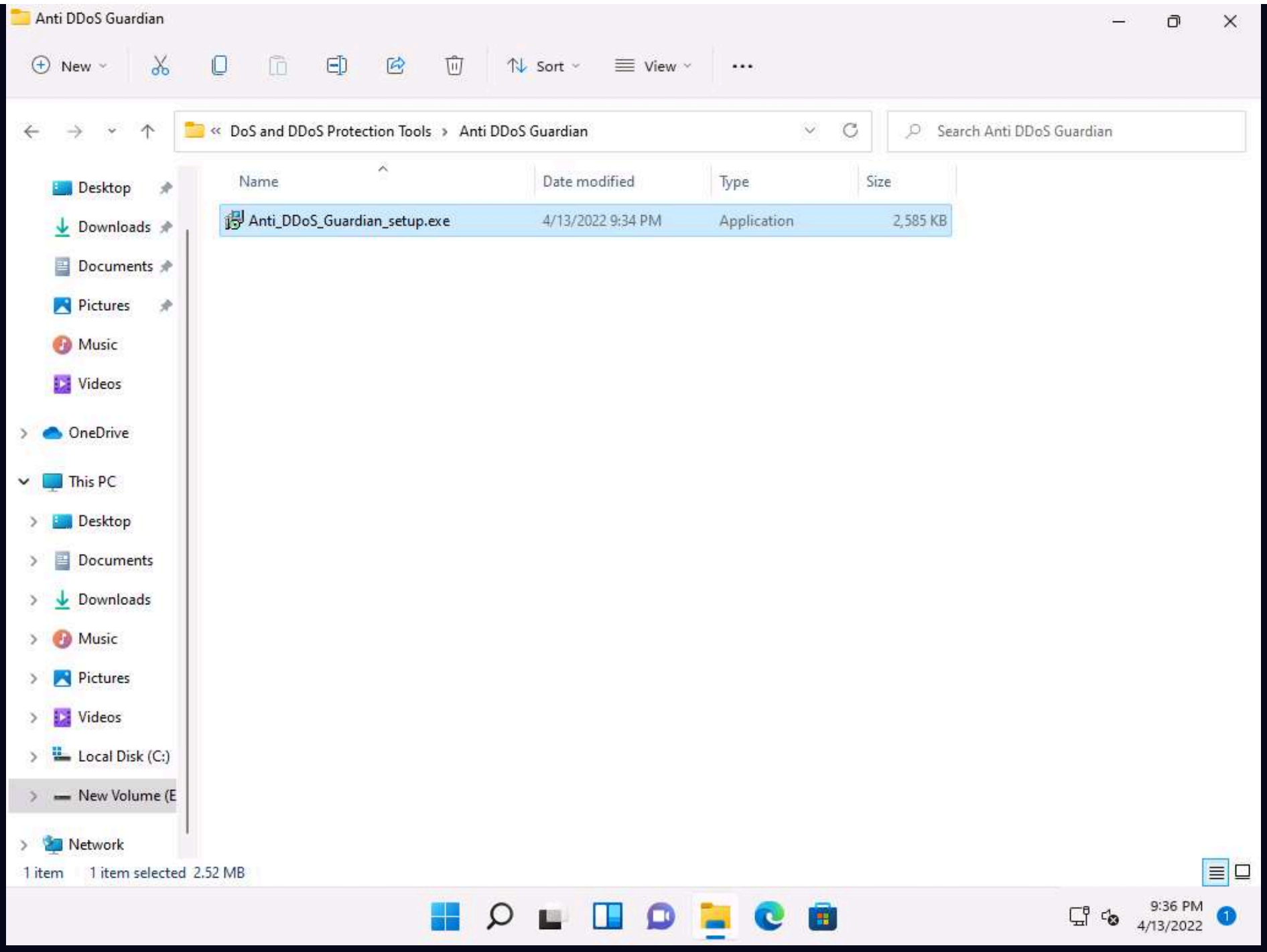
Anti DDoS Guardian is a DDoS attack protection tool. It protects IIS servers, Apache serves, game servers, Camfrog servers, mail servers, FTP servers, VOIP PBX, and SIP servers and other systems. Anti DDoS Guardian monitors each incoming and outgoing packet in Real-Time. It displays the local address, 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.

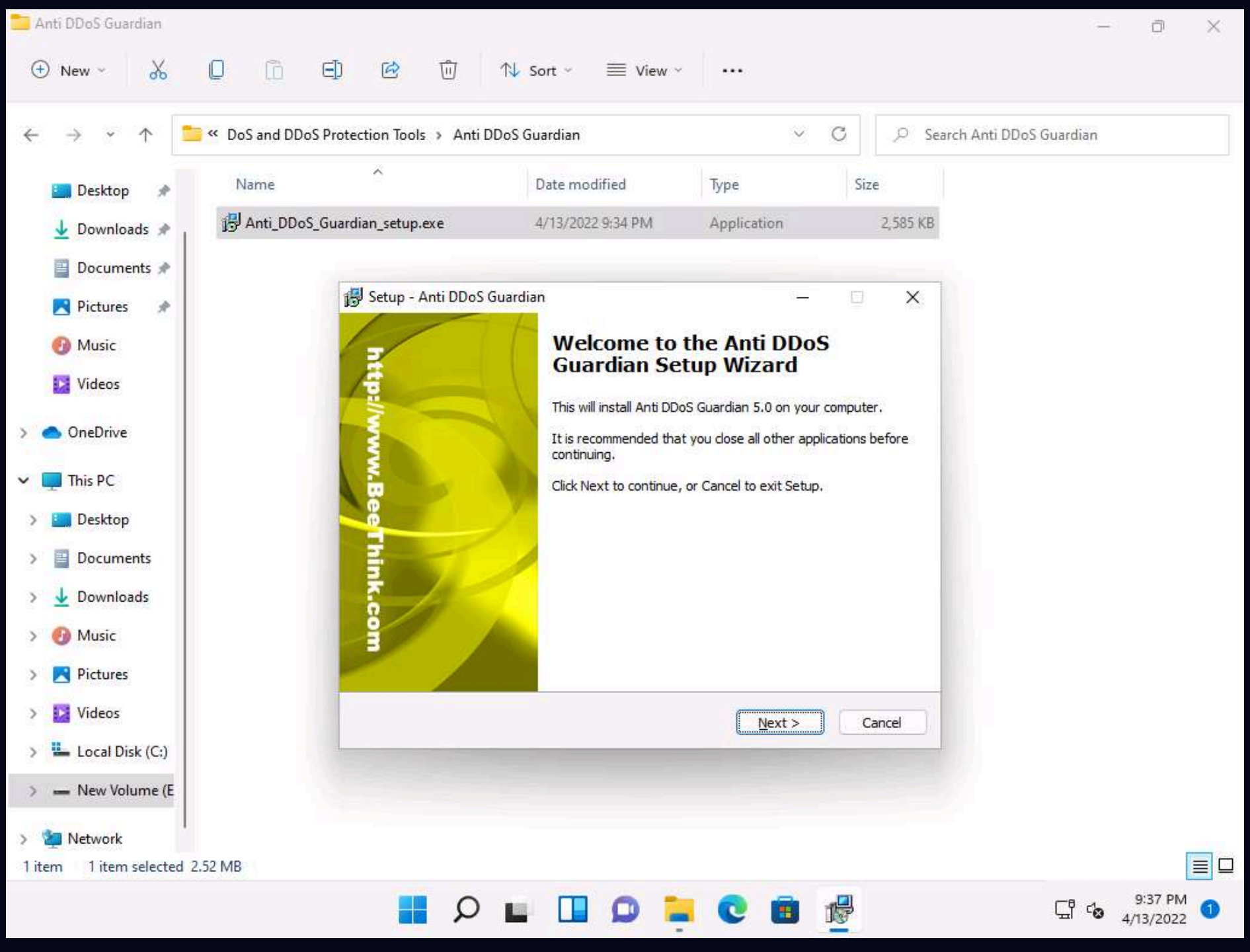
> Note: In this task, we will use the **Windows Server 2019** and **Windows Server 2022** machines to perform a DDoS attack on the target system, **Windows 11**.

