# Capstone Engagement

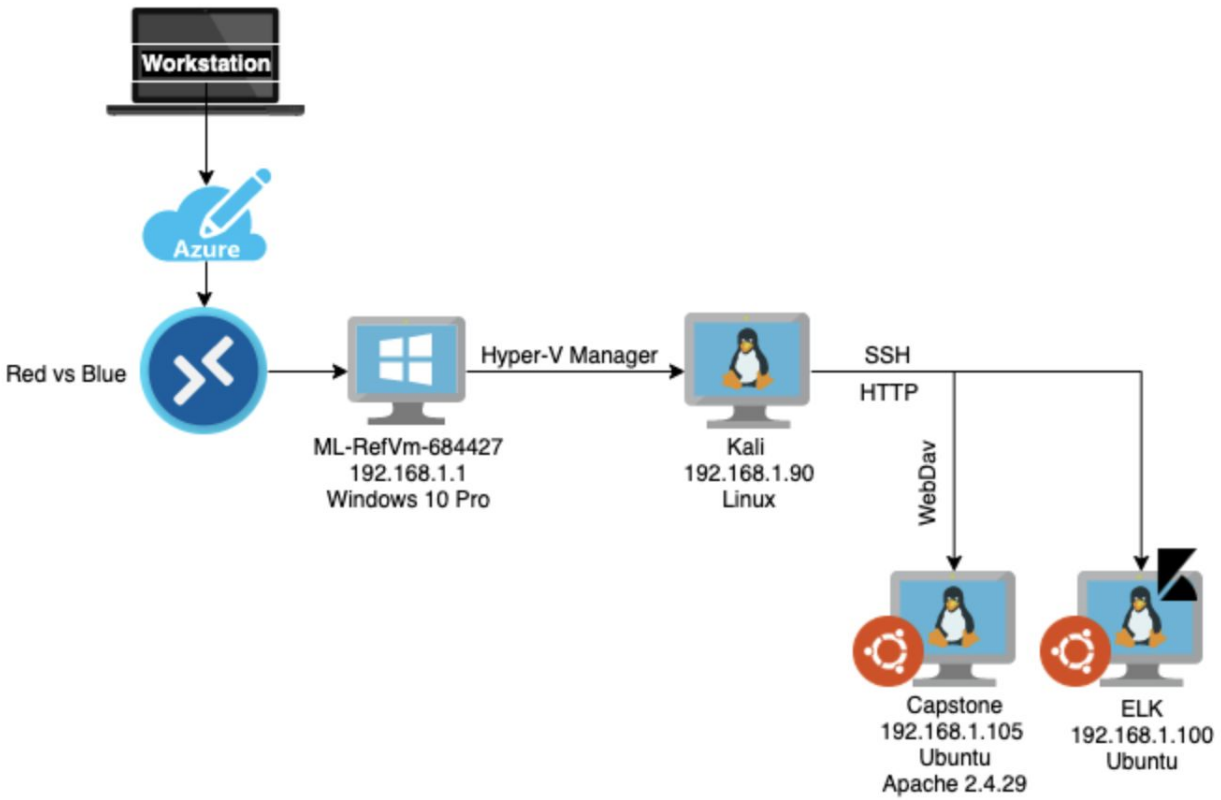
## Assessment, Analysis, and Hardening of a Vulnerable System

# Table of Contents

This document contains the following sections:

# Network Topology

# Network Topology




**Network**
Address Range:255
Netmask:255.255.255
Gateway:10.0.0.1

**Machines**
IPv4: 192.168.1.1
OS: Windows 10 Pro
Hostname:
ML-RefVm-684427

IPv4: 192.168.1.105
OS: Ubuntu Linux
Hostname:Capstone

IPv4: 192.168.1.100
OS: Ubuntu Linux
Hostname:ELK

IPv4: 192.168.1.90
OS: Kali Linux
Hostname:Kali

# Red Team

Security Assessment

# Recon: Describing the Target

## Nmap identified the following hosts on the network:

| Hostname | IP Address | Role on Network |
|---|---|---|
| ML-RefVm-684427 | 192.168.1.1 | Host |
| ELK | 192.168.1.100 | Elk server |
| Capstone | 192.168.1.105 | Target |
| Kali | 192.168.1.90 | Pen test machine |

