Proof Of Concept

Linux Security- Exploitation & Hardening

Task 2: Remote Access & SSH Hardening

1. Executive Summary

This PoC demonstrates the risks associated with insecure SSH configurations, such as allowing root login and password-based authentication. It includes enabling SSH, performing a brute-force attack, and then hardening the SSH configuration to prevent unauthorized access.

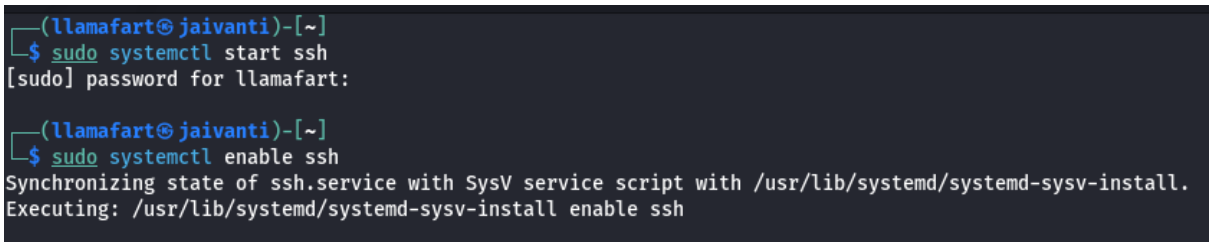
2. Objectives

- **Setup:** Enable SSH on a Linux machine, allow root login, and enable password authentication.
- **Exploit:** Perform a brute-force attack on SSH using tools like hydra or medusa.
- **Mitigation:** Disable root login, enable key-based authentication, and configure fail2ban to prevent brute-force attacks.

3. Setup

3.1. Enable SSH and Configure Insecure Settings

1. **Start and Enable SSH Service**:



2. **Edit SSH Configuration to allow root login and password authentication:**

Open the SSH configuration file:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ sudo nano /etc/ssh/sshd_config

┌──(llamafart㉿jaivanti)-[~]
└─$ sudo systemctl restart ssh
```

Modify the following lines:

```
#LoginGraceTime 2m
PermitRootLogin yes
#StrictModes yes
#MaxAuthTries 6
#MaxSessions 10

#PubkeyAuthentication yes

# Expect .ssh/authorized_keys2 to be disregarded by default in future.
#AuthorizedKeysFile     .ssh/authorized_keys .ssh/authorized_keys2

#AuthorizedPrincipalsFile none

#AuthorizedKeysCommand none
#AuthorizedKeysCommandUser nobody

# For this to work you will also need host keys in /etc/ssh/ssh_known_hosts
#HostbasedAuthentication no
# Change to yes if you don't trust ~/.ssh/known_hosts for
# HostbasedAuthentication
#IgnoreUserKnownHosts no
# Don't read the user's ~/.rhosts and ~/.shosts files
#IgnoreRhosts yes

# To disable tunneled clear text passwords, change to no here!
PasswordAuthentication yes
#PermitEmptyPasswords no
```

4. Exploitation

4.1. Perform a Brute-Force Attack Using Hydra

1. **Create a Wordlist & Run Hydra to Brute-Force SSH**:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ nano wordlist.txt

┌──(llamafart㉿jaivanti)-[~]
└─$ hydra -L wordlist.txt -P wordlist.txt ssh://localhost
Hydra v9.5 (c) 2023 by van Hauser/THC & David Maciejak - Please do not use in military or secret service

Hydra (https://github.com/vanhauser-thc/thc-hydra) starting at 2025-03-11 22:09:33
[WARNING] Many SSH configurations limit the number of parallel tasks, it is recommended to reduce the tas
[DATA] max 9 tasks per 1 server, overall 9 tasks, 9 login tries (l:3/p:3), ~1 try per task
[DATA] attacking ssh://localhost:22/
[22][ssh] host: localhost   login: [redacted]   password: [redacted]
1 of 1 target successfully completed, 1 valid password found
Hydra (https://github.com/vanhauser-thc/thc-hydra) finished at 2025-03-11 22:09:37
```

