Lab 3: Detect Network Sniffing

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

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

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.

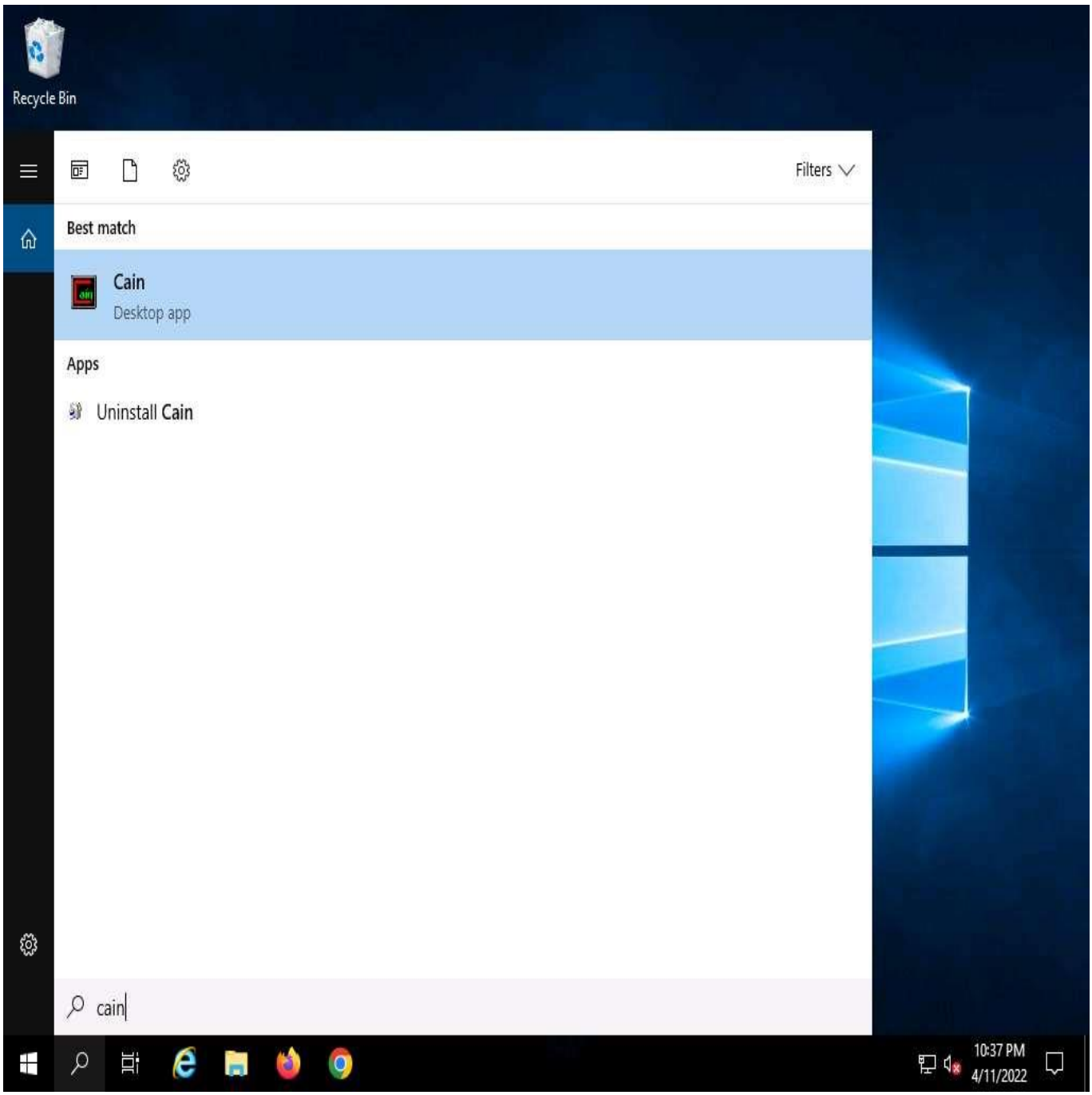
The ethical hacker and pen tester must assess the organization or target of evaluation for ARP poisoning vulnerabilities.

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.

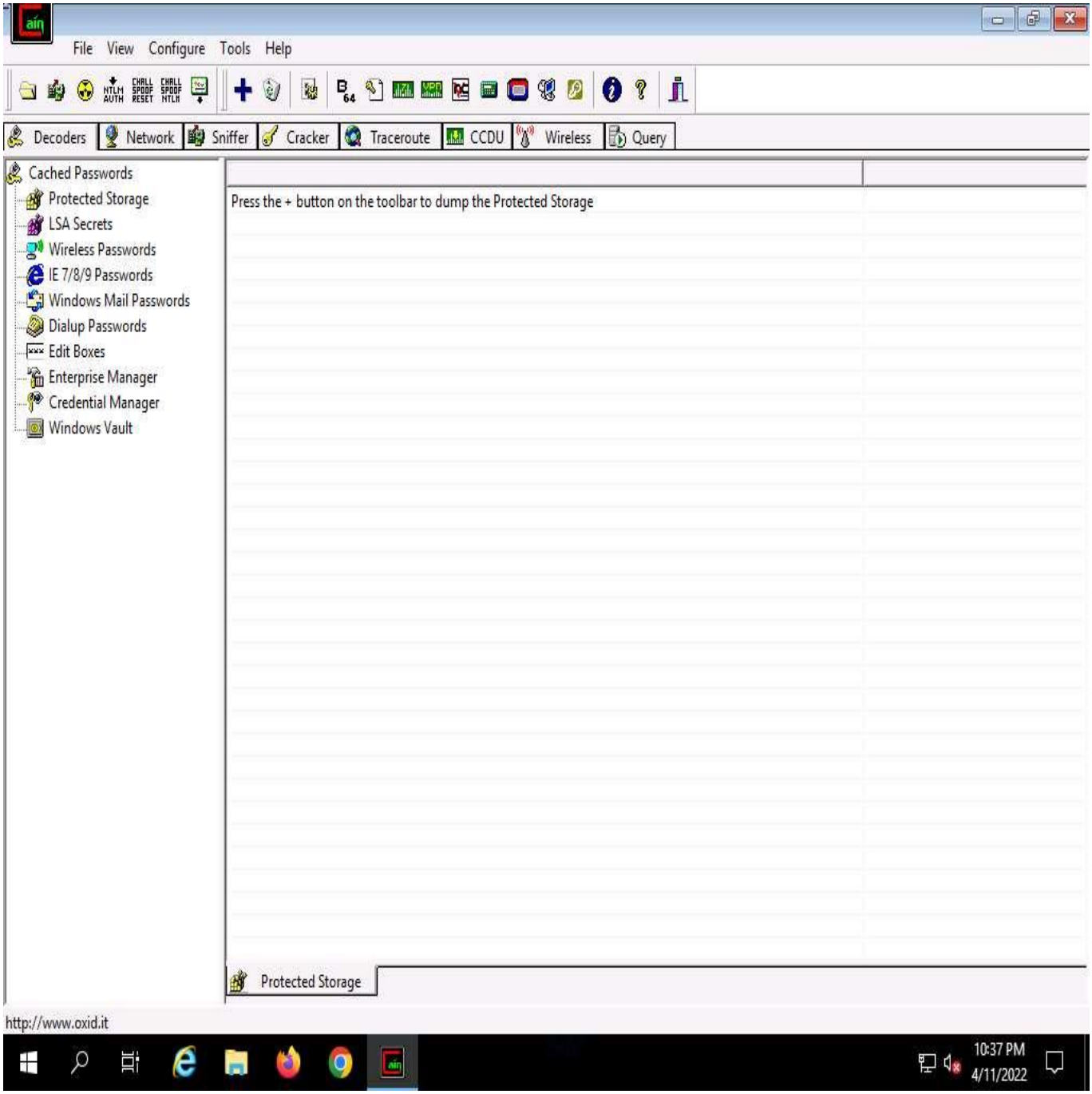
In this task, we will use the **Windows Server 2019** machine as the host machine to perform ARP poisoning, and will sniff traffic flowing between the **Windows 11** and **Parrot Security** machines. We will use the same machine

(**Windows Server 2019**) to detect ARP poisoning and use the **Windows 11** machine to detect promiscuous mode in the network.

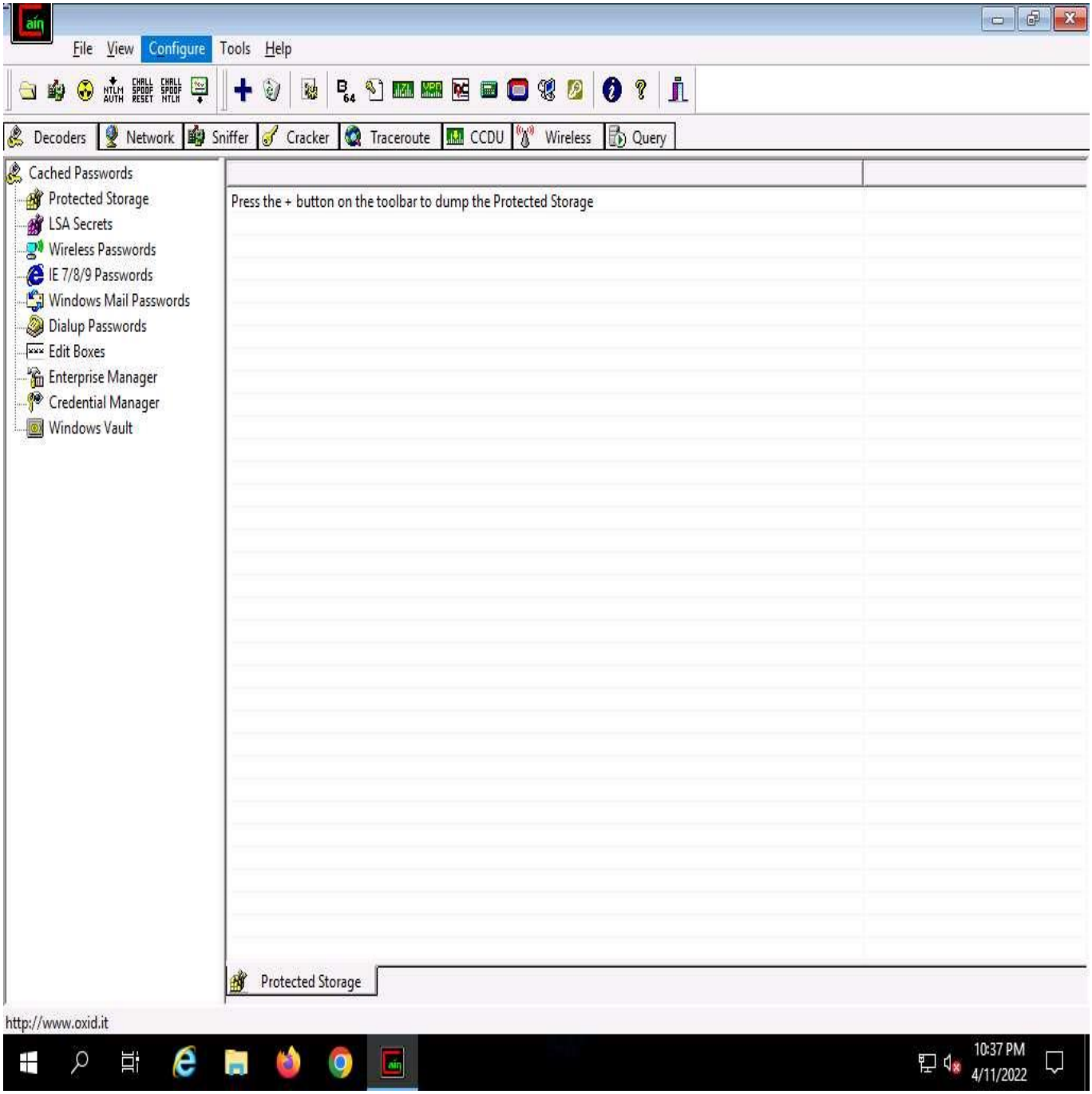
1. Click Windows Server 2019 to switch to the **Windows Server 2019** machine.
2. Click the **Type here to search** icon at the bottom of **Desktop** and type **cain**. Click **Cain** from the results.



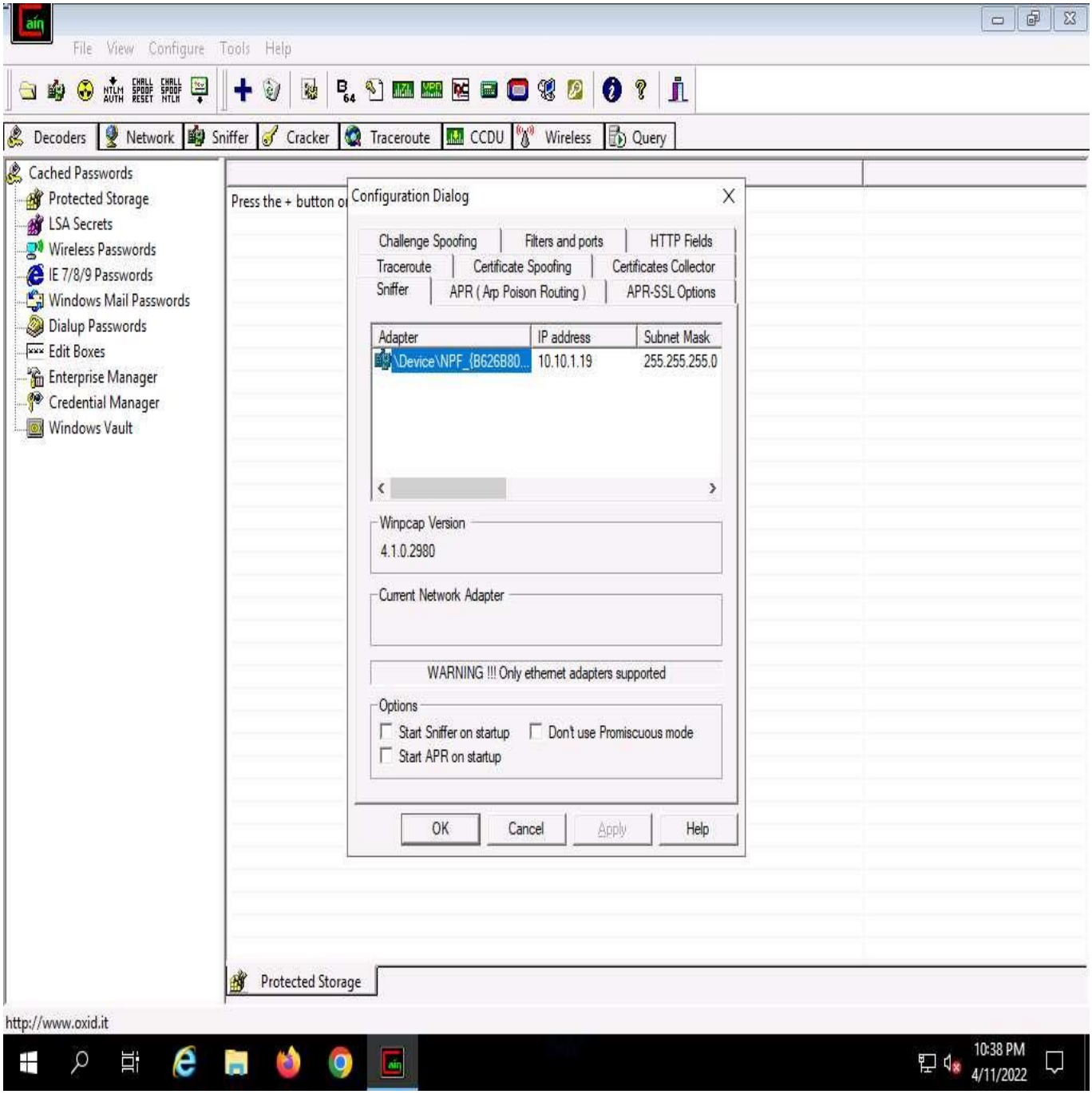
3. The **Cain & Abel** main window appears, as shown in the screenshot.



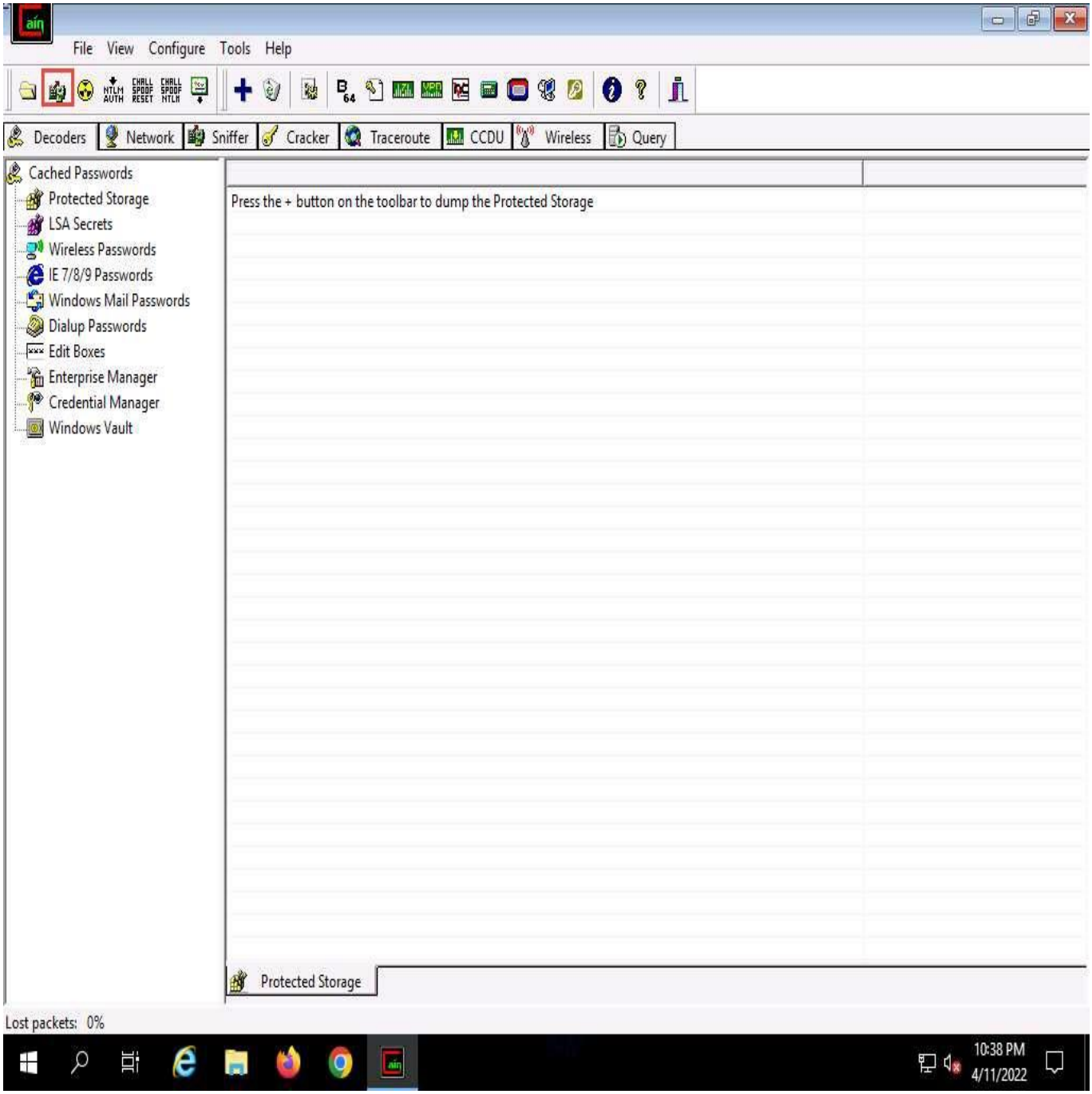
4. ☐ Click **Configure** from the menu bar to configure an ethernet card.



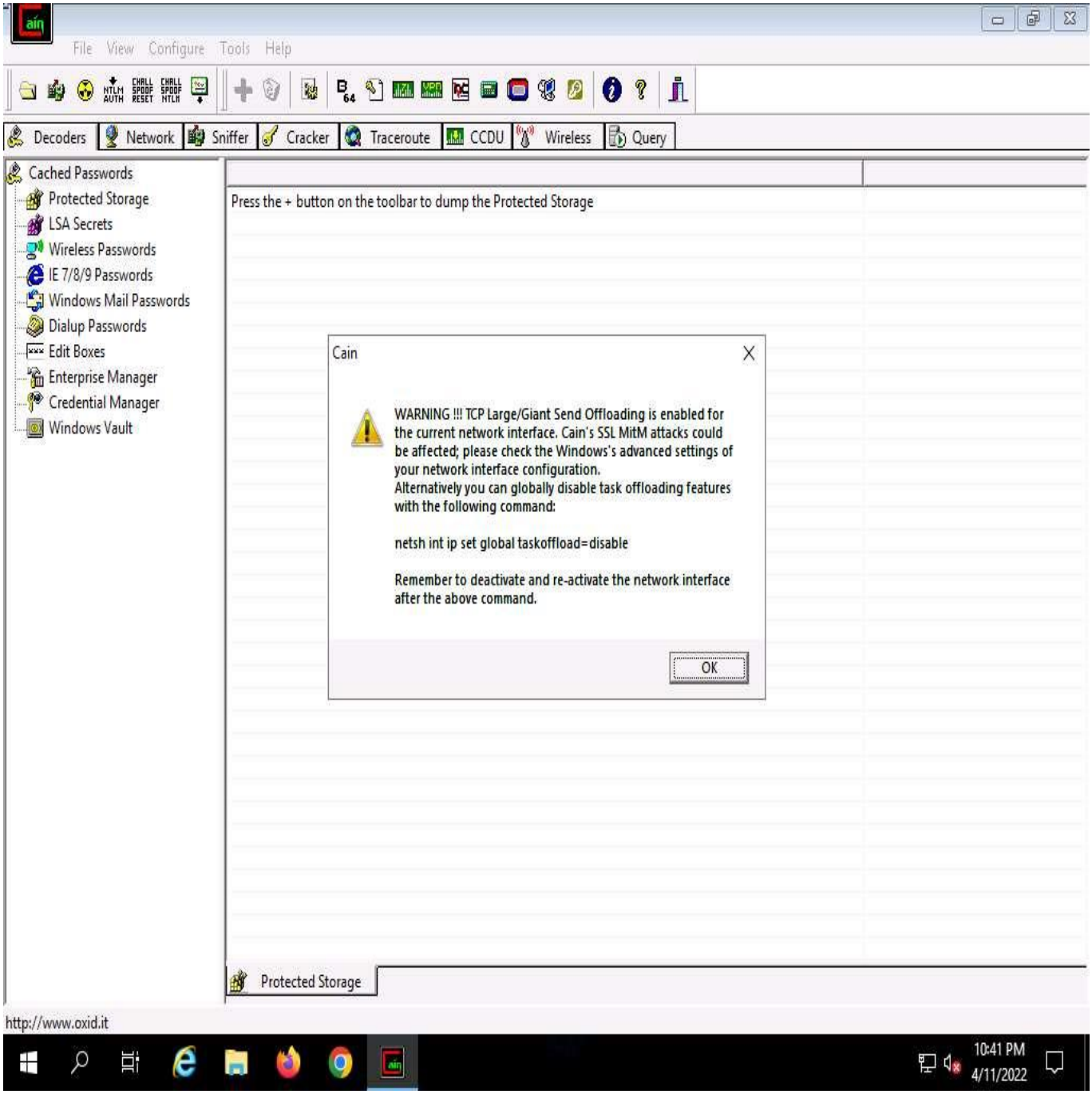
5. ☐ The **Configuration Dialog** window appears. The **Sniffer** tab is selected by default. Ensure that the **Adapter** associated with the **IP address** of the machine is selected and click **OK**.



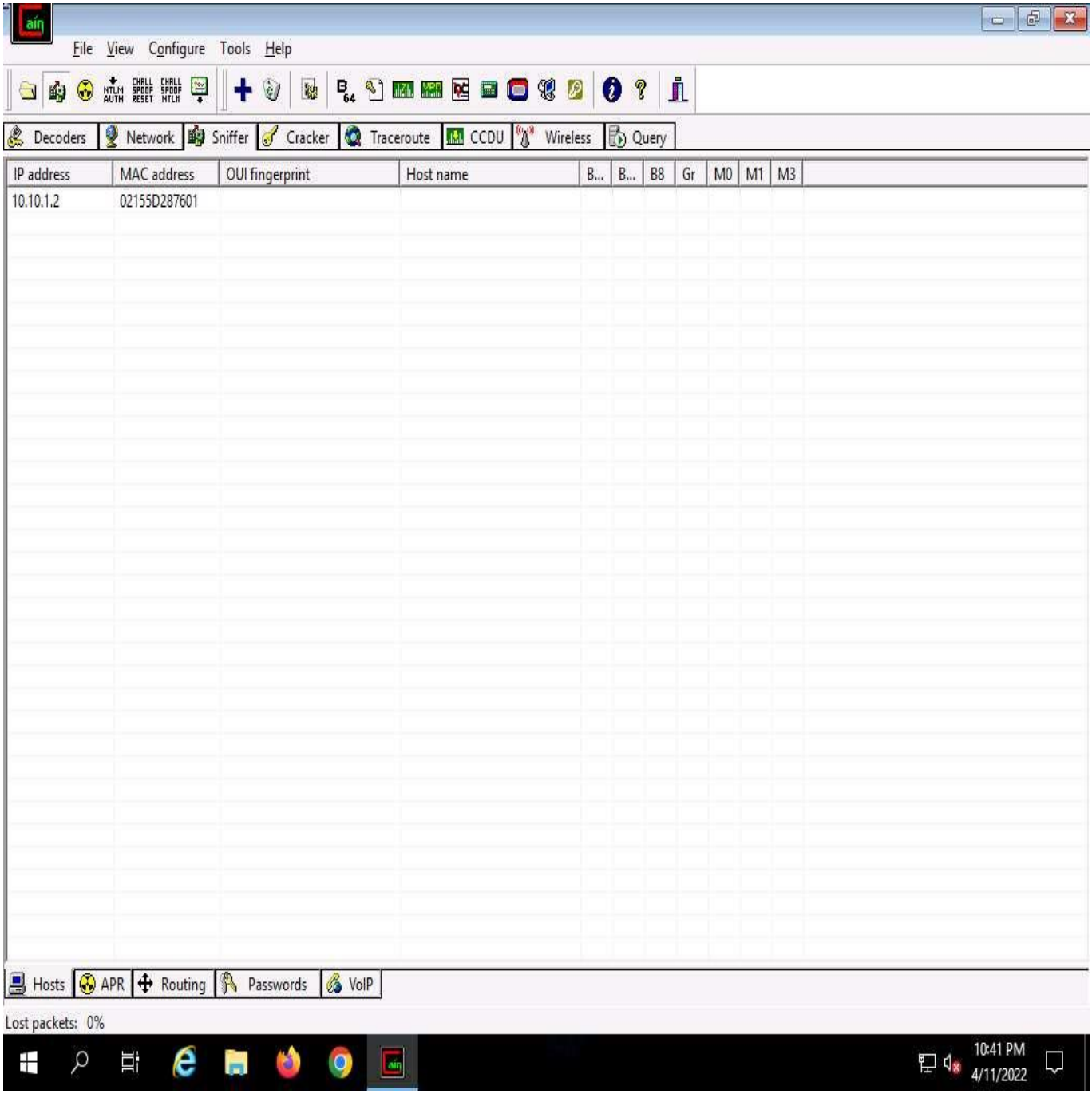
6. ☐ Click the **Start/Stop Sniffer** icon on the toolbar to begin sniffing.



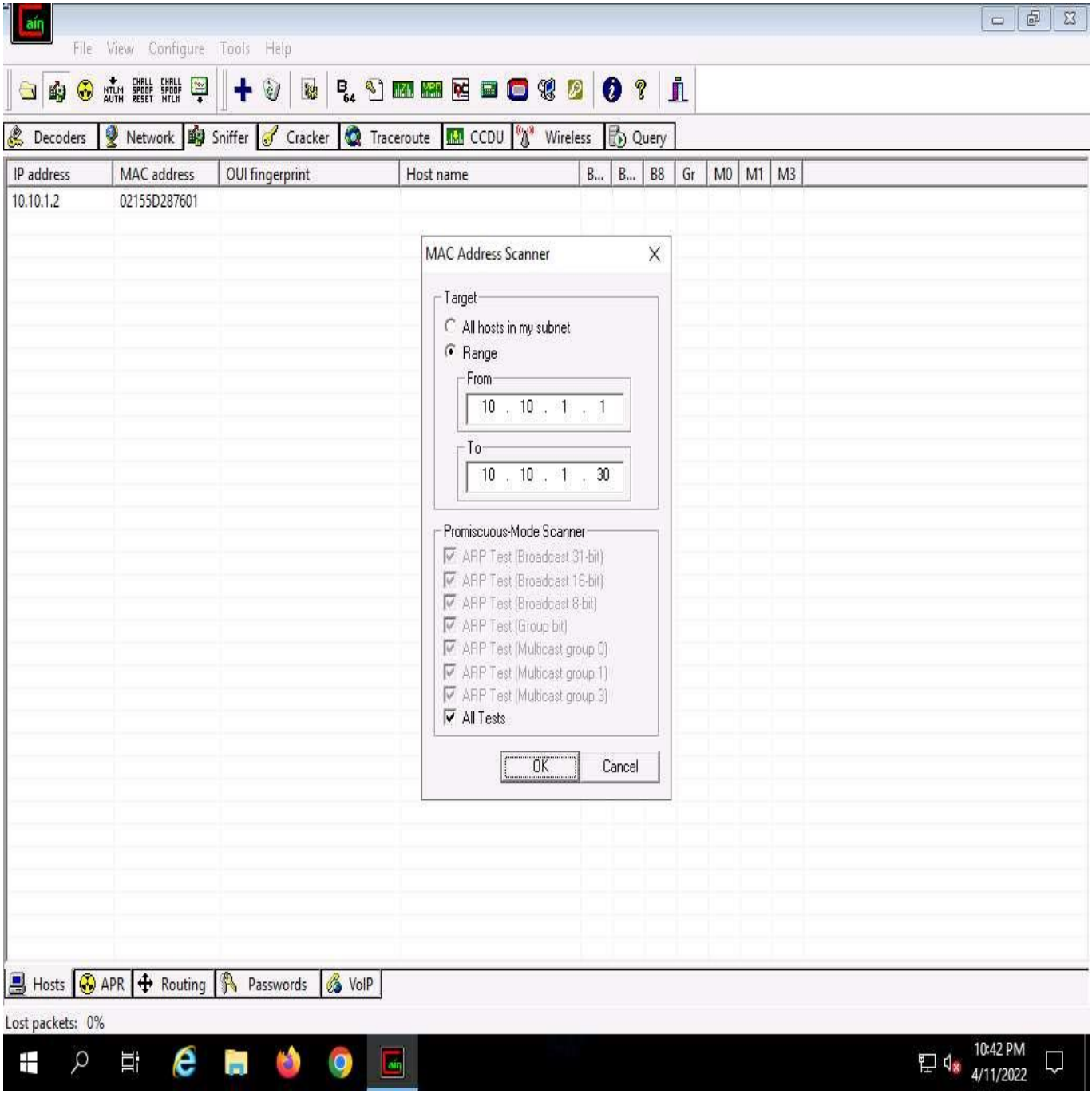
7. ☐ The **Cain** pop-up appears with a **Warning** message, click **OK**.