# Vulnerability Assessment

## The assessment uncovered the following critical vulnerabilities in the target:

| Vulnerability | Description | Impact |
|---|---|---|
| *HTTP* | *Unsecure protocol that handles communications between web servers and browsers.* | *Loss of data, browser hijacking, session hijacking, xxs, sensitive data exposure, etc.* |
| SSH | OpenSSH using port 22 that can be used to remotely log into a machine. | Access to data, loss of data, access to administrator, full machine access, etc. |
| WebDav | "WebDAV is an industry standard extension to the HTTP specification that adds a capability for authorized users to remotely add and manage the content of a web server." | Connect to a server and add an exploit for example, shell.php. |
| reverse_tcp | Server(target) initiates a connection to host(attacker). | Allows the attacker machine to listen for a connection to the target to take control of the device and pass commands. |

# Exploitation: HTTP

01

**Tools & Processes**

- Nmap service and version scan on Target's IP address.
- Mozilla Firefox address bar, input Target's IP address.

02

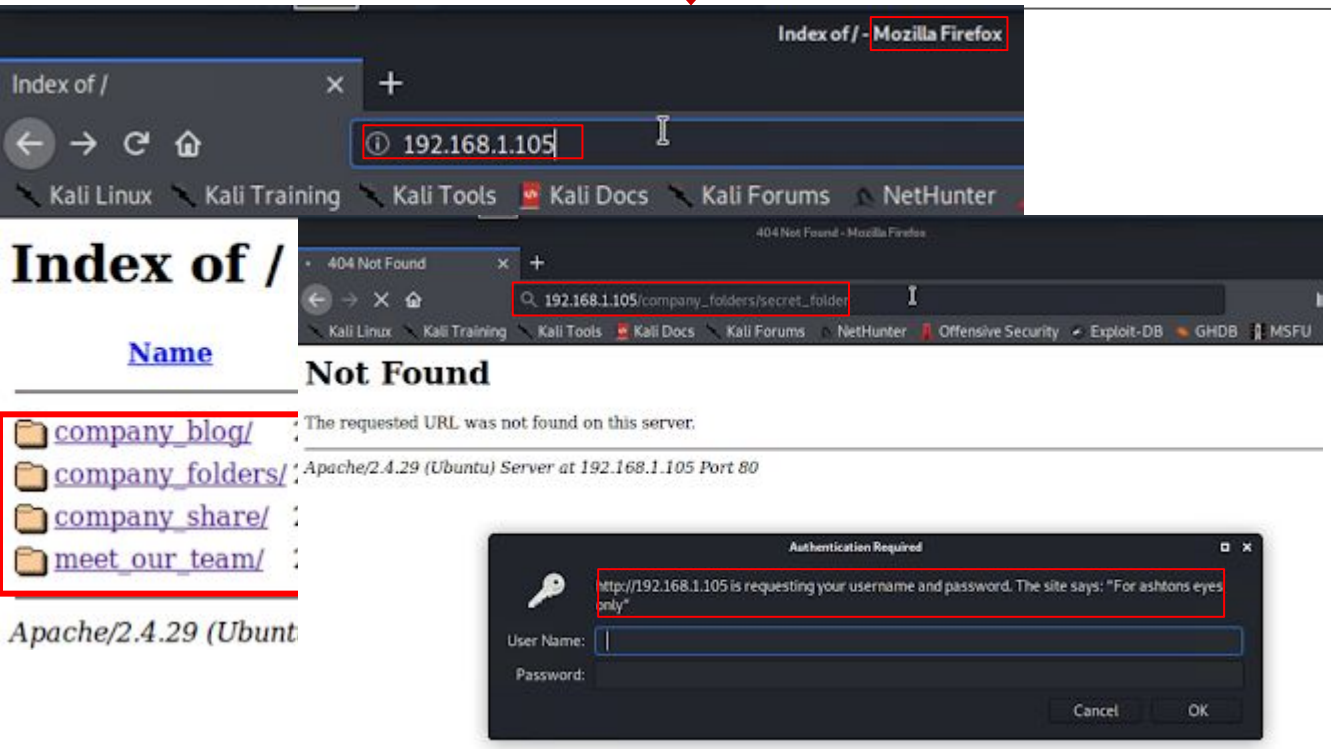
**Achievements**

- Gained access to the Target's directories.
  - Reviewed each file
- Located a hidden directory.
- Gained access to multiple user credentials using a brute force attack.