1. 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.**

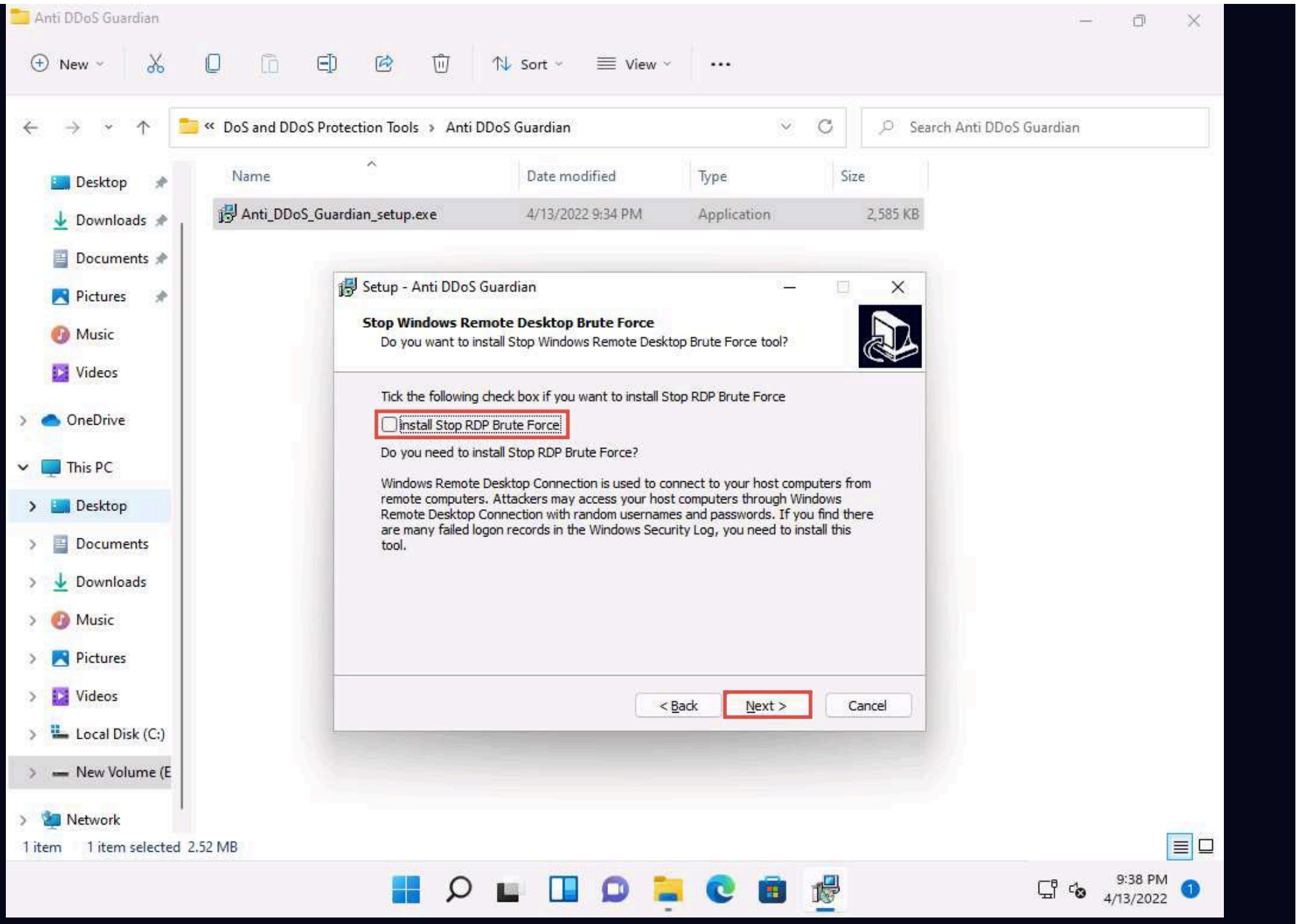
   > Note: If a **User Account Control** pop-up appears, click **Yes**.
   >
   > Note: If an **Open File - Security Warning** pop-up appears, click **Run**.



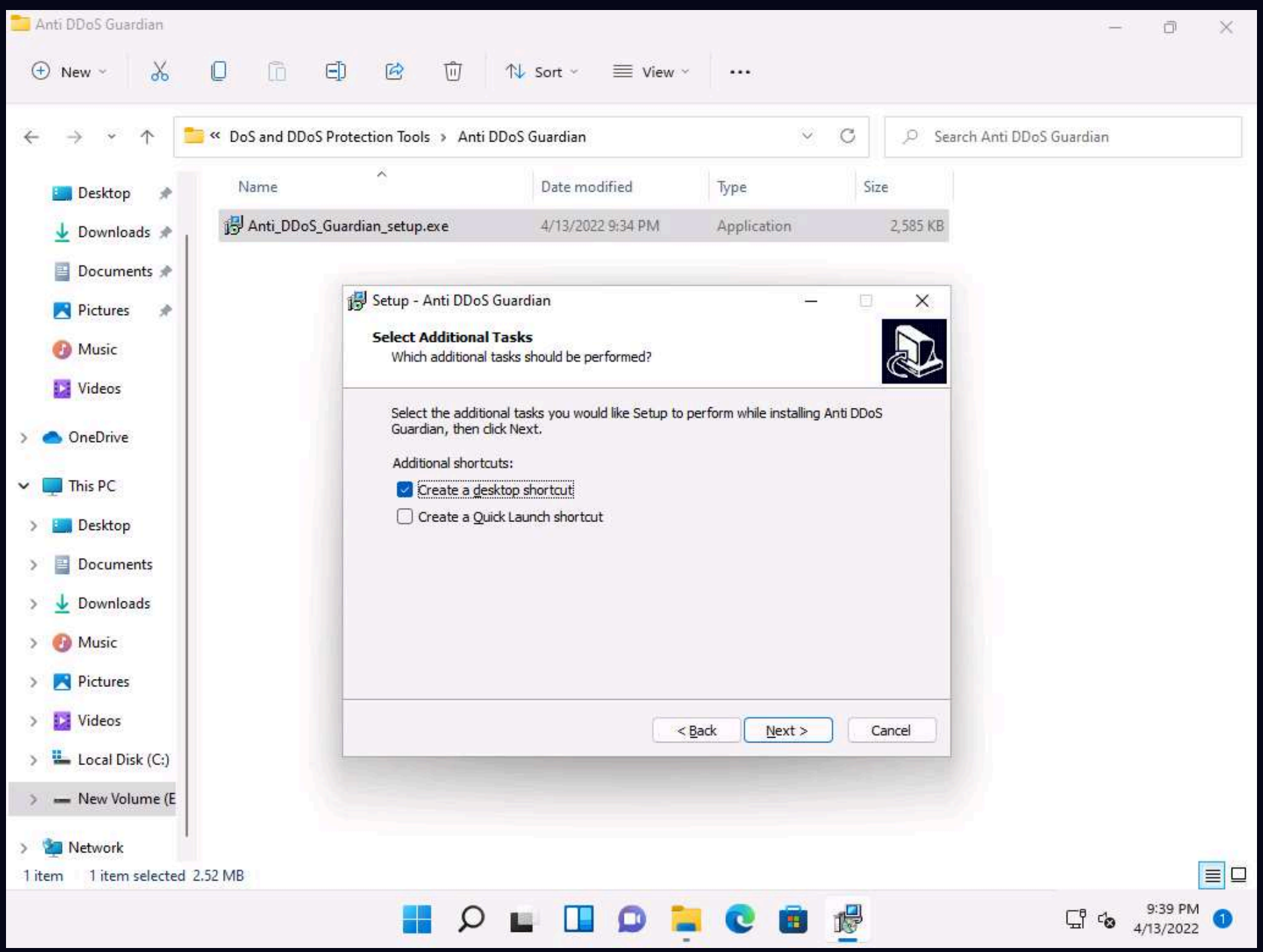

2. The **Setup - Anti DDoS Guardian window** appears; click **Next**. Follow the wizard-driven installation steps to install the application.



