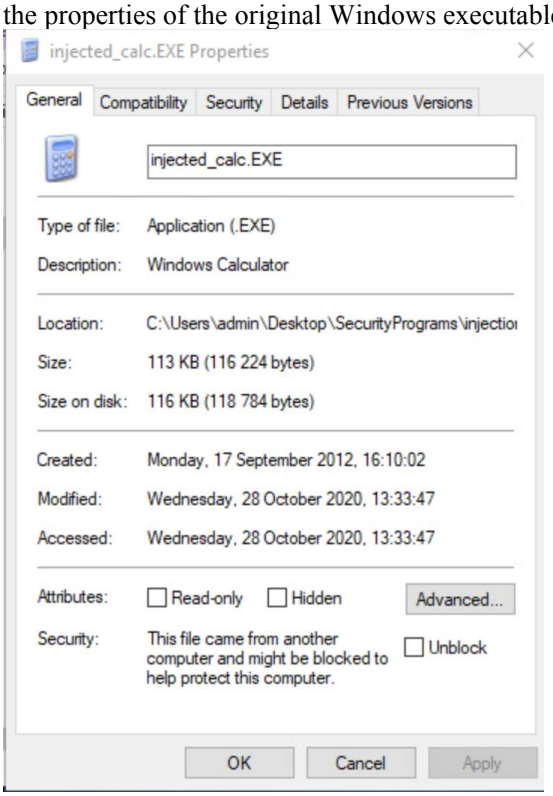
Laboratory Assignments for Windows

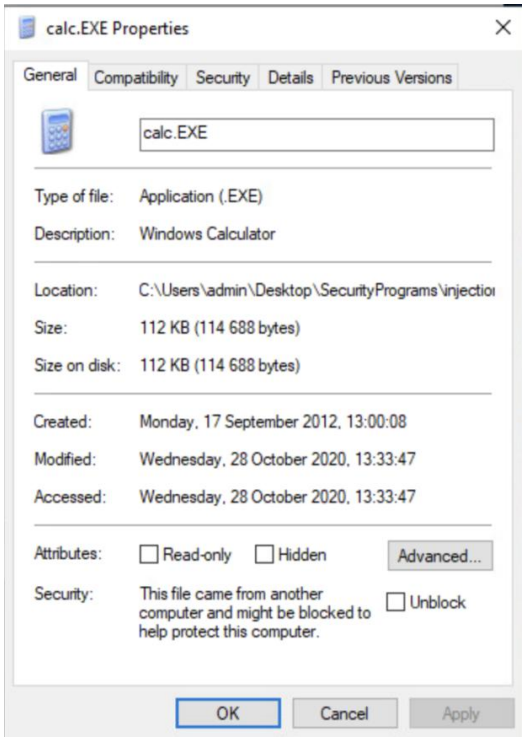
Exercise 1:Trojan Horse and Hash Functions

Comments

Locate the Executable Files: Navigate to the Desktop folder and go to the "SecurityPrograms\injection" directory.

Inspect Properties: Right-click on "injected_calc.exe" and examine its properties. Similarly, examine the properties of the original Windows executable "calc.exe" in the same directory.





Execute the Injected Program: Double-click on "injected_calc.exe" to observe its behavior. Note any unusual friendly greetings, which are not typical for a calculator program. Perform basic calculation tasks to ensure the program behaves like a normal calculator.

Upon double-clicking on injected_calc.exe, a "Hello, World" greeting is displayed. After clicking "OK," a standard calculator appears. Performing basic arithmetic operations within the calculator reveals that its functionality is identical to that of the standard calculator.

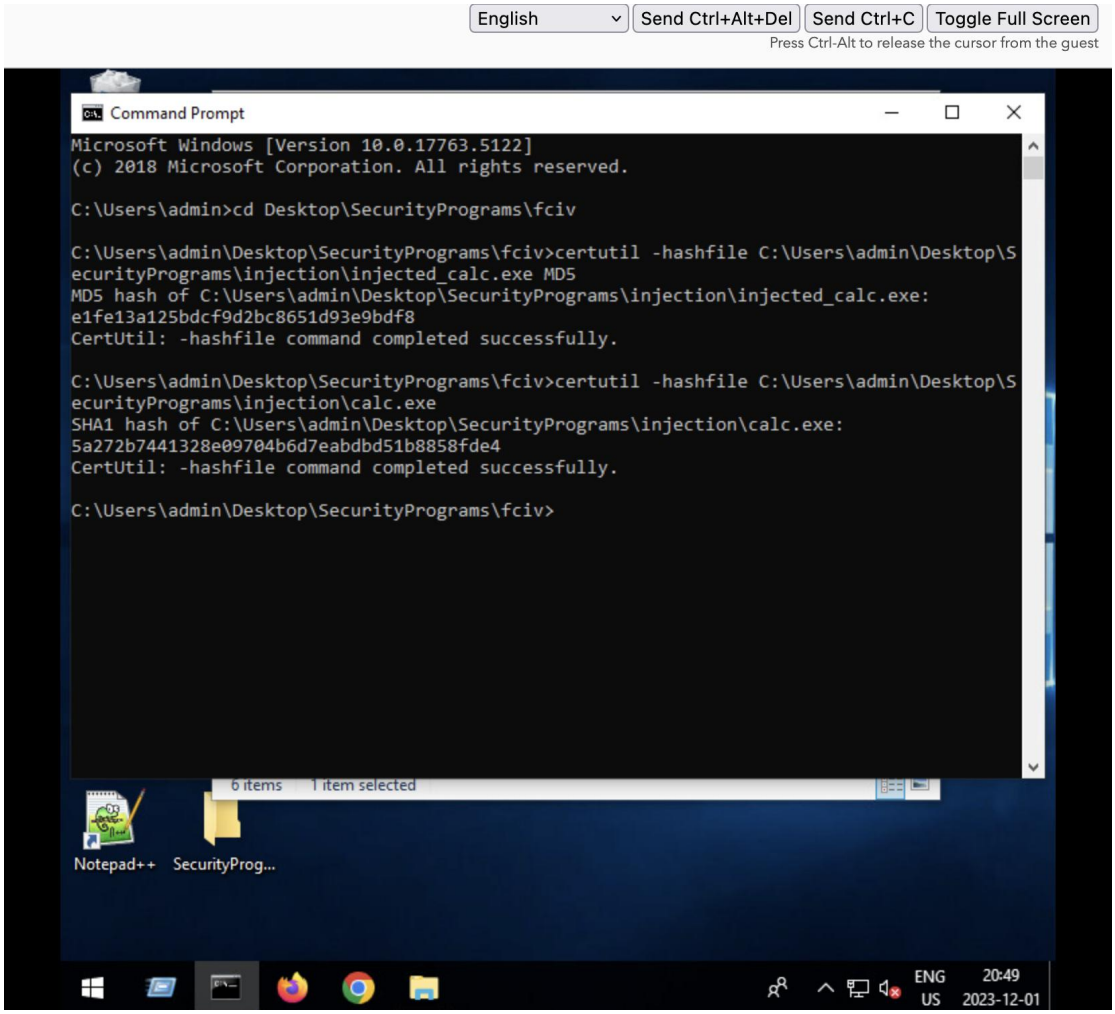
This behavior aligns with the description that the injected code has introduced a friendly greeting but otherwise maintains the normal calculator functionality. The injected code appears to be harmless, demonstrating that modifications to the executable can alter its behavior without compromising its basic features, at least in this specific example.

Verify File Integrity Using Hashes: Open a Command Prompt by clicking the Windows Start button and selecting the Command Prompt app. Change the working directory to the "fciv" folder inside "SecurityPrograms" by typing: *cd Desktop\SecurityPrograms\fciv*

Execute hash commands for both files:
C:\Users\admin\Desktop\SecurityPrograms\fciv>certutil-

hashfileC:\Users\admin\Desktop\SecurityPrograms\injection\injected_calc.exe MD5

C:\Users\admin\Desktop\SecurityPrograms\fciv>certutil-hashfileC:\Users\admin\Desktop\SecurityPrograms\injection\calc.exe MD5



Compare the MD5 hashes: They should be significantly different. Fciv is a command-line tool for File Checksum Integrity Verification, used to generate hash values for files. Certutil.exe is another tool for computing file hash values. Examine the hash values of the two files. Since injected_calc.exe has been injected with additional code, its hash value differs from that of calc.exe.

Reflections

The injection of code into executable files poses significant security risks, as attackers or malicious software may exploit such modifications for various purposes. These modifications can enable unauthorized access to systems by exploiting vulnerabilities or introducing malicious functionality.

Additionally, attackers might inject code to steal sensitive data, compromise confidentiality, or turn a legitimate executable into a vehicle for spreading malware across a network. Privilege escalation is another concern, where injected code may exploit vulnerabilities to elevate privileges, granting attackers more control over a system. In certain cases, the injection of malicious code can lead to denial-of-service situations, causing instability or crashes. These threats can manifest through supply chain attacks, compromising the development or distribution process, or post-exploitation activities after gaining initial access.

To mitigate these risks, security measures such as code signing, file integrity monitoring, network segmentation, behavioral analysis, user education, patch management, and endpoint protection are essential. Regular security audits and a proactive approach to security, including rapid incident response, contribute to an overall robust defense against the potential dangers associated with modified executables.

Exercise 2. Windows Registry

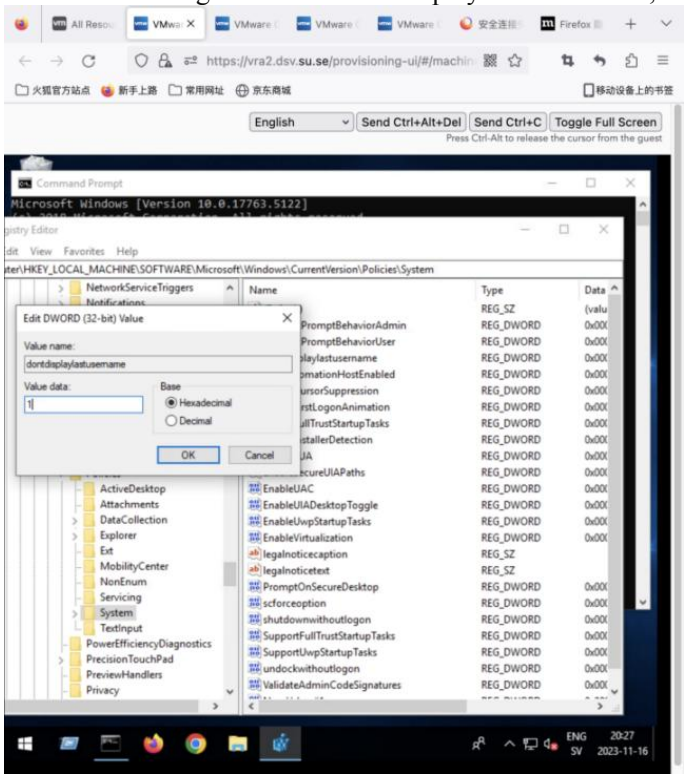
Registry Exercise A: Hide the Last User's Username

Access Registry Editor: Open the registry editor by running "Regedit" from the Start menu's Run option.
Navigate to Specific Registry Folder: Go to HKEY_LOCAL_MACHINE in the registry editor.

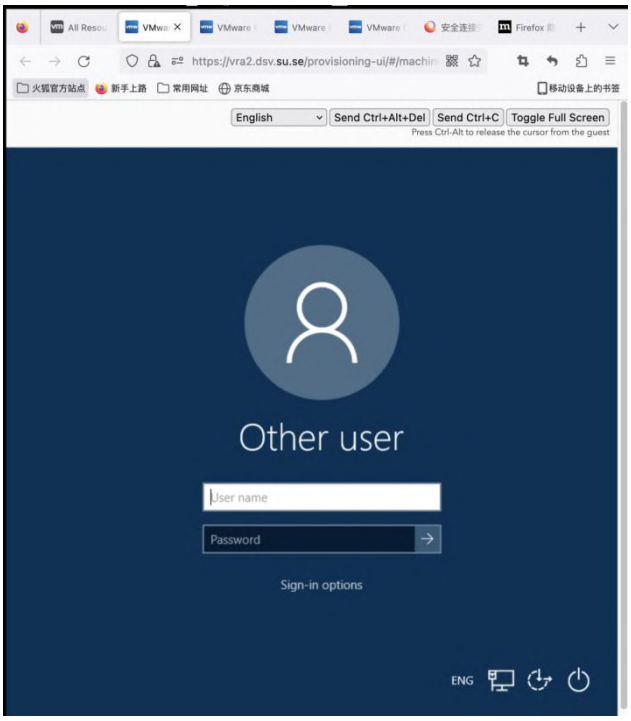
Find the System Policies Path: Follow the path: SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system within HKEY_LOCAL_MACHINE.

Check for Existing Value: Look for a value called DontDisplayLastUserName. If it doesn't exist, create it as a DWORD Value.

Set the Value: Right-click on DontDisplayLastUserName, choose Modify, and set its value to 1.

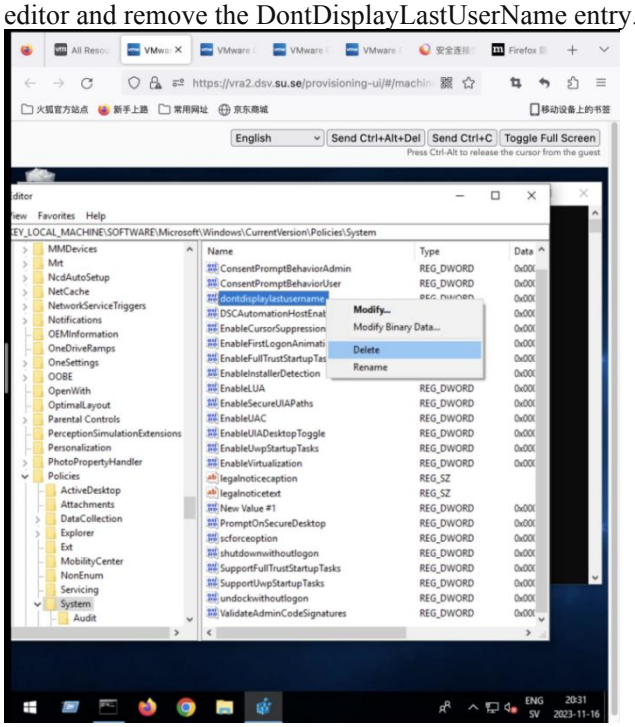


Log Off: Log off the system to apply the changes.



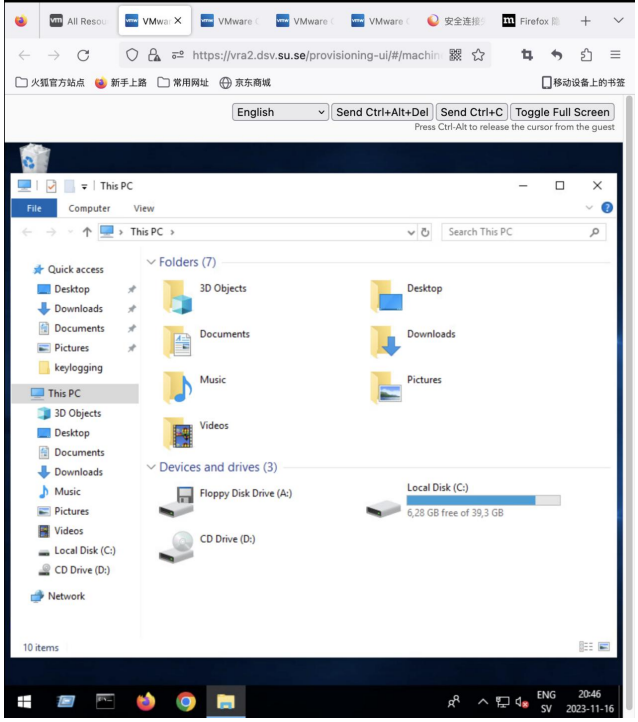
Verify Changes: Log in again, and you should no longer see the last user's username in the login window.

Remove Registry Entry: If needed, after confirming the change, you can go back to the registry editor and remove the DontDisplayLastUserName entry.



Reflections

Hiding the last user's username from the login window can enhance security by preventing unauthorized users from easily obtaining information about the system's previous user. This is a good practice, especially in environments where multiple users may access the same system.

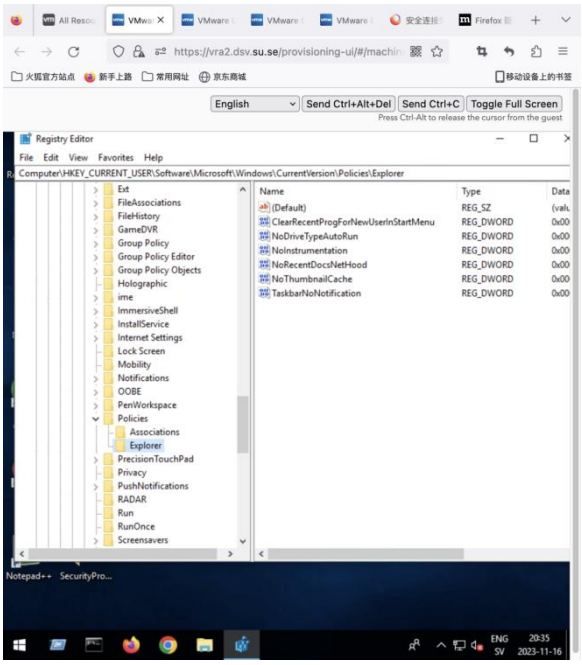


Registry Exercise B: Hide Drives in Windows Explorer

Access Registry Editor: Start the registry editor.

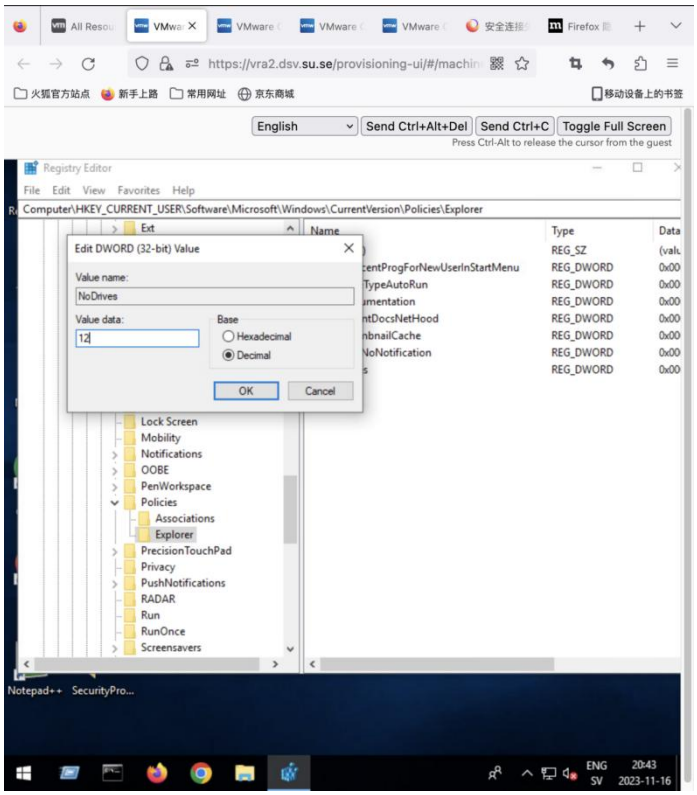
Navigate to User-Specific Folder: Choose the folder HKEY_CURRENT_USER in the registry.

Locate or Create Explorer Policies Path: Follow the path *SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\Explorer*. If the key doesn't exist, create it by right-clicking, and selecting New -> Key.



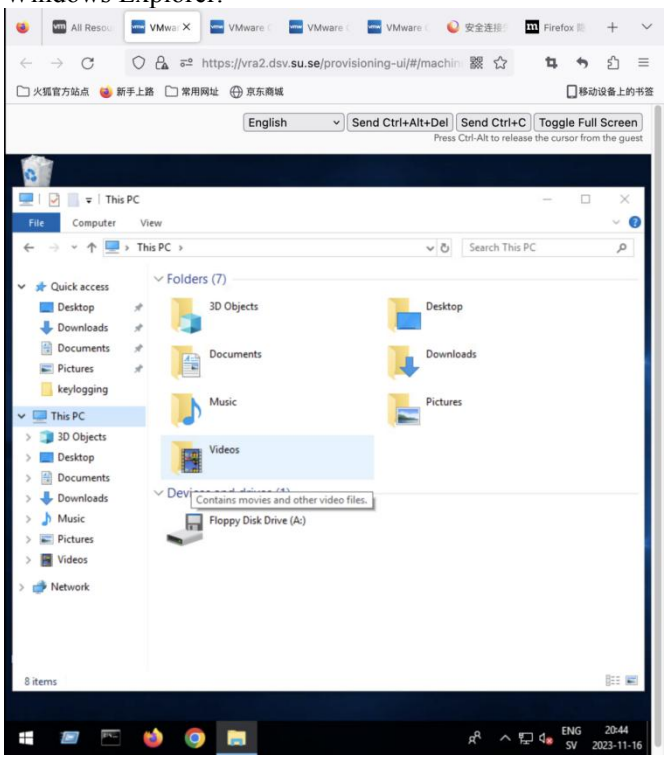
Add a New Value: Inside the Explorer folder, add a new DWORD Value and name it NoDrives.

Set Drive Visibility: Modify the NoDrives value and enter the decimal value corresponding to the drive you want to hide. Drive values are alphabetically ordered (A = 1, B = 2, C = 4, D = 8, and so on). To hide multiple drives, add the values. For example, to hide drives C and D, enter the value 12.

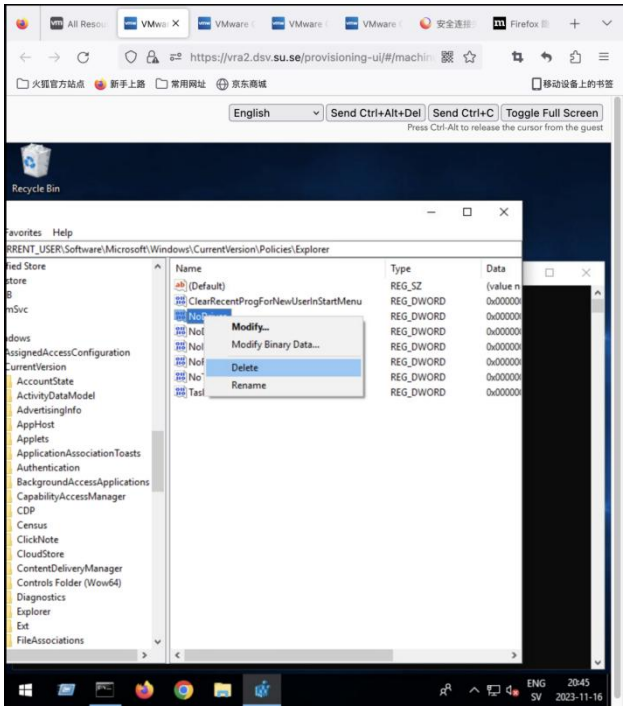


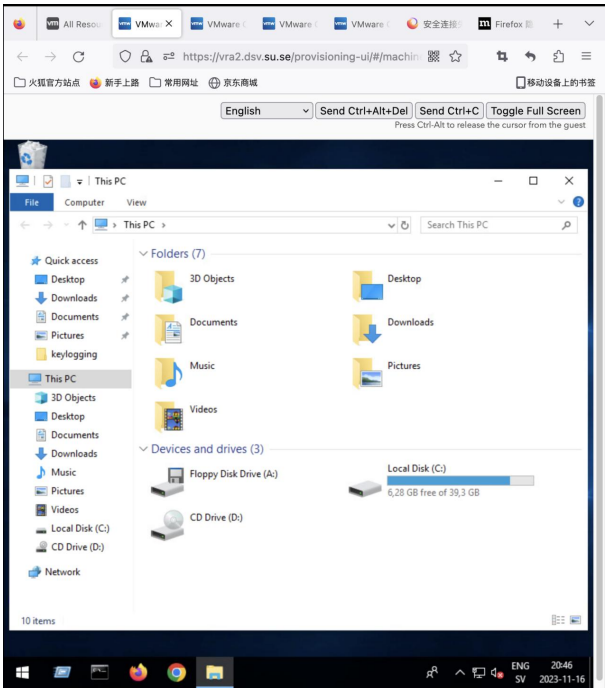
Log Off and Log On: Log off and then log on again (no need to restart) for the changes to take effect.

Verify Drive Visibility: After logging in, the specified drives should no longer be visible in Windows Explorer.



Restore Drive Visibility:To make the drives visible again, remove the NoDrives value from the registry. Log off and log on again for the changes to be reflected in Windows Explorer.





Reflections
Hiding drives in Windows Explorer can be useful in certain scenarios, such as restricting access to sensitive data on specific drives. However, it's important to note that this method is a basic form of access control and may not provide strong security. Users with sufficient technical knowledge may still be able to access hidden drives.

Registry Exercise C: Disable the "Run" Option in the Start Menu

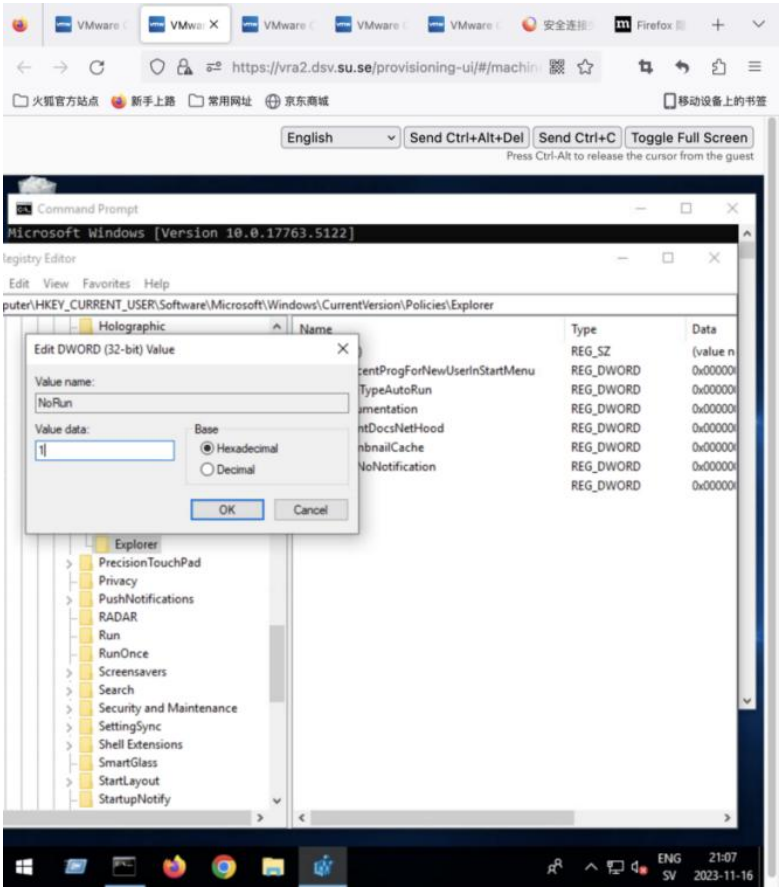
Access Registry Editor: Start the registry editor.

Navigate to User-Specific Folder: Choose the folder HKEY_CURRENT_USER in the registry.

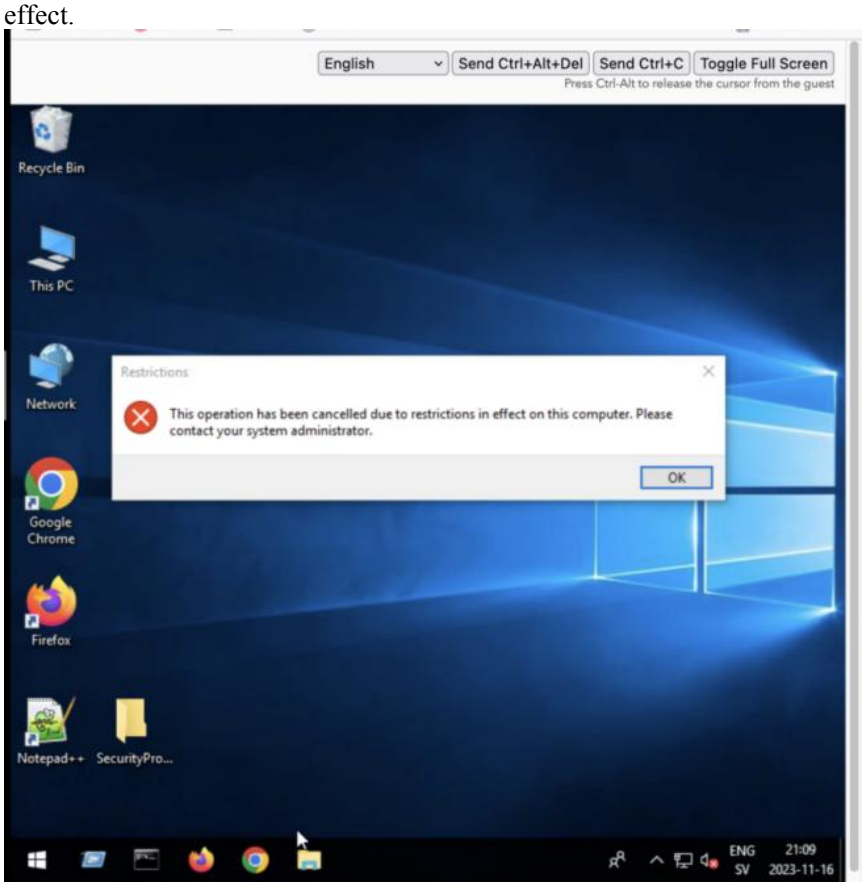
Locate or Create Explorer Policies Path: Follow the path *SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\Explorer.*

Add a New Value: Inside the Explorer folder, add a new DWORD Value and name it NoRun.

Set Value to Disable Program Execution: Modify the NoRun value and enter 1.

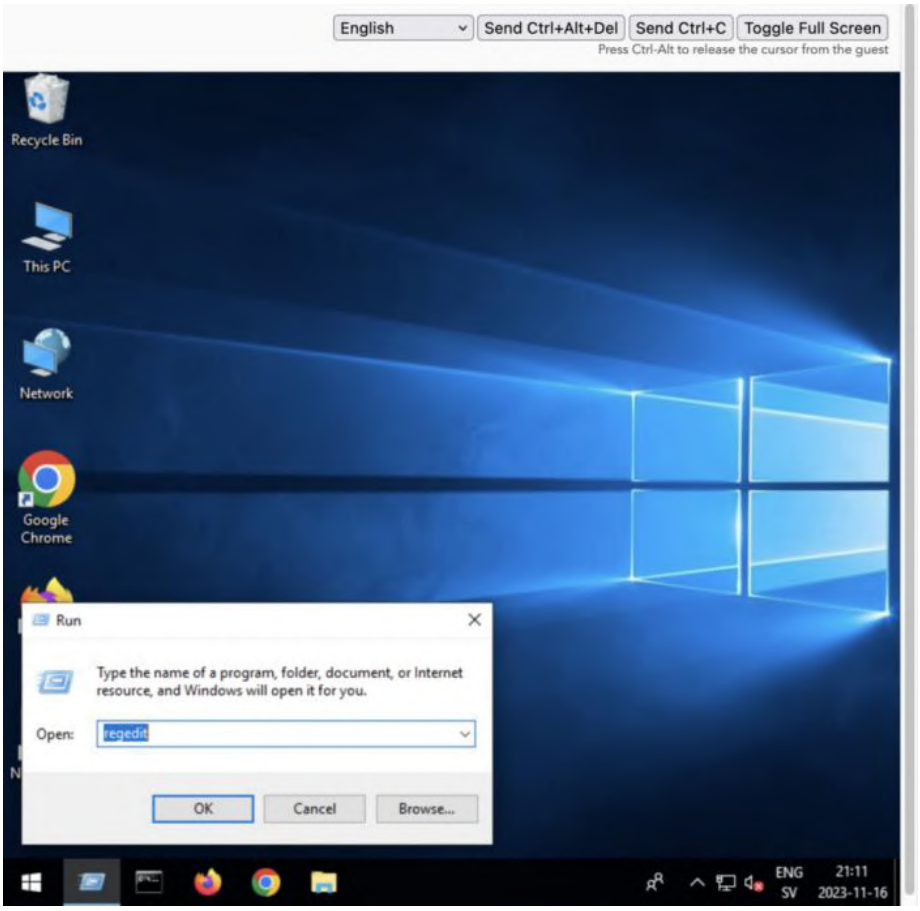


Log Off and Log On: Log off and then log on to the system (do not restart) for the changes to take effect.