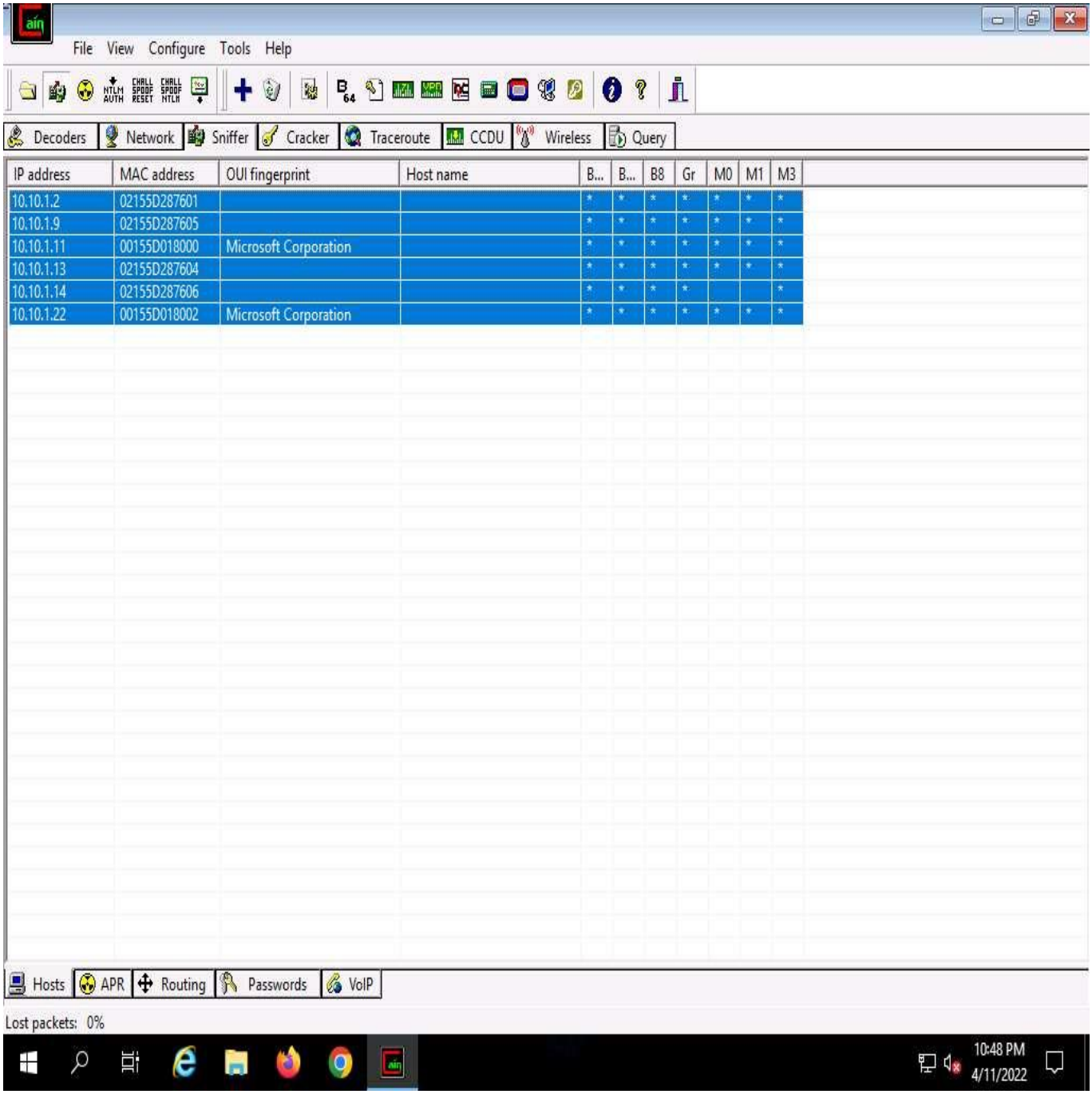
8. Now, click the **Sniffer** tab.



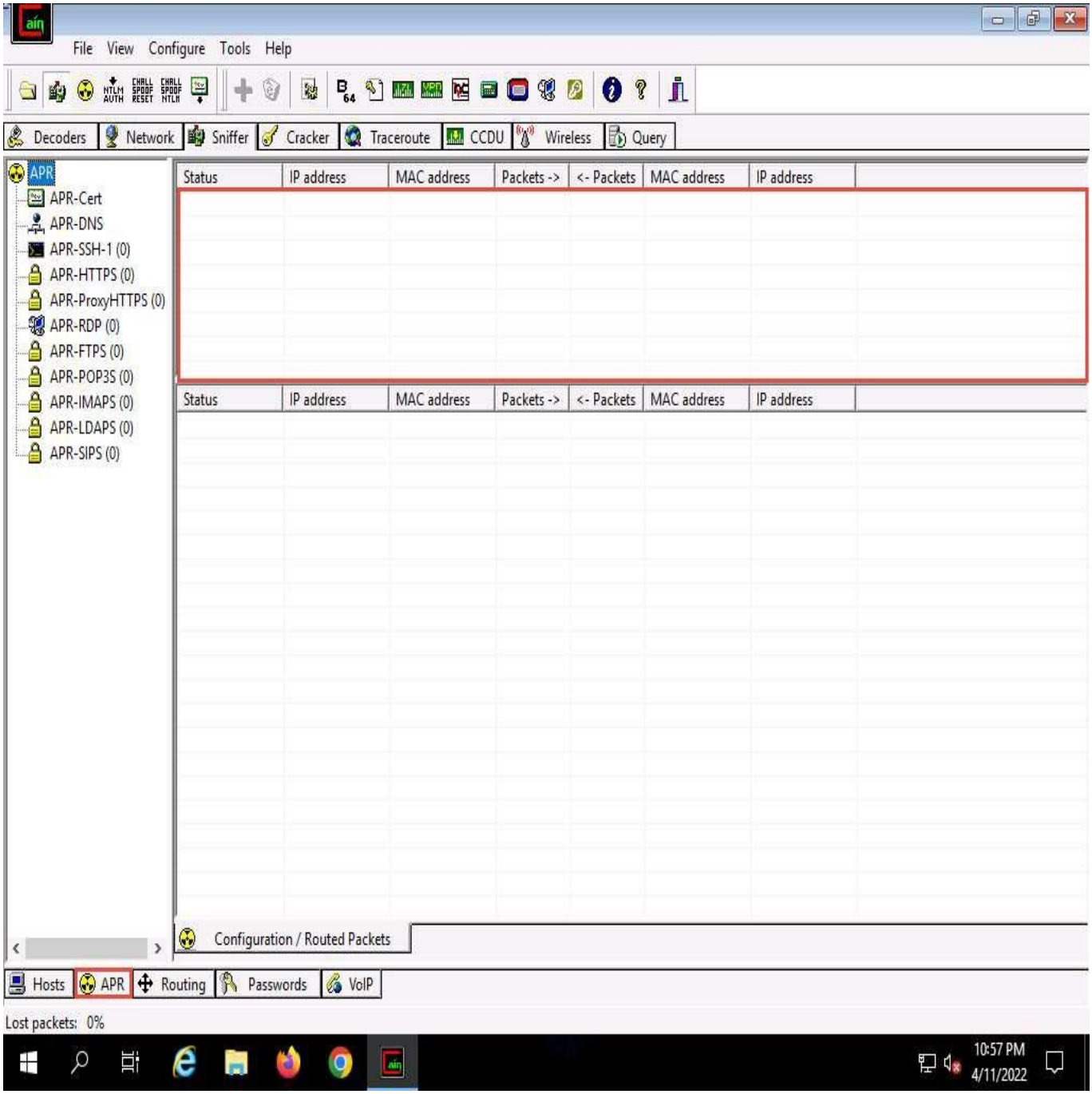
9. ☐ Click the plus (**+**) icon or right-click in the window and select **Scan MAC Addresses** to scan the network for hosts.
10. ☐ The **MAC Address Scanner** window appears. Check **the Range** radio button and specify the IP address range as **10.10.1.1-10.10.1.30**. Select the **All Tests** checkbox;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



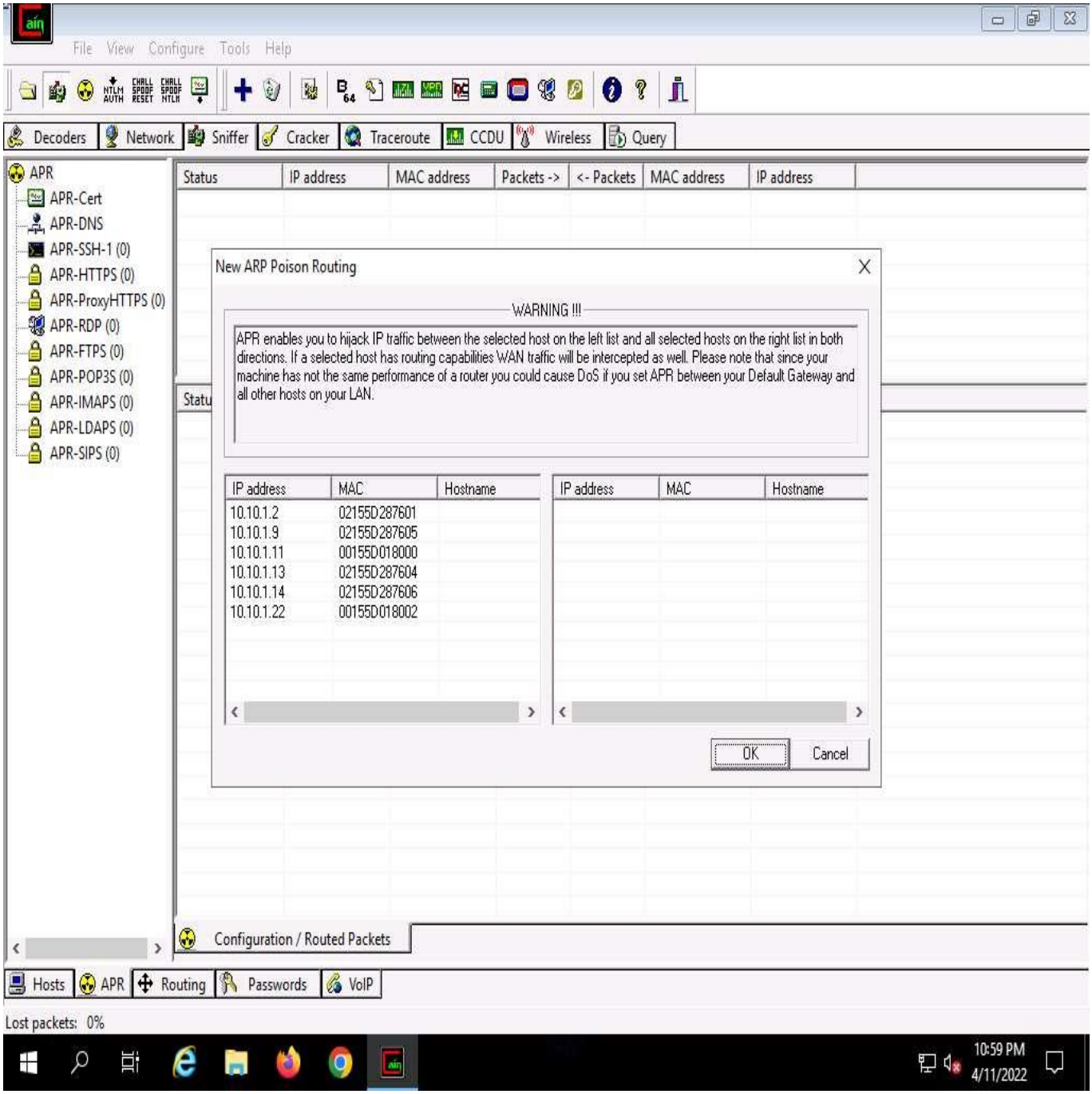
11. ☐ Cain & Abel starts scanning for MAC addresses and lists all those found.
12. ☐ After the completion of the scan, a list of all active IP addresses along with their corresponding MAC addresses is displayed, as shown in the screenshot.



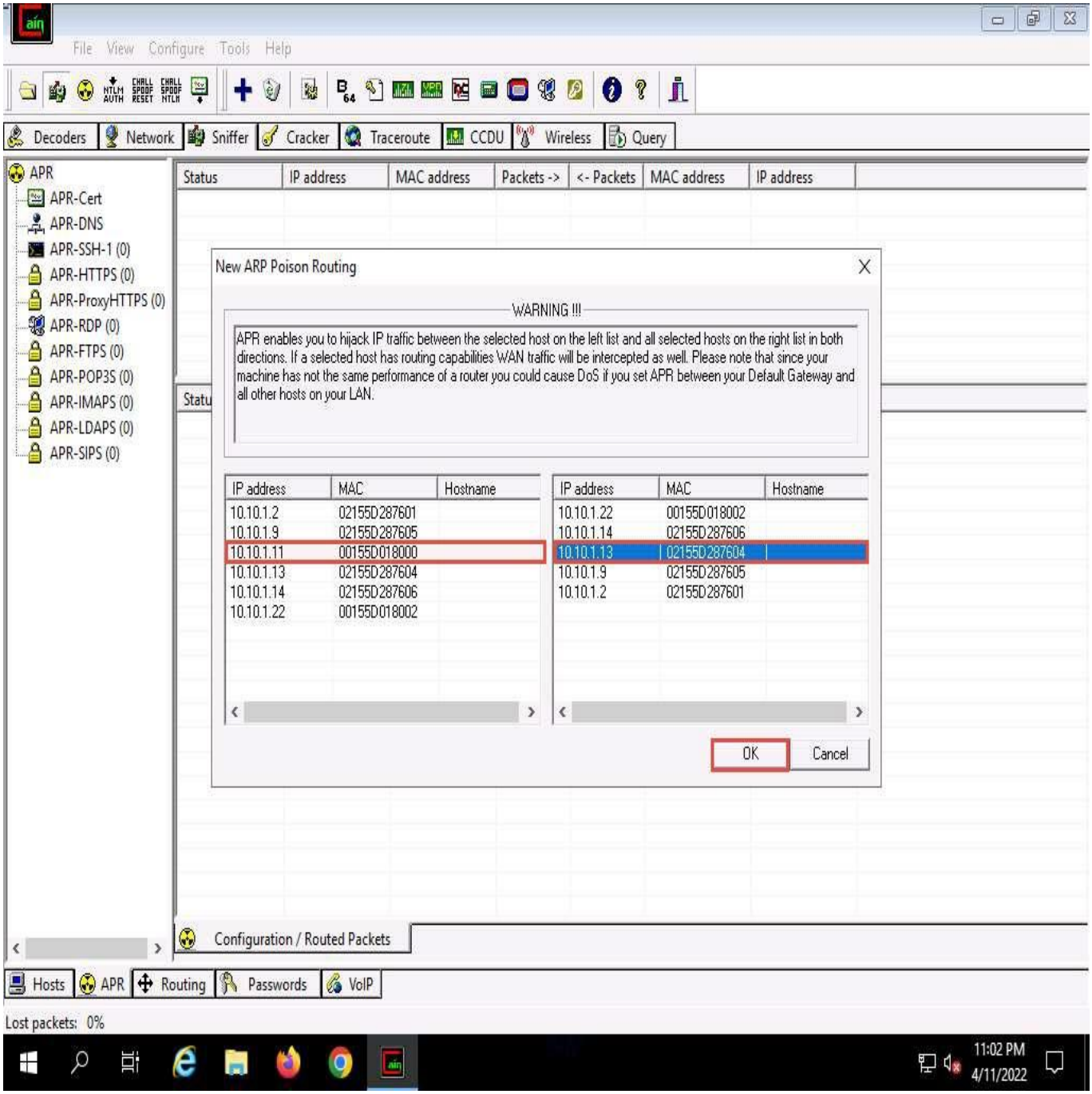
13. ☐ Now, click the **APR** tab at the bottom of the window.
14. ☐ APR options appear in the left-hand pane. Click anywhere on the topmost section in the right-hand pane to activate the plus (**+**) icon.



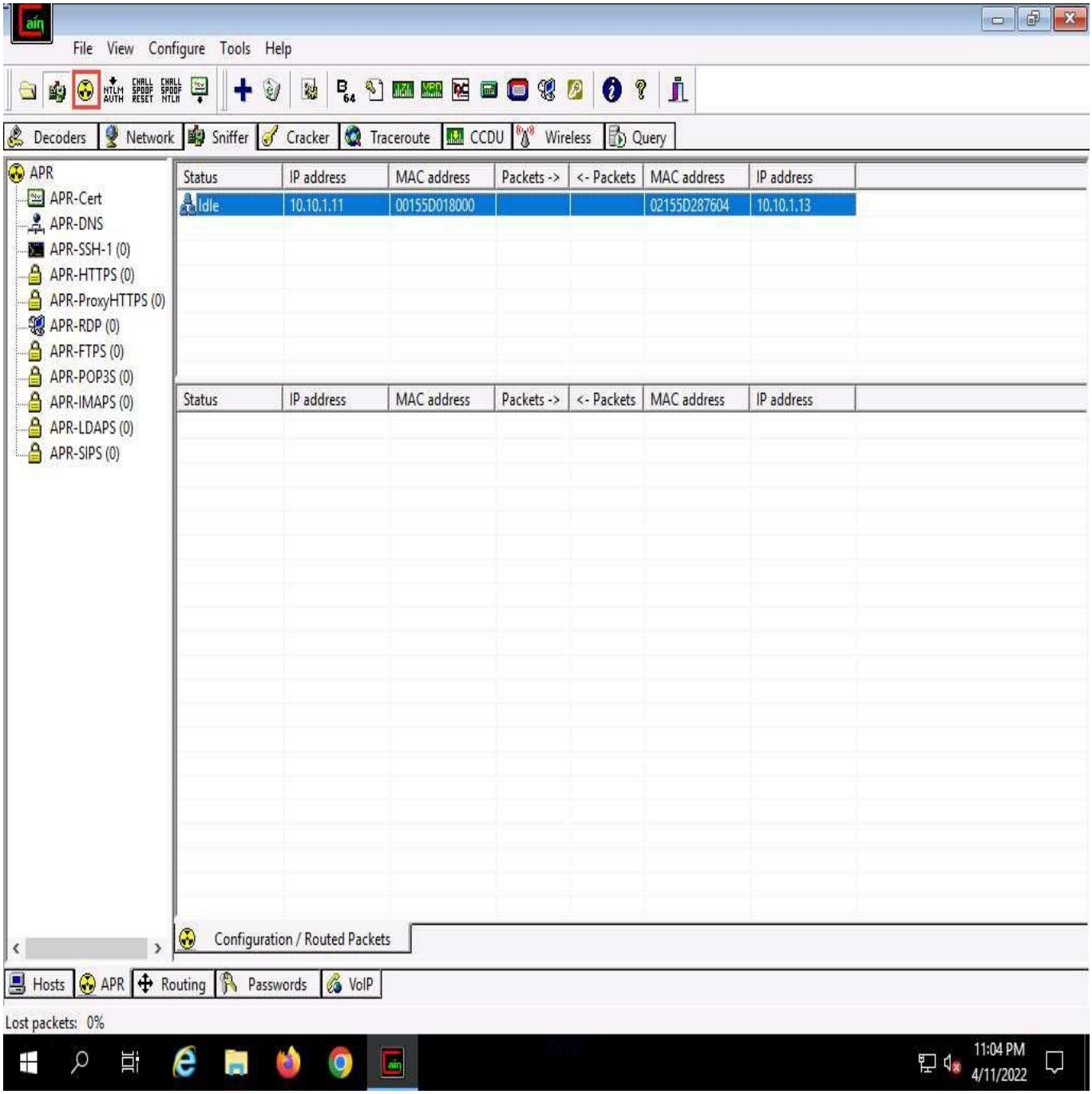
15. ☐ Click the plus (**+**) icon; a **New ARP Poison Routing** window appears; from which we can add IPs to listen to traffic.



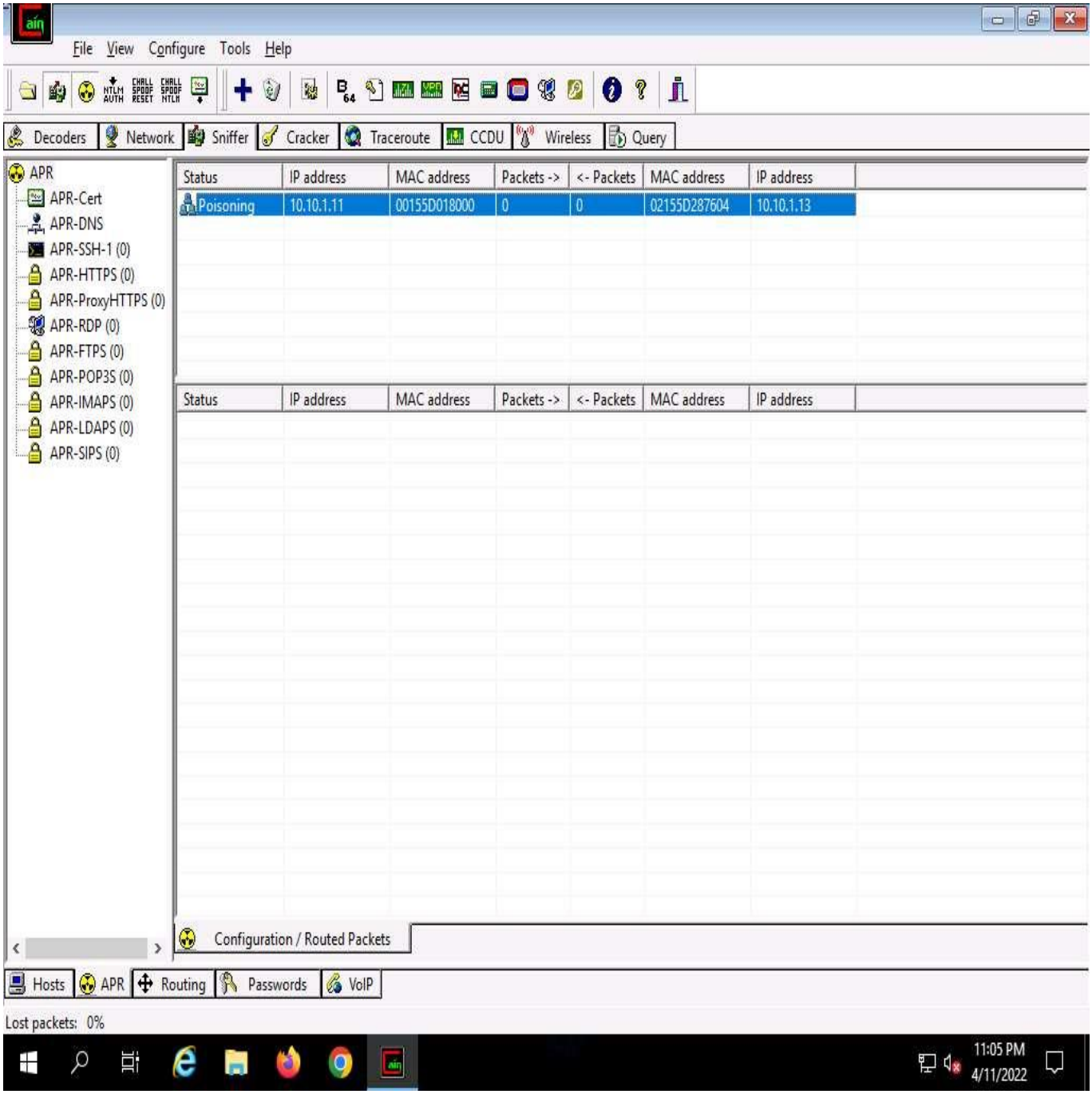
16. ☐ To monitor the traffic between two systems (here, **Windows 11** and **Parrot Security**), from the left-hand pane, click to select **10.10.1.11** (**Windows 11**) and from the right-hand pane, click **10.10.1.13** (**Parrot Security**); click **OK**. By doing so, you are setting Cain to perform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



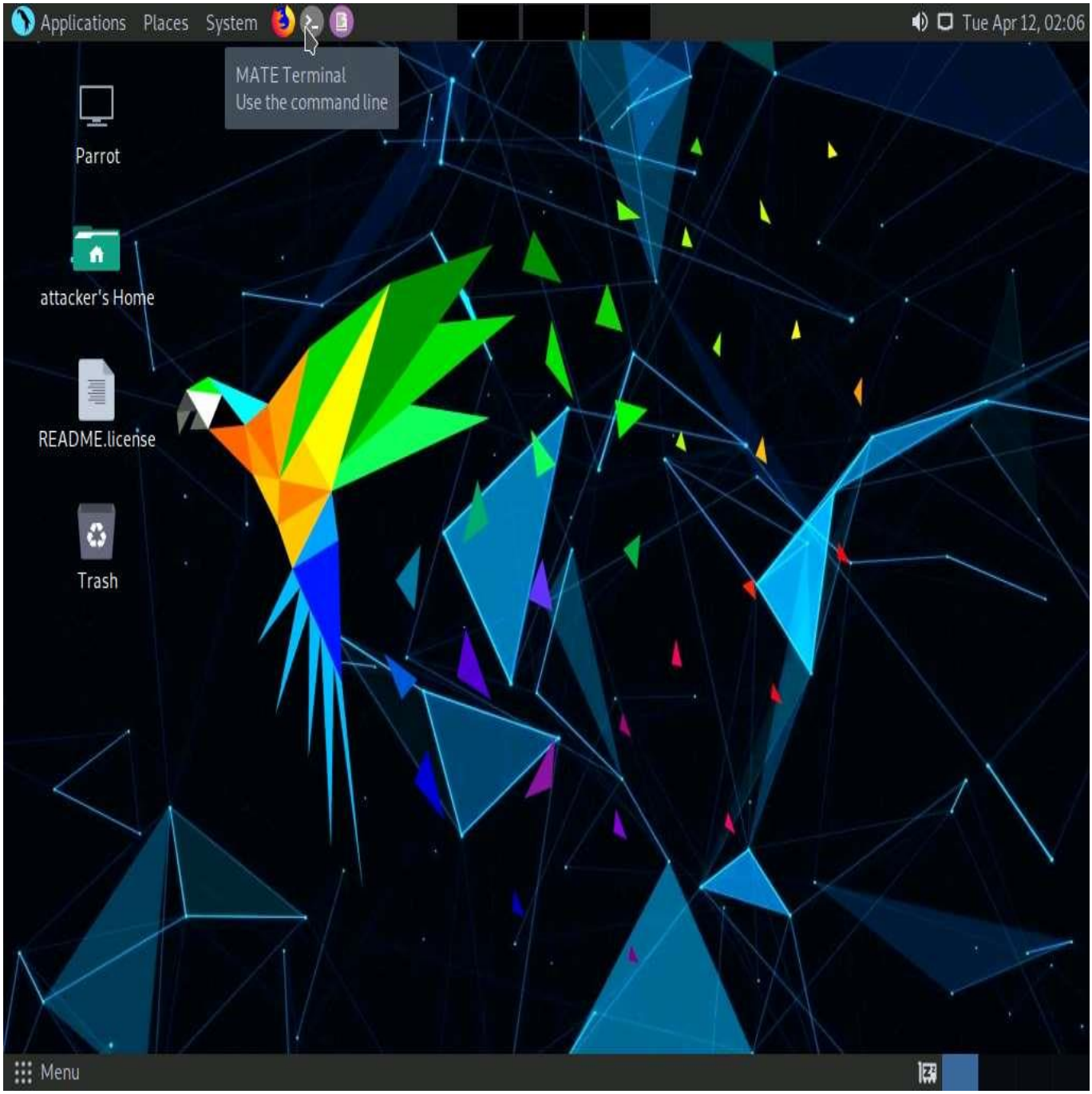
17. ☐ Click to select the created target IP address scan that is displayed in the **Configuration / Routed Packets** tab.
18. ☐ Click on the **Start/Stop APR** icon to start capturing ARP packets.



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.



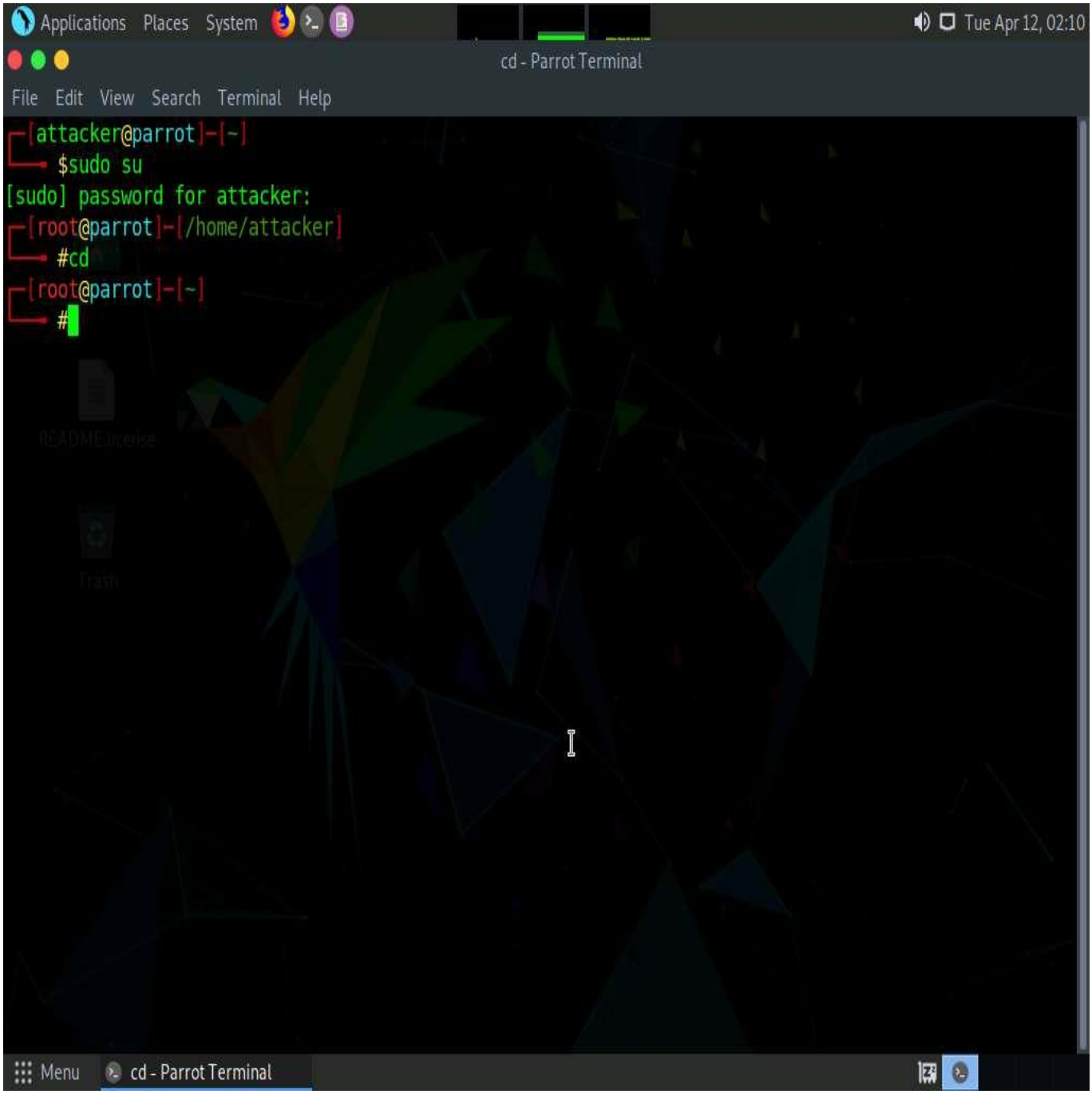
20. ☐ Cain & Abel intercepts the traffic traversing between these two machines.
21. ☐ To generate traffic between the machines, you need to ping one target machine using the other.
22. ☐ Click Parrot Security to switch to the **Parrot Security** machine.
23. ☐ Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.