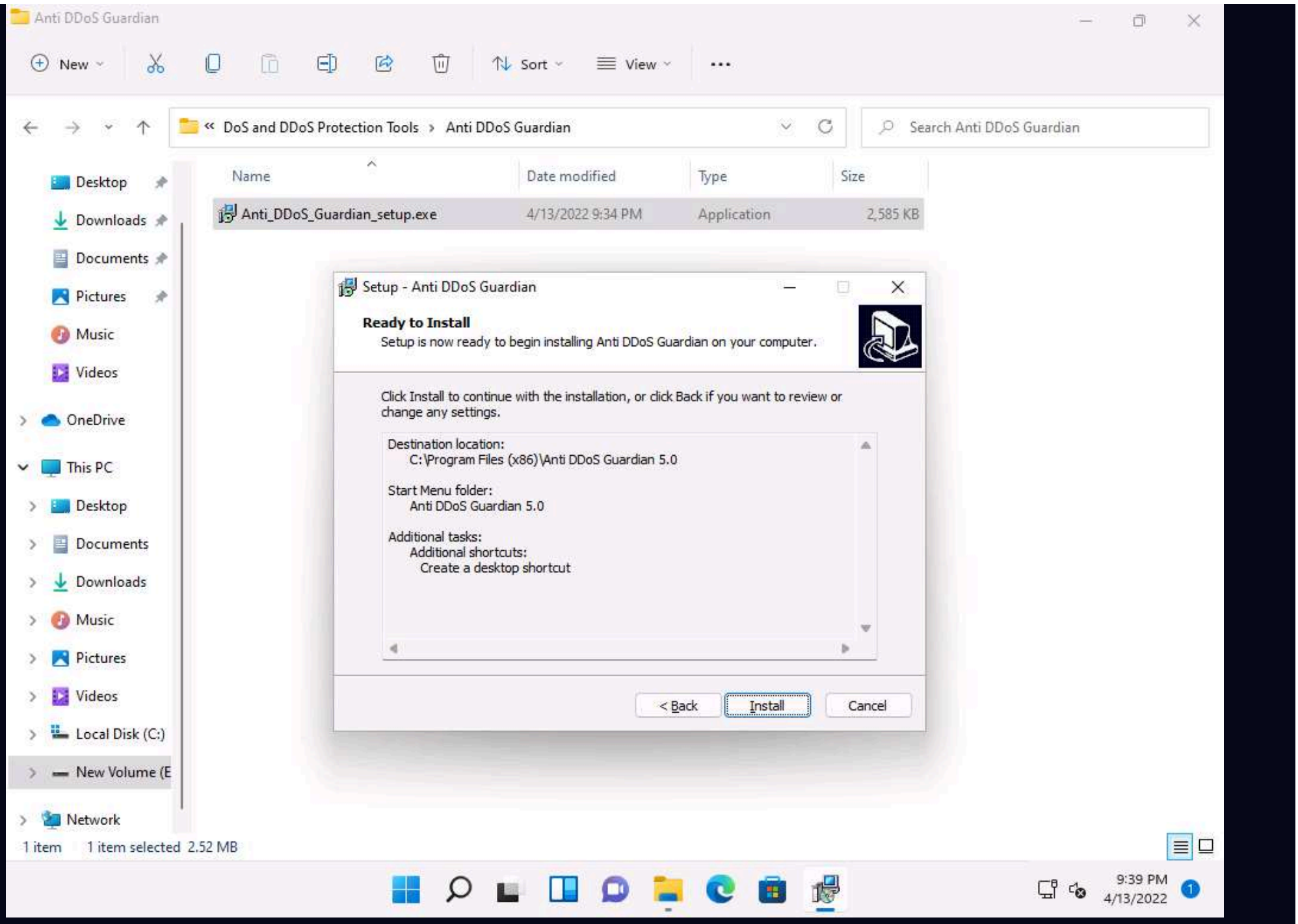

3. In the **Stop Windows Remote Desktop Brute Force** wizard, uncheck the **install Stop RDP Brute Force** option, and click **Next**.