Verify Start Menu Changes: After logging in, the option to run programs from the Start menu should no longer be available.

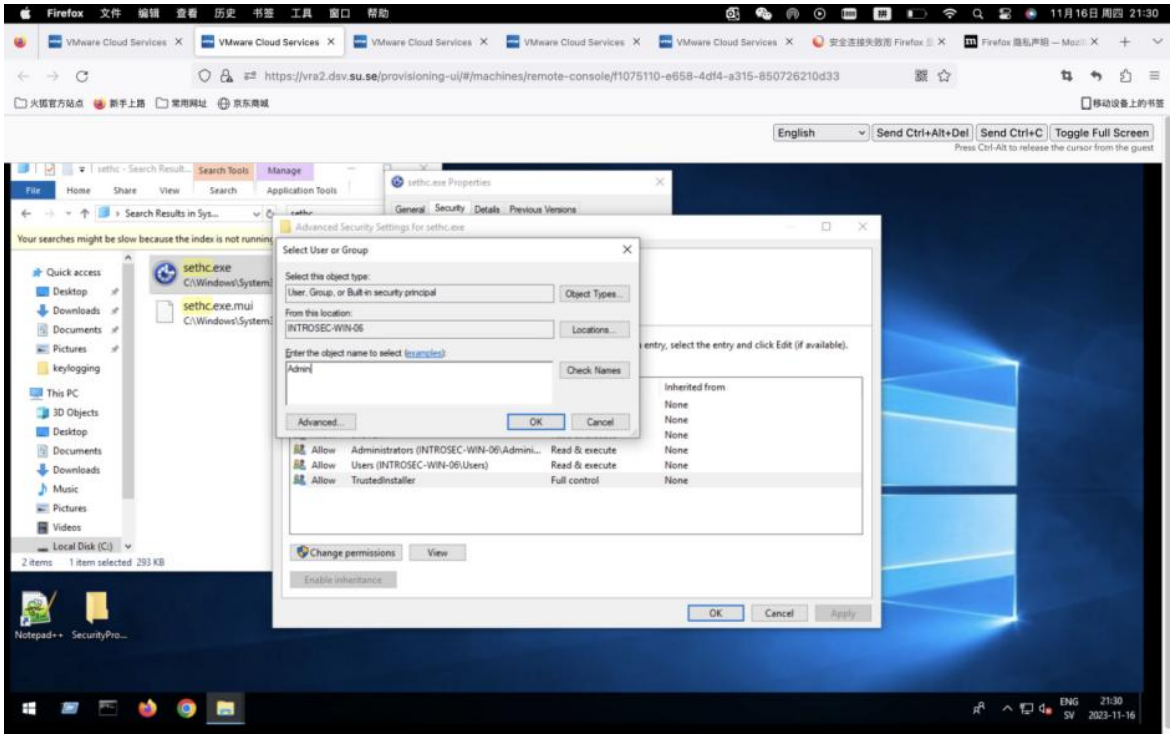
Locate Registry Editor: Open the Command Prompt and enter "regedit" to launch the registry editor.



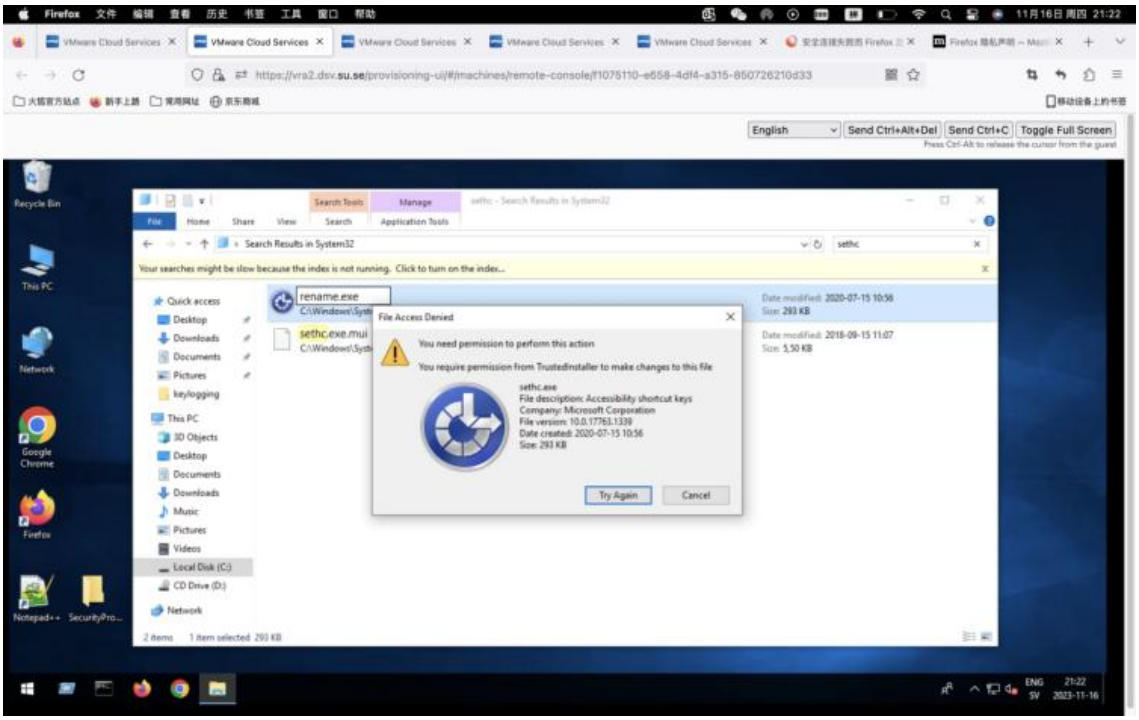
Reflections

Disabling the Run button in the Start menu is often done as a prevention from users running unauthorized software or batch scripts. (www.Maxi-Pedia.com, *Group policy: Remove run menu from start menu*) This could be relevant in environments where there is a need for strict control over the programs that users can run. However, it's important to consider the impact on user convenience and the need for legitimate system administration tasks.

Exercise 3. Spoofing – Bypassing the Login Screen



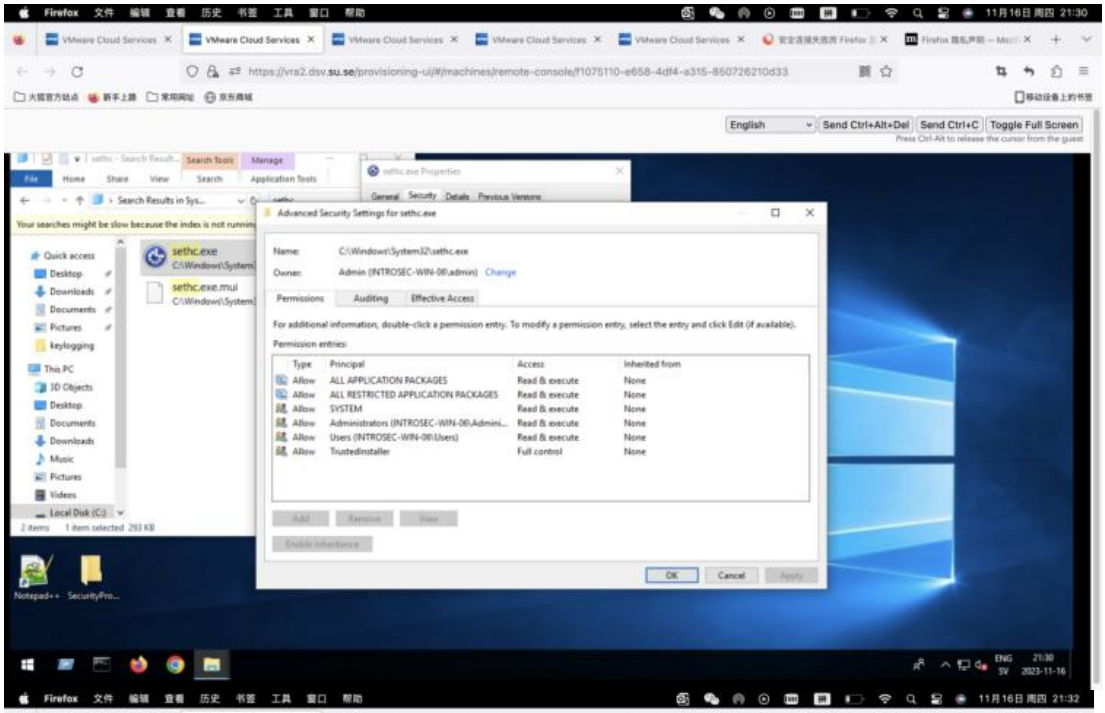
Comments:
Navigate to C:\Windows\System32 on the VM.
Attempt to rename sethc.exe; Windows will indicate that only the owner (TrustedInstaller) can modify the file.

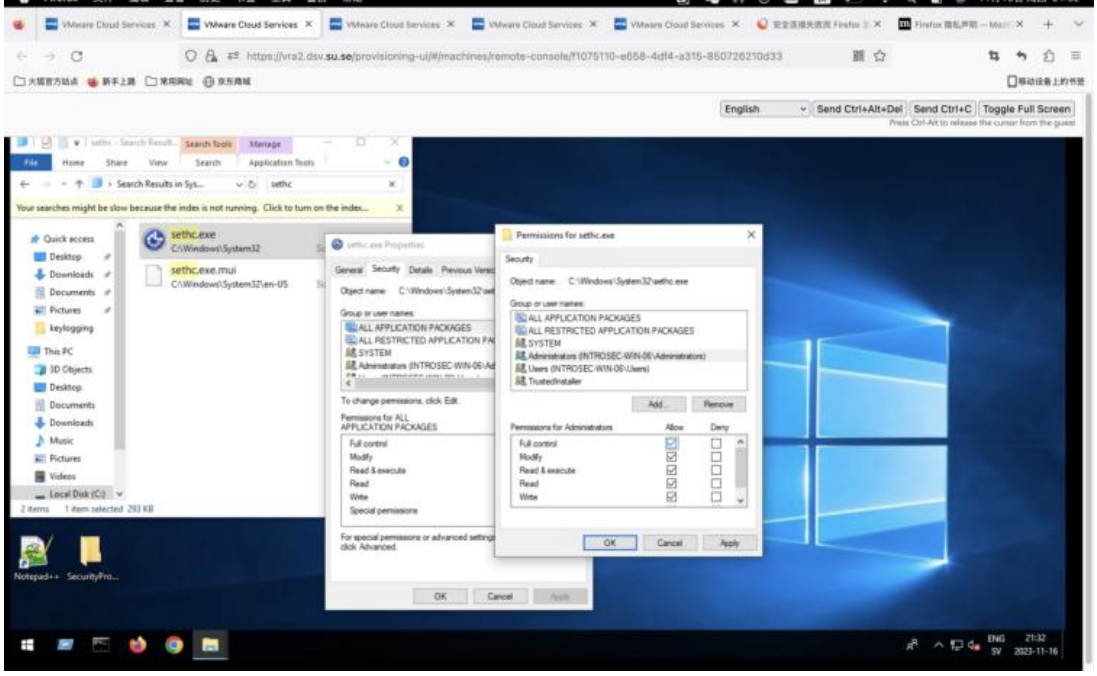


Right-click on the file, go to Properties, switch to the Security tab, and click Advanced to confirm TrustedInstaller as the owner.

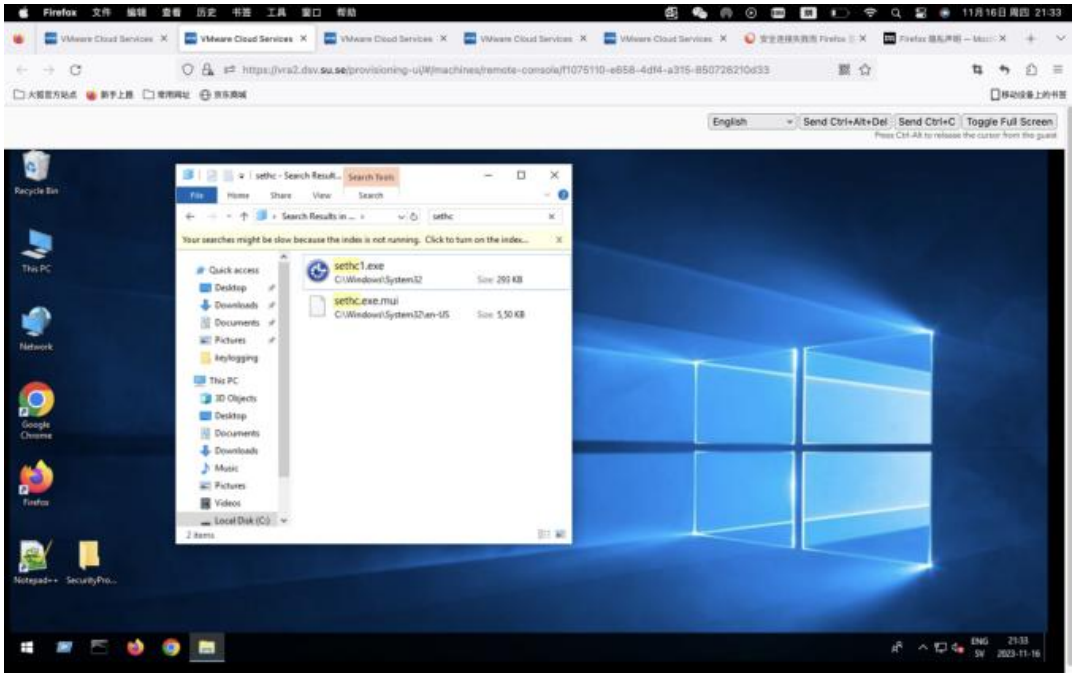
Change the owner to a specified user account, granting ownership of the object.

Open properties again, switch to the Security tab, press Edit, select Administrators, and grant Full Control.

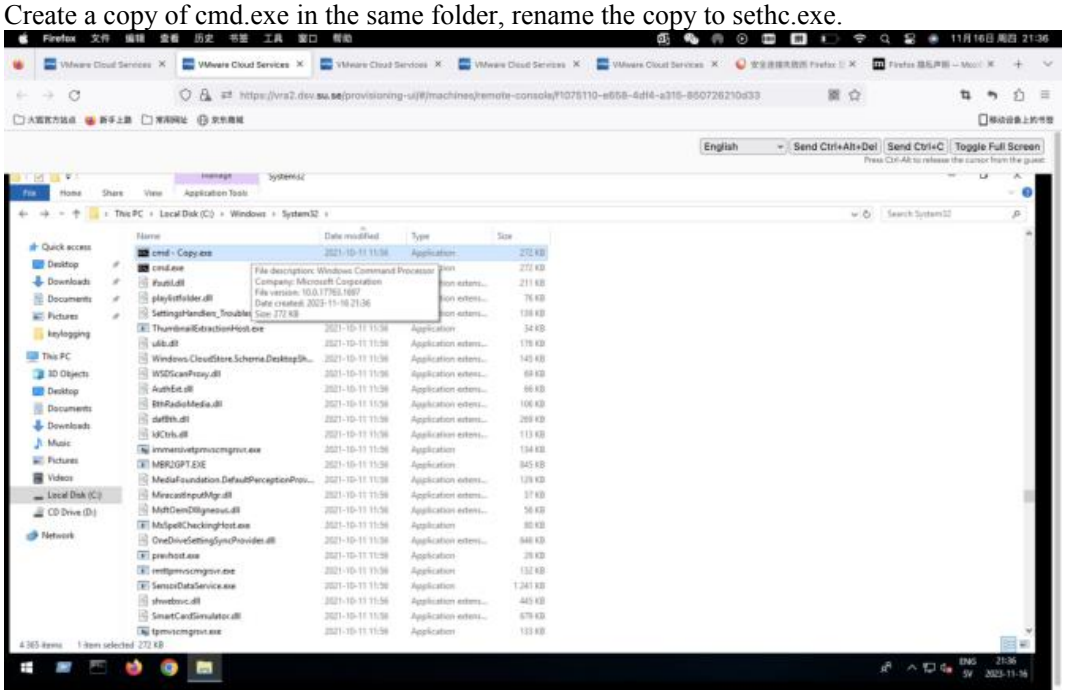


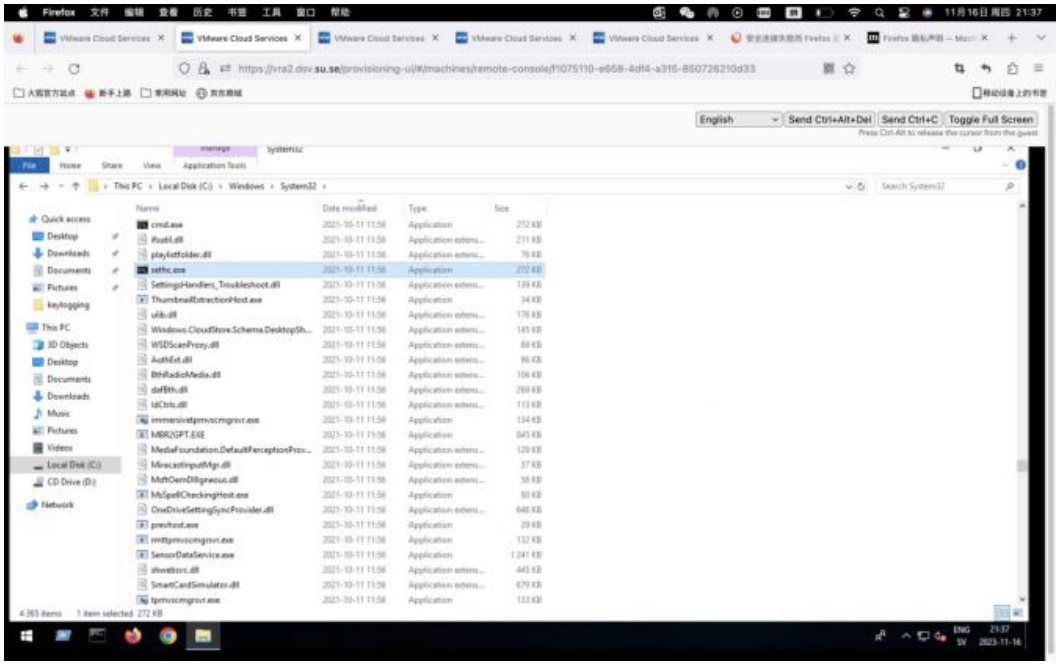


After applying changes, try renaming sethc.exe again.



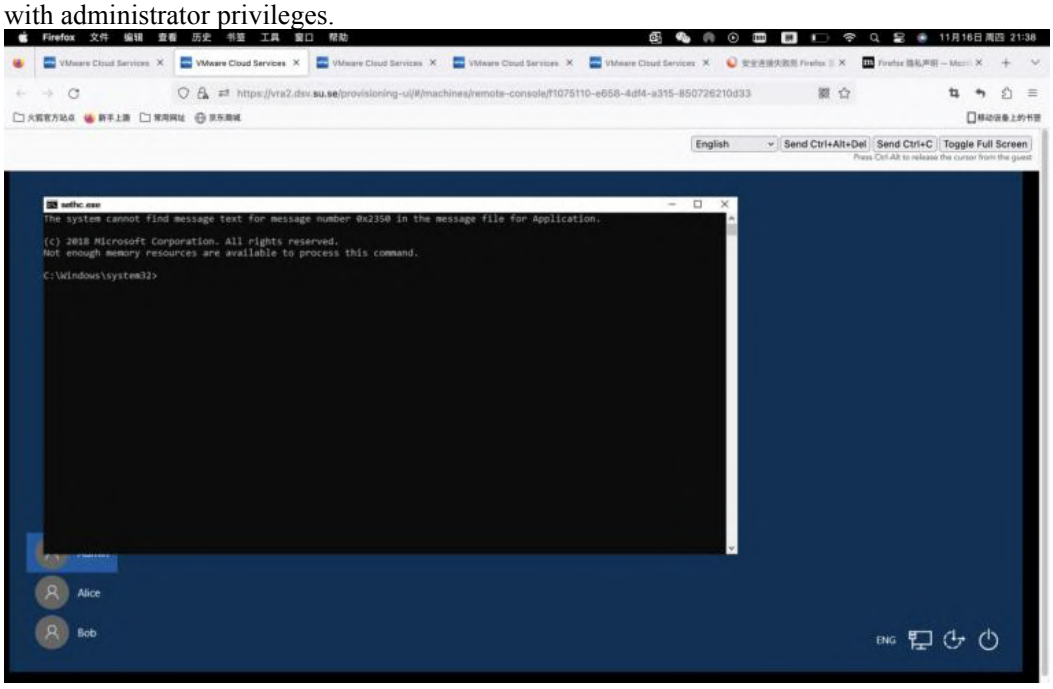
Create a copy of cmd.exe in the same folder, rename the copy to sethc.exe.



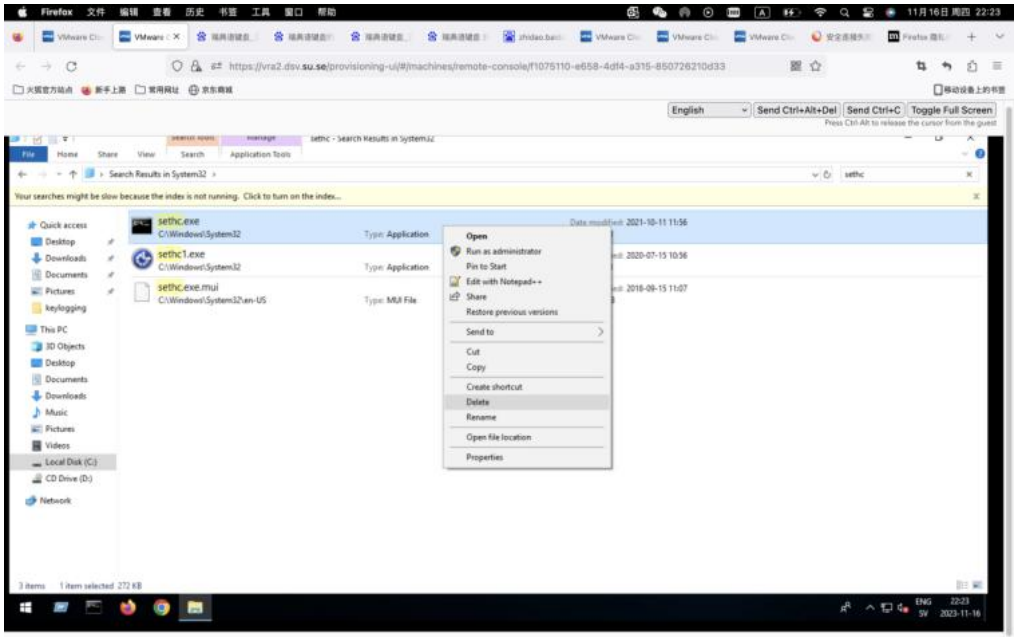


Log Off and Login: Log off from the Windows session using either the "Send Ctrl+Alt+Del" button or the Start Menu.

On the login screen, press the Shift button five times. This action should open a command line with administrator privileges.

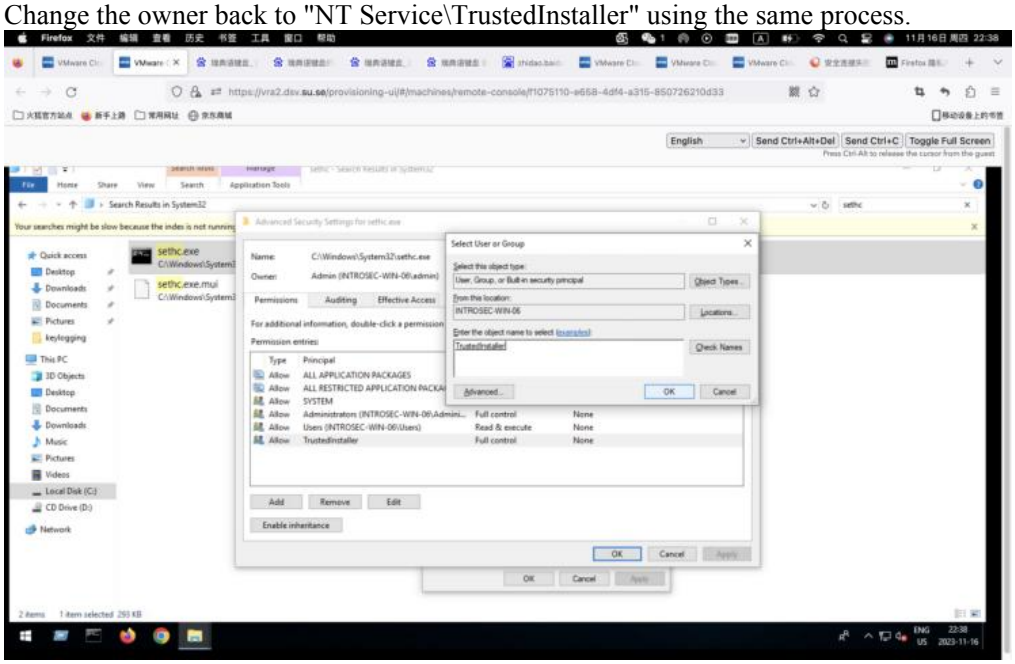


Delete the current sethc.exe (a copy of cmd.exe).

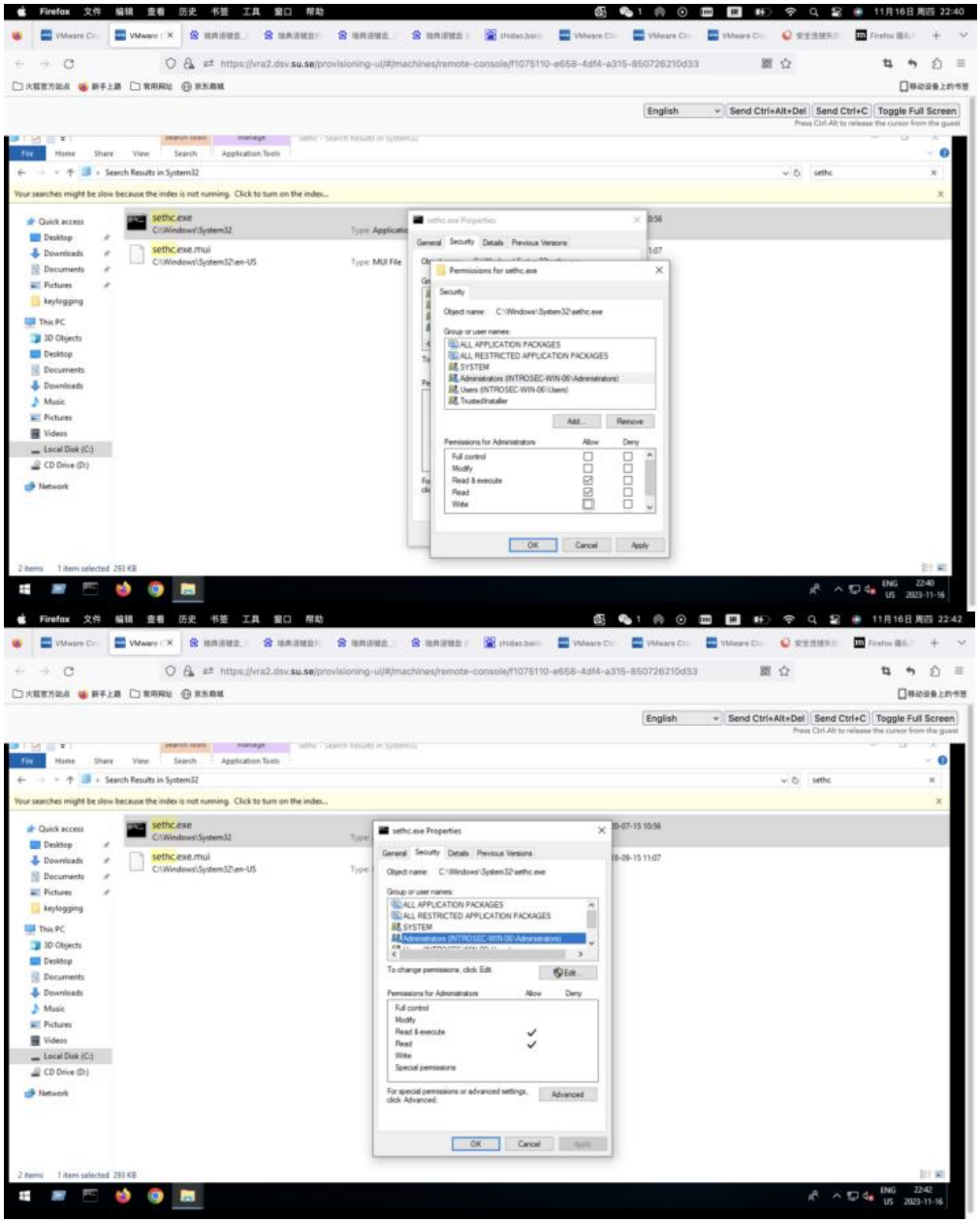


Rename the original sethc.exe file back to its original name.

Change the owner back to "NT Service\TrustedInstaller" using the same process.



Set the Administrator account back to having only "Read" and "Read & Execute" permissions.

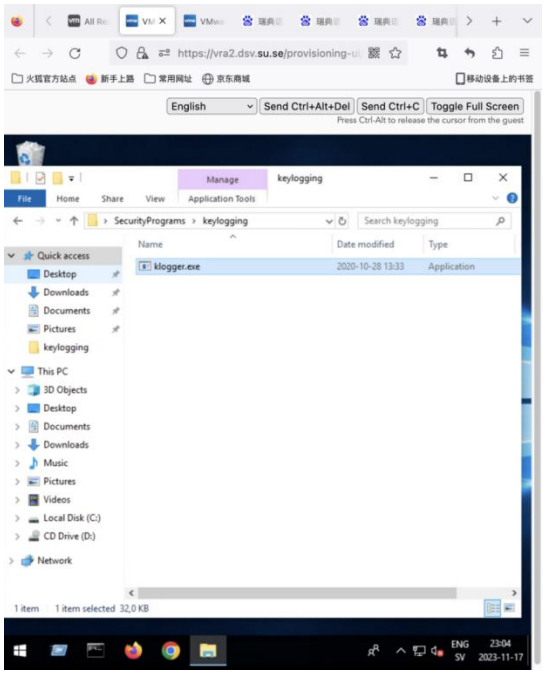


Reflections

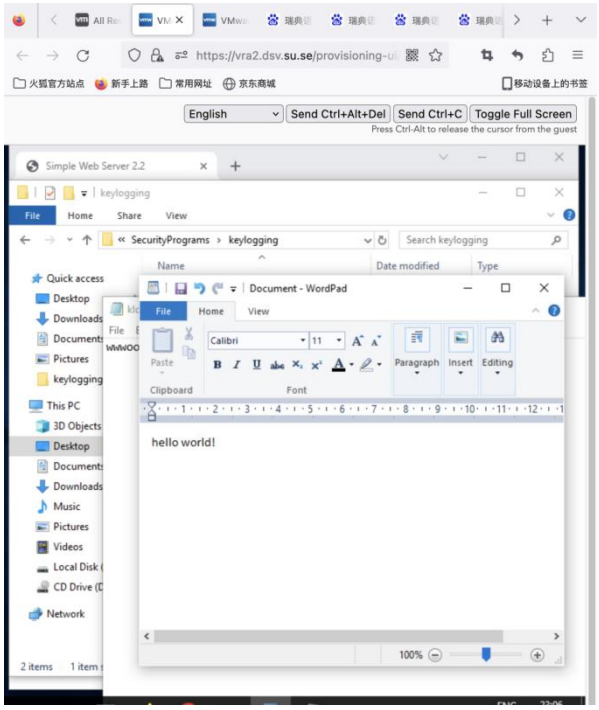
Administrator access to a computer's command shell allows significant actions like modifying settings, installing software, and managing accounts. Security measures include digital signatures for application integrity, file permissions, and Windows Resource Protection for system stability.