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

The password that you type will not be visible.

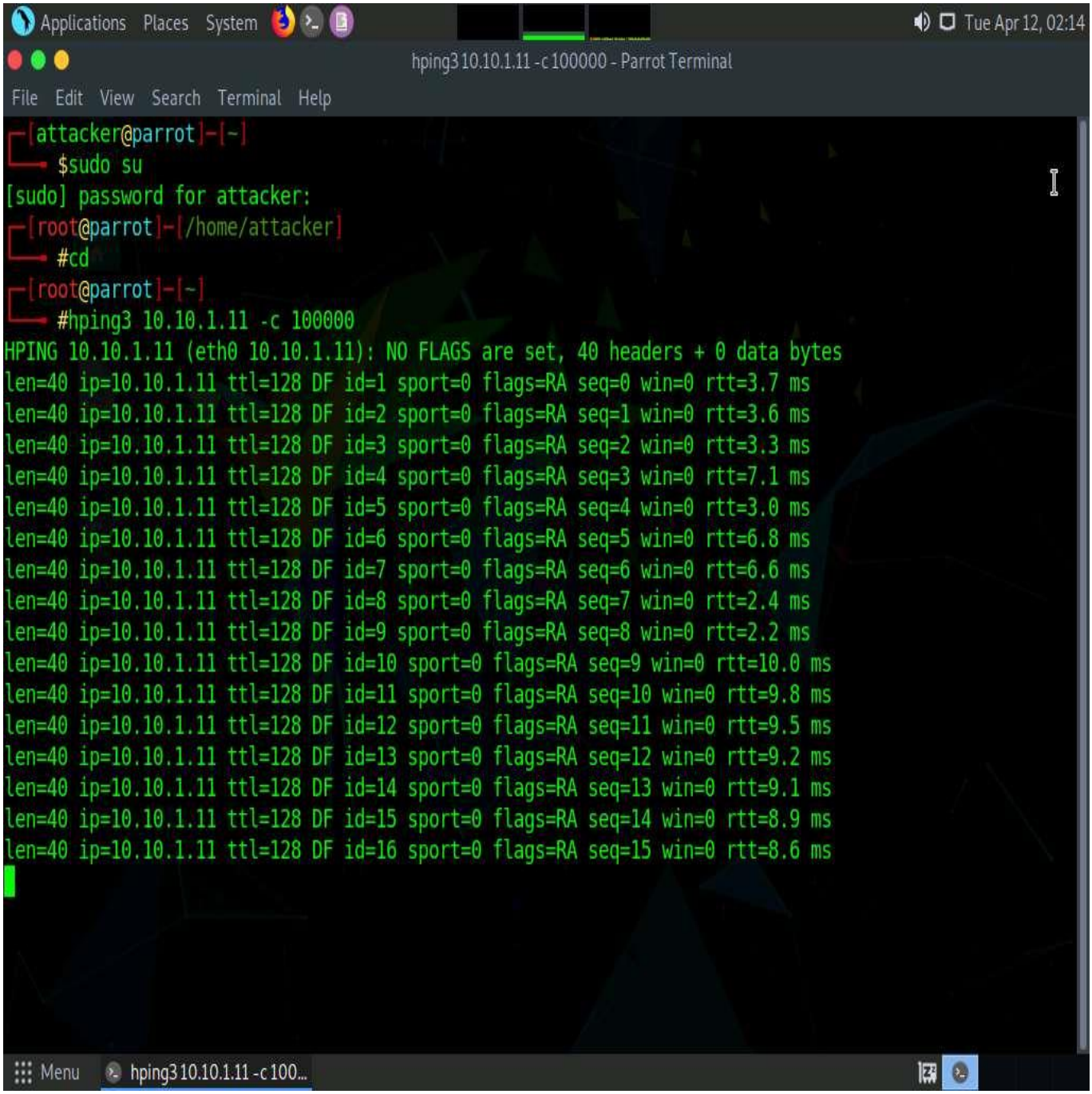
26. ☐ Now, type **cd** and press **Enter** to jump to the root directory.



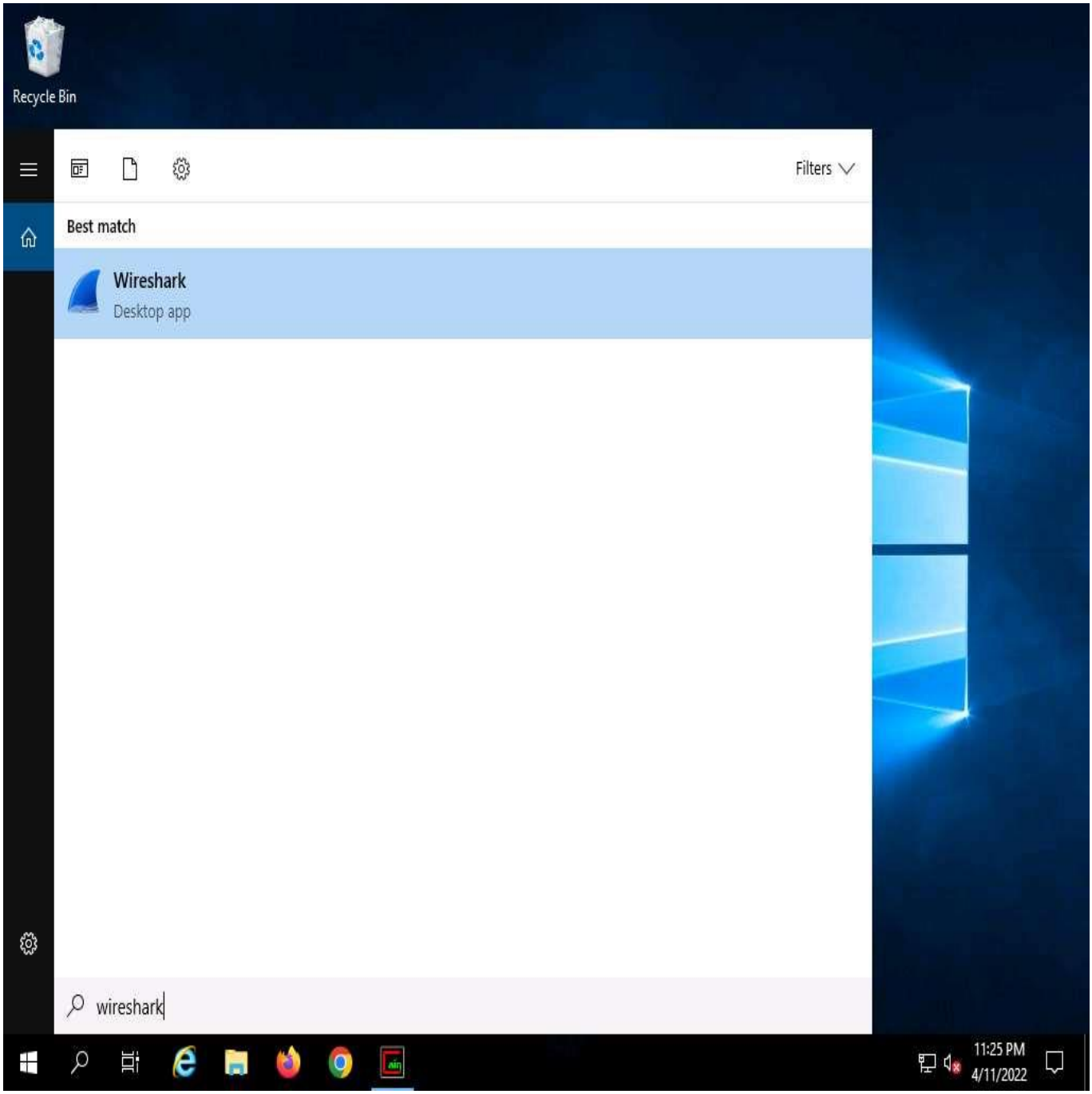
27. ☐ A **Parrot Terminal** window appears; type **hping3 [Target IP Address] -c 100000** (here, target IP address is **10.10.1.11 [Windows 11]**) and press **Enter**.

-c: specifies the packet count.

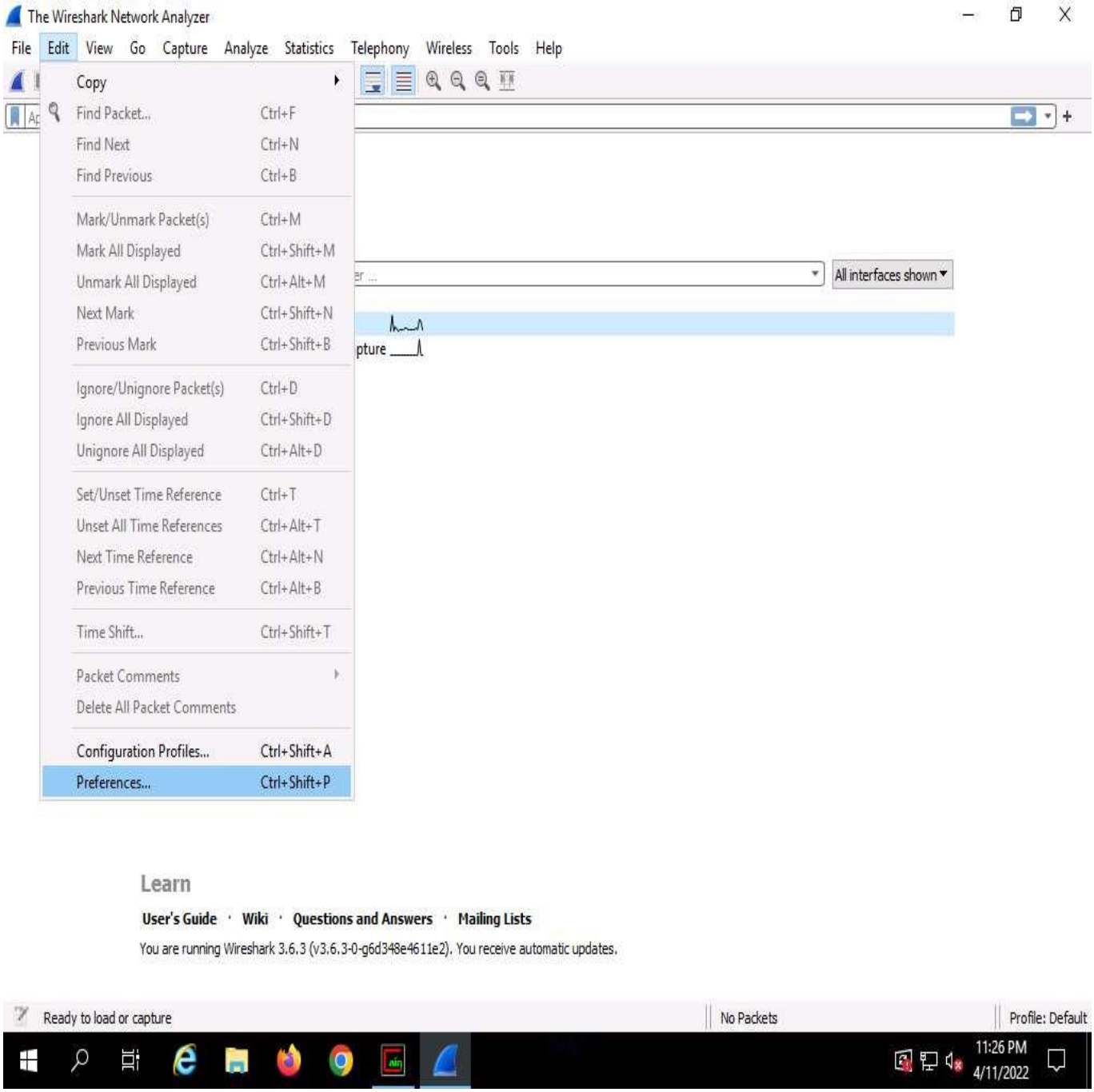
28. ☐ This command will start pinging the target machine (**Windows 11**) with 100,000 packets.



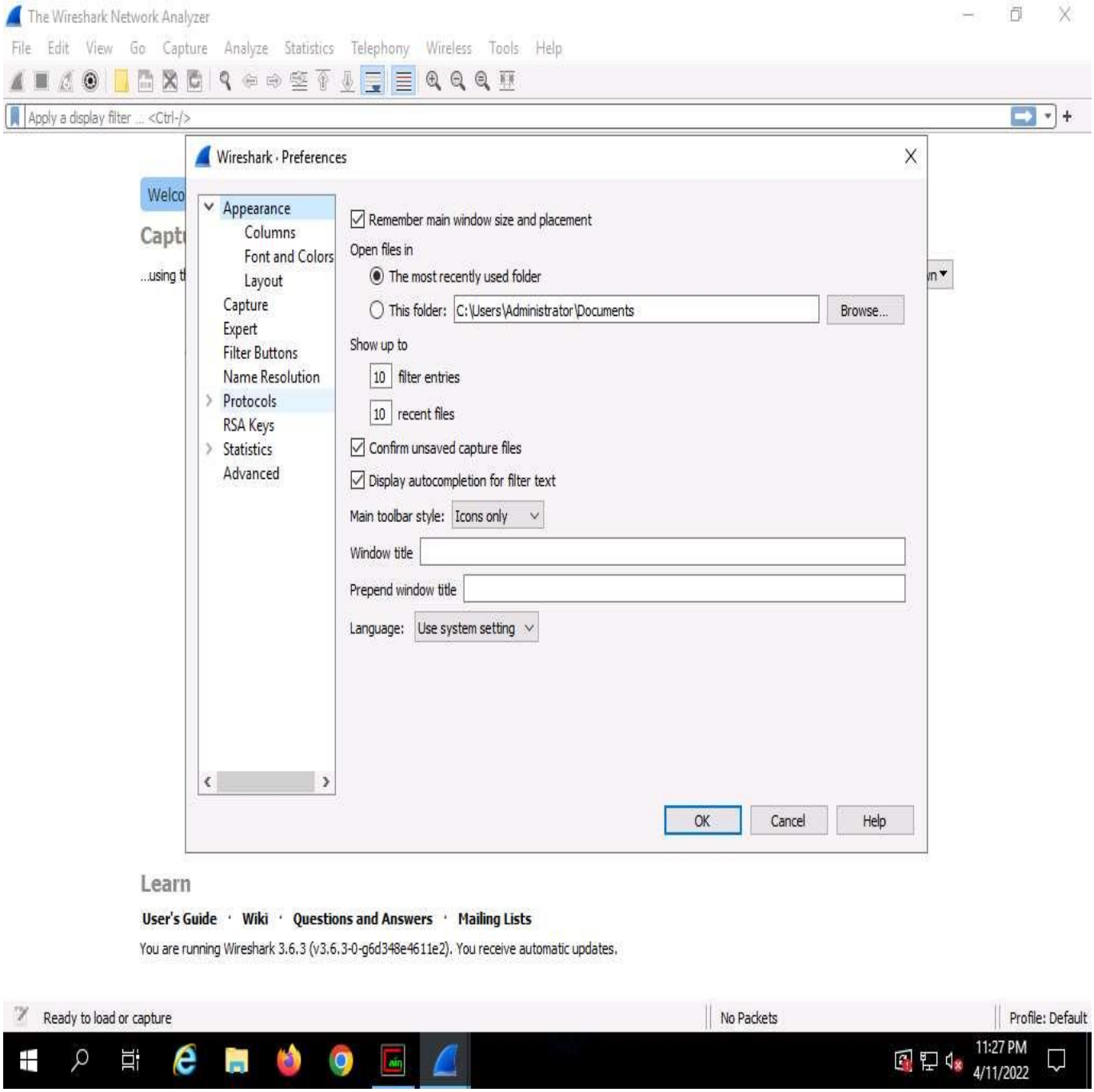
29. ☐ Leave the command running and immediately click Windows Server 2019 to switch to the **Windows Server 2019** machine.
30. ☐ Click the **Type here to search** icon at the bottom of **Desktop** and type **wireshark**.
Click **Wireshark** from the results.



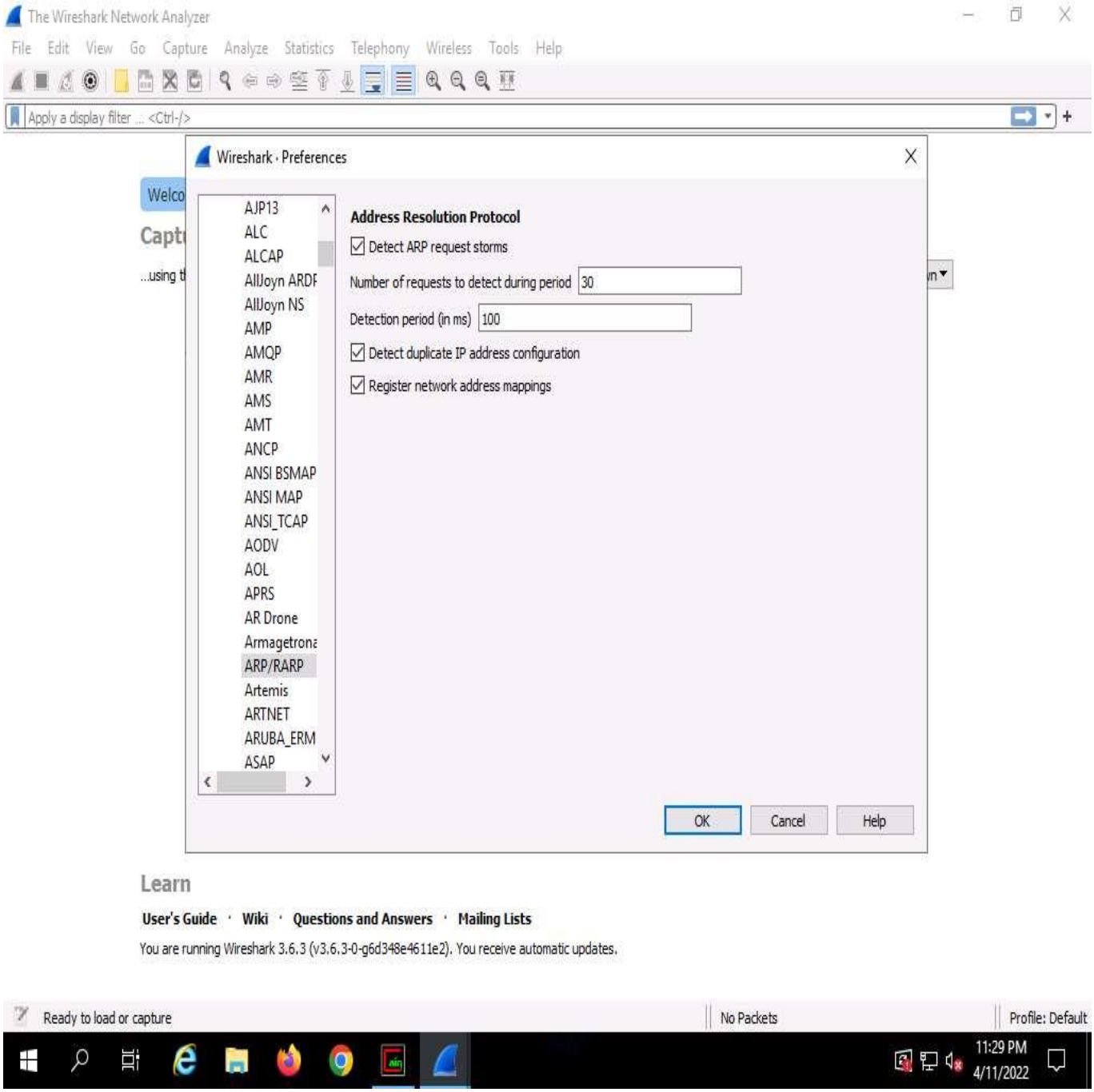
31. ☐ The **Wireshark Network Analyzer** window appears; click **Edit** in the menu bar and select **Preferences...**.



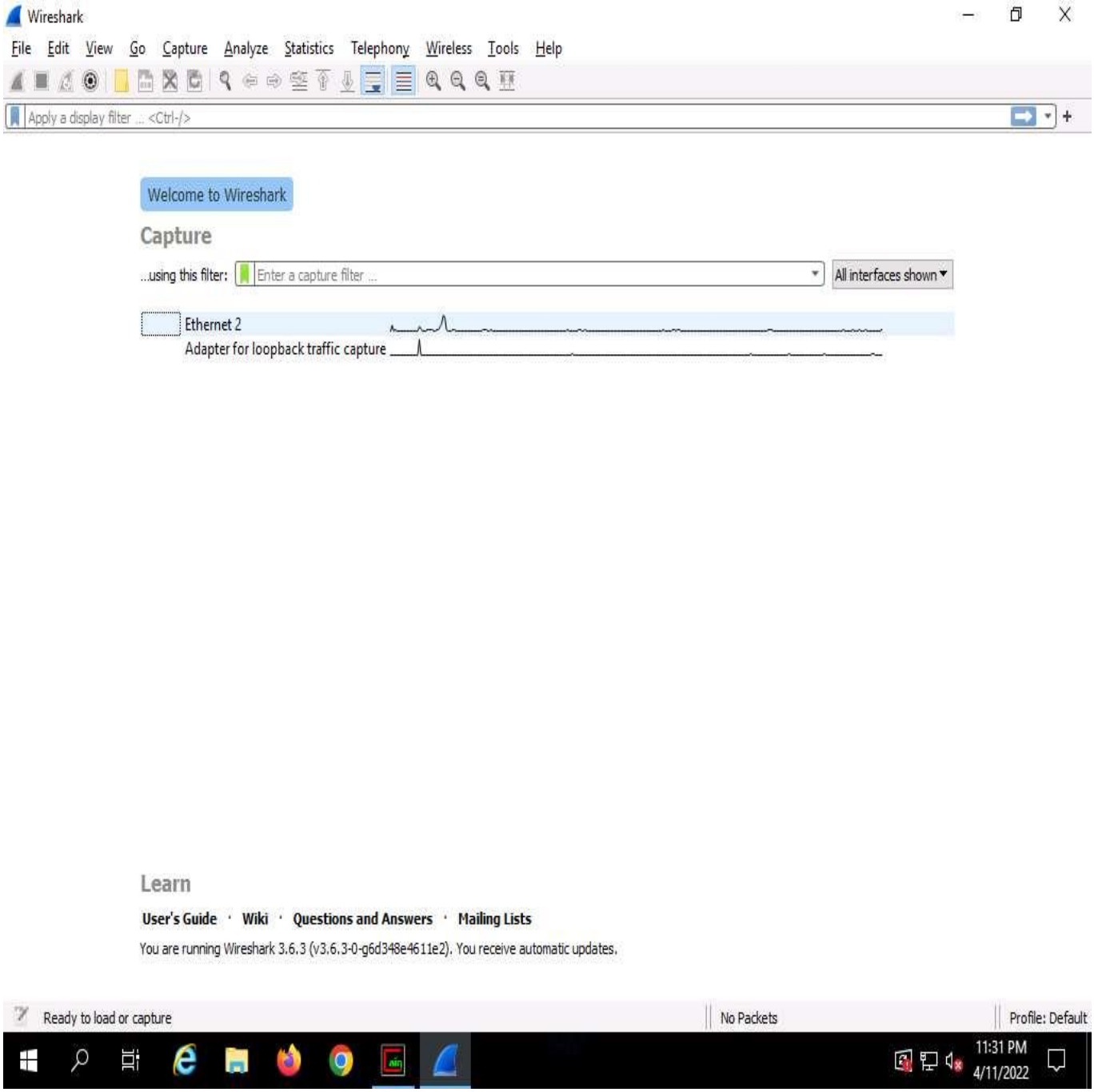
32. ☐ The **Wireshark . Preferences** window appears; expand the **Protocols** node.



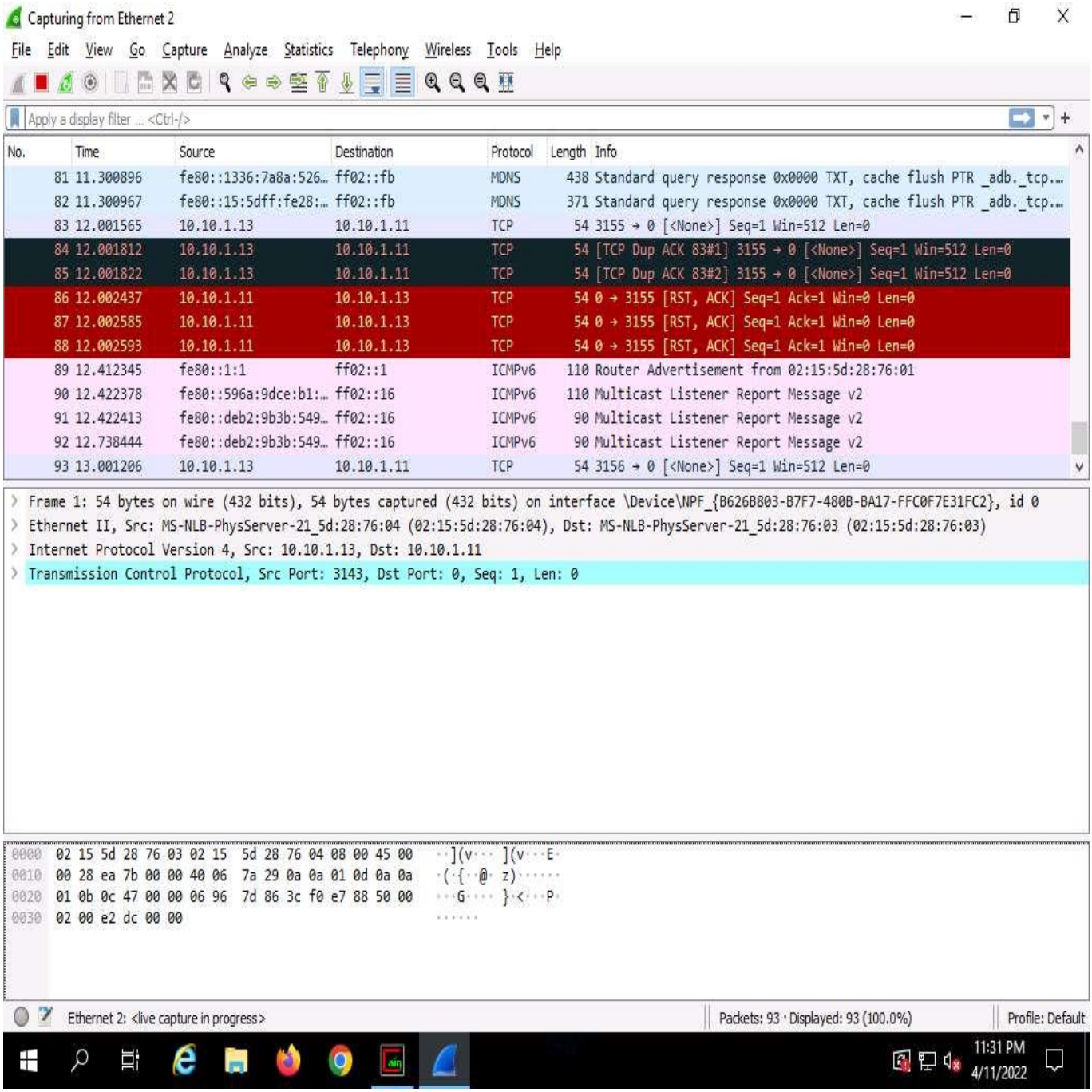
33. ☐ Scroll-down in the **Protocols** node and select the **ARP/RARP** option.
34. ☐ From the right-hand pane, click the **Detect ARP request storms** checkbox and ensure that the **Detect duplicate IP address configuration** checkbox is checked; click **OK**.



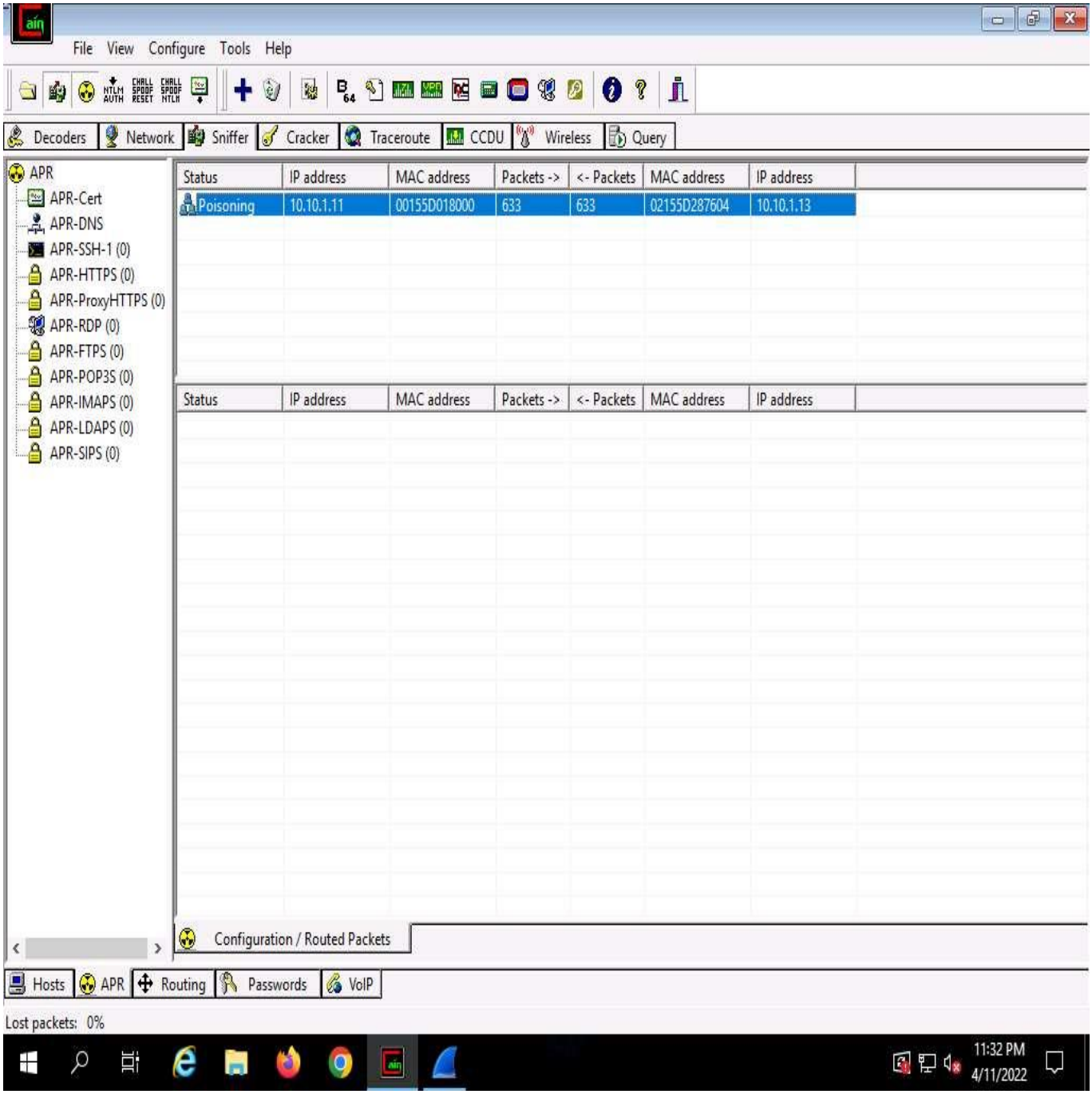
35. ☐ Now, double-click on the adapter associated with your network (here, **Ethernet2**) to start capturing the network packets.