03

```
root@Kali:~# nmap -sV 192.168.1.105
Starting Nmap 7.80 ( https://nmap.org ) a
Nmap scan report for 192.168.1.105
Host is up (0.00070s latency).
Not shown: 998 closed ports
PORT    STATE SERVICE VERSION
22/tcp open  ssh     OpenSSH 7.6p1 Ubuntu
l 2.0)
80/tcp open  http    Apache httpd 2.4.29
```

# Exploitation: HTTP 03 Continued...




User Name: **ashton**
Password: **leopoldo**

- Hidden directory,

**/company_folders/secret_folder**

- Terminal command:

**hydra -l ashton -P rockyou.txt -s 80 -f -vV 192.168.1.105 http-get http://192.168.1.105/company_folders/secret_folder**

Syntax: hydra -l username -P wordlist -s port -f -vV target_ip_address http-get secret_directory_path

# Exploitation: HTTP 03 Continued...

Index of /company_folders/secret_fo

Index of /company_folders/s

192.168.1.105/company_folders/secret_folder/

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## Index of /company_folders/secret

| Name | Last modified | Size | Description |
|---|---|---|---|
| Parent Directory | | - | |
| connect_to_corp_server | 2019-05-07 18:28 | 414 | |

*Apache/2.4.29 (Ubuntu) Server at 192.168.1.105 Port 80*

Mozilla Firefox

192.168.1.105/company_fol

192.168.1.105/company_folders/secret_folder/connect_to_corp_server

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Personal Note

In order to connect to our companies webdav server I need to use ryan's account (Hash:d7dad0a5cd7c8376eeb50d69b3ccd352)

1. I need to open the folder on the left hand bar
2. I need to click "Other Locations"
3. I need to type "dav://172.16.84.205/webdav/"
4. I will be prompted for my user (but i'll use ryans account) and password

https://crackstation.net

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CrackStation

Defuse.ca

CrackStation Password Hashing Security Defuse Security

Free Password Hash Cracker

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

d7dad0a5cd7c8376eeb50d69b3ccd352

I'm not a robot reCAPTCHA

Crack Hashes

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD160, 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.

User Name: **ryan**
Password: **linux4u**

# Exploitation: SSH

01

**Tools & Processes**

- Nmap service and version scan on Target's IP address.
  - OpenSSH
- HTTP exploit provided me with usernames and passwords

02

**Achievements**

- Successfully remotely logged into Target.

03

- Command Line::

**nmap -sV 192.168.1.105**

**ssh ashton@192.168.1.105**
*ashton@192.168.1.105's password:* **leopoldo**
*ashton@server:*

**ssh ryan@192.168.1.105**
*ryan@192.168.1.105's password:* **linux4u**
*ryan@server:*

# Exploitation: WebDav

01

**Tools & Processes**

- HTTP exploit provided me with usernames and passwords
- Network-File Manager

02

**Achievements**

- Successfully connected to the server via WebDav and planted a reverse shell into the directory.

03

- Network-File Manager address bar input:

**dav://192.168.1.105/webdav**

- Entered credentials,

Username: **ryan**
Password: **linux4u**

# Blue Team

## Log Analysis and Attack Characterization

# Analysis: Identifying the Port Scan

**20,123** hits

Jan 14, 2021 @ 02:00:00.000 - Jan 14, 2021 @ 02:30:00.000 — Auto

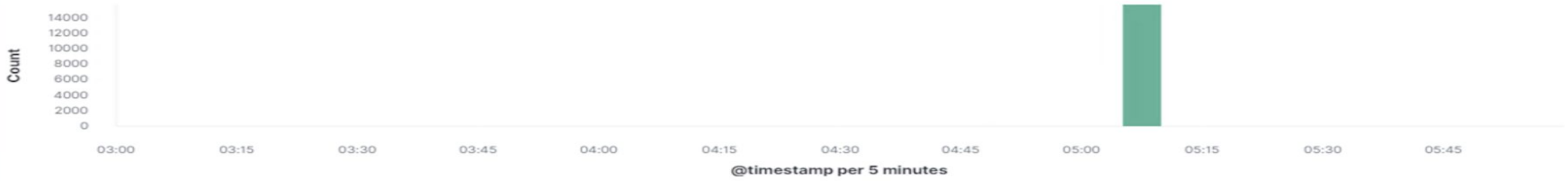

| Time | source.ip | source.port | destination.ip | destination.port |
|---|---|---|---|---|
| Jan 14, 2021 @ 02:30:00.000 | 192.168.1.90 | 52202 | 192.168.1.105 | 22 |
| Jan 14, 2021 @ 02:29:50.009 | 192.168.1.90 | 34814 | 192.168.1.100 | 9200 |
| Jan 14, 2021 @ 02:29:50.009 | 192.168.1.90 | 52202 | 192.168.1.105 | 22 |
| Jan 14, 2021 @ 02:29:50.000 | 192.168.1.90 | 52202 | 192.168.1.105 | 22 |
| Jan 14, 2021 @ 02:29:40.009 | 192.168.1.90 | 55002 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:40.009 | 192.168.1.90 | 55004 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:40.009 | 192.168.1.90 | 55006 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:40.009 | 192.168.1.90 | 34814 | 192.168.1.100 | 9200 |
| Jan 14, 2021 @ 02:29:40.009 | 192.168.1.90 | 52202 | 192.168.1.105 | 22 |
| Jan 14, 2021 @ 02:29:40.000 | 192.168.1.90 | 52202 | 192.168.1.105 | 22 |
| Jan 14, 2021 @ 02:29:40.000 | 192.168.1.90 | 55002 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:40.000 | 192.168.1.90 | 55004 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:40.000 | 192.168.1.90 | 55006 | 192.168.1.105 | 80 |
| Jan 14, 2021 @ 02:29:30.009 | 192.168.1.90 | 55002 | 192.168.1.105 | 80 |

- What time did the port scan occur? 02:00
- How many packets were sent, and from which IP?
  20,123 hits
- What indicates that this was a port scan? Source ip was hitting multiple ports in a short time frame

# Analysis: Finding the Request for the Hidden Directory

**15,687** hits

Jan 16, 2021 @ 03:00:00.000 - Jan 16, 2021 @ 06:00:00.000 — Auto



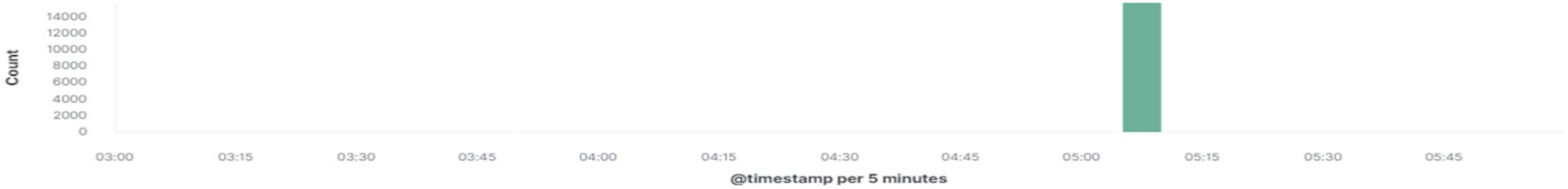

| Time | _source |
|---|---|
| > Jan 16, 2021 @ 05:13:49.237 | url.domain: 192.168.1.105 url.path: /company_folders/secret_folder @timestamp: Jan 16, 2021 @ 05:13:49.237 http.request.bytes: 385B http.request.headers.content-length: 0 http.request.method: get http.response.body.bytes: 338B http.response.headers.content-length: 338 http.response.headers.content-type: text/html; charset=iso-8859-1 http.response.status_phrase: moved permanently http.response.status_code: 301 http.response.bytes: 626B http.version: 1.1 event.duration: 0.6 event.start: Jan 16, 2021 @ 05:13:49.237 event.end: Jan 16, 2021 @ 05:13:49.237 event.kind: event |
| > Jan 16, 2021 @ 05:13:49.212 | url.path: /company_folders/secret_folder url.domain: 192.168.1.105 @timestamp: Jan 16, 2021 @ 05:13:49.212 type: http method: get query: GET /company_folders/secret_folder host.name: Kali user_agent.original: Mozilla/5.0 (X11; Linux x86_64; rv:68.0) Gecko/20100101 Firefox/68.0 agent.type: packetbeat agent.version: 7.8.0 agent.hostname: Kali agent.ephemeral_id: daa55f0c-419a-4569-be13-df2a72fedc50 agent.id: 26444e58-c83e-4d56-854f-bd90ace159df agent.name: Kali http.request.method: get http.request.bytes: 385B http.request.headers.content-length: 0 http.response.status_phrase: moved |
| > Jan 16, 2021 @ 05:06:35.480 | url.domain: 192.168.1.105 url.path: /company_folders/secret_folder @timestamp: Jan 16, 2021 @ 05:06:35.480 user_agent.original: Mozilla/4.0 (Hydra) query: GET /company_folders/secret_folder network.community_id: 1:ffEP8yAfokOtRUTdQBMV2P4PQfQ= network.bytes: 861B network.type: ipv4 network.transport: tcp network.protocol: http network.direction: inbound url.full: http://192.168.1.105/company_folders/secret_folder |