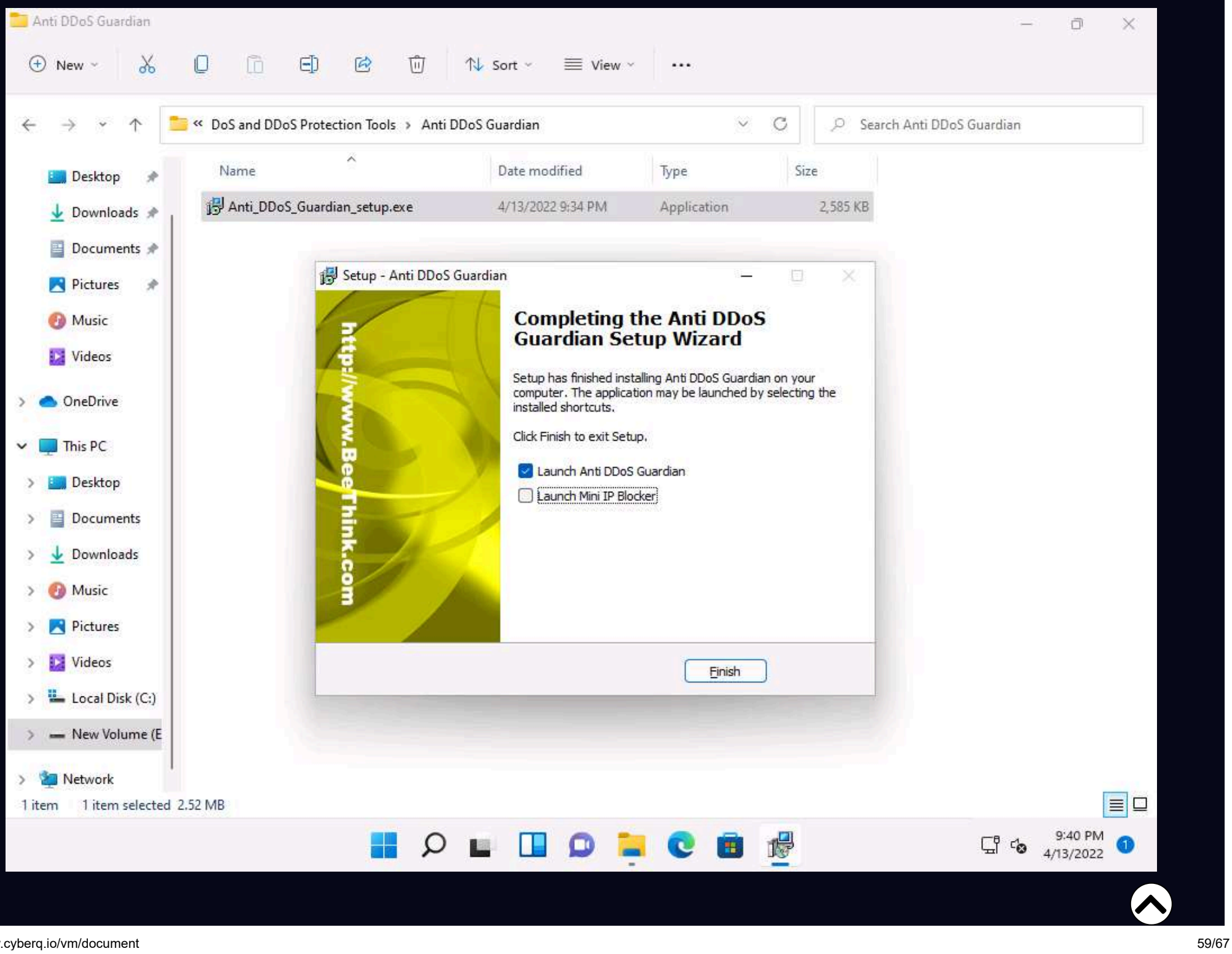

4. The **Select Additional Tasks** wizard appears; check the **Create a desktop shortcut** option, and click **Next**.




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

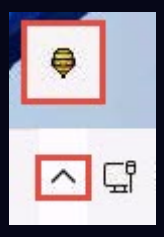


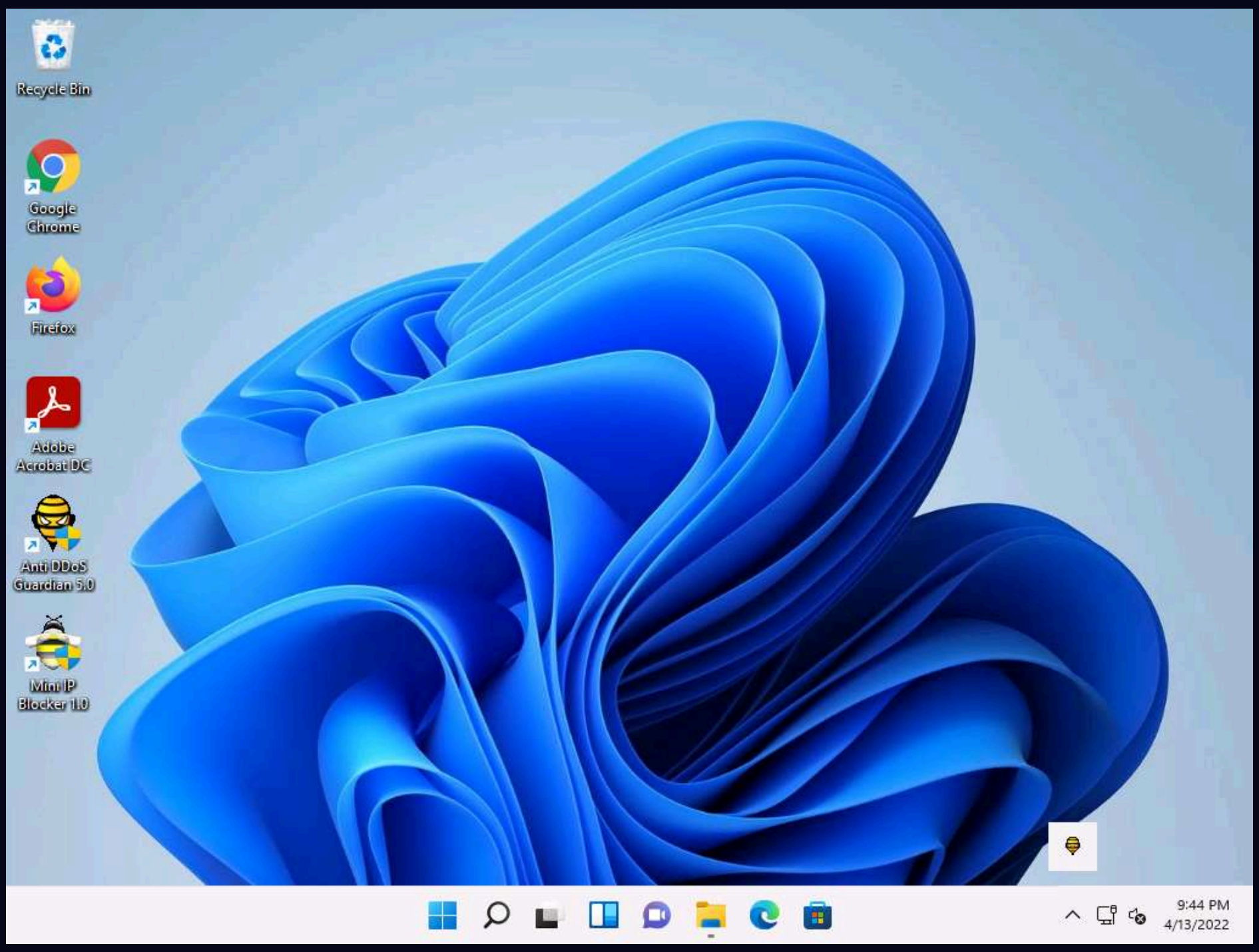

6. The **Completing the Anti DDoS Guardian Setup Wizard** window appears; uncheck the **Launch Mini IP Blocker** option and click **Finish**.



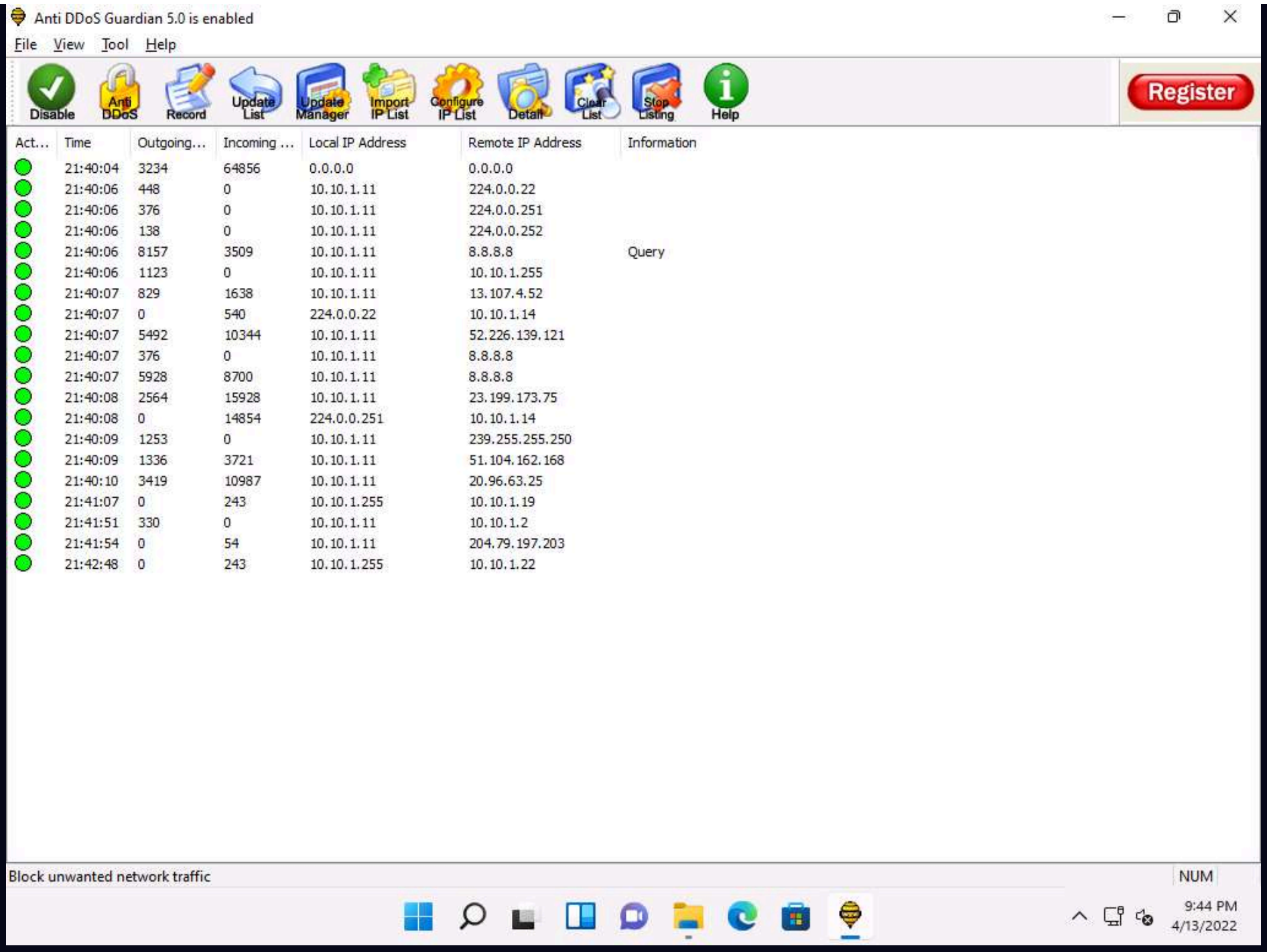
7. The **Anti-DDoS Wizard** window appears; click **Continue** in all the wizard steps, leaving all the default settings. In the last window, click **Finish**.