Exercise 4. Monitoring keyboard strokes

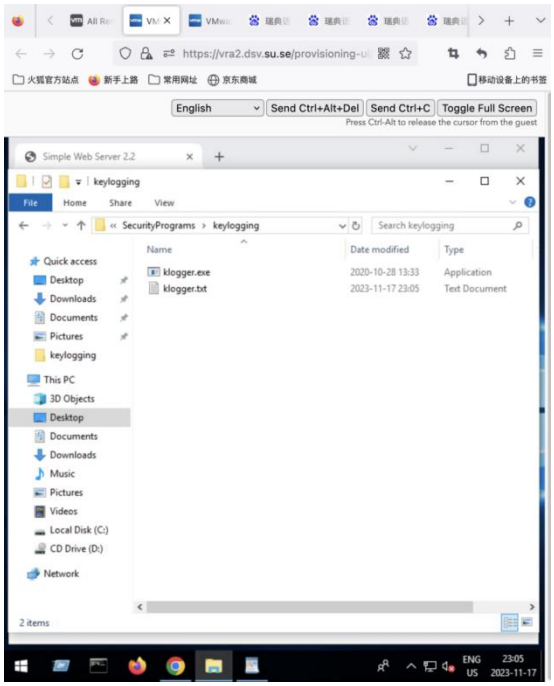
Start the keylogger program: Begin by running the program "klogger.exe," located in the directory (SecurityPrograms\keylogging).



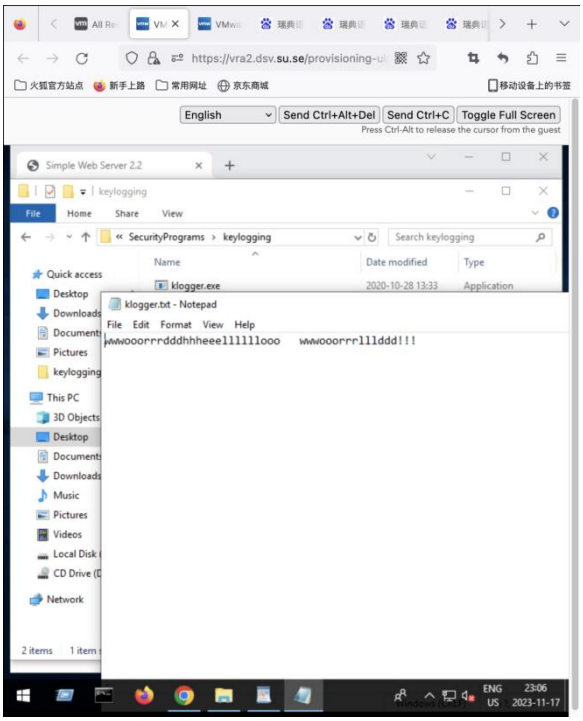
Normal computer usage: Use the computer as you normally would, engaging in activities such as browsing the Internet or writing a text document.



Inspect the directory: Open the directory from where you initiated the klogger.exe program. Look for a file named "klogger.txt" within this directory.



Examine the content of klogger.txt: Check the content of the "klogger.txt" file. It is likely to contain a record of keystrokes captured while the keylogger program was running.



Check for repeated keystrokes: Determine if the logged keyboard strokes appear more than once in the file. If repetitions are found, it indicates that the keylogger program was initiated multiple times, with each instance appending the latest keystrokes to the same file.

Close the program using Task Manager: To terminate the keylogger program, open Task Manager (Ctrl + Alt + Del) and locate the process or processes named "klogger.exe." End these processes to stop the keylogging activity.

Reflections

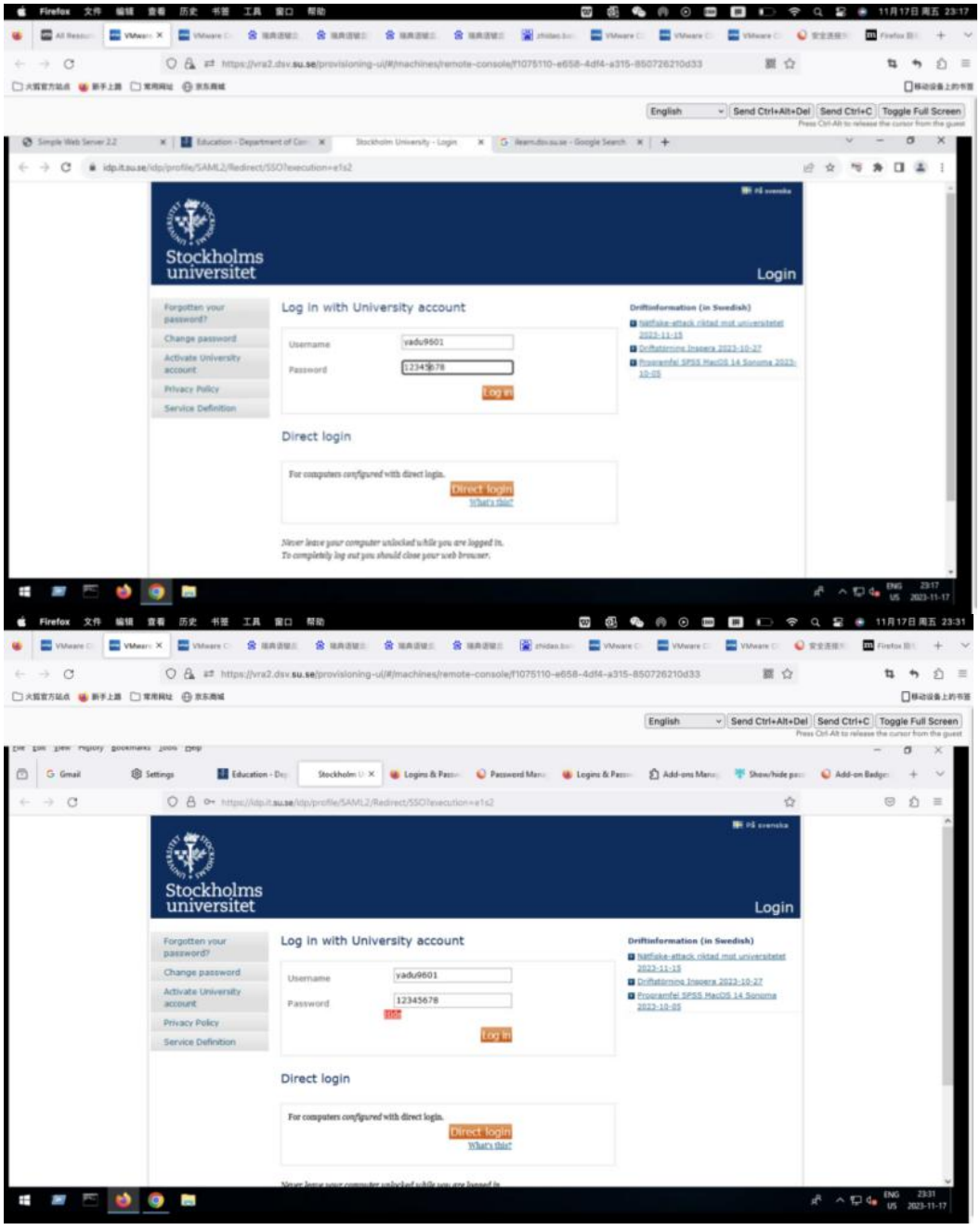
To safeguard against keylogging, administrators and common users should implement essential measures. Firstly, it is crucial to install reliable antivirus software and keep it updated regularly to detect and remove potential keyloggers. Simultaneously, maintaining up-to-date operating systems and software is imperative to patch security vulnerabilities. Moreover, being cautious when downloading files, avoiding content from untrustworthy sources, and staying vigilant about email attachments can effectively diminish the likelihood of keylogging. Users should limit their privileges by utilizing non-administrator accounts for routine tasks, diminishing the impact of potential keyloggers. Ensuring the security of Wi-Fi networks through the use of strong passwords and WPA3 encryption helps prevent unauthorized access. Enabling Two-Factor Authentication (2FA) adds an extra layer of protection, while the use of virtual keyboards for sensitive information entry and application whitelisting to allow only trusted applications further fortify system security. Implementing these straightforward measures collectively contributes to an enhanced system security posture, minimizing the potential risk of falling victim to keylogging activities.

Exercise 5. Disclosing masked passwords

Preparation with ShowPassword extension: The Google Chrome Browser within a virtual machine is configured with the ShowPassword extension. This extension allows the revealing of masked passwords in login dialogs accessed through the Chrome browser.

Access a login page: Navigate to a website where a login is required, such as a DSV/Stockholm University page that may redirect to idp.it.su.se (e.g., ilearn2.dsv.su.se). Input any text into the password field without entering the actual password. The field typically displays dots or stars instead of the actual characters.

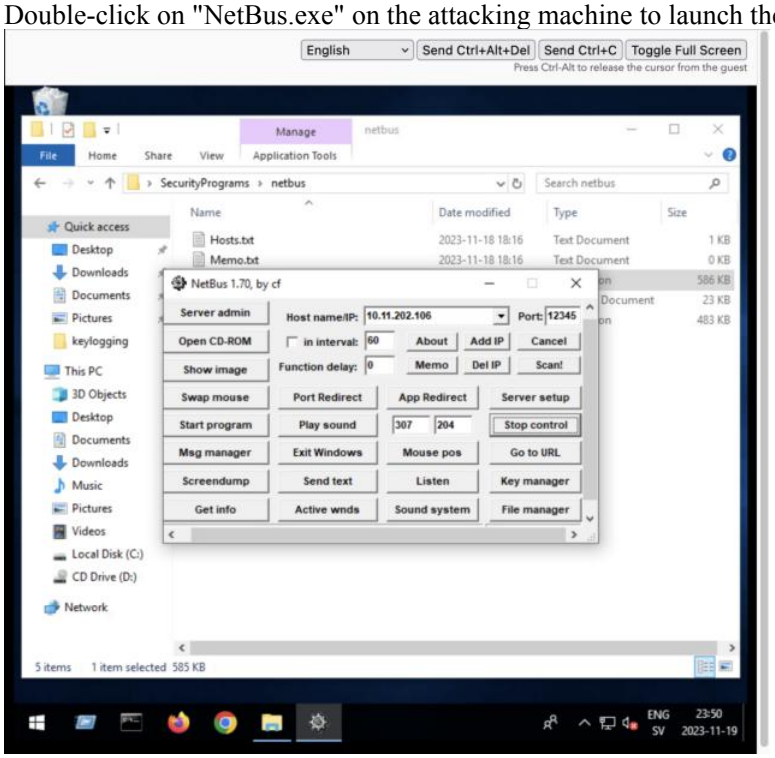
Trigger the unmasking: Press the Ctrl key on the keyboard. This action triggers the ShowPassword extension to reveal the previously masked password in plain text within the password field.



Reflections
This assignment about password masking and its vulnerability to certain browser extensions provides a logical pathway to several key insights. Firstly, it illuminates the inherent risks associated with password entry, showcasing the limitations of traditional password masking methods and prompting the need for heightened security awareness among users. Moreover, it indirectly underscores the significance of robust password management practices and the implementation of multifactor authentication.

Exercise 6. NetBus – Take control over another computer

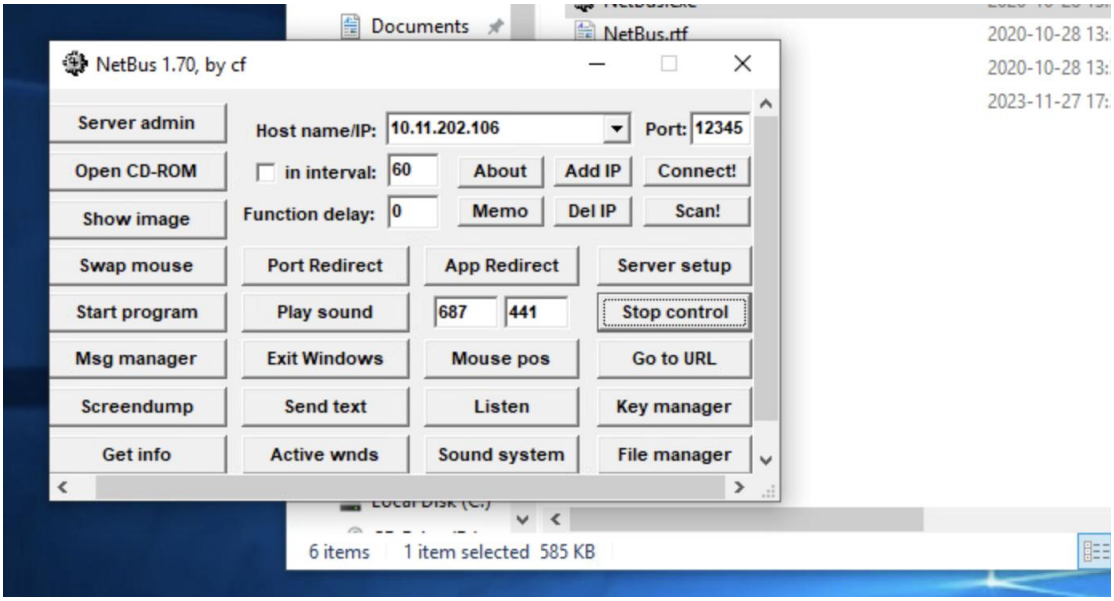
Navigating to the directory "SecurityPrograms\netbus."
I am double-clicking on "Patch.exe" on the target machine to initiate the server (NetBus server).
Double-click on "NetBus.exe" on the attacking machine to launch the client, providing a GUI.



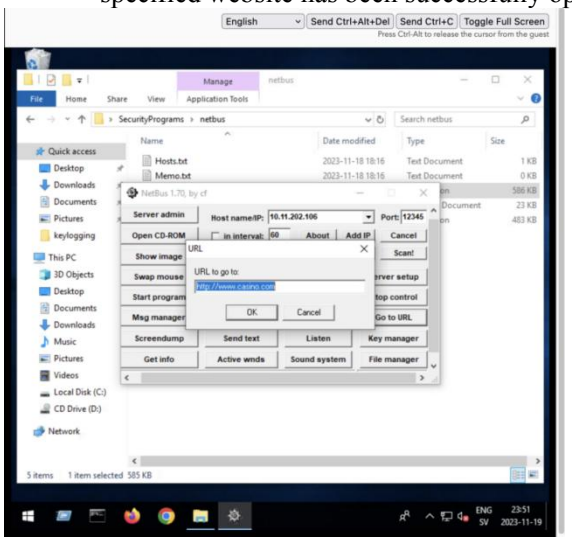
Adding the IP address(10.11.202.106) of the target machine to the client.
We obtained permission from the victim group and obtained their IP address, which is 10.11.2.108.
The IP address of the virtual machine running "Patch.exe" is also available.
Pressing "Connect" to establish a connection with the victim's computer.
Testing various options of NetBus, an example is given for the "Start Program" command, where the Calculator application on the target machine is launched using the path "C:\Windows\System32\win32calc.exe."

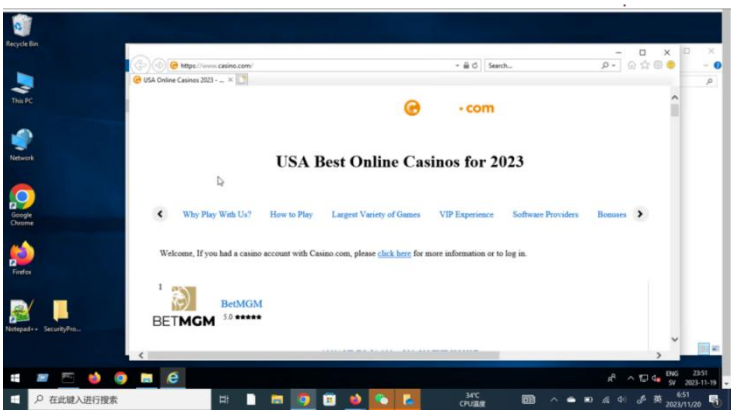
We try to explore interesting programs that can run on the target machine:

1. By clicking "Control Mouse", we can observe that we have control over the mouse on the target machine's desktop and we can see the mouse movement parameters. And by clicking "Stop control", we can finish our mouse control.

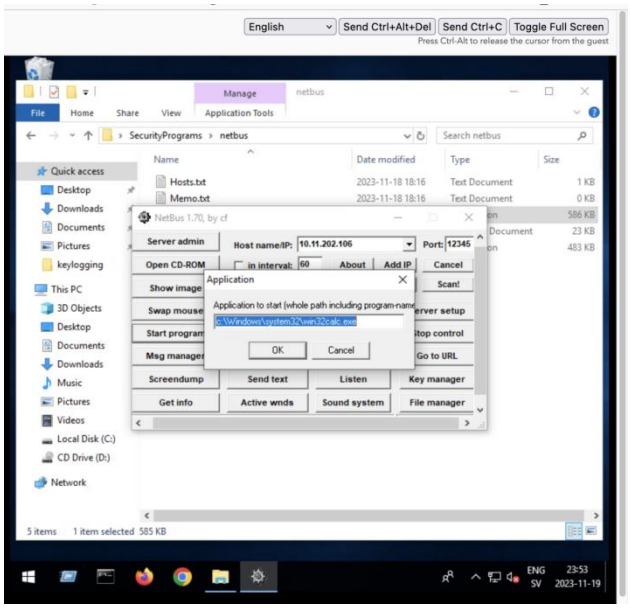


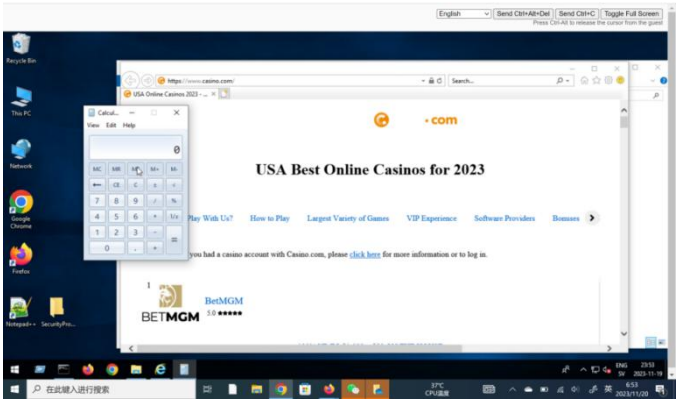
2. By clicking "Go to URL", When we click "Go to URL," we observe the appearance of a prompt on the interface requesting a URL to visit. The default website provided is *www.casino.com*. Upon clicking OK, we can see that on the victim's Windows VM, the specified website has been successfully opened.



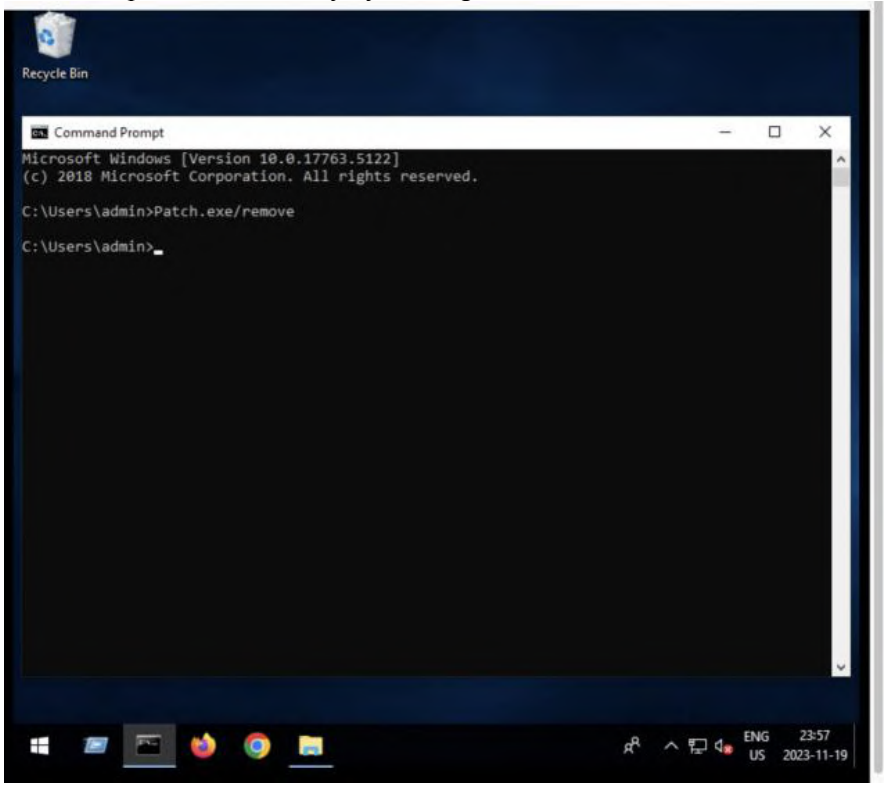


3. By clicking "Start Program", an application window appears, displaying the path of the Calculator application on the victim's Windows virtual machine. Upon clicking OK, we observe that on the victim's Windows desktop, the Calculator application has been successfully opened.





We can stop NetBus manually by running the command “Patch.exe /remove”.



Reflections

NetBus is a remote administration tool. It consists of two main components: the server and the client. The primary functionalities of NetBus include remote control, CD tray manipulation, mouse control, information display, opening web pages, taking screenshots, and more. It allows users to control the target computer running the server through the client, enabling remote execution of various operations such as file manipulation and application launching. Users can also swap the left and right mouse buttons on the target computer, causing confusion and disruption. Additionally, NetBus permits remote opening of the target computer's browser, navigating to specified web pages, which can be used to guide the target user to malicious sites. Due to the potential for misuse, NetBus is now considered a potential malicious tool, and explicit authorization and permission from the owners of the relevant systems and networks should be obtained before conducting any experiments or tests.

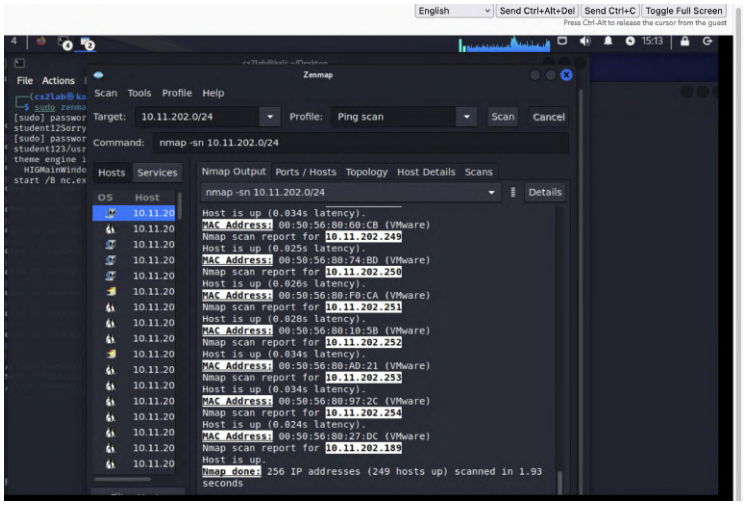
Laboratory Assignments for Kali Linux

Exercise 1. Utilising port- and vulnerability scanners

1. Zenmap

Zenmap Launch: Start Zenmap by entering "zenmap-kbx" in the Linux command shell with root privileges, or use "sudo zenmap-kbx" in a non-root shell. This will open the GUI of Zenmap.

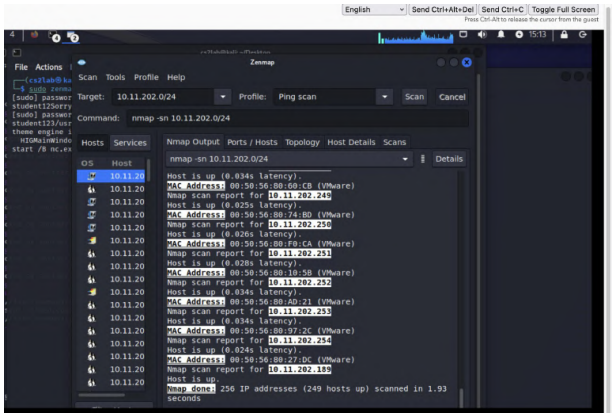
Fill in Target Information: In the Zenmap interface, there is a field called "Target." You need to enter the IP address "10.11.202.0/24." in this field.



Choose Scan Type: Select the scan type “Ping Scanfrom” in the configuration file dropdown menu.

Execute the Scan: Click the "Scan" button to initiate the scan. Zenmap performed a Ping scan to determine which hosts within the specified range are active.

View Scan Results: After the scan is complete, the results of the scan on the Zenmap interface are showed, which include information about discovered active hosts, open ports, and other relevant details such as MAC address.



2. Nmap

When you enter "nmap" in the command line, a series of options and parameters used to configure different aspects of Nmap scanning will be showed. Here are some common options and their functions:

1) Target Specification: nmap [Scan Type] [Options] {target specification}

2) Host Discovery:

- -sn: Perform host discovery only, without port scanning.
- -Pn: Skip host discovery and proceed directly to port scanning.

3) Scan Techniques:

- -sS: TCP SYN scan (half-open scan).
- -sT: TCP connect scan.
- -sU: UDP scan.
- -sF, -sX: FIN and Xmas scans.
- -sA: ACK scan.
- -sP: Ping scan.
- -sN, -sF, -sX: NULL, FIN, and Xmas scans.

4) Port Specification and Scan Order:

- -p <port ranges>: Specify the range of ports to scan.
- -p-: Scan all 65535 ports.
- --top-ports <number>: Scan the most common ports.

5) Output Options:

- -oN <file>: Save results to a file (plain text format).
- -oX <file>: Save results in XML format.
- -oG <file>: Save results in script-friendly format.

6) Timing and Performance:

- -T<0-5>: Set the scanning speed, 0 being the slowest, 5 the fastest.
- --min-hostgroup <size>: Set the minimum host group size.
- --max-hostgroup <size>: Set the maximum host group size.

7) Scripting:

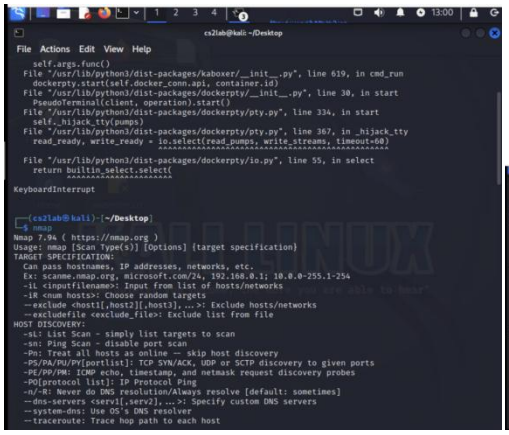
- --script <script>: Run specific Nmap scripts.
- --script-args <args>: Pass arguments to scripts.

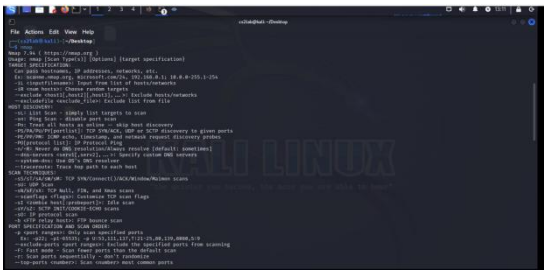
8) Aggressive Scan Options:

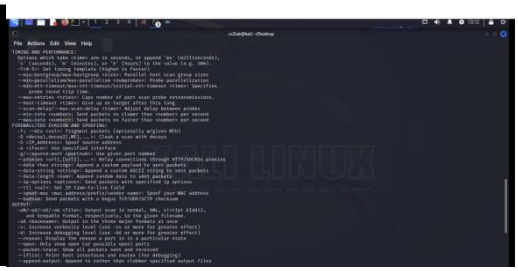
- -A: Enable OS detection, version detection, script scanning, etc.

9) Firewall/IDS Evasion and Spoofing:

- -f: Use fragmented IP packets.
- --spoof-mac <mac address>: Spoof the target using the specified MAC address.







3. Scanning Virtual Machines by Nmap

Windows VM

Enter command *'sudo nmap report for 10.11.202.104'* to start the scanning

Linux VM

Enter command ‘sudo *nmap report for 10.11.202.189’* to start the scanning

Metasploitable

Enter command ‘sudo *nmap report for 10.11.202.15’* to start the scanning

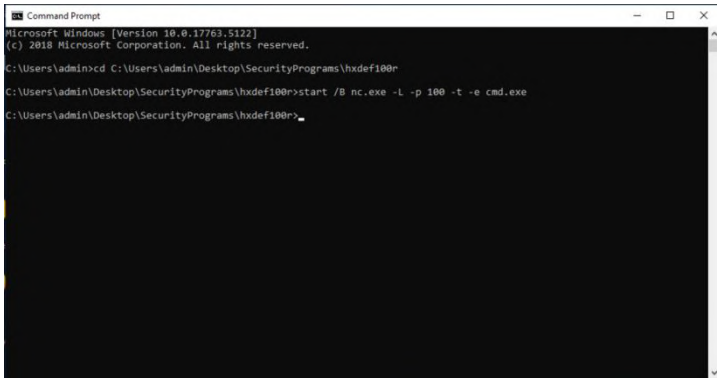
Reflections: Comparison of scanning results between Windows VM and Linux VM

In the comparison of the scanning results between the Windows VM and Linux VM using the Zenmap tool, both hosts for the Windows VM and Linux VM are found to be active. Notably, the Windows VM displays four open ports, while the Linux VM shows no scanned ports, with all ports are in an ignored state.

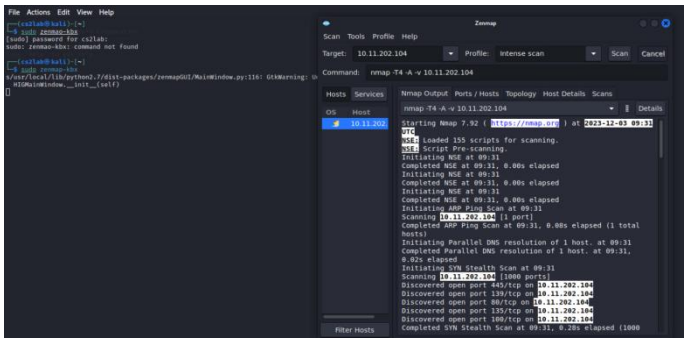
On the one hand, the presence of open ports in the Windows VM suggests potential vulnerabilities that could be exploited. On the other hand, the Linux VM, with all ports in an ignored state, may indicate a more restrictive and potentially secure configuration.

4. Scanning Windows VM with an “nc.exe” backdoor

Open the backdoor on the Windows VM: Enter *C:\Users\admin\Desktop\SecurityPrograms\hxdef100r* to direct to the file. Then enter the following command: *start /B nc.exe -L -p 100 -t -e cmd.exe to* open the backdoor.

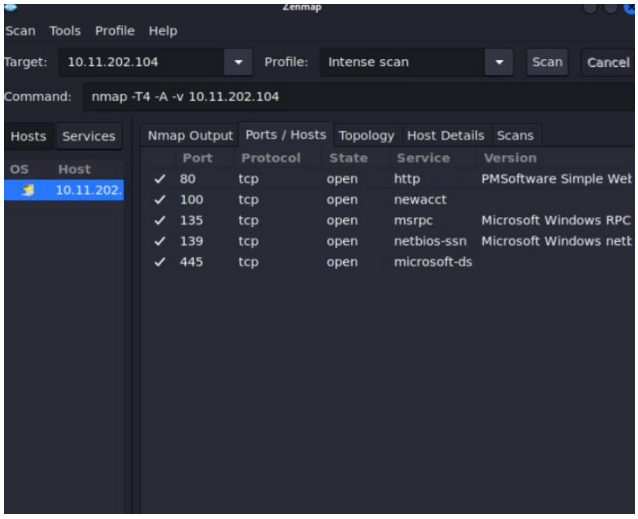


Scanning Windows VM with an “nc.exe” backdoor: Enter the ip address of the Windows VM(10.11.202.104) and start the intense scan.Then the scanning results are displayed.



