Ethical Hacking Project

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Network Penetration Testing with Real-World Exploits and Security Remediation

Project Objectives

Introduction

This project focuses on conducting penetration testing within a controlled and isolated lab environment designed to simulate real-world cyber-attacks that malicious hackers might use to compromise systems. The primary objective is to develop a comprehensive understanding of the ethical hacking lifecycle and to gain practical, hands-on experience in identifying and addressing security vulnerabilities.

Theory

Network penetration testing is a critical cybersecurity practice aimed at evaluating the security posture of an organization's network infrastructure. It involves simulating attacks from both external (unauthorized users) and internal (potentially malicious insiders) threat actors to uncover vulnerabilities before they can be exploited in real-world scenarios. The primary objective is to identify and address security weaknesses proactively, thereby strengthening the overall defense mechanisms of the system.

The testing process is conducted in a structured, multi-phase approach that mirrors the tactics and techniques used by actual attackers:

1. **Reconnaissance:**
   The initial phase focuses on gathering publicly available information about the target network. This includes passive methods like DNS queries, WHOIS lookups, and open-source intelligence (OSINT) to understand the potential attack surface.

2. **Scanning and Enumeration:**
   In this phase, the tester actively interacts with the network to detect open ports, running services, and system configurations. Tools like Nmap, Nessus, and Netcat are commonly used to identify potential vulnerabilities and map the network layout.
3. **Exploitation:**
   Based on the information gathered, known exploits are leveraged to gain unauthorized access to systems or services. This step demonstrates how a real attacker might compromise the network using software flaws, misconfigurations, or weak credentials.
4. **Post-Exploitation:**
   After gaining access, the focus shifts to exploring the compromised environment. This may involve privilege escalation to gain administrative rights, accessing sensitive data, maintaining persistent access, or simulating lateral movement across the network.
5. **Remediation:**
   The final phase involves compiling a detailed report of the findings, including exploited vulnerabilities and potential risks. Security recommendations and mitigation strategies are provided to help the organization patch vulnerabilities, improve configurations, and reinforce overall network security.

Project Requirements

Operating Systems:

Operating System	Description
Kali Linux (Attacking machine)	The attacker machine, containing preinstalled penetration testing tools.
Metasploitable (Target machine)	A vulnerable machine to practice attacks on.

Tools Details

Tool	Purpose / Description
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

Task 1: Basic Network Scan

Command: nmap -v 192.168.112.0/24

IP 1

```
Nmap scan report for 192.168.112.1
Host is up (0.00066s latency).
Not shown: 999 filtered tcp ports (no-response)
PORT     STATE SERVICE
8080/tcp open  http-proxy
MAC Address: 00:50:56:C0:00:01 (VMware)
```

IP 2 -> Traget IP

```
Nmap scan report for 192.168.112.129
Host is up (0.00089s 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:F9:40:C0 (VMware)
```

IP 3

```
Nmap scan report for 192.168.112.254
Host is up (0.00041s latency).
All 1000 scanned ports on 192.168.112.254 are in ignored states.
Not shown: 1000 filtered tcp ports (no-response)
MAC Address: 00:50:56:ED:09:CE (VMware)
```

IP 4

```
Nmap scan report for 192.168.112.128
Host is up (0.0000080s latency).
All 1000 scanned ports on 192.168.112.128 are in ignored states.
Not shown: 1000 closed tcp ports (reset)
```

Task 2: Reconnaissance

2.1. Scanning for Hidden Ports

Command: nmap -v -p- 192.168.112.129

```
Nmap scan report for 192.168.112.129
Host is up (0.0013s latency).
Not shown: 65505 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
3632/tcp  open  distccd
5432/tcp  open  postgresql
5900/tcp  open  vnc
6000/tcp  open  X11
6667/tcp  open  irc
6697/tcp  open  ircs-u
8009/tcp  open  ajp13
8180/tcp  open  unknown
8787/tcp  open  msgsrvr
33119/tcp open  unknown
46278/tcp open  unknown
53616/tcp open  unknown
55796/tcp open  unknown
MAC Address: 00:0C:29:F9:40:C0 (VMware)
```