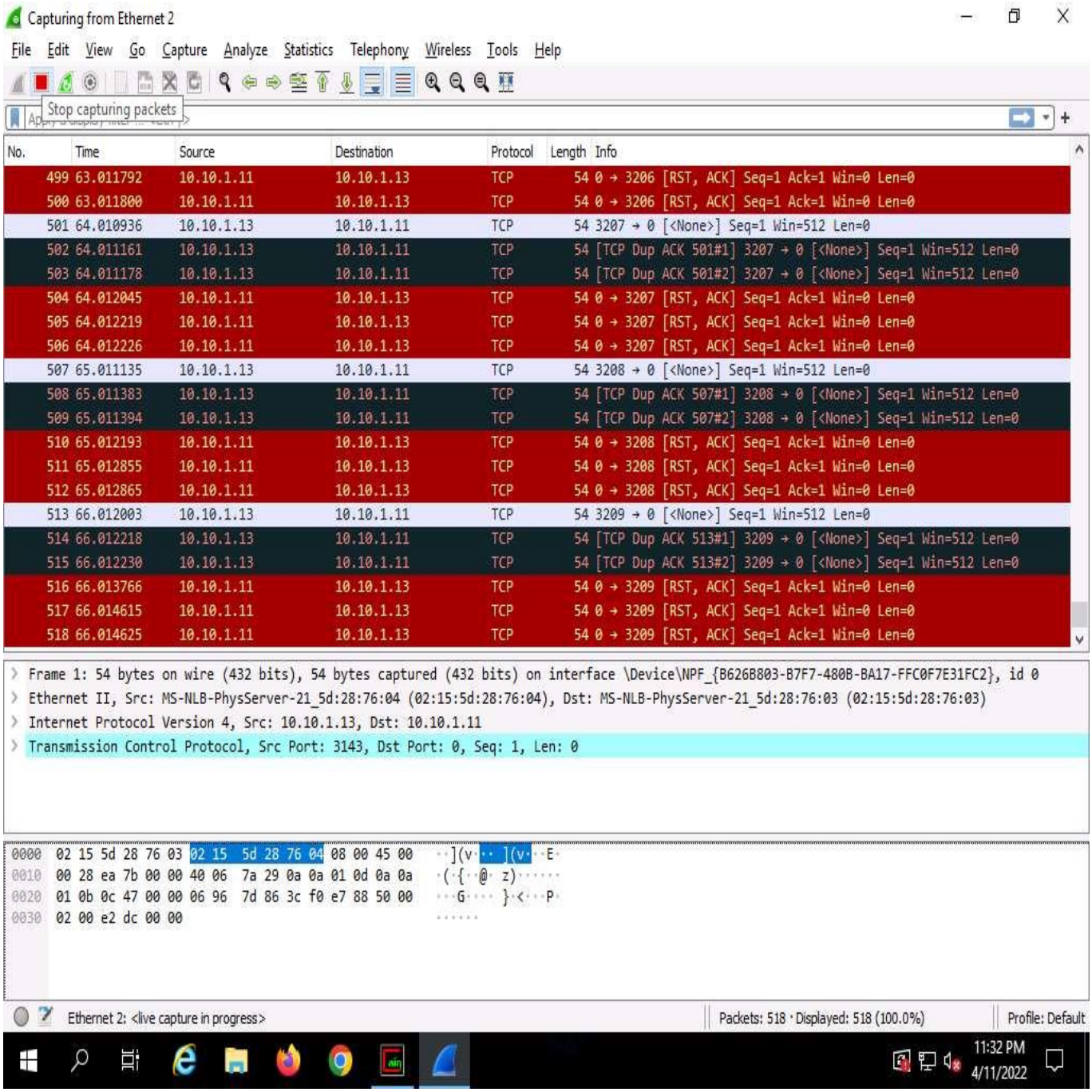
36. ☐ **Wireshark** begins to capture the traffic between the two machines, as shown in the screenshot.



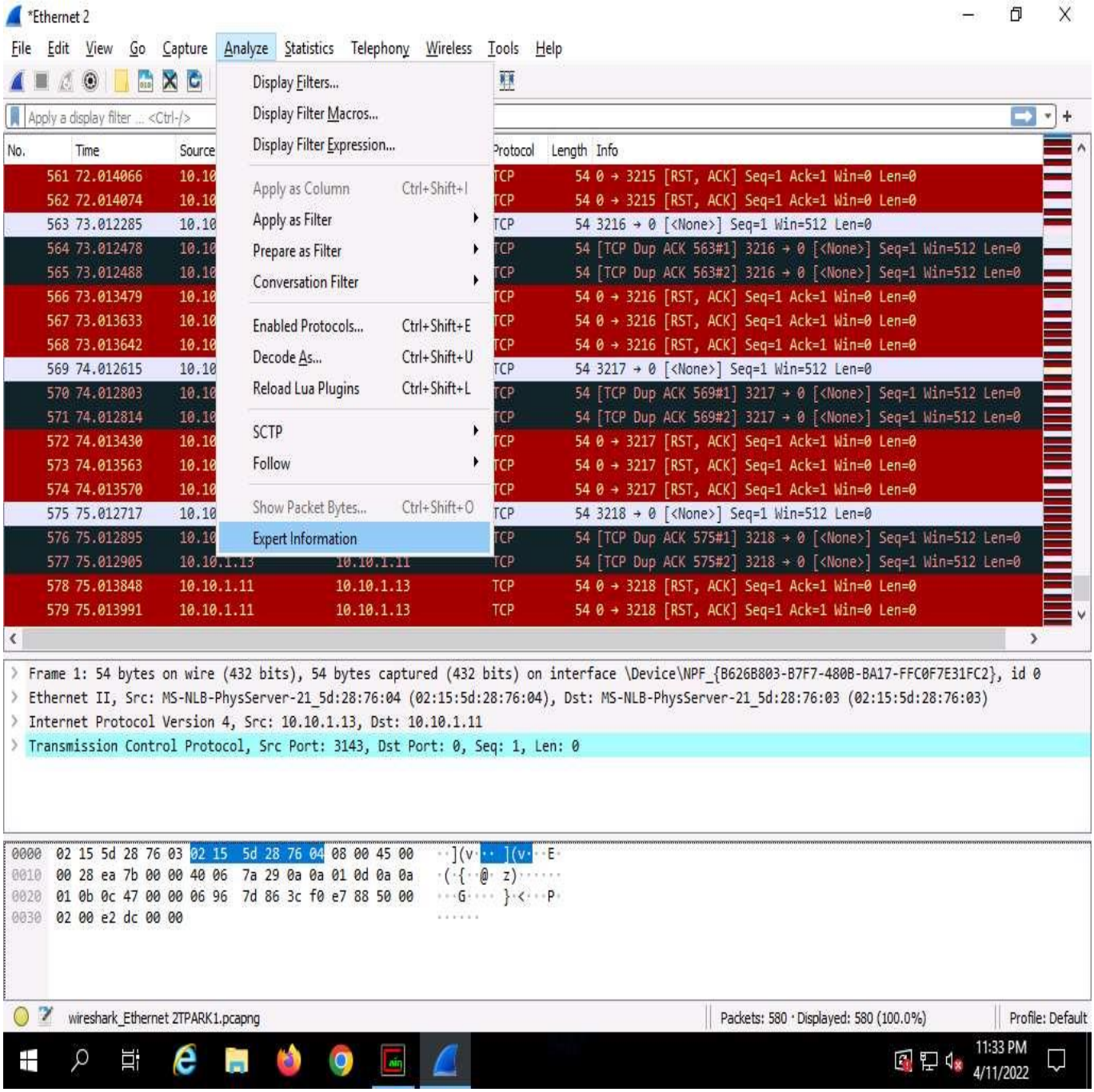
37. ☐ Switch to the **Cain & Abel** window to observe the packets flowing between the two machines.



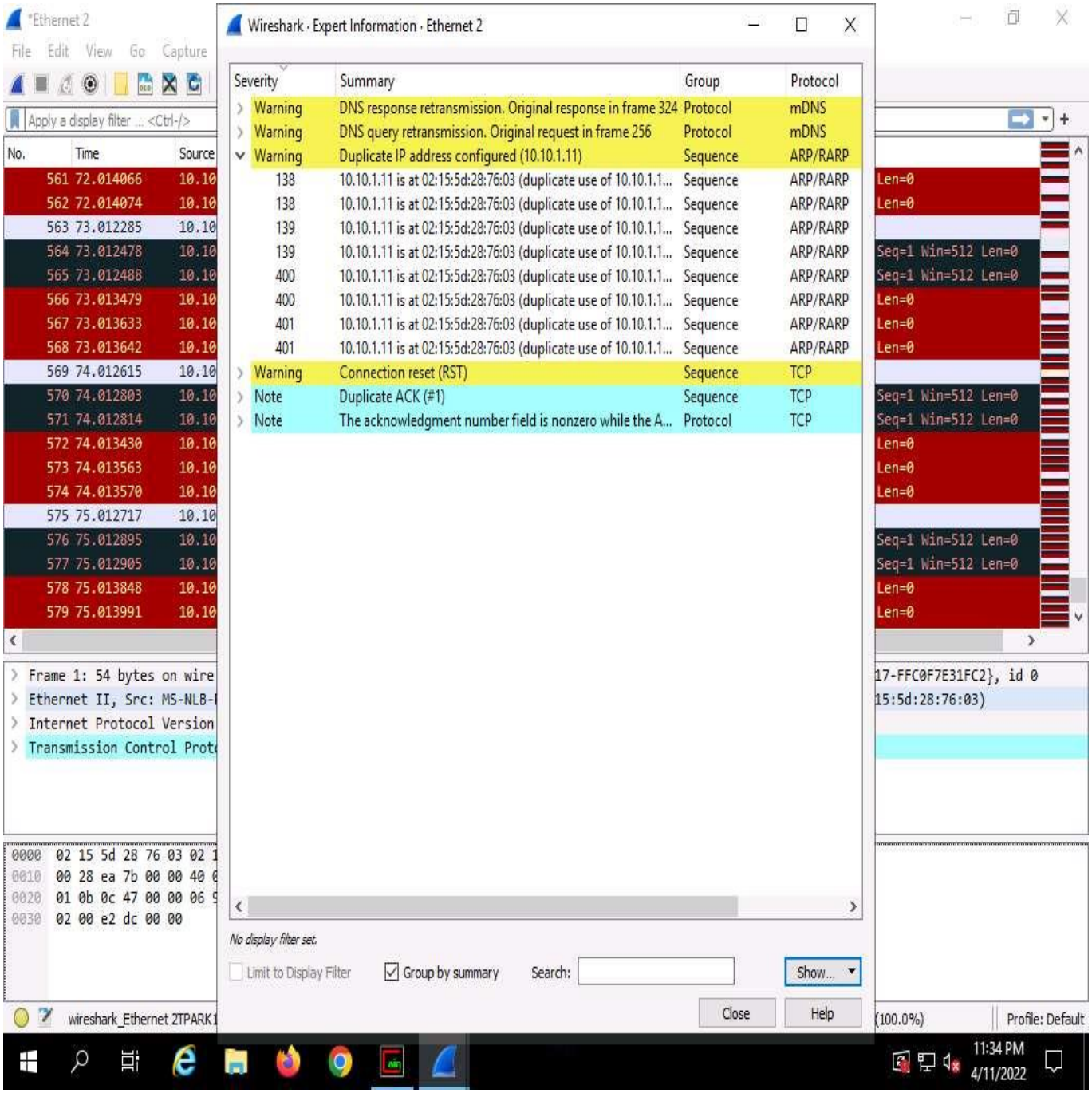
38. ☐ Now, switch to **Wireshark** and click the **Stop packet capturing** icon to stop the packet capturing.



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

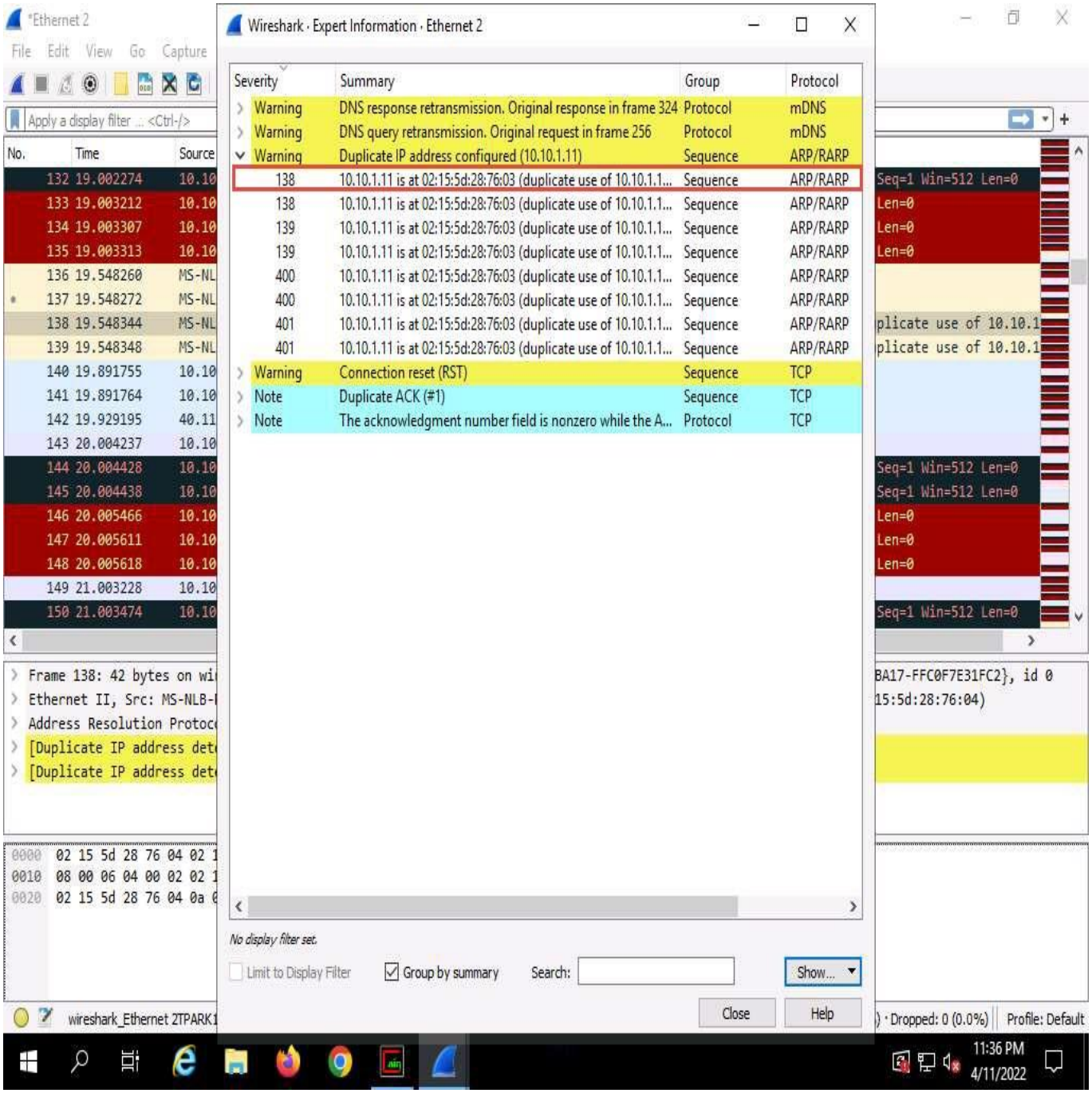


40. ☐ The **Wireshark . Expert Information** window appears; click to expand the **Warning** node labeled **Duplicate IP address configured (10.10.1.11)**, running on the **ARP/RARP** protocol.



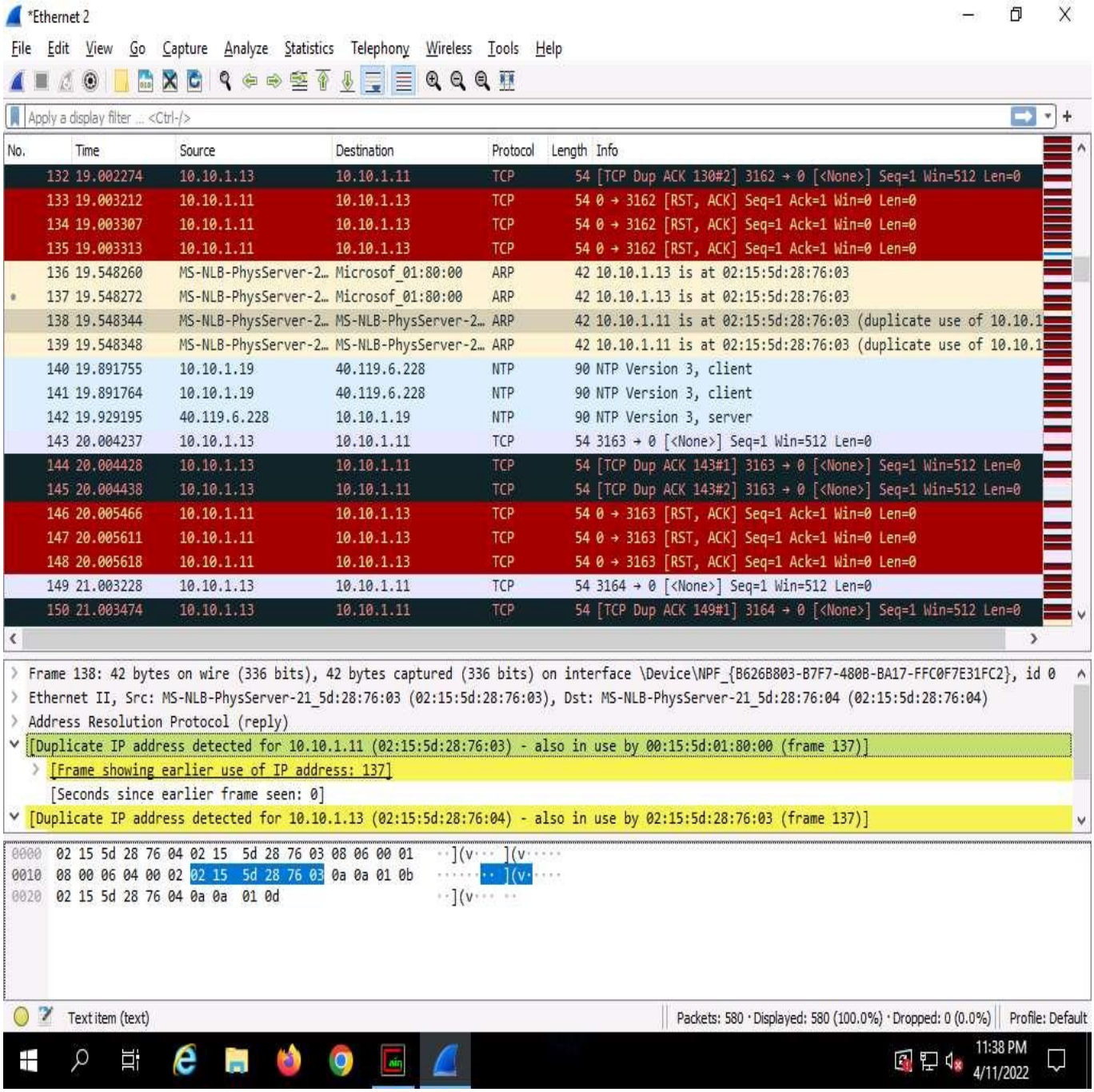
41. ☐ Arrange the **Wireshark . Expert Information** window above the **Wireshark** window so that you can view the packet number and the **Packet details** section.

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



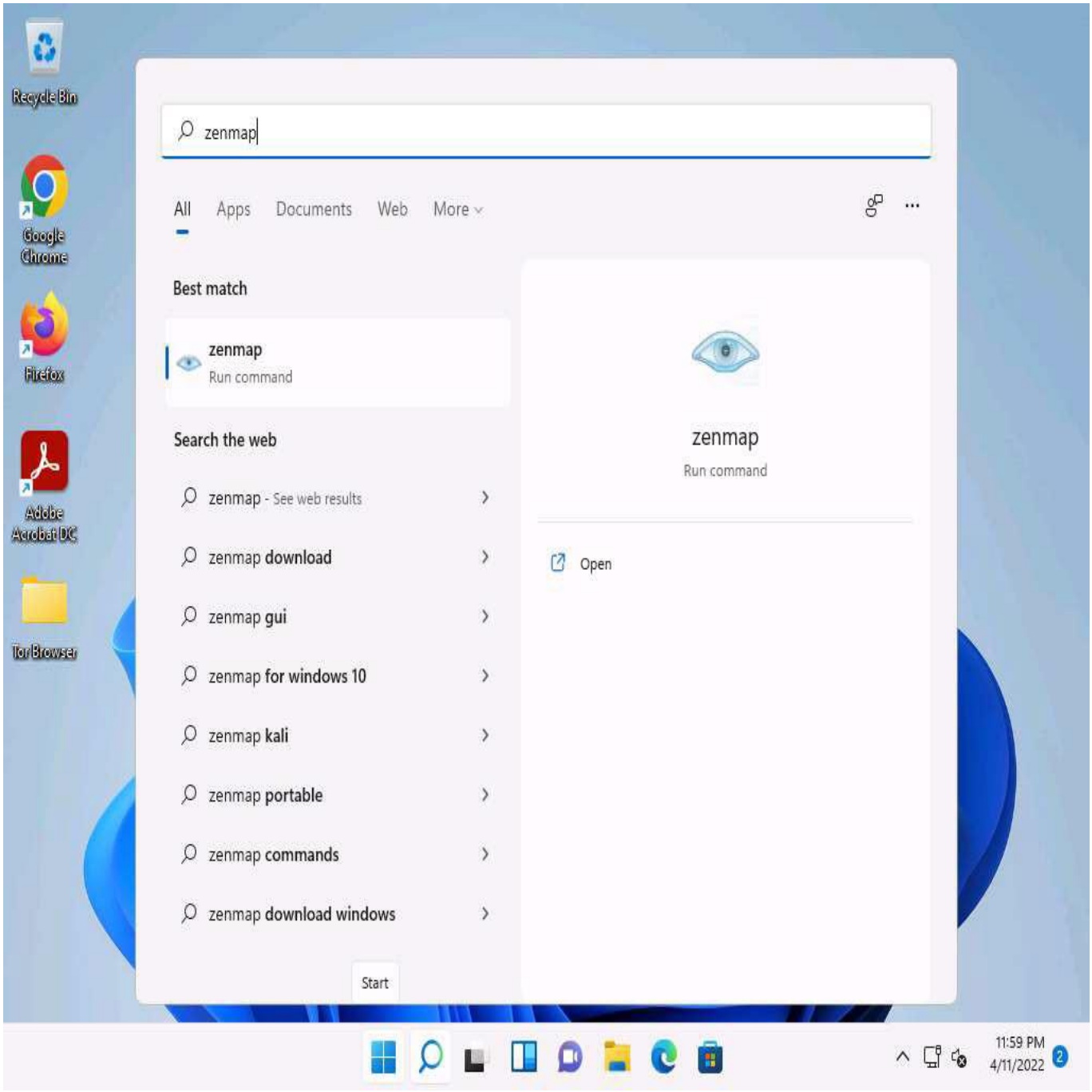
43. ☐ On selecting the packet number, **Wireshark** highlights the packet, and its associated information is displayed under the packet details section. Close the **Wireshark . Expert Information** window.

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

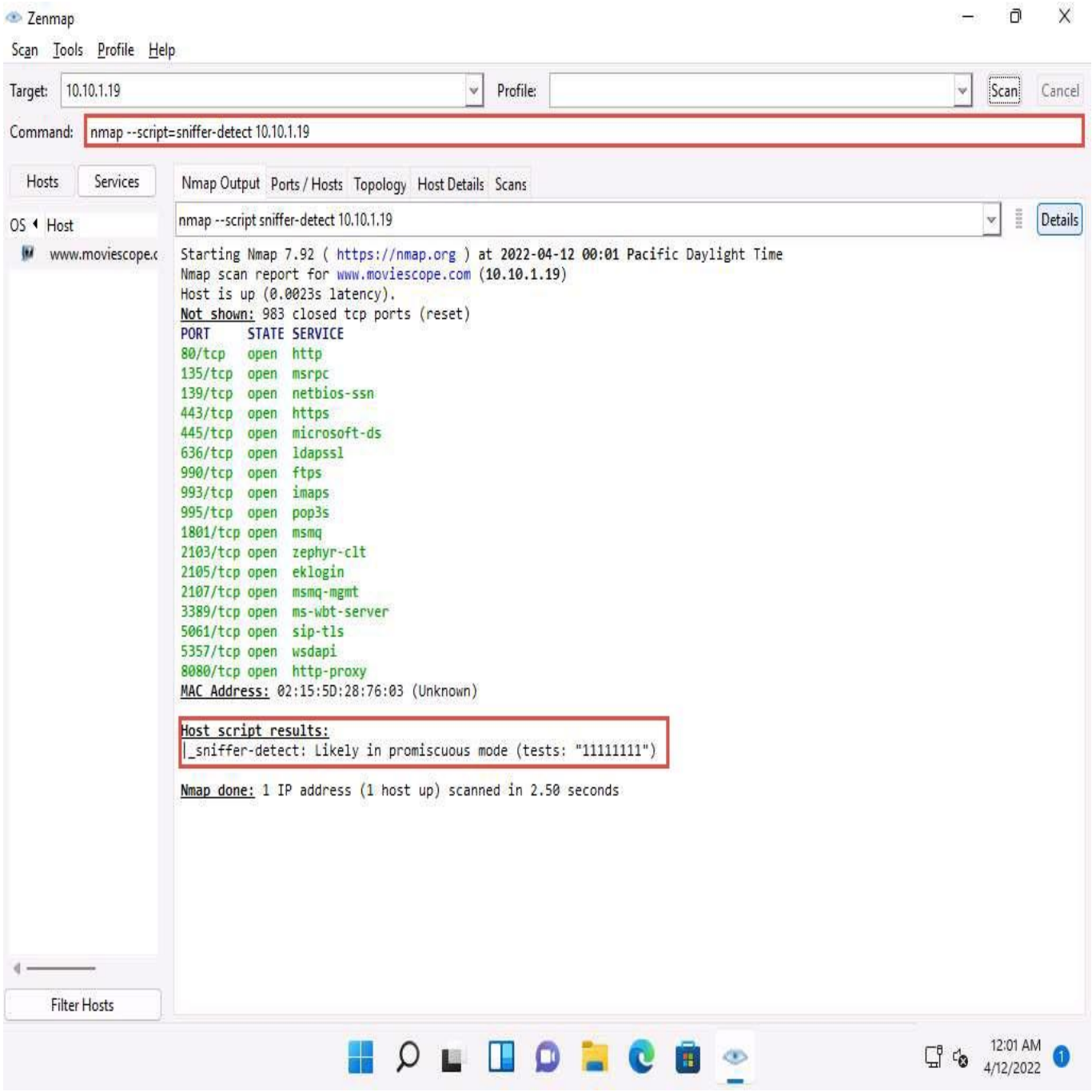


ARP spoofing succeeds by changing the IP address of the attacker's computer to the IP address of the target computer. A forged ARP request and reply packet find a place in the target ARP cache in this process. As the ARP reply has been forged, the destination computer (target) sends frames to the attacker's 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.

45. ☐ This concludes the demonstration of detecting ARP poisoning in a switch-based network.
46. ☐ Close the **Wireshark** window and leave all other windows running.
47. ☐ Now, we shall perform promiscuous mode detection using Nmap.
48. ☐ Now, Click Windows 11 to switch to the **Windows 11** 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.



49. ☐ 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**.
50. ☐ 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.



51. ☐ Close the **Nmap** tool window and document all the acquired information.
52. ☐ 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 pentesters in quickly detecting ARP poisoning and ARP flooding attack and in locating attack source.