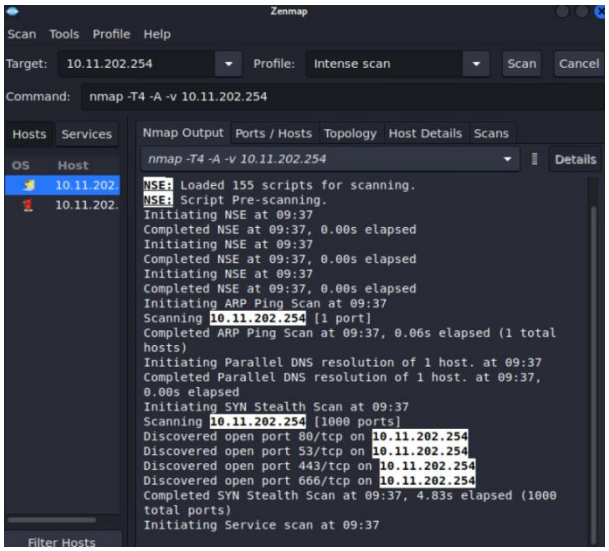
Reflection

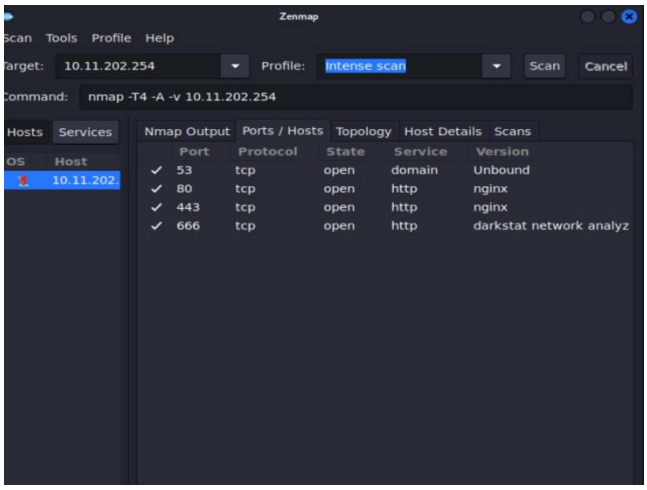
In contrast to the scanning results before the open backdoor, which revealed the presence of 4 available ports, the current scanning results indicate an addition of a new port 100. This port is now associated with the service provided by "newacct," suggesting the successful execution of the scanning.



5. Scanning Firewall (the firewall is located at- 10.11.202.254)

Scanning the firewall: Enter the firewall address (10.11.202.254) and initiate the intensive scan. Subsequently, the scanning results are displayed.





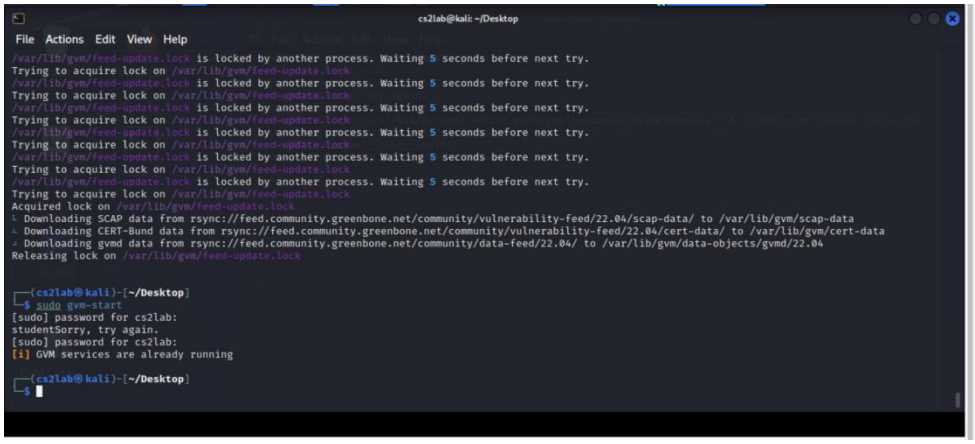
Reflection

During the intensive scan through the firewall, a total of four ports are discovered, all of which were found to be in the open state. Notably, Port 80, 443, and 666 are associated with the HTTP service, while Port 53 is dedicated to domain services. This information highlights the specific ports and services that are accessible through the firewall.

6. Greenbone Vulnerability Management (GVM) [OpenVAS]

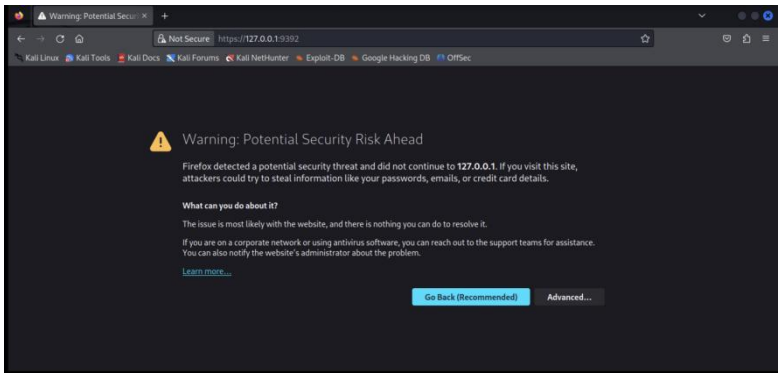
Setup the GVM configurations and Enter the following commands:

- sudo gvm-setup
- sudo gvm-check-setup
- sudo greenbone-feed-sync
- sudo gvm-start

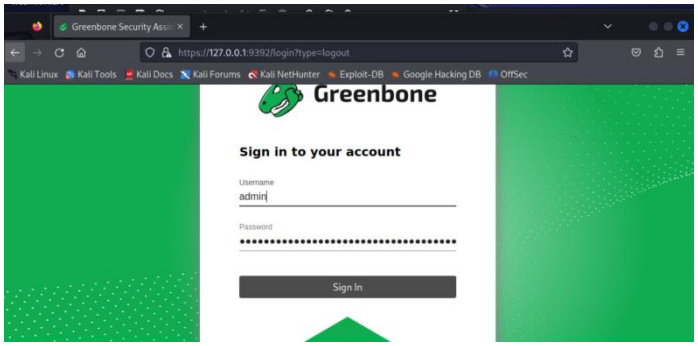


Access the Server URL: In the web browser, navigate to the following URL: https://127.0.0.1:9392

Ignore Certificate Warning : There is a certificate error and then ignore the warning and proceed to access the site.

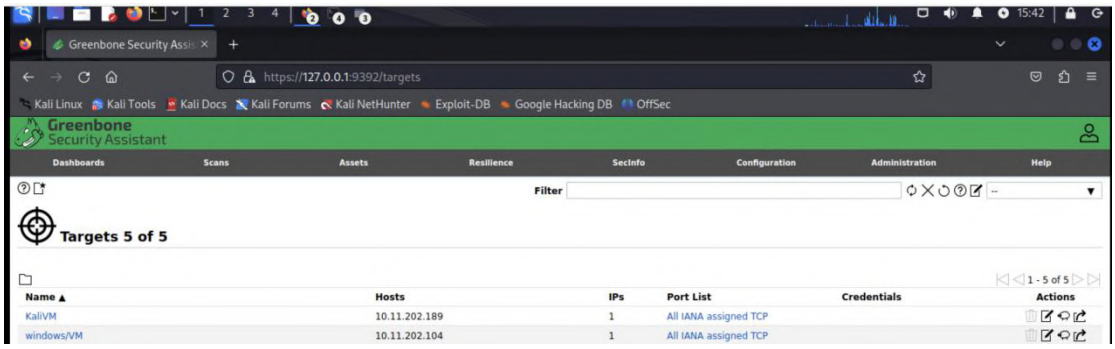


Login to GVM/OpenVAS: Open the file named GVM Credentials on the desktop to retrieve the necessary login information.Use the credentials to log in to the GVM/OpenVAS web interface.



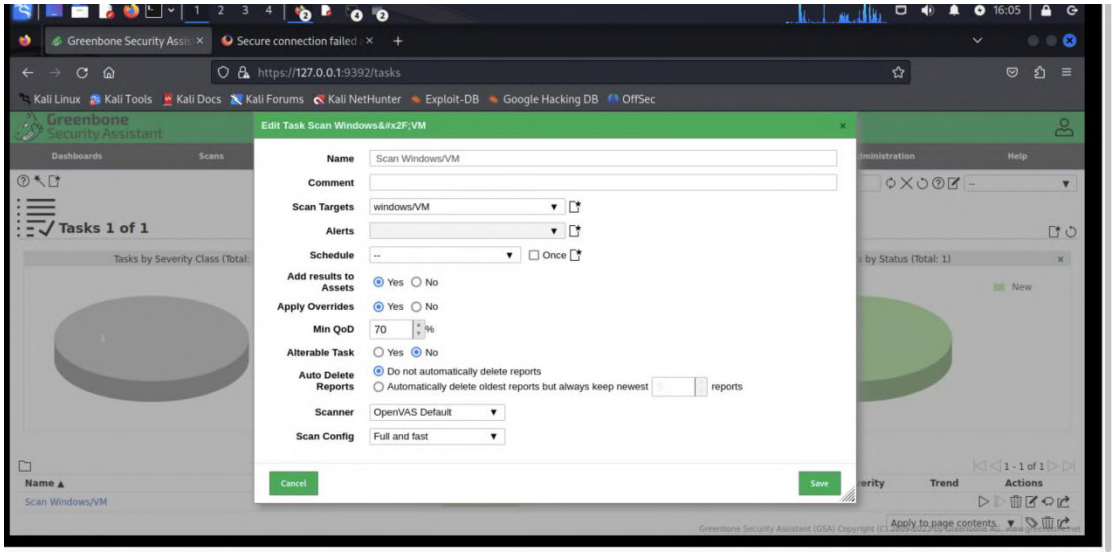
Create a Target:

- Go to Configuration > Targets.
- Click on "New Target" and name the scanning task.
- In the "Manual" section under the "Hosts" field, respectively add the IP address of the windows VM(10.11.202.104) and Kali Linux VM(10.11.202.189).
- Click "Save."



Create a Task:

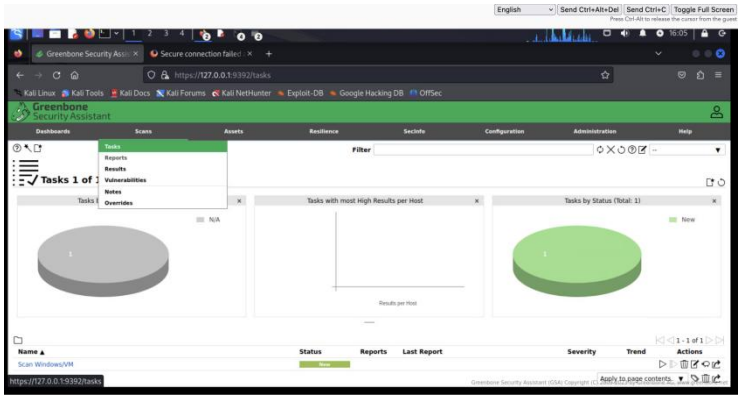
- Navigate to Scans > Tasks.
- Click on "New Task" at the top-left.
- Specify a name for the task, select the previously created scan target, and choose a defalut scan configuration.



- Review and set other options for the task.
- Click "Save."

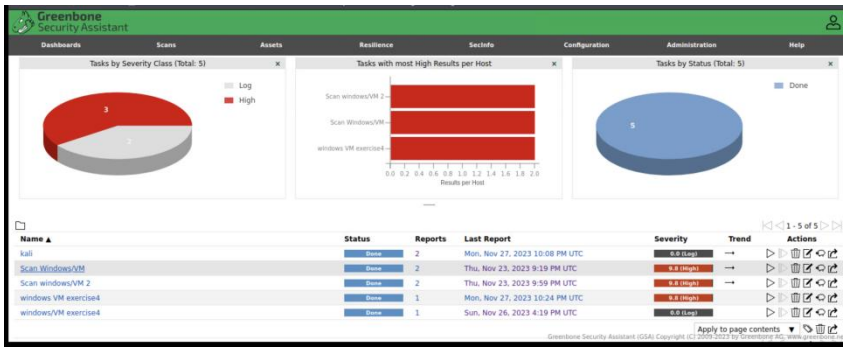
Start the Task:

- In the Tasks screen, locate the row for the newly created task.
- Click on the "Start" button.
- Wait for the status to change to "Requested," and then a progress bar should appear.



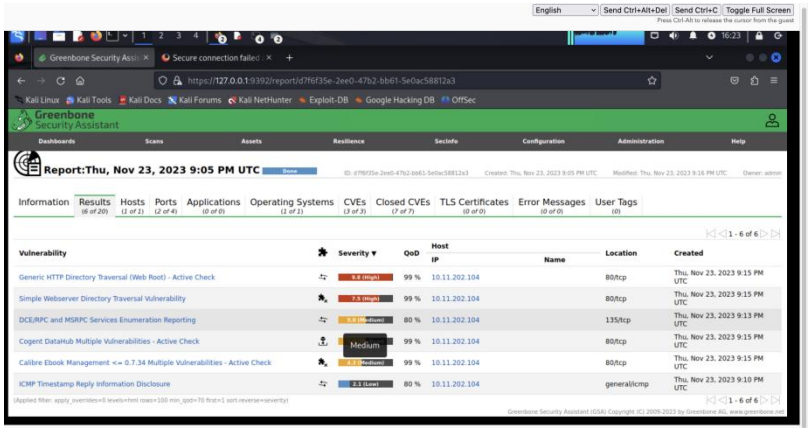
Monitor Task Progress:
Wait for the task to finish. The progress status may take some time depending on server resources and concurrent activities.

Check Task Status:
In the Tasks list, when the task is complete, the status bar will turn blue and indicate "Done."



View Report:
Click on the blue "Done" status bar to go to the report. Go through the respective tabs (Information, Results, Hosts, Ports, Applications, Operating Systems, CVE's, etc.) to identify key information.

- The report of windows VM
  You can observe all identified vulnerabilities from the scan, including Generic HTTP Directory Traversal (Web Root) - Active Check, Simple Webserver Directory Traversal Vulnerability, and ICMP Timestamp Reply Information Disclosure, along with their corresponding severity assessments.



Upon clicking on each vulnerability, you can access comprehensive details, encompassing detection results, detection methods, security impact, and recommended solutions for remediation. Taking Generic HTTP Directory Traversal (Web Root) - Active Check as an example, the report indicates that this vulnerability may lead to consequences such as the disclosure of confidential information and potential arbitrary code execution.

Detection Result

```
The following affected URL(s) were found (limited to 3 results):

Vulnerable URL: http://10.11.202.104/../../../../../../windows/win.ini

Request:
GET /../../../../../../windows/win.ini HTTP/1.1
Connection: Close
Host: 10.11.202.104
Pragma: no-cache
Cache-Control: no-cache
User-Agent: Mozilla/5.0 [en] (X11, U; OpenVAS-VT 22.7.5)
Accept: image/gif, image/x-xbitmap, image/jpeg, image/pjpeg, image/png, */*
Accept-Language: en
Accept-Charset: iso-8859-1,*,utf-8

Response:
HTTP/1.1 400 Bad Request
Server: PMSoftware-SWS/2.2
Date: Thu, 28 Nov 2023 20:54:34 GMT
Connection: close
```

Impact

Successfully exploiting this issue may allow an attacker to access paths and directories that should normally not be accessible by a user. This can result in effects ranging from disclosure of confidential information to arbitrary code execution.

Solution

Solution Type: Mitigation
Contact the vendor for a solution.

Detection Method

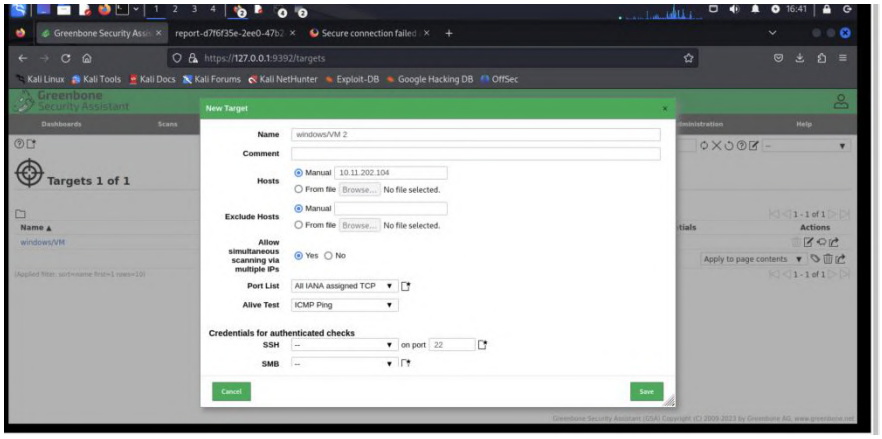
Sends various crafted HTTP requests to the web root of the remote web server and checks the responses.

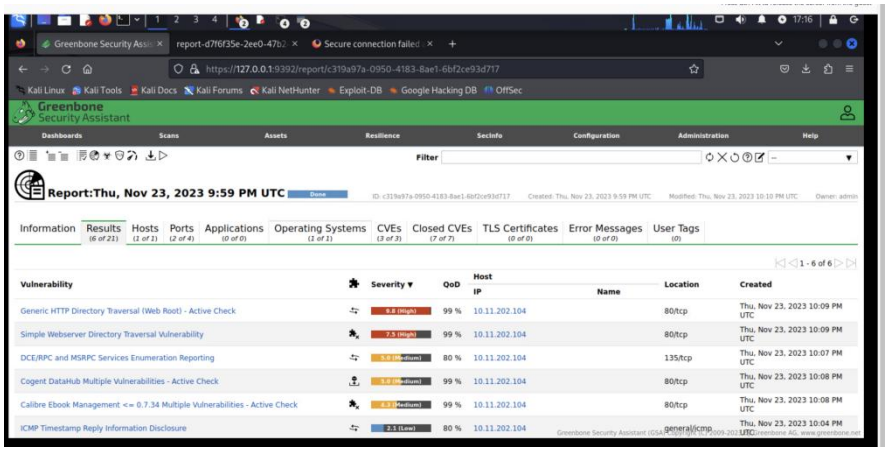
Details: Generic HTTP Directory Traversal (Web Root) - Active Check OID: 1.3.6.1.4.1.25623.1.0.106756

Version used: 2023-11-03T05:05:46Z

- The report of windows VM 2
  The configuration in Alive test is changed from Scan Config Default to ICMP Ping and the

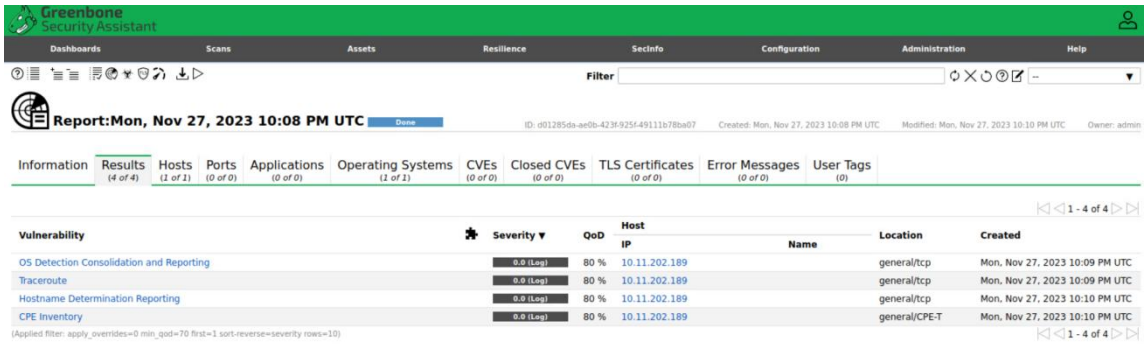
got the same results as the previous one.





- The report of windows Kali Linux VM

  All identified vulnerabilities, including OS Detection Consolidation and Reporting, Traceroute, Hostname Determination Reporting, and CPE Inventory, can be observed from the scan, along with their corresponding severity at level 0.



- The report of Metasploitable

In the results of scanning Metasploitable, a higher number of vulnerabilities with elevated severity levels is evident compared to Windows and Kali Linux. This suggests a lower security status, posing a substantial risk to the confidentiality, integrity, and availability of information.

Information | Results (69 of 593) | Hosts (1 of 1) | Ports (20 of 23) | Applications (16 of 16) | Operating Systems (1 of 1) | CVEs (34 of 34) | Closed CVEs (0 of 0) | TLS Certificates (2 of 2) | Error Messages (0 of 0) | User Tags (0)

Vulnerability	Severity ▾	QoD	Host IP
Operating System (OS) End of Life (EOL) Detection	10.0 (High)	80 %	10.11.202.15
Distributed Ruby (dRuby/DRb) Multiple Remote Code Execution Vulnerabilities	10.0 (High)	99 %	10.11.202.15
Possible Backdoor: Ingreslock	10.0 (High)	99 %	10.11.202.15
rlogin Passwordless Login	10.0 (High)	80 %	10.11.202.15
TWiki XSS and Command Execution Vulnerabilities	10.0 (High)	80 %	10.11.202.15
The rexec service is running	10.0 (High)	80 %	10.11.202.15
Apache Tomcat AJP RCE Vulnerability (Ghostcat)	9.8 (High)	99 %	10.11.202.15
MySQL / MariaDB Default Credentials (MySQL Protocol)	9.8 (High)	95 %	10.11.202.15
DistCC RCE Vulnerability (CVE-2004-2687)	9.3 (High)	99 %	10.11.202.15
VNC Brute Force Login	9.0 (High)	95 %	10.11.202.15
PostgreSQL Default Credentials (PostgreSQL Protocol)	9.0 (High)	99 %	10.11.202.15
UnrealIRCd Authentication Spoofing Vulnerability	8.1 (High)	80 %	10.11.202.15
PHP-CGI-based setups vulnerability when parsing query string parameters from php files.	7.5 (High)	95 %	10.11.202.15
FTP Brute Force Logins Reporting	7.5 (High)	95 %	10.11.202.15
FTP Brute Force Logins Reporting	7.5 (High)	95 %	10.11.202.15
Java RMI Server Insecure Default Configuration RCE Vulnerability	7.5 (High)	95 %	10.11.202.15
UnrealIRCd Backdoor	7.5 (High)	70 %	10.11.202.15
vsftpd Compromised Source Packages Backdoor Vulnerability	7.5 (High)	99 %	10.11.202.15
vsftpd Compromised Source Packages Backdoor Vulnerability	7.5 (High)	99 %	10.11.202.15
phpinfo() output Reporting	7.5 (High)	80 %	10.11.202.15
The rlogin service is running	7.5 (High)	80 %	10.11.202.15
rsh Unencrypted Cleartext Login	7.5 (High)	80 %	10.11.202.15

- Reflection: Comparison between Kali and Windows and Metasploitable

In the context of a vulnerability scan using Greenbone, vulnerabilities with severity levels of 0 are generally considered low-risk or benign, and they may not require immediate attention or remediation. While higher severity levels (e.g., 4 or 5) typically indicate more critical security issues that should be addressed promptly to enhance the overall security posture of the system.

An analysis of vulnerability severity levels reveals significant disparities among Kali, Windows, and Metasploitable. There are no scanned vulnerabilities with higher severity levels in the Kali Linux VM; only a few vulnerabilities at level 0 were found. In the Windows VM, there are two vulnerabilities with high severity, along with some at medium and low levels. Moreover, there are quite a lot of high-severity vulnerabilities in Metasploitable, indicating an urgent need to promptly address those critical security issues.

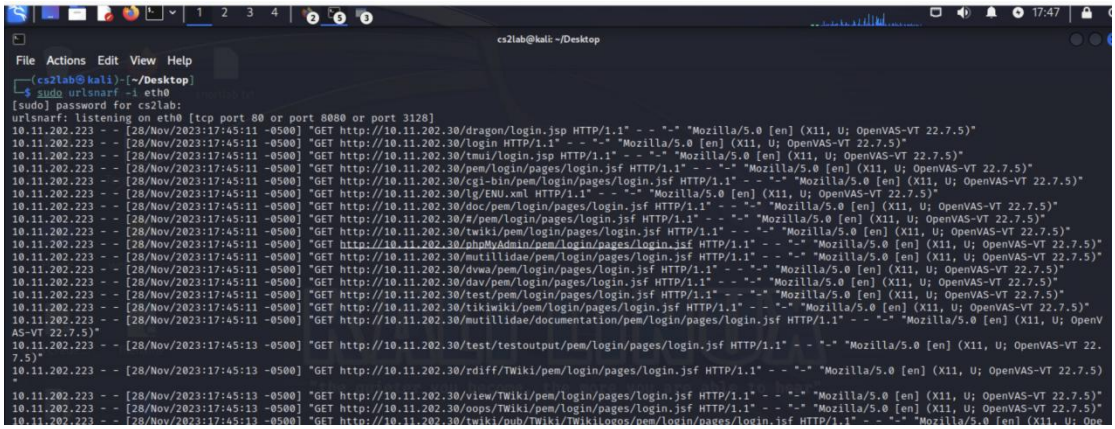
In summary, the security levels ascend from Metasploitable to Windows and further to Kali. This comparison underscores the varying degrees of vulnerability across the three systems, emphasizing the urgency in addressing and mitigating security risks in accordance with their severity levels.

Exercise 2: Utilising sniffer tools

1. Urlsnarf

Firstly, we log in to the Kali VM and use the 'ifconfig' command to obtain the IP address, which is 10.11.203.189.", and obtain the network interface eth0 of our Kali VM.

In a root shell enter, we enter "*sudo urlsnarf –i eth0*" to start the program, then we can see that urlsnarf will start monitoring network traffic on the specified interface and capture and display HTTP GET requests in real time. If we visit a website using a web browser on our VM at this time, we will see the URL of the website we visited. In order to proceed with the subsequent steps, we send Ctrl+C to pause running urlsnarf.



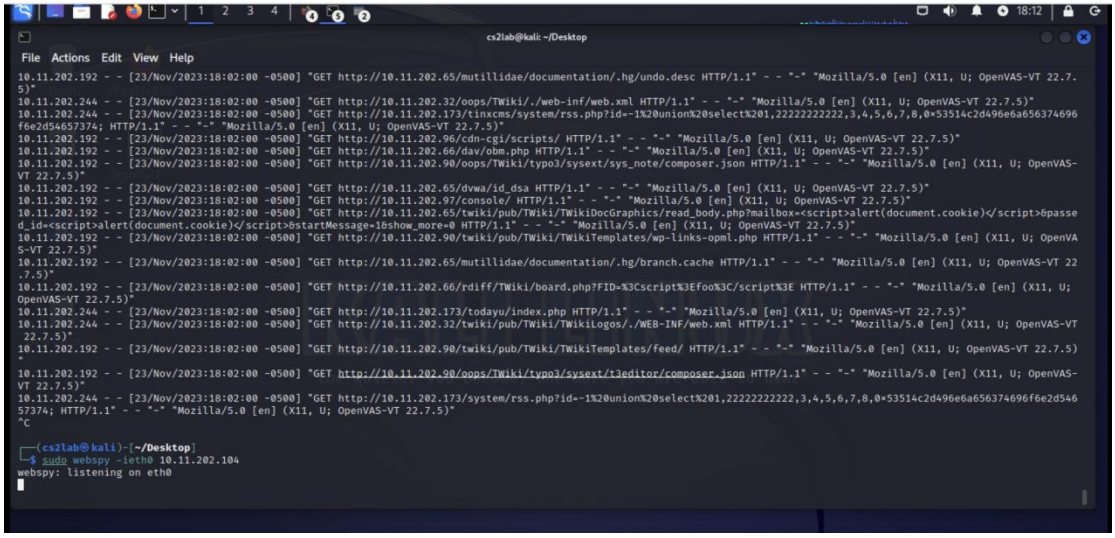
Reflection

In this experiment, we use the tool urlsnarf for network monitoring and capturing HTTP requests.This showcased the tool's capability to intercept unencrypted HTTP traffic and extract information such as requested URLs, methods, and source IP addresses. We can see the vulnerability of unsecured communication over the network. This capability highlights potential confidentiality (Bishop) risks, as sensitive information exchanged over HTTP might be exposed. So, we may need secure protocols like HTTPS to protect data in transit.

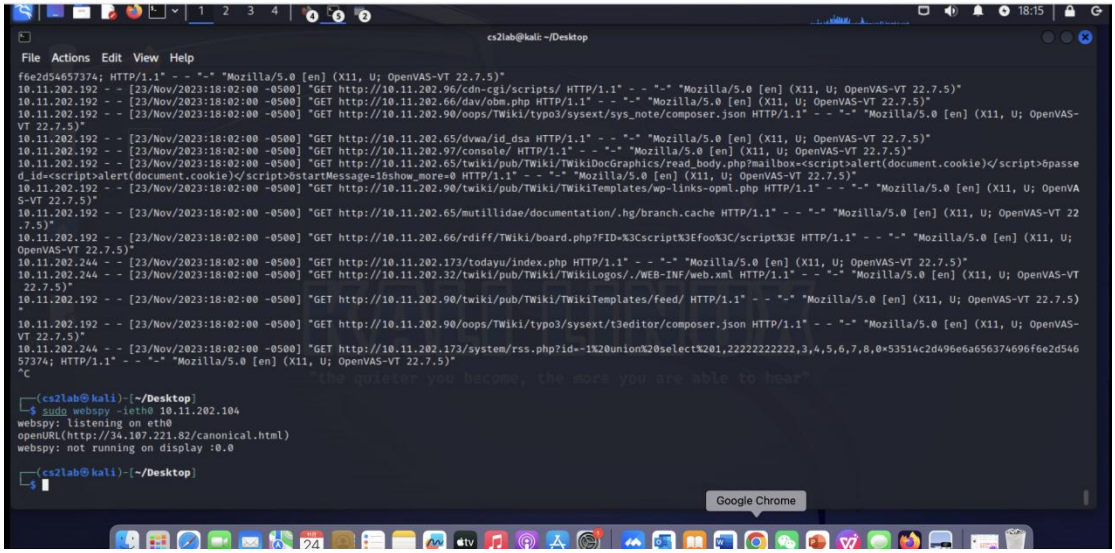
2. Webspy

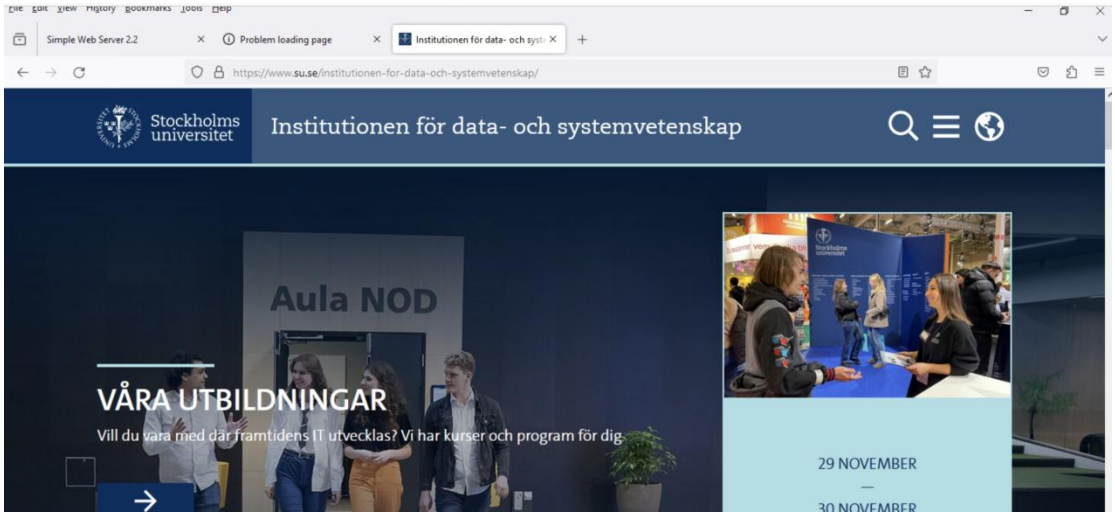
We start Firefox on the Kali Linux VM and hide it temporarily, then we start Firefox/Explorer on the Windows VM. Then we enter the Kali terminal command shell and enter "*sudo webspy –ieth0 10.11.202.104*" (10.11.202.104 is our Windows IP) . We can observe that

webspy has commenced monitoring the activities of the Windows virtual machine's IP



After that, we open the SU homepage(http://34.107.221.82/canoical.html) on the windows VM Firefox. Afterward, in the Kali Linux Terminal Emulator, we observe that webspy has captured the IP addresses of the websites accessed by the Windows VM upon login."