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

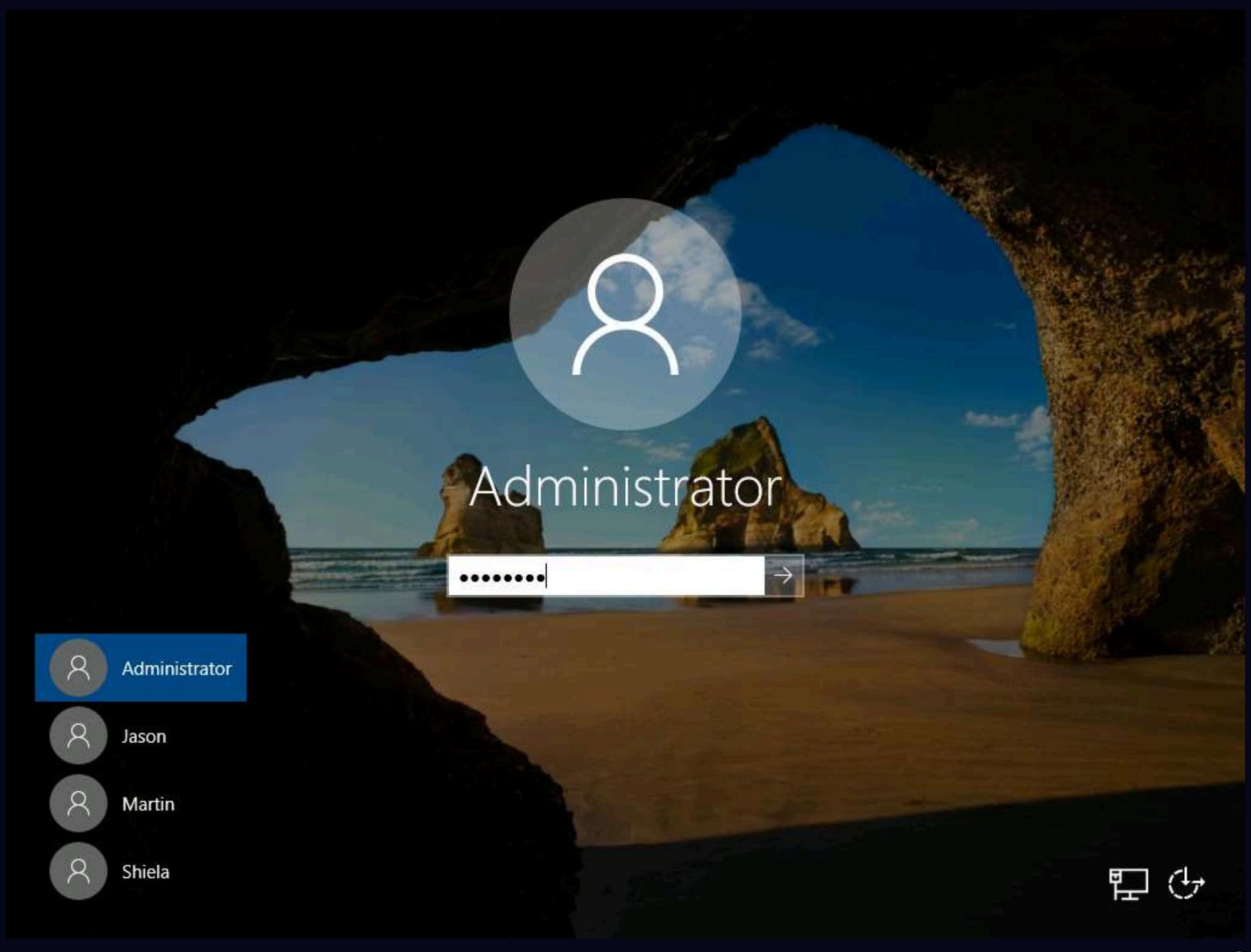





9. The **Anti DDoS Guardian** window appears, displaying information about incoming and outgoing traffic, as shown in the screenshot.

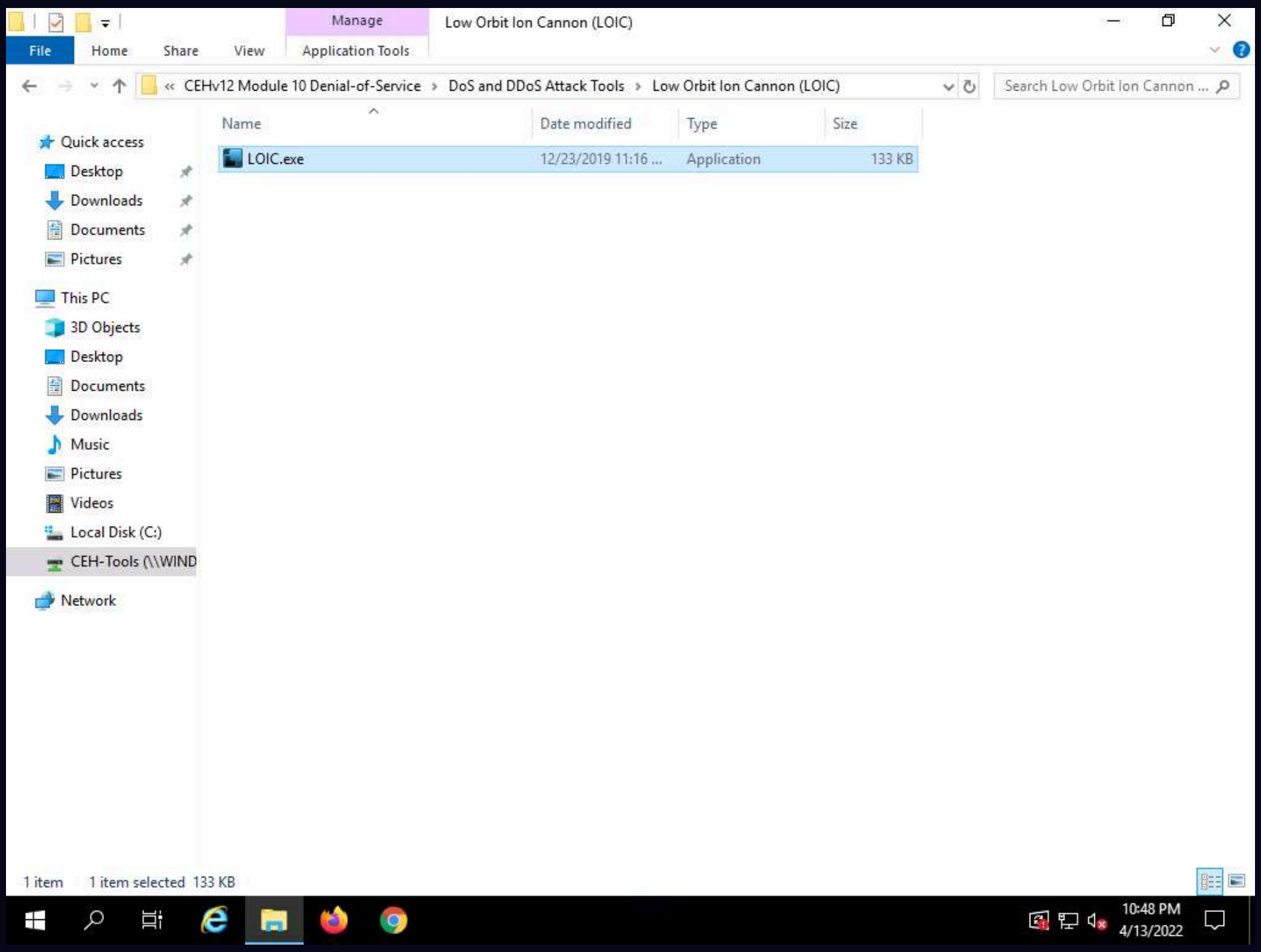



10. Now, click **CEHv12 Windows Server 2019** to switch to the **Windows Server 2019** and click **Ctrl+Alt+Del** to activate the machine. By default, **Administrator** profile is selected, type **Pa$$w0rd** in the Password field and press **Enter** to log in.



11. 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**.