- What time did the request occur? 03:00
- How many requests were made? 15, 687 hits
- Which files were requested? /company_folders/secret_folder
- What did they contain? User ryan's password hash and instructions on how to connect to WebDav

# Analysis: Uncovering the Brute Force Attack

**15,683** hits

Jan 16, 2021 @ 03:00:00.000 - Jan 16, 2021 @ 06:00:00.000 — Auto



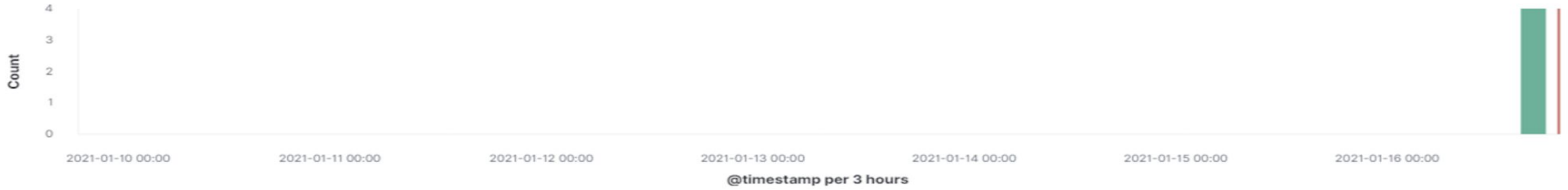

| Time | _source |
|---|---|
| > Jan 16, 2021 @ 05:06:35.480 | user_agent.original: Mozilla/4.0 (Hydra) url.domain: 192.168.1.105 @timestamp: Jan 16, 2021 @ 05:06:35.480 query: GET /company_folders/secret_folder network.community_id: 1:ffEP8yAfokOtRUTdQBMV2P4PQfQ= network.bytes: 861B network.type: ipv4 network.transport: tcp network.protocol: http network.direction: inbound url.path: /company_folders/secret_folder url.full: http://192.168.1.105/company_folders/secret_folder url.scheme: http method: get type: http server.ip: 192.168.1.105 server.port: 80 server.bytes: 698B agent.hostname: server1 agent.id: de2238f6-73be-44db-906f- |
| > Jan 16, 2021 @ 05:06:35.470 | url.domain: 192.168.1.105 user_agent.original: Mozilla/4.0 (Hydra) @timestamp: Jan 16, 2021 @ 05:06:35.470 destination.ip: 192.168.1.105 destination.port: 80 destination.bytes: 698B http.response.status_phrase: unauthorized http.response.status_code: 401 http.response.bytes: 698B http.response.body.bytes: 460B http.response.headers.content-length: 460 http.response.headers.content-type: text/html; charset=iso-8859-1 http.version: 1.1 http.request.headers.content-length: 0 http.request.method: get http.request.bytes: 159B type: http query: GET /company_folders/secret_folder |
| > Jan 16, 2021 @ 05:06:35.460 | url.domain: 192.168.1.105 user_agent.original: Mozilla/4.0 (Hydra) @timestamp: Jan 16, 2021 @ 05:06:35.460 url.path: /company_folders/secret_folder url.full: http://192.168.1.105/company_folders/secret_folder url.scheme: http destination.bytes: 698B destination.ip: 192.168.1.105 destination.port: 80 server.ip: 192.168.1.105 server.port: 80 |

- How many requests were made in the attack? 15, 683 hits
- How many requests had been made before the attacker discovered the password? 15, 681