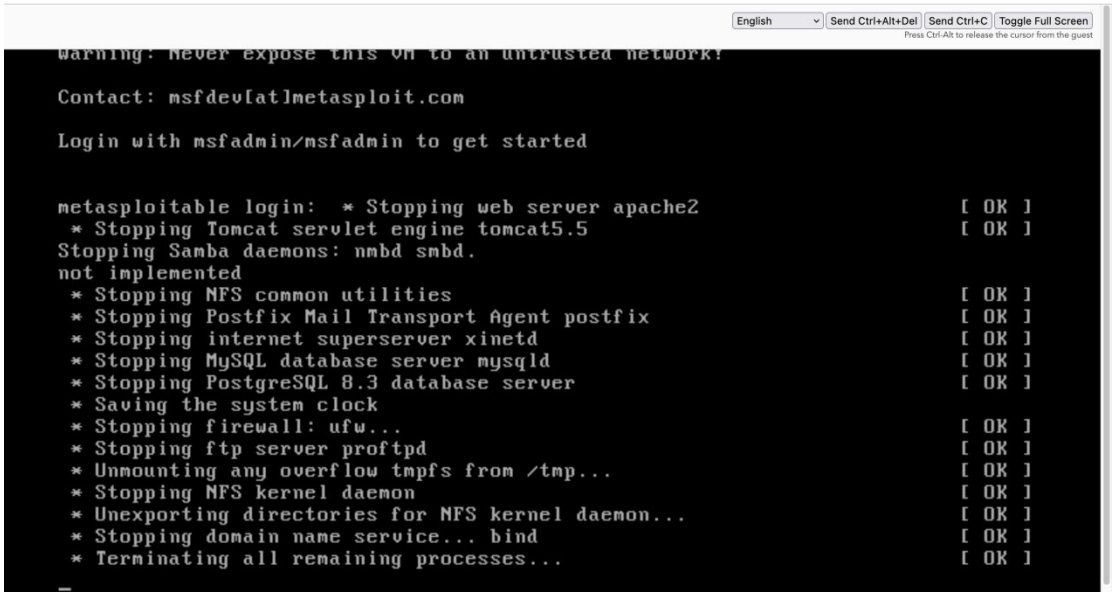
Reflection

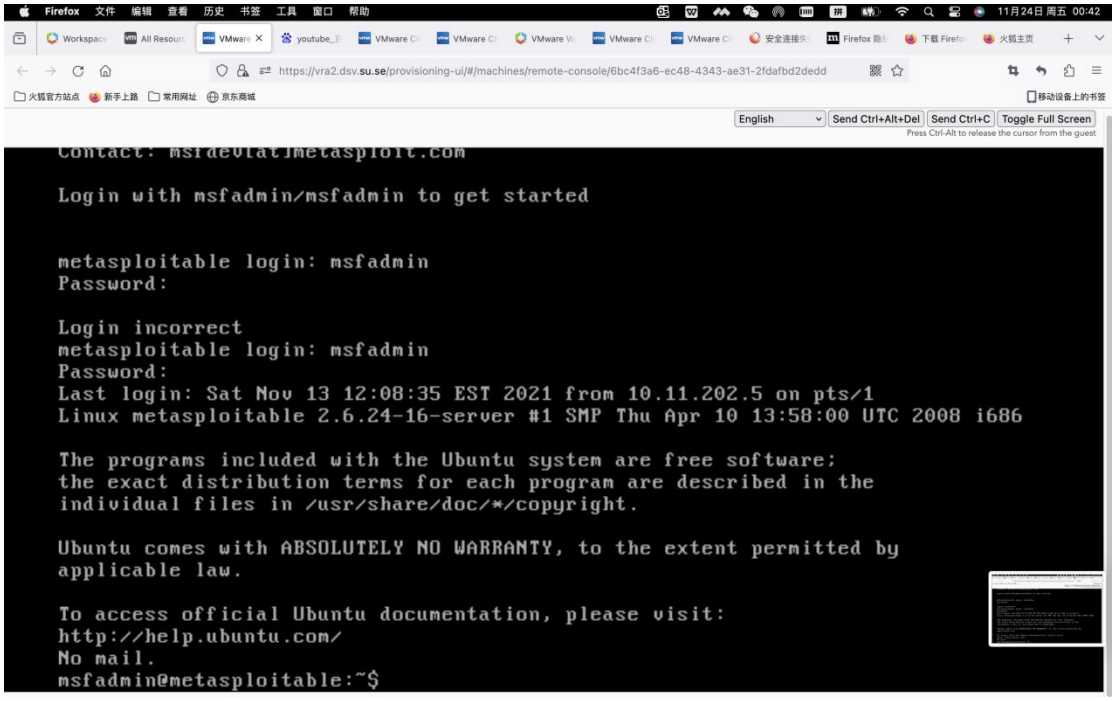
Webspy can capture and display details such as URL, target IP, port, and protocol in real time, enabling visualization of web activities occurring on Windows VM. When we monitor network traffic, Webspy can track and record users' activities on the network, including the websites they visit, the protocols they use, and the destination of their communications. When using tools like Webspy, it is essential to ensure that network monitoring activities are legal. Adhering to the principle of least privilege (Bishop), we should only gather and utilize necessary information for legitimate monitoring purposes and avoid excessive data collection.

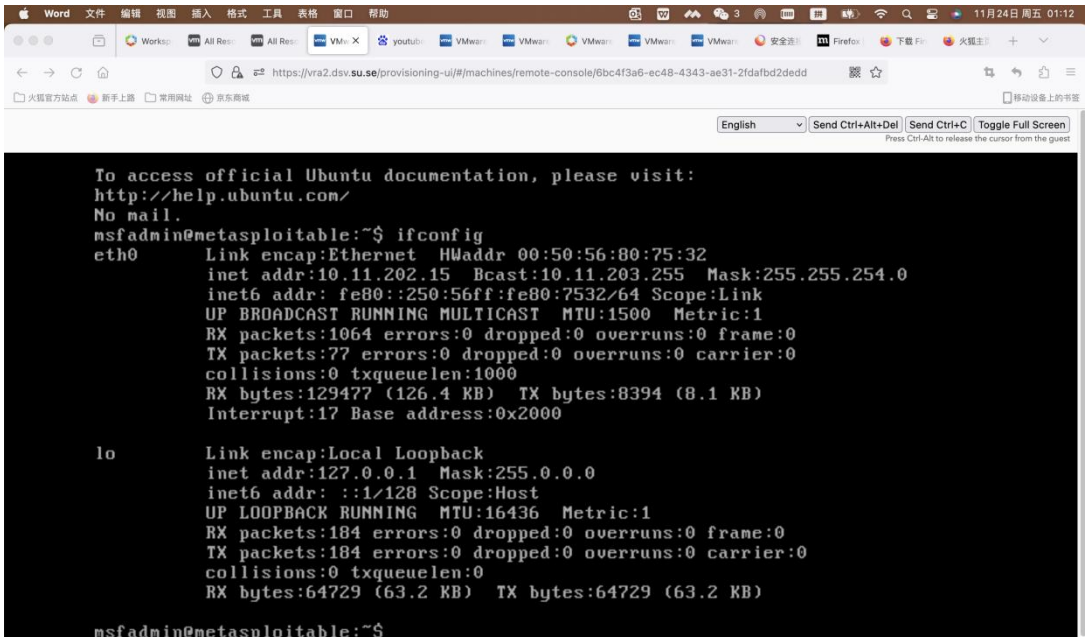
3. **Dsniff**

First, we enter "*sudo dsniff*" in the root shell of the computer to start dsniff.

In order to proceed with the subsequent steps, we now log in to Metasploitable and enter ifconfig on the command. We can get the IP 10.11.202.15 and network interface eth0 of Metasploitable.

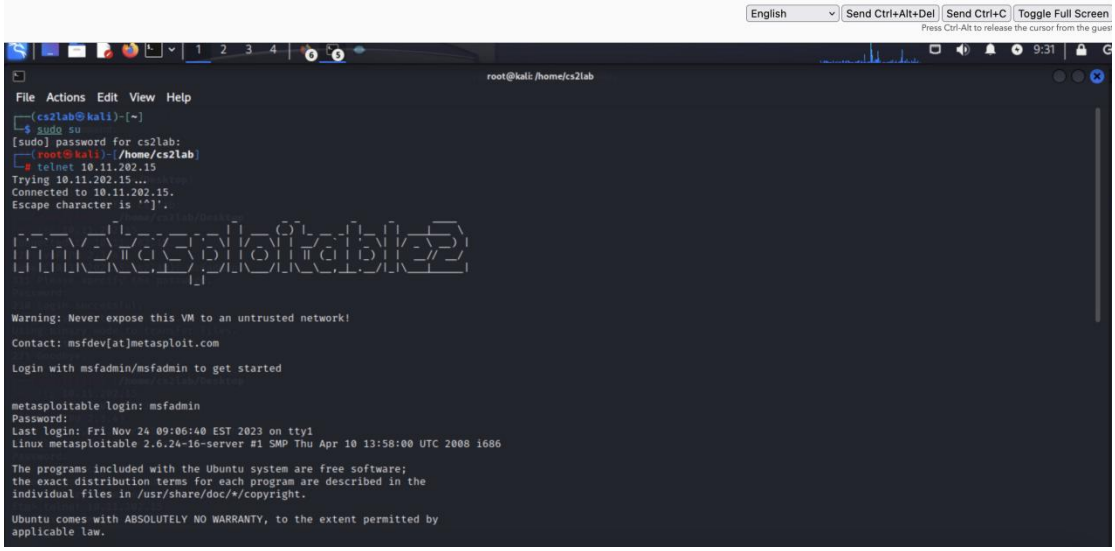




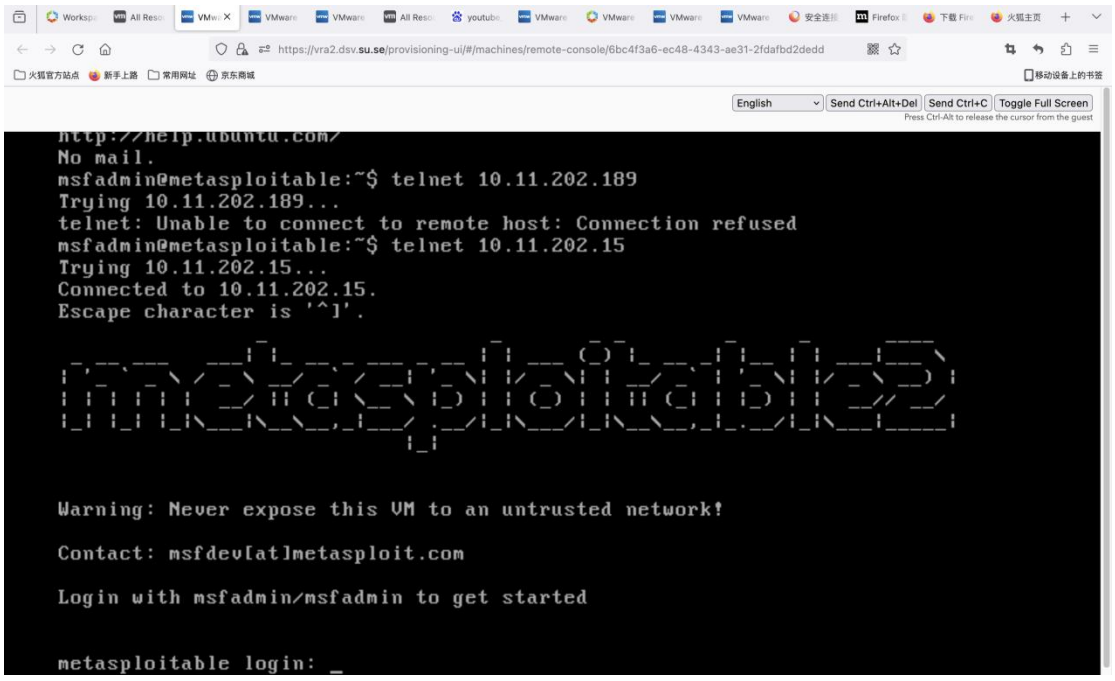


We return to the Kali VM and open a new root shell. We login to the ftp server by typing ftp 10.11.202.15 and enter our Metasploitable account(msfadmin) and password (msfadmin) in the terminal. We can see information related to the FTP login in the terminal, including the login credentials.

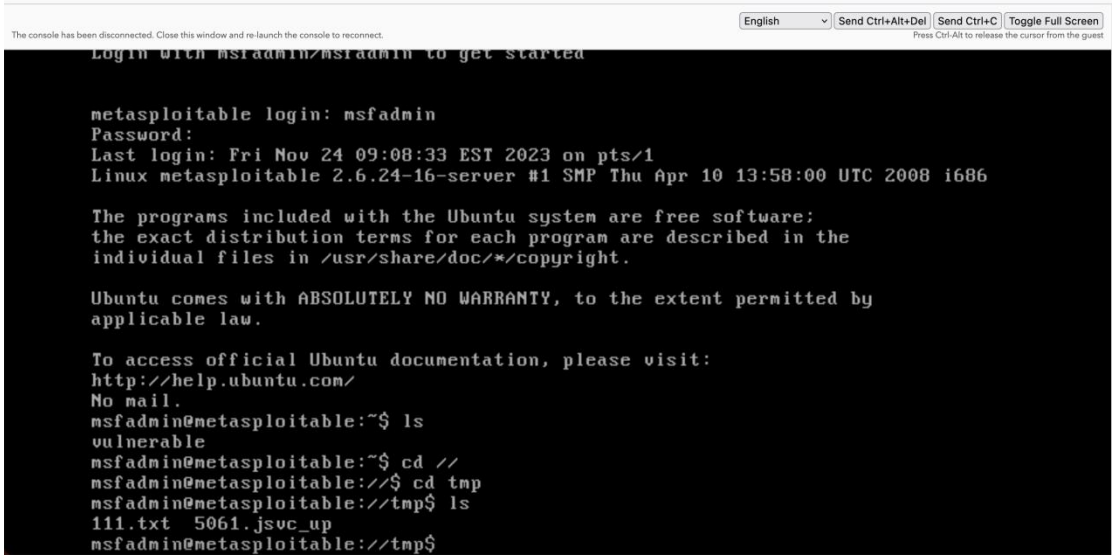
We open a new roll shell and enter “*sudo su*” in the root shell of kali. After root@kali appears, we enter telnet 10.11.202.15(Metasploitable VM IP) We try to connect via Telnet to the target machine with IP address 10.11.202.15. We are remotely connected to the Metasploitable VM and are ready to perform some operations or gain access to the system.

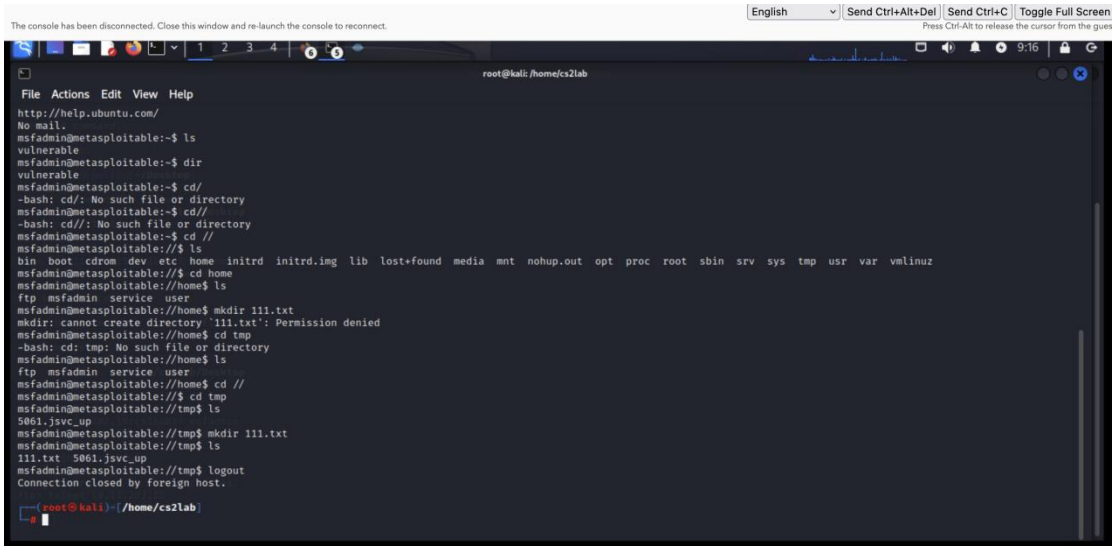


Now we login to the (Metasploitable) telnet server with telnet 10.11.202.15. We see the login prompt for the Metasploitable system and enter our username and password as required.



When we perform some commands and operations in Metasploitable (for example, use the ls command to view the file list), the output of these commands and operations will be displayed in the Kali Linux VM terminal (for example, we view 111.txt and 5061.jsvc_up). Since we are connected through Telnet to Metasploitable, all input and output will be transmitted through Telnet and visible in the Kali Linux VM terminal.



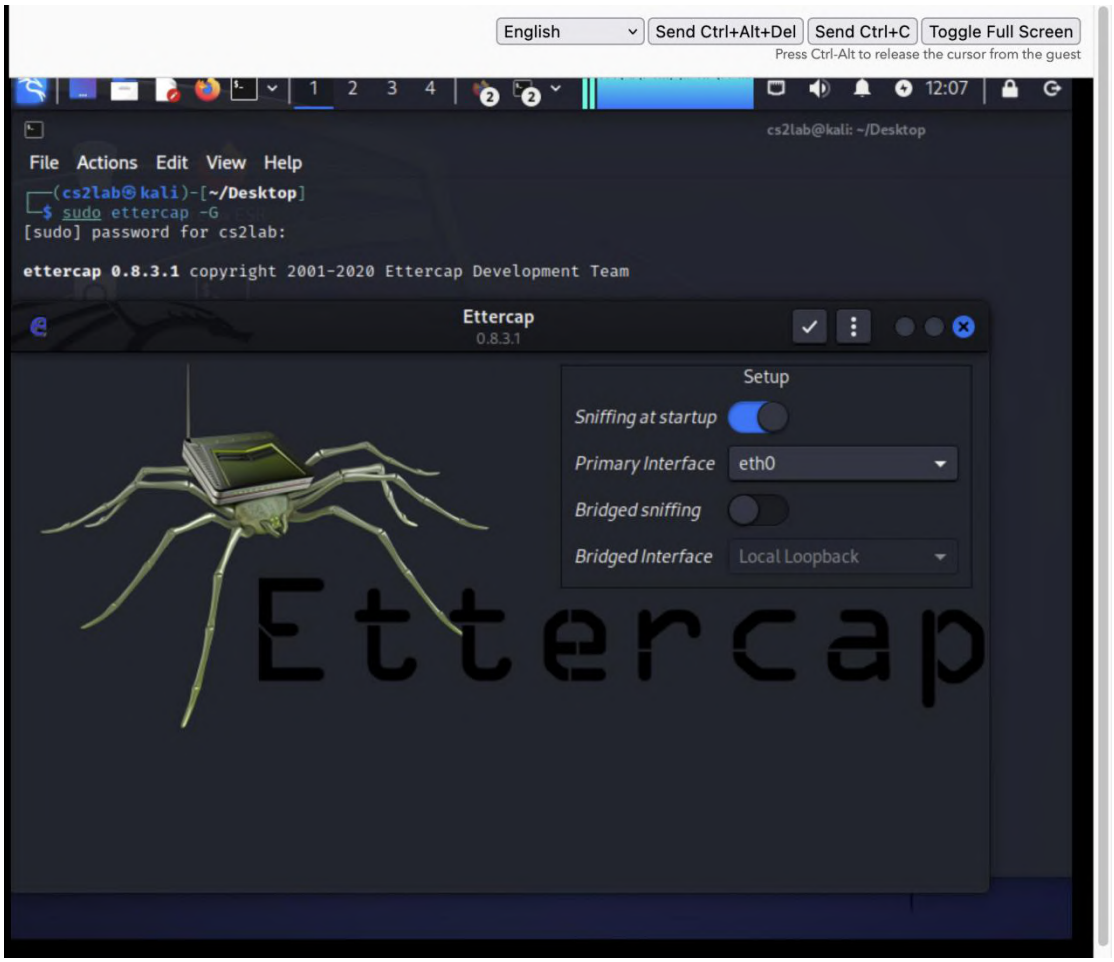


Reflection

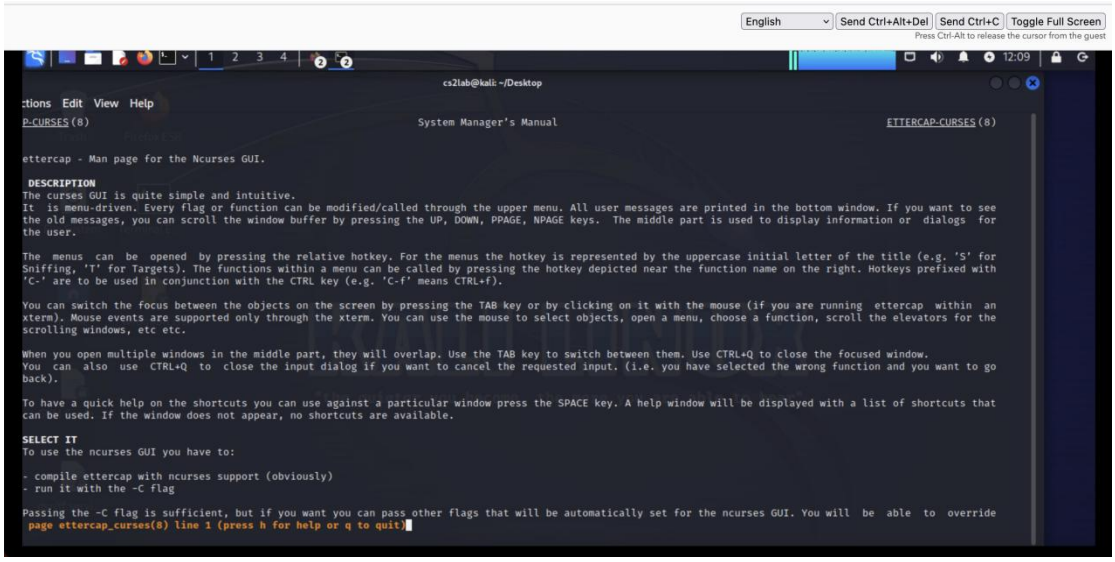
Using Dsniff allows us to view and control command execution on the target system (Metasploitable) connected via Telnet on the attacker's machine (Kali Linux). By logging into the FTP server and Telnet server, we simulated the scenario of user authentication in the experiment, and discovered the risk that user authentication information may be intercepted by attackers in an unsecured network. This highlights the need to ensure effective authentication mechanisms (Bishop) and the use of secure transport protocols.

4. Ettercap

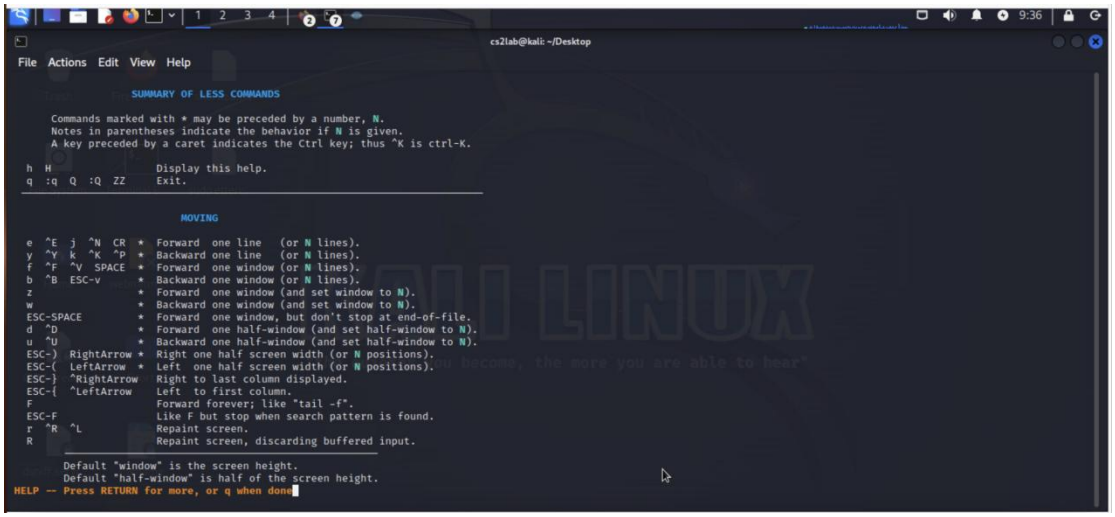
When we enter the command "*sudo ettercap -G*" in the kali linux VM terminal window to start Ettercap, because the option tells Ettercap to use GTK2 GUI (graphical user interface), therefore, Ettercap's graphical user interface will be started and displayed in the terminal window. We can see Ettercap's main interface, which contains various tools, options, and menus.



We continue to enter "*man errercap_curses*" in the terminal, we can see the manual page, which is the documentation or instructions, for Ettercap's Ncurses interface. The document provides a general overview of Ettercap's Ncurses GUI. It describes the simplicity and intuitiveness of the menu-driven interface, how to navigate and interact with windows, open menus, and use hotkeys. It also covers window management, focusing on overlapping windows, and provides a quick help feature for shortcuts.



We follow the prompts and enter h after page Ettercap_curses(8) line 1 (press h for help or q to quit). The help information of the Ettercap tool will be displayed. This is the help page for Ettercap, showing a summary of some of the commands and keyboard shortcuts available in the Ettercap command line interface. These commands and shortcuts are used to move, navigate, redraw the screen, and more in Ettercap's command line interface.



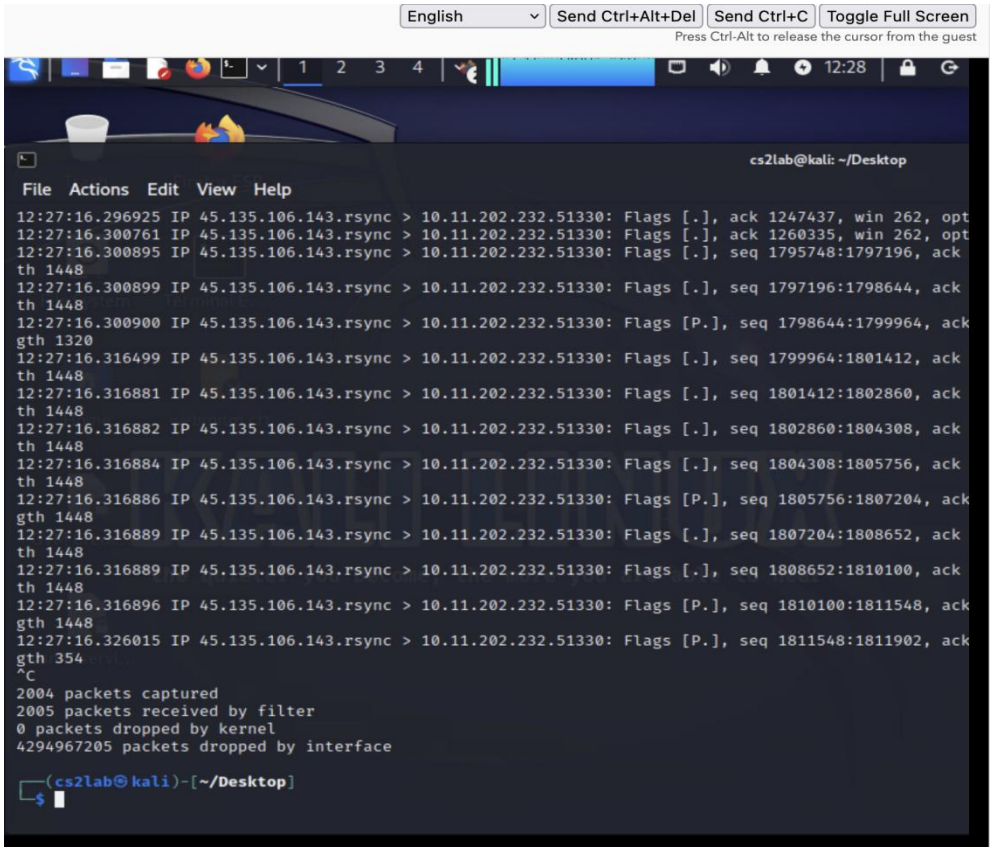
Reflection

Ettercap is a network security tool mainly used for Man-in-the-Middle Attacks. Ettercap may be used to steal sensitive information from network traffic, such as usernames, passwords, etc., which violates confidentiality. The use of Ettercap may lead to data tampering, thus violating the Integrity (Bishop). Unauthorized use of Ettercap may result in unauthorized access to systems and data, which violates the principle of authorization (Bishop).

Exercise 3. Analysing network traffic

1. Tcpdump

Run tcpdump Command: Enter the command "*sudo tcpdump -i eth0*" in the shell and pause by sending Ctrl+C, halting the ongoing process.

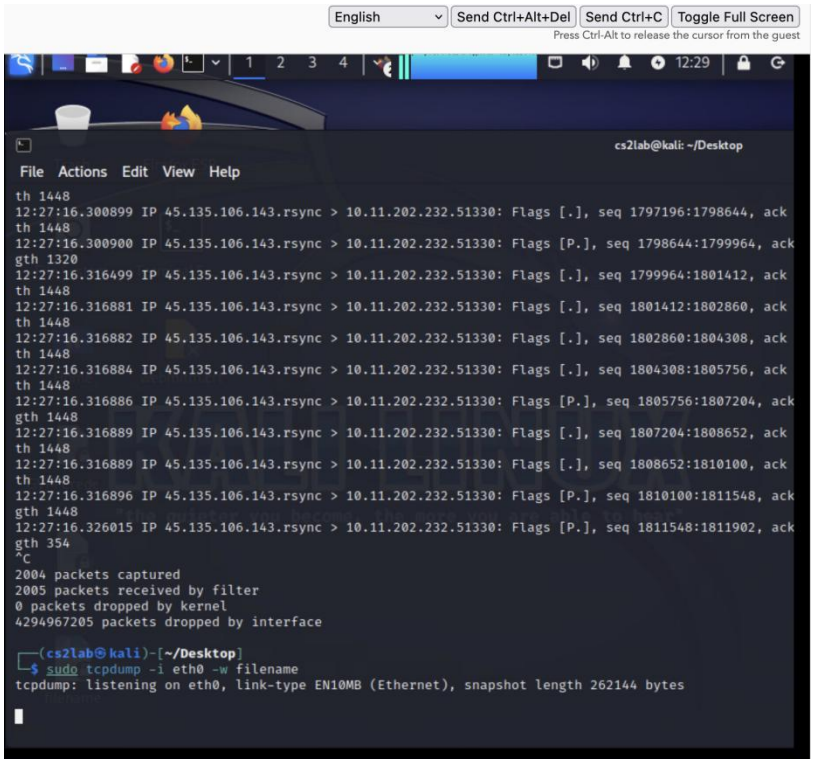


Reflections

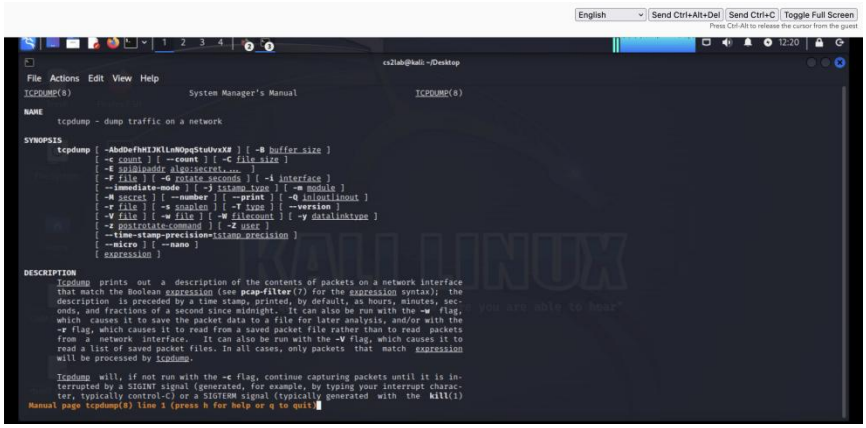
The operation begins with the initiation of packet capture by executing the "*sudo tcpdump -i eth0*" command in the shell. This command activates the tcpdump tool and collects information related to packets transmitted through the eth0 network interface. This gathered data encompasses details such as source and destination IP addresses, ports, protocols, and more.