5. Mitigation

5.1. Disable Root Login and Password Authentication

1. Edit SSH Configuration:

Open the SSH configuration file and modify the following lines:

```
#LoginGraceTime 2m
PermitRootLogin no
#StrictModes yes
#MaxAuthTries 6
#MaxSessions 10

#PubkeyAuthentication yes

# Expect .ssh/authorized_keys2 to be disregarded by default in future.
#AuthorizedKeysFile     .ssh/authorized_keys .ssh/authorized_keys2

#AuthorizedPrincipalsFile none

#AuthorizedKeysCommand none
#AuthorizedKeysCommandUser nobody

# For this to work you will also need host keys in /etc/ssh/ssh_known_hosts
#HostbasedAuthentication no
# Change to yes if you don't trust ~/.ssh/known_hosts for
# HostbasedAuthentication
#IgnoreUserKnownHosts no
# Don't read the user's ~/.rhosts and ~/.shosts files
#IgnoreRhosts yes

# To disable tunneled clear text passwords, change to no here!
PasswordAuthentication no
#PermitEmptyPasswords no
```

Save and exit the file, then restart the SSH service:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ sudo nano /etc/ssh/sshd_config
[sudo] password for llamafart:

┌──(llamafart㉿jaivanti)-[~]
└─$ sudo systemctl restart ssh
```

5.2. Enable Key-Based Authentication

1. Generate SSH Keys (on the client machine):

```
┌──(llamafart㉿jaivanti)-[~]
└─$ ssh-keygen -t rsa -b 4096
Generating public/private rsa key pair.
Enter file in which to save the key (/home/llamafart/.ssh/id_rsa): urmom
Enter passphrase for "urmom" (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in urmom
Your public key has been saved in urmom.pub
The key fingerprint is:
SHA256:[redacted] llamafart@jaivanti
The key's randomart image is:
+---[RSA 4096]----+
|..o      .o.     |
|o= o     +oo     |
|=E  .   ..=  .   |
|= .+   o..o.=    |
|o . *o +S B .    |
| . *. o  =       |
|. o + ..o        |
| . * +. o.       |
|  +o+ .o.o       |
+----[SHA256]-----+
```

2. Copy the Public Key to the Server:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ ssh-copy-id llamafart@localhost
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: ssh-add -L
The authenticity of host 'localhost (::1)' can't be established.
ED25519 key fingerprint is SHA256:[redacted].
This host key is known by the following other names/addresses:
    ~/.ssh/known_hosts:4: [hashed name]
    ~/.ssh/known_hosts:5: [hashed name]
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed

/usr/bin/ssh-copy-id: WARNING: All keys were skipped because they already exist on the remote system.
                (if you think this is a mistake, you may want to use -f option)
```

5.3. Configure Fail2Ban to Prevent Brute-Force Attacks

1. Install Fail2Ban & Configure Fail2Ban for SSH:

Create a local configuration file:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ sudo apt install fail2ban -y
fail2ban is already the newest version (1.1.0-7).
Summary:
  Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 1048

┌──(llamafart㉿jaivanti)-[~]
└─$ sudo nano /etc/fail2ban/jail.local
```

Add the following lines:

```
 GNU nano 8.2                                                    /etc/fail2ban/jail.local *
[sshd]
[sshd]
enabled = true
port = ssh
filter = sshd
logpath = /var/log/auth.log
maxretry = 3
bantime = 3600
enabled = true
maxretry = 3
bantime = 600
```

Save and exit the file, then restart Fail2Ban:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ sudo systemctl restart fail2ban
```

2. **Verify Fail2Ban Status**:

```
┌──(llamafart㉿jaivanti)-[~]
└─$ ssh llamafart@localhost
Linux jaivanti 6.11.2-amd64 #1 SMP PREEMPT_DYNAMIC Kali 6.11.2-1kali1 (2024-10-15) x86_64

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

Kali GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Mar 11 12:50:45 2025 from 10.12.8.147
┌──(llamafart㉿jaivanti)-[~]
└─$ ssh root@localhost
root@localhost: Permission denied (publickey).
```

6. Conclusion:

This PoC successfully demonstrated the risks of insecure SSH configurations and the effectiveness of hardening measures. By disabling root login, enforcing key-based authentication, and preventing brute-force attacks, the SSH service was secured