Capstone Engagement

Assessment, Analysis, and Hardening of a Vulnerable System

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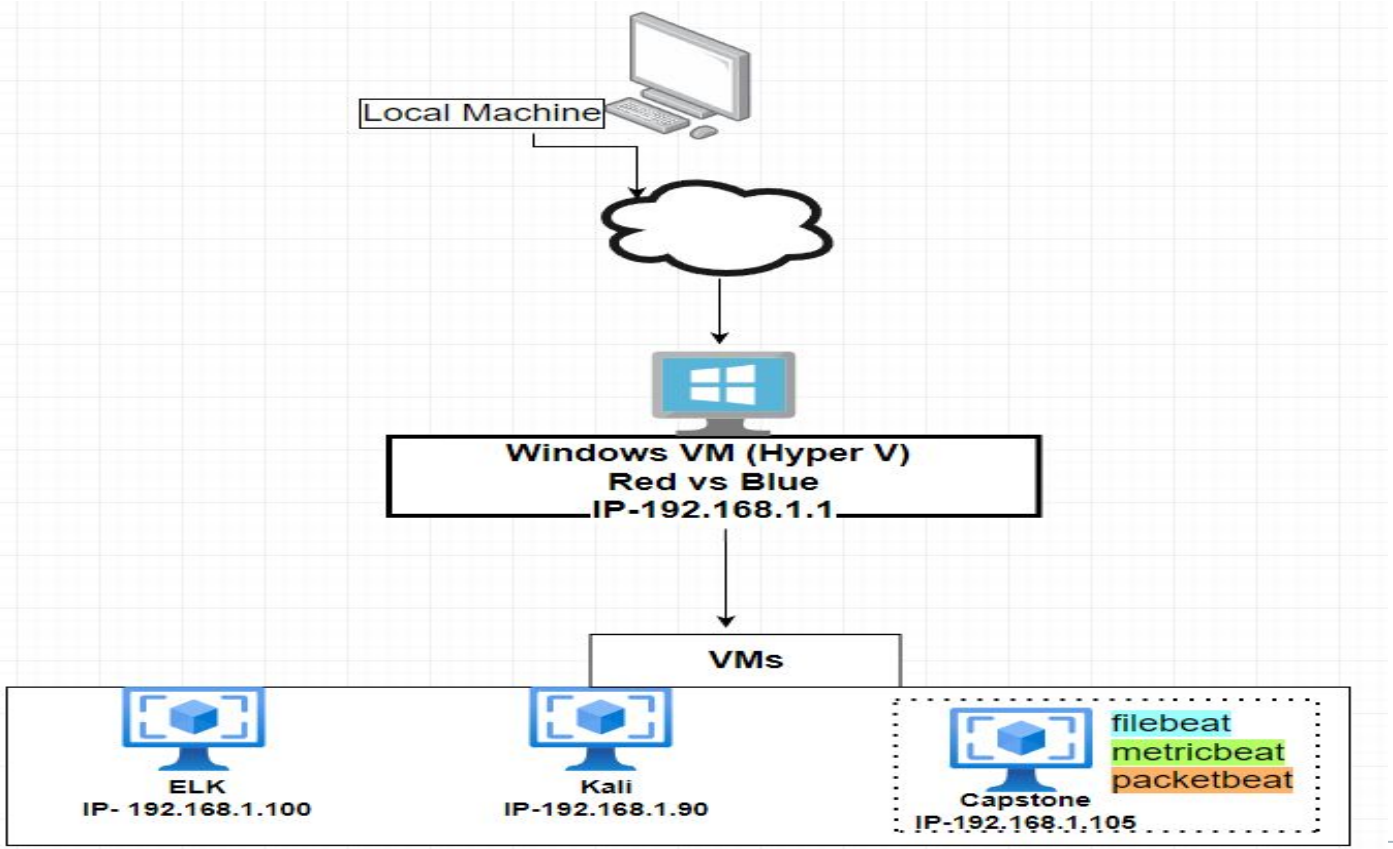
Network Topology

Network Topology



Network
Address Range:192.168.1.0/24
Netmask:255.255.255.0
Gateway:10.0.0.1

Machines
IPv4:192.168.1
OS:Linux
Hostname:Red vs Blue

IPv4:192.168.1.100
OS:Linux
Hostname:Elk

IPv4:192.168.1.90
OS:Kali Linux
Hostname:Kali

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
Capstone	192.168.1.105	Target Machine using Apache Web Server
Kali	192.168.1.90	Attacking machine running on Kali Linux
Elk	192.168.1.100	Logging service capturing data and server activity.
Hyper V Manager	192.168.1.1	Software that contains and visualizes multiple virtual machines.