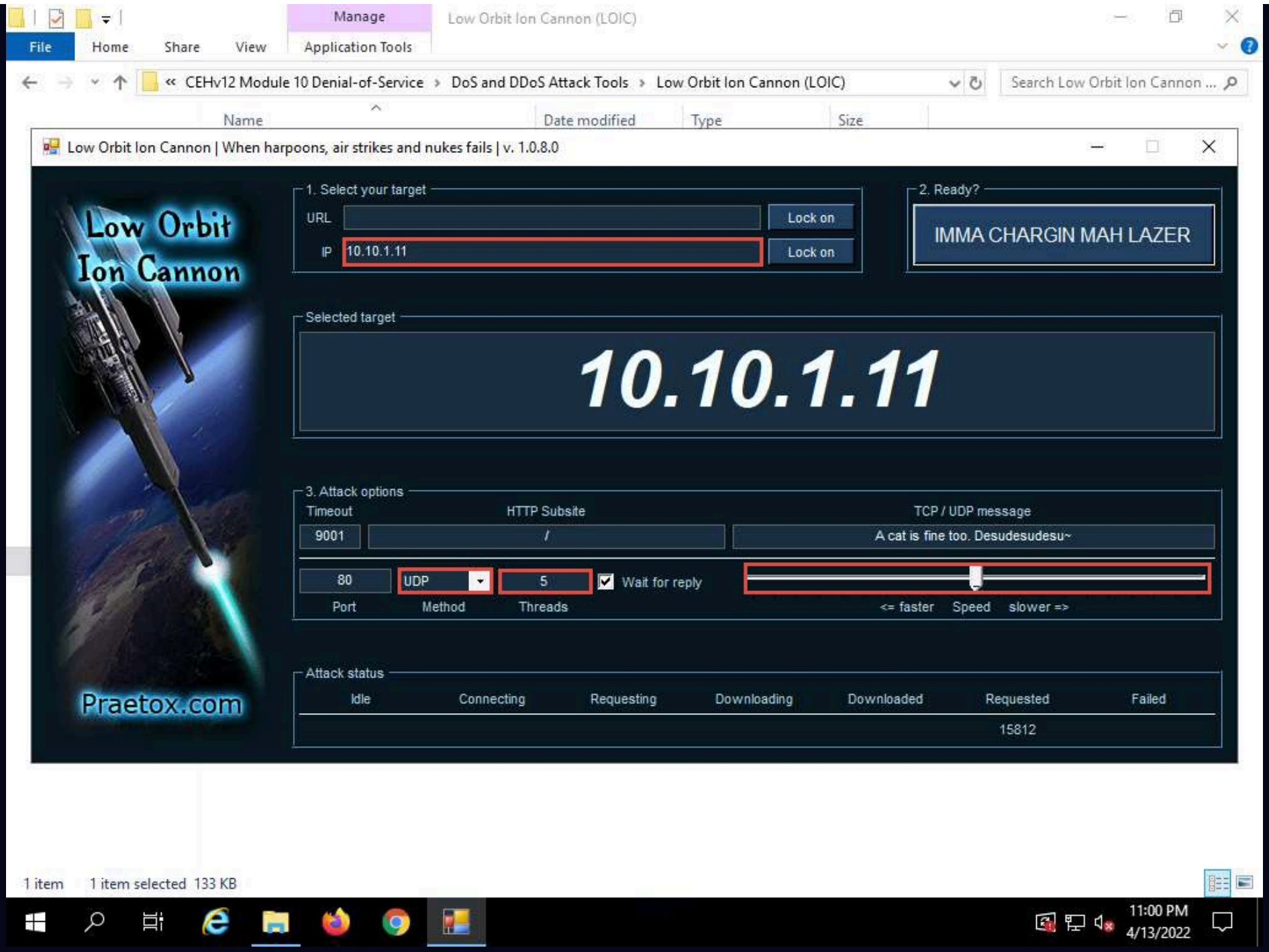
Note: If an **Open File - Security Warning** pop-up appears, click **Run**.




12. The **Low Orbit Ion Cannon** main window appears.

13. Perform the following settings:

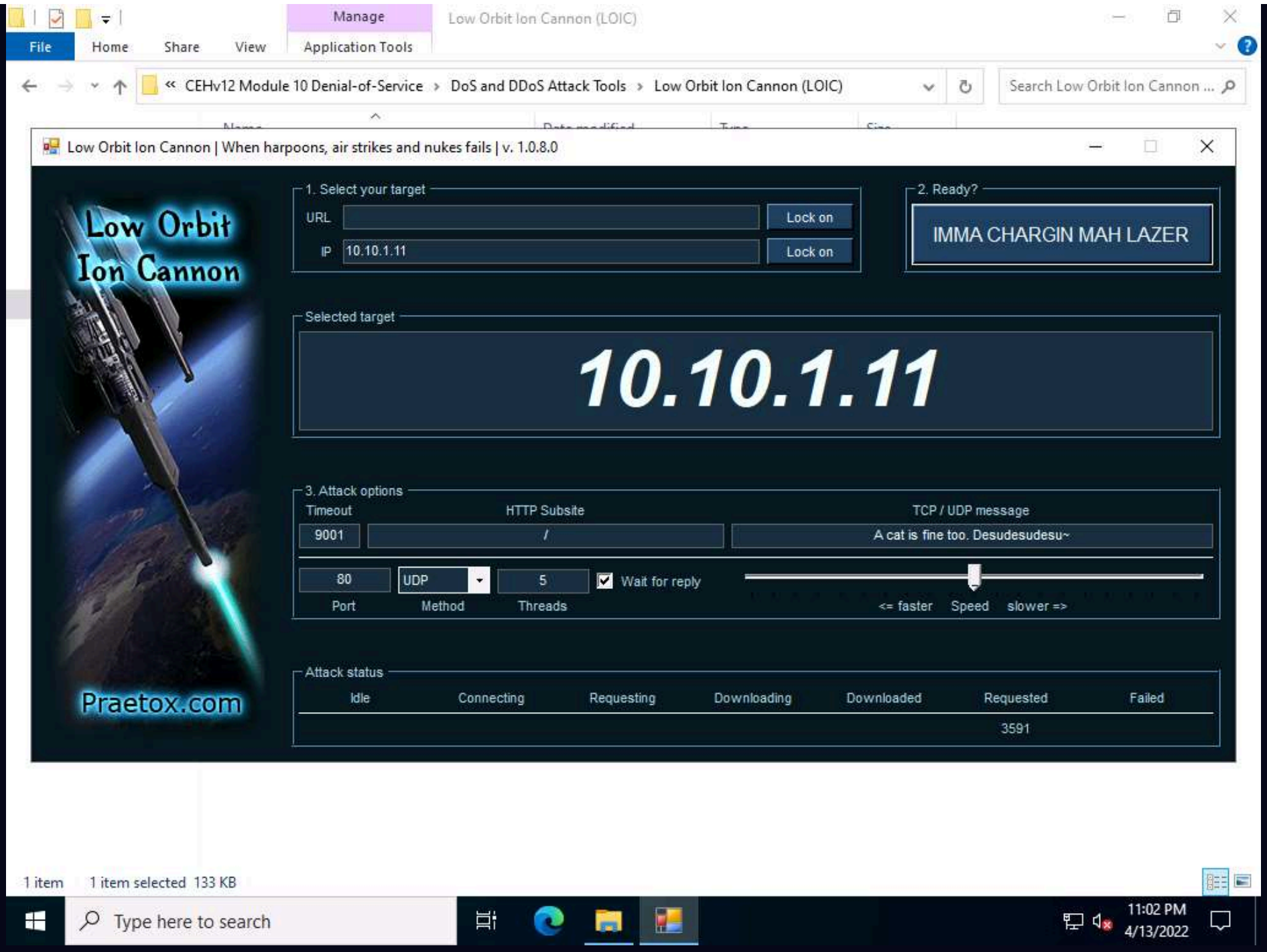
    - Under the **Select your target** section, type the target IP address under the **IP** field (here, **10.10.1.11**), and then click the **Lock on** button to add the target devices.
    - Under the **Attack options** section, select **UDP** from the drop-down list in **Method**. Set the thread's value to **5** under the **Threads** field. Slide the power bar to the middle.