Total Hidden Ports = 7

List of hidden ports

1. 8787

2. 36588

3. 53204

4. 53452

5. 59437

6. 3632

7. 6697

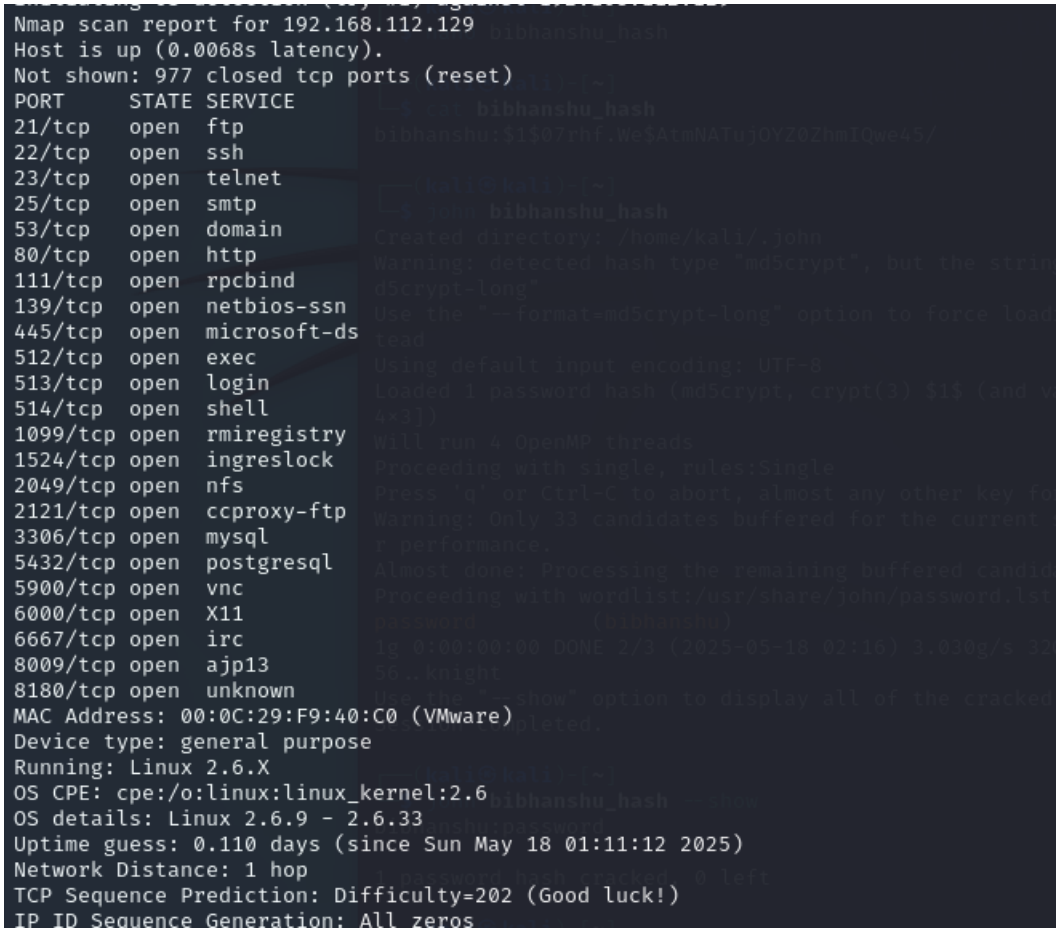
2.2. Service Version Detection

Command: nmap -v -p- -sV 192.168.112.129

```
Nmap scan report for 192.168.112.129
Host is up (0.0020s latency).
Not shown: 65505 closed tcp ports (reset)
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
3632/tcp  open  distccd     distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.4-1ubuntu4))
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
6697/tcp  open  irc         UnrealIRCd
8009/tcp  open  ajp13       Apache Jserv (Protocol v1.3)
8180/tcp  open  http        Apache Tomcat/Coyote JSP engine 1.1
8787/tcp  open  drb         Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)
33119/tcp open  java-rmi    GNU Classpath grmiregistry
46278/tcp open  mountd      1-3 (RPC #100005)
53616/tcp open  nlockmgr    1-4 (RPC #100021)
55796/tcp open  status      1 (RPC #100024)
MAC Address: 00:0C:29:F9:40:C0 (VMware)
Service Info: Hosts:  metasploitable.localdomain, irc.Metasploitable.LAN; OSs: U
nix, Linux; CPE: cpe:/o:linux:linux_kernel
```

2.3. Operating System Detection

Command: nmap -v -O 192.168.112.129



Task 3: Enumeration

Target IP Address: 192.168.112.129

Operating System Details:

MAC Address: 00:0C:29:F9:40:C0 (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 with Open 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 5.0.51a3ubuntu5
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