Throughout the operation, real-time updates are integral to the process. The results continuously refresh in real-time, providing an up-to-date showcase of information pertaining to the captured packets. This dynamic display ensures that users can monitor and analyze the current state of the captured data as the operation progresses.

Save Packet Capture Information to File: Enter the command "*sudo tcpdump -i ethN -w filename*" to save the log information to a file named "filename." This step involves saving the previously paused network packet capture information to a file.

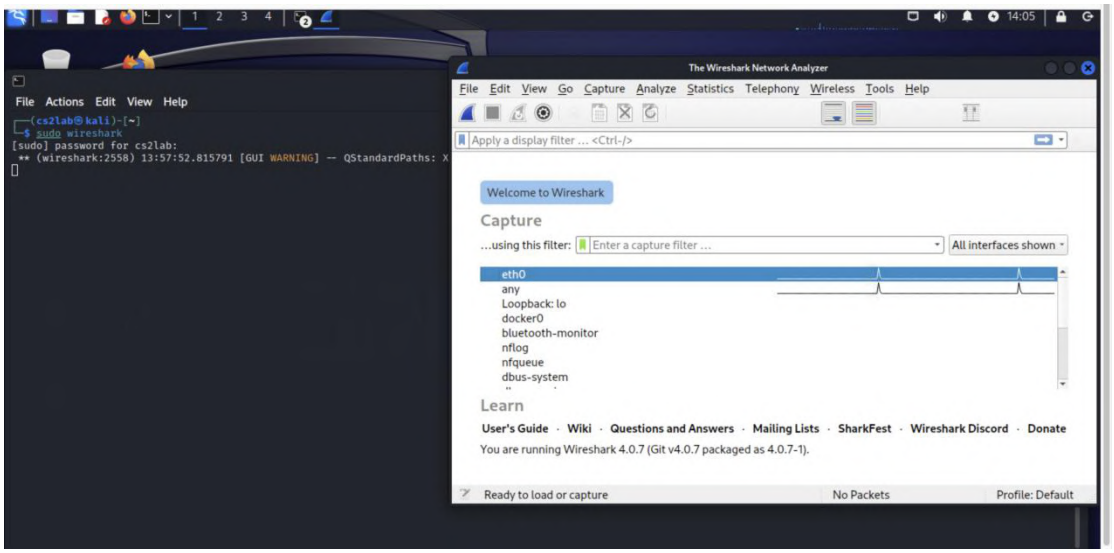


Access Tool Manual: Next, enter "sudo man tcpdump" in the command line. This command will display the manual page for the tcpdump tool. The manual page serves as a comprehensive document, offering information about the command, its usage, and relevant configuration options.

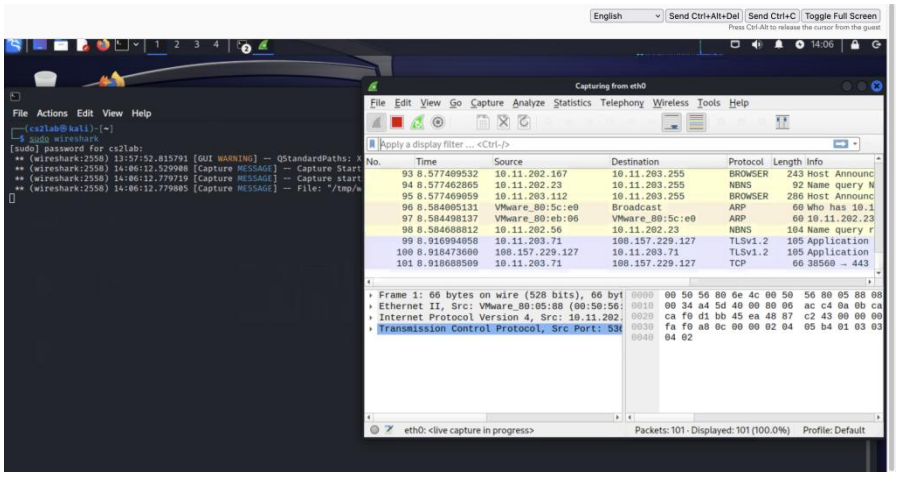


2. Wireshark

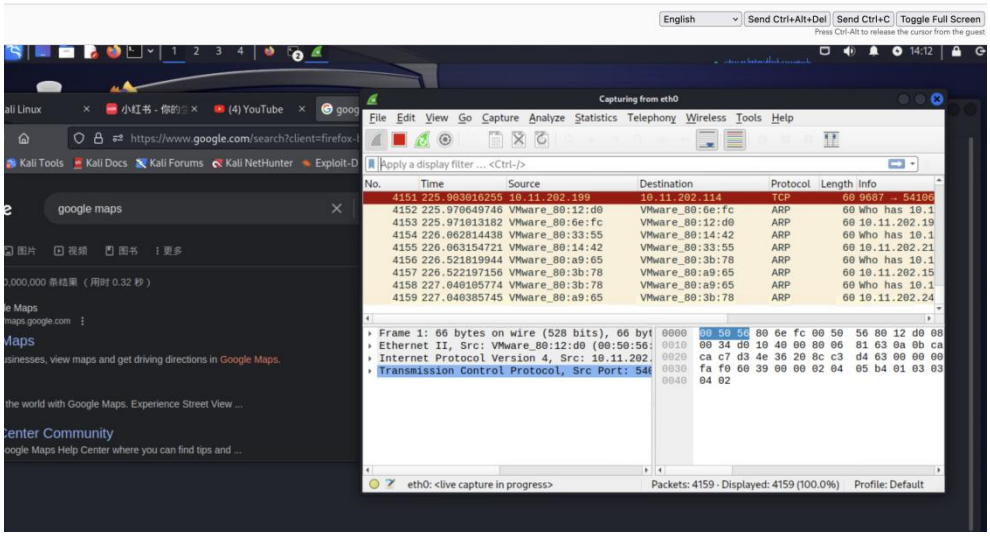
Initiate Wireshark: Start the Wireshark program by entering the command "*sudo wireshark*" in a non-root shell.



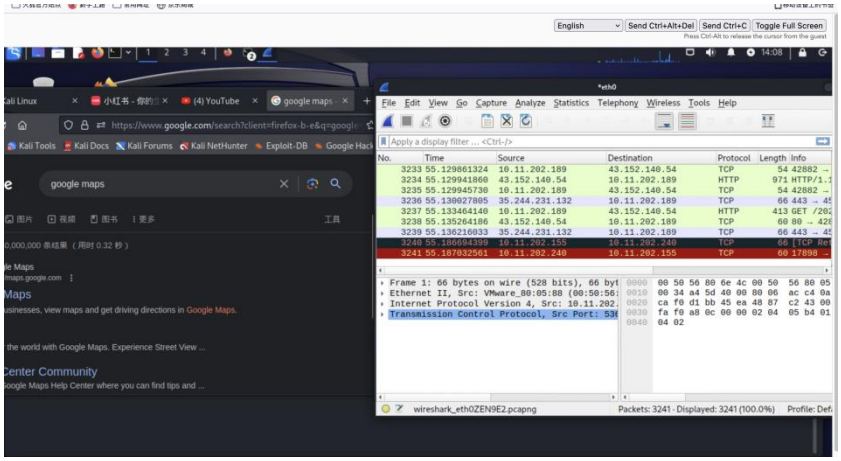
Select Network Interface: Select "eth0." to capture network traffic. Navigate to Capture > Start or use the Shark-fin icon/button to commence the capture. Wireshark begins monitoring traffic passing through the eth0 network interface.



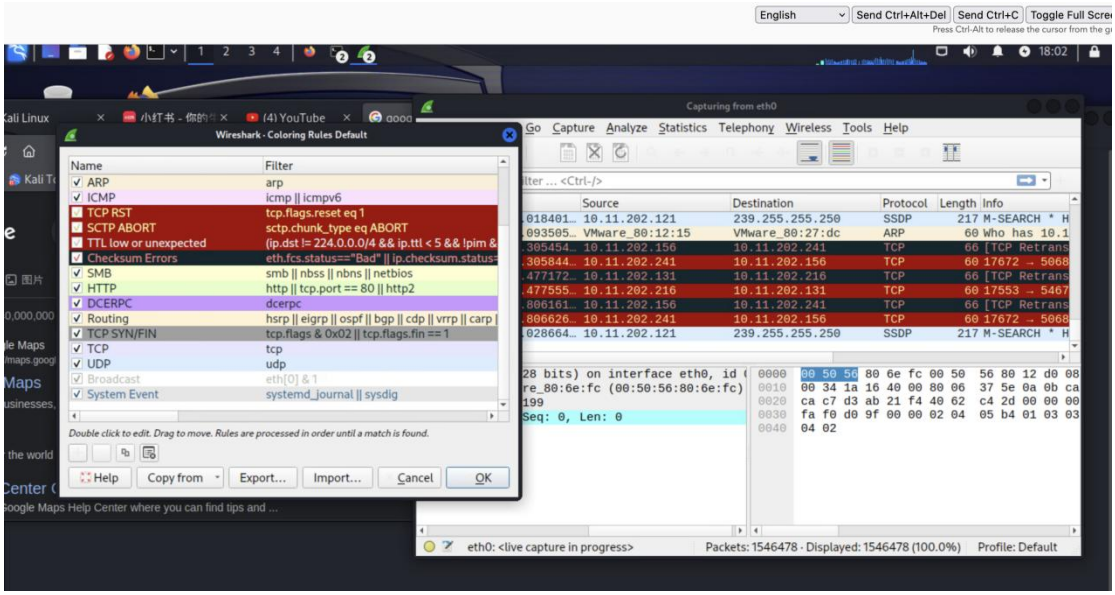
Generate Network Traffic: Use the web browser to visit a website, allowing network traffic to flow. Observe the ongoing capture.



Stop Capture and Observe: Stop the traffic capture by going to Capture > Stop. Examine the logged network traffic to gain insights into the captured data.



Analyze Logs: Check the logs to explore the information captured.

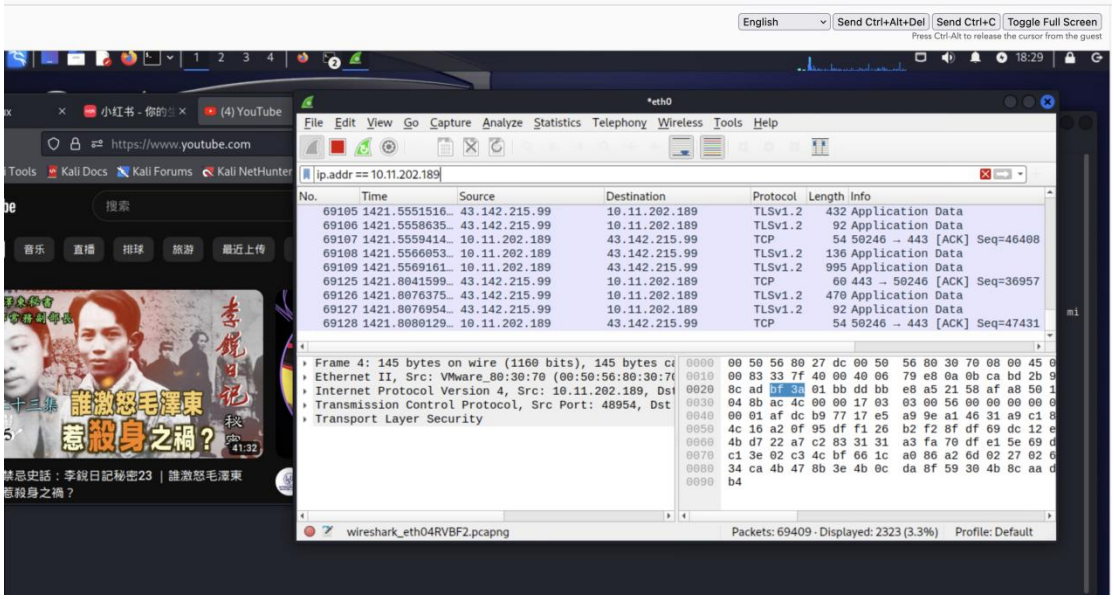


Refelction

When analyzing network traffic using Wireshark, each line of data packets is color-coded, the various colors correspond to different protocols and can be viewed in Wireshark's "View Coloring Rules." Here are some common colors and their meanings:

- Black: Typically used to denote unresolved or unsupported protocols.
- Blue: Represents TCP packets, encompassing common web traffic, file transfers, and more.
- Green: Indicates UDP packets, commonly used for audio/video streaming, DNS queries, etc.
- Red: Represents erroneous packets or those not adhering to protocol specifications.
- Light Blue: Represents DNS traffic.
- Yellow: Indicates ICMP traffic, commonly used for ping and traceroute activities.
- Purple: Represents ARP (Address Resolution Protocol) traffic.
- Gray: Represents other types of traffic, such as LLDP (Link Layer Discovery Protocol).

Filter the captured information: In the "Apply a Display Filter" section, enter a filtering condition, for example, ip.addr == 10.11.202.189 (local IP address). Click the right arrow "Apply" on the right side and the filtered information is showed.



Refelction

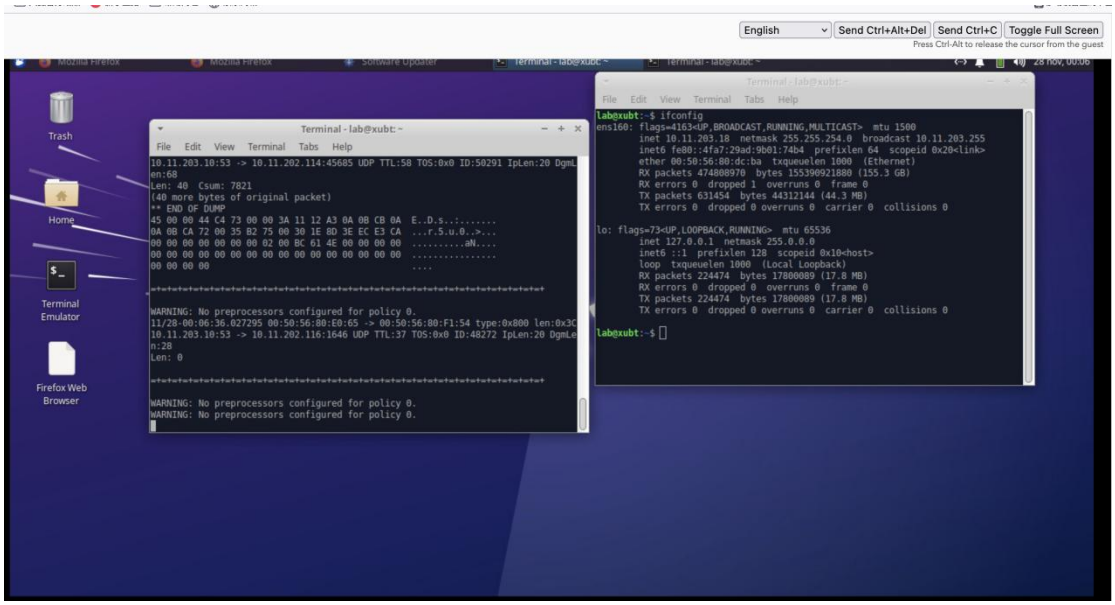
When selecting a packet in Wireshark, the "Packet Detail" section appears in the lower-left corner, and clicking the left arrow expands detailed information for each layer. For instance, 11th packet reveals content spanning four hierarchical layers:

- Frame: The lowest layer, displaying information about the packet's physical layer.
- Ethernet: The data link layer, presenting details about the Ethernet frame.
- Internet Protocol: The network layer, showcasing the header information of the IP protocol.
- Transmission Control Protocol (TCP): The transport layer, exhibiting the header information of the TCP protocol.

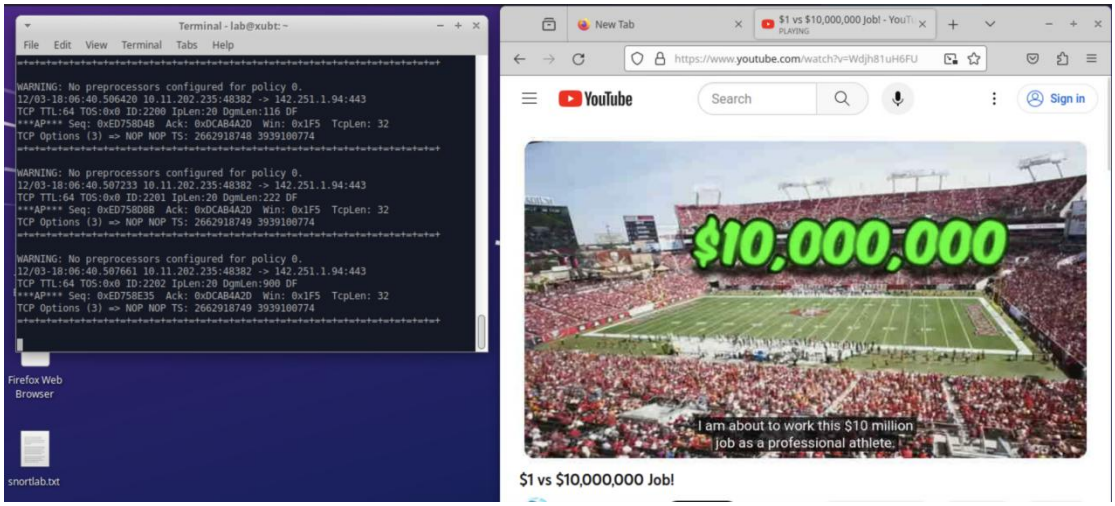
In the lower-right corner is the "Dissector Pane," displaying the content of the original message. Through this interface, one can delve into the structure and content of each packet, facilitating a detailed analysis and comprehension of the intricacies of network communication.

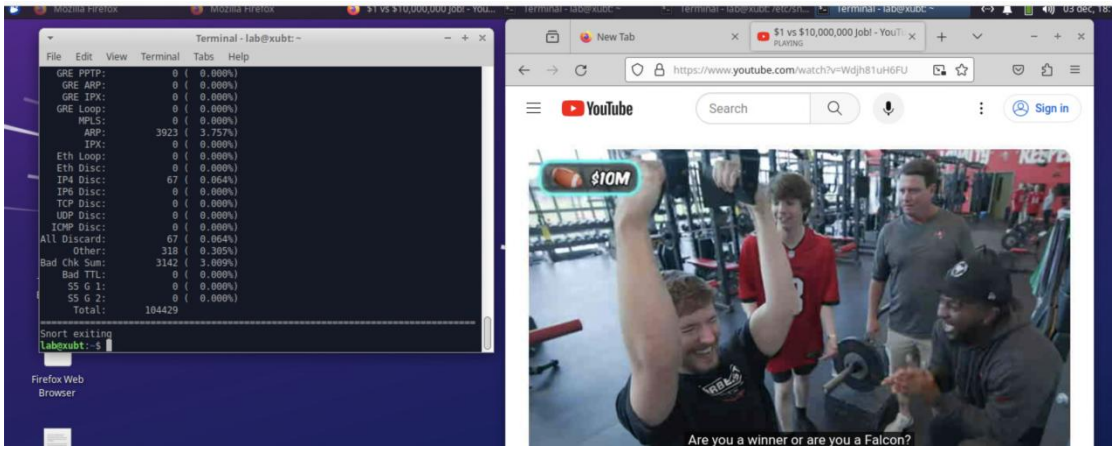
3. Snort

We start the XUBUNTU Linux virtual machine and enter ifconfig in the terminal window. The system will display the configuration information of the current network interface. This includes the interface name (ens160), the IP address of the interface, and other network configuration parameters.

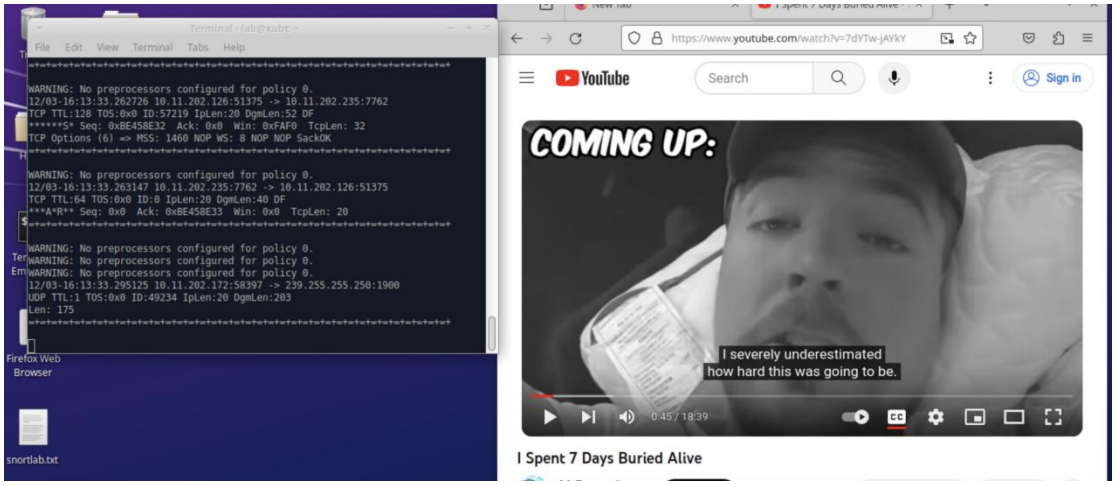


We open a terminal window and run the following command to start Snort: sudo snort -v -i ens160. We can see that snort displays details about the captured traffic on the terminal. Then we open YouTube and play a video. We can see that snort displays details about the captured traffic on the terminal. When we press Ctrl+C, snort will stop running. On the terminal, we see some statistics about snort, such as the number of packets captured, rules triggered, etc.

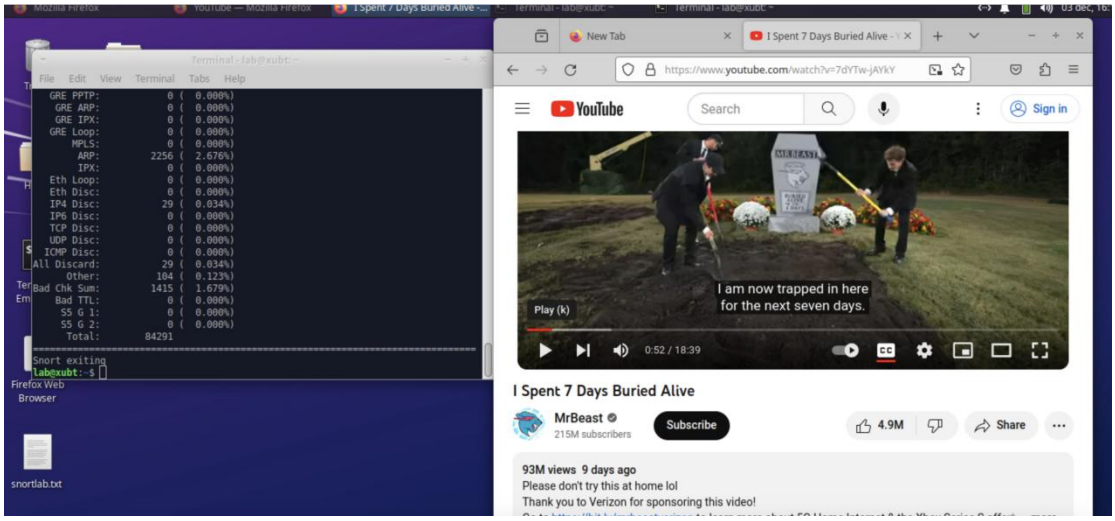




We open a terminal window and run the following command to dispalymor detailed information: sudo snort -vde -i ens160. We can see Snort start analyzing the traffic in real time and display the logs on the screen. If we open the YouTube page in a browser and start browsing videos or perform other actions, we can see the traffic information displayed by observing Snort in the terminal. Snort records network traffic and related events in real time. Next, we randomly click on a video to start playing, observe the traffic information displayed in the terminal.



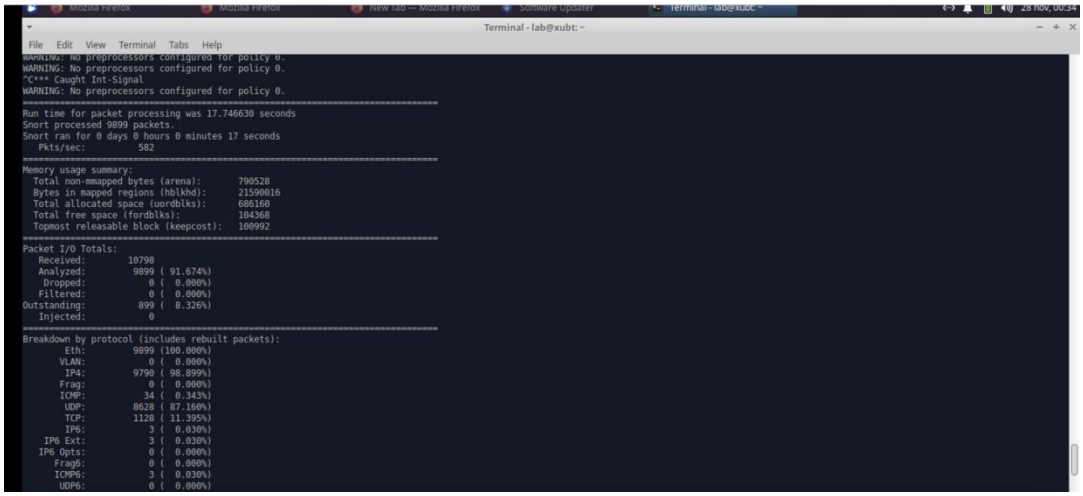
We wait a while to ensure that Snort captures enough network traffic, and then we press the Ctrl+C key combination in the terminal to stop snort. We see that Snort stops capturing and displays statistics including the number of packets captured, rules triggered, the protocol (such as TCP, UDP) and port number used by the data packet, etc.

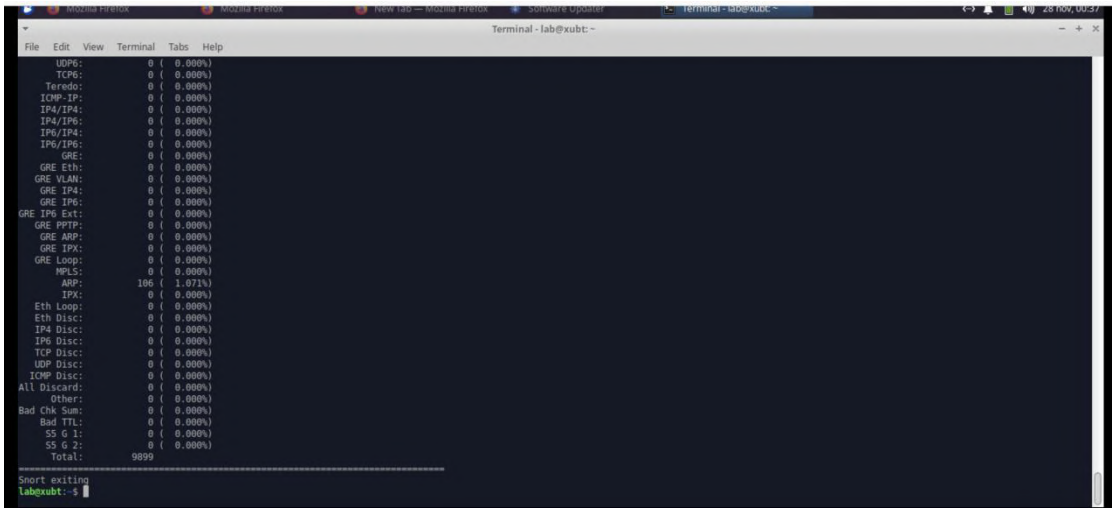


We open the terminal window in the XUBUNTU Linux virtual machine and enter "*sudo snort -vdi ens160 > ~/Desktop/snortlab.txt*" to run Snort and save the log to a file:

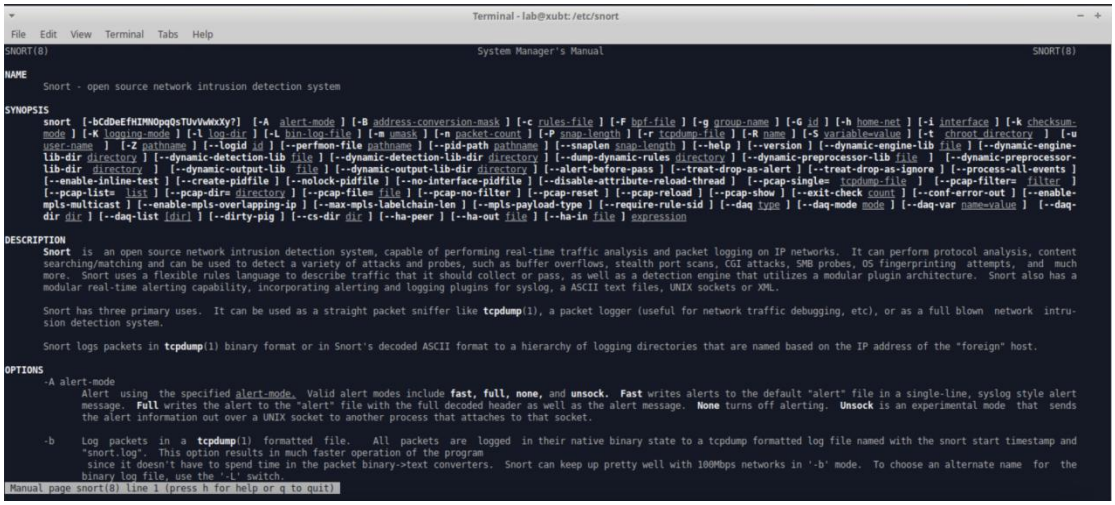
This command helps us save the traffic information previously captured through the "*sudo snort -vde -i ens160*" command into a text file for later analysis, review, or other purposes.