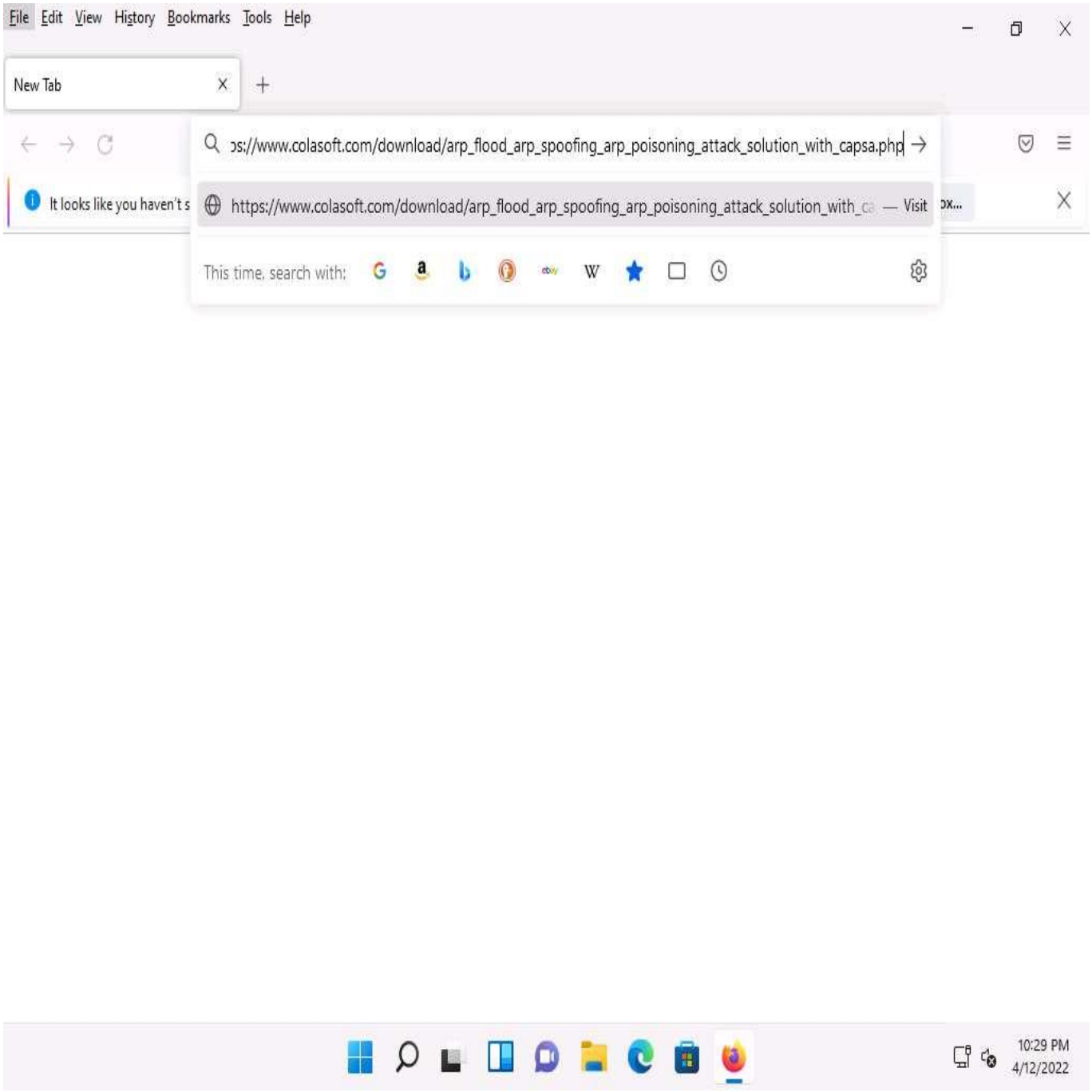
Habu

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

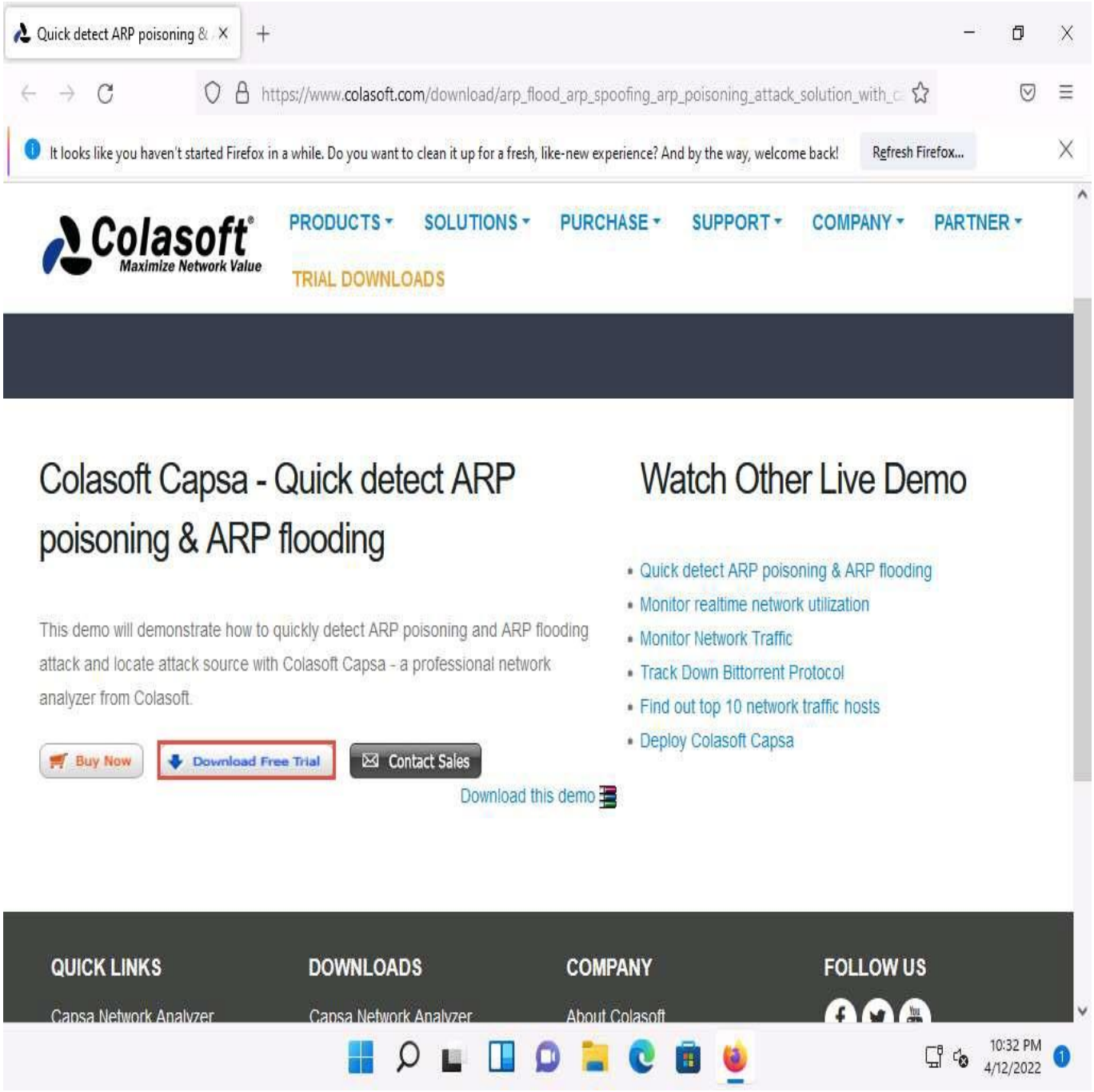
Here, we will use Habu tool to perform ARP poisoning attack on the target system and use Capsa Network Analyser to detect the attack.

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

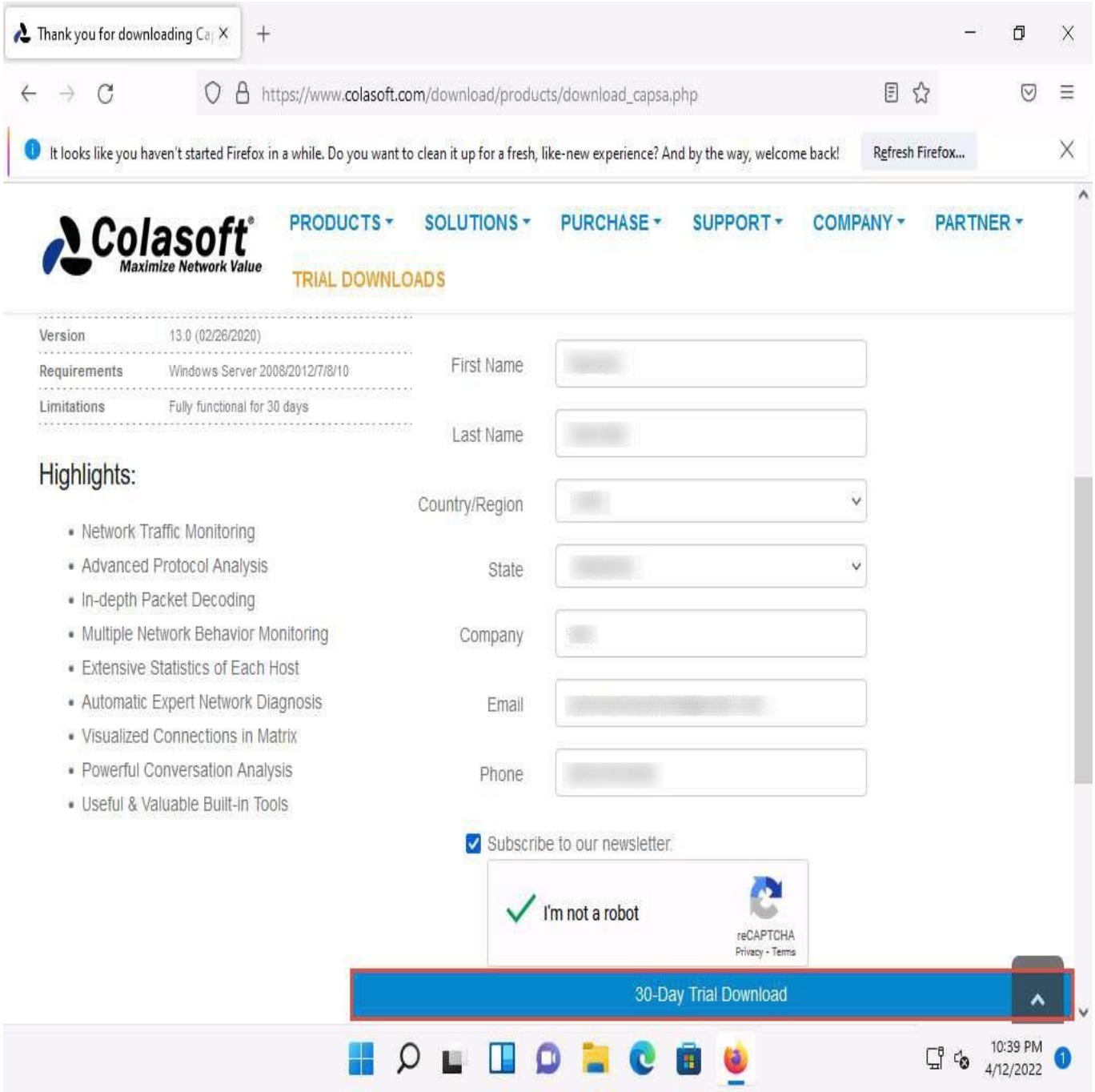


3. ☐ In the **Colasoft Capsa - Quick detect ARP poisoning & ARP flooding** window, click on **Download Free Trial** button.

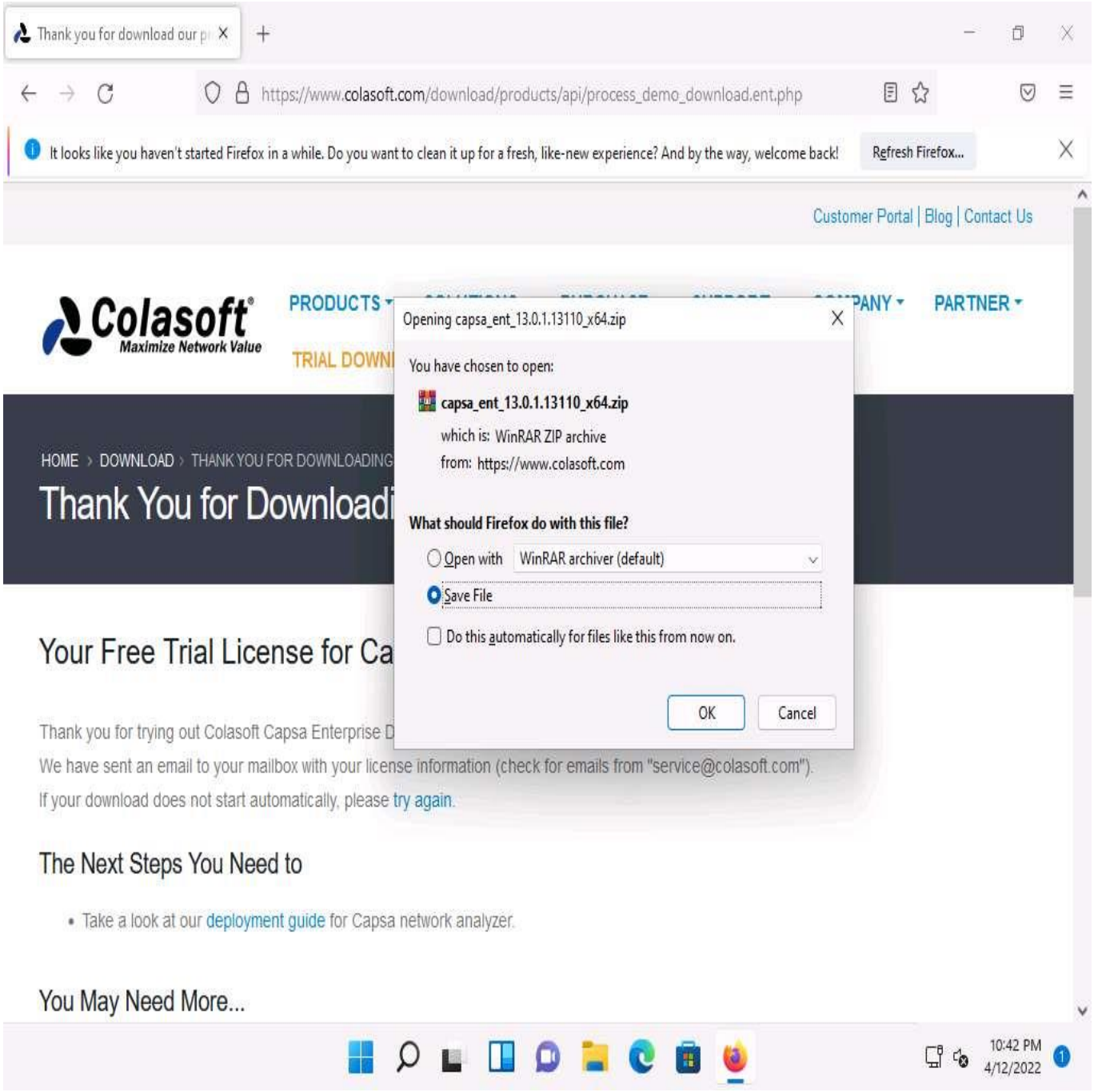


4. ☐ You will be redirected to **Download Capsa Enterprise Trial** window, scroll-down and fill all the required personal details and click on **30-Day Trial Download**.

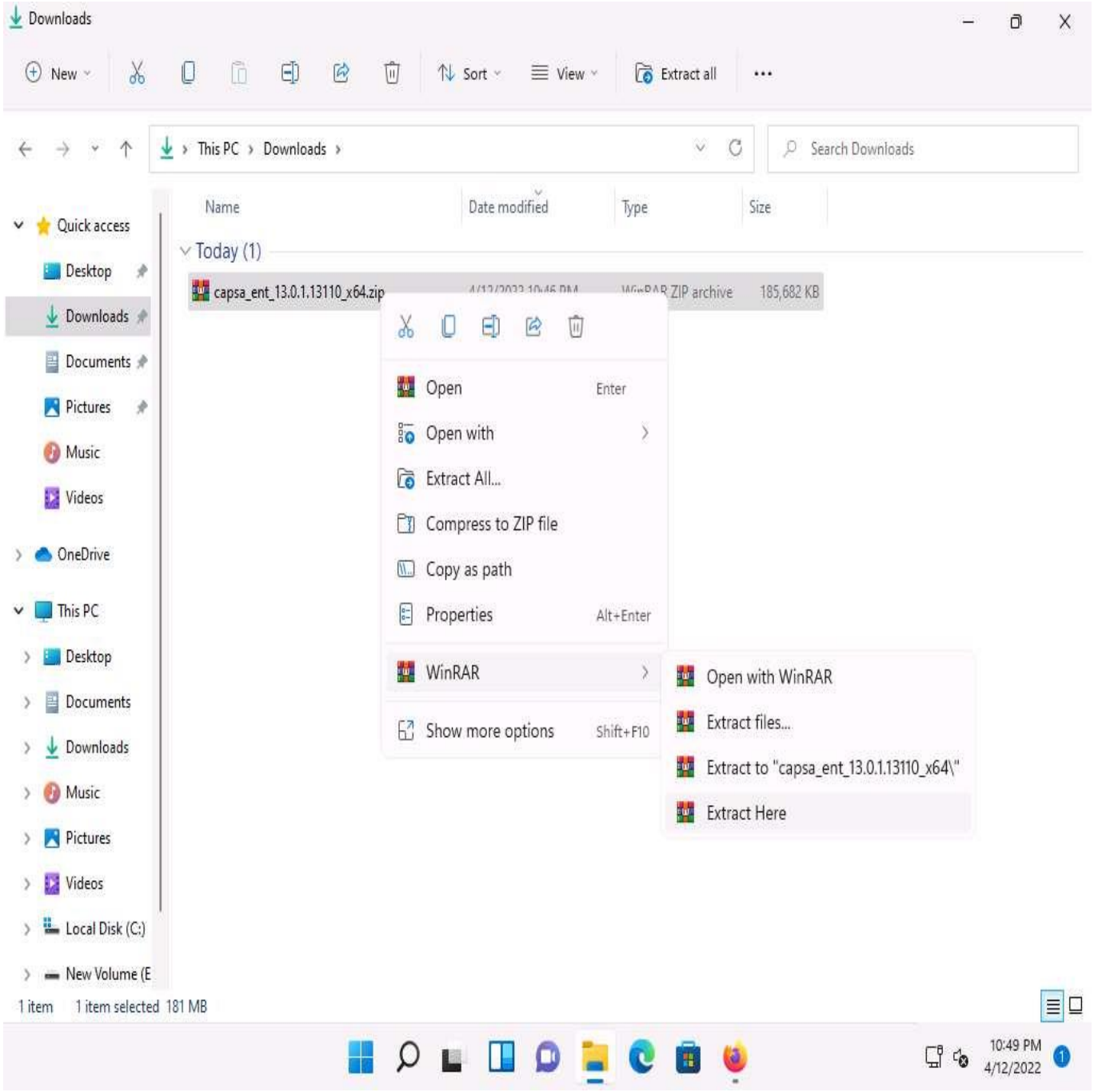
Here, you must provide your professional **EMAIL ADDRESS** (work or school accounts).



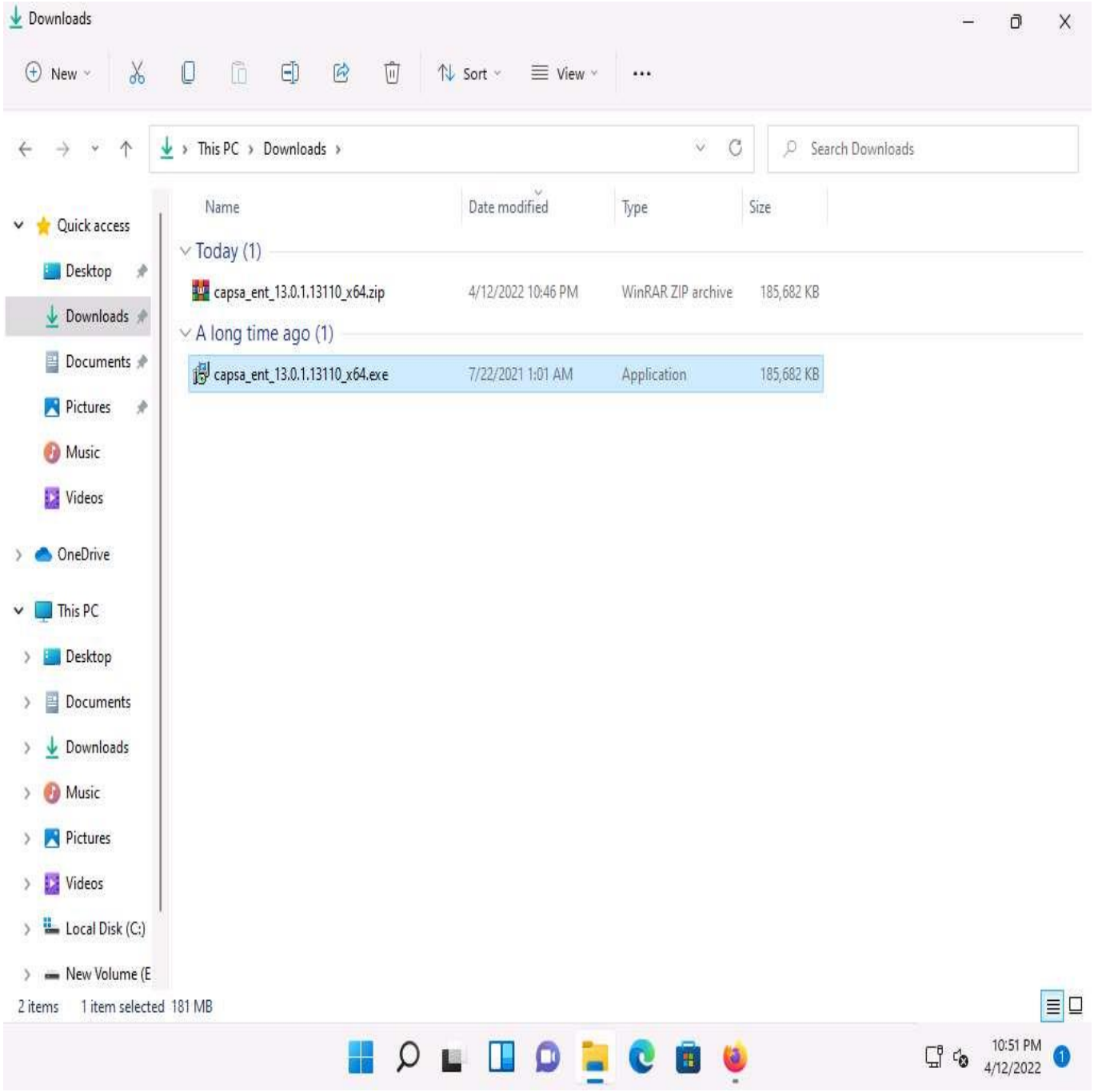
5. ☐ You will be redirected to download page, if **Opening capsa_ent_13.0.1.13110_x64.zip** pop-up appears select **Save File** radio button and click on **OK**.



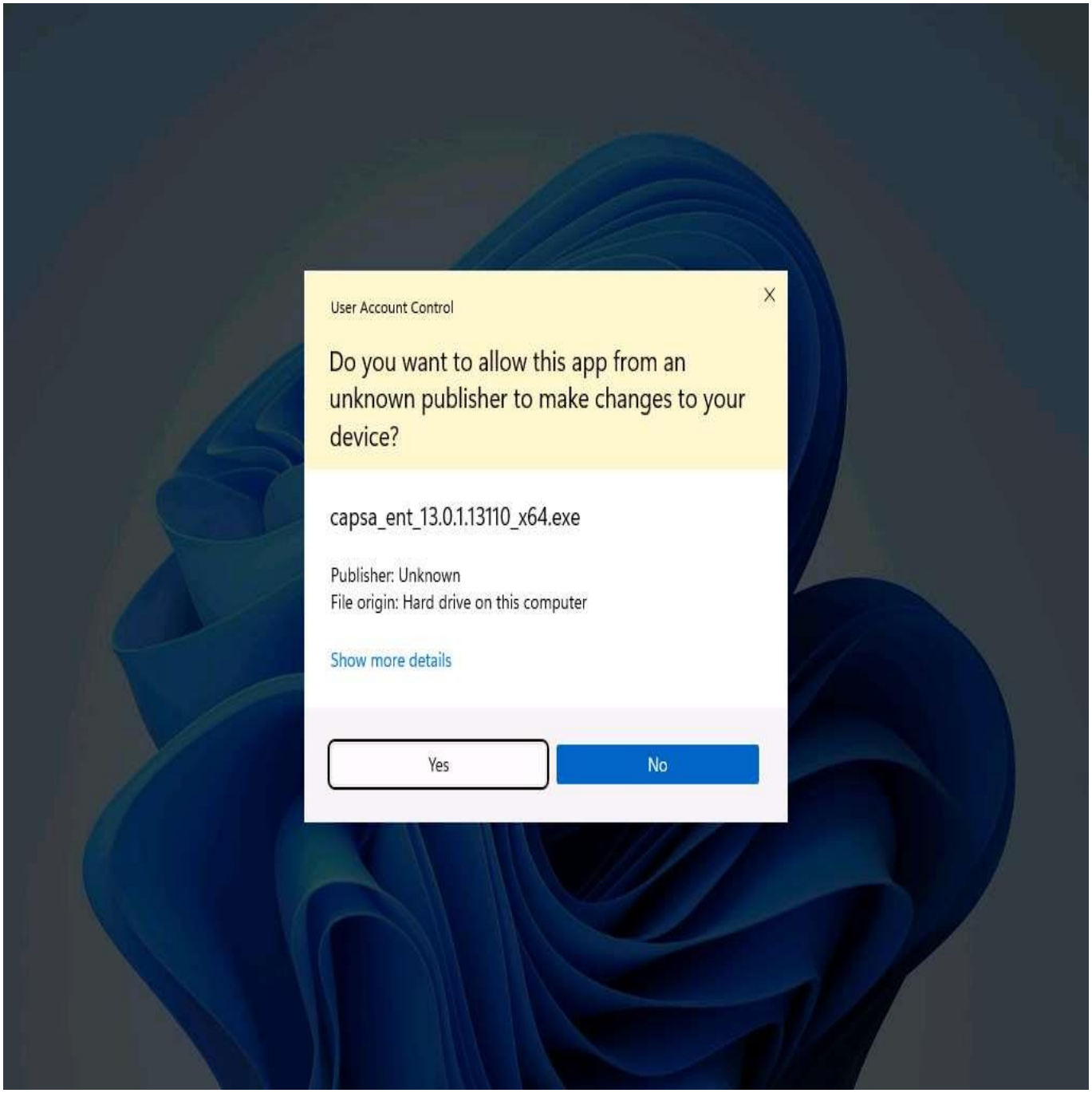
6. ☐ The **capsa_ent_13.0.1.13110_x64.zip** file starts downloading, it will take approximately **5** minutes for the download.
7. ☐ Once the download completes, navigate to the **Downloads** folder and right-click on **capsa_ent_13.0.1.13110_x64.zip** file and hover the cursor over **WinRAR** and select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



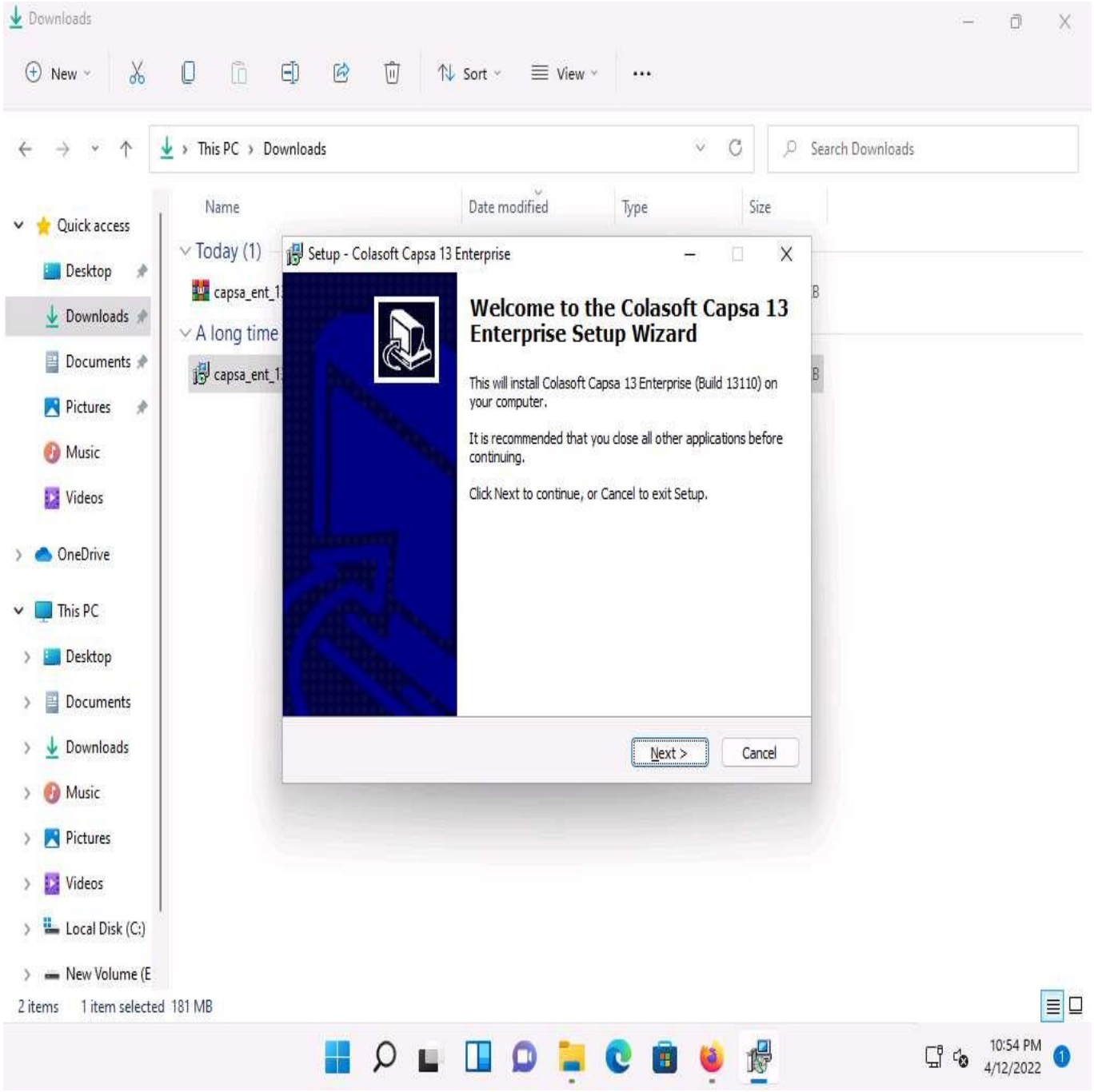
8. ☐ Once the extraction is completed, double-click the **capsa_ent_13.0.1.13110_x64.exe** file.



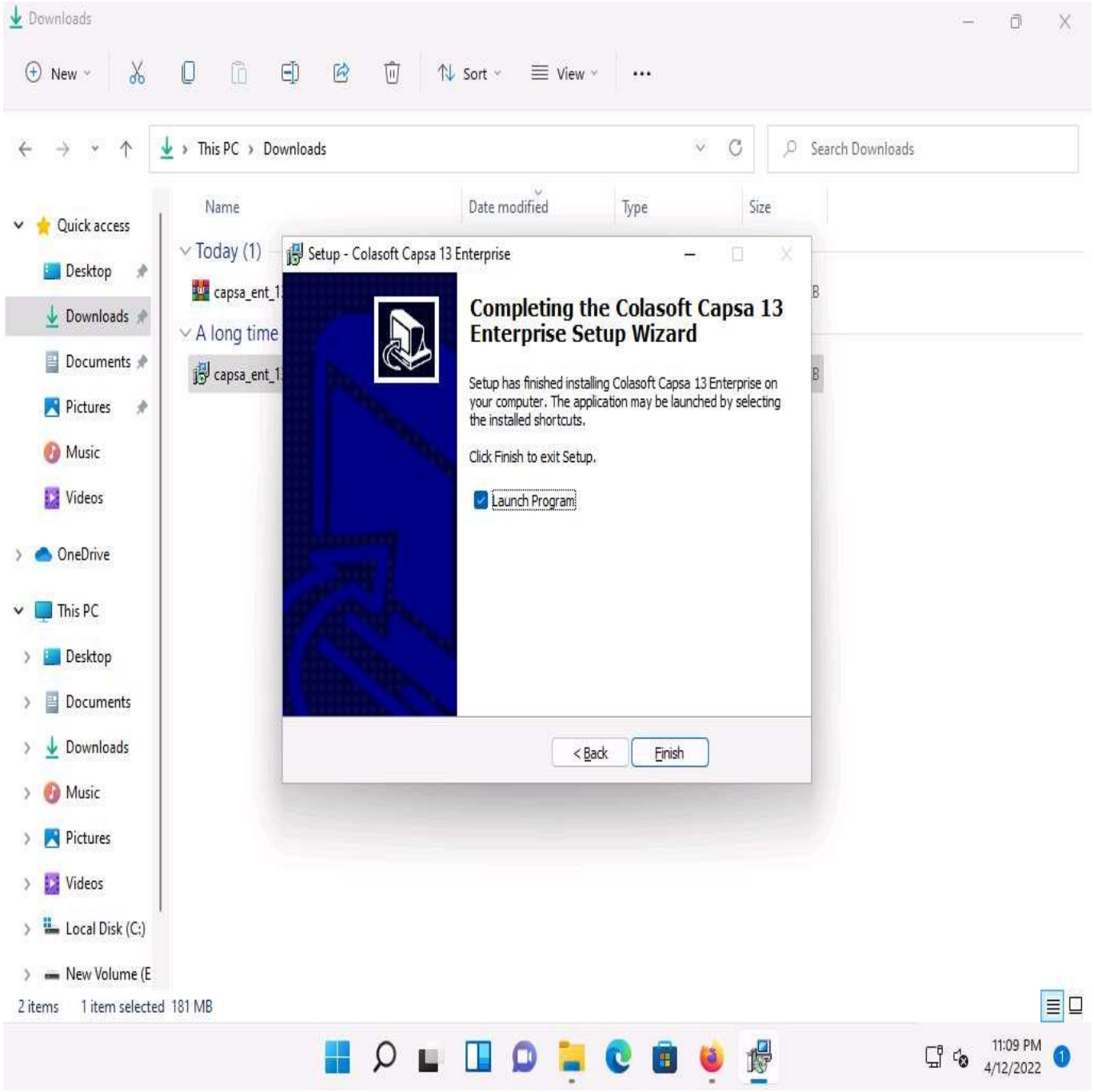
9. ☐ A **User Account Control** pop-up appears; click **Yes**.