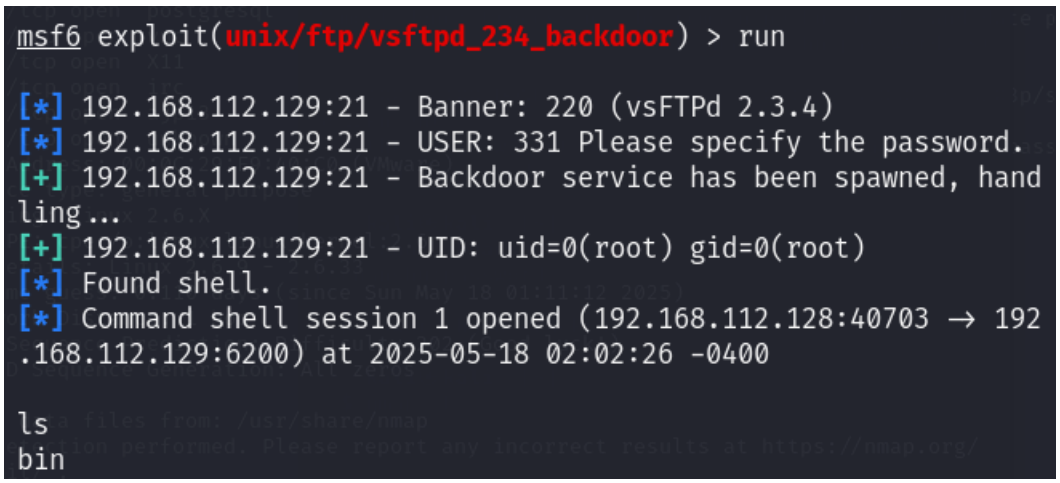
Hidden Ports with Service Versions

Port	State	Service	Version

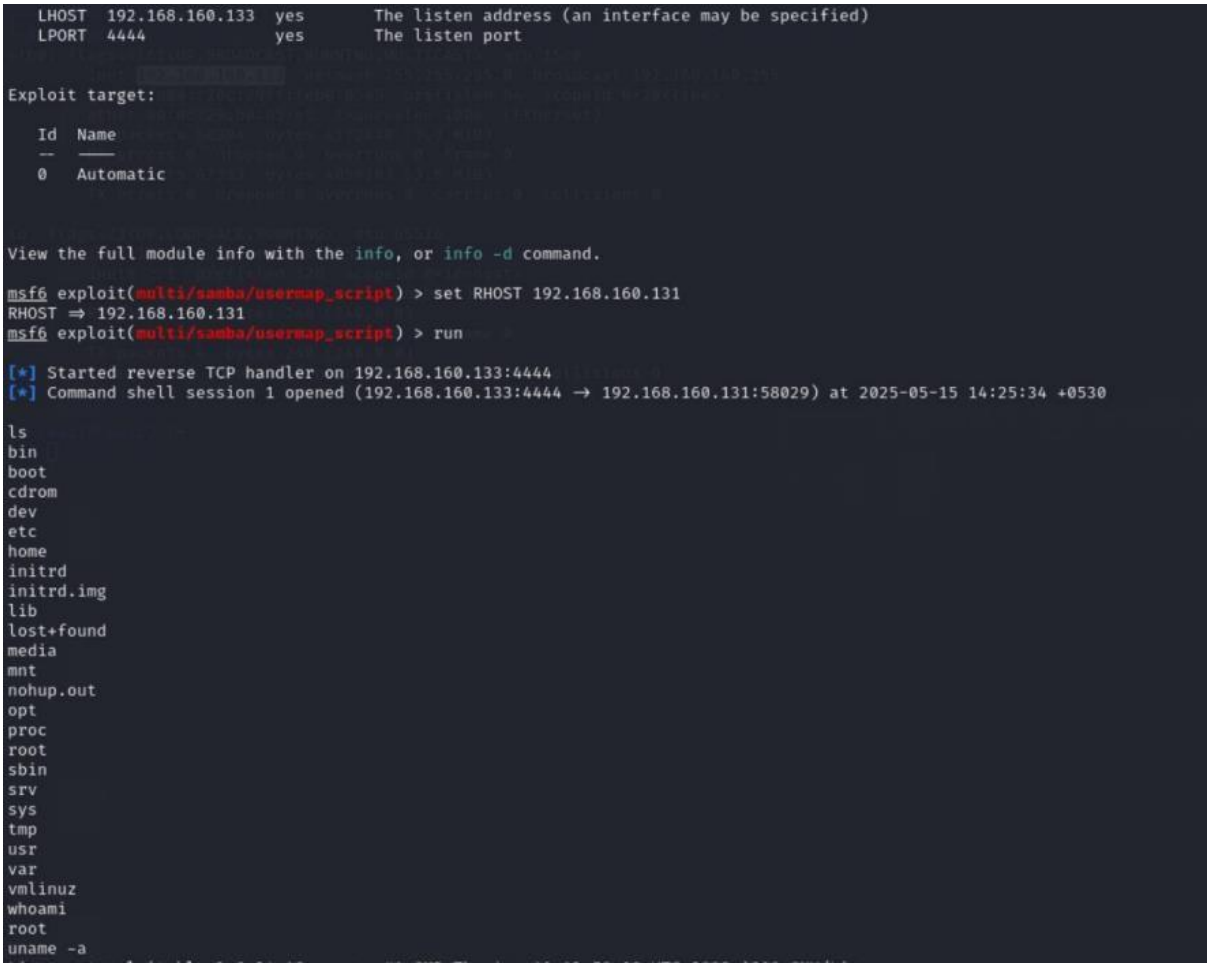
8787/tcp	open	drb	Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)
3632/tcp	open	distccd	distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.41ubuntu4))
6697/tcp	open	irc	UnrealIRCd
35851/tcp	open	mountd	1-3 (RPC #100005)
36571/tcp	open	nlockmgr	1-4 (RPC #100021)
44585/tcp	open	java-rmi	GNU Classpath grmiregistry
51228/tcp	open	status	1 (RPC #100024)