14. Now, switch to the **Windows Server 2022** machine and follow **Steps 11 - 13** to launch LOIC and configure it.

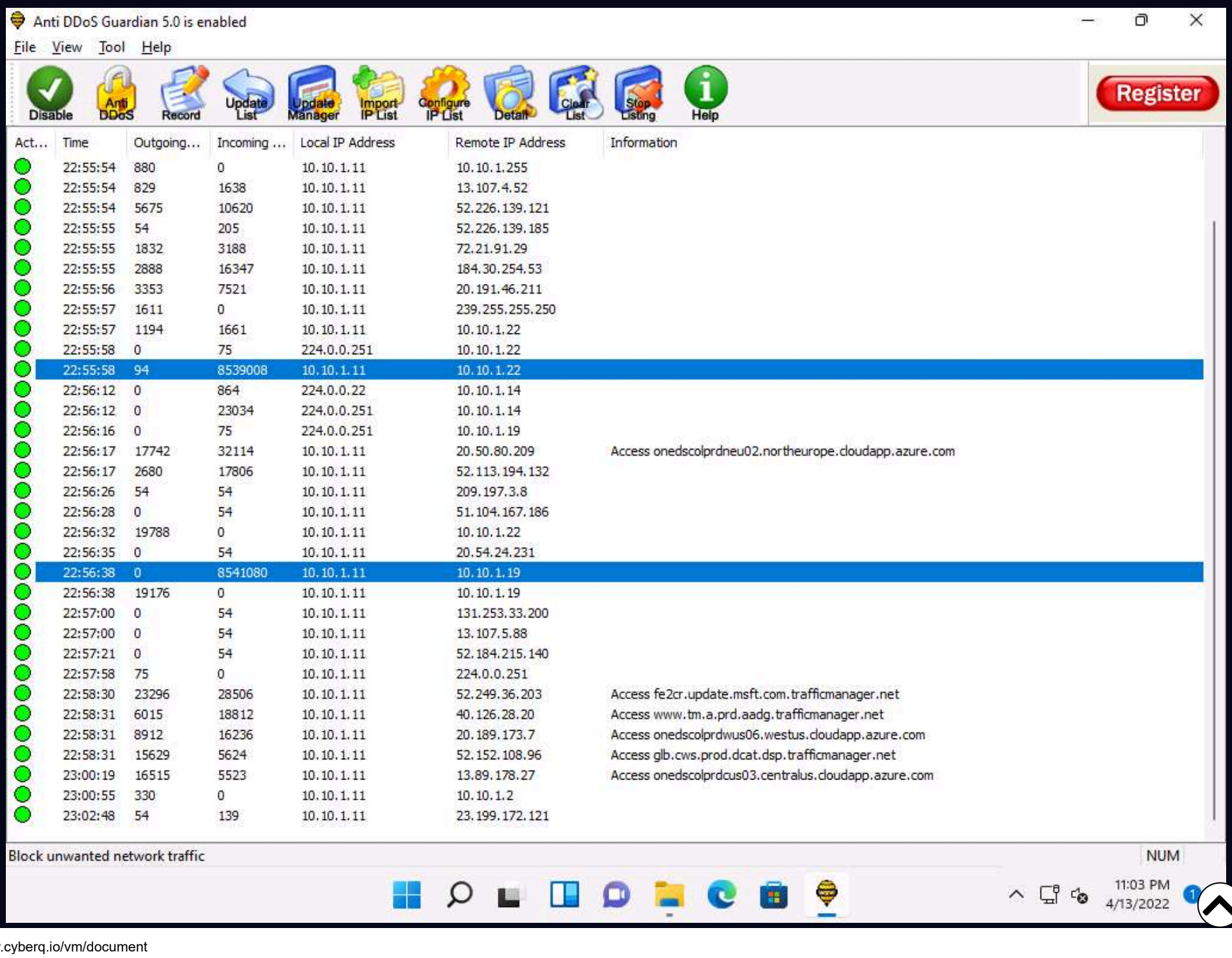
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.

15. 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.




16. Click **CEHv12 Windows 11** to switch back to the **Windows 11** machine and observe the packets captured by **Anti DDoS Guardian**.

17. 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]**).



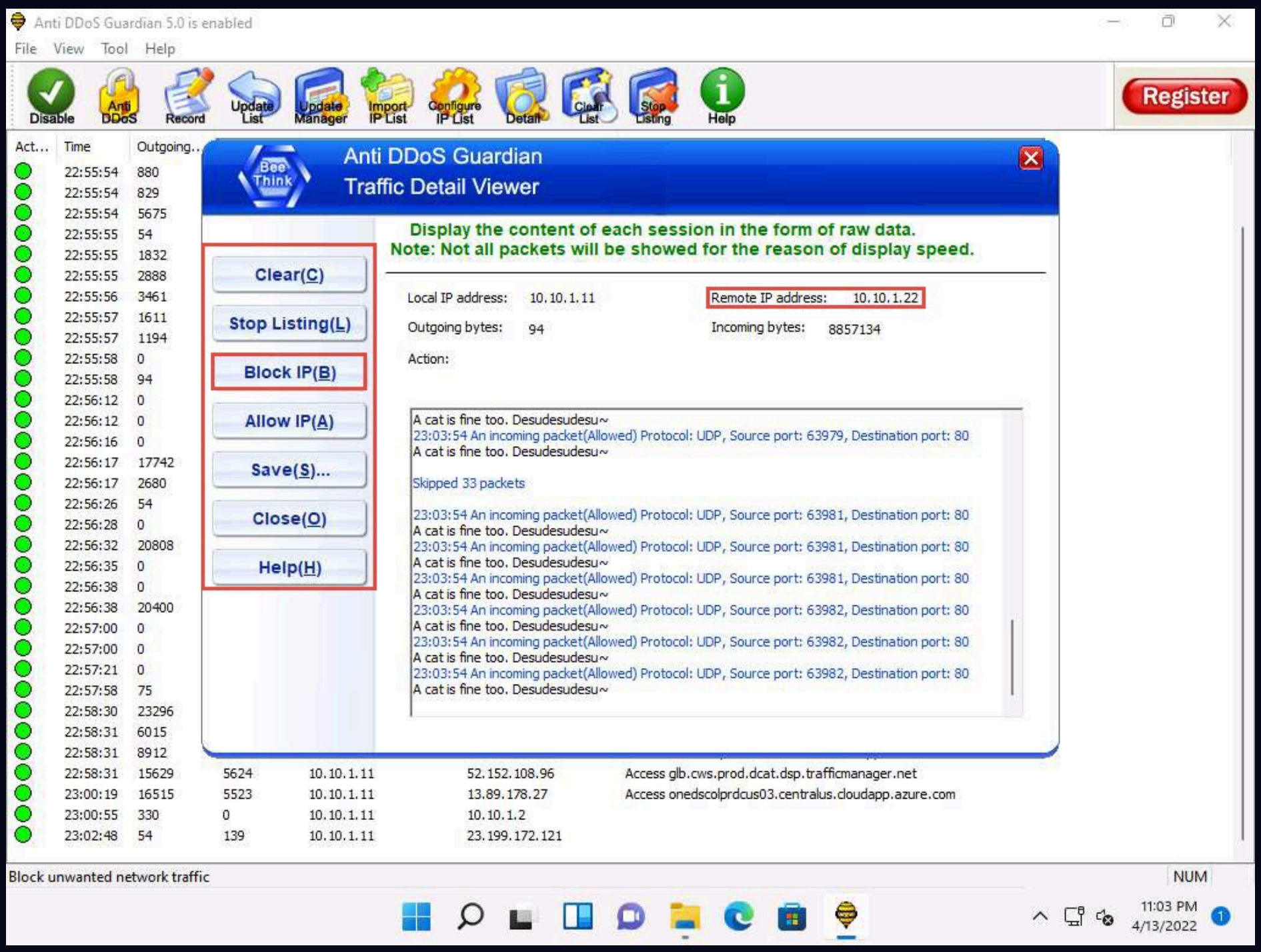
18. Double-click any of the sessions **10.10.1.19** or **10.10.1.22**.