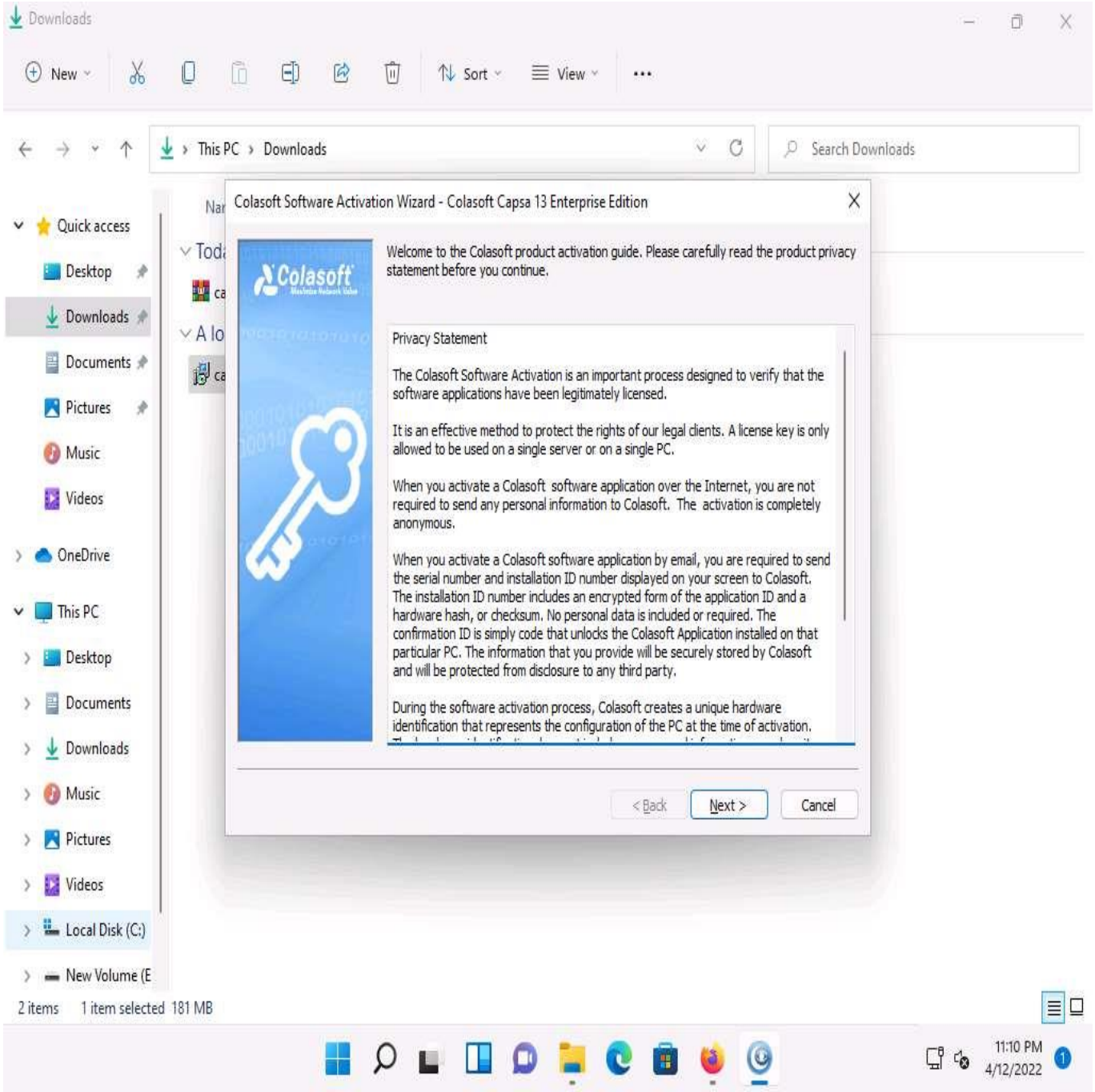
10. **Setup - Colasoft Capsa 13 Enterprise** window appears, click **Next** and follow the wizard driven steps to install **Colasoft Capsa 13 Enterprise** tool.



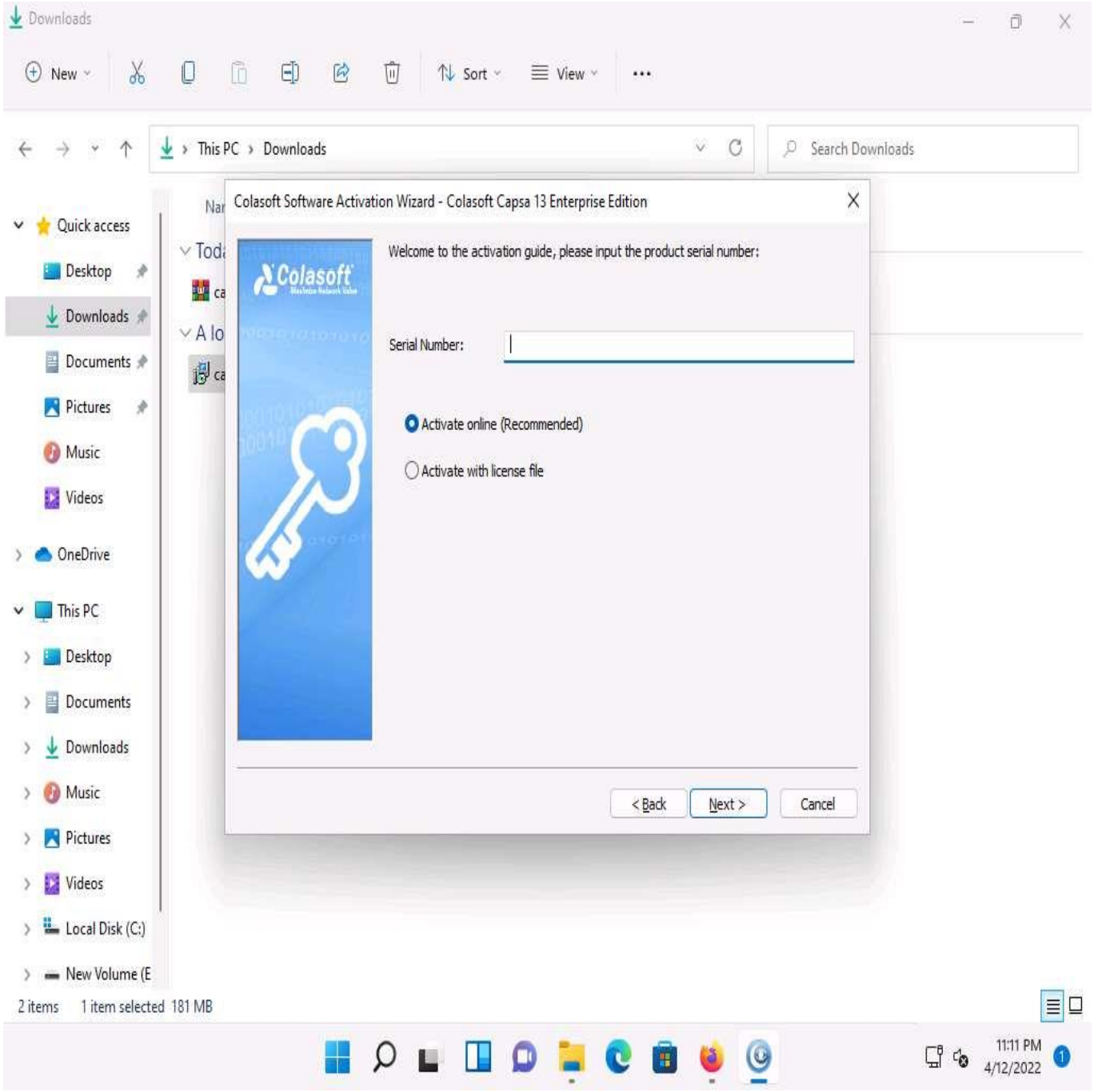
11. ☐ In the **Completing the Colasoft Capsa 13 Enterprise Setup** Wizard, ensure that **Launch Program** checkbox is checked and click on **Finish**.



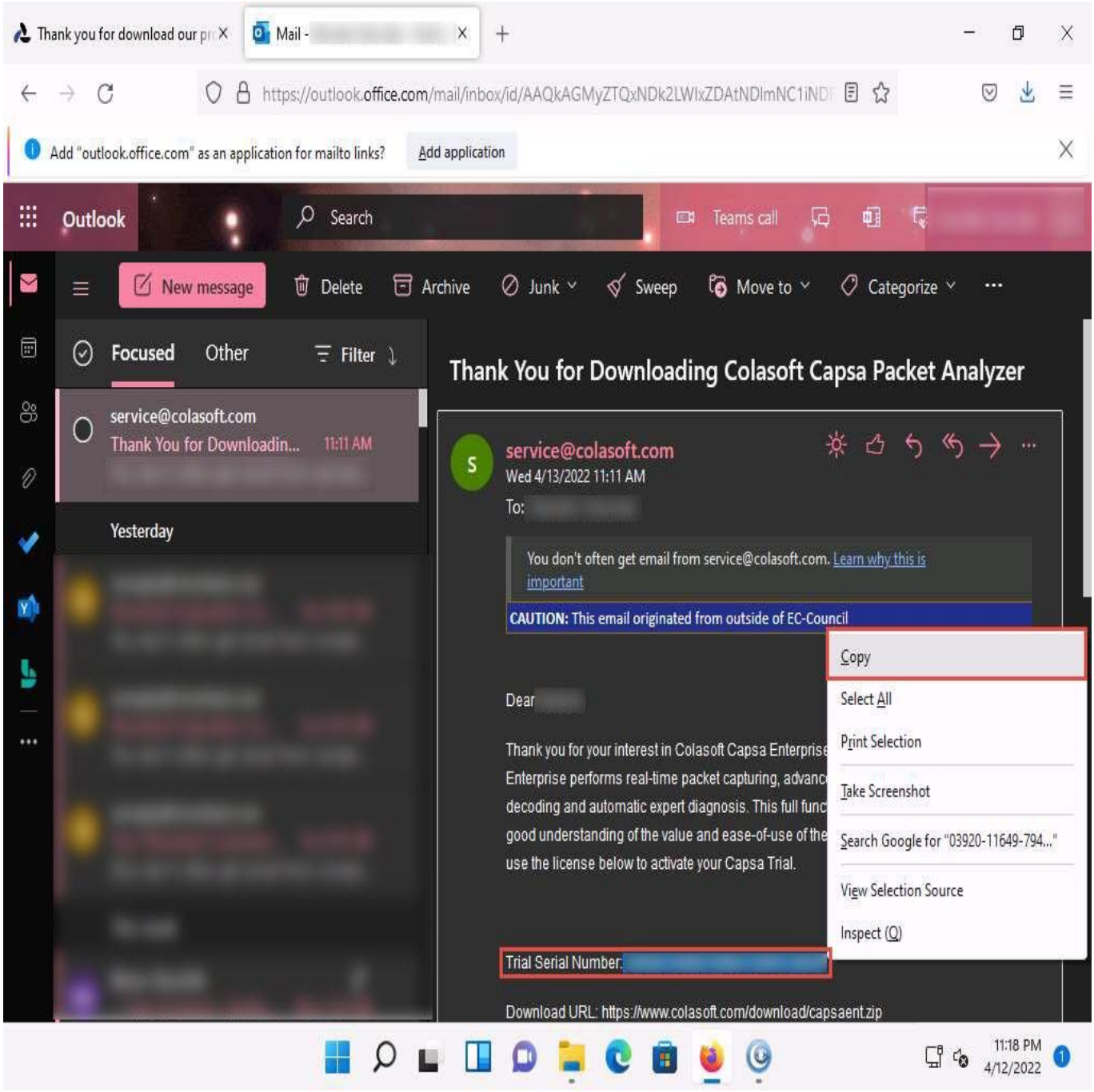
12. ☐ In the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window, click **Next**.



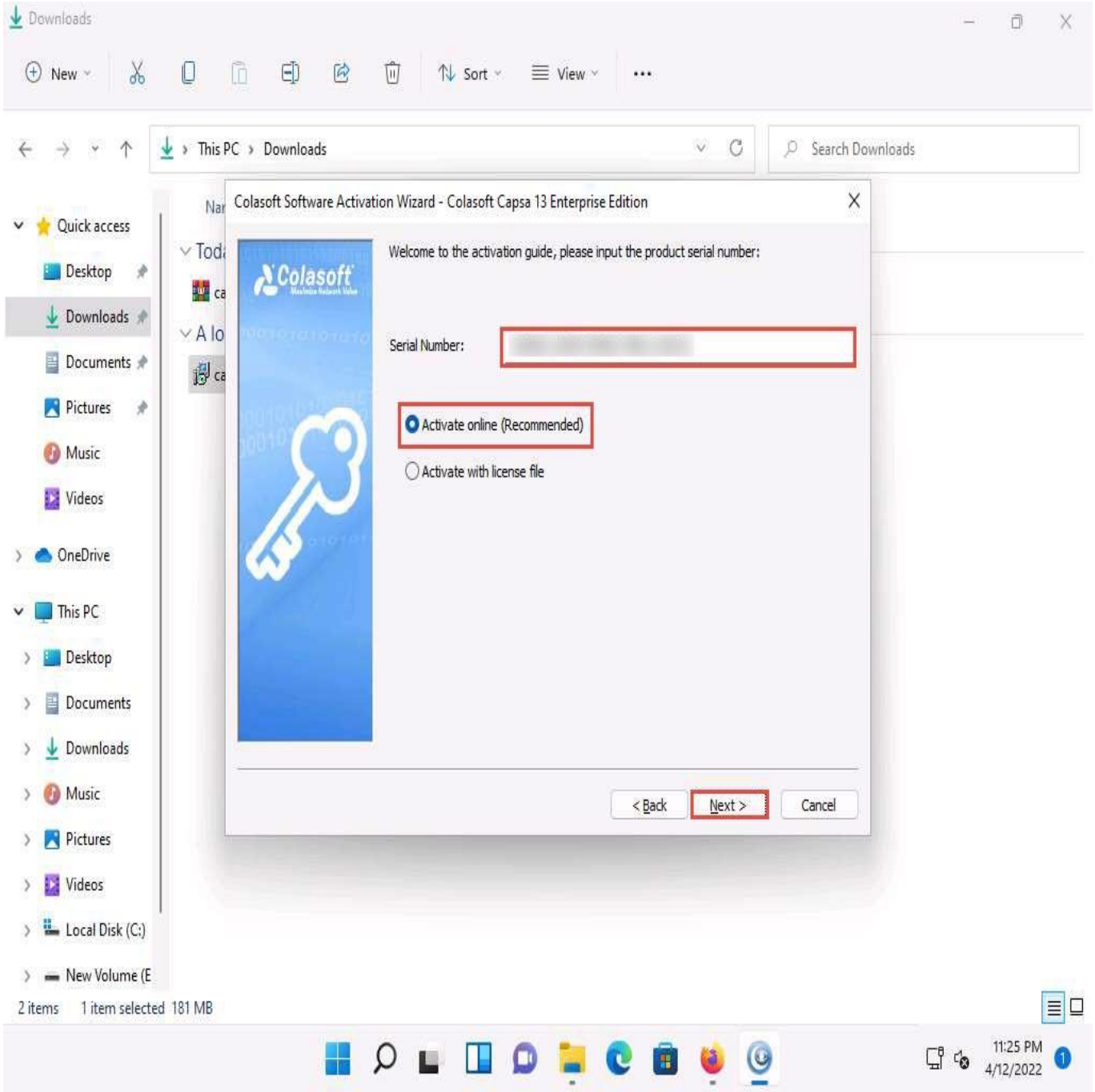
13. ☐ In the next window we need to enter the serial number to activate the license.



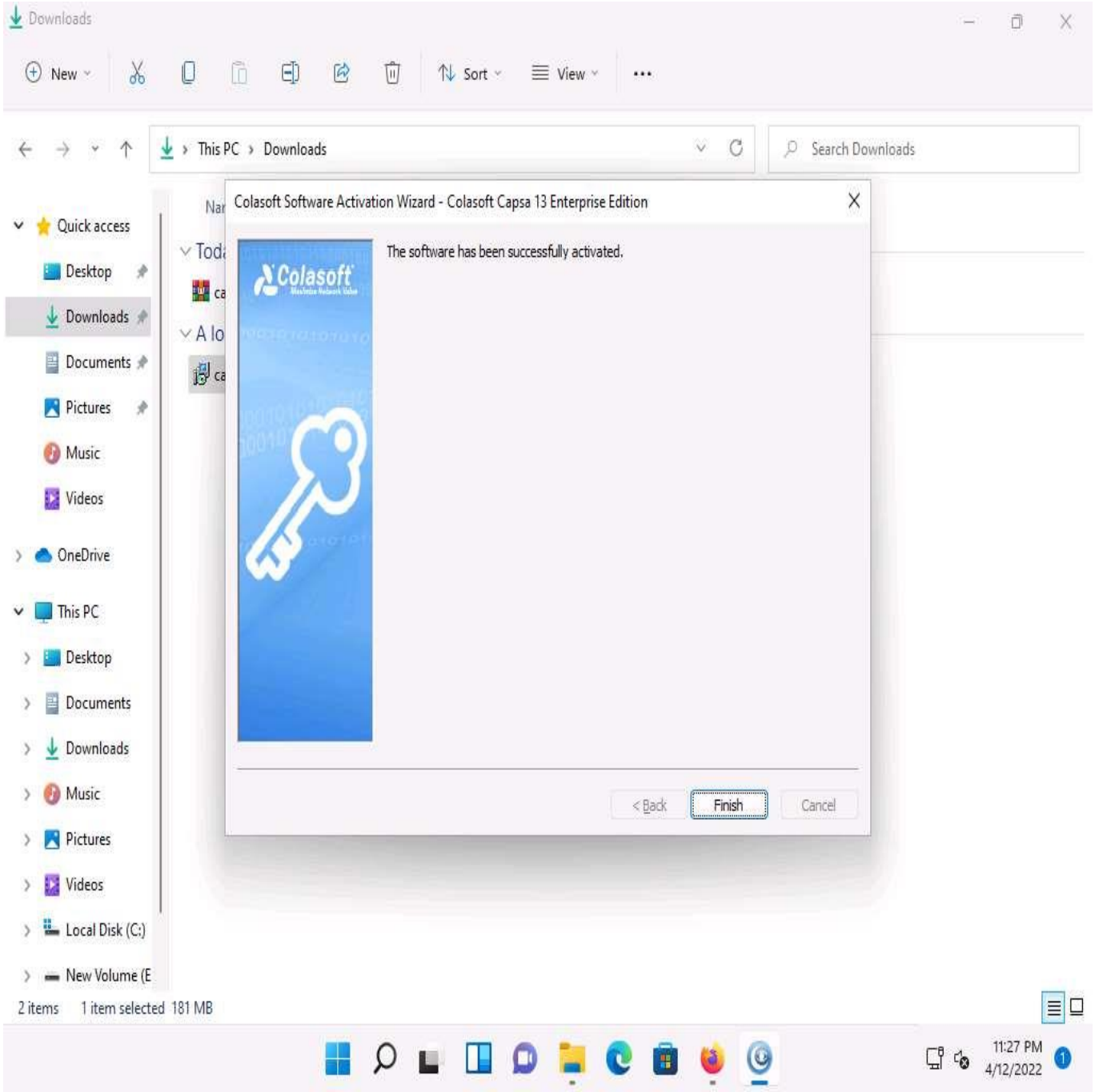
14. ☐ Leave the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** as it is and switch to the browser.
15. ☐ Open a new tab in the browser and log in to the email account you provided during registration. Open the email from **service@colasoft.com** and copy the **Trial Serial Number** as shown in the screenshot.



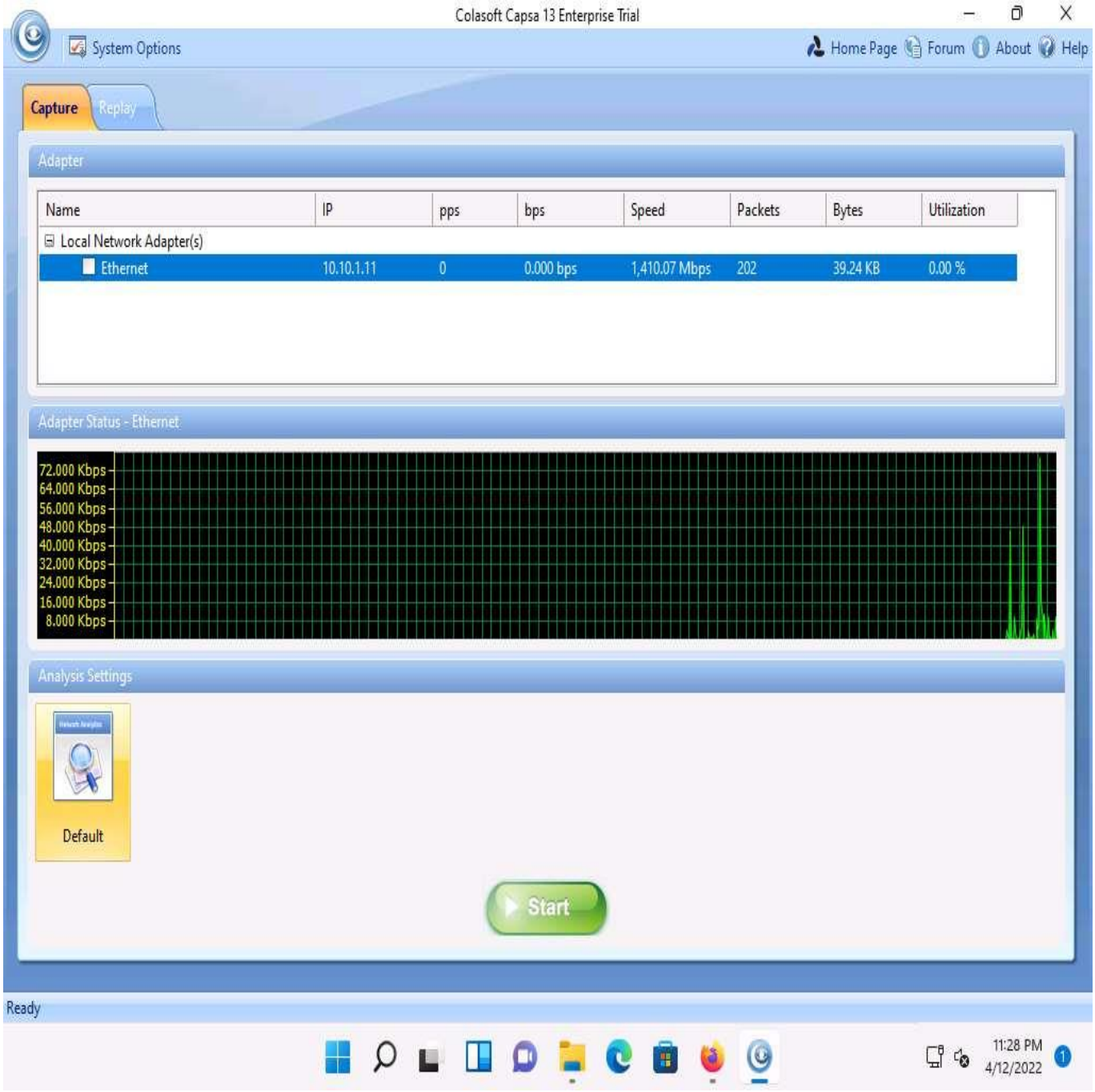
16. ☐ Now, minimize the browser window and switch to the **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window and paste the copied serial number in the **Serial Number** field. Ensure that **Activate online (Recommended)** radio button is selected and click on **Next**.



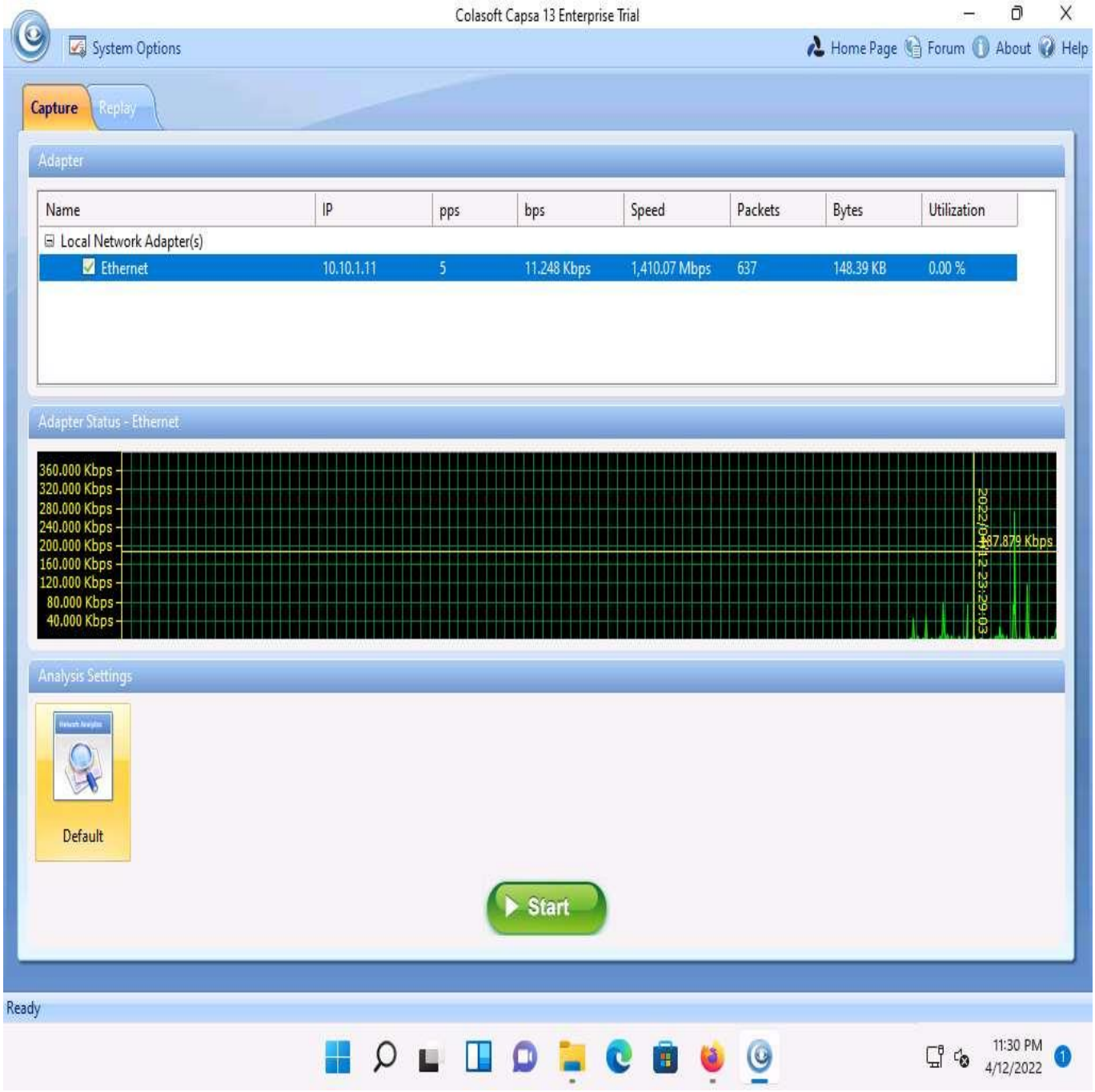
17. A **Colasoft Software Activation Wizard - Colasoft Capsa 13 Enterprise Edition** window appears, showing that the software has been successfully activated, click on **Finish**.



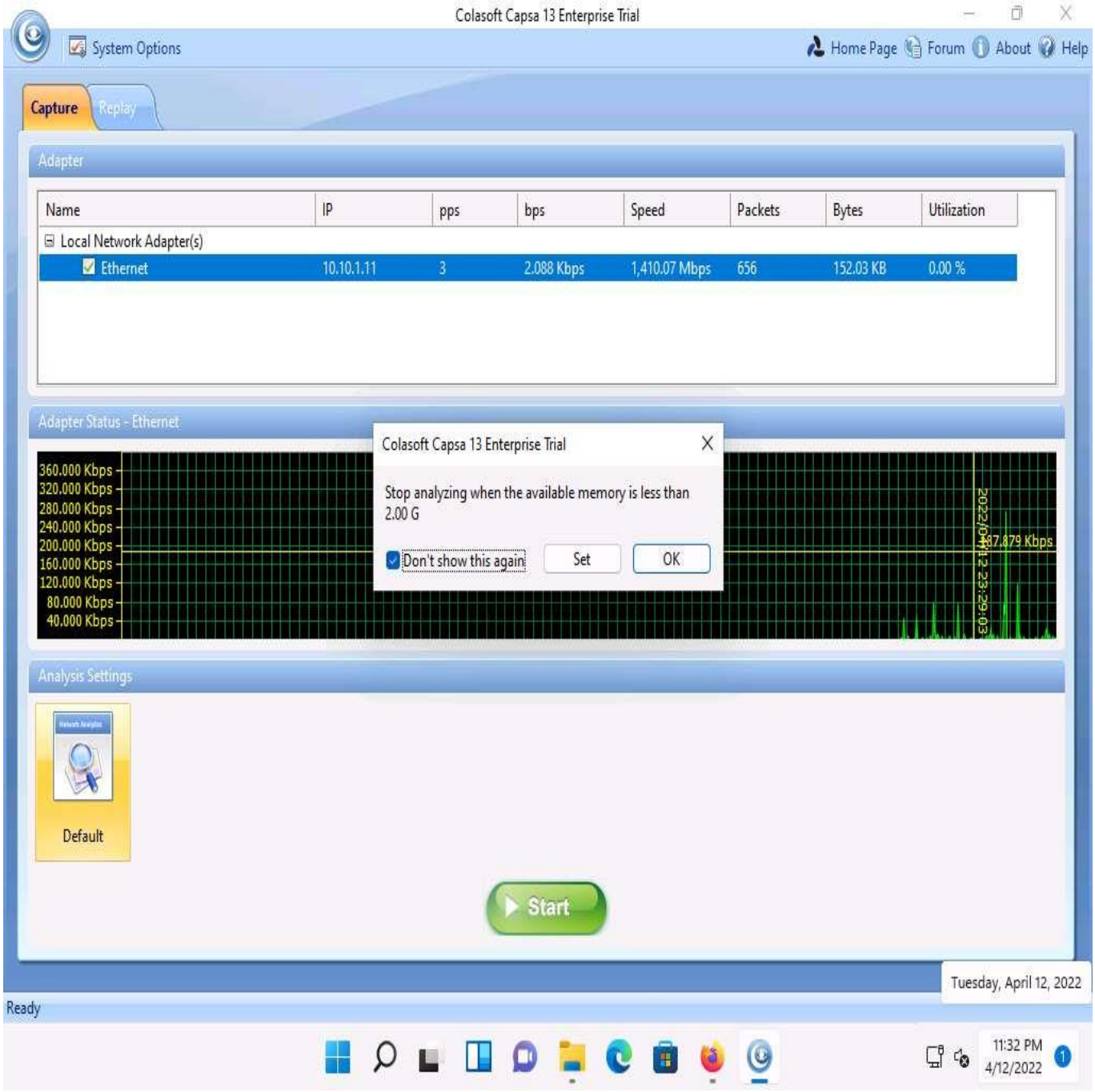
18. ☐ After successful installation, A **Colasoft Capsa 13 Enterprise Trial** window appears.