Vulnerability Assessment

The assessment uncovered the following critical vulnerabilities in the target:

Vulnerability	Description	Impact
Out of date software	Old version of Apache was being used without being patched.	Leaves vulnerabilities open to attackers to connect to the network.
Lack of password complexity	Users on the network lacked complex passwords ex.(numbers, characters, capitalization)	Created a weak point for the attacker to easily crack password to access confidential information.
Vulnerable ports open to public	Port 80 and port 22 showed as open to any source on an Nmap scan	Allowed the attacked to connect directly from the internet on their machine.

Exploitation: Open Vulnerable Ports

01

Tools & Processes

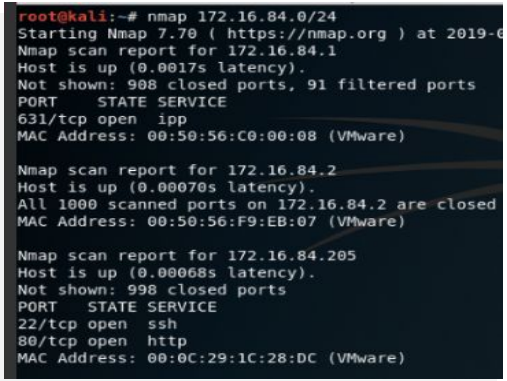
Ran an Nmap scan on the servers network.

02

Achievements

Showed port 80 and port 22 were open that allows any source to connect to the network.

03



Exploitation: Lack of Password Complexity

01

Tools & Processes

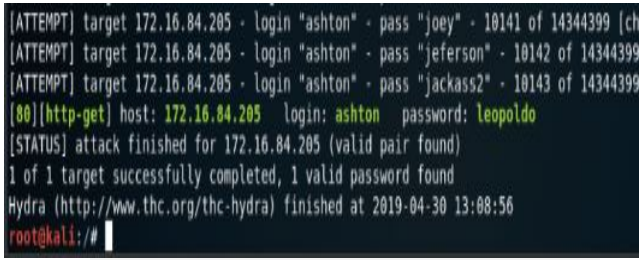
Hydra was used to brute force attack the password for ashton

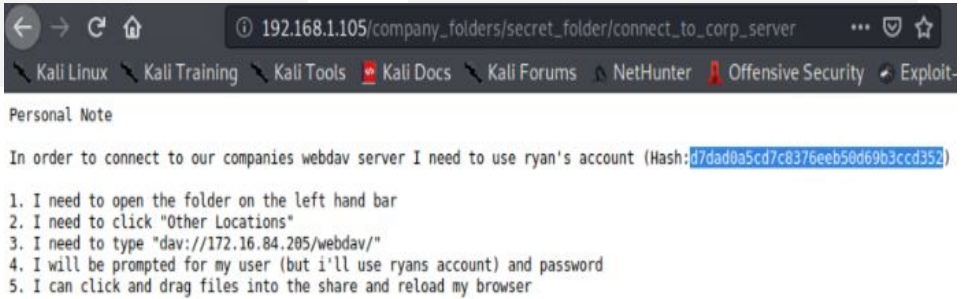
02

Achievements

Accessed /company_folders/secret_folder directory from the server.

03





Exploitation: Out of Date Software

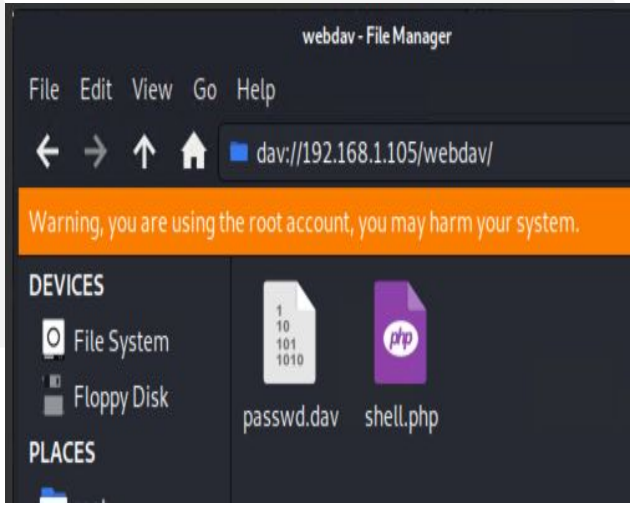
01

Tools & Processes
Created a reverse shell with msfvenom. From there a listener was set up in Metasploit by creating a payload.