We first create a directory named "test" on the desktop. Then we open the terminal window in the XUBUNTU Linux VM and enter the command "*sudo snort -vde -l ~/Desktop/test –i ens160 -h 10.11.202.0/24*". Then we open YouTube, watch some videos, and then after a while, press Ctrl+C to stop Snort's capture. In this example, only traffic with destination IP addresses in the range 10.11.202.0 to 10.11.202.255 will be logged. When we stop the capture, Snort will display statistics about the capture, including the number of packets captured, rules triggered, and other relevant
statistics





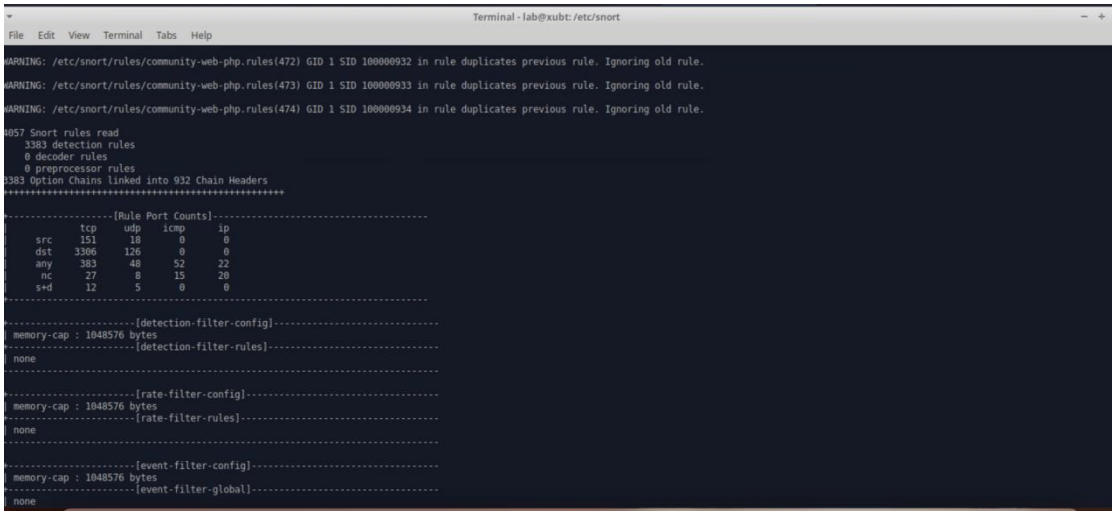
We open the terminal and use the command "*cd /etc/snort*" to navigate to the Snort configuration directory /etc/snort. Then we enter "man snort". We can see the Snort manual page. We can see detailed instructions about the Snort tool, including command line options, configuration file descriptions, synopsis, etc. We press q to exit the manual page and return to the terminal.

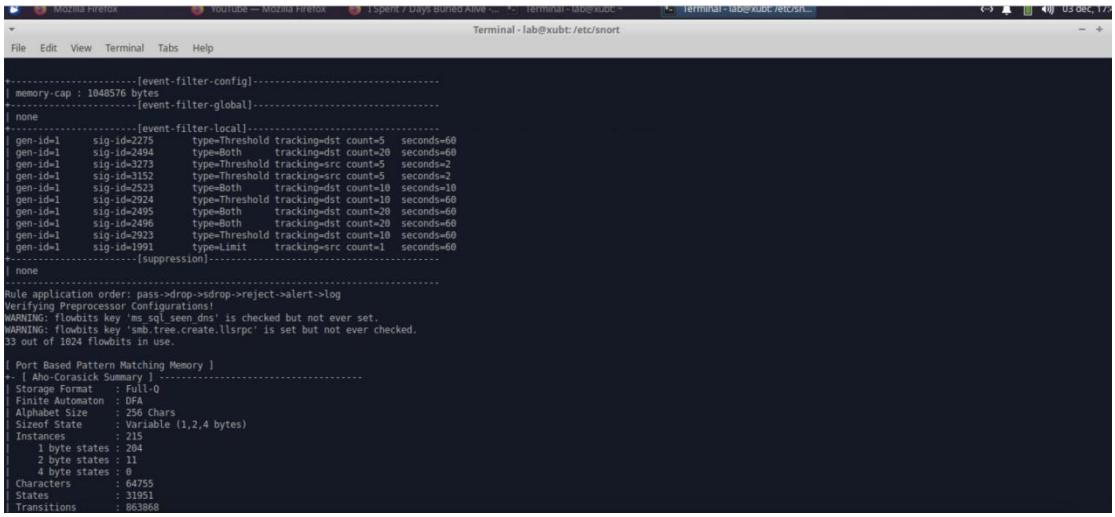


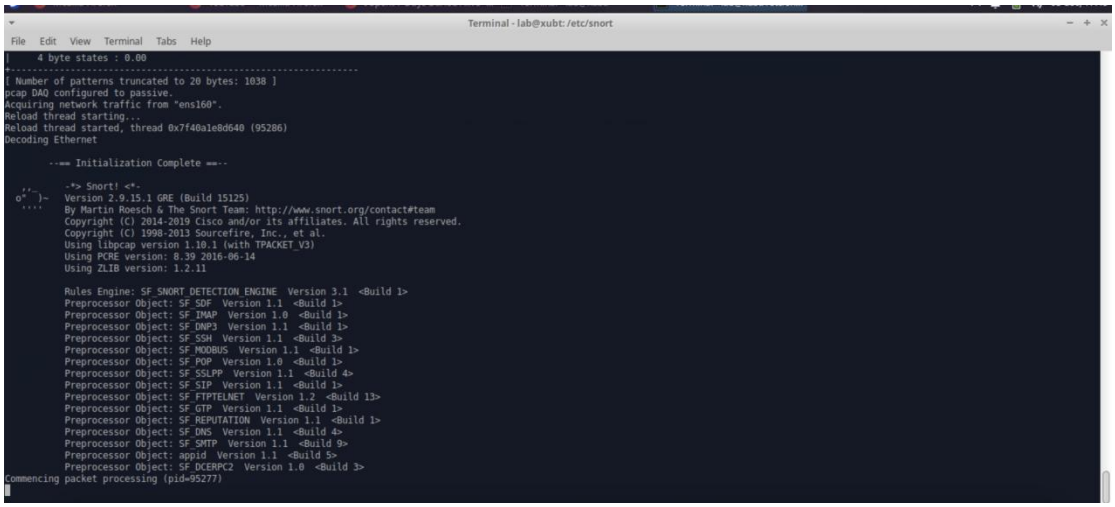
We open the terminal and use the command "*cd /etc/snort*" to navigate to the Snort configuration directory /etc/snort. Then we enter "*sudo snort -d -h 10.11.202.0/24 -i ens160 -L ~/Desktop/test -c snort.conf*".

```
Snort exiting
lab@xubt:~$ mkdir ~/Desktop/test
mkdir: cannot create directory '/home/lab/Desktop/test': File exists
lab@xubt:~$ cd /etc/snort
lab@xubt:/etc/snort$ snort -d -h 10.11.202.0/24 -i ens160 -l ~/Desktop/test -c snort.conf
Running in IDS mode

        --== Initializing Snort ==--
Initializing Output Plugins!
Initializing Preprocessors!
Initializing Plug-ins!
Parsing Rules file "snort.conf"
ERROR: snort.conf(0) Unable to open rules file "snort.conf": Permission denied.

Fatal Error, Quitting..
lab@xubt:/etc/snort$ sudo snort -d -h 10.11.202.0/24 -i ens160 -l ~/Desktop/test -c snort.conf
```

We start the Snort tool and run it in debug mode and start monitoring to the traffic of the specified network range (-h 10.11.202.0/24) and interface (-i ens160), and the captured traffic data will be saved to the desktop "test" folder. Snort will perform detection according to the rules of the configuration file (-c snort.conf). We can see the details of the captured packets and events on the terminal.







Reflections: Compare the info from tcpdump to the info from Snort

Similarities: Both tcpdump and Snort can capture network packets, and both tools can provide detailed information about the protocols used in the captured packets, such as TCP, UDP, ICMP, etc. Both tools will typically display the source and destination IP addresses and ports of the captured packets.

Differences: tcpdump is primarily a packet capture tool, while Snort is designed for intrusion detection and prevention. tcpdump provides low-level analysis of network packets, displaying the raw data. Instead, Snort performs more advanced analysis, interpreting packet contents to identify potential security threats based on rules.

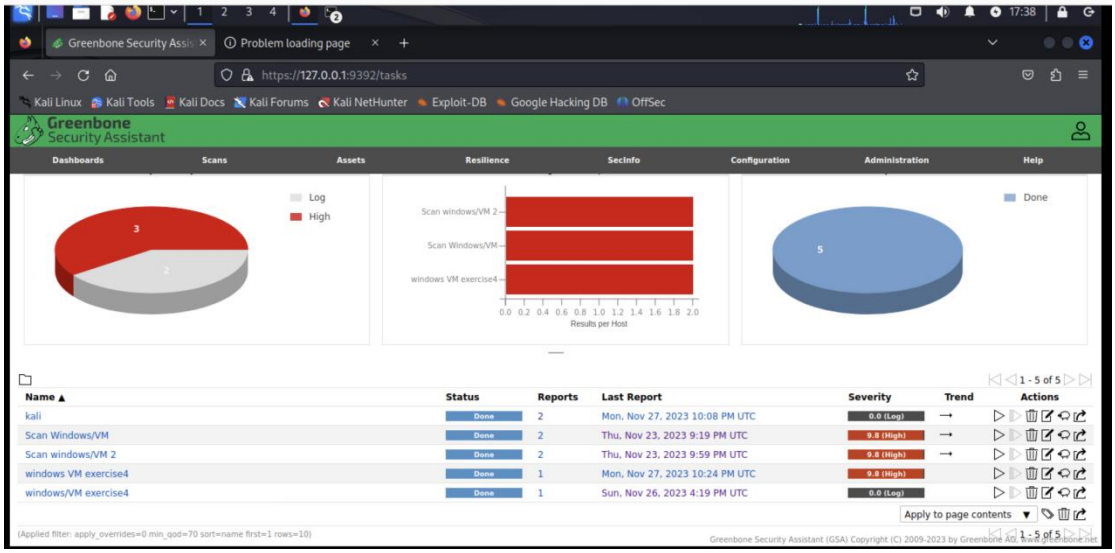
Exercise 4：Metasploit – h4Xing made easy

To check whether the previous GVM (Greenbone Vulnerability Management) scan could identify vulnerabilities in the system or application, we scanned the Windows VM again.

We Successfully log in to the GVM system using the credentials provided. In the GVM interface, we select Manual Task by clicking on the icon with an asterisk in the upper left corner.

- Name the new task "windows/VM exercise4".
- Comparing the previously performed Windows scan reports, it was found that the previously identified vulnerabilities still existed.

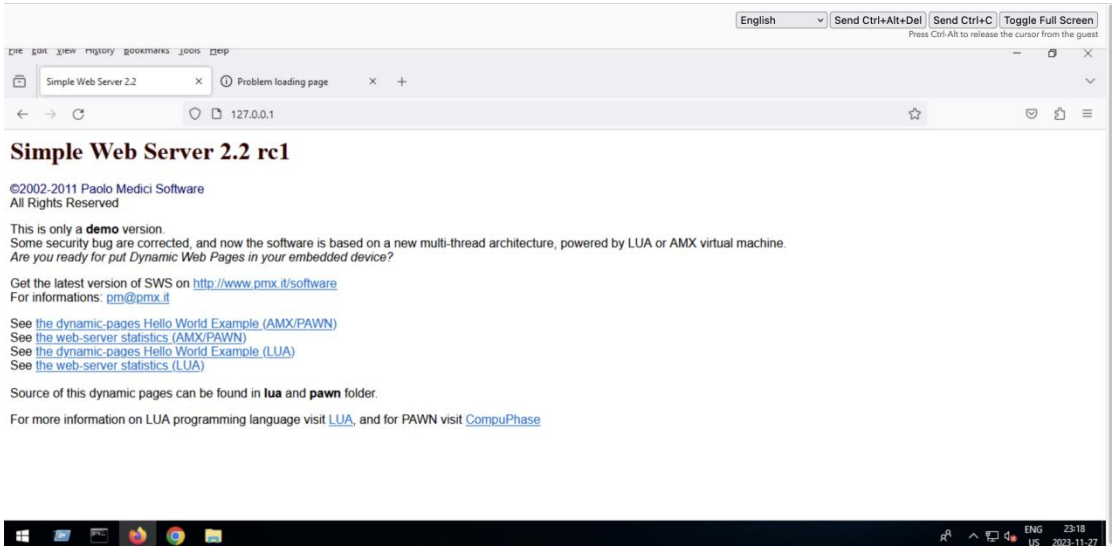
This is further proof that previously performed GVM scans are still effective and can continue to identify vulnerabilities in the system or application.

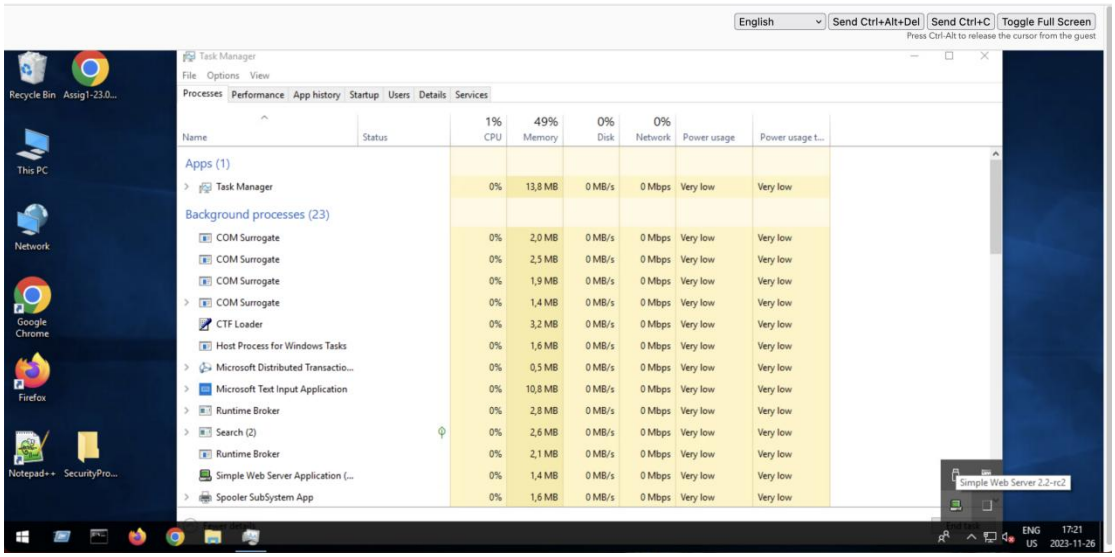


Reflection

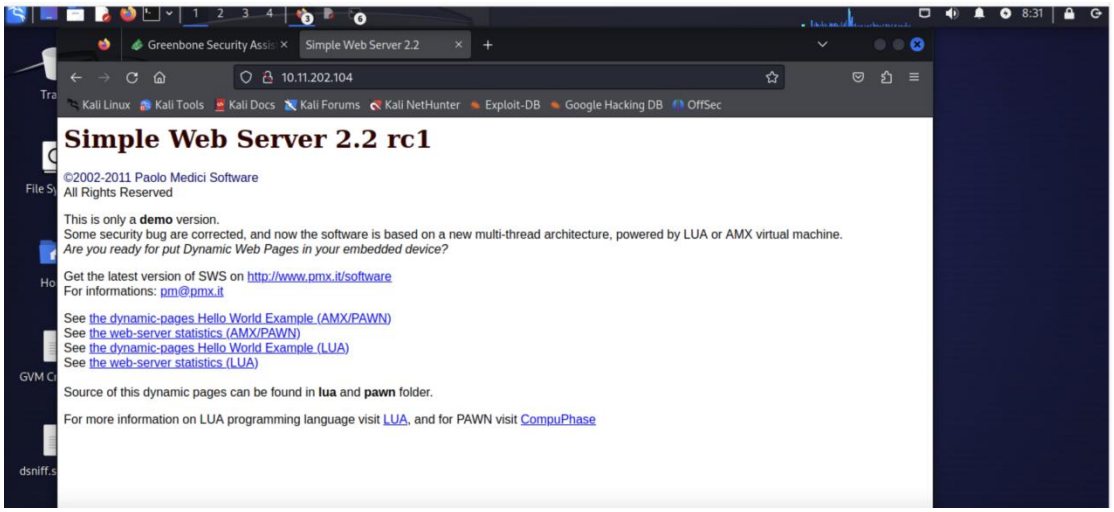
Re-examining the results of previous GVM scans can help us identify potential vulnerabilities in the system, which is very important for selecting appropriate exploits in subsequent attack steps. If the previous vulnerability has been fixed, then the attacker needs to find new vulnerabilities. By regularly using tools such as GVM to perform vulnerability scanning, the administrators can detect and correct potential problems early, and repair potential vulnerabilities in a timely manner, which helps reduce the time window in which the system is exposed to threats. Reducing the system's vulnerability duration through effective mechanisms demonstrates the principle of economy of mechanism.

To confirm that SimpleWebServer is running on Windows, we open a browser in the Windows VM and enter http://127.0.0.1. We observed that SimpleWebServer is running normally and can be accessed through the browser.





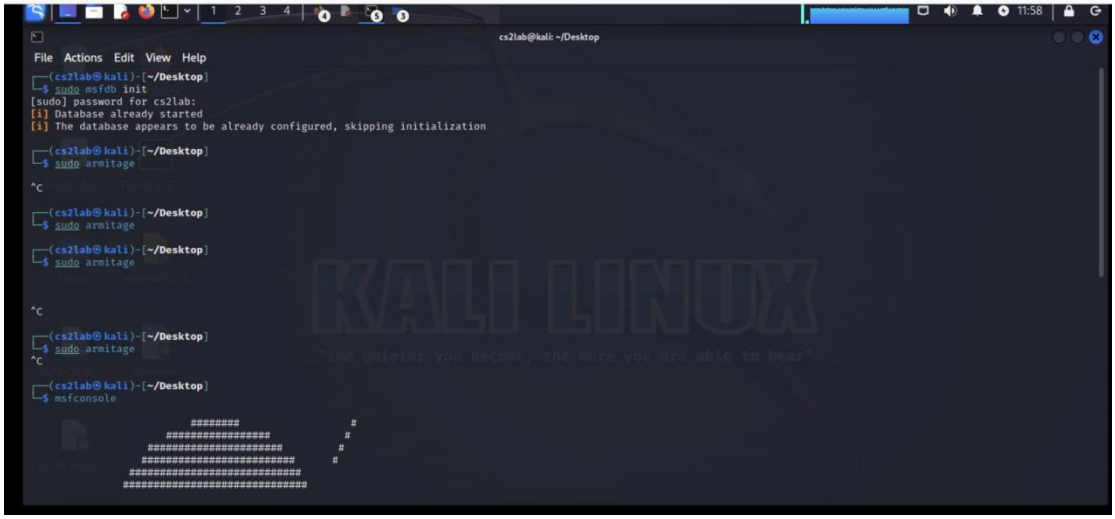
And now we know that the version of Simple Web Server on Windows VM is 2.2rc2, which is known to have vulnerabilities.

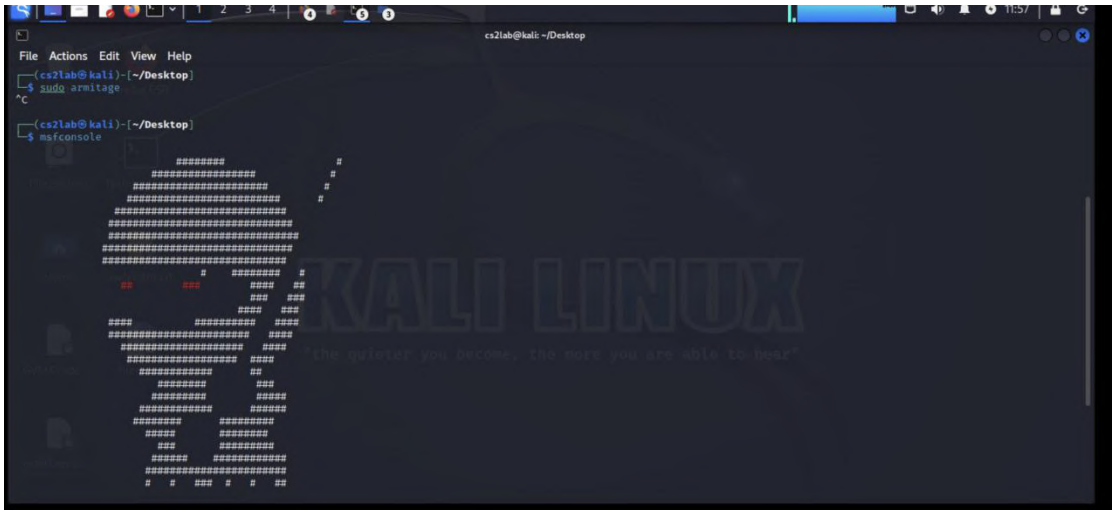


We opened Firefox on the Kali VM and entered http://10.11.202.104 (the IP address of the

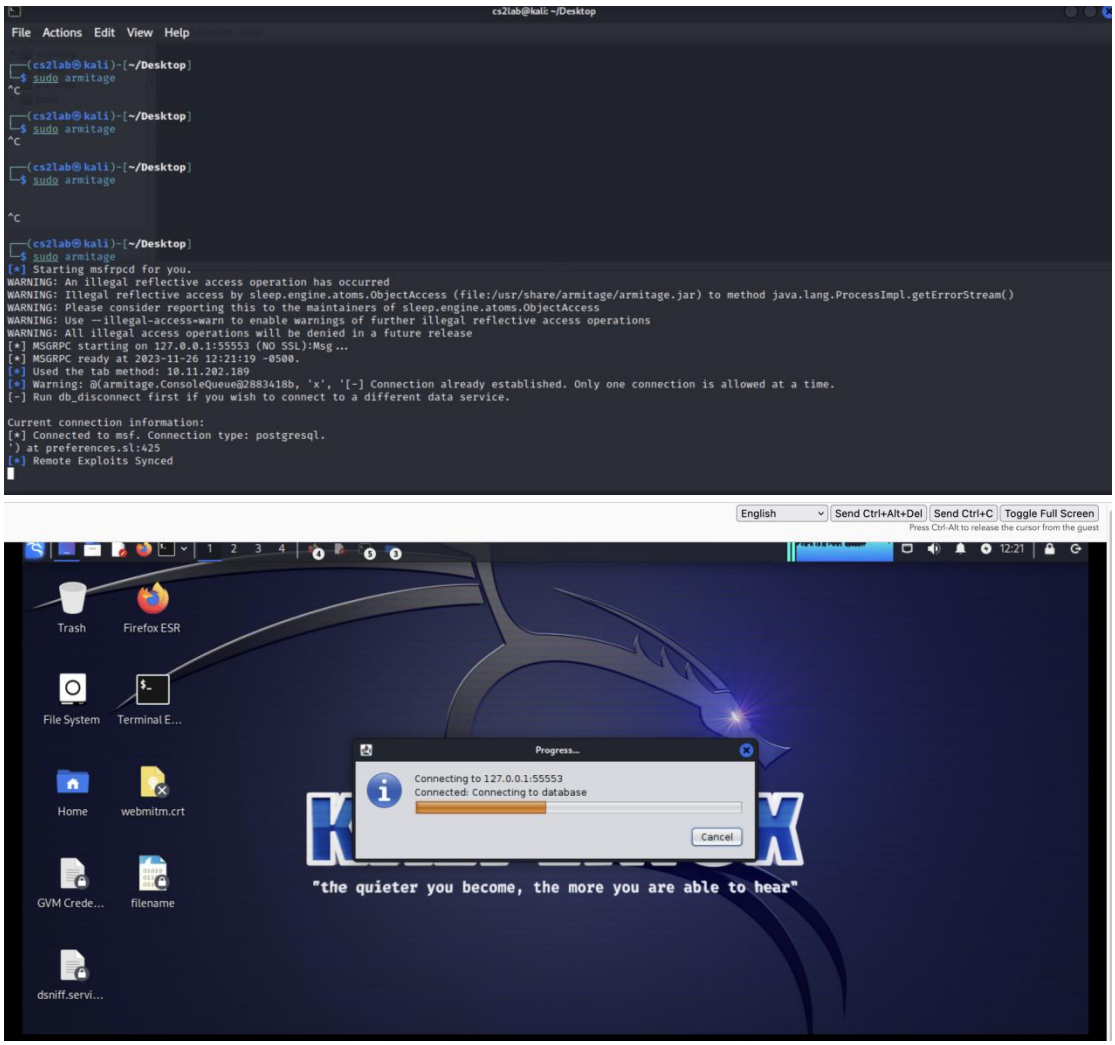
Windows virtual machine). We found that we could access the homepage of the target server. We can ensure that the web server on Windows VM is running and the network is configured correctly to communicate with the Kali VM.

In order to start the Metasploit framework, we open the Kali Linux terminal and enter the command “sudo msfdb init”. We can see that the database is already started and configured. Then We enter and run msfconsole in the Kali Linux terminal to ensure that the Metasploit framework is running in the background.

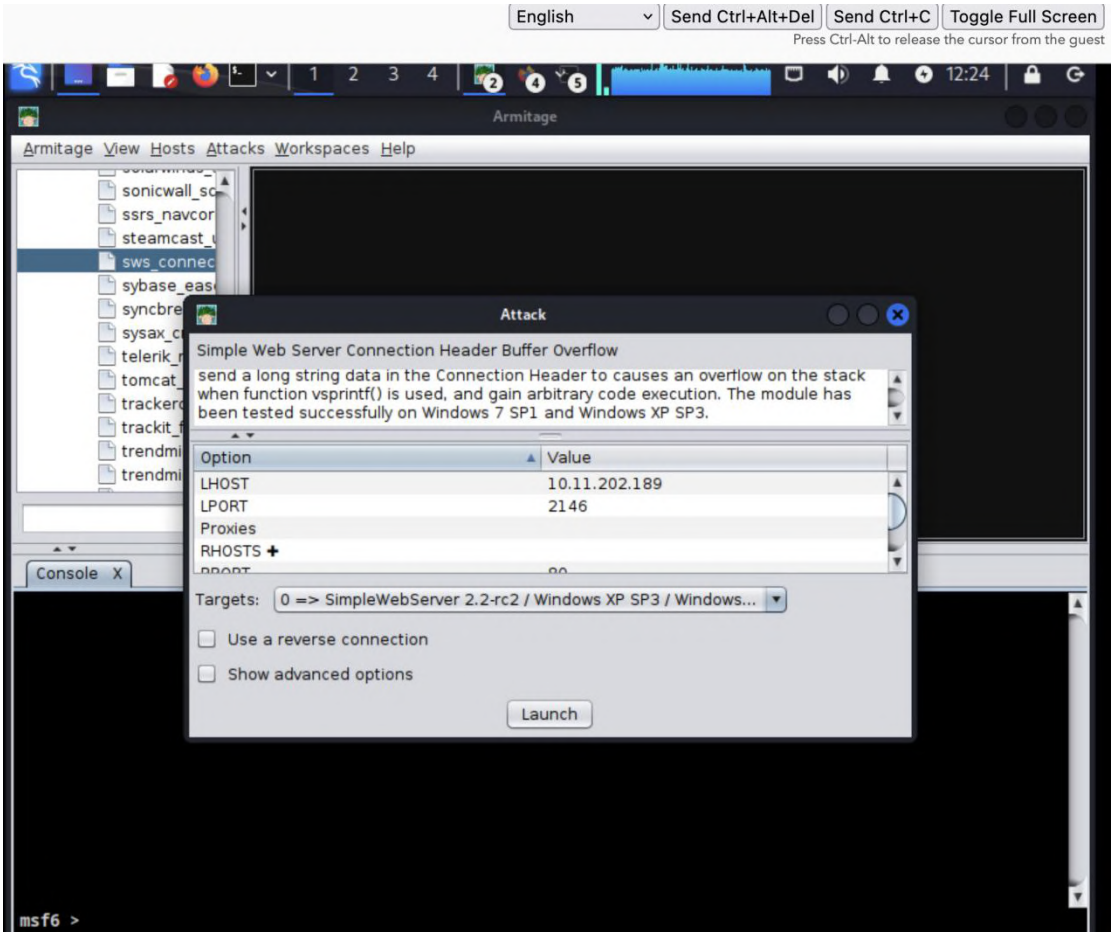




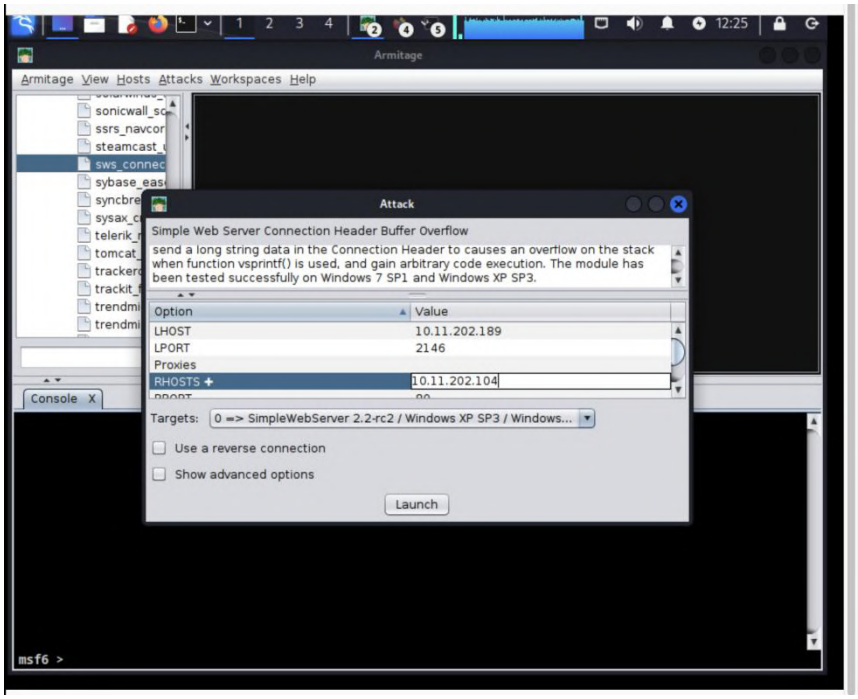
We continue typing in the terminal and run “sudo Armitage”, and In the Armitage GUI, we click the “Connect” button, we follow the prompts to start “Metasploit’s RPC Server”, and click “Yes”. After waiting for a while, we see that Armitage opens successfully, and we can see that Armitage includes menus such as view, hosts, attacks, workspace, etc. The console at the bottom displays execution information and command line operation results.



We navigate to "exploit > windows > http > sws_connection_bof" in the Armitage GUI and read the description. We see a description explaining the module's purpose, attack targets, and implementation methods. We can configure parameters in the option column to customize the attack, including setting the target IP address (RHOSTS), target port (RPORT), etc.