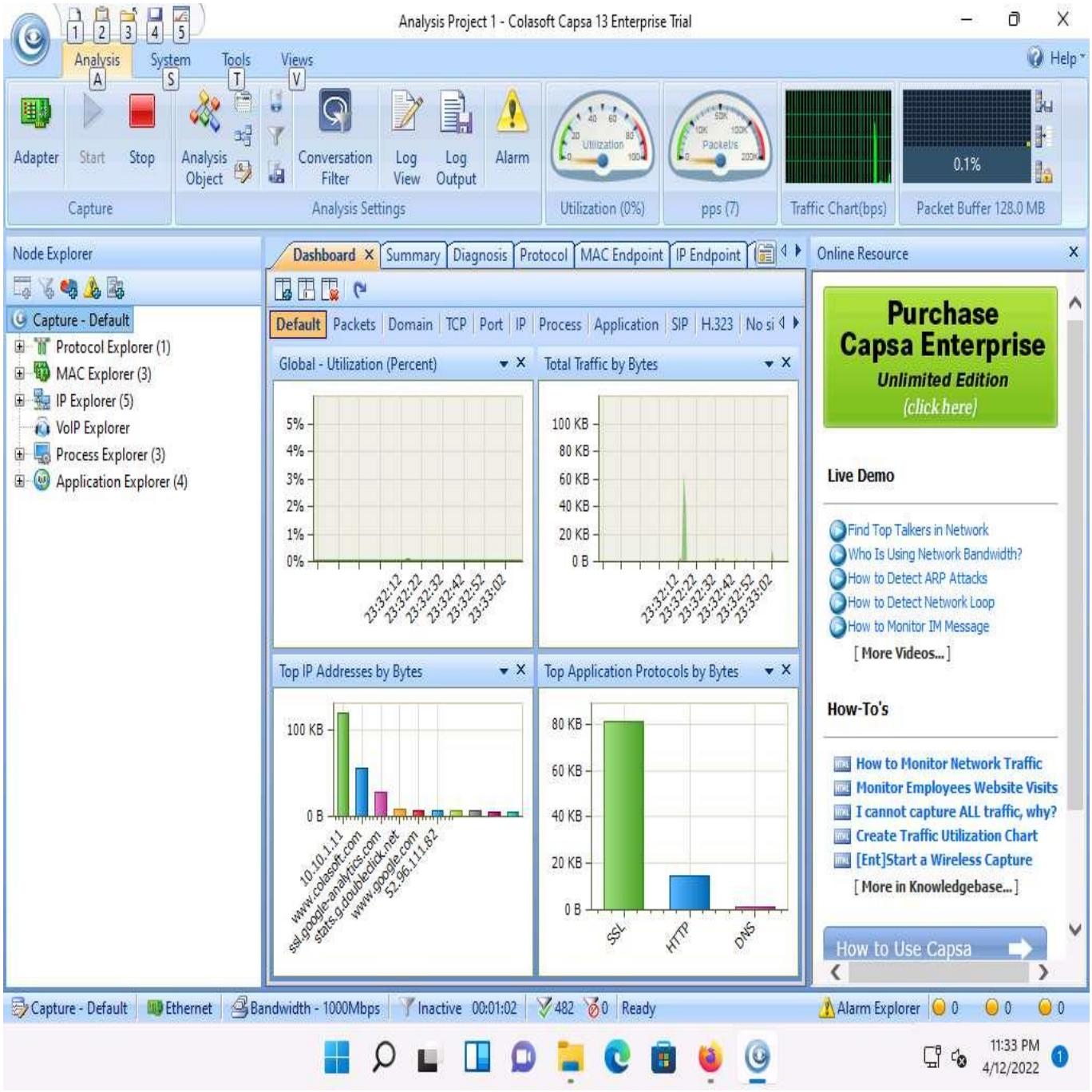
19. ☐ In the **Colasoft Capsa 13 Enterprise Trial** window check the checkbox beside the available adapter (here, **Ethernet**) and click on **Start**.



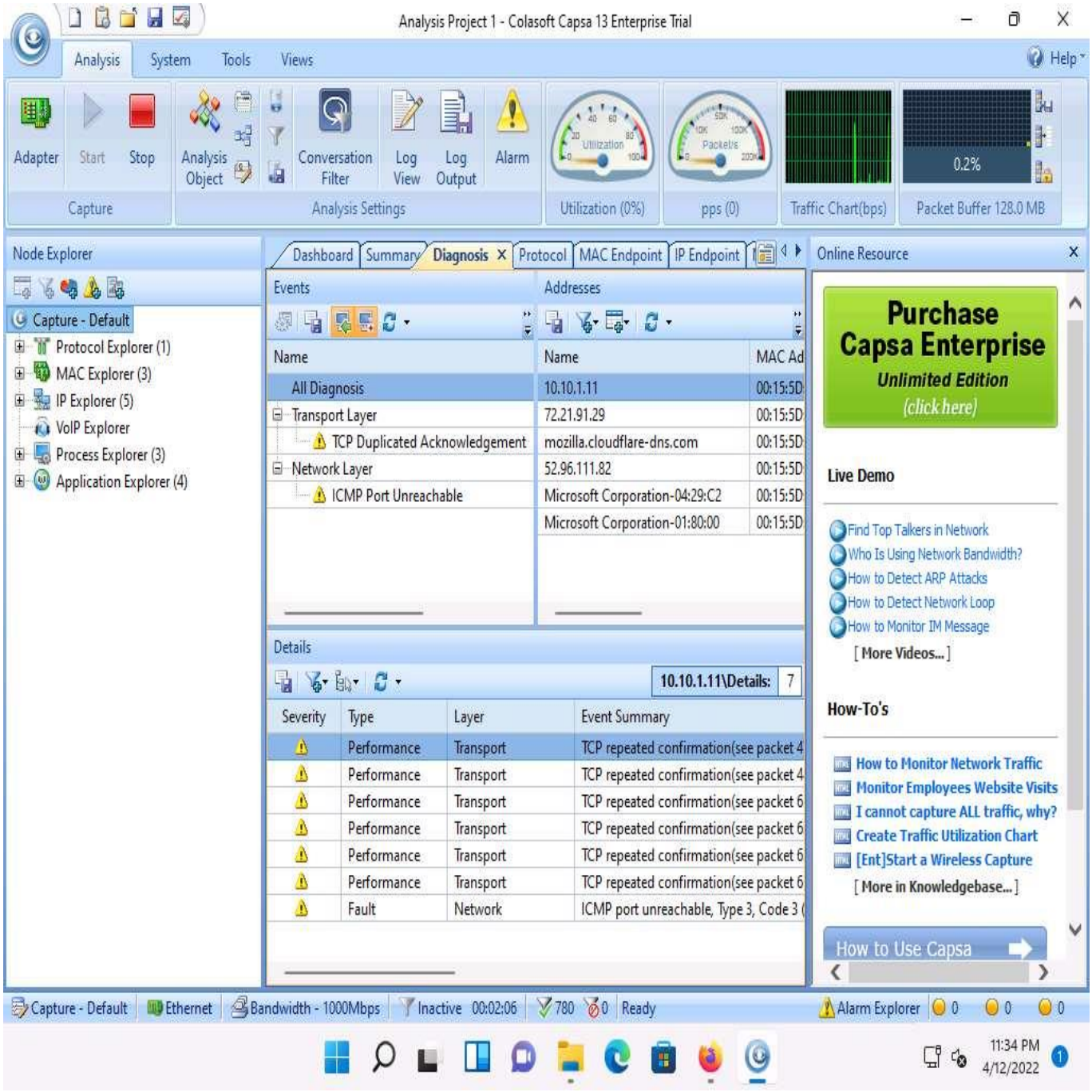
20. ☐ If a **Colasoft Capsa 13 Enterprise Trial** pop-up appears, select **Don't show this again** checkbox and click on **OK**.



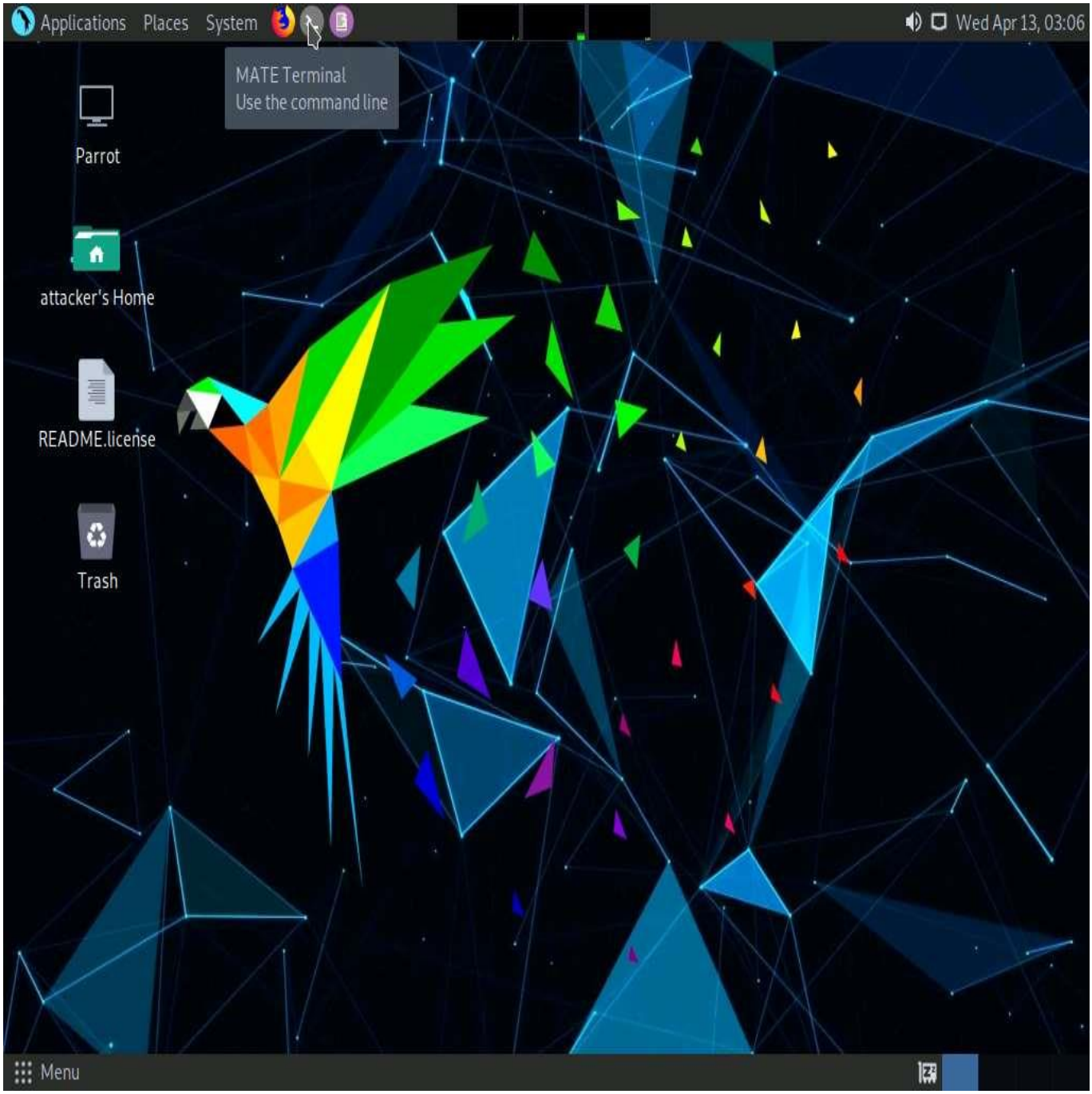
21. ☐ The **Analysis Project 1 - Colasoft Capsa 13 Enterprise Trial** window appears, as shown in the screenshot.



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

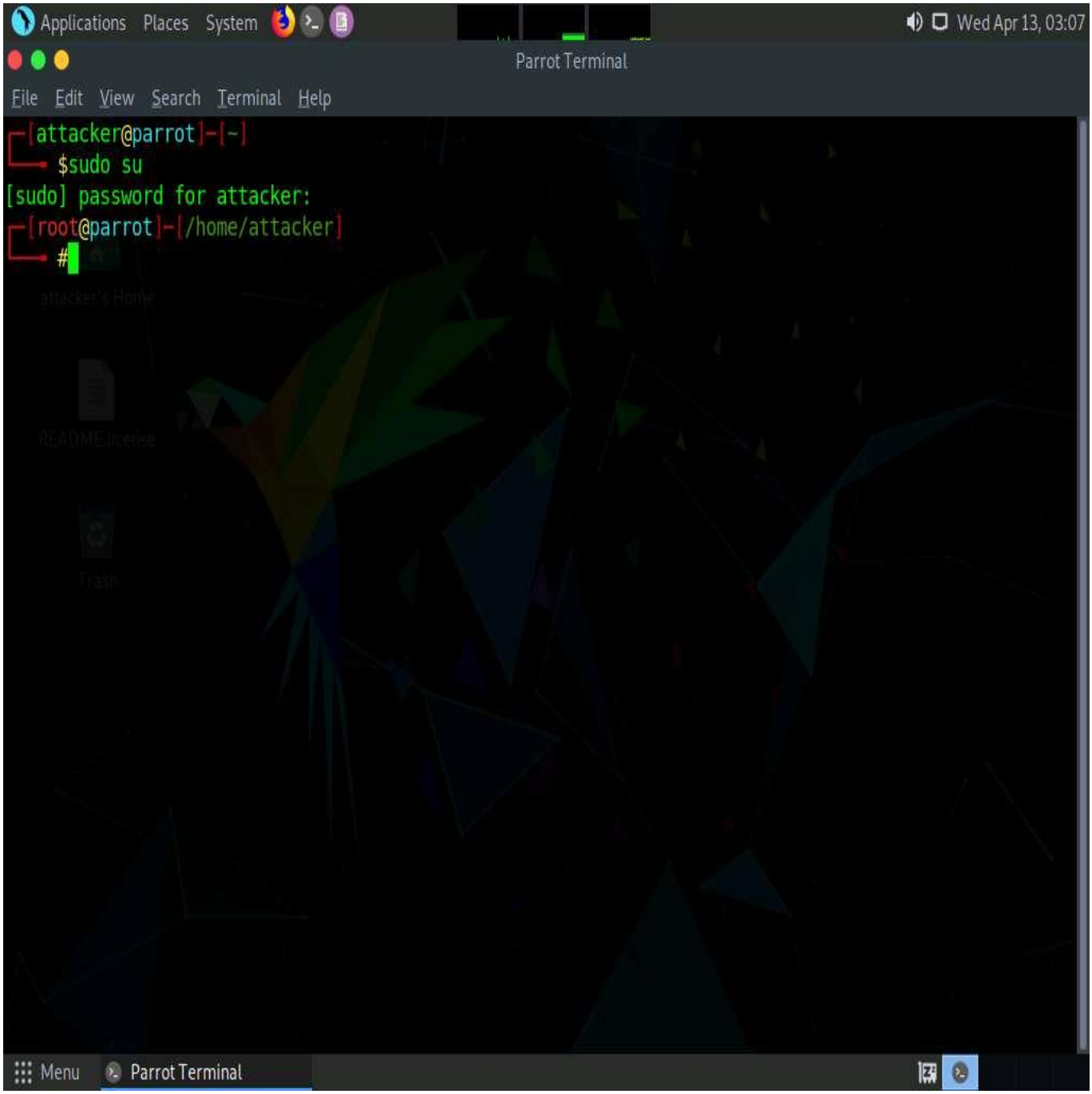


23. ☐ Click on Parrot Security to switch to **Parrot Security** machine.
24. ☐ Click the **MATE Terminal** icon at the top of the **Desktop** window to open a **Terminal** window.



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**.

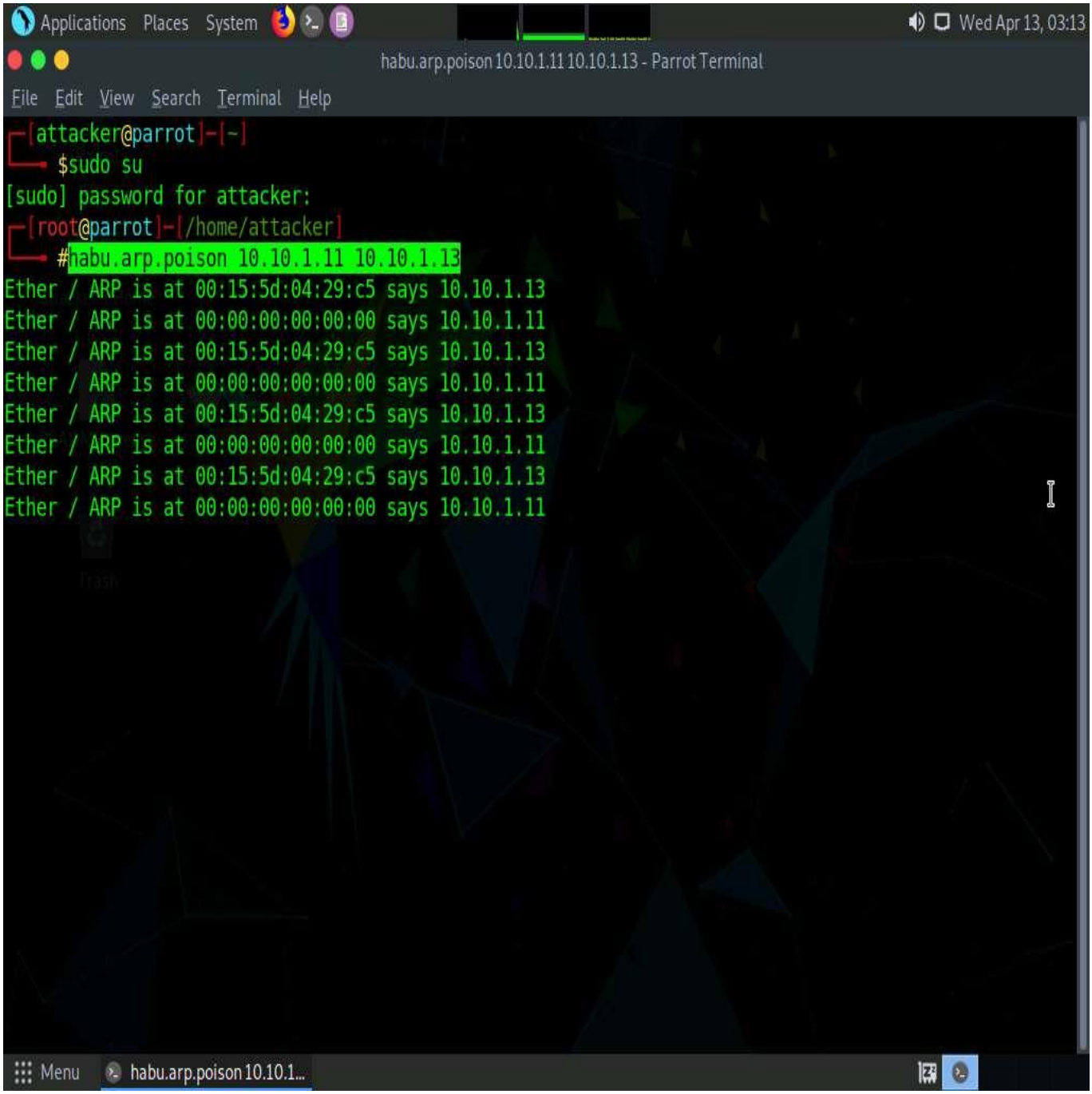
The password that you type will not be visible.



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.

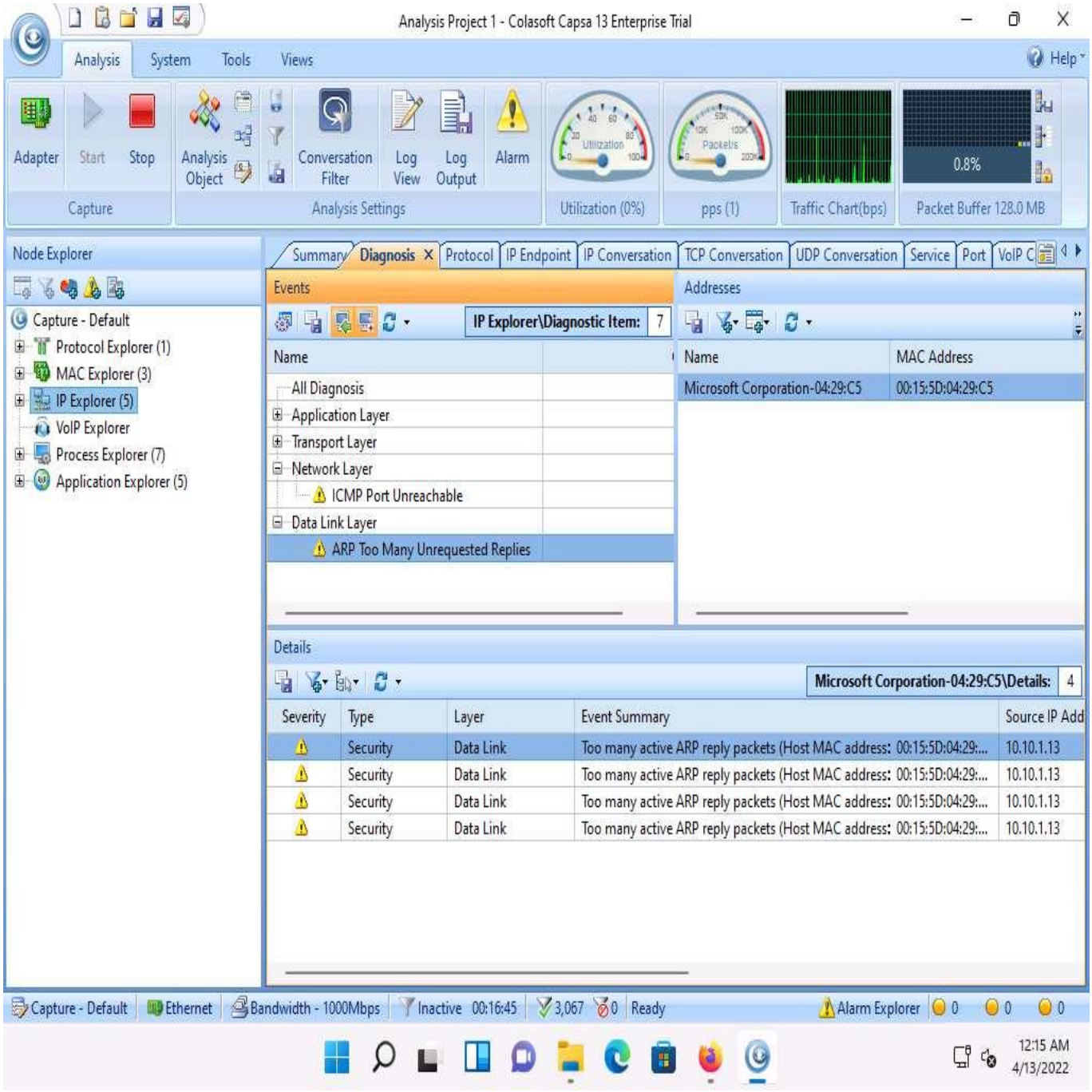
The above command sends ARP **'is-at'** packets to the specified victim(s), poisoning their ARP tables to send their traffic to the attacker system.

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

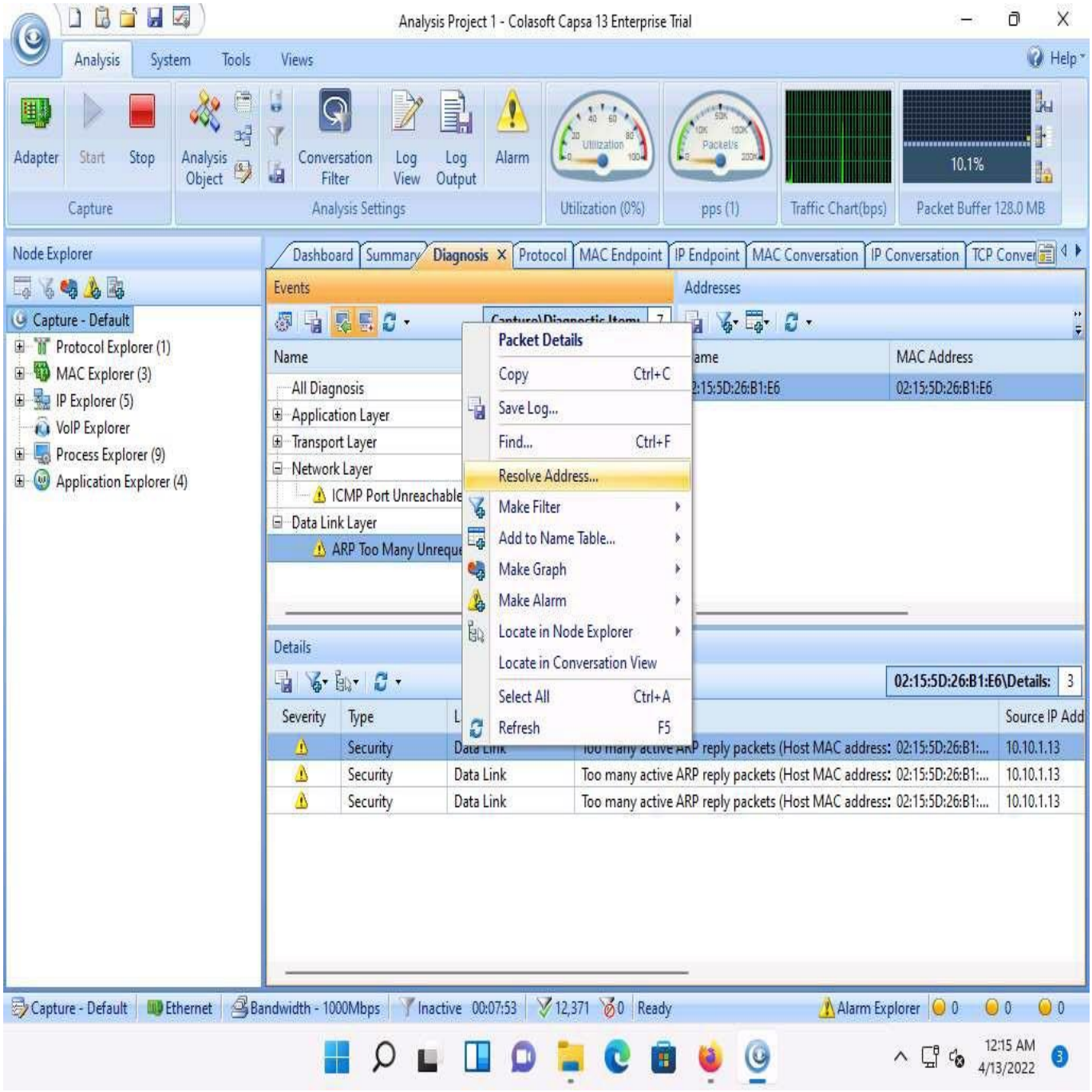


28. ☐ Click Windows 11 to switch to **Windows 11** machine.
29. ☐ In the **Diagnosis** tab, expand the **Data Link Layer** node to see the **ARP Too Many Unrequested Replies** warning.

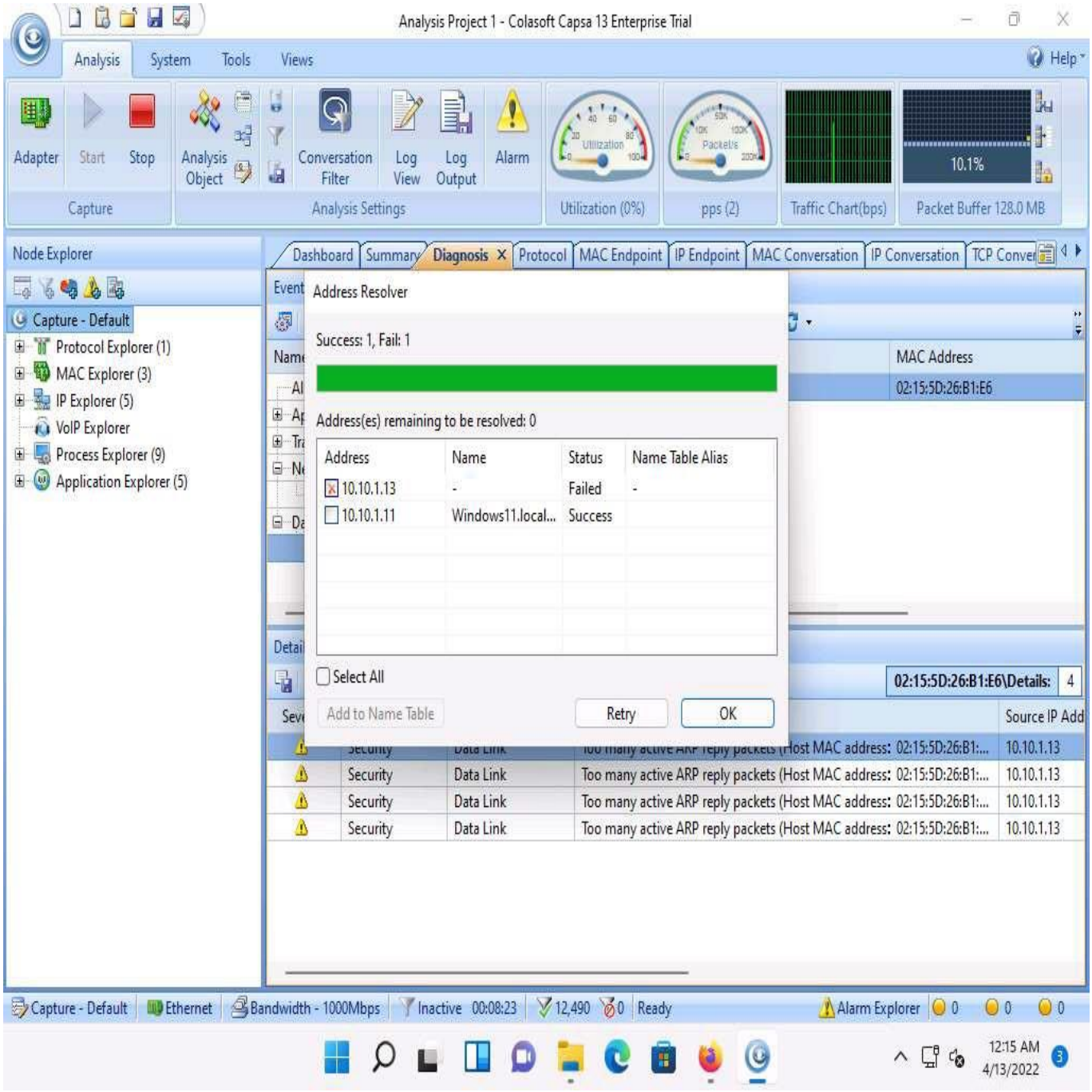
It will take approximately **10** minutes for the tool to capture the **ARP** requests.