Task 4: Exploitation of Services

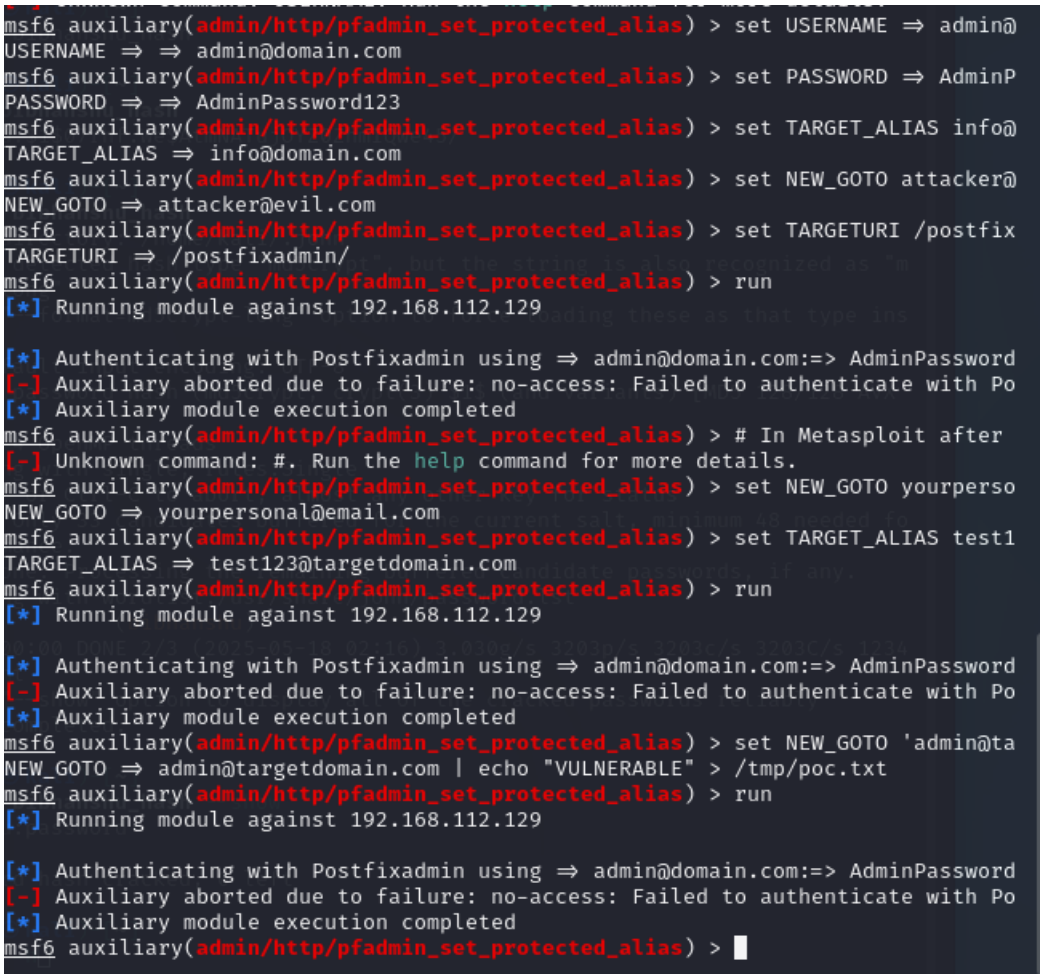
vsftpd 2.3.4: Exploited via known backdoor vulnerability