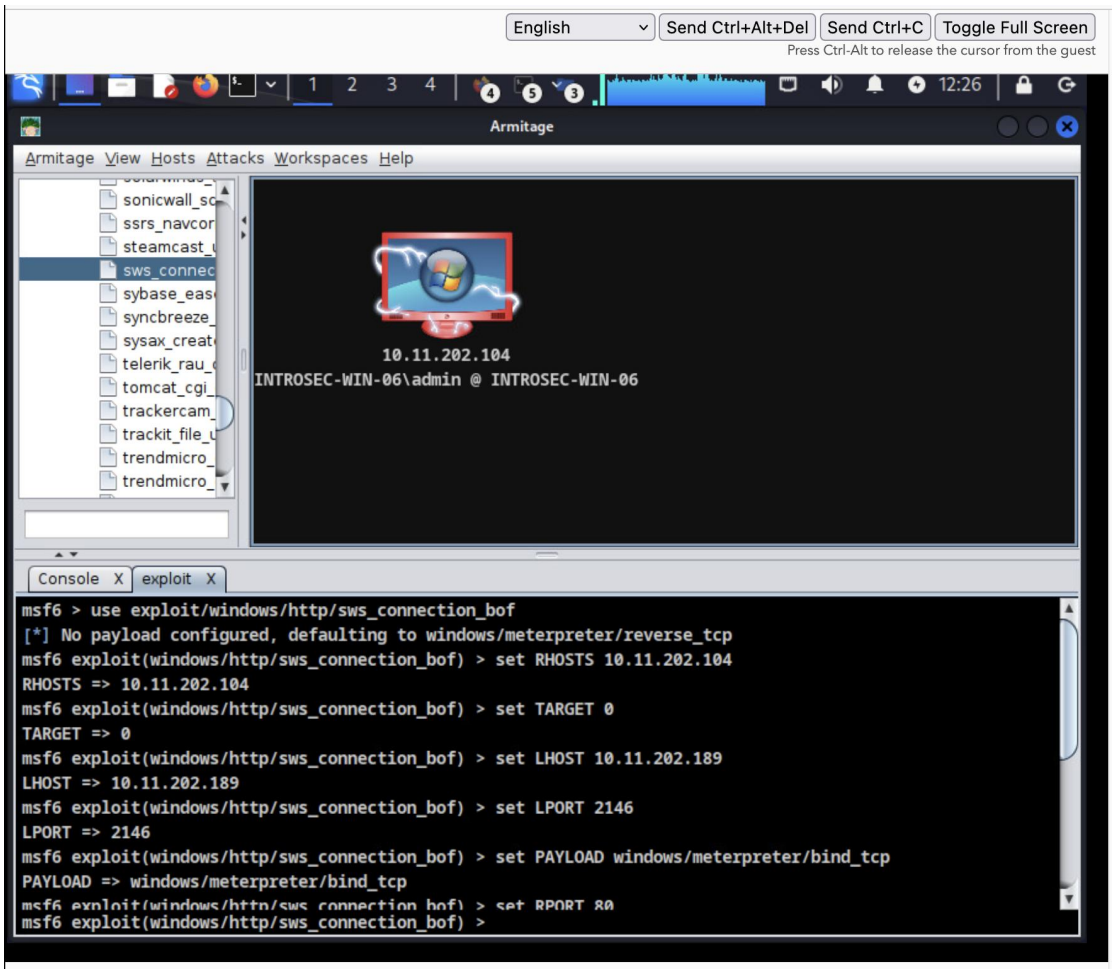


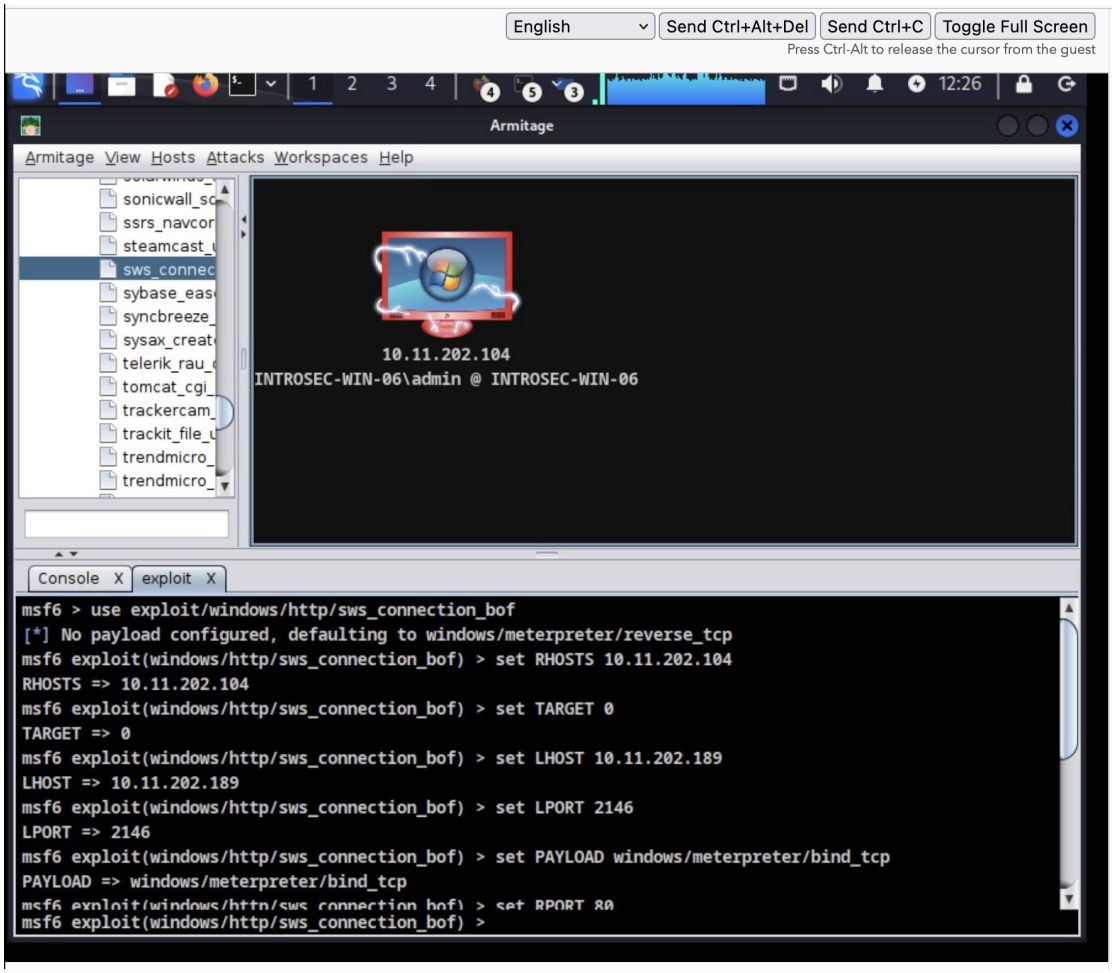
We set "Targets" to "0 => SimpleWebServer2.2-rc2 / Windows XP SP3 / Windows" and enter the Windows VM IP 10.11.202.104 in the RHOSTS field and then we enter “Launch”. We now tell the Metasploit attack module information about the target.

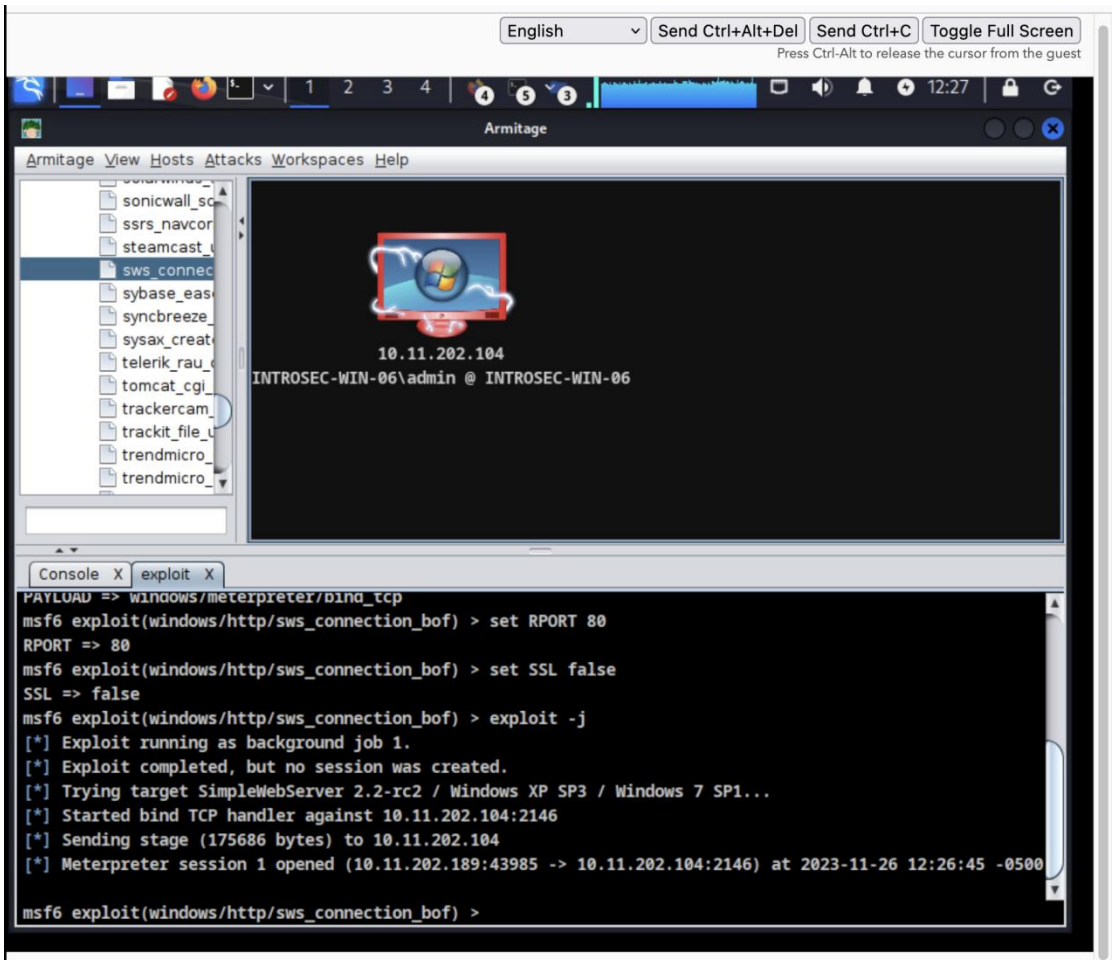


After a while, we see that a red machine with a lightning symbol will appear in the right blank

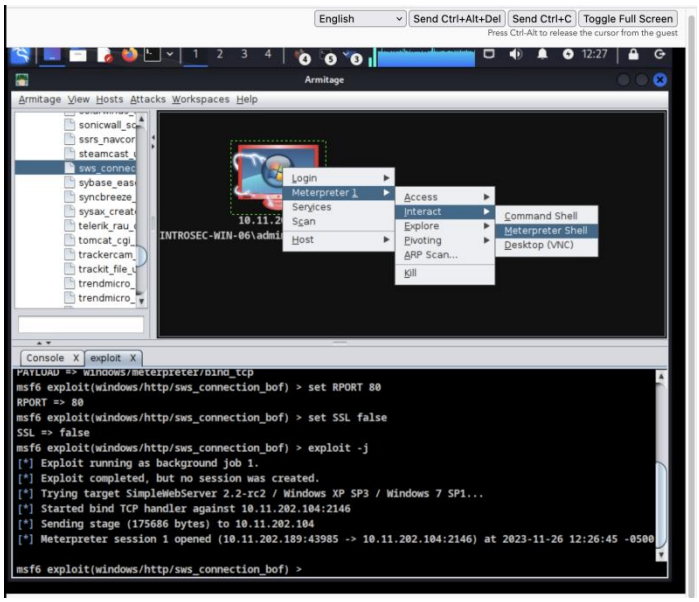
area of the Armitage GUI. The serial number and IP address of our group's windows VM are displayed below this icon. This icon usually indicates a successful Metasploit attack, and red may indicate high risk or importance. In the window below, we can see Console and Exploit. We can enter commands in the console, view modules, set parameters, and perform attacks in Exploit.




English
Send Ctrl+Alt+Del
Send Ctrl+C
Toggle Full Screen
Press Ctrl-Alt to release the cursor from the guest
12:26
Armitage
Armitage View Hosts Attacks Workspaces Help
sonicwall_sc
ssrs_navcor
steamcast_
sws_connec
sybase_eas
syncbreeze_
sysax_creat
telerik_rau_
tomcat_cgi_
trackercam_
trackit_file_
trendmicro_
trendmicro_
10.11.202.104
INTROSEC-WIN-06\admin @ INTROSEC-WIN-06
Console X
exploit X
msf6 > use exploit/windows/http/sws_connection_bof
[*] No payload configured, defaulting to windows/meterpreter/reverse_tcp
msf6 exploit(windows/http/sws_connection_bof) > set RHOSTS 10.11.202.104
RHOSTS => 10.11.202.104
msf6 exploit(windows/http/sws_connection_bof) > set TARGET 0
TARGET => 0
msf6 exploit(windows/http/sws_connection_bof) > set LHOST 10.11.202.189
LHOST => 10.11.202.189
msf6 exploit(windows/http/sws_connection_bof) > set LPORT 2146
LPORT => 2146
msf6 exploit(windows/http/sws_connection_bof) > set PAYLOAD windows/meterpreter/bind_tcp
PAYLOAD => windows/meterpreter/bind_tcp
msf6 exploit(windows/http/sws_connection_bof) > set RPORT 80
msf6 exploit(windows/http/sws_connection_bof) >



We right-click this machine and select Meterpreter 1 > Interact > Meterpreter Shell to get the shell on the target machine. And then we can see that the Meterpreter Shell window has been opened and displayed in the command line interface below

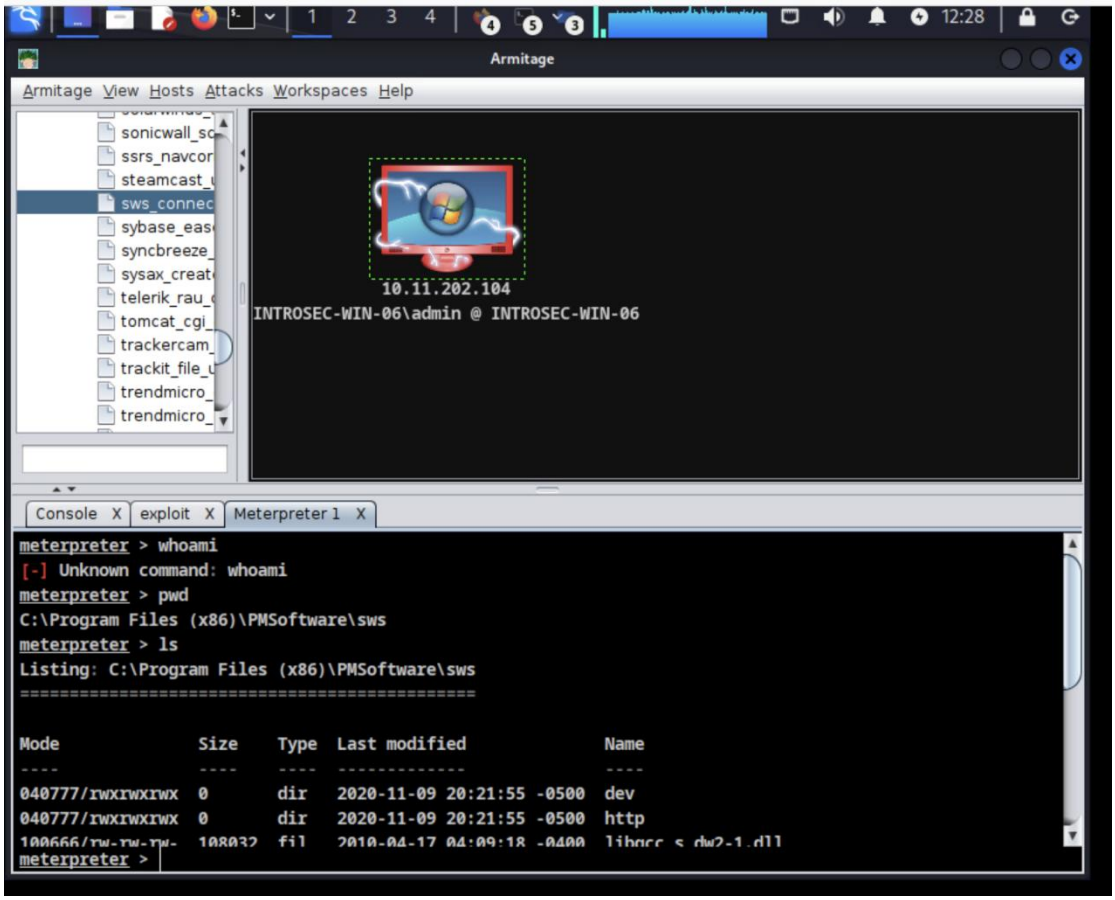


In the Meterpreter Shell window, we can execute a variety of simple commands to explore the target system:

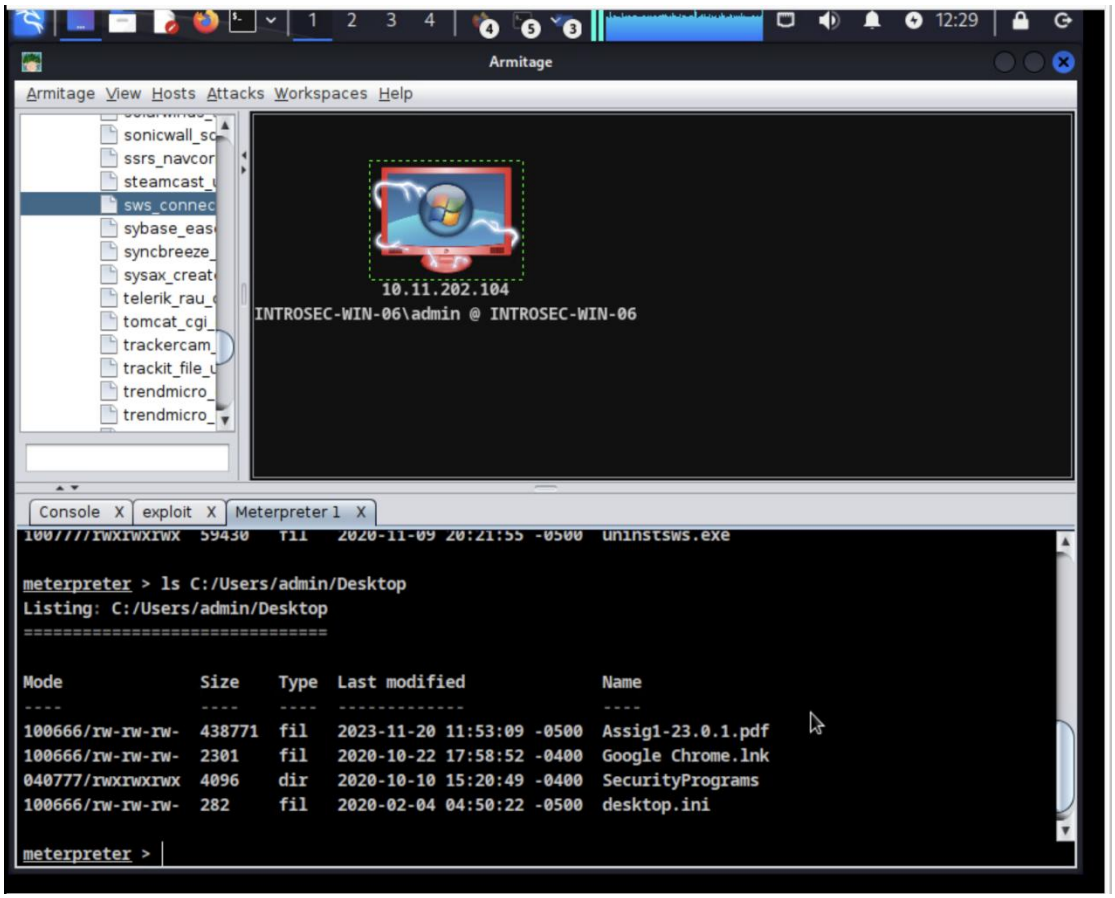
By executing “pwd” in the Meterpreter Shell, we see that it returns the path to the directory where

the current Meterpreter Shell is located.

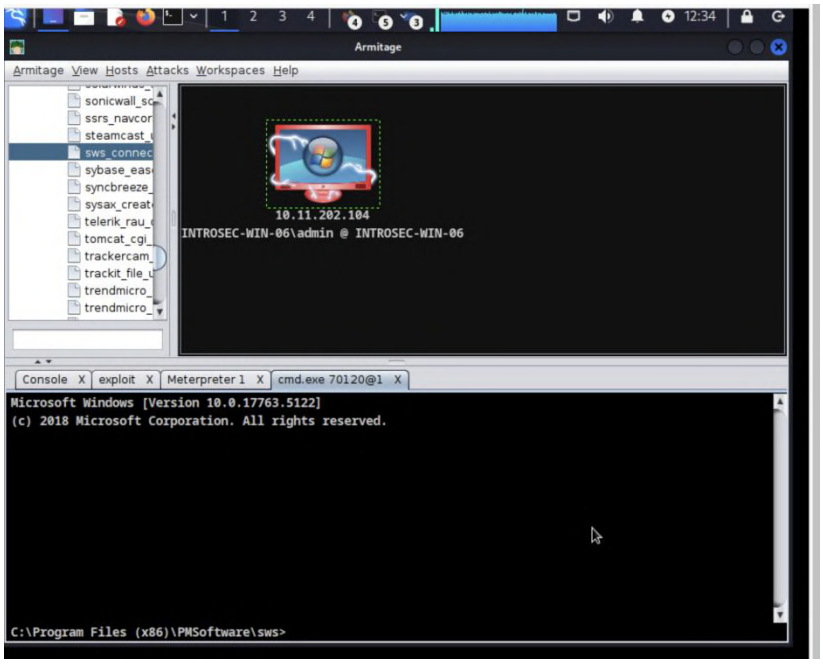
By executing “ls” in the Meterpreter Shell, we can see the files and subdirectories in the current directory.



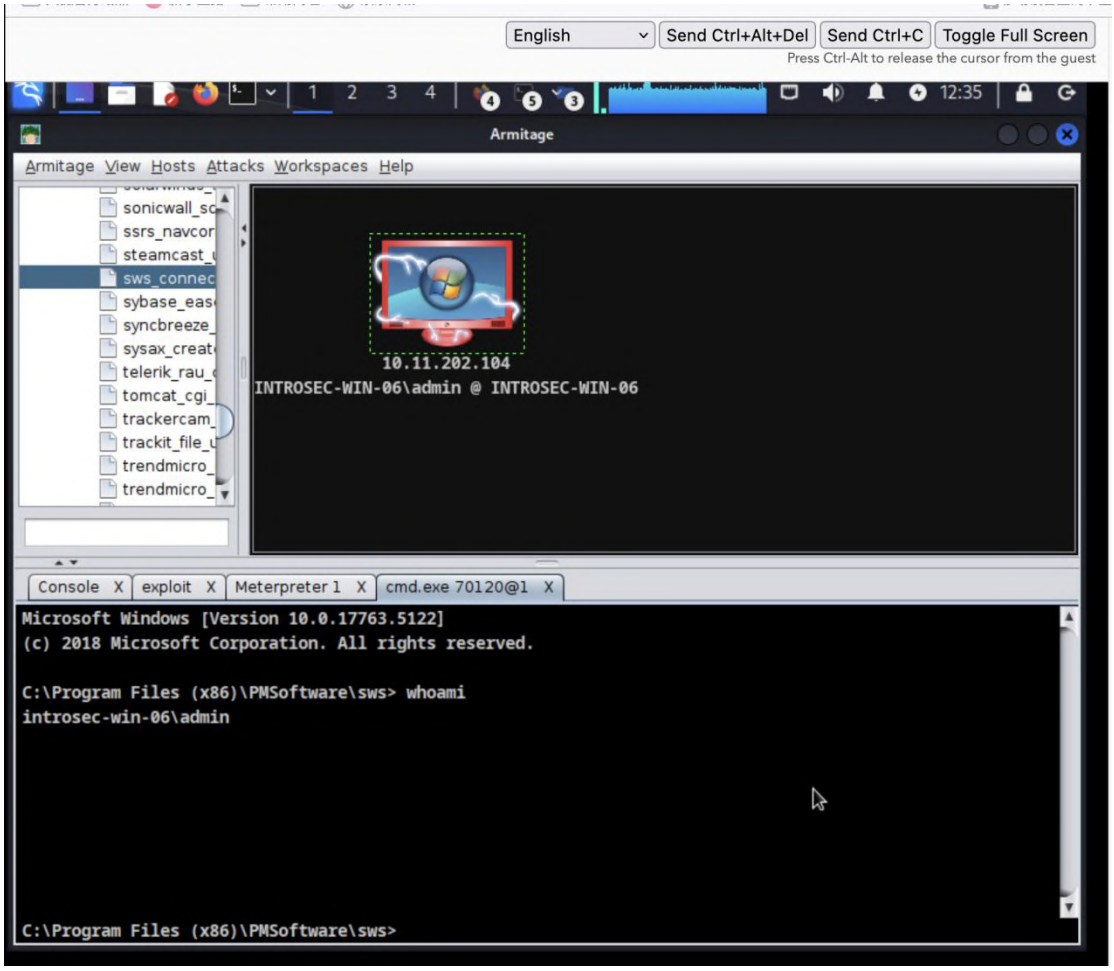
By executing “*ls C:/Users/admin/Desktop*”, we can see the files and folders on the desktop of user "admin" in Windows VM



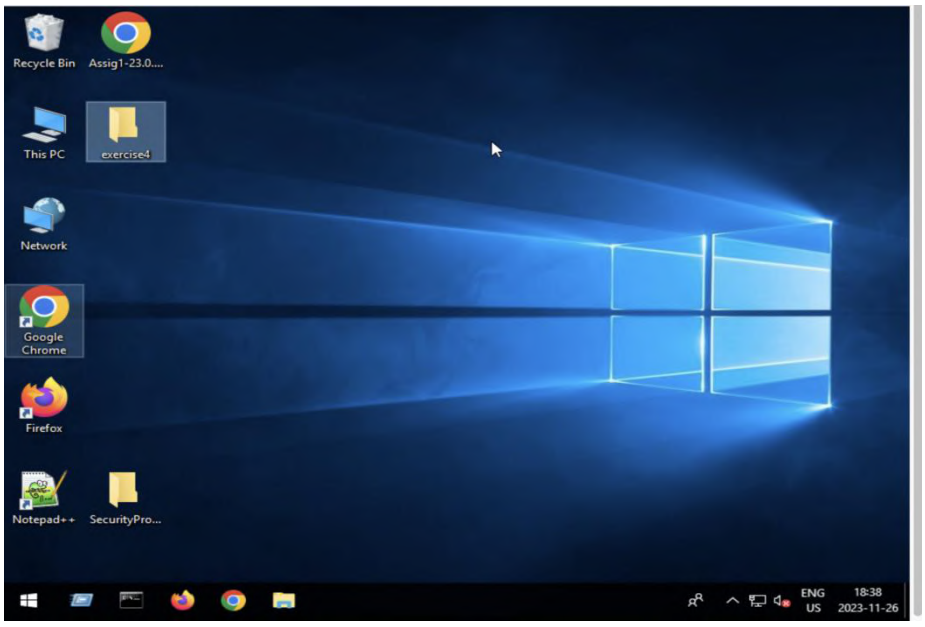
We try to switch from the Meterpreter Shell to Windows Command Prompt environment. We execute the following command in the Meterpreter Shell: shell, which will switch to the Windows Command Prompt environment, and we will see the prompt change to C:\>. We can use Windows commands now.



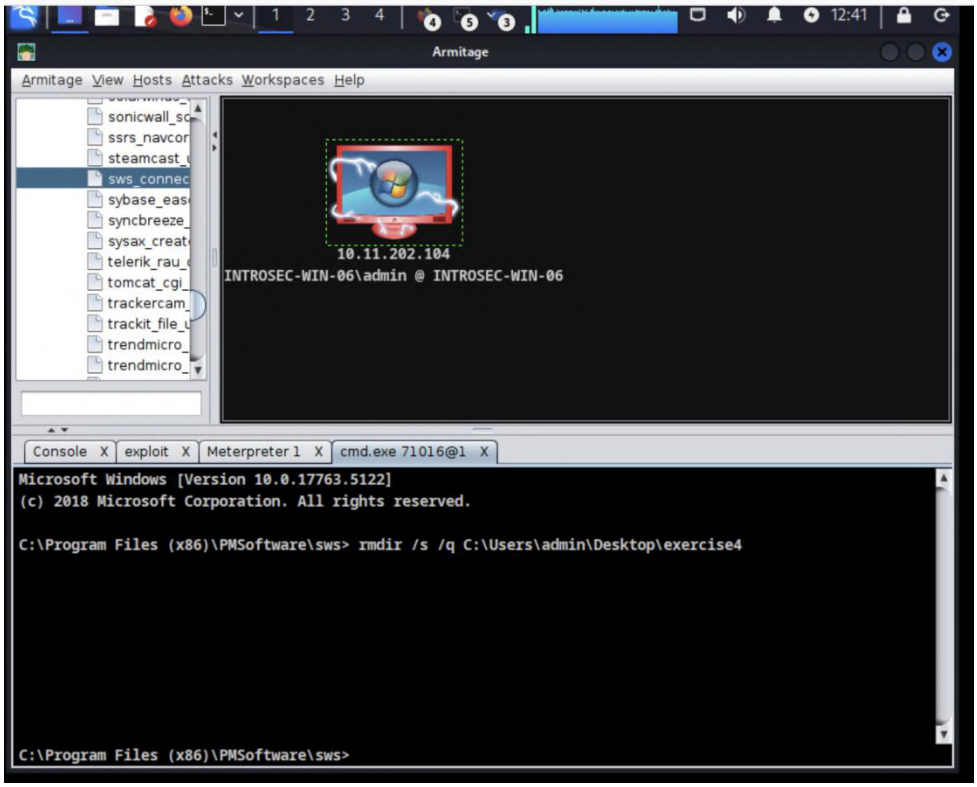
In the Windows command window, we execute "whoami" and press Enter. We see our Windows user identity “INTROSEC-WIN-06\admin @ INTROSEC-WIN-06”.



Now we want to figure out how can we manipulate the user's Windows VM desktop. Firstly we created a folder named exercise4 on the desktop of Windows VM:



Secondly, we execute “shell” in the Meterpreter Shell, and then we switch Meterpreter mode to Command Shell mode. We delete the folder named "exercise4" by entering the command “*rmdir /s /q C:\Users\admin\Desktop\exercise4*”.



Now we can see that the exercise4 file on the Windows VM has been perfectly deleted.

Reflection

Armitage is a tool built on the Metasploit framework and an optional interface for Metasploit. Armitage provides a graphical user interface of the Metasploit framework. We can perform various attack operations through the visual interface without directly using the command line. When we use the Metasploit framework and Armitage to conduct penetration testing and

vulnerability exploitation activities, we should follow the principle of least privilege (Bishop) and only operate with the minimum privileges required for penetration testing to reduce potential risks.

Reference

1. Bishop, M., Sullivan, E. and Ruppel, M., 2019. *Computer Security*: Art and Science. Second edition ed. Boston: Addison-Wesley
2. Deland-Han. (n.d.). *Using group policy objects to hide specified drives - windows client*. Windows Client | Microsoft Learn. https://learn.microsoft.com/en-us/troubleshoot/windows-client/group-policy/using-group-policy-objects-hide-specified-drives
3. *ETTERCAP: Kali linux tools*. Kali Linux. (2023, December 1). https://www.kali.org/tools/ettercap/
4. GeeksforGeeks. (2022, September 8). *Port Scanning Attack*. GeeksforGeeks. https://www.geeksforgeeks.org/port-scanning-attack/
5. *Greenbone openvas.* OpenVAS. (n.d.). https://www.openvas.org/
6. *Home: Tcpdump & libpcap.* Home | TCPDUMP & LIBPCAP. (n.d.). https://www.tcpdump.org/
7. *How to protect yourself against Keyloggers - Citrix Blogs*. Citrix Blogs - Official Citrix Blogs. (2022, January 24). https://www.citrix.com/blogs/2022/01/18/protect-against-keyloggers/
8. *Masking passwords: Help or hindrance?*. SitePoint. (n.d.). https://www.sitepoint.com/masking-passwords-help-or-hindrance/
9. O'Donnell, A. (2021, June 25). *What are packet sniffers and how do they work?*. Lifewire. https://www.lifewire.com/what-is-a-packet-sniffer-2487312
10. Snort setup guides for emerging threats prevention. (n.d.). https://www.snort.org/documents
11. *Vad är tvåfaktorautentisering (2FA)?: Microsoft security. Vad är tvåfaktorautentisering (2FA)?* | Microsoft Security. (n.d.). https://www.microsoft.com/sv-se/security/business/security-101/what-is-two-factor-authentication-2fa
12. Wikimedia Foundation. (2020, November 29). *NetBus*. Wikipedia. https://sv.wikipedia.org/wiki/NetBus
13. Wikimedia Foundation. (2023, September 27). *Windows Resource Protection*. Wikipedia. https://en.wikipedia.org/wiki/Windows_Resource_Protection
14. www.Maxi-Pedia.com. (n.d.). *Group policy: Remove run menu from start menu*. All categories. http://www.maxi-pedia.com/remove+Run+menu+from+Start+menu