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.

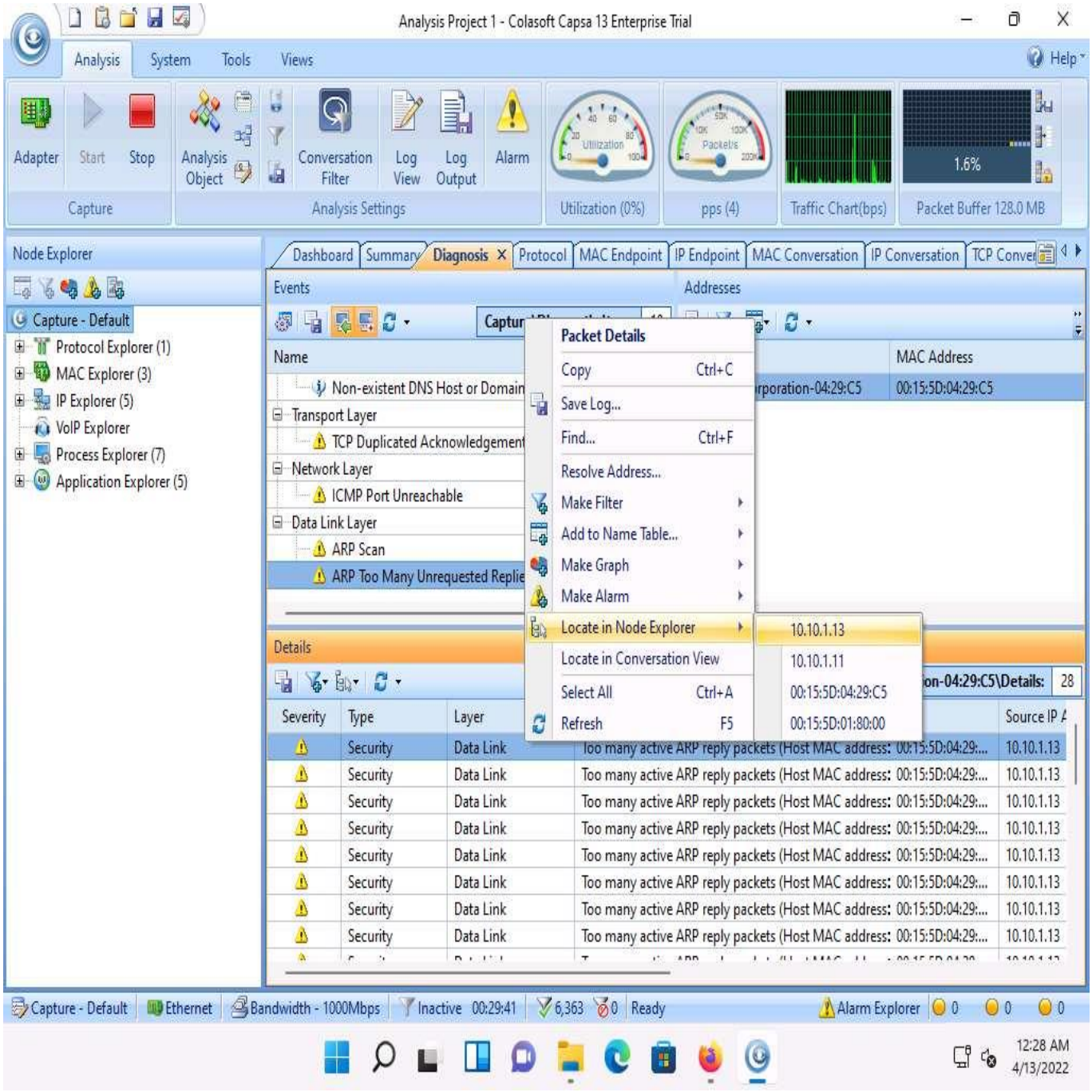


32. ☐ An **Address Resolver** pop-up appears, once the address resolving completes click on **OK**.

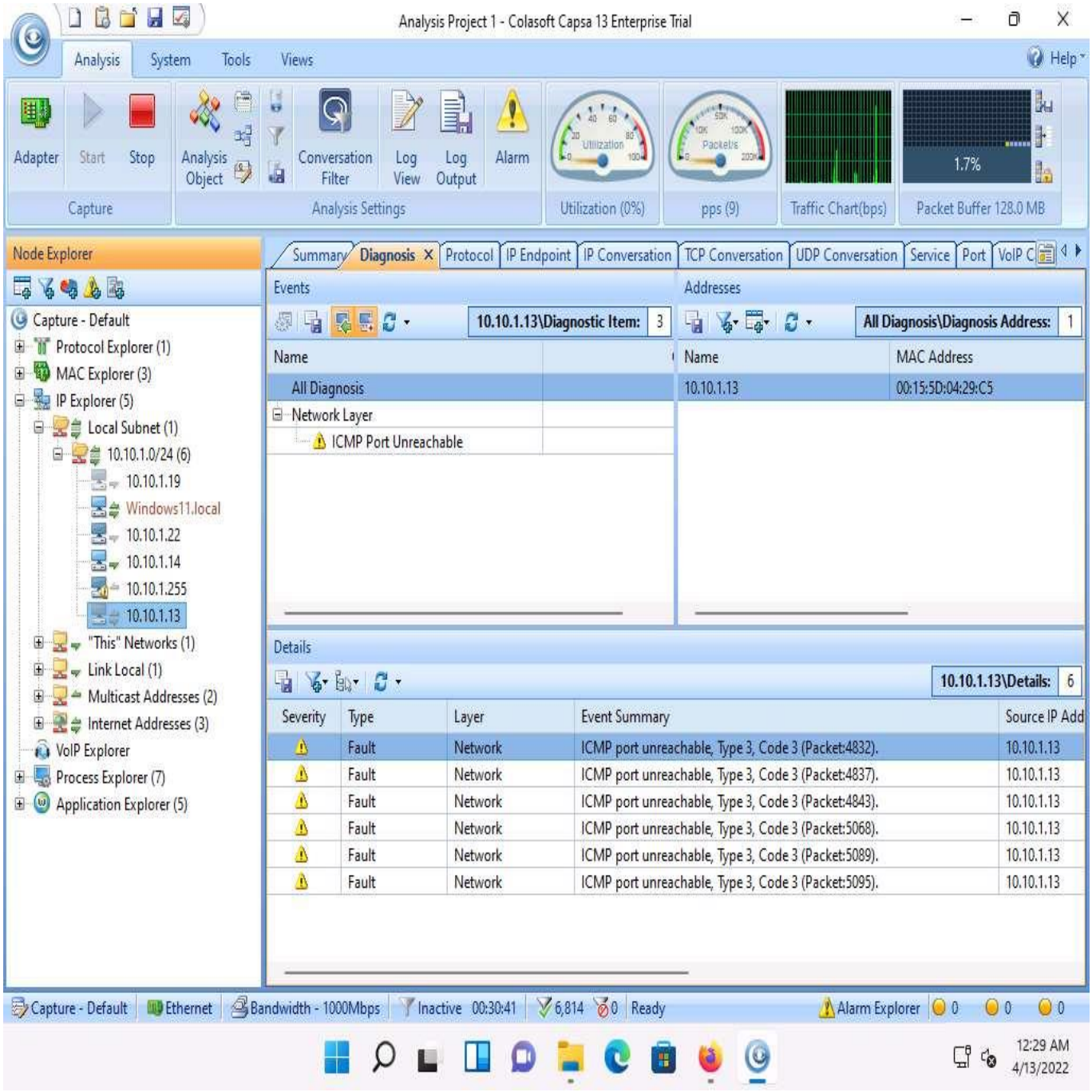


33. ☐ Now to locate the Parrot Machine's IP address click on **Capture Default** option under **Node Explorer** section in the left-pane.
34. ☐ Right-click any warning in the **Details** tab and click on **Locate in Node Explorer** and select **Parrot Security** machine's IP address from the list (here, **10.10.1.13**).

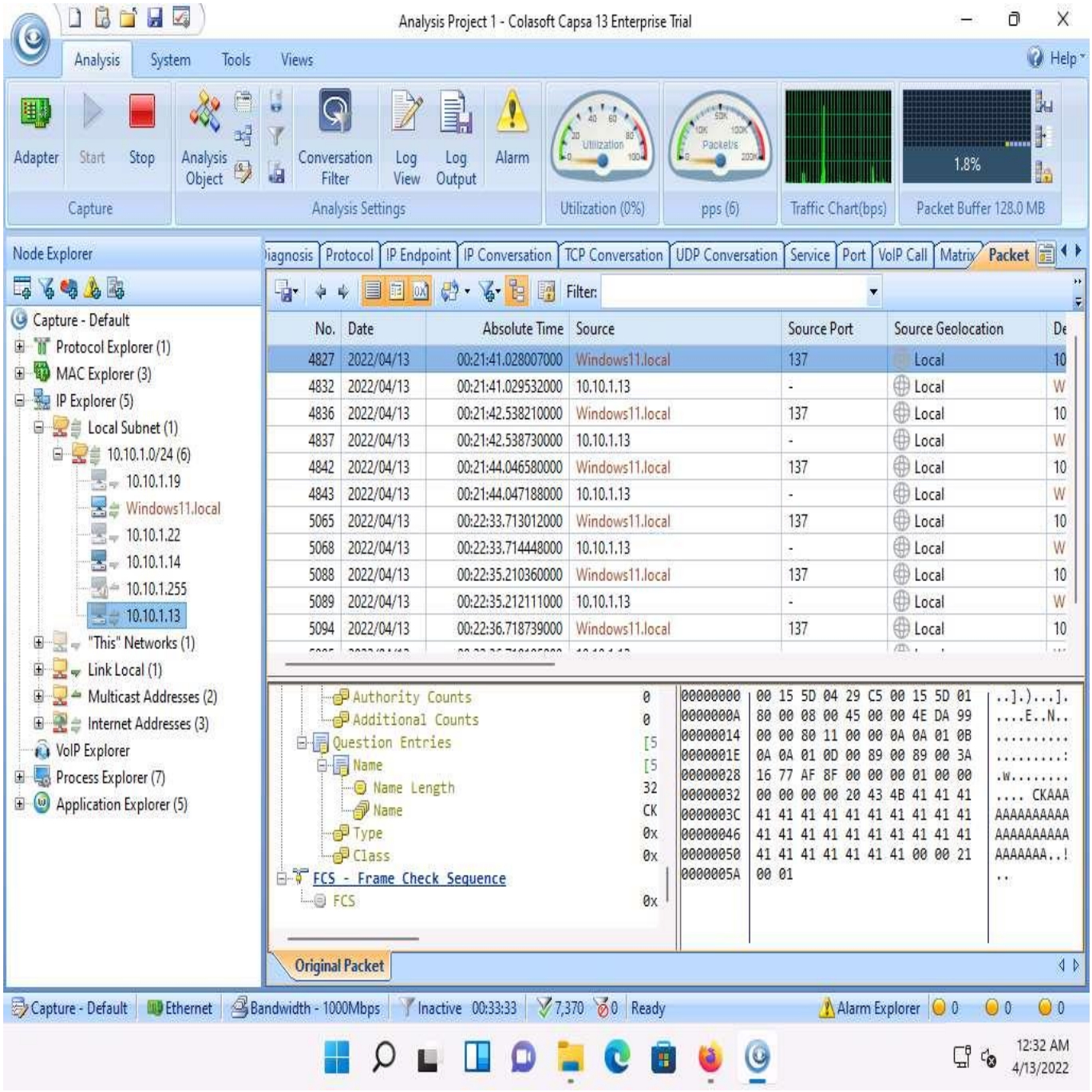
Here, the IP address of the Parrot Security machine is the attacker's IP address.



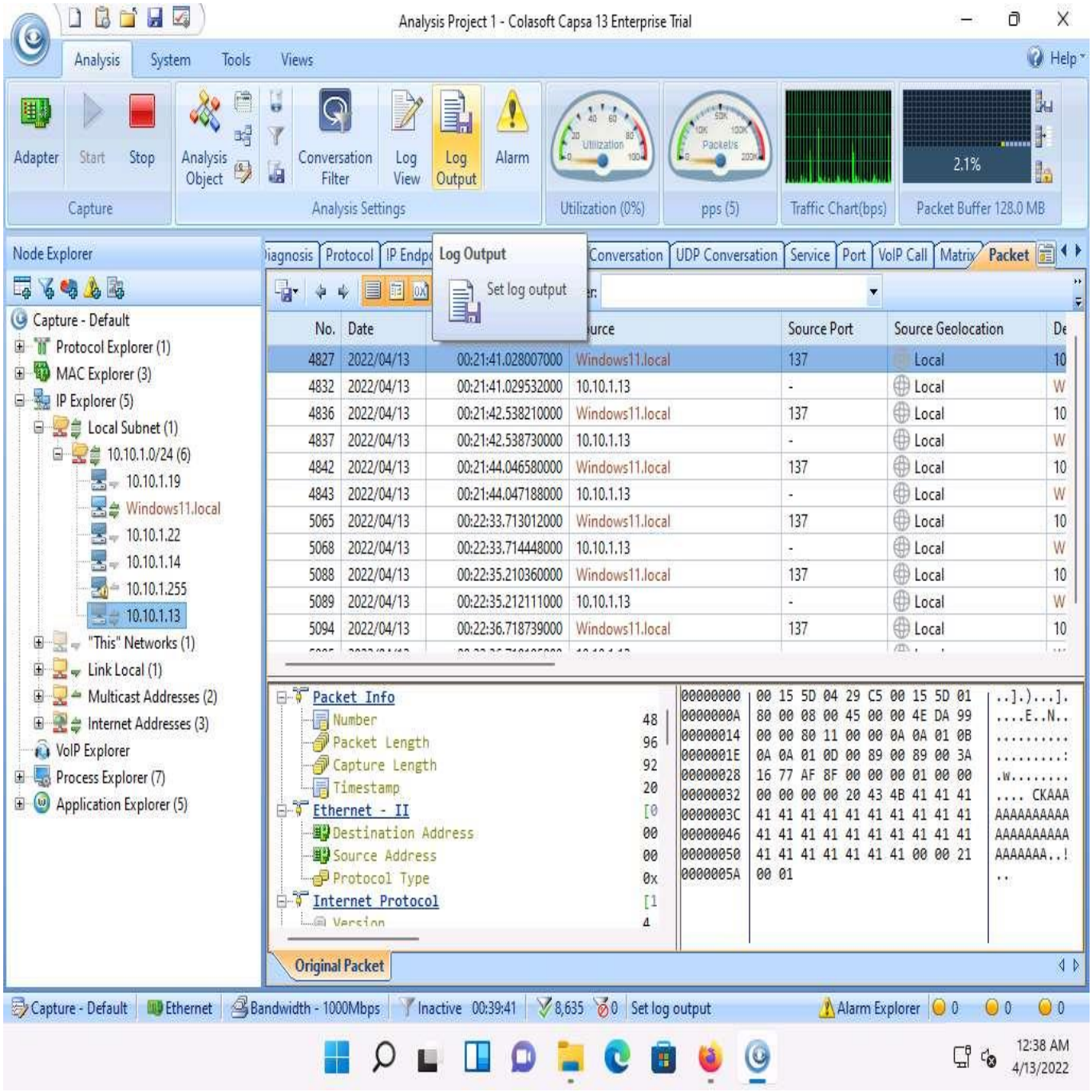
35. ☐ The IP address of the Parrot Security machine is displayed under **Node Explorer** section in the left-pane.



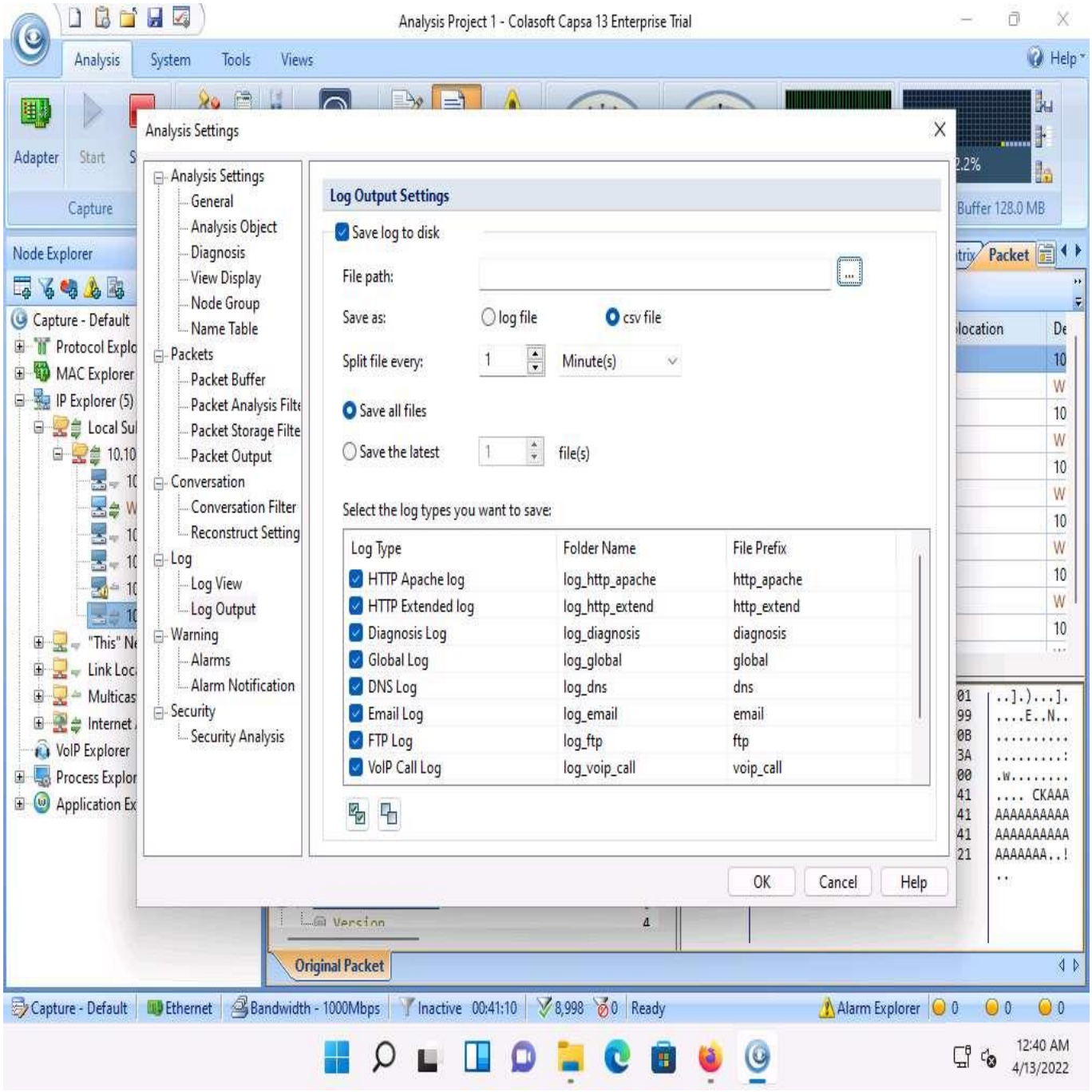
36. ☐ Now click on **Packet** tab in the **Analysis Project 1 - Colasoft Capsa 13 Enterprise Trial** window, to check the packets transferred by the **Parrot Security** machine.



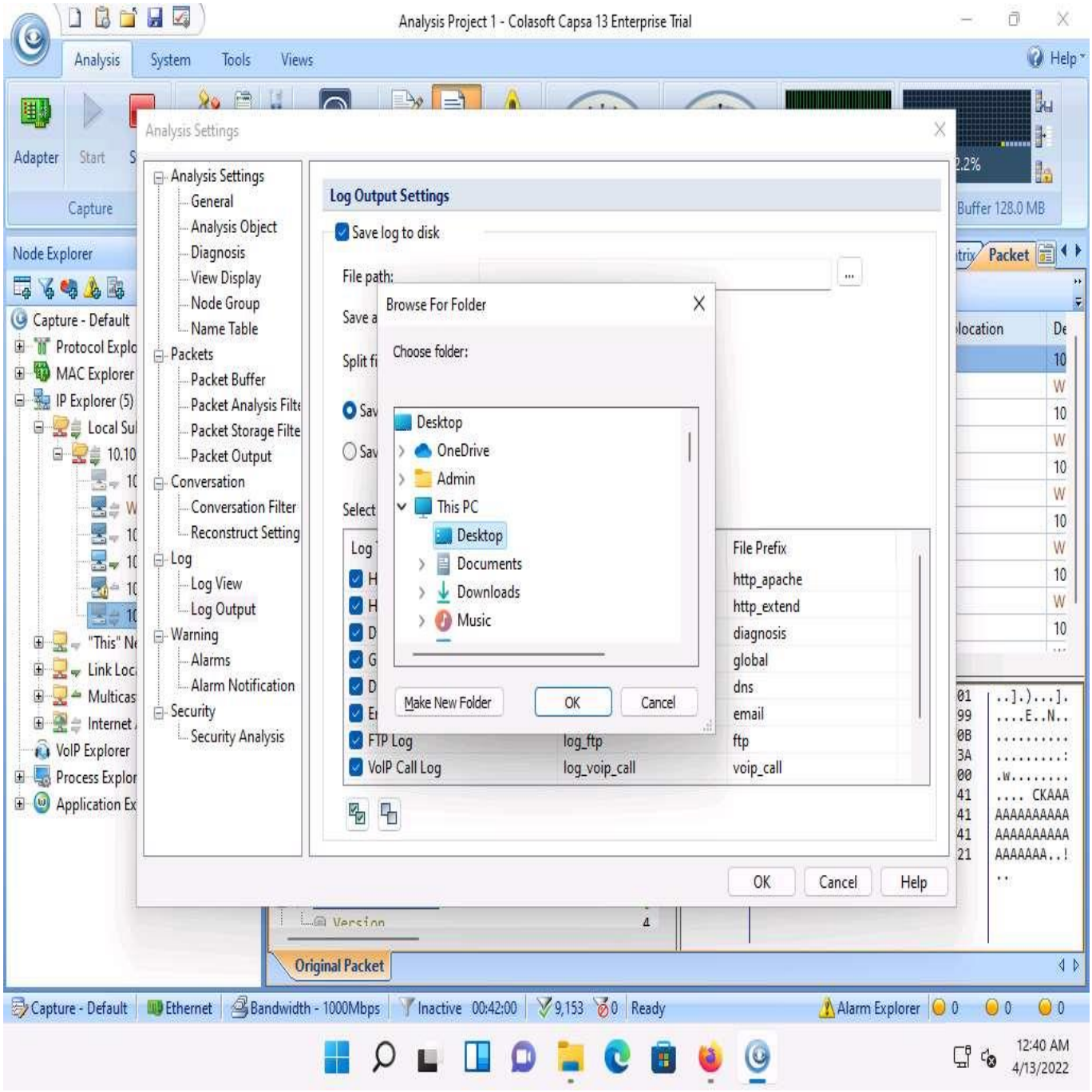
37. ☐ Similarly you can navigate to all the available tabs such as **Protocol**, **MAC Endpoint**, **IP Endpoint**, **MAC Conversation**, **IP Conversation** etc.
38. ☐ After completing the analysis click on **Log Output** option from the menubar.



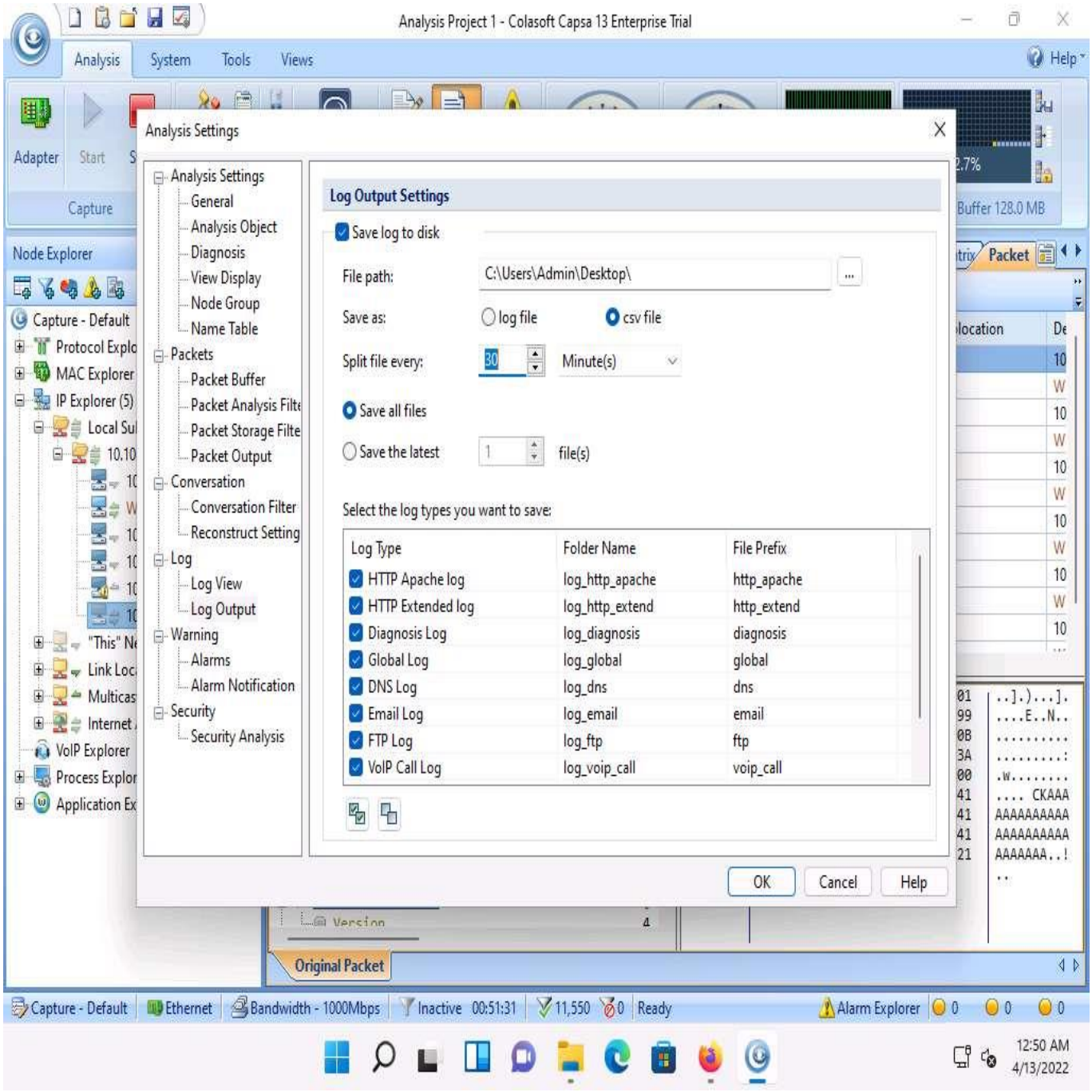
39. In the **Analysis Settings window**, check the **Save log to disk** checkbox and click the ellipsis button under **File path** option.



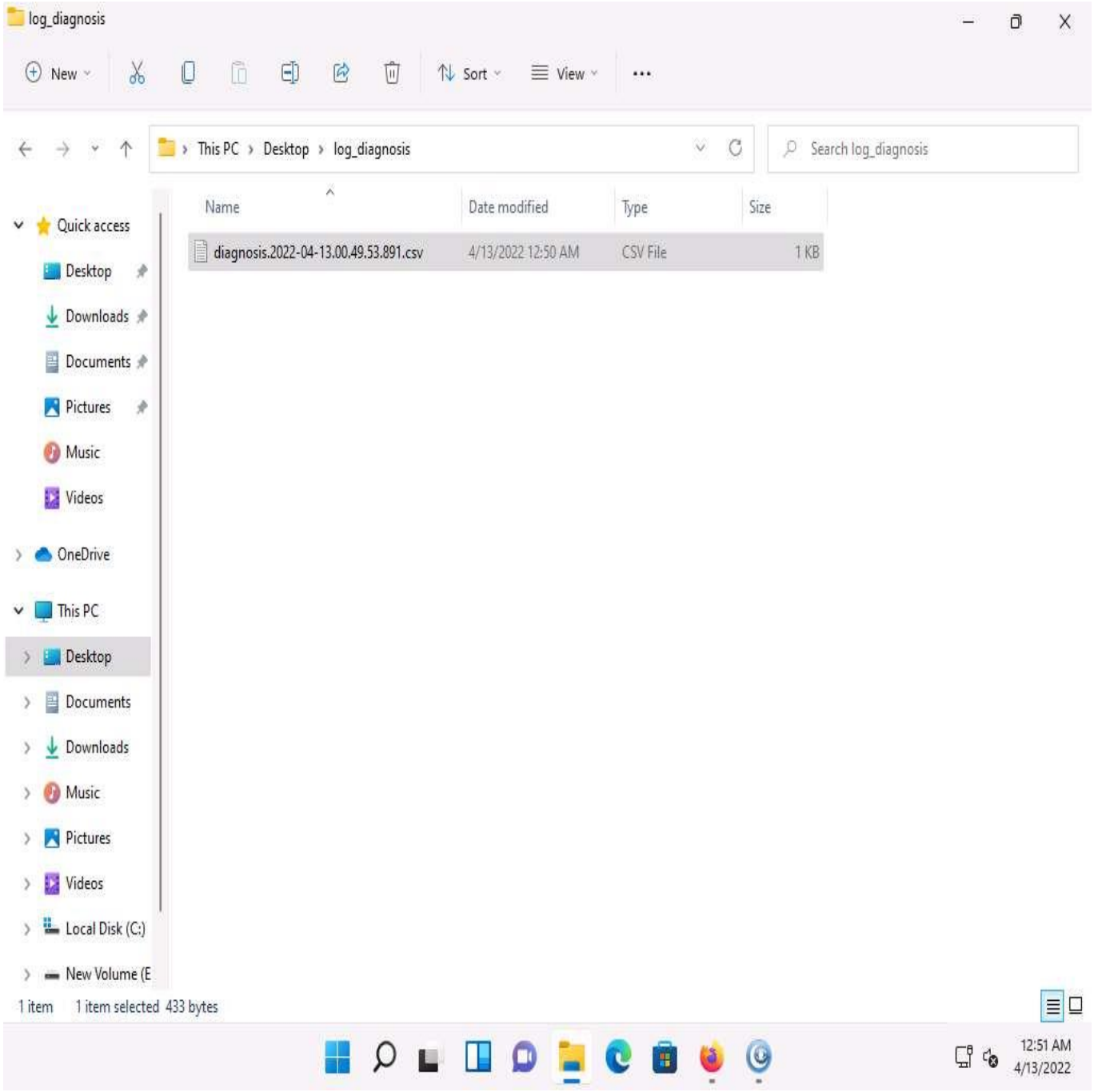
40. ☐ In the **Browse For Folder** window, select **Desktop** and click on **OK**.



41. ☐ 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**.



42. ☐ We can see that the csv log file is created in **Desktop -> log_diagnosis** location.



43. ☐ This concludes the demonstration of detecting ARP poisoning using the Capsa Network Analyzer.
44. ☐ Close all open windows and document all the acquired information.