OpenSSH 4.7p1: Brute-force attack executed successfully



Postfix smtpd: Privilege escalation achieved via crafted payload injection.



Task 5 - Create user with root permission

Command: addUser bibhanshu

Password: password

Task 6: Cracking Password Hashes

Stored Hash in `hashes.txt`: bibhanshu:$1$07rhf.We$AtmNATujOYZ0ZhmIQwe45/

Commands:

john bibhanshu_hash

john bibhanshu_hash --show

Cracked Password: Password

Task 7: Remediation and Recommendations

vsftpd 2.3.4 – Vulnerable Backdoor Detected

- Issue: The vsftpd version 2.3.4 contains a known malicious backdoor that can allow unauthorized attackers to gain remote access to the system, compromising its security. This vulnerability is critical as it permits unauthorized remote code execution.
- Impact: Remote attackers can exploit this backdoor to take full control of the affected server, potentially leading to data breaches or service disruptions.
- Recommended Fix: Immediately upgrade vsftpd to version 3.0.5 or later, which has addressed this backdoor vulnerability and includes enhanced security features.

OpenSSH 4.7p1 – Outdated and Susceptible to Brute-force Attacks

- Issue: OpenSSH version 4.7p1 is significantly outdated and lacks modern security improvements. It is vulnerable to brute-force attacks due to insufficient protection mechanisms and lack of support for stronger cryptographic algorithms.
- Impact: Attackers may successfully guess or crack authentication credentials through repeated attempts, risking unauthorized server access and potential data compromise.
- Recommended Fix: Upgrade OpenSSH to the latest stable release, currently OpenSSH 9.6, which incorporates advanced security features including improved key exchange methods, rate-limiting, and robust authentication mechanisms.

Postfix SMTP Server (smtpd) – Potential Remote Exploitation Risk

- Issue: The Postfix smptd service is misconfigured or running with known vulnerabilities that may allow remote attackers to relay emails, send spoofed messages, or, in certain cases, achieve remote code execution depending on the exploit used. Lack of proper authentication or access controls exacerbates this risk.

- Impact: Malicious actors could exploit the service to distribute spam, perform phishing attacks, impersonate trusted sources, or further penetrate internal systems, potentially resulting in data breaches, IP blacklisting, or full system compromise
- Recommended Fix: Review and apply the latest Postfix security patches. Disable unnecessary SMTP features like open relaying. Enforce strong authentication mechanisms (e.g., SMTP AUTH and TLS), and restrict access using firewall rules, mynetwork directives, and header/body checks to limit interactions to trusted networks only.

Major Learning From this project

This project provided me with a comprehensive and hands-on understanding of fundamental Linux system administration and security practices.

Key areas of learning included:

User Account Management: I gained proficiency in creating and managing user accounts within a Linux environment, including an in-depth understanding of how user information is stored and managed within system files. This involved examining the mechanisms for password storage, specifically the use of hashed formats. Furthermore, I explored password security concepts through the practical application of tools like John the Ripper in conjunction with wordlists to demonstrate vulnerability assessment.

Network Scanning and Service Enumeration: I developed practical skills in network reconnaissance utilizing Nmap. This included employing various scan types to identify open ports (nmap -v), determine the versions of services running on those ports (nmap -sV), and fingerprint operating systems (nmap -O).

Vulnerability Identification and Mitigation: I explored common network services, such as SMB and R services, to identify potentially outdated or insecure configurations. This analysis fostered my understanding of the importance of regular updates and secure configuration management to mitigate security risks effectively.

System Security Auditing and Remediation: I acquired the ability to systematically identify system vulnerabilities and propose appropriate remediation strategies. This involved recommending actions such as software updates and the implementation of more robust security configurations to enhance overall system integrity.

Through these practical exercises, I cultivated a deeper appreciation for system security principles and best practices.