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

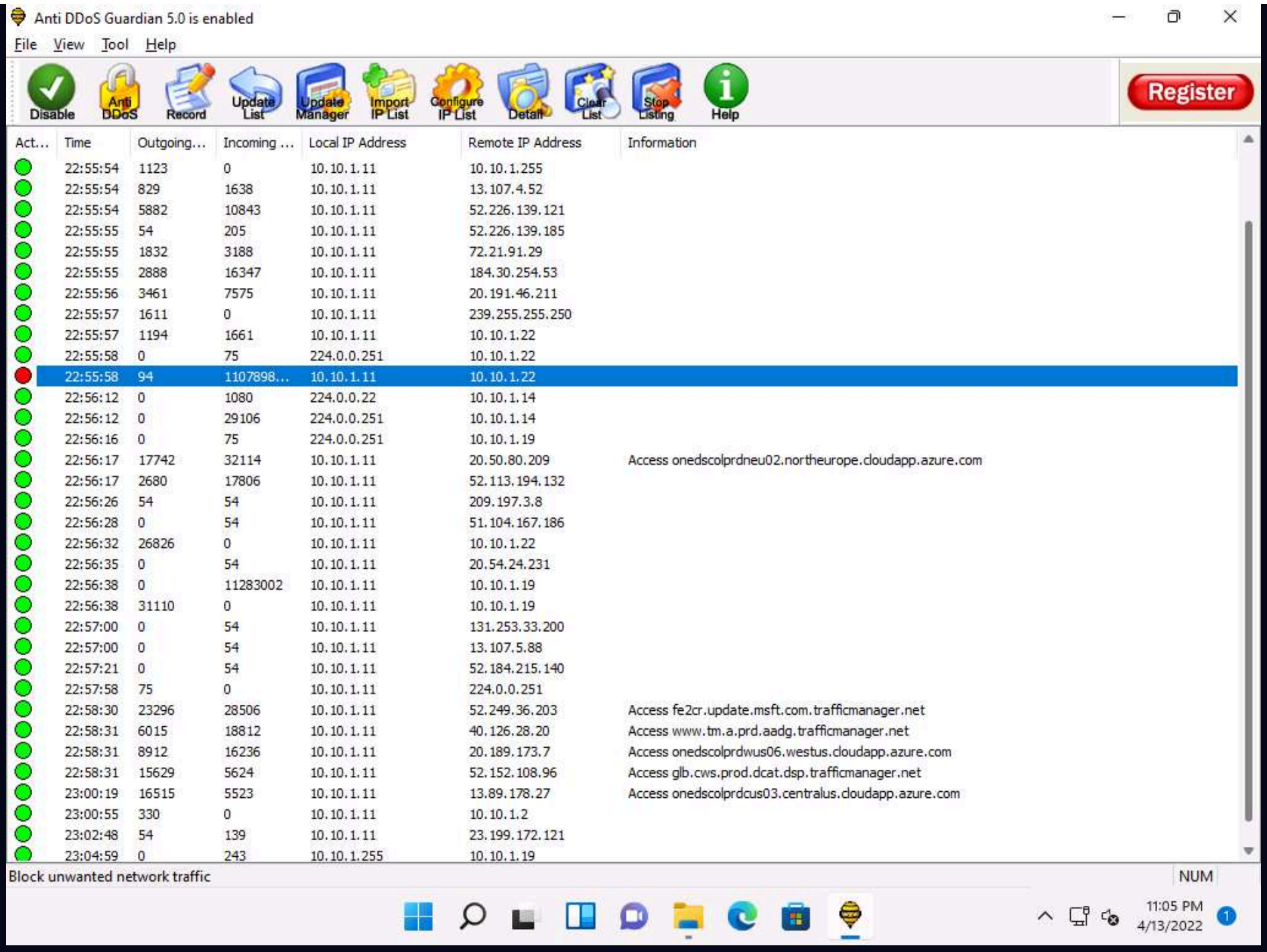
19. The **Anti DDoS Guardian Traffic Detail Viewer** window appears, displaying the content of the selected session in the form of raw data. You can observe the high number of incoming bytes from **Remote IP address 10.10.1.22**, as shown in the screenshot.

20. 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.

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



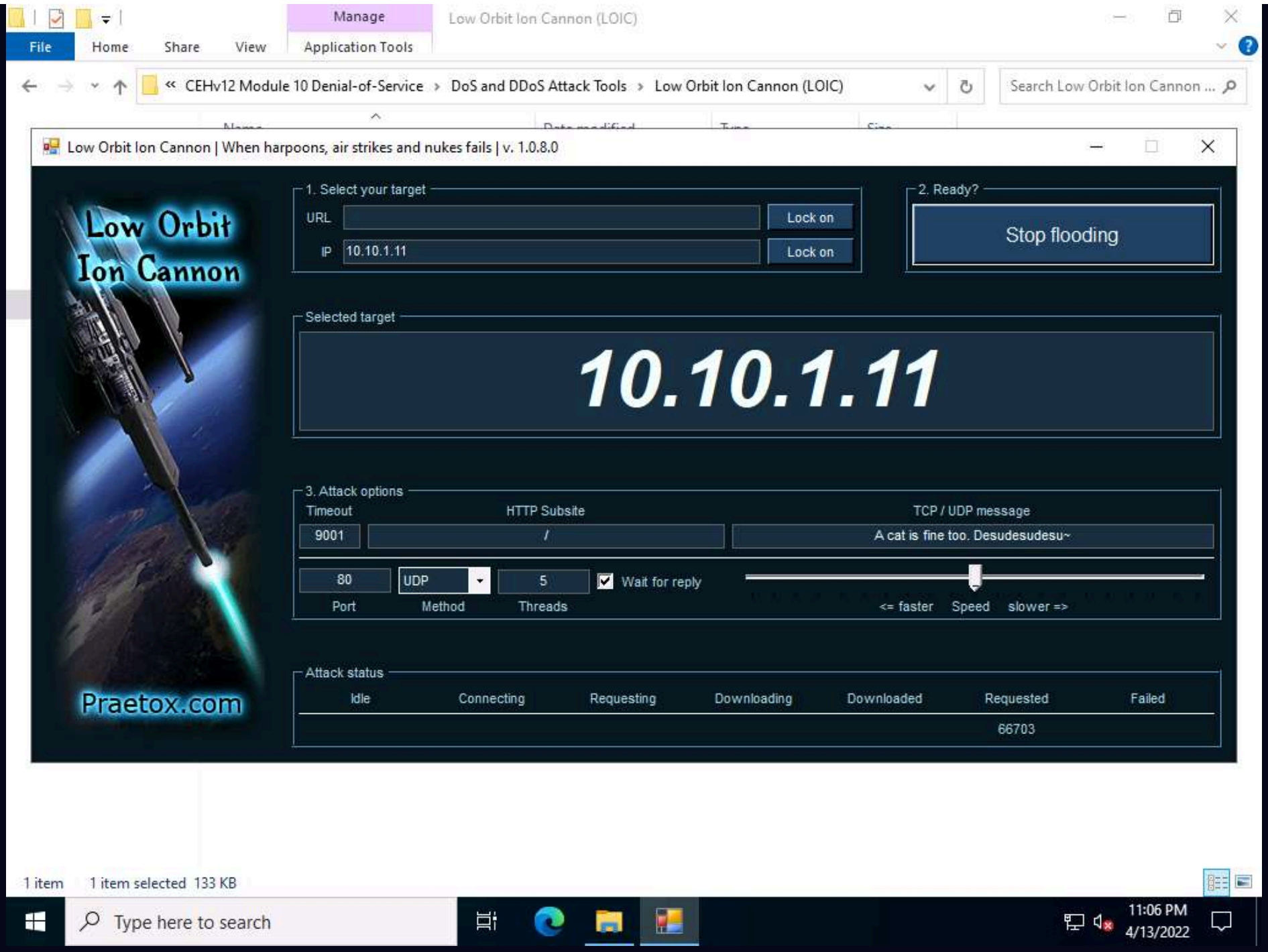

22. Observe that the blocked IP session turns red in the **Action Taken** column.




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

24. 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**).

> Note: To switch to the **Windows Server 2019**, click **CEHv12 Windows Server 2019**.
>
> Note: To switch to the **Windows Server 2022**, click **CEHv12 Windows Server 2022**.




25. This concludes the demonstration of how to detect and protect against a DDoS attack using Anti DDoS Guardian.

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

27. 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.

28. Click **CEHv12 Windows 11** to switch to the **Windows 11** machine. Navigate to **Control Panel** --> **Programs** --> **Programs and Features** and uninstall **Anti DDoS Guardian**.