02

Achievements
Successful upload and activated a PHP reverse shell script to the WebDav directory.

03

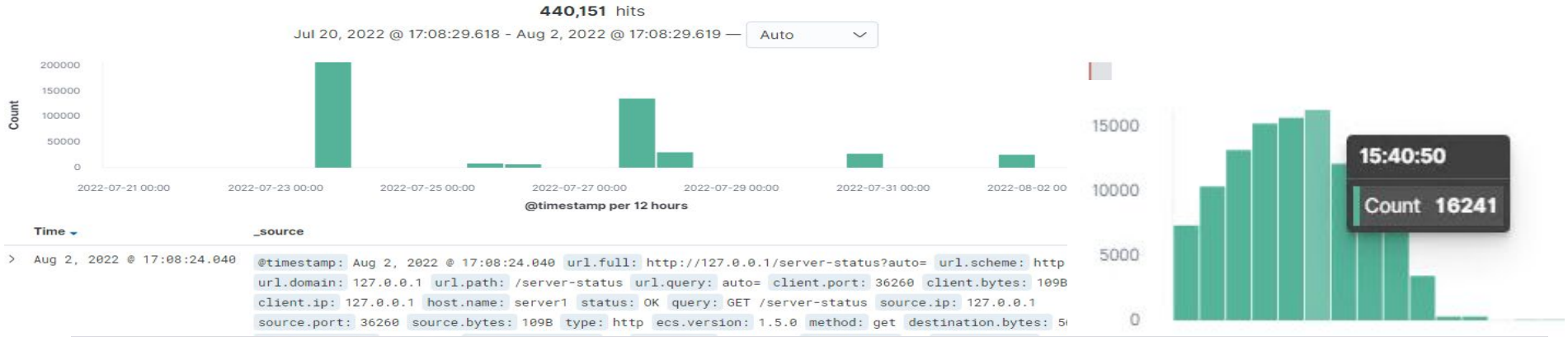


Blue Team
Log Analysis and Attack Characterization

Analysis: Identifying the Port Scan

Answer the following questions in bullet points under the screenshot if space allows. Otherwise, add the answers to speaker notes.

- What time did the port scan occur? 3:40pm
- How many packets were sent, and from which IP? 11 packets from IP: 192.168.1.90
- What indicates that this was a port scan? The HTTP request through port 80.



Analysis: Finding the Request for the Hidden Directory

Answer the following questions in bullet points under the screenshot if space allows. Otherwise, add the answers to speaker notes.

- What time did the request occur? July 23rd 2022 @ 3:43 pm
- How many requests were made? 16,352
- Which files were requested? /company_folders/secret_folder/
- What did they contain? The secret folder contained a password hash for the user Ryan.

Top 10 HTTP requests [Packetbeat] ECS

url.full: Descending	Count
http://192.168.1.105/company_folders/secret_folder/	16,352
http://192.168.1.105/webdav	174
http://192.168.1.105/webdav/passwd.dav	30
http://192.168.1.105/webdav/normalfile.exe	16
http://192.168.1.105/company_folders/	14

Export: Raw Formatted

> Jul 23, 2022 @ 15:43:20.223 url.path: /company_folders/secret_folder/ @timestamp: Jul 23, 2022 @ 15:43:20.223 destination.ip: 192.168.1.105 destination.port: 80 destination.bytes: 733B user_agent.original: Mozilla/5.0 (X11; Linux x86_64; rv:68.0) Gecko/20100101 Firefox/68.0 status: OK http.version: 1.1 http.request.headers.content-length: 0 http.request.method: get http.request.bytes: 386B http.response.body.bytes: 482B http.response.headers.content-length: 482 http.response.headers.content-type: text/html;charset=UTF-8 http.response.status_phrase: ok