# Analysis: Finding the WebDAV Connection

**4** hits

Jan 9, 2021 @ 19:22:57.513 - Jan 16, 2021 @ 19:22:57.514 — Auto




| Time | _source |
|---|---|
| Jan 16, 2021 @ 17:36:17.114 | url.domain: 192.168.1.105 query: GET /webdav/passwd.dav @timestamp: Jan 16, 2021 @ 17:36:17.114 url.full: http://192.168.1.105/webdav/passwd.dav url.scheme: http url.path: /webdav/passwd.dav server.bytes: 301B server.ip: 192.168.1.105 server.port: 80 network.protocol: http network.direction: inbound network.community_id: 1:Oj5xHb80azAUYNzGVOLKQJfCqvY= network.bytes: 709B network.type: ipv4 network.transport: tcp agent.ephemeral_id: 09b64d0f-931f-426e-830e-28db4c81d905 agent.hostname: server1 agent.id: de2238f6-73be-44db-906f-12490aa5ab17 agent.version: 7.7.0 agent.type: packetbeat host.name: server1 ecs.version: 1.5.0 client.bytes: 408B |
| Jan 16, 2021 @ 17:36:16.981 | url.domain: 192.168.1.105 query: GET /webdav/passwd.dav @timestamp: Jan 16, 2021 @ 17:36:16.981 status: OK network.community_id: 1:Oj5xHb80azAUYNzGVOLKQJfCqvY= network.bytes: 709B network.type: ipv4 network.transport: tcp network.protocol: http network.direction: outbound method: get url.scheme: http url.path: /webdav/passwd.dav url.full: http://192.168.1.105/webdav/passwd.dav source.ip: 192.168.1.90 source.port: 43342 source.bytes: 408B destination.port: 80 destination.bytes: 301B destination.ip: 192.168.1.105 ecs.version: 1.5.0 host.name: Kali server.ip: 192.168.1.105 server.port: 80 server.bytes: 301B type: http event.end: Jan 16, 2021 @ |
| Jan 16, 2021 @ 17:34:53.308 | url.domain: 192.168.1.105 query: GET /webdav/shell.php @timestamp: Jan 16, 2021 @ 17:34:53.308 error.message: Unmatched request http.version: 1.1 http.request.bytes: 209B http.request.headers.content-length: 0 http.request.method: get event.category: network_traffic event.dataset: http event.start: Jan 16, 2021 @ 17:34:53.308 event.kind: event type: http network.transport: tcp network.protocol: http |

get

- How many requests were made to this directory? 4 hits
- Which files were requested? shell.php

# Blue Team

## Proposed Alarms and Mitigation Strategies

# Mitigation: Blocking the Port Scan

## Alarm

What kind of alarm can be set to detect future port scans?

- Create a rule to alert when there are consecutive ports scans or ping request.

What threshold would you set to activate this alarm?

- 10 port scans in one minute or 100 consecutive ping request.

## System Hardening

What configurations can be set on the host to mitigate port scans?

- Install firewall
- TCP Wrappers
- Uncover Holes in the network

Describe the solution. If possible, provide required command lines.

- Block pings and ICMP requests
- Add a rich rule to block the servers IP addresses or domains
- Run a port scan and close unused ports.

# Mitigation: Finding the Request for the Hidden Directory

## Alarm

What kind of alarm can be set to detect future unauthorized access?

- Create an alert when Hidden Directory is requested from a non whitelisted IP

What threshold would you set to activate this alarm?

- 5

## System Hardening

- Create a firewall rule to only allow IP addresses 192.168.1.1 and 192.168.1.105 to access port 80
- Use port 443 instead of 80
- Remove all existence of a hidden directory from the website

# Mitigation: Preventing Brute Force Attacks

## Alarm

What kind of alarm can be set to detect future brute force attacks?

- Create a rule to detect Hydra

What threshold would you set to activate this alarm?

- 3 failed login attempts

## System Hardening

What configuration can be set on the host to block brute force attacks?

- Enforce the use of strong passwords
- Use multifactor
- Lockout policy

Describe the solution. If possible, provide the required command line(s).

- Lock accounts after several failed login attempts and then unlock it as the administrator
- Use multiple factors to authenticate identity and grant access to accounts
- force users to define long and complex passwords. You should also enforce periodical password changes

# Mitigation: Detecting the WebDAV Connection

## Alarm

What kind of alarm can be set to detect future access to this directory?

- Create an when unauthorized IP address attempts to access the tool

What threshold would you set to activate this alarm?

- 5

## System Hardening

- Set up alert source.ip : (not <whitelisted IP> or <whitelisted IP>)
- If you do not use this extension, you should disable it
- Patch/Repair the vulnerability

# Mitigation: Identifying Reverse Shell Uploads

## Alarm

What kind of alarm can be set to detect future file uploads?

- Create a alert for http.request.method : “put” and source : (not 192.168.1.105 or 192.168.1.1)

What threshold would you set to activate this alarm?

- 5

## System Hardening

- “lock down outgoing connectivity to allow only specific remote IP addresses and ports for the required services”

# the End