> Jul 23, 2022 @ 15:43:19.900 url.path: /company_folders/secret_folder/ @timestamp: Jul 23, 2022 @ 15:43:19.900 status: OK host.name: Kali event.kind: event event.category: network_traffic event.dataset: http event.duration: 1.7 event.start: Jul 23, 2022 @ 15:43:19.900 event.end: Jul 23, 2022 @ 15:43:19.901 destination.ip: 192.168.1.105 destination.port: 80 destination.bytes: 733B url.full: http://192.168.1.105/company_folders/secret_folder/ url.scheme: http url.domain: 192.168.1.105 query: GET /company_folders/secret_folder/ agent.version: 7.8.0 agent.hostname: Kali

> Jul 23, 2022 @ 15:42:45.155 url.path: /company_folders/secret_folder/ @timestamp: Jul 23, 2022 @ 15:42:45.155 destination.ip: 192.168.1.105 destination.port: 80 destination.bytes: 735B event.category: network_traffic event.dataset: http event.duration: 0.3 event.start: Jul 23, 2022 @ 15:42:45.155 event.end: Jul 23, 2022 @ 15:42:45.156 event.kind: event source.ip: 192.168.1.90 source.port: 36298 source.bytes: 343B query: GET /company_folders/secret_folder/ host.name: server1 agent.id: de2238f6-73be-44db-906f-12490aa5ab17

Analysis: Uncovering the Brute Force Attack

Answer the following questions in bullet points under the screenshot if space allows. Otherwise, add the answers to speaker notes.

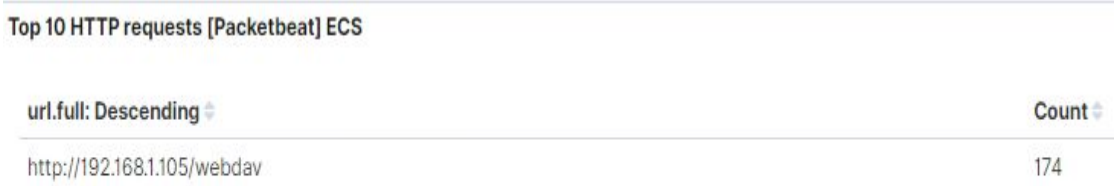
- The file was requested 3,207 times before the attacker successfully requested the file 1 time July 23rd 2022 @ 3:40pm.

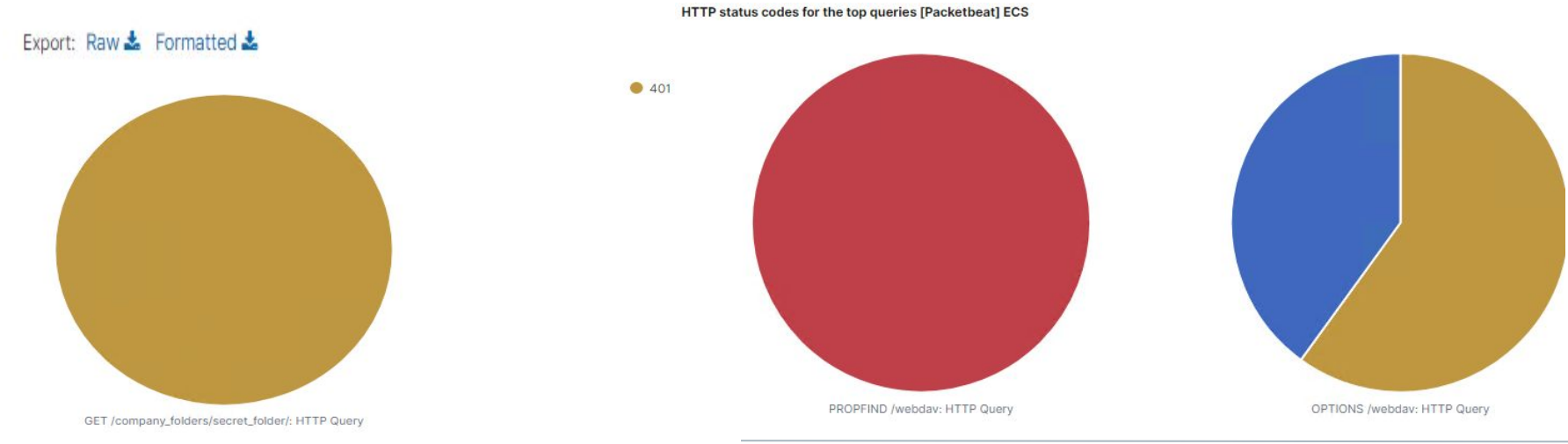
Time	_source
Jul 23, 2022 @ 15:40:08.000	event.outcome: success agent.hostname: server1 agent.id: 07143c2c-842d-4407-8ad8-90e08d99f87a agent.type: filebeat agent.ephemeral_id: fa647d40-aae5-443f-b482-0285cde11cac agent.version: 7.7.0 log.file.path: /var/log/apache2/access.log log.offset: 566,954 source.address: 127.0.0.1 source.ip: 127.0.0.1 fileset.name: access url.original: /server-status?auto= input.type: log @timestamp: Jul 23, 2022 @ 15:40:08.000 ecs.version: 1.5.0 service.type: apache host.name: server1 http.request.referrer: - http.request.method: get http.response.status_code: 200 http.response.body.bytes: 596B http.version: 1.1 event.kind: event event.created: Jul 23, 2022 @ 15:40:09.588 event.module: apache event.category: web event.dataset: apache.access user.name: - user_agent.original: Go-http-client/1.1 user_agent.name: Go-http-client

Analysis: Finding the WebDAV Connection

Answer the following questions in bullet points under the screenshot if space allows. Otherwise, add the answers to speaker notes.

- How many requests were made to this directory? 174 requests
- Which files were requested? HTTP query for GET /company_folders/secret_folder/





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?

- Setting an alert for scan and sweep filters to capture high levels of port scans from a single IP.

What threshold would you set to activate this alarm?

- Placing a threshold value determined off of baseline activity for connection attempts from a specific IP. Once the threshold is met the alert is sent.

System Hardening

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

- Deploying adaptive firewalls.
- Also setting up filters to block port scans.

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

- Adaptive firewalls block ports when malicious IPs are trying to scan them.
- Filters for 7000-7003 (TCP / UDP port scan / host sweeps), as well as 7004 and 7016 (ICMP & ICMPv6 host sweep).

Mitigation: Finding the Request for the Hidden Directory

Alarm

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

- An alert can be put in place for any IP address that's not authorized to access this file / directory.

What threshold would you set to activate this alarm?

- The threshold would be 1, met by any machine IP not whitelisted for this directory.

System Hardening

What configuration can be set on the host to block unwanted access?

- Only allowing this directory to be accessed by certain IPs.

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

- Open Apache Configuration File.
- Restrict Access by IP. Once you have opened the appropriate configuration file, look for <Directory> tag.
- Restart Apache web server

Mitigation: Preventing Brute Force Attacks

Alarm

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

- A 401 Unauthorized alert can be created for the server.

What threshold would you set to activate this alarm?

- When a baseline of 5 over a 1 hour period is met, the alert would then be triggered.

System Hardening

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

- Allowing only a certain amount of failed login attempts.
- Using MFA (Multi Factor Authentication)

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

- Alter account policies for logins on the server.
- Implement a multi factor authentication process for user logins.

Mitigation: Detecting the WebDAV Connection

Alarm

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

- Setting an alert when any attempt is made to access this directory outside of the whitelisted IPs.

What threshold would you set to activate this alarm?

- Creating a range for accepted IPs.
- Setting a threshold of 1 attempt for any unauthorized IPs.

System Hardening

What configuration can be set on the host to control access?

- Creating a firewall rule to protect this directory.
- Not allowing access to this directory from the web, especially from a non-local source.

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

- Blacklisting all IPs outside of Whitelisted IPs.
- Blocking port 80 and 443.

Mitigation: Identifying Reverse Shell Uploads

Alarm

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

- Setting up an alert for .php files uploaded to the server, as well as an alert for the firewall including traffic going through port 80, 443, and 4444.

What threshold would you set to activate this alarm?

- The threshold would be for any .php files, and any traffic moving through / trying to connect to port 80, 443, and 4444, triggering the set alarm.

System Hardening

What configuration can be set on the host to block file uploads?

- Taking away the ability to upload any type of files from the web, and only allowing uploads from a local source.

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

- Block port 80, 443, and 4444.


The End